



City of Vaughan

IAFF L1595 GIS Study and Master Fire Plan

Analysis

December 2023



The VPFFA engaged the International Association of Fire Fighters (IAFF) Headquarters to perform a data driven GIS analysis of the VFRS' performance capabilities using the computer-aided dispatch (CAD) data for responses performed from January 1, 2016 and December 31, 2022 inclusive.

Subsequently, the VPFFA has done a cross-analysis of the IAFF GIS Study completed in July 2023 with the *City of Vaughan Master Fire Plan and City-Wide Risk Assessment – Final Report* that was completed in February 2018 by Dillon Consulting to cover the 10-year period of 2017-2027.

There are extensive similarities and links between the Master Fire Plan (MFP) and the IAFF GIS Study. Several of the recommendations that were made in the MFP are the same recommendations found in this GIS Study.

Additionally, given this GIS analysis was completed at the approximate half-way point of the MFP – when the MFP's five year update should have occurredⁱ - the findings are of grave concern to the Association, both for the safety of our members and for the safety of the public.

Station Location Analysis and Deployment:

The GIS analysis highlights that VFRS operates without sufficient resources to respond efficiently and effectively due the small number of stations relative to the size of the response boundary for the City.ⁱⁱ

A quick analysis of some of our historical comparators in close proximity to our geographic area, the VFRS has the highest response area per station of 27.4 square kilometers:

CITY	POPULATION*	SQ.KMS	# OF FIRE STATIONS	STATION/SQ.KM
Toronto	2,794,356	641 sq kms	85	1 per 7.54 sq kms
Mississauga	717,961	288 sq kms	23	1 per 12.52 sq kms
Brampton	656,480	265 sq kms	13	1 per 20.38 sq kms
Markham	338,503	210 sq kms	9	1 per 23.33 sq kms
Oakville	213,759	139 sq kms	9	1 per 15.44 sq kms
Richmond Hill	202,022	101 sq kms	6	1 per 16.83 sq kms
Barrie	147,829	99 sq kms	5	1 per 19.8 sq kms
VAUGHAN	323,103	274 sq kms	10	1 per 27.4 sq kms

*Population Estimates based on the Statistics Canada 2021 Census of Population

The MFP also acknowledged that in 2017, only 24% of the City's geographical area was covered within a four minute travel time resulting in a number of significant gaps in response coverageⁱⁱⁱ. In Figure 30 of the MFP, it clearly identifies the areas of the City at risk against the historical call volumes^{iv}.



The MFP addressed that there were changes in the methodologies employed between The 2007 MFP and the 2017 MFP due to an overestimation of response area coverage in the 2007 MFP^v.

While also acknowledging that traffic congestion & the road network^{vi} are also contributing factors, the outcome has contributed to significant gaps in response areas identified between the stations under the 2017 MFP that were not identified in the 2007 MFP^{vii}.

Importance of Time with Respect to Fire Growth^{viii}

Extensively addressed in the IAFF GIS Study under “Fire Suppression Operations: Fire Growth and Staffing Needs”, there is an entire section in the MFP addressing this same scientific factual information^{ix} Time is a critical component with respect to the growth of a fire and the success of intervention by firefighters.

Understanding fire growth rate and time is imperative when assessing fire operations performance targets and identifying which areas of the community may have extended response times due to long travel distance. This impacts not just Fire Suppression, but also Fire Prevention and Education.

“The success of firefighting intervention, given the exponential increase in fire temperature and the potential for loss of property/loss of life with the progression of time, further support the importance of public education and prevention programs.”^x

In addition to addressing the significant gaps in our coverage area for Suppression, a priority should be targeted public education and prevention program initiatives in the northern areas of the City.

Current Fire Suppression Guidelines, Industry Standards and Industry Best Practices^{xi}

The 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” is a standard that is designed for larger municipalities such as the City of Vaughan.

It’s referenced in detail throughout the MFP^{xii} and widely considered best practices by the fire service in North America. One of the 45 recommendations made in the MFP included that the VFRS should follow this standard:

“It is recommended that VFRS adopt turnout time, initial response within the urban area and depth of response within the urban area performance objectives that reflect NFPA 1710.”

This is the recommended response standard used in the IAFF GIS Study.



IAFF GIS - Risk Assessment:

The IAFF GIS study compared several different levels of risk including population distribution, vulnerable populations, and housing characteristics.

The *City-Wide Risk Assessment – Appendix ‘A’* from the 2017 MFP, includes more extensive detail regarding the building stock profile, geographic profile, past fire loss profile, response profile, hazard profile and economic profile to create the risk model upon which the MFP recommendations were made.

When viewing the various maps of the Risk Models^{xiii} presented in the the 2017 MFP, many of these same areas are identified as moderate to high risk in both documents.

Workload Analysis – Call Volume:

The analysis of historical call volume by station and apparatus is virtually identical between both reports.

The MFP identifies the busiest stations as 7-1, 7-2, 7-3, 7-5, and 7-7. In particular, it identifies that E771 had the highest workload per unit^{xiv} which aligns with the data from the GIS as well.

Workload Analysis – Travel Time:

The MFP had similar 90th percentile travel times for emergency calls between 2012-2016, ranging from 360 to 421 seconds depending on the type of call^{xv}. Well above the NFPA Standard of 240 seconds. The updated average of 452 seconds is possibly due to the increased traffic congestion throughout the City over the period of 2016-2022.

Overall, the same information that was presented in the 2017 MFP is replicated in the results of the GIS Study.

Station Allocation:

When evaluating the station locations, the IAFF considered the placement of the planned location of Station 7-12 and recommended the placement of two additional stations to optimize the first-responding apparatus coverage to historical incidents for the period in question.

As noted in the 2017 MFP, station location analysis is largely dependent on the initial response analysis and is the driver for the analysis of modifications to station locations^{xvi}. When viewing the information in the MFP, the current state of the VFRS encompasses the “Future ‘Do Nothing’” scenarios^{xvii} as we have only added Fire Station 7-4 that was already in progress at the time of the MFP.



The GIS Study identifies that given the current placement of stations and apparatus, the VFRS was only able to meet the NFPA 1710 Standard for 40% of the calls within 240 seconds – less than half of the required 90%.

When analyzing the information from the MFP against the GIS, the MFP predicted that only 52% of the call volumes city wide or 54% of the call volumes in the urban area would meet the NFPA 1710 Standard of 240 seconds or less^{xviii}.

Viewing Figure 35 from the MFP^{xix} against the GIS “Incidents with First-Arriving Units Over 240 Seconds” heat map, the same areas are identified as unable to meet the standard.

Of note on the GIS map, there is some intensification in the areas around Station 7-1 and the area west of Station 7-5. Possible reasons for this could likely include the fact that those two stations have had their second apparatus taken out of service over the period being evaluated.

Network Coverage:

The network coverage analysis represented the percentage of the road network that can be accessed by VFRS apparatus in 5 distinct scenarios in accordance with NFPA 1710 Standards:

NFPA 1710 RESPONSE STANDARD		
1st Due Engine Company (Initial Response)		240 seconds or less – 90% of the time
2nd Due Engine, Rescue or Aerial Company		360 seconds or less – 90% of the time
Initial Full Alarm Assignment (Depth of Response)	<i>Low Hazard (17 FF)</i>	480 seconds or less – 90% of the time
	<i>Medium Hazard (26 FF)</i>	480 seconds or less – 90% of the time
	<i>High Hazard (39 FF)</i>	610 seconds or less – 90% of the time

1st Due Company:

The GIS study indicates that only 29.5% of the City’s total road network can be accessed within that time period, compared to 40.2% of the road network if the recommendations are adopted (7-11, 7-12, & 7-13 plus 2 additional apparatus (two apparatus (1 engine/1 aerial) at both 7-6 and 7-12).

This aligns almost identically with the recommendations in the MFP that showed that our current “Do Nothing” scenario would account for 27% of the city-wide area but with the “Future Infill and Infrastructural Renewal Scenario B”, would provide a coverage area of 35% of the city-wide area^{xx}. The recommendations in Scenario B included 7-11, 7-12, 7-13 and the re-location of 7-2 to the JOC property.



2nd Arriving Ladder Company:

In this case, the GIS evaluated the arrival of the 2nd arriving company being an aerial device. The MFP under existing conditions could only meet this requirement for 20% of the geographic area of the City^{xxi}. Its recommendation was to add a 3rd aerial device to Station 7-2. While an aerial was added to Station 7-6, according to the GIS analysis, the placement of this aerial is only reaching the response standard for 13.8% of the road network.

The addition of the 4th aerial at Station 7-12 and a first run engine out of Station 7-6 increases this coverage to 30.6% of the road network.

Depth of Response:

The difference between the GIS and the MFP is the threshold used to calculate the “Depth of Response”. In the MFP, the metric used was 14 Firefighters arriving in 480 seconds (8 minutes or less) for 90% of incidents^{xxii}, which is less than the minimum standard for a low hazard incident.

A **low hazard** structure fire would be considered a residential two-storey, single family dwelling with no basement/exposures, a **medium hazard** structure fire would be considered open-air strip shopping centres or three-storey garden style apartments, and a **high hazard** structure fire would be considered a high-rise structure.

The MFP with the lower standard still recognized that the City’s depth of response only covered approximately 11% of the area of the City and only 13% of the urban area^{xxiii}. Even if the full recommendations were completed from the MFP, this would only result in 20% coverage of the City.

When viewed in comparison with our peer departments from the *Master Fire Plan Appendix C – Emergency Response Coverage Peer Summary*, our depth of response was already abysmal (see Appendix ‘A’).

It should not come as a surprise that the GIS analysis shows only a 3.1% area of coverage for low hazard structure fires and 0% area of coverage for all medium and high hazard structure fires. In fact, the MFP Risk Model also identified a high risk level of 2,000,000 for residential high-rises at the time of the analysis^{xxiv}.



Conclusion:

The ultimate decision making lies with City Council to make the determination on the level of service to provide^{xxv} The municipal council assesses their level of resources based on determining it's "local needs and circumstances"^{xxvi} and it is important that any consideration of these matters be risk-based.

As of July 1, 2024, communities are required under *O. Reg. 378/18: Community Risk Assessments* to utilize their risk assessments to inform decisions about the provision of fire protection services^{xxvii}. These Risk Assessments need to be completed every 5 years and reviewed annually.

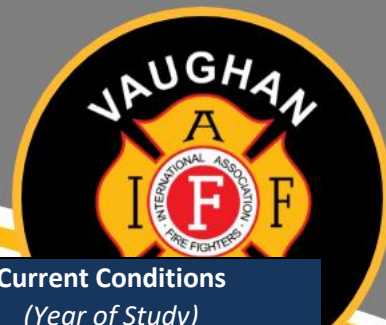
What is clear based on the results of this GIS and the 2017-2027 Master Fire Plan is that the VFRS has fallen behind in it's capacity to respond to any low, medium or high hazard structure fires.

These recommendations made in the GIS Study for 5 additional apparatus and 3 additional stations, is not out of alignment with the varied recommendations made in the 2017 MFP.

While the Association understands that there are procurement constraints with the physical building of additional stations, there are other immediate steps that could be taken to mitigate the current level of risk and would be an appropriate first step to commence closing these large gaps.

With the support of City Council, the Association is willing to work with Fire Administration to come up with feasible solutions in the best interests of the community and the health & safety of our members.

APPENDIX 'A'



Fire Service	Performance Measures (Council Approved)	Current Conditions (Year of Study)	
		Initial Response (% of area)	Depth of Response (% of area)
Town of Oakville	<p>Initial Response: Target 90% of responses a full response travel time of 480 seconds or less.</p> <p>Depth of Response: This target relates to the division's performance measure of achieving 14 (15 previously) firefighters on-scene within 8 minutes of travel time for 90% of calls.</p>	66% (2016)	58% (2016)
City of Mississauga	<p>Initial Response: 6 minutes and 20 second total response time for 90% of the calls for the first arriving truck based on NFPA 1710 standards and best practice.</p> <p>Depth of Response: 20 firefighters arriving on scene within 10 minutes and 20 seconds to a fire in a single family residential occupancy to support simultaneous rescue and suppression capabilities 90% of the time.</p>	46% (2014)	20% (2014)
City of Markham	<p>Initial Response: performance measure targeted of 90% coverage within 6 minutes from the time of the call (4 minutes of travel time).</p> <p>Depth of Response: 8 minutes travel time (15 Firefighters), with 90% coverage</p>	55% (2010)	43% (2010)
Central York Fire Services	<p>Initial Response: Four firefighters arriving on scene within 6 minutes of total response time 90% of the time.</p> <p>Depth of Response: Twelve firefighters arriving on scene within 10 minutes of total response time 90% of the time.</p>	60% (2014)	69% (2014)
City of Oshawa	<p>Initial Response: Four firefighters arriving on scene within a 4 minute travel time to 90% of fire suppression incidents.</p> <p>Depth of Response: Fourteen firefighters arriving on scene within an eight minute travel time to 90% of fire suppression incidents.</p>	84% (2013)	89% (2013)
Town of Richmond Hill	<p style="text-align: center;">Within the defined Urban Area:</p> <p>Initial Response: Four firefighters arriving on scene within a 4 minute travel time to fire suppression incidents.</p> <p>Depth of Response: Fourteen firefighters arriving on scene within an 8 minute travel time to fire suppression incidents.</p>	52% (2016)	11% (2016)
City of Vaughan	<p>Initial Response: Four firefighters arriving on scene within a 4 minute travel time to 90% of fire suppression incidents.</p> <p>Depth of Response: Fourteen firefighters arriving on scene within an 8 minute travel time to 90% of fire suppression incidents.</p> <p style="text-align: center;"><i>(Recommended in 2017 Master Fire Plan)</i></p>	30% (2017)	13% (2017)



REFERENCES:

- ⁱ Dillon Consulting (2018) *City of Vaughan City-wide Risk Assessment Appendix 'A'* Feb 2018, Section 12.0 Pg. 73
- ⁱⁱ IAFF Headquarters (2023) *VFRS Fire Operations Study – Staffing and Deployment*
- ⁱⁱⁱ Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2 pg 147-148
- ^{iv} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2 pg 149
- ^v Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2.3 pg 152
- ^{vi} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2.1 pg 150
- ^{vii} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2.3 pg 152
- ^{viii} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.5.1, Pg. 117
- ^{ix} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.5.1, Pg. 117
- ^x Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.5.1, Pg. 117
- ^{xi} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.6. Pg. 118-126
- ^{xii} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.6.1.1 Pg. 119
- ^{xiii} Dillon Consulting (2018) *City of Vaughan City-wide Risk Assessment Appendix 'A'* Feb 2018, Section 10.3 pg. 65
- ^{xiv} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.8.2 pg 130
- ^{xv} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.8.8, Pg. 138-140
- ^{xvi} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2, Pg. 147
- ^{xvii} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2.6 Pg. 157
- ^{xviii} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2.6 Pg. 157
- ^{xix} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2.6 Pg. 158
- ^{xx} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.2.12 Pg. 169
- ^{xxi} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.5 Pg. 182
- ^{xxii} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.5.3 Pg. 188
- ^{xxiii} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.5.7 Pg. 194
- ^{xxiv} Dillon Consulting (2018) *City of Vaughan City-wide Risk Assessment Appendix 'A'* Feb 2018, Section 10.0 Pg. 64
- ^{xxv} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.10.6 Pg. 210
- ^{xxvi} Dillon Consulting (2018) *City of Vaughan Master Fire Plan – Final Report* Feb 2018 – 16-4492, Section 6.5.1, Pg. 119
- ^{xxvii} OFM (September 2023) *Interpretation of s. 6(3) of the Fire Protection and Prevention Act*