Improving Transit Safety and Security

Prepared By: Jacqueline Darwood
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INTRODUCTION

Transit customers rely on transit operators to provide reliable and safe day-to-day public transit services.

To improve safety and reliability of transit systems, many key engineering implementations have been innovated.

These include improvements in station planning/design and rail operations and simulation.

In addition, based on recent facts and evidences, extreme physical and cyber threats become more common and even more dangerous to the public.

INTRODUCTION

WHAT FACTORS IMPACT TRANSIT SAFETY - Transit safety and security is directly impacted by the plan, design ad operation of the system

HOW CAN TRANSIT SAFETY & SECURITY BE IMPROVED -Transit safety may be affected by deliberate acts or by accidents

TOOLS AND TECHNOLOGY TO IMPROVE TRANSIT SAFETY AND SECURITY – AI, Passenger Modelling Software, Operations Modelling Software and BIG DATA.

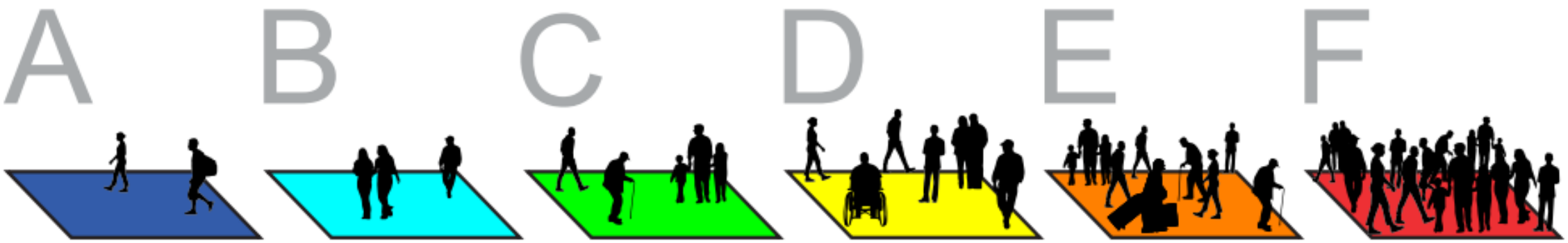
Rail Transit Infrastructure

- Rail gradient and alignment
- Ventilation Systems
- Stations
- Communications
- Signal Systems
- Vehicle Storage
- Fleet

Improving Planning and Design of Station

- Level of Service
- Vertical circulation Elements
- Platform Width
- Service Frequency
- Vehicle dwell time
- # of customers boarding and alighting trains

Level of Service	Flow Rate *(pedestrian/minute/meter)*	Density *(pedestrian per squared meter)*
A	≤ 7	≤ 0.08
B	7 - 23	0.08 - 0.27
C	23 - 33	0.27 - 0.45
D	33 - 49	0.45 - 0.69
E	49 - 82	0.69 - 1.66
F	≥ 82	≥ 1.66



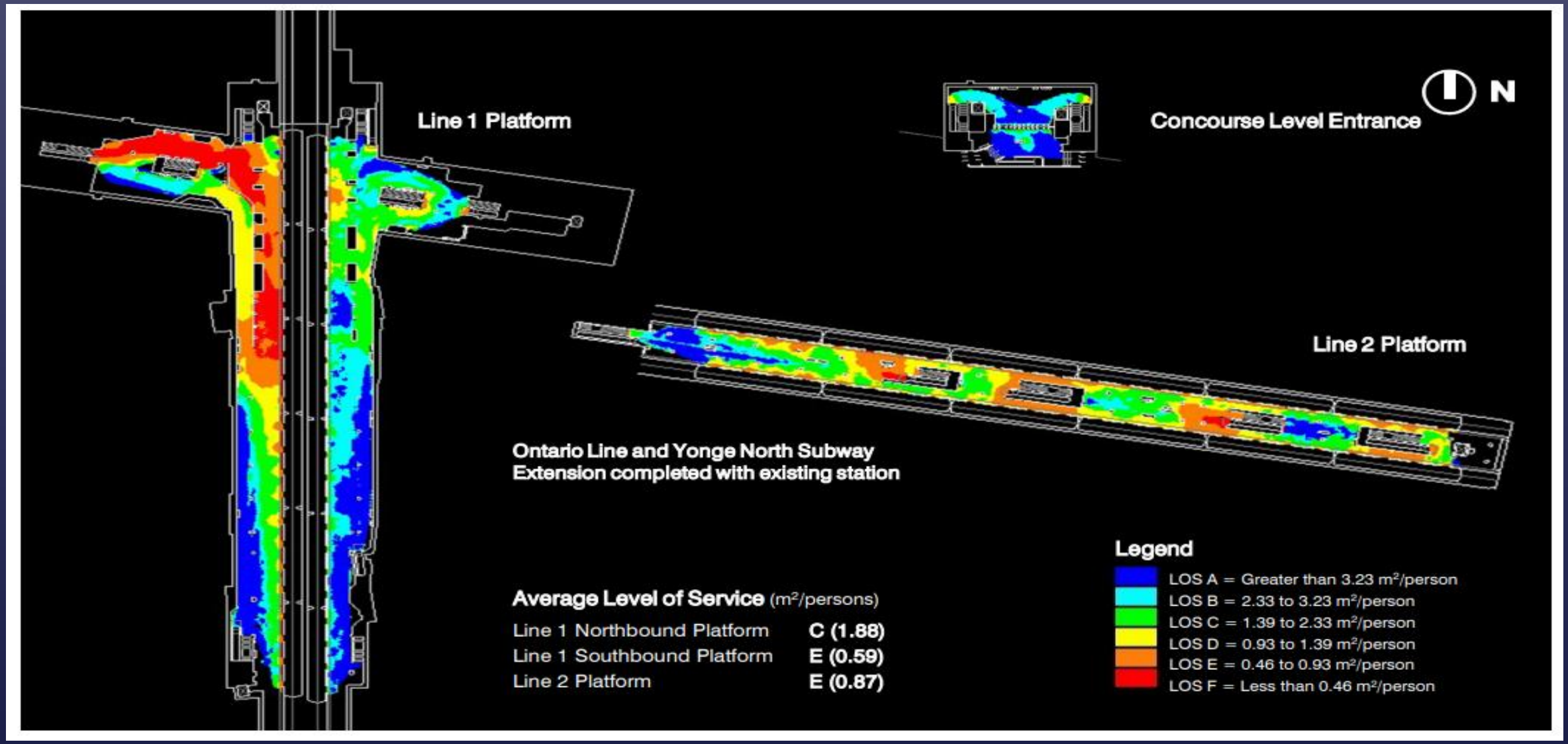
Level of service	Definition
A	Free circulation
B	Uni-directional flows and free circulation with only minor conflicts.
C	Slightly restricted circulation, with difficulty passing others. Reverse and cross-flows with difficulty.
D	Restricted circulation for most. Reverse and cross-flows with significant difficulty.
E	Restricted circulation for all. Intermittent stoppages and serious difficulty for reverse and cross-flows.
F	Complete breakdown of flow with frequent stoppages.

Fruin’s Levels of Service

Improving Station Safety – Station Capacity Planning

- Passenger Modelling
- Vehicle modeling
- Integrated Railway and Pedestrian Simulation.
- Crime Prevention Through Environmental Design principles

Bloor Yonge Level of Service 2031 AM Peak

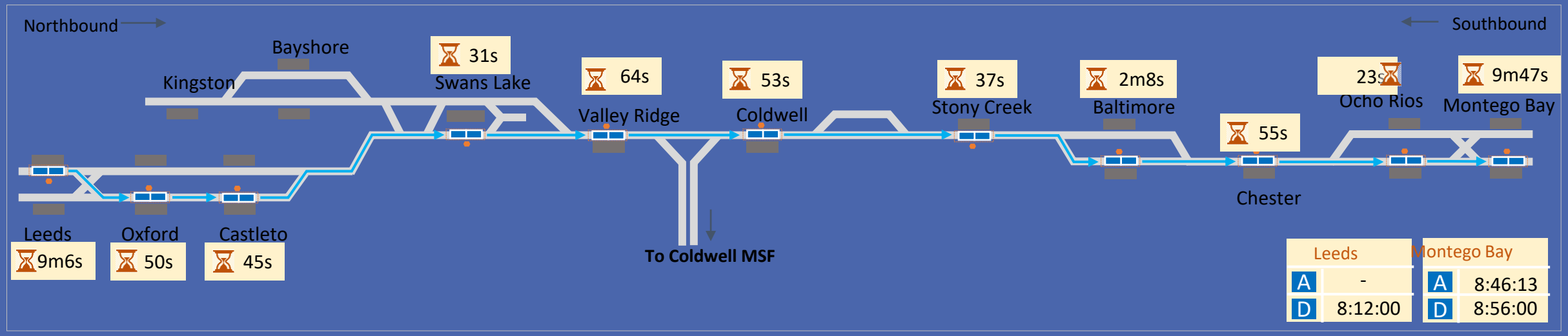


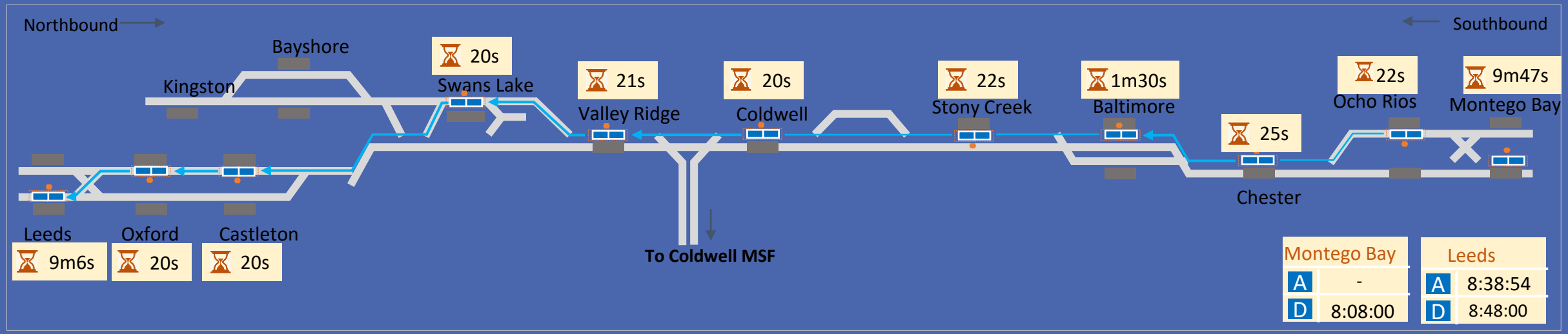
Source: TTC Board Report Dec. 2021

Improving Planning and Vehicle Operational Modeling

- Simulate railway movements and conflicts in the corridor.
- Modelling of vehicle characteristics, track alignments and grades, signalling systems and track routing.
- Simulation of train movements follows a specified timetable with delay distributions at predetermined locations

Single Line Operational Modeling – Station Dwell Time





Mainline Train | Stop at the Platform | Dwell Time | Transit Time | A Arrival Time | D Departure Time

Safer Operations – TTC Bloor/Yonge Capacity Improvement

- Expansion of Line 1 northbound and southbound platforms
- A new second platform to enhance capacity for eastbound passengers on Line 2
- Line 2 original platform reconfiguration to enhance capacity for westbound passengers
- A new barrier-free entrance
- A new exit to Bloor Street
- New escalators, elevators and stairs

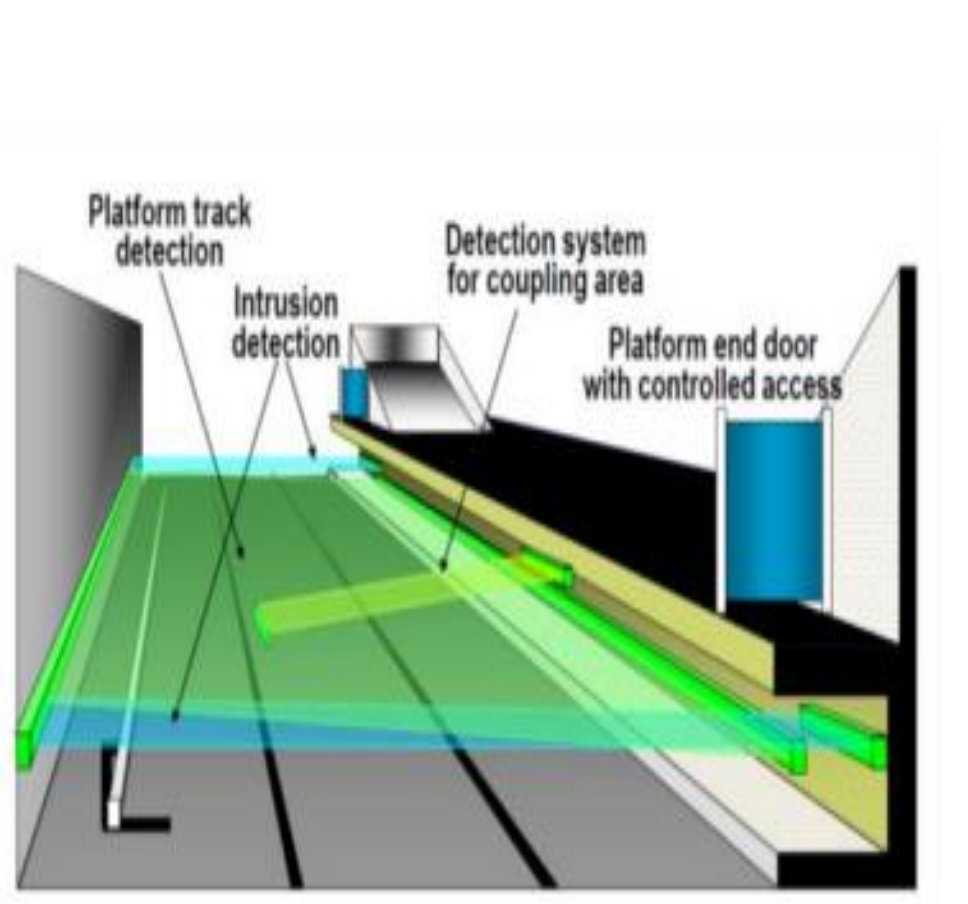
Platform Congestion Bloor/Yonge 1973 after Line 1 Extension

Station Operations Improvement

- Eglington Crosstown
  - All 15 stations will be equipped with a Guideway Intrusion Detection System (GIDS) that uses laser scanners to sense when people and objects enter the tracks.
  - Installation of Platform warning scanners above the yellow tactile strips that sit on the edge of the platforms.

  In the event that a person steps onto the tactile strips, the scanner triggers an automatic audio message that plays over the station PA system.

Guideway Intrusion Detection System



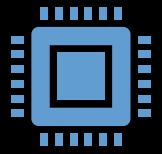
Source: Guideway Intrusion Detection Systems for Rail Transit APTA Rail Baltimore 2017

Platform edge detection in stations which do not have screen doors

Detection along the railway tracks and other points of intrusion

MONITORING

Platform Edge Doors



CCTV for Platform Monitoring and Motion Mass Detection System monitored by CBTC to stop train

Apply AI to the data that we are already collecting e.g. Automated Fare Collection, to identify changes and trends in passenger flow to support service frequency adjustments

Adjust programing of fare gates to delay entry to overcrowded platforms

Apply AI applied to do video analytics - Detecting and alerting about potential issues such as aggressive or furtive behaviour

NEXT STEPS

Collaboration

Research/Testing

QUESTIONS?