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NOTE REGARDING NEXT STEPS AND IMPLEMENTATION

This Service and Organizational Study provides advice and recommendations to the City Manager and was conducted in consultation with the Divisions. The Study identifies actions and directions that could result in more efficient and effective service delivery, organizational and operation arrangements and associated savings.

The City Manager will work closely with senior management to determine which of the actions are feasible and can be implemented, implementation methods and timeframes, and estimated savings. In some cases, further study many be required; in other cases the actions may not be deemed feasible. Implementation will be conducted using various methods and may be reported through annual operating budget processes or in a report to Council, where specific authorities are necessary. In all cases, implementation will comply with collective agreements, human resources policies and legal obligations.

Preliminary estimated financial implications have been identified in the study by year where possible. In some cases financial implications may be included in the 2014 or future years budget submissions.

Appendix C

A Service and Organizational Study of Toronto's Emergency Medical Services and Fire Services

Final Report

June 2013

Pomax

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1.0 Introduction

1.1 Background

In April of 2011, City Council considered a report from the City Manager and Deputy City Manager/Chief Financial Officer regarding the initiation of a Service Review Program, which was intended to help mitigate the 2012 Operating Outlook Pressure and, in the longer term, contribute to resolving the City's structural deficit.

The Service Review Program includes three key components:

- A Core Service Review that examines what services the City delivers and at what level;
- Service Efficiency Studies that examine how the City delivers its services; and
- A User Fee Review that examines the City's fees to determine the extent to which they are fair, and collect the full service cost.

KPMG LLP was retained by the City Manager to assist with the Core Service Review which:

- Reviewed and analyzed all City services, activities and service levels provided by divisions and agencies and applied a core service filter to services;
- Identified which services are provided at higher than standard service level;
- Conducted a jurisdictional review of comparable municipalities and jurisdictions; and
- Identified options and opportunities to change services and service levels.

KPMG conducted a core service filter assessment which ranked services by the following categories:

- Mandatory: required by legislation;
- Essential: critical to operation of the City;
- Traditional: provided by virtually all large municipalities for many years; and
- Other/Discretionary: provided by the City to respond to particular community needs.

KPMG also put forward options and opportunities for the City's consideration to change services and service levels, provided preliminary information on risks and implications of making these changes and potential timelines for implementation, and provided a high level order of magnitude of potential savings for each opportunity.

The opportunities identified through the Core Services Review related to Toronto Emergency Medical Services (TEMS) included:

- Consider outsourcing some or all of non-emergency inter-facility patient transports
- Consider eliminating Community Medicine activities.
- Consider integrating TEMS and TFS organizationally and developing new models to shift more resources to TEMS response over time.

The opportunities identified through the Core Services Review related to Toronto Fire Services (TFS) included:

- Consider reducing the range of medical calls to which the fire department responds.
- Consider integrating TEMS and TFS organizationally and developing new models to shift more resources to TEMS response and less to TFS response over time.
- Consider the opportunities to improve fire response times and decrease equipment requirements through dynamic staging.

City Council's Executive Committee referred the KPMG opportunities with respect to TEMS and TFS to the City Manager for inclusion in broader service and organizational studies to be reported to Standing Committee and City Council as required.

1.2 Project Overview

The project objective and deliverables were inclusive of the following activities:

A) Documenting and assessing the current operations of TEMS & TFS, including but not limited to:

- An analysis of service demand and required resource levels projected through to 2022 taking into consideration public safety performance (such as response times and service levels), demographics, population, traffic, built form, legislative and health and safety requirements.
- Conducting a scientific and academic literature review that identifies industry best practices, emerging challenges and risks that should guide service delivery.
- Conducting a scan to identify potential immediate (2012/2013) operational efficiencies considering a range of strategies such as business process re-engineering, outsourcing or alternative service delivery, automation, shared services and service innovation that may result in cost savings.
- Identifying estimated high level savings, implementation costs and timeframes of operational efficiencies and potential risks and implications, including, for example, impacts on service delivery, impacts that are cross-divisional or enterprise-wide and other effects of proposed changes.

B) Conducting an evaluation and analysis of comparable Canadian, American and international jurisdictions to identify a full range of service delivery model options.

- Identifying comparator jurisdictions, taking into account scale, population density, complexity, legislative context, economic and social factors, organizational mandates, funding mechanisms including fee-for-service billing, maturity of the service delivery model, and other relevant governance, organizational, and service attributes.
- The final list of comparator jurisdictions was approved by the City of Toronto as part of the study work plan and during the mid-range timeline of the project.

C) Proposing service delivery and organizational model options that optimize efficiencies while ensuring service effectiveness.

This objective included comparing the proposed models to the current service delivery models and describing the relative advantages and disadvantages of each, including an analysis of:

- Key model features including structure, reporting in the City administration, staffing requirements and service delivery attributes;
- Comprehensive health and safety risk assessment to consider the impact of proposed service delivery changes on staff and public safety;
- Consideration of service delivery models which use resources most efficiently and eliminate or explicitly minimize duplication with respect to responding to medical calls;
- Strengths, limitations and challenges including potential implications with respect to service delivery, incident and patient outcomes, funding, collective agreements, wages and pension adjustments;
- Organizational cultural impacts, risks to operational and organizational success, and benefits to the City;
- Potential risks and mitigation strategies;
- Short and long-term training and certification costs if applicable, including wages equipment, tuition, and instructor costs;
- Legislative and funding requirements;
- Estimated order of magnitude cost savings for 2013 and future years;
- Detailed implementation work plan, timelines and estimated implementation costs including phased implementation if appropriate;
- The number and locations of fire and EMS stations particularly with respect to the proposed service delivery and organizational model options
- Consideration of station requirements including short, medium and long term capital priorities to implement station retrofits if applicable; and
- Estimated short, medium and long term operating and capital investments if required.

Areas outside of the scope for the study were:

1. Examining the facilities management, real estate and fleet functions in TEMS & TFS.
2. The Toronto Police Service contribution to the Tiered Emergency Response Agreement.
3. The response time target of 90% was not subject to review as part of this study[1]. However, travel time was considered in the context of the scientific and academic literature review, the evaluation and analysis of comparable jurisdictions and proposed service delivery and organizational model options, including a comprehensive health and safety risk assessment to consider the impact of any proposed changes on staff and

[1] The veracity of 90th percentile fire and EMS targets was not examined as a separate subject. However, there was a necessity to use 90th percentile parameters, either identified by the city or based upon scientific literature, as one of the parameters to determine resource requirements.

public safety; implications with respect to service delivery and incident and patient outcomes; potential risks and mitigation strategies; and an assessment of liability issues.

1.3 Project Methodology

Our approach to Toronto's fire and EMS project was not unlike that of similar projects conducted by other consultant teams, or the techniques that would be used by other consulting companies, except for the magnitude of the assignment and detail with which the data was examined.

The project process included:

- Key informant Interviews;
- Site visits;
- Review and assessment of organizational and staffing models;
- Research and analysis of best practices and service delivery models;
- Data collection and analysis;
- Resource and apparatus modelling;
- Fire sub-risk overview;
- Concept development and analysis; and
- Jurisdiction and literature review.

Interviews

Our interviews included departmental representatives, Fire and EMS Chiefs, Deputies, Divisional Chiefs and other ranks at TFS and TEMS. Interviews and orientations within the fire and EMS departments took place to discuss organizational perspectives, and position roles and responsibilities. The consulting team also conducted interviews with other City divisions to garner a wider understanding of TFS and TEMS and their context within the overall corporate organization.

TFS	*TEMS*	*Other City Divisions*
• Policy, Project and Public Information • Special Projects and Emergency Planning • Fire Protection and Public Education • Communications Centre • Staff Services • Operations Division • Information and Communication Systems	• Communications Centre • Program Development and Service Quality • Operational Support • Operations • Policy and Project Management • Community Medicine • Public Information and Media	• Office of Emergency Management • Human Resources, Employment Services • Toronto Planning: Community Planning; Special Projects • Financial Planning • Deputy City Manager Clusters A, B, and C • Toronto Building

• Facilities and Material Management • Professional Development and Operations Training • Toronto Firefighters Association 3888	• Financial Services (shared by fire and EMS) • Communications Systems Engineering • Toronto Paramedic Association • CUPE Local 416	• Purchasing and Materials Management

Additionally, Interviews were conducted with base hospital physicians at the Sunnybrook Centre for Prehospital Medicine as well as with physicians for TEMS and TFS, to understand the base hospitals:

- Roles and responsibilities
- Support of a revised tiered response protocol with respect to the frequency and circumstances under which fire apparatus and staff are dispatched to medical emergencies
- Determination of fire and EMS response parameters
- Roles and responsibilities of fire and EMS in medical response
- Response criteria perspective and the criticality of response time.

Site Visits

Our process encompassed site visits to fire stations, fire training locations, and an introduction to areas of the city that demonstrated the challenges that firefighters face. Site visits provided an opportunity to add context to project tasks and to gain perspective. The visits included the following stations and the TFS communication centre.

- Station 313, Rosedale & Cabbage Town
- Station 314, Hospital Row & Queens Park, U of T
- Station 325, Regent Park
- Station 332, High Rise, Hospital Row, Entertainment District, Rogers Centre, CN Tower, Union Station, The Path, traffic congestion, underground malls, and subway and hydro vaults
- Station 426, Parkdale, the Gardener Expressway, St. Joseph's Hospital, the Lake Row Housing, old building stock.

Site visits for emergency medical services took a different approach since paramedics are often mobile and not at the stations. In addition to station visits, Pomax observed shift change processes, talked to paramedics on the road and at hospitals, observed hospital offload processes, and spent several days in total at the TEMS communication centre.

Study Review Principles

This study was based on the following principles:

- To rely on factual evidence for concept development and study recommendations;
- To understand the issues, concerns or suggestions of front-line fire and EMS responders, and managers;
- To evaluate the experience, success and challenges of other service delivery models; and
- To assess reasonable alternatives and service delivery models within the needs and constraints of Toronto.

2.0 Toronto Fire Services

2.1 An Introduction to Fire Services

2.1.1 Fire Fighting and its Challenges

Fire services is an 'all hazards' and 'all response' agency. In fact, contrary to what most people realize, fighting fires is, fortunately, a small, albeit critical, part of the services fire departments provide. It is also important to understand that TFS responds to over 10,000 incidents a year that are reported as fires to the TFS dispatch centre whereas, in 2011, 2,033 turned out to be structure fires. The balance are incidents such as no loss outdoor fires, pots on stove, overheating, human perceived emergencies, and other incidents, some of which could become structure fires. The important thing of which to be aware is that when a fire emergency is called into the fire dispatch centre it must be responded to as such.

Complexity of Fire Response

Although the response to a working fire incident is a complex matter, there is not a lot of evidence to indicate what happens when resources do not respond in a timely fashion with sufficient personnel to undertake and complete the critical tasks required for successful intervention. Fires are dynamic events which, without intervention, will progress and grow exponentially, and that is the reason why minutes and seconds count.

Tests by independent agencies inform us that the contents of buildings have changed considerably over the years and, as a result, the type of fuels and heat energy stored in modern furnishings are considerably higher than in wood and natural fabrics of yesterday.

To further complicate matters, from the perspective of the fire crews, lightweight engineered construction materials have added an additional consideration concerning safe operations. The use of lightweight engineered construction material in floors and roofs of newer buildings means that different tactics must be employed to safely engage in interior operations, including extinguishment and rescue. Engineered lumber burns faster than dimensional lumber and modern furnishings emit high levels of toxicity when ignited. As a result, the window of opportunity for successful intervention and rescue is greatly reduced. The time to flashover[2] has been reduced significantly over the past 20 years and the time for crews to confine a fire to the room of origin has correspondingly been reduced, which underscores the necessity of a timely response. More important, it underscores the importance of ***prevention*** **and** ***education*** activities to reduce the incidence of fires, and other steps to reduce danger to occupants and fire fighters. These include covering engineered lumber with drywall or flame retardant paints and installing sprinkler systems.

[2] A flashover is the near-simultaneous ignition of most of the directly exposed combustible material in an enclosed area.

A March 2012 summary report[3] from Underwriters Laboratory and the National Institute of Standards and Technology reviewed the results of a series of experiments aimed at assessing the fire performance of engineered floor systems. The experiments resulted in a number of outcomes, depending on the floor system and whether it was protected by drywall or sprinkler systems, with structural failure occurring at around 5 minutes in cases of a 7.25 inch steel C-joist on 24 inch centers under heavy weight loads, to unlimited structural time when protected by sprinkler systems.

In the United States, changes to the International Residential Code (IRC) require a one hour flame rating for floor assemblies. This will limit builders' ability to use engineered lumber or I-joists for some flooring systems unless the bottom of the joists is covered with drywall, or sprinkler systems are installed. Unfortunately, the IRC is a model-code book, so it does not become law unless adopted by a local jurisdiction. Alternatively, manufacturers are producing engineered joists with an applied flame retardant, such as Weyerhaeuser's product, called 'Flak Jacket', which complies with the new one-hour flame rating guideline. Nevertheless, there is a generation of buildings using engineered floor joists that may compromise the safety of occupants and firefighters unless steps are taken to mitigate this risk.

In the 1970s, a National Institute of Standards and Technology (NIST) study found that people had approximately 17 minutes to escape a fire after a smoke alarm activates. But when the institute repeated the study in 2004, it found that the escape window had shrunk to just three minutes for the most susceptible of the population in relatively close proximity to a sudden intense fire[i]. However, occupants in other areas of a house – for example, a second floor bedroom with the doors closed – have double the time to escape *assuming* they are quickly alerted by a smoke alarm. This underlines the value of having interconnected smoke alarms so that when one is activated, all are activated. It also underlines the importance of public education so that the public understands the need for smoke alarms and other preventative tactics.

Residential building style and size has changed in the past half century. Prior to the availability of engineered lumber and the use of lightweight steel, which have made it possible to reduce the number of support walls, houses featured smaller, separated rooms which assisted in confining fires and reducing the availability of oxygen. Expansive living environments also provide an opportunity for smoke and toxic gasses to spread throughout a house.

Notwithstanding these valid concerns, we will show that except for one circumstance of a building constructed in 2003, all other fire deaths in Toronto in the 3 years for which data was available (2009 – 2011), have occurred in buildings constructed in the 1970s and earlier using dimensional lumber. This suggests that fire risk and deaths may be more related to factors other than building materials.

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[3] http://www.ul.com/global/documents/offerings/industries/buildingmaterials/fireservice/basementfires/2009%20NIST%20ARRA%20Compilation%20Report.pdf

Fire Response Protocols

Fire professionals on our consulting team emphasize the importance of establishing fire response protocols which dispatch sufficient resources to undertake firefighting operations as quickly as possible. They assert that the only resources that should be held back from an original fire response dispatch are apparatus which are of a support nature, and are not needed to perform any of the critical tasks that are required in the successful intervention of a working fire.

It has not been the practice of fire services to provide detailed step by step descriptions of the exact tactical actions taken by individual fire crews while performing firefighting and rescue operations. As a result, it is extremely difficult to deconstruct the activities of response crews as part of a debriefing process. This has not been a requirement of normal or common practice and has been confined to exceptional circumstances involved in severe injuries, fatalities, or criminal activities that had the potential for action or prosecution through the courts. The norm is that fire incident reports were primarily used by insurance providers as a basis for policy application, and by the Office of the Fire Marshal for determining the cause and origin of fires in the province. However, with the cooperation of TFS, our team has created a high-level process map of firefighting tasks typical of several fire emergencies. It can be found in ***Appendix B - Assignments and Resources Required at Fire Incidents***.

The total impact of fire is never completely and accurately captured in fire service loss reports. Estimates by fire services are rarely, if ever, confirmed with the insurance industry. The insurance numbers are usually finalized weeks or months after a fire and there is no process in place for follow up. What is generally captured in fire reports is only the physical loss to the building and contents, without value placed on the net cost or social impact of issues such as temporary relocation while repairs are carried out. The net economic loss from fire is not captured in the fire loss numbers and can, in many instances, far exceed the loss to building and contents. It is accurate to say that the fire report figures are estimates and the process used by the fire service is not an exact science.

Impacts of Fires

Fires in business or industry have a net economic impact on the broader community. It is possible that a fire may be confined to one business, although it may spread and devastate a larger area particularly if sufficient resources are not in place to intervene and aggressively attack and stop its progress. We can see this impact in rural areas where losses to farm buildings and equipment could be in the millions of dollars because the frequency of fires is not sufficient to warrant the significant costs of implementing a career firefighting service, and travel distances are great.

The impact of a fire can extend well beyond the damage and loss to individual buildings. There is also a direct impact upon the lives and economic outlook for building owners, businesses, and employees, as well as adjacent buildings and businesses.

Although all reasonable efforts must be taken to respond to and extinguish fires as quickly as possible, thereby mitigating the associated psychological and net economic impact, the best approach is to improve public education and inspection services and avoid, to the extent possible, the occurrence of fire.

2.1.2 Convergence of Fire Apparatus

Fire stations do not operate as standalone entities. It would be prohibitively expensive, in the City of Toronto, to house all the equipment and apparatus that may be required to provide an appropriate response to all incidents within each station's response area. Urban based fire departments respond on a station convergence basis, which means that fire trucks from several stations respond simultaneously and converge required resources on the affected location. The level of that convergence is based upon the risk level of the occupancy and the required critical tasks to be performed in the event of a fire.

A firefighting scenario

Fire services' equipment, apparatus, and staffing requirements vary and are guided, in large part, by legislation in Ontario; standards and guidelines from entities such as the Ontario Fire Marshall's Office and the National Fire Protection Association; and a community's service level profile which is determined by municipal council. Fire extinguishment crews, ladder crews, rescue groups, rapid intervention teams, Incident Management Systems (IMS) positions, and tactical reserve are examples of assignments that must be adequately staffed at the scene of the working structure fire. In addition, the Incident Commander (IC) needs to consider the total extinguishment staffing requirements based on rate of flow, backup lines, placement of lines above the fire and the establishment of secondary water supply. 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, defines tasks and minimum staffing recommendations for the initial response. These resource levels per task include:

1. Establishing command (minimum one person);
2. Establishing a minimum uninterrupted water supply of 400 GPM (1514 L/min) (minimum one person);
3. Establishing an attack line and backup line flowing at least 300 GPM (1136l/min) (minimum four people);
4. One support person for each line (minimum two people);
5. At least one search and rescue team (minimum two people);
6. At least one ventilation team (minimum two people);
7. Establish an initial rapid intervention crew RIC; (minimum two people, expanding to four);
8. If an aerial ladder is in use, a person operating the aerial ladder (minimum one person).

These minimum staffing guidelines total 15 firefighters, expanding to 17 firefighters when an additional 2 people augment the initial rapid intervention crew. The TFS initial response is comprised of 16 to 17 firefighters including the District Chief and Fire Incident Technician (please see the firefighting tasks process map at the end of this section).

There are occasions where the first-arriving unit(s) control the fire, and the total response defined in NFPA 1710 is not required. As an example, the first-arriving pumper and aerial truck companies conduct the initial attack on a mattress fire inside a residential property. The pumper extinguishes the fire and provides an interrupted water supply as well as the two-out rapid intervention crew[4] (RIC). Aerial Truck company members conduct a quick search and rescue with one crew while the other crew vents the building.

On other occasions the staffing needs are greater than the initial response outlined in NFPA 1710. In these cases departments must call for additional alarms (apparatus and staff) in order to conduct the tasks required during such incidents. Consider a fire on the second floor of an unoccupied auto parts store with external exposures (outside walls) on three sides. Each fire company has an officer, an apparatus operator, and two firefighters on duty.

In a scenario such as this the first arriving officer takes command and gives an initial report indicating a working fire on the second floor while working with another member of the crew in advancing a standard pre-connect hose line to the second floor. As per the standard operating procedure a forward lay 100 mm hose supplies the initial operation from the closest fire hydrant. The apparatus operator remains at the pumper, while the firefighter assigned to the hydrant hooks up and then joins the apparatus operator as part of the initial rapid intervention crew RIC. This assumes that the firefighter hooking up to the hydrant will be able to join the apparatus operator as a member of the initial RIC before the attack team enters the structure.

The second arriving pumper company will advance an additional hose line to the fire floor to increase the rate of flow or provide a backup hose line to the first-in attack team. Otherwise, they are to advance a hose line to the floor above the fire. Realizing that there is a working fire in a pre-incident plan building that requires a large rate of flow, the officer of the second pumper company plans to back up the initial pumper company by advancing a 65 mm hose line into the building.

The second pumper company would probably not secure a source of water for itself. The second pumper company officer would radio command to advise that a second source of water has not been secured. One firefighter from the second pumper joins the firefighter from first pumper to form a dedicated rapid intervention crew. The remaining three crew members from pumper two would advance a 65 mm hose line off the first pumper company's pumper. The second responding fire pumper is parked out of the way of other arriving apparatus, but in a position to be ready to protect exterior exposures, should it become necessary.

There is a good chance that the water applied from these two hose lines will be adequate to control the fire. Reconnaissance is really the best way to determine the need for more lines to

[4] Two firefighters who remain prepared to rescue fellow firefighters in case of an adverse incident that could threaten the welfare of the firefighters extinguishing the fire.

control the fire. In any case, there is still a critical need to back up the hose lines operating on the fire floor, secure additional water supplies and get a hose line to the third.

If an aerial truck arrives early there may be a need for this crew to force entry into the building. Otherwise, the pumper company crews will be responsible for this task. The aerial company's crew will split up with two firefighters providing aerial duties such as horizontal ventilation for the pumper companies working on the second floor, laddering the second floor (and third floor if there is one), and controlling utilities (isolating gas and hydro). The other two members of the aerial truck company will work above the fire, conducting the primary search and checking for fire extension on the third floor.

The first arriving chief officer establishes an exterior stationary command post and confers with the company commander on the first pumper who was serving as the initial incident commander. Pumper one's officer advises the chief officer of the progress being made on the fire. After a careful size-up, the chief officer assumes the position of incident commander and develops the following incident action plan:

1. Conduct the primary search of all floors. (Companies currently on the second and third floors will be responsible for searching these floors)
2. Ladder the building on 2nd and 3rd floors to provide alternative egress for firefighters
3. Advance a backup hose line to the second floor
4. Advance a hose line to the third floor
5. Secure a second water supply
6. Stage pumper and truck company as a tactical reserve
7. Plan for possible defensive operation
8. Set up a rehab (a place for firefighters to rest and cool off from the heat of the fire)

Most urban fire departments send a large response to a commercial building or a high-rise building. However, in the immediate example being discussed here, the incident commander's action plan would include several additional tasks that have not been staffed and there is no tactical reserve where the two person minimum is assigned as a rapid intervention crew. Continuing operations will require additional resources.

The third pumper is instructed to supply its apparatus with the 100 mm supply line into an advance 45 mm hose line the third floor. The fourth pumper will back up the two lines operating on the fire floor with a 65 mm hose line advanced from the third pumper's apparatus. At this stage, the members of the aerial truck should be free to complete primary search and check for extension on the first.

A heavy rescue crew, upon arrival, could be assigned as the dedicated rapid intervention crew with one member assigned to become the accountability officer. The two members assigned to the rapid intervention from first pumper and second pumper can now rejoin their company. The third aerial truck company and fifth pumper company would standby two blocks from the scene. Additional staff officers could be assigned to fill the positions of safety officer or planning section chief. While it may be possible to double up on some assignments firefighter safety must never be compromised.

Without an exposure or rescue problem, and with all companies taking appropriate action, this fire required what would be an extra alarm assignment. Note that three or four firefighters are assigned to each hose line, with the exception of the first line, where only two firefighters are available for interior assignments. Operating a hose line with two firefighters is an absolute minimum and very arduous task. Two firefighters can safely operate a 45 mm hose stream during practice session. During an actual fire, it may be necessary to advance a hose line up stairways, around obstacles, and through multiple doorways, then operate the hose line from a crawling or kneeling position, all of which greatly increase the effort needed to successfully place a hose line position. Assigning all available personnel from a single company to a hose line not only provides the staffing necessary to properly position and operate the attack line, it also maintains company unity and accountability.

There are circumstances where the apparatus used to deliver staffing to the incident scene is more than sufficient to support an offensive operation. One of the challenges faced by an incident commander is to properly position on-scene apparatus to best utilize their capabilities. Apparatus that are not needed at the incident scene should be parked out of the way, preferably in a position that allows access to water supplies and makes them available to support possible defensive action (exterior operations).

During large-scale incidents, apparatus are often assigned to a staging area. In such a circumstance the incident commander should designate a staging officer to manage and coordinate all companies assigned to the staging area. At this “stage” the apparatus would have the staffing necessary to function as a unit, such as a pumper company and aerial truck company. Apparatus without adequate staffing would be classified as out of service or parts, rather than staged.

Incident commanders could face the temptation to use on scene apparatus whether they are needed or not. However, more often than not, during offensive operations there is a need for additional staffing, not additional apparatus and placing unnecessary apparatus in an immediate fire zone could block access if a change in tactics is required.

To conduct a safe and effective offensive operation, an incident commander must consider a number of different factors. One of the most important considerations is to determine whether there are sufficient personnel and resources on scene to deliver the required rate of water flow needed to suppress a fire, and to protect firefighters. In addition, an incident commander would consider the probable duration of the event and the sustainability of critical operations when deploying resources.

Figure 1 lists critical tasks required at a fire at a major occupancy.

Figure 1 - Major Occupancy Sample Critical Tasks

CriticTask List					
1	Incident Command	10	Water Supply	19	Overhaul
2	Incident Safety Officer		· Pressurized	20	Lighting
3	Search & Rescue		· Non-pressurized	21	Rehabilitation
4	Rapid Intervention Team (RIT)	11	Forcible Entry Team	22	Operations Officer
5	Accountability	12	Exposure Protection	23	Logistics Officer
6	Pump Operator	13	Entry Control	24	Administrative Officer
7	Attack Line (Confine & Extinguish) + Backup	14	Sector Officers	25	Planning Officer
8	Ventilation	15	Air Management (air refilling station etc)	26	Evacuations (large scale)
9	Laddering	16	Utilities	27	Communications (dispatch)
	· Aerial or elevating device operator	17	Occupant Safety	28	Public Information Officer
		18	Salvage		

A graphic depiction of the activities, assignments and resources required for several different fire incidents can be found at the figures listed below within ***Appendix***

Figure 9 - First Alarm Response Resources Required
Figure 10 - Fire Fighting Process, Bungalow Fire
Figure 11 - Second Alarm Response Resources Required
Figure 12 - Fire Fighting Process - High Rise

Successful intervention at a working fire is a function of time and resources. Without the proper resources deployed for the earliest possible intervention, conditions deteriorate and the impact of the fire worsens. Needless to say, those directly affected by the escalation of the fire are the building occupants and the firefighters.

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[i] Tenability time is when the first tenability limit is exceeded 1.5 m (5 ft) from the floor at any point along the primary escape path. The tolerance of people to fire conditions is a subject of considerable debate worldwide, because it has significant implications for public safety and for product liability. Deciding on appropriate tolerance limits is highly complex because of the broad variability among people and the need for conservatism to protect the more vulnerable portions of any population.

As noted in the National Institute of Standards Technical Note 1455-1, February 2008 Revision, this topic has been the subject of work by an international committee of experts working as ISO Technical Committee (TC) 92, subcommittee (SC) 3. This group has published a technical standard, ISO TS 13571 [26], that recommends limits of human tolerance to fire products. These limits are also consistent with the recommendations in the SFPE Handbook of Fire Protection Engineering [23]. Limits for elevated temperature and toxic gas species were taken from ISO TS 13571. For smoke obscuration, an optical density of 0.25 m-1 was used as a tenability criterion, a value typically used by the smoke alarm industry.

It should be noted that ISO TS 13571 is considered by most (including its principle authors) to be highly conservative, stating that the ***"... values are intended to assure with high confidence that even vulnerable people will not be incapacitated, then killed."*** Thus, any observations based on analyses using these values may look much worse than what would be seen in actual use because ***tenability is based on the most susceptible of the population***. The ISO TS 13571 values represent the best, international consensus so they were used for the primary analysis, but the data has been made available so that others can examine the impact of other limits.

Time Needed for Escape

As with the original Indiana Dunes tests, Technical Note 1455-1 does not select a value of time needed for escape since this is highly variable and is a function of the age and condition of the occupants, travel distances, behavior affecting pre-movement times, etc. An independent analysis of the Indiana Dunes data in 1975 [43] chose 3 min as an (arbitrary) reference number. A subsequent study funded by NIST at the University of Massachusetts (Amherst) [44] found average times needed to awaken sleeping occupants, phone the fire department, and evacuate all family members was about ***50 seconds for families with children*** and ***nearly 70 seconds for the elderly***.

2.2 Fire Services Data and Statistics

When we think of fire departments, most of us think of firefighting but TFS also responds to many other emergencies including floods, swift water rescue, hazardous materials, natural gas or propane leaks, electrical emergencies, and many others. Clearly, when we don't know who to call we depend on the fire department. Toronto's fire services also respond to medical emergencies where they provide rapid assistance to patients in respiratory or cardiac arrest, anaphylactic shock, and other serious situations until paramedics can arrive. Fire fighters then continue to assist paramedics with medical care. Without doubt, Toronto's fire services are a critical part of public safety in the city.

Sources of Data

Readers should be aware that there are two forms of data used during this discussion of fire services data and statistics. There is a set of information based upon how the details of an incident was received by the fire service call taker and dispatched to the fire responders, and another set that defines the outcome of the incident.

The incident as it was received is usually captured within the Computer Aided Dispatch system or CAD whereas the outcome of the incident may be part of the Record Management System or RMS. For instance, a call for assistance might be received by the fire call taker as a 'fire' and the fire responders would be dispatched and given the information of a reported fire. Upon arrival, they might discover a pot on a stove or something overheating, and the incident outcome would be recorded, in the Record Management System, as overheating or 'pot on stove' rather than a fire. Another possibility is a call that could be reported as a garbage container on fire but, upon arrival of the fire crew, it could have spread to a garage or other structure. Therefore, the outcome might be captured in the Record Management System as a structure fire.

We use the Computer Aided Dispatch information to explain incidents received and the Record Management System to explain the result of an incident. This also helps to explain the variance between call type as received and outcome, which could be substantially different.

Emergency Medical Services experiences the same type of variances and tracks them in an effort to determine the relationship between information received at the time of a call being received, the result, and indicators that assist EMS to determine the most appropriate and efficient resource level required, when a call is received.

Although we usually indicate the source of data throughout this document, readers should recognize that Computer Aided Dispatch (CAD) information is used if it is not expressly noted that Record Management System (RMS) or outcome data is used.

Core fire incident volume

Chart 1- Population Growth Related to Core Fire Incidents, relates historic and expected population change to core incident volume for a corresponding number of years. We have defined 'Core Incidents' as all calls to which the fire service responds except for responses to fire alarms and medical calls.

Medical calls were filtered out because they are responded to, based upon the contingency capacity within the fire service. To explain this another way, fire services are often available for calls; stations aren't constantly active or responding to incidents which means that the capacity available, while waiting for a core fire incident to occur, can be used to respond to medical emergencies. Therefore, fire response to medical emergencies should not be an influencing factor on the need for staff and resources within the fire services. However, TFS explains that, except in very rare circumstances, a response is always sent to a medical call. If a fire truck is available at a station within the catchment area of the medical incident, that truck is sent. If the closest station is already occupied on another incident the next closest truck is sent. Nevertheless, the number of responses, each year, to medical calls by the fire service can be reasonably influenced by policy and operations. For example, a revised medical response protocol instituted in June of 2012 is estimated to have reduced the number of fire responses to medical calls from approximately 86,000 to less than 50,000 annually.

As well, although the fire service plays an important role in responding to some medical incidents, ambulances or emergency medical services' response vehicles would also be responding to the same incidents. There is the possibility that operational discretion could be factored into a decision about fire trucks responding to some medical incidents when the closest station is already engaged. TFS and TEMS, along with direction from their medical advisors, should take this into account when forming response policies.

Alarms have been filtered out because they have declined in volume between 2005 and 2011, in part because of the fines the City has instituted for false alarms, and education of alarm companies and owners. In 2005 TFS responded to 29,063 alarms ringing and in 2011, 22,476[5]. The implementation of increased fines and education has positively influenced the number of fire alarms occurring annually. Although there is a possibility that the number of other call types might be influenced by policy, the degree of change is unlikely to be as pronounced as with medical calls and fire alarms. Therefore, the inclusion of fire alarms and medical calls in these calculations would skew the appearance of changes in fire service activity.

When fire service responses from 2005 to 2011 are examined and medical emergencies and alarm calls are filtered out (Chart 1- Population Growth Related to Core Fire Incidents), we find that the fire service's call volume, by type, has remained stable or declined during that time period. When the core fire incident trend is compared to Toronto's population growth we can see that there is actually a decline in incident growth. Put another way, population growth and fire core incident volume are not directly related and Toronto's population growth is not a signal of increased call volume for the fire service, at least not on a straight-line per capita basis. This is not unique to Toronto. The City of Vancouver Fire and Rescue Service's Strategic Plan states:

Historically the primary role of most Fire Departments was to respond to fires as they occur. With the evolution of fire and building codes and increased emphasis placed on fire prevention and education, we are seeing that the number of fires have remained quite consistent over the past five years, even though the population has increased.

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[5] There is a difference in the count between alarms reported by alarm companies (19,933), and all alarms (22,476), because some alarms are called in by other than alarm companies.

Chart 1- Population Growth Related to Core Fire Incidents

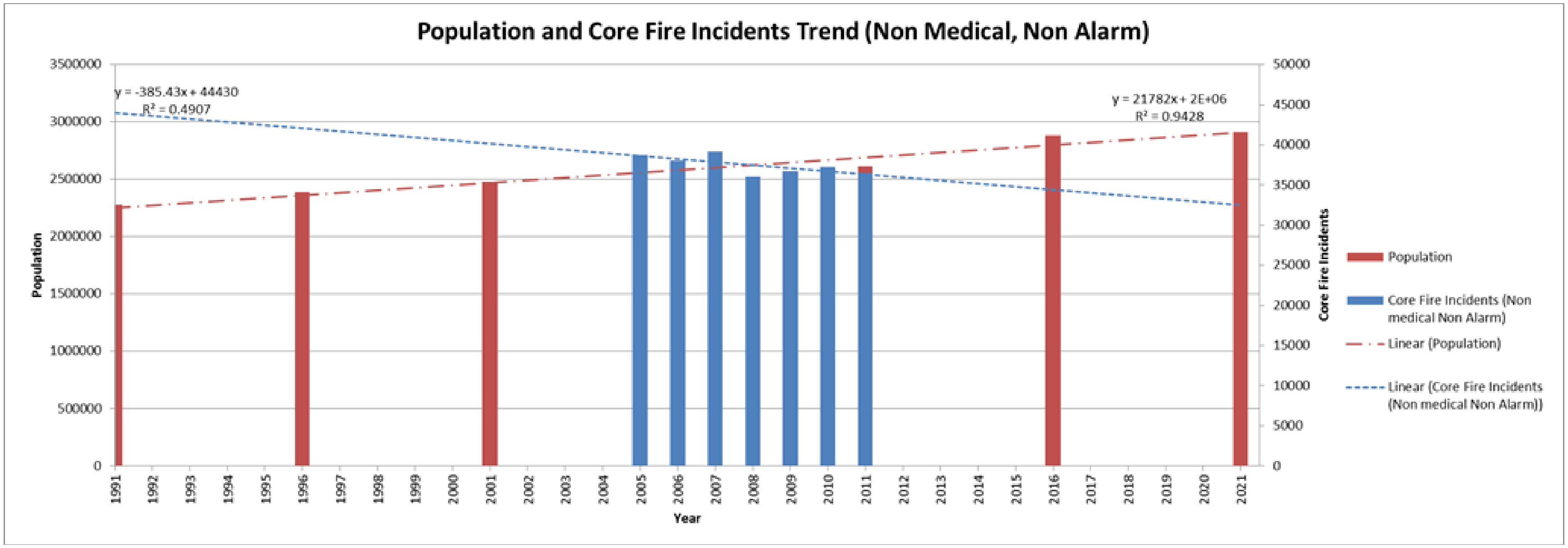
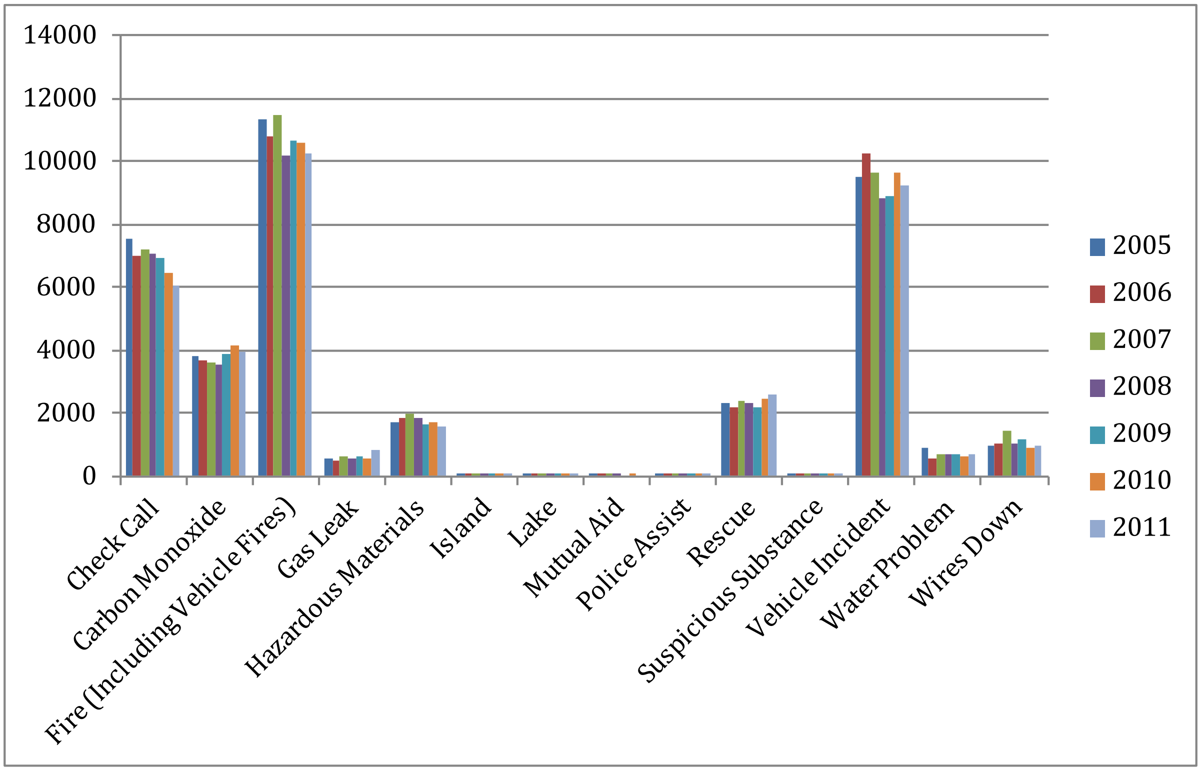


Chart 2 reflects call volumes, by type, as **dispatched**, not by outcome or as really found.

Chart 2 - Responses by Type by Year

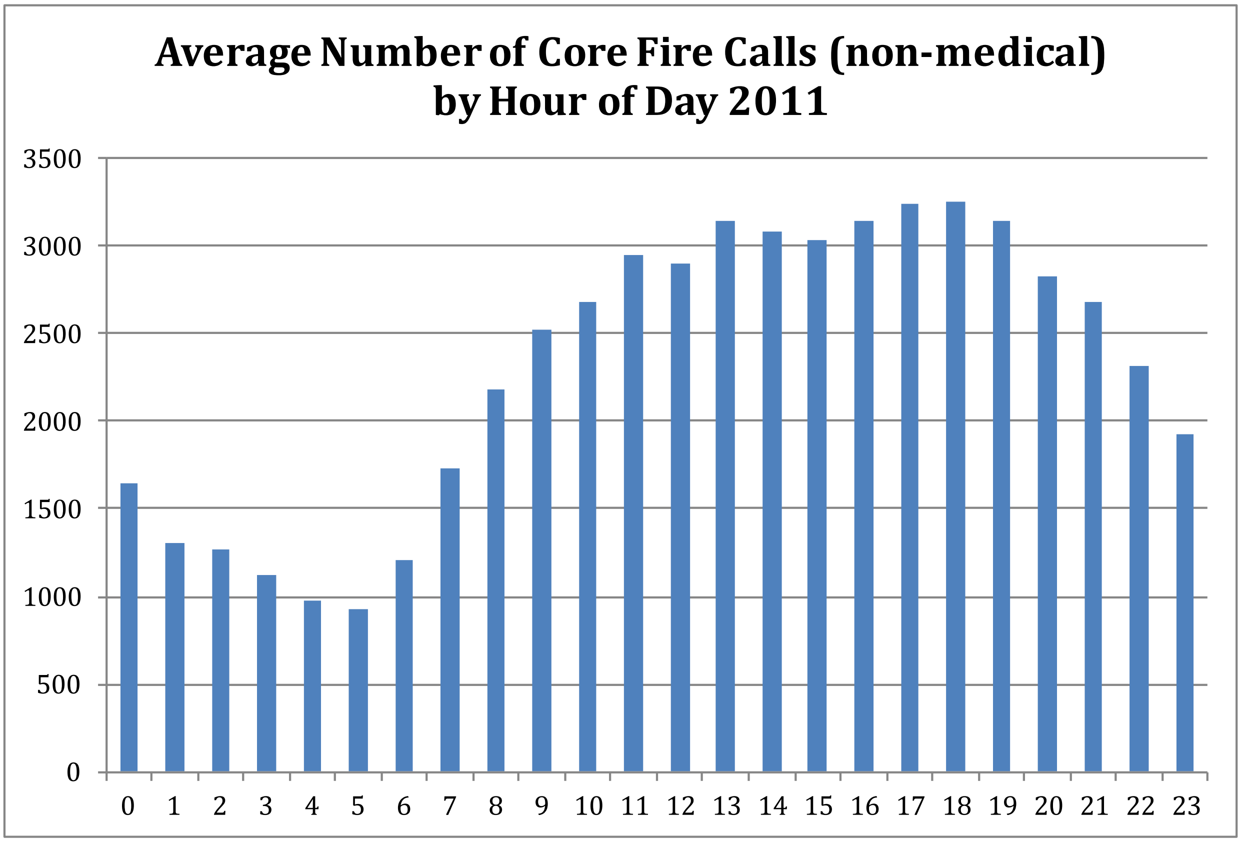


TFS call load and frequency by time of day

When call load and frequency, by time of day, are examined; that is, the number of incidents and when they occur, we find that the greatest number of emergencies take place between approximately 11:00 AM and 7 PM and decline in frequency until 5:00 AM when they climb slowly to 11:00 AM.

The frequency of calls during the 4:00 to 5:00 AM hour – approximately 900 spread over 365 days for that hour or under 3 incidents in the city, on average, is approximately 30% of the volume of calls received between the 5:00 and 6:00 PM hour (approximately 3300 per hour over 365 days or just over 9 per hour on average). Please see Chart 3.

Chart 3 - Average Number of Core Fire Calls by Hour of Day



To accommodate this call load, TFS nominally[6] staffs 128 apparatus (trucks), 24 hours a day, every day of the year. In addition, within it's available contingency, when apparatus and staff were not responding to core fire calls, TFS responded to another approximately 84,000 medical calls in 2011 to assist the public and TEMS. At the beginning of June 2012 the protocols that determine when fire services should respond to medical calls were revised to increase efficiency and effectiveness. In concert with physicians at Sunnybrook Centre for Prehospital Medicine, protocols were revised to ensure that TFS responded to medical calls where history and statistics showed that there might be a one in one hundred (1%) chance, or more, that fire fighter intervention could be of benefit to a patient.

The data continues to be evaluated but early indications are that focusing fire response to medical calls in this manner will reduce the occurrence of response to an average of approximately 4,000 times a month rather than 7,000, while maintaining the same level of benefit to patients.

On average, response to medical calls used approximately 20 minutes of available contingency time or 28,000 hours of staff time (84,000 medical incidents x 20 minutes = 1,680,000 minutes or 28,000 staff hours). The reduction in medical response activity is expected to return

[6] In most cases fewer apparatus are staffed because of absences due to vacations, illness, and other paid time off.

approximately 11,300 staff hours annually, or 31 staff hours per day across the city, to TFS's available contingency.

As noted earlier, Chart 3 shows the average number of fire incidents (calls) that occur during each hour of the day. So, during peak call periods, between 1800 and 1900 hours (6:00 PM and 7:00 PM) 3,250 incidents took place in 2011. The 1800 – 1900 hour time slot occurs once a day or 365 days a year, which means that TFS responds to an average of 9 calls each day during that hour throughout the city. During the 5:00 AM to 6:00 AM time slot that average drops to 2.54 calls throughout the city.

It is important to note that these are averages and the actual number of incidents that occur each day and hour can fluctuate greatly. For example, severe weather often causes a spike in call volume for such things as downed power lines or car accidents. In addition, the number of apparatus (trucks) that are sent to each incident varies. Some calls, such as a hydro pole fire or assistance at an accident scene, might only require one truck whereas there are occasions when 20 trucks may be required for a working fire.

TFS respond to many residential and commercial fire alarms each year

Other than medical emergencies, alarm responses are the highest frequency of calls received by the TFS. Alarm calls are reported to the TFS by alarm companies which monitor commercial and residential establishments. Most fortunately, out of 19,933 alarm responses in 2011 only 188 (less than 1%), turned out to be fires. By far the greatest number of responses was caused by alarm equipment malfunction, accidental alarms, and alarms tripped on purpose (human malicious). Details of alarm responses and their outcome can be seen in Chart 4 - Alarm Outcome by Category.

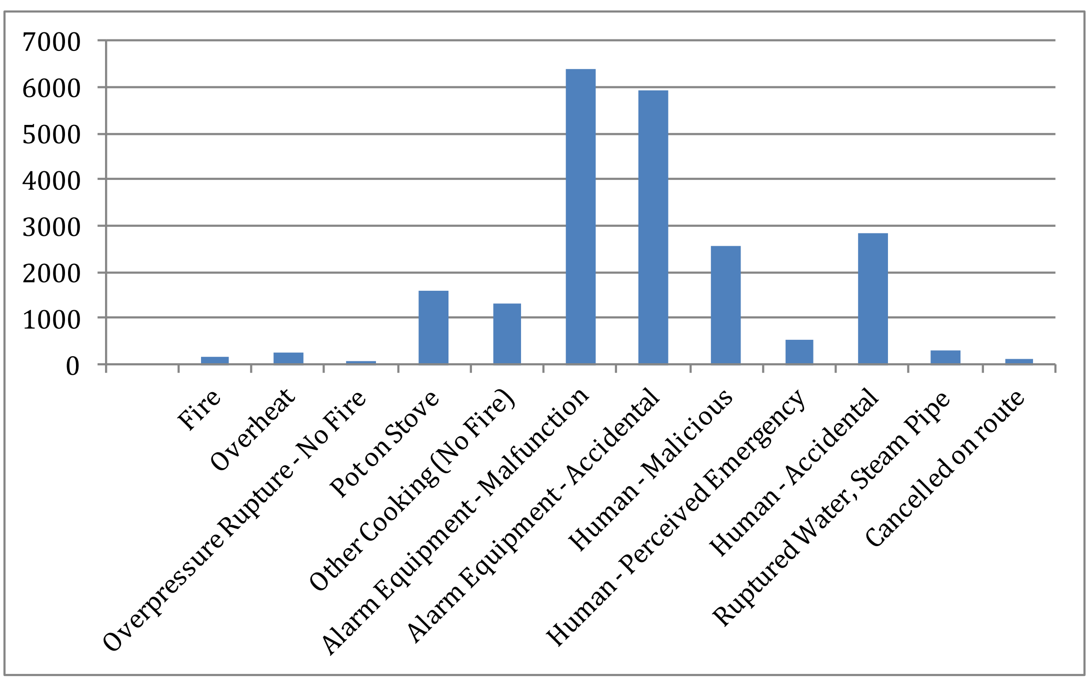


Chart 4 - Alarm Outcome by Category

2.2.1 Fire Service Staffing Pattern and Levels

The TFS staffing summary is shown in ***Appendix C – TFS Unit Chart*** by command, district, station, apparatus type, and staffing level. As noted earlier, 128 apparatus are staffed 24 hours a day although it is rare that level of availability is in place. TFS tells us that the equivalent of 2 to 3 fire trucks are usually out of service due to paid absences (sick time, vacation, other owed time off). In addition, hiring freezes have meant that another 2 fire trucks remain unstaffed. As well, up to 16 fire units are removed from front line service for purposes of continuing education and practice. However, these vehicles can be quickly returned to front line service if required because of call load. So, at any given time TFS will staff approximately 123 apparatus although 16 of those might be assigned to training duties.

A question that is sometimes asked is why the fire service requires the same level of staffing at night when the incidences of calls are 30% of the volume at peak hours. In comparison, police and emergency medical services reduce their staffing levels to reflect the considerably fewer calls that occur during off-peak hours. Toronto's EMS, for example, may have 84 ambulances available during peak periods but half that number during some overnight periods when the incidence of call events decreases. The fire service explains that the same level of staffing is required to be able to respond to potential fires within the 4 and 8 minute response targets approved by City Council and as laid out within the National Fire Protection Association Guidelines.

This is a difficult issue to resolve. If the need for fire service staffing levels was based on the frequency of calls only, there could be a significant reduction in staff and apparatus during some hours. But, if the City subscribes to the philosophy that response time is important no matter the frequency of calls, then allocation of apparatus and staff must be based on the geography that can be covered in four minutes as well as support response by other apparatus within 8 minutes. In that case, staff levels must remain the same 24 hours a day. However, police and EMS decrease their staff levels during off-peak times which may result in an increase in response times due to fewer resources. Nevertheless, the possibility of increased response times is tempered by the fact that incident occurrence is considerably lower than during peak volume periods.

In contrast to police and EMS, fire is staffed based on a full risk model; response time is considered paramount and the much reduced likelihood of an incident occurring is not taken into account in the determination of staff and equipment required. If the fire service was staffed based on the same probability risk model as police and EMS, costs would decrease dramatically but response times could increase beyond the 4 and 8 minute targets during off peak hours. This possible increase in response times is moderated by the fact that fewer incidents occur, which means the likelihood of a delay occurring is also decreased.

Even if the City of Toronto subscribes to an 'all risk' philosophy for fire protection rather than the 'probability risk' philosophy that is applied to police and EMS – that is, full staffing must be in place to respond to any type of incident at any hour, even though data shows that the probability of that incident happening is low during some periods of the day fire services efficiencies can still be accomplished in a planned manner over several years.

2.2.2 Reserve Capacity and the Diminishing Likelihood of Incidents

An important consideration for emergency services is the 'reserve capacity' of the organization. This means the resources that are available to handle the next incident. Police and fire determine required reserve capacity based on statistical history and the likelihood of 'the next call' occurring. For instance, if statistics based on day and hour, show that a police service will receive 20 calls for assistance then sufficient staff and vehicles should be available to respond to the historical volume. The average length of call, by type, will be considered in determining the resources required as will an acceptable response time. Some calls for assistance would require an immediate reaction while others might not need to be handled as quickly. Then the police would determine the reserve capacity required to reasonably accommodate peak call loads – again, based on history. That reserve capacity may be 1 additional police car or foot patrol per district, shared between districts, or whatever other ability may be required to protect the public. Emergency medical services calculates staffing and resource needs based on similar statistics and calculations.

The fire service applies a different metric to resource requirements which is response time. An advantage of applying this metric, rather than response time combined with incident history, is that there is a substantial reserve capacity within TFS. Consider the circumstance of a 2 or 3 alarm fire where 15 to 20 apparatus are on scene at any time. TFS nominally staffs approximately 120 apparatus 24 hours a day. If 20 apparatus are engaged on a fire incident 100 apparatus remain available for response in the city. It is true, though, that firefighters are rotated out of the fire scene because of the physical strain of firefighting, and trucks are moved around the city to compensate for the rotation and to provide coverage to the response area affected by the fire. But even if 40 trucks are engaged in firefighting or coverage rotation, another 80 remain available to protect the city. Nevertheless, there is always the possibility that other alarm calls, traffic accidents, or other rescues might occur throughout the city at the same time as apparatus and staff are engaged at a 3 alarm fire.

Statistically, these concurrent incidents don't happen often. Table 1 - Multiple Call Occurrence in Station Area indicates that on a city-wide basis concurrent incidents happened less than 6% of the time in 2011. Although reserve capacity is a vital consideration in staffing any emergency service another factor has to be considered, and that is the diminishing likelihood of additional incidents taking place. Diminishing likelihood is another way of saying "Sooner or later the calls stop coming in" and the likelihood of the 'next call' occurring can be determined from statistical analysis of previous years' incident volume. In the case of the fire service, as with police and EMS, there will be occasions that the targeted response times cannot be met. Nevertheless, there is ample evidence in this document that reserve capacity is more than adequate within the fire service.

2.2.3 Fire Service Incident Types and Frequency

The relationship, in volume and percentage, between 'All Incidents', 'Medical Incidents', 'False Alarms', and 'Fires', by station response area, is shown in ***Appendix D – Relationship in volume and percentage, between 'All Incidents', 'Medical Incidents', 'False Alarms', and 'Fires', by station response area***. These four categories were chosen because 'All Incidents' demonstrates the demand within each station area; 'Medical Incidents' are the most frequent fire service responses, alarms ringing (most of which, fortunately, turn out to be 'False Alarms'), are the second most frequent type of occurrence; and 'Fires' are included since that is the category of response that most of us associate with the fire service. 'Total Calls' and 'Medical Calls' categories were sourced from the Computer Aided Dispatch. 'False Alarms' and 'Fires' were sourced from the Record Management System because it is only after firefighters have arrived can it be determined whether an alarm was 'false' or whether an reported fire turned out to be a fire.

It is important to note that ***Appendix D – Relationship in volume and percentage, between 'All Incidents', 'Medical Incidents', 'False Alarms', and 'Fires', by station response area*** indicates only those incidents which took place within the station area. So, as an example, Station 111 responded to only 4 fires within its immediate response area in 2011 but it responded, as part of the required apparatus, to other station areas on another 36 occasions when there was a fire.

The columns next to each category indicate the percentage that each category of calls makes up out of the total number of incidents that occur within each station's response area. For example, in the excerpt from ***Appendix D – Relationship in volume and percentage, between 'All Incidents', 'Medical Incidents', 'False Alarms', and 'Fires', by station response area***, shown below, there were:

- 2,165 total incidents in station 112's area in 2011,
- 1,489 or 69% were responses to medical calls,
- 188 or 9% of all incidents were false alarms (they were dispatched as 'alarms ringing'; they were only found to be false alarms after the fire service's arrival),
- 18 or 0.8% of all incidents were fires

Station	2011 All Incidents	2011 Medical Calls	Percent of All Calls in Station Area	2011 False Alarms	Percent of All Calls in Station Area2	2011 Fires	Percent of All Calls in Station Area3	Total Percentage of Medical, False Alarm, and Fire Incidents
111	1210	823	68%	109	9%	4	0.3%	77%
112	2165	1489	69%	188	9%	18	0.8%	78%
113	1645	986	60%	187	11%	23	1.4%	73%

Information for all stations is found in ***Appendix D – Relationship in volume and percentage, between 'All Incidents', 'Medical Incidents', 'False Alarms', and 'Fires', by station response area*** and indicates that in 2011, 58% of all responses by the fire service were to medical calls, 14% were to alarms, and 1.4% were to fires. Readers should keep in mind that this information is based on outcome of incidents, not as they were dispatched. As noted previously, the fire service may have been dispatched to a fire only to find out that it was an overheated pot on a stove. In that case the Record Management System would record the incident as an overheated pot but it may have become a fire if appropriate action was not taken.

2.2.4 Frequency of Structure Fires Within Each Station Area

Chart 5 - Structure Fires by Month - 2011 indicates the number of structure fires that occurred monthly in 2011 within each station area. The number of fires shown does not include fires other than structure fires; that is, automobile fires, grass fires, and other non-structure fires are not included in this count.

Chart 5 - Structure Fires by Month - 2011

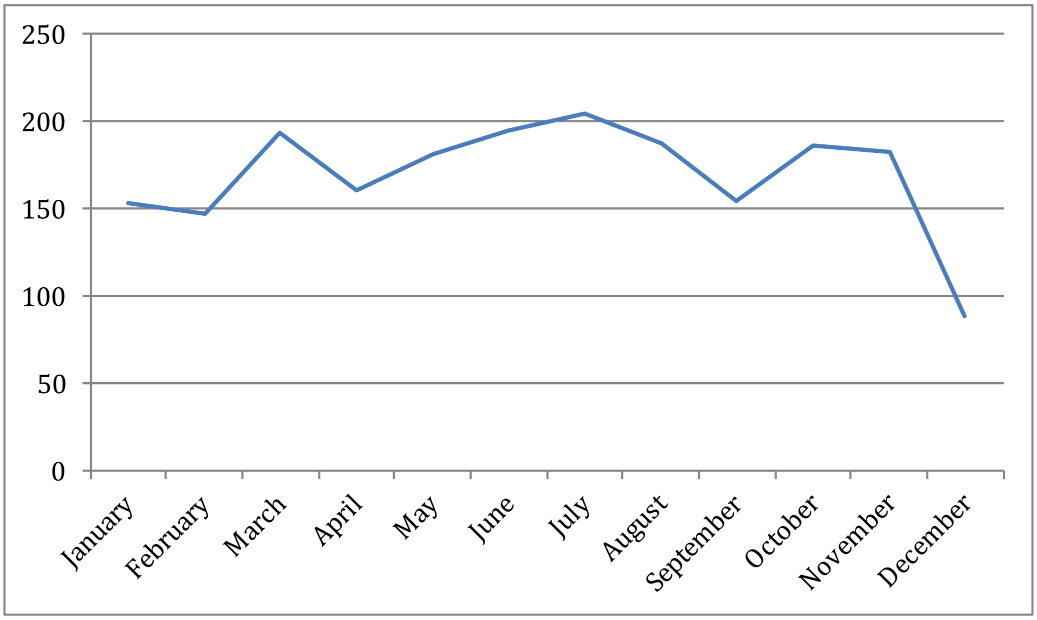


Exhibit 1 - Fires by Month Within Each Station Area in 2011

	January	February	March	April	May	June	July	August	September	October	November	December	Total
111				1			1		1		1		4
112	1	3	1		2	1	3	3	2	2			18
113	1	1	1	1	4	2	4	4		2	2	1	23
114	1		5	6	2	2	7	4	3	2	3	2	37
115	4	1	2	2		2	2	2	2	4			21
116	1	1	1			2	1	1	1	1	1	1	11
121	2	3	1	1	1			1					9
122			2	1	1			1	1	1	1	1	9
123	3				2	2	1	1			2		11
125			1		2	2	3						8
131		1				2		3	2		2	3	13
132		1	4	2	3	2	6	2	4	2	2		28
133	3	1	2	2	4	1	4	1	3	3	4		28
134	1	1	4	3	3	3	2	1	2	1	1	2	24
135	1	1	1		2	2	1			2	1	2	13
141	1	5	5		5	4	5	2	3	3	10	1	44
142	7	5	3	7	2	10	5	5	5	4	1	2	56
143	2	2	3	3	2	3		5	4	2		3	29
145	1	4	2	1	2	5	4	2	1	6	2	1	31
146	1	1	3	3	3	3	6	7	4	6	8	3	48
211	3		1	1	3			1	1		2		12
212	4		1	2	1	4	5	4	1	1	1		24
213	2		4	3	1	1	1	4	1	3	2	1	23
214	1	1	2	3		2			3	1	4	1	18
215	2		1	1		2	2		1		1	2	12
222	1		1	2		4	3	4	2		4	1	22
223	2	3	5	4	5		2	2	2	3	3	1	32
224		1	1	1	5	3	3	2		4	4	3	27
225	3	1	2	1	3	2	3	1	5	4	4	2	31
226	1	2		2	2	4	2	1	2	3	2	1	22
227	1	1	2	2	3		2					1	12
231	4	1	2	5	7	4	3	5	3	4	2	1	41
232	2	3	6	1	3	1	2	1	2	1	1		23
233	1	1	1	1	1	2	2		2		2	1	14
234	3	2	2	6	2			1	3	5	4	1	29
235	3	2	4	2	1	2	1	1	1	4	1	2	24
241	1	1		2			1	1	1		3		10
242	1	2	2	2	3	2	2		2		3	1	20
243		3	1	2	1	3		2		1	2		15
244	2	2	2	3	2	3	5	2	2	2	2	3	30
245		2	4	3	3	2	1	1	1	1	1	1	20

	January	February	March	April	May	June	July	August	September	October	November	December	Total
311		2	3	2	3	4	1	1	1	3			20
312		3	2	2	1	4	4	4	4	3	3		30
313	4	2	3	5	2	7	3	2	2	4	4	2	40
314	2	4	6	1	2	2	4	4	5	3	7	1	41
315	3	3	6	1	3	3	5	2	4	4	1	2	37
321	1	1	3			1	1			1	1	2	11
322		5	3	3	2	4		4	1	5	1	2	30
323	2		2	1		3	3	7	2	1	1		22
324	3	3	2		2	1	2		1	1			15
325	4	6	5	4	3	5	7	2	1	11	4	2	54
326		1	1	2	5	1	2		2	1	1	1	17
331		2	1	2	4	5	4	1	2	2	7	1	31
332	3	2	3	3	3	3	6	4	3	11	8	2	51
333	3	2	4	1	2	1	1	1	2	1	4	2	24
334	1	1	2	2		1	1	3	1	2	1		15
335						1			1				2
341	4		4	3	2		2	6	2	4	2	1	30
342	2		1	1	2	1	2	2	4	2	1	1	19
343	1	2	4	1	2	3	2	7	1	2	1	4	30
344	2	1	3	1	3	3	3	1	2	4	2	1	26
345	4	3		2	4	1	4	2	6	2	2	1	31
346								1					1
411	4	4	2	7	3	4	7	7	2	5	8	4	57
412	1	1	4	1	4		2	4			1		18
413	2	5	3	1	3	2	6	3	2	1	2	1	31
415	3	2	1	3	1	3	3	3	1	2	3	2	27
421	3	1	2	2	5	3	1	5	4	4	2		32
422	3	3		2	2	2	2	5	2	1	2	1	25
423	4	4	1	1	1	4	3	4	3	1	6	1	33
424					3	1	1	1		1			7
425	3	1	1			1	3	1	2				12
426	6	6	8	5	6	4	3	3	2	1	3		47
431	1		2	1		1			1	1	1		8
432	2	1	1	5		1	2	1	3	2	2		20
433	4	1	3	1	3	5	1	6		7		1	32
434			3	1	2	4	2		1	2	1	1	17
435	2	4	3	1	3	2	1	2	1	3	3	1	26
441	4	3	4	3	3	1	5	5	2	2	1	1	34
442	2	4	4		3	8	5		3	3	1	2	35
443	1	3	5	3	2	2	2	3	2	3	2	2	30
444				1	1		1	1		1	1		6
445	1	2	4	3	5	4	2	2	2	1	3	1	30
No Stn ID	1								2				3
Total	**153**	**147**	**194**	**160**	**181**	**195**	**204**	**188**	**155**	**186**	**182**	**88**	**2033**
Data Source: Toronto Fire Service Record Management System													

2.2.5 Fire Response Time by Hour of Day

Fire response is made up of 3 distinct time components over which the fire service has control.

These distinct time components make up the total response time as follows:

1. **Alarm to notification** – this is from the time the phone rings at the fire dispatch centre to the time fire crews are alerted to an emergency; traditionally, the time the telephone rings has been referred to as the 'alarm' time and should not be confused with 'alarms ringing'.
2. **Turnout Time** – this is the time from when the crews are alerted of an emergency to the time the fire apparatus (trucks) start moving out of the station;
3. **Travel Time** – this is the time it takes to drive from the fire station to the incident. It is sometimes described as 'wheels rolling to wheels stopped'.

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, 2010 Edition defines these time components and sets targets against which fire services should measure their performance:

Alarm to notification time is defined by NFPA 1710, Section 3.3.53.3 as **Alarm Processing Time.** The time interval from when the alarm is acknowledged at the communication centre until response information begins to be transmitted via voice or electronic means to emergency response facilities (ERFs) and emergency response units (ERUs) [fire apparatus].

Section 4.1.2.3.3 of NFPA 1710 states: The fire department shall establish a performance objective of having an alarm processing time of not more than **60** seconds for at least 90 percent of the alarms and not more than **90** seconds for at least 99 percent of the alarms, as specified by NFPA 1221.

Turnout Time is defined by Section 3.3.53.8 of NFPA 1710 as the time interval that begins when the emergency response facilities (ERFs) and emergency response units (ERUs) notification process begins by either an audible alarm or visual annunciation or both and ends at the beginning point of travel time. Section 4.1.2.1(2) of NFPA 1710 states: The fire department shall establish the following objectives:

80 seconds for turnout time for fire and special operations response and 60 seconds turnout time for EMS response.

Travel Time is defined by Section 3.3.53.7 as the time interval that begins when a unit is en route to the emergency incident and ends when the unit arrives at the scene. Section 4.1.2.1 (3) of NFPA 1710 states: The fire department shall establish the following objectives:

240 seconds or less travel time for the arrival of the first arriving engine company at a fire suppression incident and 480 seconds or less travel time for the deployment of an initial full alarm assignment at a fire suppression incident.

There is another time component over which the fire department doesn't have control and that is the time from ignition to 'alarm' (when the fire is reported to the fire communications centre). This time component could be positively affected by public awareness of fire or other emergency risk through a robust public education, inspection, prevention, and enforcement program.

Does daytime traffic have a negative effect on response time?

Appendix E – Response Times by Fire Station examines response times for each fire station, by fire district, response component, and by time of day. This exercise was undertaken because we were informed that daytime traffic has an effect on the time it takes to respond to an emergency; in other words the more traffic there is, the slower the response, and the greater risk to the public if there is a delay in arrival. Intuitively, that concern seems reasonable.

To measure the differential between daytime traffic and nighttime traffic response, we took two six hour blocks of time for the full year of 2011 and compared the following time components at the 90th percentile:

- Alarm to Arrived scene – from the time the telephone rings (the 'alarm') at the dispatch centre to the time the fire crews arrive at the scene
- Alerted to Arrived scene – from the time the fire crews are notified by a dispatcher of an emergency to the time they arrive at the scene
- Enroute to Arrive (travel time) – from the time the apparatus leaves the station to the time fire crews arrive at the scene (drive time or travel time)

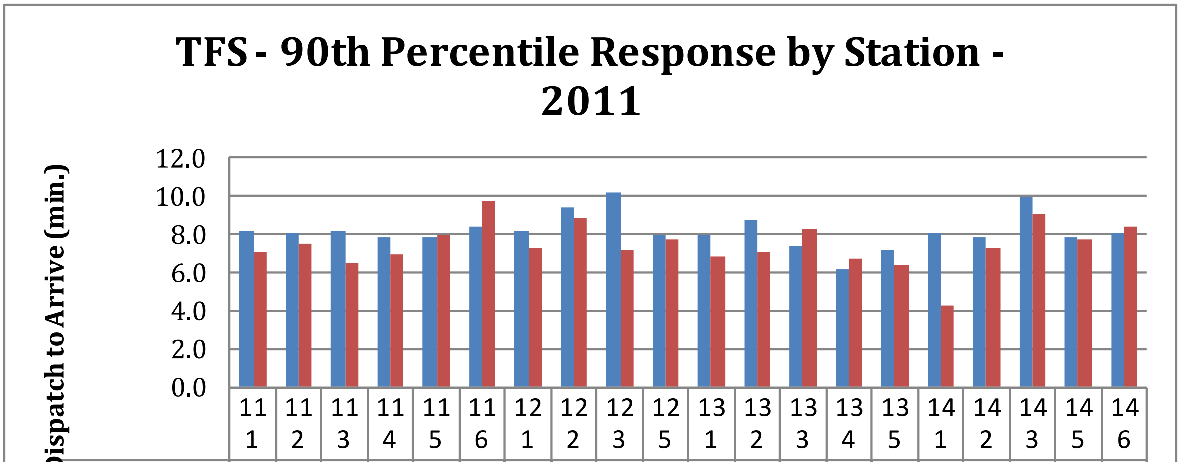
The two blocks of time were from midnight to 6:00 AM (0000 – 0600 hours), and from noon to 6:00 PM (1200 – 1800 hours) when traffic is heavier or at its peak. The 90th percentile denotes the time to which 90 percent of calls were responded in 2011. For example, in ***Appendix E – Response Times by Fire Station,*** within the category of 'Alarm to Arrived Scene', Station 111 has a 90th percentile time of 10 minutes between 0000 and 0600 hours. This means that between midnight and 6 AM, 90 percent of all calls were responded to in 10 minutes or less and 10% of calls took longer. The 90th percentile is a common measurement point in emergency services.

If daytime traffic impedes response time, then travel (enroute to arrive) should take less time during the 0000 – 0600 hour period than during the 1200 – 1800 hour period, and for the most part it does, although there were 7 stations which showed that travel time took longer at night than during the day; in one case, almost 3 minutes longer than during the day. The majority of fire stations showed that the 90th percentile travel time (wheels rolling to wheels stopped), was less at night than during the day and that would be expected. But we also discovered that 42 of the stations had a longer response time during the night – when it should take the same or less time than during the day – when turnout time (that is, firefighters alerted at the station until a truck left the station), was taken into account as well as travel time. The apparent inconsistencies are shown in red in ***Appendix E – Response Times by Fire Station***.

There could be several reasons for this discrepancy although the most obvious possibility is that fire fighters sleep at night and it takes longer to pull oneself together and get out of the station in a timely manner. It should be clear that we are not making a negative comment about the fact firefighters sleep. They work 24 hour shifts, firefighting is a strenuous job, and there should be no expectation that they should stay awake for 24 hours. In fact, there could be other reasons for the apparent delays including the time it takes to navigate from the rest area to the fire trucks at night, or other as yet unknown factors. It is also important to note that the other

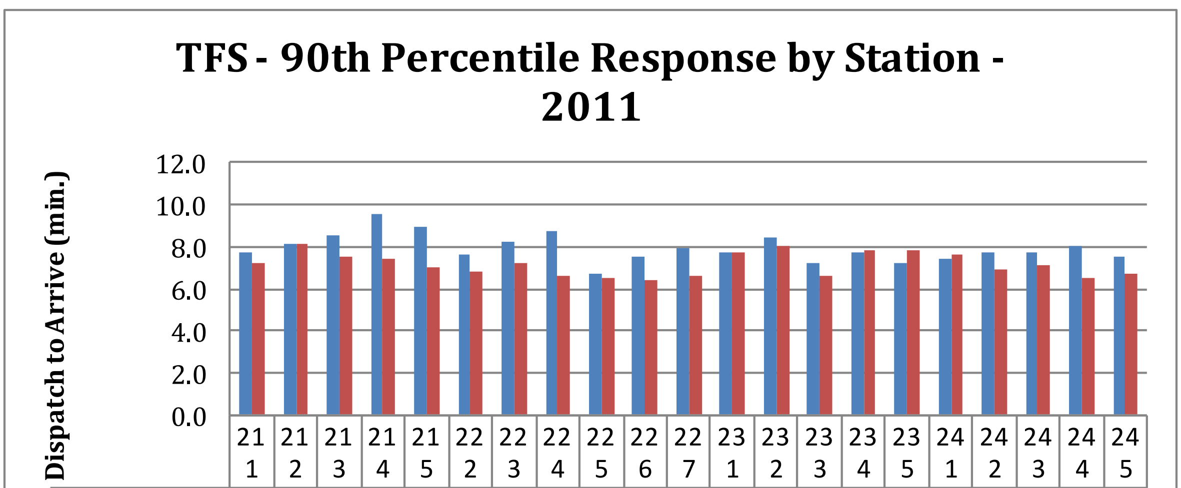
42 stations were able to respond in the same or less time at night than on days so station design and location of the rest areas in relation to the apparatus floor could also be a cause. TFS is already seeking a resolution to the elongated nighttime responses, and we would expect that when its performance is examined a year from now, the cause of the discrepancy will have been discovered.

Figure 2 - District 1 – Day – Night Response Comparison



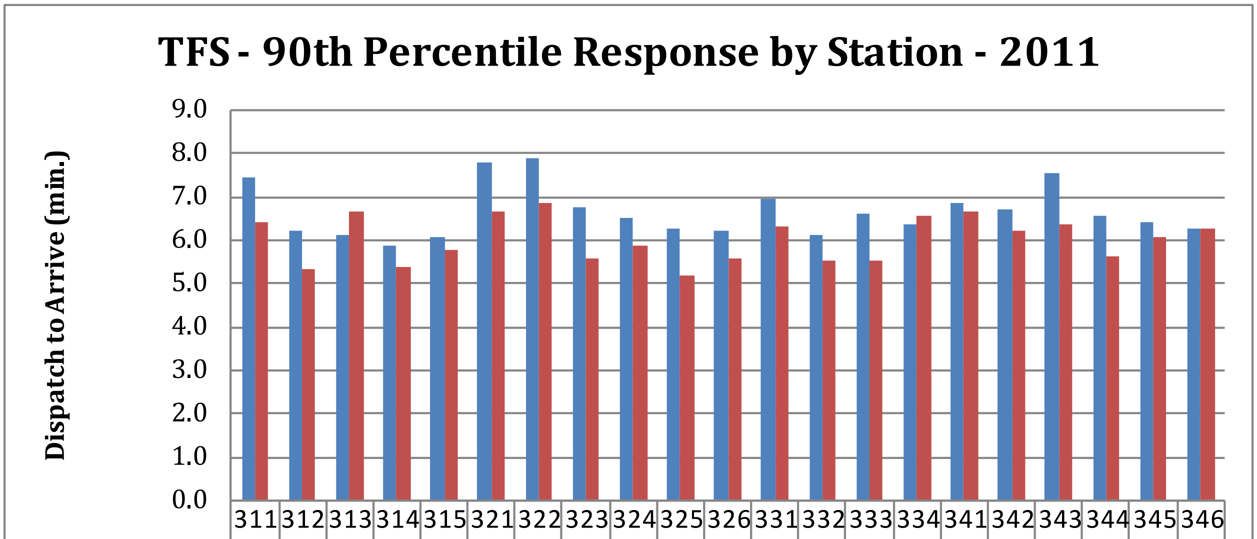
	111	112	113	114	115	116	121	122	123	125	131	132	133	134	135	141	142	143	145	146
0000 to 0600	8.2	8.1	8.1	7.8	7.9	8.4	8.2	9.4	10.	7.9	8.0	8.7	7.4	6.2	7.1	8.1	7.8	10.	7.8	8.1
1200 to 1800	7.0	7.6	6.5	6.9	8.0	9.7	7.2	8.9	7.2	7.8	6.8	7.1	8.2	6.7	6.4	4.3	7.3	9.0	7.7	8.4

Figure 3- District 2 – Day – Night Response Comparison



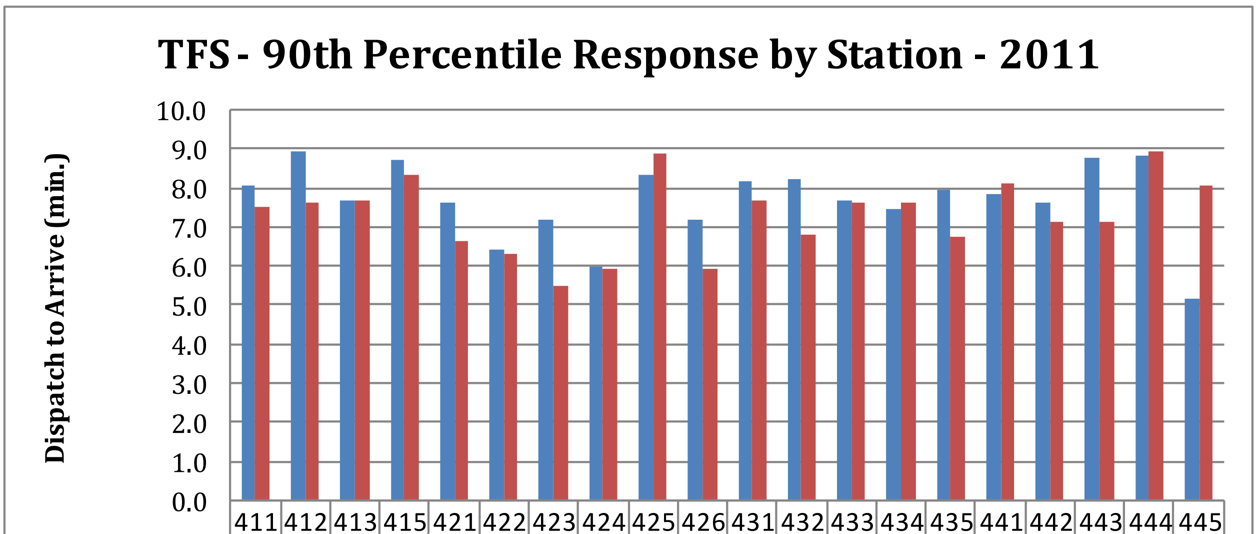
	211	212	213	214	215	222	223	224	225	226	227	231	232	233	234	235	241	242	243	244	245
0000 to 0600	7.8	8.2	8.5	9.6	8.9	7.6	8.3	8.7	6.8	7.6	8.0	7.8	8.4	7.2	7.7	7.3	7.5	7.7	7.8	8.0	7.6
1200 to 1800	7.2	8.2	7.5	7.4	7.0	6.8	7.3	6.7	6.5	6.5	6.6	7.7	8.0	6.6	7.8	7.8	7.7	7.0	7.1	6.5	6.7

Figure 4- District 3 – Day – Night Response Comparison



	311	312	313	314	315	321	322	323	324	325	326	331	332	333	334	341	342	343	344	345	346
0000 to 0600	7.4	6.2	6.1	5.9	6.1	7.8	7.9	6.8	6.5	6.3	6.2	7.0	6.1	6.6	6.4	6.9	6.7	7.5	6.6	6.4	6.3
1200 to 1800	6.4	5.3	6.7	5.4	5.8	6.6	6.9	5.6	5.9	5.2	5.6	6.3	5.5	5.5	6.5	6.7	6.2	6.4	5.6	6.1	6.3

Figure 5- District 4 – Day – Night Response Comparison



	411	412	413	415	421	422	423	424	425	426	431	432	433	434	435	441	442	443	444	445
0000 to 0600	8.1	9.0	7.7	8.7	7.6	6.4	7.2	6.0	8.3	7.2	8.2	8.2	7.7	7.5	7.9	7.8	7.6	8.8	8.8	5.1
1200 to 1800	7.5	7.6	7.7	8.3	6.6	6.3	5.5	6.0	8.9	5.9	7.7	6.8	7.6	7.6	6.8	8.1	7.1	7.1	8.9	8.1

2.2.6 Multiple Incident Occurrences by Fire Station Area

Another issue that has to be considered within the frequency of calls is the occurrence of multiple calls; that is, how often does another call occur in a station's area when the primary responders (the first pumper or rescue unit), is already active with another call. If this circumstance occurs frequently – perhaps more than 30% to 40% of the time, there is a possibility that an adjacent staffed apparatus would need to be deployed to provide secondary coverage when the primary vehicle is dispatched. If the occurrence of a second incident happens frequently, it may be possible that resources would even have to be added to a station area.

Table 1 shows for each fire station, the total number of core[7] calls that were received in the station area, the number of times a second call was received at the same date and hour, and the percentage of time more than one incident took place concurrently.

Multiple events occurred most frequently at station 426 at just over 11% of the time, and the least often at station 434, just under 1.5% of the time. On a service-wide basis the incidence of concurrent incidents is approximately 6%.

Considering the low frequency with which second incidents occur in each station area within the same hour and date as another incident is taking place, there is no indication that any stations require additional apparatus to service call load.

[7] Please see 2.2 Fire Services Data and Statistics

Table 1 - Multiple Call Occurrence in Station Area

Station	Total Number of Core Calls in 2011 (Not Medical Calls)	Number of Times in 2011 More Than One Call Was Received at the Same Date and Hour	% Occurrence
111	364	14	3.85%
112	642	30	4.67%
113	601	30	4.99%
114	1069	83	7.76%
115	549	25	4.55%
116	490	15	3.06%
121	577	30	5.20%
122	377	9	2.39%
123	443	21	4.74%
125	366	14	3.83%
131	583	25	4.29%
132	1088	78	7.17%
133	578	29	5.02%
134	882	67	7.60%
135	582	21	3.61%
141	938	71	7.57%
142	1126	86	7.64%
143	577	25	4.33%
145	644	31	4.81%
146	750	49	6.53%
211	297	14	4.71%
212	393	11	2.80%
213	603	33	5.47%
214	378	9	2.38%
215	245	8	3.27%
222	769	42	5.46%
223	860	54	6.28%
224	597	32	5.36%
225	780	46	5.90%
226	766	41	5.35%
227	453	10	2.21%
231	831	46	5.54%
232	714	38	5.32%
233	529	30	5.67%
234	658	28	4.26%
235	541	23	4.25%
241	347	12	3.46%
242	505	26	5.15%
243	515	19	3.69%
244	787	47	5.97%
245	508	18	3.54%

Station	Total Number of Core Calls in 2011 (Not Medical Calls)	Number of Times in 2011 More Than One Call Was Received at the Same Date and Hour	% Occurrence
311	828	53	6.40%
312	946	54	5.71%
313	1202	99	8.24%
314	1626	167	10.27%
315	836	47	5.62%
321	380	15	3.95%
322	750	38	5.07%
323	598	26	4.35%
324	473	12	2.54%
325	1479	131	8.86%
326	413	15	3.63%
331	896	32	3.57%
332	1592	159	9.99%
333	989	77	7.79%
334	648	20	3.09%
335	77	0	0.00%
341	708	40	5.65%
342	385	13	3.38%
343	540	16	2.96%
344	871	53	6.08%
345	754	35	4.64%
346	69	2	2.90%
411	625	22	3.52%
412	486	18	3.70%
413	898	52	5.79%
415	569	25	4.39%
421	705	37	5.25%
422	335	9	2.69%
423	679	36	5.30%
424	223	4	1.79%
425	332	5	1.51%
426	1682	191	11.36%
431	350	12	3.43%
432	412	22	5.34%
433	753	46	6.11%
434	272	4	1.47%
435	595	22	3.70%
441	909	59	6.49%
442	1011	71	7.02%
443	740	45	6.08%
444	433	23	5.31%
445	836	62	7.42%
Total	**55207**	**3209**	**5.81%**

2.2.7 Conclusions

To help us determine the resource requirements for Toronto's fire service we reviewed:

- The frequency of incidents and type of incidents that occurred in each station area
- The frequency of incidents to which apparatus responded in another station area
- The outcome of all incidents by major category based upon TFS's Record Management System
- Multiple call occurrences which examines the number of times annually that more than one core fire call was received in a station area at the same date and hour
- All fire and medical calls to which stations responded whether within or outside the station catchment area
- Fire incidents, medical incidents and false alarms for the period 2009 – 2011 to determine trend

The data, when broken into the details that have been provided in the chapter exhibits and appendices, tells us that the fire service responds most often to medical calls – over 84,000 in 2011; next, to alarms – just over 19,900 but declining; then to pot on stove and other cooking incidents (no fire, but could become fire without intervention); and fortunately, down on the frequency scale, structure fires. This observation is not meant to diminish the importance of fire fighter response to potential fire emergencies. Many of the 'pot on stove' or other cooking incidents could quickly become fire emergencies although the frequency of these might be mitigated with strong awareness and public education campaigns.

We found that:

- Fire service responses have remained flat or declined between 2005 and 2011. Reports that fire responses are increasing are due to a higher incidence of medical calls, directly due to increased EMS events. A change in guidelines for the response of fire to medical calls will likely result in a decline of over 30,000 annual responses by fire to medical calls and the availability of 12,000 staff hours (about 31 hours of staff time per day, city-wide) to TFS's available contingency.
- TFS's staffing is based on station location geography and endeavoring to maintain a consistent response time to incidents no matter the time of day, in accordance with NFPA 1710. To accomplish that, the same number of staff must be available 24 hours a day. However, call volume during some periods of the night declines by almost 70% from peak daytime hours. The alternative to maintaining the same staffing levels at all hours is to institute a probability risk model in the fire service. A probability risk model, similar to police and EMS, recognizes that the probability of an incident occurrence declines significantly during some hours, and accepts the possibility that response times may be protracted for a few of those incidents. Implementing a staffing pattern based on precepts similar to police and EMS would save a significant amount of money within the fire service.

- Another opportunity is to explore a dynamic staging, predictive modeling, pre-emptive traffic controls approach to the placement of fire resources and apparatus. This could improve response times and decrease equipment requirements by helping to predict fire response demand and deploy resources accordingly.
- In 2011, 58% of all events by the fire service were to medical calls, 14% were to alarms, and 1.4% was to fires. Readers should keep in mind that this information is based on outcome of incidents, not as they were dispatched. The other approximately 27% were to a wide range of incident types.
- An indicator of activity level, sufficient to warrant additional resources at the station level is the frequency of other incidents or calls occurring when the station is already engaged on a call. We found that on a service-wide basis a second call occurs in a station area less than 6% of the time that staff is already responding to an incident. The greatest incidence of this occurring is just over 11% of the time at station 426. The lowest occurrence is 1.47% at station 434.
- Considering the low frequency with which second incidents occur in each station area at the same time as another incident is taking place, there is no indication that any stations require additional apparatus to service call load.

2.3 Demographics and Fire Related Civilian Injury & Death Statistics

The incidence of civilian injuries and death due to fire is always a concern for the City and public. The intention of this section is to determine if there is a correlation between civilian major injuries and death and demographic information.

Appendix F – Maps Indicating Demographics and Fire Related Civilian Injury & Death provides 8 maps as a visual reference relating to this discussion.

Demographic data was obtained from the City's planning department and analyzed at a neighbourhood level to understand trend variations across the city. A neighbourhood level aggregation was chosen because almost all recent (2011) demographic information was detailed only at this level.

Fire related civilian injury and death data, summarized for the years 2009, 2010, and 2011, was obtained from TFS and screened to exclude minor injuries. This data was geocoded to locate the incidents and then researched to observe any demographic trends. The demographic trend observation was performed by superimposing major injury and death statistics on the planning department's neighbourhood level information. A summary of the factors observed and their respective assessment are presented below.

2011 Population per Neighbourhood

Map 1 (***Appendix F – Maps Indicating Demographics and Fire Related Civilian Injury & Death***) shows the location of major injuries and death contrasted with neighbourhood level population for

2011 across the city. Observation does not show any significant relationship between the neighbourhood level population value and frequency of major injuries and fatalities due to fire.

2011 Population Density per Neighbourhood

Map 2 ***(Appendix F – Maps Indicating Demographics and Fire Related Civilian Injury & Death***) shows major injuries and death locations for 2009 – 2011 compared to 2011 population density by neighbourhood. The population density was obtained by dividing the 2011 population by the physical area of each neighbourhood. Barring a few neighbourhoods, the exhibit demonstrates a general trend of higher frequency of major civilian injuries and death where neighbourhoods are more densely populated. It can be inferred that there may be a higher probability of civilian injuries and death due to fires in more densely populated neighbourhoods.

2011 Senior Population and Population Density per Neighbourhood

Maps 3 and 4 (***Appendix F – Maps Indicating Demographics and Fire Related Civilian Injury & Death)*** present the population and population density respectively for seniors (aged 65+) per neighbourhood (2009 – 2011). Similar to Map 1, the major injuries and death phenomenon do not demonstrate any visible relationship with the senior population. Map 4, the senior population relationship with major injuries and death, indicates the possibility of a higher frequency of major civilian injuries and death where neighbourhoods have a higher density of senior population. The trend is largely similar to the overall population density relationship with major injuries and death observed in Map 2. If any relationship exists, it may be more attributable to population density than seniors' population. In any event, with the data available, the relationship cannot be determined.

2006 Average Household Earnings per Neighbourhood

Map 5 (***Appendix F – Maps Indicating Demographics and Fire Related Civilian Injury & Death***) presents a map of Toronto showing average 2006 household income values per neighbourhood and its relationship to incidences of major injuries and death. The 2006 household earnings values were the latest available at the time of compiling this report and the overall average household earnings for the City of Toronto stood at $80,343 in 2006. The occurrence of major injuries and death for civilians appears to be more prevalent in lower earning neighbourhoods, and the lowest earning neighbourhoods seem to demonstrate a higher occurrence of such major injuries and death. In fact, most of the major injuries and death are observed to have happened in neighbourhoods with lower household earnings than the 2006 Toronto average ($80,343), or geographically close to those neighbourhoods. One could theorize this phenomenon by observing that people living in those neighbourhoods may be less likely to have disposable income for fire safety or to undertake fire risk-related residential repairs. On the other hand, there are other modest income neighbourhoods with a low incidence of injuries or deaths. Nevertheless, lower income areas combined with higher density suggest the need for targeted public awareness for fire safety.

2.3.1 Observations - Demographics

A geographic investigation into the relationship between major civilian injury and death due to fire was conducted to find out if there was any trend with relevant demographic indicators. The investigation revealed that there is a general prevalence of major injuries and death in neighbourhoods that are more densely populated than average. There is also a possible trend of such mishaps occurring in neighbourhoods with lower than average household earnings.

We found that, for the years 2009, 2010, and 2011:

1. Of the 39 civilian deaths, 37 occurred in living quarters
   i. 21 in single family and semi-detached houses,
   ii. 2 in townhouses/row houses, and
   iii. 14 in multi-unit residential apartments including high-rises.

   The remaining two fire-related deaths occurred in a commercial building and an institutional building.
2. A breakdown of the age of the buildings was determined and we found:
   i. Only 1 out of all 39 properties was built as recently as 2003.
   ii. 35 were built in or before 1972.
   iii. 1 out of 39 data has no record of year built. However, the adjacent properties were built in 1914 and 1972 respectively.
   iv. 8 out of 39 (20.5%) civilian deaths occurred in high rise buildings 7 storeys and higher. Another 7 deaths occurred in buildings between 3 and 6 storeys.

Maps 6, 7, and 8 (***Appendix F – Maps Indicating Demographics and Fire Related Civilian Injury & Death***), illustrate the location of civilian major injuries and deaths for years 2009, 2010, and 2011 by neighbourhood.

Major Injury stats (2009-2011):

1. Of the 63 civilian major injury (not fatal) incidents, 1 involved a truck on a roadway. Out of the remaining 62 incidents, 52 occurred in living quarters:
   i. 22 in single family and semi-detached houses,
   ii. 4 in townhouses/row houses, and
   iii. 24 in multi-unit residential apartments including high-rises).

The non-residential major injuries occurred in Commercial (3), Industrial (2), and Institutional (5) locations.

2. A breakdown of the age of the buildings indicates that :
   i. 9 properties out of 63 do not have a year of build (+1 for the fire injury that happened on the road). It is understood that a few properties were recently built, but most of them seem well established buildings built some considerable time ago.
   ii. 49 out of 53 properties with documented age were built in or prior to 1973.
   iii. 16 out of 63 major injuries occurred in high rise buildings 7 storeys and higher. Another 10 major injuries occurred in buildings between 3 and 6 storeys.

Given this, we assert that a neighbourhood analysis by the fire service, in partnership with Toronto's planning department and social services agencies, could assist with targeting prevention and education programs in more vulnerable areas.

2.3.2 Conclusions

While this is a preliminary investigation, there are indicators of a possible relationship between demographic markers and the occurrence of civilian major injury and death. Therefore, based on the information gathered with the cooperation of Toronto's Fire Services and Planning Department, we have determined that an increased risk of civilian injury and death may occur in neighbourhoods with a higher population density and lower than average income.

In the period 2009 – 2011, fire deaths have been more prevalent in buildings constructed over 40 years ago and the majority (all except 2), have occurred in residences. Twenty-one of those were in single family or semi-detached, 14 in low or high rise residential apartments, and 2 in town houses or row houses.

The availability of similar data, in the future, would enable TFS to target vulnerable areas for the purpose of increased awareness, education, and prevention and possibly reduce the incidence of fire and the associated risk of civilian injury and death. Although TFS already participates on committees with other City of Toronto departments, a greater presence and scope of involvement would be expected to have a more positive outcome on occurrence of fire and prevention of injury and death. However, TFS would require a much larger cadre of fire prevention and education officials as well as business analysts to analyze statistics and assist with determining the most effective use of targeted prevention techniques.

2.4 Fire Services Staff and Apparatus Requirements

An important part of this project was to determine the fire and EMS resource levels required to protect the city and meet service demand projected through to the year 2022. This section addresses the fire service's staff and apparatus requirements.

The National Fire Protection Association's target for the arrival of the first apparatus at a fire suppression incident is 240 seconds travel time or less (4 minutes). This is also the target found in TFS's 2007 Fire Master Plan.

NFPA 4.1.2.1 (3) states:

The fire department shall establish the following objectives:

*(3)*240 seconds or less travel time for the arrival of the first arriving engine company at a fire suppression incident and 480 seconds or less travel time for the deployment of an initial full alarm assignment at a fire suppression incident.*

Structural Fire Fighting is defined as *The activities of rescue, fire suppression, and property conservation in buildings or other structures, vehicles, rail cars, marine vessels, aircraft, or like properties.* And, Fire Suppression is defined as *The activities involved in controlling and extinguishing fires.*

If the City of Toronto supports the 240 second objective then fire stations should be situated, throughout the city, to accomplish a 4 minute initial response to fire suppression incidents, and 8 minutes of travel time to accomplish a full deployment of staff and apparatus.

The resource requirement established by the TFS to a reported residential fire requires response by

- 2 pumpers
- An aerial unit
- An X unit (an **X** apparatus is a truck of any kind that ensures the response delivers at least 16 firefighters to an incident within 8 minutes). In some cases additional units are sent if one of the initial response apparatus is short staffed due to illness or other absence.
- A Rescue or a Squad
- A District Chief and Fire Incident Technician (FIT)

A response to a residential fire requires the trucks and accompanying staff shown in Exhibit 2.

Exhibit 2 - Apparatus Required for an Initial Response to a Residential Fire

Within 4 Minutes		Within 8 Minutes									
											
											
		Staffing									
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
4	5	4	5	3	5	4	6	3	5	2	2

FIR Fire - Residential P P A X R/S D

Sixteen fire fighters in 8 minutes is the requirement for a single family dwelling but the number of fire fighters and apparatus varies depending on the situation. A highrise residential fire downtown would require, for initial response:

- 2 pumpers
- An aerial unit
- Another unit (X unit)
- A Rescue unit or a Squad
- A District Chief

A response to a highrise residential fire requires the trucks and accompanying staff shown in Exhibit 3.

Exhibit 3 - Apparatus Required for an Initial Response to a Highrise Residential Fire

Within 4 Minutes		Within 8 Minutes									
											
											
		Staffing									
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
4	5	4	5	3	5	4	6	3	5	2	2

FIHR Fire - Highrise Residential P P A X R/S D

If the reported fire was at a highrise residential building <u>downtown</u> the response would be as shown in Exhibit 4.

Exhibit 4 - Apparatus Required for an Initial Response to a Highrise Residential Fire Downtown

Within 4 Minutes		Within 8 Minutes									
											
											
		Staffing									
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
4	5	4	5	3	5	4	6	3	5	2	2

FIHRD Fire - Highrise Residential - Downtown P P A R/S H (or X) D

The different apparatus requirements and scenarios shown in Exhibit 2, Exhibit 3, and Exhibit 4 indicate the variables that have to be considered in determining an acceptable resource level to various emergencies. The following sections describe the process to arrive at the conclusions and recommendations.

2.4.1 Determining Resource Requirements to Meet Demand

A significant effort was put into determining the resources required for TFS to meet the objectives stated in NFPA 4.1.2.1 (3) and those in the 2007 Fire Master Plan.

Fire stations in Toronto are situated, to the extent possible, in such a way that apparatus located at those stations can achieve the travel time stipulated by NFPA 4.1.2.1 (3), since fire apparatus most often respond from a station based environment. However, TFS' records indicate it has not been able to meet a 240 second target 90% of the time.

The process we undertook was designed to determine the resources required to achieve a four minute travel time objective.

Background

The response analysis was completed using ESRI's ArcGIS mapping software. Environmental Systems Research Institute (ESRI) is the world's leading developer of geographic information systems. The company indicates it has installed base of more than one million users in more than 350,000 organizations, including most US federal agencies and national mapping agencies, all 50 US state health departments, transportation agencies, forestry companies, utilities, state and local government, schools and universities, non-government organizations, and commercial businesses. Its products are also used by the City of Toronto. ArcGIS is mapping software that enables manipulation of shapefiles and geodatabases. It is widely used for many functions including transportation and response analysis.

We want to thank Toronto's Social Development, Finance and Administration Division for providing the latest, available, Toronto street network dataset for the purpose of completing this analysis. Also, all available TFS response locations were geocoded by SDFA to ensure accuracy of incident location[8].

A Basic Explanation of the Analysis Method

The analysis consists of two components:

1. **The Mapping Component**

   Mapping software (ESRI ArcGIS 10.1) was used to plot the routes and distance that an apparatus can travel from a station within a specified period of time.

   The end points of these routes are joined forming a ***polygon***. The polygon theoretically defines the area that a vehicle can travel in a given period of time. In this case, the objective was to define the area that can be covered by a fire apparatus within the 4 minute NFPA and City of Toronto target. This process was performed for 80 of TFS's 82 fire stations except for the seasonal stations located at the Canadian National Exhibition grounds and the Toronto Island.

2. **The Mathematical Component**

   Mathematical tools were used to incorporate the results from the mapping component to determine the apparatus needed to ensure a full assignment can reach incidents in eight minutes.

   This component determines whether there are available resources within or adjacent to each 4 minute polygon to ensure that a full deployment of apparatus and staff can reach each suppression incident within 480 seconds (8 minutes).

A Basic Explanation of the Apparatus Location Analysis

There are three steps to the apparatus location analysis:

- The first step is to use ArcGIS to create polygons that represent the theoretical area that can be reached from a fire station within a specified period of time. In this case it was the 4 and 8 minute targets specified by TFS and NFPA 1710.
- The second step is to adjust the polygons to more accurately account for the impact of traffic and other factors.
- The third step is to use the adjusted polygons and mathematical calculations to understand where apparatus should be housed to ensure the TFS response objectives are met.

[8] Not all the address information incidents would geocode. Only incidents that matched geocoding parameters were used in the adjustment calculation.

The first step is to create the polygons. Four minute and eight minute polygons were created for each TFS station using ESRI's ArcGIS 10.1 mapping software. These polygons represent the distances apparatus can travel within four and eight minutes respectively from a fire station.

The second step is to adjust the polygons for greater accuracy to more accurately reflect traffic impedance and other factors which could delay the response of fire apparatus. This is because mapping software assumes a normal or typical travel time and may not adequately consider traffic impedance and other factors in Toronto that can impact the time it takes pumpers and aerials to reach incidents.

This adjustment was done based on the difference between the actual time it took for apparatus to travel to incidents and the time suggested by the mapping software. 'Actual time' was determined using actual call data from TFS' computer aided dispatch information[9]. Since responses to actual incidents usually took longer than the software calculated, the size of the polygons was decreased from those originally created by the mapping software to better reflect the actual responses.

In step 3 fire trucks were relocated from station to station, within the software, to achieve a 4 minute response. The adjusted polygons were used to understand where apparatus should be located to ensure the TFS response requirements could be met. In other words, the placement of apparatus would have to be adjusted to reflect the polygons – and theoretical response areas – that could be reached within 4 minutes.

In addition, eight minute response of a full assignment of apparatus and staff was determined using a ***linear programming***[10] mathematical model (please see the endnote in this section for an explanation of linear programming). The same mathematical program was used to understand where apparatus should be located in order to achieve a full first alarm assignment, within 8 minutes, to all parts of Toronto.

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[9] The computer aided dispatch is used to capture the time of each stage of each incident from the time an alarm (the telephone call), is received until apparatus returns to a station and is once again available for response.

[10] **Linear programming** is a mathematical optimization process used to find the very best solution from among those available. *Best* depends on the problem at hand; in this case, to identify the stations to house pumpers, rescues, and aerials so that the required apparatus type and staff can reach a fire incident within specific periods of time, and doing so with the most efficient level of resources.

Linear Programming is a commonly applied form of constraint optimization which is used to seek out the best point of function while respecting various constraints, such as the TFS's response requirements and the distances apparatus can travel.

The main elements of a constrained optimization problem are:

- *Variables* (also called decision variables). The variables usually represent things that you can adjust or control, for example the number of apparatus
- *Objective Function*. This is a mathematical expression that combines the variables to express the goal (to minimize the number of pumpers, rescue units, and aerials needed).
- *Constraints*. These are mathematical expressions that combine the variables to express limits on the possible solutions. For example, at least 16 firefighters and the required apparatus type must arrive at an incident within 8 minutes.
- *Variable bounds*. It is unlikely that the variables in an optimization problem are negatively or positively limitless. Instead the variables usually have bounds; for example, the number of apparatus must be positive and must be integers (You can't have half a pumper!)

In *linear programming* all of the mathematical expressions for the objective function and constraints are linear. The *programming* in linear programming is an archaic use of the word 'programming' to mean planning. Linear programming can be thought of as 'planning with linear models'.

From: *Practical Optimization: A Gentle Introduction*; John W. Chinneck, 2001; Carleton University

The objective of the linear program is to minimize the number of apparatus needed while at the same time making sure two pumpers (or rescues), and one aerial can reach potential fires within eight minutes. Other apparatus (designated as "X" apparatus), must also reach major incidents so that the first response to residential and commercial alarms includes at least 16 firefighters (including Division Chiefs). Note that the analysis assumed that Division Chiefs would continue to be based from their current station locations.

2.4.2 Caveats and Assumptions

- Other staffed fire suppression apparatus (e.g. air light, hazmat and others which are referred to as ***Specialized Apparatus*** in Section 3.3.10.3 of NFPA 1710) are ***not*** included in the scope of this analysis and may be a necessary component of a second alarm response.
- No adjustments have been suggested to Toronto's current response or use of air light, hazmat, high rise, or other specialized apparatus.
- It is assumed the pumper currently on the island will continue to be housed there.
- It is assumed that the location of fire stations will not change; e.g., no new stations will be built in new locations or stations closed.
- It is assumed that no apparatus will be reduced, increased, or relocated other than those suggested by the results of this analysis.
- Like every other analysis of this kind the assumption is that all staff and apparatus are available and in stations which isn't always the case.

The variance between what our analysis indicates are the required resource levels to achieve the response metrics to a suppression incident in Toronto, as described above, and TFS' existing resources requires some caution in its interpretation.

Our analysis indicates that the number of resources required to:

- accomplish a 4 minute initial response to a fire suppression incident;
- followed by an 8 minute response for the deployment of a full alarm assignment;
- applied on a Toronto-wide basis would be 106 apparatus in total compared to TFS's existing total of 128.

The distribution of these resources, by type, is shown in Table 2, below.

Table 2 - Comparison of Current Apparatus Configuration and Proposed Configuration

Row	Apparatus Type	Pumpers	Rescue	Aerials	Squads	Air Light	HazMat Unit	High Rise Unit	Total Apparatus
1	Current Configuration	58	28	30	5	4	2	1	128
2	Analyzed Configuration (Pumpers & Rescues)	72		22	5	4	2	1	106

Command Units and District Chief Units are not shown in the count since they are external to the daily staffed apparatus.

Some factors have to be considered

The variance between the analyzed configuration (Row 2 in Table 2) and the current staffing configuration (Row 1) is not as pronounced as it first appears. Some factors have to be considered:

- We noted in the section 2.2 Fire Services Data and Statistics, that Toronto's total apparatus includes a contingency for vacancies and paid absences which could be 2 to 3.5 apparatus a day.
- The current resource configuration includes a contingency of up to 16 apparatus a day (or 12.5% of the apparatus) for training purposes; that is, up to 16 trucks a day might be moved from front line service to training. Training is a crucial factor in firefighters' maintaining competence for the many varied tasks they have to perform. However, these apparatus can quickly be deployed back to front line service if call volume warrants.
- The Pomax analysis assumes 106 pumpers and rescue trucks are required to ensure fire response to the city within mandated parameters. However, this estimation does not account for the 2.5 to 3 apparatus per day vacant due to paid absences or other reasons. It also does not make allowances for training requirements which currently utilize 12.5% of the apparatus and front line staff. That equates to another (106 x 12.5%) = 13 apparatus.
- Paid absences and training represent 16 apparatus per day, on average, which results in total of (106 + 13 + 3) = 122 apparatus
- There is a difference of 6 apparatus between current nominal staffing of 128 and Pomax's calculated requirement of 122.

2.4.3 A Re-evaluation of the TFS Resource Analysis

Recognizing that any suggestion that a change in fire resource requirements in Toronto will be closely examined, particularly one that suggests that the fire service can accomplish its existing response requirements with fewer resources, we undertook a second analysis based on geography, response time, and existing station locations. This assessment was designed to determine if there are any fire stations that provide extensive redundant coverage; that is, the response areas overlap to a great extent, and what impact there would be on geographic and address coverage if they were removed from the fire services system.

The second analysis (the one explained below), is a more traditional method of calculating fire service resource needs and has been used at least twice before in the City of Toronto: in the 1999 Fire and EMS Station Location Study led by KPMG, and for the Fire Master Plan in 2007, also led by KPMG. However, in 1999 and 2007 EMME/2, a transportation planning tool, was used instead of ArcInfo although they serve similar purposes. This method is commonly used for fire and EMS station location analysis as well as determining police 'beats', and is widely used for transportation analysis.

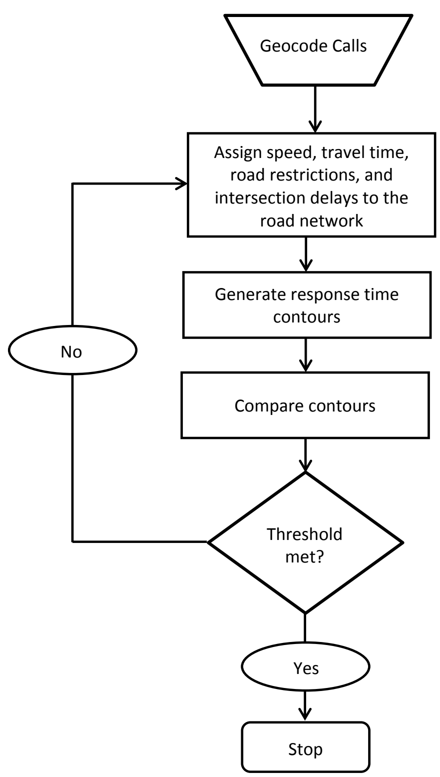
This approach created a Geographic Information Systems (GIS) based simulation model using ArcMAP 10[11] and its network analyst extension. The model plots and analyzes the response time contours for the existing stations in Toronto.

The determination and calibration of response time contours is a four-step process[12]:

1. Geocoding the fire calls onto the network,
2. Assigning speed and travel time to the network links,
3. Generating response time contours (4 minute, and 8 minute) for each station, and
4. Comparing of the number of geocoded calls included in the response contour to the pattern of the total call dataset.

The final three steps are part of an iterative framework. Each step is briefly described below.

Figure 6 - Response time model calibration flow chart



[11] ArcMap is one of several applications integrated into ArcGIS for Desktop and is used to view, edit and query geospatial data, and create maps.
[12] This four-step process is a standard method in traffic and response analysis.

Step 1—Geocode Call Data – Geocode the fire calls data to spatially locate each call on to the model network.

Normally, this is done through Global Positioning System (GPS) coordinates contained in the call origination point data. Sometimes, the data will not have GPS coordinates, but only a street address. In those cases, the model should have street address range information so that the call origin data can be correctly located in the model. Assigning these call data to the mapping is referred to as *geocoding*.

This step also includes cleaning of the data, to remove major anomalies, such as partial data entries, street name corrections, and averaging out the response times in case there are multiple instances of fire response to a particular location (assuming the start point was the same). This step was completed by Toronto's Social Development, Finance and Administration Unit.

A 75-80 percent accuracy threshold is generally accepted in the industry to account for inaccurate address entries during data creation and transfer. Also all responses that were reported to be over 15 minutes were discarded.

The above matched calls were stratified based on the associated fire station and a response time of 4 minutes or less, and 8 minute or less.

Step 2—Speed, Travel Time, Road Restrictions, Intersection Delays Assignment to the Road Network

a. An initial speed and travel time were assigned to each link on the network based on posted speeds. Travel restrictions including one-way prohibitions were also imposed as posted. This was initially completed by Toronto's Social Development, Finance & Administration Division.

b. Fire apparatus travel times were further modified to reflect time lost for turning movements at intersections, intersection congestion delays etc.. Some one-way travel restrictions were also eased, meaning emergency vehicles were allowed to violate the one-way travel restrictions on collector roads (short sections on minor streets). However, no one-way violations were allowed for major arterials, expressways, and ramps. Any travel restrictions on trails were taken into account.

Step 3—Generate Response Time Contours

a. Four and eight minute response travel time contours for each fire station were developed using the network analyst extension in ArcMap 10. These represent the distance that fire apparatus can travel from its station within 4 and 8 minutes respectively.

b. For all calls that were responded by each station, there were numerous situations where multiple units responded to a call, or multiple responses were made to one location in the course of the year (happens more often in multi-unit residences, for example). All such multiple response times were averaged for each call originating location. That way the outlier effects are expected to be minimized.

c. The calculated travel time, travel restrictions, network travel time and intersection delays, were used as factors to generate the response contours.

Step 4—Comparison of Modeled Time Contours to Actual Data

a. Representative stations were chosen across the City to calibrate the generated contours according to the observed values. Each of the generated travel time contours was compared to the extent of the distribution of the 4.0 minute calls for the respective stations. This was also repeated for 8.0 minute calls.

b. The intersection turning movement delay values were fine-tuned so that the resulting contours reflected the observed values well, both for 4-minute and 8-minute windows. This was done by comparing how many responses the contour wrongly predicted, both inside and outside the contour (as in points that should have been within a 4 minute or 8 minute contour but were left out, as well as points that were captured within the contour, but should have been out because they were greater than 4 minutes or 8-minutes). The intersection turning movement delay values were adjusted until the variances were reduced as much as possible, or in other words the ArcMap generated contour was best reflecting the observed (real-life TFS) data.

c. The process was repeated with all the representative fire stations to arrive at the overall best combination of the intersection turning movement delay values. The percentage match for 4-minute contours was between 73 and 85%, and the match for 8-minute contours was between 82 and 91%. This is considered an acceptable to very good match by transportation industry standards.

d. A 75 percent threshold is generally used for attaining calibration because some calls in the dataset have human error in the data generation point, and to also account for outliers in the dataset. Outliers are incident records that appear to have: (1) incorrectly-entered address ranges, (2) trip start and end times that indicate incorrect travel time from the fire hall, or (3) other anomalies. Although there is no scientific basis, the 75 percent threshold is an industry accepted practice for response time modeling.

The resulting 4 and 8 minute coverage contours are shown in the attached maps: *Fire Stations: 4-Minute Coverage* and *Fire Stations: 8-Minute Coverage*.

Coverage Overlap Analysis

In the course of our coverage area contours analysis, we noted that fire stations in the city are generally located so as to provide a quick response to calls, especially in the critical first 4 minutes. Nevertheless, it was observed that a few of the stations demonstrated significant overlap of a 4-minute coverage area with adjacent stations, meaning that in case of an emergency call in those areas, there was more than one station that could provide adequate coverage within the first 4-minutes. These are stations 312, 325, 332, 343, and 424. An analysis was conducted to determine the loss of 4-minute coverage if these were removed. In an ideal scenario, there should be no reduction in coverage by removing a station if that station coverage area was completely overlapped by other station areas. Each scenario was analyzed for 4, and 8-minute travel time contours, first with all fire stations unchanged and, second with the absence of the stations mentioned. The coverage comparisons were based on two parameters: geographic area; and building address points. Note that according to the City's available maps and statistics, the geographic area of Toronto is 641.45 sq. km., and there are 516,000 address points in the City. Numerical coverage comparisons are presented in Table 3, below.

Table 3 - Contour coverage for Toronto with and without Fire Stations 312, 325, 332, 343 and 424

Contours	All Fire Stations Intact (1)		Without Stations 312, 325, 332, 343 and 424 (2)		Coverage Change (1)-(2)	
	Geographic Coverage (%)	Address Coverage (%)	Geographic Coverage (%)	Address Coverage (%)	Geographic Coverage (%)	Address Coverage (%)
4-minute	78.94	90.35	78.91	90.25	0.03	0.10
8-minute	93.21	99.00	93.21	99.00	0.00	0.00

As can be seen from Table 3, the 4-minute coverage change by removing the five fire stations is about 0.03% geography, and 0.10% address points (0.14 sq. km., and 544 address points respectively). With 8-minute coverage contours, there is no observed loss of coverage if the aforementioned stations were not in place. This shows that fire stations 312, 325, 332, 343, and 424 could be assumed to be redundant and other adjacent stations could provide effective coverage with little loss in 4-min response time limit.

Table 3 indicates that change in total geographic coverage, based on the fire station adjustments suggested above, is a reduction of 0.03% in 4 minute coverage. Translated to address points, 0.10% (0.14 sq. km., and 544 address points respectively), would fall outside the 4 minute travel time area. With 8-minute coverage contours, there is no observed loss of coverage by removing the aforementioned stations. This indicates that fire stations 312, 325, 332, 343, and 424 can contribute to efficiencies the city may wish to put into place, and other adjacent stations could effectively provide effective coverage with little loss in 4-minute response time limit.

Maps 6 and 7 indicate Toronto's calculated 4 minute and 8 minute travel time areas. Map 8 is offered as an example and demonstrates concurrent station coverage more clearly than can be observed in Maps 6 and 7.

Some qualifiers to these results

As has been said many times, our analysis is based on 4 and 8 minute response parameters and the analysis indicated that the 4 and 8 minute targets could be met, with minimal loss of address or geographic coverage even if stations 312, 325, 332, 343, and 424 were not in place. However, except for 343, these stations currently achieve a lower than 4 minute 90th percentile. Specifically, in 2011, the 90th percentile response to the areas covered by these stations were:

Table 4 - 2011 90th Percentile Response Times for Stations 312, 325, 332, 343, and 424

Station	90th Percentile Response Time in 2011 in Minutes and seconds
312	3:15
325	3:22
332	3:36
343	4:22
424	3:16

- Other than station 424 at 426 Runnymede Road, the other stations are in the downtown core where there is a proliferation of high rise buildings.
- Station 343 already has a 90th percentile which exceeds the 4 minute target therefore we would be cautious about any further suggestion that it should become redundant.
- Travel time in the 312, 325 and 332 catchment areas would increase by 24 seconds to 45 seconds at the 90th percentile (although they would still achieve the 4 minute travel time target).
- The additional travel time from other stations would increase the Initiating Action/Intervention Time in these high-rise areas (NFPA 3.3.53.3 defines ***Initiating Action/Intervention Time*** as the time interval from when a unit arrives on the scene to the initiation of emergency mitigation).

Our analysis has to be tempered with operational expertise and realities

Our two analyses indicate that there are opportunities for efficiencies based on a realigned distribution of firefighting apparatus. However, our analysis has to be tempered with operational expertise and realities.

During the 2013 budget process, TFS put forward reductions to meet the zero increase budget:

- *"Five front line emergency response vehicles will be deleted from the operations division on a permanent basis. This represents a reduction of 83 operations staff, and reassignment of the remaining 17 staff assigned to these vehicles to assist with staffing levels on other vehicles, which may keep more trucks in service on a daily basis."*
- *"The vehicles proposed for deletion include:"*

Table 5 - Table Excerpt from TFS Briefing Note

			# of Truck Runs				
Truck	**Address**	**Ward**	**2011**	**2010**	**2009**	**2008**	**2007**
P424	426 Runnymede Rd.	13	1,350	1,342	1,335	1,331	1,333
P413	1549 Albion Rd.	1	1,676	1,560	2,145	1,603	1,896
P215*	5318 Lawrence Ave. E.	44	720	698	689	653	725
A324*	840 Gerrard St. E.	30	908	936	829	996	1,032
P213*	7 Lapsley Rd.	42	1,690	1,599	1,735	1,486	1,500

- *"Four of the five vehicles identified represent secondary trucks in existing fire stations, and do not result in station closures. The removal of P424 includes a recommendation to close the fire station, which has been recommended through various studies over the years, starting with the Toronto Fire Department Master Fire Plan completed in 1987, the 1999 KPMG study, and most recently in the 2007 Master Fire Plan."*

2.4.4 Observations

The two GIS analyses we conducted using ArcGIS indicates that there is an opportunity for rationalization of resources within TFS, and there are several options to the rationalization. One of the options for apparatus reduction is the one stated in Briefing Note #17.

Although our analysis does not highlight the particular stations discussed in Briefing Note #17 – except for Station 424 – they do support the intent of the Note. However, realignment of apparatus does not have to specifically follow our findings since each step taken to gain efficiency has a secondary effect on other possible efficiencies. The specific re-distribution of stations and apparatus should be left to the operational expertise of the Fire Chief and City of Toronto administration. Nevertheless, since the option laid out in the briefing note is likely the least disruptive of any possibility, that may be the best way to proceed.

Continued analysis could refine resource distribution even further and may discover other configurations of stations and equipment that would achieve an acceptable level of efficiency. However, evidence indicates that the best opportunity for change and future reconfiguration of apparatus is in conjunction with increased fire prevention and public education initiatives.

The ability to determine the most efficient and effective distribution of resources requires an acceptable support structure. This includes a Business Intelligence tool as noted in Appendix 'B' of the 2007 – 2011 Fire Master Plan recommendations as well as sufficient staff to utilize the software and provide detailed information to fire administration.

Existing and future records management systems should be used to identify trends in emergency incidents to identify areas of concern for public educators, to ensure resources are used as effectively as possible. This includes identification of the need for increased use of existing programs, and the need to develop new programs to deal with emerging or new issues.

Business Intelligence project being implemented in 2011 will expand in future years to include RMS data mining/analysis. Establishing an interface between One Step and RMS is a requirement of the initiative.

Changes to the provision of fire services and a shift in the manner of conducting business – that is, an equal emphasis on public education and fire prevention dealt are always controversial. Therefore, it would be reasonable for the City to strongly consider public discussion and consultation as part of future change processes.

2.4.5 Recommendations

- Continue to implement Business Intelligence reporting software in TFS as a means to enhance the availability and depth of statistical and response information. Enhance business analysis capability in TFS to maximize the use and capacity of the Business Intelligence software.

- Continue to move forward with the closure of station 424 at 426 Runnymede Road and consider other apparatus rationalization.

2.5 Fire Service Risk and Mitigation

This section examines the concept of 'risk' as well as action that has been found, in other jurisdictions, to mitigate risk

2.5.1 Fire Sub-Risk Overview

Typically an Operational Review of the magnitude presented in this report should include a Comprehensive Fire Risk Assessment (CFRA) or analysis in order to quantify and substantiate the final recommendations. Unfortunately, the time and complexity of this task did not allow for a CFRA to be undertaken. Instead, we performed a Fire Sub-Risk Overview which can be found in ***Appendix G – Risk – High Level Overview*** and we suggest Toronto should be aware that any rationalization of resources beyond those already recommended in this report, without consideration of a comprehensive review, might result in decisions being made that have unintentional consequences for the city.

A comprehensive review should include a comparison of data from past and current Fire Underwriter Survey (FUS) reports. These reports include a review of factors separate from fire service readiness and response capability, but which can have an impact upon the community fire risk profile.

Major features assessed during fire protection surveys include:

1. Water supply systems - 30%
2. Fire department administration and operations - 30%
3. Fire service communications - 10%
4. Fire safety control including building and fire prevention codes and their
5. enforcement. - 20%

These functions are measured against recognized standards of fire protection. The insurance ratings dictate part of the cost to Toronto taxpayers for fire damage protection through premium costs. Total costs for fire protection to individual taxpayers and building occupants is the combined total of the fire service portion of their municipal tax and insurance premium costs for fire. Insurance costs can be impacted by the factors considered in a FUS report. In 2002 FUS conducted a survey and prepared a report for the City of Toronto indicating the City had retained its Commercial Classification of 3 pending a review. In the staff report to Council, it was pointed out that Toronto retained its Commercial Classification assisted by the hiring of an additional 55 firefighters which "demonstrated the City would provide the means for TFS to maintain the appropriate level of fire apparatus in service". The Underwriters found the City's fire services at that time to be "generally understaffed to meet its commitments in both its vehicle staffing and in important support functions". A FUS survey has recently been completed for the City and a discussion of that impact has already been held with City Council. The previous survey (2002) was unavailable to Pomax for review.

It should be emphasized that this risk overview looks at the fire risk issue only and does not include many other response activities provided by TFS.

2.5.2 Observations and Conclusions from the Risk Overview

The City should consider the following actions:

1) Conducting a comprehensive Fire Risk Analysis for the purpose of establishing the level of community risk and the magnitude or extent of potential loss and the probability of such loss. This analysis should include the involvement of senior building inspection staff.
2) Establishing annual Fire Code Compliance inspections of high risk occupancies by TFS personnel.
3) Adopting an aggressive enforcement policy for all Fire Code violations that impact upon the immediate life safety of the occupants of a building.
4) Establishing a policy and method for reimbursement of every inspection required as a result of non-compliance with the Ontario Fire Code.
5) Piloting the concept of specialty teams for complex occupancies and develop in-house expertise to assist inspectors with the application of the Fire Code in these occupancies.
6) Aggressively pursuing mobile technology solutions to improve the efficiency of inspection and enforcement of the Fire Code requirements for buildings.
7) Establishing a fire prevention activity policy for operations crews including a training program on pertinent areas of the Ontario Fire Code.
8) Establishing a Fire Investigation team which would conduct in-depth investigations of specific fire incidents to determine cause to better identify the "fire problem" in Toronto so that appropriate proactive programs can be tailored to the needs identified by the investigations.

2.5.3 Refocusing on Prevention and Inspection

We noted earlier that, when evaluating an acceptable level of resources and possible efficiencies, the City should take into account the opportunity for change and possible future reconfiguration of apparatus in conjunction with increased fire prevention and public education initiatives. It is important to note that any efficiency in staff and apparatus should not take place in isolation. A robust approach to data capture, analysis, fire prevention, public education, and working with other City agencies will be required in concert with other efficiencies.

The United Kingdom embarked on a journey, more than 10 years ago, to become more efficient in many areas of public service, including fire services. Cities in the United Kingdom focused their efforts on prevention and education during a period of budget reduction and there are lessons for the City of Toronto in the ***process*** used to accomplish efficiencies. We have heard a number of comments that there is a different social fabric in the United Kingdom, building construction and legislation is different, firefighting techniques are different, and those differences cause challenges when trying to apply them to Canada. We listened the concerns and comments that were expressed but ***applying the process*** used to accomplish change and efficiency in the UK is easily transferrable to Canada.

We also understand that, intuitively, one would expect that reduced fire response would result in an increased death rate from fire however, that was not the case in the UK. The downward trend in fire deaths, as seen in Chart 6 - United Kingdom Fire Deaths 2002/3 - 2010/11 even while there were reductions in fire staff levels, has been attributed to increased Home Safety Checks, as well as other prevention initiatives and the use of software such as Phoenix and PinPoint[13] which helps to determine fluid staffing and apparatus configurations based on hour of the day.

Chart 7 - Accidental Dwelling Fires and Home Fire Risk Assessment demonstrates the decline in dwelling fires in the Greater Manchester area of the United Kingdom in relation to an increase in home fire risk inspections, at the same time as staffing and resource efficiencies were being put into place (please see Chart 8 - United Kingdom Cumulative Staff Reductions). Similar results have been achieved across the United Kingdom.

Please also see Exhibit 5 - London Financial Times - United Kingdom Fire Services' Overhaul from the London Financial Times.

Although Toronto isn't facing massive budget reductions from a central level of government that were the catalyst for finding new ways of conducting business in the fire services of the United Kingdom, refocusing efforts on fire prevention and inspection, the utilization of off the shelf software such as Phoenix and PinPoint, and a greater involvement with other City departments, could eventually result in the City experiencing cost savings as was seen in the United Kingdom.

Additional information about the United Kingdom Fire Service, particularly the City of Manchester can be found in ***Appendix K – Case Study: United Kingdom***.

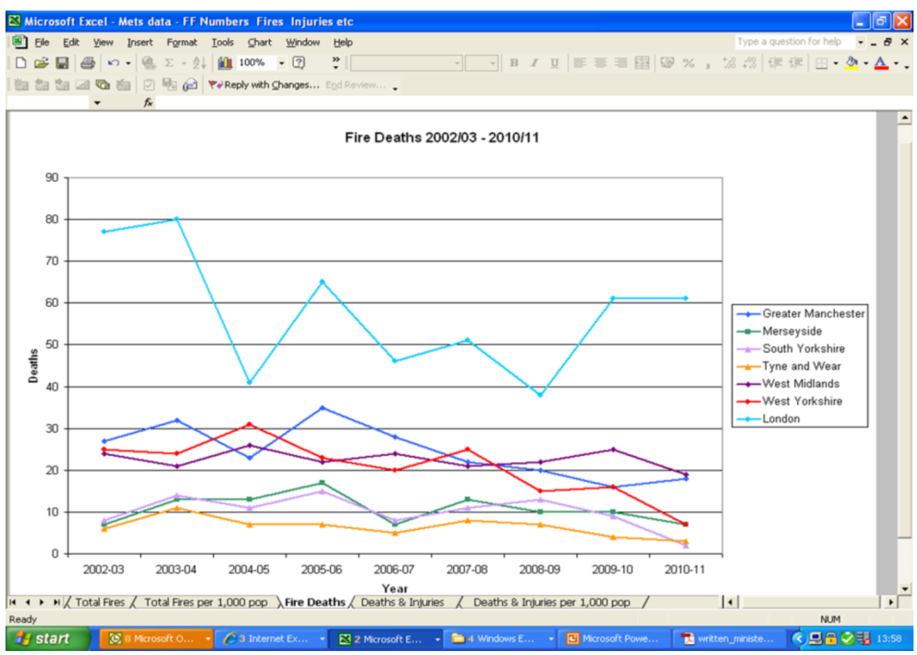


Chart 6 - United Kingdom Fire Deaths 2002/3 - 2010/11

[13] Phoenix and PinPoint are software programs produced by Active Informatics. Similar programs are available from other software companies.

Chart 7 - Accidental Dwelling Fires and Home Fire Risk Assessment

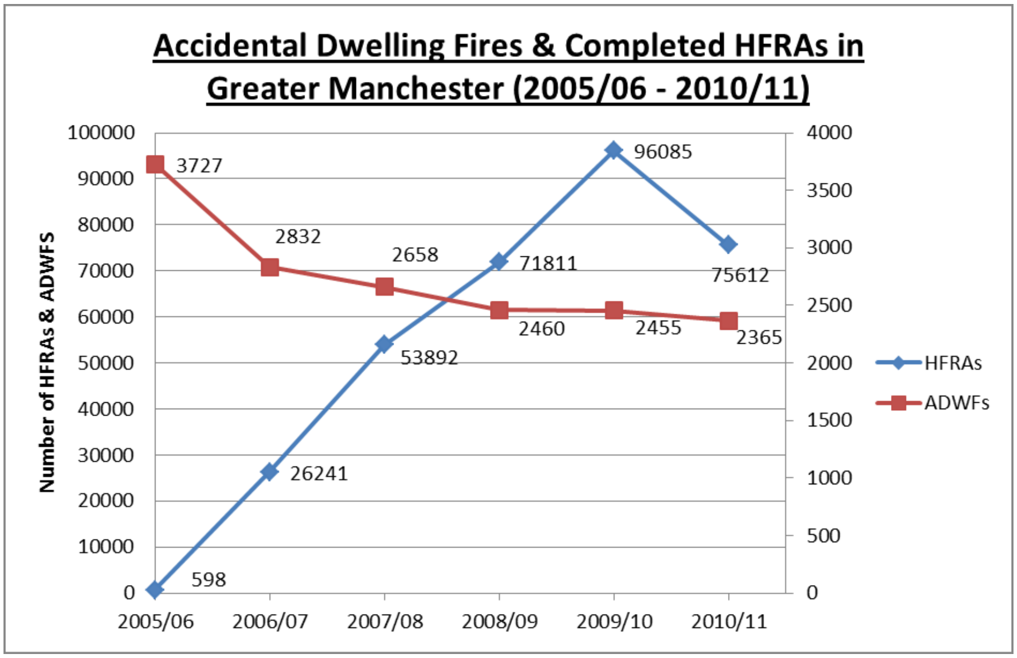


Chart 8 - United Kingdom Cumulative Staff Reductions

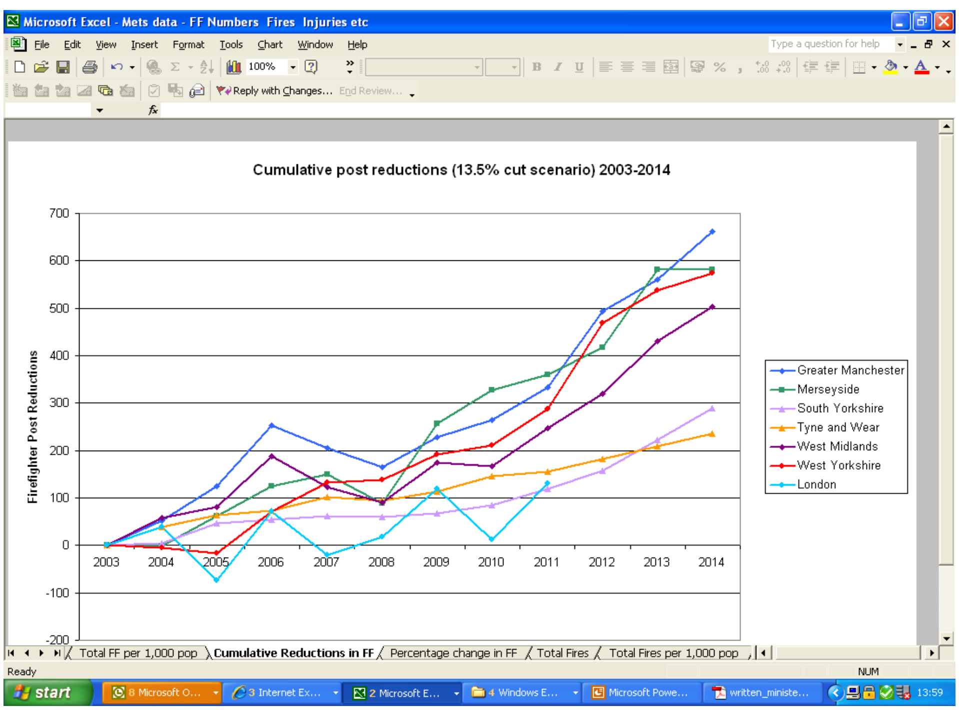


Exhibit 5 - London Financial Times - United Kingdom Fire Services' Overhaul

Battling budget cuts How Manchester and London are faring

7 mins

Manchester fire brigade's target for reaching fires where lives and property are at risk

6 mins

London's target time, with a second engine targeted within 8 minutes

£20m

Savings made by Manchester over the past three years

£48m

Sum London fire brigade has to cut over the next two years

30%

Reduction in number of incidents in Manchester that involve fire engines

18

Number of fire engines that London needs to axe in order to hit savings targets

Fire crews tackle a London blaze during 2011 riots Rex

Fire service overhaul puts heat on public sector

Manchester

Radical reforms are seen as a model of how costs can be cut while cover is maintained, says **Sarah Neville**

When the alarm sounds in Sale fire station in Greater Manchester, the well-drilled men of blue watch shrug on their protective gear and climb aboard the waiting engine in 30 seconds flat.

The smooth efficiency of the "turnout" has changed little for decades, even if the pole down which firefighters once slid is preserved only for show and the bell that tolled from the town hall in an emergency is relegated to a glass case at the station entrance.

But the evident respect for tradition obscures the astonishing changes in the service of the past decade.

By 2015 Greater Manchester fire and rescue service will since the millennium have shed almost one in three frontline staff. It has done this through radically altering its focus from fighting fires to preventing them.

Alongside these operational changes it has developed a sophisticated database to measure relative danger and, in turn, to target dwindling resources – removing one engine from leafy Sale, for example, after identifying the community as "low risk".

In marked contrast to the NHS – which is moving only slowly towards a "24/7" service where consultants will take their turn on night shifts – Manchester's fire service began overhauling its rigid shift patterns in 2006, recognising that some areas needed more staff at night while others saw demand peak during the day.

If a service once seen as a redoubt of ossified practices can embrace much-needed change, so can any public service, argues Andrew Haldenby, head of the pro-market think tank Reform.

"Some of the leading edge reforms to fire services should influence other public services, in particular changes to the workforce and efforts to match resources to risks," he says.

An intensifying row over fire station closures in London, where data obtained by the FT reveals varying response times, has underlined the difficulties of cutting back services under the cosh of austerity.

Steve McGuirk, Greater Manchester's chief fire officer, acknowledges the service had the advantage of beginning transformation in buoyant economic times.

Following a wrenching national strike more than a decade ago, a pay settlement meant big savings had to be found. At the same time political and social changes – from the rise of terrorism to the fall of chip pans – created powerful external drivers for change.

There is "no quick fix" for slimming the public sector without damaging the service the public receives, he warns. His advice is to "do all the 'low hanging fruit' stuff... and use that time while you're making [those] savings to think very, very deeply about the long-term implications of the cuts that you're making."

Steve Forster, who manages the Salford fire station, represents demand management in action. An evangelist for data collection, he shows a bar chart with one line soaring over the rest: kitchen fires. This intelligence allowed him to zoom in on a trouble spot – a tower block housing students with a marked propensity to burn the dinner.

Rather than resign himself to a rash of resource-sapping call-outs, he sent some of his officers in to give the youngsters lessons in how to cook safely.

Yet for all the massive strides Manchester and other fire services have made, it faces the same imperative as the rest of the public sector to make still more – a prospect that fills Mr McGuirk with alarm.

"We are at a tipping point," he warns. "We have taken huge resources out of the system and, up to a point, we've been able to manage that by reducing demand. But you can't carry on forever."

Tory boroughs join backlash against plan that would close 18 fire stations

Boris Johnson has come under pressure from two Tory London councils over a planned £48m budget cut that would close 12 fire stations, **write James Pickford and Martin Stabe**.

Kensington and Chelsea joined Westminster this week in opposing the mayor's intention.

As the political furore intensifies, the Financial Times today publishes data, obtained from the London Fire Brigade through a Freedom of Information request, that show response times are shorter in central London than in outer boroughs, where stations will be largely untouched.

The LFB said the closures would not lengthen response times. Fire crews aim to arrive at an incident within six minutes, with a second engine targeted to arrive within eight minutes.

Mr Johnson said: "This must and will be about improving London's fire service." The mayor has said he will force a consultation into the cuts, after they were rejected by the London Fire and Emergency Planning Authority.

Philippa Roe, Westminster council leader, said: "The justification for closing these fire stations seems to be that fires are rarer in modern buildings – but 75 per cent of Westminster is a conservation area."

The Fifth London Safety Plan, produced by Ron Dobson, LFB commissioner, and backed by the mayor, will see 520 jobs, 12 stations and 18 fire engines axed.

Labour members on the London Assembly will today call for Mr Johnson to freeze his share of council tax rather than cut it by 1.2 per cent as planned, and use the money to keep stations open.

INTERACTIVE MAP

How fast is the London Fire Brigade? The most detailed ever map of response times **www.ft.com/firemap**

2.5.4 Prevention/Education/Investigation/Enforcement

Toronto's Fire Prevention operations meet the minimum requirements of the Fire Protection and Prevention Act with respect to:

- a simplified risk assessment
- a smoke alarm program
- distribution of fire safety education materials
- inspections upon complaint or request

However, it is unlikely that they meet the needs of the community related to the City of Toronto's building stock, density and demographics. Fire inspections, code enforcement, fire investigation and public education are key components to decreasing fire occurrence as well as the resulting impact upon people and property.

Inspection and enforcement have been long-standing issues throughout Ontario. As far back as December of 1983, the Honourable Justice John Webber issued a Report of the Public Inquiry into Fire Safety in Highrise Buildings. Justice Webber was appointed by Order-In-Council to conduct the inquiry in the aftermath of a number of serious fires in highrise buildings, the bulk of which were in Toronto. Among the recommendations were:

> "2.8 Increased funding should be provided to ensure proper inspection by Ontario Building Code and Ontario Fire Code inspectors of all highrise buildings."
>
> "2.11 The Ontario Fire Code should be more actively enforced and the courts should impose substantially increased penalties for breaches of the Ontario Fire Code, and upon convictions for Criminal Code offences involving fire safety matters."

Toronto's "needs" far outstrip its resources and capabilities related to fire prevention activities. There is a need for TFS to become more proactive with inspection and public education programs. Additionally, a more aggressive code enforcement policy and level of action is needed as a critical component of ensuring compliance with the Ontario Fire Code. Time should be spent preparing a consistent approach to the sentencing aspect of legal proceedings to maximize the fines assessed, particularly in violations having an impact on immediate life safety.

Fire operations (suppression) personnel should be engaged in more fire prevention related activities as part of their regular duties. And suppression crews should be trained to a level of understanding in the application of the Ontario Fire Code to allow them to carry out at least a basic level of inspection, particularly where there is a mixed commercial/residential use of a building. These crews should also be trained to a level of understanding related to Fire Code requirements for immediate life safety issues, higher risk residential occupancies such as highrise apartments and condos, retirement homes, etc., to the point that they can coordinate inspection and follow up requirements with fire prevention officers.

Effective prevention and public education begins with knowing what the fire problem is in the community. Knowing the fire problem requires the investigation and determination of the cause of fires. There should be an effort to investigate every residential fire to determine origin and cause. Where investigations uncover Ontario Fire Code violations there should be a policy for prosecution. Where investigations indicate the possibility of criminal liability, investigators should be working closely with the police with a view to prosecution; for example; criminal negligence in fatalities where there was no working smoke alarm.

The Fire Prevention and Public Education Division has proposed a phased-in, cyclical building inspection program, based upon risk. That proposal is set out in Table 6 - Proposed Risk Based Inspection Chart. Our notes gleaned from interviews with the Fire Prevention and Public Education Division follow that table. But we don't believe the implementation to be adequately aggressive. Additionally, the way the process is laid out does not provide the flexibility required to be responsive to the needed mix of inspection and education staff at any time of the program implementation process.

Table 6 - Proposed Risk Based Inspection Chart

Occupancy	Total # of Occupancies (#)	Hours per Inspection (H)	Total Hours (# x H = T)	Frequency (F) (1 = annual)	Total Inspection Days (TD) T x F/7	Total Person Years (TPY) TD/168
Assembly - General	5,597	1	5597	1	799.6	4.8
Assembly > 150	737	2	1474	1	210.6	1.3
Assembly >300	353	3.5	1235.5	1	176.5	1.1
Elementary Schools	806	3	2418	1	345.4	2.1
High Schools	205	4	820	1	117.1	0.7
Daycares	900	3	2700	1	385.7	2.3
Hospitals	40	80	3200	0.5	228.6	1.4
B1	30	4	120	1	17.1	0.1
B2	221	3	663	1	94.7	0.6
B3	159	2.5	397.5	1	56.8	0.3
Rooming Houses & Group Homes	1,718	2	3436	1	490.9	2.9
Residential High Rise	3,720	4	14880	0.5	1062.9	6.3
Residential Mid Rise	4,257	2	8514	0.5	608.1	3.6
Night Clubs	100	2	200	2	57.1	0.3
Hotel, High Rise	100	5	500	1	71.4	0.4
Hotel, Mid Rise	33	4	132	1	18.9	0.1
Business, Mercantile & Personal Services	20,784	1	20784	0.3	890.7	5.3
High Hazard Industrial Occupancies	2,775	4	11100	1	1585.7	9.4
Medium Hazard Industrial Occupancies	7,919	3	23757	0.5	1696.9	10.1
Low Hazard Industrial Occupancies	964	2	1928	0.3	82.6	0.5
			Full Time Insepction Staff Required			**53.6**

Observations from interviews with the Fire Prevention and Public Education Division

1) ***Program Basis***

   a. According to TFS's experience, most fire death reports that they have reviewed indicate that some fire code violation existed in the building where the death occurred. More effective code enforcement should reduce these tragedies.

   b. The inspection staff complement proposed by TFS (Table 6) is based upon information from many very experienced code enforcement people both in Toronto and from the NFPA technical committee which are writing the NFPA 1730 standard for Fire Prevention.

   c. TFS suggests that implementation of this program be piloted in one command with 15 dedicated people. We continue to believe a more aggressive approach starting with 27 additional fire prevention staff in 2014 and a further 27 in 2015 will jump-start the prevention program.

2) ***TFS proposes to consolidate enforcement offices to one office in each command and Public Education into one location for the city.***

   a. There is an expectation that improvements in supervision and consistency of enforcement would be gained.

   b. It is also believed that consolidation would allow the Captain to Inspector ratio and the District Chief to Captain ratio to be increased resulting in savings when expanding the number of inspection staff.

   c. Staff training would be easier and there would be efficiencies in work assignment resulting in better service to the public.

   d. TFS expects cost savings as less backfill acting time would be required for the officer ranks, and there would be more efficient use of facilities, support staff, vehicles, etc. Once again, a six month pilot in one command is suggested. Costs should be monitored to prove these expectations.

   e. Another expectation is that establishing one Public Education Centre in Toronto will mean more efficient use of staff time which should result in contact with far more citizens over the year. The theory is that children's and other groups would travel to TFS for education. However, TFS should provide supporting evidence, from other departments, of reduced staff costs and improved educational opportunities before putting this system into place. It's possible that increased staff costs from having several public education facilities in the city would be offset by a higher level of awareness, greater public safety, and eventually reduced fire costs.

   f. We support any move towards greater education, prevention, and awareness but beliefs and expectations need to be supported with a business case before money is spent to put in place a system that may not deliver on those beliefs and expectations.

3) ***Mobile/portable computing for Fire Code Enforcement inspection wor***k. To work properly and increase efficiency, inspectors must be able to input data while performing inspections and viewing violations. There must then be the capability to generate a report and send it to the owner of the building in real time. This will require a commitment to acquire and support the appropriate technology. TFS suggests a pilot involving 10 inspectors in one command as a pilot project to assess hardware and software.

4) ***Specialty teams for complicated occupancies***. There are some occupancies in Toronto that are very complicated, high risk and few in number. It is not practical to keep all staff trained and have enough practice to maintain the knowledge in some of these occupancy types.

5) ***Operational staff can be used to perform fire code enforcement inspection duties*** in certain occupancies, and expand public education activities in their station districts.

6) ***TFS has identified the need to have a Post Fire Investigation team to investigate the cause of fires in Toronto***. Three of the 54 recommended fire prevention and inspection staff would be required to initiate this program. This would assist TFS in identifying local trends related to smaller fires and "near misses" upon which risk, response, prevention and education programs can be tailored. Currently only large fire and fire fatality investigations take place. TFS suggests that a pilot project assigning 1 investigator to each Command should be instituted in 2013. These individuals would be Fire Prevention Officers trained as investigators who could perform fire prevention duties when not actively involved in an investigation.

7) **The Ontario Fire Code makes it the responsibility of building owner's to comply with the Code**. Responsible owners who are compliant with the Ontario Fire Code should be entitled to a cyclical inspection as part of what their taxes provide. However, taxpayers should not be burdened with having to pick up the costs for subsequent inspections triggered by non-compliance. To that end, the City should consider a policy and authority to charge building owners for every inspection that is triggered by non-compliance with the Ontario Fire Code.

References
OFC, FPPA, NFPA and TFS proposal

Conclusions and Comments

While we agree with the spirit of the staffing enhancement proposed in Table 6 the staff numbers are inadequate to accommodate an inspection and enforcement program, as well as a public education and prevention program. We observed from the United Kingdom's experience that a strong inspection and prevention strategy is important, and should be considered an investment in the cost reduction process, if a service-wide cost mitigation initiative is to be successful. The Division has requested and justified 54 new staff for inspections alone whereas, to meet both inspection and prevention programs the additional complement should be closer to 100 staff.

As well, instead of new complement being restricted to inspection programs as shown in Table 6, these complement should be a mix of inspection, enforcement, education and prevention, and business analyst staff as required by the Fire Prevention and Public Education Division from time to time.

The annual cost of a fire inspector is $103,430, which includes salary, benefits, and uniform costs.

- Annual costs for 54 inspectors would be (54 x $103,430) = $5.4 million
- Annual costs for 100 public education and inspection staff would be (100 x $103,430) = $10,343,000

An investment in public education and inspection staff should result in:

- a reduced risk and incidence of fires on a per capita basis;
- a reduction in false alarms (although that will also affect income due to a reduced level of fines);
- reduced property loss;
- a reduced risk of loss of life and injury to both private citizens and firefighters;
- the ability for the City to reduce suppression staff over a prolonged period of approximately 10 years; and,
- recovery of the cost of inspection and education staff through other efficiencies.

We recognize the realities of a $10.3 million budget implication based on the hiring of 100 additional staff, as well as the logistics of hiring, training, placing staff in the field, implementing associated technology, and coordinating enhanced education and inspection programs. Our expectation is that a program expansion of this magnitude would take place over several years.

Our expectation is that the benefits of an increased education, prevention, and inspection program should become apparent approximately 5 years after implementation by way of a reduction in emergency responses within the operations and fire suppression division. The City may want to evaluate the possibility of further rationalization of fire resources at that time. In the interim, and in preparation for the expected benefits of prevention initiatives, it is important to undertake a comprehensive risk analysis of the City in addition to engaging the public to discuss the benefits and implications of fire service rationalization.

To achieve a substantial reduction in response costs, the focus of the fire services must change to a human services organization. To spur that change both TEMS and the Fire Services should report to the Deputy City Manager with responsibility for human and social services. Another high priority, after accomplishing this organizational change, is to achieve a refocusing strategy so that fire services can take on a greater role in mitigating the effect of fire and other emergency impacts on the citizens of Toronto by means of education and prevention.

2.5.5 Recommendations

- Implement dynamic staging and use of predictive modeling and pre-emptive traffic controls to better predict demand and more effectively deploy fire resources and apparatus.
- Conduct a city-wide comprehensive fire risk analysis to review opportunities for further reductions and rationalization of fire response and suppression resources and apparatus.
- Implement a strategy to focus TFS resources on prevention, inspection and public education to reduce the incidence of fires and other emergencies. The strategy should consider increasing public education, prevention, and inspection staff at TFS by 54 FTEs in the shorter-term with a further increase of 46 FTEs in future years.
- Develop a more integrated City approach to emergency prevention and education to better coordinate City efforts across multiple divisions to reduce fire and other emergencies, particularly in vulnerable communities.
- Adopt an aggressive enforcement policy for Fire Code violations that impact upon the immediate life safety of the occupants of a building.
- Establish a policy and method to require building and site owners to bear the cost for follow up inspections required as a result of non-compliance with the Ontario Fire Code.
- Establish annual Fire Code Compliance inspections of high risk occupancies.
- Establish a Fire Investigation team to conduct in-depth investigations and determine the cause of fire incidents in Toronto. Improve prevention programs by integrating causes identified by fire investigations into program design.
- Train fire suppression crews on key areas of the Ontario Fire Code and utilize them to augment incident prevention and inspection activities.
- Pursue mobile technology solutions to improve the efficiency of inspection and enforcement of Fire Code requirements.

3.0 Toronto Emergency Medical Services

3.1 Advanced Life Support and Advanced Care Paramedics in EMS

This section examines the level of pre-hospital medical care that should be provided to the City of Toronto and the most effective method of delivering that care. There are some fundamental issues that should be discussed as a precursor to determining the most appropriate level of pre-hospital medical care for Toronto and the method of delivery.

The issues are the 1) utilization of primary and advanced care paramedics and the care they can provide and 2) the delivery model which includes firefighters.

In this section, the following questions are discussed:

1. Does having *advanced life support* or *advanced care paramedic* staff matter?
2. To what extent does having *advanced life support* or *advanced care paramedic* staff matter?
3. How should pre-hospital care be delivered?
4. Does response time matter?

Advanced life support refers to the service provided by advanced care paramedics. So functionally, the terms are used interchangeably, one indicating the service provided and one indicating the service providers.

The questions of whether advanced life support (ALS) should be provided, to what degree, and in what format have been around since the origins of pre-hospital care. Analyses, research, and publications have been presented by many participants in medical specialties, emergency management, politics, public health, nursing, operational management, and economics.

Indeed, the City of Toronto was an early adopter in Ontario with the introduction of advanced care paramedics in the mid-1980s, a move that helped to create the shift towards advanced pre-hospital care in many other areas of the province. The Ontario Pre-hospital Advanced Life Support (OPALS) study was designed and implemented in the late 1990s to assist the provincial government in determining whether ALS was of benefit. We examined whether it made a difference in patient morbidity and mortality. TEMS leadership and guidance was instrumental in the development of this initiative, which is now successfully implemented in most major population areas in Ontario where there are advanced care paramedics (ACP).

Given the considerable and available research on ALS, and Toronto's significant experience with Advanced Care Paramedics, the consulting team's goal was not to repeat existing research and conventional knowledge. Instead, the approach was to use the team's extensive knowledge base, experience, and findings from *emerging* research to analyze the impact of ALS and ACP on patient care and operations.

There are some challenges in applying available literature (research). First, clinical trials can only test what can be measured. Mortality can be measured, is obviously important, and is used as the most common outcome. However, only a small percentage of the patients seen by EMS staff die, so there has to be an extremely large effect in what is being studied in order to change mortality rates. Medical care, both pre-hospital and in-hospital, has its primary effects on morbidity, something that is difficult to measure and quantify.

In order to find hard targets to measure, research relies on proxies. In EMS, the performance of procedures in the field has commonly been used as a proxy measure for ALS intervention. This is why most studies are done on trauma and cardiac arrest. Unfortunately equating the need for procedures with a need for ALS is not a clear association. Experience shows that the ALS *intervention* with the largest impact on patient care is appropriate critical clinical decision making.

Take a specific critical clinical procedure such as endotracheal intubation, which is the placement of a tube through the vocal cords to aid breathing. The skill in and of itself is difficult to learn and takes repeated practice to maintain, however, the most important part of endotracheal intubation impacting patient care is the decision to perform the skill or not. In some clinical conditions, endotracheal intubation is actually related to negative outcomes. In trials, the patients who did not require endotracheal intubation in the field are often placed in the category of patients not requiring ALS intervention. In reality, those patients received ALS level decision-making and global airway management outside of the placement of a tube. We believe, and the evidence supports, that often the patient not intubated by an ACP received the better ALS decision.

Studies intended to answer the question of ALS utility look primarily at trauma and at mortality rates. Specific to trauma, mortality is tied to the speed of delivery to surgical care; hence the aphorism *trauma is a surgical disease*. Minimum pre-hospital and emergency department times are required. Procedures in the field are related to increased mortality because apart from a few specific time-critical, life-saving interventions based on sound clinical decision-making – decompression of tension pneumothorax (collapse of a lung under tension), control of major external bleeding, or intubation/global airway management – some advanced procedures only prolong scene times. Research demonstrates that establishing an intravenous (IV) line in the pre-hospital setting does not save lives in trauma. However, the skill and ability of the paramedic to discern when an IV is appropriate, and to be able to perform the skill when needed, can be a critical factor in other clinical conditions.

Aspects of the Ontario Pre-hospital Advanced Life Support (OPALS) series of trials[2] are frequently cited as showing no benefit from ALS, and a worsening mortality for the most severely injured trauma patients. This is not surprising given what we now know about trauma care. Evidence shows that previous methods of field intubation of patients with head trauma worsened mortality by inadvertently affecting oxygen levels in the blood and carbon dioxide levels in the brain. However the OPALS results have to be evaluated carefully and in their entirety with respect to the performance of ALS care in the pre-hospital setting. Moving from the selection of trauma patients to those with medical issues such as congestive heart failure, it is clear the subset of patients in OPALS with respiratory distress did better with ALS. Treatment of respiratory distress requires high-level decision making with multiple options available. The training and experience of ACPs becomes apparent in these situations.

Another difficulty in interpreting the literature with respect to metropolitan Canadian areas is the definition of Advanced Life Support. Basic life support (BLS) in many countries is provided by responders with skill levels similar to the Canadian Emergency Medical Responder[14] however, most countries have no intermediate level provider such as the Canadian primary care paramedic. ALS may be considered any skills above the level of BLS including such things as intravenous fluid administration and basic symptom relief, such as administration of Ventolin for asthma, which in Canada are part of the Primary Care Paramedic National Occupational Competency Profile. A study measuring ALS effect on mortality in asthma, and using ventolin administration as a proxy for ALS care, cannot be generalized to a metro Canadian system. Most asthmatics are now successfully treated by PCPs who are able to administer the required medication. This study will tell us that Ventolin administration makes a difference but cannot discriminate between ALS and BLS for us. ALS treat the sickest of the asthma patients and while the effect on mortality exists, the number of patients is small and may not show up clearly statistically. Effect on morbidity is large but not measured. A different study would have to be designed, looking specifically at this patient group, to answer the question of ALS effect in severe asthma.

The Cochrane review[15] of ALS was performed specifically to answer the question of whether or not low to middle income countries should invest in ALS training. The OPALS study figures prominently in the review. The Cochrane recommendation is that low to middle income countries should invest in emergency department care and basic system efficiencies before considering a move to ALS. A sensible recommendation, but it is critical to interpret these findings with recognition that they are *not* talking about systems with ALS in place or where BLS and the receiving emergency department system are already well developed.

With respect to applicability to Toronto, the consulting team would add that as a major metropolitan area, in the heart of a leading developed country, the city of Toronto can in no way be interpreted as a low to middle-income developing area. It has one of the best living standards in Canada and an extensively developed system of primary, tertiary, and quaternary health care. The TEMS system, with extensive funding support from the provincial government, is a key element of the broader health care system.

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[14] The National Occupational Competency Profile for Paramedics defines Emergency Medical Responders as having successfully completed a recognized training program in emergency patient care and transportation. Historically, EMRs have been the medical first responder in rural and remote communities. They are often associated with volunteer emergency services organizations, and may be the sole provider of emergency medical services in some communities. EMRs may be responsible for initial assessments, the provision of safe and prudent care, and the transport of a patient to the most appropriate health care facility.

[15] Cochrane Reviews are systematic reviews of primary research in human health care and health policy, and are internationally recognized as the highest standard in evidence-based health care. They investigate the effects of interventions for prevention, treatment and rehabilitation. They also assess the accuracy of a diagnostic test for a given condition in a specific patient group and setting. They are published online in The Cochrane Library.

Each systematic review addresses a clearly formulated question; for example: *Can antibiotics help in alleviating the symptoms of a sore throat?* All the existing primary research on a topic that meets certain criteria is searched for and collated, and then assessed using stringent guidelines, to establish whether or not there is conclusive evidence about a specific treatment. The reviews are updated regularly, ensuring that treatment decisions can be based on the most up-to-date and reliable evidence.

3.1.1 Layering and Targeting Strategies

Targeting is the practice of ensuring the right level of responder (primary care paramedic [PCP] or advanced care paramedic [ACP]) is sent to the call. Layering is the practice of sending both levels of responders on some calls. For example, a caller with shortness of breath and a history of asthma who is able to speak clearly over the phone to the call taker and not in distress (MPDS "C" category) requires PCPs to administer anti-asthma medication (Ventolin) and transport to hospital. A patient with a history of asthma who is short of breath but unable to speak without stopping between words (MPDS "D") may have impending respiratory failure and may require ALS level airway management and intervention. ALS is layered along with BLS. It is possible that once BLS arrives and administers ventolin, the patient could turn around and get better quickly. It is also possible that the patient may not improve with BLS intervention. BLS can cancel ALS if not required or ALS can attend and help in the early phase of management then clear for the next call. If ALS is required at the scene, this patient is likely sick enough that both paramedics will be required to treat during transport to hospital with one of the PCPs driving. One study in Houston is looking at targeting vs. non-targeting in cardiac arrest found improved survival in the targeted systems[10.]

In looking at the question of *layering and targeting*, it is clear from a practical response perspective that multiple, trained clinical responders are required for some high acuity calls. Using cardiac arrest as an example, mortality is tied to response time, quality of cardiopulmonary resuscitation (CPR), timing of defibrillation, and overall efficient scene management. CPR requires compressions to a 2.5-inch depth at a rate of 100 to 110 compressions per minute. CPR tires the compressor rapidly and it is well established that the quality of compressions deteriorates within one to two, 2-minute cycles. The compressor is changed out every 2 to 4 minutes, requiring a pool of trained responders to draw on. Airway management, defibrillation, IV starts, medication administration, and scene, bystander, and family management add to the complexity of the CPR process. Movement of the patient to the ambulance, often across uneven terrain and up or down stairs, also requires a team to lift/carry/move the stretcher, pay attention to all lines and tubes, and continue care.

Other high acuity calls, such as high acuity trauma and respiratory distress, require similar numbers of hands at the scene. In effect, the sicker the patient, the more hands are required for safe treatment and transport. The sickest patients often require two highly trained responders, preferably at the ACP or higher level, in the patient compartment during transportation. Without layering in this small subset of calls, the second paramedic responder rendering care in the ambulance patient compartment would not be available. Patients requiring a layered response are the sickest therefore, time is of the essence. The practice of responding a single unit to assess the patient and call for back up if required, delays care and does not serve the patient optimally. This subset of patients is best served if both responding layers are sent initially and the second layer cancelled by the first arriving vehicle as required. As previously discussed, the responders tasked with possibly cancelling a higher level of responder must have appropriate training and knowledge, and resources to do so safely.

Review by the consulting team shows that the TEMS is a leader in the process of identifying which calls require layering. Hence Toronto's ALS vehicles can be *targeted* where they are most effective. The recent change in the first responder allocation of the TFS on calls is the first phase of this longitudinal project. While layering is a common occurrence in EMS systems, targeting is not. This attempt represents cutting edge work and the consulting team supports its continuation. The physicians providing oversight for the Sunnybrook Centre for Prehospital Medicine and TFS all expressed a willingness to work with this project to hone the targeting in the system to achieve best resource allocation practices while also achieving high quality clinical outcomes.

Evidence supporting the layered and targeted approaches from a clinical perspective was generated by Deputy Chief Alan Craig and others from the TEMS, and from a range of other sources. The evidence indicates that for the safe and effective performance of highly technical procedures, and for honing clinical decision making with respect to when to perform those procedures, the paramedic who completes more procedures gets better at them. An illuminating example involves cardiac arrest and its frequency of occurrence. If we accept the norm of two cardiac arrests per 1,000 people per year, then in a city the size of Toronto, paramedics will respond to about 5,000 cardiac arrests per year (Toronto's rate of cardiac arrests is somewhat lower). If there are 300 ALS paramedics, and each one of them works with another so that they are in a two-person team, then each ALS paramedic will likely run about 16 cardiac arrests per year. If there are only 100 ALS paramedics, they will run approximately 50 cardiac arrests per year. The evidence presented by Deputy Chief Craig and others indicates the paramedics that respond to more cardiac arrest calls provide better treatment and have higher patient survival rates.

The challenge of course is operational. In a system wanting to ensure ALS is – with some level of predictability (say 90 percent) – on every call that can benefit from it, then services require either a large number of ALS for response time coverage or a combination of BLS and ALS response to deal with both the clinical and the response time issues. If there is less ALS capability in a geographic area, it will likely take longer to get to an incident and a co-responder would need to arrive first. If the gap in time is greater, then you increasingly need that co-responder to have more training, for example to the PCP level.

British Columbia Model

In the British Columbia model for Metro Vancouver, layering and targeting has been the practice for many years. Of the 72 vehicles staffed at peak daytime hours, only 8 are ALS capable. Yet they achieve a near 90 percent capture rate for the ALS being *dispatched on calls that medical oversight has discerned as clinically likely to require an ALS responder*. BLS responders are sent on calls that ALS responders are sent on if BLS responders are available. The BLS responders play:

- A gatekeeper role – to cancel ALS responders if they are not required, thus freeing ALS responders for other incidents
- A transport role – to transport the patient for the ALS crew while the ALS crew is performing ongoing care to critical patients, where a two-person clinical team is required in the patient compartment

- A non-ALS care role – to look after and transport the patient following ALS assessment and determination that ALS care is not required

A primary issue with the British Columbia model of delivery is that the ALS unit is often cancelled while en route or at scene despite the clinical efficacy of the caller telephone triage tool (Medical Priority Dispatch System). Experience within the British Columbia system indicates that up to 70 percent of ALS responses do not result in transport by ALS responders.

The non-transport rate does not mean the ALS provider was not required at the scene. They often intervene briefly or provide a more sophisticated lens on decision making. The ACPs can prevent inappropriate treatment and release by recognizing subtle signs of a more severe disease. For example, an elderly patient with abdominal pain may not look ill despite an impending catastrophic situation in the abdomen. Elder patients prefer not to be transported to the hospital and will refuse transportation if a paramedic implies they are not ill with a statement such as, "well your vital signs are good and you look OK to me." A paramedic with less training and experience may accept the patient's refusal for transportation to the hospital. ACPs are more likely to counsel the patient strongly to go to hospital.

An additional issue with a layered and targeted system is that for a relatively large number of responses, two ambulance resources are required—one ALS and one BLS. Contrarily, some systems with a larger ALS capacity can provide coverage with a single vehicle response but this reduces the number of ALS skills Advanced Care Paramedics will be able to experience. The layered and targeted system provides excellent clinical exposure and competency, and excellent clinical results. In effect, the goal is to avoid having too few ACPs (not enough to provide service where needed) or too many (dilution of skills leading to an impact on care provision).

Other Roles of the ALS Responder

An important consideration with ALS responders is that they perform a broader role and function than saving lives or performing lifesaving interventions. For example, the value of pain control to patients cannot be overestimated.

Just as every intervention from a physician or a nurse is not expected to be lifesaving, and just as more than 90 percent of all the patients arriving at the emergency department don't have an immediately life threatening condition, we also don't expect an ALS paramedic just to save lives. They are expected to perform good clinical medicine, to reliably discern the critical from the urgent, and the urgent from the non-urgent, and to bridge the time and care appropriately to other health care practitioners. The role of ALS responder is more than emergency intervention management.

3.1.2 The Advanced Life Support Dilemma

The past 30 years of innovation in EMS has placed many former Advanced Care Paramedic interventions into the hands of Primary Care Paramedics and first responder providers. Automated external defibrillators represent a good example of this change. The 35-pound, orange, Mennen Greatbach units of the 1970s have been replaced with the 5-pound, automated, public access defibrillation units in airports. TEMS is extensively involved in the strategy, management, and roll out of public access defibrillation units in Toronto, with patients surviving potentially deadly events as result of the initiative.

Technology and improved educational programs have allowed Primary Care Paramedics to safely provide increasingly sophisticated care. Unfortunately, the industry throughout North America has been slow to alter the portfolio of ALS providers. The gap between Advanced and Primary care provision has narrowed to the point that the utility of ALS gets put into question. The potential of ALS providers remains untapped. Projects such as the Long and Brier Islands Community Paramedic Project show the potential for expanded use of paramedics in the community.

The London Ambulance Service in the United Kingdom successfully deploys *expanded care paramedics* with 2 years of training beyond the ALS level to mitigate low acuity calls and transports. These paramedics also provide better care for patients such as the elderly in long term care facilities who traditionally do not do well in hospitals. These patients have prolonged emergency department times when they do require hospital care and require ambulance transfer both to and from the hospital. (The above information was provided during a communication with Dr. Fionna Moore, Medical Director, London Ambulance Service).

Advanced care paramedics, or an equivalent to the London Emergency Care Paramedic, can be one piece of the mitigation strategy for low acuity calls. These responders can manage simple lacerations, wound management, and, as seen in the Long and Brier Islands Project, communicate with Family Physicians to organize non-urgent solutions to the situation (booked x-ray, small modifications in medication, etc.), and avoid emergency department transport and visits.

An advanced care paramedic, as the responder in an Emergency Response Vehicle, provides an advantage over using a primary care paramedic in that role. An experienced advanced care paramedic can provide a skilled extra set of hands to a primary care paramedic or advanced care paramedic crew without layering another ambulance. In addition, the training of an advanced care paramedic provides a higher degree of patient safety in a “refusal of care” or “no care rendered” situation as outlined previously.

Paramedics have an ability to be self-directing and work in variable surroundings with various patients and bystanders. Those that successfully move to the ALS level have a greater degree of leadership and decision-making skills. These skills are honed during ALS training. An issue not discussed, but important in every system, is that ALS paramedics teach. Layered or targeted at a scene, ALS providers mentor and teach BLS paramedics. In a collegial system, the BLS paramedics gain insight and knowledge from the ALS providers every day. This interaction improves the patient care delivered by the BLS paramedics thereby improving the general level of patient care in the system.

3.1.3 Does Response Time Matter?

This raises the question whether response times actually matter. There are many perspectives on this question. From a clinical perspective, in the small subset of patients experiencing a cardiac arrest, the entire chain of events creates a clear relationship to survival. We also know that the nature of ambulance dispatch call taking will create both false positives (responses to potential cardiac arrest calls that turn out not to be cardiac arrests) and potentially false negatives (responses assessed as some other problem that turn out to be cardiac arrests). Most EMS systems, including TEMS, are based on the premise of improving the specificity[16] of the dispatch call type while providing the patient the benefit of any doubt. False positives are the inevitable result.

Almost 40 years ago, based on what was known at the time, EMS experts determined that an 8 minute EMS response was the standard to be achieved. Eight minutes has subsequently been interpreted as 8 minutes 59 seconds and this has become the "gold standard". Whether this standard is correct or not is difficult to prove in a system where so many factors contribute to both the morbidity and mortality of patients and where the pool of patients is so diverse. It is important to understand that the 8 minute, 59 second target refers to the entire response time from answering the phone at the dispatch centre to arrival of the paramedics at the patient. Call handling by the dispatcher and the "chute" time of notifying paramedics and getting them onto the road and driving, are all pieces of the 8:59 standard.

In trauma, response time has been shown to be less important than the choice of receiving hospital. Arrival at a trauma receiving hospital first rather than a non-trauma community hospital improves mortality by 25%. On the other hand, response times are clearly important when dealing with time critical problems such as respiratory distress, chest pain/acute coronary syndrome, status epilepticus, stroke, and cardiac arrest. In cardiac arrest (CA), time to defibrillation for ventricular fibrillation (v. fib) is a primary factor in survival. With the advent of newer CPR techniques, public access defibrillation, and recognition of the time criticality, survival from v.fib CA in metro areas has improved from the 12-14% range pre 2006 to 25-30%. The landmark defibrillation study in Las Vegas showed that patients with a presenting rhythm of v. fib and defibrillated in under 3 minutes had a 74% survival to hospital discharge, neurologically intact[2]. Survival was 49% in those defibrillated after 3 minutes. A recent 2 year multicenter study in Belgrade, Serbia found that EMS response time of less than 4 minutes was associated with increased survival to hospital discharge and at 1 year[3].

A paper from the Resuscitation Outcomes Consortium found that survival is increased in witnessed cardiac arrest and recommends that patients be educated as to the signs of impending CA so as to be able to access 911 prior to the arrest[4].
Status epilepticus is the situation where a seizure does not break spontaneously but continues unremittingly. This is a neurologic emergency as it can result in neurological impairment. A recent review of status epilepticus in children recommends that treatment begin within 5 minutes[5].

ST-elevation Myocardial Infarct or STEMI is the type of acute heart attack requiring treatment with cardiac catheterization (percutaneous coronary intervention or PCI) within 90 minutes, for

[16] Specificity in this respect means whether the dispatch call determinant based on the Medical Priority Dispatch system call taking algorithm was reflective of the actual patient requirements. Typically in a response evaluation we want to see both sensitivity - the ability of the question or determinant to not miss a patient or avoidance of false negatives - and specificity - the ability to capture only those that it should, or avoidance of false positives

best outcome. The 90 minute benchmark is calculated from first medical contact. The clock used to start at first ECG in the emergency department but it has been well proven that recognition of STEMI in the field by paramedics performing ECG and then alerting the cardiac catheterization lab by phone and/or transmission of ECG shortens time intervals dramatically and improves outcomes as dramatically. First paramedic contact to balloon time of 90 minutes is now achievable and TEMS has such a program in place[6]. However, the identification of STEMI from call intake is extremely difficult. In order to achieve rapid response to STEMI, a rapid response to all non-traumatic chest pain calls is required.

A very recent (2012) report, "Do Emergency Medical System Response Times Matter for Health Outcomes" published in *Health Economics*, was based on a large sample size extending over a six-year period in the metropolitan-urban setting of Salt Lake City, Utah.[17]

The abstract of this report offers a conclusive and persuasive statement regarding the impact of EMS response time:

"The introduction of technology aimed at reducing the response times of emergency medical services has been one of the principal innovations in crisis care over the last several decades. These substantial investments have typically been justified by an assumed link between shorter response times and improved health outcomes. However, current medical research does not generally show a relationship between response time and mortality. In this study, we explain the discrepancy between conventional wisdom and mortality; existing medical research fails to account for the endogeneity of incident severity and response times. … We find that response times significantly affect mortality and the likelihood of being admitted to the hospital, but not procedures or utilization within the hospital."

The report indicates that response times of less than 2 minutes produced the greatest reductions in mortality, although the study's author identified that response times less than 10 minutes still reduced mortality relative to longer response times, although not as much as the measurements at the 2, 3, 4, or 5 minute intervals. In reviewing the positive effect of shorter response times on both hospital admission and subsequent EMS system responses to the same patient, clear measures of morbidity reduction in the involved patients based upon response times, are also demonstrated.

While it is impossible to correlate patient outcome directly with 8 minutes, or 8 minutes 59 seconds there is no suggestion that rapid EMS response is undesirable or unimportant for certain patients. From a strictly medical lens, 8:59 is too long for many patients where treatment should begin within minutes. Cardiac arrest and status epilepticus are two examples. Response times greater than 8 minutes may be medically acceptable in some case but there is no question that it would degrade the mortality in cardiac arrest and likely impact morbidity/mortality for other time critical emergencies. There is no way to predict whether the

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[17] Wilde, ET. *Do Emergency Medical System Response Times Matter for Health Outcomes*. Health Economics. 2012. wileyonlinelibrary.com.

next call will be a low acuity ankle sprain or a cardiac arrest. Generally speaking, the faster the response the better it is for time sensitive illness and injury, but efforts toward improving response times has to be balanced with system requirements. For example, the cost to improve EMS response to the 5 minute range would more than double the existing EMS budget. A broader population medicine lens is applied to EMS systems to achieve a combination of best patient outcome and system efficiency.

The industry standard of 8:59 has remained in place for many years, as it is the best compromise between medical necessity and operational efficiency. While we cannot say categorically that 8:59 is the "correct" response time, we also cannot say that it is not, nor is there another number that fits the bill as well.

3.1.4 Observations and Conclusions

The TEMS is expected to arrive within 8 minutes and 59 seconds 90 percent of the time when called to the sickest of patients (please see ***3.3 TEMS Staffing Demand Analysis - the sickest patients are classified in the Medical Priority Dispatch System algorithm as Delta and Echo.***) The TEMS has regularly reported to City Council on this issue because, while the approved response target is 8:59, TEMS has not had a 90th percentile response time better than 10 minutes and 24 seconds since 2002.

As already noted, in addition to the actual system deployment plans, the response time performance to a known target level is a function of the response time zones, system capacity, and road network. Simply put, if the expected targets, the dynamically-adjusted historical call volume patterns, and the road network capacity are known, a system can be modeled that will achieve the response time targets. TEMS has analyzed this extensively and has drawn the conclusion that to achieve their target performance, additional staffing is required. The consulting team's analysis concurs with that conclusion.

TEMS requires additional staffing concurrent with the analysis shown in ***3.3.2 Method 2 -- Based on an 8 Minute 59 Second Response*** **Parameter**.

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3.2 Ambulance Offload Time Review across Toronto Hospitals

Ambulance offload delays at hospitals absorb a significant EMS resource level. This section, in conjunction with ***Appendix H – An Examination of Ambulance Offload Times*** examines the causes and possible resolutions

3.2.1 Introduction

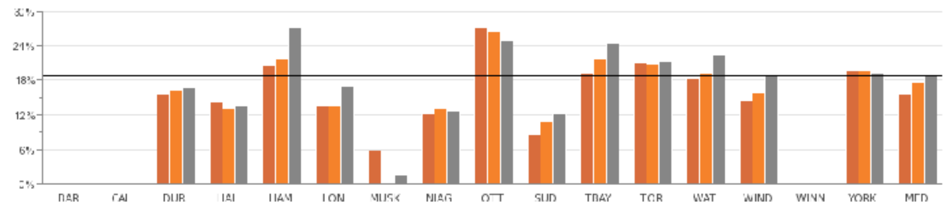
Ambulance offload time, that is the time it takes paramedics to transfer the care of a patient to hospital staff, is a concern across Canada. Only a few years ago paramedics could wait for several hours in an emergency department hallway, while a patient remained on the EMS stretcher, before being able to transfer care to hospitals. The reason for these delays was attributed to a lack of hospital beds which, in turn, was attributed to chronic patients awaiting rooms in long term care facilities. The result was that this ‘bed backup’ worked its way down to the EMS patient who, unless critically ill or injured, remained on the EMS stretcher until an emergency department bed became available.

Significant improvements in hospital wait times have been made across Ontario in the past few years, partly due to nursing staff dedicated to reducing ambulance wait times and ongoing efforts by TEMS to work with hospitals to improve offload efficiencies. TEMS’ hospital wait times now average about 45 minutes although some hospitals have longer wait times than others. It is interesting to note though, that according to the Ontario Municipal Benchmarking Initiative data, some municipalities such as Durham, Hamilton, London, Sudbury, Thunder Bay, Waterloo, and Windsor are experiencing an increase in hospital wait times since 2009. Toronto has also experienced a slight wait time deterioration (please see ***Chart 9 - OMBI Data - Percent of Time Lost to Hospital Turnaround***).

Chart 9 - OMBI Data - Percent of Time Lost to Hospital Turnaround

What percent of time do ambulances spend at the hospital?

Fig 6.4 Percent of Ambulance Time Lost to Hospital Turnaround



2009	N/A	N/A	15.5%	14.1%	20.7%	13.4%	5.7%	12.2%	27.2%	8.6%	19.3%	21.1%	18.3%	14.4%	N/A	19.8%	15.5%
2010	N/A	N/A	16.3%	13.1%	21.8%	13.6%	N/A	13.1%	26.4%	10.8%	21.6%	20.8%	19.2%	15.8%	N/A	19.6%	17.8%
2011	N/A	N/A	16.7%	13.4%	27.3%	17.0%	1.4%	12.6%	25.0%	12.2%	24.5%	21.4%	22.3%	18.7%	N/A	19.3%	18.7%

Source: EMDS150 (Community Impact)

Comment: Time spent in hospital includes the time it takes to transfer a patient, delays in transfer care due to lack of hospital resources (off-load delay), paperwork and other activities. The more time paramedics spend in the hospital process equates to less time they are available on the road.

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The consulting team undertook a review of TEMS' hospital wait times because, from an efficiency point of view, significant vehicle availability can be consumed for hospital wait time (the amount of time paramedics spend waiting in an emergency department hallway). In 2011, Toronto transported approximately 190,000 patients to hospitals. Reducing hospital wait times by an average of 5 minutes conceptually puts 15,800 hours of ambulance time - the equivalent of almost two ambulances 24 hours a day, 7 days a week - back on the road.

However, there is another way to consider hospital wait time. If wait time represents an average of 15 minutes per patient transported to hospital that represents 47,500 hours of wait time per year based on 190,000 patients (15 X 190,000 = 2,850,000 minutes ÷ 60 = 47,500 hours). If a staff member is paid for 2080 hours a year, 47,500 hours represents (47,500 ÷ 2080 =) 22.8 staff equivalents. But there are 2 paramedics waiting for an average of 15 minutes which doubles this calculation to 45.67 staff equivalents. The average annual salary for a Primary Care Paramedic including benefits and ancillary costs is approximately $108,000 per year which, when multiplied by 45.67 staff equivalents means that hospital wait time represents approximately $4,932,700 a year to TEMS. Fifty percent of EMS costs are borne by the Ministry of Health and Long Term Care and the balance by the City. So, hospital wait time represents a cost of approximately $2,466,000 a year to the City of Toronto. This figure underlines the urgency of mitigating the number of transportations to hospital, where reasonable.

Our goal within this section of the project was not to solve the wait time issue since the reasons that influence 'wait time' are complex and the solution is beyond what we can discover in a few weeks of effort. Our goal is to recommend action that the TEMS can take to better define the parameters that influence ambulance offload time.

3.2.2 Observations and Conclusions

Several weeks of effort were committed to trying to determine those things that contribute to offload delays. The most important thing we have discovered is that definitively measuring why paramedics contribute so much to hospital wait time during their working hours is not easy. The solution is unlikely to be found in one component of the overall ambulance offload process. On the other hand, the process is muddy and not clearly defined but delineating the process is what TEMS needs to do as part of its continuing effort to reduce wait times.

After analyzing the data collected in this study, Pomax also offers the following observations although some of them are hospital centric and TEMS will have to depend on goodwill with the hospitals in order to see these observations accomplished**.**

- Define Transfer of Care as the point when a hospital healthcare provider has been assigned to a patient and the patient is physically transferred to a hospital stretcher. Ideally, at the point of transfer of care, the EMS staff are released from their healthcare responsibility and accountability. Defining transfer of care this way would enable standardization among hospitals. Currently, interpretation of transfer of care is inconsistent among hospitals.
- For validation purposes, implement a transfer of care dual sign-off by the hospital and EMS staff. This enables a mutual agreement and record of when transfer of care took place. Currently the hospital staff determines the transfer of care point.
- Through operational efficiency events, identify accountability and create standards of work for both hospital and EMS staff. For example, patient registration by TEMS during post transfer of care should be reconsidered since it may be more appropriate as a hospital activity. Currently, accountability of EMS and hospital staff for pre-transfer time and post-transfer time activity varies among hospitals.
- Hospitals should complete operational efficiency events to identify areas of improvement for both patient flow and workflow as evidenced by the success at Mount Sinai and Toronto General Hospital. Additionally, TEMS should map their workflow to identify standards of work and variations in practices. Currently, not all hospital emergency departments and TEMS have completed formal operational efficiency exercises.
- Hospitals should provide their strategy for utilization of RN offload to EMS, including role, responsibility, shift schedule, and contingency planning in the event of short staffing. Furthermore, each hospital should provide an annual report outlining the multi-year trending analysis comparing RN offload coverage and non-RN offload coverage hours. Each hospital should be encouraged to do peer hospital comparisons. Currently, RN offload utilization is variable among hospitals.

- Review emergency department Wait Time funding agreement (incentive funding formulae) and consider incentive dollars to include arrival of EMS to triage and triage to transfer of care or ambulance turnaround target time. Consider a penalty equivalent to a reduction in incentive payment for any delay in ambulance turnaround time consistent with the new funding agreement recently introduced in York Region. The current model, that of a monetary incentive for reducing the total emergency department wait time for all patients from triage was established in previous years.

Where possible, TEMS should actively encourage hospitals, through any existing mechanisms, to engage with them in a proactive manner to reduce the number of available ambulance unit hours lost from response capacity through delays in offloading patients within the expected time frames. We are aware that TEMS has been very active in its efforts to solve this problem considering that recovering ambulance time also results in recovering money and making ambulance hours available to the street.

TEMS should endeavor to make use of an individual or organization with expertise in Lean or Six Sigma-type process reengineering to define, perhaps through process mapping, the practices that take place during hospital waits. Additionally, that person may be able to work with hospitals in streamlining the pre-transfer time and defining an actual transfer of care time. We expect that this will not only recover the cost of investment in a relatively short period of time but may also be available to introduce and imbed Lean principles in all other facets of the emergency medical services department. The time could be shared with TFS which, like other organizations, would benefit from the introduction of Lean values and philosophy.

Is Offload Wait Time an EMS Contribution to Hospital Care?

Another consideration is whether hospital wait time represents patient care on behalf of the Ontario health care system. EMS is part of Ontario's health care system and shares in the continuum of care for patients. Paramedics monitor and care for a patient while waiting for a hospital to accept their patient. Without the assistance of paramedics, hospitals would be fully responsible for monitoring and housing patients, many of whom would require a stretcher rather than a waiting room chair. So, we suggest that paramedic wait time at hospitals, by TEMS, represents a benefit to the health care system which could be considered to cost the City approximately $2,466,000 annually.

Although a short term solution is unlikely, this annual cost should be a discussion point with the province and LHINs during budget discussions.

<u>3.2.3 Recommendations</u>

- Utilize Lean processes to define the activities that contribute to paramedic wait times at hospitals and identify possible relief techniques.

3.3 TEMS Staffing Demand Analysis

Calculating the ambulance availability requirements for TEMS is more complex than most municipalities because of the magnitude of the TEMS call volume and because the majority of incidents are responded to from a location other than an ambulance station; for example, from a hospital or other mobile location.

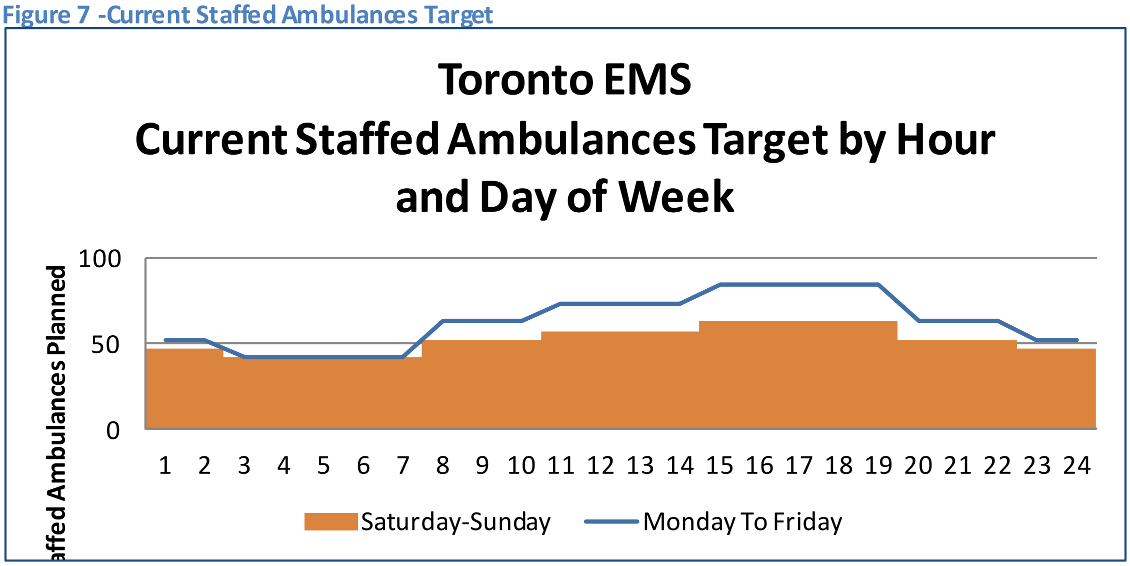
In addition to the *Neighbourhood Demand Analysis*, authored by TEMS and led by Deputy Chief Alan Craig, we used two other methods to calculate vehicle availability requirements. Both included similar processes, diverging somewhat in methodology but arriving at similar outcomes.

3.3.1 Method 1 -- Based on a 10 minute Travel Time Model (Not including 2 Minute Call Taking and Dispatch Time)

Although there is good evidence that the best time target for Emergency Medical Services to meet, with respect to patient care, is 8 minutes and 59 seconds at the 90^{th} percentile for emergency events (defined as Echo and Delta) (please see ***3.1.3 Does Response Time Matter?***) we also – for comparative purposes – assessed the resource requirements to achieve a 10 minute travel time target. In this scenario, from the time the call for assistance is received to the time an appropriately staffed ambulance arrives, means that travel time should not exceed 10 minutes at least 90% of the time, plus an additional 2 minutes would be allocated to call taking and dispatch functions for a total time of 12 minutes.

The current TEMS staffing model, by hour of day and day of week was utilized in the actual demand analysis template to provide a baseline for actual work performance and comparison with the preferred staffing model. A visual representation is provided in Figure 7 and more detailed information is provided in ***Appendix I – TEMS Staffing Analysis Supporting Documentation – 10 Minute Travel Time Target (Not including 2 Minute Call Taking and Dispatch Time)***.

Figure 7 -Current Staffed Ambulances Target



As Figure 7 shows, ambulance staffing during weekdays (Monday to Friday) is planned at a higher level than Saturdays and Sundays other than the early morning hours of 03:00 through 07:00 where staffing levels are the same irrespective of the day of week.

There are two significant challenges represented with this staffing model. First, staffing is increased during various hours Monday through Friday on the historic assumption that service demand is higher during those periods. We know from analysis that actual average daily demand and response volumes do not vary as significantly across these groups as they once did, primarily with the reduction in non-emergency interfacility transfer volumes previously performed by TEMS.

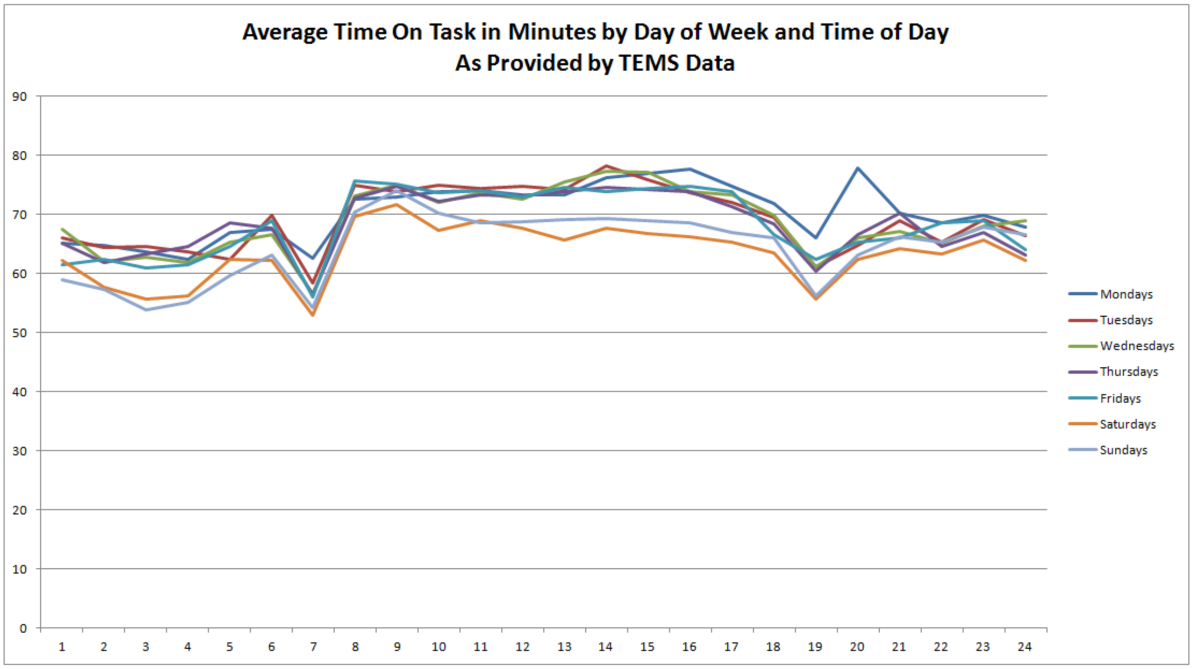
Second, the uniform staffing level during individual hour periods does not reflect analysis that demand and response volume will vary across the days in the selected staffing period (weekday or weekend). For example the planned staffing between 02:00 and 07:00 on Saturdays is the same as it on weeknights while the actual service demand and response volume is much different.

The analysis performed is intended to balance the actual experienced response volumes, based on the 2011 responses by Basic Life Support (BLS) and Advanced Life Support (ALS) ambulances. The desired outcome from this analysis is to demonstrate what staffing levels are required by hour of day and day of week to provide a reliable response to the most acute life threatening emergencies (classified in the Medical Priority Dispatch System (MPDS) as Delta and Echo responses) within the desired less than 11 minute 59 second time frame at a 90% confidence level.

Key Process Metrics for the Analysis

- Responses by specialized ancillary, support, or non-transport vehicles and supervisory personnel, are not counted in the historical response volumes, and intentionally excluded from the analysis, as an ambulance is also required to respond to each of these events.
- Actual response volumes by the ambulance are used rather than event volumes. It is normal within any EMS system that some events require more than one ambulance to respond to them based upon clinical and situational evaluation, such as major motor vehicle accidents or very complex clinical calls.
- Ambulance response volumes have been tabulated into day of week tables providing a specific hourly response volume for each day of the week in a single layered table. For example, the Monday table shows all of the response volumes for each of the Mondays in the entire year, the Tuesday table shows all the hours of all the Tuesdays, and so on.
- Time on task provided by TEMS for only the responding ambulances, and averaged out to a time of day and day of week level, providing 168 individual time measures which, as can be readily seen in Chart 10 can vary significantly. This variance can be attributed to a range of factors including hospital busy periods, traffic patterns and congestion. Adjustment of the template for the actual average experienced time on task by hour of day and day of week provides an acceptable level of variance in the analysis.

Chart 10 - Time On Task by Day of Week and Time of Day



- Calculations were then performed in the individual day of week summaries to determine, by hour of day, what the:
  - Minimum, or lowest, call volume was on any of the individual dates. For example, across 52 Mondays between the hours of 14:00 and 15:00 the smallest number of ambulance responses was 24 (March 14, 2011);
  - Maximum, or the highest experienced call volume on any of the individual dates. For example across 52 Mondays between the hours of 14:00 and 15:00 the highest number of ambulance responses was 81 (September 12, 2011);
  - The response volume arithmetic mean (average), median (value in the exact middle of the range), and mode (most frequently occurring value) for each hour were also calculated to provide an understanding of the distribution of volume values. For example for response volumes across 52 Mondays between the hours of 14:00 and 15:00 the mean was 46.6 responses, the median was essentially the same at 46.5 responses, while the mode was higher at 50 responses, suggestive of a right skewed distribution.
  - The 90th percentile volume, an indication of the point at which only 1 day in 10 had a higher volume in that particular hour, was also calculated. For example, across 52 Mondays between the hours of 14:00 and 15:00 only 1 day in 10 had a response volume higher than 61 responses.
  - The "average high" was calculated by using the average of the volumes in each month to assist in determining any seasonal trends. For example, across 52

Mondays between the hours of 14:00 and 15:00 the average of the monthly volumes was 61.3 responses.

- The "average peak" was calculated by using the highest representative volumes in each month for that hour of day, and calculating the average of those peak volumes and then multiplying the volume by the TMT (Time Managing Task), or time on task, multiplier. This provides recognition and adjustment for the variance in actual work time duration which may be shorter or longer than the 60 minute duration for that hour period. For example, across 52 Mondays between the hours of 14:00 and 15:00 the calculated average of the monthly peaks times the TMT was the equivalent of 78 responses.
- A "smoothed average peak" was developed to adjust for the reality of responses bleeding across individual hours by virtue of both the point in time during that hour that the actual call was received and the actual time on task at times exceeding the physical hour represented within the time period. For calculation purposes the smoothed average peak represents 20% of the average peak volume of the hour before, 60% of the average peak volume of the current hour, and 20% of the average peak volume of the hour after.

- Actual current staffing levels from the provided staffing pattern (Figure 8 and ***Appendix I***) are included to visually demonstrate the actual response capacity. For calculation purposes it is assumed that all planned staffed ambulances are staffed. Discussions with TEMS management and staff consistently demonstrated that actual staffing is usually lower than planned staffing;
- A "UH Adj/Eff Buffer" is inserted into the analysis to reflect the reality that a minimum number of ambulances must be available at the appropriate locations throughout the city at any point in time to provide the required Delta-Echo response time performance with any degree of reliability.
- A "Staff To" calculation is then made to determine for each hour of day, and each day of week, what the optimal staffing level should be to achieve this performance. This calculation includes an assumption that the service should provide an adequate number of staffed ambulances to perform known expected average peak volumes while maintaining a normal response capacity to provide predictable emergency service delivery to the next incoming emergency call through the "UH Adj/Eff Buffer".

The analysis demonstrates that in order to effectively provide service to the existing demand while ensuring ability to respond predictably to life threatening Delta and Echo calls, an increase in ambulance staffing is required. This increase in staffing should reflect known variations in volume by hour of day and day of week, and should likely be in the area of approximately 87,272 ambulance unit hours. While these hours reflect the equivalent of approximately 10 additional ambulances staffed 24 hours a day, our analysis demonstrates staffing must be allocated to those hours showing the most need. As an example, most weekdays are already adequately staffed between approximately midnight and 6:00 or 7:00

AM. However, Saturday and Sunday early morning hours require augmented staffing. Other hours of the day, particularly between 9:00 AM and 5:00 PM require additional staffing.

TEMS has completed extensive work in this area, utilizing an expert third-party scheduling consultant to evaluate several different schedules that will maximize its use of existing resources. On January 23, 2013, TEMS implemented new schedules for paramedics that closely match peak emergency call demand during weekdays and weekends.

In addition to specific staffing increases, the analysis model also provides that some current staffing hours should be adjusted to provide better value for the actual expenditure on response capacity.

Net total increases in staffing hours by day of week are summarized in Table 7

Table 7 - Net Total Recommended Ambulance Hours

Staffing Shortfall		
	Weekly Hours	**Annual Hours**
Mondays	304	15,809
Tuesdays	258	13,408
Wednesdays	262	13,636
Thursdays	289	15,051
Fridays	307	15,939
Saturdays	150	7,946
Sundays	103	5,479
Total	1,673	87,272

The 87,272 ambulance unit hours represent approximately 100 staff equivalents including those already approved for the 2013 budget year. The calculations shown in Table 8 indicate costs associated with this enhancement over a 10 year period.

Staffing increases shown in years 2015 to 2022 represent expected staffing pressure based on projected per capita EMS events as the population grows. The premise is based on the supposition that if an additional 100 staff represents the right number of paramedics for Toronto's population by 2014, then that per capita representation should continue resulting in additional staff. The same principle was applied in ***3.3.2 Method 2 -- Based on an 8 Minute 59 Second Response Parameter*** and Table 9.

Both tables are calculated based on current salary levels.

Table 8 – 10 Year Annual Impact of EMS Staff Increases Based on 100 Staff Equivalents

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Paramedics	851	901	951	955	957	959	961	963	965	967	969
Increase (Decrease) from prior year		50	50	4	2	2	2	2	2	2	2
Annual Cost per Paramedic		$108,177	$108,177	$108,177	$108,177	$108,177	$108,177	$108,177	$108,177	$108,177	$108,177
Incremental Inc (Dec) in Costs		$5,408,870	$5,408,870	$432,710	$216,355	$216,355	$216,355	$216,355	$216,355	$216,355	$216,355
Total Cumulative Inc (Dec) in Costs		$5,408,870	$10,817,741	$11,250,451	$11,466,805	$11,683,160	$11,899,515	$12,115,870	$12,332,225	$12,548,579	$12,764,934
Actual Impact After MOH Cost Sharing		$2,704,435	$5,408,870	$5,625,225	$5,733,403	$5,841,580	$5,949,757	$6,057,935	$6,166,112	$6,274,290	$6,382,467

Shift Times

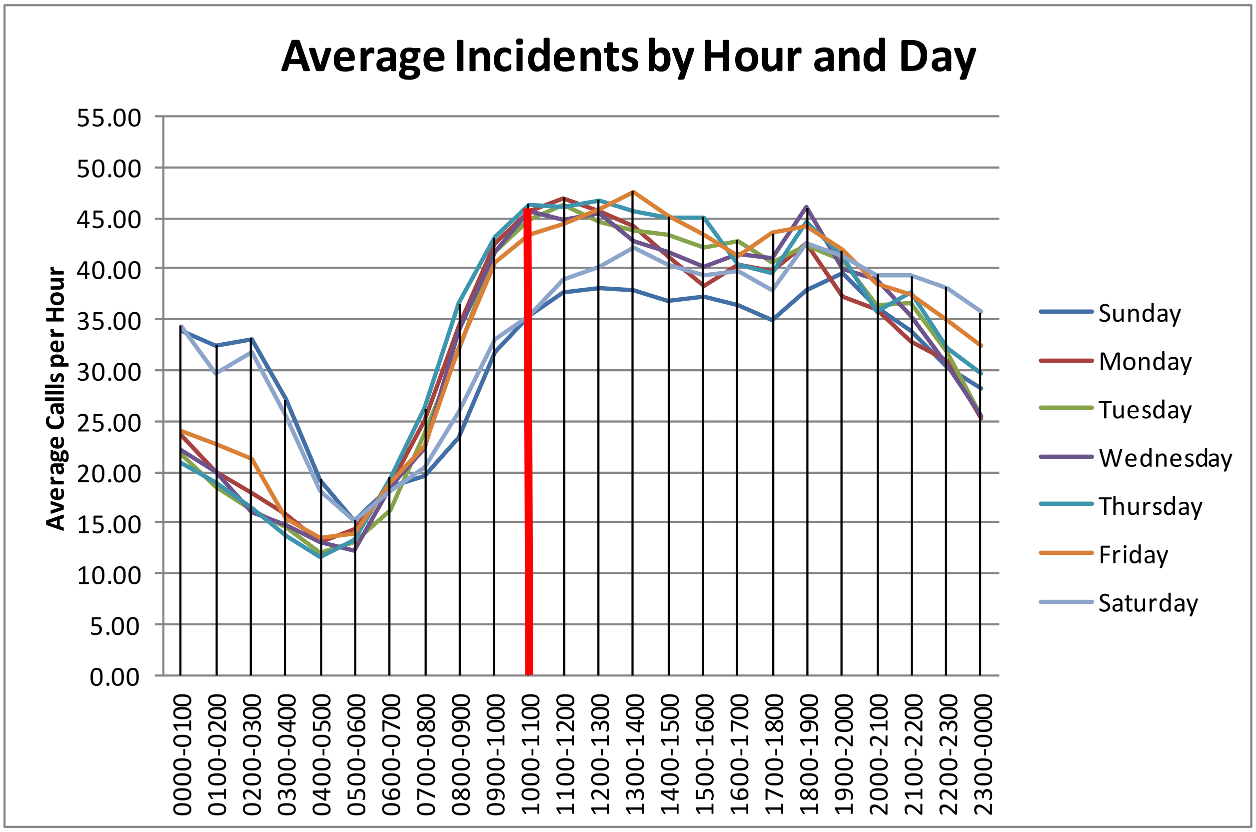
Another important point that we have discovered is that existing shift start times do not coincide with call load times. Currently, TEMS has a shift start time of 10:00 AM to augment vehicle availability for the busiest hours of the day. A best practice is to start shifts a sufficient period of time ahead of expected call load times so that paramedics can arrive at station, check vehicles, equipment, and medication, and be prepared to respond as incident activity increases. However, the red vertical bar on Chart 11 clearly demonstrates that close to peak call loads are occurring by 10:00 AM which is when the primary support shift starts.

TEMS should adjust the current 10:00 AM shift start time to 09:00 AM and, to the extent practical, adjust other shift start and end times to ensure they are synchronized to call load.

Subsequent to this 'shift start time' observation first being discussed with TEMS, in addition to implementing new shift schedules to balance the number of staff working on weekdays and weekends, TEMS has incorporated appropriate recommended changes to the shift start and end times that also match peak emergency call demand during each a 24-hour period.

TEMS' new scheduling process appears properly designed to move paramedic resources into predictably high emergency call volume areas and balance paramedic workload.

Chart 11 - Average EMS Incidents by Hour and Day



3.3.2 Method 2 -- Based on an 8 Minute 59 Second Response Parameter

There is good evidence that the best time target for Emergency Medical Services to meet with respect to patient care is 8 minutes and 59 seconds at the 90th percentile for emergency events (defined as Echo and Delta)(See ***3.1.3 Does Response Time Matter?***). To achieve this target, from the time the call for assistance is received to the time an appropriately staffed ambulance arrives, means that travel time should not exceed 6 minutes and 59 seconds at least 90% of the time. The first 2 minutes of the time target are allocated to call taking and dispatch functions.

To achieve a sub 9 minute patient care and response target will require approximately 223,450 additional staffed vehicle hours which translates to approximately 225 additional full time equivalent staff (less recent hiring approvals), at a **total** annual cost of approximately $24,000,000 by 2016 (please see Table 9. Again, in accordance with the *Ambulance Act* the Upper Tier Municipality (Toronto) and the Province of Ontario share the costs of approved ambulance operations on a 50-50 basis.

Table 9 – 10 Year Annual Impact of EMS Staff Increases Based on 225 Staff Equivalents

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Paramedics	851	907	963	1019	1076	1078	1081	1083	1085	1087	1089
Increase (Decrease) from prior year		56	56	56	57	2	3	2	2	2	2
Annual Cost per Paramedic		$108,177	$108,177	$108,177	$108,177	$108,177	$108,177	$108,177	$108,177	$108,177	$108,177
Incremental Inc (Dec) in Costs		$6,057,935	$6,057,935	$6,057,935	$6,166,112	$216,355	$324,532	$216,355	$216,355	$216,355	$216,355
Total Cumulative Inc (Dec) in Costs		$6,057,935	$12,115,870	$18,173,805	$24,339,917	$24,556,272	$24,880,804	$25,097,159	$25,313,514	$25,529,868	$25,746,223
Actual Impact After MOH Cost Sharing		$3,028,967	$6,057,935	$9,086,902	$12,169,958	$12,278,136	$12,440,402	$12,548,579	$12,656,757	$12,764,934	$12,873,112

Our analysis included a spatial examination to ensure sufficient ambulance backup across the city in order to achieve a 6 minute 59 second, or less, travel time to critical emergency calls. The analysis was performed using a simulation model on ESRI ArcMap and its Network Analyst Extension to generate coverage contours.

But first it was necessary to ensure that the ambulance coverage contours that were generated by ArcMap reflected “reality”, that is, intersection queue delays, turn movement delays, etc. The following steps were undertaken to calibrate the generated contour to reflect observed values.

Step 1: Only the Echo and Delta calls were retained for analysis, as they reflected the most acute, life-threatening emergency conditions.

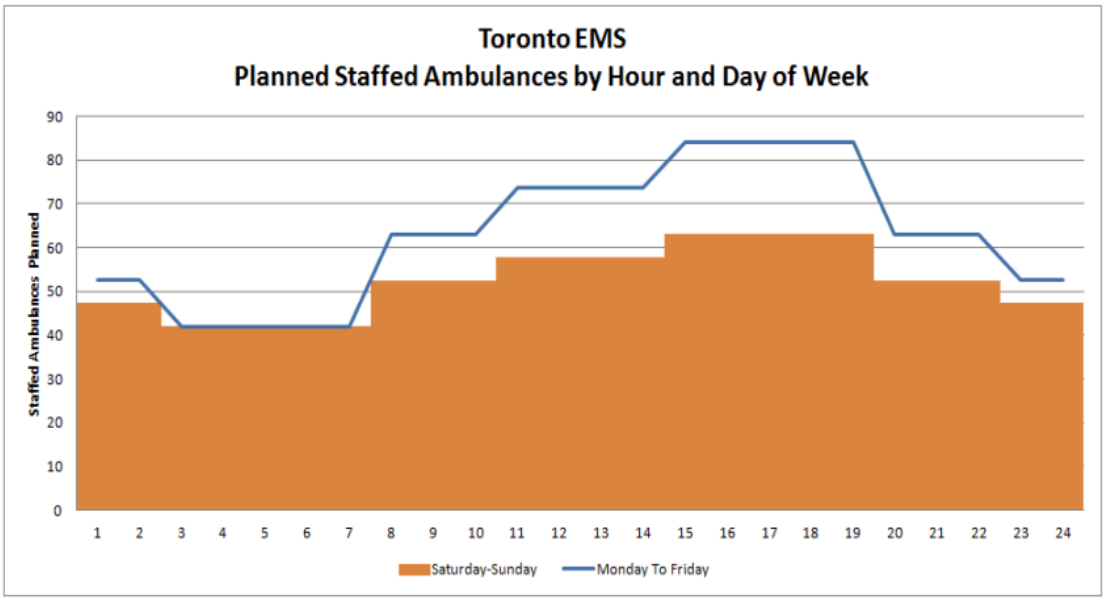
Step 2: Ambulances in Toronto are on a fluid deployment system so at any time that a call is received an ambulance could be at its own station, covering a different station, or mobile in any area of the city. However, for our analysis it was important that we got a representative sample of data that show multiple ambulance starts from one station location to address emergency calls. Fortunately, there were an adequate number of responses from ambulance stations across the city to provide information needed to properly calibrate the data.

The calibration steps followed the same steps as described in the fire station coverage analysis (See ***2.4.3 A Re-evaluation of the TFS Resource Analysis)***. The intersection delay parameters thus developed were used to develop coverage contours across the city. However, a major point of difference was that, in the case of EMS, the goal was to cover the full city with as little contour overlap as possible while still providing 6:59 minute travel time coverage. Minimal overlap translates into a higher level of efficiency. The resulting analysis revealed the need for 27 reserve capacity ambulances to accomplish 6:59 minutes coverage. The resulting contour map is shown as Map 9.

TEMS Staffing Demand Analysis

The current TEMS staffing model, by hour of day and day of week was utilized in the actual demand analysis template to provide a baseline for actual work performance and comparison with the preferred staffing model. A visual representation is provided in Figure 8 below and a summary template outlining the planned staffing is found in **Error! Reference source not found.**.

Figure 8 - Planned Staffing Hours (Current)



As demonstrated in Figure 7 ambulance staffing during weekdays (Monday to Friday) is planned at a higher level that for weekends (Saturdays and Sundays) excepting the early morning hours of 03:00 through 07:00 where the staffing levels are the same irrespective of the day of week.

There are two significant challenges represented with this staffing model. First, staffing is increased during various hours Monday through Friday on the historic assumption that service demand is higher during those periods. We know from analysis, and confirmation of approach by senior TEMS leaders, that actual average daily demand and response volumes do not vary as significantly across these groups as they once did, primarily with the reduction in non-emergency interfacility transfer volumes previously performed by TEMS.

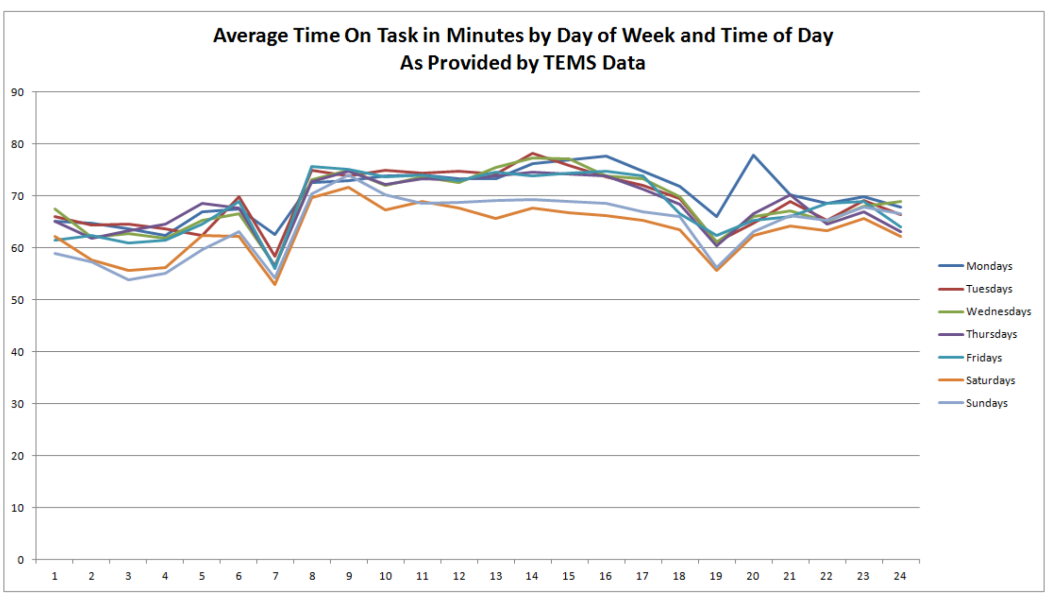
Second, the uniform staffing level during individual hour periods does not reflect analysis that demand and response volume will vary across the days in the selected staffing period (weekday or weekend). For example the planned staffing between 02:00 AM and 07:00 AM on Saturdays is approximately the same as it is on weeknights while the actual service demand and response volume is much different.

The analysis performed is intended to balance the actual experienced response volumes, based on the 2011 responses by Basic Life Support (BLS) and Advanced Life Support (ALS) ambulances. The desired outcome from this analysis is to demonstrate what staffing levels are required by hour of day and day of week to provide a reliable response to the most acute life threatening emergencies (classified in the medical priority dispatch system as Delta and Echo responses) within the desired less than 9 minute time frame at a 90% confidence level.

Key process metrics for the analysis include the following:

- Responses by specialized ancillary, support, or non-transport vehicles and supervisory personnel, are not counted in the historical response volumes, and intentionally excluded from the analysis, as an ambulance is also required to respond to each of these events.
- Actual response volumes by the ambulance are used rather than event volumes. It is normal, and best practice, within large consolidated EMS systems that some events require more than one ambulance to respond to them based upon clinical and situational evaluation, such as major motor vehicle accidents or very complex clinical calls. Stratification of the available ambulance resources which will result in "layering" of both ALS and BLS resources to the same event in order to provide sufficient high acuity patients to sustain clinical excellence by the ALS practitioners, and still maintaining a high "capture rate" of patients requiring ALS level of care actually receiving it, may exacerbate this duplication of responses.
- Ambulance response volumes have been tabulated into day of week tables providing a specific hourly response volume for each day of the week in a single layered table. For example, the Monday table shows all of the response volumes for each of the Mondays in the entire year, the Tuesday table shows all the hours of all the Tuesdays, and so on.

Figure 9 – Time on Task



- Time on task (represented in the graphic analysis as TMT – Time Managing Task) provided by TEMS for only the responding ambulances, was independently analyzed for each response and averaged out to a time of day and day of week level, providing 168 individual time measures which, as can be readily seen in Figure 2, above, can vary significantly. This variance can be attributed to a range of factors including hospital busy periods, traffic patterns and congestion. Adjustment of the template for the actual average experienced time on task by hour of day and day of week provides an acceptable level of variance in the analysis.
- The actual time on task within the graphic analysis was then adjusted to include provision for necessary rest breaks for staff which are both contractually and ethically required. The allowances included within the analysis was constructed as follows:
    - A complete normal work shift for paramedics is established at 12 (12:00) hours.
    - Paramedics should normally be provided, to the extent possible given workload demands and emergency operational needs, a 30 minute meal period and three (3) fifteen (15) minute breaks during their operational shift.
    - Mathematical calculation then provides that of a 12:00 hour shift the paramedic actual performance of responses, or immediate availability for responses, should occupy 10 hours and 45 minutes (10:45). This provides a calculation co-efficient of 0.89583333% of the normal work shift being available for, or actually on, assignment.
    - The actual time on task (TMT) is then modified (TMT, expressed as a decimal calculation divided by the shift adjustment co-efficient) to adjust for the required work breaks through the entire shift.
- Calculations were then performed in the individual day of week summaries to determine, by hour of day, what the:
    - minimum, or lowest, call volume was on any of the individual dates. For example, across 52 Mondays between the hours of 14:00 and 15:00 the smallest number of ambulance responses was 24 (March 14, 2011);
    - maximum, or the highest experienced call volume on any of the individual dates. For example across 52 Mondays between the hours of 14:00 and 15:00 the highest number of ambulance responses was 81 (September 12, 2011);
    - The response volume arithmetic mean (average), median (value in the exact middle of the range), and mode (most frequently occurring value) for each hour were also calculated to provide an understanding of the distribution of volume values. For example for response volumes across 52 Mondays between the hours of 14:00 and 15:00 the mean was 46.6 responses, the median was essentially the same at 46.5 responses, while the mode was higher at 50 responses, suggestive of a right skewed distribution.

- The 90th percentile volume, an indication of the point at which only 1 day in 10 had a higher volume in that particular hour, was also calculated. For example, across 52 Mondays between the hours of 14:00 and 15:00 only 1 day in 10 had a response volume higher than 61 responses.
- The "average high" was calculated by using the average of the volumes in each month to assist in determining any seasonal trends. For example, across 52 Mondays between the hours of 14:00 and 15:00 the average of the monthly volumes was 61.3 responses.
- The "average peak" was calculated by using the highest representative volumes in each month for that hour of day, and calculating the average of those peak volumes and then multiplying the volume by the TMT, or time on task, multiplier. This provides recognition and adjustment for the variance in actual work time duration which may be shorter or longer than the 60 minute duration for that hour period. For example, across 52 Mondays between the hours of 14:00 and 15:00 the calculated average of the monthly peak times, the shift adjusted TMT was the equivalent of 87 responses.
- A "smoothed average peak" was developed to adjust for the reality of responses bleeding across individual hours by virtue of both the point in time during that hour that the actual call was received and the actual time on task at times exceeding the physical hour represented within the time period. For calculation purposes the smoothed average peak represents 20% of the average peak volume of the hour before, 60% of the average peak volume of the current hour, and 20% of the average peak volume of the hour after.

- Actual current staffing levels from the provided staffing pattern (Figure 8 and ***Appendix I***) are included to visually demonstrate the actual response capacity. For calculation purposes it is assumed that all planned staffed ambulances are staffed. Discussions with TEMS management and staff consistently demonstrated that actual staffing is usually lower than planned staffing;
- A "UH Adj/Eff Buffer" is inserted into the analysis to reflect the reality that a minimum number of ambulances must be available at the appropriate locations throughout the city at any point in time to provide the required Delta-Echo response time performance with any degree of reliability. Independent ESRI based mapping analysis was performed to determine how many individual sectors, or response based polygons, would be required to provide complete coverage of the city based upon a 6 minute and 59 second (6:59) routine response travel time 100% of the time. For clarity the response travel time is the interval recorded as T3 (when the ambulance starts moving on a response) through to T4 (the time they arrive at the scene). Actual call reception and call handling time within the dispatch centre (T0 – call received in dispatch through to T2 – ambulance crew notified of the response) and the crew "chute" time (T2 through to T3) are not included in these calculations. In combination it is expected that TEMS will manage the combined time from call reception (T0) through to crew notification (T2) within a 2:00 minute time window 90%

of the time. The combination of a 2:00 time frame for T0 to T2, and a 6:59 time frame for T2-T4, reliably provides for the combined high acuity emergency response time of 8:59. A pictorial presentation of the ESRI zonal mapping showing the identified response zone polygons was shown previously on Map 9.

- Toronto staff analysis (the "Neighbourhood" report) suggests that 28 response zones or polygons are appropriate. Our independent analysis suggests that there should be 27 response zones.
- We intentionally created the response polygons based upon normal posted traffic speed limits and driving patterns to provide flexibility for response. While recognizing that there is not an ambulance station in the exact epicentre of each 6:59 polygon, the general analysis remains that if an ambulance is available within the polygon, and they are responding on an emergency basis to emergency calls, they should reliably be able to respond to events within the polygon in the desired time frame.
- Based on the results of our independent mapping analysis and feedback from TEMS staff, and including standardized time on task measures adjusted for reliable employee breaks, we believe that if 27 ambulances are available 90 percent of the time across the geography, that the response time target of less than 9 minutes for Delta and Echo responses can be achieved at a 90% confidence level.
- A "Performance Staffing" calculation is then made to determine for each hour of day, and each day of week, what the optimal staffing level should be to achieve the desired response time performance. This calculation includes an assumption that the service should provide an adequate number of staffed ambulances to perform known expected average peak volumes while maintaining a normal response capacity to provide predictable emergency service delivery to the next incoming emergency call through the "UH Adj/Eff Buffer". To be clear, the assumption is that throughout the operating period, the number of ambulances on shift will vary based upon known and relatively predictable call patterns. During each operating period, the service should maintain to the best extent possible 27 ambulances strategically placed to ensure response zone coverage and response time performance. The balance of the resources will be consumed consistently at the high average peak levels to manage a smoothed peak volume. This planning provides capacity for excess response demand, special situations, and dynamic spatial redistribution in an aggressive system status management plan based on predictive analysis as is already provided through the use of the Optima software installed within the TEMS dispatch centre.
- Our analysis does not provide for coverage at all times of the absolute peak response levels that may be experienced. Analysis provides an understanding that these peaks are relatively rare, sometimes only happening once a year. There will be situations where the absolute peak demand exceeds the expected vehicle consumption and those situations will be managed through spatial distribution of the calculated effectiveness buffer to the extent possible.

The analysis demonstrates that in order to effectively provide service to the existing demand while ensuring ability to respond predictably to life threatening Delta and Echo calls with a 90%

confidence level in under 9 minutes, an increase in ambulance staffing is required. This increase in staffing should reflect known variations in volume by hour of day and day of week, and should likely be in the area of approximately 223,451 staffed ambulance unit hours.

While these hours reflect the equivalent of approximately 25.5 additional ambulances staffed 24 hours a day 7 days a week, our analysis clearly demonstrates that the staffing must be temporally adjusted based upon need. In the current parlance this means that staffing should be through staggered starts to match known and predictable call patterns rather than a small number of selected start and stop shift times across the week. We recognize that TEMS has introduced some of these staggered start periods already to maximally utilize the available resources and they should continue working with the Union representatives on extending, and periodically adjusting, these patterns.

In addition to specific staffing increases, the analysis model also provides that some current staffing hours should be adjusted to provide better value for the actual expenditure on response capacity.

Net total increases in staffing hours by day of week are summarized below.

Table 10

Staffing Shortfall (Unit Hours – rounded)		
	Weekly Hours	**Annual Hours**
Mondays	589	30,610
Tuesdays	602	31,308
Wednesdays	616	32,045
Thursdays	660	34,307
Fridays	677	35,197
Saturdays	608	32,207
Sundays	524	27,773
Total	4,275	223,451

3.3.3 Observations

While the analysis completed provides the picture of what level of ambulance staffing is currently required to provide high quality, timely, and responsive service to the residents of the City of Toronto, it is a reflection of a point in time. Variables such as time on task, actual experienced call volumes, and spatial drive time variation will all serve to impact upon the results. For example, if we anticipate that demand and response volume will increase at the same rate that it has historically, which is around 2.78% (see Table 11), then the service will likely respond to approximately 6,000 more service requests next year. If the average time on task, meaning the time from when the ambulance starts on the call through to when it is clear of the call, is the same as the overall average of 75.4 minutes, as adjusted to allow for established breaks, then actual task time will have increased by a full 7,587 unit hours, the equivalent of one ambulance being occupied for almost 21 hours every day of the year.

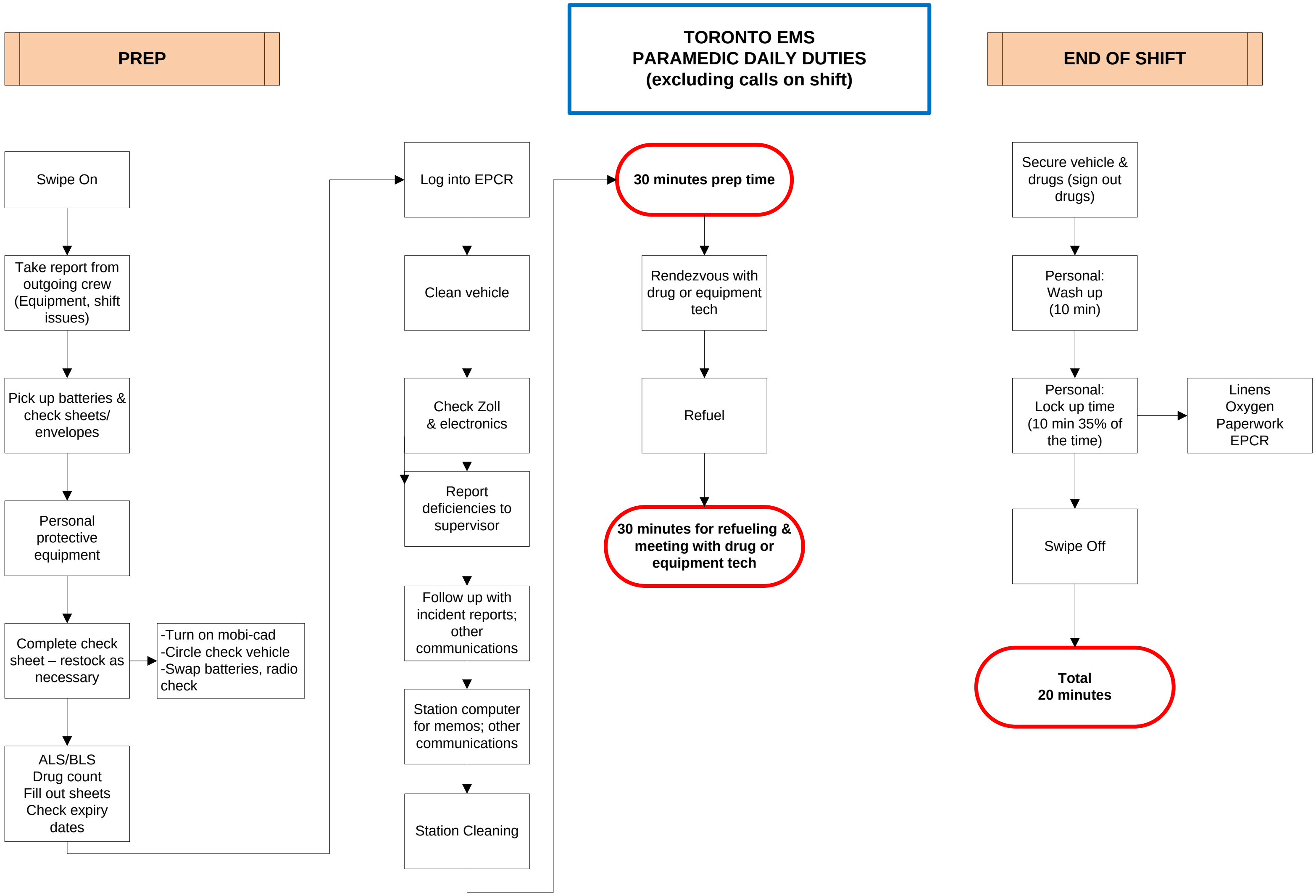
The consequence of not recognizing the increased workload, or balancing it through various strategies or response reduction such as community paramedicine or enhanced call screening and diversion, will predictably result in the service not being able to achieve the desired response time performance levels. Similarly, changes in road networks or other travel patterns may result in necessary adjustments to the response zone polygons with a consequent increase or decrease in the number of ambulances required for the effectiveness buffer.

If the actual volume change is higher or lower, or the experienced actual time on task changes, or if the call patterns shift to a different temporal distribution, the actual staffing pattern needs to be modified to match these changes to provide the best value and consistency from the available staffing dollars.

3.3.4 Recommendation

- Increase TEMS response capacity by 223,451 staffed vehicle hours to meet demand.

Exhibit 6 - Paramedic Daily Duties Excluding Calls on Shift and Rest Breaks



3.3.5 Mitigating the Rise in Call Volumes

Between 2002 and 2011 TEMS has experienced almost a 28% increase in call volume (actual incidents not responses) (Table 11). This upward trend would have been greater except for the efforts of TEMS to reduce non-urgent patient transfers by working with hospitals and other institutions to use other means such as patient transport services, hospital conveyances where available, or family-provided transportation.

Table 11 - EMS Call Volume - Year over Year Percentage Changes 2002 - 2011

Call Volume - Historical Trends											Percentage Change	Average Annual Change	
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2002-2011	2002-2011	2006-2011
0-Echo	3309	3543	3411	4233	3884	4116	4080	4544	4569	4377			
		7.07%	-3.73%	24.10%	-8.24%	5.97%	-0.87%	11.37%	0.55%	-4.20%	32.28%	3.56%	0.76%
1-Delta	60128	61148	60748	68139	68573	70542	72840	74513	78629	81348			
		1.70%	-0.65%	12.17%	0.64%	2.87%	3.26%	2.30%	5.52%	3.46%	35.29%	3.47%	3.01%
2-Charlie	20849	22982	24803	24329	28595	29555	31187	29829	31639	32309			
		10.23%	7.92%	-1.91%	17.53%	3.36%	5.52%	-4.35%	6.07%	2.12%	54.97%	5.17%	5.04%
3-Bravo	52542	54532	53966	50418	50330	52039	52153	55000	58975	61159			
		3.79%	-1.04%	-6.57%	-0.17%	3.40%	0.22%	5.46%	7.23%	3.70%	16.40%	1.78%	3.30%
4-Alpha	33011	33422	33308	30716	31092	33812	34637	33702	34885	37998			
		1.25%	-0.34%	-7.78%	1.22%	8.75%	2.44%	-2.70%	3.51%	8.92%	15.11%	1.70%	3.69%
Total Time Sensitive Calls	169839	175627	176236	177835	182474	190064	194897	197588	208697	217191			
		3.41%	0.35%	0.91%	2.61%	4.16%	2.54%	1.38%	5.62%	4.07%	27.88%	2.78%	3.40%

TEMS's call volume trend is increasing at a rate greater than the city's population growth (***Chart 12***).

- In 2002:
  - the city's population was 2,481,510 (this is actually the 2001 population, although the trend line shows fewer than the actual 2001 population)
  - the total time sensitive EMS call volume was 169,389.

Therefore the calls per capita = 169,389**/**2,481,510 = 0.0683

- In 2006:
  - the city's population was 2,503,270
  - the total time sensitive EMS call volume was 182,474

Therefore the calls per capita = 182,474**/**2,503,270 = 0.0729

- In 2011:
  - The city's population was 2,615,070
  - The total time sensitive EMS call volume was 217,191

Therefore the calls per capita = 217,191**/**2,615,070 = 0.0831

The growth of calls **per capita** since 2002 has been (0.0831-0.0683)/0.0683 = 21.67% but population growth in the same time period has been (2,615,070-2,481,510)/2,481,510 = 5.38%

Therefore, the rate of unique ambulance incidents is increasing at a greater rate than the population. Of course, it is difficult to predict if this trend will continue.

Chart 12 - Population and EMS Call Volume Trend

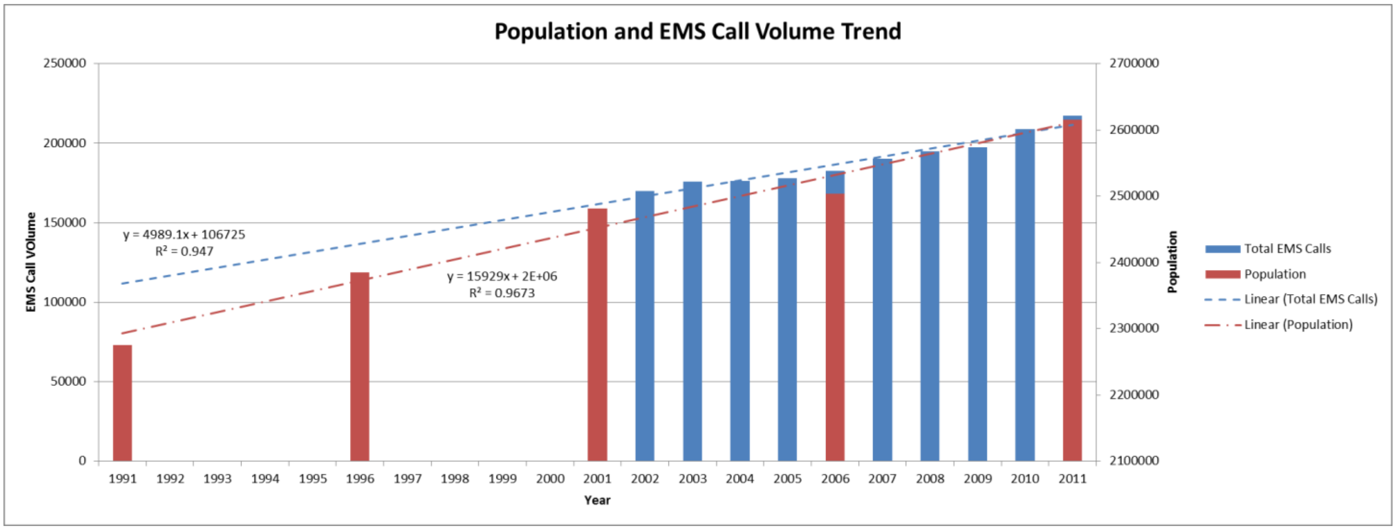


Table 11 - EMS Call Volume - Year over Year Percentage Changes 2002 - 2011 indicates that the average annual change in Total Time Sensitive Calls (blue highlight), was 2.78% from 2002 to 2011, and 3.4% from 2006 to 2011. Based on this history and the indication that EMS call volume per capita has been increasing since 2002, it seems reasonable to expect that TEMS may experience an average annual call volume increase of 2% – 4% over the next 10 years as Toronto's population grows. Assuming a conservative growth of 2% per year to 2021, Toronto could experience a total increase of 43,220 unique dispatched incidents between 2012 and 2021. This estimate may be conservative and is dependent upon the growth rate of the city and the success TEMS has with implementing other measures to mitigate call growth.

If this forecast of 43,220 additional unique incidents becomes true, and if the premises shown in the bullets below are accepted, then Toronto will require 9 additional ambulances to keep pace with growth. If the call growth rate is 4%, the city will require 18 additional ambulances in the next 10 years.

- There are 12 vehicle hours in a shift
- 30 minutes are allocated to beginning of shift preparation time (see Exhibit 6)
- 20 minutes are allocated to end of shift process (see Exhibit 6)
- Ideally, 90 minutes are allocated to mealtimes and two refreshment breaks per 12 hour shift

Therefore,

- There are 720 minutes in a shift
- 140 minutes are allocated to breaks and preparation
- 580 minutes remain for service provision (incident response)
- Each incident that requires patient transport consumes an average of 80 minutes

- Therefore, on average, each ambulance can provide service to (580/80 =) 7.25 incidents per shift

This calculation does not take into account multiple vehicle responses or peak demand.

In 2011 dollars, to staff and fuel one ambulance 24 hours a day, for 365 days costs $926,735 not including maintenance and support requirements. Therefore 9 ambulances will increase the EMS budget by ($926,735 x 9) = $8,341,000; 18 ambulances will increase the budget by ($926,735 x 18) = $16,681,000. There is the potential, depending on the distribution of call increases (hour of day, day of week), that the growth effect may be less costly but it is not possible to determine at this point. Nevertheless, efforts towards call mitigation will have a direct effect on reducing potential budget increases.

One Initiative is Not Enough

A single initiative cannot reduce call or transport volume sufficiently to make an appreciable difference. A number of separate initiatives is required—some of them in concert with other arms of healthcare. The following examples illustrate some initiatives to consider.

Community (or Expanded Care) Paramedics or MDs in the Communications Centre

Low acuity calls can be rescreened and vetted. During the 2010 Winter Olympics, the British Columbia Ambulance Service placed an EMS physician in their communications centre 16 hours per day to recall low acuity callers (Alpha-Q determinant). Over the 17 days of the Olympics, the physicians were able to find an alternate solution (no ambulance) for 28 percent of the callers they spoke with. In response to a screening question, two to three callers per day who did require a hospital visit said they would have been willing to take a taxi had that been available. (unpublished, Dr. Karen Wanger, Regional Medical Director, British Columbia Ambulance Service). Patient satisfaction was almost universally good.

Priority Solutions Integrated Access Management

The Priority Solutions Integrated Access Management (PSIAM) system, working in conjunction with the Medical Priority Dispatch System software already in use by TEMS, has the potential to clinically guide some low acuity ambulance responses to other community alternatives. TEMS should consider implementing this system. Similar systems are already in place in Houston, Mecklenburg, Melbourne, and areas of the United Kingdom including London. Niagara EMS is currently embarking on the second stage of a clinical trial with this system.

Other "No Send" Decision Rules

Other *decision rules* also exist for *no send* protocols or alternate solutions. Dr. Friedberg with TEMS has developed a model for use in the TEMS Central Ambulance Communications Centre. Taxi chits are an oft-cited idea as an alternative to ambulance for ambulatory, low acuity callers.

3.3.6 Community Paramedicine Program

The Community Paramedicine Program is an ongoing concept and effort by TEMS and its paramedics to provide "added value" for the City within the work already performed.

The following initiatives are part of the Community Paramedicine Program:

- Community Referral by EMS (CREMS)
- Community Agency Notification
- Hot and Cold Weather Response Programs
- Influenza Vaccination
- Bed Bug Identification and Prevention
- Safety programs (e.g., Window and Balcony Safety)

The consultant team member who reviewed the program found it to be very patient and systems focused, and at relatively low cost to the City, particularly considering the Province is paying 50% of the costs. Program costs, which include a small number of complement positions, direct administrative time and some material costs, are not specifically tracked which makes it difficult to assess a cost – benefit.

TEMS indicates that it treats 30% of all residents of Toronto who are 75+ years of age, at least once per year. Many of these calls are not life-threatening or time sensitive and paramedics are uniquely positioned to connect with the elderly and vulnerable in their homes.

The consulting group KPMG suggested, as part of the Core Service Review, that the Community Paramedicine Program costs the City somewhere in the area of $2.6 million. The direct costs for the program are not well tracked – although we recommend that they should be, as well as capturing possible offsetting savings or deferrals – but they are expected to be significantly lower than $2.6 million. It doesn't appear that KPMG's calculations took into account any potential offsetting cost avoidances, although we aren't sure of this. Further, we are not able to discern the methodology utilized by KPMG to determine which costs were allocated to community paramedicine.

While there is some financial return to TEMS from some of the community paramedicine program activities these returns are not really strongly tracked either, and that is not unusual. Programs such as these are developmental, and many costs are really a theoretical construct – for example, if there are 1,000 ambulance responses mitigated, and the average cost per ambulance response is $500, the mathematically calculated $500,000 isn't really saved unless actual response capacity can be taken off the road. What occurs is a decrease in future response growth. So 'savings' in this case must be measured as avoiding future financial pressures; for example, as described in ***Chart 12 - Population and EMS Call Volume Trend***.

Some staff working in the program may be workplace accommodation type placements; for example, workers returning from WSIB time off. During the review, the consulting team was advised that all staff involved, excepting 3, are workplace accommodations. Where a worker is injured and must remain off duty due to inability to perform normal duties, a Schedule 2 employer, such as Toronto, must pay the full cost of wages and benefits through the Workers' Safety Insurance Board, as well as administration costs. Enabling employees to rejoin productive and related work is important not only to the employee but could be less costly to the employer.

TEMS maintains records of referrals by the Community Referral Program by EMS (CREMS). This is a program whereby paramedics on 911 calls make a note, and with the patient's consent, refer vulnerable patients to partner agencies such as Community Care Access Centres (CCACs) or other social agencies so that assistance can be provided to patients to promote independent living. Referred patients are often frequent users of ambulance services because they may not have another means of access to health care or they do not have adequate support where they reside. Therefore, an effective referral may result in the reduction of many additional responses to a single patient by getting them the right care at the right time by the right provider (please see ***Exhibit 7 - Excerpt from Community Referral Program Records***). Approximately 3,900 patients have been referred for further assistance since 2006 with 904 referrals in 2011.

Exhibit 7 - Excerpt from Community Referral Program Records

Date	Time	Client Transported to hospital (Y or N), and if Y, which hospital?	Local CCAC	Existing or New	Current services for existing clients or admit/non-admit information for new clients	Disposition (service changes, hospitalized, LTCHs, etc.)	Health Issue, Diagnosis, Case Notes	Pre CREMS EMS Calls	Pre CREMS Transports	Pre CREMS Time One Task	Post CREMS EMS Calls	Post CREMS Transports	Post CREMS Time On Task
1-Jan-11	1:17pm	Y-York Central	Central			Still in hospital awaiting convalescent care	Hallucinations in the morning for the last couple of days. Had a fall and broke her right shoulder. Lives with husband. Decreased mobility.	3	3	6.71	2	2	6.31
1-Jan-11	2:22pm	N	TC CCAC	New	Admitted	PSW	Alzheimers. Failure to cope with anxiety.	2	2	3.04	1	1	2.04
2-Jan-11		Y-STMH	TC CCAC	New	Admitted -	PSW	Respiratory infection. Mobility concerns. Has a walker	1	1	2.67	0	0	0
3-Jan-11	11:13am	Y-SHSC	Central	New	Non admit,	declined service	90 years old, depressed and lonely, several calls to EMS. Community outreach program will be good for him.	4	1	5.63	1	1	1.59
3-Jan-11	6:11pm	N	CE CCAC			Information not available	92 years old. Fell and was not able to get up. No obvious injuries. Lives alone.	1	0	0.99	0	0	0
3-Jan-11	10:05am	N	CE CCAC			Information not available	Frequent falls - twice a week. Mobility decreased.	8	0	7	1	0	0.46
3-Jan-11	6:23pm	N	TC CCAC	New	Admitted	PSW & PT	Elderly, dementia. Freq ambulance response. Trouble with eating and personal care.	3	2	5.24	0	0	0
3-Jan-11	3:26pm	Y-Scarb Grace	Central			PSW	Fell on the right wrist. Elderly, living alone.	1	1	2.63	0	0	0
4-Jan-11	11:15am	Y-STJHC	TC CCAC	New	Admitted -	OT	Lives alone. Suffering from neglect. Abdominal discomfort.	3	3	6.41	1	1	1.67
4-Jan-11	9:08am	Y-NYGH	Central	Existing		Increase PSW, add nursing	Confused. Acting abnormally for the last few days. Obese.	4	1	5.14	0	0	0
5-Jan-11	2:56pm	N	MH CCAC			Information not available	Risk of falls. Fell in the bathroom and was there for 3 hours. High BP. Unsteady on her feet.	2	2	7.52	0	0	0
5-Jan-11	7:35pm	Y-SGH	CE CCAC			Information not available	SOB. Living condition unkempt.	1	1	1.94	0	0	0
5-Jan-11	6:05pm	N	TC CCAC	Existing		PSW increased	Issues with med compliance due to increasing confusion. Needs assessment on nursing assistance and possible long-term care.	2	0	1.67	0	0	0

A CREMS fact sheet, provided by TEMS, is attached at the end of this section and indicates a 50% or more decline in ambulance use for the referred patients. Admittedly, within the scope of the total incidents responded to by TEMS each year, this is a small number of patients. However, the important point is that each program or effort, that mitigates call volume growth, offsets the potential of additional resources being required. Nevertheless, programs that mitigate growth cannot cost more than the growth being moderated which underlines the importance of accurate tracking and reporting of program benefits.

It is possible that referral programs generate greater offsets to partner agencies such as CCACs and hospitals. An effective referral is understood to have a downstream impact on CCAC discharge (less total time in the CCAC care), increases in flow speed through an emergency department when clients do visit, and decreased length of stay in hospitals. All of these are uncosted significant drivers for health care partners.

Another area for offsetting costs may be in other City departments such as social services (less interactions), housing (improved care and conditions), and other supports. One example of a potential is the flagging of 'hoarders' by EMS as they visit patients in their homes. Hoarding is understood to be a cause of the 200 Wellesley St. incident, and prevention of this type of long-term displacement of a high occupancy building at City expense is extremely significant - not to mention the quality of life and health of all the other residents.

An extremely good example of a very low cost solution to ensure patients receive the right care, and their primary care providers are aware of the EMS response and interactions, is the Community Agency Notification (CAN). In its simplest format, patients are registered with unique identification on an *'in case of emergency'* (ICE) form that is located in their residence. Where the paramedic has an interaction, they contact the central phone number, key in the unique ID, and then provide a verbal description. The care provider will then receive an email with an attached voice file outlining exactly what is happening to their patient.

Our review leads us to believe that the various community paramedicine program activities can become part of Toronto's and the province's social support network. However, there are no clear evaluation criteria to determine if what the consultants and TEMS senior staff believe is true about community paramedicine, actually is. There are a number of programs such as the Long and Brier Islands Community Paramedic initiative, Winnipeg's Main Street Project, and numerous programs in the United Kingdom and Europe but most of these meet a need for ancillary agencies rather than EMS. In these examples, EMS serves the purpose of delivering care in the community rather than transporting a patient to hospital that may be some distance away. For example, in the Long and Brier Islands, the closest hospital is almost two hours away so, although adding EMS staff to the island is more costly for EMS, it provides a value and service to the 1250 residents of the island. In Winnipeg, the cost of EMS service to the Main Street project is equivalent to adding 3 staffed ambulances to the service. However, it is seen as a significant reduction in hospital costs and a valuable service to the Main Street community, and the cost is not borne by the ambulance service but by the provincial health system. Community Paramedicine is growing across Canada because of its potential to provide patient care alternatives that result in improved outcomes for the patient, the EMS system and society.

So, while we agree that the Community Paramedicine program should continue and be promoted, the costs and benefits should be closely monitored to determine where value is delivered. We suggest that value doesn't have to be monetary only but it could also be measured in quality of life, particularly for some of Toronto's population in need of assistance.

Potential community paramedicine activities for the future, focused on the needs of the patients, the support of the broader health care system, and the unique opportunities for early intervention that the business of paramedicine provides, could include:

- Structured negotiations with the Ontario Ministry of Health and Long Term Care, and the various LHINs, to create funding sources to extend the concepts of community paramedicine programs.
- Creation of a Priority Solutions Integrated Access Management (PSIAM) program for the TEMS Dispatch. PSIAM can be utilized only in dispatch centres accredited in the use of MPDS, and Toronto has achieved that. This system, at its most aggressive, could conceivably see all Alpha level calls triaged from the primary EMS Call Taker to a secondary, more highly trained, call taker who would use PSIAM to elicit further information.

  Outcomes may then be:

  - dispatch referral of the caller to an alternative community resource (response is not sending an ambulance) - Hear and Refer
  - dispatching a higher level Expanded Care Paramedic (ECP) responder assess the routine needs of the patients and provide on scene care rather than transporting to hospital – "See and Refer", "See and Treat", and
  - the traditional dispatching of a traditional ambulance with the expectation of transporting to hospital
- Establishment of a more highly trained EMS provider to be utilized in conjunction with PSIAM, dispatched to low acuity calls with the expectation of the single provider performing either a 'treat and refer' of the patient, or a 'treat and release' of the patient, instead of transporting to a health care facility. This truly is the concept of mobilized health care and well within the current nature of EMS at an international level, particularly in the UK and Australia.

3.3.7 Conclusions

Community Paramedicine, based on early information from some parts of North America and Europe, is expected to slow the growth of event volumes. Further, it fits with the human services principle of reducing the need for urgent responses to patients that have not had the benefit of preventative care. It is programs that, with continued monitoring and adjustment, can become more valuable as the program grows in sophistication.

The direct costs of the program are not well tracked, although they should be, as well as capturing possible offsetting savings or deferrals. Additional effort should be put into capturing costs and tangible and intangible program benefits.

Community Paramedicine should continue to be delivered in partnership with other City departments, including TFS. The fire department can contribute during the pursuit of its human services initiative of public education, prevention, and inspection.

TEMS should work with the province to investigate opportunities for Community Paramedicine to improve efficiencies, provide improved service to patients' not requiring emergency room visits, and decrease traditional paramedic responses to emergency calls.

3.3.8 Recommendations

- Continue the Community Paramedicine program as part of a strategy to provide the most appropriate patient treatment and reduce emergency medical response call demand.

Exhibit 8 - Community Paramedicine Information Sheet from TEMS

Community Referrals by EMS

Paramedics may be the first, and in some cases, the only health care provider to make contact with our most vulnerable and marginalized patients.

Since the TEMS Community Referrals by Emergency Medical Services Program was rolled out in 2008, there have been **over 3,700 referrals made to Toronto CCAC's by TEMS paramedics for over 3,200 patients**.

All paramedics are in a unique position to advocate for patients who are not already receiving services at home by making a referral to CCAC. Most of these patients would not have been identified by CCAC as they have yet to be connected with home services even after discharge from hospital. Of those who are receiving services, additional referrals by paramedics can increase their opportunity to receive more services at home thereby mitigating further calls to 911 and hospital visits.

2011 Referral Summary

904 CREMS referrals made in 2011.

Below is a chart demonstrating the number of calls, transports and time-on-task that referred patients had generated 6 months before their referral (Pre-CREMS), as well as the number of calls, transports, time-on-task and a percent change for those same patients 6 months post referral (Post-CREMS).

Pre-CREMS			Post-CREMS					
Calls	Transports	ToT	Calls	%*	Transports	%*	ToT	%*
2715	1654	4597.28	1340	-50.6%	582	-64.8%	1898.87	-58.7%

ToT – Time on Task

%* = Percent change calculated by (Pre-CREMS – Post-CREMS) / Pre-CREMS

CCAC Definition – A Community Care Access Centre (CCAC) connect patients with the care they need at home and within their community. CCAC helps patients/clients stay in their home longer by providing care in the home and by coordinating care in the community, including specialized support services (nursing, occupational therapy, physiotherapy, social services, pharmacy, etc..). There are a total of 4 CCAC's that fall within the City of Toronto's catchment area.

- Toronto Central CCAC receives approximately 40-45% of the Community Referrals submitted by TEMS Paramedics.
- The selection of nursing, personal support (PSW), occupational therapy, physiotherapy is based on the significant impact these services have on a patient's health and their risk for injury.
- Providing nursing care in the home is much more cost effective than in a hospital setting; this type of nursing care may include wound care, diabetes/medication/hypertension management, urinary catheter care.
- Providing physiotherapy, occupational therapy and/or personal support is extremely valuable in preventing falls in the home which can result in significant health problems, frequent calls to 911, and hospitalizations.

4.0 Consolidated FIRE-EMS Models

An important objective of this study is to determine the efficacy of a consolidated fire – EMS department for the City of Toronto. This section examines evidence to help determine the medical, operational and economic feasibility of such a service delivery structure. Intuitively, many people support the idea of a combined fire – EMS delivery structure assuming that it will save money and be more effective in the provision of emergency medical services. This section examines the facts including, where available, the documented experience of other jurisdictions and its applicability to the City of Toronto. The examination is based on existing legislation and an understanding that legislation, regulations, and directives will not change significantly in the foreseeable future.

4.1 Consolidating TFS and TEMS

Consolidation Would be Essential if Response Operations were Combined

Consolidating the emergency medical services and fire services in a single organization would be essential if the response operations were combined. In some cities, the apparatus and staff that are used to respond to medical emergencies are cross-trained and used to support fire suppression response. In such cities, combining the EMS and fire response functions into a single department is essential. Not only must operational response be coordinated but staff must be trained to ensure an effective response. In Toronto, by contrast, while the fire services and emergency medical services coordinate their response to some (but not all) medical calls, staff members are not cross-trained. Combining operations in a single department therefore is not imperative.

Consolidation Would Create Some Benefits

Consolidating the emergency medical services and fire services in a single department has the potential to create benefits. Some efficiencies would likely result if the support functions of the EMS department and fire department were more closely tied, in the same way as cooperation with other divisions and corporate partners could create efficiencies and benefits. In particular, efficiencies might be achieved in the following areas:

- Communications
- Quartermaster and warehousing
- Vehicle maintenance (for some vehicles)
- Equipment maintenance
- Radio repair and maintenance
- Facility maintenance
- Technology support

The area where the benefits of consolidation would likely be greatest – communications – might be difficult to capture. The TEMS' communications function is fully supported and funded by the province and must conform to provincial requirements. Managing a communications centre that meets city EMS, provincial, and city fire requirements would be difficult. In addition, some of the benefits of the consolidation would be offset by the administrative costs associated with tracking costs and making appropriate charge-backs to the province.

Consolidation Benefits Offset by Other Factors

The leaders of TFS and TEMS share a commitment to effective management, developing sound systems to: (1) support operational efficiency and improved service, and (2) strengthening data based decision making. In addition, the chief of each department is focusing on key strategic initiatives. For example, the TEMS chief is focused on identifying ways to provide alternative service delivery options that will reduce the growth of call volume. The Fire Chief is evaluating how response alternatives might vary by areas of the city.

However, the approach taken to implement these improvements will vary significantly in each department. If the departments were consolidated, the challenging task of implementing improved management practices and systems in each department would be multiplied. Moreover, the effort that would be required to establish a consolidated department would divert attention from each department’s strategic initiatives.

We have not been able to find any records of a consolidation having gone relatively smoothly but there is evidence that merging of separate fire and emergency medical services is often beset with challenges. There can be many reasons for this including collective agreements, personality clashes – both at the front line staff level as well as senior administration – and operating differences. The City of Winnipeg is an example of an organization that consolidated fire and EMS and, 15 years later, have come close to resolving the many issues that occurred.

Consolidation is usually precipitated by financial issues, service provision shortfalls, or because the idea of amalgamation is championed by a senior administrator in fire or EMS. However, although there are a number of publications advocating fire and EMS mergers, we have not been able to find any independent studies that lay out evidence that a consolidated entity is financially, operationally, or organizationally advantageous in the circumstance where the two organizations are competent.

From an organizational perspective, as can be seen within this part of the report, consolidation will not reduce the number of administrative staff since there are not position responsibilities within each organization that can be assumed by one or the other organization. In other words, senior staff do not have time on their hands to take on a larger role. Some duties may be pushed from a Deputy to a Division Chief or Commander because, in a consolidated organization a Deputy may take on a greater scope of responsibility, but the number of people required to satisfy a function will remain the same.

Collaborating Instead of Consolidating

TFS and TEMS do not need to be combined to take advantage of the benefits of coordinating the delivery of support services. By working closely together, as with other divisions and corporate partners, the managers of support functions in each department can find ways to create synergies, reduce costs, and improve operational performance. Indeed, these managers should be expected to work together to leverage the resources of each department to the benefit of both departments. It is worth noting that the two departments—who share a manager to oversee financial operations—are already working together to reduce costs.

4.1.1 Conclusion and Observations

Consolidation is usually precipitated by financial issues, service provision shortfalls, or because the idea of amalgamation is championed by a senior administrator in fire or EMS. However, although there are a number of publications advocating fire and EMS mergers, we have not been able to find any independent studies that lay out evidence that a consolidated entity is financially, operationally, or organizationally advantageous in the circumstance where the two organizations are competent. However, there is ample evidence that merging of separate fire and emergency medical services is often beset with challenges.

- Considering the documented upheaval of organizational consolidation of fire and emergency medical services, and
- Considering there is no evidence that a consolidated entity is financially, operationally, or organizationally advantageous in the circumstance where the two organizations are competent, and
- Considering that by working closely together, and with other divisions and corporate partners, managers within fire and EMS can find ways to create synergies, reduce costs, and improve operational performance

We find that there are no reasons to consider the consolidation of the TEMS and TFS.

4.1.2 Recommendation

- Do not consolidate TFS and TEMS.

4.2 The History of Firefighter Response to Medical Events in Ontario

Very few people are aware of the origin of firefighter response to medical events in Ontario. The principal author of this report was significantly involved in the early discussions that led to the decision by the Emergency Health Services Branch (EHSB) of the Ministry of Health to introduce and promote the practice of firefighter medical response.

In the early 1990s, prior to the downloading of ambulance service responsibility from the province to municipalities, a city in what is now Halton Region requested additional ambulance coverage because they believed that response, in some cases, was not sufficiently rapid. An analysis of this request by Emergency Health Services Branch led decision makers to believe that coverage in the requesting city was adequate in comparison to similar cities. However, EHSB recognized that the request and pressure for augmented ambulance coverage would continue, and the belief was that if this city was successful similar requests would be received from other municipalities at a significant cost to the province. The strategy was decided upon to acknowledge the municipality's concern but to suggest that the city should take on some of the responsibility of protecting its citizens, via the practice of firefighter response, when ambulance response was delayed beyond normal response times. In fact, over a period of time, the decision was made to actively promote this concept throughout Ontario. This promotion included having Emergency Health Services Branch regional and head office staff conduct presentations to municipal councils to convince municipalities that fire services should respond to medical emergencies if an ambulance was delayed beyond the normal response times.

Over several years, the practice of fire department response to medical incidents was expanded by Emergency Health Services Branch based on medical research, but also political expediency and liability concerns. The decision was made that expanded fire department response, beyond those occasions when an ambulance was abnormally delayed, might help to save lives, such as in cases of cardiac arrest, but also reduced liability for Ministry of Health dispatch centres in case actual events turned out to be more serious than initially determined. Over the ensuing years firefighter medical response has become a normal practice in many Ontario municipalities. Nevertheless, some jurisdictions have decided to scale back firefighter medical response due to the cost and lack of evidence that response time has an impact on the majority of patient ailments and injury; for example, some jurisdictions will send firefighters to cardiac calls only.

4.3 Firefighters as Paramedics

Firefighters fulfilling the role of paramedics or emergency medical technicians are a model that is found more commonly in the United States and, to a lesser extent, in some limited areas of Canada. Where firefighters perform a *paramedic* role, over and above an initial co-responder role such as is currently performed by the TFS, it is typically in one of the following configurations:

- **Provision of all ambulance service activities**, meaning that firefighters trained as paramedics actually staff the ambulances which are operated directly by the fire service;
- **Provision of some ambulance service activities**, meaning that firefighters trained as paramedics staff *some* of the ambulances within a community, and perform some of the responses, while another agency or organization staffs their own ambulances with trained paramedics and also responds to some of the calls for service within the community;
- **Provision of either basic or advanced care by firefighters trained as paramedics as part of a responding fire apparatus**. Ambulance service and patient transportation is provided by another agency or organization which staffs their own ambulances with trained paramedics and responds to the same calls.

In the United States, where firefighter paramedics are most prevalent, and with which we, in Canada, are most familiar, those models came about because of the nature of private ambulance services; for example:

- Some private ambulance services supported themselves by directly billing patients in much the same way that happened in Ontario over 40 years ago (private for profit). That was not a viable business model and even the most conscientious ambulance services could not always be counted on to deliver assistance when required. Municipalities turned to fire departments, a stable organization with available service capacity (available time), to provide emergency medical services.
- Ambulance service did not exist; fire assumed the responsibility by virtue of it being an established, stable entity.
- In a few municipalities, Philadelphia for example, EMS also acts as an adjunct for firefighting. Ambulance service in some United States jurisdictions is not as in demand as in Ontario due to the differences in insurance coverage. Therefore, since EMS is not busy, comparatively speaking, there is time available to support firefighting duties. This was a model prevalent in some parts of Alberta until early 2009. In Alberta municipalities such as Lethbridge, Red Deer, Fort McMurray, Medicine Hat, and many smaller locations, a fire truck and ambulance would be sent to almost all fire incidents which would allow five firefighters – including two firefighter paramedics from the ambulance – to be the initial response to fires. This response model reduced the need for firefighters. In the same way, two paramedics and three firefighters would respond to medical calls, in part to keep the team together in case of a fire.
- In April of 2009 Alberta moved ambulance service from a municipal responsibility to a provincial health responsibility and is moving away, as quickly as possible, from paramedics acting as firefighters, although this practice still exists in a few locations.

4.3.1 The Winnipeg Experience

A Canadian system which is often held out as an example of an effective fire-fighter paramedic service, and is used to support the argument in favor of implementing a similar model in other communities, is Winnipeg. However, it is important to understand the background to how the Winnipeg Fire and Emergency Medical Services amalgamation came to be, at what cost the model was established, what challenges were encountered, and what benefits are being derived. We visited the Winnipeg Fire and Emergency Services in July of 2012 as part of our research into Toronto's project.

The Winnipeg Fire Paramedic Service (WFPS) is an amalgamated fire and ambulance organization. The functions and different alignment of the two services are recognized in terms of funding. Fire services are municipally funded and EMS costs are shared between the Manitoba Health Ministry, the City of Winnipeg, and end user revenues.

In the 1970s Winnipeg's ambulance services were privately operated, plus there were four fire rescue units responding to 30,000 calls a year. Firefighters who staffed the fire rescue units were trained in first aid and occasionally transported patients, however there was virtually no interaction between fire and the private ambulance services.

In June, 1975 a provincial and municipal political will emerged to improve the quality of services being provided by the two emergency organizations. The province eliminated all private ambulance companies and assumed both operational and budgetary responsibility for EMS through the Health Ministry. A municipal training program was developed and delivered to all firefighters, and a revised fire services infrastructure was gradually created.

In 1980 the Winnipeg Fire Chief recommended full amalgamation of fire and ambulance departments to a city Ad Hoc Committee. In response, the city engaged the services of J.E. Peterson & Associates to conduct a feasibility study. The consultant group recommended full amalgamation and projected a potential cost saving of approximately $1.5 million per year. This recommendation was not immediately implemented but in 1986, Council approved an operational audit of the Winnipeg Fire Department to be conducted by Cresap, McCormick and Paget who made several recommendations, projecting significant savings, such as:

- Reducing duplication of pumpers (6 pumpers and 108 firefighters) with an annual cost saving of over $4 million.
- Closing two fire stations with an annual cost saving of $3.5 million.
- Not adding Driver/Aids for district chiefs
- Reducing the overstaffing in the communication centre.

Council resolved to phase in the recommendations over seven years. As the recommendations were being phased in, talk of amalgamation was rekindled in the 1994 working paper ***A New Direction for Civic Administration***[18]. This was followed by an interim report to the Board of Commissioners outlining the history and progress to date with respect to amalgamating city services. This report[19], prepared by Frank S. Kowal, executive assistant to the Commissioner of Protection, Parks and Culture, dated October 31, 1995, actually recommended that the Winnipeg Fire Department and the Winnipeg Ambulance Department NOT be amalgamated.

In 1997 consultant George Cuff was retained by the Winnipeg City Council to conduct an ***Organizational Review and Performance Assessment***[20]**,** the terms of reference being the amalgamation of as many services as possible provided by the City of Winnipeg. At the same time (1997) Gary R. Richardson completed his Masters of Public Administration thesis; **An Analysis of fire department and ambulance integration from a process perspective: Utilizing Winnipeg, Manitoba as a case study**.[21] The most salient conclusion he reached after two years of studying the pros and cons of amalgamation efforts across North America and Winnipeg was that:

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[18] City of Winnipeg, A New Direction for Civic Administration, April 1994

[19] Kowals, Frank, Executive Assistant to the Commissioner of Protection, Parks and Culture. Re: Proposed Amalgamation of the Fire and Ambulance Departments. October, 1995.

[20] Cuff, George B. & Associates. Organizational Review and Performance Assessment: A corporate review. 1997.

[21] Richards, Gary R. **An analysis of fire department and ambulance integration from a process perspective: Utilizing Winnipeg, Manitoba as a case study**. National Library of Canada, 1996.

*"While it is apparent that if Winnipeg wants more efficient and effective emergency services, a full amalgamation of the Fire and Ambulance departments is a way to achieve them it is also as evident that the **process** through which this is achieved is crucial to success, for despite the content of other reports, it was universally the **process** that determined success or failure in the jurisdictions studied."*

Richardson further concluded that ultimately amalgamation "is a people problem" and as such "the process must involve the people who will work in whatever system is created."

At the same time as ongoing discussions about consolidation were taking place, fire and ambulance services were amalgamated in 1998 with little to no notice of senior fire or EMS staff. The rationale for amalgamation with fire services 'taking over' ambulance was very simple. At that time, fire services had a better and more established management system and physical infrastructure, and establishing a similar structure for EMS could be avoided with amalgamation. The fact that personnel details were not addressed at the time of amalgamation created significant difficulties that continue to linger almost 15 years later. The two major issues were the cultural differences between the services, and labor relations.

The cultural differences became amplified when the two services were brought into close proximity by sharing space in a station. There have been numerous problems encountered, including forms of harassment, which were well publicized in the media. Our interviews with senior staff indicate these events have subsided; however, labor relations problems continue to be an issue. There are five unions in the amalgamated service, resulting in significant wage and working condition differences. This situation inadvertently provided an opportunity for cross-trained applicants to enter the amalgamated service as a paramedic, with the intent of moving to fire as soon as the opportunity presented itself since movement to the fire discipline is considered an advancement. Management has stopped this practice, particularly due to the effects on EMS staffing.

The current chief and his senior staff are of the belief that when the amalgamation decision was made it should have been implemented with a clean slate wherein all staff would have to apply for positions. The chief believes that use of a carefully designed selection process would have afforded the opportunity to "weed out" those with extreme negatively polarized cultural and labor relations views.

The internal volatility of Winnipeg's combined fire and emergency medical services have subsided since its early years; however, there is no evidence that the existing configuration is operationally or monetarily more or less effective than a separate fire – EMS model. Winnipeg did not track the differential in costs between the previous separated model and the existing. This is because the decision to consolidate was made for political rather than operational or financial reasons.

4.3.2 Other Research Findings

We researched literature in an effort to find studies that offer reasonable operational, organizational, or financial evidence to conclude that there are advantages to one or more of the firefighter paramedic models. The results are that:

- We have not found literature that proves a firefighter paramedic model is more efficient or advantageous than the system Toronto currently enjoys.
- Where the literature recommends a model, it is one that fits the municipality or jurisdiction being studied and is not held out as being applicable to other jurisdictions.
- Literature that recommends fire based EMS systems is usually published by organizations such as the International Fire Fighters' Association or the International Association of Fire Chiefs which could be considered by some to have a bias towards that model. As noted previously, although we read studies from, or sponsored by, fire or EMS associations, we were very cautious about using them unless they contained compelling evidence with respect to the subject matter.
- In some cases, conclusions within the literature were based on anecdotal information; for example, in some studies there may have been no baseline for measurement, neither was there prospective or historical data gathering but the ‘prevailing opinion’ within the municipality or organization was that their firefighter paramedic model was advantageous.
- In Alberta, since 2009, urban emergency medical services have been transitioned away from a fire centric model to a health services model even though some small municipalities still operate ambulances through their fire department under contract to Alberta Health Services.

In summary, we were unable to find literature that provides evidence of a fire – EMS model being financially, operationally or organizationally superior to the model Toronto currently enjoys.

The important point to note is that each jurisdiction, where firefighter paramedic response is provided, arrived at that delivery model as a result of a variety of factors. It has suited the specific needs of the jurisdiction to adopt that model, often without financial or operational evidence, but it does not mean the experience is transferrable to Toronto. In addition, the change process has taken a significant number of years and the costs of that change process have not been tracked.

4.4 Legislation and other Factors Affecting EMS and Fire Operational Consolidation

Almost all jurisdictions are required to operate within comprehensive legislative, regulatory, and medical oversight parameters which are applicable regardless of the provider type.

The consulting team reviewed and analyzed the following to derive the conclusions presented at the end of this section:

1. relevant publications and legislation;
2. consulting team knowledge of the TFS and EMS operations derived from information collected as part of the overall study; and,
3. existing consulting team knowledge of public safety and public safety services.

Ambulance Regulation and Current Ambulance Requirements

In Ontario, patient transportation to a hospital or other destination requires an ambulance that is fully equipped and staffed in accordance with legislated and regulatory requirements. The ambulance service must operate in accordance with the *Ambulance Act* (Ambulance Act, R.S.O. 1990, Chapter A.19), and all of the regulations, policies, and certification standards required there under (which we refer to as the 'legislative requirements'). The legislative requirements are considerable in depth and breadth.

The TFS and TEMS currently operate cooperatively as independent elements under a single overarching municipal organization structure. The City of Toronto is responsible for meeting applicable land ambulance legislation including: staffing, operations, response times, equipment standards, training, qualifications, certification, and particular operational standards. The *Ambulance Act*, Part 5, Section 8, outlines that where an individual or agency wishes to operate an ambulance service a "certificate to operate" is required. In addition, this certificate is subject to initial, scheduled periodic, and unscheduled scrutiny and review from the certifying authority, which is currently the Ministry of Health and Long-term Care (MOHLTC).

Toronto is also responsible for ensuring paramedics practice in accordance with MOHLTC requirements as specified in the Basic Life Support Care Standards and the Advanced Life Support Care Standards. Additionally, Toronto must be aligned and work with a designated base hospital program for the purpose of medical oversight and delegation of medical acts. The base hospital program is funded and guided by the MOHLTC through a performance agreement to ensure consistency, continuity, quality, and accountability. The base hospital is the Sunnybrook Centre for Pre-hospital Medicine.

However, because the TFS does not currently provide ambulance service, it is not required to operate or function in accordance with the *Ambulance Act* and legislative requirements.

Ambulance Act

The *Ambulance Act* defines ambulance service as follows:

> *"ambulance service" means, subject to subsection (2), a service that is held out to the public as available for the conveyance of persons by ambulance"; and*
>
> *"land ambulance services" includes all services provided by an ambulance service in connection with the transportation of persons by land";*

If Toronto decides to combine fire and EMS services into a single operating entity – meaning a complete merger of roles and functions – the *ambulance service* elements of the *new* operating entity will have to be defined.

If Toronto decides upon a firefighter paramedic model that results in some firefighters achieving certification as either Primary Care or Advanced Care Paramedics, and if those skills are delivered to patients by firefighters, then it is possible – perhaps likely – that the MOHLTC will consider that as being the provision of ambulance service. Such service delivery would then be subject to legislation and regulation as part of an ambulance service. This is probably true no matter the organizational model; that is, within a consolidated fire – EMS system or, alternatively, the delivery of PCP or ACP patient care by the fire service.

As a concrete example, the TEMS currently operates a number of single-person response units, each staffed by either a primary care paramedic (PCP) or an advanced care paramedic (APC). The MOHLTC qualifies these units as *emergency response vehicles*, or ERVs. In compliance with MOHLTC requirements, the paramedics assigned to an ERV must be qualified in accordance with the *Ambulance Act* and legislated requirements. The paramedics must practice their profession in accordance with the published mandatory care standards [22,23,24].

> *"As a condition of employment, each employee and volunteer in the applicant/operator's service, who is required to provide patient care, will provide such patient care in accordance with the standards set out in the Basic Life Support Patient Care Standards (version 1.0) dated October 1995, and where applicable, the Advanced Life Support Patient Care Standards published by the Ministry as those documents may be amended from time to time."*

Paramedics operating an Emergency Response Vehicle are subject to ongoing review and evaluation by both the service operator and the base hospital for the performance of medical acts.

Further, to satisfy mandatory service review criteria when operating an Emergency Response Vehicle, the equipment utilized must match the equipment mandated by the MOHLTC:

> *"Each vehicle used as an emergency response vehicle in the applicant/operator's service shall contain as a minimum the accessory and patient care equipment set out in the document titled 'Provincial Equipment Standards for Ontario Ambulance Services,' published by the Ministry of Health and Long-Term Care."*

Additionally, the vehicle in which they respond must meet all MOHLTC criteria for selection and maintenance.

> *"Each emergency response vehicle used in the applicant's service and the patient care and accessory equipment contained therein shall be maintained in a safe operating condition, in a clean and sanitary condition and in proper working order.*
>
> *Only ambulances and emergency response vehicles that comply with the applicable version at time of manufacture of 'Ontario Provincial Ambulance and Emergency Response Vehicle Standard,' published by the Ministry as may be amended from time to time, are or will be used in the applicant/operator's ambulance service."*

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[22] Ontario Basic Life Support Patient Care Standards
http://www.ambulance-transition.com/pdf_documents/bls_patient_care_standards_2.0.pdf

[23] Ontario Advanced Life Support Patient Care Standards
http://www.ambulance-transition.com/pdf_documents/standards_advanced_life_supports_patient_care.pdf

[24] Ambulance Service Patient Care and Transportation Standards
http://www.ambulance-transition.com/pdf_documents/standards_amb_service_patient_care_transportation.pdf

Notwithstanding these requirements, the consulting team expects that the City of Toronto has the capability of satisfying the legislation and regulations as laid out by the Ministry of Health should a firefighter-paramedic initial response model be adopted. Nevertheless, these are considerations that must be taken into account and will require negotiation with the Ministry of Health and Long Term Care.

The Impact of Legislation on Changes to EMS Service

If the City of Toronto decides to modify its pre-hospital patient care response methodology by staffing fire apparatus with paramedics, there must be clarity with respect to legislative mandate. As noted previously, all TFS personnel and operations currently are outside the control, jurisdiction, and oversight of the *Ambulance Act*.

If fire apparatus are staffed with firefighter paramedics and the fire service and EMS continue as separate entities rather than consolidated:

1. Would firefighter paramedics qualified at the Primary or Advanced Care Paramedic level and, providing medical care, be certified to provide that care in accordance with the *Ambulance Act*?
2. Would fire service equipment and vehicles utilized in the performance of a firefighter paramedic medical response (pumpers, rescues) be subject to the requirements mandated for vehicles and equipment in accordance with the *Ambulance Act*?

Even in the case of an organizational merger where the two entities would become the Toronto Fire and Emergency Medical Service (or the Toronto Emergency Medical and Fire Service) the question of applicability of the vehicle and equipment standards remains.

A review of the Toronto Professional Firefighters' Association, Local 3888, and the City of Toronto collective agreement does not reveal any *paramedic* classification within the TFS. A review of other TFS policies and procedures, and discussions with fire and EMS senior staff indicate that, while primary firefighter training and retraining cycles include requirements for some medical responder training, there is no recognized professional standard or training which would qualify a firefighter to be recognized or practice as a paramedic.

Legislated change occurs when it benefits the province and patients. The history of change since the initial 1969 enactment of the *Ambulance Act* and the 1974 initial regulations pursuant to the act, suggests broad political, medical, and public support would be required, and while not out of the question, such change is unlikely to occur. So one premise guiding this discussion, and for the consulting team’s recommendations, is that the legislative requirements will remain essentially unchanged for the foreseeable future.

4.5 Firefighter Paramedic Models

From an operational perspective, there are a limited number of ways in which firefighter paramedics (FFPs) can be implemented. In a general sense, the higher level models include potential for:

1. Separate staffing by occupational specialty – firefighting staff are trained as firefighters, paramedic staff are trained as paramedics, and staff function in their primary occupational role.
2. Separate staffing with overlap of training for some – some of the paramedics and firefighters are cross trained, and wherever they are, they work in both roles
3. Combined staff – all staff are trained as firefighters and paramedics (generally referred to as cross trained).

4.5.1 Fire First Responders Acting as Gatekeepers

An operational model that was suggested to the consulting team during early project orientation meetings with fire service deputies and division chiefs, was that of the fire service acting as gatekeepers; that is, responding to medical emergencies and, where possible or practical, not also sending EMS until confirmation of a need by the arriving fire paramedic, or advising EMS to change the response urgency, or even cancelling the response. The concept is to make use of available fire service resources to alleviate call volume pressure on the emergency medical services system.

TEMS documented approximately 352,000 responses in 2011 and approximately 190,100 patients transported. The volume difference between responses and patients carried is because more than one ambulance may be sent to an incident; for example, an ACP and PCP ambulance, as well as an emergency response unit, could be sent to the same incident, patients may refuse transport to hospital, or there may not be patients at an incident. Another factor which contributes to the volume variance is that there may be no available ambulances within an acceptable response distance from an event so the closest ambulance is sent, which may be some distance away. Then, when a closer ambulance becomes available, the first ambulance is cancelled and a closer ambulance is dispatched. Records then show that two ambulances responded to one incident. Ambulances which have been dispatched to a non-life threatening incident can be reassigned to a higher priority call thereby delaying a lower priority call. For example, we are aware of an incident when ambulances, originally dispatched to a non-life threatening call, were reassigned 9 times. That incident would register 9 responses but only one patient carried. The concept suggested by TFS is intended, in part, to reduce the number of responses by single PCP medical emergency response vehicles, BLS and ALS ambulances, due to multiple dispatches.

Some EMS systems utilize primary care paramedic responders as gatekeepers to assist in managing the allocation of other resources. In some situations, this role may be filled by a primary care paramedic crew in a regular ambulance. They would make a clinical determination whether an advanced care paramedic (ACP) is required. In other models, including Toronto and many other Ontario systems, a single PCP may be sent as a sole responder in an emergency response unit to determine whether either a basic life support (BLS) or an advanced life support (ALS) ambulance is required. The Winnipeg Fire and Paramedic Service uses a variation on this role through assignment of a PCP, as part of a full fire response team and apparatus, to some events to determine whether an ambulance response is required.

A gatekeeping role to preserve ambulance response capacity presumes a relatively sophisticated level of knowledge and skill by the PCP practitioner. Such skills are normally achieved through training, medical oversight, and extensive clinical experience. While cancellation or deferral of an ambulance response due to no patient being found at a reported incident is relatively easy and generally risk tolerant, the cancellation or deferral of an ambulance response based on a clinical assessment of patient need is a different matter. A high level of training and thorough knowledge and understanding of pathophysiology is required to safely cancel responding paramedics or to treat and release.

As already noted, the TFS does not require a PCP level of training, and instead, relies upon an appropriate, but less qualified level, similar to an emergency medical responder (EMR). In making a determination whether first responders trained at an EMR level can safely assess patients (to decide whether an ambulance response can be cancelled or deferred), the consulting team looked to other jurisdictions and literature to determine efficacy and safety, but there was no literature available supporting such a conclusion.

The consulting team has knowledge from an unpublished trial involving qualified fire first responders at the Surrey Fire Department in British Columbia, trained at a level equivalent to that of the TFS, and the BC Emergency and Health Services Commission. The goal of the study was to determine whether a fire department response – without a concurrent EMS response to some motor vehicle accidents, and firefighter determination as to whether an ambulance was in fact required – would be clinically safe. A corollary to this was the economic evaluation of what ambulance resources would be saved by this response model. The rationale for selecting motor vehicle accidents for this review was primarily the high rate of ambulance cancellation on scene due to patient refusal of service.

The trial was discontinued from a patient safety perspective as the medical oversight responsible for evaluation of the study determined that firefighters trained at the first responder level, or the higher emergency medical responder level, did not possess the clinical interpretive skills required to consistently and safely determine that patient medical care was not required.

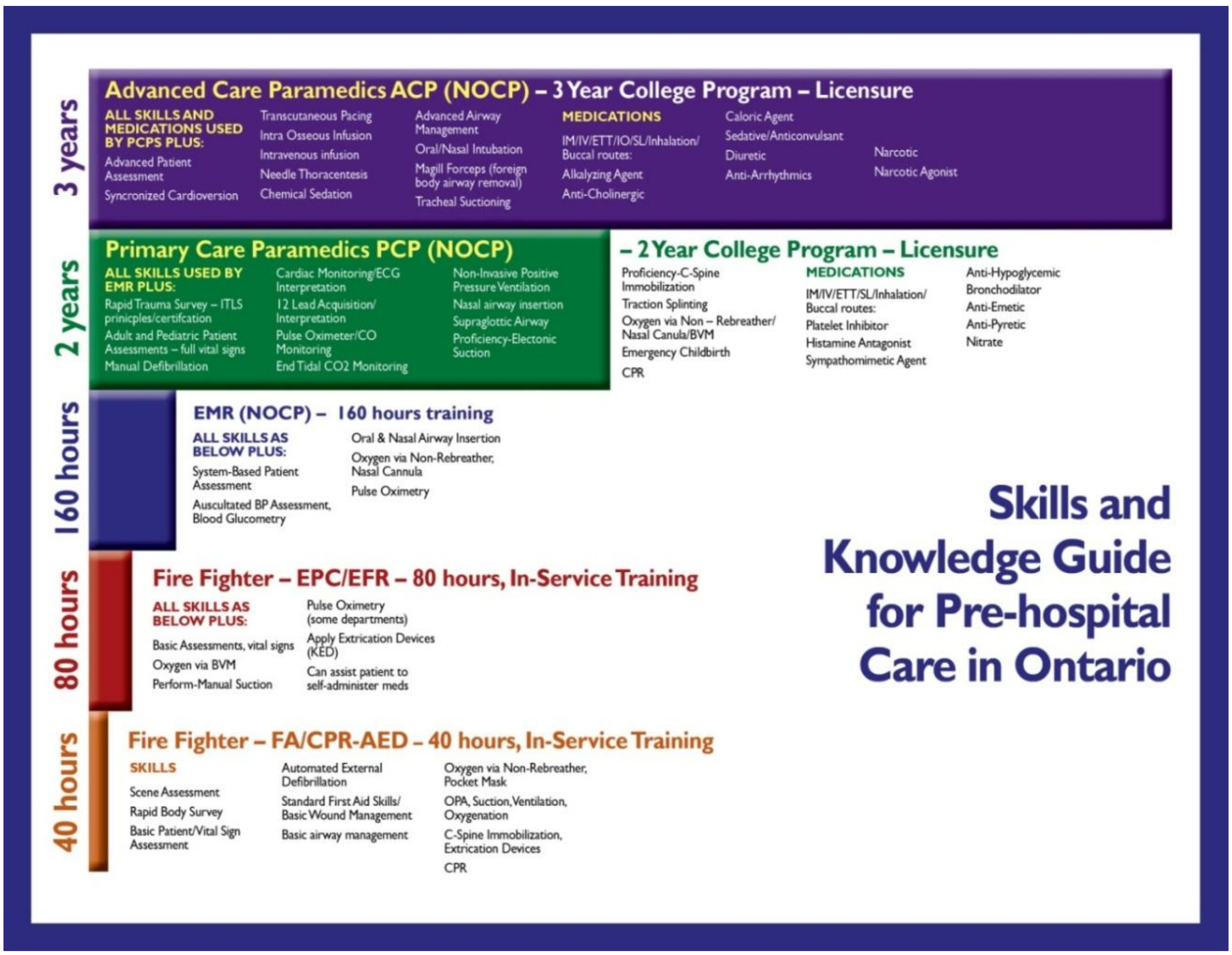
4.5.2 Training

Paramedicine is the practice of medicine and must be viewed as part of the entire health care system continuum. The care provided at the primary care and advanced care paramedic level is unquestionably a significant factor in the health, wellbeing, and survival of patients using the ambulance system. There is an extensive history outlining the development of training levels and the professional certification required to be a paramedic.

Overview information received from the TFS outlines that firefighting staff are trained to the equivalent of the EMR level through an in-house training process. Medical oversight of the training is provided under contract by Dr. Michael Feldman, the base hospital physician *assigned* to the TFS. Dr. Noah Forman is also under contract with TFS and primarily deals with Occupational Safety and Health (OSH), but liaises with the base hospital.

In descriptive terms, firefighters are trained in first aid procedures, cardiopulmonary resuscitation, use of an automated external defibrillator, and assisting patients to take their own medications. Use of an EpiPen® auto-injector to treat anaphylaxis (severe allergic reactions) was added to their skill set in 2012. An overall descriptive comparison of emergency medical responder training with the PCP and ACP training can be seen in Exhibit 9.

Exhibit 9 - Skills and Knowledge Guide for Pre-hospital Skills in Ontario



Basic firefighter recruit training is achieved over a 9 week period. Within those 9 weeks, a 2-week classroom component involving in-house training based on the emergency medical responder curriculum, and other needs as determined by the involved physicians, is provided. In addition, recruits complete a 1-week, online, self-directed, computer-based emergency medical responder training module. New recruits therefore receive a total of approximately 120 hours of EMR training.

Further module training in EMR activities was described as being two, 4-hour classroom sessions plus two, 1-hour online self-directed sessions annually. This represents a total maintenance requirement of around 10 hours per year for emergency medical responder training.

4.5.3 Accredited EMR Training Programs

The *National Occupational Competency Profiles* (NOCPs) for responders[25] outlines EMR training as the entry level of recognized training for pre-hospital care. The NOCPs were developed through a *Human Resources and Development Canada* grant as a joint project between the Paramedic Association of Canada and the Canadian Medical Association (CMA). Accreditation of training and education programs meeting the criteria is performed through the Conjoint Accreditation Services[26]. There are currently 68 institutions across Canada accredited to provide paramedic training at the four levels (Emergency Medical Responder; Primary Care Paramedic; Advanced Care Paramedic; and Critical Care Paramedic or CCP). While there are no Ontario institutions listed by the Conjoint Accreditation Services as being currently accredited for EMR training[27], some unaccredited training programs such as the Advanced Rescue Consulting[28] 4-week course, the First Responder Ontario[29] 3-week course, and the 15-day Emergency Services Academy[30] course are available.

The validity of an accredited training program for paramedic practice has been supported through the Coalition of Paramedic Regulators (COPR)[31] in the national development of interprovincial mobility and recognition of educational practice established to facilitate the Trade and Industry Labour Mobility Act (TILMA).

Firefighters, EMR Training, and Eligibility to Practice as a Paramedic

Dr. Michael Feldman, Medical Director, EMS Special Operations/Firefighter Emergency Patient Care Program at Sunnybrook Centre for Pre-hospital Medicine, indicates that TFS medical training was originally based on and now exceeds the Ontario Fire Marshal Emergency Patient Care II standard. He also states that Toronto firefighter medical training meets or exceeds the following standards:

- Ontario Fire Marshal's Emergency Patient Care II standard

[25] National Occupational Competency Profile for Paramedic Practitioners http://www.cepcp.ca/main/paramedic/ems/NOCP.pdf
[26] Canadian Medical Association Conjoint Accreditation Program http://www.cma.ca/learning/conjointaccreditation
[27] http://www.cma.ca/index.php?ci_id=50602&la_id=1#PARA-ON
[28] http://www.arcrescue.com/fr.htm#mfr
[29] http://www.froems.com/training.html
[30] http://www.esacanada.com/programs_responder.php
[31] Coalition of Paramedic Regulators (COPR) http://www.copr.ca/

- The Paramedic Association of Canada National Occupational Competency Profile for Emergency Medical Responders
- The Ontario Ministry of Health and Long-Term Care Emergency Health Services Branch "Basic Life Support Standards"

Dr. Feldman notes that the program *"is not recognized by an external certifying agency per se, but our base hospital is part of the team that sets the standards for Ontario. There is no available accreditation for firefighter medical training at our level, and we have intentionally not accepted the lower standards offered by other programs. The certification of our program is therefore by the Medical Council of the Sunnybrook Centre for Pre-hospital Medicine. The training (and associated quality assurance process) is mandatory for defibrillation and administration of epinephrine."*

Firefighters and Eligibility to Practice as a Paramedic

Even though many of Toronto's firefighters achieve a level of qualification as described by Dr. Feldman, and training for epinephrine administration and defibrillation is mandatory for all firefighters, the training does not provide eligibility to practice or work in a patient care capacity in a land ambulance service in the Province of Ontario. This means that in order for a firefighter to be qualified to perform patient care as part of a land ambulance service, upgrading or conversion of staff would be required.

The TFS Chief advised the consulting team that around 100 firefighters are trained at the emergency medical care assistant (EMCA) level but we were not able to determine the number that are qualified at the Advanced EMCA level[32], which is the essential prerequisite for employment in Ontario as a primary care paramedic. For the purpose of this analysis we have assumed that all of these EMCA-trained firefighters are qualified at the advanced level.

In documents provided to the consulting team, the TFS noted there are normally 128 pieces of fire apparatus at 82 stations available for deployment each day. To ensure that one firefighter paramedic is available for response from each station would require 411 firefighter paramedics including a contingency for absence replacement (please see Table 12 and Table 13).

Table 12 – Annual Firefighter Paramedic Hours Required

Number of Fire Stations	Number of Firefighter Paramedics (FFP) per Station	Hours per Day	Days per Year	Total FFP Hours Annually
82	1	24	365	718,320

Table 13 - Total Firefighter Paramedic Complement Required

Annual Hours of Work per FFP	2184
FFP required to staff stations (718,320 ÷ 2184)	329

[32] Successful graduation from a certified ambulance program at a college of applied arts and technology provides a diploma in Paramedicine and eligibility to write the provincial Advanced Emergency Medical Care Assistant (AEMCA) exams. Successful completion of the provincial certification exam qualifies a candidate as an Advanced Emergency Medical Care Attendant and then eligible to be trained and certified by a designated Base Hospital to practice as a Primary Care Paramedic

Absence contingency for vacation, Illness, etc. (25% of 329)	82
Total FFP required (329 + 82)	411

The training program for primary care paramedics generally includes a two year or four semester academic stream at an Ontario accredited primary care paramedic training program. Candidates must complete the academic training program and then succeed in the provincial Advanced Emergency Medical Care Assistant (AEMCA) examination and certification process. Once provincially certified as an AEMCA, the paramedic then must successfully complete specialized base hospital training and skills certification before actually practicing as a primary care paramedic. Moving sufficient firefighters forward to achieve a goal of having a primary care paramedic in every station would require significant time and costs. In addition to tuition and travel costs, the cost of wages, process development, and management costs would be considerable.

The Collective Agreement between the Toronto Professional Fire Fighters Association (TPFFA) Local 3888 and the City of Toronto, Article 51.01, states:

"Should the TFS require certificates of qualification in addition to what is presently required for the current positions coming within the 3888 Unit, the cost of such certification shall be borne by the City."

We have calculated the average annual cost of a firefighter (based on information supplied by TFS) to be $107,896 including salary, benefits, uniforms, dry cleaning, and other employment costs. Tuition and other related costs for the 2-year paramedic program are estimated at approximately $15,000 per student[33].

Therefore, the estimate to train 411 firefighters to the PCP level would be approximately $6.16 million for tuition, books, and other requirements, plus a direct replacement wage cost of $67.11 million (411 complement, minus 100 [current trained EMCA complement] multiplied by $107,896). This calculation assumes a 100 percent success rate in both the program and the provincial certification examination, which has not been the actual experience. Prudence would suggest at least a 10 percent remediation rate, further increasing the cost.

There are ways to mitigate this cost, of course.

- It may be possible to negotiate a reduced student rate with one of the accredited primary care paramedic training programs
- It may be possible to hire primary care paramedics and train them as fire fighters as attrition occurs in the existing TFS ranks. However, at the expected rate of attrition this option could take up to 5 years to achieve. This also assumes that TFS complement levels stay at the current rate or the process could take several more years
- The estimated 100 EMCAs currently employed by TFS may already be certified which might reduce the costs of training or the duration of the tuition option

[33] Humber College example: http://www.humber.ca/program/paramedic

- The Toronto Professional Fire Fighters' Association may be willing to negotiate a form of reduced compensation to a firefighter paramedic configuration.

In any event, our estimation (unless there is an arrangement to mitigate the cost), is either $73.29 ($67.13 + $6.16) million to train sufficient firefighters to the Advanced EMCA level – probably over a period of 2.5 to 3 years – or a lower but, as yet, unknown cost while attrition allows TFS to hire qualified AEMCAs.

In any event, accomplishing an objective of ensuring a qualified primary care paramedic is available at each fire station, at all times, in order to achieve a firefighter paramedic model of ambulance service delivery is expected to be an expensive and lengthy undertaking.

4.5.4 Advanced Care Paramedic (Advanced Life Support) Firefighter Medical Efficacy

There are some jurisdictions, notably in the United States, where advanced care paramedics are deployed on fire apparatus. One of the considerations in evaluating the potential to move forward with sufficient firefighters at the advanced care level – aside from the skills retention and training capacity issues, and assuming success in the training program – is that significant further expense would be incurred. Tuition for an accredited advanced care paramedic program is much higher, generally ranging at around $35,000 per candidate, as a result of the more intense clinical exposure and related costs. A further full year of training, including supervised clinical placement, is required. Finally, ambulance service knowledge, based on the development of advanced care paramedic capacity, indicates that experience as a primary care paramedic, as well as suitability for the advanced training, is essential. Not all primary care paramedics are either capable or successful in advanced care paramedic training.

4.5.5 Cultural Differences between Paramedics and Firefighters

The consulting team sees a number of challenges to be overcome, including a cultural divide, should there be a desire to provide firefighter advanced life support. The cultural issue, seen by most EMS physicians and operations experts, was also voiced by the TEMS Base Hospital, physicians and the TFS' physicians. Advanced life support decision-making and scene management require independence and an ability to tailor care to changing environments. Fire service culture is more paramilitary, both a necessity and a virtue in that work environment. People who successfully pursue a career in emergency medical services may not be well suited from a personality standpoint to be successful in a fire service role, and vice versa. This cultural phenomenon is observed in the nursing profession and other areas of healthcare. Different personality types choose different medical specialties: cardiology versus dermatology versus emergency medicine. Cultural differences were stated to be a primary challenge within the consolidation of fire and emergency medical services in Winnipeg.

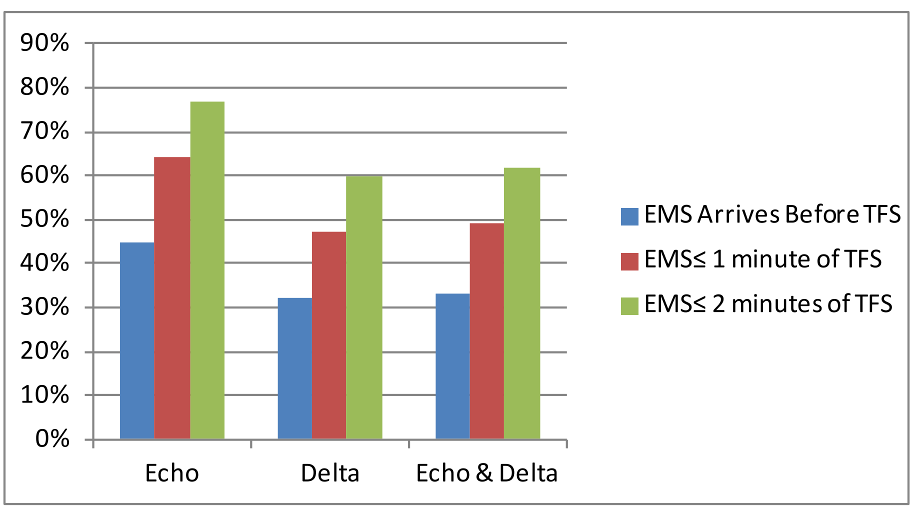
4.5.6 Challenge of Maintaining Skills

Another challenge to Advanced Life Support (ALS) staffing on fire apparatus involves skills maintenance and maintenance of competency. Current research shows that skill maintenance and competency can be negatively affected in an all advanced life support ambulance system where practitioners are not regularly utilizing their skills and knowledge. The consulting team believes these same challenges would be exacerbated in an advanced life support fire apparatus response system.

Because most patients calling 911 do not have an immediately life-threatening problem, an advanced life support paramedic in an all ALS system (ALS on every ambulance) will see low acuity patients more often than not, and the small proportion of patients with immediate life threatening problems will be dispersed among many. Hence advanced life support paramedics will not complete difficult procedures on a regular basis and will have difficulty maintaining skills. Skills maintenance then has to be confirmed in clinical laboratory sessions, classroom exposures, and even in hospital operating rooms. While this is possible, it is expensive and does not make up for the experience gained in real time situations.

The TFS arrives at Echo and Delta events before TEMS 67 percent of the time (although EMS reaches the scene within 2 minutes of the fire service in just over 60% of the cases when fire arrives first). Considering this small window between the arrival of the fire and emergency medical services, the opportunity for an advanced care paramedic on a pumper to assess, treat, and perform procedures will be rare (please see Chart 13 - Fire - EMS Arrival). Skills maintenance generally requires such things as at least one intubation every 3 months and other continuing medical education exercises requiring rotation through hospital operating rooms. According to Dr. Rick Verbeek, anesthesiologists are charging increasing amounts to have paramedics in the operating room. In the British Columbia experience, and in many other jurisdictions, there is a similar issue of saturation, where it is becoming difficult to accommodate paramedics in operating rooms along with medical students and anesthesiology residents. While we have not specifically canvassed training facility capacity, we believe that adding firefighters or more paramedics may not be logistically possible in the system.

Chart 13 - Fire - EMS Arrival



<u>4.5.7 Women as ALS Providers on Fire Apparatus</u>

Opportunities for women in EMS have improved steadily over time and women now make up 30 to 40 percent of the ambulance system workforce. Women are regularly found in both junior and senior managerial roles. While opportunities for women in fire services do exist, they are not as well established or defined. The consulting team believes that any initiative to shift paramedic responsibilities to a fire based model would need to include strategies from a gender and equity perspective to ensure a comprehensive balance is sustained at the outset.

4.6 Goal of a first responder system

An important question for Toronto to ask is, what is the objective of placing a primary care paramedic or advanced care paramedic on fire apparatus? The original intention of the first responder system was for TFS to provide needed time-critical interventions for the few additional minutes that it might take TEMS to arrive. It is an appropriate supplement to EMS response of time-critical emergencies.

There are a few time-critical medical emergencies that require intervention within minutes, such as

- cardiac arrest,
- anaphylaxis (severe allergic reactions),
- respiratory failure,
- tension pneumothorax, and
- airway obstruction

First responder occupational competency profiles were designed to address those time-critical incidents that are reasonably recognized and treated with the minimal training available at this level.

The TFS already has the tools to deal with these problems – for example CPR and automatic external defibrillators for cardiac arrest, and bag and mask ventilation for respiratory failure, and recently, Epi-pens for the treatment of anaphylaxis was added to the TFS capability. The other time-critical problems are more complex: tension pneumothorax is the collapse of a lung under tension. It is not a common occurrence; documented 18 times in the past year according to TEMS data *(personal communication, Dr. Karen Wanger with Dr. Rick Verbeek)*. Tension pneumothorax is difficult to recognize and decompression is a skill with potentially significant complications making it an advanced life support level maneuver. Airway obstruction is similarly uncommon and requires ALS level training and experience with laryngoscope and Magill forceps to resolve. Therefore, the TFS already has the skills to intervene in the majority of time-critical events when they arrive first.

Other time urgent problems requiring advanced life support care (chest pain, respiratory distress, stroke, and shock states) are not critical over an additional 2- to 5-minute span while waiting for EMS. During that interval, fire first responders apply oxygen as required, organize the scene, and gather vital sign and medication information. These efforts improve the efficiency of the EMS crew at their arrival. There is little advantage for the expense of training firefighters to a higher level. Most respondents we interviewed (not paramedics), said the money would be better spent improving EMS response times and improving TFS response times to the calls they currently attend.

4.6.1 Shift Patterns

The shifting of medical responsibility, particularly at a higher and more intense clinical level, requires an understanding of the effect of extended work hours on clinical competency and safety.

The Toronto Professional Firefighters' Association, in an extensive document outlining their position on extended shifts, maintained that it is preferable to schedule work on a 24-hour shift model, where firefighters work a continuous 24-hour period with allowance and provisions for *rest* during the shift[34]. Based upon a negotiations mandate, this schedule supplanted the previously negotiated *10/14* two-shift a day approach, which is outlined in their collective agreement. Operational staffing for TFS is best described as a *flat* staffing model, with exactly the same number of apparatus normally scheduled around the clock.

Toronto firefighters work approximately 91, 24-hour days, or 2,184 hours of service availability per year. Although the 24-hour shift model ensures maximal fire response capacity to events at all times of the day, it does not facilitate peak hour staffing changes, with reductions in planned staffing complement over the predictable slow time periods of the day. Further, a 24-hour-shift model assumes adequate time for rest during the shift, a reality that is not provided for in a high performance, dynamic deployment, EMS system such as that operated by TEMS.

This model of staffing, and the actual shift duration, is distinct from the TEMS. The TEMS call volume has peaks and valleys in a relatively predictable manner and provides the ability to shift resources to the time periods in which they are needed. For example, planned peak daytime staffing is 84 units, and the lowest planned nighttime staffing is between 02:00 and 06:00 when 42 units are staffed. Currently, TEMS operational staffing is primarily based on 12 hour shifts, with staggered start and end times to maintain continuity and peak load capacity.

Historically, fire services stand ready for maximal response at any time of the day. This means that there are periods when fire service capacity is available and ready, rather than in use. The culture and history around fire services includes the provision of sleeping quarters (bedrooms), rules, and regulations around use of them, and expectations with respect to the ability to rest during a portion of the shift. This approach is of course distinct from the emergency medical services culture and the operations of the TEMS.

Shift Models Can Influence Patient Care

Shift models can influence patient care. Can a paramedic working on the fire schedule provide consistent and high-quality patient care at any point during their shift? The International

34 Response to City Ergonomics Department, report on the 24 hour shift: TPFFA, undated.

Association of Fire Chiefs (IAFC)[35] takes a potentially differing view on the issue of shift duration in identifying that:

"...highly publicized fatigue-related adverse events have necessitated reform. The authors congratulate the organizations funding this work for anticipating the continued need to juxtapose the work demands and job structures of firefighters and EMS responders and the excellence in performance that typifies those professions. We believe that as the poet said, limits in human abilities must be acknowledged, and adjusting to dynamic work influences is critical for continuing to exceed existing high performance standards, while maintaining the health and wellbeing of firefighters and EMS responders."

The current TFS 24-hour shift pattern may provide a schedule satisfactory for labor relations for the TPFFA and the City. However, it is not a suitable schedule from which paramedics can practice safe patient care. Research is increasingly demonstrating that where paramedics and health care workers are working long hours and receive insufficient rest, they make clinical errors. These are preventable clinical errors that can influence patient morbidity and mortality.

In clearly concluding that the shifts of health care workers need to be managed and reduced, Lockley et al. stated in their recent report[36] that:

"The weight of evidence strongly suggests that extended-duration work shifts significantly increase fatigue and impair performance and safety. From the standpoint of both providers and patients, the hours routinely worked by health care providers in the United States are unsafe. To reduce the unacceptably high rate of preventable fatigue-related medical error and injuries among health care workers, the United States must establish and enforce safe work-hour limits."

In a frightening sample summarizing the effect of a 24-hour shift on medical interns as health care providers, the researchers describe that:

"(interns)....working traditional schedules with recurrent 24-hour shifts:

- *Make 36 percent more serious medical errors than those whose scheduled work is limited to 16 consecutive hours*
- *Make five times as many serious diagnostic errors*
- *Have twice as many on-the-job attentional failures*
- *Suffer 61 percent more needlestick and other sharp injuries after their 20th consecutive hour of work*
- *Double their risk of a motor vehicle crash when driving home after 24 hours of work*
- *Experience a 1.5 to 2 standard deviation (S.D.) deterioration in performance relative to baseline rested performance on both clinical and nonclinical tasks*

[35] International Association of Fire Chiefs: *The Effects of Sleep Deprivation on Firefighters and EMS Responders*, June 2007.
[36] *Effects of Health Care Provider Work Hours and Sleep Deprivation on Safety and Performance*. Steven W. Lockley, PhD et al., The Joint Commission Journal on Quality and Patient Safety. Nov 2007. Vol 33 Number 11 Supplement

- *Suffer decrements in performance commensurate with those induced by a blood alcohol level of 0.05 to 0.10 percent"*

Translating this to the EMS world, Patterson et al.[37] provided similar conclusions regarding risk of medical error, harm, injury, and safety for paramedics in stating that:

> *"After controlling for confounding, we identified 1.9 greater odds of injury (95 percent CI 1.1, 3.3), 2.2 greater odds of medical error or AE (95 percent CI 1.4, 3.3), and 3.6 greater odds of safety-compromising behavior (95 percent CI 1.5, 8.3) among fatigued respondents versus non-fatigued respondents. One of the key causative factors identified in this research was EMS workers working 24-hour shifts."*

Finally, Patterson et al.[38] provide similar findings in their review of EMS workers, with clear linkage between the issue of fatigue and working extended shift hours.

> *"Shift length is likely related to fatigue, with longer EMS shifts potentially impairing certain aspects of job performance. 33 Individuals who stay awake for 19 or 24 hours show impairment on a simple reaction time test similar to research subjects with blood alcohol concentrations of 0.05 percent and 0.10 percent, respectively."*

Shift Models and Performance

The consulting team is not aware of ambulance service providers in major metropolitan centers across Canada and the U.S. (with some fire-based exceptions in the U.S.) with a 24-hour shift pattern. The consulting team cannot support such a pattern for a clinical patient care provider. While the practice is already existent at the primary first responder level for the TFS, the consulting team believes the risk, based on evidence, of 24-hour shifts is too clear at the higher qualification levels where paramedics have clinical decision making and focused, precise, clinical care responsibility.

Considering that shift overruns due to patient care are not infrequent in Emergency Medical Services the consulting team will not support a paramedic shift model that exceeds 12 hours duration, rather than 16 hours as noted earlier.

This concern influences the provision and integration of paramedic responders within the TFS response team. An agreement with the TPFFA would need to be achieved if the idea of firefighter paramedics is entertained. The agreement would have to outline that either the scheduling provisions for TFS operations be reverted to maximum 12-hour shift staffing, or alternatively, that medical responders working as part of TFS be on a different staffing and delivery pattern than responders that do not have an advanced clinical practice role. Acting upon this concern could have a financial impact on the TFS operations, potentially requiring an

[37] *Association Between Poor Sleep, Fatigue, and Safety Outcomes in Emergency Medical Services Providers*. P Daniel Patterson, PhD. et al., Pre-hospital Emergency Care. 2012;16:86–97.

[38] *Sleep Quality and Fatigue Among Pre-hospital Providers*. P Daniel Patterson, PhD, MPH, et al. Pre-hospital Emergency Care, April/June 2010. Volume 14, Number 2.

increase in operational firefighting staff to support an appropriate work pattern. Whether it has an impact in the form of increased staffing or not, the effect of having staff with 12 and 24 hour shift patterns staffing a single pumper will cause operational inefficiencies within the fire services. For example, overtime is likely to increase and, in some cases, an incoming paramedic firefighter may not have an apparatus to staff if the pumper is out of the station at shift change.

4.6.2 Fire Response Volumes to Medical Events

At the outset of this project, the data provided by the TFS indicated that, in 2011, it responded to 84,710 medical events. The frequency of medical responses had increased by about 19 percent over the 7-year period starting in 2005. This represents fire response to approximately 24% of all EMS events and 44% of patients transported by EMS.

In June of 2012, based on research and recommendations from base hospital physicians and an authoritative panel, and incorporating both TEMS and TFS medical oversight, the City implemented a change to protocols which reduced the annual number of fire responses to medical events to approximately 50,000 while maintaining an appropriate clinical service delivery model. First responders are now being assigned to events where there is a 1 percent or more expectation of first responder intervention having the possibility of a more positive patient outcome.

If, in a paramedic firefighter model, the fire service responded to most medical calls (there were 254,514 unique medical incidents in 2011), the TFS response volume would increase by more than 200,000 medical responses per year from current. The impact of this increase on the TFS staff's ability to rest within a 24-hour shift would be significant. Further, equipment and operating costs for the TFS fire apparatus (currently approximately $4.98 per kilometer), would potentially rise steeply.

Alternatively, to avoid responding to such a high volume of incidents even in a paramedic firefighter response model, TFS could continue the existing practice of responding to only those calls where there is a 1 percent or more expectation of first responder intervention having the possibility of a more positive patient outcome. However, the disadvantage of that response model is the impact on skills maintenance for a firefighter paramedic insofar as there would be approximately 84 firefighter paramedics on duty at any time responding to a total of 50,000 incidents annually or an average of 136 a day. There would be some days when individual firefighter paramedics would encounter only one or two patients - or possibly none – and there will be many times when patients will not require an intervention of the nature that would allow firefighter paramedics to practice and maintain skills. In the model discussed here, skills maintenance would be a challenge not only for firefighter paramedics, but it might reduce the opportunity for EMS paramedics to practice and maintain their skills since there would be more paramedics on the road resulting in staff saturation.

If all or most fire apparatus are staffed by a firefighter paramedic, then perhaps – as in Winnipeg – only fire apparatus may need to be sent to some calls. However, the decision as to which calls require a firefighter paramedic, but not an ambulance, pending assessment by a firefighter paramedic, would have to be based on base hospital physician input.

For response to high acuity calls, where the skills of the responding paramedic may be required, research would be required to determine which calls are clinically safe to send only a single responder (no backup). If a backup is required (as in about 75 percent of the cases), the backup is delayed unless it is dispatched at the outset of the call. For example, motor vehicle accidents may or may not have a patient, and a patient may or may not be critical. Yet a delayed response to a motor vehicle accident can delay needed and appropriate high-level clinical care and transportation. Severe trauma is one of the actual clinical indicators that empirical research almost uniformly reports as benefitting from shorter times to definitive care. Delaying ambulance response to these patients speculatively would be equivalent to delaying ambulance transport times.

We must keep in mind that one of the considerations for the implementation of firefighter paramedics is to reduce call volume pressure on emergency medical services possibly by firefighter paramedics attending some incidents and then deciding whether an ambulance is needed rather than dispatching one immediately. Ministry of Health and Long Term Care concurrence would be required as, presently, there is no option for the emergency medical services dispatch centre to not send an ambulance to a service request. In fact, legislation requires that an ambulance be sent to every request. Therefore, it is likely that legislative change would have to be put in place in order to delay ambulance dispatch, in some cases, until firefighter paramedics make a decision that transportation is required.

There is no evidence that, within existing legislation, there will be an impact in the form of reduced ambulance responses because of the implementation of paramedics on fire trucks. Therefore, we are not able to find an advantage in this regard by utilizing firefighter paramedics.

Decision-making by a paramedic in regards to the need for ambulance clinical treatment/transportation includes a high risk factor, and such decision-making requires extensive medical oversight. Some systems send single paramedics to low acuity events to determine if there is a need for other treatment (or referral other than hospital transport). Essentially, this is the model that the TEMS is attempting to put into place as part of their community paramedicine approach. The paradox of this approach is that the ambulance responses best served by this model are the low acuity calls—calls to which the TFS do not respond.

Typically, systems implementing low acuity response models, such as the expanded care paramedic model used in the UK, use higher trained paramedics (the equivalent of an advanced care paramedic with additional training). From a clinical perspective, this creates less risk of adverse outcomes. Further, low acuity response models generally use a single responder in a low acuity response vehicle, not a full fire response crew with a major piece of equipment. In low acuity calls, less is better. So the primary care paramedic, as part of the fire crew, is likely not the best utilization of resources on low acuity calls. A firefighter paramedic response model does not present any advantage to mitigation programs such as community paramedicine.

The model that Toronto uses today includes a fire first responder, trained to an acceptable level to provide immediate, short-term interventions as part of a continuum of care, supported by higher trained paramedics and appropriate transport units.

4.6.3 Considerations and Conclusions

Certainly, Toronto has a robust, system-leading ambulance service unlike the history of some locations in the United States; it does not have several ambulance services as there were in

Winnipeg; and Toronto does not have an ambulance service with available time to fight fires as in Philadelphia or some parts of Alberta.

So the key questions are:

1. What Toronto-centric operational reasons are there for adopting one of the firefighting paramedic models?
2. Will a combined fire – EMS patient care delivery model be beneficial to citizens of the City of Toronto, and why?

There are two possible primary consolidation models:

1. Consolidate the fire – EMS system; and
2. The implementation of paramedics on fire trucks to alleviate pressure on the EMS system.

Considering that:

- There are factors that must be taken into account with respect to legislation and response vehicles that will require negotiation with the Ministry of Health and Long Term Care.
- A gatekeeping role to preserve ambulance response capacity presumes a relatively sophisticated level of knowledge and skill by the primary care practitioner. Such skills are normally achieved through training, medical oversight, and extensive clinical experience.
- To train 411 firefighters to the PCP level would cost approximately $6.16 million for tuition, books, and other requirements, plus a direct wage cost of $67.13 million.
- Cultural differences were stated to be a primary challenge within the consolidation of fire and emergency medical services in Winnipeg.
- Skills maintenance will be a challenge due to the added number of EMS practitioners within the fire service. Skills will have to be honed in a hospital setting adding additional training and staff replacement costs.
- Opportunities for women in fire services are not as well established or defined as in EMS. Any initiative to shift paramedic responsibilities to a fire based model would need to include strategies from a gender and equity perspective to ensure a comprehensive balance is sustained at the outset.
- The TFS arrives at Echo and Delta events before TEMS 67% of the time but TEMS reaches the scene within 2 minutes of the fire service in just over 60% of the cases when fire arrives first.
- The original intention of the first responder system was for TFS to provide needed time-critical interventions for the few additional minutes that it might take TEMS to arrive. It is an appropriate supplement, not a substitute, to TEMS response on time-critical emergencies.

- The TFS already has the tools and training to deal with the comparatively few time-critical medical emergencies that require intervention within minutes until paramedics can arrive.
- Most respondents we interviewed (not paramedics), said the money would be better spent improving EMS response times and improving TFS response times to the calls they currently attend.
- Firefighters work a 24 hour shift pattern. There is ample evidence that shifts in excess of 16 hours – likely less – are detrimental to patient treatment as well as practitioners.
- There is no evidence that, within existing legislation, there will be an impact in the form of reduced ambulance responses because of the implementation of paramedics on fire trucks. Therefore, there is no advantage in this regard by utilizing firefighter paramedics.
- The firefighter paramedic response model does not present any advantage to mitigation programs such as community paramedicine.

Our review has led to the following conclusions:

- There is no advantage to a firefighter paramedic service delivery model in Toronto. Startup costs are significant and maintenance of skills will present a significant challenge.
- The implementation of paramedics within the fire service, whether as part of an integration of TFS and TEMS or the continuation of the two entities would require extensive review of operating parameters. Toronto leadership and the MOHLTC would have to discuss the applicability of the *Ambulance Act* and other regulations to a firefighter paramedic response model.
- System modification to train firefighters as paramedics in order to place a paramedic on one apparatus per station would require an expenditure of greater than ($6.16 + $67.13) = $73 million or more. Alternatively, hiring paramedics, upon attrition in the firefighter ranks, and training them as firefighters, would take approximately 5 years or more to achieve.
- System modification to place a paramedic on every, or most, responding fire apparatus would likely not result in improved clinical outcomes.
- System modification to place a paramedic on every, or most, responding fire apparatus would require those personnel to be scheduled in a clinically acceptable, supportable, and safe shift pattern (not 24 hour shifts), which could increase the cost of TFS operations.
- The existing responder training level for TFS personnel is clinically appropriate for immediate response to most medical or traumatic injuries, when responders are appropriately trained and qualified paramedics follow closely.

- Based on the evidence of other major cities as well as our analysis of Toronto, there is no benefit to a firefighter paramedic model in Toronto – in fact there are several disadvantages.
- We also recognize that the idea of firefighter paramedics has been a subject of much debate in Toronto and North America. In Toronto, at least, this examination should conclude the debate.

4.6.4 Recommendation

- Do not consider implementing a firefighter-paramedic model of pre-hospital emergency medical care in either an organizationally consolidated entity or in the existing separate organizational design.

4.7 Organizational Analyses of TFS and TEMS

This section of the report provides

a) An organizational design assessment of the TFS and TEMS, and

b) The potential for consolidation of the TFS and TEMS from a design perspective.

The section is divided into five parts:

- Approach to conducting organizational assessments
- Framework for evaluating organizational alternatives
- Organizational alternatives for the emergency medical services
- Organizational alternatives for the fire services, and
- Potential consolidation of the fire services and emergency medical services

4.7.1 Overall Approach to Conducting Organizational Assessments

Organizational Analysis is More Art than Science

Determining an organizational structure that is objectively best for an entity is generally not possible. Knowledgeable leaders and even experts may disagree about the virtues of different structures. Within the range of reasonable alternatives, some observers might prefer one alternative while others might prefer another.

In addition, the structure that will work best for an organization depends on its people, management systems, culture, and priorities. For example, an organizational structure that is theoretically sound will not serve an organization well unless the existing staff has the capabilities to implement the structure[39]. Available management systems also affect what

[39] Of course, if the structure is sound, an organization might work to develop the staff capabilities needed to support the structure and implement the structure over time.

organizational structures are practical. In general, more effective information and communications systems are needed to implement a decentralized structure than to implement a more centralized structure. Moreover, the culture of an organization influences organizational features that should be emphasized. While an organization with a strong culture of accountability may not need a structure that facilitates accountability, other organizations may need organizational structures to enhance accountability and performance. Organizational priorities—which may change over time—also influence the types of structures that will work best for an organization.

The management style and capabilities of key leaders also influence the type of structure that should be implemented. No matter how capable, all managers have strengths and weaknesses. An effective structure leverages managerial strengths and compensates for short-comings.

Organizational Analysis Should Explicitly Consider Tradeoffs in Organizational Alternatives

The *art* of organizational design centers on making tradeoffs. An organizational structure designed to help an organization achieve one set of objectives and priorities may be ill suited to support efforts to achieve different objectives. Hence, *effectively* evaluating organizational alternatives requires making these tradeoffs explicit. To the extent possible, tradeoffs implicit in an entity's organizational structure should reflect the organization's needs and priorities.

The Systematic Approach Taken to Develop and Evaluate Organizational Alternatives

Our general approach to developing recommended organizational structures for each department has seven steps:

1. Identify purposes of organizational structures used to evaluate organizational alternatives
2. Weight the relative value of each organizational purpose
3. Develop alternative structures using structural paradigms
4. Use an organizational purposes framework to evaluate each alternative
5. Develop an organizational alternative that combines the best features of the most promising alternatives
6. Assess the viability of this alternative given each department's people, systems, and culture
7. Use the evaluation framework to confirm benefits of the recommended structure

Taking this approach has a number of advantages:

- A systematic approach is taken to assess the relative merits of alternative organizational structures
- Evaluation criteria are weighted to reflect the city of Toronto's priorities
- The best features of the paradigmatic organizational structures are combined to develop the recommended structure

- The recommended structure is assessed in terms of its viability; this ensures that a theoretically sound organizational structure, which may not be operationally or otherwise practical, will not be recommended.

4.7.2 Evaluation Framework

The framework that was used to evaluate organizational alternatives was developed in two steps. First, *core purposes of organizational structure* were identified. Next, each *core purpose was weighted* to reflect its relative importance to the city of Toronto.

Core Purposes of Organizational Structure

Sixteen core purposes of organizational structure were identified:

- *Oversight:* Oversee the work of subordinates and work to ensure unit objectives are met;
- *Accountability:* Facilitate efforts to hold individuals accountable for achieving organizational objectives;
- *Decision-making and authority:* Clarify the individuals who are responsible for making key decisions, and assign to them, the authority needed to make, and as necessary, enforce decisions;
- *Expertise and judgment:* Allow the organization to benefit from the expertise and judgment of key personnel;
- *Internal communications:* Provide a vehicle through which information is communicated from one part of the organization to another;
- *External communications:* Facilitate efforts to communicate effectively with external stakeholders;
- *Coaching/support:* Provide mechanisms for ensuring individuals have the support they need to effectively achieve organizational objectives;
- *Flexibility:* Support efforts to respond effectively to emerging needs and to proactively address issues;
- *Sustainability in addressing long-term objectives:* Facilitate efforts to take a consistent approach to addressing long-term objectives;
- *Values:* Highlight functions that are consistent with and communicate organizational values to both internal and external stakeholders;
- *Capabilities:* Ensure that the capabilities crucial to organizational success (for example, understanding citizen needs or establishing effective performance management systems) are available;
- *Service:* Facilitate efforts to provide high-quality services that are tailored to resident needs;

- *Organizational structure costs:* Minimize the structure's costs;
- *Operational cost-effectiveness:* Support efforts to make efficient use of resources throughout the organization and to leverage synergies among similar functions;
- *Employee development:* Create opportunities to engage employees (allowing them to develop needed capabilities) and support succession planning;
- *Reduce risks and liabilities:* Provide checks and balances and other features that reduce the organization's risks and liabilities.

Weighting of Core Organizational Purposes

Each organizational purpose was weighted to reflect its relative priority to the City of Toronto (based on the consultants' understanding of these priorities). The relative priority for each purpose was weighted so that the sum of the weights for all purposes equaled 1 (see **Error! eference source not found.**).

Table 14 - Weight Given to Each Organizational Purpose

Organizational Purpose	Weighting
Accountability	0.105
Operational cost-effectiveness	0.105
Service	0.105
Flexibility	0.093
Sustainability	0.093
Capabilities	0.075
Decision-making and authority	0.063
Organizational structure costs	0.063
Oversight	0.063
Expertise and judgment	0.050
External communications	0.040
Internal communications	0.040
Values	0.030
Coaching/support	0.025
Employee development	0.025
Reduce risks and liabilities	0.025
Total all purposes	1.000

Evaluation Framework

To evaluate organizational alternatives each *potential structure* is rated on a 5-point scale where a rating of *1* means the structure does "not at all" support the organizational purpose and a rating of *5* means the structure "fully supports" the organizational purpose. Multiplying the weighting for each organizational purpose by the rating for each purpose and then summing them over all organizational purposes results in a single evaluation score that can be used to assess the relative merits of alternative structures.

For the intents of this analysis, the current structure is rated a *3* for each organizational purpose (and therefore has an overall evaluation score of 3.0 after the weighted scores for each organizational purpose is summed). The ratings for each organizational purpose for each organizational alternative presented will be compared to the current structure. Consequently, the overall evaluation score for each alternative reflects a comparison to the current structure.

4.7.3 TEMS Organizational Assessment

The development of organizational alternatives for the emergency medical services proceeded in a number of steps:

Step 1—Develop alternative structures using the structural paradigms

Step 2—Evaluate each alternative

Step 3—Develop an organizational alternative that combines the best features of the most promising alternatives

Step 4—Assess the viability of this alternative

Step 5—Confirm the benefits of the recommended structure

Four paradigmatic organizational structures were developed:

1. **Geographic**—Deploys and organizes resources by geographic area
2. **Management expertise**—Organizes resources around the management expertise needed to perform specific activities
3. **Customer**—Organizes the department by customer grouping
4. **Key functions**—Identifies key functions needed for organizational success and organizes around those functions

Geographic Structure

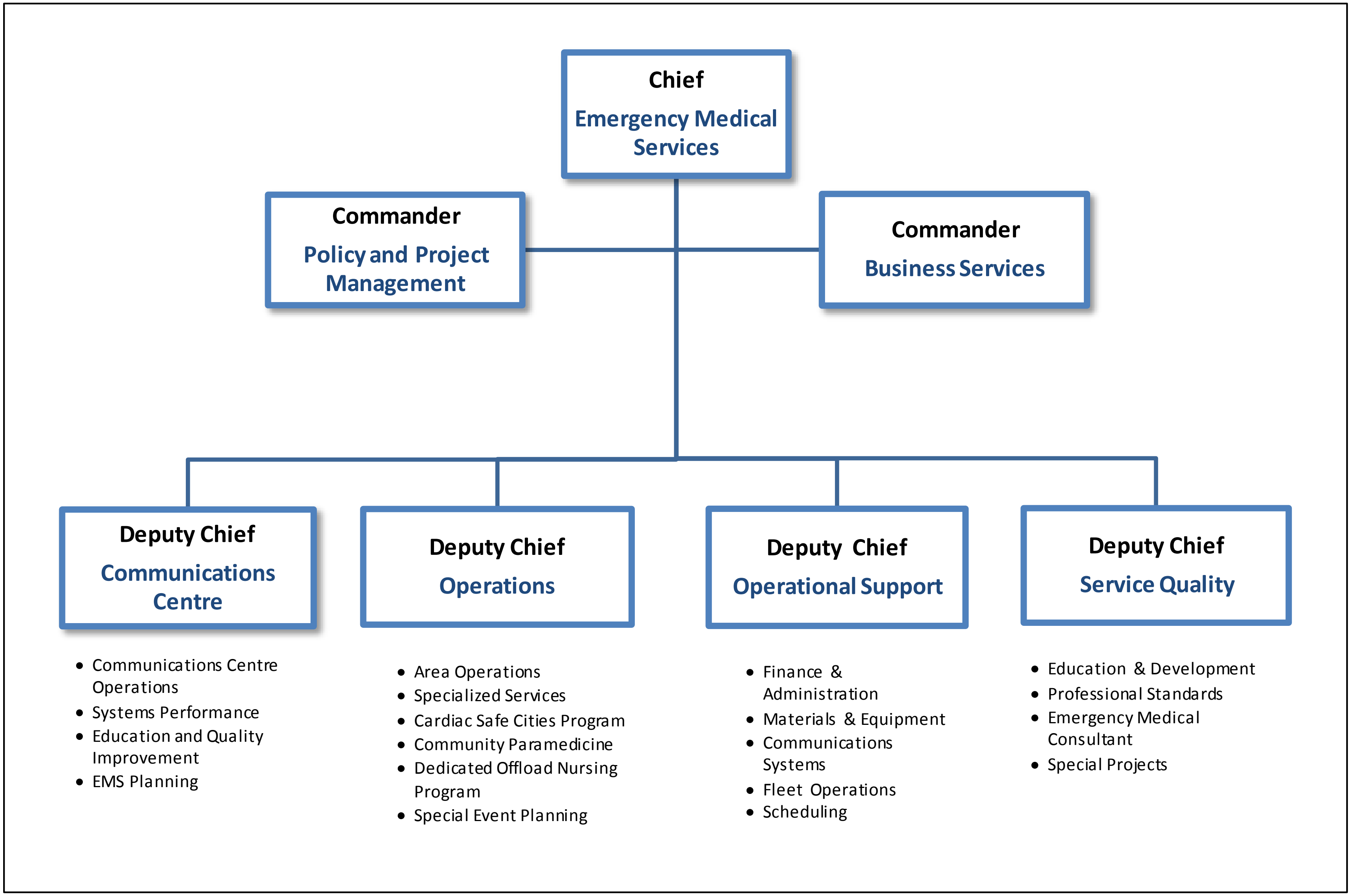
In a geographically oriented structure, service delivery is organized around geographic areas. Geographic managers are charged with tailoring services to address the needs of each geographic area. Support functions and activities are assigned to geographic units as long as it is cost-effective to do so.

Table 40 presents the structure of the emergency medical services as if it were organized geographically. The primary difference between a geographic structure and the current structure is that the programs that support more effective operations (the dedicated offload nursing program) and alternative approaches to providing service (the *Cardiac Safe City Program* and the Community Paramedicine Program are assigned to the operations unit. In this structure, the commanders who are responsible for each geographic district would not only be charged with ensuring high quality EMS services are provided, but also charged with efforts to provide service alternatives.

As compared to the current structure, a geographically oriented structure represents an improvement in three areas: accountability, service, and flexibility.

Table 15—Structure of the Emergency Medical Services if Organized Geographically

Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	4.000	0.420	Accountability for the full range of service alternatives in a given geographic area is enhanced
Operational cost-effectiveness	0.105	3.000	0.315	
Service	0.105	4.000	0.420	Strengthens ability to tailor services to needs
Flexibility	0.093	4.000	0.372	Ability to adjust services to reflect emerging needs in a given area is enhanced
Sustainability	0.093	3.000	0.279	
Capabilities	0.075	3.000	0.225	
Decision-making and authority	0.063	3.000	0.189	
Organizational structure costs	0.063	3.000	0.189	
Oversight	0.063	3.000	0.189	
Expertise and judgment	0.050	3.000	0.150	
External communications	0.040	3.000	0.120	
Internal communications	0.040	3.000	0.120	
Values	0.030	3.000	0.090	
Coaching/support	0.025	3.000	0.075	
Employee development	0.025	3.000	0.075	
Reduce risks and liabilities	0.025	3.000	0.075	
Total all purposes	1.000		3.303	



GEOGRAPHICALLY ORIENTED EMERGENCY MEDICAL SERVICES STRUCTURE

Management Expertise Oriented Structure

The expertise of managers drives a structure focused on leveraging managerial skills and experience. This organizational alternative takes as an assumption that managers who are effective managing one type of enterprise may be less effective handling another type of enterprise. Moreover, when structures are organized around management expertise, the staff assigned to units tends to have similar capabilities. This often facilitates efforts to leverage staff expertise across units.

Table 16 presents the structure of the emergency medical services if it were organized around management expertise. The structure groups EMS functions into areas requiring different management skills and abilities:

- 24-hour emergency operations
- Non-emergency support
- Human resource management
- Program development and management
- Systemic improvement
- External relations

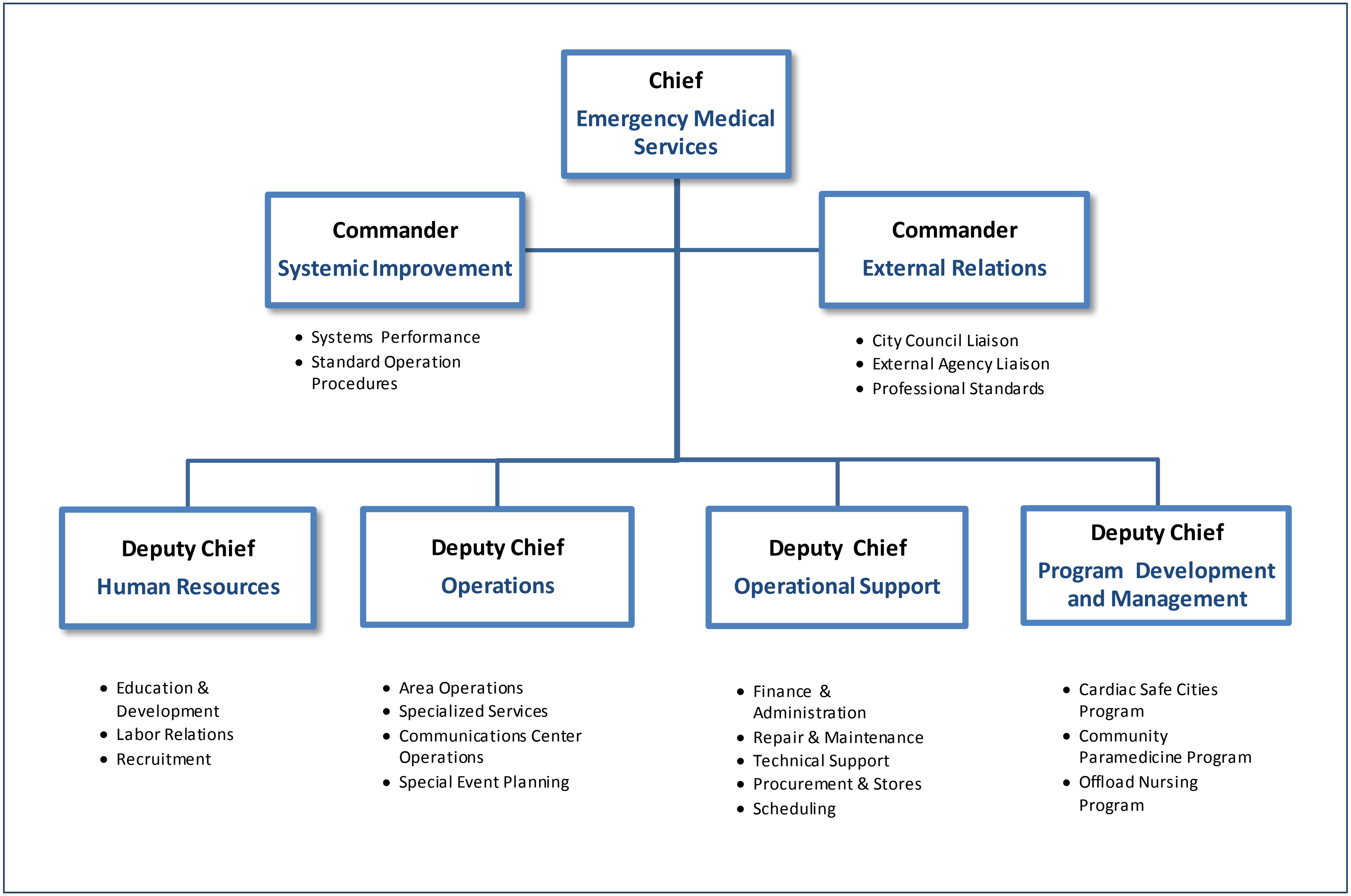
The operations unit would include both EMS response and communications operations—both of which are 24-hour enterprises. The communications function, however, would only include 24-hour operations. The systems performance function that is currently part of the communications division would report to the systemic improvement unit. The EMS planning function would be assigned to the technical support functions, and the communications training would be assigned to human resources.

In this structure, non-emergency support functions would also be organized into units that can leverage managerial skills: finance and administration, repair and maintenance, technical support, procurement and stores and scheduling.

A structure organized around management expertise represents an improvement over the current structure in seven areas: accountability, operational cost-effectiveness, service, capabilities, expertise and judgment, external communications, and employee development.

Table 16 - Structure of Emergency Medical Services if it were Organized around Management Expertise

Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	4.000	0.420	Accountability for key functions—human resources, systemic improvement, and external relations—will be enhanced.
Operational cost-effectiveness	0.105	4.000	0.420	Managers with appropriate expertise will be able to enhance cost-effective operations.
Service	0.105	4.000	0.420	A unit is established that focuses on systemic improvement.
Flexibility	0.093	3.000	0.279	
Sustainability	0.093	3.000	0.279	
Capabilities	0.075	4.000	0.300	Capabilities important to the organization's success—systemic improvement and external relations—report to a single manager.
Decision-making and authority	0.063	3.000	0.189	
Organizational structure costs	0.063	3.000	0.189	
Oversight	0.063	3.000	0.189	
Expertise and judgment	0.050	5.000	0.250	The structure is designed to leverage expertise and judgment of managers.
External communications	0.040	4.000	0.160	External communications will be enhanced by combining the functions in a single unit.
Internal communications	0.040	3.000	0.120	
Values	0.030	3.000	0.090	
Coaching/support	0.025	3.000	0.075	
Employee development	0.025	4.000	0.100	Rotating commanders and superintendents through the systemic improvement functions would build operational improvement skills and perspectives.
Reduce risks and liabilities	0.025	3.000	0.075	
Total all purposes	1.000		3.555	



EMS STRUCTURE ORGANIZED AROUND MANAGEMENT EXPERTISE

Customer Oriented Structure

Table 17 presents the structure of the emergency medical services if it were organized around customer groupings. Four customer groupings were used in developing this organizational alternative:

1. Emergency response customers
2. Non-emergency response customers
3. Internal customers
4. External stakeholders

While a customer-oriented structure would reduce the number of senior managers needed and would potentially improve service – accountability, operational cost-effectiveness, flexibility, capabilities and expertise, and judgment would suffer.

Key Functions Oriented Structure

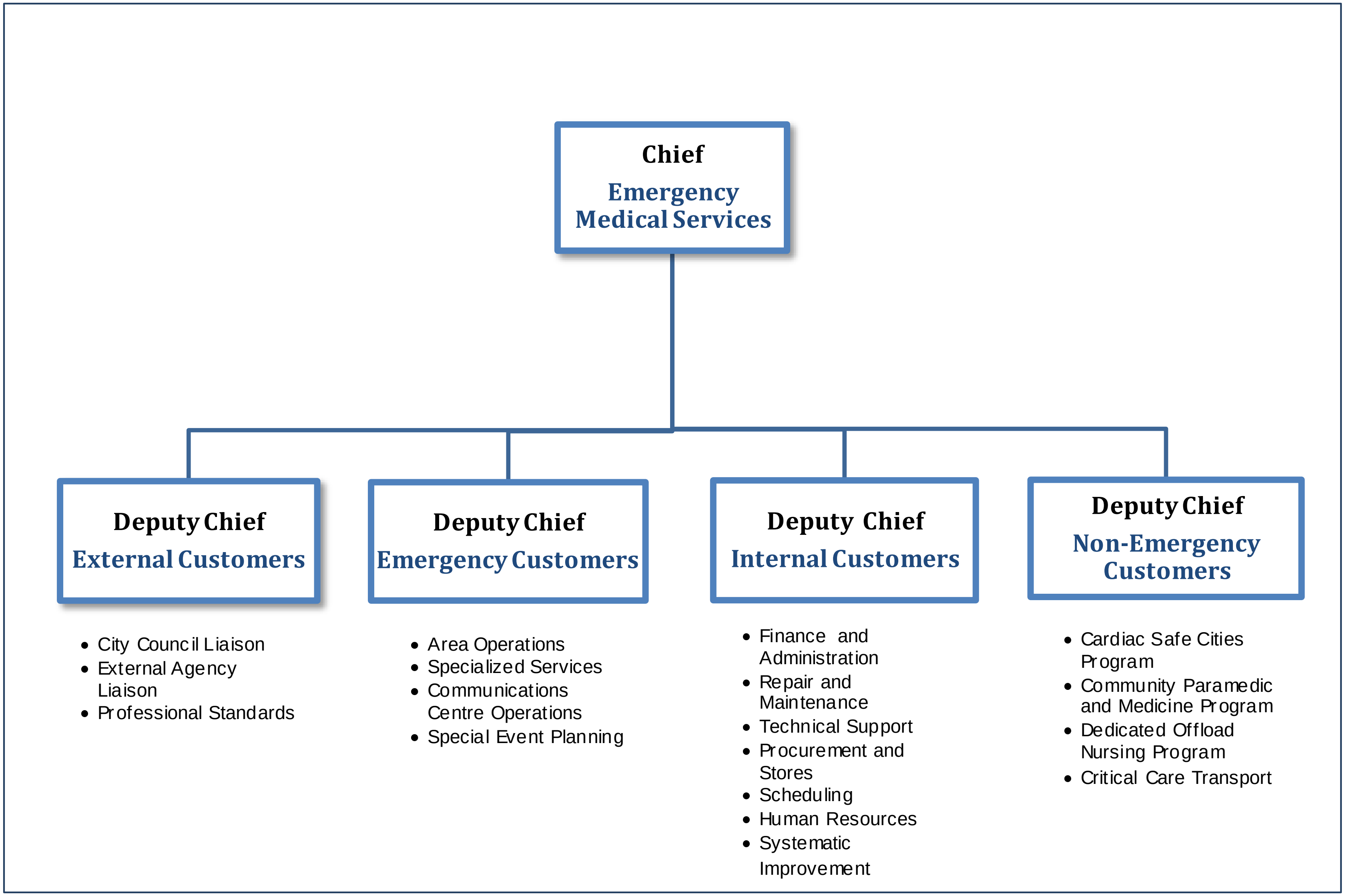
Table 18 presents the structure of the emergency medical services if it were organized around the activities and functions that are the most important to the department's success. The *key functions* were identified based on discussions with department leaders and the experience of the consulting team:

- Management and operational analysis
- Emergency response
- Human resource management
- Alternative response
- Communications
- Operational support
- External relationship management

A *key functions* organization represents an improvement over the current structure in seven areas: accountability; operational effectiveness; service; sustainability; capabilities; external communications; values; and employee development.

Table 17 - Structure of Emergency Medical Services if it were organized around Customer Groupings

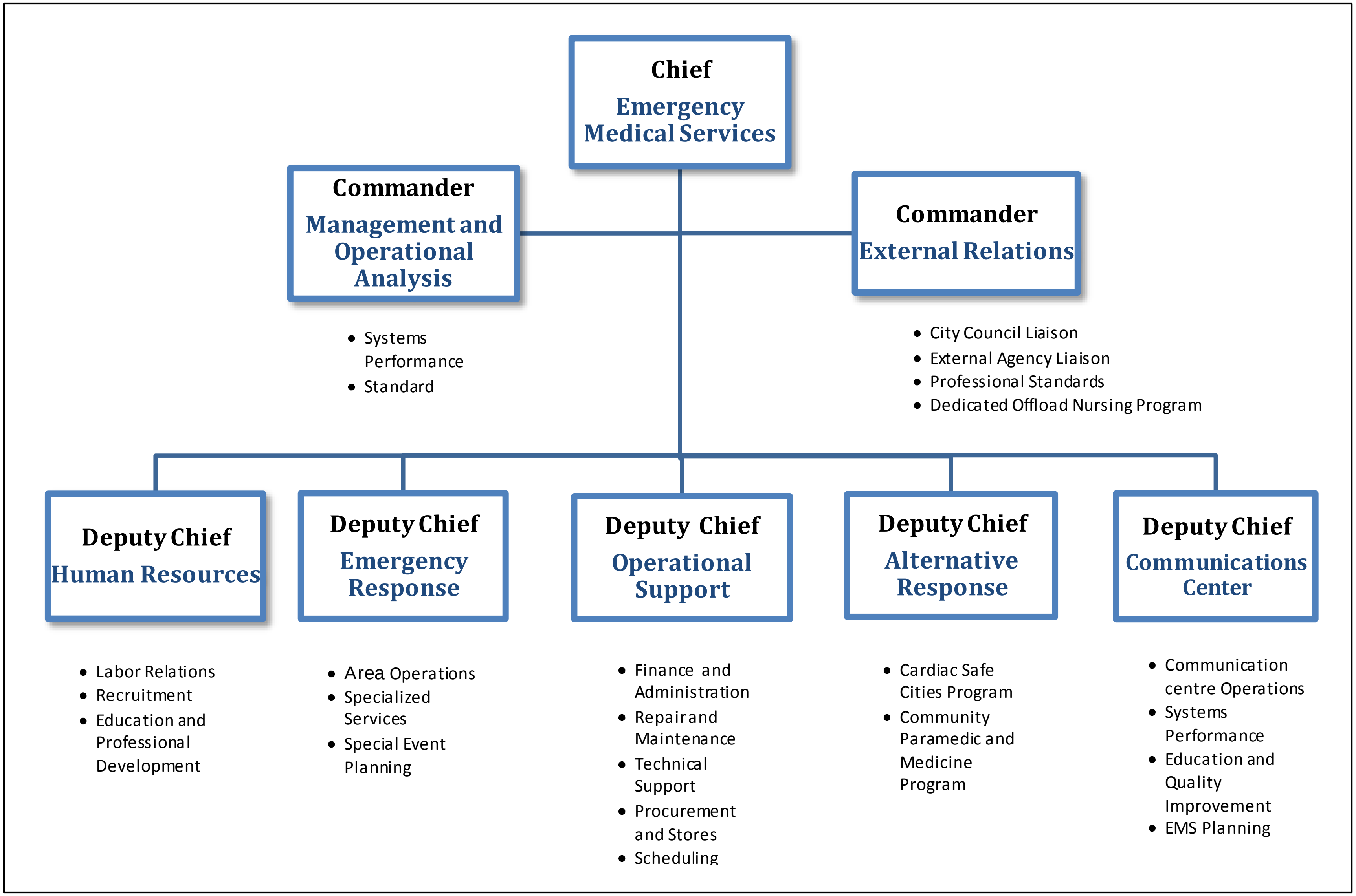
Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	2.000	0.210	Assigning disparate functions to the same organizational units will limit accountability for the performance of some functions.
Operational cost-effectiveness	0.105	2.000	0.210	Separating responsibility for critical care transport from emergency response may increase costs.
Service	0.105	4.000	0.420	Services can be tailored to better meet the needs of customers.
Flexibility	0.093	2.000	0.186	Assigning staff who address the needs of different customers to the different units limits operational flexibility.
Sustainability	0.093	3.000	0.279	
Capabilities	0.075	2.000	0.150	Responsibility for functions critical to organizational success (for example, human resources and systemic improvement) has a lower organizational profile.
Decision-making and authority	0.063	3.000	0.189	
Organizational structure costs	0.063	4.000	0.252	Fewer senior managers are needed to implement this structure.
Oversight	0.063	3.000	0.189	
Expertise and judgment	0.050	2.000	0.100	Combining disparate functions to the same organizational units makes it more difficult to leverage expertise and judgment.
External communications	0.040	3.000	0.120	
Internal communications	0.040	3.000	0.120	
Values	0.030	3.000	0.090	
Coaching/support	0.025	3.000	0.075	
Employee development	0.025	3.000	0.075	
Reduce risks and liabilities	0.025	3.000	0.075	
Total all purposes	1.000		2.740	



CUSTOMER ORIENTED EMS STRUCTURE (Customer Groupings)

Table 18 - Structure of the Emergency Medical Services as if it Were Organized Around Key Functions

Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	4.000	0.420	Accountability for the functions most critical to the department's success is well defined.
Operational cost-effectiveness	0.105	4.000	0.420	A unit is established specifically responsible for identifying opportunities to improve management and operations.
Service	0.105	5.000	0.525	
Flexibility	0.093	3.000	0.279	
Sustainability	0.093	4.000	0.372	The structure emphasizes the department's key strategic initiatives—the need to develop and implement alternative service delivery options
Capabilities	0.075	5.000	0.375	The structure is organized around the capabilities most critical to the department's success.
Decision-making and authority	0.063	3.000	0.189	
Organizational structure costs	0.063	2.000	0.126	Implementing a customer oriented structure will increase management needs somewhat.
Oversight	0.063	3.000	0.189	
Expertise and judgment	0.050	3.000	0.150	
External communications	0.040	4.000	0.160	A unit is dedicated to supporting external communications.
Internal communications	0.040	3.000	0.120	
Values	0.030	5.000	0.150	The structure reflects the functions that are most important to the department's success.
Coaching/support	0.025	3.000	0.075	
Employee development	0.025	4.000	0.100	A unit is established that focuses on employee quality; rotating staff through the systemic improvement unit will also develop needed skills.
Reduce risks and liabilities	0.025	3.000	0.075	
Total all purposes	1.000		3.725	



KEY FUNCTIONS ORIENTED EMS STRUCTURE

4.7.4 TEMS Recommended Structure

The recommended organizational structure for EMS is that of a geographic orientation but tempered to reflect management expertise.

Key features of the Recommended Structure

Promising features of each paradigmatic organizational structure were used to develop the recommended structure presented in Table 19. This structure organizes the delivery of the department's core services geographically. Unlike in the geographic structural alternative, however, this geographic orientation is tempered to reflect management expertise. For example, instead of assigning responsibility for managing service delivery alternatives to the section managers, responsibility for developing alternative service delivery approaches is assigned to its own unit. Geographic managers will, however, have a strong incentive to implement viable alternative service delivery approaches because they will be held accountable for managing call volume in their regions.

The key functions necessary to the department's success – systemic improvement, external relations, human resources, operations, operational support, and alternative service delivery – are highlighted in the recommended structure. This structure will enhance accountability for performing these key functions. The structure also facilitates a manager's ability to focus on what they do best.

- The Deputy Chief—Alternative Service Delivery will focus exclusively on developing and supporting the implementation of these programs.[40]
- The Deputy Chief—Human Resources will be responsible for ensuring the quality of department staff.
- All 24-hour operations – The EMS response and transport as well as communications—are assigned to the Deputy Chief – Operations.[41]
- Responsibility for performance improvement efforts is assigned to a single manager.[42]
- Responsibility for external relations – which is especially important to a department whose funding is provided by both the province and the City – is assigned to a single manager.

[40] The offload nursing program reports to the Deputy Chief whose operating unit directly benefits from this program.
[41] Communications support functions (e.g., systems performance, education and quality improvement, and EMS planning) are assigned to units focusing on these issues for the entire department.
[42] The operations superintendents who report centrally and currently support improvement efforts are assigned to this unit.

Table 19 - Recommended Structure of the Emergency Medical Services—Geographically Organized Structure Tempered to Reflect Management Expertise

Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	4.000	0.420	Accountability for the functions most critical to the department's success is well defined.
Operational cost-effectiveness	0.105	4.000	0.420	A unit is established specifically to be responsible for identifying opportunities to improve management, and the operations segment is incorporated in the structure; the structure also facilitates efforts to leverage management expertise.
Service	0.105	4.000	0.420	The unit's focuses on systemic improvement will also focus on improving services.
Flexibility	0.093	3.000	0.279	
Sustainability	0.093	4.000	0.372	The structure emphasizes the department's key strategic initiatives—the need to develop and implement alternative service delivery options.
Capabilities	0.075	5.000	0.375	The structure is organized around the capabilities most critical to the department's success.
Decision-making and authority	0.063	3.000	0.189	
Organizational structure costs	0.063	4.000	0.252	Implementing this structure will modestly reduce organization structure costs.
Oversight	0.063	3.000	0.189	
Expertise and judgment	0.050	5.000	0.250	The structure is designed to leverage expertise and judgment of managers.
External communications	0.040	4.000	0.160	A unit is dedicated to supporting external communications.
Internal communications	0.040	3.000	0.120	
Values	0.030	5.000	0.150	The structure reflects the functions that are most important to the department's success.
Coaching/support	0.025	3.000	0.075	
Employee development	0.025	4.000	0.100	A unit is established that focuses on employee quality; rotating staff through the systemic improvement unit will also develop needed skills.
Reduce risks and liabilities	0.025	3.000	0.075	
Total all purposes	1.000		3.846	

Operational support units are organized based on types of expertise needed to manage the units.

Viability of the Recommended Structure

Implementing the recommended structure is viable. No people, systems, or cultural barriers should hinder implementation of the recommended organizational structure because the structure retains key features of the department's service delivery and support systems. However, the recommended reorganization of key functions should allow the EMS chief to leverage the skills of key managers more effectively.

The only barrier to implementation relates to funding. The recommended structure assigns functions that are currently dedicated to the Communications Division (systems performance, education and quality improvement, and EMS planning) to units that serve the entire organization. Because communications operations are currently 100 percent funded by the province, these crucial communications support functions are also fully funded by the province. If the recommended structure is implemented, these functions must continue to be fully funded by the province.

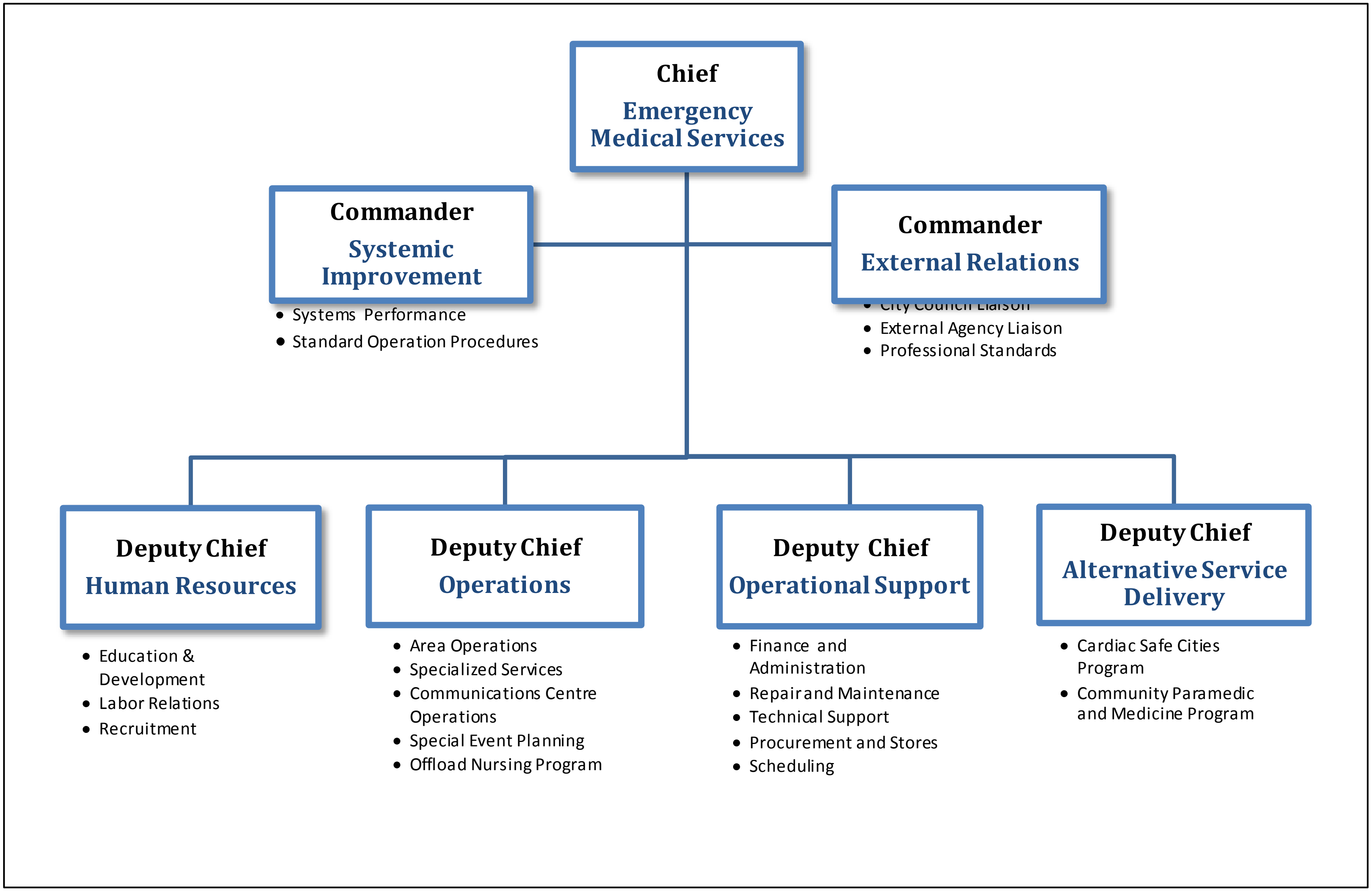
Benefits of the Recommended Structure

The recommended structure represents a significant improvement over the current structure and each of the paradigmatic alternatives. The overall rating of 3.846 for the recommended structure is higher than the score for the other alternatives and is significantly higher than the rating of 3.000 for the current structure.

Observations

We discussed the organizational recommendation with the Chief of TEMS. Our discussions revealed some challenges in implementing and operating within the recommended structure, particularly with the span of control for the Deputy Chief of Operations which could make this organizational design unwieldy. Nevertheless, the Chief will consider the analysis and recommendations as he assesses the best fit organizational design for Emergency Medical Services.

EMERGENCY MEDICAL SERVICES RECOMMENDED ORGANIZATIONAL STRUCTURE



4.7.5 TFS Organizational Assessment

The development of organizational alternatives for the fire service followed the same steps as for the Emergency Medical Services. In addition, the same four paradigmatic organizational structures were developed for the fire services—geographic, management expertise, customer, and key functions.

1. **Geographic**—Deploys and organizes resources by geographic area
2. **Management expertise**—Organizes resources around the management expertise needed to perform specific activities
3. **Customer**—Organizes the department by customer grouping
4. **Key functions**—Identifies key functions needed for organizational success and organizes around those functions

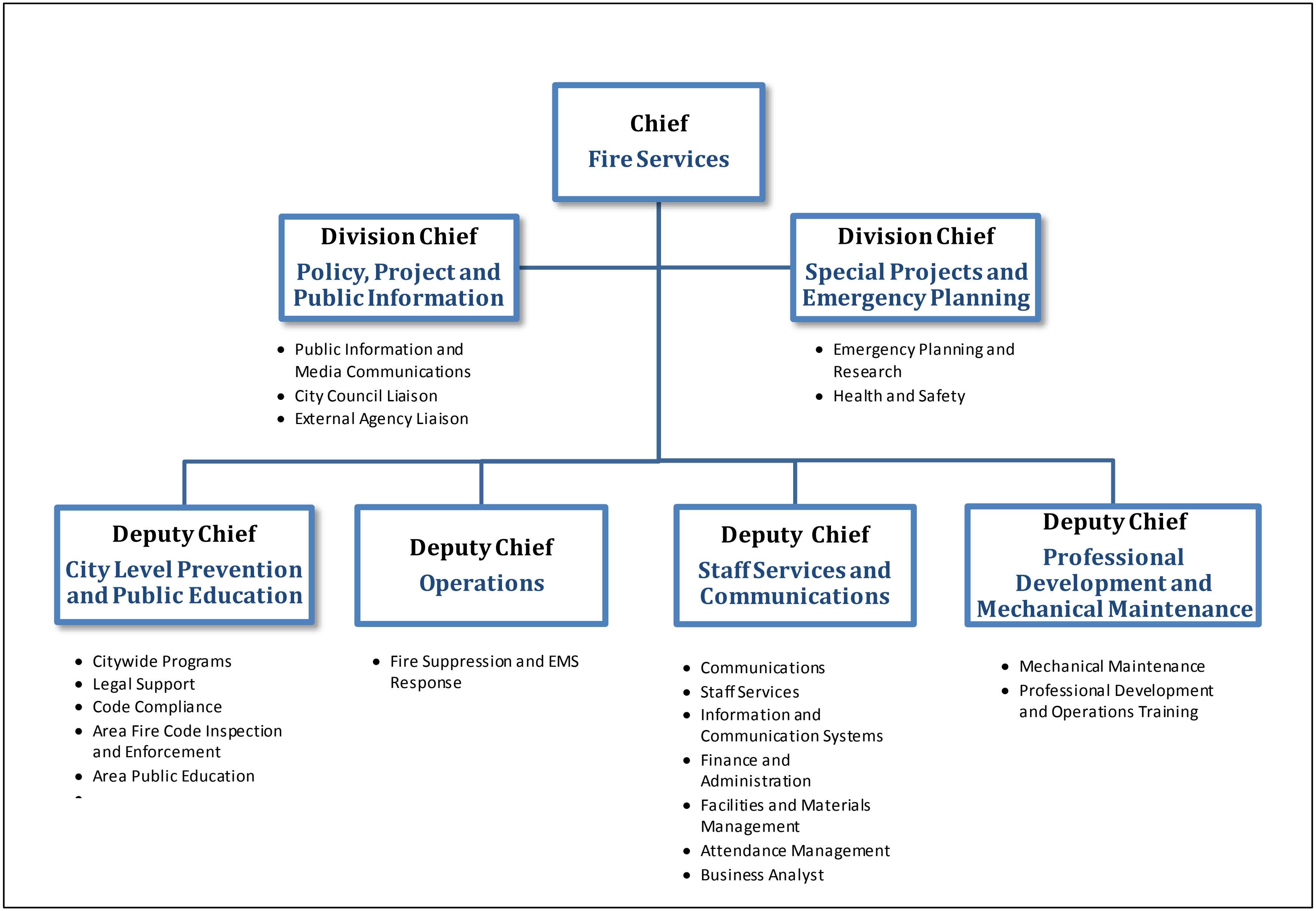
Geographic Structure

Table 20 presents a fire service organizational structure using the geography paradigm. In this organizational alternative, a single manager would be responsible for the delivery of the full range of fire department services in an area. This responsibility would include fire suppression, EMS response, fire code inspection, and enforcement. A centralized prevention and public education unit would be retained, however, to perform functions that cannot be effectively decentralized. These prevention and education functions include developing public education programs, implementing citywide public education programs, providing support for enforcement cases that will go to court, and working with stakeholders to identify alternative approaches to complying with the fire code.

A geographically organized structure supports key organizational purposes more effectively than the current structure. Organizing services geographically enhances accountability, promotes flexibility, and facilitates efforts to use fire suppression staff to more broadly support fire department objectives.

Table 20 - Structure of the Fire Service if Organized by Geography

Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	4.000	0.420	Accountability for the level of service provided in a given geographic area is enhanced.
Operational Cost-Effectiveness	0.105	5.000	0.525	This structure facilitates efforts to use suppression staff to support inspection and public education needs.
Service	0.105	5.000	0.525	Creates opportunity to tailor services to needs; substantially more inspections will be performed and public education efforts will be enhanced.
Flexibility	0.093	4.000	0.372	Ability to adjust services to reflect needs in a given area is enhanced.
Sustainability	0.093	3.000	0.279	
Capabilities	0.075	3.000	0.225	
Decision-Making And Authority	0.063	3.000	0.189	
Organizational Structure Costs	0.063	3.000	0.189	
Oversight	0.063	3.000	0.189	
Expertise And Judgment	0.050	3.000	0.150	
External Communications	0.040	3.000	0.120	
Internal Communications	0.040	3.000	0.120	
Values	0.030	3.000	0.090	
Coaching/Support	0.025	3.000	0.075	
Employee Development	0.025	3.000	0.075	
Reduce Risks And Liabilities	0.025	3.000	0.075	
Total All Purposes	1.000		3.618	



GEOGRAPHICALLY ORIENTED FIRE SERVICE STRUCTURE

Management Expertise Oriented Structure

Table 21 presents the structure of the fire services if it were organized around management expertise. In this alternative, all 24 operations—fire suppression, EMS response, and communications—are assigned to a single manager. The structure also leverages the skills and experience of managers in the following areas:

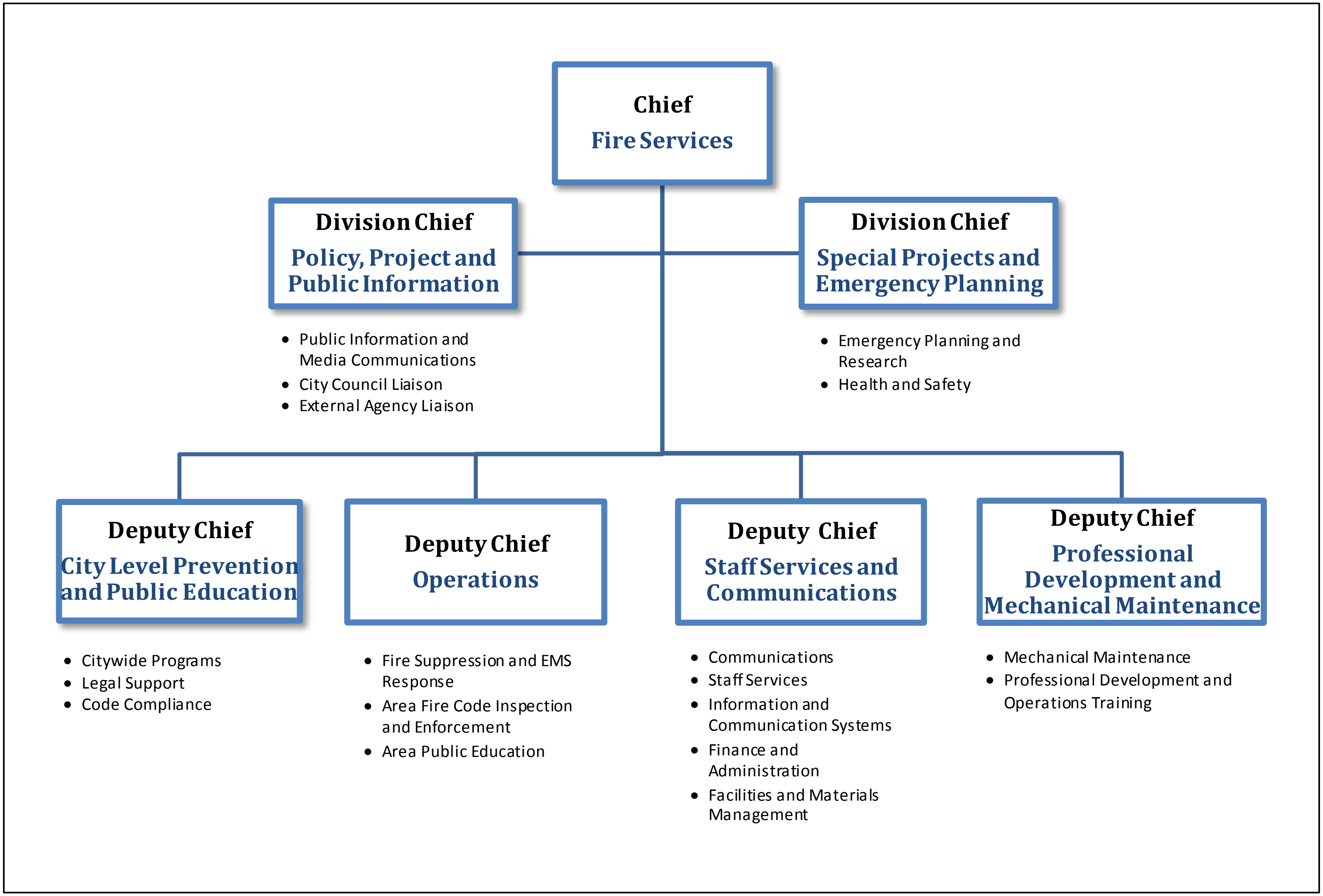
- Fire prevention and public education
- Support services
- Human resources
- External relations
- Emergency planning and research
- Health and safety

In addition, in this structure support services are grouped to reflect the skills and expertise of support services managers.

A structure that is organized around management expertise meets organizational purposes somewhat more effectively than the current structure. While changes from the current structure are modest, organizing around the skills and expertise of managers will enhance accountability, operational cost-effectiveness and expertise and judgment.

Table 21 - Structure Of The Fire Services Organized Around Management Expertise

Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	4.000	0.420	Accountability for selected functions—external relations and human resources—will be enhanced.
Operational cost-effectiveness	0.105	4.000	0.420	Managers with appropriate expertise will be able to enhance cost-effective operations; but changes as compared to current structure are modest.
Service	0.105	3.000	0.315	
Flexibility	0.093	3.000	0.279	
Sustainability	0.093	3.000	0.279	
Capabilities	0.075	3.000	0.225	
Decision-making and authority	0.063	3.000	0.189	
Organizational structure costs	0.063	3.000	0.189	
Oversight	0.063	3.000	0.189	
Expertise and judgment	0.050	4.000	0.200	The structure is designed to leverage expertise and judgment of managers; but changes as compared to the current structure are modest.
External communications	0.040	3.000	0.120	
Internal communications	0.040	3.000	0.120	
Values	0.030	3.000	0.090	
Coaching/support	0.025	3.000	0.075	
Employee development	0.025	3.000	0.075	
Reduce risks and liabilities	0.025	3.000	0.075	
Total all purposes	1.000		3.260	



MANAGEMENT EXPERTISE ORIENTED FIRE SERVICES STRUCTURE

Customer Oriented Structure

Table 22 presents the structure of the fire services if it were organized around customer groupings. As with the EMS paradigm, four customer groupings were used in developing this organizational alternative:

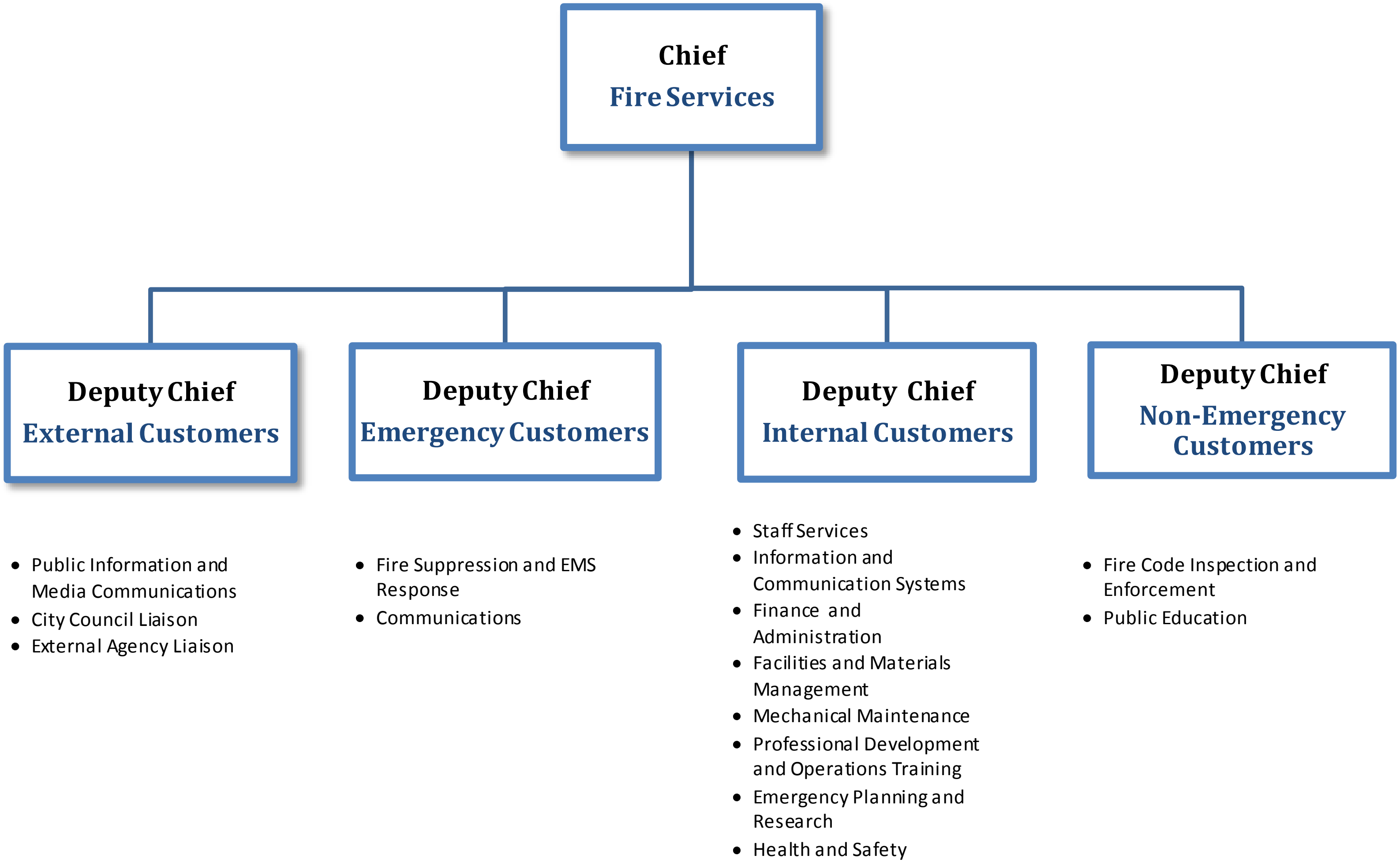
- Emergency response customers
- Non-emergency response customers
- Internal customers
- External stakeholders

A customer oriented structure meets fire services needs less well than the current structure. While service will be enhanced and fewer management positions are needed, a customer oriented structure reduces accountability, flexibility, capabilities, and expertise and judgment.

Table 22 - Structure of the Fire Services Organized Around Customer Orientation

Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	2.000	0.210	Assigning disparate functions to the same organizational units will limit accountability for the performance of some functions.
Operational cost-effectiveness	0.105	3.000	0.315	
Service	0.105	4.000	0.420	Services can be tailored to better meet the needs of customers.
Flexibility	0.093	2.000	0.186	Assigning staff who address the needs of different customers to the different units limits operational flexibility.
Sustainability	0.093	3.000	0.279	
Capabilities	0.075	2.000	0.150	Responsibility for functions critical to organizational success (for example, human resources and systemic improvement) has a lower organizational profile.
Decision-making and authority	0.063	3.000	0.189	
Organizational structure costs	0.063	4.000	0.252	Fewer senior managers are needed to implement this structure.
Oversight	0.063	3.000	0.189	
Expertise and judgment	0.050	2.000	0.100	Combining disparate functions to the same organizational units makes it more difficult to leverage expertise and judgment.
External communications	0.040	3.000	0.120	
Internal communications	0.040	3.000	0.120	
Values	0.030	3.000	0.090	
Coaching/support	0.025	3.000	0.075	
Employee development	0.025	3.000	0.075	
Reduce risks and liabilities	0.025	3.000	0.075	
Total all purposes	1.000		2.845	

CUSTOMER ORIENTED FIRE SERVICES STRUCTURE



Key Functions Oriented Structure

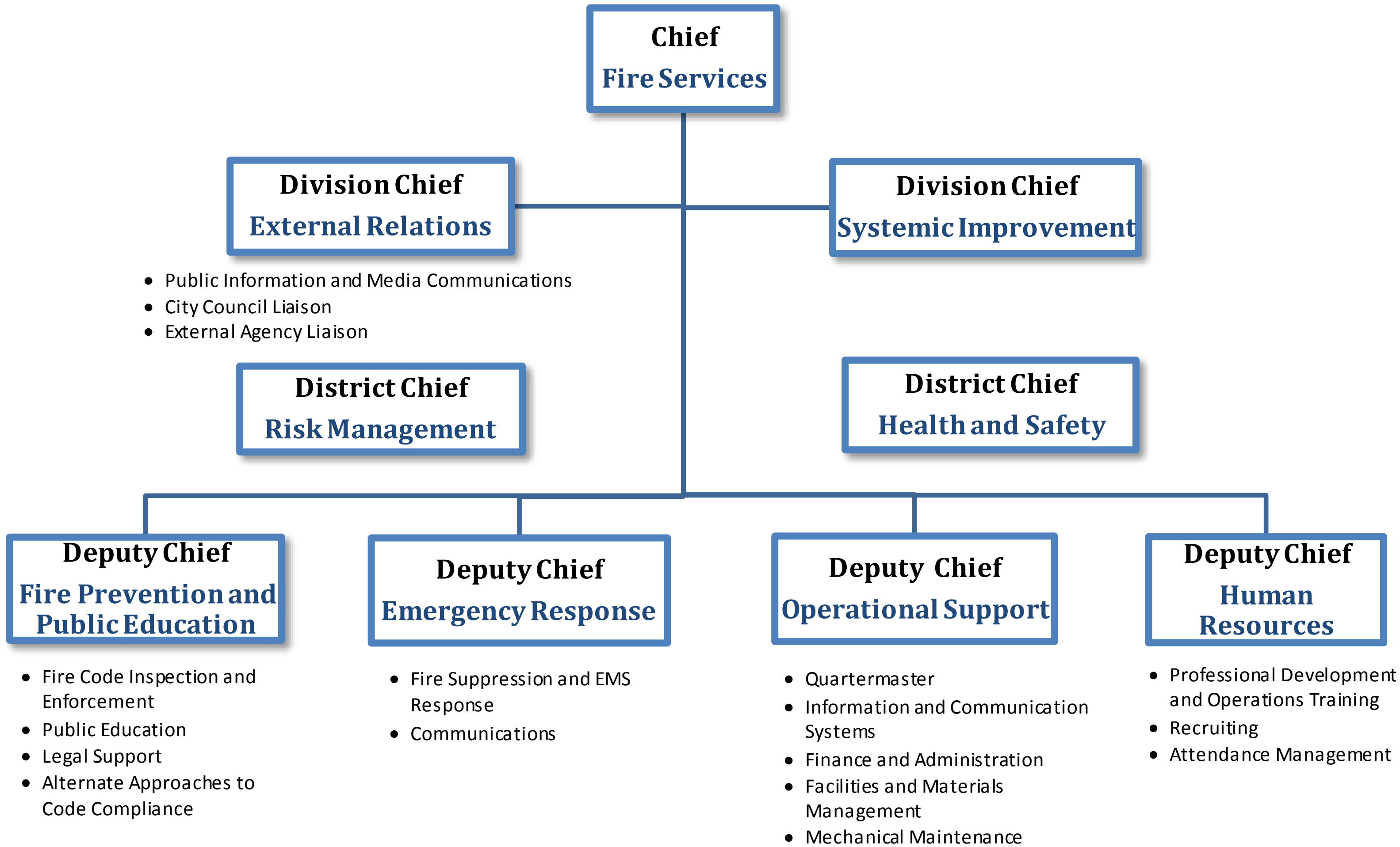
Table 23 presents the structure of the fire services if it were organized around the activities and functions that are the most important to the department's success. These key functions were identified based on based on discussions with department leaders and the experience of the POMAX consulting team:

- Emergency response
- Fire prevention and public education
- Operational support
- Human resources
- External relations
- Systemic improvement
- Risk management
- Health and safety

A *key functions* organizational structure represents an improvement over the current structure in a number of areas. While a key functions structure is more expensive than the current structure, this structure is rated higher than the current structure in terms of accountability, operational cost-effectiveness, service, sustainability, capabilities, external communications, values, employee development, and reducing risks and liabilities.

Table 23 - Structure of the Fire Services Organized Around the Activities and Functions Most Important To Success (Key Functions)

Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	4.000	0.420	Accountability for the functions most critical to the department's success is well defined.
Operational cost-effectiveness	0.105	4.000	0.420	A unit is established specifically responsible for identifying opportunities to improve management and operations.
Service	0.105	4.000	0.420	A unit is established that is responsible for improving operational performance.
Flexibility	0.093	3.000	0.279	
Sustainability	0.093	4.000	0.372	By emphasizing risk management the structure supports a consistent focus on determining how best to use resources to manage risks in a way that reflects city needs.
Capabilities	0.075	5.000	0.375	The structure is organized around the capabilities most critical to the department's success.
Decision-making and authority	0.063	3.000	0.189	
Organizational structure costs	0.063	2.000	0.126	Implementing a customer oriented structure will increase management needs somewhat.
Oversight	0.063	3.000	0.189	
Expertise and judgment	0.050	3.000	0.150	
External communications	0.040	4.000	0.160	A unit is dedicated to supporting external communications.
Internal communications	0.040	3.000	0.120	
Values	0.030	5.000	0.150	The structure reflects the functions that are most important to the department's success.
Coaching/support	0.025	3.000	0.075	
Employee development	0.025	4.000	0.100	A unit is established that focuses on employee quality; rotating staff through the systemic improvement unit will also develop needed skills.
Reduce risks and liabilities	0.025	5.000	0.125	Functions are emphasized that promote employee safety and the fire service's management of risks.
Total all purposes	1.000		3.670	



KEY FUNCTIONS ORIENTED FIRE SERVICES STRUCTURE

4.7.6 TFS Recommended Structure

Key Features of the Recommended Structure

Promising features of each paradigmatic organizational structure were used to develop the recommended structure presented in

Table 24. The structure organizes the delivery of the department's core services geographically. A single manager is responsible for the full range of fire services services—suppression, medical response, inspections, and education—in each organizational area. Assigning these responsibilities to the same manager will facilitate the integration of these services. In addition, the geographic manager will be charged with ensuring fire suppression staff support all department services. The structure also leverages the expertise of key managers:

- The Deputy Chief—Operations oversees all 24-hour operations
- Support functions—that cannot be assigned to geographic districts—are grouped based on management expertise
- A single manager is responsible for ensuring the quality of fire services employees
- The department's analytic capabilities will be assigned to a single unit that will support strategic (e.g., risk management), tactical (e.g., operational practices) and management (e.g., using data to drive decision making) improvements[43]

The structure highlights key functions that are crucial to the department's long-term success—risk management, and management and operational improvement.

Viability of the Recommended Structure

While the recommended organizational structure is viable, successfully implementing the structure will require a shift in the department's orientation. In particular, organizing service delivery by region—and holding managers accountable for the full range of fire department services provided in that region—will require a major shift in orientation for the department. Instead of assigning responsibility for services into different organizational *silos*, managers will be required to integrate services and to leverage all the resources reporting to them to achieve organizational objectives. In an organization the size of the TFS, ensuring the expectation that fire suppression crews support inspection and public education activities is consistently implemented will be difficult unless a single manager is accountable for both functions.

[43] Because this function reports directly to the chief, it will be positioned to have broad influence on the department.

Table 24 - The Recommended Structure Of The Fire Services (Geographic Orientation)

Organizational Purpose	Weighting	Score	Total	Comments
Accountability	0.105	5.000	0.525	Combining service delivery by geographic area facilitates efforts to leverage suppression staff to support inspection and public education needs
Operational cost-effectiveness	0.105	5.000	0.525	Creates opportunity to tailor services to needs; substantially more inspections will be performed and public education efforts will be enhanced.
Service	0.105	4.000	0.420	Ability to adjust services to reflect needs in a given area is enhanced.
Flexibility	0.093	4.000	0.372	Ability to adjust services to reflect needs in a given area is enhanced.
Sustainability	0.093	4.000	0.372	The structure emphasizes the department's key strategic initiatives—the need to develop and implement alternative service delivery options
Capabilities	0.075	4.000	0.300	By emphasizing risk management the structure supports a consistent effort on determining how best to use resources to manage risks in a way that reflects city needs.
Decision-making and authority	0.063	5.000	0.315	The structure is organized around the capabilities most critical to the department's success.
Organizational structure costs	0.063	3.000	0.189	
Oversight	0.063	3.000	0.189	
Expertise and judgment	0.050	4.000	0.200	The structure is designed to leverage expertise and judgment of managers; but changes as compared to the current structure are modest.
External communications	0.040	4.000	0.160	A unit is dedicated to supporting external communications.
Internal communications	0.040	3.000	0.120	
Values	0.030	5.000	0.150	The structure reflects the functions that are most important to the department's success.
Coaching/support	0.025	3.000	0.075	
Employee development	0.025	4.000	0.100	A unit is established that focuses on employee quality; rotating staff through the systemic improvement unit will also develop needed skills.
Reduce risks and liabilities	0.025	5.000	0.125	Functions are emphasized that promote employee safety and the fire service's management of risks.
Total all purposes	1.000		4.137	

Other aspects of the recommended structure will also require a change in culture. For example, using analysis and information to drive decision making about all aspects of the department's operations will represent a change for many department managers. Again, unless the expectation that information be used to drive decision making is supported by an organizational change, implementing this concept will be difficult.

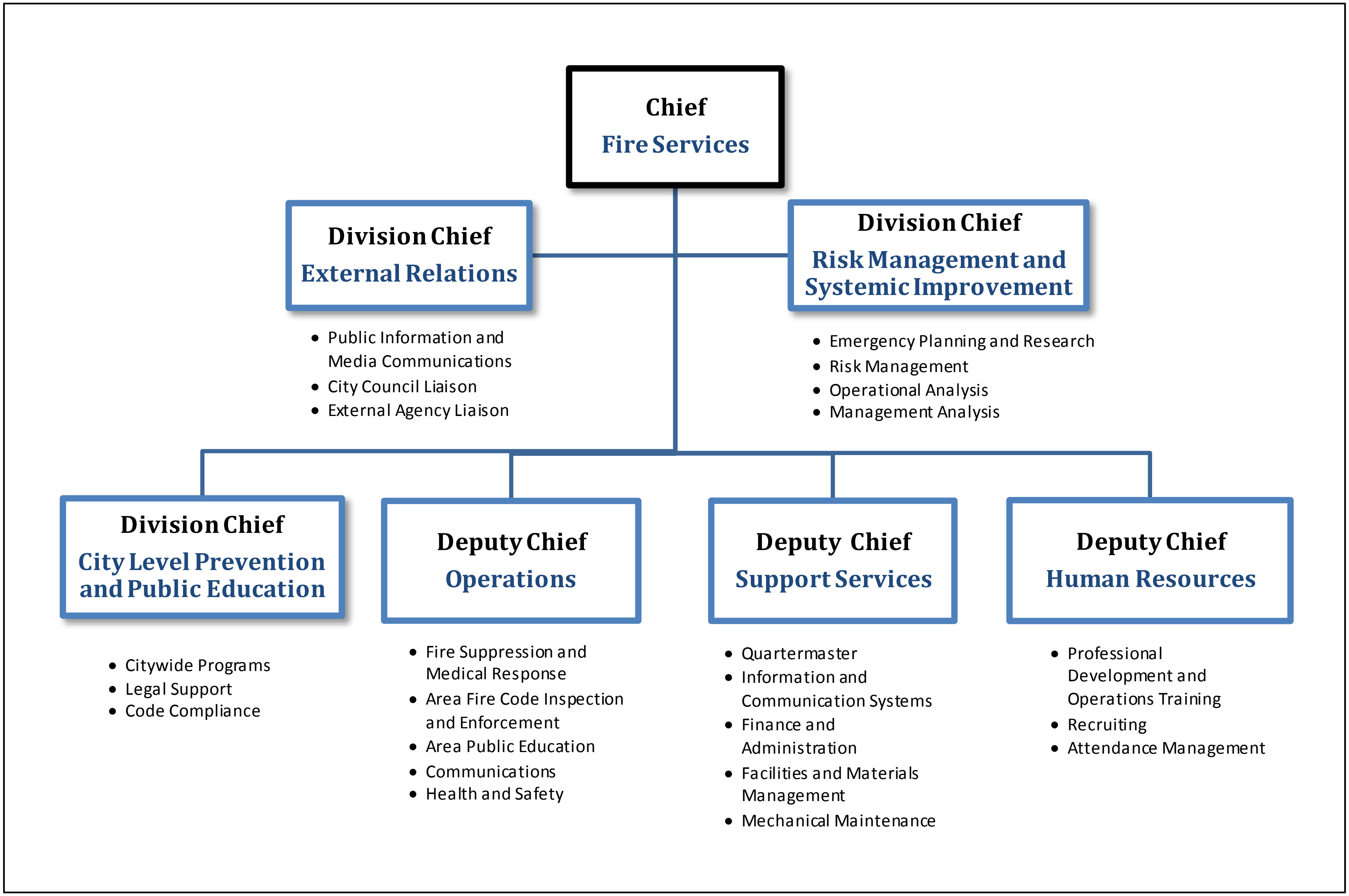
Other aspects of the recommended structure reflect a reorganization of responsibilities to take advantage of the expertise of managers and should not be difficult to implement.

Benefits of the Recommended Structure

The recommended structure represents a significant improvement over the current structure and each of the paradigmatic alternatives. The overall rating of 4.137 for the recommended structure is higher than the other alternatives presented in the study, and it is significantly higher than the rating of 3.000 for the current structure.

Toronto's Fire Chief sees some challenges with implementing the recommended structure.

TFS was in the process of organizational realignment before this report was received. The Chief expressed some concern about the breadth of responsibility, particularly for the Deputy Chief of Operations, in this structure. Similar to the perspective of the Chief of TEMS, the Fire Chief will take into account the ideas and discussion presented in this section as organizational priorities are implemented.



FIRE SERVICES RECOMMENDED ORGANIZATIONAL STRUCTURE

5.0 Consolidation of Communication Centres

One of the questions to be answered by the Toronto Service and Organizational Study is whether it is feasible and desirable to consolidate the TFS and TEMS communication centres.

Consolidation is most often feasible from a technical infrastructure and facilities point of view and easier to achieve when the amalgamation involves a single emergency discipline (police or fire or EMS). Greater challenges are experienced from an operational, financial, governance or political point of view particularly when multi-jurisdictional agencies (police, fire, EMS) are considered for dispatch amalgamation. Differences in staff qualification criteria, intake training, the need for staff to learn dissimilar operational methods, continuing education, maintaining skill sets by discipline, and the stressors of changing dispatch roles (switching between police, fire, and ambulance methods) all have a profound impact on the operation of consolidated dispatch centers as well as field operations.

People who have not had the opportunity to experience the day to day work of emergency call taking and dispatching sometimes wonder what difficulty there is in answering a telephone and sending an emergency responder to an address – but it is a difficult job for many reasons, and only a minority of the population have the aptitude for it and even fewer can learn all the skill sets required to call take and dispatch for two or three types of emergency services.

Consolidation success can be characterized in several different ways. Building and technical infrastructure consolidation may be a success even if the dispatch entities continue to operate individually (co-housing). In this way radio, secure power systems, data communication systems and backups may be housed in one or two locations and used by all entities. A common computer aided dispatch and other systems (geographic information systems, automatic vehicle location, telephony) may be more easily supported than different systems at different locations. A common backup communications center would be expected to eventually reduce costs and improve productivity.

Dispatch consolidation would be a significant culture change no matter to what degree the consolidation takes place and it would have to be handled as carefully as any cultural shift, or a jurisdiction will find itself coping with the personnel fallout for, literally, the next generation.

Intuition tells us that dispatch consolidation is straightforward - but it is far from simple. Dispatch consolidation is usually explored because of the need to reduce expenditures and avoid costs but in some cases the initial capital cost of amalgamation has an extended period before cost recovery takes place. The greatest cost avoidance can be expected in salaries, wages, and benefits since the degree of scale will mean that fewer staff are required in a fully consolidated dispatch center. However, staff reductions also bring forward the issues of human resource management and, possibly, separation costs. In addition, lengthier intake training periods – due to needing to train new hires to dispatch each emergency service - and continuing education will offset some savings. And the possibility of increased staff turnover because of the rigors of dispatching different emergency response disciplines with different policies, procedures, standing orders, and methods might also represent additional costs, sometimes very significant.

Even though there are many pitfalls to consolidation, it can be successful assuming that the feasibility is carefully studied, all aspects of buildings, technology, backup facilities, and staff change are taken into account, and a comprehensive strategy and project plan are employed to transition into a consolidated environment. Achieving success could take from 3 to 10 years depending on how success is defined.

The feasibility of consolidating the fire and EMS dispatch centres has to be examined from the perspectives of staff levels, technology, funding, organization, and operation. It's possible that a negative report on any one or two of these areas could negate the feasibility of consolidation.

In Ontario, the consolidation of fire and EMS communication centres has another major implication to be considered. That is, Ontario's Ministry of Health and Long Term Care funds almost all of the operation and most of the technology of Toronto's ambulance communication centres at the 100% level. And, those areas which are not funded – such as some of the technology – are closely legislated and regulated in much the same way as emergency medical services in Ontario. Toronto is somewhat unique in Ontario since it operates its own ambulance communication centre, as does Niagara region, whereas most other ambulance communication centres in the province are either directly operated by the Ministry of Health and Long Term Care or are under contract to operate like an MOHLTC centre. However, this uniqueness will not preclude Toronto from having to negotiate possible changes to staff and technology funding levels if the City moves forward with consolidation; nor will the City have full control over the type of technology that can be installed if it has an impact on the provincial platform.

5.1.1 Staffing and Technology

The primary areas of consideration when evaluating consolidation feasibility are staffing and technology. In some cases, consolidation will allow a similar level of work that is being accomplished by two or more centers, to be accomplished in a combined centre, using fewer full time equivalents. This is because in any environment that incoming calls cannot – or should not – be delayed before answering, there has to be a reasonable level of staff availability, or surplus capacity, to accommodate peak call loads. A consolidated communications centre may be able to reduce the surplus capacity experienced in each communications centre while still ensuring sufficient capacity to handle incoming calls during peak activity times.

Our review included examining the staff levels at the EMS and fire communications centres to determine if staff resources were adequate in both organizations and then assessing whether efficiencies gained within a consolidated entity would offset the technical and initial operational costs of consolidation.

We also examined the technical impact of consolidation and the expected period of recovery before evaluating the possible organization and operation of a combined communications centre.

5.1.2 TEMS

As we noted previously, one of the considerations and complications in determining EMS communications staff levels is that the communications staff are fully funded by the Ministry of Health and Long Term Care. So, while we can make recommendations with respect to EMS communications staff levels, the City of Toronto will have to negotiate funding with the Emergency Health Services Branch of MOHLTC.

Calculating the required call taker and dispatcher staff levels at EMS was a complicated process since the levels fluctuate depending on call volume, time of day, and day of week. Our initial calculations assumed a static base level of call takers and dispatchers; for example, 4 call takers and 4 quadrant dispatchers 24 hours a day with some increase based on peak event (call) volumes. In fact, this isn't the case. There can be as few as one or two call takers and two dispatchers on duty depending on the time of day or night. Unusual increases in event load are compensated by supervisory staff assisting as necessary. This is a laudable and cost efficient approach to staffing the communications centre except it results in understaffing over many hours of the day and night thereby decreasing capacity for supervisory oversight and quality assurance.

Another factor has to be considered: the communications centre staffing has to be considered as part of the overall EMS response to patient events. The staffing demand analysis in the ***3.3 TEMS Staffing Demand Analysis*** section of this report, calculates paramedic resource levels, based on response to the most urgent patients, within 8 minutes and 59 seconds of the call for assistance being received at the EMS communications centre. This response target includes 2 minutes for call takers and dispatchers to receive the call; determine the most appropriate EMS resource to respond to the incident and assign it, and a maximum travel time of 6 minutes and 59 seconds for paramedics to reach the incident. The two minute dispatch handling time target can usually be met when calls are received in a linear fashion (one at a time), but becomes much more difficult as call volumes increase and dispatchers have to conduct multiple resource assignments, which is almost consistently the case at TEMS. So, any inability for communications centre staff to achieve a two minute call taking and dispatch time target partially negates the benefit of staffing paramedic resources to achieve a sub 7 minute travel time. TEMS acknowledges that the 2 minute call receiving and dispatch target is not currently being met.

The EMS communications staff level calculation spreadsheets leading to our conclusions are attached[44]. These indicate the requirement for an additional 3 full time equivalents assuming that there is a minimum of 4 call takers and 4 dispatchers 24 hours a day. However, as noted previously, there can be as few as one or two call takers and two dispatchers on duty depending on the time of day or night. Unusual increases in event load are compensated by

[44] The staff level calculation worksheets are attached as an exhibit but they are complicated to the extent that readers will not be able to understand the process unless they are able to see the formulas in each cell and, even with that, the spreadsheets and conclusions probably require 'live' explanations. We're happy to provide those live explanations and assist TEMS in any way we can.

supervisory staff assisting as necessary but results in understaffing over many hours of the day and night thereby decreasing capacity for supervisory oversight and quality assurance.

To ensure accuracy of EMS communications centre staffing needs, recalculation of the staffing levels should be undertaken by EMS on an hour by hour and day by day basis to reflect the true full time equivalent requirements. Pomax's working paper calculations lead us to believe the true additional FTE requirement is likely to be 8 or more depending upon the actual fluctuation in existing staff levels.

The recalculation can be accomplished by TEMS, using our worksheets and formulas, and we would be pleased to assist as required. We did not go further with calculations since EMS communications staff levels is an item which the City has to negotiate with the Emergency Health Services Branch of the MOHLTC and a live calculation tool, such as our spreadsheets, might assist during those negotiations.

5.1.3 TFS

A review of the current call taker and dispatcher staffing levels for the TFS (TFS) was completed in order to determine if an appropriate staffing model was in place with respect to total call volume as well as the required operational duties and responsibilities.

The TFS communicator staffing analysis was conducted based on the Erlang C formula; Erlang C is a standardized telecommunications engineering formula used for communications and call centres that use queuing technology. Erlang C expresses the probability that calls may be queued as opposed to immediately being served. If all call takers or dispatchers are busy when a call or dispatch event is presented, the incident is queued. Erlang C calculates the probability of queuing offered traffic, assuming that blocked calls or events stay in the system until they can be handled. In addition to Erlang modeling of the TFS Communication Centre, a TFS dispatcher per hour workload analysis was completed and a peer review of total annualized call volumes, call taker and dispatcher staffing levels, and the performance based service standard used to determine staffing levels was conducted of Vancouver Fire Rescue Service, Calgary Fire Department, and Ottawa Fire Service.

Erlang calculations only consider the measurable components of a communication centre when determining the total resources required; the components are average calls per hour, average time per call, and the acceptable service level (average delay or percentage of calls answered within a set number of seconds). In public safety communication centres, and specifically fire dispatch centres, there are other factors that must be considered when determining appropriate staffing levels. These factors include mass calling events that overwhelm a communication centre and the various tasks and responsibilities required of call takers and dispatchers throughout the course of an emergency event in support of fire operations.

Based on the Erlang C modeling of the TFS call taker and dispatcher staffing levels, and consideration of other factors that must be addressed when determining appropriate staffing levels for fire dispatch centre, the following comments are offered.

Call Taking Function

The calculated call taker staffing level results are based on Erlang C calculations and identifies a minimum of three (3) call takers for day shift and two (2) for night shift; this is based on the existing business model of call taking.

Other call taking configurations were considered such as: (a) having administration calls answered by an administrative staff person, at least during peak daytime hours (administration calls are currently answered by call takers, and (b) excluding both administration calls and calls from TEMS. The rationale for these considerations is that it may be more cost effective to have administration calls handled by TFS administration staff. This option should be further investigated.

The option of excluding calls from emergency medical services was considered as EMS indicated that they will be soon using a computer interface for all communications on medical calls. Currently, medical calls are presented directly to the TFS dispatch queue via the computer aided dispatch interface while additional information, lift assist requests, and similar information is transmitted by telephone.

Dispatch Function

The calculated dispatcher staffing levels, based on Erlang C calculations and the workload per hour analysis, identify a minimum of three (3) dispatchers required for both day and night shifts. As a result of the random nature of dispatcher support activities during an active incident and to account for large scale events and instances of extreme dispatcher activity (e.g., severe weather events, tactical dispatching, etc.) the minimum dispatcher staffing level should be four (4) for both day and night shifts.

TFS should consider moving to a revised dispatcher staffing level of four (4) dispatchers for both day and night shifts from the current staffing level of six (6) dispatchers for both day and night shifts.

5.1.4 Methodology

The industry standard accepted methodology for public safety staffing analyses is the use of Erlang calculations. There are three North American organizations responsible for establishing the administrative and operational guidelines and procedures for Public Safety Answering Points (PSAP). These are the Association of Communication Officials (APCO), the National Fire Protection Association (NFPA), and the National Emergency Number Association (NENA).

In 2003, NENA formally adopted Erlang formula calculations as the baseline for staffing in their *PSAP Staffing Guidelines Report*[45]. In addition to the staffing report, NENA's *Resource List* refers to Erlang for staffing requirements.[46]

With respect to fire service operations, NFPA describes itself as "the world's leading advocate of fire prevention and an authoritative source on public safety"[47] and is often considered the

[45] NENA website http://www.nena.org/?page=psap_staffingguide&terms=staffing
[46] NENA website http://www.nena.org/?page=HR_ResourceList

North American industry benchmark with respect to fire service operations including emergency call answering and dispatching. The applicable standard for PSAP operations is NFPA 1221-*Standard for the Installation, Maintenance, and Use of Emergency Service Communications Systems*. While 1221 speaks to the issue of PSAP staffing it does not prescribe the total number of staff positions; rather it states that "the AHJ (Authority Having Jurisdiction) shall ensure that there are sufficient telecommunicators available to effect the prompt receipt and processing of alarms needed to meet the requirements of Section 7.4"[48]. To this end, NFPA provides prescriptive performance targets with respect to the emergency call answering and dispatching of resources.[49]

Section 7.4 includes the following:

7.4.1 Ninety-five percent of alarms received on emergency lines shall be answered within 15 seconds, and 99 percent of alarms shall be answered within 40 seconds.

7.4.2 Ninety percent of emergency alarm dispatching shall be completed within 60 seconds, and 99 percent of alarm processing shall be completed within 90 seconds.[50]

During the time of the TFS Communications Centre review, the NFPA adopted the latest version of the 1221 standard (2013 edition) which has changed the performance measurement for emergency alarm dispatching. For purposes of comparison, the most current version of NFPA 1221 (2013) states the following for alarm processing:

7.4.1 Ninety-five percent of alarms received on emergency lines shall be answered within 15 seconds, and 99 percent of alarms shall be answered within 40 seconds.

7.4.2 With the exception of the calls types identified in Section 7.4.2.2, 80 percent of emergency alarm dispatching shall be completed within 60 seconds, and 95 percent of alarm processing shall be completed within 106 seconds.[51]

7.4.2.2 Emergency alarm processing for the following call types shall be completed within 90 seconds 90 percent of the time and within 120 seconds 99 percent of the time:

1. *Calls requiring emergency medical dispatch questioning and pre-arrival instructions*
2. *Calls requiring language translation*
3. *Calls requiring the use of a TTY/TDD device or audio/video relay services*

[47] NFPA website http://www.nfpa.org/categorylist.asp?categoryid=143&url=about%20us
[48] NFPA 1221 Section 7.3.1
[49] NFPA 1221 Section 7.4
[50] Refer to Appendix B
[51] Refer to Appendix B

4. *Calls of a criminal activity that require information vital to emergency responder safety prior to dispatching units*
5. *Hazardous material incident*
6. *Technical rescue*

The 2010 version of NFPA 1221 did not provide different performance measurements based on specific call types.

For purposes of this staffing analysis, alarm processing standards as per the 2012 version NFPA 1221 are considered. TFS' current Quality Assurance program is based on the performance criteria of the 2010 version of the standard; therefore, these performance metrics are used to ensure common and consistent comparison of current performance management.

5.1.5 Erlang Calculations

Erlang calculations are standardized, scientific-based telecommunications engineering calculations used extensively throughout industry, including public safety, to determine a number of unknown communications centre variables, such as the total number of telephone lines required or the total number of staff required in a call centre. A number of metrics are considered in Erlang calculations and the appropriate Erlang formula is selected based on the configuration of the centre.

As the TFS Communications Centre uses queuing technology for both the call taking and dispatching activities, this analysis was completed using the Erlang C formula. Erlang C expresses the probability that calls may be queued as opposed to immediately being served. If all call takers or dispatchers are busy when an incident is presented, the call is queued. Erlang C calculates the probability of queuing calls, assuming that blocked calls or events stay in the system until they can be handled.

5.1.6 Metrics

The metrics used to assist in the determination of staffing levels at the TFS Communications Centre were provided by TFS:

Table 25 - Staffing Analysis Metrics

Staffing Analysis Metrics	
Metric	**Value**
1. Average annual total call volume (emergency and non-emergency calls)	241,813
2. Average annual total administration calls	147,821
3. Average annual total emergency calls	142,263
4. Average offer to answer time for non-emergency calls	4 seconds
5. Average offer to answer time for emergency calls	4 seconds
6. Average call taker time for non-emergency calls	41 seconds
7. Average weighted call taker time for various options[52]: 7.1. All calls	 46 seconds

[52] 10% of captain's line call volume has been assumed in call taker loading

7.2. Administration calls excluded 7.3. Administration and TEMS calls excluded 7.4. TEMS calls excluded	54 seconds 57 seconds 46 seconds
8. Average total dispatch time	66 seconds
9. Target time to answer calls (percentile as per NFPA 1221-2010)	95% of calls in 15 seconds 99% of calls in 40 seconds
10. Target time to dispatch event (percentile as per NFPA 1221 - 2010)	90% of calls in 60 seconds 99% of calls in 90 seconds

TFS has indicated "our goal is to dispatch every call as it comes in"[53]. As such, in addition to the NFPA 1221's performance metrics, an analysis was completed based on all calls (emergency and non-emergency) being answered as they "come in".

5.1.7 Site Visit

A site visit was conducted of the TFS Communications Centre. During the time on site, District Chief Pade provided a comprehensive overview of the centre's operations. In addition, time was spent meeting with a call taker and a dispatcher in order to review these operations and question the staff on typical duties and any associated challenges. Lastly, a meeting was held with Division Chief Vera Maute and Executive Officer Scott Robinson.

Functional Role Descriptions

To ensure that all of the necessary tasks required of TFS Call Takers and Dispatchers were considered as part of this analysis, functional job descriptions were requested and reviewed[54]. This was necessary to ensure that in addition to the standard responsibilities of each position being considered in the analysis there were no unique or specialized tasks that are required of TFS call takers or dispatchers.

A review of the functional role descriptions identifies that the tasks and responsibilities are typical of the industry. There are no tasks or responsibilities that are beyond the scope of normal operations and that would negatively affect their ability to answer and process emergency calls for service.

5.1.8 Staffing Analysis

An analysis of the current staffing levels for Call Takers and Dispatchers was completed using the Erlang C formula. The following table summarizes the results of the analysis:

[53] Email from Division Chief Vera Maute dated September 13, 2012
[54] The functional job descriptions of Call Taker and Dispatcher can be found in Appendix B

Table 26 - TFS Communications Centre Staffing Analysis

TFS Communications Centre Staffing Analysis			
Call Takers			
Shift	**Current Staffing Levels**	**Erlang C Calculated Staffing Levels (NFPA 1221-2010)**	**Comments**
Option #1			
Day	4	3	Includes 9-1-1 lines, fire emergency line, TEMS line, administration line and 10% of captain's line call volume
Night	3	2	
Option #2			
Day	4	2	Includes 9-1-1 lines, fire emergency line, TEMS line, and 10% of captain's line call volume. Administration line excluded.
Night	3	2	
Option #3			
Day	4	2	Includes 9-1-1 lines, fire emergency line, and 10% of captain's line call volume. Administration line and TEMS line excluded.
Night	3	2	
Option #4			
Day	4	2	Includes 9-1-1 lines, fire emergency line, administration line, and 10% of captain's line call volume. TEMS line excluded.
Night	3	2	
Dispatchers			
Shift	**Current Staffing Levels**	**Erlang C Calculated Staffing Levels (NFPA 1221-2010)**	**Comments**
Day	6	4	Erlang calculated dispatcher staffing levels only consider the time required to process the alarm (call received to station alerted) and it does not account for the time required for ongoing communication and support of the responding unit(s).
Night	6	4	

Various options of call taker work loading were analyzed, ranging from a high workload level of handling all of the current telephone activity (status quo) to a low of call takers only handling emergency calls (9-1-1 lines and the emergency direct line only plus an percentage of overflow from the captain's line).

Erlang C calculations for the dispatch function only address the time required for the initial dispatch of an emergency event (the time from receipt of the emergency alarm until the fire station(s) is alerted. However, it is important to consider that dispatchers are involved in ongoing communications and activities after the event has been dispatched, and this impacts the centre's overall incident handling capacity. While there is no statistical data that measures the average time a dispatcher is committed to a call nor is there any industry standard or best practice information in this regard, a calculation of assumed dispatcher workload per hour was completed.

The time that a dispatcher is busy with ongoing communication and other activities directly related to the support of an emergency call varies greatly and is largely dependent on the nature of the incident. For events such as medical calls, there is typically minimal interaction between the incident commander and the dispatcher thereby allowing the dispatcher to pay attention to other events and perform dispatch related functions. In contrast, for large events such as structure fires or hazardous materials incidents, a dispatcher may be dedicated to the incident[55] for an extended period of time and is therefore unavailable to dispatch any other emergency calls. For purposes of determining dispatcher workload per hour, the analysis assumed an average of 180 seconds (three minutes) of dispatcher time required for medical calls and 600 seconds (ten minutes) for all other call types. Based on this analysis, a minimum of three (3) dispatchers are required for both day and night shifts in order to both meet the NFPA criteria for dispatch processing as well as perform the assumed workload per hour.

Due to the random nature of dispatcher support activities and to account for large scale incidents and instances of extreme dispatcher activity (e.g., severe weather events), our recommendation is that the minimum dispatcher staffing level be four (4) for both day and night shifts.

As noted above, during the time that the staffing analysis was being conducted, the National Fire Protection Association released a new version of NFPA 1221 (2013). The significant change with respect to performance management in the new version is a reduction of the percentile for dispatching emergency alarms. Prior to the 2013 version, this performance measurement was 90% of calls dispatched in 60 seconds and in the new version the percentile is 80%.

The dispatcher staffing analysis was re-evaluated in consideration of this performance management change and there is no change in the minimum number of dispatchers required.

5.1.9 Current Performance Measurement

TFS has adopted NFPA 1221 as the performance target for emergency call taking and dispatching. However, we found that TFS has limited statistical data regarding its current performance management based on the NFPA 1221 90th percentile due to "a systemic problem causing a delay in the calltaker/dispatcher handoff"[56]. The identified issue was not resolved until a Computer Aided Dispatch upgrade was completed in the fall of 2011. After the upgrade was completed and all staff had become familiar with the appropriate operating procedures, performance management analysis and reporting was undertaken.

Based on the available data (January 2011 to May 2011), the average for alarm processing for TFS is 1:06 (one minute and six seconds). As per NFPA 1221 (2010), the prescribed threshold of is "ninety percent of emergency alarm dispatching shall be completed within 60 seconds, and 99 percent of alarm processing shall be completed within 99 seconds."

Table 27 – TFS Communications Centre Performance Management Summary

TFS Communications Centre Performance Management Summary		
TFS Measured Average - 90th Percentile	**NFPA 1221 (2010) – 90th Percentile**	**NFPA 1221 (2013) – 80th Percentile**
1:06	1:00	1:00

The dispatch performance management of the TFS Communications Centre – for the period examined – did not meet the 90th percentile requirement of the 2010 standard yet it would

[55] NFPA 1221 Section 7.3.3
[56] Email from Division Chief Vera Maute dated September 17, 2012

probably meet the 80th percentile requirement of the 2013 standard of NFPA 1221. TFS calculates call taker and dispatcher performance based on a model of "all calls in" even though NFPA 1221 refers to the processing of emergency alarms[57] and allows for the exclusion of non-emergency calls from quality assurance and performance management analysis.

5.1.10 Data Analysis Considerations and Limitations

Erlang C calculations are linear in their approach as they do not account for some of the unique operational situations that typically occur in public safety dispatch centres. Staffing analyses using Erlang formulas account for identifiable technical and mathematical probabilities associated to call centres. Erlang derived staffing levels are accurate and reliable when the considered variables are clearly quantifiable and measurable.

Considerations

In public safety call taking and dispatching, there are some variables that are not quantifiable yet they have an impact on Communications centre operations and standards of service. Accordingly, there are considerations and limitations that should also be considered, in addition to the Erlang C calculations, in order to understand the complexities of a public safety Communications centre and determine appropriate staffing levels to meet adopted performance standards.

The following have been considered:

- Call volumes were calculated as an average using seven years of TFS published data
  - We noted that there appears to be a significant increase in administration calls starting in 2009.
- Medical calls were excluded from the total of all events that lead to a dispatchable event. As these calls are transferred directly to the dispatch queue in the TFS Communications Centre, these events are not presented to the call takers and therefore do not add to their average total number of calls.
  - TEMS has noted that they will soon be starting to use the CAD to CAD interface for all communication with TFS regarding medical calls; therefore, annual calls to TFS from TEMS will significantly decrease.

Limitations

The following limitations must be noted in the staffing analysis:

- Mass/multiple call events to the communications centre. The statistical data representing total number of emergency calls processed in the communications centre only account for a single call being received to report the emergency.
  - Mass calling to the communication centre will occur with significant events such as large fires, motor vehicle crashes on highways, and other similar high-profile

[57] Refer to Section 7.4.2 of NFPA 1221

emergency incidents. In many of these instances the communications centre can receive very high number of emergency calls. Each call must be answered and the caller interrogated to determine if they are reporting the same incident and not, in fact, calling to report a new emergency event.

- Multiple calling will occur during severe weather events such as wind storms or significant weather situations such as snow storms, freezing rain, etc. In these situations, multiple calls will be received in the communications centre reporting an exceptionally high number of emergency events. Often these are separate emergencies and not mass calling of the same event.

- Erlang calculations only account for the resources required for the presentation of a call and the disposition of the call based on prescribed performance criteria. In fire service communications, this involves:
  - disposition of calls (emergency or non-emergency) by call takers involving call answer, interrogation and call completion (termination of call or creation of an event for the dispatcher)
  - presentation of dispatch event to dispatcher and the notification of the event to the appropriate fire station(s)
  - Erlang calculations do not consider the multitude of tasks that are required of both dispatchers and call takers during an emergency incident. During an emergency incident, a dispatcher is required to perform several tasks in support of fire operations, thereby effectively removing the dispatcher from being available to participate in another emergency event.

5.1.11 Fire Dispatch Survey

In order to help qualify appropriate minimum staffing levels for call takers and dispatchers for TFS, three Canadian fire services were surveyed: Vancouver Fire Rescue, Calgary Fire Department, and Ottawa Fire Department.

The departments were surveyed on total number of calls to their fire dispatch centres (emergency and non-emergency), call taker and dispatcher staffing levels, and the staffing model used to determine these levels. The information is summarized in Table 28.

Table 28 – Summary of Peer Review Staffing Levels

Peer Review of TFS Communications Centre Staffing Levels				
Department	**Total call volume (2011)**	**Call Takers**	**Dispatchers**	**Staffing Model**
Toronto				
Average Call Volume	241,813	4	6	NFPA 1221
Average Without Administration Calls	111,041			
Vancouver Fire Rescue	44,388	Shared	2	
Calgary Fire Department	47,968	Shared	2	NFPA 1221
Ottawa Fire Services	85,382	3	3	NFPA 1221

Vancouver Fire Rescue is dispatched by EComm (Emergency Communications for Southwest BC), a multi-jurisdictional agency that provides primary 9-1-1 call answer as well as emergency dispatch and communications for 30 police and fire agencies throughout south-east British Columbia. As part of the EComm operational model, Vancouver Fire Rescue is dispatched by two dedicated dispatchers while call taking is handled by shared call takers.

Calgary Fire Department is dispatched by the City of Calgary's Public Safety Communications (PSC) unit. As part of the City of Calgary's PSC operational model, Calgary Fire Department is dispatched by two dedicated dispatchers while call taking is handled by call takers who work for PSC. In late 2012, the dispatch staffing model was increased to two dedicated dispatchers as previous to this Calgary Fire Department had one dedicated dispatcher.

Ottawa indicates that it tries to maintain a staff of 6 between 07:00hrs to 17:00hrs, Monday to Friday and part-time dispatchers are used in a replacement role. When fully staffed with 7 positions, there are 3 call takers, one supervisor and three dispatchers. When staffing is at 6, there are two call takers, one supervisor and three dispatchers and, when at minimum staffing of 5, one call taker, one supervisor and three dispatchers.

5.1.12 Conclusion – TFS Call Taker and Dispatcher Staffing Levels

Our analysis of existing call taker and dispatch staffing levels indicates there is available capacity in both areas.

Communications Centre Technology

POMAX personnel reviewed the use of technology in the TFS and Emergency Medical Services communications centres, looking for potential efficiencies and savings in the application, implementation, and ongoing maintenance of systems.

We determined that there are three primary models, or options, for communications technology, each of which is driven by the potential organizational and operational design of the two communications centres. The capital and maintenance cost of these options may also influence the operational design of the communications centres.

Option 1: Consolidate into a single centre with combined operations in a shared room with shared technologies and common computer aided dispatch (CAD). Implementation would be done in a single conversion. This cost of this option has been estimated over five years including annual maintenance (Please see ***Table 30 – Technology Financial Options***).

Option 2: Separate dispatch centres but with shared technology with possible graduated progression to a fully consolidated centre.

Option 3: The existing organizational and operational configuration would continue with separate dispatch centers, technology would not be shared – except the radio system as noted below – but two additional dispatcher consoles and a minimum of one call taker console would be added to the TEMS communications centre to accommodate additional staff that may be negotiated with the Ministry of Health and Long Term Care. These positions are physical seats and desk space. They should not be confused with full time equivalents. The additional physical positions do not become a factor in considering costs if MOHLTC agrees to pay for the technology and positions as part of staffing increases.

Options 1 and 2 involve the consolidation of technology platforms in order to improve communications between the dispatch centres, cost avoidance for new technology upgrades, and cost savings through reduction in annual operating and personnel costs.

Since there is currently a shared radio system, and plans to migrate to a new radio system that is shared by all public safety agencies, we did not review the use of the radio system other than to consider that the voice logging recorder equipment will be replaced under that project.

The technologies considered include the following:

- Computer Aided Dispatch (CAD)
- Telephony
- Recording Systems

5.1.13 Computer Aided Dispatch (CAD)

Toronto's Fire Service and Emergency Medical Services use Tier 1 CAD systems (Intergraph and TriTech[58] CAD respectively), that have large client bases of EMS, fire and combined EMS/Fire dispatch operations. Either product could be utilized effectively to support fire and EMS operations on the same platform in an amalgamated dispatch operation or shared technology; however, there are a number of factors to be considered.

We also considered the possibility of adding EMS and fire to the Intergraph CAD system used by the Toronto Police Service because of possible benefits such as economy of scale, or the electronic exchange of information between police, fire, and EMS. However, because of security considerations, police services rarely allow non-police access to their CAD and maintain dispatch platforms separate from other organizations. For example, the City of Calgary had an initiative in place that intended to have police, fire, and EMS housed in one dispatch centre with all communications staff being able to dispatch all emergency services. Throughout that initiative Calgary Police Services maintained a separate CAD system. The initiative did not come to fruition and the three organizations, while housed in the same dispatch room, operate as separate entities.

Both Intergraph and VisiCad have a large number of clients operating fire and EMS communications centers, and either product would work well in the scenarios outlined in options 1 or 2. Our next step was to consider the number of interfaces that each system has and the resource effort that would be required to port those interfaces to the other platform.

Based on experience working with both vendors in numerous locations including Alberta Health Services; the Province of Ontario; EMS in the Regions of York, Durham, Peel, Halton, the County of Simcoe; Edmonton Fire; Vancouver (E-Comm); BC Ambulance; and others, POMAX's experience is that TriTech is more open to the type of customization and interface development that has been done by TEMS. Intergraph tends to develop all its interfaces on a time and

[58] TriTech's computer aided dispatch is also known as VisiCAD

materials basis and does not support clients' in-house interface development. Moreover there are multiple CAD associated external interfaces in use at EMS that would have to be built into the Intergraph installation if EMS were to use Intergraph CAD. TFS has comparatively fewer interfaces to the EMS CAD platform, fire RMS (record management system) and MOSCAD (Motorola Supervisory Control and Data Acquisition) for fire hall alerting.

TFS Interfaces

- MOSCAD
- Fire Link and Sun Pro message server to link to the fire record management system
- iMobile with integrated GPS

TEMS Interfaces

- Locution Station/Vehicle Alerting
- Alert Line (medical alarm monitoring)
- First Watch (performance monitoring against key performance indicators)
- Avtech Internet Protocol (IP) telephony
- GPS interfaces
- Patient Distribution System
- Optima (Siren Live Deployment and Siren Live Dispatch) *
- Seamless dispatch/vehicle transfer (Future) **

* Optima Corporation's real-time products include Siren Live Deployment and Siren Live Dispatch. The latter product was primarily developed for Toronto and is intended to assist dispatchers by recommending vehicle assignments. Siren Live Deployment is software that monitors the status of resources as well as historical call volume by day of week and time of day and then uses predictive analytics to forecast changes in the system over the next 20 minutes to assist dispatchers with best possible coverage decisions with least possible vehicle movement.

** Ambulance communications centres (ACS) and Central Ambulance Communications Centres[59] (CACC), surrounding Toronto use a customized version of the TriTech CAD. The principal customization was around 'seamlessness' which allows any ambulance communications centre to receive and generate an incident and send it electronically to another ACS thus providing 'seamless' ambulance service and vehicle following (tracking and monitoring). Although TEMS' communications centres do not yet have the facility to participate in this form of electronic information exchange, it is expected to do so in the future although a target date is not yet firm. Seamlessness is considered a critical component to providing ambulance services in Ontario.

This application can also facilitate the handling of calls along the municipal border of Toronto. In some circumstances, an ambulance emergency call can be routed to a communications

[59] Central Ambulance Communication Centres are operated by the Ontario Ministry of Health and Long Term Care; Ambulance Communications Centres are operated by municipalities or other non- Ministry of Health organizations (e.g. Toronto, Niagara Region, Kingston-Frontenac, etc.). Both CACCs and ACSs perform the same functions and use the same or similar equipment. Except for some minor variances, both CACCs and ACS are fully funded by MOHLTC.

centre that is not the one responsible for the geographic area in which an emergency occurs. This could be due to the caller contacting emergency services on behalf of a family member in another municipality, a cell phone call, or other reason. In such circumstances, 'seamless functionality' permits the dispatch centre receiving the call to take all pertinent information – as if it was the dispatch centre responsible for the geographic area of the incident – and electronically transfer the information to the correct dispatch centre. Without 'seamless functionality' the dispatch centre receiving the call would have to take information from the caller, telephone the responding dispatch centre, and verbally transfer the information which would use up valuable minutes. 'Seamless functionality' still results in delays of several seconds to a minute on individual calls but is much superior to a manual transfer of information.

Another feature of electronic seamlessness is the ability to transfer vehicle and patient information from one dispatch centre to another. For example, in a situation where a patient is transferred from Mississauga General to St. Michael's Hospital in Toronto, the Mississauga CACC could transfer vehicle information and dispatch-level patient information to the VisiCAD system at TEMS. TEMS could monitor and track the status of that vehicle as it completes the call. Similarly when a Toronto vehicle takes a patient to a surrounding jurisdiction, the CACC in that jurisdiction could update the dispatch records, saving time and resources for TEMS in the completion of the dispatch record.

An additional TriTech advantage is that it has an established interface to Locution, an automated alerting system that provides computer generated spoken alerting instead of a dispatcher having to enunciate call information to responders. This saves dispatcher time which, on a per call basis isn't substantial, but is cumulative. Locution's traditional install base is fire departments, including some locations in Canada, such as Vancouver and Edmonton, which means that it could be implemented at Toronto's fire stations. The installation of Locution would also solve another problem faced by TFS. Currently, the TFS crew alerting system operates on a consecutive alert basis. This means that when several stations have to be alerted to respond to an incident, each station is notified consecutively so delays in responses occur since the last station may be notified 20 to 30 seconds after the first station. Locution is capable of concurrent notification thus possibly reducing overall response times of a full complement of firefighters and apparatus.

Factors to consider in deciding on an acceptable CAD are outlined in Table 29 - Computer Aided Dispatch Considerations.

Table 29 - Computer Aided Dispatch Considerations

CAD	Pro	Con
TriTech	• The Ministry of Health pays for a significant portion of the capital and operational budget • Future plans are to achieve 'seamlessness' with Ontario's other CACCs and ACSs to support handover of vehicle and call data on transfers into and out of the city • There are more systems interfaced to the EMS CAD than the Fire CAD • Able to add fire halls to Locution Alerting System,	• No local support staff • US vendor so all payments in US funds (although that is less of a problem with the dollar at or close to par)

	possibly reducing crew notification time, as an incremental add on to existing interface	
Intergraph	• Greater presence in Canada (police, fire, EMS) • Larger fire install base in Canada • Large EMS install base in Canada including BC Ambulance Service and Alberta Health Services • Local support is available in Mississauga.	• Tend to be a more expensive solution especially hourly rates for development and support • Expensive to port EMS interfaces

An important consideration in deciding which CAD technology to use is that the Ministry of Health and Long Term Care provides almost all capital and operational funds associated with the EMS computer aided dispatch and TEMS's dispatch centre. Our experience working with MOHLTC, and other Ontario departments that contribute to the design and maintenance of the CAD and associated technology, is that they are adamant about having a standard CAD technology platform throughout the province and are reluctant to approve departures to that standardization. A decision to utilize Intergraph rather than TriTech for an EMS computer aided dispatch, though not out of the question, will likely require extensive negotiation with MOHLTC.

These factors lead us to the conclusion that a combined EMS – fire dispatch operation, or sharing of technology, should use the TriTech computer aided dispatch software.

5.1.14 Voice Logging (Recording)

Initial delivery of Next Generation (NG)[60] 9-1-1, expected by 2014 (and probably installed at the Toronto Police Service 9-1-1 Centre soon after), will include Internet Protocol (IP) telephony which can be very complex for recording. This complexity extends to:

- **Last message replay** – playing back a recording of a call that was very recently received to clarify the call content;
- **Follow-up playback** – listening to calls for the purpose of quality control or internal investigation; and
- **Disclosure** – gathering information for a police investigation or civil action request.

Playback voice quality, and accurately following IP telephone conversation threads, is very challenging for many voice logging companies. Therefore, it is essential that new or upgraded technology includes a proven product that works with both legacy telephone and radio equipment as well as future IP based telephony and radio voice systems.

The existing recording equipment at the fire and EMS communications centres will be replaced as part of the City's emergency services radio upgrade project. Our understanding from email communication with Motorola Solutions, the company awarded the contract for the replacement of the radio infrastructure, is that the recording equipment is expected to be ready for customer witnessed acceptance testing in early December 2013. Therefore, the cost

[60] In addition to the features provided by the current Enhanced 9-1-1, **Next Generation 9-1-1 (NG9-1-1)** prepares emergency services to keep pace with changing methods of communication and data transfer. Next Generation 9-1-1 enables communication via text messaging (including the transmission of text for the hearing impaired community), and allows the transmission of images, video and other data to a public safety answering point or emergency service. NG9-1-1 infrastructure is intended to replace the current services over time.

of recording equipment for existing fire and EMS dispatch positions is already captured within the radio system replacement project, but it does not include the cost of two additional dispatcher positions (option 3) since this was not anticipated at the time of the Motorola contract award.

5.1.15 Telephony

As noted in the voice logging section, next generation (NG) 9-1-1 will include voice over IP. The Toronto Police Service and the 9-1-1 centre will be on the leading edge of this deployment by 2014, which means that to avoid the need for additional interfaces to transition from the police (9-1-1) IP system to a conventional or legacy telephone system – particularly at the fire communications centre – both TFS and the TEMS will need to have IP telephony in place. TEMS uses a Computer Telephony Interface[61] (CTI) system, manufactured by a company called Avtec, that is partially IP based, but the fire service employs a traditional Nortel Option 61 Private Branch Exchange[62] (PBX) that is not CTI or IP based. TEMS, via a relatively simple incremental upgrade to the Avtec system, can make it fully IP and the fire service can then utilize the same telephone switch rather than purchasing a new, separate unit.

So, if we assume that a consolidation of Fire and EMS Dispatch would use a TriTech CAD that TFS and TEMS will go onto an upgraded NICE[63] logging system, and that TFS will join the TEMS Avtech telephony platform then two consolidation options are available:

Option 1: Consolidate into a single centre (EMS location) with combined operations in a shared room with shared technologies and common CAD. Implementation would be done in a single conversion. This option has been calculated over five years with annual maintenance.

Option 2: Separate dispatch centres but with shared technology with graduated progression. Two additional EMS positions (year 1); step by step implementation of each primary technology for fire; expect primary technologies in need of urgent attention (the TFS phone system, voice logging recorders) would be shared first (year 1) and other technologies (i.e. CAD, Mobile) would be shared later (year 3). Physical consolidation of the communications centres would not be part of this scope; however, with an increase in shared technologies some barriers to consolidation would be removed. This option does not include costs of new workstations for fire as it does not consider the relocation to EMS. This option has been calculated over five years with annual maintenance.

Note that these costs (shown in ***Table 30 – Technology Financial Options***) are the one-time costs for primary technologies and their related annual support/maintenance costs and therefore do not include internal implementation costs (project management, support/IT Staff) or base infrastructure impact costs (i.e. internal networks, building modifications.)

[61] Computer telephony interface is the use of computers to manage telephone calls.
[62] Private Branch Exchange: A private branch exchange (PBX) is a telephone exchange that serves a particular office, as opposed to one that a common carrier or telephone company operates for many businesses or for the general public.
[63] Neptune Intelligence Computer Engineering (NICE) Systems Ltd. specializes in telephone voice recording, data security, and surveillance as well as systems that analyse this recorded data and metadata. The company serves various industries, such as financial services, telecommunications, healthcare, outsourcers, retail, media, travel, service providers, and utilities.

Assumptions:

1. Primary technologies are:
    a. CAD (VisiCAD) – Based on total costs for 12 or 14 seats with test seats (used by developers to test changes (5 seats), training (5 for dispatch, 5 for mobile), disaster recovery and production environments). This increase in physical seats and desk space may require renovations to the EMS communications centre or, possibly, a physical separation between call takers and dispatchers. For example, call takers could utilize the space in the current TFS communications centre while dispatchers are housed in the EMS communications centre space.
    b. Mobile software for crew use (VisiNet Mobile)
    c. Voice Logging (NICE) (Option 2 includes 2 new logging recorder positions for EMS)
    d. Phones (AVTec) (as this is required for each option, option 1 will require 12 new and option 2 will require 14)
    e. Console furniture (one per new workstation at EMS. Option 1 will require 12 new for Fire at EMS location and Option 2 will only require 2 new for EMS)
    f. ALERT line (one per workstation as all can operate as call takers)
    g. Decision Support (Optima) (EMS dispatchers only) Only 2 additional in each option
    h. Medical Protocol Software (ProQA) (All positions)
    i. No Fire ProQA
    j. Backup voice radio for dispatcher positions (1 per dispatcher) in case the main radio system fails
    k. CAD environments include TEST (5 licenses), TRAINING (5 licenses) and DR (Disaster Recovery) which require a full set of additional licenses.

2. All existing dispatch servers are capable of supporting the addition of 12 fire CAD workstations and would not need to be replaced until the next scheduled replacement date. Therefore, no replacement server hardware costs have been included.

3. Option 1 includes small efficiency gains through call taker consolidation that will allow EMS to achieve additional dispatch resources without adding staff.

Note: The next major release for Intergraph's iMobile software is a new product called Mobile for Public Safety. It will require retraining of existing users so that would be a logical time to migrate from iMobile to the TriTech VisiNet Mobile, for which the licence cost is essentially 50% less expensive. For the 174 Fire mobiles there is a savings of $172,260 on the software licences ($990 savings per licence).

Table 30 – Technology Financial Options

	Option 1 – Full Consolidation		Option 2 – Shared Technology	
	One Time	Annual Maintenance over 5 Years	One Time	Annual Maintenance over 5 Years
Tritech CAD and Visinet Mobile for Fire	$712,745	$517,875	$733,745	$333,825
Locution	$738,000	$203,650	$738,000	$122,190
ProQA	$34,800	$31,320	$5,800	$5,220
Workstations	$372,000	$93,000	$62,000	$15,500
ALERT	$10,200	$9,180	$1,700	$1,530
Backup Radio	$18,000	$16,200	$3,000	$2,700
Decision Support	$1,200	$1,080	$189,000	$170,100
	$1,886,945	$872,305	$1,733,245	$651,065

Option 2, shared technology, is approximately $153,000 less expensive in capital costs (one time), and approximately $200,000 less expensive in ongoing maintenance costs over a 5-year period than option 1, full consolidation.

5.1.16 Examining the Options and Feasibility of Consolidation

Our calculations of required fire service call taker and dispatcher staffing indicates that, to meet NFPA 1221 performance guidelines for the existing call taking model, the minimum number of call takers required is three during peak daytime periods and two at night. That's a reduction of one complement position 24 hours a day.

Our calculation of TFS staff levels required for dispatching indicates that 3 dispatchers are required 24 hours a day. But, due to the random nature of dispatcher support activities and to account for large scale incidents and instances of extreme dispatcher activity (e.g. severe weather events), we recommend that the minimum dispatcher staffing level should be four for both day and night shifts. This is two less than the current complement of 6 dispatchers 24 hours a day.

Option 1: Consolidate the TEMS and TFS communications centres

The result of this analysis indicates that 3 call taker – dispatcher staff positions could be reduced in the TFS communications centre resulting in an annual saving of $1.3 million when benefits and paid absences are taken into account (***Table 31***). In an amalgamated EMS – fire communications centre option these 3 complement could offset 3 positions required by emergency medical services. However, since the Ministry of Health and Long Term Care funds 100% of the TEMS communication centre staff cost, consolidating fire and EMS communications and using fire complement positions to offset needed staffing for EMS would really result in Toronto assuming some of the cost of a currently fully funded communication centre.

Table 31 - TFS Staff Complement Cost Recovery

Staff	hrs/day	days	total hours	FTE	Salary	Annual Result	Paid Absences %	Paid Absences $	Benefits 27.2%	Total Cost
3	24	365	26280	12	$75,000	$902,473	25%	$225,618	$245,473	$1,373,563

Option 2: Consolidate the communications centres and reduce staff levels at the fire communication centre as a separate action

Another option would be to reduce the staff levels at the TFS communication centre as well as consolidating the two dispatch centres. This would result in an annual saving of over $1.3 million in TFS staff cost, but there would be no obvious operational or monetary benefit directly related to consolidating the 2 centres.

Option 3: Continue with separate communications centres but share technology and infrastructure

A third option would be to continue with separate communication centres, reduce the TFS communications staffing levels thus saving approximately $1.3 million a year, and share technology platforms whenever possible. For example, when it is time to upgrade the fire service's Intergraph computer aided dispatch, Toronto should assess the possibility of sharing the EMS computer aided dispatch platform to see if it is possible to reduce forward technology costs. This option may be possible if it does not impose on the Ministry of Health and Long Term Care concerns about a standard EMS CAD platform across Ontario. Other systems such as Decision Support and Locution may also be able to be implemented by TFS at a reduced cost. Savings could also be realized by TFS utilizing the EMS telephone platform.

Option 4: Continue with separate communications centres, share technology and infrastructure; generate revenue to offset TFS staff costs

A fourth option is similar to option 3 except there would be no staff reduction in the fire communications centre except perhaps through attrition. Instead, TFS could consider revenue generation in the form of offering call taking and dispatch services to other municipalities. A number of municipalities in the Greater Toronto Area and further afield are seeking ways to reduce costs, often by outsourcing their dispatch function. The City may want to consider reducing costs by increasing revenue. The concept does raise some labour relations considerations as do any of these options other than the status quo.

5.1.17 Other Considerations in Consolidation

There are factors other than technology and staffing that have to be taken into account when considering the possibility of consolidation. For example, in Toronto, the amalgamation of fire and EMS communications centres would bring together two different union groups performing the same job, with slightly different pay scales and substantially different working condition agreements. Experience at other communications centres, where these issues were not resolved before amalgamation, has shown that it was a point of contention for many years.

Consolidation of the two centres could also precipitate opening negotiations with Emergency Health Services Branch of the Ministry of Health and Long Term Care with respect to a new shared funding model.

We also recognize that consolidations are monetarily successful when reductions in staff costs offset initial infrastructure and technology costs, and thereafter reduce costs compared to operating more than one communications centre. In this case, some staff reductions can be accomplished without consolidation, as can sharing of infrastructure and technology. Since consolidations are often hampered by labour relations issues that can continue for a substantial period of time (10 to 15 years is not uncommon), consolidation should not be a consideration if similar cost reduction can be achieved in a less intrusive manner.

Finally, we have not considered here the possible reduction of information technology or other support staff in the case of a full consolidation. Even though it is probable that some form of support staff rationalization could take place within 3 to 5 years, the actual positions are not easily identifiable and there would probably be reasonable counterpoints to support staff reduction. For example, moving fire to a different technology platform will require appropriately qualified project staff for approximately 2 years. Nevertheless even a shared technology initiative, as we have described in this chapter, would likely result in eventual reduced technology support staff needs.

One other factor has to be taken into account and that is, in a consolidated model, there should be the eventual rationalization of supervisory positions from the current levels. For example, would all EMS communications centre supervisor and fire communications captain positions be required in a consolidated communications centre? Probably not, and it is possible that 30% or more of the positions could eventually be reduced. However, history at other consolidated communications centres shows that it is likely to be several years before a consolidated centre functions at a high enough level to allow the reduction of supervisory positions. Therefore, this possibility was not factored into the overall equation. Also, the issue of negotiating a new funding model with the Ministry of Health must be kept in mind. The MOHLTC would probably also want to benefit from reduced costs resulting from a consolidated dispatch model.

5.1.18 Observations and Conclusions

As we noted in the introduction of this section, the feasibility of consolidating the fire and EMS dispatch centres has to be examined from the perspectives of staff levels, technology, funding, organization, and operation. We indicated that a negative report on any one or two of these areas could negate the feasibility of consolidation.

Our assessment indicates that the benefits of consolidating the currently separate fire and emergency medical service centres can be achieved without consolidation. In fact, consolidating the centres will precipitate the negative effects of labour relations issues, and the possibility of opening up communications centre funding negotiations with the Ministry of Health and Long Term Care.

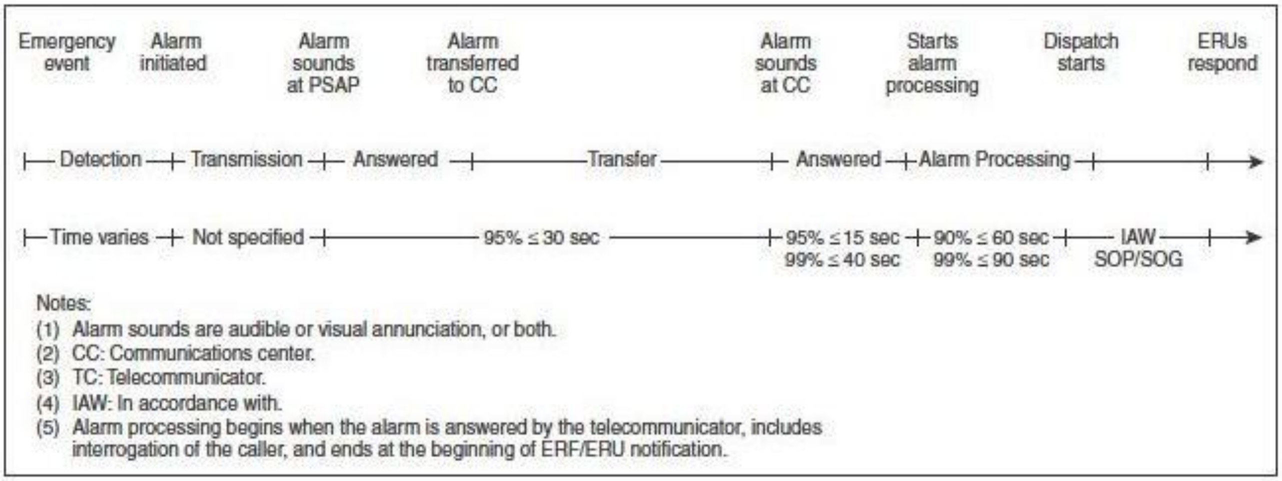
The two communications centres are already housed in the same building, use the same radio communications system and other infrastructure, and have an opportunity to reduce future technology costs, particularly in the fire service, by building onto existing EMS technology platforms.

5.1.19 Recommendations

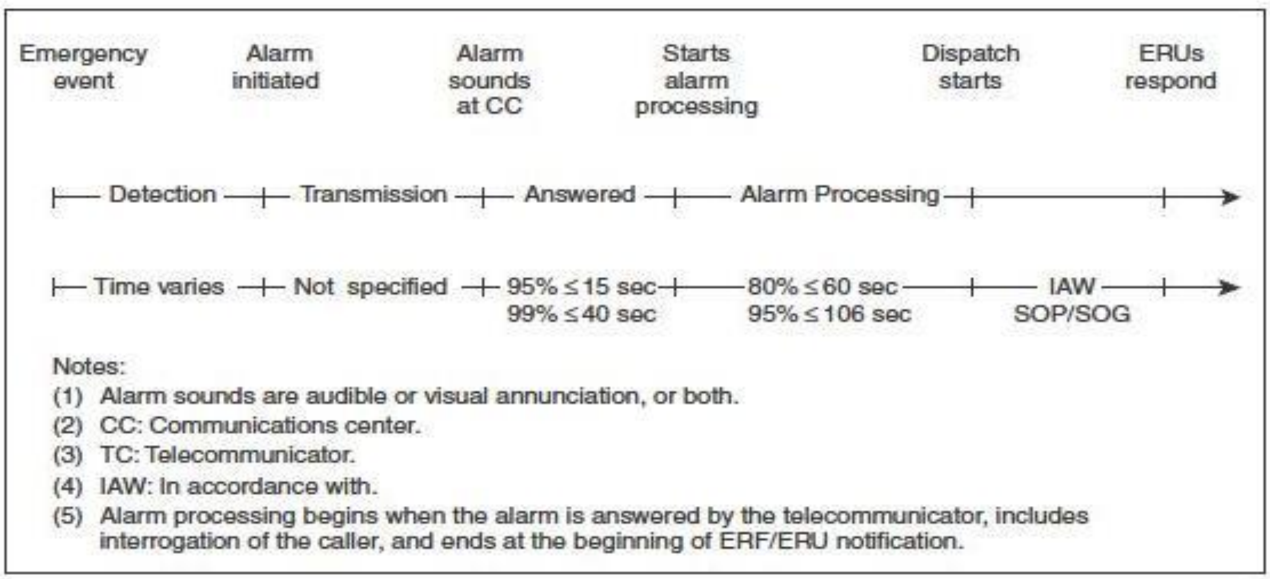
- Do not move to a full operational consolidation of the TFS and TEMS communications centres but evaluate sharing technology platforms when upgrading emergency services communications technology.
- Evaluate opportunities for the TFS communications centre to provide service to other municipal fire departments to generate revenue and offset costs.
- Advocate with the Ministry of Health and Long Term Care for acceptable staff levels for the TEMS communications centre.

<u>NFPA Alarm Time Line</u>

2010 Version



2013 Version



6.0 Jurisdictional Comparison

The intent of jurisdictional comparators is to determine if there are practices or benchmarks in other municipalities that may be locally beneficial to either TFS or TEMS.

Several potential comparator municipalities were discussed with both fire and EMS. The fire service chose Houston, Chicago, and Edmonton as comparable municipalities. Responses to our contact and survey inquiries were received from Houston and Edmonton but Chicago declined. TEMS felt that international locations would provide information most applicable to TEMS. Surveys were sent to New South Wales Ambulance, and Ambulance Victoria in Australia, and direct inquiries were made to personal contacts in the United Kingdom.

The survey results can be found on the following pages. They are interesting and probably most useful to fire and emergency medical service professionals in comparing response criteria. For example, Houston responds to a reported high rise fire with 6 pumpers, 4 aerials, 4 District Chiefs, 1 BLS ambulance, 1 ALS ambulance, and 1 Safety Officer, whereas Toronto responds with 2 pumpers, an aerial, a rescue or a squad, one other apparatus, and a District Chief. On the other hand, Houston sends one apparatus to a report of an alarm but Toronto sends 3 apparatus. The survey response detail can be found in ***Appendix A – Detailed Jurisdictional Comparison***.

The benefits of emergency medical services information from Australia may not be significant. The Australian organizations are substantially larger with respect to area covered and population base – they respond to urban, rural, and remote environments – and employ approximately 4,000 staff each.

Information from the Ambulance Trusts of England was provided to us in their standard report form rather than in the survey format, and is included in tables in this section. Please note that statistical information from the Ambulance Trusts of England shows the **month of June** 2012 only whereas all other tables provide **annual** statistics.

Of interest is Table 39 in this section which indicates the proportion of incidents managed without the need for transport to an Accident and Emergency Department. This table represents efforts being made by the Ambulance Trusts to treat patients in their residences or on scene, where appropriate, rather than transporting to hospital. This is similar to one of Toronto's initiatives with the Community Paramedicine Program. On average, throughout England, approximately 35% of patients are treated without needing to be transported to an Accident and Emergency Department. This practice, where appropriate, reduces the pressure on ambulance resources with respect to transportation time, hospital wait times, and emergency department patient load.

Comparison highlights for Houston, Edmonton, Ambulance Victoria, Ambulance New South Wales, and Toronto are shown in Table 32 to Table 37 in this section. The United Kingdom ambulance information for England can be found in Table 38 to Table 39 in this section. The detailed survey information for Houston, Edmonton, Ambulance Victoria, and Ambulance New South Wales can be found in ***Appendix A - Detailed Jurisdictional Comparison***.

6.1.1 Survey Results

Table 32 - Jurisdictional Comparators - Population, Area, and Service Type

	Area (KM^2)	Population	Service Type	Notes
Toronto	641	2.79 million	Separate fire and EMS	
Houston Fire - EMS	1,554	2.1 million	Combined fire - EMS	
Edmonton Fire	700	817,500	Fire	
Ambulance Victoria	227,490	5.575 million	EMS	State wide
Ambulance New South Wales	801,600	7.25 million	EMS	State wide

Table 33 Jurisdictional Comparators - Staff Levels

	Full Time Equivalents	Front Line Firefighters	Paramedics	Notes
Toronto Fire	3,182.3	2,786		
Houston Fire - EMS	3,970	1,726	450	
Edmonton Fire	1,117	951		
TEMS	1,220.5		933	
Ambulance Victoria	3,826		2,725	
Ambulance New South Wales	4,241.8		3,231.4	

Table 34 - Jurisdictional Comparators - Budget

	Budget	Notes
Toronto Fire	$370,125,800	2012 Approved
Houston Fire - EMS	$433,218,000	For Emergency Response (including fire and EMS): $326,508,622
Edmonton Fire	$166,137,000	Net of Revenue
TEMS	$174,487,500	2012 Approved
Ambulance Victoria	$572,620,000	2011-2012 in Australia dollars (AUD and Canadian dollar are at par)
Ambulance New South Wales	$690,000,000	2011-2012 in Australia dollars (AUD and Canadian dollar are at par)

Table 35 - Jurisdictional Comparators - Stations

	Stations	Notes
Toronto Fire	84	
Houston Fire - EMS	92	84 ambulances are housed at fire stations – supported by private ambulance services
Edmonton Fire	26	
TEMS	45	
Ambulance Victoria	246	
Ambulance New South Wales	226	

Table 36 - Jurisdictional Comparators - Incidents

	EMS Incidents	Fire Incidents	Other Incidents	Notes
Toronto Fire	86,380	58,954		
Houston Fire - EMS	230,605	46,200		
Edmonton Fire		36,384		9,104 (structural fires, non-structural fires, and alarms)
TEMS	217,190			
Ambulance Victoria	489,857			
Ambulance New South Wales	865,725			

Table 37 - Jurisdictional Comparators – Response Time – Call Receipt to Arrive at Incident

	Fire Suppression Emergencies 90th Percentile (mm:ss)	Fire Suppression Emergencies Average (mm:ss)	EMS Emergencies 90th Percentile (mm:ss)	EMS Emergencies Average (mm:ss)	Notes
Toronto Fire	7:39				Fire and EMS responses combined
Houston Fire - EMS	11:24	7:25	10:57	Not Reported	Minutes and Seconds
Edmonton Fire	8:30	5:47	See details	Not Reported	
TEMS			10:54 Echo		13:18 (Delta)
Ambulance Victoria			22:04	13:26	Statewide
Ambulance New South Wales			20:27	10:70	Sydney only

6.1.2 Ambulance Trusts in England

Table 38, below indicates the performance parameters for Red 1 EMS incidents at various Ambulance Trusts in England. Red 1 calls are very similar to EMS ***Echo*** calls in Toronto. In England, Red 1 calls are described as "… *the most time critical, and cover cardiac arrest patients who are not breathing and do not have a pulse, and other severe conditions such as airway obstruction*". The Department of Health in England notes that Red 1 patients account for less than 5% of all calls, similar to most areas of North America and Toronto.

The target response time for Red 1 calls, from the time the call for assistance is received by the ambulance call taker (known as Call Connect), until a paramedic arrives at the incident is 8 minutes, in 75% of cases. The paramedic arriving within 8 minutes does not have to be in a transport capable ambulance but a transport capable ambulance is expected to arrive within 19 minutes 75% of the time. Fire does not respond to medical calls in most areas of England.

Table 38 - Ambulance Trusts in England - Red 1 Call Performance (Echo) – June 2012 Statistics

Name	Number of Red 1 calls resulting in an emergency response	Number of Red 1 calls resulting in an emergency response within 8 minutes	Proportion of calls responded to within 8 minutes	95th percentile of time from Call Connect of a Red 1 call to an emergency response arriving at the scene of the incident
England	10,376	7,825	75.4%	-
East Midlands Ambulance Service NHS Trust	2,109	1,637	77.6%	14.4
East of England Ambulance Service NHS Trust	788	561	71.2%	15.3
Great Western Ambulance Service NHS Trust	542	424	78.2%	13.4
Isle of Wight NHS Trust	17	12	70.6%	11.3
London Ambulance Service NHS Trust	1,191	898	75.4%	16.4
North East Ambulance Service NHS Trust	220	169	76.8%	12.2
North West Ambulance Service NHS Trust	2,486	1,882	75.7%	15.4
South Central Ambulance Service NHS Foundation Trust	423	306	72.3%	17.0
South East Coast Ambulance Service NHS Foundation Trust	419	296	70.6%	16.7
South Western Ambulance Service NHS Foundation Trust	226	154	68.1%	15.0
West Midlands Ambulance Service NHS Trust	507	406	80.1%	12.2
Yorkshire Ambulance Service NHS Trust	1,448	1,080	74.6%	13.8

Table 39, below, shows the number of EMS calls in June 2012 where patients were given telephone advice, or treated at the scene, and then went to a location other than an emergency department. Column 7 indicates the percentage of patients treated without need for transport to an Accident and Emergency Department. One of the objectives of Toronto's Emergency Medical Services is to eventually reduce the number of patient responses and transports to hospital, where appropriate, or the growth of patient responses and transports to hospital, through the Community Paramedicine Program and other practices.

Table 39- Ambulance calls closed with telephone advice or managed without transport to Accident and Emergency (where clinically appropriate) - June 2012 Statistics

1	2	3	4	5	6	7
Name	All emergency calls that receive a telephone or face-to-face response from the ambulance service	Number of calls resolved by telephone advice	Proportion of calls closed by telephone advice	All emergency calls that receive a face-to-face response from the ambulance service	Number of patients discharged after treatment at the scene or onward referral to an alternative care pathway and those with a patient journey to a destination other than Type 1 or 2 A&E	Proportion of incidents managed without need for transport to Accident and Emergency department
England	519,277	31,435	6.1%	511,930	181,587	35.5%
East Midlands Ambulance Service NHS Trust	50,216	3,494	7.0%	46,669	18,834	40.4%
East of England Ambulance Service NHS Trust	56,318	3,956	7.0%	57,916	26,640	46.0%
Great Western Ambulance Service NHS Trust	17,949	1,725	9.6%	16,657	8,018	48.1%
Isle of Wight NHS Trust	1,730	134	7.7%	1,596	748	46.9%
London Ambulance Service NHS Trust	93,032	5,048	5.4%	87,984	28,225	32.1%
North East Ambulance Service NHS Trust	27,185	992	3.6%	26,887	8,444	31.4%
North West Ambulance Service NHS Trust	70,323	2,425	3.4%	68,539	15,817	23.1%
South Central Ambulance Service NHS Foundation Trust	14,563	1,743	12.0%	31,574	12,942	41.0%
South East Coast Ambulance Service NHS Foundation Trust	45,963	3,785	8.2%	42,178	17,399	41.3%
South Western Ambulance Service NHS Foundation Trust	30,762	1,768	5.7%	27,166	13,180	48.5%
West Midlands Ambulance Service NHS Trust	61,926	3,886	6.3%	58,040	20,213	34.8%
Yorkshire Ambulance Service NHS Trust	49,310	2,479	5.0%	46,724	11,127	23.8%

Table 40, below, indicates the percentage of patients who re-contact the ambulance system in England after being provided advice by telephone (no face-to-face contact) (column 4) and the percentage who re-contact after being treated and discharged at the scene instead of being transported to hospital (column 7). The intent of the telephone contact, and on-scene treatment and discharge where appropriate, is to reduce the number of patient responses and transports to hospital. Similar practices are under consideration at TEMS.

Country-wide, 14% of patients who are given telephone advice rather than ambulance response re-contacted the ambulance service within 24 hours. Approximately 6% of patients who are treated and discharged at the scene (no transport to hospital) re-contact the ambulance service within 24 hours.

Table 40 - Ambulance Trusts in England - Patient Re-contact Percentage After Telephone Advice and On-scene treatment - June 2012 Statistics

1	2	3	4	5	6	7
Name	**Calls closed with telephone advice**	**Calls closed with telephone advice where re-contact occurs within 24 hours**	**Proportion of patients who re-contacted following dischage of care, by telephone within 24 hours**	**Patients treated and discharged on scene**	**Patients treated and discharged on scene where re-contact occurs within 24 hours**	**Proportion of patients who re-contacted following treatment and discharge at the scene, within 24 hours**
England	31,435	4,386	14.0%	166,850	9,879	5.9%
East Midlands Ambulance Service NHS Trust	3,494	165	4.7%	14,508	943	6.5%
East of England Ambulance Service NHS Trust	3,956	522	13.2%	21,291	1,492	7.0%
Great Western Ambulance Service NHS Trust	1,725	251	14.6%	7,063	320	4.5%
Isle of Wight NHS Trust	134	6	4.5%	514	8	1.6%
London Ambulance Service NHS Trust	5,048	138	2.7%	33,776	1,399	4.1%
North East Ambulance Service NHS Trust	992	161	16.2%	6,014	287	4.8%
North West Ambulance Service NHS Trust	2,425	771	31.8%	14,004	838	6.0%
South Central Ambulance Service NHS Foundation Trust	1,743	367	21.1%	12,820	1,022	8.0%
South East Coast Ambulance Service NHS Foundation Trust	3,785	469	12.4%	15,285	742	4.9%
South Western Ambulance Service NHS Foundation Trust	1,768	271	15.3%	11,848	882	7.4%
West Midlands Ambulance Service NHS Trust	3,886	574	14.8%	19,910	1,115	5.6%
Yorkshire Ambulance Service NHS Trust	2,479	691	27.9%	9,817	831	8.5%

Please see ***Appendix A - Detailed Jurisdictional Comparison*** for additional service comparator details.

7.0 Culture and Change

One of the tasks within this project is to "propose service delivery and organizational model options that optimize efficiencies while ensuring service effectiveness". Within that task is the need to identify organizational cultural impacts that a proposed concept might produce, since cultural factors generally are considered to be potential barriers to change.

Fire and emergency medical services are generally accepted to have cultures specific to each organization. This part of the report discusses the relevance and implications of change and cultures.

Culture Defined

Human growth and development professionals subscribe to the premise that people, and the organizations they create, develop in an invariant[64] hierarchical sequence of stages, one of which sets out the concept of work culture. A cognitive developmental orientation characterized as a 'reference group' perspective describes a stage at which a group's culture is predominant and can be identified by a structure in thinking. This 'reference group' can include any occupation such as social workers, physicians, engineers, nurses, fire fighters, or paramedics. Simply put, almost all of us have the same approach and perspective to our jobs as others in our work group or profession that do essentially the same job. Sometimes, when someone inside or external to our reference group puts forward a new way of achieving the purpose of the job function, it may be seen as exciting, and therefore embraced, or contrary and possibly resisted or condemned as wrong thinking.

As a result of socialization over time, individuals subscribe to the group's beliefs, values and ways of doing things. In fact, it's possible that individuals choose some of these professions based on their existing thought process and social perspective. Fire and pre-hospital emergency medical services staff are no different to others and, with few exceptions, become socialized to their respective profession's culture. Understanding culture in these general terms helps to explain why some changes are readily embraced while others aren't. This understanding can also assist with developing methods to facilitate change.

The most significant stage content for both services is the belief in, and the value placed, on a timely response to emergency situations, utilizing their skills to ensure public safety and, to the extent possible, preventing incidents from taking place.

A reference group's perspective represents the beliefs, values, and ways of doing things (culture). Emergency medical and fire services culture is one of helping people in time of vulnerability. The tools of their trade include education, equipment, vehicles, medications, and research informed procedures. When the tools change and the adjustment is perceived as

[64] Something that does not change under a transformation, such as from one reference frame to another.

beneficial, both services tend to embrace rather than resist these types of innovations. In some cases, change may be supported by evidence, sometimes not, but if it is intuitively seen as useful it is often accepted. This applies to all professions, not just fire and EMS.

On the other hand, if a change is seen as striking at a core belief of a profession it is strongly resisted with few exceptions. It is often, for all of us not just fire and pre-hospital emergency medical services, difficult to accept a paradigm shift that finds new ways of accomplishing our core purpose or, in fact, changes our core purpose.

The axiom about structural change is that a formidable force is required to precipitate it. The necessary force is often referred to as a 'burning platform' which can mean any number of events but common to all is decisive action. *Without decisive action and a clear strategy, change in structure can often be indefinitely deferred. As long as decisive action is not taken and a structural change is not imminent, there is nothing to be lost by agreeing to a paradigm shift in the future, thereby essentially protecting the stage structure status quo.*

Our efforts in consulting comparable municipalities, examining studies and consultant reports, and visiting locations such as Winnipeg and Manchester, for the purpose of researching this assignment, has convinced us that jurisdictions, internationally, are exploring different methods, equipment, tools, deployment and crewing configurations to do the job better and more efficiently. In the United Kingdom an ideological shift, which places fire prevention and education as equally important to fire response, started more than 10 years ago in reaction to a fiscal burning platform.

Also in the UK, emergency medical services place an increased focus on becoming a mobile health resource; a similar shift can be observed in the Long and Brier Islands Community Paramedic project in Nova Scotia. Instead of being primarily reactive, these emergency medical services are proactive by taking health care to a full range of patient groups while decreasing transports to hospitals.

This report is about change. It is about the ability of the City of Toronto to move its emergency services in the direction of prevention, proactivity, the reduction or avoidance of cost, and towards viewing the human services perspective as equally important as emergency response. It's about recognizing that even though emergency response will continue to be an important part of the fire and emergency medical services departments' role, strengthened prevention, public education, and proven but different ways of delivering service and care should be the future of Toronto's emergency services. The focus of Toronto's fire and EMS departments should be their role in the social fabric of the city – that is, preventing fires; treating patients in their residences when possible; promoting public awareness of health, fire, and safety risk; and protecting the most vulnerable in the municipality.

We hope that this report is a catalyst that helps to move the emergency services towards a new way of doing business but we aren't naïve. There will be great resistance to some parts of this report; there will be statements about increasing the risk to the public, that the traditional response to emergencies is of greatest importance, and anecdotes will be offered to support those contentions. Nevertheless, we encourage everyone to read this report to find out why reducing or avoiding cost while achieving the same level of service, and promoting the human and social services side of emergency services, is indeed possible and proven.

Notwithstanding the reality that there will always be a need to save someone's life medically, to rescue someone from a potential fatality, or to suppress a blaze, the better value for money is to apply resources to decreasing the risk of the events occurring. Primary focus on prevention requires a structural change in thinking, which then precipitates a new culture with different beliefs and values. How this emerges is determined by how well the change is managed once transition is triggered by decisive action. Most importantly, change must involve the people who will create the new culture.

Appendices

Appendix A – Detailed Jurisdictional Comparison

Fire Service Jurisdictional Comparators

DEMOGRAPHICS

Location	Comparator Criteria			
	Population	**Coverage Area (Sq.mi/km)**	**Median Household Income**	**% below poverty level**
Houston, Texas	2,145,146	599	$ 42,962	21.0 %
Edmonton, Alberta	817,498	270	$ 84,100	14.1%

SERVICES

Location	Comparator Criteria				
	Is BLS First Response Provided to Medical Emergencies?	**Is ALS First Response Provided to Medical Emergencies?**	**Does the department deploy BLS ambulances that respond to emergency incidents & transport patients?**	**Does the department deploy ALS ambulances that respond to emergency incidents & transport patients?**	**Does the department provide non-emergency transport services (eg. hospital to hospital)?**
Houston, Texas	Yes	Yes	Yes	Yes	No
Edmonton, Alberta	Emergency Medical Response level only provided by Fire Rescue Operations personnel.	No	No	No	No

STAFFING

Location	Comparator Criteria					
	Total # of budgeted department employees	**Total # of budgeted uniform staff**	**Total # of budgeted firefighters**	**Total # of budgeted civilian staff**	**Are paramedics uniform or civilian?**	**Total # of budgeted paramedics**
Houston, Texas	3970	3851	Firefighter- 1726 (including 98 probationary FF)	119	uniform	450
Edmonton, Alberta	1,117	1,081	951	36	n/a	n/a

ORGANIZATIONAL STRUCTURE

Location	Comparator Criteria						
	Do emergency medical response staff (other than 1st responders) report in a separate organizational "line" from fire suppression personnel	**If no, what is the rank structure for this unit**	**If no, what is the number of budgeted positions for each rank**	**If yes, what is the fire suppression rank structure**	**If yes, what is the number of budgeted positions for each fire suppression rank**	**If yes, what is the EMS rank structure**	**If yes, what is the number of budgeted positions for each EMS rank**
Houston, Texas	No	Firefighter, Engineer/Operator (EO), Captain, Senior Captain, District Chief, Deputy Chief	Firefighter- 1,726 (including 98 probationary FF) EO- 1, 065 Captain-431 Sr. Captain- 156 District Chief-102 Deputy Chief- 8	n/a	n/a	n/a	n/a
Edmonton, Alberta	n/a	n/a	n/a	n/a	n/a	n/a	n/a

BUDGET (latest fiscal year)

Location	Comparator Criteria		
	Total department budget	Total budgeted amount for fire operations	Total budgeted amount for EMS operations
Houston, Texas	$433,218,057	For Emergency Response (including fire and EMS): $326,508,622	Combined under fire operations
Edmonton, Alberta	$166,137,000 (net of revenue)	$120,953,000 (net of revenue)	n/a

STATIONS/APPARATUS

Location	Comparator Criteria				
	Does the department deploy ALS engine or ladder companies	Number of stations with staffed firefighting and/or EMS apparatus:	Number of staffed apparatus (by type) deployed 24-hours a day:	Number of staffed apparatus (by type) deployed for less than 24-hours a day	Minimum number of staff assigned to each fire suppression apparatus by type of apparatus:
Houston, Texas	No	92 (including 4 ARFF stations and 1 Haz-Mat station)	87 engines 37 trucks (ladders/towers/quints) 21 district chiefs (16 with Incident Commander Technicians) 11 boosters 50 transport basic life support (BLS) units (ambulances) 34 transport advance life support (ALS) units (medics and squads) 11 non-transport ALS units (squads) 2 medical safety units 450 credentialed Paramedics 10 EMS supervisors 3 haz-mat units (including 1 foam pumper) 3 rescue trucks (additionally 2 reserve rescue trucks) 11 crash trucks (additionally 2 reserve	none	engines, ladders- 4; district chiefs- 2; ALS, BLS units- 2; rescue, ARFF, haz-mat- 4

			crash trucks) 3 cascade Trucks 1 rehab truck 1 command van 3 safety officers 10 evacuation boats 8 rescue boats 2 utility vehicles 1 mobile ventilation unit		
Edmonton, Alberta	We do not provide ALS service. Engine (pumper) and Ladder units provide EMR first response only	26 (Includes a new station to be operational shortly)	27 Pumpers, 8 Ladders, 6 Rescues, 5 Tankers, 1 Hazmat	---	4 for Pumper, Ladder, Rescue, HAZMAT has 5, 2 for Tankers If there is only a single pumper unit assigned to a station it is staffed with a minimum of 5 personnel

STATIONS/APPARATUS – CONT.

Location	Comparator Criteria							
	Mix of staff assigned to each type of fire suppression apparatus (e.g. firefighter, firefighter/paramedic, firefighter/EMT)	Minimum number of staff assigned to each type of EMS unit (by type of unit):	Mix of staff assigned to each type of EMS unit (e.g. paramedics, EMTs, other) by type of EMS unit	Number of specialized hazardous materials apparatus deployed	Does the department have a replacement cycle for fire suppression apparatus	If yes, what is the replacement cycle	Does the department have a replacement cycle for EMS units	If yes, what is the replacement cycle
Houston, Texas	engine- 1 captain, 1 EO, 2 firefighters; ladder- I sr. captain, 1 EO, 2 firefighters; district chief- 1 district chief, 1- EO;	2	BLS- 1 EO (EMT), 1 firefighter (EMT); ALS- 1 EO (Paramedic), 1 firefighter	2	Yes	HFD fire apparatus are considered frontline a minimum of 8 years before	Yes	HFD replacement cycle for EMS units is based on actual vehicle

			(paramedic			being considered for replacement/ reserve program. The average service life of HFD heavy apparatus is 8 to 12 yrs		mileage. 120k to 150k is the average mileage an EMS unit must have before it's considered for replacement. HFD remounts its box modules on new cab chassis.
Edmonton, Alberta	All staff are firefighters	n/a	n/a	2 (1 staffed and the other shared crew with Pumper)	Yes	13 years for Pumper, 17 years for Rescue, Ladder, and Tanker, and 10 years for Hazmat unit.	n/a	n/a

INCIDENTS (FOR LATEST YEAR AVAILABLE)

Location	Comparator Criteria			
	Total number of incidents responded to	**Total number of fire suppression incidents responded to:**	**Total number of EMS incidents responded to**	**Total number of other incidents responded to**
Houston, Texas (2011)	276,805	46,200	230,605	NONE
Edmonton, Alberta	36,384	9,104 (structural fires, non-structural fires, and alarms)	23,731	3,549

OPERATIONAL RESPONSE

Location	Comparator Criteria								
	What is the number and type of apparatus/staff (including battalion chiefs and/or deputy chiefs) which respond to the following types of incidents:								
	Car fire	**Car fire with injuries**	**Dumpster/trash fire**	**Grass/brush fire**	**Alarm in an apartment**	**Alarm in a dwelling (non-apartment)**	**Dwelling fire**	**High rise fire**	**Apartment or commercial building under 7 stories**
Houston, Texas	1 Engine	1 Engine, 1 BLS	1 Engine	1 Engine, 1 Booster	1 Engine	1 Engine	3 Engines, 1 Ladder, 1 District Chief, 1 BLS	6 Engines, 4 Ladders, 4 District Chiefs, 1 BLS, 1 ALS, 1 Safety Officer	4 Engines, 2 Ladders, 2 District Chiefs, 1 BLS, 1 Safety Officer
Edmonton, Alberta	1 P, 1 L or T, 1 HZ if Hazmat present	2 P, 1 R, 1 L, 1 T, 1 DC, 1 HZ if Hazmat present	1 P	1 P, 1 T, 1 ATP	2 P, 1 R, 1 L, 1 T, 1 DC, 1 HZ if Hazmat present	2 P, 1 R, 1 L, 1 T, 1 DC, 1 HZ if Hazmat present	3 P, 1 R, 1 L, 1 T, 1 DC	3 P, 1 R, 2 L, 1 T, 1 DC	3 P, 1 R, 2 L, 1 T, 1 DC, 1 HZ if Hazmat present

Location	Comparator Criteria								
	What is the number and type of apparatus/staff (including battalion chiefs and/or deputy chiefs) which respond to the following types of incidents:								
	BLS	**ALS**	**Auto accident**	**Auto accident – extrication needed**	**Industrial fire**	**Hazardous materials incident**	**Subway fire**	**Does the department comply with two-in two-out standards**	**Are battalion chiefs assigned aides? Drivers?**
Houston, Texas	closest apparatus with EMT's	closest apparatus with Paramedics	closest EMT	1 Engine, 1 Ladder, 1 District Chief, 1 BLS, 1 Rescue truck	4 Engines, 2 Ladders, 2 District Chiefs, 1 BLS, 1 Safety Officer	4 Engines, 1 Ladder, 1 District Chief, 1 BLS, 1 Safety Officer, 1 Haz-Mat	n/a	yes	Yes, they are the same position
Edmonton, Alberta	**n/a**	**n/a**	1 P, 1 L or 1T	1 P, 1 R, 1 L or 1T	3 P, 1 R, 2 L, 1 T, 1 DC, 1 HZ if Hazmat present	1 P, 1 HZ, (1 R, 1 DC, and 2 Padded depending upon incident type)	3 P, 1 R, 2 L, 1 T, 1 DC, 1 HZ, 1 SAL	Firefighters are tracked going in and out through accountability worksheet	No

CALL-TAKING AND DISPATCH SERVICES

Location	Comparator Criteria								
	Does the department's call-taking and dispatch unit function as the primary or the secondary PSAP for answering 911 calls?	Are fire/EMS call-taking services provided in-house? (Services after the initial 911 call has been answered should be considered call-taking services for these questions)	If yes, what is the shift schedule for call-takers?	If yes, how many seats are typically staffed for each shift?	If yes, number of budgeted uniform positions (excluding managers/ supervisors):	If yes, number of budgeted uniform manager/supervisor positions	If yes, number of budgeted civilian staff positions (excluding managers/ supervisors):	If yes, number of budgeted civilian manager/ supervisor positions	If call-taking is not provided in-house who provides the service and at what cost to the fire department?
Houston, Texas	Primary	No	---	---	---	---	---	---	City of Houston Emergency Center, cost not available
Edmonton, Alberta	Secondary PSAP	Only Fire call-taking services	2 - 10 hrs day shifts, 2 - 14 hrs night shifts, 2 days off, 2 - 10 hrs day shifts, 2 - 14 hrs night shifts, 6 days off	Minimum of 2 and up to 5 based on staffing level and/or call volume	29 (total Call-takers and Dispatchers)	9 in total for the Communications Centre (8 Officers and 1 Chief)	---	---	n/a
		Note: the terminology is a little limiting – hopefully this provides a better picture of the staffing in the centre. There is a minimum of 6 uniformed personnel (maximum of 9) assigned per shift covering call evaluation, dispatch, on-scene support. Out of this staffing there are always 2 officers assigned per shift, the number of Emergency Communication Specialists (ECS) can vary between 4 and 7.							

		There is 1 ECS position assigned to day shifts only Monday to Friday. There are 2 additional uniformed positions to support training and technical support filled on a rotational basis. There is one Chief. Total Staffing is 40 uniformed personnel

CALL-TAKING AND DISPATCH SERVICES – CONT.

Location	Comparator Criteria									
	Are dispatch services provided in-house	**If yes, what is the shift schedule for dispatchers**	**If yes, how may dispatch seats are typically staffed on each shift?**	**If yes, number of budgeted uniform staff positions (excluding managers/supervisors):**	**If yes, number of budgeted uniform manager/supervisor positions**	**If yes, number of budgeted civilian staff positions: (excluding managers/ supervisors**	**If yes, number of budgeted civilian manager/ supervisor positions:**	**If dispatch is not provided in-house who provides the service and at what cost to the fire department?**	**Is a priority dispatch system used (e.g., are some calls held before being dispatched if no unit is available to respond)?**	**Is a commercial fire or EMS call taking tool used (such as Medical Priority Dispatch or Fire Priority Dispatch**
Houston, Texas	yes	24 hours	15	11	3	0	0	---	No	No
Edmonton, Alberta	Yes, for Fire units only	Same as call-takers	2	29 (total Call-takers and Dispatchers)	9 in total for the Communications Centre (8 Officers and 1 Chief)	---	---	n/a	Yes, we have not yet had an occasion when no Fire Rescue unit is available to respond.	Yes, Fire Priority Dispatch

RESPONSE TIMES (PLEASE INDICATE IF RESPONSE TIMES ARE IN MINUTES AND SECONDS OR MINUTES AND FRACTIONS OF MINUTES) (.1 minute = 6 seconds)

Location	Comparator Criteria										
		What is the average response time to fire suppression on emergency calls? (from call receipt to arrival at scene)	**What is the average response time for first responders to medical calls? (from call receipt to arrival at scene)**	**What is the average response time of ALS apparatus to ALS emergency calls? (from call receipt to arrival at scene)**	**What is the average response time of BLS apparatus to BLS emergency calls? (from call receipt to arrival at scene)**	**What is the average response time to EMS non-emergency calls? (from call receipt to arrival at scene**	**What is the 90th percentile response time to fire suppression on emergency calls? (from call receipt to arrival at scene)**	**What is the 90th percentile response time for first responders to medical calls? (from call receipt to arrival at scene)**	**What is the 90th percentile response time of ALS apparatus to ALS emergency calls? (from call receipt to arrival at scene)**	**What is the 90th percentile response time of BLS apparatus to BLS emergency calls? (from call receipt to arrival at scene)**	**What is the 90th percentile response time to EMS non-emergency calls? (from call receipt to arrival at scene)**	**What is the 90th percentile response time to fire suppression on emergency calls? (from call receipt to arrival at scene)**
Houston, Texas	Minutes & seconds	7:25	7:50	not available	not available	not available	11:24	10:57	not available	not available	not available	11:24
Edmonton, Alberta	Minutes & seconds	5 min 47 sec (all front-line Fire unit types)	7 min 1 sec (Pumper unit type and for B, C, D, and E emergency medical calls)	n/a	n/a	12 min 9 sec (Pumper unit type and for "A" non-emergency medical calls)	8 min 30 sec (Pumper unit type)	10 min 20 sec (Pumper unit type and for B, C, D, and E emergency medical calls)	n/a	n/a	Please see note below	Not provided
	Note: 40 min 36 sec (Pumper unit type for "A" non-emergency medical calls). These calls are not automatically sent to Fire Communications Centre and transferred by Alberta Health Services (AHS) to us only if Fire assistance is required which is well after the call was received by AHS and EMS arrival mainly for lift assists at the scene and/or hospital.										

SHIFT SCHEDULES (e.g., 24-hour, 2-10s, 2-14s, 4-8s)

Location	Comparator Criteria			
	For staff assigned to fire suppression apparatus	**For paramedics assigned to EMS units**	**For EMTs assigned to EMS units**	**For staff assigned to provide training**
Houston, Texas	24- hour on, 24- hour off, 24 hour on, 5 days off with rotating debit day each month.	same as fire suppression	same as fire suppression	5 days, 40 hours per week, or 4-10's, 40 hours per week
Edmonton, Alberta	2 - 10 hrs day shifts, 2 - 14 hrs night shifts, 2 days off, 2 - 10 hrs day shifts, 2 - 14 hrs night shifts, 6 days off	n/a	n/a	4 - 11.08 hrs day shifts, 2 days off, 4 - 11.08 hrs day shifts, 6 days off

PAID WORK WEEK (Number of hours)

Location	Comparator Criteria						
	For staff assigned to fire suppression units	**For staff assigned to EMS/rescue units**	**For arson investigators**	**For staff assigned to provide training**	**Is premium or overtime pay included as part of the regular work week for any employee**	**If yes, for which functions/positions**	**If yes, how is overtime pay structured for each position (e.g. time and a half; percentage of weekly pay)**
Houston, Texas	46.7 hours per week	46.7 hours per week	40 hours per week	40 hours per week	No	---	---
Edmonton, Alberta	42	n/a	42	38.75	No	---	---

INCENTIVE PAY

Location	Comparator Criteria				
	What types of additional certification/training result in incentive pay	**If incentive pay is provided, what is the percent of salary or dollar amount**	**Is there a maximum and what is the maximum**	**Do first-line supervisors qualify for incentive pay if they have required certification/training**	**Do managers qualify for incentive pay if they have required certification/training?**
Houston, Texas	see attachment schedule	see attachment schedule	see attachment schedule	Yes	Yes
Edmonton, Alberta	n/a	---	---	---	---

TRAINING

Location	Comparator Criteria			
	Number of hours devoted to formal in-service training: for firefighters	**Number of hours devoted to formal in-service training for paramedics**	**Does the department require mandatory physical training for uniform staff**	**Does the Department take apparatus and staff out of front line service for training purposes (apparatus and staff are put back into front line service if call volume warrants)**
Houston, Texas	Minimum 20 hours per month	Minimum 20 hours per month	No	Yes
Edmonton, Alberta	(1) 4 to 6 "Core Competency Skills" maintenance programs each ranging between 2 to 6 hours. (2) "Medical Core Competency" programs every quarterly ranging between 2 to 4 hours. (3) Fall protection recertification training every 3 years which is about 4 hours. For specialized teams; Technical Rescue Team run quarterly programs each for about 4 hours. Hazmat team	n/a	No, but there is a Health and Wellness program in place that provides guidance and fitness direction. Each Fire station has fitness equipment for the crews to work out and train.	Yes, if required for the training and depending upon the training being conducted.

	run various programs (river booming exercises 4 times a year {full day}, mass decontamination once a year {2 to 4 hrs} and equipment review 1 to 2 hrs in length twice a month.			

EMERGENCY MEDICAL OPERATIONS: EMS Staff

Location	**Comparator Criteria**		
	Is the medical director a full-time position	**Are staff assigned to ALS ambulances also firefighters**	**Are staff assigned to BLS ambulances also firefighters**
Houston, Texas	yes	yes	yes
Edmonton, Alberta	NOTE: we have a medical Director retained on contract to provide support to the First responders Program. This is not a full time position.	n/a	n/a

EMS BILLING

Location	Comparator Criteria						
	Is EMS billing outsourced or performed in-house	If outsourced to which company and at what cost (Percent of receipts, percent of collections)?	If in-house, what is the number of budgeted uniform staff assigned to this function?	If in-house, what is the number of budgeted civilian staff assigned to this function	What is the percent of individuals receiving services who are billed?	What is the collection rate?	Does the department charge for medical services when there is no transport
Houston, Texas	outsourced	Zerox, cost not available	---	---	Not available	Not available	No
Edmonton, Alberta	n/a	n/a	n/a	n/a	n/a	n/a	n/a

FALSE ALARM BILLING

Location	Comparator Criteria							
	Does the Department bill for commercial and industrial false alarms? If yes, what is the rate per responding apparatus?	Does the Department bill for residential false alarms? If yes, what is the rate per responding apparatus?	What number of false alarms were billed in the last year for which you have records?	Is False Alarm billing outsourced or performed in-house?	If outsourced to which company and at what cost (Percent of receipts, percent of collections)?	If in-house, what is the number of budgeted uniform staff assigned to this function?	If in-house, what is the number of budgeted civilian staff assigned to this function?	On average, how many days elapse from the time the false alarm occurs until and invoice is sent out?
Houston, Texas	Yes, $325.00 per false alarm	No	17,471	In-house	---	None	10 employees, but they have other permitting duties as well	10 days
Edmonton, Alberta	Yes, We charge per response. First response;	Yes, same as above. Rates	926 false alarms were	Assume this is supposed to	n/a	1 person (Assistant	1 Clerical	Next working day

	No Charge, Second Response; $76.00, Third Response; $380.00, Fourth Response and each subsequent response; $758.00. Security alarms routed to the Fire Rescue Services are charged $758.00 /per response. These responses are to the same premises during each calendar year. Note rates are not per apparatus but per call. The Fee for Services Bylaw is currently under review and rates may increase in 2013.	are not calculated per apparatus but per call	confirmed as false in the past year.	say false alarm billing in which case the following applies: In-House		Fire Marshall)		

FIRE PREVENTION

Location	Comparator Criteria									
	Are targets established for code enforcement? If yes, what are the targets	Are targets established for building plan review? If yes, what are the targets	Number of full-time uniform positions budgeted for fire prevention activities related to code enforcement and building plan review	How many of these positions are supervisory	Number of full-time civilian positions budgeted for fire prevention activities related to code enforcement and building plan review):	How many of these positions are supervisory	Number of full-time uniform positions budgeted for fire prevention outreach activities (that is, activities that are not related to code enforcement and building plan review):	How many of these positions are supervisory	Number of full-time civilian positions budgeted for fire prevention outreach activities (that is, activities that are not related to code enforcement and building plan review):	How many of these positions are supervisory
Houston, Texas	no	no	122	25	0	0	6	2	0	0
Edmonton, Alberta	Please see note below	No	35	1 FM, 2 AFM, 7 Captains total = 10	none	none	5	1 Captain	none	none
	Note: Yes, we follow a Council Approved Quality Management Plan, we inspect all Risk 4 inspections (High Probability and High Consequence)(Maximum Risk) on a yearly basis and all Risk 3 inspections (Low Probability and High Consequence)(High/Special Risk) every 2 years. This year's target is 9660 inspections. Lower risk inspections (Risk 1 & 2) are done on a complaint or request basis.									

ARSON INVESTIGATIONS

Location	Comparator Criteria						
	Are arson investigations the responsibility of the police department or the fire department?	**If responsibility of the fire department are investigators civilian or uniform staff?**	**If responsibility of the fire department, do arson investigators have law enforcement powers?**	**If responsibility of the fire department how many arson cases were investigated in the past 12 months?**	**If responsibility of the fire department, what is the shift schedule for arson investigators?**	**If responsibility of the fire department number of budgeted arson investigator positions:**	**How many of these positions are supervisory?**
Houston, Texas	fire department	uniform	yes	1, 053	3 shifts: day, night, weekend	68	16
Edmonton, Alberta	The City of Edmonton Fire Rescue and the City of Edmonton Police Services jointly conduct Arson Investigations. Fire Investigators are responsible for determining the Origin, Cause, and Circumstance of all fires. The Edmonton Police Service use the Fire Investigators determination	Total of 13 full-time uniformed staff for the Fire Investigations section	Fire Investigators do not have law enforcement powers.	Fire Investigators typically conduct approximately 900 fires per year. Approximately 30% of these fires are determined to be caused by arson. An additional 5% of the fires that have an undetermined cause are also investigated, totaling 35% of fires in Edmonton are investigated by EPS Arson Detectives.	2 - 10 hrs day shifts, 2 - 14 hrs night shifts, 2 days off, 2 - 10 hrs day shifts, 2 - 14 hrs night shifts, 6 days off	13 Fire Investigators (includes the Chief of Investigations and 4 Senior Captains) conduct Arson Investigations.	5 - The Chief of Fire Investigations and 4 Senior Captains who are responsible to supervise their platoon.

	as a basis to conduct a criminal investigation to determine who is criminally responsible for causing the fire.						

PERSONNEL

Location	Comparator Criteria					
	Are new firefighter hires required to be certified firefighters?	**Are new paramedic hires required to be certified paramedics?**	**Does the department require mandatory annual physical exams?**	**Are employment candidates required to pass a fitness test?**	**What are the educational requirements for new firefighter hires**	**What are the educational requirements for new paramedic hires?**
Houston, Texas	Yes	No	No	Yes	FIREFIGHTER TRAINEE: Applicants must have a minimum of sixty (60) transferable semester college credit hours from an accredited learning institution of higher education recognized by the State Board of Education in the State in which the college resides and accredited by the Southern Association of Colleges and Schools or a similar regional association recognized by the United States Department of Education, and a High School Diploma or General Equivalency Diploma (GED). Acceptable hours are those with a grade of "C" or better of each course	PARAMEDIC FIREFIGHTER: Paramedics must have a minimum of 15 transferable semester college credit hours with a minimum grade of "C" or better in each college level course taken from an accredited college/university. A "Course Completion Certificate" for Firefighter, EMT or Paramedic programs may be accepted in lieu of the 15 transferable college credit hours provided that the program meets TCFP and TDSHS licensing standards. Applicants must have an active Texas Department of State Health

					taken from an accredited college or university. Not more than two (2) one (1) hour Recreational Physical Education courses will be accepted. CERTIFIED FIREFIGHTER/EMT TRAINEE: Certified Firefighter/EMT Trainees must have a minimum of 15 transferable semester college credit hours with a minimum grade of "C" or better in each college level course taken from an accredited college/university. A "Course Completion Certificate" for Firefighter, EMT or Paramedic programs may be accepted in lieu of the 15 transferable semester college credit hours provided that the program meets TCFP and TDSHS licensing standards. Applicant must be in possession of an active Texas Commission on Fire Protection State Firefighter Certification Basic or higher, and an active Texas Department of State Health Services EMT Basic or higher certification.	Services EMT-Paramedic certification or license.
Edmonton, Alberta	no	n/a	No, annual physical exams participation is voluntary, confidential, and non-punitive.	Yes	Grade 12	n/a

OTHER

Location	Comparator Criteria			
	Is determining the cause and origin of fires typically the responsibility of a line fire suppression officer (e.g., battalion chief, captain, or lieutenant)?	**If no, which positions typically determine the cause and origin of fires?**	**If yes, under what circumstances would a line suppression officer not determine the cause and origin of a fire?**	**If the department provides any non-fire rescue related services, please list:**
Houston, Texas	Yes	---	suspicious or fatality fire	none
Edmonton, Alberta	No	Fire Investigations section	n/a	Confined space / structural collapse, elevator / escalator, extrication / entrapped, high angle, and water / ice rescues

Emergency Medical Service Jurisdictional Comparators

DEMOGRAPHICS

Location	Comparator Criteria			
	Population	Coverage Area (Sq.mi/km)	Median Household Income	% below poverty level
Ambulance Victoria	5,574,500 State of Victoria	227,490.91 km2	**$AUD 73,944**	
New South Wales	7.25 million	801,600 km2	$1,099 disposable income	11%

SERVICES

Location	Comparator Criteria				
	Is BLS First Response Provided to Medical Emergencies?	Is ALS First Response Provided to Medical Emergencies?	Does the department deploy BLS ambulances that respond to emergency incidents & transport patients?	Does the department deploy ALS ambulances that respond to emergency incidents & transport patients?	Does the department provide non-emergency transport services (eg. hospital to hospital)?
Ambulance Victoria	ALS only	Yes	No	Yes	Yes, primarily contracted
New South Wales	Yes	Yes	Yes	Yes	Yes

STAFFING

Location	Comparator Criteria					
	Total # of budgeted department employees	Total # of budgeted uniform staff	Total # of budgeted frontline paramedics	Total # of budgeted civilian staff	Are paramedics uniform or civilian?	Total # of budgeted paramedics
Ambulance Victoria	774	3052	2725	N/A	N/A	N/A
New South Wales	4,241.8 FTE	3762.63 full time equivalent staff as at 1 October 2012 under our definition of “Operations”. This includes paramedics, operational managers, control centre officers, Aeromedical staff, non-emergency patient transport staff, nurses, executive assistants for operations.	3231.44 full time equivalent staff using the definition of a paramedic employed in a frontline paramedic position i.e. not an paramedic who is an educator or an emergency call taker/dispatcher			

ORGANIZATIONAL STRUCTURE

Location	Comparator Criteria	
	Please describe the department's rank structure	**What is the number of budgeted positions for each rank?**
Ambulance Victoria	See attached	NA – We don't budget by rank
New South Wales	Rank for paramedic positions are shown in next column in hierarchy order: General Manager Operations Directors Operations Deputy Director Operations Zone Managers District Managers Station Officers	General Manager Operations = 1 FTE Director Metropolitan Operations = 1 FTE Director Regional Operations = 1 FTE Deputy Directors Operations = 8 FTE Zone Managers = 18 FTE District Managers = 118 FTE Station Officer = 289

BUDGET (latest fiscal year)

Location	Comparator Criteria			
	Total department budget	**Is the total budgeted amount for EMS operations the same as the total department budget?**	**Total budgeted overtime amount**	**Total overtime amount budgeted for paid lunch breaks**
Ambulance Victoria	Expenditure across all services in 2011-12 financial year was $572.620 million AUD Source: 2011-12 Ambulance Victoria Annual Report operating statement page 51	No. AV provides non-emergency road and air services. Approximately 19% of budgeted expenditure is allocated to non-emergency services. The majority of non-emergency services in metropolitan areas are provided through outsourced contract arrangements with third party private providers. It is important to note that AV is a semi-independent Statutory Authority and not within the Health Department. Source: internal AV reports – this information is not published externally	Overtime expenditure in 2011-12 was $47.2 million AUD Source: internal AV reports – this information is not published externally	AV includes meal allowances in the base rate that allows AV to instruct crews where and when (within agreed timeframes) to have a meal break. There are also allowances paid for late and spoilt meals on a sliding scale. AV has not agreed at this point to associate any overtime pays to not accessing a meal break. Estimated cost in penalties for 2012 (Statewide) is $3.5m. does not allocate a budget for paid lunch breaks – overtime is either for a replacement full shift, incidental (at end of rostered shift) or built into the roster (which allows for a shift pattern totaling above the weekly hours)

New South Wales	$690 Million AUD	Not Answered	Not Answered	Overtime is not budgeted for paid lunch breaks. Penalty payments may arise from missed crib breaks or crib breaks away from station with a budget for these two penalties of $3.7 million

STATIONS/APPARATUS

Location	Comparator Criteria				
	Number of staffed EMS stations	**Number of staffed ambulances or other response vehicles (by type) deployed 24-hours a day**	**Number of staffed ambulances or other response vehicles (by type) deployed for less than 24-hours a day:**	**Number of staff assigned to each type of response vehicle:**	**Does the department have a replacement cycle for EMS vehicles**
Ambulance Victoria	246	162 x 2 person ALS single stretcher ambulances 12 x 1 person MICA single responders (no stretcher capacity) 15 x 2 person MICA stretcher capacity 5 x single person MICA Helicopter 1 x 1 person fixed wing	18 X 2 person stretcher ambulances 10 hrs a day 40 x 2 person stretcher ambulances 10 hrs a day 4 x 2 person MICA stretcher 3 x 1 person MICA single responders 12 hr (no stretcher capacity) 2 x 1 person fixed wing	As in previous columns	230,000 kms
New South Wales	226	999 EMS & non-emergency vehicles 428 single responder & operational support vehicles 87 general support	- -	1 x single responder vehicles 2 x BLS, ALS	Majority of fleet is leased for maximum of 3 years, 4WD vehicles 3 for 4 years

INCIDENTS (FOR LATEST YEAR AVAILABLE)

Location	Comparator Criteria		
	Total number of incidents responded to	**Total number of EMS incidents responded to:**	**Total number of other incidents responded to**
Ambulance Victoria	801,583	489,857 (includes 4,418 emergency responses from Air Ambulance)	311,996
New South Wales	1,183,795 (2011/12)	865,725	318,070

CALL-TAKING AND DISPATCH SERVICES

Location	Comparator Criteria				
	Does the department's call-taking and dispatch unit function as the primary or the secondary PSAP for answering 911 calls?	**Are EMS call-taking services provided in-house? (Services after the initial 911 call (or similar emergency access number) has been answered should be considered call-taking services for these questions)**	**If yes, what is the shift schedule for call-takers?**	**If yes, how many seats are typically staffed for each shift?**	**If yes, number of budgeted uniform positions (excluding managers/supervisors)**
Ambulance Victoria	N/A	No, EMS call taking & dispatch is provided by Emergency Services Telecommunications Authority (ESTA) – a state, statutory authority.	N/A	N/A	N/A
New South Wales	Secondary provider (after Telstra) for both call taking and dispatch utilising Medical Priority Dispatch Systems and VisiCAD.	Telstra (major telecommunications provider) in Melbourne or Sydney and transferred to the correct Emergency Service Organisation.	Call takers working 24 hours a day, the primary rosters in the larger Control Centres are 12 hour shifts supplemented with shorter shift for the peak periods during the day and evening.	Minimum of 10 call takers across the state during the middle of the night with up to 30 during peak periods.	There are a total of 92.04 (Full Time Equivalent) Call taking positions and 134.48 (Full Time Equivalent) dispatch positions there are no specified uniform or non-uniform positions.

Location	Comparator Criteria					
	If yes, number of budgeted uniform manager/supervisor positions	**If yes, number of budgeted civilian staff positions (excluding managers/supervisors)**	**If yes, number of budgeted civilian manager/supervisor positions**	**If call-taking is not provided in-house who provides the service and at what cost to the department?**	**Is a priority dispatch system used (e.g., are some calls held before being dispatched if no unit is available to respond)?**	**Is a commercial EMS call taking tool used (such as Medical Priority Dispatch or Criteria Based Dispatch)?**
Ambulance Victoria	N/A	No, EMS call taking & dispatch is provided by Emergency Services Telecommunications Authority (ESTA) – a state, statutory authority.	N/A	ESTA. Cost $19.6m (State-wide CTD/CAD Services Costs for 2012/13 Financial Year)	Yes – AMPDS event descriptor is immediately linked to an AV Dispatch Grid which determines the type and number of response resources or whether an event can be transferred to the AV Referral Service (where a secondary triage process occurs)N/A	Medical Priority Dispatch System
New South Wales	48 uniformed manager/supervisor positions across 4 Control Centres.	As in previous cell	Nil, no appointed civilian manager/supervisor positions	N/A	Yes	MPDS

RESPONSE TIMES (PLEASE INDICATE IF RESPONSE TIMES ARE IN MINUTES AND SECONDS OR MINUTES AND FRACTIONS OF MINUTES) (.1 minute = 6 seconds)

Location	Comparator			
	What is the average response time for first responders to medical calls? (from call receipt to arrival at scene)	**What is the average response time of ALS transport capable vehicles to ALS emergency calls? (from call receipt to arrival at scene)**	**What is the average response time of BLS transport capable vehicles to BLS emergency calls? (from call receipt to arrival at scene)**	**What is the average response time to EMS non-emergency calls? (from call receipt to arrival at scene)**
Ambulance Victoria	13 minutes 26 seconds Note: Only statewide Code 1 (Time Critical) response times are used, Code 2 (Acute Non-Critical) and Code 3 (Routine) incidents are excluded. Note that nearest available ambulance dispatched regardless of ALS or Intensive Care	13 minutes 26 seconds Note: Only statewide Code 1 (Time Critical) response times are used, Code 2 (Acute Non-Critical) and Code 3 (Routine) incidents are excluded. Note that nearest available ambulance dispatched regardless of ALS or Intensive Care	N/A	Not applicable as all Ambulance Victoria's non-emergency transports are pre-booked. Crew arrives at patient location at agreed pre-determined time.
New South Wales	Notes on ASNSW response time measurement • In accordance with the Australian standard the Ambulance Service of New South Wales (ASNSW) only reports ambulance response times in terms of the 50th and 90th percentile for Priority 1 (P1) incidents i.e. emergency cases requiring an immediate response. In New South Wales ambulance response time is calculated from the time the incident is recorded in the dispatch queue to the time the first ambulance vehicle arrives at scene. The time point data used are sourced from ASNSW Computer Aided Dispatch system. • ASNSW does not compile separate response time information for ALS and BLS. • Provided below are the 2011-12 50th and 90th percentile response times (minutes) for the whole of the state of New South Wales and for the capital city Sydney.			
New South Wales	Ambulance 50th Percentile Response Time (minutes) to emergency (P1) incidents, New South Wales, 2011-12	10.93		
New South Wales	Ambulance 50th Percentile Response Time (minutes) to emergency (P1) incidents,	10.70		

	Sydney, 2011-12			
New South Wales	Ambulance 90th Percentile Response Time (minutes) to emergency (P1) incidents, New South Wales, 2011-12	22.52		
New South Wales	Ambulance 90th Percentile Response Time (minutes) to emergency (P1) incidents, Sydney, 2011-12	20.07		

RESPONSE TIMES – CONT.

Location	Comparator			
	What is the 90th percentile response time for first responders to medical calls? (from call receipt to arrival at scene)	**What is the 90th percentile response time of ALS transport capable vehicles to ALS emergency calls? (from call receipt to arrival at scene)**	**What is the 90th percentile response time of BLS transport capable vehicles to BLS emergency calls? (from call receipt to arrival at scene)**	**What is the 90th percentile response time to EMS non-emergency calls? (from call receipt to arrival at scene)**
Ambulance Victoria	22 minutes 4 seconds Note: Only statewide Code 1 (Time Critical) response times are used, Code 2 (Acute Non-Critical) and Code 3 (Routine) incidents are excluded. This is statewide figure, metropolitan use of fire service is faster.	22 minutes 4 seconds Note: Only statewide Code 1 (Time Critical) response times are used, Code 2 (Acute Non-Critical) and Code 3 (Routine) incidents are excluded.	N/A	Not applicable as all Ambulance Victoria's non-emergency transports are pre-booked. Crew arrives at patient location at agreed pre-determined time.

SHIFT SCHEDULES (e.g., 24-hour, 2-10s, 2-14s, 4-8s)

Location	Comparator	
	Please provide general information on your shift schedules	**Are part time or casual staff employed as paramedics?**
Ambulance Victoria	10/14 = 2 x 10 hr. days and 2 x 14 hr. nights and 4 days off. Blended roster =10 hr. day plus 10 or 12 hr. day plus 10 or 12 hr. afternoon and a 14 hour nightshift. These are the main rosters there are a variety of others	Yes

New South Wales	Metropolitan – 4 days on x 5 days off (12 hour shifts) Rural – Predominately 8 hour shifts matched to demand (with on-call components) averaging 38 hours a week. 7 days on with no more than 14 in 28 nights on-call. Roster/demand matching review undertaken every 6 months	Yes (part time)

PAID WORK WEEK (NUMBER OF HOURS)

Location	Comparator				
	For staff assigned to EMS/rescue units	For staff assigned to provide training	Is premium or overtime pay included as part of the regular work week for any employee?	If yes, for which functions/positions?	If yes, how is overtime pay structured for each position (e.g. time and a half; percentage of weekly pay)?
Ambulance Victoria	N/A	N/A	N/A	N/A	N/A
New South Wales	38 hours	38 hours	No – overtime and/or penalties are only paid as worked	N/A	N/A

INCENTIVE PAY

Location	Comparator				
	What types of additional certification/training result in incentive pay?	If incentive pay is provided, what is the percent of salary or dollar amount?	Is there a maximum and what is the maximum?	Do first-line supervisors qualify for incentive pay if they have required certification/training?	Do managers qualify for incentive pay if they have required certification/training?
Ambulance Victoria	N/A	N/A	N/A	N/A	N/A
New South Wales	Higher level Clinical qualifications receive specialist allowances	This is built into the wage structure. This varies depending on period of service. Equates to approximately $40 per week for 1st year specialist up to $80 per week for 3rd year (and greater) specialist.	See previous cell	No	No

TRAINING

Location	Comparator			
	Number of hours devoted to formal in-service training for paramedics:	**Does the department require mandatory physical training for uniform staff?**	**Does the department take vehicles and staff out of front line service for training purposes (apparatus and staff are put back into front line service if call volume warrants)**	**Is the medical director a full-time position?**
Ambulance Victoria	93,258	No	Not Answered	No. AV operates under Standing Orders approved by Health Department.
New South Wales	1 week every 18 months average	Only for specialist access Paramedics	Yes. Staff are allocated to a designated training workshop every 18 months	No

PERSONNEL

Location	Comparator			
	Are new paramedic hires required to be certified paramedics?	**Does the department require mandatory annual physical exams?**	**Are employment candidates required to pass a fitness test?**	**What are the educational requirements for new paramedic hires?**
Ambulance Victoria	They need to have completed an approved university Health Science degree qualification as a paramedic	No	Yes	Bachelor Degree
New South Wales	No, untrained paramedics become qualified after 3 years of training and practical on the job experience. Graduates with recognized paramedic degrees become qualified after around 35 weeks of training and practical on the job experience. Former paramedics or people with other medical qualifications and suitable prior work experience such as registered nurses and defence force medics, become qualified after receiving an appropriate amount of training and practical experience. Once qualified and certified, paramedics are required to maintain their certificate to practice every 3 years.	We have not had mandatory physical examinations in the past. However from 2012 onwards paramedics will be required to perform a mandatory 6 medical examination every 3 years.	All new operational employees, (paramedics, control centre officers, patient transport officers) are required to pass a comprehensive medical examination. Paramedics and Patient Transport Officers are currently required to pass a step test assessing their cardiovascular fitness which is associated with job tasks such as administering CPR.	We are transitioning to tertiary entry for paramedics i.e. they will require a recognized paramedic degree. However at the moment we also accept applicants with no qualifications or medical experience and provide 3 years of on the job training and practical experience resulting in awarding of a Diploma by our internal registered training organization.

OTHER

Location	Comparator	
	Does fire or police services provide first responder service? If so, under what circumstances?	**What is fee structure for paramedic care or ambulance transportation?**
Ambulance Victoria	Fire for suspected cardiac arrest cases	Fee for service using rates published by Victorian Department of Health (emergency fees) – see **http://www.health.vic.gov.au/ambulance/fees.htm** **or Ambulance Victoria (non-emergency fees) – see** **http://www.ambulance.vic.gov.au/About-Us/Fees.html**
New South Wales	Various agencies may provide a community first responder service in remote locations	Ambulance services are fee for service, however exemptions exist for pensioners, holders of health care concession cards etc. Refer to the attached policy on Ambulance fees.

OTHER – CONT.

Location	Comparator	
	Does state or national health insurance cover all or part of the cost of ambulance care and transportation?	**Is there a portion of the cost paid by the patient? If so, how much?**
Ambulance Victoria	Transports covered for holders of State pension or health care concession cards, see: http://www.health.vic.gov.au/ambulance/guidelines/concessions.htm National coverage provided for war veterans through Department of Veterans Affairs, see: http://www.dva.gov.au/BENEFITSANDSERVICES/TRANSPORT/Pages/amb%20trans.aspx Private health insurance and ambulance insurance also available but paid for by public Transport Accident Commission (TAC) and Worksafe pay for transports relating to road accidents and workplace accidents respectively under their rules: See www.tac.vic.gov.au and www.worksafe.vic.gov.au	No co-payment for transports under State Health Care Card or Pensioner concession (State government concession) or for eligible war veterans transports (Federal government concession). Patients not covered by a concession, or covered under TAC or Worksafe are liable to pay 100% of the published fee. Ambulance Victoria offers an ambulance membership scheme that enables the public to ensure against these costs (members of the scheme are covered for 100% of Ambulance Victoria fees for medically necessary transports as outlined in the AV Membership Scheme Business Rules, see the AV website: http://www.ambulance.vic.gov.au/Media/docs/32220%20AV%20Business%20Rules%2012pp%20DL-a86cb1b7-a4c8-4cda-b5ab-901df156a9d0-0.pdf for a copy of the business rules)
New South Wales	No – although the State Government provides a subsidy of 49% of the cost of emergency medical services to NSW residents (as determined by the NSW Independent Pricing and Regulatory Tribunal)	Yes – 51% of the cost of emergency medical services as determined by the NSW Independent Pricing and Regulatory Tribunal assuming the patient is not otherwise exempt or covered by private health insurance. On most occasions this results in a charge of $350-$400 for patients who are not otherwise covered.

Appendix B - Assignments and Resources Required at Fire Incidents

Figure 9 - First Alarm Response Resources Required

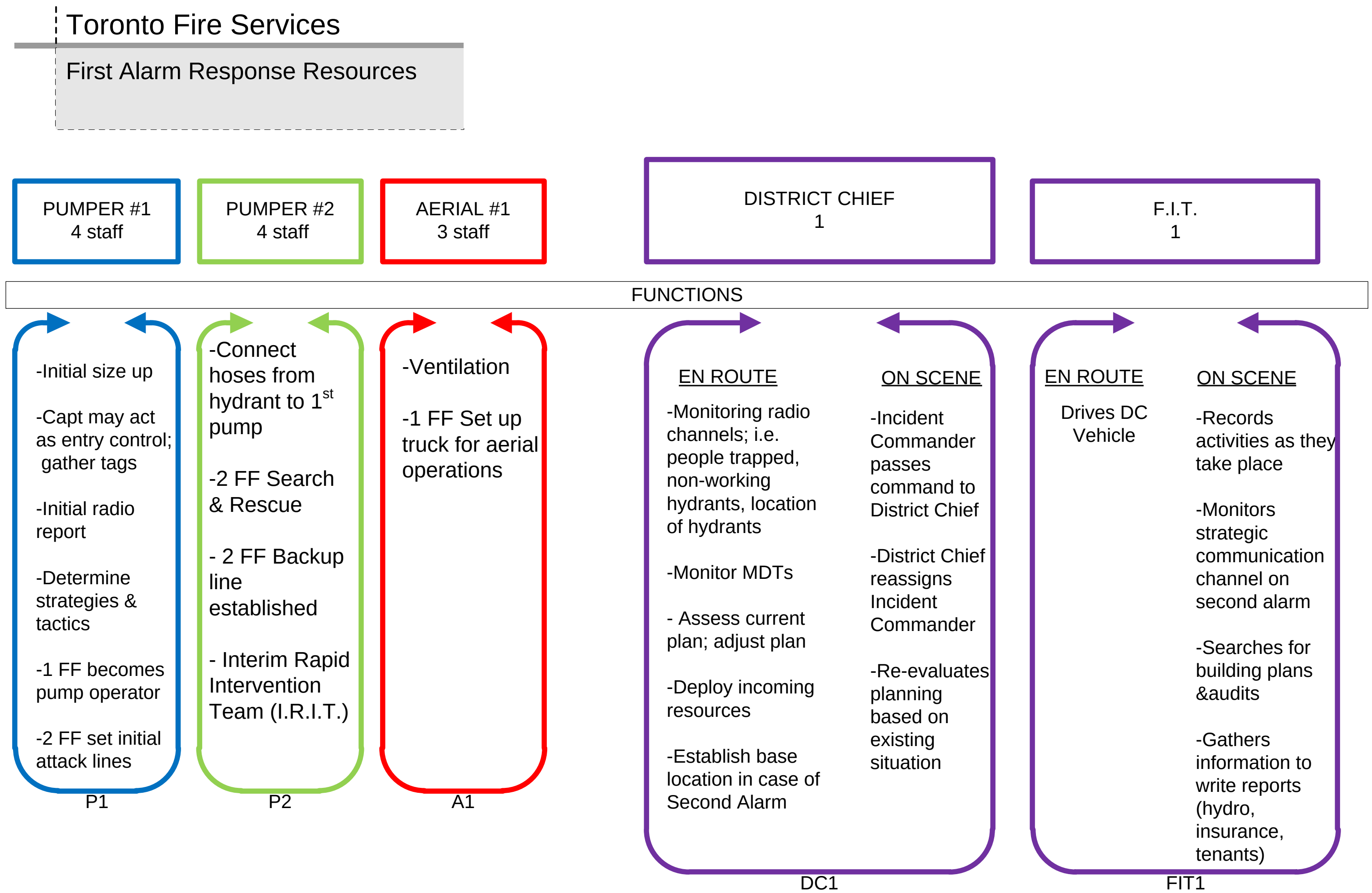


Figure 10 - Fire Fighting Process, Bungalow Fire

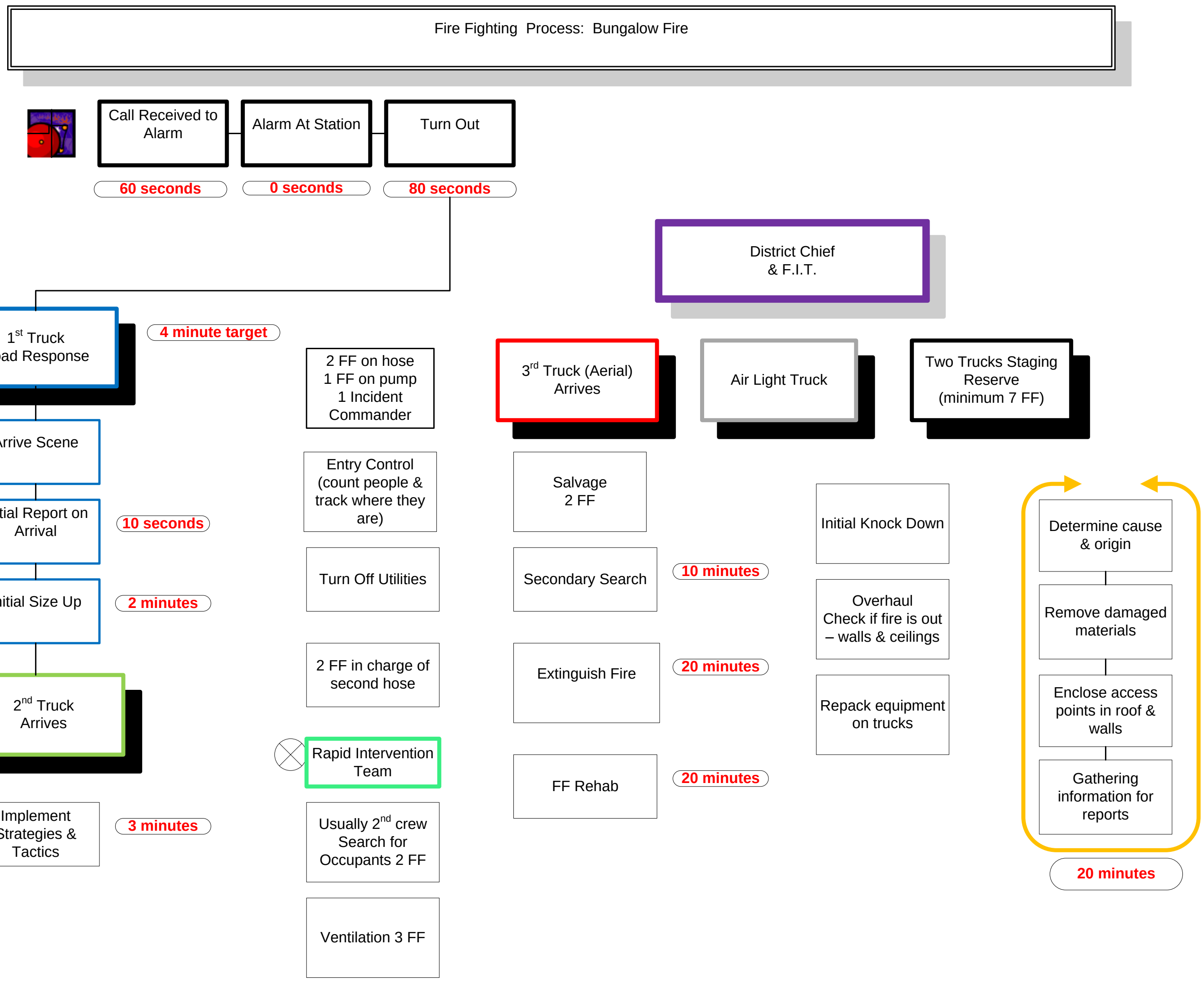


Figure 11 - Second Alarm Response Resources Required

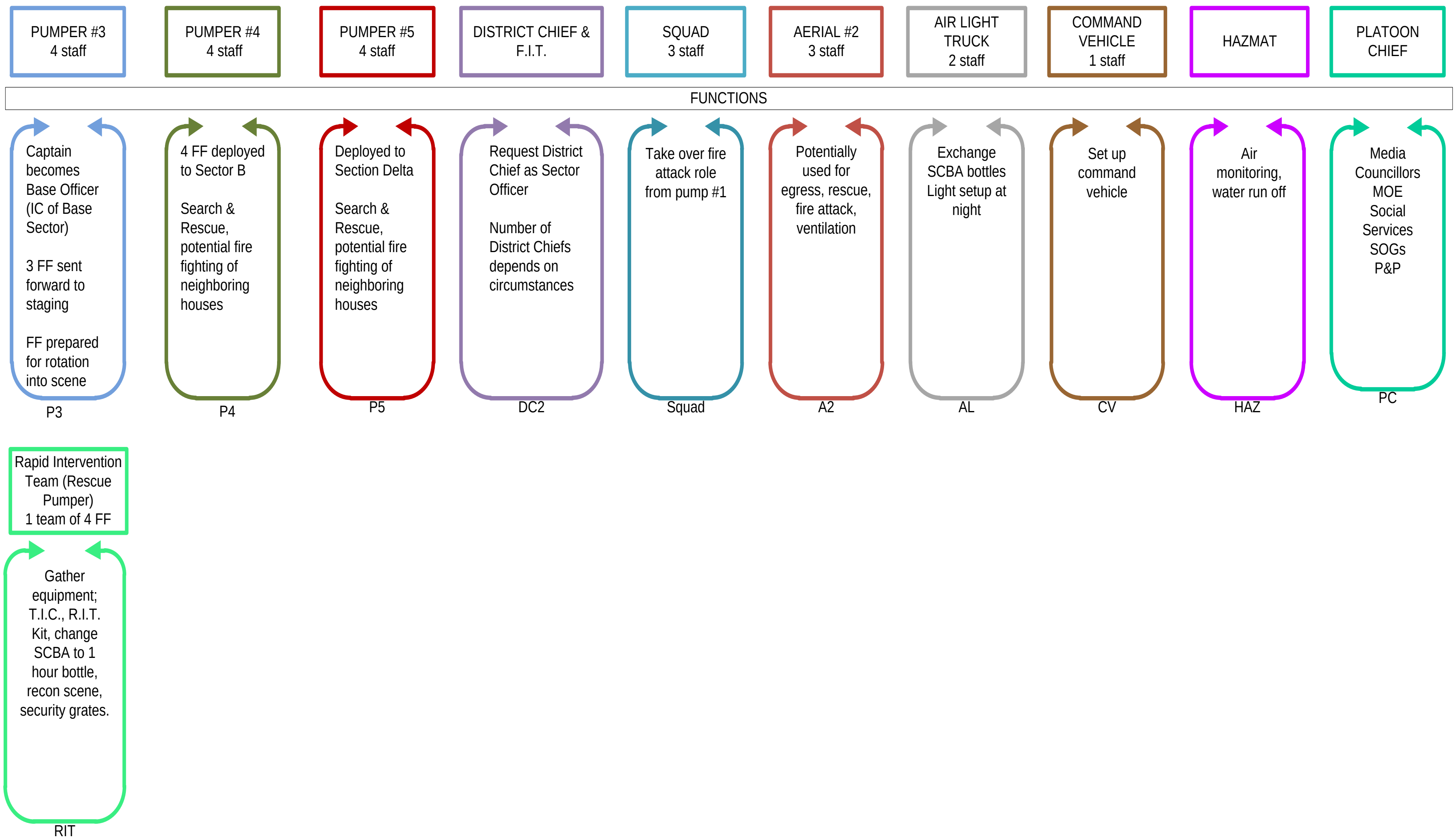
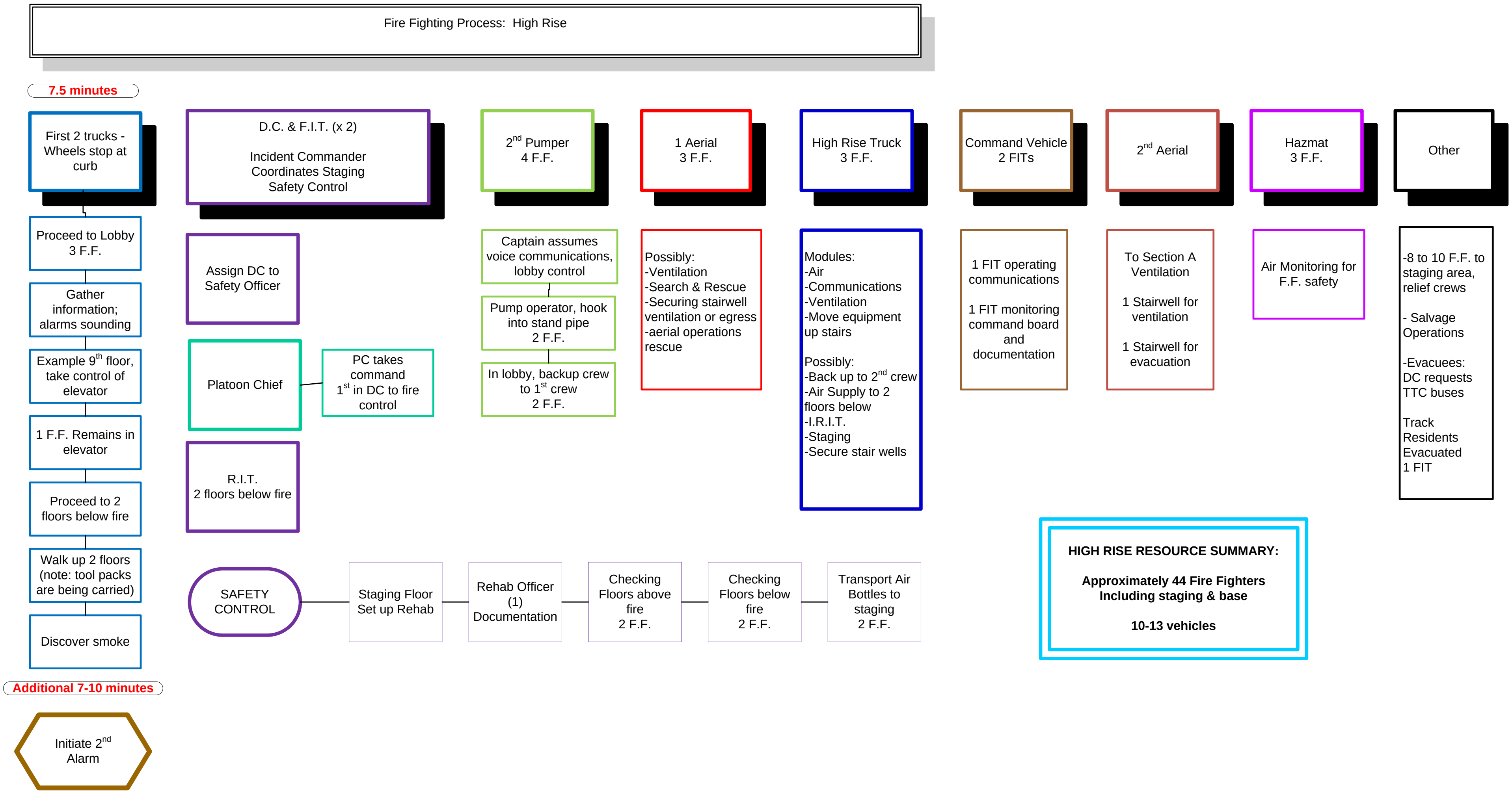


Figure 12 - Fire Fighting Process - High Rise


Fire Fighting Process: High Rise
7.5 minutes
First 2 trucks - Wheels stop at curb
Proceed to Lobby 3 F.F.
Gather information; alarms sounding
Example 9th floor, take control of elevator
1 F.F. Remains in elevator
Proceed to 2 floors below fire
Walk up 2 floors (note: tool packs are being carried)
Discover smoke
Additional 7-10 minutes
Initiate 2nd Alarm
D.C. & F.I.T. (x 2)
Incident Commander Coordinates Staging Safety Control
Assign DC to Safety Officer
Platoon Chief
PC takes command 1st in DC to fire control
R.I.T. 2 floors below fire
2nd Pumper 4 F.F.
Captain assumes voice communications, lobby control
Pump operator, hook into stand pipe 2 F.F.
In lobby, backup crew to 1st crew 2 F.F.
1 Aerial 3 F.F.
Possibly: -Ventilation -Search & Rescue -Securing stairwell ventilation or egress -aerial operations rescue
High Rise Truck 3 F.F.
Modules: -Air -Communications -Ventilation -Move equipment up stairs
Possibly: -Back up to 2nd crew -Air Supply to 2 floors below -I.R.I.T. -Staging -Secure stair wells
Command Vehicle 2 FITs
1 FIT operating communications
1 FIT monitoring command board and documentation
2nd Aerial
To Section A Ventilation
1 Stairwell for ventilation
1 Stairwell for evacuation
Hazmat 3 F.F.
Air Monitoring for F.F. safety
Other
-8 to 10 F.F. to staging area, relief crews
- Salvage Operations
-Evacuees: DC requests TTC buses
Track Residents Evacuated 1 FIT
SAFETY CONTROL
Staging Floor Set up Rehab
Rehab Officer (1) Documentation
Checking Floors above fire 2 F.F.
Checking Floors below fire 2 F.F.
Transport Air Bottles to staging 2 F.F.
HIGH RISE RESOURCE SUMMARY:
Approximately 44 Fire Fighters Including staging & base
10-13 vehicles

Appendix C – TFS Unit Chart

City of Toronto Fire Services Unit Staffing Chart

Staffing Legend:	Pumpers		Rescue		Aerials		Squads			
	Full	Min	Full	Min	Full	Min	Full	Min		
	5	4	6	4	5	3	5	3		
	Air Light		**Command**		**DC**		**HazMat Unit**		**High Rise Unit**	
	Full	Min	Full	Min	Full	Min	Full	Min	Full	Min
	3	2	1	1	2	2	5	3	5	3

'Min' refers to the minimum number of staff to be assigned to the vehicle for that vehicle to be in service.

Command Units staffed by management.

5 staff are assigned to vehicles for administrative purposes; this takes into consideration the staffing levels needed to allow for vacation and unscheduled absence.

Rescues are assigned either 5 or 6 as an administrative number and run with 4.

			TYPE & NUMBER OF UNITS									Staffing		SPECIAL OPS & COMMAND & UNITS
COMMAND	DISTRICT	Stations	Pumpers	Rescue	Aerials	Squads	Air Light	Command Units	DC Units	HazMat Unit	High Rise Unit	Full	Min	
Staff Levels														
1 - North														
	1	111	1						1			7	6	
		112		1								6	4	
		113	1		1							10	7	Hazmat Pumper
		114	1		1		1	1				14	10	Air Light Unit, CMD unit
		115		1								6	4	
		116	1									5	4	
	2	121	1									5	4	
		122		1								6	4	
		123	1						1			7	6	
		125	1									5	4	
	3	131	1		1							10	7	
		132	1						1			7	6	
		133		1	1							11	7	
		134		1								6	4	**District 1 Unstaffed Units**
		135	1		1							10	7	HS145 HazMat Support
	4	141	1									5	4	DE145 Decon Unit
		142	1		1				1			12	9	DS145 Decon Unit
		143	1			1						10	7	
		145	1							1		10	7	Hazmat Materials Unit; Haz Support Unit
		146	1									5	4	
Command 1 Total:		**20**	**15**	**5**	**6**	**1**	**1**	**1**	**4**	**1**	**0**	**157**	**115**	

COMMAND	DISTRICT	Stations	TYPE & NUMBER OF UNITS									Staffing		SPECIAL OPS & COMMAND & UNITS
			Pumpers	Rescue	Aerials	Squads	Air Light	Command Units	DC Units	HazMat Unit	High Rise Unit	Full	Min	
Staff Levels														
2 - East														
	1	211	1									5	4	Water Tanker
		212	1						1			7	6	
		213	1		1							10	7	
		214		1								6	4	
		215	1		1							10	7	
	2	222	1		1							10	7	
		223	1									5	4	Support 7 - bluff rescue pumper
		224	1	1								11	8	
		225		1					1			8	6	
		226	1		1							10	7	
		227	1									5	4	
	3	231		1	1		1		1			16	11	Air Light Unit
		232	1			1						10	7	Bluff Rescue
		233	1									5	4	
		234	1									5	4	Decon Unit
		235		1								6	4	Husar, Trench Rescue
	4	241		1								6	4	Typhoon Fan
		242	1						1			7	6	**District 2 Unstaffed Units**
		243		1								6	4	WT211 Water Tanker
		244	1		1							10	7	SUP7 Support
		245	1									5	4	DE234 Decon Unit
														HS234 HazMat Support
Command 2 Total:		**21**	**15**	**7**	**6**	**1**	**1**	**0**	**4**	**0**	**0**	**163**	**119**	TS125 Trench Support
														TRS235 Trench Rescue

COMMAND	DISTRICT	Stations	Pumpers	Rescue	Aerials	Squads	Air Light	Command Units	DC Units	HazMat Unit	High Rise Unit	Full	Min	
Staff Levels														
3- South														
	1	311	1									5	4	
		312	1		1				1			12	9	
		313	1			1						10	7	
		314	1									5	4	
		315	1		1							10	7	
	2	321		1	1							11	7	
		322	1		1							10	7	
		323	1						1			7	6	
		324	1		1							10	7	
		325	1	1	1							16	11	
		326		1								6	4	
	3	331	1		1	1						15	10	Tower Aerials
		332	1					1	1	1	1	18	13	Hazmat Unit; CMD Unit; Haz support
		333	1		1		1					13	9	Air Light Unit
		334	1									5	4	Fireboat
		335	1									5	4	Quint
	4	341		1	1							11	7	**District 3 Unstaffed Units**
		342	1									5	4	HS332 HazMat Support
		343	1									5	4	Box 12 (Station 345)
		344	1									5	4	
		345		1	1				1			13	9	Box 12
		346												
Command 3 Total:		**21**	**17**	**5**	**10**	**2**	**1**	**1**	**4**	**1**	**1**	**197**	**141**	

COMMAND	DISTRICT	Stations	Pumpers	Rescue	Aerials	Squads	Air Light	Command Units	DC Units	HazMat Unit	High Rise Unit	Full	Min	
Staff Levels														
4 - West														
	1	411		1	1							11	7	
		412		1								6	4	
		413	1	1								11	8	
		415	1		1				1			12	9	
	2	421		1	1		1					14	9	Air Light Unit
		422	1									5	4	
		423		1	1				1			13	9	
		424	1									5	4	
		425		1								6	4	
		426	1	1	1							16	11	
	3	431	1									5	4	
		432	1		1				1			12	9	
		433	1		1							10	7	Haz support unit
		434		1								6	4	
		435		1								6	4	
	4	441		1	1							11	7	**District 3 Unstaffed Units**
		442	1									5	4	HS442 HazMat Support
		443	1									5	4	
		444		1								6	4	
		445	1			1			1			12	9	
Command 4 Total:		**20**	**11**	**11**	**8**	**1**	**1**	**0**	**4**	**0**	**0**	**177**	**125**	
TOTAL STATIONS		82												
TOTAL VEHICLES & SQUADS			**58**	**28**	**30**	**5**	**4**	**2**	**16**	**2**	**1**			
TOTAL STAFF PER SHIFT												**694**	**500**	

Appendix D – Relationship in volume and percentage, between 'All Incidents', 'Medical Incidents', 'False Alarms', and 'Fires', by station response area

Station	2011 All Incidents	2011 Medical Calls	Percent of All Calls in Station Area	2011 False Alarms	Percent of All Calls in Station Area2	2011 Fires	Percent of All Calls in Station Area3	Total Percentage of Medical, False Alarm, and Fire Incidents
111	1210	823	68%	109	9%	4	0.3%	77%
112	2165	1489	69%	188	9%	18	0.8%	78%
113	1645	986	60%	187	11%	23	1.4%	73%
114	2874	1703	59%	387	13%	37	1.3%	74%
115	1373	793	58%	166	12%	21	1.5%	71%
116	1076	536	50%	137	13%	11	1.0%	64%
121	1149	531	46%	184	16%	9	0.8%	63%
122	820	391	48%	153	19%	9	1.1%	67%
123	1212	729	60%	159	13%	11	0.9%	74%
125	971	533	55%	145	15%	8	0.8%	71%
131	1070	428	40%	270	25%	13	1.2%	66%
132	2665	1498	56%	325	12%	28	1.1%	69%
133	1603	962	60%	188	12%	28	1.7%	73%
134	2342	1346	57%	324	14%	24	1.0%	72%
135	1165	527	45%	236	20%	13	1.1%	67%
141	1942	964	50%	443	23%	44	2.3%	75%
142	2974	1752	59%	393	13%	56	1.9%	74%
143	1637	993	61%	161	10%	29	1.8%	72%
145	1622	864	53%	182	11%	31	1.9%	66%
146	1790	915	51%	234	13%	48	2.7%	67%
211	737	345	47%	118	16%	12	1.6%	64%
212	980	569	58%	93	9%	24	2.4%	70%
213	1614	940	58%	192	12%	23	1.4%	72%
214	899	483	54%	81	9%	18	2.0%	65%
215	754	484	64%	62	8%	12	1.6%	74%
222	2408	1539	64%	281	12%	22	0.9%	76%
223	2450	1532	63%	235	10%	32	1.3%	73%
224	1736	1063	61%	155	9%	27	1.6%	72%
225	2174	1314	60%	221	10%	31	1.4%	72%
226	2135	1316	62%	275	13%	22	1.0%	76%
227	1116	614	55%	109	10%	12	1.1%	66%
231	2524	1620	64%	270	11%	41	1.6%	77%
232	2098	1296	62%	244	12%	23	1.1%	74%
233	1615	1033	64%	152	9%	14	0.9%	74%
234	2023	1330	66%	192	9%	29	1.4%	77%
235	1720	1124	65%	145	8%	24	1.4%	75%
241	1102	675	61%	142	13%	10	0.9%	75%
242	1350	801	59%	161	12%	20	1.5%	73%
243	1234	692	56%	197	16%	15	1.2%	73%
244	2060	1190	58%	273	13%	30	1.5%	72%
245	1432	821	57%	159	11%	20	1.4%	70%

Station	2011 All Incidents	2011 Medical Calls	Percent of All Calls in Station Area	2011 False Alarms	Percent of All Calls in Station Area2	2011 Fires	Percent of All Calls in Station Area3	Total Percentage of Medical, False Alarm, and Fire Incidents
311	1986	1039	52%	400	20%	20	1.0%	73%
312	2193	1196	55%	504	23%	30	1.4%	79%
313	2977	1628	55%	539	18%	40	1.3%	74%
314	4310	2578	60%	980	23%	41	1.0%	84%
315	2614	1660	64%	342	13%	37	1.4%	78%
321	898	453	50%	165	18%	11	1.2%	70%
322	2154	1288	60%	244	11%	30	1.4%	73%
323	1815	1171	65%	164	9%	22	1.2%	75%
324	1492	961	64%	178	12%	15	1.0%	77%
325	3885	2216	57%	785	20%	54	1.4%	79%
326	942	512	54%	121	13%	17	1.8%	69%
331	2193	1227	56%	366	17%	31	1.4%	74%
332	4031	2346	58%	867	22%	51	1.3%	81%
333	2154	1097	51%	472	22%	24	1.1%	74%
334	1420	711	50%	316	22%	15	1.1%	73%
335	139	25	18%	9	6%	2	1.4%	26%
341	2161	1412	65%	178	8%	30	1.4%	75%
342	1194	792	66%	73	6%	19	1.6%	74%
343	1496	920	61%	170	11%	30	2.0%	75%
344	2067	1162	56%	296	14%	26	1.3%	72%
345	1991	1204	60%	231	12%	31	1.6%	74%
346	164	92	56%	51	31%	1	0.6%	88%
411	1584	897	57%	176	11%	57	3.6%	71%
412	1065	535	50%	192	18%	18	1.7%	70%
413	2526	1555	62%	307	12%	31	1.2%	75%
415	1425	813	57%	156	11%	27	1.9%	70%
421	2107	1294	61%	241	11%	32	1.5%	74%
422	1009	663	66%	75	7%	25	2.5%	76%
423	1685	971	58%	177	11%	33	2.0%	70%
424	687	458	67%	60	9%	7	1.0%	76%
425	778	431	55%	99	13%	12	1.5%	70%
426	4517	2630	58%	611	14%	47	1.0%	73%
431	1144	726	63%	125	11%	8	0.7%	75%
432	1004	546	54%	138	14%	20	2.0%	70%
433	1971	1144	58%	205	10%	32	1.6%	70%
434	857	507	59%	90	11%	17	2.0%	72%
435	1469	830	57%	173	12%	26	1.8%	70%
441	1907	887	47%	338	18%	34	1.8%	66%
442	2455	1386	56%	354	14%	35	1.4%	72%
443	2194	1368	62%	255	12%	30	1.4%	75%
444	1178	695	59%	128	11%	6	0.5%	70%
445	2023	1136	56%	251	12%	30	1.5%	70%
No Station ID	7	4		3		3		
Grand Total	145334	84710	58%	19933	14%	2033	1.4%	73%
Data Sources:								
Total Calls and Medical Calls: CAD Data - Event Detail								
Fire and False Alarms: RMS Data								

Appendix E – Response Times by Fire Station

Exhibit A - Day - Night Comparison 2011 District 1

90th Percentile Station		111	112	113	114	115	116	121	122	123	125	131	132	133	134	135	141	142	143	145	146
Alarm to Arrive (min)	**0000 to 0600**	10.0	9.1	9.9	9.4	9.0	11.8	10.0	10.1	11.5	9.1	9.1	10.0	9.6	7.9	8.5	9.3	9.0	11.4	8.6	9.5
	1200 to 1800	8.2	9.1	7.8	8.1	9.0	11.2	8.5	10.3	8.7	10.0	7.9	8.5	9.8	8.7	7.7	9.0	8.7	11.1	9.0	9.8
Differential		1.8	0.0	2.1	1.3	0.0	0.6	1.5	-0.3	2.7	-0.9	1.2	1.6	-0.2	-0.8	0.8	0.4	0.3	0.2	-0.4	-0.3
Comparing night to day, call received to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																					
		111	**112**	**113**	**114**	**115**	**116**	**121**	**122**	**123**	**125**	**131**	**132**	**133**	**134**	**135**	**141**	**142**	**143**	**145**	**146**
Alerted to Arrive (min)	**0000 to 0600**	8.2	8.1	8.1	7.8	7.9	8.4	8.2	9.4	10.2	7.9	8.0	8.7	7.4	6.2	7.1	8.1	7.8	10.0	7.8	8.1
	1200 to 1800	7.0	7.6	6.5	6.9	8.0	9.7	7.2	8.9	7.2	7.8	6.8	7.1	8.2	6.7	6.4	4.3	7.3	9.0	7.7	8.4
Differential		1.1	0.5	1.7	0.9	-0.1	-1.3	0.9	0.5	2.9	0.1	1.1	1.6	-0.8	-0.5	0.8	3.9	0.5	1.0	0.1	-0.3
Comparing night to day, dispatched to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																					
		111	**112**	**113**	**114**	**115**	**116**	**121**	**122**	**123**	**125**	**131**	**132**	**133**	**134**	**135**	**141**	**142**	**143**	**145**	**146**
Enroute To Arrive (min)	**0000 to 0600**	5.2	4.7	5.3	5.1	5.2	5.5	5.4	6.3	8.3	5.1	5.7	6.2	4.7	3.9	4.2	5.3	5.3	7.6	5.1	5.2
	1200 to 1800	5.3	5.7	5.3	5.3	6.4	7.7	5.3	6.0	5.5	5.5	5.1	5.5	6.1	5.0	4.7	5.8	5.6	7.3	6.0	6.2
Differential		-0.1	-1.0	0.0	-0.2	-1.2	-2.2	0.1	0.3	2.8	-0.4	0.6	0.8	-1.4	-1.1	-0.5	-0.5	-0.3	0.3	-0.9	-1.0
Comparing night to day, enroute to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																					
		111	**112**	**113**	**114**	**115**	**116**	**121**	**122**	**123**	**125**	**131**	**132**	**133**	**134**	**135**	**141**	**142**	**143**	**145**	**146**
Number of Incidents Apparatus Housed In Station Responded To (2011)	**0000 to 0600**	46	77	64	125	74	48	62	34	38	30	69	94	90	86	74	123	158	82	56	76
	1200 to 1800	109	196	216	353	182	153	165	157	131	107	238	324	230	234	277	215	391	252	200	206
Number of Incidents in Station Area	**0000 to 0600**	42	75	64	139	65	58	67	33	42	42	59	108	79	98	61	151	146	64	72	92
	1200 to 1800	97	206	215	361	169	186	185	150	151	128	211	412	184	316	224	306	385	199	225	260
Average time out of service per call (min)	**0000 to 0600**	30.1	20.6	26.0	24.9	25.5	21.4	26.2	21.8	21.5	33.9	19.9	22.4	25.0	21.3	20.5	26.8	23.3	28.6	33.0	28.6
	1200 to 1800	20.5	20.5	23.7	24.5	25.4	23.8	19.6	20.6	25.0	33.8	15.8	23.3	23.7	20.3	18.9	23.3	20.6	22.7	25.2	24.8

Exhibit B - Day - Night Comparison 2011 District 2

90th Percentile	Station	211	212	213	214	215	222	223	224	225	226	227	231	232	233	234	235	241	242	243	244	245
Alarm to Arrive (min)	0000 to 0600	9.1	9.0	10.5	10.8	10.7	8.8	9.9	10.3	8.6	9.4	9.8	9.5	9.8	8.2	8.9	9.2	9.1	8.9	9.1	9.3	8.6
	1200 to 1800	8.3	10.1	9.0	9.3	8.7	8.2	8.6	8.2	7.7	8.2	8.1	8.9	10.2	7.9	9.3	9.1	9.4	8.0	8.2	8.3	9.1
Differential		0.7	-1.1	1.5	1.6	2.0	0.6	1.3	2.1	0.9	1.2	1.7	0.6	-0.5	0.3	-0.4	0.1	-0.3	1.0	0.9	1.0	-0.5
Comparing night to day, call received to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																						
		211	212	213	214	215	222	223	224	225	226	227	231	232	233	234	235	241	242	243	244	245
Alerted to Arrive (min)	0000 to 0600	7.8	8.2	8.5	9.6	8.9	7.6	8.3	8.7	6.8	7.6	8.0	7.8	8.4	7.2	7.7	7.3	7.5	7.7	7.8	8.0	7.6
	1200 to 1800	7.2	8.2	7.5	7.4	7.0	6.8	7.3	6.7	6.5	6.5	6.6	7.7	8.0	6.6	7.8	7.8	7.7	7.0	7.1	6.5	6.7
Differential		0.6	0.0	1.0	2.2	1.9	0.8	1.0	2.0	0.3	1.1	1.4	0.1	0.4	0.6	-0.1	-0.5	-0.2	0.8	0.6	1.5	0.9
Comparing night to day, dispatched to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																						
		211	212	213	214	215	222	223	224	225	226	227	231	232	233	234	235	241	242	243	244	245
Enroute To Arrive (min)	0000 to 0600	5.5	5.2	5.8	6.9	6.4	4.5	6.2	5.0	4.2	4.6	5.3	5.4	5.7	4.5	4.8	4.7	4.4	5.4	5.4	5.4	5.2
	1200 to 1800	5.7	6.1	5.7	5.5	5.3	5.3	5.5	4.5	4.7	4.7	4.7	5.7	6.4	5.1	5.8	5.7	5.5	5.3	5.3	4.8	5.3
Differential		-0.2	-0.9	0.1	1.4	1.1	-0.8	0.7	0.5	-0.5	0.0	0.7	-0.3	-0.7	-0.6	-1.0	-1.0	-1.2	0.1	0.0	0.6	-0.1
Comparing night to day, enroute to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																						
		211	212	213	214	215	222	223	224	225	226	227	231	232	233	234	235	241	242	243	244	245
Number of Incidents Apparatus Housed In Station Responded To (2011)	0000 to 0600	26	49	72	43	41	98	93	92	87	104	55	91	106	48	79	65	26	50	55	70	57
	1200 to 1800	77	129	185	139	115	235	217	216	197	259	134	295	293	162	184	180	95	160	172	277	165
Number of Incidents in Station Area	0000 to 0600	34	52	80	41	36	109	103	88	117	105	59	88	91	58	77	62	37	48	54	74	57
	1200 to 1800	103	122	194	145	81	230	294	199	244	254	142	299	247	173	205	192	115	181	187	280	178
Average time out of service per call (min)	0000 to 0600	20.9	24.2	23.7	26.1	36.7	21.1	27.1	20.8	23.1	20.7	20.6	24.7	20.0	23.9	22.9	24.4	21.5	26.2	29.6	20.4	23.3
	1200 to 1800	15.3	23.4	20.2	19.9	19.0	19.8	21.2	17.8	18.5	18.5	22.2	19.2	18.4	23.9	22.9	18.1	19.9	19.9	18.5	18.0	20.4

Exhibit C - Day - Night Comparison 2011 District 3

90th Percentile

	Station	311	312	313	314	315	321	322	323	324	325	326	331	332	333	334	341	342	343	344	345	346
Alarm to Arrive (min)	**0000 to 0600**	9.3	7.7	7.5	6.9	7.8	9.6	8.6	8.3	7.7	7.6	7.7	8.3	7.5	7.8	7.8	8.3	7.6	9.9	7.9	7.8	8.1
	1200 to 1800	7.5	6.7	9.1	6.8	7.2	8.6	8.8	7.0	7.9	6.5	7.2	7.4	6.8	6.9	8.7	8.2	7.1	8.0	7.0	7.6	7.1
Differential		1.8	1.0	-1.6	0.1	0.6	0.9	-0.2	1.3	-0.1	1.1	0.5	0.9	0.7	0.9	-0.9	0.1	0.5	1.9	0.9	0.2	1.0
Comparing night to day, call received to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																						
		311	**312**	**313**	**314**	**315**	**321**	**322**	**323**	**324**	**325**	**326**	**331**	**332**	**333**	**334**	**341**	**342**	**343**	**344**	**345**	**346**
Alerted to Arrive (min)	**0000 to 0600**	7.4	6.2	6.1	5.9	6.1	7.8	7.9	6.8	6.5	6.3	6.2	7.0	6.1	6.6	6.4	6.9	6.7	7.5	6.6	6.4	6.3
	1200 to 1800	6.4	5.3	6.7	5.4	5.8	6.6	6.9	5.6	5.9	5.2	5.6	6.3	5.5	5.5	6.5	6.7	6.2	6.4	5.6	6.1	6.3
Differential		1.0	0.9	-0.6	0.5	0.3	1.1	1.0	1.2	0.6	1.1	0.7	0.7	0.6	1.1	-0.2	0.2	0.5	1.2	1.0	0.4	0.0
Comparing night to day, dispatched to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																						
		311	**312**	**313**	**314**	**315**	**321**	**322**	**323**	**324**	**325**	**326**	**331**	**332**	**333**	**334**	**341**	**342**	**343**	**344**	**345**	**346**
Enroute To Arrive (min)	**0000 to 0600**	4.4	3.6	4.0	3.5	3.9	5.4	4.5	4.1	3.7	3.6	3.8	4.1	3.6	3.9	4.2	4.1	4.5	4.5	4.5	4.2	2.4
	1200 to 1800	4.3	3.9	5.3	3.8	4.3	4.8	5.1	4.0	4.2	3.7	3.8	4.5	4.2	4.0	5.1	5.1	4.6	4.7	4.1	4.4	3.5
Differential		0.2	-0.3	-1.3	-0.3	-0.4	0.6	-0.6	0.0	-0.5	-0.1	0.0	-0.4	-0.6	-0.1	-0.9	-1.0	-0.1	-0.2	0.4	-0.2	-1.1
Comparing night to day, enroute to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																						
		311	**312**	**313**	**314**	**315**	**321**	**322**	**323**	**324**	**325**	**326**	**331**	**332**	**333**	**334**	**341**	**342**	**343**	**344**	**345**	**346**
Number of Incidents Apparatus Housed In Station Responded To (2011)	**0000 to 0600**	64	158	170	182	148	38	87	69	70	266	62	172	204	153	72	89	55	56	115	113	1
	1200 to 1800	208	383	350	333	295	160	254	181	165	510	142	297	342	301	150	272	120	156	295	266	3
Number of Incidents in Station Area	**0000 to 0600**	87	139	177	258	140	28	88	83	70	247	56	151	301	168	93	87	62	69	108	111	11
	1200 to 1800	306	313	418	529	280	150	261	210	152	439	134	244	455	297	208	261	134	189	301	246	19
Average time out of service per call (min)	**0000 to 0600**	31.7	17.4	16.8	18.2	20.4	33.9	20.7	27.3	22.4	16.6	20.4	22.4	19.5	20.5	23.3	24.7	22.5	26.7	24.5	22.7	42.7
	1200 to 1800	19.2	16.5	17.9	16.0	18.0	20.1	20.1	17.1	17.9	15.6	19.1	19.6	19.0	17.6	23.5	22.5	25.2	22.2	18.8	19.7	11.7

Exhibit D - Day - Night Comparison 2011 District 4																					
90th Percentile																					
	Station	411	412	413	415	421	422	423	424	425	426	431	432	433	434	435	441	442	443	444	445
Alarm to Arrive (min)	0000 to 0600	9.4	10.1	9.0	10.4	9.4	8.3	8.0	7.0	10.3	8.8	9.6	9.6	9.4	9.0	9.8	9.3	9.0	10.3	11.1	10.0
	1200 to 1800	9.2	9.1	8.9	9.5	8.1	7.5	7.2	8.2	10.8	7.4	8.8	8.1	9.4	8.9	8.3	9.7	8.7	8.7	10.6	9.9
Differential		0.2	1.0	0.0	0.9	1.3	0.8	0.8	-1.2	-0.5	1.3	0.8	1.5	0.0	0.1	1.5	-0.4	0.3	1.6	0.5	0.2
Comparing night to day, call received to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																					
		411	412	413	415	421	422	423	424	425	426	431	432	433	434	435	441	442	443	444	445
Alerted to Arrive (min)	0000 to 0600	8.1	9.0	7.7	8.7	7.6	6.4	7.2	6.0	8.3	7.2	8.2	8.2	7.7	7.5	7.9	7.8	7.6	8.8	8.8	5.1
	1200 to 1800	7.5	7.6	7.7	8.3	6.6	6.3	5.5	6.0	8.9	5.9	7.7	6.8	7.6	7.6	6.8	8.1	7.1	7.1	8.9	8.1
Differential		0.5	1.3	0.0	0.4	1.0	0.1	1.7	0.0	-0.6	1.2	0.5	1.4	0.1	-0.2	1.2	-0.3	0.5	1.7	-0.1	-2.9
Comparing night to day, dispatched to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																					
		411	412	413	415	421	422	423	424	425	426	431	432	433	434	435	441	442	443	444	445
Enroute To Arrive (min)	0000 to 0600	5.2	6.1	4.6	6.1	4.4	4.3	4.2	4.2	5.5	4.5	5.1	5.8	5.0	5.1	5.0	5.5	5.1	5.5	6.1	5.7
	1200 to 1800	5.7	5.9	5.3	6.3	4.7	4.8	4.1	4.1	7.1	4.4	6.0	5.0	5.7	5.7	5.2	6.3	5.5	5.1	6.6	6.4
Differential		-0.6	0.2	-0.7	-0.2	-0.3	-0.5	0.1	0.1	-1.6	0.1	-0.9	0.8	-0.7	-0.6	-0.2	-0.8	-0.4	0.5	-0.5	-0.6
Comparing night to day, enroute to arrived scene differential should be ~0.0 min or less between 0000 - 0600 than 1200 - 1800																					
		411	412	413	415	421	422	423	424	425	426	431	432	433	434	435	441	442	443	444	445
Number of Incidents Apparatus Housed In Station Responded To (2011)	0000 to 0600	65	62	131	72	78	43	85	38	46	238	29	43	106	23	88	98	130	69	54	88
	1200 to 1800	199	131	309	230	262	110	208	112	116	483	95	141	220	86	170	274	300	208	169	248
Number of Incidents in Station Area	0000 to 0600	69	71	124	61	81	38	98	31	42	247	35	41	106	26	100	113	150	78	44	116
	1200 to 1800	222	166	277	208	256	106	226	71	117	531	115	150	245	99	183	300	361	280	173	268
Average time out of service per call (min)	0000 to 0600	30.3	27.9	25.4	23.5	28.3	27.0	29.2	29.9	26.9	22.3	16.0	25.1	24.0	22.8	22.0	27.3	24.1	24.3	25.0	25.4
	1200 to 1800	26.5	23.2	22.0	22.5	21.3	22.1	20.7	21.7	22.1	18.9	18.7	21.7	23.7	21.6	22.1	27.3	22.5	22.4	23.0	24.1

Notes

771 calls in the 0000 to 0600 window had road response times less than 1.5 minutes or more than 15 minutes and the times were not included in the calculations. (The calls were included in the counts)

2406 calls in the 1200 to 1800 window had road response times less than 1.5 minutes or more than 15 minutes and the times were not included in the calculations. (The calls were included in the counts)

Appendix F – Maps Indicating Demographics and Fire Related Civilian Injury & Death

Appendix G – Risk – High Level Overview

Risk – High Level Overview

In place of the Comprehensive Fire Risk Analysis, a general high level review of the fire risk for the City of Toronto was done using the Office of the Ontario Fire Marshal (OFM) document entitled "Comprehensive Fire Safety Effectiveness Model: Fire Risk Sub-Model, June 2009" as the guideline for this cursory overview. Much of the content of this section is taken from the Fire Marshal's Guideline.

In the document risk is defined as a measure of the probability and consequence of an adverse effect to health, property, organization, environment, or community as a result of an event, activity or operation. For the purposes of the Fire Risk Sub-model, such an event refers to a fire incident along with the effects of heat, smoke, and toxicity threats generated from the incident.

The Fire Risk Sub-Model offers guidance on the likelihood of events, the consequence levels of events, along with suggestions for matching probability and consequence to priority levels for attention and action.

Table 41 - Likelihood Levels as Defined by the Ontario Fire Marshal

Description	Level	Specifics
Rare	1	-may occur in exceptional circumstances -no incidents in the past 15 years
Unlikely	2	-could occur at some time, especially if circumstances change -5 to 15 years since last incident
Possible	3	-might occur under current circumstances -1 incident in the past 5 years
Likely	4	-will probably occur at some time under current circumstances -multiple or recurring incidents in the past 5 years
Almost Certain	5	-expected to occur in most circumstances unless circumstances change -multiple or recurring incidents in the past year

The OFM suggests that the frequency of incidents should only be used as a general guide when determining this value. It should be complemented with consideration of events that occur within other communities. Events that have not taken place for a long time in one community may occur more frequently elsewhere.

Table 42 - Consequence Levels as Defined by the Ontario Fire Marshal

Description	Level	Specifics
Insignificant	1	1. no life safety issue 2. limited valued or no property loss 3. no impact to local economy and/or 4. no effect on general living conditions
Minor	2	1. potential risk to life safety of occupants 2. minor property loss 3. minimal disruption to business activity and/or 4. minimal impact on general living conditions
Moderate	3	1. threat to life safety of occupants 2. moderate property loss 3. poses threat to small businesses and/or 4. could pose threat to quality of the environment
Major	4	1. potential for a large loss of life 2. would result in significant property damage 3. significant threat to large businesses, local economy and tourism, and/or 4. impact to the environment would result in a short term partial evacuation of local residents and businesses
Catastrophic	5	1. significant loss of life 2. multiple property damage to significant portion of the municipality 3. long term disruption of businesses, local employment, and tourism and/or 4. environmental damage that would result in long-term evacuation of local residents and businesses

The consequences, as a result of fire, are the potential loss or negative outcomes associated with the event. The application of professional judgment and reviews of past occurrences are important methods used for quantifying consequence levels. Estimating the consequence level due to fire involves an evaluation of four components:

Life Safety

- Injuries or loss of life due to occupant and firefighter exposure to life threatening fire or other situations;

Property Loss

- Monetary losses relating to private and public buildings, property content, irreplaceable assets, significant historic/symbolic landmarks and critical infrastructure;

Economic Impact

- Monetary losses associated with property income, business closures, downturn in tourism, tax assessment value, employment layoffs;

Environmental Impact

- Harm to human and non-human (i.e. wildlife, fish and vegetation) species of life and general decline in quality of life within the community due to air/water/soil contamination as a result of fire and fire suppression activities.

Risk and priority levels are defined as follows and shown in the matrix in :

- L=Low Risk - Priority Level 1 (L1)-manage by routine programs and procedures, maintain risk monitoring
- M = Moderate Risk Priority Level 2 (L2)-requires specific allocation of management responsibility including monitoring and response procedures
- H = High Risk Priority - Level 3 (L3)-community threat, senior management attention needed
- E = Extreme Risk - Priority Level 4 (L4)-serious threat, detailed research and management planning required at senior levels

Table 43 - Ontario Fire Marshal Risk Analysis Matrix

Probability	Consequence				
	1 (Insignificant)	2 (Minor)	3 Moderate	4 (Major)	5 (Catastrophic)
1 (Rare)	L (L1)	L (L1)	M (L2)	H (L3)	H (L3)
2 (Unlikely)	L (L1)	L (L1)	M (L2)	H (L3)	E (L4)
3 (Possible)	L (L1)	M (L2)	H (L3)	E (L4)	E (L4)
4 (Likely)	M (L2)	H (L3)	H (L3)	E (L4)	E (L4)
5 (Almost Certain)	H (L3)	H (L3)	H (L3)	E (L4)	E (L4)

The OFM Sub Risk Model document provides an overview of the considerations for each risk factor and offers some samples of concerns related to a Community Fire Risk Profile.

Property Stock
Building Age and Construction
Demographic Profile
Past Fire Loss
Building Height and Area
Building Exposures
Geography/Topography
Fuel Load

In each of these identified risk factors identified by the OFM, Toronto has a number of areas of concern. The city has the most diverse property stock in Ontario. There are large areas of the City, identified by the Planning Department as centres and avenues for future growth where existing buildings predate the National Building Code and the Ontario Building Code.

Toronto has more highrise buildings than any other city in the province and is among the leaders in highrise building numbers across North America. According to a report dated December 2, 2011 in the Toronto Star, Toronto ranked No. 1 in North American cities for highrises under construction in 2011 with 150 while No. 2 Mexico City had 88 and No. 3 New York City had 86. Of the 150 in Toronto, 140 were condo towers, 15 were office towers, 10 were rental buildings, 6 were hospitals and 4 were hotels. The same report pointed out that Toronto ranked second in North America for the number of highrise buildings with 1,879. According to the report 39% of Toronto households were now in highrise buildings.

Many of Toronto's buildings in the core centres are closely constructed or connected to each other. Accessibility and response can be impeded by traffic and construction congestion, streetcar transit infrastructure and rush hour volumes. Toronto has a significant history of large fire and other major incidents involving building and neighbourhood evacuations and economic impact upon businesses where TFS is the lead response group (Sunrise Propane explosion, Queen Street West fire, 2 Secord Avenue Hydro Vault explosion, 200 Wellesley highrise fire). In addition to hazardous and combustible materials housed in industrial and commercial operations throughout the city, there are large quantities of these materials being transported through the city on highways, streets and rail lines. Toronto is on the flight path for three airports.

HIRA (Hazardous Incident Risk Assessment) Report

It is a requirement from municipalities under the Emergency Management and Civil Protection Act that "in developing its emergency management program, every municipality shall identify and assess the various hazards and risks to public safety that could give rise to emergencies and identify the facilities and other elements of the infrastructure that are at risk of being affected by emergencies"

A review of the TFS's role in Community Emergency Preparedness and Response shows that 90.3% of the Specific Hazards identified in the community HIRA report will involve TFS as a major responder. In addition, 80.6% of identified HIRA specific hazards are not directly related to firefighting but fall within the areas for which TFS is trained and equipped to provide emergency service

The 31 hazards identified in the report are potential long-term events which will deplete normal response capabilities

The HIRA report states High, Medium and Low probability phases in which TFS would be a major responder where 87.5% of the hazards are in the High and Medium range.

It should be pointed out that TFS would be a major responder where these types of events occur at a level below that of a declared emergency. These include but are not limited to special operations such as wildland/interface firefighting, technical rescue, marine firefighting, joint operations responses, urban search and rescue, mass casualty response, hazardous materials mitigation, counter-terrorist response, and incident management teams for disaster response. In addition, TFS responds to water and ice rescue, vehicle extrication, and other public hazards, many of which are typically high risk and which require specialized skills, knowledge and abilities from firefighters. TFS is a critical component in the all hazards protection provided to those living or visiting in Toronto.

Reference:

- HIRA report, report to City Council (FUS) 2002 and FUS report
- TFS Simplified Risk Assessment (Material Supplement) June 2012

TORONTO

The City of Toronto is a large, densely populated urban city with all of the complex attributes of other large cities, and then some. Toronto ranks in the top ten cities in the world in high-rise buildings per capita. Toronto has risks that most other cities its size do not have to contend with - subway system, the PATH system, island residents, island airport, CN Tower, to name a few. There are 41 Special Structures identified by Toronto City Planning, Research and Information, 30 of which are located within the area bounded by Spadina, Dundas, Jarvis and Lake Ontario. They have also identified that the vast majority of buildings in Toronto were constructed from pre-1900 to 1970 (332,317 buildings out of 451,460 or 73.6%). This puts construction of the majority of buildings in Toronto prior to the enactment of the Ontario Building Code (1975) and the Ontario Fire Code (1981).

The Toronto City Planning, Policy & Research Unit has estimated Toronto's daytime population at approximately 3,045,417 people. This figure is roughly 430,000 people more than the city's population. Commuters coming into the city to work, as well as students and tourists account for much of the daily increase.

The city also received approximately 152,000 applications for residential units between 2006 and 2011. Of these, 40,000 proposed units have been approved but not yet under construction, and another 38,450 are under construction but not yet completed. Taken together, these 78,500 (currently) un-occupied units could house up to an additional 140,500 people. However, to put this into perspective, the city’s population is not expected to grow to that extent until after 2028, assuming growth remains steady. Readers should also reference Chart 1- Population Growth Related to Core Fire Incidents which indicates:

> *When fire service responses from 2005 to 2011 are examined and medical emergencies and alarm calls are filtered out … we find that the fire service’s call volume, by type, has remained stable or declined during that time period. When the core fire incident trend is compared to Toronto’s population growth we can see that there is actually a decline in incident growth. Put another way, population growth and fire core incident volume are not directly related and Toronto’s population growth is not a signal of increased call volume for the fire service, at least not on a straight-line per capita basis.*

So, while we recognize that infrastructure and population growth can affect risk, evidence indicates that there is not a correlation between elevated risk just because of growth; other factors have to be in place also, and TFS has the opportunity to ameliorate any increase in risk through education, prevention, leading a lobby for changes to the fire code and building code (such as residential sprinklers), and increased enforcement.

Toronto's population is continuing to shift. In the five years since the 2006 Census, Toronto has continued to gain older adults; the share of adults 75+ years has increased from 7.0% to 7.2%. At the same time, the number of children 0-4 has also increased by 5,530 or 4.1%.

The two fastest growing age groups between 2006 and 2011 were people aged 60-64 years and 85+ years. Those aged 60-64 grew by 28.8% (from 109,465 to 140,965) while the 85+ group increased 5% (from 43,100 to 54,965). According to projections prepared by the City Planning Division, between 1996 and 2011 the number of seniors was expected to grow by 39,315 persons or by 12.3%. The 2011 census data shows the actual change among Toronto seniors 65+ is 18.0% - well above the projected estimates.

The senior cohort in Toronto is expected to increase strongly in the coming years. Between 2011 and 2031 City Planning projects the size of this group to increase by one-third. Charts 14 and 15 from the Ontario Fire Marshal's Office illustrates the death rate and the death risk by age group for the province of Ontario.

The Ontario Fire Marshal reports that people in the 50+ age bracket are the most vulnerable group when it comes to fire fatality in Ontario although there is indication that this is the case in Toronto. Nevertheless, we don't dispute that this is accurate on a province-wide basis.

Chart 14 - Ontario-wide Fire Deaths by Age

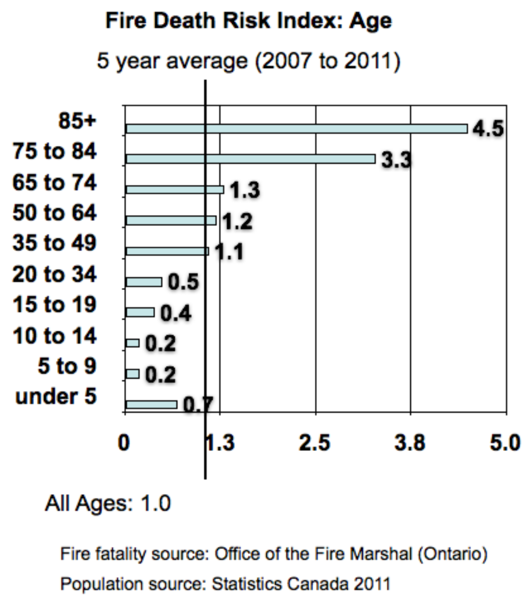
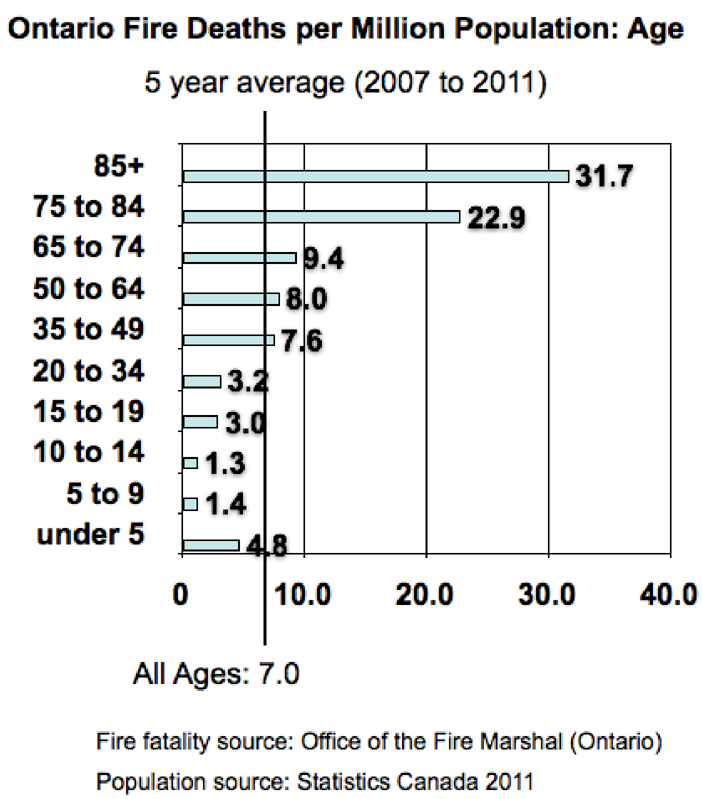


Chart 15 - Fire Death Risk Index



This is a growing demographic group in Toronto which will need more attention in terms of public education efforts for fire safety, and with inspections of fire code compliance where this group lives in residential settings that include highrise apartments and condominiums, retirement or assisted living settings, nursing homes and other care facilities. Toronto's age cohorts according to Statistics Canada can be found in Table 36.

Table 44 - StatCan Toronto Age Cohort

	2001		2006		2011	
	Population	**%**	**Population**	**%**	**Population**	**%**
0-4	143,510	5.78%	134980	5.39%	140510	5.37%
05-14	290310	11.70%	274640	10.97%	260350	9.96%
15-24	308415	12.43%	318655	12.73%	333515	12.75%
25-34	413020	16.64%	385925	15.42%	413015	15.79%
35-44	429860	17.32%	415615	16.60%	387805	14.83%
45-54	337470	13.60%	362425	14.48%	398915	15.25%
55-64	221080	8.91%	257585	10.29%	303495	11.61%
65-74	185180	7.46%	178995	7.15%	188630	7.21%
75-84	116400	4.69%	131350	5.25%	133845	5.12%
85+	36265	1.46%	43100	1.72%	54965	2.10%
	2,481,510	100.00%	2,503,270	100.00%	2,615,045	100.00%

Upon further examination though, we find that a general decline in fire related incidents offsets whatever growth may be expected because of an aging demographic. ***Table 45 - Percentage and Population Change, by Cohort, Between 2006 and 2011***, demonstrates the percentage and population change, by cohort, between 2006 and 2011 based on StatCan information.

Table 45 - Percentage and Population Change, by Cohort, Between 2006 and 2011

2005 - 2011					
	2006	**2011**	**Percentage Change**	**Population Change**	**Fire Response Per Capita***
0-4	134980	140510	4.1%	5,530	**1.39%**
05-14	274640	260350	-5.2%	-14,290	
15-24	318655	333515	4.7%	14,860	
25-34	385925	413015	7.0%	27,090	
35-44	415615	387805	-6.7%	-27,810	
45-54	362425	398915	10.1%	36,490	
55-64	257585	303495	17.8%	45,910	
65-74	178995	188630	5.4%	9,635	
75-84	131350	133845	1.9%	2,495	
85+	43100	54965	27.5%	11,865	
	StatCan Population Change 2001 - 2011			111,775	
	Call Growth that Should Occur if Per Capita Hypothesis is True				**1559**
	Actual Call Change 2005 - 2011 (Chart 2)				**-1535**
	*Non-medical, non-alarm calls per capita 2011				

According to StatCan Toronto's population grew by 111,775 between 2006 and 2011 (). In 2011 TFS's core incidents per capita was 0.014 or 1.39%. The highest incidents per capita was 0.015 in 2006. If one assumes that incident volume is directly related to population, then the fire service should have seen an increase of 1,559 incidents between 2006 and 2011 (population growth of 111,775 x 1.39% = 1,559). In actuality there was a decrease of core calls (non-medical, non-alarm) of 1,535 during the same period (2.2 Fire Services Data and Statistics).

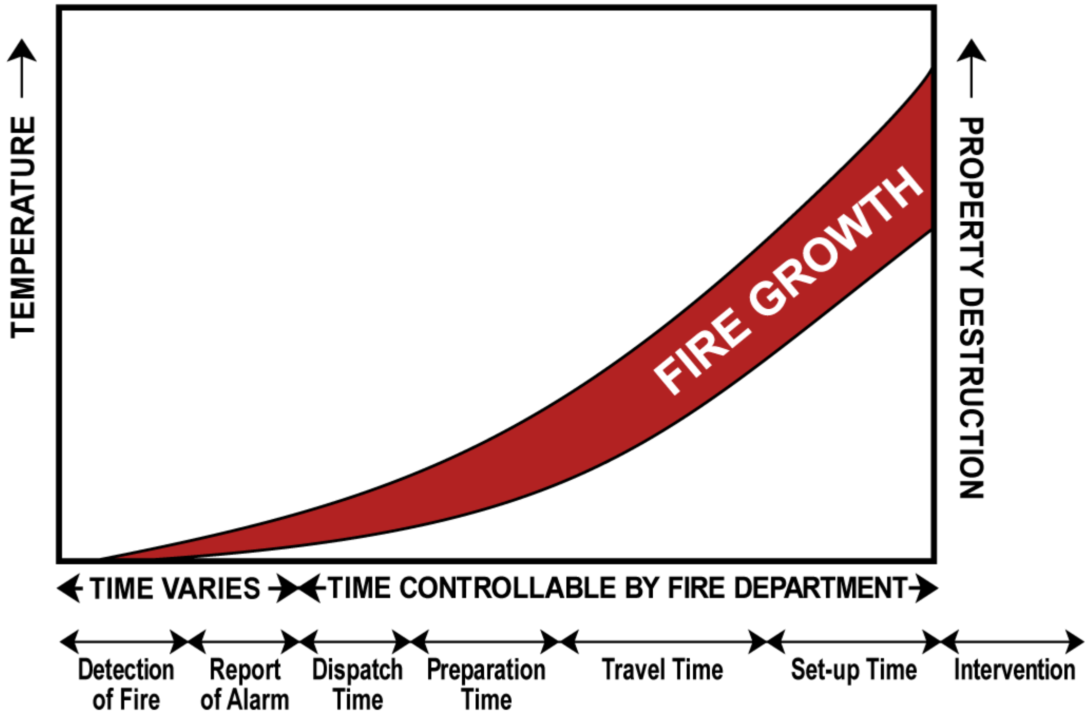
Therefore, we conclude, in the case of TFS, population growth does not translate into an increase in incidents.

Operations

Structural firefighting operations are complex in nature and require both simultaneous and sequential tasks to be performed for safe and successful intervention and mitigation of an incident. Structural fires can range from small detached sheds or storage facilities to multi-storey, multi-use high-rise buildings or huge commercial/industrial facilities. The larger the building, the more complex structural firefighting operations become, and greater become the number of tasks that have to be performed. Fires in small structures as well as large structures require sustainability of required tasks in order to achieve the objectives of rescue, control and extinguishment, and protection of property and the environment. In order to be able to operate safely, an organizational structure (Incident Command/Incident Management) is put into play at each and every event involving the fire service. The critical tasks are assigned to teams as part of the overall plan established by the incident commander. The timely and coordinated performance of the critical tasks determines the level of success of firefighting operations. Time is always the enemy when dealing with fire. The fire expands exponentially from the point of origin to the room of origin; from incipient stage to flashover; from room of origin to multiple rooms; from contents alone to contents and structural components. Fire does not stand still and wait patiently for attention and intervention.

“The Office of the Fire Marshal (OFM) recognizes an organized, rapid, aggressive and offensive approach to fire suppression as the most effective strategy to mitigate a fire, therefore potentially reducing the loss of life and property. This strategy is based upon the OFM Fire Progression Curve (See graph below). A fire grows upon itself exponentially - time versus fire growth.

ILLUSTRATION OF TYPICAL TIME / FIRE GROWTH RELATIONSHIP



NOTES: The fire progression curve is subject to variation due to a number of factors such as the type of material and volume of material involved.

The various factors, from the time the fire begins until intervention takes place, are all subject to variation.

Preparation time for full-time fire fighters means the time to dress and depart the station.

Preparation time for volunteer fire fighters includes the time to respond to the station as well as to dress and depart the station.

The impact of time on fire growth cannot be underestimated and an understanding of the time/fire growth relationship is essential when assessing risks and developing response standards, protocols and fireground tactics.” (OFM Operational Planning: A Guide to Matching Resource Deployment and Risk, January 24, 2011)

TFS operates out of 82 fire stations in 4 command districts. The mapping of residential fire locations over the past 3 years shows that fires have occurred in every command and virtually every station district. Similar mapping for commercial/industrial fires shows that these fires occur within each of the commands and in most station districts over the period.

Currently TFS is sending sufficient resources as first response to single family residences in suburban setting areas based upon the NFPA 1710 Standard (since the addition of the extra vehicle in July of 2012). It should be pointed out that the NFPA 1710 standard is based upon a suburban setting response to a single family, two-storey residence of 2,000 square feet or less with no basement and no exposures. Where there is a basement, exposures, more than 2 storeys and or a larger dwelling, adjustments in response must be made to address the additional task requirements. Where TFS is responding to urban single family dwellings with any of the additional conditions there should be an increase in first response resources. NFPA 1710 states:

5.2.4 Deployment.

5.2.4.1.1 The fire department’s fire suppression resources shall be deployed to provide for the arrival of an pumper company within a 240-second travel time to 90 percent of the incidents as established in Chapter 4.

5.2.4.1.2* Personnel assigned to the initial arriving company shall have the capability to implement an initial rapid intervention crew (IRIC).

5.2.4.2 Initial Full Alarm Assignment Capability.

5.2.4.2.1 The fire department shall have the capability to de- ploy an initial full alarm assignment within a 480-second travel time to 90 percent of the incidents as established in Chapter 4.

5.2.4.2.2* The initial full alarm assignment to a structure fire in a typical 2000 ft2 (186 m2), two-story single-family dwelling without basement and with no exposures shall provide for the following:

(1) Establishment of incident command outside of the hazard area for the overall coordination and direction of the initial full alarm assignment with a minimum of one individual dedicated to this task

(2) Establishment of an uninterrupted water supply of a minimum of 400 gpm (1520 L/min) for 30 minutes with sup- ply line(s) maintained by an operator

(3) Establishment of an effective water flow application rate of 300 gpm (1140 L/min) from two handlines, each of which has a minimum flow rate of 100 gpm (380 L/min) with each handline operated by a minimum of two individuals to effectively and safely maintain the line

(4) Provision of one support person for each attack and backup line deployed to provide hydrant hookup and to assist in laying of hose lines, utility control, and forcible entry

(5) Provision of at least one victim search and rescue team with each such team consisting of a minimum of two individuals (6) Provision of at least one team, consisting of a minimum of two individuals, to raise ground ladders and perform ventilation

(6) Provision of at least one team, consisting of a minimum of two individuals, to raise ground ladders and perform ventilation
(7) If an aerial device is used in operations, one person to function as an aerial operator and maintain primary control of the aerial device at all times
(8) Establishment of an IRIC consisting of a minimum of two properly equipped and trained individuals
5.2.4.2.3* Fire departments that respond to fires in high-, medium-, or low-hazard occupancies that present hazards greater than those found in the low-hazard occupancy described in 5.2.4.2.2 shall deploy additional resources on the initial alarm.
5.2.4.3 Additional Alarm Assignments.
5.2.4.3.1* The fire department shall have the capability to deploy additional alarm assignments that can provide for additional command staff, personnel, and additional services, including the application of water to the fire; engagement in search and rescue, forcible entry, ventilation, and preservation of property; safety and accountability for personnel; and provision of support activities for those situations that are beyond the capability of the initial full alarm assignment.
5.2.4.3.2 When an incident escalates beyond an initial full alarm assignment or when significant risk is present to the fire fighters due to the magnitude of the incident, the incident commander shall upgrade the IRIC to a full rapid intervention crew(s) (RIC) that consists of an officer and at least three fire- fighters who are fully equipped and trained in RIC operations.
5.2.4.3.3 An incident safety officer shall be deployed to all incidents that escalate beyond an initial full alarm assignment or when significant risk is present to fire fighters.
5.2.4.3.4 The incident safety officer shall ensure that the safety and health system is established as required in Section 6.1."

The range of critical tasks taken from "Operational Planning: An Official Guide to Matching Resource Deployment and Risk - January 24, 2011" issued by the OFM is set out on the following page. The matrix illustrates the complexity and magnitude of tasks that may need to be performed by firefighters, in many cases simultaneously, in order to minimize the impacts of a working fire on people, property and business.

Critical Task Matrix (Form 300A)									
		Low Risk		**Moderate Risk**		**High Risk**		**Extreme Risk**	
	Fireground Critical Tasks	**LERL**	**UERL**	**LERL**	**UERL**	**LERL**	**UERL**	**LERL**	**UERL**
Incident Response (Note: Where zero or no number has been assigned, the task may be performed at the direction of the incident commander.)	Incident Command*	1	1	1	1	1	1	1	1
	Pump Operator	1	1	1	1	1	1	1	1
	Attack Line (Confine & Extinguish)	2	2	2	2	2	2	2	2
	Additional Pump Operator(s)	0	0	0	2	2	4	4	6
	Additional Attack Line (Confine & Extinguish) + Backup	0	0	0	4	4	8	8	12
	Search & Rescue	0	0	2	4	2	6	2	8
	Initial Rapid Intervention Team (IRIT)	0	0	4	6	8	16	12	22
	Ventilation	0	2	2	2	2	4	2	8
	Water Supply – pressurized	0	1	1	1	1	1	1	2
	Water Supply – non-pressurized	0	3	1	4	2	6	4	8
	Forcible Entry Team	0	0	0	0	0	1	0	1
	Utilities	0	1	1	1	1	1	1	1
	Laddering (Ground Ladders)	0	2	0	2	0	4	0	6
	Laddering (Aerial or elevating device operator)	0	0	0	2	0	2	0	2
	Exposure Protection			0	4	2	6	2	6
	Incident Safety Officer			0	1	1	1	1	1
	Accountability			1	1	1	1	1	1
	Entry Control			0	2	1	4	1	4
	Rehabilitation			0	1	1	1	1	1
	Salvage			0	2	2	2	2	2
	Lighting					0	2	0	2
	Directing Occupants					0	4	0	4
	Scribe					1	1	1	1
	Sector Officers					1	4	1	4
	Air Management (air refilling station, etc.)							1	2
Other or Additional Response Considerations	Logistics Officer								
	Administrative and/or Finance Officer								
	Planning Officer								
	Evacuations (large scale)								
	Communications (dispatch)								
	Public Information Officer								
	Overhaul								
	Additional Firefighters								
Summary	Incident Response Range	4	13	16	43	36	83	49	108
	Total Fire Department including External								
	Fire Call Incident Response Range (+, –, within)								

Critical Task Matrix (Form 300A)								
	Low Risk		**Moderate Risk**		**High Risk**		**Extreme Risk**	
Fireground Critical Tasks	**LERL**	**UERL**	**LERL**	**UERL**	**LERL**	**UERL**	**LERL**	**UERL**

Notes:
LERL = Lower Effective Response Level & UERL = Upper Effective Response Level, [together form the critical staffing range]
This tool provides a range of staffing requirements only. Actual numbers may vary depending on the fire risk that exists in the municipality. Tasks performed on fireground based on decisions made by Incident Commander.
Planning moderate, high and extreme risk occupancies/locations will further validate staffing requirements.
Simultaneous events will require further consideration due to additional personnel requirements beyond the scope of this matrix.
*Incident Command will assume responsibilities of the incident safety officer, accountability and entry control when no person has been assigned.

Appendix H – An Examination of Ambulance Offload Times at Hospitals

Terminology and Concepts

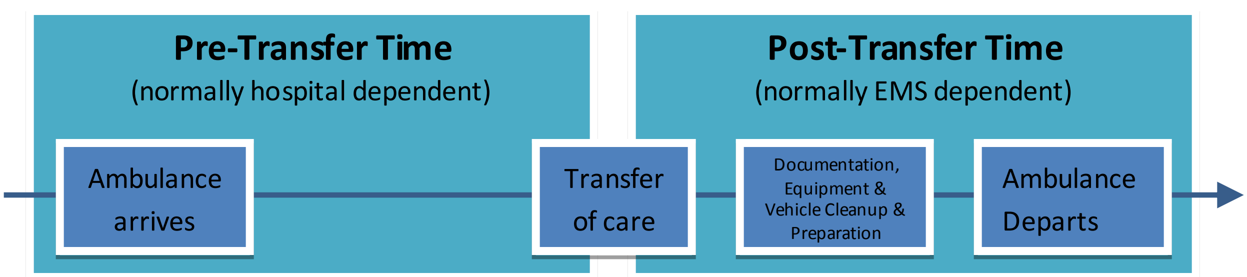
The following terminology and concepts are used throughout the discussion of ambulance offload times:

Ambulance offload time is the total time between ambulance arrival at the hospital and ambulance departure from the hospital.
Transfer of care is the process (or point) at which patient care is transferred from the EMS staff to the hospital staff.
Pre-transfer time starts when the ambulance arrives at the hospital and ends when *transfer of care* takes place.
Post-transfer time starts when *transfer of care* is completed (hospital accepts responsibility for the patient) and ends when the ambulance leaves the hospital.
Transfer of care time is the time required to compete the transfer-of-care process.

Concepts of Ambulance Offload Time

Ambulance offload time can be divided into two segments: *pre-transfer time* and *post-transfer time*. *Pre-transfer time* is typically dependent on the performance of the hospital. *Post-transfer time* is typically dependent on the performance of the EMS staff (Figure 13, below).

Figure 13 - Schematic showing how ambulance offload time can be analyzed



Delayed Availability

The ideal ambulance offloading scenario would include a clear transfer of patient care at the *transfer of care* point. In other words, transfer of care will take place once the hospital reports via the Patient Destination System[65] that transfer has occurred. However, it has been reported, and we have observed that paramedics sometimes continue to be delayed after transfer of care has been reported because a report still has to be given to the receiving nurse or other reasons for delay occur. Theoretically, once *transfer of care* is completed, and reported, EMS staff would be free to prepare their ambulance and equipment for the next assignment and leave the hospital. That is not always the case.

Realistically, and in most current offloading scenarios, the hospital and EMS share accountability during *transfer of care*. *Transfer of care* is a process, not a point in time, and this can delay availability of the EMS staff.

What do EMS Staff do During Post-Transfer Time?

Once *transfer of care* takes place, the EMS staff are free to leave. However, they must also complete a number of tasks before they can respond to the next call. These tasks can include: cleaning and making up the stretcher after the patient disembarks, recovering and cleaning EMS equipment that could be with the patient, restocking the ambulance, completing patient care records, and more. Some of these tasks can be accomplished by one paramedic during the wait time while the second paramedic monitors the patient.

When *post-transfer time* is measured, errors can occur. For example, the emergency department may have pushed the button that notifies the TEMS dispatch that the patient has been accepted, but the patient may not have been transferred to an emergency department stretcher. The patient could be on a hospital stretcher but the nurse who will care for the patient has not yet received the transfer report from the paramedics. When false *post-transfer times* were noted, they were not included in the analyses.

Ambulance Offload Time versus Pre-Transfer and Post-Transfer Times

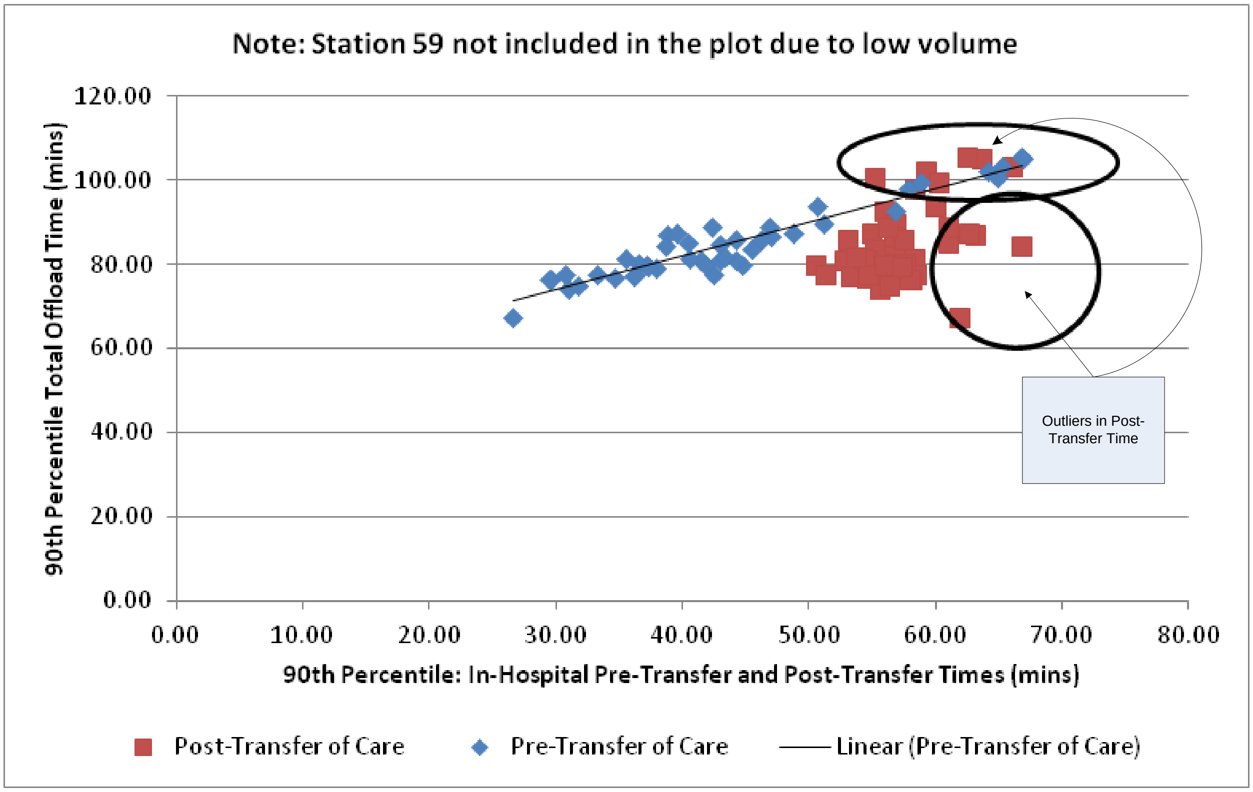
The data indicates a relatively linear correlation between ambulance offload time and the *pre-transfer time* (blue points) which are both at a 90th percentile calculation (Chart 16). This suggests that the ambulance offload time is directly correlated to the *pre-transfer time*. In other words, the longer the *pre-transfer time*, the longer the ambulance offload time.

The data also shows that *post-transfer time* (red points) is not linear with the ambulance offload time. The data is clustered around 80 minutes of ambulance offload time. However, there are some outliers with 100+ minutes of ambulance offload time (at a 90th percentile calculation). Hence, the relationship between ambulance offload time and *post-transfer*

[65] An interconnecting system between TEMS and Toronto area hospitals which suggests patient destination based on hospital activity and patient severity. Emergency departments also use the patient destination system to report, to the TEMS communication centre, when transfer of care has taken place.

time is not linear. Moreover, the *post-transfer times* have a narrower range, with some outliers. The overall impact of *pre-transfer time* and *post-transfer time* on ambulance offload time deserves further review.

Chart 16 - 2011 Correlation between ambulance offload time versus *pre-transfer time* and *post-transfer time* by station area level (i.e. location of the call)



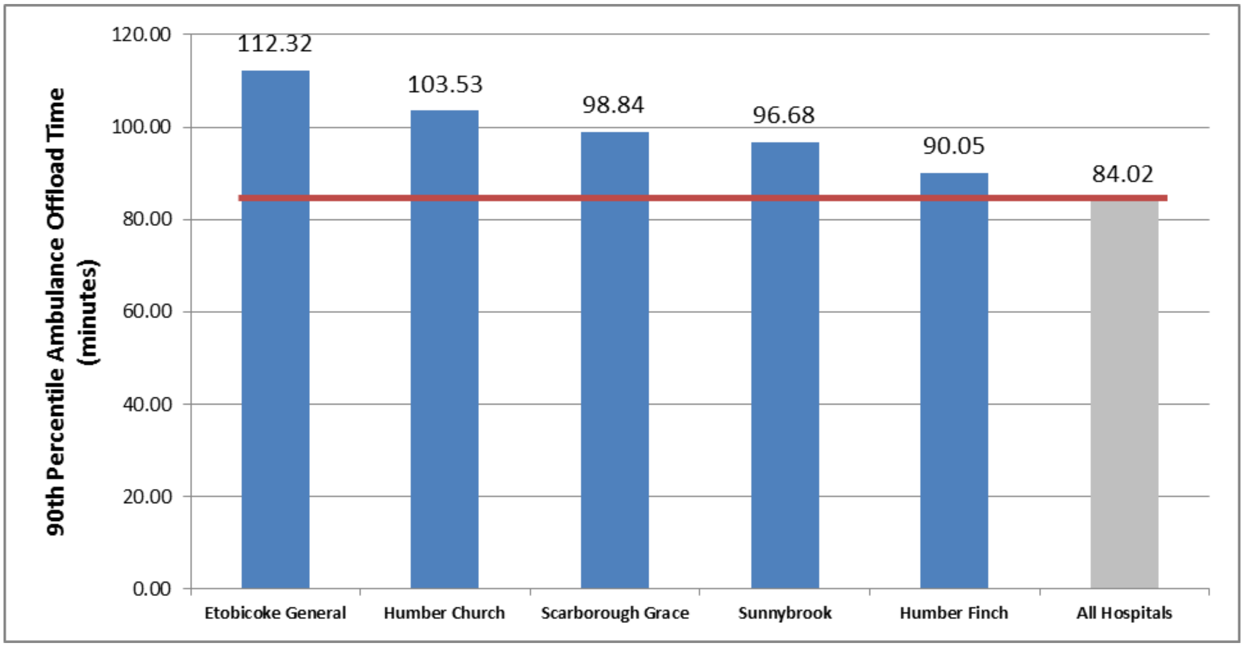
Ambulance Offload Times at Toronto Hospitals

We note that the five hospitals with the longest ambulance offload times in 2011 (measured at the 90th percentile), are also hospitals that have an RN offload initiative (Chart 17). The RN offload initiative makes RNs available at a hospital to facilitate the ambulance offload process. In these five hospitals, the RN initiative may not be achieving the results expected.

There are Toronto hospitals, however, that have had successes with the RN offload initiative. A contributing factor, particularly in the average ambulance offload time for all hospitals, is the change to the *Pay-For-Results* performance initiative by the Ministry of Health and the Local Health Integration Network (MOH/LHIN), where overall emergency wait times have improved significantly. A reduction in overall emergency department wait times assists in reducing the time that paramedics have to wait to transfer their patients to the care of emergency departments. Therefore, it is possible that the combination of the

Pay-For-Results performance initiative and the RN offload initiative have contributed to reduce emergency department wait times.

Chart 17 - 2011 Data Showing the Five Toronto Hospitals with the Highest Ambulance Offload Times and the Average Ambulance Offload Times for all Hospitals[66]



Transfer of Care Time

The time to complete the *transfer of care* process was analyzed among hospitals. Currently, hospitals indicate *transfer of care* time in the Patient Destination System (PDS) by pushing a button which sends a signal to the ambulance communications centre's computer aided dispatch. *Transfer of care* times are considered invalid when *transfer of care* is captured after the ambulance leaves the hospital. Additionally, calculations in *pre-transfer times* and *post-transfer times* will be incorrect if the *transfer of care* times is not correctly captured.

Table 46 - Number of transports in 2011 with valid and invalid transfer of care times shows that 78% of *transfer of care* times are valid among the 173,308 transport records captured in 2011. But the level of compliance for capturing valid *transfer of care* times varies among hospitals, with Etobicoke General and Humber Finch having 44.0% and 75.3% compliance rates respectively, below the average of 78%. These two hospitals are also among the five Toronto hospitals with the longest ambulance offload time (***Chart 17***).

Currently, TEMS sends monthly compliance reports to each hospital that shows *transfer of care times,* and this practice encourages improvements in data capture compliance.

[66] The All Hospitals calculation includes all hospital transports in the Patient Destination System (PDS)

Capturing valid *transfer of care times* is critical to understanding the performance of *pre-transfer times* and *post-transfer times*.

Table 46 - Number of transports in 2011 with valid and invalid *transfer of care times*

	Invalid *Transfer of Care* Times[67]	Valid *Transfer of Care* Times	Institutions Without *Transfer of Care* measurements	Total Transports Captured	% Inclusion of *Pre-transfer time* and *post-transfer time* Calculation Based on Valid *Transfer of Care* Times
Ajax			40	40	
Brampton			23	23	
Branson			2	2	
Credit Valley			23	23	
East General	3,179	11,686		14,865	78.6
Etobicoke General	5,412	4,254		9,666	44.0
Humber Church	2,937	10,062		12,999	77.4
Humber Finch	2,377	7,234		9,611	75.3
Markham Stouffville			143	143	
Trillium - Mississauga General	1,205	990		2,195	45.1
Mount Sinai	1,419	10,357		11,776	88.0
North York General	2,818	10,811		13,629	79.3
Scarborough Centenary	1,766	8,426		10,192	82.7
Scarborough General	3,124	10,099		13,223	76.4
Scarborough Grace	1,940	7,254		9,194	78.9
Sick Kids	633	1,818		2,451	74.2
St Joseph's	4,641	11,091		15,732	70.5
St Mikes	1,707	10,831		12,538	86.4
Sunnybrook	2,900	9,871		12,771	77.3
Toronto General	1,090	9,022		10,112	89.2
Toronto Western	845	11,141		11,986	93.0
Women's College			2	2	
York			135	135	
Grand Total	37,993	134,947	368	173,308	Average = 78.0

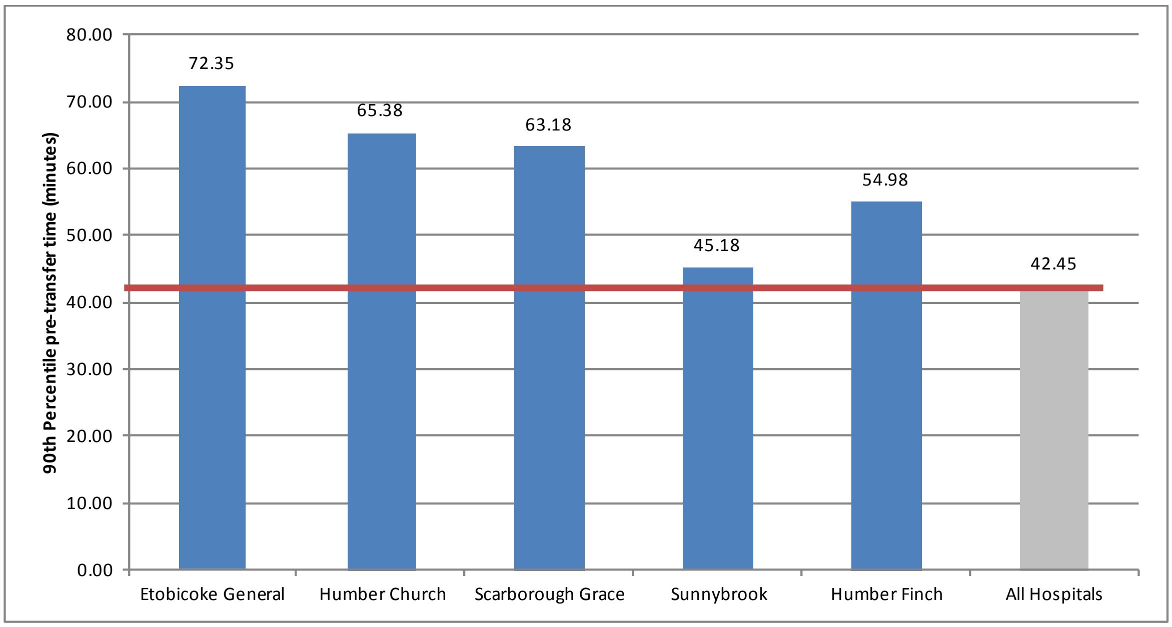
[67] If either the *pre-transfer time* or *post-transfer time* is negative, then that record for the *pre-transfer time* or *post-transfer time* calculation is not included.

Pre-Transfer Times and Post-Transfer Times

Pre-transfer Times

The five Toronto hospitals with the longest *ambulance offload times* were also examined for *pre-transfer time* and *post-transfer time* performance. Chart 18, Chart 19, and Chart 20, below show that hospitals with the longest ambulance offload times also have longer than average *pre-transfer times*. Four of the five hospitals (with Sunnybrook being the exception) had *pre-transfer times* much higher than the 90th percentile *ambulance offload times* of all hospitals. Etobicoke General had the highest *pre-transfer time* at 72.35 minutes (90th Percentile).

Chart 18 - 2011 90th Percentile *pre-transfer times* for all hospitals and the five hospitals with the highest *pre-transfer times*[68]



[68] Calculations include all hospital transports in the PDS system. The five individual hospitals have the RN offload initiative.

Post-Transfer Times

An analysis of *post-transfer times* shows only two out of five hospitals had *post-transfer times* higher than that of all hospitals. This suggests that longer ambulance offload times are not necessarily attributed to longer *post-transfer times* ***Chart 16 - 2011 Correlation between ambulance offload time versus pre-transfer time and post-transfer time by station area level*** (i.e. location of the call) and ***Chart 19***. Interestingly, Sunnybrook's ambulance offload time is influenced more by *post-transfer time* than *pre-transfer time*. Etobicoke General had both longer *pre-transfer times* and *post-transfer times*, indicating both time categories are contributing to longer ambulance offload times (Chart 18, page 271, and Chart 19 page 273).

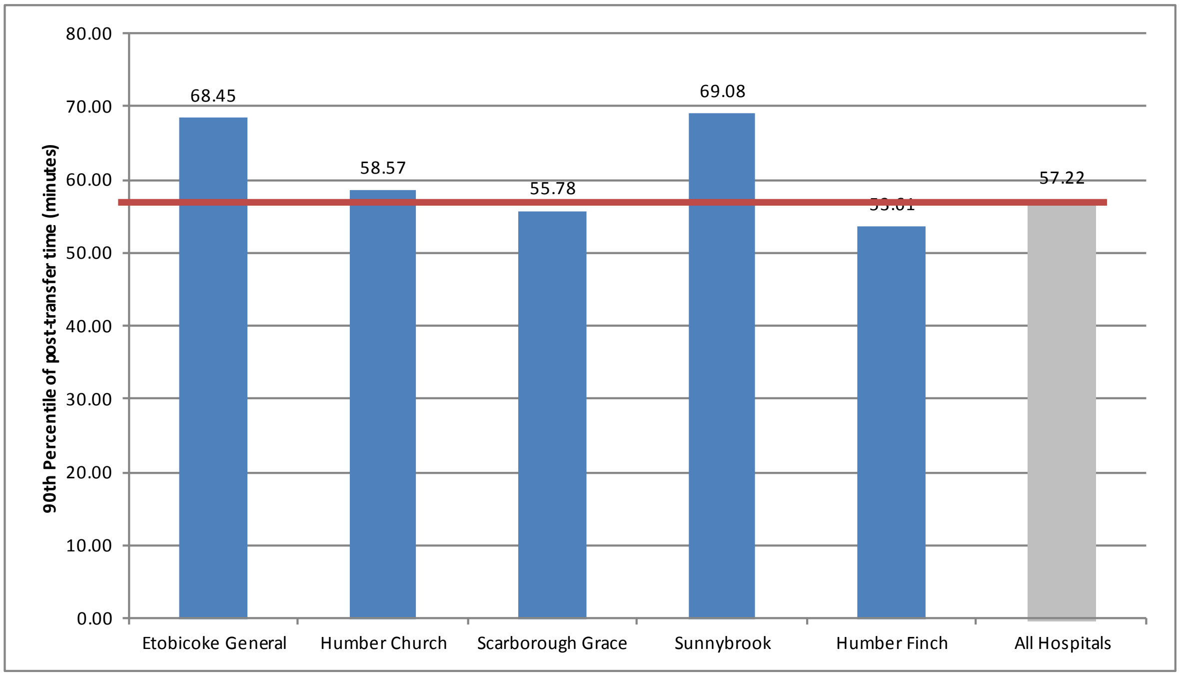
As noted earlier, Etobicoke General and Humber Finch hospitals had a low rate of capture for *transfer of care* times (*Table 46 - Number of transports in 2011 with valid and invalid transfer of care times*). Hence the smaller sample size of valid *transfer of care* times should be considered in the interpretation of *pre-transfer time* and *post-transfer time* analyses.

In general, longer *pre-transfer times* impact ambulance offload times. Here, EMS staff are dependent on internal hospital processes which reduces their ability to control or limit their wait time. There are some cases, however, where *post-transfer times* seem to contribute to the ambulance off-load time, especially at Etobicoke General and Sunnybrook hospitals (***Chart 19***).

Some observations suggest that this may be due to the EMS staff being involved in a hospital's patient flow processes such as registration during peak times. If this is the case, then there may be a shared accountability between hospitals and EMS staff during *post-transfer time*. This is in conflict with the ideal scenario where the EMS staff is relieved of patient care immediately after *transfer of care*.

Ideally, in order to verify the apparent conflicting observation and results, hospitals should conduct work flow mapping to better understand and define the work load of each party during *post-transfer time.* Our observation notwithstanding, we also recognize that work flow mapping ambulance offload time may not be hospitals' highest priority.

Chart 19 - 2011 90th Percentile *post-transfer times* for all hospitals and the five hospitals with the highest *pre-transfer times*[69]



RN Offload Coverage

The RN offload initiative is a MOHLTC initiative launched in the fall of 2008. The initiative includes funding for RN support at each of the participating Toronto hospitals for specific hours of the day. Some hospitals receive 16 hours/day of RN support while other hospitals receive 12 hours/day of RN support. The goal of the RN offload initiative is to expedite the patient offload process, thus reducing the ambulance offload time.

For the discussion below:

- ***Chart 20*** compares *pre-transfer times* to RN offload coverage using a *90th percentile analysis.*
- ***Chart 21*** compares *post-transfer times* to RN offload coverage using an *average value analysis.*
- ***Chart 22*** compares *post-transfer time*s to RN offload coverage using a *90th percentile analysis.*
- ***Chart 23*** compares pre-transfer times to RN offload coverage using an average value analysis

[69] Calculations include all hospital transports in the PDS system. The five individual hospitals have the RN offload initiative

Again, the hospitals listed in these charts have the highest ambulance offload times of the hospitals considered in this study.

The data appears to show there is no significant difference between having RN offload coverage and not having RN offload coverage as it relates to *pre-transfer times* and *post-transfer times* with the exception of Humber Church hospital (***Chart 20*** and ***Chart 22***).

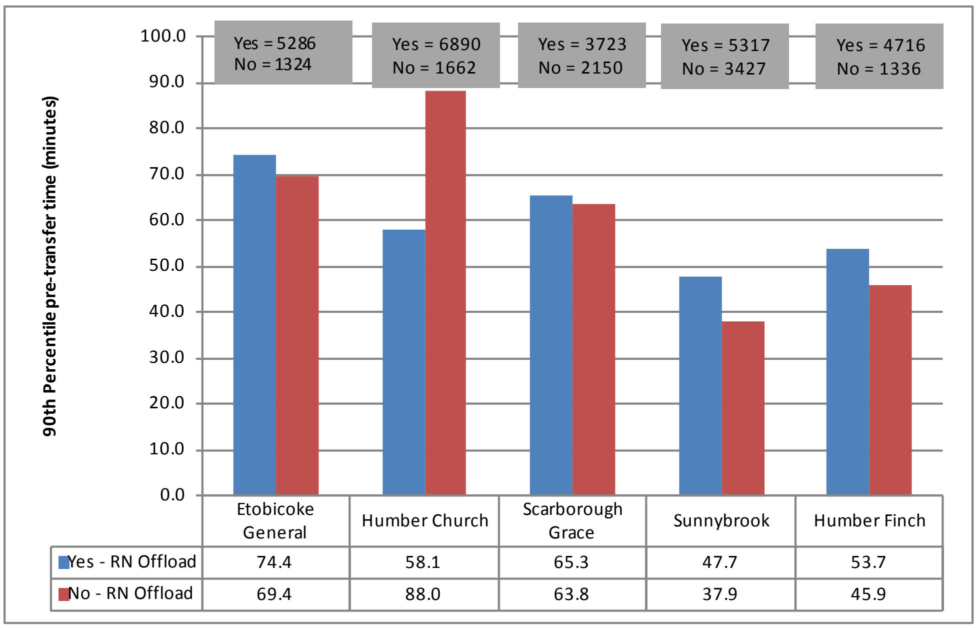
Since funding for offload registered nurses is aimed at those times with peak emergency department volumes, it is possible that offload delays would be significantly longer if offload RNs were not available. In Humber Church, the RN offload initiative seems to reduce the *pre-transfer time* significantly from 88.0 minutes during no RN offload coverage to 58.1 minutes during RN offload coverage (***Chart 20***).

Chart 21 and ***Chart 22***

Chart 23 shows a greater than expected difference between average and 90th percentile calculations, with average offload values appearing to be significantly lower. This is explained by the fact that average calculations included outliers where very short durations offset very long durations. For 90th percentile calculations, some outliers are excluded.

Out of ten transports, at 90th percentile, nine transports would have certain offload values. For example, in ***Chart 22,*** at Etobicoke General, wait time during *pre-transfer time* is within 74.4 minutes nine of ten times during RN offload coverage hours. Thus, it is useful to view the data at 90th percentile, where the calculations include a majority of the offload durations in realistic terms rather than simply looking at average values where outliers may skew the analysis.

Chart 20 – A comparison of *pre-transfer times* with and without RN offload coverage from January to September 2011 (90th percentile analysis)



	Etobicoke General	Humber Church	Scarborough Grace	Sunnybrook	Humber Finch
Yes - RN Offload	74.4	58.1	65.3	47.7	53.7
No - RN Offload	69.4	88.0	63.8	37.9	45.9

Chart 21 - A comparison of *post-transfer times* with and without RN offload coverage from January to September 2011 (averages analyzed)

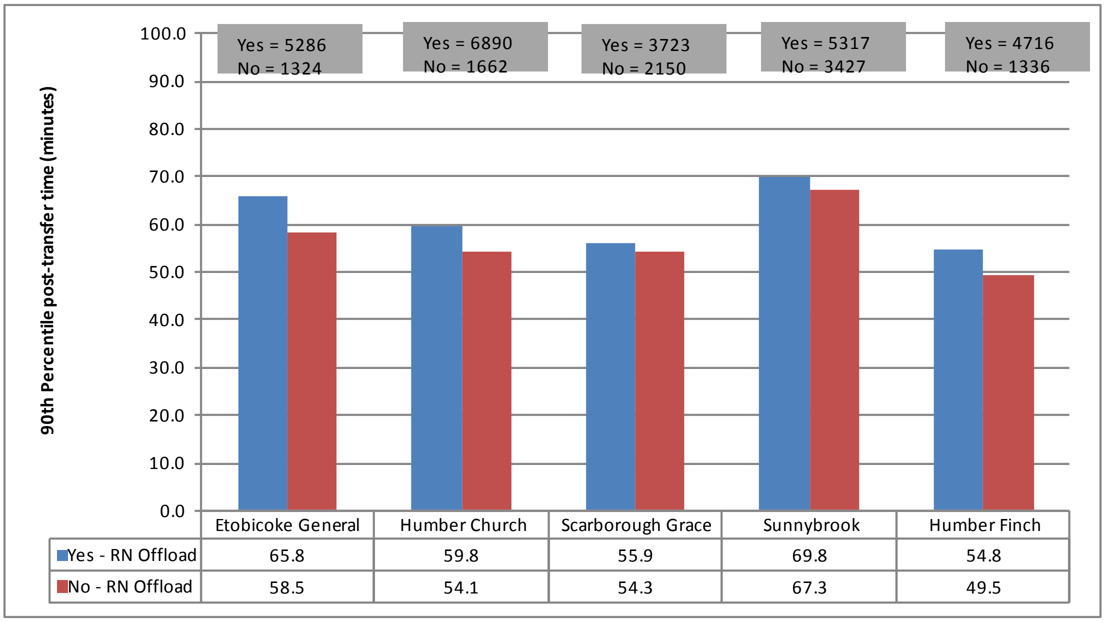


Chart 22 - A comparison of *post-transfer times* with and without RN offload coverage from January to September 2011 (90^{th} percentile analysis)

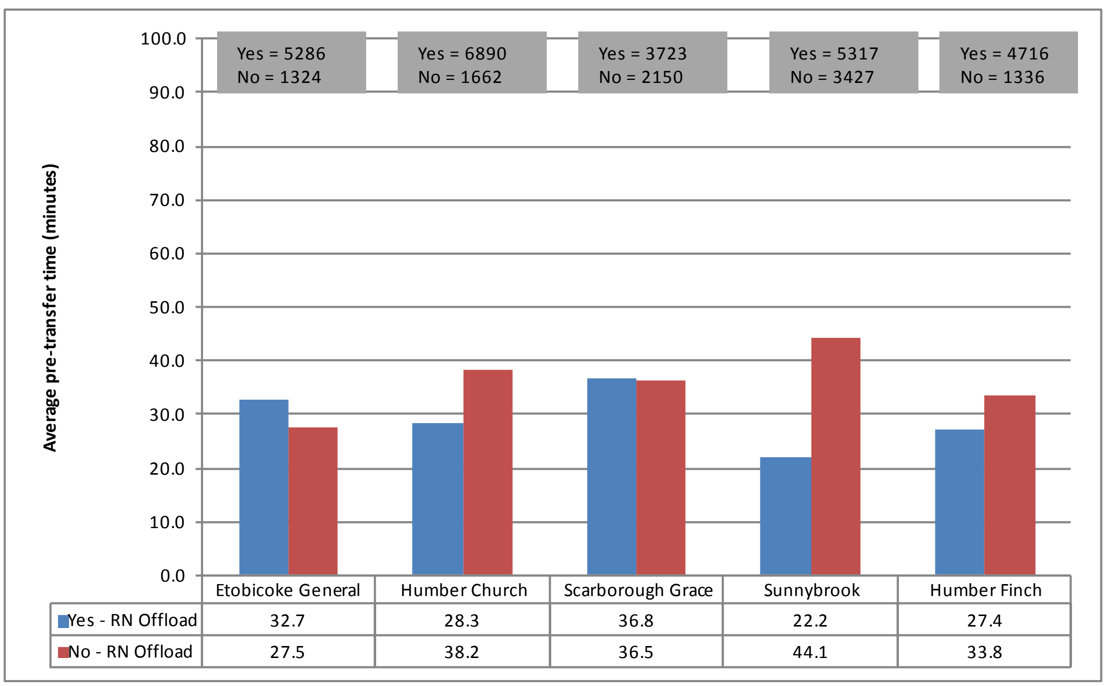
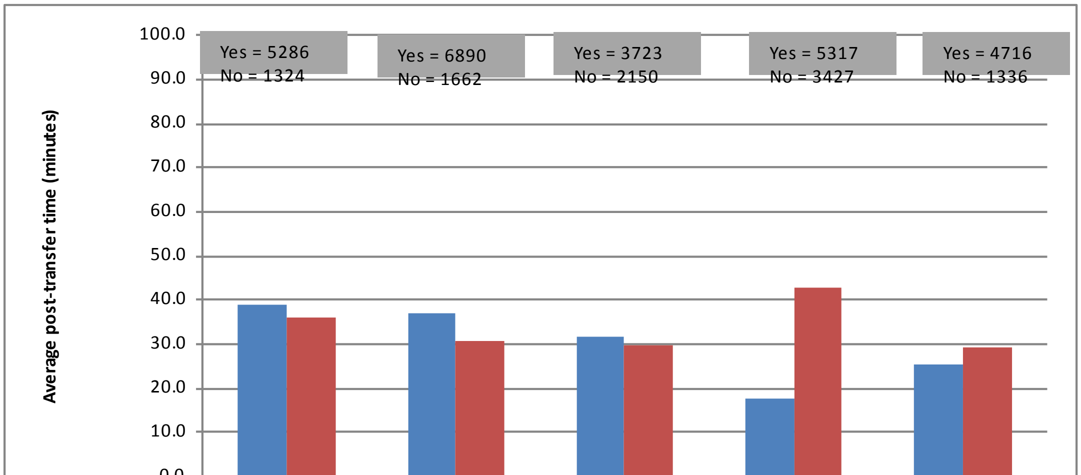


Chart 23 - A comparison of *pre-transfer times* with and without RN offload coverage from January to September 2011 (averages analyzed)



	Etobicoke General	Humber Church	Scarborough Grace	Sunnybrook	Humber Finch
Yes - RN Offload	39.0	37.0	31.8	17.7	25.6
No - RN Offload	35.9	30.6	29.6	42.6	29.3

Summary of Results

An analysis of the data enables us to make the following general observations:

1. The longer the *pre-transfer time*, the longer the *ambulance offload time* (logical observation).
2. There was no linear correlation between *post-transfer time* and *ambulance offload time*. With a couple of exceptions, longer *post-transfer times* did not consistently result in longer *ambulance offload times*.
3. Some hospitals have improved *ambulance offload times* by participating in the RN offload initiative. The five hospitals with the longest *ambulance offload times*, however, also participate in the RN offload initiative.
4. There does not appear to be a significant difference between having RN offload coverage and not having RN offload coverage as it relates to *pre-transfer times* and *post-transfer times* with the exception of Humber Church hospital. However, since funding for offload registered nurses is aimed at those times with peak emergency department volumes, it is possible that offload delays would be significantly longer if offload RNs were not available.
5. Recording valid *transfer of care times* can provide valuable information for process improvement. Of 173,308 transport records captured in 2011, 78 percent of the *transfer of care times* is valid which means that 22% aren't.
6. Establishment of a rigorous Lean management review process for all elements and factors of the pre- and post-transfer of care time intervals at each of the involved receiving hospital sites would likely be of value.

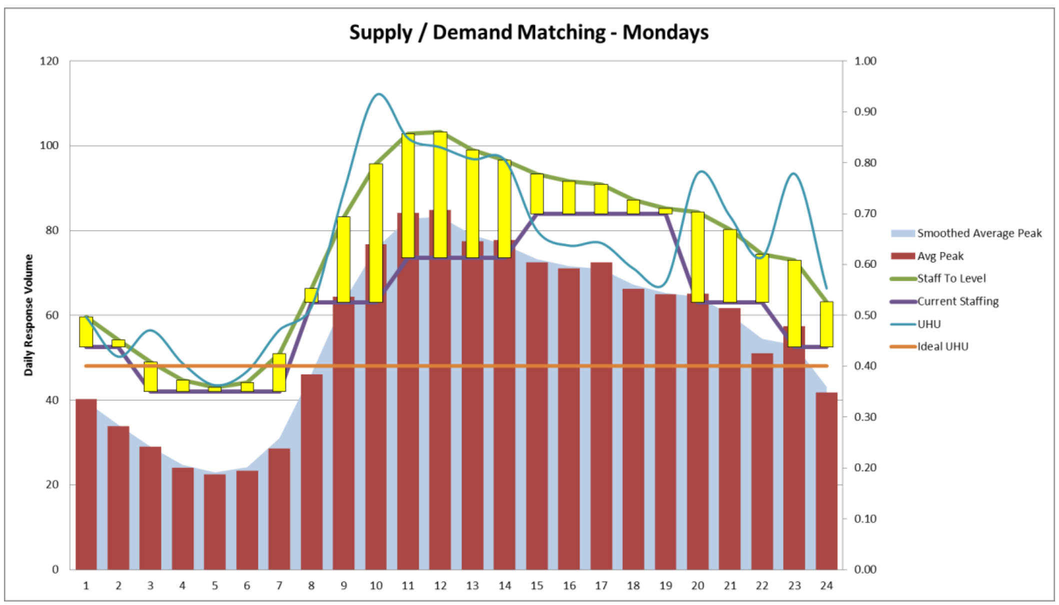
Appendix I – TEMS Staffing Analysis Supporting Documentation – 10 Minute Travel Time Target (Not including 2 Minute Call Taking and Dispatch Time)

TEMS Staffing Model by Hour of Day and Day of Week:

Planned Staffing Pattern			Source: TEMS (Alan Craig - August 2012)				
Station	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
00-01	52.5	52.5	52.5	52.5	52.5	47.25	47.25
01-02	52.5	52.5	52.5	52.5	52.5	47.25	47.25
02-03	42	42	42	42	42	42	42
03-04	42	42	42	42	42	42	42
04-05	42	42	42	42	42	42	42
05-06	42	42	42	42	42	42	42
06-07	42	42	42	42	42	42	42
07-08	63	63	63	63	63	52.5	52.5
08-09	63	63	63	63	63	52.5	52.5
09-10	63	63	63	63	63	52.5	52.5
10-11	73.5	73.5	73.5	73.5	73.5	57.75	57.75
11-12	73.5	73.5	73.5	73.5	73.5	57.75	57.75
12-13	73.5	73.5	73.5	73.5	73.5	57.75	57.75
13-14	73.5	73.5	73.5	73.5	73.5	57.75	57.75
14-15	84	84	84	84	84	63	63
15-16	84	84	84	84	84	63	63
16-17	84	84	84	84	84	63	63
17-18	84	84	84	84	84	63	63
18-19	84	84	84	84	84	63	63
19-20	63	63	63	63	63	52.5	52.5
20-21	63	63	63	63	63	52.5	52.5
21-22	63	63	63	63	63	52.5	52.5
22-23	52.5	52.5	52.5	52.5	52.5	47.25	47.25
23-24	52.5	52.5	52.5	52.5	52.5	47.25	47.25

Mondays Analysis Summary and Chart

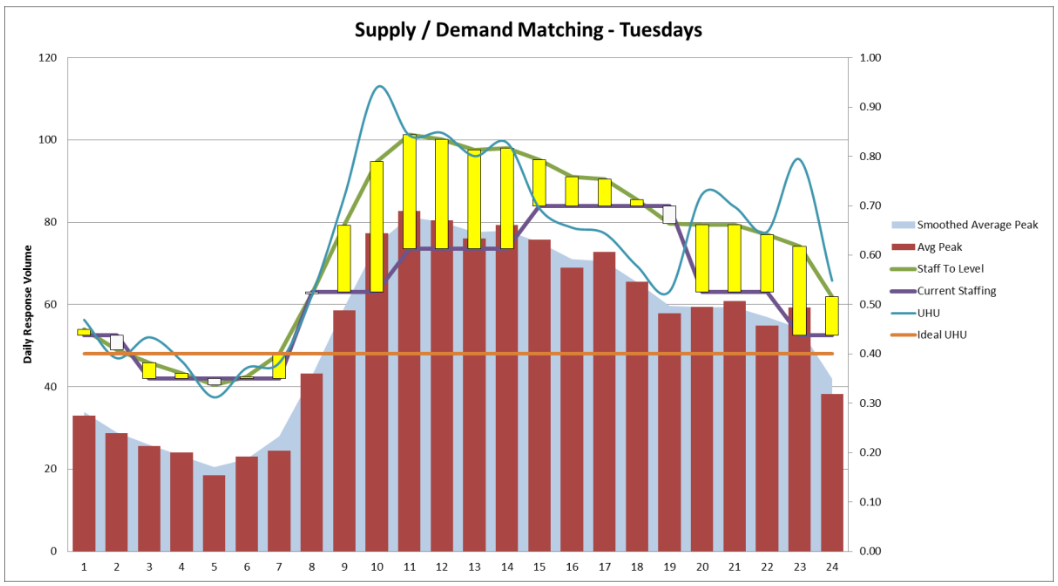
Total Responses	1250	1060	968	853	711	759	988	1402	2003	2485	2629	2599	2524	2425	2273	2149	2254	2161	2243	1968	1947	1763	1826	1337
Min	10	10	9	8	3	4	7	12	18	19	20	26	28	24	29	24	24	21	18	9	21	23	15	11
Max	**51**	**54**	**37**	**30**	**22**	**26**	**32**	**44**	**72**	**71**	**78**	**92**	**69**	**81**	**73**	**58**	**62**	**81**	**69**	**56**	**72**	**53**	**54**	**48**
Mean	24.0	20.4	18.6	16.4	13.7	14.6	19.0	27.0	38.5	47.8	50.6	50.0	48.5	46.6	43.7	41.3	43.3	41.6	43.1	37.8	38.2	34.6	35.8	26.2
Median	23	19	18	16	13	14	18	25	36	48	52.5	50.5	48	46.5	43	42	43.5	41	43	38.5	37	34	35	26
Mode	25	17	20	19	12	13	18	24	36	43	55	55	37	50	53	47	45	45	43	42	32	35	29	19
StDev	8.7	8.0	6.2	4.9	4.6	4.4	6.0	8.0	11.4	9.7	12.6	12.7	9.4	11.2	8.5	8.3	8.9	10.1	10.3	9.6	10.9	7.0	9.0	7.5
Avg high	37.1	31.4	27.6	23.2	20.2	20.8	27.4	38.2	53.1	62.2	68.3	69.5	63.3	61.3	56.5	54.8	58.3	55.1	58.2	49.6	53.8	44.8	49.3	36.8
90th Percentile Rank	32.2	31	26.2	23.2	20	19.2	27.2	38.4	54.2	58.4	65.2	62.4	63	61	54.2	53	56.6	51.2	56.2	50.2	53	43.3	48	35.9
TMT Multiplier	1.08	1.08	1.06	1.04	1.11	1.12	1.04	1.21	1.21	1.23	1.23	1.22	1.22	1.27	1.28	1.29	1.24	1.20	1.10	1.30	1.17	1.14	1.16	1.13
Avg Peak	40	34	29	24	22	23	29	46	64	77	84	85	77	78	73	71	72	66	65	65	62	51	57	42
2x StDev + Mean	41.4	36.3	31.1	26.3	22.8	23.5	31.1	42.9	61.3	67.1	75.7	75.4	67.4	69.0	60.6	58.0	61.1	61.7	63.6	57.0	60.0	48.5	53.7	41.2
Smoothed Average Peak	39.63	34.2	29	24.7	22.9	24.2	31	46.3	63.2	75.76	82.8	83.22	78.963	76.63	73.26	71.6	70.94	67.22	65.266	64.4	60.2	54.5	53	43.1
Blended Demand	37.8	33.8	28.8	24.7	21.9	22.3	29.8	42.5	59.6	67.1	74.6	73.7	69.8	68.9	62.7	60.9	62.9	60.0	61.7	57.2	57.7	48.7	51.6	40.1
UH Adj/Eff Buffer	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Staff To Level	60	54	49	45	43	44	51	66	83	96	103	103	99	97	93	92	91	87	85	84	80	74	73	63
Adjust from Current Staffi	7	2	7	3	1	2	9	3	20	33	29	30	25	23	9	8	7	3	1	21	17	11	21	11
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Tuesdays Analysis Summary and Chart

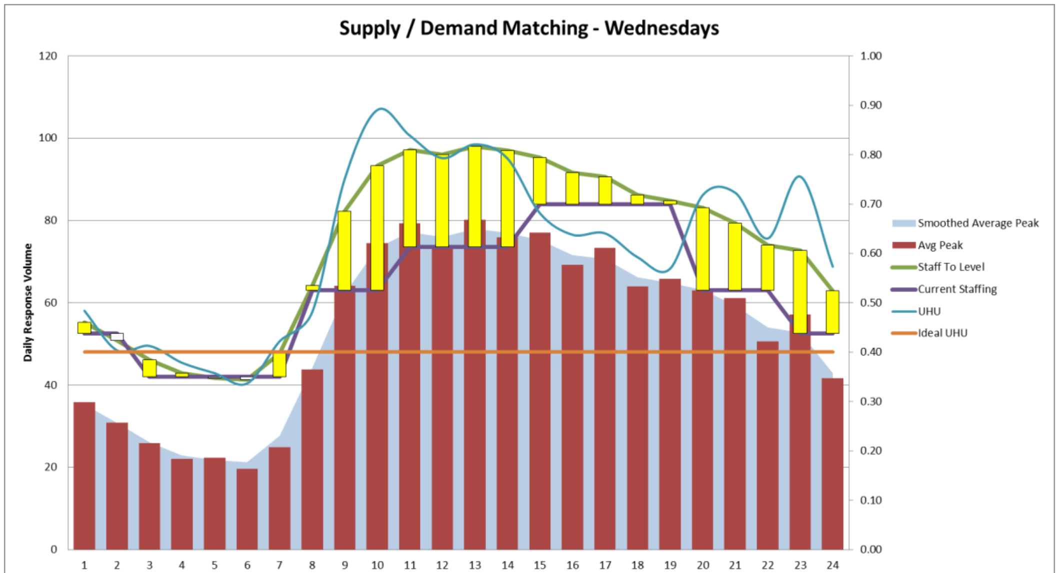
Total Responses	1164	997	881	794	656	697	859	1361	1911	2466	2599	2603	2478	2430	2400	2332	2345	2182	2262	2197	1989	1950	1881	1354
Min	12	9	6	7	7	5	6	13	13	32	28	26	30	21	32	24	30	26	25	26	21	17	22	15
Max	**34**	**32**	**34**	**26**	**24**	**25**	**33**	**46**	**51**	**71**	**76**	**73**	**71**	**68**	**70**	**66**	**69**	**68**	**65**	**71**	**71**	**60**	**84**	**42**
Mean	22.8	19.5	17.3	15.6	12.9	13.7	16.5	26.2	36.8	47.4	50.0	50.1	47.7	46.7	46.2	44.8	45.1	42.0	43.5	42.3	38.3	37.5	36.2	26.0
Median	23	19	18	15	12	14	15	26	37	46.5	50	50	46	46.5	44	46	43	41	44	41	37	37.5	35.5	26
Mode	25	19	19	12	10	11	15	27	37	41	50	50	46	49	42	48	40	30	46	35	40	35	31	30
StDev	5.0	4.7	5.4	4.6	3.5	4.4	5.6	5.9	8.0	8.7	10.7	9.8	9.8	10.2	9.4	9.4	10.2	9.8	8.9	9.7	9.3	9.2	10.6	5.9
Avg high	30.0	26.8	23.8	22.5	17.8	19.9	25.3	34.5	47.6	62.0	67.3	64.8	61.6	60.9	59.9	56.1	60.6	56.3	56.8	55.1	52.1	50.5	51.4	34.5
90th Percentile Rank	29	25	22.3	21.3	18	18.3	24.2	34	48.2	58	65.2	64.2	62.4	61.2	58.2	56.2	60.2	54.2	53.2	56	47.6	49.2	46.2	34
TMT Multiplier	1.10	1.07	1.08	1.06	1.04	1.16	0.97	1.25	1.23	1.25	1.24	1.24	1.23	1.30	1.26	1.23	1.20	1.16	1.02	1.08	1.15	1.09	1.15	1.11
Avg Peak	33	29	26	24	18	23	25	43	59	77	83	80	76	79	76	69	73	66	58	59	61	55	59	38
2x StDev + Mean	32.9	29.0	28.1	24.8	20.0	22.4	27.7	38.0	52.8	64.7	71.5	69.7	67.3	67.2	65.0	63.6	65.5	61.5	61.3	61.6	56.8	56.0	57.4	37.9
Smoothed Average Peak	33.89	28.9	25.9	23.2	20.5	22.5	28	42.6	59.3	74.71	81.25	80.06	77.59	77.96	75.093	71.02	70.51	65.43	59.668	59.4	59.4	57	54.2	41.9
Blended Demand	31.9	27.6	25.4	23.1	19.5	21.1	26.6	38.2	53.4	65.8	72.6	71.3	69.1	68.8	66.1	63.6	65.4	60.4	58.0	59.0	54.6	54.1	52.6	38.0
UH Adj/Eff Buffer	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Staff To Level	54	49	46	43	40	42	48	63	79	95	101	100	98	98	95	91	91	85	80	79	79	77	74	62
Adjust from Current Staffing	1	-4	4	1	-2	0	6	0	16	32	28	27	24	24	11	7	7	1	-4	16	16	14	22	9
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Wednesdays Analysis Summary and Chart

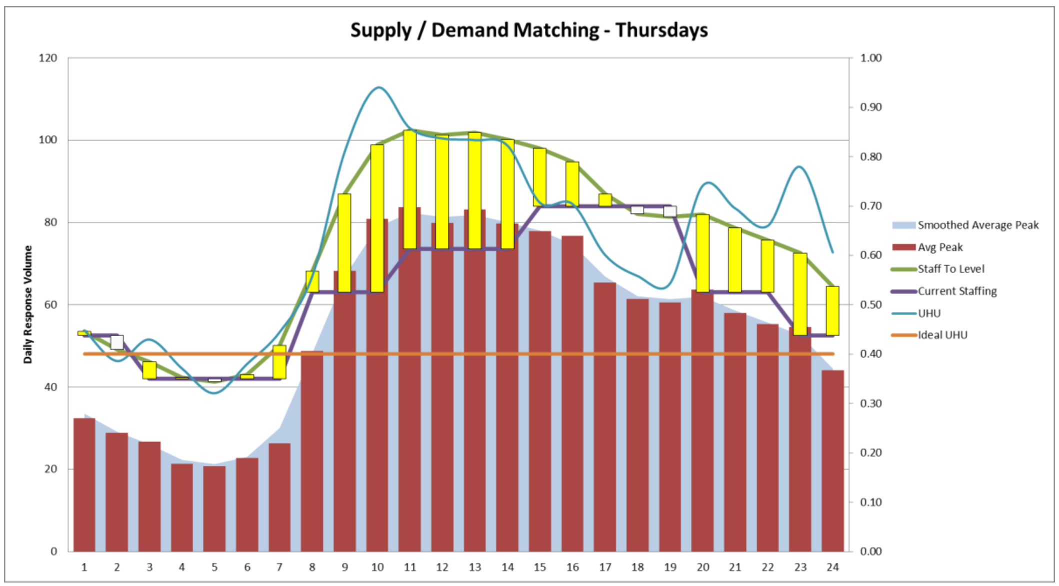
Total Responses	1175	1067	863	802	718	664	979	1294	1971	2432	2615	2508	2496	2352	2318	2266	2290	2225	2438	2139	2117	1902	1821	1361
Min	10	9	8	7	8	4	7	10	24	25	33	34	26	26	30	24	30	19	29	20	24	22	19	14
Max	**39**	**36**	**38**	**27**	**34**	**23**	**33**	**39**	**65**	**84**	**70**	**66**	**79**	**68**	**73**	**62**	**70**	**65**	**66**	**71**	**63**	**54**	**86**	**46**
Mean	22.6	20.5	16.6	15.4	13.8	12.8	18.8	24.9	37.9	46.8	50.3	48.2	48.0	45.2	44.6	43.6	44.0	42.8	46.9	41.1	40.7	36.6	35.0	26.2
Median	22	20	15.5	15.5	12.5	12	19	25	36.5	47	49	47	46	45	45	41.5	42.5	42.5	45.5	41	39.5	36	34.5	26
Mode	18	13	14	18	12	10	20	28	30	50	47	47	40	41	46	37	38	39	42	30	45	33	28	24
StDev	6.4	6.4	5.9	4.5	4.8	4.2	5.7	7.1	8.4	11.8	8.9	7.2	10.7	8.9	9.3	8.3	9.2	8.9	10.9	11.1	8.8	7.2	11.2	6.9
Avg high	31.8	29.8	24.8	21.4	20.6	17.8	26.5	36.0	51.4	62.1	64.7	60.8	63.8	59.0	60.0	55.7	60.1	55.0	64.5	57.3	54.6	46.8	50.4	36.3
90th Percentile Rank	31.2	29	23	21	18.2	20	26	32	47	60	61.2	59.6	60.4	60	56.4	55.6	56.2	53	63.2	52.6	53.2	45	48	33.6
TMT Multiplier	1.12	1.03	1.04	1.03	1.09	1.11	0.94	1.22	1.25	1.20	1.23	1.21	1.26	1.29	1.28	1.23	1.22	1.16	1.02	1.10	1.12	1.09	1.13	1.15
Avg Peak	36	31	26	22	22	20	25	44	64	74	79	74	80	76	77	69	73	64	66	63	61	51	57	42
2x StDev + Mean	35.4	33.2	28.3	24.5	23.5	21.2	30.3	39.0	54.7	70.4	68.1	62.7	69.5	63.0	63.2	60.1	62.5	60.5	68.7	63.4	58.3	51.0	57.4	39.9
Smoothed Average Peak	35.28	30.8	26.1	22.9	21.8	21.3	27.7	44.1	62.2	73.37	77.15	75.99	77.97	77.01	75.241	71.58	70.67	66.2	64.83	63.1	59.4	54	52.7	42.9
Blended Demand	34.0	31.0	25.8	22.8	21.1	20.8	28.0	38.4	54.6	67.9	68.8	66.1	69.3	66.7	64.9	62.4	63.1	59.9	65.6	59.7	57.0	50.0	52.7	38.8
UH Adj/Eff Buffer	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Staff To Level	55	51	46	43	42	41	48	64	82	93	97	96	98	97	95	92	91	86	85	83	79	74	73	63
Adjust from Current Staffing	3	-2	4	1	0	-1	6	1	19	30	24	22	24	24	11	8	7	2	1	20	16	11	20	10
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Thursdays Analysis Summary and Chart

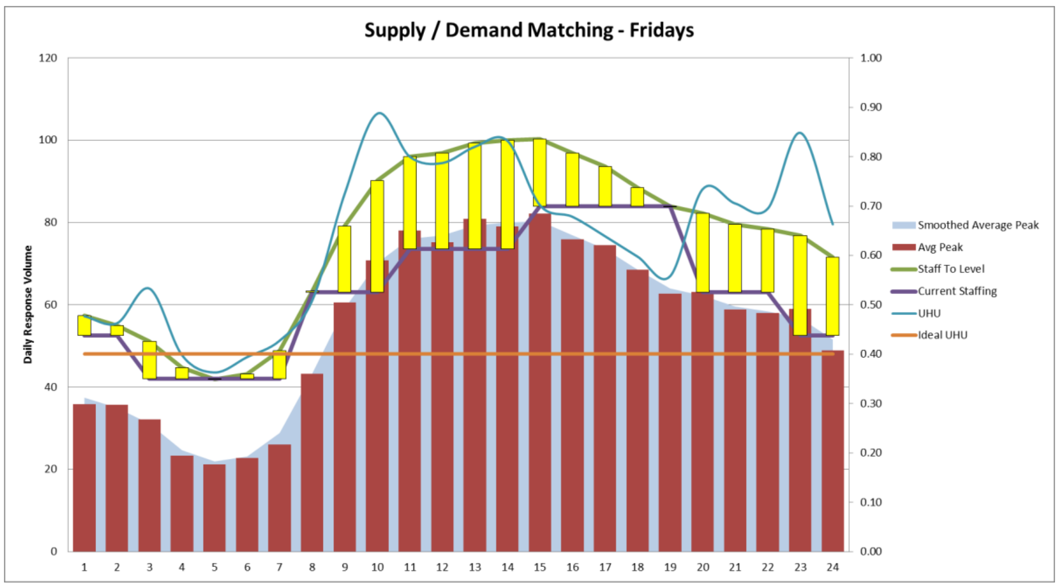
Total Responses	1127	1024	890	752	613	737	1033	1507	2132	2558	2687	2628	2592	2532	2499	2499	2208	2142	2357	2188	1950	2010	1909	1575
Min	12	5	7	6	4	7	7	13	27	25	28	31	30	31	27	33	28	26	28	21	25	19	18	13
Max	**36**	**34**	**33**	**23**	**22**	**25**	**34**	**56**	**65**	**84**	**81**	**82**	**79**	**72**	**75**	**72**	**71**	**71**	**76**	**68**	**67**	**66**	**68**	**49**
Mean	21.7	19.7	17.1	14.5	11.8	14.2	19.9	29.0	41.0	49.2	51.7	50.5	49.8	48.7	48.1	48.1	42.5	41.2	45.3	42.1	37.5	38.7	36.7	30.3
Median	21	19	16	14.5	12	13.5	20	27	40	49.5	52	48	47.5	47.5	47	49	41	41	45	40	38	39	37	30
Mode	17	16	16	12	13	12	16	27	38	48	40	57	63	43	44	53	41	36	42	39	43	39	34	32
StDev	5.6	6.4	6.4	4.2	4.3	4.6	6.0	7.5	8.6	11.1	11.1	10.3	12.0	10.3	10.8	8.2	8.1	8.9	11.0	10.6	8.3	9.0	9.0	7.6
Avg high	29.8	28.1	25.3	19.9	18.2	20.2	27.9	40.3	54.8	67.2	69.7	66.5	67.7	64.3	63.1	61.8	55.0	54.2	60.2	57.4	49.7	51.1	49.0	41.9
90th Percentile Rank	27	28	25	20	17	20	26.2	36.4	54	60.6	63.2	62.4	64.2	64	62.4	60	51	52	60.4	57.4	47	49	46.2	40.2
TMT Multiplier	1.09	1.03	1.05	1.08	1.14	1.13	0.94	1.21	1.24	1.20	1.22	1.22	1.23	1.24	1.24	1.23	1.19	1.14	1.01	1.11	1.17	1.08	1.11	1.05
Avg Peak	32	29	27	21	21	23	26	49	68	81	84	80	83	80	78	77	65	61	61	64	58	55	55	44
2x StDev + Mean	32.9	32.5	30.0	22.9	20.5	23.3	31.8	44.0	58.3	71.4	73.9	71.2	73.7	69.3	69.6	64.5	58.6	58.9	67.2	63.2	54.1	56.7	54.7	45.6
Smoothed Average Peak	33.55	29.2	26.1	22.3	21.3	23	30.1	48.2	66.9	78.88	82.36	81.33	81.842	80.07	78.042	74.69	66.88	62.08	61.386	61.9	58.6	55.7	52.6	44.5
Blended Demand	31.1	29.9	27.0	21.7	19.6	22.1	29.4	42.9	59.7	70.3	73.1	71.6	73.3	71.1	70.0	66.4	58.8	57.7	63.0	60.9	53.3	53.8	51.2	43.4
UH Adj/Eff Buffer	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Staff To Level	54	49	46	42	41	43	50	68	87	99	102	101	102	100	98	95	87	82	81	82	79	76	73	65
Adjust from Current Staffing	1	-3	4	0	-1	1	8	5	24	36	29	28	28	27	14	11	3	-2	-3	19	16	13	20	12
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Fridays Analysis Summary and Chart

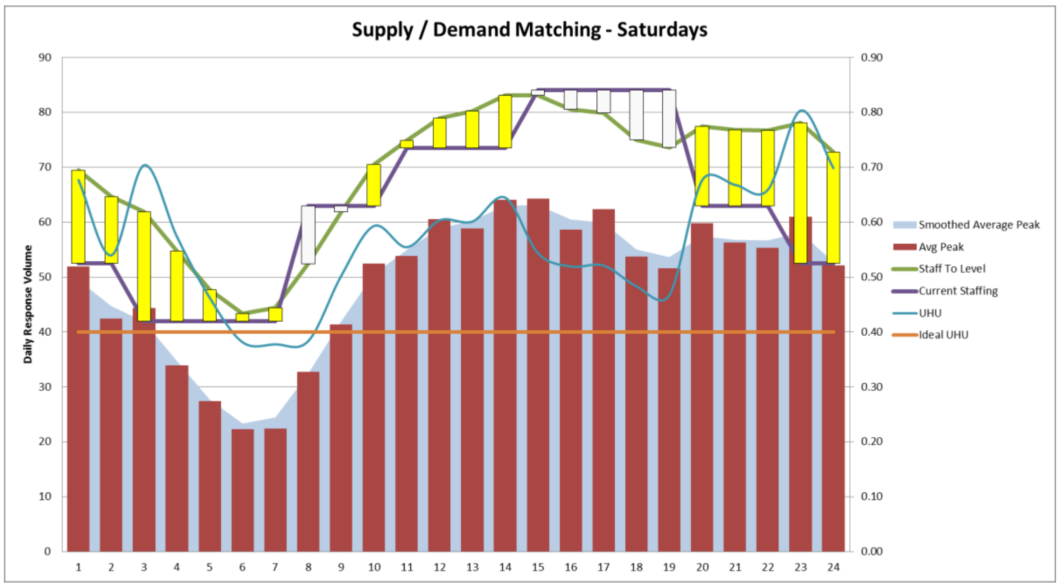
Total Responses	1272	1214	1146	848	736	749	1001	1322	1901	2369	2479	2476	2521	2587	2472	2377	2267	2353	2347	2213	2098	1991	2016	1697
Min	14	13	8	8	5	8	6	12	21	30	27	32	27	18	29	30	22	21	28	25	23	22	25	22
Max	**46**	**52**	**36**	**26**	**24**	**25**	**36**	**40**	**57**	**81**	**75**	**64**	**71**	**77**	**102**	**74**	**81**	**89**	**65**	**76**	**65**	**64**	**64**	**61**
Mean	24.5	23.3	22.0	16.3	14.2	14.4	19.3	25.4	36.6	45.6	47.7	47.6	48.5	49.8	47.5	45.7	43.6	45.3	45.1	42.6	40.3	38.3	38.8	32.6
Median	23.5	22	21.5	16.5	14.5	14	18.5	25	36	44	47	47.5	48	50	46	45.5	42	44	44	40	38.5	38	37	30.5
Mode	29	22	20	19	17	15	21	22	37	37	47	43	48	39	47	38	39	40	44	40	37	49	44	28
StDev	7.0	8.1	6.8	4.3	4.4	4.1	6.2	5.6	8.7	9.4	10.1	9.2	10.8	11.5	12.6	9.4	11.3	13.1	10.5	10.6	8.9	8.5	9.3	8.2
Avg high	35.0	34.3	31.7	22.8	19.7	20.0	27.9	33.8	48.4	57.7	62.3	61.8	65.0	64.5	66.3	60.9	60.5	61.8	60.4	58.1	54.0	50.8	50.9	45.9
90th Percentile Rank	31.2	32.2	31.2	22.2	19	20	27	34	49.4	57	60.2	60	62.2	63.6	59.8	54	56.8	60.4	59.2	54	50.2	49	51	44.4
TMT Multiplier	1.02	1.04	1.02	1.02	1.08	1.15	0.93	1.26	1.25	1.23	1.23	1.21	1.24	1.23	1.24	1.25	1.23	1.11	1.04	1.09	1.10	1.14	1.15	1.07
Avg Peak	36	36	32	23	21	23	26	43	61	71	78	75	81	79	82	76	74	68	63	63	59	58	59	49
2x StDev + Mean	38.4	39.5	35.6	24.9	22.9	22.6	31.7	36.6	53.9	64.4	67.8	66.1	70.2	72.8	72.8	64.5	66.2	71.4	66.2	63.8	58.2	55.3	57.5	49.0
Smoothed Average Peak	37.42	35	31.1	24.7	21.9	23.1	28.8	43.3	59.1	70.17	76.03	76.86	79.311	80	80.316	76.89	73.56	68.53	63.96	62.2	59.6	58.4	56.8	51.6
Blended Demand	35.7	35.5	32.6	23.9	21.3	21.9	29.2	38.0	54.1	63.8	68.0	67.7	70.6	72.1	71.0	65.1	65.5	66.8	63.1	60.0	56.0	54.2	55.1	48.3
UH Adj/Eff Buffer	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Staff To Level	57	55	51	45	42	43	49	63	79	90	96	97	99	100	100	97	94	89	84	82	80	78	77	72
Adjust from Current Staffing	5	2	9	3	0	1	7	0	16	27	23	23	26	26	16	13	10	5	0	19	17	15	24	19
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Saturdays Analysis Summary and Chart

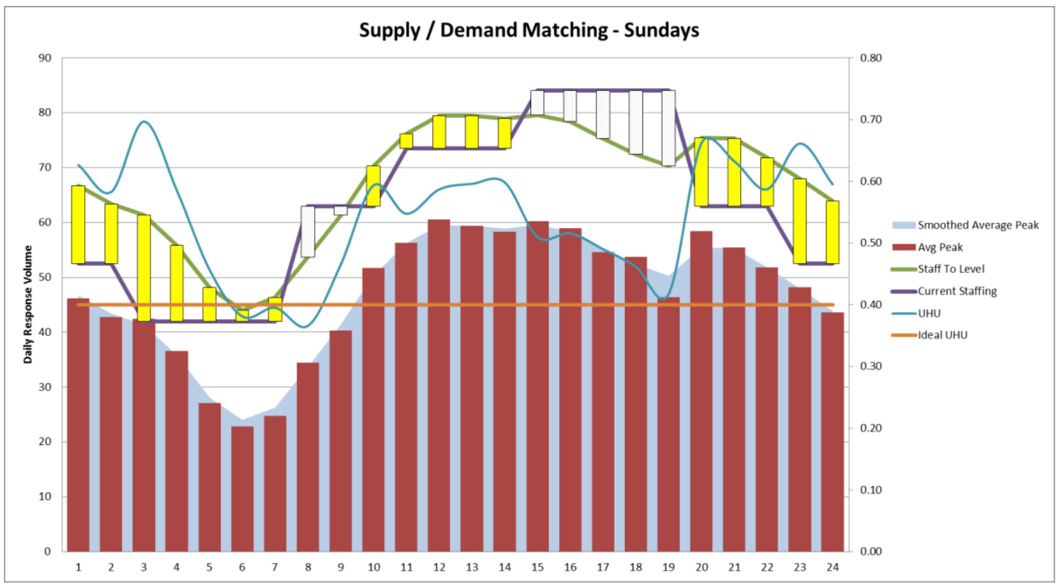
Total Responses	1817	1563	1691	1363	990	819	954	1104	1403	1767	1882	2088	2142	2229	2178	2098	2131	2036	2245	2176	2088	2089	2045	1876
Min	19	11	14	14	7	6	10	8	17	19	23	14	21	25	25	28	21	22	20	18	23	23	18	13
Max	**81**	**85**	**77**	**71**	**37**	**30**	**29**	**32**	**41**	**53**	**55**	**67**	**75**	**78**	**79**	**65**	**77**	**64**	**69**	**75**	**65**	**71**	**66**	**59**
Mean	34.3	29.5	31.9	25.7	18.7	15.5	18.0	20.8	26.5	33.3	35.5	39.4	40.4	42.1	41.1	39.6	40.2	38.4	42.4	41.1	39.4	39.4	38.6	35.4
Median	33	27	31	25	18	15	18	21	26	32	34	37	38	41	38	37	39	39	41	38	40	38	38	36
Mode	27	23	28	29	18	14	15	26	28	29	34	37	34	41	31	37	38	39	41	35	34	38	40	27
StDev	10.4	11.1	11.9	8.8	5.7	4.5	5.3	5.9	5.5	8.5	7.1	10.7	11.0	10.7	11.0	9.2	11.7	8.7	9.1	10.6	9.6	9.5	10.1	9.9
Avg high	50.1	44.2	47.8	36.3	26.3	21.5	25.4	28.3	34.7	46.8	46.9	53.8	54.3	56.8	58.0	53.2	57.3	50.1	55.9	57.6	52.7	52.6	55.8	50.3
90th Percentile Rank	44.6	38	43.6	32.2	25	21	25	28	34.4	46	44.2	53	58.2	56.8	54.4	51.2	52.2	48.4	54.2	58	50.6	50.4	50	46
TMT Multiplier	1.04	0.96	0.93	0.94	1.04	1.04	0.88	1.16	1.19	1.12	1.15	1.13	1.09	1.13	1.11	1.10	1.09	1.06	0.93	1.04	1.07	1.05	1.09	1.04
Avg Peak	52	42	44	34	27	22	22	33	41	52	54	61	59	64	64	59	62	54	52	60	56	55	61	52
2x StDev + Mean	55.1	51.8	55.6	43.2	30.1	24.5	28.6	32.5	37.4	50.3	49.7	60.8	62.4	63.4	63.1	58.0	63.6	55.8	60.6	62.3	58.6	58.4	58.7	55.1
Smoothed Average Peak	49.42	44.7	41.9	34.7	27.7	23.3	24.4	32.4	41.9	50.54	54.93	58.9	60.243	63.05	63.071	60.49	59.9	55.02	53.638	57.4	56.8	56.7	58.1	52.7
Blended Demand	49.7	44.8	47.0	36.7	27.6	22.9	26.0	31.0	37.9	48.9	49.6	57.6	60.3	61.1	60.2	56.6	58.6	53.1	56.1	59.2	55.3	55.2	55.6	51.3
UH Adj/Eff Buffer	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Staff To Level	69	65	62	55	48	43	44	52	62	71	75	79	80	83	83	80	80	75	74	77	77	77	78	73
Adjust from Current Staffing	17	12	20	13	6	1	2	-11	-1	8	1	5	7	10	-1	-4	-4	-9	-10	14	14	14	26	20
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Sundays Analysis Summary and Chart

Total Responses	1777	1700	1728	1421	1024	807	975	1042	1260	1693	1867	1997	2015	2017	1975	2008	1954	1869	1986	2102	1916	1802	1629	1493
Min	17	16	12	12	8	8	8	9	11	20	22	25	20	17	24	17	22	18	17	20	21	17	14	13
Max	**70**	**54**	**64**	**60**	**37**	**27**	**38**	**32**	**38**	**63**	**60**	**64**	**66**	**58**	**62**	**63**	**56**	**59**	**60**	**64**	**52**	**60**	**51**	**51**
Mean	34.2	32.7	33.9	27.3	19.7	15.5	18.8	20.0	24.2	32.6	35.9	38.4	38.8	38.8	38.0	38.6	37.6	35.9	38.2	40.4	36.8	34.7	31.3	28.7
Median	34	31	34	26	20	14.5	18	19	24	33	36	36	38	38	35.5	38.5	37	35	37	40	38	36	32	27
Mode	41	26	34	26	20	11	14	18	27	38	38	35	30	44	35	36	35	33	37	33	38	37	33	24
StDev	9.6	9.6	10.1	9.4	5.6	4.3	6.0	5.8	5.9	7.9	8.4	8.7	8.3	8.1	9.3	9.3	7.4	8.5	8.4	10.4	8.7	8.4	8.2	9.32
Avg high	47.1	44.8	47.0	39.8	27.8	21.7	27.4	29.3	32.7	44.2	49.3	52.9	50.8	49.5	52.4	51.6	48.9	49.1	49.0	55.6	50.3	47.6	42.0	39.8
90th Percentile Rank	41.6	49.2	47.6	35.4	26.2	21	25	27.2	32.2	40	44	48.6	48.2	51	50.4	49.4	47.2	47	50	52.2	48	43.2	42	41.4
TMT Multiplier	0.98	0.95	0.90	0.92	0.99	1.05	0.90	1.17	1.23	1.17	1.14	1.14	1.15	1.16	1.15	1.14	1.12	1.10	0.94	1.05	1.10	1.09	1.13	1.11
Avg Peak	46	43	42	37	27	23	25	34	40	52	56	61	59	58	60	59	55	54	46	58	55	52	48	44
2x StDev + Mean	53.4	52.0	54.1	46.1	30.8	24.2	30.7	31.6	36.1	48.4	52.6	55.9	55.4	55.1	56.5	57.2	52.4	53.0	55.0	61.2	54.3	51.5	47.7	47.3
Smoothed Average Peak	46.69	43.4	41.3	35.8	28.1	24	26.3	33.6	41.4	50.32	56.21	59.48	59.424	58.89	59.584	58.36	55.31	52.43	50.273	55.5	55.3	51.8	48	43.9
Blended Demand	47.2	48.2	47.7	39.1	28.4	23.1	27.3	30.8	36.6	46.2	50.9	54.7	54.4	55.0	55.5	55.0	51.6	50.8	51.8	56.3	52.5	48.8	45.9	44.2
UH Adj/Eff Buffer	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Staff To Level	67	63	61	56	48	44	46	54	61	70	76	79	79	79	80	78	75	72	70	75	75	72	68	64
Adjust from Current Staffing	14	11	19	14	6	2	4	-9	-2	7	3	6	6	5	-4	-6	-9	-12	-14	12	12	9	15	11
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Appendix J – TEMS Staffing Analysis Supporting Documentation – 8 Minute 59 Second Response Target

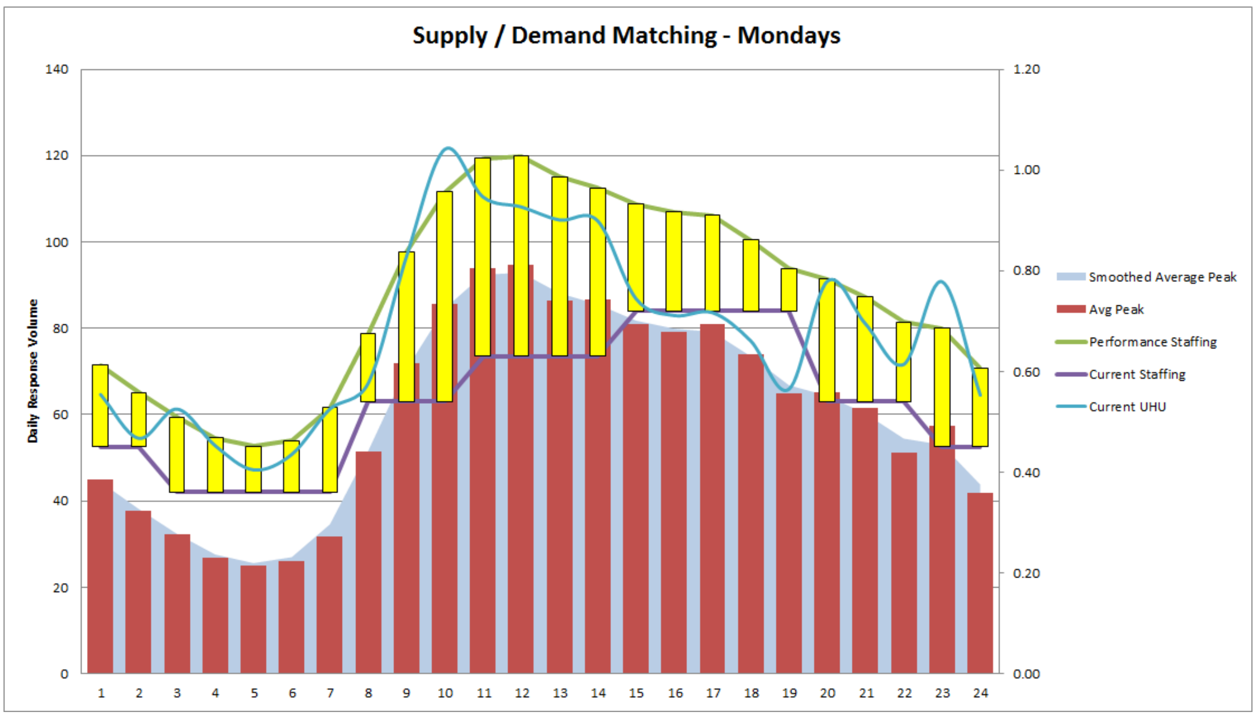
Existing TEMS Staffing Model by Hour of Day and Day of Week:

Planned Staffing Pattern Source: TEMS (Alan Craig - August 2012)

Station	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
00-01	52.5	52.5	52.5	52.5	52.5	47.25	47.25
01-02	52.5	52.5	52.5	52.5	52.5	47.25	47.25
02-03	42	42	42	42	42	42	42
03-04	42	42	42	42	42	42	42
04-05	42	42	42	42	42	42	42
05-06	42	42	42	42	42	42	42
06-07	42	42	42	42	42	42	42
07-08	63	63	63	63	63	52.5	52.5
08-09	63	63	63	63	63	52.5	52.5
09-10	63	63	63	63	63	52.5	52.5
10-11	73.5	73.5	73.5	73.5	73.5	57.75	57.75
11-12	73.5	73.5	73.5	73.5	73.5	57.75	57.75
12-13	73.5	73.5	73.5	73.5	73.5	57.75	57.75
13-14	73.5	73.5	73.5	73.5	73.5	57.75	57.75
14-15	84	84	84	84	84	63	63
15-16	84	84	84	84	84	63	63
16-17	84	84	84	84	84	63	63
17-18	84	84	84	84	84	63	63
18-19	84	84	84	84	84	63	63
19-20	63	63	63	63	63	52.5	52.5
20-21	63	63	63	63	63	52.5	52.5
21-22	63	63	63	63	63	52.5	52.5
22-23	52.5	52.5	52.5	52.5	52.5	47.25	47.25
23-24	52.5	52.5	52.5	52.5	52.5	47.25	47.25

Mondays Analysis Summary and Chart

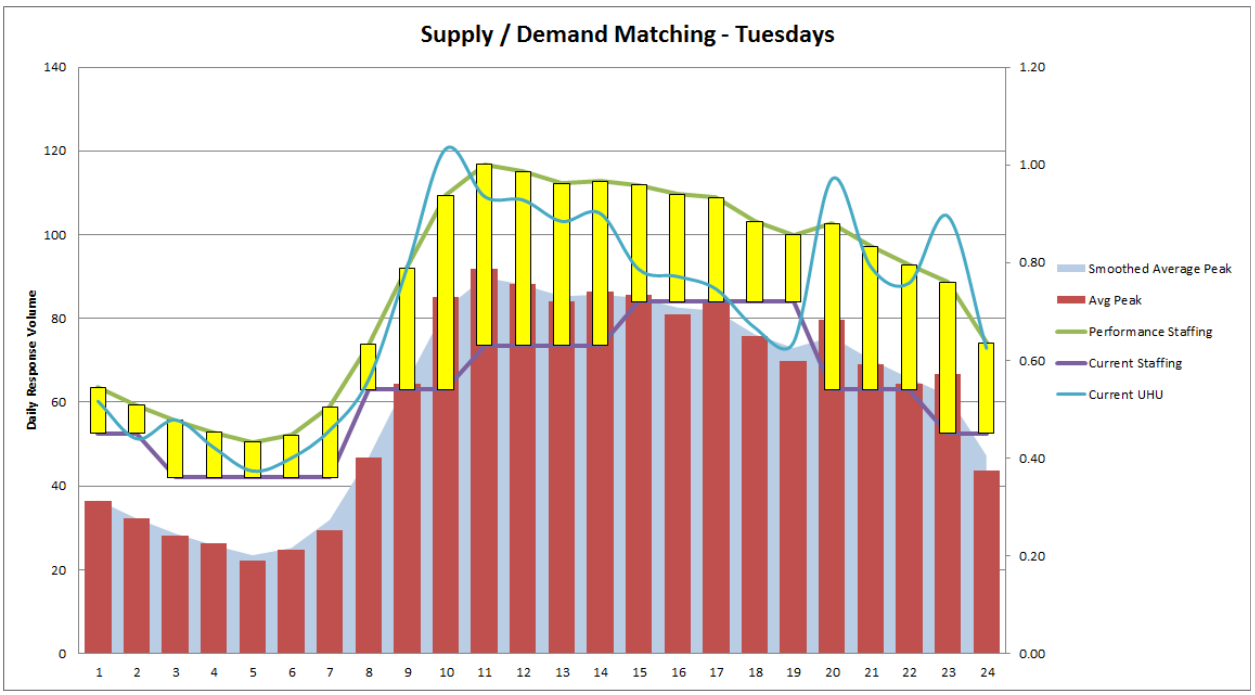
Mondays																									
Period Start Date	Jan 1 2011																								
Period End Date	Dec 31 2011																								
Number of Days In Period:	52																								
Hr Ending ---->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Total MPDS Responses	1250	1060	968	853	711	759	988	1402	2003	2485	2629	2599	2524	2425	2273	2149	2254	2161	2243	1968	1947	1763	1826	1337	**42577**
Min	10	10	9	8	3	4	7	12	18	19	20	26	28	24	29	24	24	21	18	9	21	23	15	11	**617**
Max	**51**	**54**	**37**	**30**	**22**	**26**	**32**	**44**	**72**	**71**	**78**	**92**	**69**	**81**	**73**	**58**	**62**	**81**	**69**	**56**	**72**	**53**	**54**	**48**	**1020**
Mean	24.0	20.4	18.6	16.4	13.7	14.6	19.0	27.0	38.5	47.8	50.6	50.0	48.5	46.6	43.7	41.3	43.3	41.6	43.1	37.8	38.2	34.6	35.8	26.2	**819**
Median	23	19	18	16	13	14	18	25	36	48	52.5	50.5	48	46.5	43	42	43.5	41	43	38.5	37	34	35	26	**827**
Mode	25	17	20	19	12	13	18	24	36	43	55	55	37	50	53	47	45	45	43	42	32	35	29	19	**789**
StDev	8.7	8.0	6.2	4.9	4.6	4.4	6.0	8.0	11.4	9.7	12.6	12.7	9.4	11.2	8.5	8.3	8.9	10.1	10.3	9.6	10.9	7.0	9.0	7.5	**80**
Avg high	37.1	31.4	27.6	23.2	20.2	20.8	27.4	38.2	53.1	62.2	68.3	69.5	63.3	61.3	56.5	54.8	58.3	55.1	58.2	49.6	53.8	44.8	49.3	36.8	963.2
90th Percentile Rank	32.2	31	26.2	23.2	20	19.2	27.2	38.4	54.2	58.4	65.2	62.4	63	61	54.2	53	56.6	51.2	56.2	50.2	53	43.3	48	35.9	**904**
TMT Multiplier	1.21	1.20	1.19	1.16	1.24	1.25	1.16	1.35	1.36	1.37	1.38	1.36	1.36	1.42	1.43	1.45	1.39	1.34	1.10	1.30	1.17	1.14	1.16	1.13	1.31
Avg Peak	45	38	32	27	25	26	32	51	72	86	94	95	86	87	81	79	81	74	65	65	62	51	57	42	1260
2x StDev + Mean	41.4	36.3	31.1	26.3	22.8	23.5	31.1	42.9	61.3	67.1	75.7	75.4	67.4	69.0	60.6	58.0	61.1	61.7	63.6	57.0	60.0	48.5	53.7	41.2	**979**
Smoothed Average Peak	44.41	38.1	32.4	27.6	25.6	27	34.6	51.6	70.6	84.57	92.43	92.9	88.145	85.54	81.779	79.93	79.18	73.53	66.806	64.4	60.2	54.5	53	43.8	**1453**
Blended Demand	39.4	35.2	29.9	25.7	22.8	23.2	31.0	44.3	62.0	70.0	77.8	76.9	72.9	71.8	65.5	63.6	65.6	62.1	62.2	57.2	57.7	48.7	51.6	40.3	**1258**
UH Adj/Eff Buffer	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	**648**
Performance Staffing	71	65	59	55	53	54	62	79	98	112	119	120	115	113	109	107	106	101	94	91	87	81	80	71	**2101**
Adjust from Current Staffi	19	13	17	13	11	12	20	16	35	49	46	46	42	39	25	23	22	17	10	28	24	18	28	18	
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5	**1512**



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

<u>Tuesdays</u> Analysis Summary and Chart

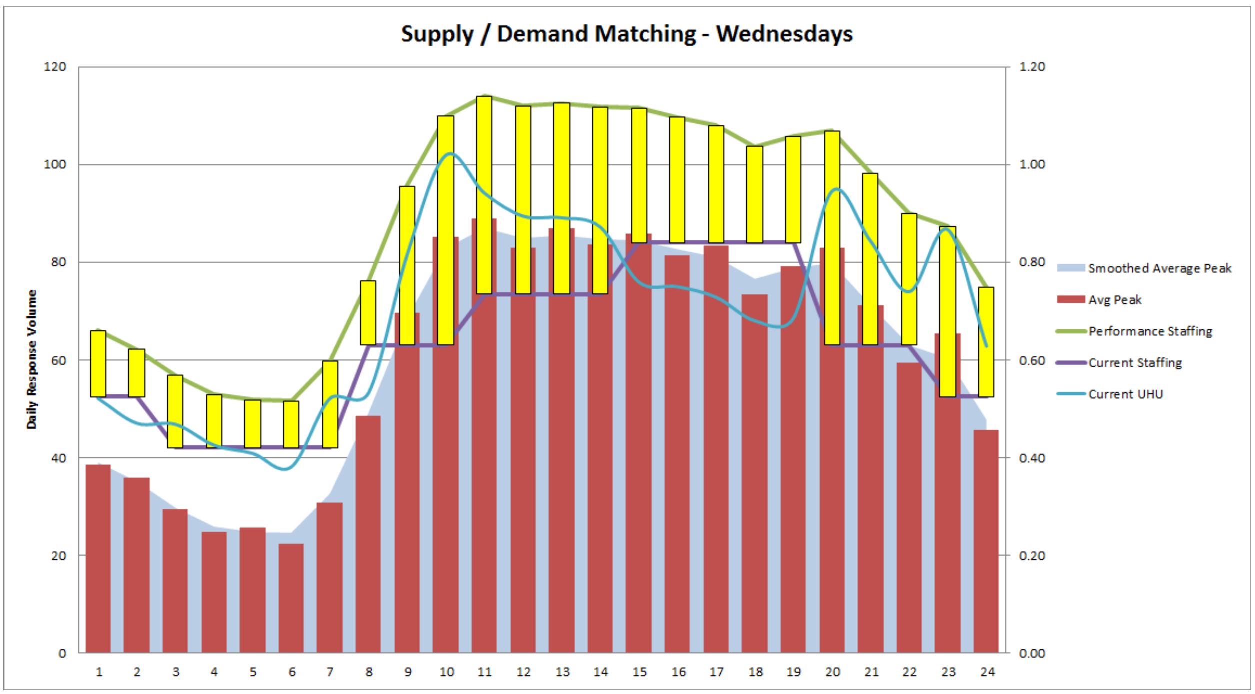
Tuesdays																									
Period Start Date	Jan 1 2011																								
Period End Date	Dec 31 2011																								
Number of Days In Periods	52																								
Hr Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Total MPDS Responses	1164	997	881	794	656	697	859	1361	1911	2466	2599	2603	2478	2430	2400	2332	2345	2182	2262	2197	1989	1950	1881	1354	**42788**
Min	12	9	6	7	7	5	6	13	13	32	28	26	30	21	32	24	30	26	25	26	21	17	22	15	**685**
Max	**34**	**32**	**34**	**26**	**24**	**25**	**33**	**46**	**51**	**71**	**76**	**73**	**71**	**68**	**70**	**66**	**69**	**68**	**65**	**71**	**71**	**60**	**84**	**42**	**989**
Mean	22.8	19.5	17.3	15.6	12.9	13.7	16.5	26.2	36.8	47.4	50.0	50.1	47.7	46.7	46.2	44.8	45.1	42.0	43.5	42.3	38.3	37.5	36.2	26.0	**823**
Median	23	19	18	15	12	14	15	26	37	46.5	50	50	46	46.5	44	46	43	41	44	41	37	37.5	35.5	26	**826**
Mode	25	19	19	12	10	11	15	27	37	41	50	50	46	49	42	48	40	30	46	35	40	35	31	30	**861**
StDev	5.0	4.7	5.4	4.6	3.5	4.4	5.6	5.9	8.0	8.7	10.7	9.8	9.8	10.2	9.4	9.4	10.2	9.8	8.9	9.7	9.3	9.2	10.6	5.9	**62**
Avg high	30.0	26.8	23.8	22.5	17.8	19.9	25.3	34.5	47.6	62.0	67.3	64.8	61.6	60.9	59.9	56.1	60.6	56.3	56.8	55.1	52.1	50.5	51.4	34.5	942.8
90th Percentile Rank	29	25	22.3	21.3	18	18.3	24.2	34	48.2	58	65.2	64.2	62.4	61.2	58.2	56.2	60.2	54.2	53.2	56	47.6	49.2	46.2	34	**889**
TMT Multiplier	1.21	1.20	1.19	1.16	1.24	1.25	1.16	1.35	1.36	1.37	1.38	1.36	1.36	1.42	1.43	1.45	1.39	1.34	1.23	1.45	1.30	1.27	1.30	1.26	1.31
Avg Peak	36	32	28	26	22	25	29	47	64	85	92	88	84	86	86	81	84	76	70	80	69	64	67	44	1236
2x StDev + Mean	32.9	29.0	28.1	24.8	20.0	22.4	27.7	38.0	52.8	64.7	71.5	69.7	67.3	67.2	65.0	63.6	65.5	61.5	61.3	61.6	56.8	56.0	57.4	37.9	**946**
Smoothed Average Peak	36.59	32.2	28.6	25.8	23.5	25.2	31.9	46.8	65.1	82.35	89.82	88.08	85.3	85.73	84.907	82.62	81.85	76.2	72.977	75.6	70.2	65.8	61.7	47.2	**1466**
Blended Demand	32.8	28.7	26.4	24.0	20.5	22.0	27.9	39.6	55.4	68.4	75.5	74.0	71.7	71.4	69.4	67.5	69.2	64.0	62.5	64.4	58.2	57.0	55.1	39.7	**1245**
UH Adj/Eff Buffer	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	**648**
Performance Staffing	64	59	56	53	50	52	59	74	92	109	117	115	112	113	112	110	109	103	100	103	97	93	89	74	**2114**
Adjust from Current Staffing	11	7	14	11	8	10	17	11	29	46	43	42	39	39	28	26	25	19	16	40	34	30	36	22	
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5	**1512**



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

<u>Wednesdays</u> Analysis Summary and Chart

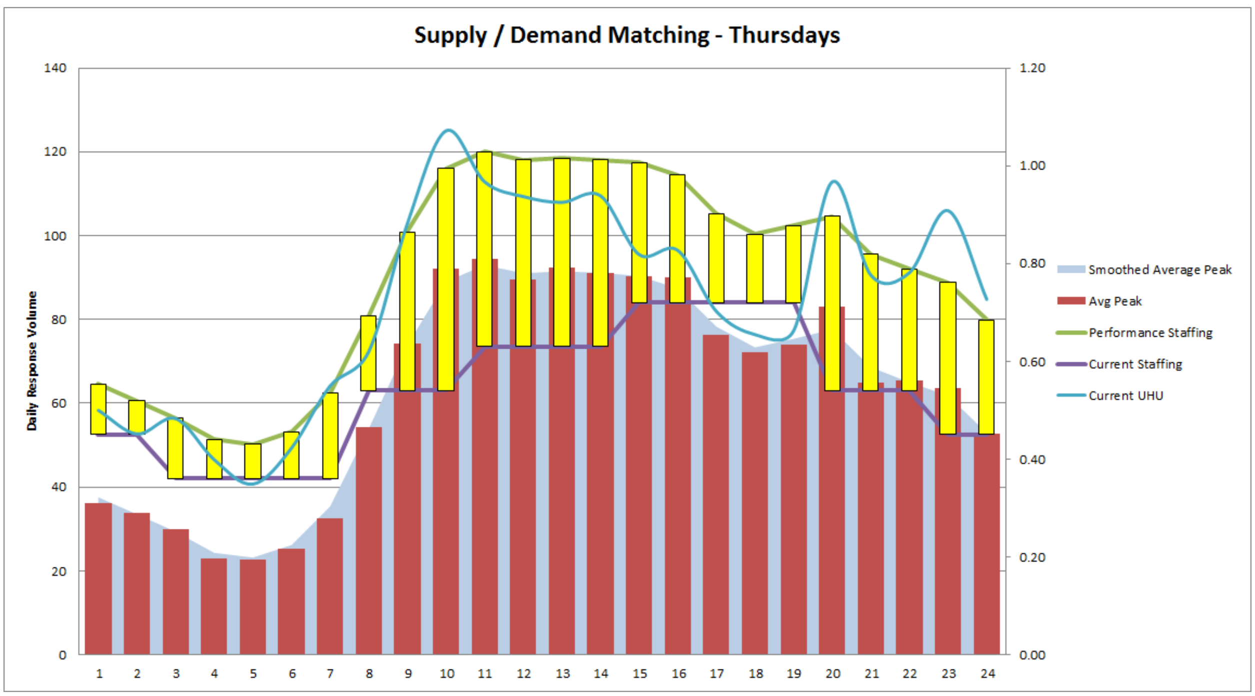
Wednesdays																									
Period Start Date	Jan 1 2011																								
Period End Date	Dec 31 2011																								
Number of Days In Periods	52																								
Hr Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Total MPDS Responses	1175	1067	863	802	718	664	979	1294	1971	2432	2615	2508	2496	2352	2318	2266	2290	2225	2438	2139	2117	1902	1821	1361	**42813**
Min	10	9	8	7	8	4	7	10	24	25	33	34	26	26	30	24	30	19	29	20	24	22	19	14	**735**
Max	**39**	**36**	**38**	**27**	**34**	**23**	**33**	**39**	**65**	**84**	**70**	**66**	**79**	**68**	**73**	**62**	**70**	**65**	**66**	**71**	**63**	**54**	**86**	**46**	**975**
Mean	22.6	20.5	16.6	15.4	13.8	12.8	18.8	24.9	37.9	46.8	50.3	48.2	48.0	45.2	44.6	43.6	44.0	42.8	46.9	41.1	40.7	36.6	35.0	26.2	**823**
Median	22	20	15.5	15.5	12.5	12	19	25	36.5	47	49	47	46	45	45	41.5	42.5	42.5	45.5	41	39.5	36	34.5	26	**812**
Mode	18	13	14	18	12	10	20	28	30	50	47	47	40	41	46	37	38	39	42	30	45	33	28	24	**857**
StDev	6.4	6.4	5.9	4.5	4.8	4.2	5.7	7.1	8.4	11.8	8.9	7.2	10.7	8.9	9.3	8.3	9.2	8.9	10.9	11.1	8.8	7.2	11.2	6.9	**57**
Avg high	31.8	29.8	24.8	21.4	20.6	17.8	26.5	36.0	51.4	62.1	64.7	60.8	63.8	59.0	60.0	55.7	60.1	55.0	64.5	57.3	54.6	46.8	50.4	36.3	958.7
90th Percentile Rank	31.2	29	23	21	18.2	20	26	32	47	60	61.2	59.6	60.4	60	56.4	55.6	56.2	53	63.2	52.6	53.2	45	48	33.6	**900**
TMT Multiplier	1.21	1.20	1.19	1.16	1.24	1.25	1.16	1.35	1.36	1.37	1.38	1.36	1.36	1.42	1.43	1.45	1.39	1.34	1.23	1.45	1.30	1.27	1.30	1.26	1.31
Avg Peak	39	36	29	25	26	22	31	49	70	85	89	83	87	84	86	81	83	73	79	83	71	59	65	46	1255
2x StDev + Mean	35.4	33.2	28.3	24.5	23.5	21.2	30.3	39.0	54.7	70.4	68.1	62.7	69.5	63.0	63.2	60.1	62.5	60.5	68.7	63.4	58.3	51.0	57.4	39.9	**938**
Smoothed Average Peak	39.02	35.1	29.7	25.9	24.8	24.6	32.6	49.2	68.6	82.86	87.01	84.94	85.486	84.72	84.484	82.65	81.03	76.61	78.81	79.8	71.2	63	60.3	47.7	**1480**
Blended Demand	35.2	32.4	27.0	23.8	22.1	21.9	29.7	40.1	56.8	71.1	72.1	69.1	71.8	69.2	68.0	66.1	66.6	63.4	70.2	65.3	60.9	53.0	55.2	40.4	**1252**
UH Adj/Eff Buffer	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	**648**
Performance Staffing	66	62	57	53	52	52	60	76	96	110	114	112	112	112	111	110	108	104	106	107	98	90	87	75	**2128**
Adjust from Current Staffing	14	10	15	11	10	10	18	13	33	47	41	38	39	38	27	26	24	20	22	44	35	27	35	22	
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5	**1512**



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Thursdays Analysis Summary and Chart

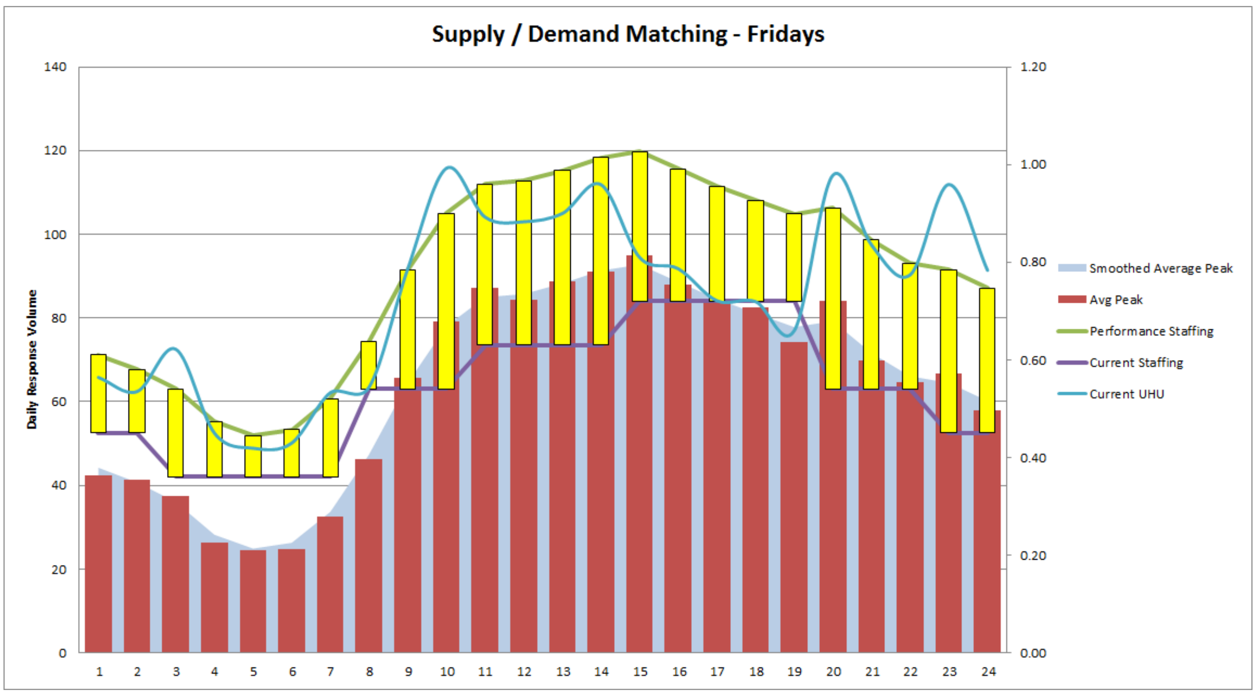
Thursdays																									
Period Start Date	Jan 1 2011																								
Period End Date	Dec 31 2011																								
Number of Days In Periods	52																								
Hr Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Total MPDS Responses	1127	1024	890	752	613	737	1033	1507	2132	2558	2687	2628	2592	2532	2499	2499	2208	2142	2357	2188	1950	2010	1909	1575	**44149**
Min	12	5	7	6	4	7	7	13	27	25	28	31	30	31	27	33	28	26	28	21	25	19	18	13	**728**
Max	**36**	**34**	**33**	**23**	**22**	**25**	**34**	**56**	**65**	**84**	**81**	**82**	**79**	**72**	**75**	**72**	**71**	**71**	**76**	**68**	**67**	**66**	**68**	**49**	**1033**
Mean	21.7	19.7	17.1	14.5	11.8	14.2	19.9	29.0	41.0	49.2	51.7	50.5	49.8	48.7	48.1	48.1	42.5	41.2	45.3	42.1	37.5	38.7	36.7	30.3	**849**
Median	21	19	16	14.5	12	13.5	20	27	40	49.5	52	48	47.5	47.5	47	49	41	41	45	40	38	39	37	30	**836**
Mode	17	16	16	12	13	12	16	27	38	48	40	57	63	43	44	53	41	36	42	39	43	39	34	32	**791**
StDev	5.6	6.4	6.4	4.2	4.3	4.6	6.0	7.5	8.6	11.1	11.1	10.3	12.0	10.3	10.8	8.2	8.1	8.9	11.0	10.6	8.3	9.0	9.0	7.6	**65**
Avg high	29.8	28.1	25.3	19.9	18.2	20.2	27.9	40.3	54.8	67.2	69.7	66.5	67.7	64.3	63.1	61.8	55.0	54.2	60.2	57.4	49.7	51.1	49.0	41.9	982.2
90th Percentile Rank	27	28	25	20	17	20	26.2	36.4	54	60.6	63.2	62.4	64.2	64	62.4	60	51	52	60.4	57.4	47	49	46.2	40.2	**941**
TMT Multiplier	1.21	1.20	1.19	1.16	1.24	1.25	1.16	1.35	1.36	1.37	1.38	1.36	1.36	1.42	1.43	1.45	1.39	1.34	1.23	1.45	1.30	1.27	1.30	1.26	1.31
Avg Peak	36	34	30	23	23	25	32	54	74	92	94	90	92	91	90	90	76	72	74	83	65	66	64	53	1286
2x StDev + Mean	32.9	32.5	30.0	22.9	20.5	23.3	31.8	44.0	58.3	71.4	73.9	71.2	73.7	69.3	69.6	64.5	58.6	58.9	67.2	63.2	54.1	56.7	54.7	45.6	**979**
Smoothed Average Peak	37.57	33.5	29.4	24.3	23.2	26.2	35.4	53.9	73.9	89.05	92.96	91.04	91.497	91.13	90.377	87.39	78.29	73.33	75.397	77.6	68.6	65	61.9	52.9	**1524**
Blended Demand	32.5	31.4	28.1	22.4	20.2	23.2	31.1	44.8	62.1	73.7	76.7	74.9	76.5	74.8	74.1	70.6	62.6	61.4	67.7	66.1	56.6	56.9	54.3	46.2	**1289**
UH Adj/Eff Buffer	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	**648**
Performance Staffing	65	61	56	51	50	53	62	81	101	116	120	118	118	118	117	114	105	100	102	105	96	92	89	80	**2172**
Adjust from Current Staffing	12	8	14	9	8	11	20	18	38	53	46	45	45	45	33	30	21	16	18	42	33	29	36	27	
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5	**1512**



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

<u>Fridays</u> Analysis Summary and Chart

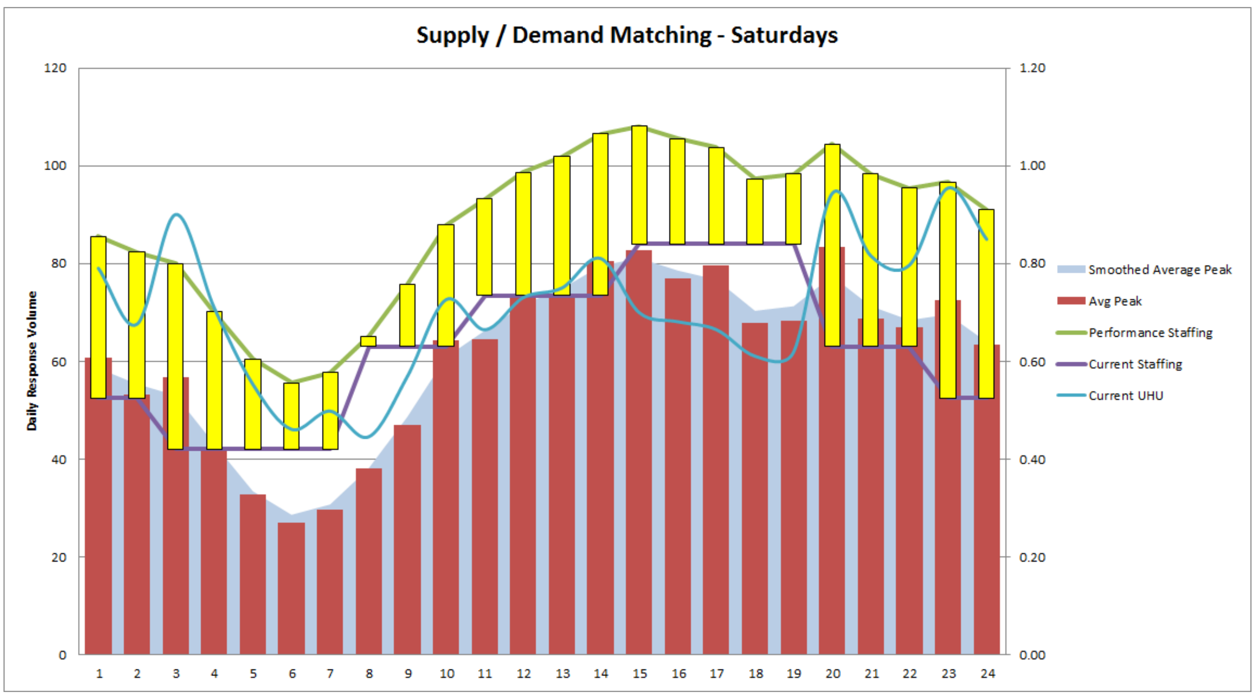
Fridays																									
Period Start Date	Jan 1 2011																								
Period End Date	Dec 31 2011																								
Number of Days In Periods	52																								
Hr Ending	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**Total**
Total MPDS Responses	1272	1214	1146	848	736	749	1001	1322	1901	2369	2479	2476	2521	2587	2472	2377	2267	2353	2347	2213	2098	1991	2016	1697	**44452**
Min	14	13	8	8	5	8	6	12	21	30	27	32	27	18	29	30	22	21	28	25	23	22	25	22	**685**
Max	**46**	**52**	**36**	**26**	**24**	**25**	**36**	**40**	**57**	**81**	**75**	**64**	**71**	**77**	**102**	**74**	**81**	**89**	**65**	**76**	**65**	**64**	**64**	**61**	**1013**
Mean	24.5	23.3	22.0	16.3	14.2	14.4	19.3	25.4	36.6	45.6	47.7	47.6	48.5	49.8	47.5	45.7	43.6	45.3	45.1	42.6	40.3	38.3	38.8	32.6	**855**
Median	23.5	22	21.5	16.5	14.5	14	18.5	25	36	44	47	47.5	48	50	46	45.5	42	44	44	40	38.5	38	37	30.5	**860**
Mode	29	22	20	19	17	15	21	22	37	37	47	43	48	39	47	38	39	40	44	40	37	49	44	28	**846**
StDev	7.0	8.1	6.8	4.3	4.4	4.1	6.2	5.6	8.7	9.4	10.1	9.2	10.8	11.5	12.6	9.4	11.3	13.1	10.5	10.6	8.9	8.5	9.3	8.2	**66**
Avg high	35.0	34.3	31.7	22.8	19.7	20.0	27.9	33.8	48.4	57.7	62.3	61.8	65.0	64.5	66.3	60.9	60.5	61.8	60.4	58.1	54.0	50.8	50.9	45.9	987.1
90th Percentile Rank	31.2	32.2	31.2	22.2	19	20	27	34	49.4	57	60.2	60	62.2	63.6	59.8	54	56.8	60.4	59.2	54	50.2	49	51	44.4	**944**
TMT Multiplier	1.21	1.20	1.19	1.16	1.24	1.25	1.16	1.35	1.36	1.37	1.38	1.36	1.36	1.42	1.43	1.45	1.39	1.34	1.23	1.45	1.30	1.27	1.30	1.26	1.31
Avg Peak	42	41	38	26	24	25	32	46	66	79	87	84	89	91	95	88	84	82	74	84	70	65	67	58	1293
2x StDev + Mean	38.4	39.5	35.6	24.9	22.9	22.6	31.7	36.6	53.9	64.4	67.8	66.1	70.2	72.8	72.8	64.5	66.2	71.4	66.2	63.8	58.2	55.3	57.5	49.0	**988**
Smoothed Average Peak	44.23	40.7	36	28.2	24.9	26.3	33.7	47.4	64.5	78.04	84.97	85.73	88.269	91.33	92.757	88.62	84.53	81.13	77.844	79.3	71.6	66.1	64.5	60.2	**1541**
Blended Demand	38.0	37.5	34.3	25.1	22.3	23.0	30.8	39.3	55.9	66.5	71.0	70.6	73.5	75.9	75.1	69.0	69.2	71.0	67.7	65.7	60.0	56.8	57.7	51.2	**1307**
UH Adj/Eff Buffer	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	**648**
Performance Staffing	71	68	63	55	52	53	61	74	91	105	112	113	115	118	120	116	112	108	105	106	99	93	92	87	**2189**
Adjust from Current Staffing	19	15	21	13	10	11	19	11	28	42	38	39	42	45	36	32	28	24	21	43	36	30	39	35	
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5	**1512**



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Saturdays Analysis Summary and Chart

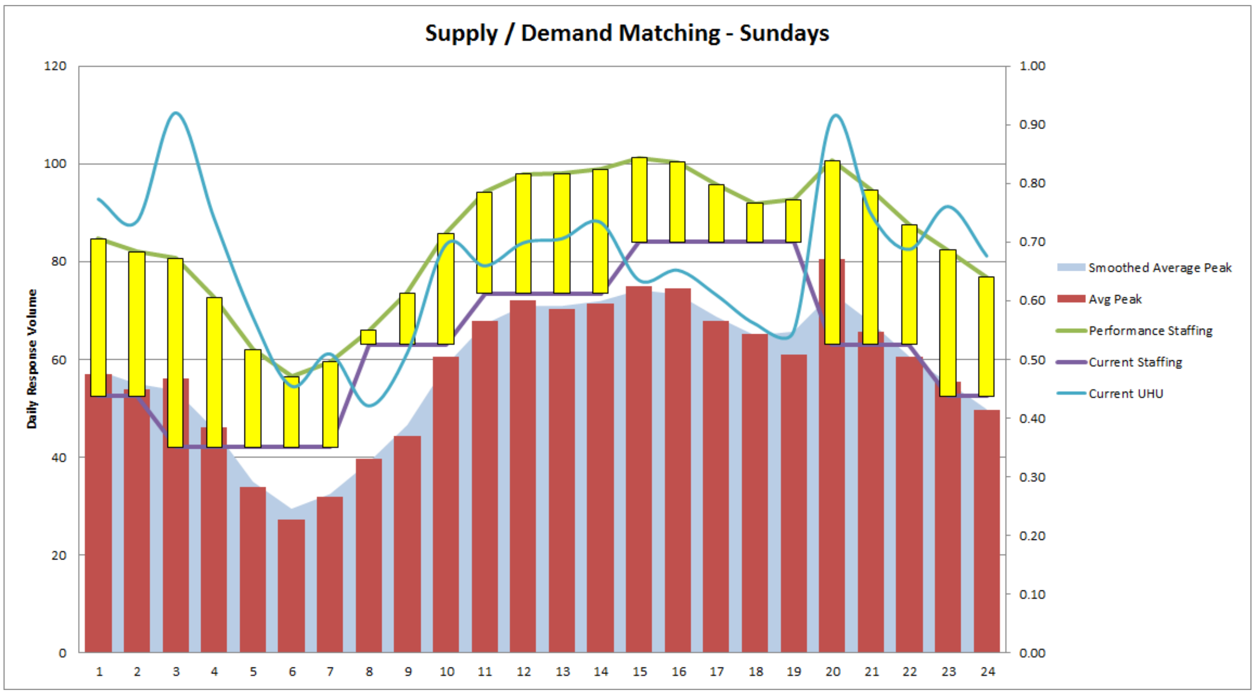
Saturdays																									
Period Start Date	Jan 1 2011																								
Period End Date	Dec 31 2011																								
Number of Days In Periods	53																								
Hr Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Total MPDS Responses	1817	1563	1691	1363	990	819	954	1104	1403	1767	1882	2088	2142	2229	2178	2098	2131	2036	2245	2176	2088	2089	2045	1876	**42774**
Min	19	11	14	14	7	6	10	8	17	19	23	14	21	25	25	28	21	22	20	18	23	23	18	13	**583**
Max	**81**	**85**	**77**	**71**	**37**	**30**	**29**	**32**	**41**	**53**	**55**	**67**	**75**	**78**	**79**	**65**	**77**	**64**	**69**	**75**	**65**	**71**	**66**	**59**	**1046**
Mean	34.3	29.5	31.9	25.7	18.7	15.5	18.0	20.8	26.5	33.3	35.5	39.4	40.4	42.1	41.1	39.6	40.2	38.4	42.4	41.1	39.4	39.4	38.6	35.4	**807**
Median	33	27	31	25	18	15	18	21	26	32	34	37	38	41	38	37	39	39	41	38	40	38	38	36	**793**
Mode	27	23	28	29	18	14	15	26	28	29	34	37	34	41	31	37	38	39	41	35	34	38	40	27	**745**
StDev	10.4	11.1	11.9	8.8	5.7	4.5	5.3	5.9	5.5	8.5	7.1	10.7	11.0	10.7	11.0	9.2	11.7	8.7	9.1	10.6	9.6	9.5	10.1	9.9	**84**
Avg high	50.1	44.2	47.8	36.3	26.3	21.5	25.4	28.3	34.7	46.8	46.9	53.8	54.3	56.8	58.0	53.2	57.3	50.1	55.9	57.6	52.7	52.6	55.8	50.3	945.3
90th Percentile Rank	44.6	38	43.6	32.2	25	21	25	28	34.4	46	44.2	53	58.2	56.8	54.4	51.2	52.2	48.4	54.2	58	50.6	50.4	50	46	**908**
TMT Multiplier	1.21	1.20	1.19	1.16	1.24	1.25	1.16	1.35	1.36	1.37	1.38	1.36	1.36	1.42	1.43	1.45	1.39	1.34	1.23	1.45	1.30	1.27	1.30	1.26	1.31
Avg Peak	61	53	57	42	33	27	30	38	47	64	65	73	73	81	83	77	80	68	68	83	69	67	73	63	1238
2x StDev + Mean	55.1	51.8	55.6	43.2	30.1	24.5	28.6	32.5	37.4	50.3	49.7	60.8	62.4	63.4	63.1	58.0	63.6	55.8	60.6	62.3	58.6	58.4	58.7	55.1	**976**
Smoothed Average Peak	58.59	55.4	53.1	43.1	33.4	28.6	30.7	38.2	48.7	60.88	66.26	71.62	74.846	79.55	81.119	78.59	76.74	70.34	71.283	77.4	71.3	68.4	69.6	64	**1472**
Blended Demand	52.8	48.4	50.8	39.5	29.5	24.7	28.1	32.9	40.2	52.4	53.4	61.8	65.1	66.6	66.2	62.6	64.2	58.2	62.0	65.9	60.2	59.1	59.4	55.0	**1259**
UH Adj/Eff Buffer	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	**648**
Performance Staffing	86	82	80	70	60	56	58	65	76	88	93	99	102	107	108	106	104	97	98	104	98	95	97	91	**2120**
Adjust from Current Staffing	33	30	38	28	18	14	16	2	13	25	20	25	28	33	24	22	20	13	14	41	35	32	44	38	
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5	**1512**



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Sundays Analysis Summary and Chart

Sundays																									
Period Start Date	Jan 1 2011																								
Period End Date	Dec 31 2011																								
Number of Days In Periods	53																								
Hr Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Total MPDS Responses	1777	1700	1728	1421	1024	807	975	1042	1260	1693	1867	1997	2015	2017	1975	2008	1954	1869	1986	2102	1916	1802	1629	1493	**40057**
Min	17	16	12	12	8	8	8	9	11	20	22	25	20	17	24	17	22	18	17	20	21	17	14	13	**0**
Max	**70**	**54**	**64**	**60**	**37**	**27**	**38**	**32**	**38**	**63**	**60**	**64**	**66**	**58**	**62**	**63**	**56**	**59**	**60**	**64**	**52**	**60**	**51**	**51**	**925**
Mean	34.2	32.7	33.9	27.3	19.7	15.5	18.8	20.0	24.2	32.6	35.9	38.4	38.8	38.8	38.0	38.6	37.6	35.9	38.2	40.4	36.8	34.7	31.3	28.7	**756**
Median	34	31	34	26	20	14.5	18	19	24	33	36	36	38	38	35.5	38.5	37	35	37	40	38	36	32	27	**764**
Mode	41	26	34	26	20	11	14	18	27	38	38	35	30	44	35	36	35	33	37	33	38	37	33	24	**718**
StDev	9.6	9.6	10.1	9.4	5.6	4.3	6.0	5.8	5.9	7.9	8.4	8.7	8.3	8.1	9.3	9.3	7.4	8.5	8.4	10.4	8.7	8.4	8.2	9.32	**123**
Avg high	47.1	44.8	47.0	39.8	27.8	21.7	27.4	29.3	32.7	44.2	49.3	52.9	50.8	49.5	52.4	51.6	48.9	49.1	49.0	55.6	50.3	47.6	42.0	39.8	892.5
90th Percentile Rank	41.6	49.2	47.6	35.4	26.2	21	25	27.2	32.2	40	44	48.6	48.2	51	50.4	49.4	47.2	47	50	52.2	48	43.2	42	41.4	**851**
TMT Multiplier	1.21	1.20	1.19	1.16	1.24	1.25	1.16	1.35	1.36	1.37	1.38	1.36	1.36	1.42	1.43	1.45	1.39	1.34	1.23	1.45	1.30	1.27	1.30	1.26	1.31
Avg Peak	57	54	56	46	34	27	32	40	44	61	68	72	70	71	75	75	68	65	61	80	66	61	55	50	1169
2x StDev + Mean	53.4	52.0	54.1	46.1	30.8	24.2	30.7	31.6	36.1	48.4	52.6	55.9	55.4	55.1	56.5	57.2	52.4	53.0	55.0	61.2	54.3	51.5	47.7	47.3	**1002**
Smoothed Average Peak	57.68	55	53.7	45.7	35	29.4	32.5	39	46.6	58.78	67.21	70.9	70.936	71.93	74.193	73.33	68.73	64.9	65.686	73.6	67.6	60.6	55.3	49.8	**1388**
Blended Demand	50.9	52.1	51.8	42.4	30.7	24.9	29.4	32.6	38.3	49.0	54.6	58.5	58.2	59.3	60.4	60.0	56.1	55.0	56.9	62.3	56.6	51.7	48.3	46.2	**1186**
UH Adj/Eff Buffer	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	**648**
Performance Staffing	85	82	81	73	62	56	59	66	74	86	94	98	98	99	101	100	96	92	93	101	95	88	82	77	**2036**
Adjust from Current Staffing	32	30	39	31	20	14	17	3	11	23	21	24	24	25	17	16	12	8	9	38	32	25	30	24	
Current Staffing	52.5	52.5	42	42	42	42	42	63	63	63	73.5	73.5	73.5	73.5	84	84	84	84	84	63	63	63	52.5	52.5	**1512**



Note: Yellow Drop Bar represents staffing gap, Blank Drop Bar represents potential surplus capacity

Appendix K – Case Study: United Kingdom

In the past 10 years emergency services in the United Kingdom have been subject to working within a progressively shrinking financial envelope yet have been able to maintain effectiveness and service to the public. In the case of fire services, changes were precipitated by a thirty to thirty-five percent, four-year staged loss of national government grant revenue which accounted for seventy percent (70%) of municipal fire service budgets. We became aware of the United Kingdom's experience in increasing effectiveness and reducing costs through seminars on risk and probability provided by the Public Entity Risk Institute[70]. Several presentations on value initiatives were offered by the Greater Manchester Fire and Rescue Service (GMFRS). From a budget of one hundred and ten million pounds (£110M) the service was compelled to function within eighty million pounds (£80M).

Manchester is not the only municipality in the United Kingdom that has found ways of maintaining a strong level of emergency services protection within diminishing financial circumstances. Many other municipalities have accomplished the same successes as Manchester by using data effectively and basing performance objectives on that data. We made a 5-day visit to the Greater Manchester Fire and Rescue Service in July 2012 to understand the scope of their accomplishments and have been in frequent contact for follow up and clarification purposes.

The United Kingdom's emergency services' effectiveness accomplishments required a shift in philosophy and a change in culture towards focusing on information gathering, prevention, and protection efforts. This included initiatives such as Home Safety Check (HSC) targeting, and engaging suppression staff in prevention and public fire safety awareness efforts.

Manchester's change in their approach to fire service included ongoing public consultation and transparency, a management will to assert their legitimate authority when necessary, and a business model approach to providing a vital community service that is more than emergency based.

The Greater Manchester Area

The Greater Manchester Area is the UK's third most populous urban area as the result of amalgamating ten boroughs in April of 1974. Greater Manchester Fire and Rescue Service covers an area of approximately 1,277 square kilometres (vs. 641.45 in Toronto) and serves a local population of approximately 2.6 million residents. As in Toronto there is significant diversity (400 languages spoken), and a considerable number of people who work in Manchester but live elsewhere.

[70] PERI provides public entities, small businesses, and nonprofit organizations with enterprise risk management information, training, data, and data analysis. PERI's goal, as stated on their website, is to be an organization that is seen by its principal customers and stakeholders as the independent thought leader and definitive resource in the field of risk management; as a constant innovator; and as a ready source of practical and highly valued products (Wikipedia)

Manchester does not have the predominance of high-rise buildings common in Toronto and there are a greater number of impoverished areas and high unemployment rate due to the off-shore relocation of its textile and manufacturing base. The streetscape and rush hour traffic patterns, for the most part, are not unlike that of Toronto with areas in both cities posing accessibility challenges.

The GMFRS has 1,794 uniformed and 423 non-uniformed staff at 41 fire stations, responding to 55,000 emergency calls annually. This is comparable to Toronto's call volume when response to medical calls are not included in Toronto's count. Manchester doesn't respond to medical events. The city has not hired any new fire fighters since 2009 and, reportedly, has no plans to do so in the foreseeable future. The city is anticipating an overall reduction of 50% in the number of fire fighters from the start of the austerity measures to its completion in another five years.

Change strategies are vetted with key stakeholders and frequent public consultations occur. These include

- Ongoing use of risk analyses data that revealed the predictability of fire occurrences, resulting in variable staffing of stations and apparatus.
- Response standards which are available to the public, and performance in meeting those standards is publicly reported each quarter.

In Greater Manchester, the determination of local risks is enhanced by the use of a commercial off-the-shelf software program called Phoenix[71]. The key inputs to the program include three years of historical fire incident data such as the number of occurrences, time of day, location, and whether the incident was accidental or deliberate. Risk levels are then assigned based on station location and political wards. Risk level determination also serves to drive fire prevention initiatives, such as Home Fire Risk Assessments, in that the higher the risk the greater the fire prevention initiatives. But it also defines staff levels and the number of apparatus that are in service at certain times of the day.

There are over 1.1 million domestic properties across Greater Manchester (vs. 516,000 address point in Toronto), and each year approximately 60,000 Home Fire Risk Assessments are completed. The emphasis on the activity is driven by research on domestic fires that indicate fires occur primarily as a result of lifestyle choices, attitudes and behaviours, rather than by pure accident. To gain more access to the most vulnerable population, GMFRS has partnered with other services, established a volunteer program, and hired a *Bridging Cultures Coordinator*.

Since April 2003 Fire and Rescue Services in England have been required to produce Integrated Risk Management Plans (IRMPs) that outline:

- How a Fire and Rescue Service identifies risk
- Strategies for reducing the risk, and
- How resources are deployed to an emergency

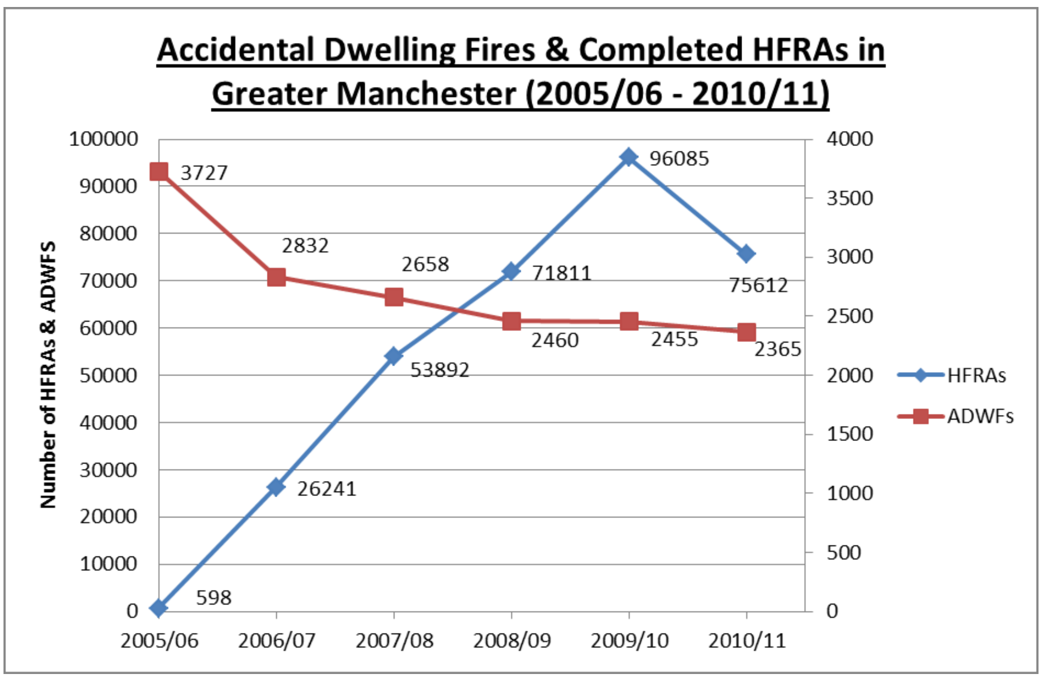
[71] Active Informatics – Pheonix FRS http://activeinformatics.com/separate/downloads/PhoenixFRS.pdf

Greater Manchester's Fire Prevention Strategy is integral to their IRMP and is described in their 2012-2015 Prevention Strategy Consultation Document accessible on their website[72].

While the GMFRS has a statutory responsibility and considers itself to have a moral obligation to undertake a community safety role, fire services' initiatives in this regard were enhanced by legislation in 2005 that shifted considerable responsibility to property owners – particularly commercial property owners – to manage their own fire risk. Fire service prevention and protection personnel will aid and advise in the creation of fire safety and prevention measures but it is the responsibility of the 'owner' to actually create, implement and monitor the measures. Prevention and protection personnel then will examine that the measures are in place and enforce them.

The following chart shows an associative decline in accidental dwelling fires in the Greater Manchester Area as Home Fire risk Assessments increased.

Chart 14 - Home Fire Risk Assessment Chart



[72] http://www.manchesterfire.gov.uk/

In a six year period during which initiatives were being implemented to shift the fire service focus to fire prevention as much as fire response

- Dwelling fires are reported to have decreased 40% and
- Fire fatalities are reported to have decreased 50%

Summary

The Greater Manchester Fire and Rescue Service, like other emergency services in the United Kingdom, has responded creatively to a 30% budget reduction, with additional cuts expected by 2015, while maintaining firefighter health and safety standards and a level of service to the community as before the loss in funding.

The process has been a gradual and data informed one. Many efficiency strategies were pilot tested and every initiative is monitored by objective means. For example, targeting high risk areas with fire prevention strategies is reported to reduce risk status categorization, and more is being done with less mostly because of fire prevention and education initiatives, and shifting responsibility, when appropriate, to property owners.

Toronto and Manchester are dissimilar in many ways and we are not suggesting that the changes implemented in Manchester and the United Kingdom can be simply transferred to Toronto. But the efficiency and effectiveness *processes* and *practices* that were used in the United Kingdom can be adapted to any jurisdiction.

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Executive Summary **http://www.manchesterfire.gov.uk/media/67821/sid_executive_summary.pdf**

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Appendix M – Team Background

A consortium of companies contributed to Toronto's project. In addition to Pomax Consulting which lead the project, it included Berkshire Advisors, MGT of America, and Stantec.

Our team is composed of individuals with extensive experience and qualifications in their respective fields. We have decided to include a short team summary here because we consider it important for readers to understand the qualifications, effort and expertise that went into this project.

Patrick R. Burke LL.B. retired as the Fire Marshal of Ontario in November of 2010. His career in community safety spans well over 40 years. Pat joined the Windsor Fire Department in 1968, working his way up through the ranks as a firefighter, lieutenant and acting captain, and being promoted to Deputy Fire Chief in 1994. In February of 2002 Pat was appointed Fire Chief of Niagara Falls, and served in that capacity until his appointment as Fire Marshal. He has coordinated all activities of fire services including firefighting, fire prevention, communications and training. In addition to the duties of Fire Chief, Pat has served on numerous Boards and Committees. Pat also pursued a law degree at the University of Windsor, and was called to the Ontario bar in 1992. In addition to his law degree, Pat also has a Bachelor of Arts in Sociology from the University of Windsor and a diploma in Labour Studies from the Labour College of Canada at the University of Montreal.

Jim Kay was General Manager and Chief of the Hamilton, Ontario Emergency Services. As Chief, he was responsible for the direct oversight of fire and EMS services, administration, emergency management, and the corporate radio system, as well as a staff of 1,150 at 31 work sites, covering an area of over 1,200 square kilometers. Jim received his Diploma in Public Administration from the University of Western Ontario in London, Ontario, and is currently working on a Public Administration Degree at Ryerson University. Jim has over 30 years of demonstrated fire service experience and an overall understanding of the delivery of emergency services.

Winston Minor of Berkshire Advisors served as a leader in the Atlanta, Georgia Fire Department for more than 29 years and served as Atlanta's fire chief for over seven years until his retirement. He managed an annual budget of approximately $60 million and strove to continue the delivery of high quality services when the city's budget situation resulted in the availability of considerably fewer resources. Chief Minor commanded over 900 employees and 35 fire stations.

Dr. Karen Wanger, MDCM, FRCPC, FACEP, is a Royal College Board certified emergency physician with subspecialty expertise in EMS Medical Direction and 13 years of experience providing medical oversight and direction for the BC Ambulance Service, the largest single provider service in Canada. Her training in both Canada and the US gives her a solid knowledge of EMS across North America and her in-depth understanding of EMS operations in addition to medical oversight makes her unique in the industry. She has a record of successful completion of multiple complex, multi-stakeholder projects. Most recently Karen served as the Acting Vice President, Medical Programs for the Emergency and Health Services Commission in BC. Dr.

Wanger is an active promoter of EMS across Canada and the US and is a frequent speaker at national and international conferences. She serves as physician member-at-large on the Board of Directors of the National Association of EMS Physicians and has recently been elected for a second term. Karen has twenty years of clinical experience in the Emergency Department of St. Paul's Hospital, a downtown, academic, tertiary care facility in Vancouver, British Columbia.

Michael Sanderson MStJ, MHSc, BA, AEMCA, is an internationally recognized Emergency Medical System administrator. With an extensive background gained during more than 38 years of EMS service, his experiences include hospital, government, and volunteer service delivery in Ontario and British Columbia. As a member of the Ontario Land Ambulance Transition Taskforce Michael was actively involved in the development of policy, legislation, and direction related to the transfer of land ambulance responsibility to Upper Tier Municipalities in Ontario. His experiences include both operational and professional executive board positions at local, provincial, and national levels. He has chaired numerous national and provincial committees including ones dealing with EMS and health care integration activity and first responder activities. Michael recently completed 11 years of service as the senior operational leader for the Lower Mainland Region of the British Columbia Ambulance Service, one of four operating regions in BC. In this role he was responsible for land ambulance and dispatch operations of one of the largest EMS operations in Canada, covering more than 90,000 square kilometers with a population of 2.6 million people. A graduate of the University of Toronto MHSc (Health Administration) program, Michael has also completed a BA (Sociology) at Wilfrid Laurier University, and is a graduate of the Humber College Ambulance and Emergency Care Program.

JoEllen Walker BA, MS, MBA, from Berkshire Advisors is an expert in quantitative and qualitative data analysis and process improvement, and has extensive experience using GIS databases to evaluate fire and EMS deployment strategies. She has conducted numerous technical studies that focused on using mathematical programming and statistical tools and metrics to analyze complex problems. She has modeled staffing needs for numerous public safety agencies including the Florida Highway Patrol; Phoenix, Arizona; Oklahoma City, Oklahoma; Memphis, Tennessee; Raleigh, North Carolina; West Palm Beach, Florida; Kansas City, Missouri; Lake County, Florida; Scottsdale, Arizona; Philadelphia, Pennsylvania; Wilmington, Delaware; Hamilton, Ohio; Ocala, Florida; and Dallas, Texas.

Prior to joining Berkshire Advisors, Ms. Coe spent nearly 15 years working in Telcordia Technology's Quality Center. Her proficiency includes GIS mapping, ISO 9000, linear programming, Malcolm Baldrige quality assurance, process analysis, queuing analysis, and Six Sigma. Ms. Walker is certified by the American Society of Quality as a Certified Quality Engineer, Certified Reliability Engineer, and Certified Quality Auditor. JoEllen holds a B.A. degree, cum laude from Hiram College; an M.S. degree from the University of Florida; and an M.B.A. degree from the Wharton School of the University of Pennsylvania.

Bryna Rabishaw RN., MBA from Stantec Inc. has over 25 years of experience in healthcare. Her area of expertise includes strategic planning and management of clinical services and systems, including utilizing LEAN methodology and processes to maximize efficiency, effectiveness and provide optimal patient experience. She has integrated health services for regional and tertiary clinical programs. As a Director of Regional Programs in Ontario, Bryna formed an appreciation of utilization of EMS for acute patient transfers, such as Code STEMI, and the reliance on high functioning non-urgent patient transportation to sustain patient flow through repatriation. Bryna worked in collaboration with Local Health Integration Networks and other healthcare centers to develop signed repatriation agreements to sustain responsibilities, achieve MOHLTC targets, and address wait time volumes. Bryna was also involved with the Critical Care Secretariat Surge Capacity planning which required the orchestration of EMS to ensure minor and moderate surge planning in collaboration with Criticall.

Amy Hayashi MBA, MSc. Physiology-Neuroscience; from Stantec Inc. Amy's expertise includes strong analytical and problem-solving skills using both clinical health information and financial databases, while identifying and presenting operational inefficiencies and improvements. Amy's experience includes acting as the Project Lead for the Ministry of Health and Long-Term Care, Critical Care Secretariat, which involved implementing a surge management strategy across Ontario hospitals. This initiative included building partnerships with stakeholders, including EMS, hospitals and Local Health Integration Networks, identifying strengths and barriers, and the development and rollout of an electronic strategy toolkit. She has worked with decision support for major trauma centers with critical care, emergency and trauma portfolios.

Michael Walker, BA MBA the President of Berkshire Advisers has 26 years of experience evaluating the organization, management, and operations of government operations including scores of fire and emergency departments. He has conducted studies for more than 100 local and state governments, including fire and EMS operations in Philadelphia, Pennsylvania; Dallas, Texas; Memphis, Tennessee; West Palm Beach, Florida; Ocala, Florida; Newport, Rhode Island; Arlington County, Virginia; Auburn, New York; Newport, Rhode Island,; Ottawa, Ontario; Pensacola, Florida; and Texas City, Texas.

Linus Li, MBA, CPA, CMA, CFM, CIA from MGT of America has over 20 years of experience conducting audits and reviews of state and local government entities. He has a broad knowledge base in conducting financial, compliance, and operational reviews of government agencies in diverse areas, such as public safety, education, and health care. Mr. Li received his undergraduate degree in Accounting and Information Systems from the University of Washington, and his Master of Business Administration from California State University, Sacramento. He is a Certified Public Accountant, a Certified Management Accountant, a Certified Financial Manager, a Certified Internal Auditor, and a member of the Institute of Internal Auditors and Institute of Management Accountants.

Mr. Li served as an Audit Supervisor/Senior Auditor Evaluator for the California State Auditor. In that role, he conducted numerous financial, compliance, and performance audits of various state agencies such as the California Department of Motor Vehicles, the California Department of Transportation, and the Governor's Office of Planning and Research. Mr. Li also worked as a financial auditor for a public accounting firm, where he was responsible for conducting external financial audits of local governments and other entities.

Alex Polgar Ph.D., R.S.W. is a Principal of POMAX Consulting. In a thirty-five year career span he has applied his clinical and extensive assessment skills to addressing challenges such as organizational and operational environments and the related impact on job performance, and assessing and optimizing work place performance. Alex's abilities include specialized services such as change management, organizational and operational structure, and their role in service delivery; creating a positive and productive work culture; environmental analysis to define work culture; organization specific recruitment and selection policies, procedures and training in the application of the methods; strategic planning; policy and procedure auditing; and, developing, implementing and evaluating orientation and in-service training initiatives.

Glen Miller, BSc, MBA, a Partner at Pomax, specializes in Information Technology & Telephony Systems for Public Safety. He has an extensive 25 year international background in Fire, EMS and Police communications and IT systems in government, nonprofit, and vendor organizations. He was the Chair of the Association of 911 Service Providers of BC (www.abc911.ca); Chair of the British Columbia Chapter of NENA; and the former president of APCO Canada. Glen has a Bachelor of Science degree in Computer Science from the University of Western Ontario, and a Master of Business Administration from the University of Liverpool. His thesis topic was "Using Technology to Affect Organizational Changes that Improve Fire Response Time".

Glen has been most recently employed as the Director of Information Technology for Emergency Communications for Southwest British Columbia (E-Comm), in Vancouver. E-Comm provides 911 emergency call-taking and consolidated dispatch services to police, fire and ambulance agencies in southwest British Columbia serving a population base of over 2 million people. As a member of the Executive Leadership Team, Glen was responsible for the management of an IT Department of 40 people. He has implemented a number of mission critical systems including computer-aided dispatch, telephony systems, 9-1-1, Police & Fire Records Management, and Emergency Management Systems as well as upgrading telephone switching equipment to next generation IP based 9-1-1 telephony.

Keith Meldrum of POMAX has over 15 years of local government public safety administration and operations experience. His expertise is in fire service administration, governance, and the operations and management of large centralized fire dispatch and communications systems. He has extensive experience in Computer Aided Dispatch and Records Management Systems, human resources and technology management. Until recently, Keith was the Chief Communications Officer for the Prince George Fire Rescue Service. As part of the senior management team, he was responsible for the management and operation of the centralized fire dispatch as well as radio, data, and technology systems for the fire department. The Prince George fire dispatch centre is the largest in western Canada in terms of agencies served and geographical service area, providing service to 82 fire and rescue agencies throughout 300,000 km^2. He has extensive experience in fire service operations including Emergency Operations Centre (EOC) management. Keith is an Applied Science Technologist (AScT) in engineering technology, a Registered Technology Manager (RTMgr), and a member of the Applied Science Technologists and Technicians of British Columbia. He is certified to the Incident Command System 300 level and is completing a Bachelor of Technology degree.

Prasenjit Roy, MASc., P.Eng. is a Senior Associate at POMAX Consulting. Prasenjit is a licensed professional engineer with over 14 years of experience. Prasenjit has successfully completed and reviewed many complex response time analysis models, traffic engineering, transportation planning and travel demand forecasting projects, and has worked both as a consultant Project Engineer in one of the largest multinational firms, and in the public sector approval authority as

Senior Engineer and Manager. Prasenjit's experience includes managing and developing computer models that simulate travel times on the road network and optimizes those travel times, system wide. He has co-ordinated and managed a number of major multi-disciplinary assignments, including environmental assessments for road and transit projects. Prasenjit is also a contributing author of Canadian Capacity Guide for Signalized Intersections. Prasenjit's experience includes municipal planning, demographics and their effect on municipal resources.

Gopa Pal, MSc. from POMAX is a municipal planner and experienced in demography and its implication on municipal resources. Gopa has over four years of experience in one of Canada's largest transportation consulting firms. She is an expert on planning compliance related issues, transportation planning in the urban environment and has extensive knowledge and experience in Geographic Information Systems (GIS) traffic impact studies, traffic operations, circulation, access, parking analysis and management, noise impact studies, noise compliance certifications, field work, data collection and design tasks. She is also proficient in SYNCHRO traffic analysis software, along with AutoCAD, and various Noise analysis software.

Terry Owen, B. Comm. of POMAX was, until recently, Chief of Emergency Systems for the City of Edmonton Fire and Rescue Services and responsible for managing all public safety technology used by Fire Rescue Services, and dispatching technologies, including radio systems, mobile computer technologies and related telecommunications.

Jon Hambides, a principal in Pomax, led the project. Jon Hambides has in-depth knowledge of the operation and administration of emergency services throughout North America as well as a strong knowledge of best practices and benchmarking in the emergency services industry. Jon's 30 year career includes experience in key senior management positions in emergency services prior to consulting.

Formerly the Manager of Resource Development for Emergency Medical Services with the Ministry of Health, he was responsible for leadership of the province's EMS emergency response preparedness program; leadership of education and training programs for 5,000 paramedics and communications staff; system wide occupational safety and health; system wide evaluation, testing, and purchase of advanced life support and basic life support patient care equipment used in 1200 Ambulances and support vehicles; the widely referenced Ontario Pre-hospital Advanced Life Support Study; paramedic certification programs and exams; and strategic leadership for the operation and amalgamation of 21 EMS Communications Centers in the largest state run EMS system in the world at that time.