

Standards of Coverage for Emergency Response 2008



TVF&R
Tualatin Valley
Fire & Rescue

Standards of Coverage for Emergency Response 2008

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SECTION 1: INTRODUCTION

District Overview

Tualatin Valley Fire & Rescue (TVF&R) is Oregon’s second-largest fire service provider agency and the state’s largest fire protection district.

Within its legal boundaries, TVF&R provides fire, EMS, and special operations response services to an area of approximately 210 square miles, within which reside some 439,856 people. 51% of these people live within one of the nine cities served by the District, and 49% live in unincorporated areas of Washington, Clackamas, or Multnomah counties. The daytime population increases significantly, fed by some of Oregon’s largest employers including Intel Corporation, General Telephone, Portland General Electric, and Nike World Headquarters. The District protects real property with an assessed valuation estimated at \$36 billion. The District currently has a Class 2 rating (on a scale of 1–10) from the Insurance Service Organization (ISO) for those areas within city limits. In all other unincorporated areas of the District, the ISO rating is a Class 3.

Legal Jurisdiction	Population	Area (MI ²)	Property Value*
Tualatin Valley Fire & Rescue	≈439,856	210.25	\$36,000,000,000

*Source: Metro Regional Land Information System (RLIS), August 2007 release.

On July 1, 1998, pursuant to a three year contract, TVF&R began providing services to the City of West Linn and the adjacent Rosemont Fire Protection District #46. In 2001, the Rosemont Fire District voted to annex to TVF&R, expanding the District’s service area.

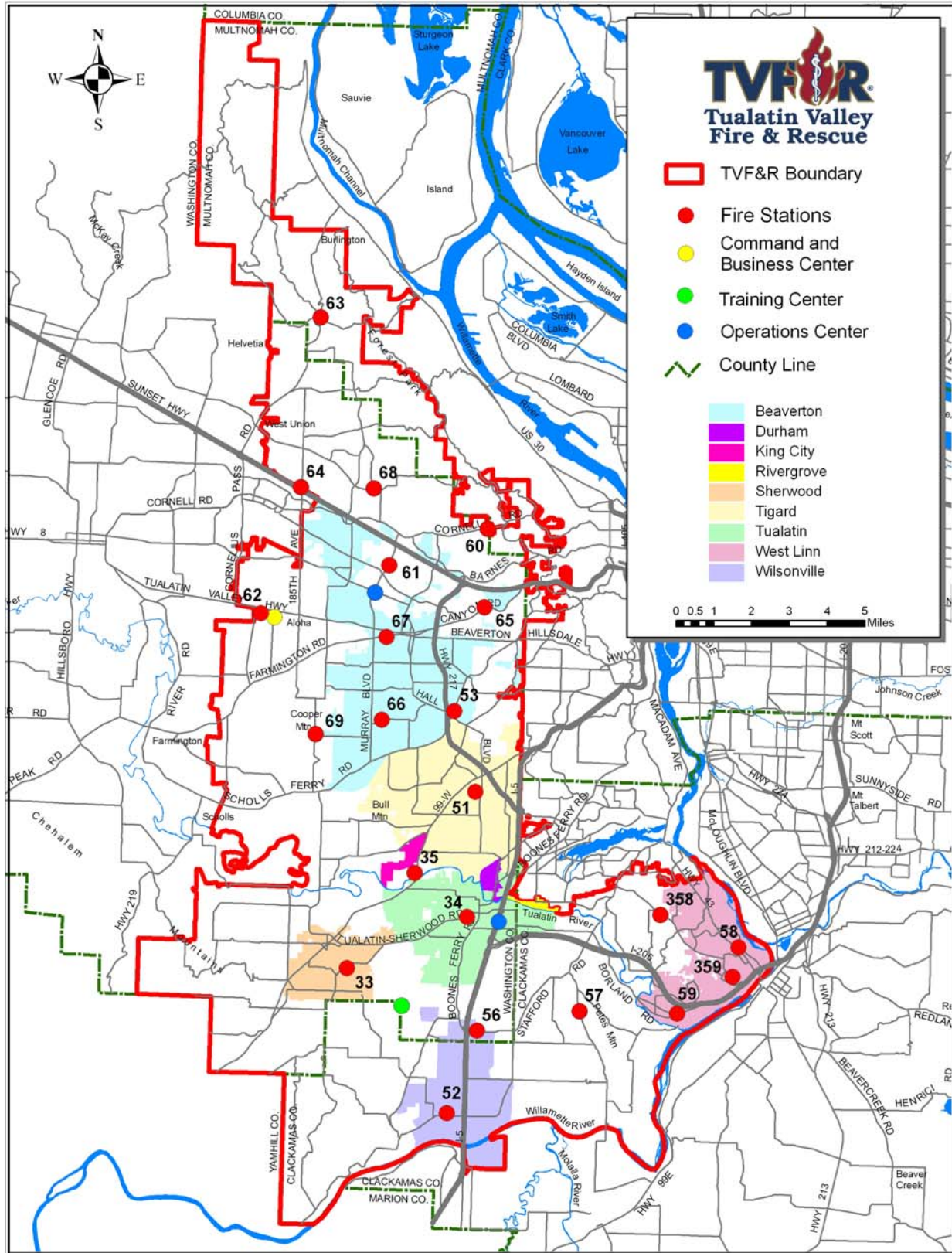
On July 1, 1999, TVF&R assumed responsibility for fire and EMS service in the City of Oregon City, pursuant to a 4-year contract for service. By January of 2003, it was apparent that budgetary issues within Oregon City would adversely affect the continuation of services from TVF&R, and the District would be unable to enter into another contract to provide emergency services to that city. Under a structured transition plan, fire and rescue services within Oregon City were turned over to Clackamas County Fire District #1 on July 1, 2003.

In March of 2004, the City of West Linn voted to annex to TVF&R effective July 1, 2004. As of July 1, 2004, the District serves nine cities and unincorporated areas of Washington, Clackamas, and Multnomah counties (see Figure 1-1).

For purposes of this document and the Center for Public Safety Excellence’s Commission on Fire Accreditation International (CPSE/CFAI) process, the Standards of Coverage established herein applies to all areas within TVF&R’s legal jurisdiction:

- City of Beaverton
- City of Durham
- City of King City
- City of Rivergrove
- City of Sherwood
- City of Tigard
- City of Tualatin
- City of West Linn
- City of Wilsonville
- Unincorporated areas of Washington, Clackamas, and Multnomah Counties

Figure 1-1. Service Area Map



Governance and Funding

TVF&R is the product of a series of mergers and consolidations which successfully reduced the tax rate required to provide fire suppression, fire prevention, and emergency medical services. Predecessor fire departments include Washington County Fire District #1, the Tualatin Fire District, the City of Beaverton Fire Department, the City of West Linn Fire Department, the Rosemont Fire District, and Skyline Fire District.

The District is incorporated under the Oregon Revised Statutes Chapter 478 as a “separate municipal corporation” and rural fire protection district. A five member Board of Directors elected from the District at large governs the District. The Board contracts for the services of a Fire Chief/Administrator who is the Chief Executive Officer of the organization. A Budget Committee and a Civil Service Commission, consisting of citizens appointed by the Board, assist the Board of Directors.

Funding is provided through property tax assessments of \$1.82 per thousand of property value (2003 figures). This includes a local option tax first approved by voters in November 2000, and reapproved in 2004 for the purposes of increasing staffing and purchasing small capital equipment. In addition, a Capital Bond was passed by the voters in 2006 to provide for the rebuilding of several fire stations, the acquisition of new property, and the construction of several new fire stations. The total budget for 2007–2008 is \$121,798,000.¹

Purpose

In general, the purpose of this Standards of Coverage document is to answer the following questions:

- What are the major risk factors within TVF&R?
- What is the risk profile of the District, and are the current resources adequate based on community expectations and safe industry practices?
- How does TVF&R’s retrospective performance compare with community expectations, national standards, and previously established goals?
- If there are performance deficiencies, what are they, and how might they be addressed?

Specifically, the Standards of Coverage helps TVF&R identify the following:

- Where should future fire stations be located?
- How should resources be deployed during different periods and types of demand?
- What type of emergency response apparatus, and what staffing levels, should be stationed in what locations, at which hours of the day?
- What is the expected maximum workload of each company (Resource Utilization Ratio)?
- What does the demand for service in each area look like, what are projected demands, and is community equity being achieved?
- What levels of service should the District provide within each emergency discipline?
- Within a comprehensive analysis of critical emergency scene tasks, what should be the District’s staffing and response time goals so that a minimum effective force can arrive in time to mitigate the emergency?

¹ TVF&R Annual Budget Document, Fiscal Year 2007-2008

This document serves as the District's Standards of Response Coverage, a critical element of the accreditation process of the Center for Public Safety Excellence's Commission on Fire Accreditation International (CPSE/CFAI), and a requirement under the National Fire Protection Association (NFPA), Standard 1710.² Standards of Response Coverage are those written procedures that determine the distribution and concentration of the fixed and mobile resources of a fire and EMS organization. These standards include several key components. This document includes a section for each component, and additional sections for quality improvement and goals. Descriptions of the topic, current practices, facts, and proposed changes are presented in each section.

The Standards of Coverage is developed through the evaluation of TVF&R's present practices, historical response data, and a comprehensive risk analysis conducted annually by the Operations Division. The results of these analyses are then used to make formal statements of the level of service that TVF&R could be expected to deliver.

² 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

SECTION 2: BASELINES, GOALS, AND OBJECTIVES

TVF&R operates under a *Strategic Plan* that includes a mission statement, goals and objectives, and annual performance statements.

Mission Statement

Tualatin Valley Fire & Rescue’s mission is to provide exceptional emergency prevention, preparedness, and response services through cost-effective innovation, individual excellence, and outstanding customer service.

Chief’s Bull’s-Eye

In a large, complex organization with multiple missions, the “Chief’s Bull’s-Eye” serves as a simple reminder of our operational priorities: Safety and Performance comprise the center of the bull’s-eye, a reminder that safety shares top priority with getting the job done effectively. Customer Service reminds us to exceed the expectations of those we serve on every call or contact. Professionalism speaks to appearing and conducting ourselves in a manner that brings credit to our agency and profession.



Baseline

For the purposes of quality improvement measurement and quantification of data, anything listed in this document as a TVF&R **baseline** is achievable with current physical resources, staffing, and levels of funding. Anything that affects District funding, staffing, or resources in an adverse manner will have a negative effect on deployment baselines, and will require an immediate analysis in order to make appropriate adjustments to the Standards of Coverage.

Service Level Objectives

Specific goals related to staffing, response times, and infrastructure development may be stated in this Standards of Coverage and should be considered as a **Service Level Objective** (also known as SLO, or **benchmark** for CPSE/CFAI purposes). When included with TVF&R baseline performance, the objective (or desired status) will be referenced in Section 12 and the following information will be provided for every goal after they have been developed, reviewed, and approved by the District's Executive Staff and Board of Directors:

Rationale: May include national, regional, or local standards used to establish goal.

Conformity to Risk Analysis and Strategic Plan: A brief report or statement confirming that the desired goal is applicable to TVF&R, considering the District's current resources, risk analysis, and perceived ability to add infrastructure, staffing, or equipment.

Estimated Cost: For implementation of goal (for example, if additional staffing is required, estimated costs of FTEs).

Time Frame: Desired timeline for implementation of goal.

Metrics: Method to measure stated goal and/or objective (using TVF&R quality improvement format).

Organizational Goals

TVF&R's organizational goals and objectives are set forth in the District's *Annual Budget Document* and *Strategic Plan* (Exhibit 1 and Exhibit 2), and are incorporated herein by reference. Specific elements relative to emergency response services are restated below because of their relevance to the development of the *Standards of Coverage for Emergency Response*.

GOAL I: Reduce the number and severity of emergency incidents.

- Arrive at 90% of emergency incidents within six minutes of being dispatched.
- Reduce the rate and severity of fires per 10,000 estimated population.
- Reduce the rate of EMS calls per 10,000 estimated population.
- Reduce severity of specific EMS calls with measurable outcomes.
- Reduce the percentage of false-alarm calls.

GOAL III: Enhance preparedness for catastrophic and unforeseen events.

- Improve the District's ability to prepare for, respond to, and recover from major emergencies and catastrophic events.
- Measurable and sustainably enhance the District's structural and non-structural seismic mitigation status.
- Enhance regional emergency management capabilities by fostering relative training, challenging exercises, and implementation of and compliance with the National Incident Management System (NIMS) by all regional partners.

GOAL VI: Promote craftsmanship, innovation, and excellence throughout the organization.

- Maintain or improve Center for Public Safety Excellence’s Commission on Fire Accreditation International (CPSE/CFAI) accredited agency status, Chief Fire Office Designation (CFOD), the current Insurance Services Office (ISO) rating, the Government Finance Office Association (GFOA) status, the State Fire Marshal’s Office “exempt jurisdiction” status, local fire code adoption including multi-family appendices, and compliance with Department of Public Safety Standards and Training (DPSST) and NIMS.
- Improve overall performance based upon the processes, systems, and criteria established by the Continuous Quality Improvement (CQI) programs.
- Increase the percentage of TVF&R members who have initiated or achieved four-year and advanced degrees.

Historically, the mission statement and *Strategic Plan* have served as guidelines for driving decisions about funding and program allocation.

SECTION 3: RISK ASSESSMENT

A comprehensive risk assessment traditionally consists of an analysis associated with demand, probability, and consequence. For some elements, such as demand (the number of calls received by the District), there are hard objective data available. For others, such as probability analysis, judgment requires data, trend analysis, and an intuitive sense related to the many additional factors that affect response performance and demand.

Risk itself is not a fixed attribute, but instead is constructed from past experience and present circumstance, and conferred upon current events.³ There are many theories related to risk, social policy, and the acceptance of consequences. For the purposes of this analysis, demand and probability will be framed by retrospective response data combined with a careful review of known extenuating factors.

It is important to mention that the elimination of all risk is impossible. Therefore, we are always faced with the situation of “residual risk.” Those who adjust the “sensitivity” of the system (e.g., determine priorities for funding and deployment) allocate risk and determine the acceptable level of residual risk. This is typically based on a risk-benefit-cost analysis, and is directly related to the resources that are readily available to help lessen risk.

In broad terms then, we rely on staff to construct an **analysis of risk** within the communities served by TVF&R, and our policymakers to **allocate risk** based on their understanding of the consequences and level of residual risk.⁴

Establishment of response performance benchmarks must include consideration of many extenuating subjective factors, such as the topography and the transportation network over which emergency responders must travel in order to meet the demands for service, the nature of emergency response activity, and patterns of future property development and population growth. Quantification of risk requires both subjective and objective factor analysis. Objective factors, for this study, are identified by evidence-based research, specific sets of data, statistical information, and other verifiable and reproducible material. Subjective factors are typically assessed as interpretation of unclear data, non-expert perception, future projections, or anecdotal evidence.

The risk assessment makes it possible to develop rational resource deployment strategies, and to identify what types of residual risk would be most probable. Simply, the goal of the risk assessment process is to determine the **probability** of an event occurring, as well as the **potential consequences** (hazard assessment) of that event. From this analysis, the agency defines their **level of response** to these events.

The resources that are **available** to respond, and the **safe deployment** of those resources, are described in Section 5 under “Critical Tasks” and “Establishment of an Effective Response Force.”

The perception of the degree of social injustice incurred related to the consequences of any emergency (e.g., fire or medical) and what is deemed acceptable residual risk in a community are typically personal opinions and will not be the same from one region to the next. Therefore, the individuality of policymakers, elections, and economics all has an effect on how communities deploy resources over a period of years. It is important to recognize that **different communities** may adopt **dissimilar resource deployment plans** for the **same type of emergency events**. These decisions are typically based on a historic distribution of community resources, personnel, funding, and infrastructure, along with geographic considerations and a host of other factors. For example, some communities may accept that they are only able to safely fight residential structure fires in a defensive mode, thereby allowing a smaller

³ D. Vaughan, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*

⁴ K. Hammond, *Human Judgment and Social Policy: Irreducible Uncertainty, Inevitable Error, Unavoidable Injustice*

response force (at less cost). Others may want aggressive, interior firefighting forces capable of rescue in all manner of dangerous environments.

In Section 5, the establishment of an effective response force is predicated upon the level of service that our communities have historically desired to support, that which is deemed safe by our staff and Labor representatives, and which is sustained in turn by the District's elected officials, the Board of Directors.

Therefore, TVF&R's *Standards of Coverage for Emergency Response* outlines a level of response that meets industry "best safe practice guidelines," and that is commensurate with community provided resources and expectations.

Terminology

Fire Flow: The amount of water required to control a fire based on building structure and contents.

Probability: An estimate of the likelihood that a particular event will occur within a given period of time.

Consequence: The risk to human life and the economic impact of an event (including fire, medical, and other events).

Occupancy Risk: An assessment of the relative risk to life and property resulting from a fire inherent in a specific occupancy or in a generic occupancy class.

Demand Zones: Areas utilized to analyze risk situations. TVF&R, because of its size and complexity, utilizes a variety of zones for different purposes:

Fire Management Zones (FMZs) are square mile zones corresponding to the geographic range-township-section grid, which are named using a four-digit system based on a datum selected by the fire service. FMZs are further divided into quarter mile quadrants denoted by the letters A, B, C, and D. FMZs and FMZ quadrants are used for map navigation purposes, clustering of non-response functions, and other administrative purposes.

Reporting Districts (RDs) are irregularly shaped zones utilized for dispatch determinations. The computer aided dispatch system (CAD) utilizes RDs to recommend apparatus to respond to events occurring within the RD. They are developed based on neighborhood configuration, traffic flow patterns, closest fire stations, and a variety of other considerations. TVF&R currently uses the Deccan International software program Box-area Automated Run-card Builder (BARB) to determine RDs. BARB provides an impedance-based analysis of the street network, and allows TVF&R to include critical data affecting travel time performance, such as the existence of traffic calming devices and single-entry neighborhoods.

City and County Boundaries are utilized for a variety of planning and reporting purposes, particularly in the area of emergency management.

Demand Zones are areas developed by TVF&R for planning and response benchmark setting purposes. After a detailed analysis, the District was subdivided in to three Demand Zones: Category "A," Category "B" and Category "C" which are more fully described on page 3–31. This three-zone structure was selected by TVF&R for use as its Demand Zone configuration.

Community Profile: An analysis of the attributes of the community based on the unique mixture of demographics, socioeconomic factors, occupancy risk, Demand Zones, and levels of service currently

provided. The District often will use existing demographic data, such as Census Tract compilations or quality improvement markers for these analyses.

Risk Assessment Components⁵

TVF&R has been refining the process of community risk analysis since 1998, and the organization has established both analytic and intuitive methods for attempting to define community risk. The Risk Profile, while subjective, is based on objective data related to demand and probability, as well as expert analysis of trends and quality improvement information. In this section, the following components are evaluated in an effort to demonstrate the types of risk that generate proposals for deploying emergency resources within the communities served by TVF&R:

1. Factors Unique to TVF&R
2. Geospatial and Growth Characteristics of TVF&R
3. Topography
4. Demographics
5. Demand: General Analysis
6. Probability: General Analysis
7. Demand and Probability
 - a. Structure Fires
 - b. Emergency Medical Services (EMS)
 - c. Special Operations—Hazardous Materials Incidents (HazMat)
 - d. Special Operations—Technical and Water Rescue
 - e. Out-of-Jurisdiction Calls
 - f. Miscellaneous Calls for Service
 - g. Temporal Analysis
 - h. Other Factors
8. Infrastructure
 - a. Transportation Networks
 - b. Buildings
9. Computation and Categorization of Risk
 - a. Objective Tools for Structures

⁵ Risk Profile Analysis Methodology has been adapted from several sources. Primary sources are: K. Hammond, *Human Judgment and Social Policy*; P. Bernstein, *Against the Gods*; D. Vose, *Risk Analysis, a Quantitative Guide*; T. Bedford, *Probabilistic Risk Analysis, Foundations and Methods*; and material from CPSE/CFAI, NFPA, and the National Fire Academy.

- b. Water Supply
- c. Risk Values
- d. EMS Call Types
- e. Demand Zones
- f. Specific Risk Areas Within TVF&R

10. Summary

Factors Unique to TVF&R

The challenge of fire station placement becomes more complex in a fire district such as Tualatin Valley Fire & Rescue. A traditional city fire department places companies in close proximity within its urban core, and with lesser concentration of resources as the neighborhoods become more suburban. Response areas are relatively simple to define: a downtown “business core,” perhaps an industrial zone, and well-established residential neighborhoods. In those cities, particularly older urban cities of the Midwest and Northeast, incident demands and the likelihood of simultaneously occurring fires and medical emergencies require that stations and apparatus be sited based on predictions of fire incident response (while apparatus utilization is primarily impacted by EMS incident response).

TVF&R serves a territory that includes several urban city cores (with moderate to high density), large expanses of mixed suburban, commercial, and industrial development, and several outlying rural areas. Over 75% of the structures within the District have been built since 1970, utilizing modern, fire resistive construction methods and building codes.

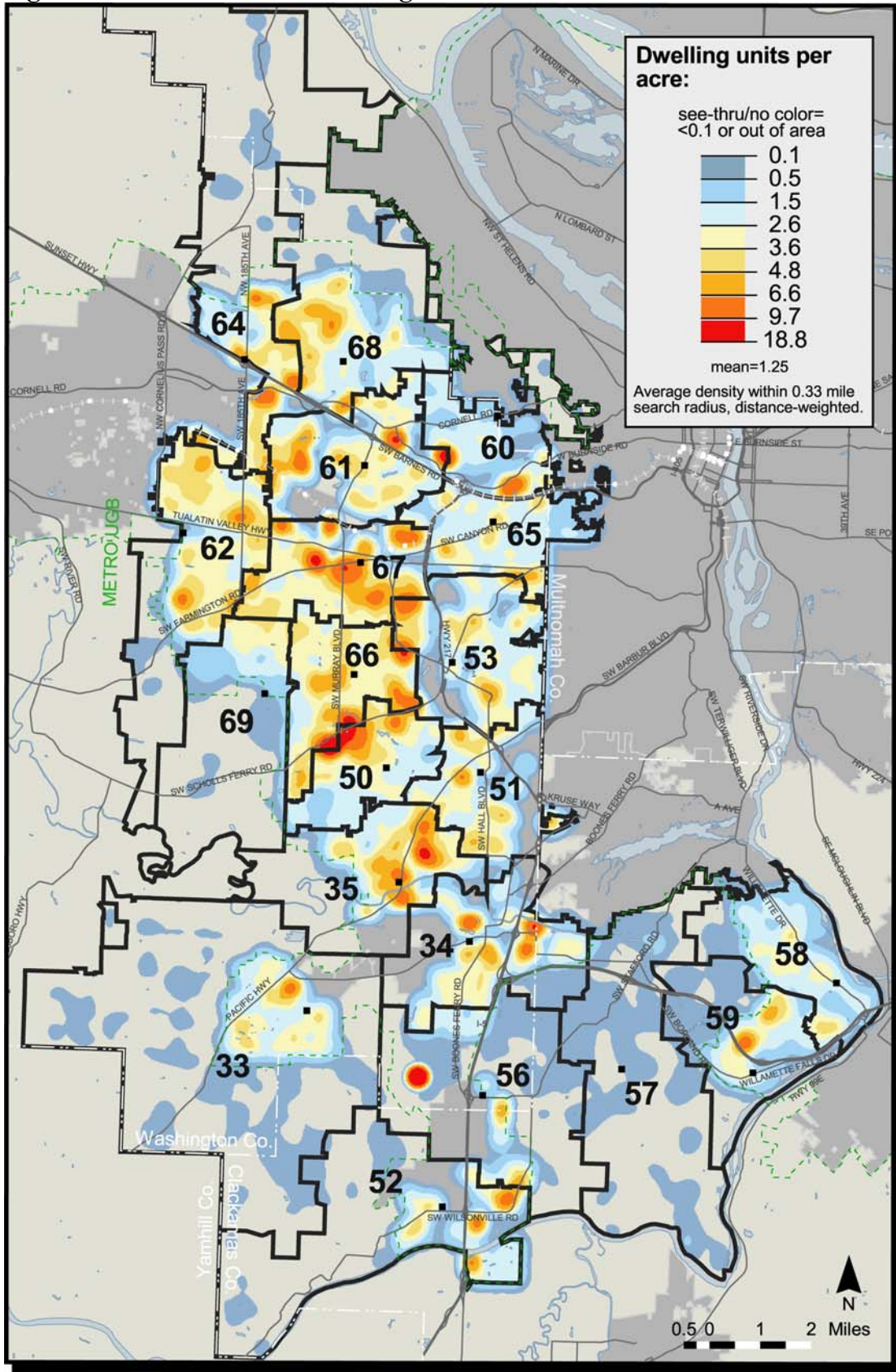
The multiple objectives within TVF&R’s mission make it challenging to establish priorities that stand over any length of time. It is difficult to assign values to programs such as injury prevention, citizen CPR, emergency management, or various self-help programs which correspond to the values that can be associated with “engineered” fire detection and control systems (alarms, sprinklers, etc.). Resources must be allocated in a manner that allows traditional fire protection and emergency medical services coverage, non-traditional public education and safety programs, and critical logistical support for all District functions.

Geospatial and Growth Characteristics of TVF&R

In order to reasonably break TVF&R’s territory into logical Demand Zones, we looked to available boundaries established by other governmental entities for guidance.

TVF&R’s customer cities are all in various phases of growth. Annexation of unincorporated territory into city limits occurs sporadically, usually when an area becomes sufficiently developed to require urban services, while at the same time having sufficient value (defined as taxable real property) to the city to warrant the costs associated with the annexation. Thus, city limits provide only limited guidance for the purposes of fire and emergency response planning. Many well-developed areas oppose annexation, and therefore are not represented within city boundaries.

Figure 3-1. Distribution: All Dwelling Units⁶



⁶ Portland State University, *Tualatin Valley Fire & Rescue Demographic Portrait and Population Forecasts 2005-2020*

The Urban Growth Boundary (UGB) established by Metro and the associated urban reserves provide better guidance.⁷ The UGB and urban reserves (in several tiers) are designated as land that will ultimately (tier two by 2017 and tier three by 2040) be developed and annexed by the cities.⁸ While some of this area at the present time is in suburban uses of varying densities, with some rural territory, the District has determined that it is prudent to assume this area will ultimately require a higher level of fire and emergency protection. This comprises approximately 52.5% (116.19 square miles) of the District's land mass, most of which has been classified in risk Category "A" (page 3–31) for the purposes of response performance.

The metropolitan Portland area is one of the fastest growing areas of the United States. Since 1990, the District has experienced a strong population growth, adding approximately 172,000 persons (66% of the 1990 population) and growing at a steady average rate of nearly 4% per year. Because of Oregon's strong land use planning laws, this growth is expected to occur in two fashions.

Residential and commercial development will occur in lands currently designated by Metro as "Urban reserves." Additional growth will occur in lands currently within the UGB through a process of "backfilling" of vacant land with high-density residential construction. Based on Metro's evaluation of suitable lands within the UGB and urban reserves, TVF&R can expect a population increase of between 9,000 and 20,000 persons per year (3–6% annual population growth). A map showing the locations where this growth will probably occur is included in Exhibit 3.

Topography

TVF&R's district is comprised of a diverse topography. In the core area of the District, the terrain is essentially flat, with two significant rivers flowing through the valley (the Tualatin and Willamette Rivers). As one moves in any direction, the terrain becomes more varied, from rolling hills to small mountains. A map showing terrain features and waterways is shown in Exhibit 4. The presence of several major hills and steep terrain prevents the construction of a typical grid street system. Instead, many of the roads follow contours, and several neighborhoods have single access points, severely limiting the response of multiple companies into the area.

In addition, steep hillsides, residential density, and "skinny" streets designed to maximize the use of suitable building sites have all contributed to areas within the District that are at risk for wildland-urban interface fires. The deployment of Brush Units strategically throughout the District, a detailed response plan for high-risk weather situations, public education programs such as "Wildfire Can Happen Here,"⁹ and maps indicating areas where building materials should conform to minimize fire spread are all parts of the District's ongoing programs to minimize this particular risk.

Demographics

A comprehensive demographic study was completed for TVF&R in February of 2008 by the Portland State University Population Research Center (Exhibit 5). This document provides the most complete picture ever constructed for the District related to population, growth, and specific demographic changes.

⁷ Metro, the Metropolitan Services District, is a regional governmental unit with boundaries encompassing portions of the three counties served by TVF&R. It is charged with land use planning, solid waste disposal, and mass transit development.

⁸ "Tiers" are areas of the "Urban Reserves" which will be added to TVF&R's Category "A" growth boundary in layers (i.e., tier one will be made available for development prior to tier two, etc.).

⁹ TVF&R Wildland-Urban Interface Program, 2006.

TVF&R currently has a population of approximately 439,856 people. Studies have concluded that the population is diverse and multi-ethnic.¹⁰ Figure 3-2 shows the current population distribution within the District, stratified by fire station First-Due Area (2007 Deccan BARB Data).

Figure 3-3 shows the yearly average births per 100 housing units for the four-year period of 2000–2004, demonstrating that Stations 62, 67, 51, 33, and 52 are experiencing higher growth in young families. This, paired with housing start data in Figure 3-4, demonstrates areas within the District where strong population growth is likely to continue, through new housing units and increased density.

Significantly, the aging of our population will continue and is expected to have adverse effects on incident volume and severity (Table 3-1). The most likely scenario shows the population over age 65 growing as a percentage of the total from 9.1% in 2005 to 13.6% in 2020.

Statistically, medical emergencies become more complex and significant with increasing age, and a decrease in mobility and sensory perception can create difficulties for those who have to evacuate a burning structure. These factors are detailed below under “Demand and Probability: EMS.”

¹⁰ Demographic Portrait and Population Forecasts, Campbell DeLong Resources, Inc., February 2008.

Figure 3-3. 2000–04 Yearly Average Births per 100 Housing Units⁶

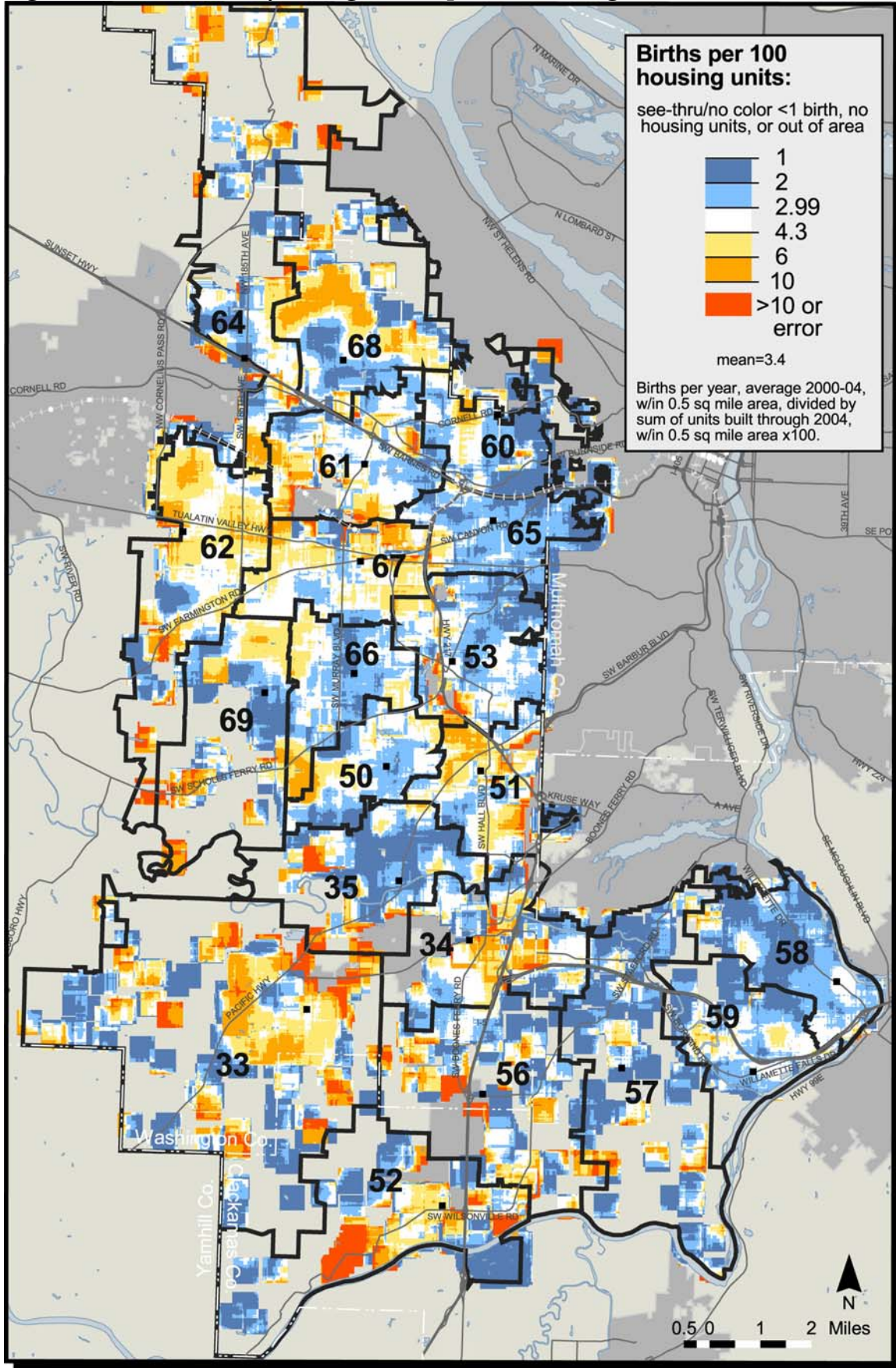
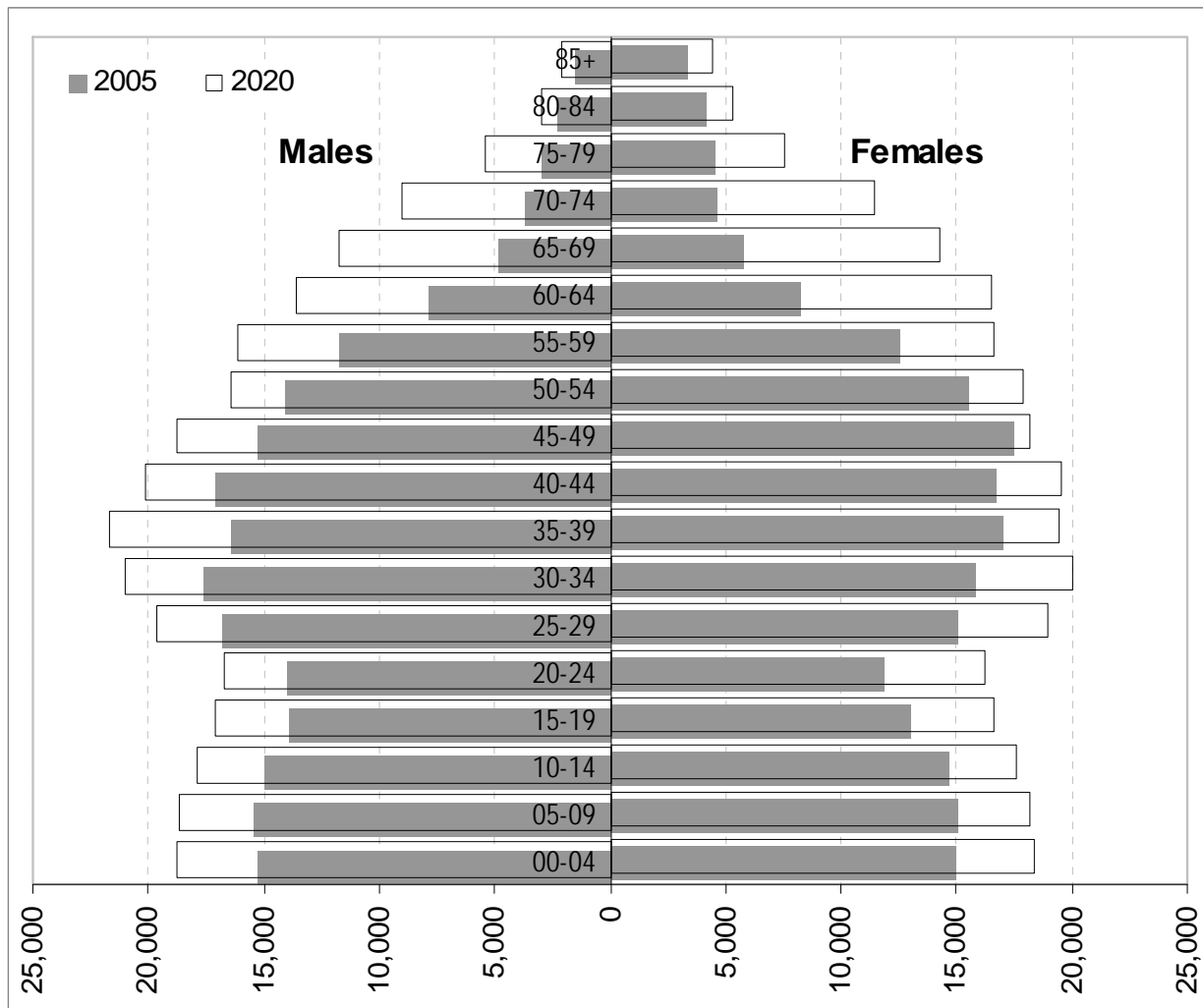


Table 3-1. Population by Age Group, Medium Growth Scenario 2005–2020⁶

	2005	2010	2015	2020
Population	415,992	451,310	503,724	545,020
Age:	<i>Percent of total population</i>			
0–19	28.2	27.5	26.6	26.3
20–64	62.7	62.6	61.7	60.1
65+	9.1	9.9	11.6	13.6
Total	100.0	100.0	100.0	100.0

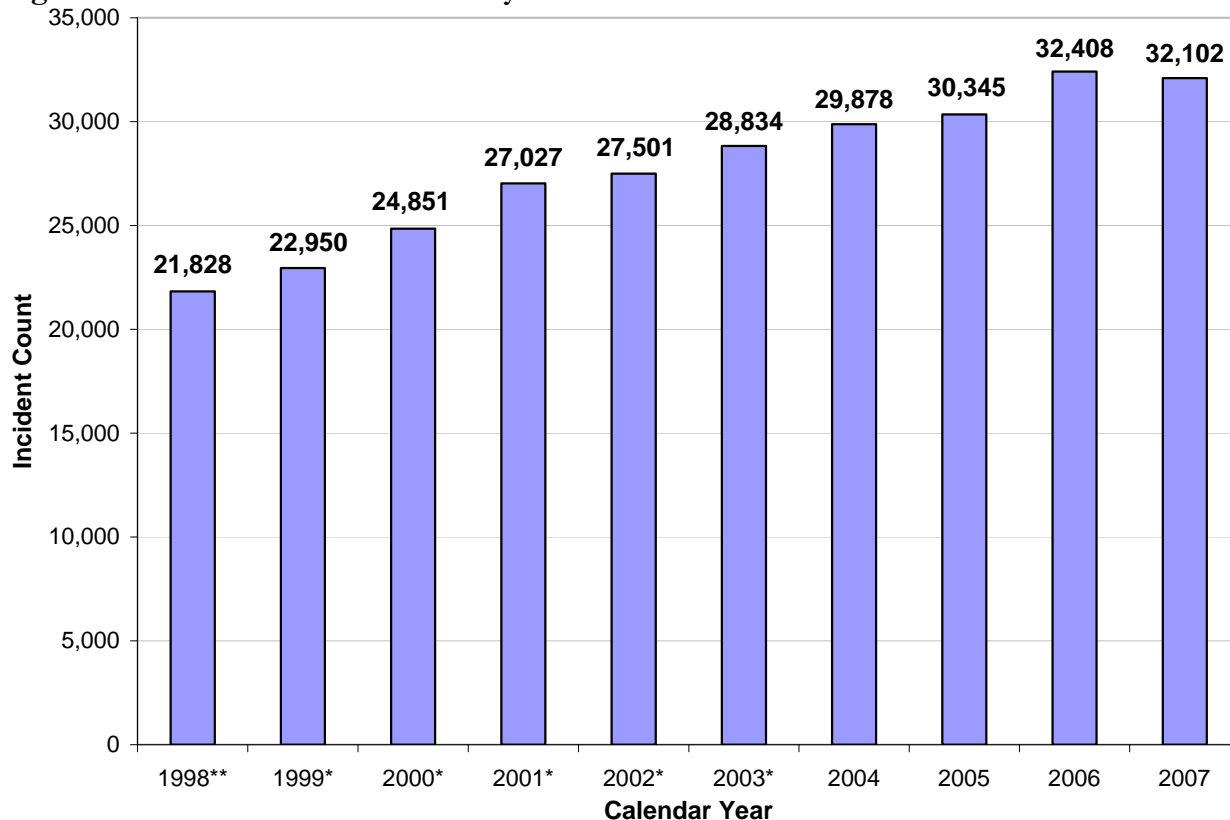
Figure 3-5. Population Pyramid, Medium Growth Scenario 2005 & 2020⁶



Demand: General Analysis¹¹

TVF&R’s call volume has increased steadily with the growth in size and population of the District.

Figure 3-6. Ten-Year Incident History



NOTE: Incident totals also include automatic and mutual aid responses to areas located outside of TVF&R’s jurisdictional boundary (e.g., Hillsboro Fire & Rescue, Lake Oswego Fire Department, and Portland Fire & Rescue).

*Incidents within Oregon City contract area are excluded.

**West Linn contract began July 1, 1998.

This summation demonstrates total call volume and frequency of all responses. TVF&R currently responds to approximately 88 calls for service each day, as shown below in Table 3-2.

Table 3-2. Frequency of All Calls for Service

	1/1/05–12/31/05*	1/1/06–12/31/06*	1/1/07–12/31/07*
Total Calls	30,345	32,408	32,103
Average per Day	83.14	88.78	87.95

*Apparatus Move-ups excluded.

Probability: General Analysis

Demand is reviewed over a three-year period in order to provide a balanced view and smooth over any irregularities caused by “spikes” related to weather events, flu outbreaks, etc. During calendar years 2005 through 2007, TVF&R responded to 94,856 incidents.

¹¹ All data utilized in this report is based on validated calendar year incident information. All data was generated by the Computer Aided Dispatch (CAD) system at Washington County Consolidated Communications Agency (WCCCA), and/or on data entered in to TVF&R’s incident reporting system by emergency response personnel.

The probability of any type emergency event is arrived at by looking at “Demand” first. Demand is the total volume of all incidents, and the probability in this analysis equates to what **type** of incident will likely occur, the **frequency**, and at what **time** of day the incident occurred. This is arrived at through a retrospective analysis of response data, aggregated in CAD Analyst and by the District’s incident reporting system.

An analysis of call types and frequencies was conducted to assess the probability of a particular event taking place. All calls for service over the last three years (January 1, 2005 through December 31, 2007) were included.¹² The base level results are shown above in Table 3-2.

Four groups of calls were examined: fires (NFPA classification 1), EMS calls (NFPA classification 3), Hazardous Materials events (NFPA classification 4), and all other calls (NFPA classifications 2, 5, 6, 7, 8 and 9). In addition, because of its extensive automatic aid and mutual aid relationships, TVF&R does not utilize the NFPA classification for “mutual aid” calls. These calls can be segregated using a separate classification scheme available in the District’s emergency response records management system.

A temporal analysis of aggregated data is also included to demonstrate the peak load demands for response services at various times of the day. This data makes a convincing case for some departures from traditional fire department scheduling and static resource deployment. This temporal analysis of peak loading is demonstrated in Figure 3-7.

Demand and Probability: Structure Fires

Tualatin Valley Fire & Rescue is dispatched to approximately 3,400 *reported* incidents per year that have the potential to result in a fully involved structure fire (Table 3-3). Often these are found to be false alarms, malfunctioning equipment, light ballast problems, smoke scares, or other things that look like a fire to the initial caller.

Table 3-3. Frequency of Calls by Dispatch Type = Structure Fire

Dispatch Code	Dispatch Code Description	2005	2006	2007
ALC	Automatic Alarm, Commercial	1,865	2,019	1,943
ALR	Automatic Alarm, Residential	812	784	778
BARN	Barn Fire	7	4	1
CFIRE	Commercial Fire	283	282	243
CHIMNEY	Chimney Fire	64	60	56
OVEN	Oven Fire	53	52	53
RFIRE	Residential Structure Fire	272	335	285
Total		3,356	3,536	3,359

NOTE: Totals do not include incidents located outside of TVF&R’s jurisdictional boundary.

For the purposes of this document, a structure fire (*situation found*) is defined as NFIRS¹³ Incident Types 111, 112, 121, 122, or 123 that occurred in TVF&R’s jurisdictional boundary, for all first alarm or greater incidents, where the total scene time was 60 minutes or greater in duration. These Incident Types reflect fires that involve the structure and do not include those incidents where the fire was able to be *confined* to a vessel with no fire extension to the surrounding structure (e.g., chimney fire, trash fire, stove top fire).

¹² This timeframe was selected because it provides a comprehensive overview of call demand over a period where a wide variety of socioeconomic changes occurred within the communities served by TVF&R.

¹³ National Fire Incident Reporting System

As demonstrated in Table 3-4, over the past three years only 3% of reported structure fires actually resulted in a working structure fire.

Table 3-4. Frequency of Structure Fires (Situation Found)

NFIRS Incident Type	NFIRS Incident Type Description	2005	2006	2007
111	Building Fire	99	110	89
112	Fire in Structure Other than in a Building	2	2	1
121	Fire in Mobile Home used as a Fixed Residence	2	0	2
122	Fire in a Motor Home, Camper, or Recreational Vehicle used as a Structure	0	0	0
123	Fire in a Portable Building when used at a Fixed Location	0	0	0
Total		103	112	92

Demand and Probability: Emergency Medical Services (EMS)

The largest proportion of emergency response activity within TVF&R is the response to requests for emergency medical services. Currently, TVF&R responds to approximately 69 EMS calls per day.

Table 3-5. Frequency of EMS Calls

	1/1/05–12/31/05	1/1/06–12/31/06	1/1/07–12/31/07
EMS Calls	23,347	24,650	25,262
Average Per Day	<i>63.96</i>	<i>67.53</i>	<i>69.21</i>

While a simple analysis of the District’s call volume and population would drive expectations that workload should increase in a generally linear fashion (call-per-thousand population), the District has instead noticed its EMS risk profile growing on an exponential basis. This non-linear increase in call complexity was studied by TVF&R’s EMS Quality Improvement Committee. Their conclusions have been validated in a secondary study, and indicate the trend will continue through at least the next five years.¹⁴ The primary factors are listed below:

- Increase in overall population of at least 3% per year (moderate predictive scenario). The linear profile shows a trend of EMS calls per thousand increasing over the past ten years.
- Increased age of the population. During the last analysis, patients over the age of 65 generate 36% more calls for service on a per-thousand basis when compared with the age group 18–65. The District is aging, with currently close to 10% of the population over the age of 65. In 2015, it is estimated this will be close to 12%, and in 2020, projections are that nearly 14% of the District will be over the age of 65.
- Increased acuity. Two trends were identified in the recent studies. First, call acuity was directly related to the age of the patient, with the more aged often having multiple medical conditions. Increased acuity is directly related to a longer time-on-task, and fire companies are out of service longer for each event. Second, more patients are being discharged early from hospitals, often with medical devices and medications that have been traditionally monitored while the patient is under a nurse’s care. These patients are regularly seen by TVF&R’s Paramedics, and more advanced

¹⁴ TVF&R EMS Quality Improvement Committee Study 2004-2006

training has been necessary in order to keep up with the advanced equipment and more significant medical conditions that are seen.

- An increase in the number of care homes for the aged. As noted earlier, TVF&R conducted a study that related EMS demand to the type of facilities within our response area.¹⁵ We have categorized these on a scale, Level 1 through Level 3, with Level 3 having the most acute residents. Over a three-year period, Level 3 facilities have consistently generated approximately one emergency call per bed per year. For example, a 120 bed facility will generate 120 calls per year; or about one call every three days for the closest fire station.
- Lack of consistent coverage through the Oregon Health Plan (OHP) and Low-Income Health Care. The OHP has been a publicly funded plan providing primary and emergency care for many of Oregon’s lower income citizens. Because of a state budget crisis, funding for the plan has been cut significantly over the past four years. As a result, many of the District’s citizens cannot afford their previously prescribed medications, nor can they afford regular visits to their physician. Additionally, the precipitous increase in costs associated with accessing standard health care services in general has pushed coverage out of range for many citizens of the District. The EMS Quality Improvement Committee has noted a significant increase in the number of general medical calls (e.g., diabetic reactions and abdominal pain), cardiac incidents, and psychiatric emergencies as the fire service becomes the “first line of defense” for community medical care. For example, Table 3-6 below shows that responses to psychiatric emergencies have increased 24% over a six-year period.

Table 3-6. Frequency of Calls by Dispatch Type = Psychiatric Emergency

Year	Incident Count
2002	542
2007	672

Demand and Probability: Special Operations—Hazardous Materials Incidents (HazMat)

TVF&R protects one of the most extensive collections of hazardous materials in the state, both in volume and in chemical complexity. These materials are found not only along the District’s transportation corridors, but within the numerous Level III HazMat facilities spread throughout the District (see Exhibit 6 for description of facilities and a more detailed description of the Regional HazMat Program). Much of this HazMat load is attributable to the “Silicon Forest” of microprocessor production facilities found in the District, predominantly in Aloha, Tualatin, and the Sunset Corridor.

Since TVF&R fields a regional HazMat team which is funded in part by the State of Oregon, it is responsible for a large geographic area outside the District’s boundaries. Therefore, some of the responses tabulated in Table 3-7 are within the District’s area of responsibility, but not within the District’s taxing authority boundary.

Table 3-7. Frequency of HazMat Team Calls

	1/1/05–12/31/05	1/1/06–12/31/06	1/1/07–12/31/07
HazMat Team Calls	38	31	33
Average per Day	0.10	0.08	0.09

NOTE: Incidents in other jurisdictions that utilized TVF&R’s Special Operations Teams are included. HazMat includes both “Technical Assist” calls and Team Deployments.

¹⁵ Residential Care Facility Study, 2002, 2003 and 2004.

Hazardous materials incidents are relatively infrequent given the diverse industrial base scattered throughout TVF&R, as well as its complex transportation network. Presently, TVF&R responds to over 30 HazMat calls per year. The number of HazMat calls has remained fairly consistent on a year-to-year basis, and Table 3-7 shows the number of HazMat calls over the reporting period.

Demand and Probability: Special Operations—Technical and Water Rescue

The District’s Technical Rescue Team has Technician Level expertise in the disciplines of Trench Rescue, Auto and Truck Extrication, Building Collapse (USAR), Confined Space Rescue, and High-Angle Rope Rescue. The Water Rescue Team provides underwater (SCUBA) search and rescue, in addition to open water and swift-water rescue (see details in Section 5).

Calls for Technical Rescue are relatively infrequent, with the predominant category of calls being specialized heavy extrication. Auto extrication equipment is carried on many TVF&R units, and all personnel are trained to the Operations Level, but there are some high-impact and heavy vehicle accidents that require the advanced equipment and training found on the Technical Rescue Team. Because there are “heavy” extrication equipment compliments on all Truck Companies and “light” compliments on many Engines and Rescues, the USAR team’s responses to complex motor vehicle crashes decreased from 2006 to 2007. This is expected to increase over the next year as the Technical Rescue Team may become a standard “Rapid Intervention” response on all confirmed structure fires.

Table 3-8. Frequency of Technical Rescue Calls

	1/1/05–12/31/05	1/1/06–12/31/06	1/1/07–12/31/07
Tech Rescue Calls	152	139	63
Average per Day	0.42	0.38	0.17

NOTE: Incidents in other jurisdictions that utilized TVF&R’s Special Operations Teams are included. Technical Rescue includes all calls for tech rescue, shoring, and building stabilization.

The Water Rescue Team incidents increase in the summer, when major waterways within TVF&R’s jurisdiction get their highest use. Because of the relatively warm water temperatures in the Pacific Northwest (even in winter the water temperatures rarely drop below the point where ice forms on static bodies of water), underwater calls for rescue often end up being recovery operations. The table below shows the demand for Water Rescue:

Table 3-9. Frequency of Water Rescue Calls

	1/1/05–12/31/05	1/1/06–12/31/06	1/1/07–12/31/07
Water Rescue Team Calls	37	40	35
Average per Day	0.10	0.11	0.10

Demand and Probability: Out-of-Jurisdiction Calls

Within the three-county metropolitan area, most service providers operate pursuant to “closest forces” or “automatic aid” agreements, creating a nearly seamless web of emergency response capabilities. It is not unusual to find personnel from two different agencies operating effectively at an emergency scene, under the supervision of a chief officer from either agency. Accordingly, the characterization of calls as “mutual aid” is not utilized except in special, infrequently occurring situations. Distribution and frequency of out-of-jurisdiction calls is set forth in Table 3-10.

Table 3-10. Out-of-Jurisdiction Responses

Jurisdiction	1/1/05–12/31/05	1/1/06–12/31/06	1/1/07–12/31/07
Hillsboro F&R	850	936	994
Lake Oswego FD	129	88	83
Wash. Co. FD #2	75	100	70
Portland F&R	189	138	69
Clack. Co. FD #1	101	86	68
Others	21	30	26
Aurora RFPD	22	20	19
Canby FD #62	1	11	16
Newberg FD	13	12	14
Totals	1,401	1,421	1,359

NOTE: The decrease in responses into Portland is based on the construction and staffing of Portland Fire & Rescue Station 16 in the Sylvan area and Station 21 in the Skyline area.

Demand and Probability: Miscellaneous Calls for Service

Like most community based fire service organizations, TVF&R serves its communities as a multifunctional service provider, fielding calls of every nature imaginable. Citizen and public assistance calls make up a minority of service requests. Table 3-11 reflects the frequency of miscellaneous service requests over the reporting period.

Table 3-11. Frequency of Miscellaneous Service Calls

	1/1/05–12/31/05	1/1/06–12/31/06	1/1/07–12/31/07
Misc. Service Calls	2,081	2,024	1,757
Average per Day	5.70	5.55	4.81

Demand and Probability: Temporal Analysis

The charts shown below use a visual aid known as the “radius graph” to display the temporal distribution of calls using the same classification scheme utilized for the frequency analysis. From a review of these three graphs, the times of day at which events are likely to occur can be ascertained.¹⁶

Within TVF&R, the trend associated with the majority of call volume occurring between the hours of 0700 and 1900 has been substantiated over the last several years. The District has not seen any significant change.

¹⁶ Previous analyses have established that these patterns have not changed significantly over the reporting period. Accordingly, data from all three time groups have been aggregated in the interests of simplicity.

Figure 3-7. All Incidents, By Hour of Day, 2005–2007

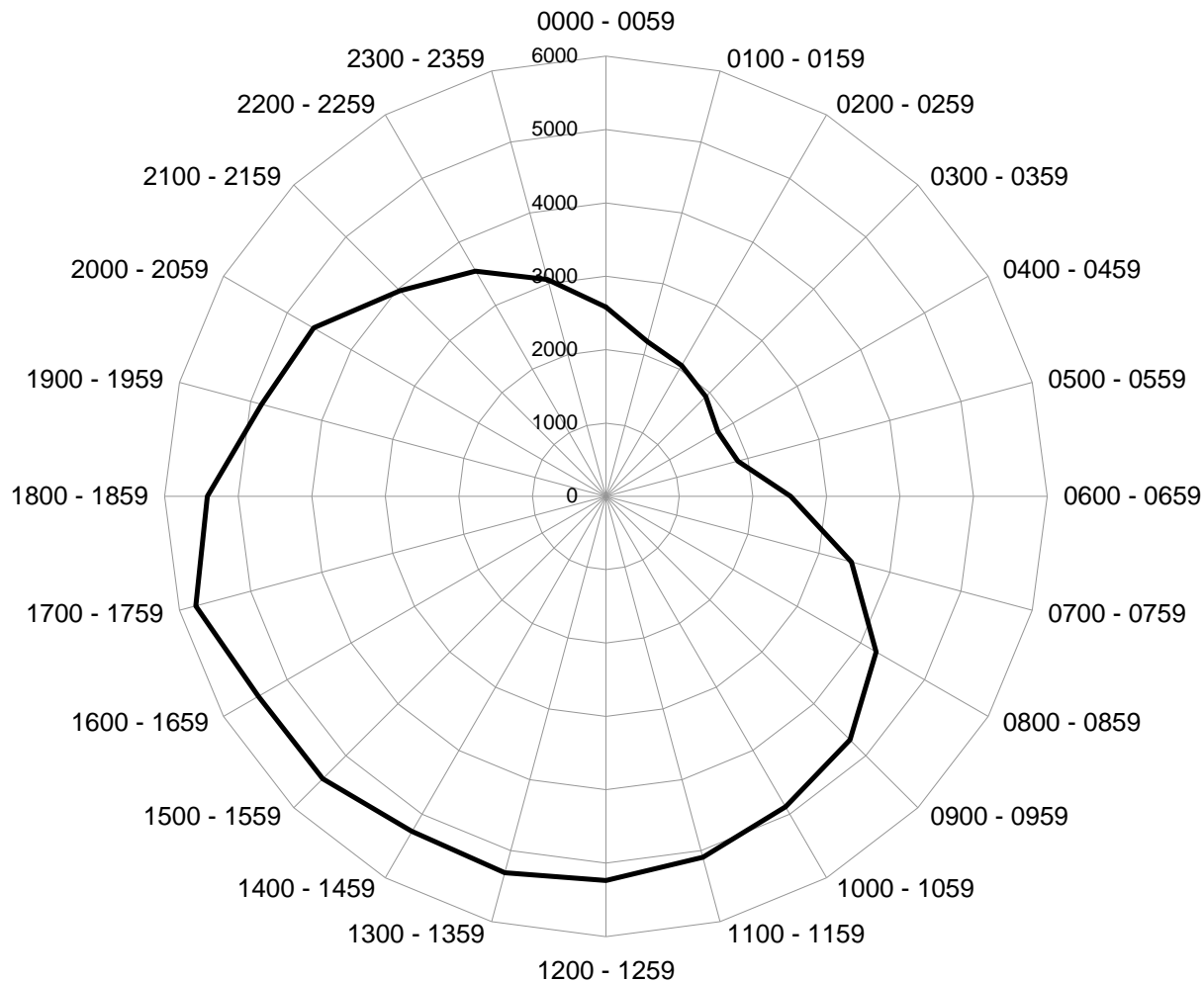


Figure 3-8. Incident Situation Found = EMS, By Hour of Day, 2005–2007

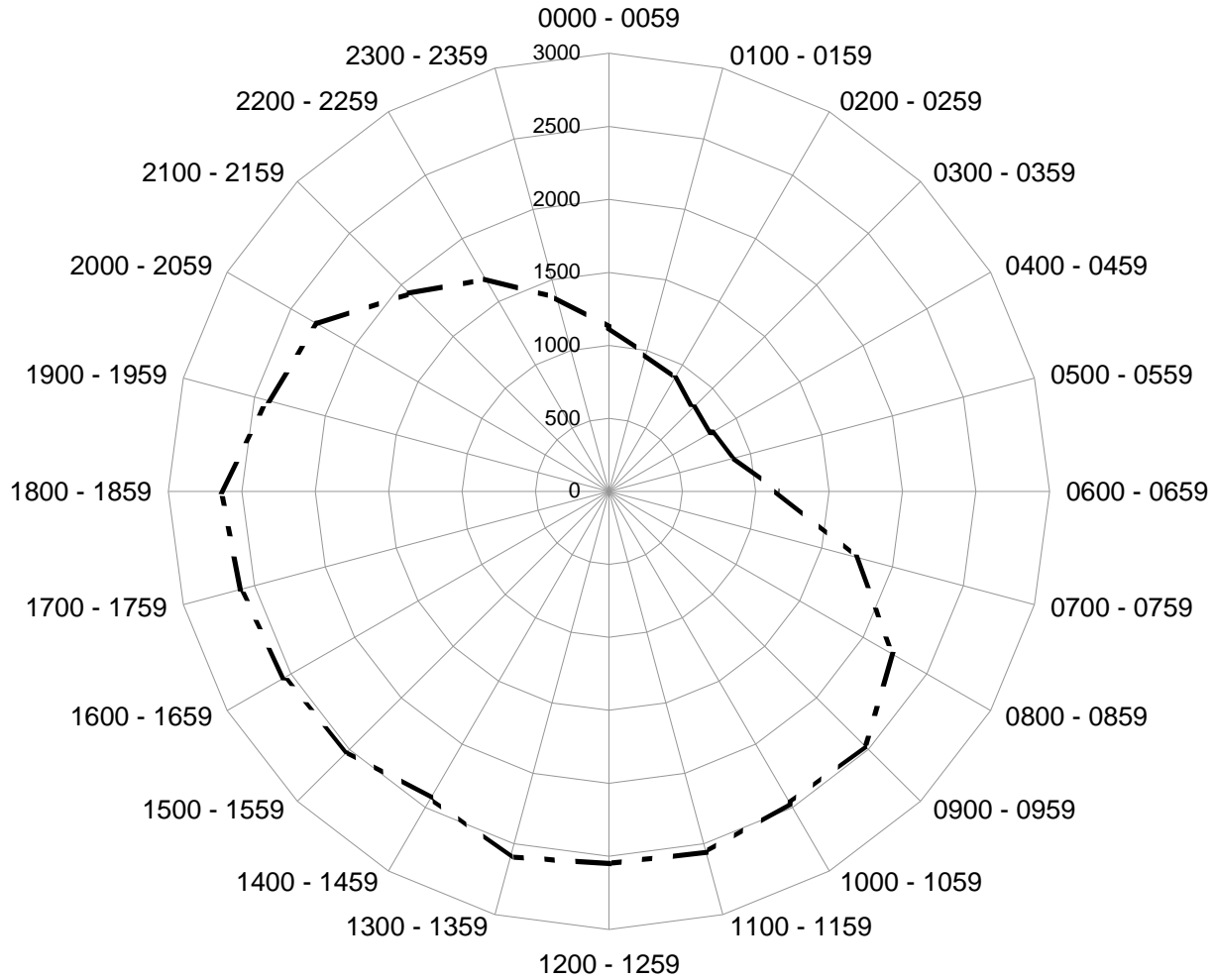
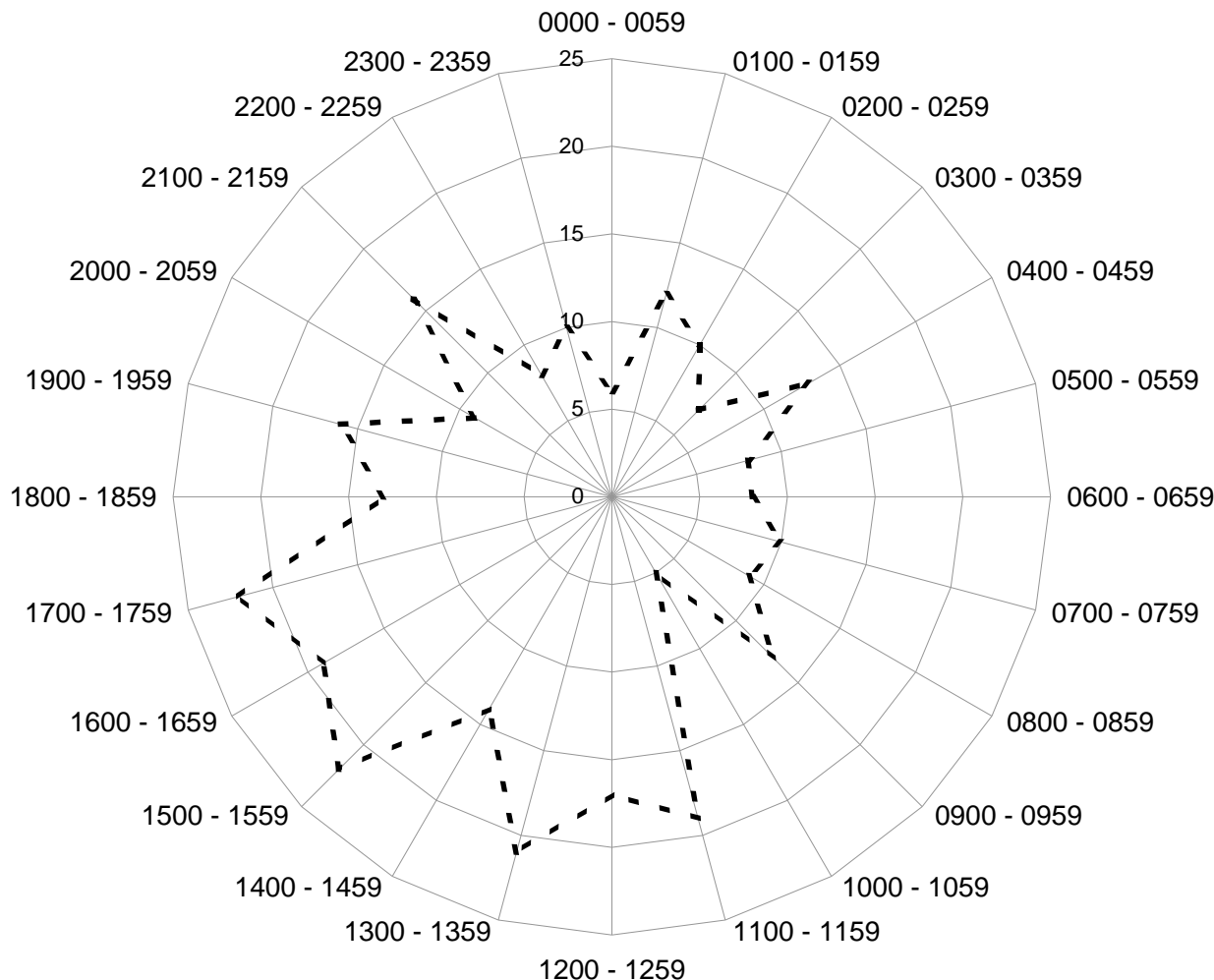


Figure 3-9. Incident Situation Found = Structure Fire, By Hour of Day, 2005–2007



Note: Structure Fires include NFIRS Incident Types 111, 112, 121, 122, or 123 that occurred in TVF&R’s jurisdictional boundary, for all one alarm or greater incidents where the total scene time was 60 minutes or greater in duration.

Because these trends are consistent, most other operational activity also occurs during the daytime hours (e.g., inspections, community service, training), and response impediments such as traffic are at their peak during the daytime hours, the District staffs additional Peak Activity Units (PAUs) from 0700 until 1900 hours, six days per week (see Section 8).

Demand and Probability: Other Factors

It should be noted that any classification of demand and probability dramatically understates the total activity of line response companies. The impact of both the intense training requirements of a multi-role fire and EMS provider and TVF&R’s “community fire station” model, with a focus on prevention and education activities, means that any response-based activity inventory alone fails to account for non-emergent activities that occur throughout the day. For example, an Engine Company responding to an “Invalid Assist” call may, concurrent with assisting the citizen, perform a smoke detector check, fall-proof the house, and distribute other educational materials.

All significant activity is captured on a daily basis in the District’s FireRMS reporting system. CAD response data is automatically entered, and those activities associated with training, prevention, and

community education are entered by the Company Officer. These activities contribute to the station's total workload, which is further defined as "Resource Utilization Ratio" and is covered in Section 8 of this document.

Infrastructure: Transportation Networks

Perhaps the greatest challenge to TVF&R's response performance lies with the transportation network throughout the District. Within the core area of the District, the transportation network is underdeveloped for the population density and increasingly burdened by heavy traffic. Periods of rush-hour congestion are steadily increasing in length, and in some areas, particularly Interstate 5 and Highways 26 and 217, traffic is extremely heavy throughout the daytime hours. Efforts to expand streets and improve traffic flow are limited by constraints on government finances and topography. For example, the Tualatin River divides the District through its middle, and there are currently only four bridges that provide access from the north to the south. Two of these are major transportation routes (Interstate 5 and Highway 99W), and any blockage on either one of these routes significantly impacts emergency movement of apparatus.

While the District openly encourages connectivity and provides regular testimony supporting projects that will enhance emergency response, several factors that slow or obstruct emergency vehicle response are beyond the District's complete control and can only be addressed through regular participation in legislative and community dialogue. For example, the District engaged in a lengthy campaign against "skinny streets," which were attempts by some planners and homebuilders to increase density by significantly narrowing street width. The District produced an educational video that was used to educate policymakers.¹⁷ Typical fire apparatus (Engine and Truck Companies) were filmed trying to negotiate existing narrow streets, especially those where parking inhibited access. Policies now include the approval of some narrow streets, but only if the structures are built with sprinkler systems; street obstructions, including turning radii, are strictly controlled.

Traffic calming devices, such as roundabouts and speed bumps are also being added to many neighborhoods in an effort to reduce residential speeds and provide a safer environment for pedestrians. All these have proven to incrementally slow the response of large fire apparatus, in some cases, as much as 15 seconds for every device that is encountered. Maintaining a balance between safe neighborhood streets and adequate response times is difficult given these circumstances. TVF&R worked with traffic engineers to develop a set of traffic calming standards which have minimal impact on fire apparatus response.¹⁸ The District encourages its governmental agencies to adopt these standards to ensure uniformity across the District.

In addition, using the Deccan International software programs to analyze travel times with street impediments, the District has been able to project the probability of degraded response into a specific neighborhood that is considering installation of devices that don't conform to the adopted calming standards. TVF&R has also designated a partial FTE to manage traffic and transportation issues, which has provided an enhanced level of coordination between the myriad of agencies that control the transportation infrastructure.

Additionally, plans for some major connecting streets have been thwarted by political or environmental concerns. The extreme traffic pressure and subsequent delays that are currently experienced on the District's major north-south arterials would be substantially reduced through the addition of a West-Side Bypass. However, funding problems, legitimate environmental concerns, and resistance to the urbanization of more farmland have currently stalled most of these proposals.

¹⁷ TVF&R Video, "Impact of Traffic Calming Devices on Incident Response," 2003

¹⁸ Traffic Calming Measures, DKS Associates: TVF&R, 2003

Within the last five years, two additional and significant pieces have been added to the District’s transportation infrastructure. The West Side Light Rail now bisects the northern portion of the District. With its associated West Side Light Rail Tunnel (the deepest transportation tunnel in the US), which straddles the TVF&R-City of Portland border, this new transportation service has added another element of significant complexity to TVF&R’s response planning efforts. Additionally, heavy rail service following the Interstate 5 and Highway 217 corridor has started, with over 35 trips per day, which places high-occupancy passenger trains on freight rail lines and further blocks roads at key rail crossing points.

Infrastructure: Buildings

The communities served by TVF&R constitute some of the fastest growing municipalities in the nation. These nine cities in three counties are served by a variety of municipal planning and building organizations. Thus, there is no accurate count of the exact numbers of buildings of various types that exist in the District.

An analysis of tax assessor data from the three counties was processed through TVF&R’s Information Technology Division, using geographic information systems software. In addition, the District’s occupancy database was queried. The number of buildings in the Single Family Residential classification is based on the number of tax lots within the jurisdictional boundary of Tualatin Valley Fire & Rescue with a Land Use designation of “SFR” (Single Family Residential) and a Building Value of greater than \$50,000.¹⁹

The following figures constitute the District’s best estimate of the numbers of buildings protected:

Table 3-12. Buildings by Classification

Classification	Number of Buildings
Single Family Residential	106,274
Multi-Family Residential	(1,328 complexes, various # of units) 4,536
Places of Assembly	599
Offices	(7,346 occupancies) 1,966
Educational Facilities	207
Fabrication & Manufacturing	454
Hazardous Materials	210
Health Care Facilities	29
Mercantile	(1,618 Occupancies) 580
Storage	745
Special Residences (Assisted Living)	52
Total	116,449

Computation and Categorization of Risk: Objective Tools for Structures

As stated earlier, classification of risk is both objective and subjective. Where possible, TVF&R has attempted to use quantifiable analysis to predict risk. In the past, comprehensive risk analyses utilized a standardized tool to stratify risk into more definitive categories and determine the values exposed to loss, the probability of an event occurring, and the consequences that such an event may have on the community. Risk, Hazard and Value Evaluation (RHAVE) analyses were computed on representative structures in each Demand Zone category, and on structures inside of each planning zone (Industrial,

¹⁹ Data Source: Metro Regional Land Information System-RLIS, August 2007 release

Commercial, Residential Low Density, Residential High Density, and Other). These analyses produce a score by which TVF&R measured risk against other, similar communities.

In the past few years, RHAVE analysis has become difficult based on program support and performance attributes. In the most recent process, the District developed its own risk analysis worksheet, with the goal of classifying risk into specific categories.²⁰ This exercise was intended to see if the level of risk associated with buildings inside the District's Demand Zones remained the same as in prior years' analyses.

One significant departure from the previous structural risk analysis conducted in RHAVE is TVF&R's efforts to quantify probability and consequence from historical response data (like EMS, which is not contemplated as a "risk" in RHAVE), and include these figures in the overall risk profile score (Exhibit 7, Risk Analysis Worksheet). The initial process to select structures for targeted risk analysis was developed to capture those buildings that had the highest risk based on previous RHAVE analyses, retrospective data, and Insurance Services Organization (ISO) ratings. The base analysis for the complete study consists of the following:

- 25% of the ISO structures within each Planning Zone type, for each city served.
- 10% of the structures within each Planning Zone with "Moderate" or higher probability scores.
- A random selection of buildings within 25% of the FMZ Quads (BoxPolys, see Section 6) in each Planning Zone.

Computation and Categorization of Risk: Water Supply

TVF&R is served by 18 separate water purveyors, and has varying densities of fire hydrant availability throughout its service area. An ISO re-rating was initiated in the fall of 2004, and statistical data collected at that time indicated there were 11,312 hydrants within TVF&R's service area. Of importance, there were no areas within the Category "A" or "B" Demand Zones without hydrants. Many rural areas within the Category "C" Demand Zone, however, are without piped water supply and Water Tenders must deliver water for fire suppression. A map depicting hydrant distribution throughout the District is regularly updated and available.²¹

Computation and Categorization of Risk: Risk Values

TVF&R believes primary risk falls into four general categories in order of severity: life risk, community economic risk, environmental or historical risk, and pure dollar loss. Examples of these are described below:

Life Risk: Any location that presents a high risk of life loss, such as high-density housing (particularly non-sprinklered and older structures), foster care homes, skilled nursing facilities, hospitals, housing within close proximity to hazardous manufacturing or storage, day-care centers, and schools.

Community Economic Risk: Those facilities that have a high dollar value, and if destroyed or damaged by fire could close or relocate, permanently or temporarily placing a severe economic burden on the community through the loss of jobs and/or tax revenue. This category also includes critical infrastructure of primary importance to the economic health and safety of the community, such as utilities, roads, and bridges.

²⁰ TVF&R Risk Analysis Worksheet, 2004

²¹ ISO Hydrant Map, 2004

Environmental or Historical Risk: Any area where a high risk of severe or permanent environmental damage would likely occur in the event of a fire loss or hazardous material spill, or any structure of significant historical significance to the community.

Pure Dollar Loss: Structures that have a high value but pose a low risk of life loss or community economic impact and are typically fully insured against loss. Examples would be large rural residential and farm structures, and some commercial buildings housing primarily inventory.

Computation and Categorization of Risk: EMS Call Types

Not all requests for emergency medical service require the same level of response. The consequences associated with not arriving in 4–6 minutes on cardiac arrest, trauma, or stroke calls are dire and are further described in Section 4. These are clearly our highest-risk emergency medical events.

In a brief study conducted in 2007, EMS incident severity was analyzed based on the type of call dispatched, and the type of situation found. The study examined data such as the number of critical medical procedures completed during the incident (e.g., airway management, administration of medications) and whether or not the patient was transported. Based upon this review of incident outcomes (consequences), our initial theory concludes that there is a much lower risk associated with certain call types. Therefore, further research will be conducted on EMS call severity and may be used as a method for stratifying risk and determining the necessary speed and weight of an EMS response (see Section 12).

Computation and Categorization of Risk: Demand Zones

Many fire departments classify risks according to a graded system which uses defined terms such as “maximum risk,” “high risk,” “moderate risk,” etc., to classify portions of the areas they protect, and to base response programming on those classifications.

Tualatin Valley Fire & Rescue has evaluated its risk profile and classified its service area into three distinct Demand Zones, which are based on the predominant **Demand, Type of Risk, Probability,** and **Consequences** within each Demand Zone.

Category “A” Demand Zone

All areas classified as Category “A” lie within the Urban Growth Boundaries (UGB) established by Metro (see FMZ Quadrant map, Exhibit 8). These areas typically have a fairly high density of industrial, commercial and residential structures. Category “A” Demand Zones have the following characteristics:

- All areas within the zone currently have or eventually will be built out with structures associated with a “Typical” to “Extreme” risk profile (see TVF&R Risk Analysis Worksheet, Exhibit 7).
- High demand. Over 90% of all demand originates within the Category “A” Demand Zones.
- Special risk properties (e.g., HazMat). 98% of all special risk properties are within this category.
- Population density. Because of the UGB, population densities are highest within the residential and commercial areas inside this zone.
- Elevated consequences. The majority of life, community economic, and environmental risks lie within the Category “A” Zone.

The District will expand its Category “A” area concurrently with expansions of the UGB, or when the existence of new infrastructure or other risk factors demand a higher level of service.

Category “B” Demand Zone

Areas classified as Category “B” by TVF&R include mainly rural property outside the current UGB, and structures associated with a “Low” to “Typical” risk profile. Category “B” areas also include some areas within the UGB, but current road infrastructure does not allow for Category “A” zone response times. Also classified as Category “B” are areas that historically were provided greater fire protection by TVF&R antecedent districts than the risks and demands might have warranted.

Because some of these areas contain substantial valuable property of relatively low density and low risk (e.g., five acre and 20 acre “mini-estates”), and because TVF&R has tried to provide a consistent service level to its constituent citizens and communities, TVF&R will continue to attempt to provide a level of coverage which may exceed actual risk and demand. These decisions may be revisited depending on the District’s ability to maintain staffing in high-volume and higher-risk areas.

Category “C” Demand Zone

Areas classified as Category “C” are the truly rural areas of the District. These areas contain primarily agricultural land and associated structures with risk profiles in the “Low” to “Typical” range. For the most part, these areas are not served by municipal water systems, nor are they equipped with fire hydrants.

In addition to these designations, TVF&R has conducted a special assessment of its wildfire hazard locations. These locations have been identified, mapped, and the information made available to our dispatch agencies and adjoining providers. Generally these areas conform to our Category “B” and “C” response areas, although there are pockets of wildland-urban interface hazard area within the Category “A” Demand Zone (consistent with statewide efforts to maintain forested and open space areas even within cities).

Computation and Categorization of Risk: Specific Risk Areas within TVF&R

Because tax limitation measures have significantly impacted the District’s ability to build new infrastructure and add staffing commensurate with incident and territorial growth, there are specific areas within the District that present a “Special Risk,” and that have substandard emergency response (Distribution and Concentration, see Sections 6 and 7) until the necessary infrastructure and staffing can be added. These areas are identified in Exhibit 9, and are further defined below:

Gaarde Road-Bull Mountain: Development on Bull Mountain is dense, with large homes built alongside steep canyons. These canyons are thick with trees and dense natural undergrowth, and in many places the interface between the natural areas and hillside homes is less than 20 feet. In addition, street connectivity in the area is poor, with streets separated by natural buffer zones. Exhibit 9, a map showing both Distribution and Concentration performance over the past three years in the area, clearly indicates that this area, although entirely within the Category “A” Risk Zone, receives service that is inequitable compared with other Category “A” areas. The District is currently addressing this through the construction of a new fire station (Station 50) on SW Walnut Street near Gaarde Road. Construction is slated to be complete by December 2008, and a 4-person Engine Company will be placed in that location.

Bethany-Springville: The Bethany Hills area is the most significant expansion of the UGB occurring within TVF&R’s service area in the last several years. Totalling over 700 acres, the first 109 acres has been zoned “R-9,” for a density of nine living units per acre. While the entire area is eventually

targeted to be within the City of Beaverton, currently it is unincorporated and being planned by Washington County. The county estimates that when fully developed, over 10,000 new residents will live within the Bethany Hills developments. Current distribution and concentration in the area is below District baseline performance. This is based on travel distances, transportation infrastructure, and the current location of District facilities. Additionally, two of the first-due fire units on structural fires in this area are currently only staffed at three firefighters per shift, affecting concentration for Total Effective Firefighting Force (TEFF). The District has recently purchased property on NW Springville Road, with the intention of building a new station when the Bethany development occurs.

Stafford Basin-East Tualatin: The area between Stafford Road and the portion of the City of Tualatin that lies east of Interstate 5 is rapidly developing. While portions of this area are currently outside the UGB, there is heavy pressure for development in the region. Transportation gridlock, which occurs a good portion of the day in downtown Tualatin, adversely affects the travel time of Station 34, geographically the closest unit to east Tualatin. In addition, the area has extended Truck Company response. From 65th Avenue east, travel times are outside District baseline performance for all types of emergencies. Because of extended travel time from existing stations, the lack of multi-company depth, and three-person staffing at two stations serving the area, there are both distribution and concentration problems with resolutions proposed in Section 12.

Central Aloha-West Beaverton: The area surrounding approximately SW 170th Avenue and Tualatin Valley Highway is outside the preferred distribution network of nearby fire stations. Box-area Automated Run-card Builder (BARB), a Deccan International software program used by the District to build impedance-based First-Due Areas, indicates that travel times to this area are typically longer than 4.5 minutes. CAD Analyst confirms that this area, dense with apartments, single family homes, and small businesses, remains underserved for both distribution and concentration (see Exhibit 9, concentration and distribution performance map of Aloha for 2004–2007). Additionally, the stations surrounding this area are some of the busiest in the District. Concentration is difficult because response reliability at nearby stations remains marginal.

Sherwood: Over the past five years, the City of Sherwood has been among the fastest growing communities in the state. Development has been particularly dense, with small lot developments, multi-family dwellings, and “row houses” becoming the predominant type of structures being built. Additionally, main arteries through the city have been widened, and both commercial and industrial development has followed. While most of the current development is within the preferred travel time network of the existing fire station, the city lacks concentration for “second tier” incidents and structure fires, and has extended Truck Company response.

Garden Home-Raleigh Hills: A recent performance analysis that was undertaken with the City of Portland Fire & Rescue (PF&R) demonstrated that both TVF&R and PF&R have distribution problems in the Raleigh Hills-Garden Home area. This area straddles the border between PF&R and TVF&R, and the closest fire stations are in Sylvan (PF&R), West Slope (TVF&R), Progress (TVF&R), and Hillsdale (PF&R). All stations are outside of the desired travel time into this area (an area generally bordered by SW Beaverton Hillsdale Highway on the north, SW 87th Avenue on the west, Garden Home/Multnomah on the south, and SW 45th on the east). A geospatial and incident demand analysis by both PF&R and TVF&R indicated that a station situated near the intersection of SW Vermont Street and SW Shattuck Road would satisfy the distribution issue and improve performance in the area to within baselines set by both fire agencies. To that end, TVF&R and PF&R have signed a memorandum of understanding that further discussions will ensue related to the possibility of co-building and co-staffing a fire station in that area (see Exhibit 10).

These deficiencies are individually addressed within the goals statements in Section 12.

Summary

TVF&R's risk profile has changed in the last five years. While the "typical" emergency event continues to be a medical call during the daylight hours in the Category "A" response zone, the increase in population age and density, coupled with infrastructure and transportation obstacles have resulted in higher risk. Time-on-task, travel time, and utilization ratios have been amplified in direct proportion to the increase in event acuity, call queuing, non-emergency demand, and traffic congestion.

Based on this risk analysis, TVF&R should expect a steady increase in the number of emergency medical events, an increase in the severity of medical calls that will equate to longer "out of service" times for the response units, and a steady number of structure fires. Even though more multi-family housing units are built with fire suppression systems, structural fire life risk is predicted to increase in greater proportion to the actual number of fires due to the aged population and the number of non-English speaking immigrants who are moving into the region.

Risk assessment associated with the probability and impact of major events (e.g., earthquakes, weather crisis) is outlined in Section 11.

SECTION 4: TIME AND ON-SCENE PERFORMANCE EXPECTATIONS

An effective emergency response force is committed to the safe, rapid, and effective performance of critical tasks. Given the risk profiles established in Section 3, time and on-scene performance expectations are the targets established for operational elements (individuals and response companies) that comprise TVF&R. minimum task performance standards, and required performance times have been established by TVF&R and are assessed annually through company evaluations.

These performance standards reflect and frequently exceed many essential competencies established by the National Fire Protection Association (NFPA), Occupational Safety & Health Administration (OSHA), Center for Public Safety Excellence's Commission on Fire Accreditation International (CPSE/CFAI), the American Heart Association, the National Registry of EMTs, and other organizations.²² In some cases, which are clearly noted in this document, response performance baselines and adopted benchmarks for TVF&R are currently lower than nationally accepted guidelines. The risk-benefit associated with the District's adopted performance benchmarks are based on the risk analysis and on the overall economic ability to eventually achieve stated goals.

Ultimately, the District's Board of Directors reviews the performance baselines and benchmarks on an annual basis and determines whether they meet the public's expectations for emergency service. Responsibility to determine safe and effective on-scene performance parameters and make recommendations to the policy makers rests with TVF&R's Line Personnel and Management Staff.

Cascade of Events: The Response Time Continuum

The CPSE/CFAI has defined response time elements as a cascade of events. This cascade is similar to that used by the medical community to describe the events leading up to the initiation, mitigation, and ultimate outcome of a cardiac arrest. Throughout this discussion, it is imperative that the reader keep in mind that some of the intervals described can be directly influenced by the fire service (reflex interval and travel interval), while others can be influenced indirectly (discovery and notification interval through public education and engineering initiatives, call processing interval through its ability to define standards and compel performance by its dispatch centers).

Measures

Careful definition of terminology is essential to any conversation about response performance. It becomes even more critical when an organization attempts to benchmark its performance against other providers. The following definitions are standardized for discussion of response performance parameters within TVF&R.

Time Points and Time Intervals: The Cascade of Events

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

Event Initiation Point: The point at which factors occur that may ultimately result in an activation of the emergency response system. Precipitating factors can occur seconds, minutes, hours, or even days before a point of awareness is reached. An example is the patient who ignores chest discomfort for days until it reaches a critical point, at which time he/she makes the decision to seek assistance (point of awareness). It is rarely possible to quantify the point at which event initiation occurs.

²² NFPA 1710, OR-OSHA Standards for Firefighting, AHA Cardiac Arrest and CVA Data 2004

An interval that shall be termed the **discovery interval** lies between the event initiation point and the emergency event awareness point.

Emergency Event Awareness: The point at which a human being or technologic “sentinel” (e.g., smoke detector, infrared heat detector) becomes aware that conditions exist requiring an activation of the emergency response system. This is considered the point of awareness.

Alarm: The point at which awareness triggers an effort to notify the emergency response system. An example of this time point is the transmittal of a local or central alarm to a public safety answering point (PSAP). This time period is typically not captured in a method where it can be measured with any accuracy.

An interval that shall be termed the **alarm transmission interval** lies between the awareness point and the alarm point. This interval can be significant, e.g. the alarm is transmitted to a distant commercial alarm monitoring organization which then retransmits the alarm to the local 9-1-1 and dispatch facility.

Notification: The point at which an alarm is received by the public safety answering point (PSAP). This transmittal may take the form of electronic or mechanical notification received and answered by the PSAP.

Call Processing Interval: The interval between the first ring of the 9-1-1 telephone at the dispatch center and the time the CAD operator activates station and/or company alerting devices. This can, if necessary, be broken down in to two additional parameters: **call taker interval** (the interval from the first ring of the 9-1-1 telephone until the call taker transfers the call to the dispatcher) and **dispatcher interval** (the interval from the time when the call taker transfers the call to the dispatcher until the dispatcher, or CAD operator activates station and/or company alerting devices). TVF&R’s primary PSAP, the Washington County Consolidated Communications Agency (WCCCA) has established a performance standard of 60 seconds for total call processing time (including dispatch time).

Reflex or Turnout Interval: The interval between the activation of station and/or company alerting devices and the time when the responding crew activates the “responding” button on the mobile computer terminal or notifies WCCCA by voice that the company is responding. During the reflex interval, crews cease other activities, don appropriate protective clothing, determine the location of the call, and board and start the fire apparatus. It is expected that the “responding” signal will be sent via Mobile Data Terminal (MDT) when personnel are aboard the apparatus, buckled in, wearing the appropriate safety gear, and the apparatus is placed in gear and begins its response.

Current NFPA guidelines (NFPA 1710) indicate that fire departments should be achieving a reflex time no greater than 60 seconds, 90% of the time, 24 hours a day. Comprehensive analysis and testing by TVF&R Operations and Information Technology staff have found the 60-second standard reflex time to be unrealistic, particularly on incidents that require firefighters to don protective clothing. Additionally, fire station design, apparatus design, station security concerns (automatic opening and closing doors), safety regulations (seatbelts), and mapping (either checking wall maps or waiting a few moments for the MDT to compute the route) have all been noted to adversely affect reflex time.

In 2003, 2004 and 2007, TVF&R undertook a comprehensive series of studies to determine what factors, both technological and human, affected our reflex times. In Exhibit 11, there is a brief outline of several Reflex Time Studies that were conducted by the District’s Operations Quality Improvement Committee. In addition, copies of the Special Notices, monthly Reflex Time Reports, stop-watch analyses, and quality improvement summaries are included. These indicate reflex times are

adversely affected by technological barriers (lack of communication towers, slow MDT capture, pager activation delays); human factors (awareness, protective clothing donning, sleep cycles); and system issues (apparatus door activations, mapping software, station designs).

The result is that TVF&R is still not certain what constitutes “best performance” that can be achieved for reflex times on a 24-hour, call-specific basis. As the testing, refinement, and research continues, the District has set an interim reflex time baseline of one minute, thirty seconds (1:30) at the 75th percentile for all Code 3 at en route responses, regardless of type, that occur during “daytime” hours (0700–2159 hours).

En Route Time: The point at which the responding apparatus signal the dispatch center that they are responding to the alarm.

Travel Interval: Begins at the termination of the reflex interval, and ends when the responding unit notifies the dispatcher unit that it has arrived on scene (again, via voice or MDT notification). It is expected that the Company Officer will signal “arrival” when the apparatus has stopped movement and parked at the incident address, or when the apparatus has arrived in a staging area.

Response Time (Response Interval): Includes those elements directly under the control of the fire service (reflex time plus travel time).

Arrival (or On-Scene) Time: The point at which the responding unit arrives on scene. Arrival is determined by actual physical arrival in front of the address or at the address of the emergency as displayed by CAD.

Initiation of Action or At Patient Time: The point at which operations to mitigate the event begin. This may include size-up, resource deployment, patient evaluation, etc. This may be variable, considering access problems associated with high-rise buildings, malls, and incidents where terrain must be traversed in order to reach the patient.

Termination of Incident: The point at which a unit(s) has completed the assignment and is available to respond to another request for service. This is marked in CAD either by the Company Officer signaling via radio that the unit is back in service, or by sending a “returning” signal via the MDT.

Customer Interval: TVF&R has derived this measure as an indicator of the customer’s perception of the performance of the emergency service system. It includes those factors that, in the customer’s perception, reflect the performance of the fire service whether or not the fire service directly controls those elements. This interval adds the call-processing interval to the response interval.

Current Externally Imposed Standards and Guidelines

Prior to the CPSE/CFAI accreditation process in 1999, the District had no formally adopted response performance objectives. With the original Standards of Coverage developed in 1999, TVF&R began the process of risk analysis and setting fractile performance standards that allow comparative evaluation between agencies.

External guidelines exist in the form of NFPA 1710² materials that are instructive for both reflex and travel time performance on a fractile basis. These, in turn, were developed by a committee that analyzed existing studies on fire spread, firefighter safety, and cardiac survival. Importantly, NFPA 1710 states that fire departments will have a deployment plan, and in addition, that they will address areas where response performance is deemed substandard through an explanation of the relevant factors.

In addition, Federal OSHA and State of Oregon OSHA rules dictate firefighter safety and have established minimum standards associated with communications, safety officers, incident command, equipment, and most significantly, parameters on when firefighters can enter Immediately Dangerous to Life and Health (IDLH) environments.²³

The IDLH staffing requirements, known in the fire service as “2-in, 2-out,” are a driving force in the development of fire unit staffing that can meet search and rescue objectives with the first-due fire unit.

Time-Temperature Curve

The time-temperature curve standard is based on data from the NFPA and the Insurance Services Organization (ISO), which have established that a typical point source of ignition in a residential house will “flash over” at some time between three and 30 minutes after ignition, turning a typical room-and-contents fire in to a structural fire of some magnitude.

While the utility of the time-temperature curve for determining response time intervals is somewhat limited, there is significant evidence that because fire grows exponentially, early intervention is critical in order to limit property loss and save lives. In order to address criticisms that may exist in using the time-temperature curve as one element of response time performance, it is important to identify weaknesses in the strategy.

1. It does not account for the time required for the existence of a fire to be “discovered” and reported to the fire department via the 9-1-1 system. While this is true, it can be viewed as adding credence to the science behind exponential fire growth. The longer the fire goes undetected, the larger it will become.
2. The time from ignition to flashover varies widely (3–30 minutes depending on building characteristics); thus it cannot provide a valid basis for the allocation of resources. While the time does vary according to the studies, “waiting for flashover” is an undesirable strategy. Ideally, the fire will be under control well before it reaches the flashover stage, and the majority of room-and-contents fires consist of combustible materials that share fuel characteristics extremely similar or identical to the studies associated with the lower part of the curve (e.g., median is five to nine minutes until flashover with an air source).
3. The curve is constantly shifting, given the numerous changes in building construction, built-in suppression systems, and the increased use of fire-resistive materials for furniture and other items typically found in the interior of occupied buildings. The curve does shift, but the argument assumes building construction techniques and fire suppression systems currently have a significant impact on fire spread within the District. In fact, the majority of TVF&R’s structure fires are in single-family dwellings, multi-family housing, and/or smaller commercial buildings that do not have built-in fire suppression systems and have contents that are not at all fire resistive (and may actually contribute to faster fire spread).²⁴
4. Fires of this type (involving flashover or potential flashover) involve less than 5% percent of TVF&R’s total responses. TVF&R is not able to quantify how many flashovers have been avoided because the first-due unit arrived quickly and effectively extinguished the fire or controlled it until other units could arrive. Retrospective analysis of this type of data would require subjective judgments related to whether the fire *would have* or *could have* flashed over if the fire had been left unattended for a period of time. An analysis demonstrating that less than

²³ OSHA 29 CFR 1910, and NIOSH 1994 CDC Guidelines on firefighter accountability.

²⁴ 2005 and 2006 Fire Experience Data, TVF&R

5% of total fires resulted in flashover could actually lend support to faster response times, based on the premise that first-due companies arriving within a short time frame were able to mitigate the emergency before it got worse.

Because the risk analysis indicates the majority of fires within TVF&R's area are likely to continue occurring in single-family or multi-family homes that do not include fire suppression or detection systems, the time-temperature curve remains relevant when discussing probable outcomes related to unchecked fire spread.

Critical Emergency Medical Time Elements

In communities like TVF&R, where the fire service is the principal provider of EMS first response, the **chain of survival** standard developed by the American Heart Association often is used to provide guidance for response performance. The chain of survival suggests that basic life support (CPR and defibrillation) should be available to the victim of a cardiac arrest within four minutes of the event, and that advanced life support (Paramedic service) should be available within eight minutes or less of the event. Early notification of emergency response services is thus paramount to successful resuscitation efforts. Recent statistics have shown a 16% decrease in survival for every minute that passes without CPR being performed.

Because cardiorespiratory arrest calls constitute a very small percentage of TVF&R's emergency responses (0.8%), it can be difficult to argue that millions of dollars in resources should be deployed for such a small factor. However, there are other, more recent studies that indicate early response by EMS is critical to limiting morbidity and mortality. For example, the statement "time is muscle" is often used to graphically indicate that the longer cardiac ischemia goes undetected or untreated, the more cardiac muscle is damaged. Response times that allow the arrival of Paramedics within six minutes who can initiate a 12-lead electrocardiogram (ECG) analysis, provide oxygen, and administer cardiac medications are important to limiting morbidity. TVF&R's Paramedics have significantly reduced the time it takes for a patient to reach the Cardiac Catheterization Lab (Cath Lab) by conducting comprehensive assessment and treatment while on scene and during transport, and by transmitting key cardiac information to the Cardiac Cath Lab at Providence St. Vincent Hospital so the lab is prepared for the patient's arrival.

In 2006 and 2007, rapid field 12-lead ECG analysis and early identification of an ST Segment Elevation Myocardial Infarction (STEMI) by TVF&R Paramedics allowed for an average savings of 30–40 minutes in the patient receiving cath lab services. The 30-day statistics for post-MI (heart attack) have consistently demonstrated a decrease in mortality of 1% for every minute saved getting to a cardiac cath lab. The advantages of quick response, early recognition, and appropriate intervention are objectively quantified.

In addition, recent studies related to stroke patient mortality and long-term morbidity have indicated that fast response and transport are critical to achieving good outcomes. This, coupled with statistics that validate the importance of rapid response to severe trauma, provide a compelling basis for setting initial medical response benchmarks at six minutes for those calls where studies have demonstrated immediate, life saving interventions can significantly reduce morbidity and mortality.²⁵

²⁵ 2002, 2004, 2006 reports from the Oregon State Health Division, Trauma Services Section.

Time and Interval Description Methodology

While average times and statistical means have some utility, they are not useful measures of performance unless coupled with some measure of central tendency such as the variance or the standard deviation which described the “shape” of the performance curve.²⁶

Because many citizens will have difficulty grasping these statistical concepts, the use of **fractile** or **percentile** analysis is gaining great favor with the operations analysis community.²⁷ Using this methodology, an organization can clearly articulate its performance baselines and benchmarks in a manner that will be easily understood. For example, “The fire apparatus will leave the station within one minute, 30 seconds of alarm activation, at least 80% of time,” is a benchmark that can clearly be understood by everyone.

Other Factors

Response intervals are a critical element in determining optimal fire station location. Statistical analysis generally focuses on the travel time for the first-due company to arrive. While this is certainly an important factor, other factors are equally significant.

Several critical tasks need to be performed during the initial stages of a structural fire: placement of attack lines, ventilation, ladder placement to upper floors and roof, water supply, and search and rescue. In addition to these actions designed to mitigate a structural fire, other tasks such as the placement and staffing of back-up lines are necessary to protect the firefighters inside a hostile environment. The accomplishment of these combined tasks requires the full compliment of apparatus and staffing assigned to a first alarm assignment. More severe incidents or complex incidents such as a fire in a high rise building require that additional alarms be called to ensure that adequate personnel, apparatus, and equipment are on scene to effectively mitigate the incident.

In a broader context, fire station location studies need to analyze regional responses and the impact that adjacent fire station response areas have on each other. Oftentimes the first-due companies may already be committed to previous alarms or are out of their immediate area for a training or public education function. The ability to fill out responses from adjacent fire stations becomes an important factor in determining adequate fire protection.

Response Performance Analysis

Methodology

TVF&R measures response performance using a variety of tools. Primarily, response data is aggregated in the CAD system, with key time intervals (e.g., responding, arrival, returning) electronically encoded via Mobile Data Terminals (MDT) in each apparatus. Where MDT measurements are not available (e.g., At Patient Side, Primary Search Completed) the dispatcher manually encodes the data into the CAD, with an understanding that manually entered data points cannot be measured in seconds because of the variables associated with human data entry.

²⁶ Two fire departments can report the same “average” response time, yet the citizens of the two communities can receive vastly different services. For example, city A, with a four minute average response time, with all response times falling between three and five minutes. City B, with the same four minute response time, could have a few calls with a response time of less than one minute and some calls where the response time was ten or more minutes. Thus the use of “averages” has the effect of concealing rather than clearly illustrating true response performance.

²⁷ In the world of EMS system compliance measures, percentile analysis is also referred to as “fractile analysis.” While not appearing in statistics texts, readers who have heard the term used should understand that it is simply another name for percentile analysis.

Retrospective performance is regularly evaluated using Deccan International's Cad Analyst program and other geo-coded maps generated by the District's Data Analyst at the request of the Operations Division.

All incidents are geo-coded for further analysis. Incident review by incident type, location, risk category, and response interval is regularly conducted, with color-coded maps generated for each Operational Division so that performance is graphically represented.

Data Collection

In past versions of Tualatin Valley Fire & Rescue's Standards of Coverage document, it was our intention to utilize the most objective response performance data set possible. This included methods for exception reporting, data cleaning, and making time adjustments based upon technology anomalies; however, after several years of use and analysis we have concluded that our ability to make a true objective response performance data set is futile. For this revision of the Standards of Coverage, we have elected to report this data set unfiltered, thereby changing our position to now include all raw data in determining our response performance standards (further outlined in the Distribution Statement later in this section). Several key initiatives are in progress that will assist us in increasing our ability to develop an objective data set (see Section 12).

Response Performance Baselines and Benchmarks

TVF&R bases its performance **baselines** and **benchmarks** on several combined factors (see Section 2 for description of baseline and benchmark as adopted by the District). The District's primary mission is to save lives and property. The District's risk profile, community expectations, and objective data associated with fire behavior and clinical survival are primary determinants in setting performance benchmarks. In order to outline the District's rationale and provide context for the current baselines and stated benchmarks, all major factors associated with performance level objectives (both baselines and benchmarks) are detailed within the previous section on Risk Assessment.

For example, in order to effectively initiate a rescue and stop the spread of a fire reported in the incipient or early growth stage, a sufficient number firefighters need to arrive prior to flashover occurring (see Section 5). A variety of research has established that the time between the incipient stage of a typical room-and-contents fire and flashover is between three and thirty minutes, with median flashover time between five and nine minutes (see Section 3, Risk Assessment). Hence, for this critical part of our mission, the ideal arrival time for the first-in unit is *prior to flashover*.

Last, there is the factor of community expectations. While not measurable in a statistical sense, community expectations are typically revealed when an adverse event (or events) brings attention to specific response parameters. For example, a particularly bad fire may shed light on how long it takes to muster the Total Effective Firefighting Force (TEFF). Local community reaction, tied with regional and national comparative analyses that typically follow these types of events will help frame customer tolerances for those who set policy.

DISTRIBUTION STATEMENT

Based on the risk analysis in Section 3, and the response performance parameters discussed in this section, TVF&R will distribute resources to achieve the following response time performance (reflex interval plus travel interval). The first-due units shall be capable of advancing the first line for fire control, initiating safe search and rescue efforts in IDLH environments even in situations where there is no known rescue, or providing advanced life support on medical incidents.

Category “A”

Current Baseline Performance: For 75% of all reported Code 3 emergency incidents, the first-due unit shall arrive within six minutes, forty seconds total response time.

Benchmark: For 90% of all reported Code 3 emergency incidents, the first-due unit shall arrive within six minutes total response time.

Category “B”

Current Baseline Performance: For 75% of all reported Code 3 emergency incidents, the first-due unit shall arrive within eight minutes, fifteen seconds total response time.

Benchmark: For 90% of all reported Code 3 emergency incidents, the first-due unit shall arrive within eight minutes total response time.

Category “C”

Current Baseline Performance and Benchmark: For 75% of all Code 3 emergency incidents, the first-due unit shall arrive within 13 minutes, 30 seconds.

Table 4-1. Baseline Performance and Benchmarks, All Code 3 Emergency Incidents

	Category “A”		Category “B”		Category “C”	
	Baseline	Benchmark	Baseline	Benchmark	Baseline	Benchmark
Min. & Sec	6:40	6:00	8:15	8:00	13:30	13:30
Dec. Min	6.67	6.00	8.25	8.00	13.50	13.50
Percentile	75%	90%	75%	90%	75%	75%

Retrospective Analysis of Performance

The following table shows TVF&R’s actual system performance for all emergency incidents during calendar years 2005 through 2007.

Table 4-2. Response Performance, 75th Percentile: All Incidents

Zone	2005			2006			2007		
	Min. & Sec.	Dec. Min.	# of Resp.	Min. & Sec.	Dec. Min.	# of Resp.	Min. & Sec.	Dec. Min.	# of Resp.
Category “A”	6:27	6.45	17,019	6:30	6.50	17,409	6:26	6.43	17,303
Category “B”	8:01	8.02	775	8:18	8.30	772	8:05	8.07	776
Category “C”	13:36	13.60	148	13:01	13.01	165	12:49	12.82	141
Overall	6:33	6.55	17,942	6:36	6.60	18,346	6:32	6.53	18,220

NOTE: Time interval from dispatch to arrival for code-3 responses. Incident totals do not include automatic and mutual aid responses to areas located outside of TVF&R’s jurisdictional boundary (e.g., Hillsboro Fire & Rescue, Lake Oswego Fire Department, and Portland Fire & Rescue).

Table 4-3. Response Performance, 75th Percentile: All Incidents 2005–2007 Combined

Zone	Minute & Second	Decimal Minute	Number of Responses
Category “A”	6:28	6.47	51,731
Category “B”	8:07	8.12	2,323
Category “C”	13:10	13.16	454
Overall	6:34	6.57	54,508

NOTE: Time interval from dispatch to arrival for code-3 responses. Incident totals do not include automatic and mutual aid responses to areas located outside of TVF&R’s jurisdictional boundary (e.g., Hillsboro Fire & Rescue, Lake Oswego Fire Department, and Portland Fire & Rescue).

Retrospective Analysis of Performance: EMS Incidents

The following table shows TVF&R’s actual system performance for **EMS incidents** during calendar years 2005 through 2007.

Table 4-4. Response Performance, 75th Percentile: EMS Incidents

Zone	2005			2006			2007		
	Min. & Sec.	Dec. Min.	# of Resp.	Min. & Sec.	Dec. Min.	# of Resp.	Min. & Sec.	Dec. Min.	# of Resp.
Category “A”	6:17	6.28	11,116	6:19	6.32	11,451	6:19	6.31	11,826
Category “B”	7:46	7.76	481	8:00	8.00	488	7:38	7.63	498
Category “C”	12:43	12.71	81	12:04	12.06	76	12:16	12.27	69
Overall	6:22	6.37	11,678	6:24	6.40	12,015	6:22	6.37	12,393

NOTE: Time interval from dispatch to arrival for code-3 responses. Incident totals do not include automatic and mutual aid responses to areas located outside of TVF&R’s jurisdictional boundary (e.g., Hillsboro Fire & Rescue, Lake Oswego Fire Department, and Portland Fire & Rescue).

Table 4-5. Response Performance, 75th Percentile: EMS Incidents 2005–2007 Combined

Zone	Minute & Second	Decimal Minute	Number of Responses
Category “A”	6:18	6.30	34,393
Category “B”	7:49	7.82	1,467
Category “C”	12:16	12.26	226
Overall	6:23	6.38	36,086

NOTE: Time interval from dispatch to arrival for code-3 responses. Incident totals do not include automatic and mutual aid responses to areas located outside of TVF&R’s jurisdictional boundary (e.g., Hillsboro Fire & Rescue, Lake Oswego Fire Department, and Portland Fire & Rescue).

SECTION 5: ON-SCENE OPERATIONS, CRITICAL TASKS, AND THE ESTABLISHMENT OF EFFECTIVE RESPONSE FORCES

On-scene operations, critical tasking, and effective response force analysis are the elements of a standards of coverage study that determine staffing levels, number of units needed, and duties to be performed on the fire scene. A fire department must be able to determine what tasks need to be completed in order to have a positive influence on the outcome of the situation, and the number of personnel and apparatus required to complete those tasks.

Furthermore, in order to provide the safest and most effective response, many of the individual tasks or assignments must be performed not in a linear sequence, but simultaneously. The best analogy would be a race team's Pit Crew. A race team could use only a few people, and perform the individual tasks in sequence, but they would likely lose the race against time. The same concept applies to emergency scene management. In a coordinated operation under the direction of an Incident Commander (IC), simultaneous fire attack, ventilation, water supply, rescue efforts, emergency egress tactics, utility control, and salvage operations are typically far more effective and result in faster mitigation of the emergency.

ON-SCENE OPERATIONS: FIRE

The variables of fire growth dynamics and property and life risk combine to determine the fire scene tasks that must be accomplished to mitigate loss. These tasks are interrelated but can be separated into two basic types: fire mitigation and life safety. Fire mitigation tasks are those related to controlling and extinguishing the fire. Life safety tasks are those related to finding trapped victims and safely removing them from the structure.

The decisions on which tactics to use depend upon the stage of the fire and the threat to life safety. If the fire is in a pre-flashover stage, firefighters can make an offensive fire attack into the building by using hand lines to attack the fire and shield trapped victims until they can be removed from the building. If the fire is in its post-flashover stage and has extended beyond the capacity or mobility of hand held hoses, or if structural damage is a threat to firefighters' safety, the structure is typically declared lost and master streams are deployed to extinguish the fire and keep it from advancing to surrounding exposures. First arriving firefighters may use a transitional "defensive to offensive" strategy (discussed below) to limit or remove an Immediately Dangerous to Life and Health (IDLH) threat while awaiting the arrival of additional resources.

Life safety tasks are based upon the number of occupants, their location, their status (e.g. awake versus sleeping), and their ability to take self-preserving action. For example, ambulatory adults need less assistance than non-ambulatory adults require. The elderly and small children generally always require more assistance.

The key to a fire department's success at a fire is adequate staffing and coordinated teamwork, regardless of whether the fireground tasks are all fire mitigation related or a combination of fire mitigation and life safety.

Tualatin Valley Fire & Rescue utilizes aggressive offensive attacks whenever possible. The first objective is to put a hose line between the victims and the fire and to rescue those victims by removing them from proximity to the hazard. The second is to contain the fire to the room of origin. Through a structured risk management plan, the District has established the following guidelines to provide direction to on-scene personnel engaged in evaluating conditions:

SECTION 5:

1. **We may risk our lives a lot to protect savable lives.**
2. **We may risk our lives a little to protect savable property.**
3. **We will not risk our lives at all to save what is already lost.**

Before on-scene procedures can be established, the initial IC must select an appropriate initial strategy—offensive, defensive, or transitional. In addition, all TVF&R incidents are managed using an established Incident Command System (ICS).²⁸

An offensive strategy is an aggressive interior fire attack. The top priority is rescue of trapped victims. Because the District desires to limit the number of fires that spread beyond the room of origin and to limit fire related deaths and injuries, the aggressive offensive attack is utilized wherever possible, given safety and other relevant concerns.

Importantly, TVF&R has established *Fire & Rescue Protocols* that clearly define safe and effective operating practices for firefighters who enter IDLH environments.²⁹ Firefighters operating in hazardous environments are required to work in teams of two or more, and during initial operations, when only one team is operating, a minimum of four personnel are required prior to entry into any IDLH area. While exceptions to the protocol are allowed under conditions where there is a highly suspected life threat that requires immediate intervention, these situations are uncommon and always trigger a comprehensive post-incident analysis.

On any fire with sustained interior (offensive) operations, TVF&R protocols require that a Rapid Intervention Team (RIT) be immediately available for every point of entry. These teams require a minimum of two firefighters with a complete compliment of equipment and a RIT Pack, which is equipped with extra air, mask, radio, and rescue equipment in the event the RIT is engaged to rescue a trapped or missing firefighter. Ideally, these teams are staffed with three to four firefighters.

Interior operations also require aggressive Truck Company operations. Primary functions are based on making the structure as safe as possible for interior operations. This entails, among other functions, securing the utilities, making multiple egress points, forcing entry and egress if required, managing smoke removal, and conducting primary searches.

A transitional strategy is utilized in the face of changing resource levels or changing fire conditions. A transitional “defensive to offensive” attack may be utilized while awaiting the arrival of sufficient resources to safely mount an offensive attack, to temporarily reduce IDLH, or until a large fire can be “knocked down” sufficiently to permit interior attack. Conversely a transitional “offensive to defensive” strategy may be employed when fire progress renders a building unsafe for continued interior operations.

A defensive strategy is one that allows for no interior fire attack, except as may be necessary to rescue trapped firefighters. No attempts are made to rescue civilian victims because in circumstances where defensive tactics are warranted, victims are presumed to be beyond rescue. Nearly all firefighting is performed from outside the structure with the goal of containing the fire to the initial structure involved.

²⁸ SOG 9.9.1, Incident Management System; and Fire & Rescue Protocols: Dividing an Incident.

²⁹ Fire & Rescue Protocols: Accountability; Fireground Safety; Risk Management; and Two-In/Two-Out & RIT.

Critical Tasks

Critical tasks are tasks that must be conducted in a timely manner by firefighters at structure fires in order to control the fire prior to flashover or to extinguish the fire in a timely manner. Time performance standards associated with accomplishing each critical task are included in the District’s Training Bulletins.

Critical tasks are described below. Allocation assumes that crews are committed to those assigned tasks (worst-case scenario), and would not be available for reassignment until after the balance of the alarm arrives on scene.

Initial Attack (Task Force Response)

The initial fireground actions begin with the arrival of the first-arriving company and continue, sequentially or in parallel, as tasks are completed and additional resources arrive. They include the following:

Table 5-1. Initial Attack Force (IAF)

Task	Residential Box	Commercial	Non-Hydranted
Size-Up and Command	1	1	1
Accountability and Initial Safety Officer	Same as Command	1	Same as Command
Pump Operations, Initial Water Supply	2	2	4
Offensive Fire Attack, IDLH Environment	2-4	2-4	2-4
Initial Attack Force	5-7	6-8	7-9

Initial Support (Total Effective Firefighting Force)

Initial support functions occur slightly later in time than initial attack functions. Typically (but by no means always), the assigned ladder Truck Company and/or other Engine Companies provide them.

Table 5-2. Total Effective Firefighting Force (TEFF)

Task	Residential Box	Commercial	Non-Hydranted
Truck Ops: Force Entry, Search, Utilities, Ventilation, Egress	4	8	4
RIT & EMS	2-4	2-4	2-4
Salvage & Overhaul	2-4	2-4	2-4
Back-up Lines	2	2	2
Rehabilitation	2	2	2
Designated Safety Officer	1	1	1
Subtotal: Initial Support	13-17	17-21	13-17
Initial Attack Force	5-7	6-8	7-9
Total Effective Firefighting Force	18-24	23-29	20-26

Secondary Support

Secondary support functions may be performed by initial response personnel “recycled” after the completion of an initial assignment, by the service/squad Engine Company dispatched on all structure fires, or by units specially called for that purpose when dictated by the situation (e.g., extremely hot weather). Secondary support functions include salvage, overhaul, staffing of the Rehab Division, air supply, etc.

As shown, 18–29 personnel are needed to accomplish the critical tasks necessary to control a typical fire in an efficient and effective manner, using TVF&R’s current staffing configuration.

In the event of a substantial (greater alarm) fire, or on request of a Duty Chief, a designated Incident Management Team comprised of chief officers and other staff is expected to arrive on scene to provide command support. The dispatch of the Incident Management Team provides an IC, Deputy Incident Commander, section chiefs for Logistics and Planning, a Public Information Officer, an additional designated Safety Officer, and other support personnel.³⁰ This relieves the on-scene commander of responsibilities not directly related to command of incident operations. The initial on-scene commander typically assumes the role of Operations Section Chief in the ICS structure.

The fire scene is unpredictable in many ways. While it is possible to state what critical tasks must be accomplished in order to extinguish the fire, it is not always possible to predict how many firefighters it will take to accomplish those tasks. The number of personnel and the amount of equipment necessary to accomplish the critical tasks listed will vary due to the following factors:

- Delayed response.
- Building construction.
- Number of occupants.
- Physical and emotional condition of occupants.
- Extent of fire upon arrival (flashover).
- Built-in fire protection.
- Area of fire involvement.
- Firefighter or civilian injuries.
- Equipment failure.

Tualatin Valley Fire & Rescue has used its experience, knowledge, and call history to determine what constitutes an effective response force. These numbers are accurate for the majority of the working structure fires in Tualatin Valley Fire & Rescue. The need for more personnel may arise on any fire scene at any time. Fire conditions must dictate the response needed for any given fire, even if that response exceeds the requirements listed in this document. The District relies on the experience and professional judgment of its company and chief officers to request additional resources (extra alarms) early in an incident whenever their expertise suggests that those resources might be needed.

³⁰ Reference TVF&R Incident Management Team, Incident Commander’s Manual

ON-SCENE OPERATIONS: EMS

Emergency Medical Services Critical Tasks

Tualatin Valley Fire & Rescue responded to more than 25,000 EMS calls in 2007. These calls included car accidents, childbirth, strokes, heart attacks, difficulty breathing, and cardiac arrests. TVF&R provides EMS first response services, with ambulance transportation being provided by one of two commercial ambulance services.

By virtue of the configuration of the EMS system in the three counties served by TVF&R, each responding ambulance will be staffed with at least one Paramedic. Accordingly, TVF&R staffs every front-line apparatus with a *minimum* of one Paramedic, providing the entire District with Advanced Life Support (ALS) first response service. Where call volume and complexity warrants, TVF&R's goal is to staff those units with a minimum of two Paramedics.

TVF&R routinely responds to EMS calls that require treatment for more than one patient. These calls include vehicle accidents, chemical exposures, construction or industrial accidents, and any other event that occurs with several people in close proximity. Patient conditions can range from minor cuts and bruises to life threatening injuries.

Total Effective EMS Force

Dispatchers are responsible for screening calls to establish the correct initial response. The first fire officer on scene amends the response once conditions have been assessed. Standard operating procedures are used to request adequate personnel. The rule of thumb is one fire company per critically injured patient (ALS), and one fire company per three patients with minor injuries (Basic Life Support [BLS]). A preprogrammed "Second Alarm Medical" response brings a minimum of two additional ALS companies, a Duty Chief, and notifies the District's EMS Chief and on-duty Incident Management Team.

Table 5-3. Total Effective EMS Force

	Basic Life Support (BLS)	Advanced Life Support (ALS)	Advanced Procedures
General Tasks	PIC, Assessment, Care	PIC, Airway Management, Medication, IV Access, Monitor/Defibrillation, Documentation	PIC, Airway Management, Medication, IV Access, Monitor/Defibrillation, CPR, Documentation, Traffic Safety
Assumed Call Types	Fall, Sick Person, General Medical, Unknown If-Injury Accidents	Stroke, Cardiac (Non-Code), Trauma, Diabetic, Abdominal Pain, Injury Accidents	Code 99, Severe Pediatric, Severe Respiratory w/ RSI, Injury Accident: MPS or Entrapment, Auto/Pedestrian w/ Entrapment
Total Effective EMS Force	2-4	3-4	6-8

ON-SCENE OPERATIONS: SPECIAL OPERATIONS

Special Operations Critical Tasks

The District currently maintains three separate Special Operations Units: a two-vehicle, eight-person Hazardous Materials Team that operates from Stations 34 and 53; a three-vehicle, seven-person Technical Rescue Team that operates from Station 51 (Rescue 51, Truck 51, and Engine 51, with additional vehicles carrying specialty equipment); and a single-vehicle, two-boat, three-person Water Rescue Team operating from Station 59.

Tualatin Valley Fire & Rescue utilizes a two-tiered approach to incidents requiring special operations capabilities.

Each line company has personnel trained to the Operations or similar level in hazardous materials response, technical rescue, and water rescue, along with limited equipment for these functions. Incidentally, many technical and specialist personnel are available on other line companies as a result of promotion and transfer. These companies respond upon dispatch as they would to other emergencies. Upon arrival, they assess whether they can mitigate the emergency with their own resources or if the special tools and expertise of the Special Operations Teams are required.

Special Operations Teams may be dispatched on the initial alarm, or may be requested by first arriving companies based on their size-up of the incident. See *Fire & Rescue Protocols*, Exhibit 12, for on-scene operational guidelines.

Hazardous Materials

When an incident presents a HazMat situation requiring skills/equipment beyond the scope of those trained to the HazMat Operations Level, the HazMat team is dispatched.

While en route, the team communicates via radio and cell phone with the scene IC and various state agencies to begin designing specific operational priorities specific to the incident. Upon arrival, the HazMat Team is designated the HazMat Group under the ICS organizational structure. The team leader confers with the IC to further assess:

- Relevant safety issues and additional resource needs.
- Hot/warm/cold zone designation.
- Product ID determination.
- Life safety/environmental damage concerns.
- Release/spill mechanism and current status.
- Risk/benefit analysis.

Following this briefing, the HazMat Team initiates interventions:

- Recon.
- Determine mitigation plan.
- Defensive and/or offensive operations.
- Field Decon.
- Debriefing/demobilization.

HazMat Team assignments are as follows:

- Team Leader
- Resource
- Entry Team (2)
- Back Up Entry Team (2)
- Safety/Medical

A minimum of one company is necessary to handle Decon responsibilities. Additional crews are used in support roles (as needed): IC/command staff, Decon support, fire suppression standby, ventilation, scene/perimeter control, medical support, etc.

Technical Rescue

The Technical Rescue Team is dispatched on incidents involving significant extrication (vehicular, industrial, etc.), confined space rescue, trench rescue, and high-angle rescue situations, where skill and equipment needs are beyond the scope of the typical line company. Because of the variety of general rescue categories and the numerous variables found within each, the Technical Rescue Team does not have an extensive pre-designated assignment list. Rather, the team leader works closely with the IC to assess the situation, evaluate resource needs, identify relevant safety issues, design an effective extrication/rescue plan, and to implement that plan within an ICS framework. The seven Technical Rescue Team members staff key positions and additional crews fill support roles (as needed): IC/command staff, medical, scene isolation/security, etc. On every scene, however, the following positions are staffed by personnel with Technical Rescue expertise:

- Incident Command Aide (or IC)
- Incident Safety Officer
- Plans Chief
- Logistics
- EMS Branch

Water Rescue

The Water Rescue Team is dispatched on incidents involving the rescue or recovery of victims entrapped or endangered by water. Currently, the Water Rescue Team consists of three on-duty members, with off-duty and associate team members available via pager. Also, the TVF&R Water Rescue Team is a member of a regional water rescue consortium, which augments a member team's efforts with additional teams from neighboring departments.

Most water related rescues can be broken down into one of two categories: surface water rescue and dive rescue. While there are many surface water rescues performed each year, the District has regularly evaluated whether to continue providing the dive component of water rescue, in that save rates for drowning victims in the Portland climate are extremely low (TVF&R and surrounding agencies have not recovered a *submerged* victim *with dive teams* who left the hospital neurologically intact in over ten years of cursory records review). However, because of the number of people using the waterways in the summer within TVF&R's borders, and the advanced skills that dive training imparts, the District has elected to continue (for now) providing dive services. This decision and the full capabilities of the team

are undergoing a comprehensive review this year, which will be completed in advance of the 2009–2010 budget process.

Upon arrival, the Water Rescue Team is designated the Water Rescue Group under the ICS organizational structure. The team leader confers with the IC to further assess the situation and accomplish the following:

- Evaluate resource needs.
- Identify relevant safety issues.
- ID, isolate, and interview witnesses.
- ID victim location.
- Recon area access and launch points.
- Design an effective rescue plan.
- Implement that plan within an ICS framework.

Water Rescue team assignments are as follows:

- Team Leader
- Safety*
- Interviewer*
- Swimmer/Diver
- Backup (2)
- Line Tender*
- Scribe*

*Denotes roles that can be performed by non-team members (with additional training).

ESTABLISHMENT OF AN EFFECTIVE RESPONSE FORCE

Once critical tasks have been identified and defined, an effective response force can be established. This force is defined as the amount of equipment and personnel that must reach an incident in a specific response zone (location) within the maximum response time. An effective response force should be able to handle incidents within the desired time frames specified in this Standards of Coverage. In order to accomplish this, units must be located close enough to the incident to arrive within the maximum prescribed response time for the full assignment of fire companies according to the risk level of the structure.

The risk of fire, medical emergency, or other emergency event cannot be held to zero. Thus, the objective of this Standards of Coverage study is to identify a balance among distribution, concentration, and reliability that will keep fire risk at a reasonable level while yielding the maximum savings of life and property.

Task Force Response vs. Full Box Alarm Assignment

Retrospective analysis of fire response data conducted over a two year period (2002–2003) indicated that a majority of fires reported to the alarm center ended up in a “recall” prior to the arrival of the TEFF (first alarm assignment of four Engines, one Truck, two chiefs, one squad). First arriving companies

either immediately mitigated the event, or found the situation to be less than a “working fire.” The analysis showed key indicators were typically present when the full Box Alarm assignment was necessary. If the alarm center received high reliability call data (multiple calls, smoke or flames showing, high-risk occupancy, or reported fire in a neighboring building), the fire was generally an “all-hands” event requiring the full first-alarm assignment.

Low reliability data (smell of smoke, smoke in the area, electrical fire, single caller “drive-by” report by cell phone, etc.) was related to fire events that were typically handled by the first arriving Engine and/or Truck Company, with the balance being returned.

Based on this evidence, and in order to more effectively utilize response forces, **Task Force** criteria were developed in 2003, and implemented in January of 2004. The criteria were based on the Initial Attack Critical Task analysis, and include one Ladder Truck, two Engine Companies, and one Duty Chief (for measurement purposes the Initial Attack Force is determined to be on-scene with the arrival of the first five personnel, as stated in the task analysis). The dispatcher can upgrade a Task Force at any time to a full Box Alarm based on receiving additional information. Responding Company Officers and Duty Chiefs can also call for a full Box assignment based on what they hear, read on their MDTs, or their experience with a particular occupancy.

The Operations Quality Improvement Committee is continually evaluating the performance of the dispatch center, and the responding companies to ensure adequate resources are sent in a timely manner when preliminary information indicates the probability for a “working fire” is high.³¹

Table 5-4. Task Force Assignments

	Residential	Commercial	Non-Hydranted
Engine Companies	2	2	2
Truck Companies	1	1	1
Duty Chiefs	1	1	1
Other	0	0	2 Tenders

Standard First Alarm Response: Full Box Assignment

A minimum effective full response force has been determined, based on fire flow capabilities and critical fireground tasks (see above), to consist of four Engine Companies (minimum fire flow capacity 4500 GPM), one Ladder Truck Company, one Utility Squad/Engine, two Duty Chiefs, and one Investigator.

In areas without hydrants, the standard response is augmented with Water Tenders to meet the additional anticipated needs for water supply.

Where the alarm involves actual or potential wildland fire, light or heavy Brush Units may accompany their assigned Engine Companies or may be special called, based on “Red Flag” warnings, information available at dispatch, or upon the arrival and size-up of initial units. “Red Flag” conditions cause the District to staff extra Brush Units (Rescue personnel move into light Brush Units), and special Wildland Fire Box Alarms are struck, bringing appropriate apparatus.

³¹ A “working fire” is a room-and-contents fire, or a structural fire. This designator is typically used when flames are evident, or when fire and smoke has significantly damaged the structure and/or contents.

SECTION 5:

Table 5-5. Full Box Assignment

	Residential	Commercial	Non-Hydranted
Engine Companies	4	4	4
Truck Companies	1	2*	1
Squad (Rehab-Air)	1	1	1
Duty Chiefs	2	2	2
Investigator	1	1	1
Other	1 Ambulance	1 Ambulance	2 Tenders, 1 Amb.

NOTE: A second Truck is not automatically added by dispatch, but the Duty Chief has discretion to add a second Truck and often does, depending on the target.

Special Risk/Hazard Response

For a special risk or hazard area, the initial standard response (regardless of Demand Zone rating) may be augmented by responding company or command officers based upon the pre-incident plan specific to the hazard. Augmentation may include the dispatch of any District resources deemed appropriate for the mitigation of the reported incident.

Where incident notification clearly indicates that the incident involves hazardous materials beyond the management capability of the initial response company, the District’s Hazardous Materials Team may be dispatched. Or, an IC may request that the HazMat Team respond when in they judge that the situation requires their special expertise or equipment.

Where incident notification clearly indicates the need for technical rescue services, the District’s Technical Rescue Team may be dispatched. An IC may special call this team when needed, and the Heavy Rescue (which carries all initial response technical rescue equipment) has discretion to self-dispatch on calls where information suggests their presence may be beneficial. In addition, all Ladder Truck Companies carry a smaller compliment of technical rescue equipment, and Truck personnel are cross-trained to the Technical Rescue Operations Level.

Ten Engine Companies carry a lighter compliment of rescue tools, the placement of which is based on an annual analysis of incident data. Extrications taking longer than 20 minutes are geo-coded and represented on a map of the District that shows all major and minor arterials. The static deployment of existing Trucks and the Technical Rescue Team is taken into account, with the goal being that an initial extrication tool and team (heavy or light compliment) reaches the scene within eight minutes from the time it is requested (if one is not present on the first-in unit).

CALL TYPES AND EFFECTIVE RESPONSE FORCE

Now that critical tasks have been determined and an effective response force for Tualatin Valley Fire & Rescue has been defined, a review of dispatch call types can be conducted. TVF&R uses the following dispatch types:

Call Types

Public Service

- 1 Engine, 1 Truck

Alarm System Activation

- 1 Response Unit

Non-Structure Fires

- 1 Engine

Residential Fire³²

- Task Force: 2 Engines, 1 Truck, 1 Duty Chief
- 1st Alarm: 4 Engines, 1 Truck, 1 Utility Squad/Engine, 2 Duty Chiefs, 1 Ambulance, 1 Investigator
- 2nd Alarm: 4 Engines, 1 Truck, 1 Utility Squad/Engine, Investigator, PIO
- 3rd Alarm: 4 Engines, 1 Truck, 1 Utility Squad/Engine, District Incident Management Team

Commercial Fire³²

- 1st Alarm: 4 Engines, 2 Trucks (Duty Chief discretion), 1 Utility Squad/Engine, 2 Duty Chiefs, 1 Ambulance, 1 Investigator
- 2nd Alarm: 4 Engines, 2 Trucks, 1 Utility Squad/Engine, Investigator, PIO
- 3rd Alarm: 4 Engines, 1 Truck, 1 Utility Squad/Engine, District Incident Management Team

Target Box (High-Rise, High-Risk Occupancy)

- 1st Alarm: 8 Engines, 2 Trucks, 1 Utility Squad/Engine, 2 Duty Chiefs, 1 Ambulance, 1 Investigator.
- 2nd Alarm: 4 Engines, 2 Trucks, 1 Utility Squad/Engine, Investigator, PIO

Brush Fire (Extreme-Red Flag Conditions)

- 1st Alarm: 4 Light Brush Units, 1 Heavy Brush Unit, 2 Engines, 1 Utility Squad/Engine, 2 Water Tenders, 2 Duty Chiefs, 1 Ambulance
- 2nd Alarm: 2 Brush Units, 1 Heavy Brush Unit, 4 Engines, 1 Utility Squad/Engine, 2 Water Tenders, Investigator
- 3rd Alarm: 3 Brush Units, 4 Engines, 2 Water Tenders, Air Unit, District Incident Management Team

Brush Fire (Wildland Fire Season)

- 1st Alarm: 2 Brush Units, 2 Engines, 1 Utility Squad/Engine, 1 Water Tender, 1 Duty Chief
- 2nd Alarm: 2 Brush Units, 2 Engines, 1 Utility Squad/Engine, 1 Water Tender, 1 Ambulance
- 3rd Alarm: 3 Brush Units, 4 Engines, 2 Water Tenders, Air Unit, District Incident Management Team

³² When an incident occurs in an area without hydrants, two Water Tenders are included on each Residential or Commercial Alarm.

Brush Fire (Non-Fire Season)

- 1st Alarm: 1 Brush Unit, 1 Engine, 1 Duty Chief
- 2nd Alarm: 1 Brush Units, 1 Engine, 1 Water Tender
- 3rd Alarm: 3 Brush Units, 4 Engines, 2 Water Tenders, Air Unit, District Incident Management Team

Emergency Medical Services

- 1st Alarm: 1 Engine or Truck, 1 Ambulance (private firm)
- 2nd Alarm: 2 Response Units (Engine/Truck/Rescue), EMS Chief and District Incident Management Team notified.

HazMat Incident

- 1st Alarm: HazMat Team, 4 Engines, 1 Truck, 1 Utility Squad/Engine, 2 Duty Chiefs, 1 Ambulance
- 2nd Alarm: 4 Engines, 1 Truck, 2 Utility Squad/Engines
- 3rd Alarm: 4 Engines, 1 Truck, 1 Utility Squad/Engine, District Incident Management Team

Technical Rescue Incident

- 1st Alarm: Technical Team, 3 Engines, 2 Trucks, 1 Utility Squad/Engine, 2 Duty Chiefs, 1 Ambulance
- 2nd Alarm: 4 Engines, 1 Truck, 2 Utility Squad/Engines
- 3rd Alarm: 4 Engines, 1 Truck, 1 Utility Squad/Engine, District Incident Management Team

Water Rescue Incident

- Water Rescue Team, 1 Engine, 1 Truck, 1 Duty Chief, 1 Ambulance

SECTION 6: DISTRIBUTION OF RESOURCES

The term “distribution” describes the resource locations needed to minimize and terminate emergencies by assuring a sufficiently rapid first-due response deployment. Distribution is measured by the percent of the jurisdiction covered by first-due units within the adopted response time benchmarks. Units must be placed (or distributed) in a manner that ensures the maximum travel time to an emergency will not generally exceed four minutes, 30 seconds using an impedance-based map.

TVF&R has used a multitude of factors, including typical benchmarks (fire flashover and defibrillation success times), as well as a sophisticated geospatial analysis of its performance for determining the maximum allowable travel time in each Demand Zone (see Section 3 for risk analysis, and Section 4 for on-scene performance). Several formal station location studies (incorporated herein by reference) have been conducted over the last few years, but all recent resource placement decisions have been based on the analyses contained within this Standards of Coverage.

Currently, TVF&R operates out of 22 stations located in two Battalions: North and South. Staffing minimums are represented as the number of personnel per shift (24-hour), and total number of personnel assigned to that station. For example, 4/12 represents 4 per shift, with 3 shifts, which equals 12 total FTE (PAU companies are an exception to this model). “Alternate” staffing below typically indicates that on-duty crews have received special training on the alternate units and are expected to “swing” to that unit and respond depending on the incident type.

NORTH BATTALION: 11 STATIONS

Career Stations: 9

Station 53—Progress

- Engine 53 (Minimum Staffing: 4/12)
- Rescue 53 (Minimum Staffing: 2/6)
- HazMat 53 (Alternate Staffing)

Station 60—Cornell Road

- Engine 60 (Minimum Staffing: 3/9)
- Light Brush 60 (Alternate Staffing)

Station 61—Butner Road

- Telesquirt 61 (Minimum Staffing: 4/12)
- PAU Rescue 61 (Minimum Staffing: 2/4)

Station 64—Somerset

- Engine 64 (Minimum Staffing: 4/12)
- Light Brush 64 (Alternate Staffing)
- Water Tender 64 (Alternate Staffing)

Station 65—West Slope

- Engine 65 (Minimum Staffing: 3/9)
- Medic 65 (Alternate Staffing)

Station 66—Brockman Road

- Engine 66 (Minimum Staffing: 4/12)
- Heavy Squad 66 (CBRNE/Mass Casualty Unit, Alternate Staffing)

Station 67—Farmington Road

- Engine 67 (Minimum Staffing: 3/9)
- Truck 67 (Minimum Staffing: 4/12)
- C5 Duty Chief (Minimum Staffing: 1/3)

Station 68—Oak Hills

- Engine 68 (Minimum Staffing: 3/9)

Station 69—Cooper Mountain

- Engine 69 (Minimum Staffing: 3/9)
- Light Brush 69 (Alternate Staffing)

Combination Career/Volunteer Stations: 1

Station 62—Aloha

- Telesqurt 62 (Minimum Staffing: 4/12)
- PAU Rescue 62 (Minimum Staffing: 2/4)
- MCC (Mobile Command Center, Alternate Staffing)
- Engine 362 (Volunteer Staffing)

Volunteer Stations: 1

Station 368—Skyline

- Engine 368 (Volunteer Staffing)
- Light Brush 368 (Volunteer Staffing)
- Water Tender 368 (Volunteer Staffing)

SOUTH BATTALION: 12 STATIONS

Career Stations: 7

Station 34—Tualatin

- Engine 34 (Minimum Staffing: 4/12)
- C6 Duty Chief (Minimum Staffing: 1/3)
- HazMat 34 (Alternate Staffing)

Station 35—King City

- Engine 35 (Minimum Staffing: 4/12)
- Rescue 35 (Minimum Staffing: 2/6)
- Water Tender 35 (Alternate Staffing)

Station 50—Walnut (Under Construction)

(The following resource is currently located at Station 34 during construction.)

- PAU Engine 50 (Minimum Staffing: 4/8)

Station 56—Elligsen Road

- Telesqurt 56 (Minimum Staffing: 3/9)
- Water Tender 56 (Alternate Staffing)

Station 57—Mountain Road

- Engine 57 (Minimum Staffing: 3/9)
- Light Brush 57 (Alternate Staffing)

Station 58—West Linn Bolton

- Engine 58 (Minimum Staffing: 4/12)
- Light Brush 58 (Alternate Staffing)

Station 59—West Linn Willamette

- Engine 59 (Minimum Staffing: 3/9)
- Dive Rescue 59 (Alternate Staffing)

Combination Career/Volunteer Stations: 3

Station 33—Sherwood

- Engine 33 (Minimum Staffing: 4/12)
- Light Brush 33 (Alternate Staffing)
- Water Tender 33 (Alternate Staffing)
- Engine 333 (Volunteer Staffing)

Station 51—Tigard

- Engine 51 (Minimum Staffing: 3/9)
- Truck 51 (Minimum Staffing: 4/12)
- Heavy Rescue 51 (Alternate Staffing)
- USAR 51 (Alternate Staffing)
- Rehab 351 (Volunteer Staffing)

Station 52—Wilsonville

- Engine 52 (Minimum Staffing: 4/12)
- Light Brush 52 (Alternate Staffing)
- Water Tender 52 (Alternate Staffing)
- Engine 352 (Volunteer Staffing)

Volunteer Stations: 2

Station 358—West Linn Rosemont

- Water Tender 358 (Volunteer Staffing)

Station 359—West Linn Sunset

- Engine 359 (Volunteer Staffing)
- Rehab 359 (Volunteer Staffing)

Station Location and Response Areas

Current distribution measurements show that incidents in established response areas meet the prescribed standards of coverage, with exceptions noted at the end of Section 3. Given our ability to selectively geo-code calls and stratify by incident type, and the fact that TVF&R is committing to turnout times of one minute, thirty seconds or less and travel times of five minutes, ten seconds or less (total response time for first-in unit of six minutes, forty seconds or less, 75% of the time), we have adopted a different methodology for creating response areas than what was previously used.

Using the Box-area Automated Run-card Builder (BARB) component of the Deccan International suite of software, station First-Due Areas are determined using an underlying impedance-based map layer. The entire District is divided up into one-square mile Fire Management Zones (FMZs), which are then subdivided into quarter-square mile sections that allow very specific measurement and response analysis. Because roads and natural barriers may not allow perfect box alignment the quarter-mile FMZs are not exactly square, but polygons based on the best possible alignment. These subsections, called “BoxPolys,” are then used to specifically define response zones for each fire station.

Impedance is updated regularly, with information from station Captains and other sources. Traffic calming devices are noted on the underlying map layer, as are single-point-of-entry neighborhoods and other restrictions to travel. Travel speeds are pre-assigned by the underlying map program, but are changed when not congruent with actual experience. Map layer changes and first-due changes are made

in the dispatch CAD only once every six months to ensure quality improvement tests are consistent for specific time periods.³³

Currently, 91% of the call volume is located within the primary response area of at least one TVF&R station *or* a station that protects TVF&R territory under an automatic aid or “closest forces” agreement. If only the response amocbas of TVF&R’s own stations are considered, that percentage falls to 88.46%. While this suggests that current infrastructure is located appropriately, there are areas of population (and incident) density that warrant serious study for either the location of a future fire station, or the relocation of an existing facility.

One of these areas is in the City of Tigard, with the center of the proposed response area in the vicinity of where SW Gaarde Street intersects SW Walnut Street. Response times in the region are well over the District’s benchmark of six minutes, 90% of the time. Denser populations are expected in the area as well, and the incident trend shows a steady increase in the number of requests for service (see Section 3, and Exhibit 9, Response Performance Map).

³³ Changes deemed urgent are made immediately. An example of an urgent change would be a map error that pre-assigned a unit or station that was obviously not correct based on Operations Staff knowledge of the District and surrounding areas.

SECTION 7: CONCENTRATION OF RESOURCES

Concentration is the spacing of multiple resources (personnel, units, and/or stations) within sufficient proximity so that an initial effective response force can be assembled on scene within prescribed timeframes. An initial effective response force is one that has been determined likely to stop the escalation of a fire emergency and bring it effectively under control (see Section 5).

In addition, concentration is associated with the ability to maintain response reliability in a particular station's First-Due Area. In TVF&R's experience, once response reliability drops below 90%, call queuing from nearby stations becomes a factor in overall response time performance by affecting a "cluster" of First-Due Areas surrounding the busier station. At TVF&R, low reliability is ideally handled by adding additional units to those stations, and by deploying Peak Activity Units (PAUs) to the deployment matrix in order to handle high-demand periods (see Section 8).

In determining desired levels of resource concentration, TVF&R again looked at risk assessment, call volume, population, and critical tasks. The number of units (determined via critical tasking analysis) needed for an Initial Attack Force (IAF) for each risk/response, are dispatched as described earlier.

Consideration of unit concentration must take into account the substantial reliance of all of the region's fire service organizations on closest forces agreements and automatic aid.

As was previously illustrated, demand for response services varies widely with the time of day. Tualatin Valley Fire & Rescue has been pursuing improvement of distribution and concentration of units through the deployment of PAUs.

PAUs improve resource **distribution** through dynamic relocation to cover areas whose usual response unit is unavailable for one reason or another (out of service for training, a community service event, occupied on an extended call, etc.).

PAUs improve resource **concentration** by providing extra resources within the system that are available to fill out or augment box alarm assignments. This is particularly useful during hours when heavy traffic impedes responding apparatus.

As the population of the District increases and reliability decreases, adding units to existing fire stations is a method of increasing the concentration of resources that must be seriously considered. Constructing response plans that make maximum use of on-duty personnel, yet still meet safety standards, should be a priority when adding additional firefighters. Additional units increase concentration of resources, which directly impacts reliability and improves response time.

One area needing greater concentration of a specific unit type is the South Battalion, south of the Tualatin River. The closest Ladder Truck Company currently responds from Tigard, effectively placing nearly all full Box Alarm TEFB out of compliance. In Section 12, the District has outlined this deficiency and strategies to effectively deal with it.

Analysis of the concentration of units at structure fires revealed that response information regarding the entire unit compliment (second and third-due units, Ladder Trucks, command officers, etc.) cannot easily be evaluated. This has a great deal to do with the way in which we collect data; specifically, the lack of capturing arrival times.

Capturing arrival times on structure fires is a struggle. What we've found based upon conversations with Company and Chief Officers, is that in the midst of the complexities of the incident that occur while en route to the fire (monitoring dispatch, mapping to the address, reviewing dispatch comments on the

MDT, etc.) coupled with overall physiologic affects (adrenaline, anxiety, etc.), the officer simply fails to push the “Arrive” button on the MDT when they arrive on scene.

Additionally, on many fires, third, fourth, and fifth due units do not immediately proceed to the scene, but “stage” until assigned. TVF&R has provided training and guidance to the crews over the past few years instructing them to “arrive” their unit on fire scenes when they arrive nearby and are asked to briefly “base” until assigned. Numerous reminders for officers to push their MDT button when they arrive on scene have been utilized as well in a variety of venues and formats. Unfortunately, we have not seen an increase in capturing this data, which in turn does not allow us to accurately capture Total Effective Firefighting Force (TEFF) performance on a large number of our structure fires. Key initiatives are in progress that will assist us in increasing our ability to develop an objective data set (see Section 12).

Utilizing our structure fire data (outlined in Section 3) we reviewed each incident from 2005–2007 to determine how many times we were able to achieve a TEFF. As illustrated below, of 307 structure fires that occurred during 2005–2007, a TEFF was achieved 75.57% of the time.

Table 7-1. Structure Fires, TEFF: 2005–2007

Year	Total Structure Fires	TEFF Achieved	Percent Achieved
2005	103	82	79.61%
2006	112	90	80.36%
2007	92	60	65.22%
Combined	307	232	75.57%

Note: Structure Fires include NFIRS Incident Types 111, 112, 121, 122, or 123 that occurred in TVF&R’s jurisdictional boundary, for all one alarm or greater incidents where the total scene time was 60 minutes or greater in duration.

CONCENTRATION STATEMENT

Current Baseline Performance: Without arrival time data as noted previously, the total response time of a unit cannot be determined. Thus, it is virtually impossible for us to accurately establish our current baseline performance in achieving a TEFF. However, as outlined in Table 4-2, our baseline performance at the 75th percentile for Category “A” emergency incidents in 2005–2007 combined is six minutes, 28 seconds (51,731 incidents). Based upon that data set, we can hypothesize that this response performance holds true for our structure fire responses and that we were able to provide a TEFF for 75.57% of these incidents.

SECTION 8: RESPONSE RELIABILITY AND RESOURCE UTILIZATION RATIOS

Response Reliability

Response reliability is the probability, expressed as a percentage, that the required amount of staff and apparatus will be available when a fire or emergency call is received. Response reliability would be 100% if every company was available and in place every time a call was received. In reality, there are times when a call is received when the first-due company is unavailable. This requires a later-due company or perhaps a Peak Activity Unit (PAU) to be assigned. If the later-due company or PAU is too far away, the call cannot be handled within the prescribed travel time.

As the number of emergency calls per day, training demands, and other activities increase, so does the probability that the prescribed company will be unavailable when a call is received (decreased reliability).

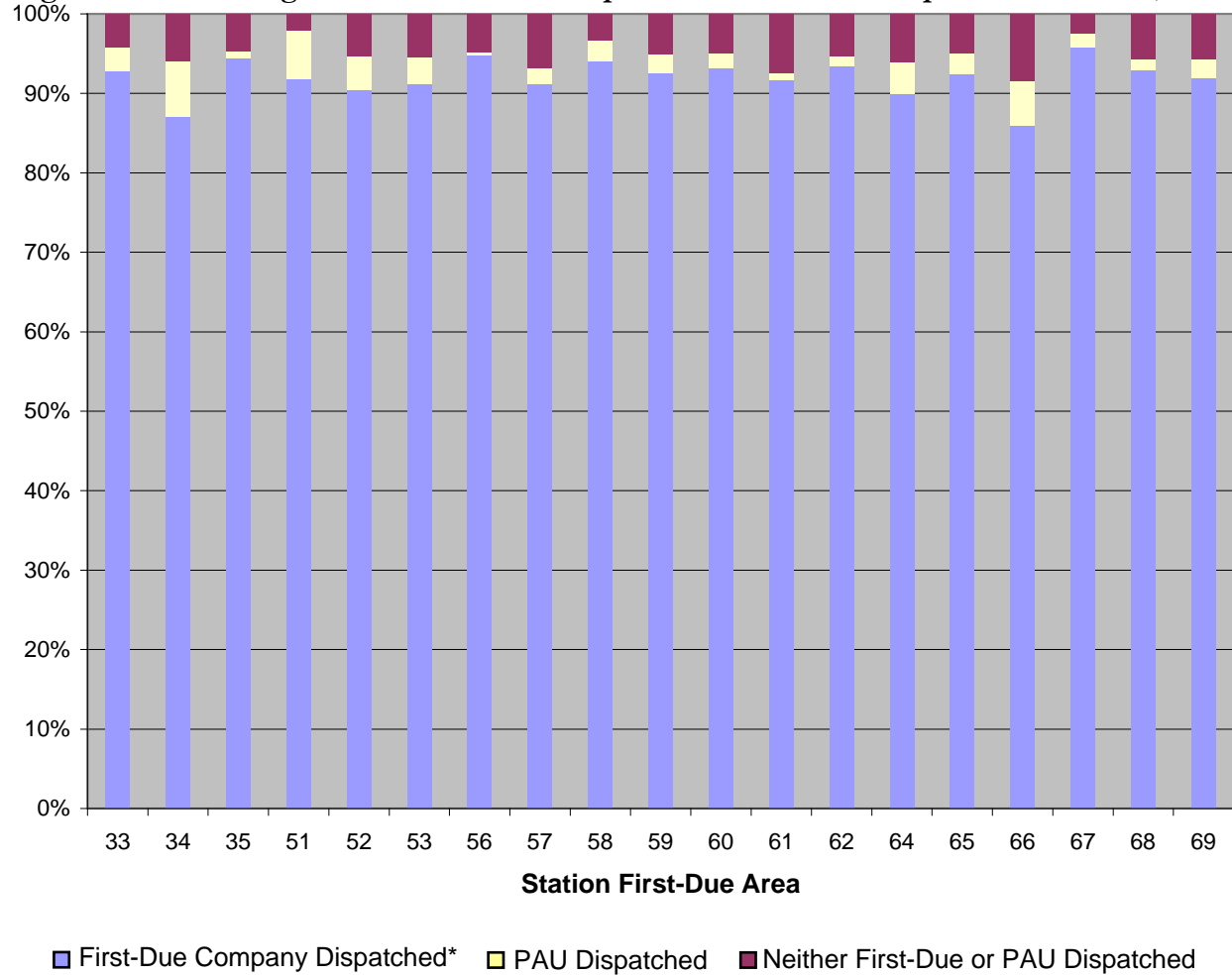
At TVF&R, PAUs are deployed on a schedule designed to impact only those times of day where call volume, training activity, and community activity is at its peak. In Section 3 (Risk Assessment), data indicates that the District's peak volume for demand is between the hours of 0700 and 1900. Therefore, PAUs are deployed dynamically throughout the District during these periods. Their "home" station, from where they begin and end their daily deployment, is based on an analysis of both incident volume and proximity to other First-Due Areas that experience significant demand.

Currently, units are based according to the outline in Section 7, Concentration of Resources.

From a data analysis standpoint, limitations in the existing CAD marginalize the ability of TVF&R to isolate calls which *could not* be handled by the assigned first-due company. As a surrogate, we have analyzed the number of calls that *were not* handled by the first-due company.³⁴ The data was then corrected to adjust for calls handled by the Peak Activity Units (PAUs) for those stations where PAUs are currently based when not dynamically deployed. The results of these analyses are reflected in Figure 8-1 and Figure 8-2 (data indicates emergency responses only).

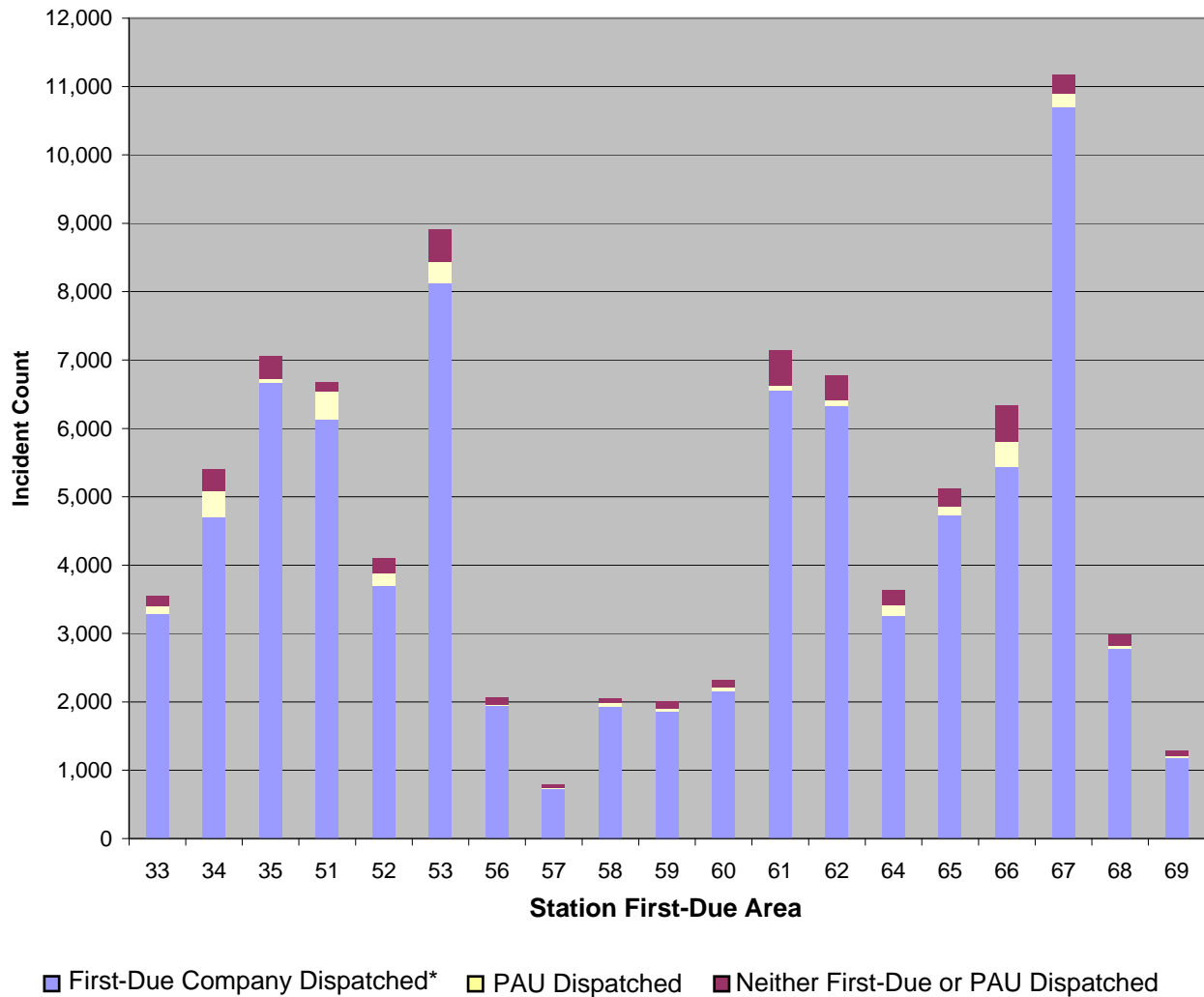
³⁴ A call might be handled by other than the first-due company when the other company was "passing through" the area, relocated for training, or for a variety of other reasons.

Figure 8-1. Percentage of Incidents with Dispatch of First-Due Companies and PAUs, 2005–2007



NOTE: PAUs are included as “First-Due Company Dispatched” in their home station First-Due Area.

Figure 8-2. Count of Incidents by Station First-Due Areas, 2005-2007



NOTE: PAUs are included as “First-Due Company Dispatched” in their home station First-Due Area.

These data show that during calendar years 2005 through and 2007, TVF&R had an overall average response reliability of 92–95%; depending on the inclusion of PAU data (see Table 8-1). One must be careful in interpreting this data, since it is based solely on the reliability of each station to their assigned First-Due Area.

Table 8-1. Response Reliability by Station First-Due Area

First-Due Area	First-Due Area Incidents	Current (2005–2007)				Previous (2004–2006)	
		First-Due Company Dispatched*		First-Due Company or PAU Dispatched		First-Due Company or PAU Dispatched	
		Incident Count	Response Reliability	Incident Count	Response Reliability	Incident Count	Response Reliability
33	3,549	3,292	92.8%	3,403	95.9%	3,182	95.3%
34	5,403	4,707	87.1%	5,080	94.0%	4,733	93.0%
35	7,057	6,666	94.5%	6,725	95.3%	6,170	94.2%
51	6,679	6,128	91.8%	6,539	97.9%	6,267	97.8%
52	4,096	3,702	90.4%	3,877	94.7%	3,773	94.0%
53	8,912	8,128	91.2%	8,431	94.6%	8,306	94.6%
56	2,056	1,948	94.7%	1,958	95.2%	1,810	94.6%
57	792	722	91.2%	738	93.2%	732	93.4%
58	2,045	1,924	94.1%	1,977	96.7%	1,633	95.8%
59	2,003	1,854	92.6%	1,902	95.0%	1,540	94.7%
60	2,315	2,157	93.2%	2,202	95.1%	2,072	94.6%
61	7,152	6,555	91.7%	6,627	92.7%	6,314	90.7%
62	6,772	6,327	93.4%	6,416	94.7%	6,019	93.7%
64	3,631	3,263	89.9%	3,411	93.9%	3,508	93.1%
65	5,120	4,735	92.5%	4,865	95.0%	4,745	95.3%
66	6,330	5,442	86.0%	5,798	91.6%	5,382	91.7%
67	11,176	10,706	95.8%	10,906	97.6%	10,505	96.8%
68	2,985	2,774	92.9%	2,817	94.4%	2,825	93.3%
69	1,290	1,186	91.9%	1,217	94.3%	1,404	92.9%
Total	89,363	82,216	92.0%	84,889	95.0%	80,920	94.3%

NOTE: PAUs are included as “First-Due Company Dispatched” in their home station First-Due Area. Incident totals are specific to a station’s First-Due Area and DO NOT include automatic and mutual aid responses to areas outside of TVF&R’s jurisdictional boundary (e.g., Hillsboro Fire & Rescue, Lake Oswego Fire Department, and Portland Fire & Rescue); therefore, these incident totals do not match the incident totals listed in Figure 3-6. Ten-Year Incident History.

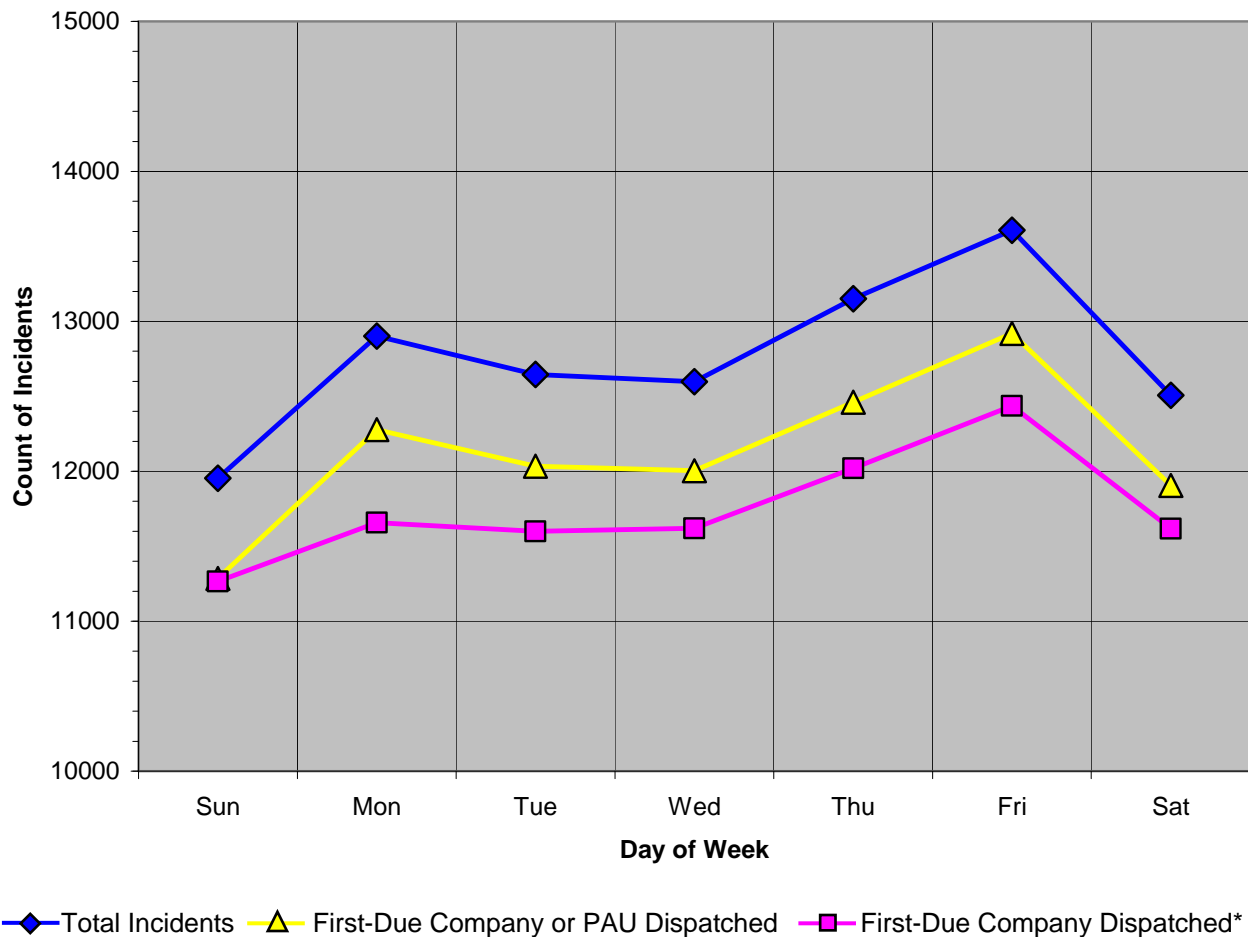
Response reliability improves significantly when the PAUs are added to the deployment matrix. Overall response reliability for the District improves from 92% without PAUs to 95% when PAU performance is considered. These statistics demonstrating the value of PAUs in the deployment matrix are more remarkable when compared on a station-by-station basis. For stations that are high volume and for those that have Special Operations Teams, the differences remain noteworthy, mirroring the trend seen by TVF&R over the past three years (Table 8-2 and Figure 8-3).

Table 8-2. Availability of First-Due Units and PAUs for Dispatch in Station First-Due Areas by Day of Week, 2005–2007

	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Overall
Total Incidents	11,954	12,901	12,645	12,598	13,150	13,608	12,507	89,363
First-Due Unit Dispatched*	11,265	11,658	11,599	11,620	12,021	12,436	11,617	82,216
First-Due Unit or PAU Unit Dispatched	11,286	12,278	12,035	12,004	12,461	12,920	11,905	84,889
Response Reliability	94.2%	90.4%	91.7%	92.2%	91.4%	91.4%	92.9%	92.0%
Response Reliability with PAUs	94.4%	95.2%	95.2%	95.3%	94.8%	94.9%	95.2%	95.0%

NOTE: PAUs are included as “First-Due Company Dispatched” in their home station First-Due Area.

Figure 8-3. Overall Response Reliability by Day of Week, 2005–2007



NOTE: PAUs are included as “First-Due Company Dispatched” in their home station First-Due Area.

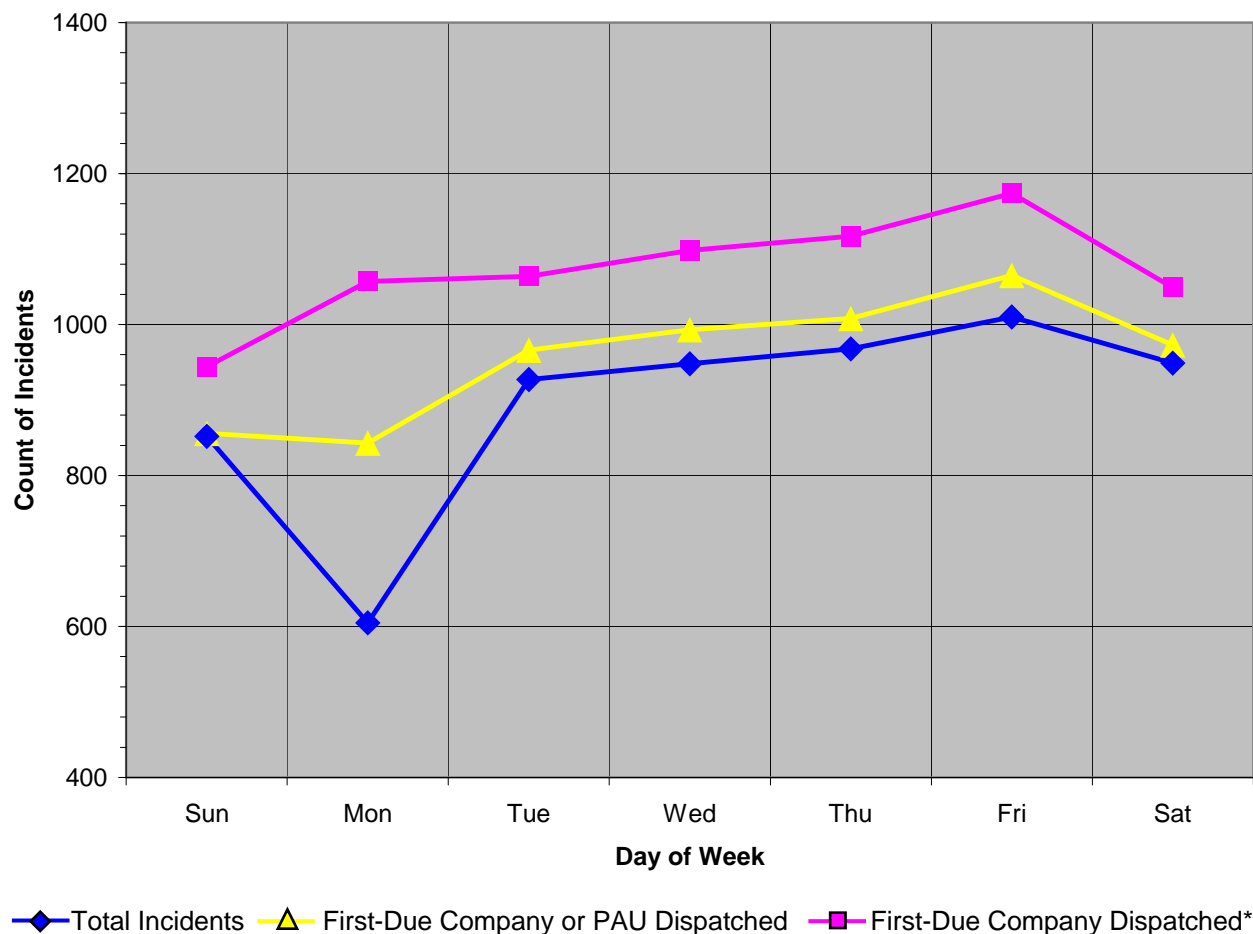
In order to more clearly analyze performance associated with PAUs, data was reviewed in those station response areas where reliability fell below 90%.

Although the following example is four years old, it remains relevant in helping to draw a visual picture of PAU deployment impact on a busy station. Station 53 is consistently one of the two busiest single-company houses in the District, and in addition, the crews fulfill mandatory hazardous materials competencies by attending drills that are scheduled every Monday. The following data (Table 8-3 and Figure 8-4) shows response reliability for Station 53 by day of the week. The graph shows all calls handled by either Engine 53 or one of the two PAU Companies as “first responder” in the Station 53 First-Due Area. As indicated, reliability for Station 53 significantly increases with the presence of a PAU, in some cases by over 20%.

Table 8-3. Availability of Station 53 Units and PAUs for Dispatch in Station 53 First-Due Area by Day of Week, 2002–2004

	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Overall
Total Incidents	944	1,057	1,064	1,098	1,117	1,174	1,049	7,503
E53 Dispatched	852	605	927	948	968	1,010	949	6,259
E53 or PAU Dispatched	856	843	966	993	1,008	1,065	973	6,704
Response Reliability	90.3%	57.2%	87.1%	86.3%	86.7%	86.0%	90.5%	83.4%
Response Reliability with PAUs	90.7%	79.8%	90.8%	90.4%	90.2%	90.7%	92.8%	89.4%

Figure 8-4. Overall Response Reliability by Day of Week, Station 53 First-Due Area, 2002–2004



NOTE: PAUs are included as “First-Due Company Dispatched” in their home station First-Due Area.

Similar improvements are demonstrated in other coverage areas. It can be construed that deployment of PAUs (shown by the difference between unadjusted and adjusted reliability percentages) to cover scheduled and unscheduled periods of first-in company unavailability improves response reliability in the District’s busiest sectors.

Responses that require more than one unit, drawdown, prolonged on-scene times, and resource exhaustion must also be considered in assessing response reliability. The data presented here suggest a fairly high degree of reliability. However, it is also evident that the lack of overlap in station First-Due Areas, coupled with an increasing call volume, are making it difficult to achieve improved response performance from static facilities.³⁵ Accordingly, TVF&R plans to continue its aggressive approach to deployment models, both static and dynamic, in exploring other performance-enhancing options.

For example, in December 2007, the PAU Rescue at Station 56 was closed and a four-person PAU Engine was opened at Station 34. PAU Rescues at Stations 35 and 53 were changed to a full 24-hour schedule to deal with the need for more resources on a 24-hour basis. PAU Rescue units (which are currently Type III Engines on a maneuverable four-wheel drive chassis, staffed with a Company Officer and an Apparatus Operator and constantly ALS) remain at Stations 61 and 62.

³⁵ As noted earlier, the District has a preferred travel time maximum of 4.5 minutes within any First-Due Area.

The Operations Quality Improvement Committee will continue to monitor response performance associated with these moves, and make adjustments as needed during the coming year.

Resource Utilization Ratios for Fire, Rescue, and EMS Units

Resource Utilization Ratios (RUR), or some other method of unit activity are commonly calculated for agencies whose sole responsibility is emergency medical response. In some systems, a “unit hour” is calculated by allocating one hour for every emergency transport. To establish a Resource Utilization Ratio for TVF&R’s fire units, the total time of all recorded daily events (NOT “man-hours,” but actual hours) are divided into the number of hours in a shift, and an RUR is established. For example, four hours of recorded activity in an eight-hour shift would equal a 0.5 RUR. Eight hours of recorded activity in an eight-hour shift would equal a 1.0 RUR.

While utilization rates of 1.0 certainly look cost-effective, they have an adverse impact on employee health, morale, and readiness, and would be entirely unreasonable for shifts that are longer than eight hours.

Additionally, RURs, when measured in a multidisciplinary organization such as TVF&R, must take into account both non-transport emergency medical events, fires (which typically take longer than one hour to mitigate), and many non-emergency tasks that are required during a typical duty shift. Therefore, calculating workload becomes much more complex.

In response to this challenge, TVF&R has adopted the following methodology, and continues to refine the process. Table 8-4 indicates those activities that are regularly performed during a TVF&R duty shift, and the amount of time allocated to each for the purposes of calculating workload. Time allocations are either directly obtained from the District’s FireRMS reporting system, or are determined by assigning a specific value to certain tasks.

In order to calculate values that could be used with some degree of accuracy, both qualitative and quantitative factors were evaluated. The overriding goal is to try and measure unit efficiency, and determine a point where efficiency begins to be compromised by workload and time.

First, average time-on-task was retrospectively obtained for a period of one year for all emergency incidents. These were established as the base time to be allocated for each event during the subsequent annual measuring period. Comparative weighting values were then established for emergency events that met certain criteria. This is done because emergency events that are of a higher complexity, occur after crews are in bed and asleep, or interrupt other daily required tasks with regularity, decrease the efficiency of the crew and, in some cases, take longer to resolve. It is self-evident that a RUR of 0.5 that consists of activity compressed into the first 12 hours of a 24-hour shift affects an emergency response crew differently than a RUR of 0.5 that consists of activity evenly spread throughout the shift, including the “normal” sleep period.

The specific types of events that were assigned weighted values for this first attempt at establishing an accurate RUR are listed below. The formulae for calculating specific weighted values include direct time comparisons, personnel interviews related to perception, and objective data from related studies.

Complex Calls: Additional time has been added for those emergency medical calls where complexity has been proven to be an issue. For example, Station 35 serves a large retirement community and consistently runs calls that are more complex than the average emergency medical event. Call complexity is calculated by taking a six-month period, analyzing emergency medical calls for the number of invasive procedures performed and the number of medications administered, and comparing that to three other locations with similar call volumes to establish a “norm.” Since more

charting and restocking is typically required, stress levels are higher, and on-scene times longer due to interventions, these calls have an added weight value.

Calls “After-Hours”: Calls occurring after 2300 hours interrupt sleep periods at the typical fire station. Since performance is affected by fatigue, all emergency events occurring between the hours of 2300 and 0500 hours have an added weight value.

High Daily Call Volume: Units that incur over six emergency calls between the hours of 0700 and 1700 are handicapped in the completion of other assigned tasks due to the multiple interruptions. Restarting projects that are interrupted mid-task is more difficult and decreases efficiency, so any unit averaging over six calls per day during the typical daily work period has a weight value added to those events.

Table 8-4. Activity Resource Utilization Ratios (RUR)

Event (includes all components) or Task	Time Allocated (Hr.)
Emergency Equipment Preparedness & House Duties	1.5
EMS Response Involving Transport	0.6
EMS Response Involving Transport: Nights	0.8
EMS Response, Complex Call	1.2
EMS Response, No Transport	0.3
EMS Response, No Transport: Nights	0.5
Fire Response, Commercial: “Working Fire”	3.0
Fire Response, No Fire (Alarm, Investigation, etc.)	0.5
Fire Response, Residential: “Working Fire”	2.0
High Call Volume, Added Weight Factor (Per Call)	0.2
Mandated Physical Fitness Activity	1.0
Personal Readiness (Self-Study, Personal Equipment, etc.)	1.0
Response Aids (Pre-Plans, Target Hazard Analysis, etc.)	1.0
Community Service Events	Actual Time: FireRMS
Continuing Education and Training	Actual Time: FireRMS
Fire Inspections	Actual Time: FireRMS
Public Education Activity	Actual Time: FireRMS
Rescue Response	Actual Time: FireRMS
Station-Assigned Programs (Wildland, Hose, Communications, etc.)	Actual Time: FireRMS

TVF&R has not yet established a maximum desired RUR for 24-hour units. Once established, if RUR rates are regularly exceeded the District will investigate methods to reduce workload for those particular units. This may be in the form of adding additional personnel on the response unit, adding peak-load units to the area, redefining work priorities during a duty shift, reallocating some types of work to less busy stations, or increasing the number of Paramedics on a unit. The District will annually evaluate this data and refine the criteria as needed.

SECTION 9: PERFORMANCE MEASUREMENT, PERFORMANCE ABNORMALITIES, QUALITY IMPROVEMENT, AND POLICY AND PRACTICE GUIDELINES

Performance Measurement and Abnormalities

Similar to risk analyses, performance measurement has both subjective and objective components. In the cleanest sense, we wish all data to be objective and to clearly articulate the outcome. However, because of the various methods of collection, and the human interaction necessary to both populate and disseminate data from a resource, decisions must be made on how to refine, represent, and interpret the information.

For example, in processing a single call at TVF&R the following steps occur for the reflex interval (see page 4–36) with each point a key link in the data collection process. At every step, there are physical factors (equipment malfunctions, transmission errors, etc.) that may affect the process. Of course, this list only covers those processes that occur after the dispatcher has initiated a call...many more occur within the PSAP:

- The dispatcher pre-alerts with a radio transmission.
- The dispatcher presses a button, sending a signal via a third-party paging company into the paging queue.
- The signal travels from the queue over the air to the pagers.
- The pager “trips” in the station, setting off the station’s tap-out system.
- Another pager also (not necessarily simultaneously) “trips” on the officer’s belt.
- Information is sent via an 800 MHz radio to the MDT inside the apparatus cab.
- The officer pushes the “respond” button and the “call” button when the apparatus is under way.
- The “respond” signal travels to a repeater, then to the dispatch center, where it is received by the CAD.
- A “confirmation” signal is sent by the CAD, through a repeater, back to the MDT.

Another factor of performance measurement is the cost-per-hour associated with each deployed unit. Many costs, such as the apparatus and equipment, are fixed, regardless of how many hours per day the unit is deployed. TVF&R strives to consistently measure cost per deployed hour, to ensure we are making the good decisions when comparing cost of operations against deployed unit hours.

Currently, the fixed unit-hour cost (not including per-mile costs of fuel and maintenance) for a Ladder Truck is \$259.64, for an Engine it is \$257.48, and for a Rescue it is \$152.07. The specific breakdowns of these costs are outlined in Exhibit 13, Unit Hour Cost for 2006–2007.

Quality Improvement Process

Because there are so many variables, TVF&R has established Quality Improvement (QI) Committees to review both deployment data and specific EMS data (Operations QI and EMS QI respectively; see Exhibit 14 for the Standard Operating Guideline [SOG] that further defines the role, mission, and parameters associated with these committees).

The Operations QI Committee meets monthly to review response time data, specific reflex time reports, and to review suggestions for the fire station Captains related to changes in the map layer or the First-Due Areas. In addition, the group forms Process Action Teams that are charged with conducting research into specific problem areas, and reporting back to the main committee (e.g., reflex or

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transmission problems at a particular station or in a specific area of the District). Examples of their work are included as Exhibit 15.

A formal Quality Improvement Program has been in place at TVF&R for the analysis of EMS incidents for several years. Sentinel and frequency indicators are monitored, and research is conducted into several aspects of patient care delivery with the assistance of our Physician Supervisors and a local medical university.

TVF&R accepts that emergency response is performed in a stressful environment with time-critical decisions, and these decisions often have to be made prior to a careful risk-benefit analysis of all the potential outcomes. Therefore, TVF&R's quality improvement process is designed to be non-punitive, and all operational problems that are reported in a timely, honest, and complete manner are carefully evaluated according to the following criteria:

- System Issues (policy, protocols, procedures)
- Education or Training Issues
- Circumstantial Influences (equipment failure, crowds, etc.)
- Human Factors (cognitive, crew resource management, decision-making, etc.)

The District has the obligation to identify system and educational problems and plan effective changes, ensuring that the results are measured through the quality improvement process so the desired improvement is achieved. Circumstances that lead to difficult scenes will be evaluated for their educational value, the case will be "blinded," and the information shared with other personnel. Negligent behavior will be carefully evaluated as to its context (intentional or non-intentional), and appropriate improvement plans will be developed.

The SOGs associated with the mission of TVF&R's Quality Improvement Committees, samples of sentinel and frequency indicators, and examples of in-depth investigative reports are available on request.

Policy and Practice Guidelines Related to Deployment and Operations

Policy and practice guidelines relating to deployment and operations are found in the District's SOGs, *Fire & Rescue Protocols*, *EMS Treatment Protocols*, and Training Bulletins.

SOGs are typically policy guidelines, and give direction for those events that are relatively predictable, non-ambiguous, can be replicated, and that the District wants done consistently. The data for decision-making is available, the budget is generally known in advance, and the issue well-defined.

Protocols are developed to enhance cue recognition, and are strategic guidelines that are purposely kept short, succinct, and in an easily followed format. They are designed for use in emergent, developing situations, and do not contain time frames except for very few, specific circumstances. Tactical checklists often accompany protocols, and are used in the field for complex events (mass casualty incidents, technical rescue, water rescue, etc). These are less reflective of policy, and more related to what the District considers "best practices."

Training Bulletins are very specific, "how to" guidelines that define procedures in detail. They are task driven, may have specific performance benchmarks (time frames), and contain safe operating practices.

These documents are referenced as Exhibit 16.

SECTION 10: SAFETY AND SURVIVAL OF FIREFIGHTERS AND CITIZENS: TRAINING, WELLNESS, AND SAFETY PROGRAMS

This section briefly outlines or references the District's programs related to the following:

- Training Programs
- Safety, Wellness Initiative, and Occupational Health Services
- Apparatus Failure Rates and Maintenance

Training and Continuing Education

Introductory and comprehensive ongoing training and education is provided to all District firefighters through the Training Division. Mandatory annual compliance is required for all key areas, with Incident Command System (ICS) and safe practices taking a predominant role (see Exhibit 17). Peak Activity Units (PAUs) are available for station coverage, and Company Officers are encouraged to develop and participate in their own multi-company drills (see Exhibit 18, District Activities Schedule example).

Safety, Wellness Initiative, and Occupational Health Services

Firefighter safety is paramount at TVF&R. Safe practices are expected, and the "Chief's Bull's-Eye" (page 2–5) clearly articulates his position of safety first. The District's Safety Program is headed by an Assistant Chief, and involves personnel from throughout the agency. The Safety Committee, chartered by the Fire Chief, meets regularly and investigates unsafe acts, recommends safe practices, and looks into new procedures or equipment that may enhance safety. Importantly, the District has on-call Incident Safety Officers as members of the Incident Management Team, and they are available 24/7 for major incident response, accident investigation, or other needs. Additionally, the District commits a second Duty Chief to every Box Alarm. The primary role of the second-due chief officer is to serve as Incident Safety Officer.

The District has also adopted a comprehensive Wellness Initiative, and employs both a Wellness Specialist and an Occupational Health Nurse full time. The Wellness Initiative Manual (see SOG 8.5.1) is a joint labor-management directive that deals with daily physical fitness expectations, regular annual physicals, fit-for-duty issues, and back-to-work situations. The District also provides work out equipment and space at every fire station, and asks that crews spend one hour per day on physical fitness activities.

Occupational Health Services provides annual pre-physical testing, annual fit tests for respirators and masks, fit-for-duty assessments, on-call physician services, blood testing, and other critical medical support functions. Both Wellness and Occupational Health are located at the District's Training Center.

Apparatus Failure Rates and Maintenance Program

The District has an extremely small mechanical failure rate for apparatus, due exclusively to the comprehensive ongoing maintenance that is provided by its Support Services Division. Per-mile costs associated with Ladder and Engine Companies for 2006 through 2007 are available in Exhibit 19, TVF&R Apparatus Plan.

Complete maintenance and overhaul services are available at the District Fleet Maintenance Shop, with mechanics who are trained in the latest apparatus maintenance practices. More detail is available in Exhibit 19, TVF&R Apparatus Plan.

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SECTION 11: MAJOR INCIDENT PREPARATION AND RESPONSE

Disaster, WMD, and Terrorism Incidents

The District has engaged in WMD and terrorism preparedness on several different levels. Locally, the District's Command and Business Operations Center is host to OCEM, the Office of Consolidated Emergency Management. OCEM and the District's own Emergency Manager have developed comprehensive plans for disaster response, and the District has standing procedures and protocols for interagency cooperation and unified command for the following types of events:³⁶

- Multiple Patient Scenes (<10 patients)
- Mass Casualty Medical Incidents (≥10 patients)
- Mass Decontamination
- Mass Fatality
- School Terrorism/Shooter
- Natural Disasters (Specifically, Floods, Earthquake, Wind, Snow & Ice)
- Hazardous Materials and Terrorism
- National Security Events

District personnel drill at least annually on one major event. For example in October 2007, the District participated in the US Department of Homeland Security Top Officials 4 (TOPOFF 4) exercise involving Arizona, Oregon, and the US territory of Guam. TOPOFF 4 was the fourth in a series of congressionally-mandated exercises involving federal agencies as well as the governments of Australia, Canada and the United Kingdom. This regional full-scale exercise involved most public-safety agencies in the greater Portland area, including local, state, and federal agencies, private industry, and hospitals. The exercise simulated a domestic terrorist attack—"dirty bomb"—and involved field, EOC, and FOC operations to accomplish major objectives in five important areas:³⁷

- Prevention: Test the handling and flow of operational and time-critical intelligence between agencies to prevent a terrorist incident.
- Incident Management: Test the full range of existing procedures for domestic incident management of a WMD terrorist event and improve top officials' (federal/state/local) capabilities to respond in partnership in accordance with the NRP and NIMS.
- Intelligence/Investigation: Test the handling and flow of operational and time-critical intelligence between agencies prior to and in response to a linked terrorist incident.
- Public Information: Practice the strategic coordination of media relations and public information issues in the context of a WMD terrorist incident or incident of national significance.
- Evaluation: Identify lessons learned and promote best practices.

The District's South Battalion Chief (C6) is the 24/7 on-call operative for any type of major incident response or mobilization. If changes in the local or national security level are transmitted, the on-duty

³⁶ Refer to Fire & Rescue Protocols: Terrorist Action, HazMat/WMD Response, Major Emergency & Disaster Operations; EMS Protocols: Multiple Patient Scene, Mass Casualty Incident, Multiple Toxic Exposure, Hazardous Materials; and Incident Management Team Planning Templates (Natural Disasters).

³⁷ Oregon Office of Emergency Management Press Release, Sept. 24, 2007

chief follows a prescribed plan to notify the Incident Management Team (IMT) Incident Commander, and to make necessary planning and logistical assignments.³⁸

In addition, through Portland area Urban Area Security Initiative (UASI) grants, TVF&R has been the recipient of several pieces of specialized equipment that will assist in major HazMat, terror, or WMD incidents. The District has deployed one of five regional Chemical, Biological, Radiological, Nuclear, Explosive (CBRNE) response units, which is equipped to deploy on any event within the region requiring mass decontamination or mass casualty resources. The District is participating in regional discussions that will result in the development of deployment plans, disaster medical care points, and mutual and automatic aid agreements for the entire Portland Metro area, with a goal of full coordination of all regional resources in the event of a major WMD or terrorist incident.

Two new HazMat apparatus, also purchased through UASI and Department of Justice (DOJ) grants, have been deployed and substantially bolster the District's capability to respond to major HazMat events (they replaced two aging HazMat apparatus). With the enhanced apparatus and equipment, the HazMat Team, which is deployed from two fire stations in the District, has the means to respond to simultaneous small events, or one large incident.

A new state-of-the-art Mobile Command Center has replaced the District's aging Mobile Operations Command Center (a large trailer) and provides self-contained voice, data, and internet-based communications and information display systems. The Mobile Command Center is best suited for incidents of extended duration, particularly (but not exclusively) with a need for specialized communications due to location, current system status, or failure of existing systems.

The District fields five Incident Management Teams (IMTs), which rotate call duty on a weekly basis (each IMT is on-call 24-hours one week at a time, once every five weeks). The IMT consists of the following positions:

- Incident Commander (IC)
- Deputy Incident Commander (DIC)
- Incident Safety Officer (ISO)
- Liaison Officer
- Public Information Officer (PIO)
- Operations Section Chief
- Planning Section Chief
- Logistics Section Chief
- District Operations Chief*
- Company Officer*

* These are TVF&R-specific, and not standard Incident Command System positions.

The District also has its own Fire Operations Center, where SitStat, ReStat, PIO, Logistics, Planning, and IC functions are conducted for major events. If the IMT is needed at the scene, the District can move its Mobile Command Center into position to provide closer level support.

³⁸ Refer to Operations Procedures for Security Alerts.

MAJOR INCIDENT PREPARATION AND HAZARD ANALYSIS

TVF&R's Emergency Manager, with Operations staff and Hazardous Materials Team input, has conducted a major incident hazard analysis that assists the District in determining where to allocate resources in disaster preparation, mitigation, and response. A hazard analysis allows TVF&R to focus its energy and resources on those hazards that are most likely and that would have the most serious impact on its citizens. The following analysis is a broad overview of the hazards that may affect the District, considered in terms of their potential impact on District operations and the people it serves. Given District size and geographic/physiographic diversity, it is important to recognize that each hazard covers a range of probabilities and vulnerabilities (e.g., Skyline has a much greater wildfire hazard than central Beaverton). Additional details and considerations may be found in the hazard-specific annexes.

Geographic Description

TVF&R serves a population of approximately 439,856, covering a total area of approximately 210 square miles. The District includes portions of several major highways (Interstates 5 and 205, State Highways 8, 10, 43, 99W, 210, and 217), rail lines (commuter, passenger, and freight), and approaches for Portland and Hillsboro International Airports. The District spans suburban through rural/frontier environments, including several areas at high risk for wildfire. More detailed information on specific areas may be found in county Natural Hazard Mitigation Plans for the counties and, where they have been completed, cities within the District.

Analysis

Category totals are determined by multiplying the weighting factor by the severity rating for each criterion listed (higher scores indicate greater risk). The results are listed in descending order of score.

Severity Rating

- Low 1–3 points
- Medium 4–6 points
- High 7–10 points

Event History (weighting factor = 2): based on significant events per 100 years.

- Low 0–1 event/100 years
- Medium 2–3 events/100 years
- High 4+ events/100 years

Vulnerability (weighting factor = 5): based on the percentage of population or property likely to be affected by the incident.

- Low <1% affected
- Medium 1–10% affected
- High >10% affected

Maximum Threat (weighting factor = 10): also based on the percentage of population or property affected.

- Low <5% affected
- Medium 5–25% affected
- High >25% affected

Probability (weighting factor = 7): based on the likelihood of another occurrence with significant District impact within a specified period of time.

- Low >1 chance/100 years
- Medium >1 chance/50 years
- High >1 chance/10 years

1. Severe Weather:

Includes windstorms, snow and ice storms, and extended periods of extreme heat or cold, but not floods. Extreme heat events are considered in terms of their impact on District residents, but not in conjunction with either drought or increased fire risk.

- History: High (16 points)
- Vulnerability: High (35 points)
- Maximum Threat: High (100 points)
- Probability: High (49 points)
- **Total: 200 points**

2. Earthquake:

Includes associated hazards such as landslides and rock falls that could be triggered by an earthquake. Although the region has a history of small earthquakes, actual damage has been slight. Principal risk resides with a Cascadia Subduction Zone earthquake, possibly in excess of Magnitude 9, and with local crustal earthquakes that could cause more local but less regional impact.

- History: Low (6 points)
- Vulnerability: High (50 points)
- Maximum Threat: High (100 points)
- Probability: Low (21 points)
- **Total: 177 points**

3. Infectious Disease Outbreak:

Includes pandemics, other novel disease outbreaks (e.g., SARS), and large-scale food- and water-borne disease outbreaks, but not seasonal disease cycles or acts of terrorism.

- History: Medium (12 points)
- Vulnerability: Low (15 points)
- Maximum Threat: High (100 points)
- Probability: Medium (42 points)
- **Total: 169 points**

4. Hazardous Materials:

Includes fixed-site and transportation incidents as well as drug labs, but not acts of terrorism. TVF&R's Fire Prevention Division maintains information on sites using/storing hazardous materials; this information is supplied by businesses as required by state and federal law. Fire Prevention, in coordination with TVF&R's HazMat Materials Team, also works with law enforcement to maintain awareness on non-reporting sites such as clandestine drug labs.

- History: High (14 points)
- Vulnerability: High (35 points)
- Maximum Threat: Medium (60 points)
- Probability: High (56 points)
- **Total: 165 Points**

5. Utility Failure:

Includes shortage or loss of power for periods >24 hours, and shortages of fuels, pipeline interruptions (except for those that qualify as hazmat), such as oil, gasoline, and diesel.

- History: Low (6 points)
- Vulnerability: Medium (30 points)
- Maximum Threat: High (90 points)
- Probability: Medium (28 points)
- **Total: 154 points**

6. Volcanic Activity:

Includes ash-fall that might result from an eruption of Mt. Saint Helens or Mt. Hood. The District does not have any direct exposure to lahars or lava flows.

- History: Medium (8 points)
- Vulnerability: High (50 points)
- Maximum Threat: High (80 points)
- Probability: Low (7 points)
- **Total: 145 points**

7. Fire:

Level II urban and interface fires are relatively common within the District. Most are handled easily through mutual aid without activation of this plan. The District faces a threat of wildland/urban interface fires from large areas of mostly undeveloped property within and adjacent to District boundaries, in incorporated and unincorporated areas.

- History: High (16 points)
- Vulnerability: Medium (25 points)
- Maximum Threat: Medium (50 points)
- Probability: High (49 points)
- **Total: 140 points**

8. Flood:

The District contains substantial portions of two rivers (Willamette and Tualatin) and several smaller streams that are subject to flooding. Despite flood controls, there is a history of minor and severe flooding (the last severe flood causing significant damage to Tualatin in 1996). Flooding related to dam failure is considered separately in this analysis.

- History: High (20 points)
- Vulnerability: Medium (25 points)
- Maximum Threat: Medium (50 points)
- Probability: Medium (42 points)
- **Total: 137 points**

9. Transportation:

Non-hazmat incidents involving automobiles, aircraft, and rail.

- History: High (20 points)
- Vulnerability: Low (5 points)
- Maximum Threat: Low (20 points)
- Probability: High (70 points)
- **Total: 115 points**

10. Civil Disturbance/Terrorism:

Includes riots, violent protests or strikes, and acts of terrorism, as well as related infrastructure disruptions (regardless of where they occur).

- History: Low (4 points)
- Vulnerability: Low (15 points)
- Maximum Threat: High (80 points)
- Probability: Low (14 points)
- **Total: 113 points**

11. Drought:

Extreme and prolonged drought may threaten drinking water and fire suppression supplies, as well as water-dependent agriculture and industry.

- History: Medium (8 points)
- Vulnerability: Medium (20 points)
- Maximum Threat: Medium (40 points)
- Probability: Low (14 points)
- **Total: 82 points**

12. Dam Failure:

Includes the Tualatin River basin downstream from Scoggins Dam and any of the hydroelectric dams on the Clackamas River (directly affecting a very small portion of West Linn).

- History: Low (2 points)
- Vulnerability: Low (5 points)
- Maximum Threat: Low (10 points)
- Probability: Low (7 points)
- **Total: 24 points**

SECTION 12: FUTURE NEEDS AND GOALS

As a multi-city, multi-county special service district, TVF&R occupies a position unfamiliar to many in the fire service. Any of the District's client cities, at any time, could withdraw from the District and establish its own fire department or contract with another provider. Accordingly, every member of TVF&R must always be aware of the importance of providing every service we do "better, faster, and cheaper" than an alternative service provider could perform. While there are finite limits to the delivery of the same service level in a "cheaper" manner, daily efforts must focus on "better" and "faster" if TVF&R is to remain the provider of choice for its current customers and other communities within the region. TVF&R's Board of Directors and leadership are firmly committed to remaining a regional service provider of the finest quality.

As stated in Section 2, all goal statements should be fully developed. This section is constructed to provide specific information related to those goals that are developed as a part of the annual evaluation of TVF&R's Standards of Coverage. The following information will be provided for every goal:

Rationale: May include national, regional, or local standard used to establish goal.

Conformity to Risk Analysis and Strategic Plan: A brief report or statement confirming that the desired goal is applicable to TVF&R, considering the District's current resources, risk analysis, and perceived ability to add infrastructure, staffing, or equipment.

Estimated Cost: For implementation of goal (for example, if additional staffing is required, estimated costs of FTEs).

Time Frame: Desired timeline for implementation of goal.

Metrics: Method to measure stated goal and/or objective (using TVF&R quality improvement format).

Once the goals and their supporting documentation have been completed and approved by the District's Executive Staff, they will be formally included as attachments to this section of the Standards of Coverage.

Operational Priorities

1. Replace CAD to improve dispatch, data collection, radio and communication capabilities, and fully implement the District's Response Aid Program.

- **Rationale:** Deployment decisions are based on data. Current constraints inherent in the District's communication infrastructure make it difficult to identify causal factors associated with incongruent data (e.g., true stop watch times vs. delayed CAD times). This, coupled with human factors (e.g., not pushing the "Arrive" button on an MDT to capture response performance) decreases our ability to collect and analyze accurate data. The bulk of capturing objective data revolves around the implementation of a new CAD system. Examples of technological advances that a new system will provide include: 1) a built in failure notification system which alerts dispatchers when signals (dispatch tones, response data from MDTs, etc.) between dispatch and responding units are not capturing appropriately; 2) vehicle locating devices that send a signal to CAD and "arrives" the unit based upon their proximity to the incident address. Additionally, access to detailed mapping and preplan applications in real time affect crew decision making capability and resource assignments.

- Conformity to Risk Analysis and Strategic Plan: Conforms to the desire to establish ideal response intervals for specific types of emergencies, and to provide the community, staff, and policy makers with accurate data in order to evaluate performance. Conforms to Strategic Goals I and VII.
- Estimated Cost: Certain components of this are covered within the Washington County Consolidated Communications Agency (WCCCA) upgrade project. Costs associated with tower improvements and WCCCA infrastructure are not outlined here. Currently WCCCA is joining in with Clackamas Communications (C-COM) for a shared CAD system. Significant reductions in the delays associated with border call transfers will occur due to a shared system and shared resources. (e.g. border calls with Clackamas County).

The District has also taken the opportunity to look at our Response Aid Program holistically, making improvements to several key areas that affect data collection and operational efficiency. These areas are identified and detailed in a Capital Improvement Plan for Communications and Information Technology. All elements of this plan tie both to the Communications and IT Strategic Goals and *Strategic Plan* Goal VII. Currently 1.7 million is budgeted in fiscal year 08–09.

- Time Frame: Most of the components should be in place before the end of fiscal year 2009.
- Metrics: Measurement of performance will be through the District's Operations Quality Improvement Committee, who will regularly abstract response data and review for problem areas and other performance indicators within the Communications Service Level Objectives.

2. Complete an analysis demonstrating whether there is a correlation between the Apartment Fire Reduction Program and the decline of structural fires within the targeted class of occupancies.

- Rationale: The District's primary Strategic Goal is to reduce the incidence and severity of fires and emergency medical incidents. Little objective data exists that will quantify the results of Fire Prevention programs. Recently, the District engaged in an award-winning program that is directed at reducing the number and severity of fires in high-risk multi-family occupancies. Reducing the need for additional operational resources is a desirable strategy and is congruent with the need to minimize loss of life and property.
- Conformity to Risk Analysis and Strategic Plan: The goal is consistent with attempting to reduce the number of fires in high-risk multi-family dwellings. The Risk Assessment (Section 3) outlines the significant potential of life and property loss that exists when fires progress to flashover in unprotected dwellings. This goal is aimed at quantifying the results of a public education program that is aimed at minimizing a significant risk factor in the community. This is also tied directly to Goal I of the *Strategic Plan*.
- Estimated Cost: Less than \$3,000 in staff time and resources, with the use of Light Duty Operations personnel for data entry and analysis.
- Time Frame: Initial analysis completed by December 31, 2008. Primary lead is the Public Education staff, with full Operations Division support.
- Metrics: 1) A statistical tool that can be used over the next 3–5 years comparing a control group of high-risk occupancies with those that have received training and education in fire risk reduction. 2) An actual reduction in fires within the targeted group of multi-family dwellings.

3. Build and staff a fire station in the Gaarde Road/Walnut Street area.

- Rationale: Repeated performance analysis has demonstrated a distribution problem in this particular neighborhood. As demonstrated in the Risk Assessment, the area continues to grow, and also includes significant wildland urban interface problems. Travel times from the closest fire stations are not consistent with the District's adopted baselines and benchmarks, and establishing a Total Effective Firefighting Force (TEFF) is hampered in this region.
- Conformity to Risk Analysis and Strategic Plan: Conforms and consistent with current response performance data. Conforms to Strategic Goal I.
- Estimated Cost: \$1.2 million to purchase land, \$2.5 million to build infrastructure, and approximately \$1.44 million per year in staffing (12 FTE).
- Time Frame: Expected completion by December 31, 2008. Staffed immediately upon completion.
- Metrics: Response performance improvements to the Bull Mountain area and for the surrounding stations and areas based on Cad Analyst data. Overall improvement in the District's compliance with adopted performance baselines and benchmarks.

4. Add a Truck Company to the South Battalion.

- Rationale: Concentration and the establishment of a TEFF within preferred time frames are based on the availability of specific resources. One critical component of firefighting is a Truck Company. The District currently has only two dedicated Truck Companies, relying on neighboring jurisdictions for truck coverage in several key areas. In the South Battalion, travel times for Trucks to Box Alarms are long, because the closest Truck comes from Station 51 (Tigard). In addition, concentration studies in the area demonstrate the need for additional truck resources, and for additional response units in the Tualatin region.
- Conformity to Risk Analysis and Strategic Plan: Conforms, and is consistent with the District's goals for both first-due response time performance, and for the arrival of the TEFF. Tied directly to Strategic Goal I.
- Estimated Cost: \$775,000 for the Truck and equipment, \$1.44 million per year in staffing (12 FTE).
- Time Frame: The Ladder Truck has been specified, funds identified, and the order placed with Pierce Manufacturing Inc. Initial staffing will occur some time after January 2009, with the potential of a Peak Activity Unit (PAU) staffing scheme until all FTE have been hired.
- Metrics: Response performance improvements in first-due unit times and in TEFF arrival times in the South Battalion region and in nearby regions.

5. Relocate Station 68 and rebuild several stations (53, 56, 58, 59, and 65) to meet deployment and risk reduction objectives.

- Rationale: Several fire stations have deficiencies that adversely impact deployment decisions. Others have deployment deficits and also do not meet modern seismic standards. The District passed a capital bond of over \$75 million to reconstruct several fire stations, both on current sites and at new locations. More detail is provided in Exhibit 20 (bond justification package).
- Conformity to Risk Analysis and Strategic Plan: The Risk Assessment outlines how time is a key performance factor. Reflex and response times are impacted by stations with poor design, deficient alarm systems, and those that are situated in less than desirable locations (for

example, Station 58 has to circle the block in order to respond to over 90% of their calls). In addition, Section 11 (Major Incident Preparation and Response) lists a seismic event (earthquake) as the second most probable catastrophic event facing the District. All the stations listed above are well below current seismic standards. Conforms to Strategic Goals I, II and IV.

- Estimated Cost: Over \$50 million. Funds have been allocated through the successful passing of a bond in 2006.
- Time Frame: Several years; refer to the bond project timeline (Exhibit 21).
- Metrics: Improved response performance and a higher degree of safety for firefighters within District facilities.

6. Fully utilize all Advanced Life Support (ALS) response resources, public and private, to achieve response performance baselines and benchmarks within TVF&R's service area. Specifically, form an alliance with private ALS providers that allows TVF&R to use their less than six minute response times to "stop the clock" on ALS calls.

- Rationale: Private providers within TVF&R's response areas currently have either an eight minute (Metro West) or a ten minute (AMR) response time benchmark, 90% of the time on all emergency medical events. This is contractually enforced, and the private providers are currently used in a "dual response" method where they are dispatched in tandem with a TVF&R ALS unit to every emergency medical call. However, with the exception of Clackamas County, there is no formal agreement that allows either entity (Metro West or TVF&R) to benefit from the other's deployed resources.
- Conformity to Risk Analysis and Strategic Plan: This proposal is directly responsive to the EMS risk analysis in Section 3. Rapid Paramedic response to certain events is critical, and since the equipment carried for medical intervention is identical between the entities, we will have a clearer picture of the total system performance on EMS incidents. Conforms to Strategic Goals I and VII.
- Estimated Cost: Very little cost (estimated to be less than \$2,000). The times are already collected by all agencies, and there might be some staff time that needs to be allocated by the District's Data Analyst to pull the two data sets together.
- Time Frame: Retrospective to January 1, 2008. Metro West is willing to provide less-than-six-minute data back to January 1, 2008, and we would use that table on a prospective basis to provide total *system* response performance.
- Metrics: Anecdotally, the response time performance of the system as a whole should be better than TVF&R alone. The key metric will be if the baseline and benchmark times for TVF&R improve after aggregating this data.

7. Develop and implement new response performance baselines and benchmarks based on emergency medical incident stratification of severity as described in Section 4. Changing the performance standards associated with these is consistent with EMS "best practice" reports and will improve the safety of personnel during response.

- Rationale: See Sections 3 and 4. Not all EMS responses require a six-minute response time. There is a methodology of categorizing incidents where calls can be stratified based on the need for urgency in our response. Refining these performance attributes will provide a measure of safer response on a percentage of medical events, and will also contribute to a better understanding of TVF&R's performance on critical events.

- Conformity to Risk Analysis and Strategic Plan: Conforms to Risk Assessment based on the method of allocating medical risk and outcomes. Conforms to Strategic Goals I and VI.
- Estimated Cost: No direct costs anticipated. Possible costs associated with training dispatchers and adding to the number of quality improvement data sets that will need to be compared and investigated.
- Time Frame: Implementation within two years.
- Metrics: Improved understanding of response performance to our critical call set.

8. “Tier Two” decisions.

Decisions after the first three priorities will be based on priorities when funding is identified. Based on the current Risk Assessment, and in no particular order of importance, the following list may be considered based on growth patterns, ability to secure property, funding tools, and performance analyses conducted within the next two to five years:

- Further analyze the need for a fire station in the Garden Home-Raleigh Hills area that is co-developed with Portland Fire & Rescue.
- Place an additional unit in the Sherwood fire station.
- Add staffing to the balance of the three-person Engine Companies.
- Construction and staffing of stations in developing areas, such as Bethany, south Sherwood, 170th and Blanton, and west Bull Mountain. Property has been secured for possible stations in Bethany, and on 170th and SW Blanton Street. The rationale for Bethany is associated with how rapidly the area develops, and constructing and staffing the station will depend on the pace and direction of development. For 170th and Blanton, the rationale is associated with Hillsboro Fire & Rescue eventually building (or rebuilding) a station on the border of the St. Mary’s property between SW 209th and approximately SW 229th. If Hillsboro Fire & Rescue moves their Brookwood Station west, then TVF&R’s Station 62 is likely no longer in an optimal location. Based on response analyses conducted in 2004–2006, a relocation of Station 62 to the area of approximately 170th and Blanton would allow continuity in distribution and would improve travel response to Aloha and west Beaverton. This could change based on where Hillsboro Fire & Rescue locates a fire station.

These particular station and resource decisions will need to be revisited on a regular basis and the pace and location of development will likely dictate which option should be pursued first. In addition, location studies conducted earlier may no longer be relevant when the decision to build new facilities is made, and current properties may have to be exchanged if they are no longer relevant based on growth, development, and political boundaries.

APPENDIX: LIST OF EXHIBITS

Exhibit 1: Annual Budget Document

Exhibit 2: Strategic Plan

Exhibit 3: Proposed Urban Reserve and UGB Population Expansion—Map

Exhibit 4: Terrain and Waterways—Map

Exhibit 5: Demographic Portrait and Population Forecasts 2005–2020

Exhibit 6: Level III HazMat Facilities and Regional HazMat Program Description

Exhibit 7: Risk Analysis Worksheet

Exhibit 8: FMZ Quadrant—Map Example

Exhibit 9: Response Performance—Map

Exhibit 10: Tualatin Valley Fire & Rescue and Portland Fire & Rescue Memorandum of Understanding

Exhibit 11: Reflex Time Study

Exhibit 12: Fire & Rescue Protocols

Exhibit 13: Unit Hour Cost for 2006–2007

Exhibit 14: Standard Operating Guideline 4.1.4, TVF&R Quality Improvement Process

Exhibit 15: Operations Quality Improvement Process Action Team Example

Exhibit 16: Standard Operating Guidelines, Protocols, and Training Bulletins—Example

Exhibit 17: Standard Operating Guideline 11.1.10, Individual Mandatory Compliance Training

Exhibit 18: District Activities Schedule—Example

Exhibit 19: Apparatus Plan

Exhibit 20: Bond Justification Package

Exhibit 21: Bond Project Timeline