



# TTC Delays Analysis 2022

Jefferson Galvez

<https://www.linkedin.com/in/jefferson-galvez/> | <https://github.com/JeffersonGalvez> |  
<https://public.tableau.com/app/profile/jefferson.galvez>

# INTRODUCTION

- The **Toronto Transit Commision (TTC)** is an agency of the Government of Ontario, established in 1920
- “The TTC’s mandate is to establish, operate and maintain the local passenger transportation system in the city of Toronto...” [1]
- Public transportation offered: **subway network, light-rail vehicles, streetcars** and **buses**



[1] [City of Toronto - Toronto Transit Commission](#)

# IMPORTANCE OF THE TTC

- The TTC services approximately **1.7 million daily commuters** within Toronto and surrounding municipalities, that's **27.0 % of Toronto's (2022) population**
- **Union Station** is Canada's largest and most complex transit hub, serving subway, light-rail, rail and streetcars, servicing **> 300,000 commuters daily**
- The TTC's Wheel-Trans service transports commuters with **disabilities and mobility challenges**, safely and reliably
- Major disruptions to such services may eventually lead to potential **losses in productivity** and revenue generation for the city of Toronto
- Prolonged impedance to public services may also yield **loss of public trust** in the local government and calls for **organizational reform** or even **privatisation** of the industry

# PROJECT OBJECTIVES



- To assess and identify the major causes of delays to the TTC's regular operations
- Estimate the potential losses and effects of these delays
- Discover possible data-driven actions/solutions to mitigate these delays and increase the quality of service provided by the TTC

# BUS DELAY CAUSES

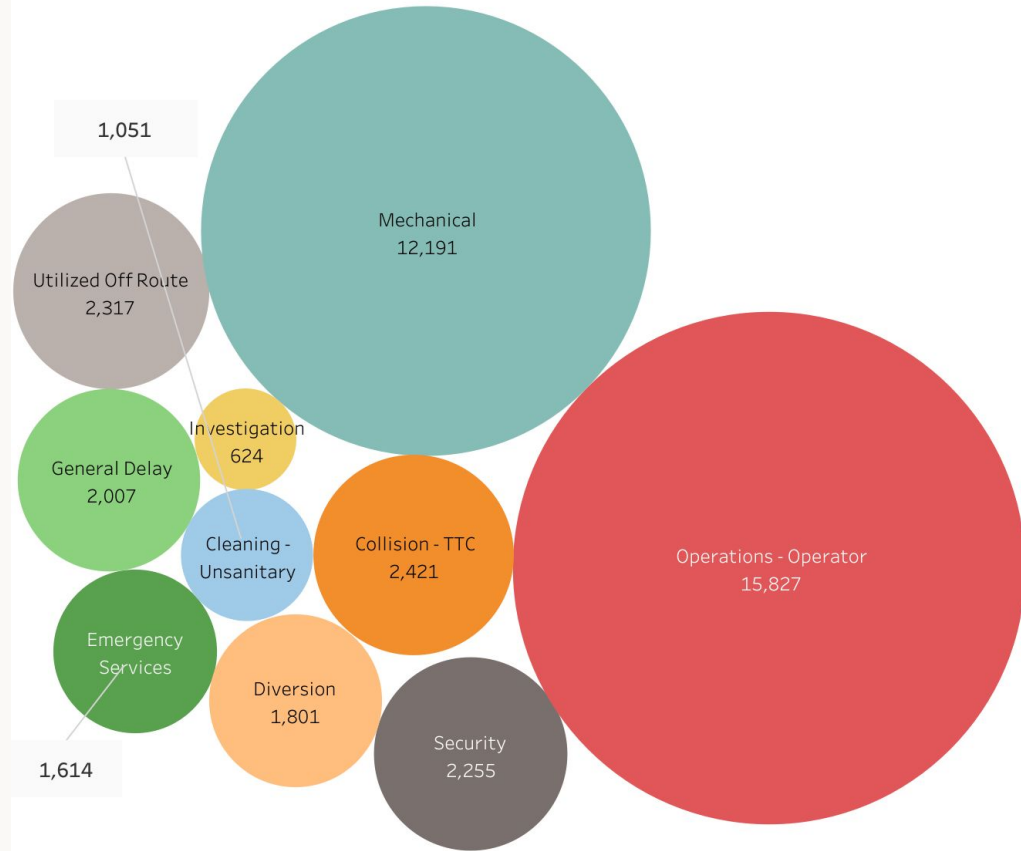
There are a total of **15 unique causes** of TTC bus delays, between January 2022 - September 2022 as reported by the TTC.

Most common cause of bus delays were due to **'Operations - Operator'**, making up **36.6%** of all delays.

Assuming this is a **human error**, it may indicate insufficient or inadequate training of bus operators.

However, other factors which may have resulted in this includes: **Quality of traffic, Road conditions and Capability of buses.**

**'Mechanical' (28.2%)** is the second most common cause. This may suggest that TTC buses are of **poor quality** and lack the maintenance required, to keep them performing optimally.



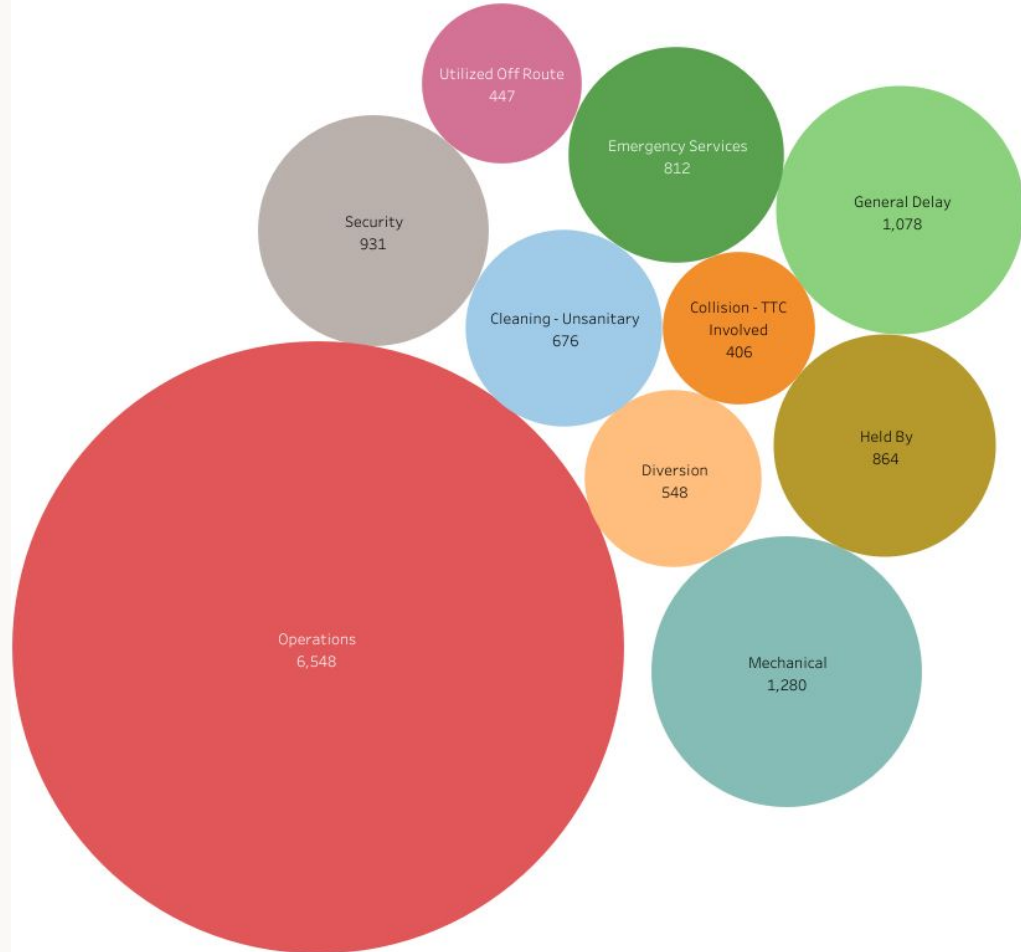
# STREETCAR DELAY CAUSES

There are a total of **15 unique causes** of TTC streetcar delays, between January 2022 - September 2022 as reported by the TTC.

Similar to bus delays, **'Operations'** are the **number 1 cause** of streetcar delays. Constituting **47.1%** of all delays. It is possible the majority of these delays may be **human error** in nature.

However, the lack of 'operator' distinction may also hint that the delay causes are **not directly linked to the streetcar drivers**.

**'Mechanical'** & **'General Delay'** causes are second and third respectively, but only account for **9.2%** & **7.8%**, respectively, of all delays.



# SUBWAY DELAY CAUSES

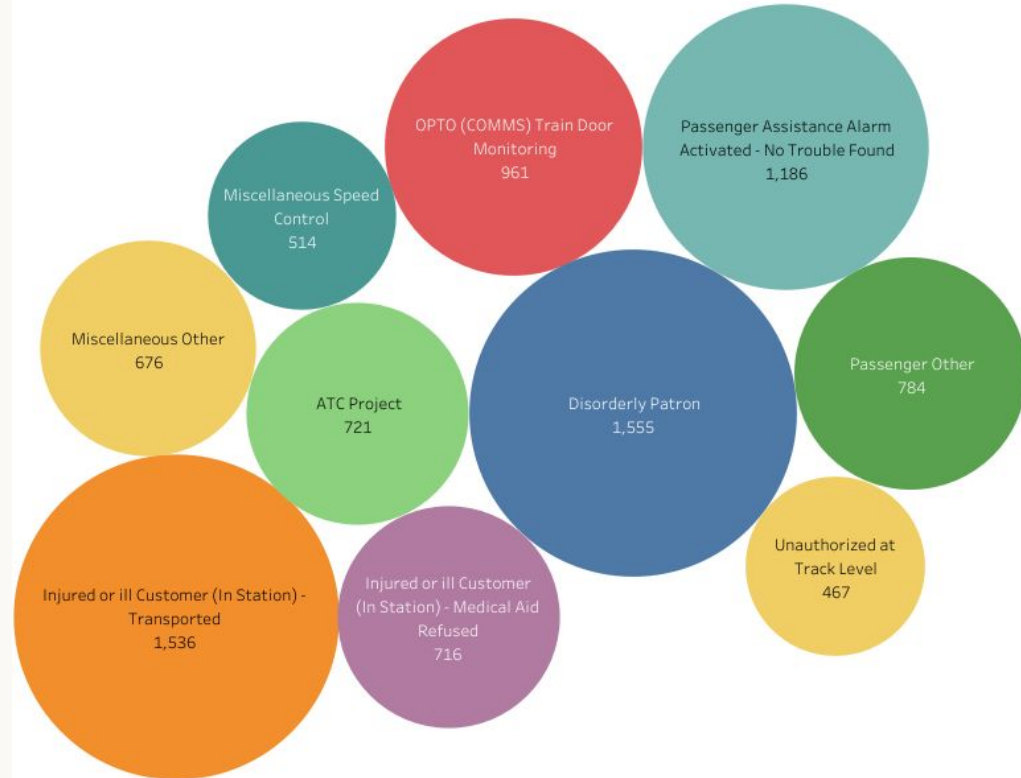
There are a total of **116 unique causes** of TTC subway delays, between January 2022 - October 2022 as reported by the TTC.

The number 1 cause of subway delays are due to **‘Disorderly Patron’** accounting for **9.4%**.

Followed by **‘Injured or Ill Customer...’** at **9.3%** and **‘...Alarm Activated...’** at **7.2%**.

Unlike buses and streetcars, the majority of subway delays appear to be **caused by passengers.**

Interesting to note, ‘Disorderly Patron’ and ‘Injured or Ill Customer...’ are almost 1:1, investigation into whether the two are directly related would be curious



# TROUBLESOME BUSES

The TTC reported **2, 072 individual buses** with mechanically related delays

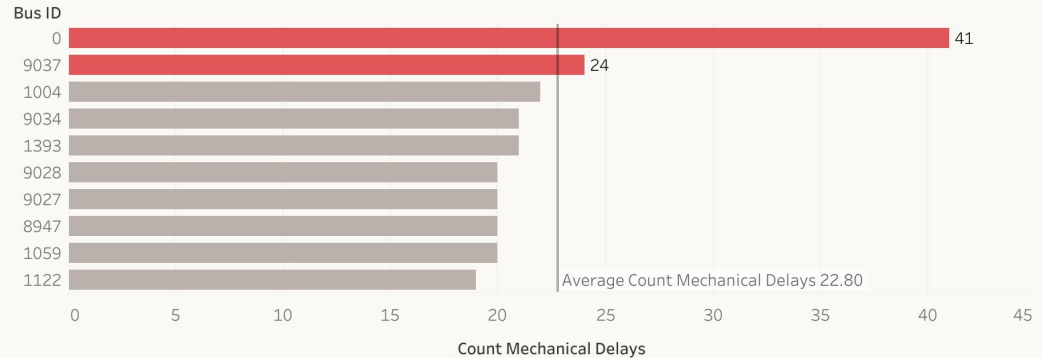
Bus ID 0 had the highest mechanical delays at 41, equivalent to **4.6 per month** from (January to September), bus ID 9037 has the equivalent of **2.7 per month**

It's possible bus ID '0' is invalid, as all other recorded bus IDs were at least 3 characters long

The **average** count of mechanical delays per bus was **5.9**

However, the **top 10** most mechanically challenged had **at least 19 incidents**

The average between the top 10 was **22.8**





# MONTHLY INSIGHTS

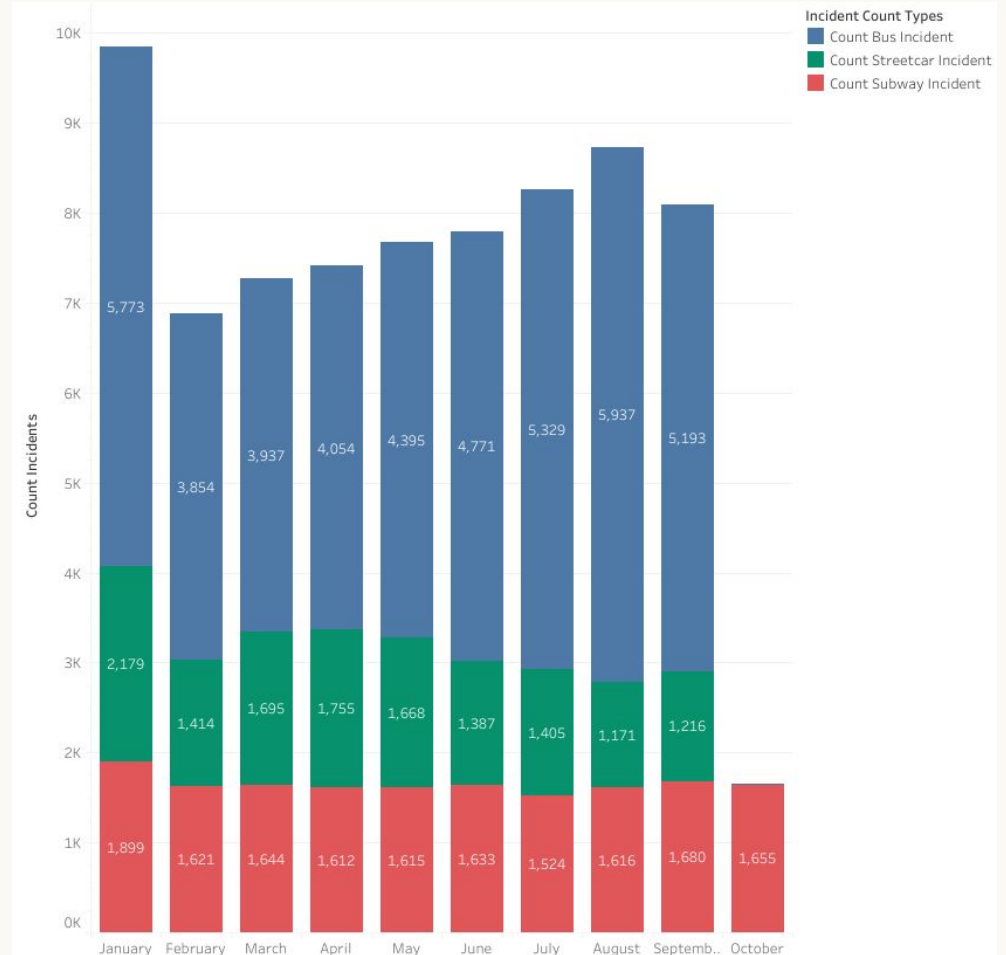
**January** experienced the highest total number of TTC delays, irrespective of service type. Note, this is also the **coldest month in Toronto** [2]

There is a **30.1% decrease** in overall TTC delays in **February**. Seemingly a result of **reactive management** to the prior month's delays

The **highest bus delay count** occurred in **August** (6, 001), not January

Buses experiences a slow growth in delays from February to August, before decreasing again. Whereas, **monthly subway count** in delays are **relatively consistent**

No October delay available for buses and streetcars at the time of this analysis



[2]

<https://weatherspark.com/h/y/19863/2022/Historical-Weather-during-2022-in-Toronto-Canada#Figures-Summary>

# WEEKLY DELAY DURATION

**Saturday and Sunday** currently experience the **highest number of TTC delays**, irrespective of service type.

**Subway delays** are the most **consistent** in terms of duration, whilst bus and streetcar delays are similarly varied.

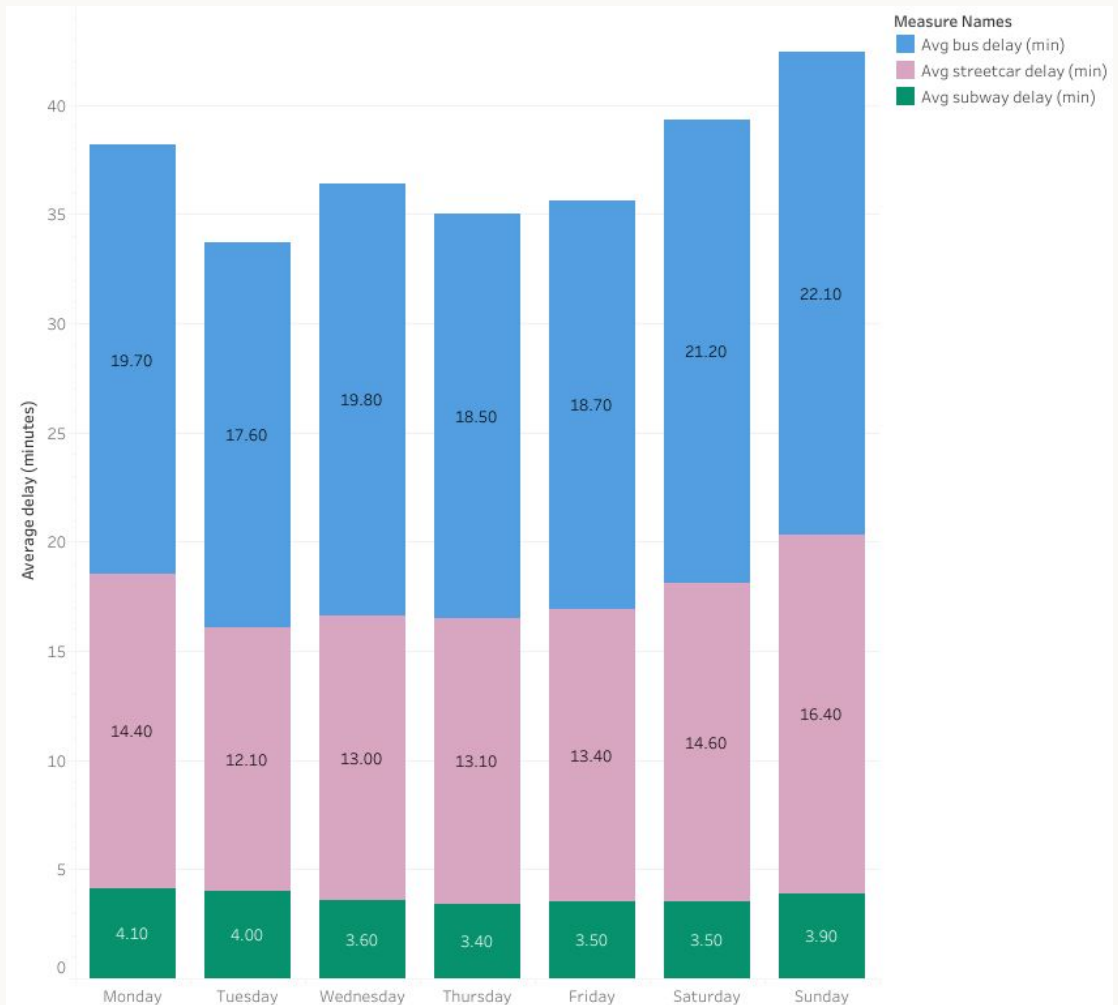
Being subjected to **overground traffic** suggests a **greater variance** in daily delays.

The **standard deviation (SD)** values below further **iterate the variance in delays** between the services:

Bus SD = 1.45

Streetcar SD = 1.30

Subway SD = 0.26



# DELAYS BY THE HOUR

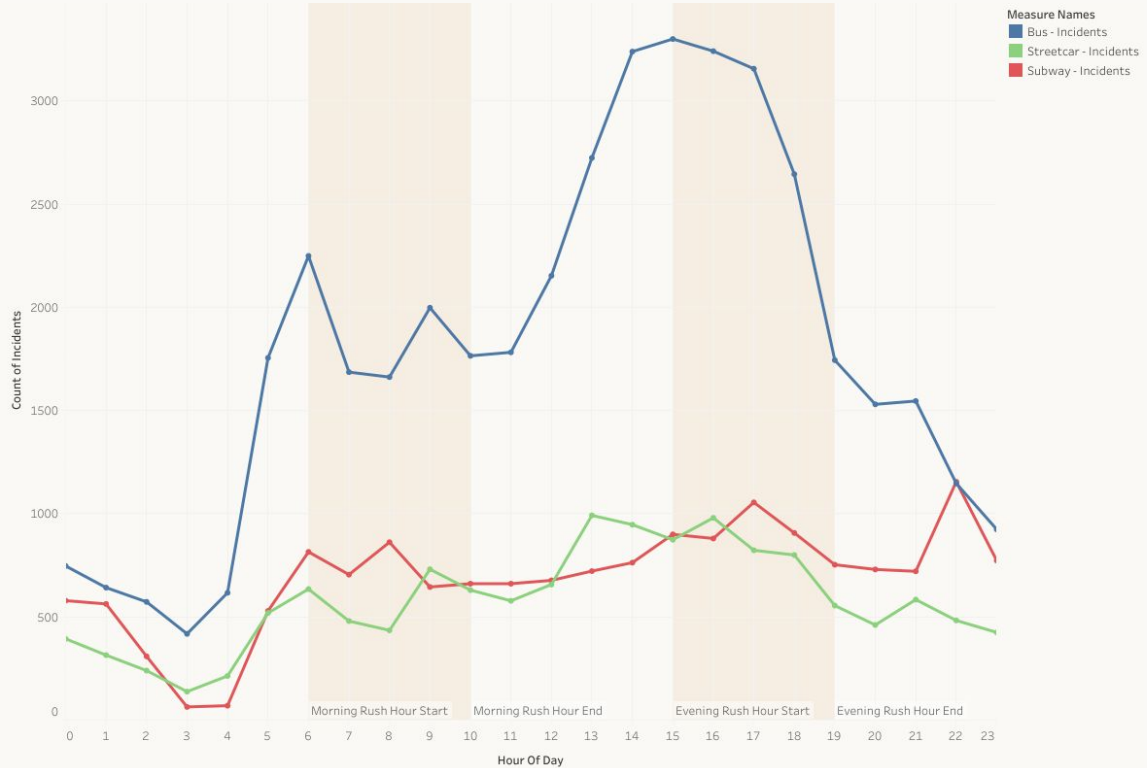
**Buses** experience the most delays in the **first hour of the morning and evening rush hours**, but **decreases by 47%** by 19:00

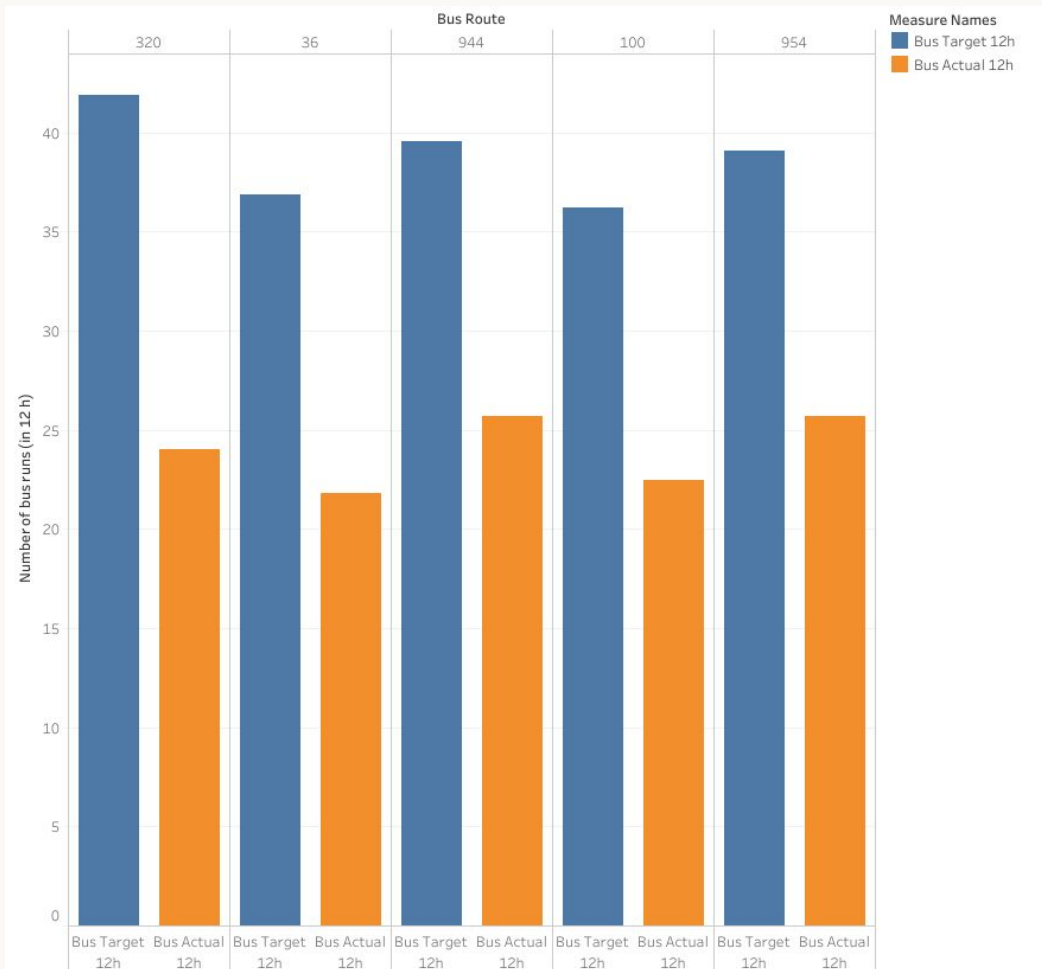
Bus delay count **sharply increases by 260%** between **04:00 – 06:00** and **85%** between **11:00 – 15:00**

**Streetcar** delay **peaks at 16:00** (and 12:00), but also decreases steadily afterwards

**Subways** are **most delayed at 22:00**, but within the rush hour periods, peak in the middle at **08:00 and 17:00**

The **least** amount of overall TTC delays occur at **03:00**



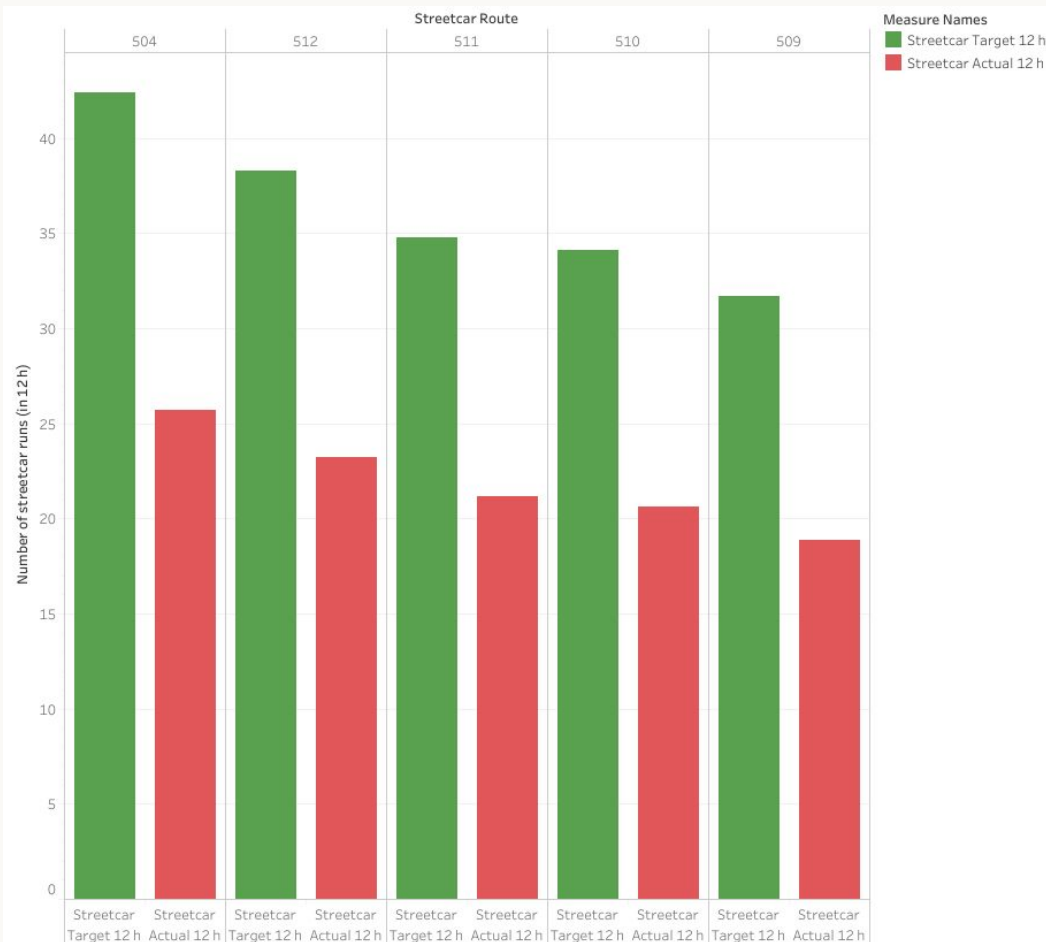


# BUS DELAY EFFECTS ON SERVICES

In a **12 h period**, routes 320, 36, 944, 100 and 954 have the **greatest (effective) loss of scheduled bus services** due to delays

Most common form of delay: **'Operations - Operator'**, except for route 944 ('Mechanical')

As a result of delays, route **320 only delivers 57.3%** of its targeted runs, route **36 only 59.1%**, route **944 only 64.9%**, route **100 only 62.2%** and route **954 only 65.7%**



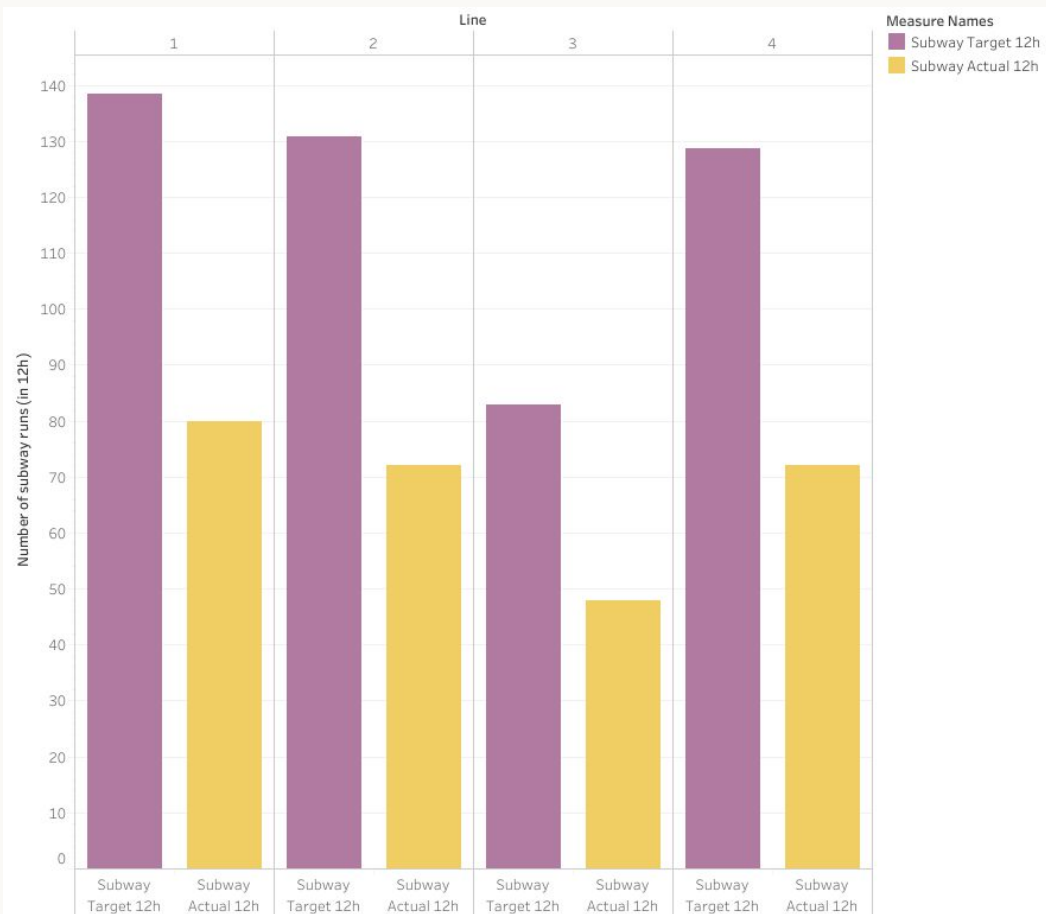
# STREETCAR DELAY EFFECTS ON SERVICE

In a **12 h period**, routes 504, 512, 511, 510 and 509 have the **greatest (effective) loss of scheduled streetcar services** due to delays

All five routes most common type of delay are **'Operations'**

These delays result in route **504 and 512 only delivering 60.6%** of their services, route **511 only 60.9%**, route **510 only 60.4%** and route **506 only 59.6%**

Route 504 has the **greatest difference** between targeted and actual streetcar runs of **16.7**



# SUBWAY DELAY EFFECTS ON SERVICE

In a **12 h period** line 2 (Bloor-Danforth) has the **greatest (effective) loss of scheduled subway services** due to delays

Line 2's most common cause of delay is due to **'Injured or ill Customer (In Station) - Transported'**

Due to higher travel speeds, subways trains have a greater target service value

**Line 2** currently **only fulfills 55.0%** of its targeted services, line 1 only **57.8%**, line 3 only **58.0%** and line 4 only **56.0%**

Meaning that, in 12h, line 2 is effectively losing 58.9 scheduled services due to delays

# THE DATA-DRIVEN SOLUTIONS



# OPTIMIZING BUS SERVICES

- **Further training** may be implemented to alleviate 'Operations - Operator' delays, assuming they are due to the bus driver's **human error**
  - Other factors such as quality of external traffic may also need to be assessed to effectively deploy re-training
- **Maintenance** procedures should be **revisited and made more rigorous** at least – depending on severity of mechanical delay, repeat offenders (bus units) may require replacing
  - Detailed reports on mechanical delay will aid in optimizing the procedure
- Highest delay count occurs in **January**, is this correlation or causation? If truly causation, consider **winterizing** buses and operators if not already in place
- **Increasing service volume** between **11:00 - 15:00**, may ease steep rising delay counts through these hours as this may be due to a lower regular schedule
  - Important to still tackle root causes of delays as increasing service volume may proportionally increase delay count



# OPTIMIZING STREETCAR SERVICES

- **Further significant investigation** required to ascertain which specific element(s) of 'Operations' are responsible for delays
  - E.g.: If operators, **further training** may be implemented. If inefficient conduction, **route planning** may need optimizing and possibly construction of **dedicated lanes** (i.e. absent of conventional motor traffic)
- Similarly to buses, **winterization** of streetcar and tracks may be required to address peak **January** delays
- **Assessment** on the impact of **increasing streetcar service** volume during **rush hours** should be carried out – would such an increase only contribute to traffic and delays?
- **Dedicated staff** to oversee **onboard security** may be implemented to increase overall safety of passengers, driver and address 'Security' related delays

# OPTIMIZING SUBWAY SERVICES

- **Onboard and station security** must be heightened to tackle major 'Disorderly Patron' delays
  - This may include present and active **TTC security**, passive measures such as **increased CCTV networks** (with warnings) or preventative measures, such as **stern station gates**
- Clear and bright **warnings of (legally enforceable) fines** should be present around alarms to prevent misuse and reduce 'Passenger Assistance Alarm Activated - No Trouble Found' delays
- Investigation into **health and safety liabilities** onboard and at stations and **faster access to medical attention** from services are recommended to ease 'Passenger Assistance Alarm Activated - No Trouble Found' delays
- **January** peak delays may be due to **increased ridership** this month, in response to increased bus and streetcar delays, thus increased likelihood and count of subway delays



# CONCLUSION

- All three services types are currently severely **under-delivering** due to delays, loss of revenue as a result has not been investigated, but suspected to be **compelling**
- **Significant improvements** to **buses and streetcar operations** are required to solve the majority of their delays
- Subway trains and stations are in dire need to **improve security and health and safety measures** to mitigate most of their delays
- **Maintenance and repair protocols** of buses and streetcars require **refinement** – potentially being an **'easier'** fix to delays **relative** to other causes
- Delays during rush hours **do not** spike as one may **expect**, efforts to ease delays can be focused on **hours leading up to rush hours**