Breaking into emergency shuttle service:
Aspects and impacts of retracting buses from existing scheduled bus services

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OVERVIEW

To deal with rail service interruptions transit agencies retract buses from scheduled services to offer shuttle services

Nevertheless, very few efforts are found in the literature to assess the effectiveness of this strategy and explore its impacts

This study aims at exploring the different aspects and impacts of dispatching buses from scheduled routes to deal with subway and streetcars service interruptions in Toronto

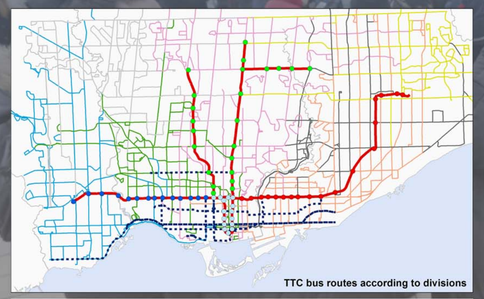
TTC PROTOCOLS

TTC retracts buses from scheduled routes to deal with subway service interruptions according to:

- The location of service interruption, day of week, time period, number of affected stations, and duration of interruption
- Buses are equally retracted from all bus divisions, and bus divisions are advised to retract buses from frequent routes first

TTC has no protocols for streetcar shuttle service, and the decisions are made on an ad-hoc basis

Expected incident time		+30 MINS			1 - 30 MINS		
Closed subway stations		1-4	5-9	10+	1-4	5-9	10+
Percentage (%)		3.33%	6.66%	10%	1.67%	3.33%	5.00%
Time period	Number of buses for regular service	Number of required buses for the shuttle service					
6:00 – 9:00	1325	44	88	133	22	44	66
9:00 – 15:00	881	29	59	88	15	29	44
15:00 – 19:00	1426	47	95	143	24	47	71
19:00 – 22:00	819	27	55	82	14	27	41
22:00 – 1:00	506	17	34	51	8	17	25



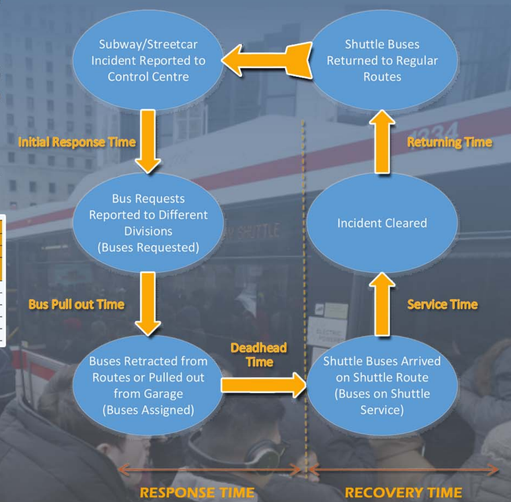
TTC bus routes according to divisions

METHODOLOGY

The study uses detailed subway and streetcar shuttle service reports collected in 2015 by the Toronto Transit Commission (TTC). Each shuttle report includes information about:

- Date, time, subway and streetcar location, direction of travel, incidents start and end time, type of incident and shuttle provided From/To
- Number of requested buses and assigned buses
- Assigned buses vehicle number, scheduled bus routes, time taken from and back to the route

The study utilizes a detailed framework to understand different aspects of the shuttle service workflow



According to this framework, performance measures include:

1. Number of Requested and Assigned Buses
2. Impacted bus routes
3. Response and recovery times
4. Incident types

RESULTS

1. # of requested & assigned buses

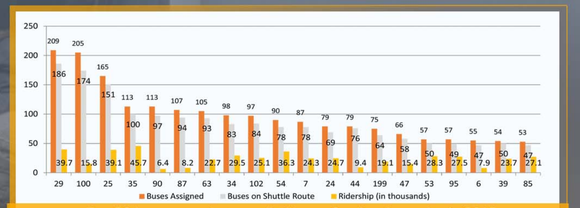
In 2015, the TTC dispatched shuttle bus services in response to 924 and 144 incidents in the streetcar and subway networks, respectively

Buses requested and assigned per incident by mode and weekday vs. weekend

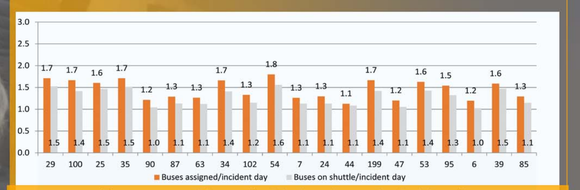
Daily incidents and total daily delay by month

Daily buses requested and assigned by month

2. Impacted bus routes

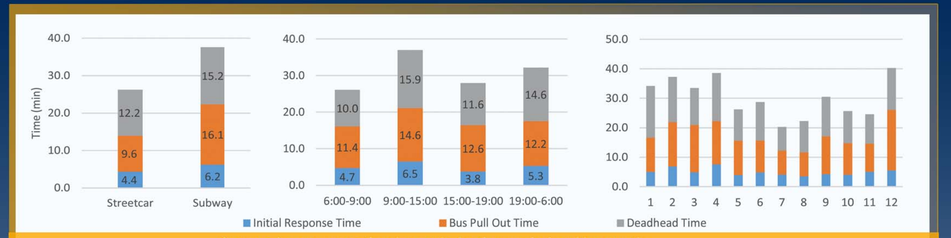


Top 20 bus routes that supplied buses for shuttle service in 2015



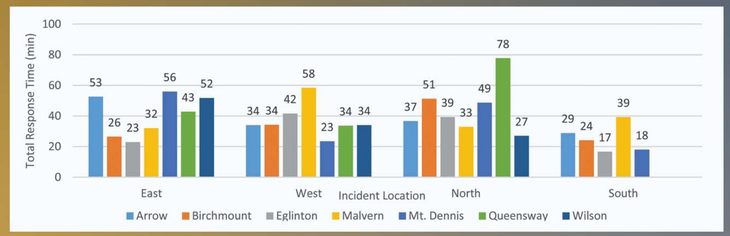
Buses retracted from scheduled service on the incident days

3. Response and recovery times



Average bus response time by mode, by time period and by month

BUS RESPONSE TIME BY LOCATION IN SUBWAY NETWORK AND DIVISION



Average recovery time by mode and by time period

4. Incident types

Reason	Incidents	Buses Requested	Buses Assigned	Average Response Time (min)	Average Clear Time (min)
A. Streetcar incidents					
Auto/Pedestrian Accident	372	1.9	1.8	21.7	53.6
Disabled Streetcar	145	1.9	1.7	18.0	52.9
Cold Weather	83	2.6	2.3	61.3	453.6
Overhead Wire Down	30	3	2.4	31.6	152.8
Working Fire/Fire on Streetcars	15	2.2	2	36.8	85.2
Medical Emergency	11	1.9	1.7	16.8	21.8
B. Subway incidents					
Fire, Smoke or Burning Odour	32	6.3	6.2	31.5	60.8
Power Problem	14	12.5	9.9	52.5	307.2
Suicides on the Subway Tracks	12	9.6	9.4	40.1	111.8
Unauthorized at Track Level	10	6.3	5.6	23.3	51.8
Medical Emergency	10	6.7	7.5	44.6	111
Cold Weather	7	5	4.7	20.8	41.6

CONCLUSIONS

- The paper explores the aspects and impacts of bus bridging using the large-case multimodal transit system of Toronto, offering a better understanding of both the effects of subway and streetcar service interruptions
- There are considerable fluctuations in the number of requested & assigned buses, and in the system response and recovery times that are not only within mode, but also across modes
- The paper highlights the need of more flexible protocols that recognize the variations in system response time over the year, especially during the winter season

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