Analysis and Options: National Fire Prevention Association 1710 and Service Levels and Response Time Targets

Before determining options that would bring the City of Calgary's response into alignment with National Fire Prevention Association (NFPA) 1710, the Calgary Fire Department (CFD) conducted a comprehensive analysis of current service levels and performance.
The analysis below describes:

- How CFD response time compares to NFPA benchmarks, and the cost and timelines of closing this gap
- Options for improving CFD's response service levels to better align with Calgary's Service Level and Response Time Targets (SLRTT), along with internal continuous improvement initiatives at CFD that are aimed at improving response time service levels
- Comparison to other Canadian municipalities
- Other factors which have an impact on CFD's response.

NFPA 1710 Benchmarks

To evaluate CFD's current performance and response, analysis focused on response time and its components to identify gaps between Calgary's service levels and NFPA 1710. The CFD's response performance shows a significant gap when measured to NFPA 1710 benchmarks.

Analysis on the three components of response time (dispatch, turnout, and travel) was conducted. Dispatch analysis focused on time elapsed between call received and first, second, third and any subsequent apparatus dispatched by 9-1-1 and potential impacts of alternate protocols, and turnout analysis focused on current performance achievements as compared to NFPA 1710 benchmarks. To examine travel impacts, a multi-stage analysis was undertaken to:

1. Determine what gaps exist in terms of exposed geographic area and risk level with current CFD coverage, assuming no dispatch delays for NFPA 1710 benchmarks. This analysis examined:
   a) the area in which a single engine carrying four firefighters as established by existing Calgary fire stations can reach within either a four-minute travel time (NFPA 1710) or four-minute, thirty second travel time (SLRTT goal), and the resources required to fulfill each response time standard, and
   b) the area in which Effective Response Force (ERF)[1] could be met and the resources required to fulfil each ERF response time standard.
2. Develop scenarios to address coverage for both first-in engine and ERF within the context of NFPA 1710.

[1] Effective Response Force is measured as the time it takes 12 firefighters to assemble at the scene of a fire

Base travel time modelling was conducted, and then refined with data from actual fire incident calls received, as well as factors including construction, traffic patterns and flow, weather, etc. to provide as realistic a representation of actual travel time and first-in engine coverage as possible. Once analysis of gaps and resources required to meet NFPA 1710 was conducted, an analysis of existing gaps and resources required to meet Calgary's SLRTT was also conducted. Below are the options to improve fire service levels that emerged from the analysis. Analysis does account for increased coverage provided by planned growth stations at Belvedere (Q3 2023), South Shepard (2023-2026), West MacLeod (funded for capital, unfunded for operating, 2023-2026) and Haskayne (unfunded, 2023-2026).

Response Time Comparison

The following table uses NFPA standards to measure CFD performance, which vary according to call type and do not match how CFD measures performance.

Table 3.1: CFD actual response time as compared to NFPA 1710 benchmarks

Event/response type (NFPA)		Response time target, 90th percentile (min: sec)	
		NFPA 1710 target times	CFD Performance when using NFPA
			2021
1st-in engin	Fire suppression *(All)*	06:24	08:18
Initial full-alarm assignment/ERF	Single-family dwelling *(Low hazard fire)* *(17 firefighters)*	10:24	14:59
	3-story garden-style apartment *(Medium hazard fire)* *(28 firefighters)*	10:24	17:10
	Open-air strip shopping centre *(Medium hazard fire)* *(28 firefighters)*	10:24	14:46
	High-rise building *(High hazard fire)* *(43 firefighters)*	12:34	16:29

Investment and timeframes to meet NFPA 1710

Travel time analysis determined that within the context of NFPA 1710, substantial geographic areas are outside the NFPA 1710 benchmarks. Implementation of NFPA 1710 would require significant changes over 15-20 years and significant investment. It should be noted that the degree of investment required to meet NFPA 1710 as detailed below is based upon Calgary as it exists today – as the municipality continues to change and evolve, analysis of resources required to meet NFPA 1710 benchmarks will need to be conducted again to determine best-fit

strategies for that future context. The following NFPA strategies would require implementation of the SLRTT strategies listed in Options 1, 2 and 3 under "Options to Close the Gap to SLRTT" below as prerequisites to achieve NFPA 1710 targets.

Table 3.2: Investments to meet NFPA 1710 in Calgary

Target (min: sec)	Operating cost	Capital cost	FTEs
First-in Engine (6:24)	$30.4M	$144M	176
ERF (low-high risk: 10:24-12:34)	$132.3M	$36M	785
NFPA Budget Required	$162.7M	$180M	961
Total SLRTT Budget Required (below)	$51.9M	$51M	315
Total Investment to meet NFPA 1710	**$214.5M**	**$231M**	**1276**

Options to Close the Gap to SLRTT

Shown below is Calgary's overall performance in 2021 compared to the SLRTT:

Table 3.3: Service Levels & Response Time Targets and Current Performance

	First-in Engine/Unit		Effective Response Force*	
	Goal	2021 Performance	Goal	2021 Performance
Fires & fire-related calls	**7:00** (90% of the time)	**7:40** (90% of the time)	**11:00** (90% of the time)	**13:20** (90% of the time)
Critical medical interventions	**6:30** (90% of the time)	**7:08** (90% of the time)	N/A	

***Effective Response Force:** assembling 12 firefighters at the scene of a fire with minimum of 2 engines, 1 aerial

The following options could be implemented to get closer to Calgary's Council-approved SLRTT for fire response service levels.

1. **Increase Staffing Levels and Convert Rescues to Aerials:** This strategy includes increasing staffing levels on existing aerial apparatus from two to four firefighters and

converting six rescue apparatus to aerial apparatus. This will help with ensuring that more aerials are available for emergency calls, and that when an aerial apparatus arrives on an emergency scene, it is staffed with enough people that more critical tasks can be completed faster, without waiting for more firefighters to arrive on separate apparatus.

2. **Increase Aerial Apparatus Fleet:** This strategy would add four new aerials to the CFD fleet. Aerials are important because they offer important functions such as an elevated water stream for firefighting, a safe exit route for firefighters and a way to rescue people who may be trapped above the ground floor of a structure.

3. **Add Fire Stations:** This option explores the impact of two additional stations which will have a major positive impact on first-in response in the areas where the new stations are placed and will contribute to overall ERF improvements.

The analysis looked at apparatus travel time, and areas of exposure for both the first-in engine target of seven minutes and the ERF target of 11 minutes to all fire incidents regardless of structure type. The areas where it is most difficult to meet targets are primarily around the periphery of Calgary, which will be addressed as future fire stations are constructed, however some gaps also exist within established areas and communities. These solutions would provide a total improvement of over 60 seconds in ERF, and significant impacts to first-in engine coverage in specific locations. Table 3.4 outlines the cost and impact of these three options.

Table 3.4: Strategies to meet Calgary's SLRTT

Option #	Target (min: sec)	Strategy	Operating cost	Capital cost	Total FTEs	Predicted Response Time Improvement
Option 1	**ERF**: Strategies to address majority of system gaps (11:00)	Increased aerial and rescue staffing to four per apparatus, initial 2023 implementation on five aerials, remainder in 2026.	$8.6M (2023)	$ -	54	12 seconds
			$20.6M (2026)	$ -	129	13 seconds
		Conversion of 6 rescue apparatus to aerial apparatus	$0	$9M	-	30 seconds

Option 2		4 new aerial apparatus	$14.9M (2026)	$6M	88	17 seconds
	SLRTT ERF Budget Required		$44.1M	$15M	271	
						Response time improvement, per coverage area
Option 3	**First-in engine** (7:00)	1 station, far NW	$3.8M	$18M	22	22 seconds
		1 station, deep SE	$3.8M	$18M	22	54 seconds
	SLRTT First-in Engine Budget Required		$7.6M	$36M	44	
Total SLRTT Budget Required			**$51.9M**	**$51M**	**315**	
Total Response Time Impact of Strategies Combined			**1:15**			

Continuous Improvement Measures: Improve Dispatch Time and Improve Turnout Time

Improving dispatch and turnout time is a challenge faced by almost all fire departments, and CFD continues to work on improving in these areas.

Fire incident data analysis reveals that current dispatch time for the first apparatus takes 1 minute and 28 seconds 90 per cent of the time on ERF responses. The subsequent apparatus can take from 2 minutes, 49 seconds to 4 minutes, 18 second, 90 per cent of the time, to be dispatched. A review of dispatch protocols, in collaboration with Calgary 9-1-1 will proceed internally to develop efficiencies and improve response time. CFD will continue to review dispatch protocols to find opportunities for improvement.

Turnout time is the time it takes from when firefighters are notified in the station, to be enroute to the emergency. The CFD's turnout time target is 90 seconds and NFPA 1710's turnout time target is 80 seconds. CFD's actual turnout time is between 1:57 for first-in engine and 2:07 for ERF, 90 per cent of the time. A review targeted at optimizing turnout procedures will proceed internally.

Comparison with Canadian Municipalities:

The table below compares response time targets by various Canadian municipalities. Our research did not find any comparable municipalities that met NFPA 1710 targets in Canada. Only target times for first-in engine and low risk/single family dwelling response are represented below.[2]

Table 3.5: Response Level Targets by Comparable Canadian Cities

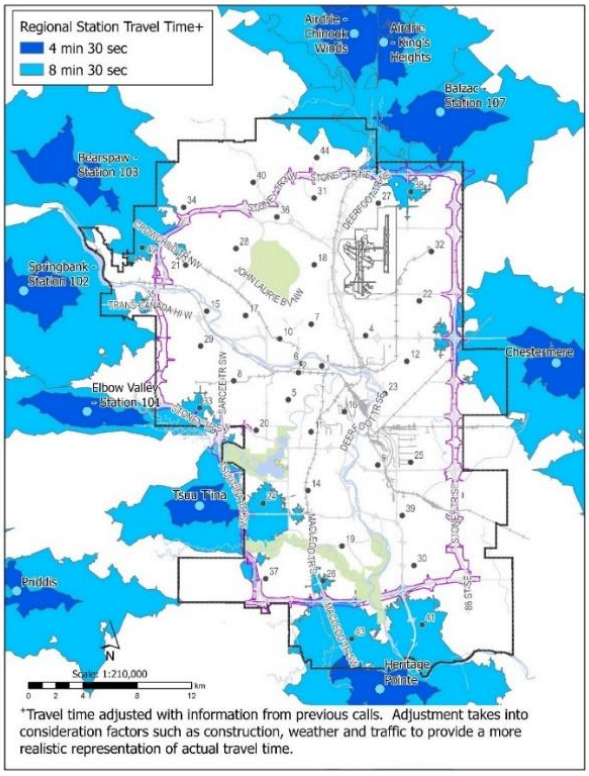
[2] Due to the variation in response to the less frequently occurring medium and high-risk scenarios tied to the differing municipal composition of the cities surveyed, these scenarios are not reported below.

Municipality	First-in engine		Effective Response Force	
	Target Time (min: sec)	Staff Dispatched	Target Time (min: sec)	Staff measured to target time
Calgary	7:00	4	11:00	12 (minimum 2 engines, 1 aerial)
Edmonton	7:00	4	11:00	16
Ottawa	7:41	4	12:12	16
Toronto	6:24	4	10:24	24
Montreal	6:24	4	10:24	19
Halifax	8:00	4	11:00	14

Regional Response

The secondary regional response agreements that exist with surrounding municipalities enable CFD to fill gaps in response for outlying areas of Calgary. The stations in Figure 3.1 can provide support to outlying locations within municipal boundaries within eight minutes thirty seconds if CFD identifies that support is required and dispatches these responders. Expansion to these agreements for automatic aid, that is, response from secondary regional responders without CFD-directed dispatch into Calgary proper, could be explored in the future. It is likely that any expansion would also see a request for automatic aid from CFD to surrounding municipalities and rural areas, and any contract or agreement modifications would require an extensive legal and risk analysis as well as analysis of the response and interoperability capabilities of the agency providing the automatic aid.

Figure 3.1: Regional response impacts within Calgary city limits



Additional considerations: Relief factor, equipment moves and growth

Relief factor has a substantial impact on CFD availability and coverage. This is the additional component of firefighters serving on shift to ensure continuity of service as staffing levels fluctuate due to illness, vacation, injury, leaves of absence, and training, among other factors.

If insufficient staff are present to ensure minimum staffing requirements are met or staffing levels are nearing that point, several triggers will occur:

1) Staff will be called in on overtime to fill gaps in the system,
2) Training activities will be cancelled (a risk to the municipality as a well-trained fire service is essential for public safety and is also now a legislative requirement), and
3) Apparatus will be shifted around the system to close gaps in service.

Apparatus movement occurs on an almost daily basis. This creates inefficiencies, and potential delays in response.

In November 2021, Council approved an increase to the complement of firefighters to support relief factor, and recruitment for these firefighters is currently underway. It is recommended that relief factor continue to be monitored and evaluated as these new firefighters are hired and move into active duty to determine impacts and if relief factor requires further support in the future.

In addition, fire coverage is accounted for when budgeting for new community growth. If Council directs CFD to invest to reach SLRTT through the 2023-2026 service plans and budgets process, there will need for a corresponding increase in fire service budget for new communities, so that each new station has the capacity to reach SLRTT.

Preliminary analysis indicates that for each two stations, one to two new auxiliary apparatus (depending on auxiliary apparatus staffing levels), such as an aerial, would be needed to improve coverage. Currently, new stations are only budgeted with one engine. Also, should NFPA be adopted as a guiding document, new growth stations should be planned based on a 4-minute travel time rather than the current 4 minutes, 30 second travel time from SLRTT, which would increase the total number of stations needed.