

INTEGRATED PLANNING, ENGINEERING, & OPERATIONS IN LRT DESIGN

A CASE STUDY OF THE CITY OF EDMONTON'S METRO LINE EXTENSION

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RAIL CONFERENCE //



Outline

- Part 1 Background
- Part 2 Problem Statement
- Part 3 Literature Review
- Part 4 General Procedure & Analysis
- Part 5 Outcomes & Key Takeaways





PART 1: BACKGROUND





Suburban LRT





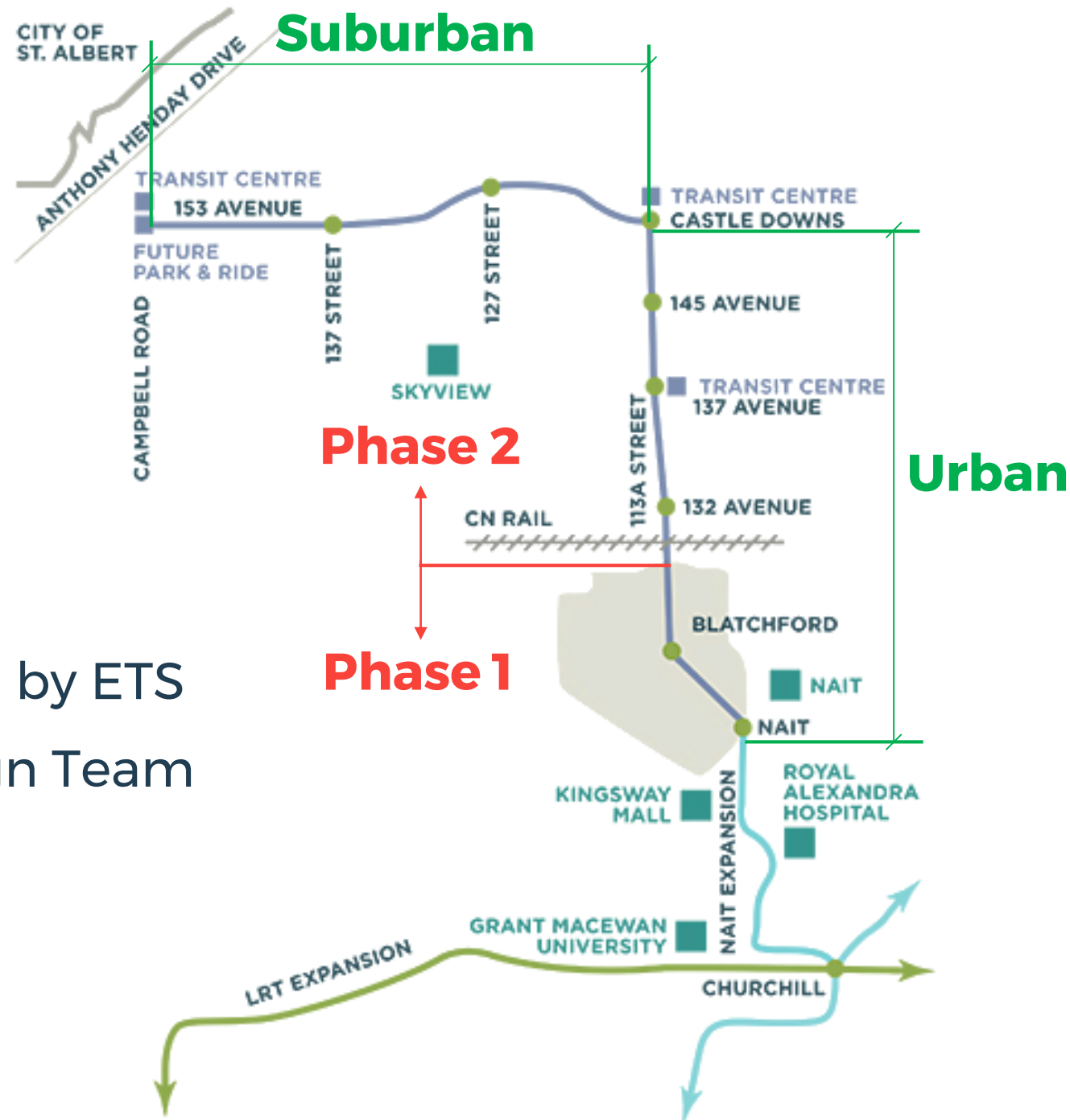
Urban LRT





Metro Line Extension

- Planned in 2 Phases
- 11 km and 9 stations
- First Urban Style corridor operated by ETS
- WSP part of the Engineering Design Team





PART 2: PROBLEM STATEMENT



New Risks Introduced and Questions to be Answered

- Can intersection / guideway safety concerns be addressed?
- Will there be unacceptable delay / service variability?
- Can greater reliance on operator vigilance be accepted?
- Can speeds be increased above the current line sight rules?

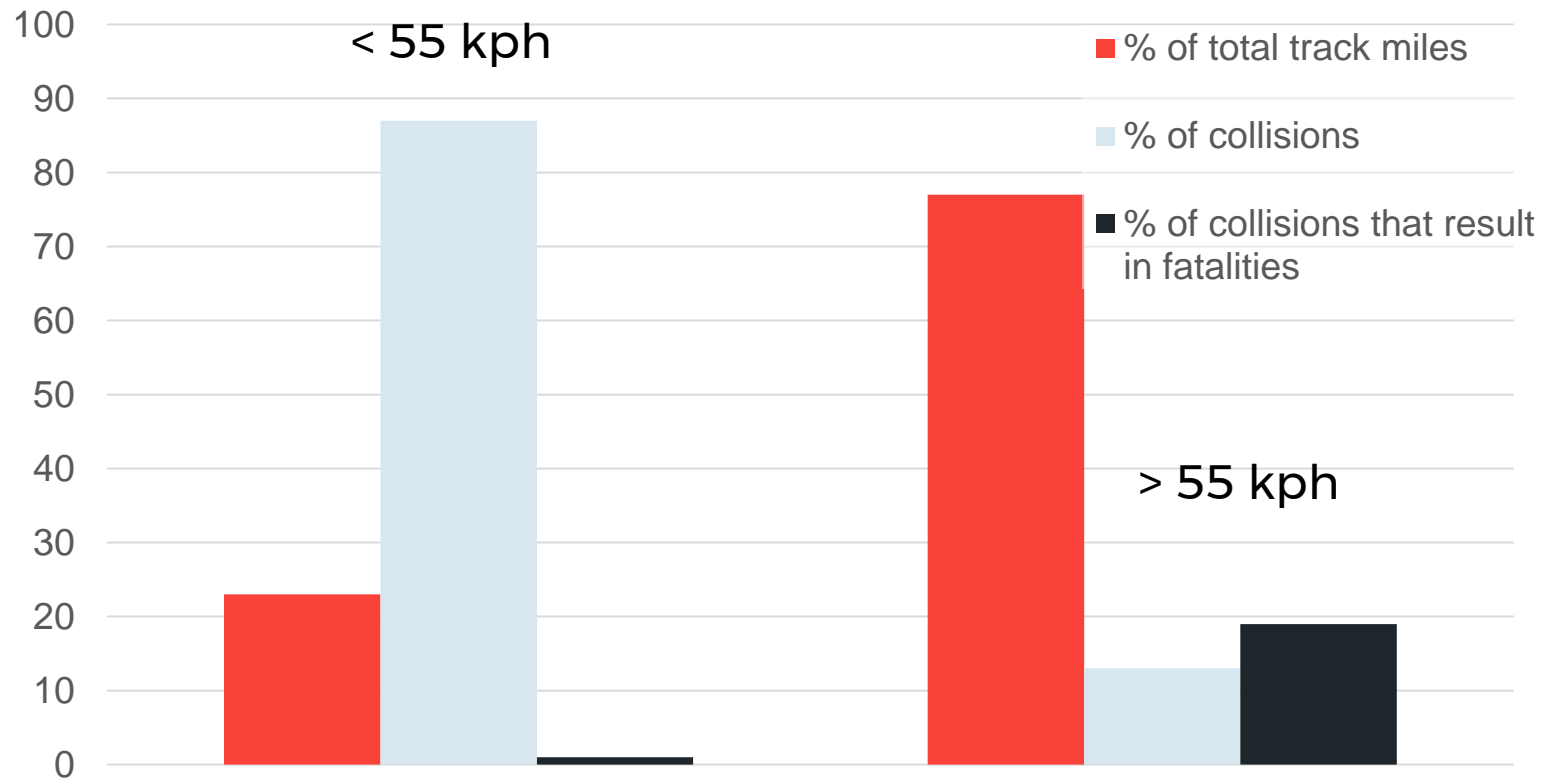
How can efficiency (cost, performance) be maximized while achieving safety?



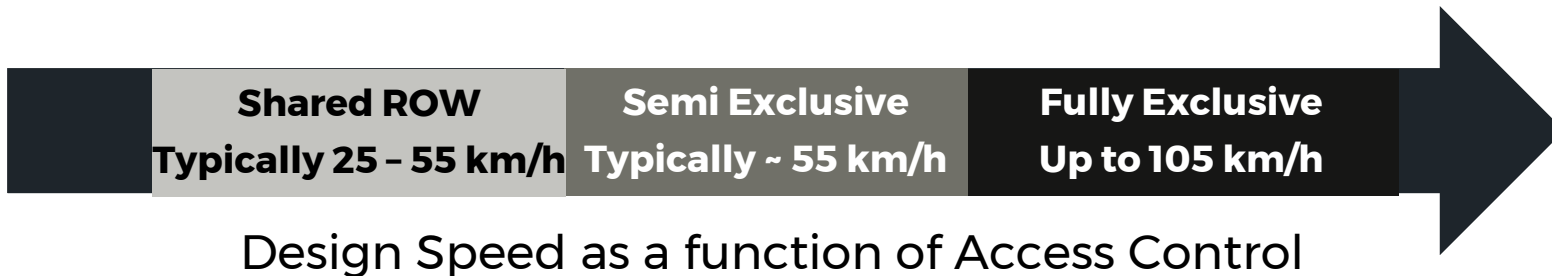
PART 3: LITERATURE REVIEW



Operating Speed compared to Collision Incidents



The data proves it: Highly urban, low-speed systems have more collisions but with reduced severity



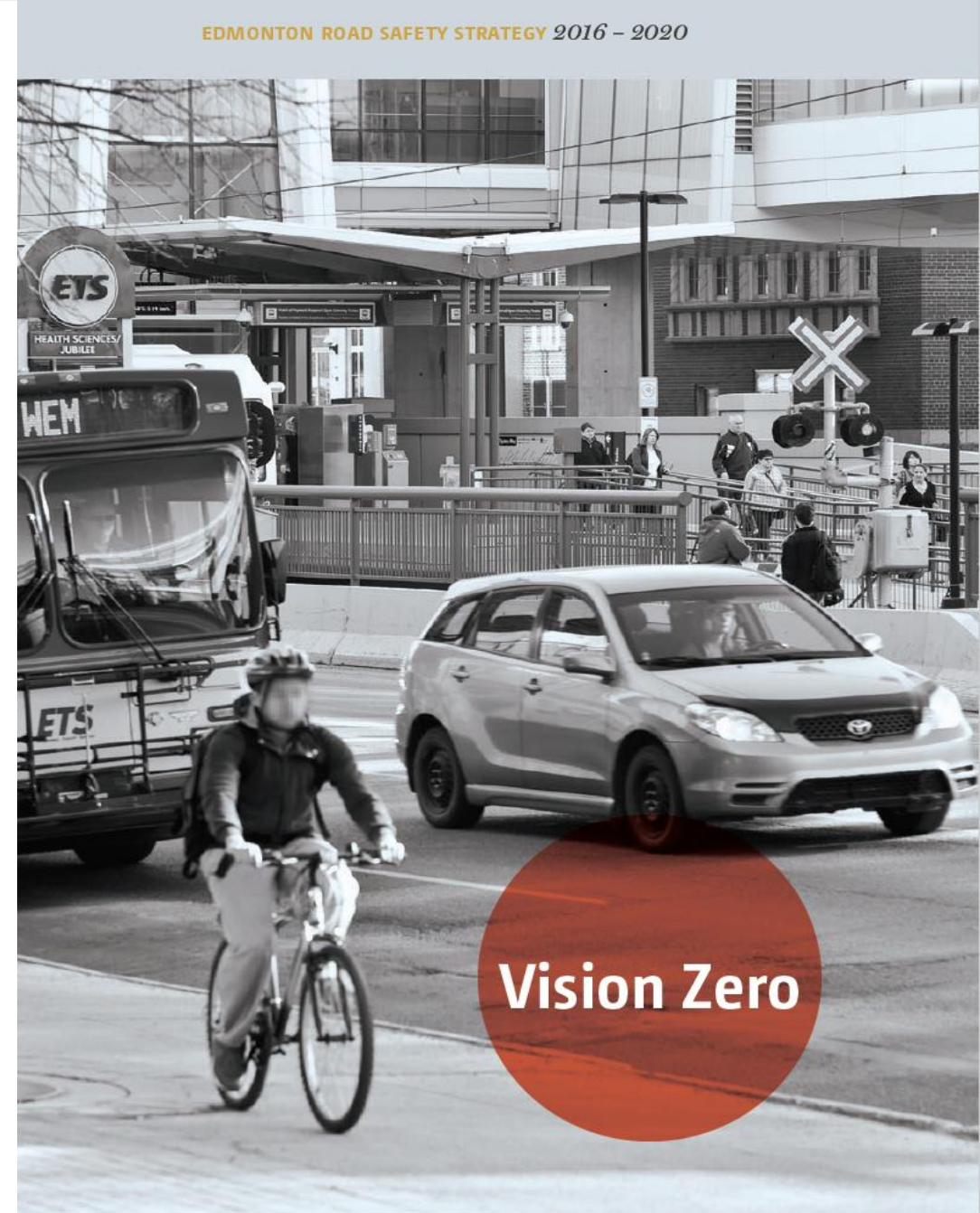


Vision Zero

Edmonton is the first Canadian city to officially adopt Vision Zero

Scenario	Max Speed
Locations with possible conflicts between pedestrians and cars	30 km/h
Intersections with possible side impacts between cars	50 km/h
Roads with possible frontal impacts between cars	70 km/h
Roads with no possibility of side impact or frontal impact (only impact with infrastructure)	100+ km/h

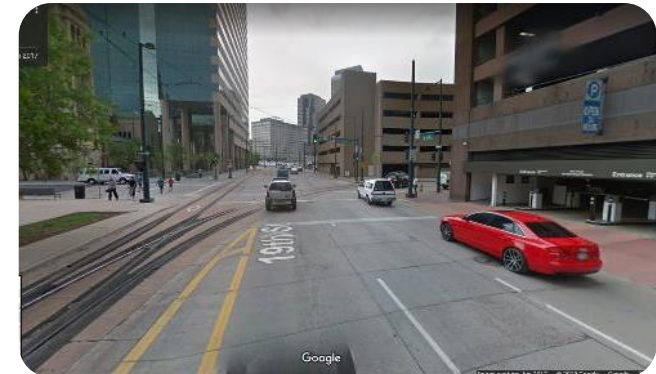
Strong Correlation can be seen to TCRP Access Control Requirements





Benchmarking against Similar North American Systems

Agency, City	Speed in Urban Environments	Access Control Description
San Diego Trolley, Inc., San Diego ¹	Posted speed limit	Downtown – Street Running; Otherwise, Fully Separated
RTD, Denver ¹	30 km/h	Street Running
Calgary Transit, Calgary	40 km/h	Downtown - Street Running
TTC, Toronto ¹	40 - 60 km/h	Street Running or Centre Running
TRI-MET, Portland	55 km/h	Centre Running
Waterloo LRT, Waterloo (Ontario)	20 - 50 km/h	Mixed. Street running, Centre or Side Running.



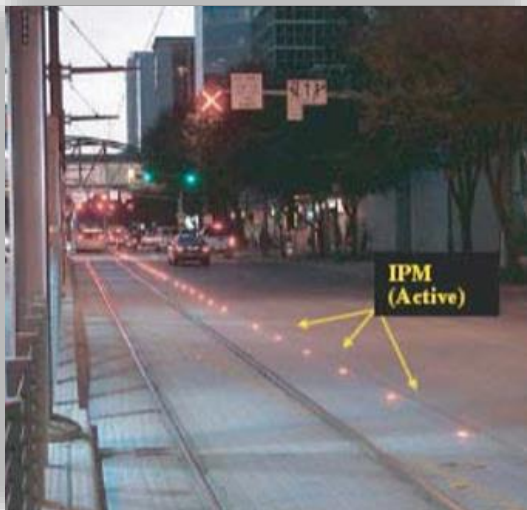
1. Team conducted deep-dive analysis in partnership with other Transit Agencies to analyze rulebook deltas to support migration to Urban Style



Sample 'Toolbox' of Solutions to Mitigate Hazards

Planning	Design	Operations
Regulatory Framework	Signs and Signals (LRVs and Public)	Rules (sighting requirements)
Urban Integration Strategy	Architectural control	Speeds
Technology Strategy	TSP	Training

The Urban LRT **integrated team** is thoroughly equipped to tackle the task at hand.



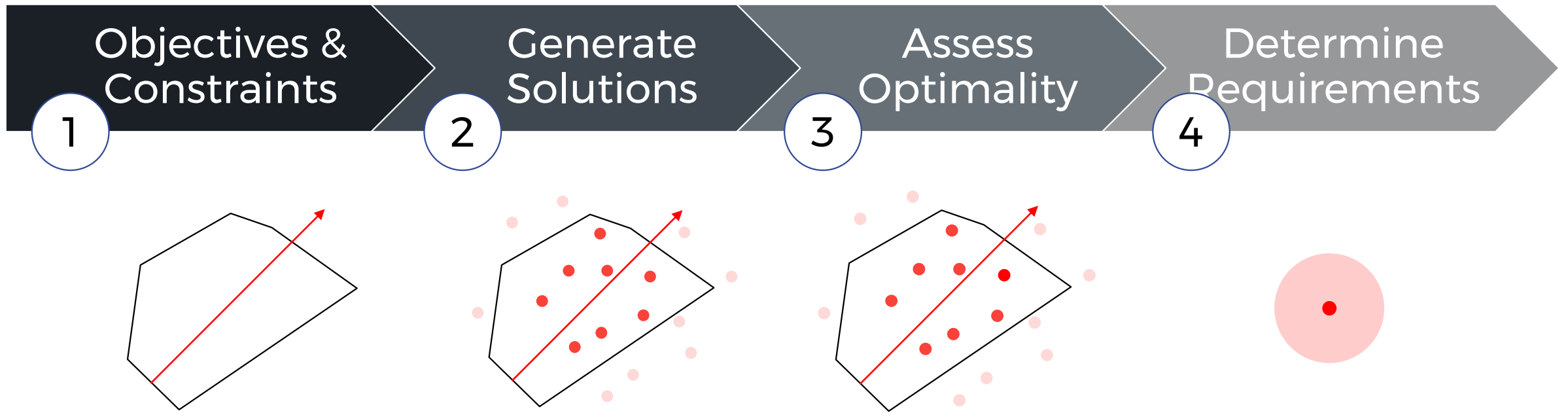


PART 4: GENERAL PROCEDURE & ANALYSIS



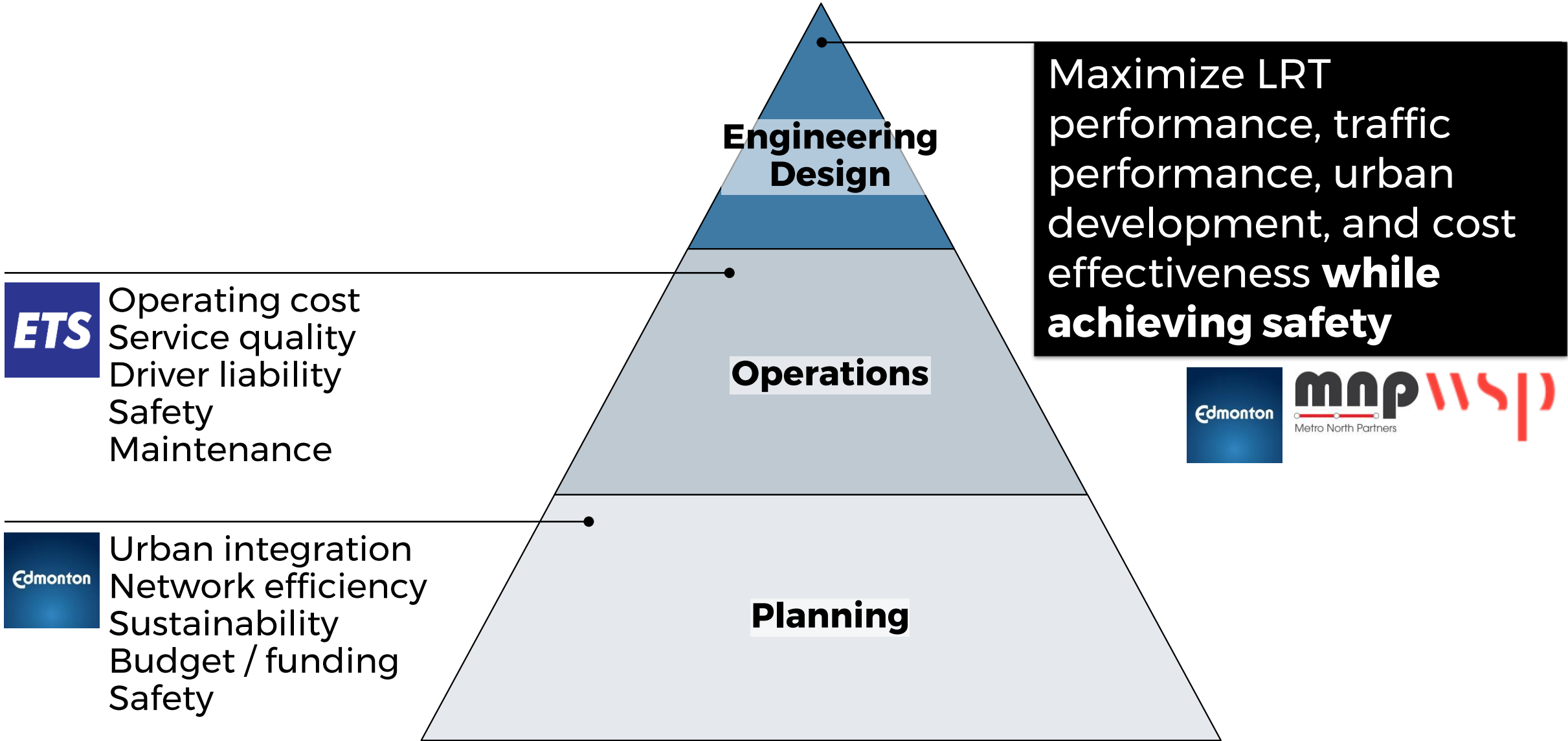
Design Procedure

How can efficiency (cost, performance) be maximized while achieving safety?



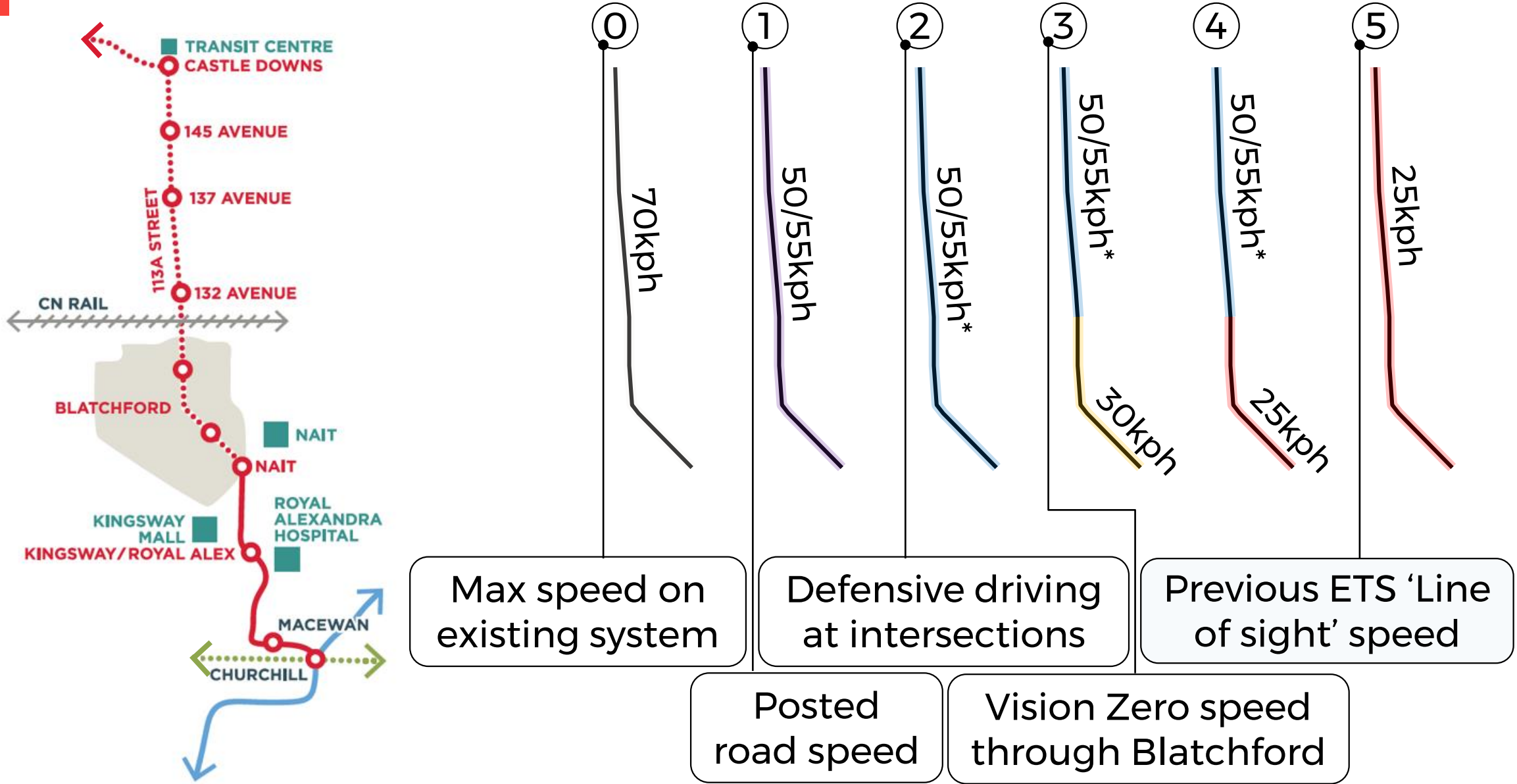
1

Define objectives and constraints



2

Generate feasible solutions



3

Assess Optimality

Quantitative analysis through simulation:

- Iterative performance simulations
- Integrated simulation process
 - OpenTrack -> Rail Operation
 - VISSIM -> Traffic Operation
 - Data exchange

LRT

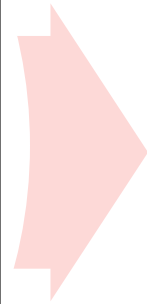
PTV VISSIM

Traffic

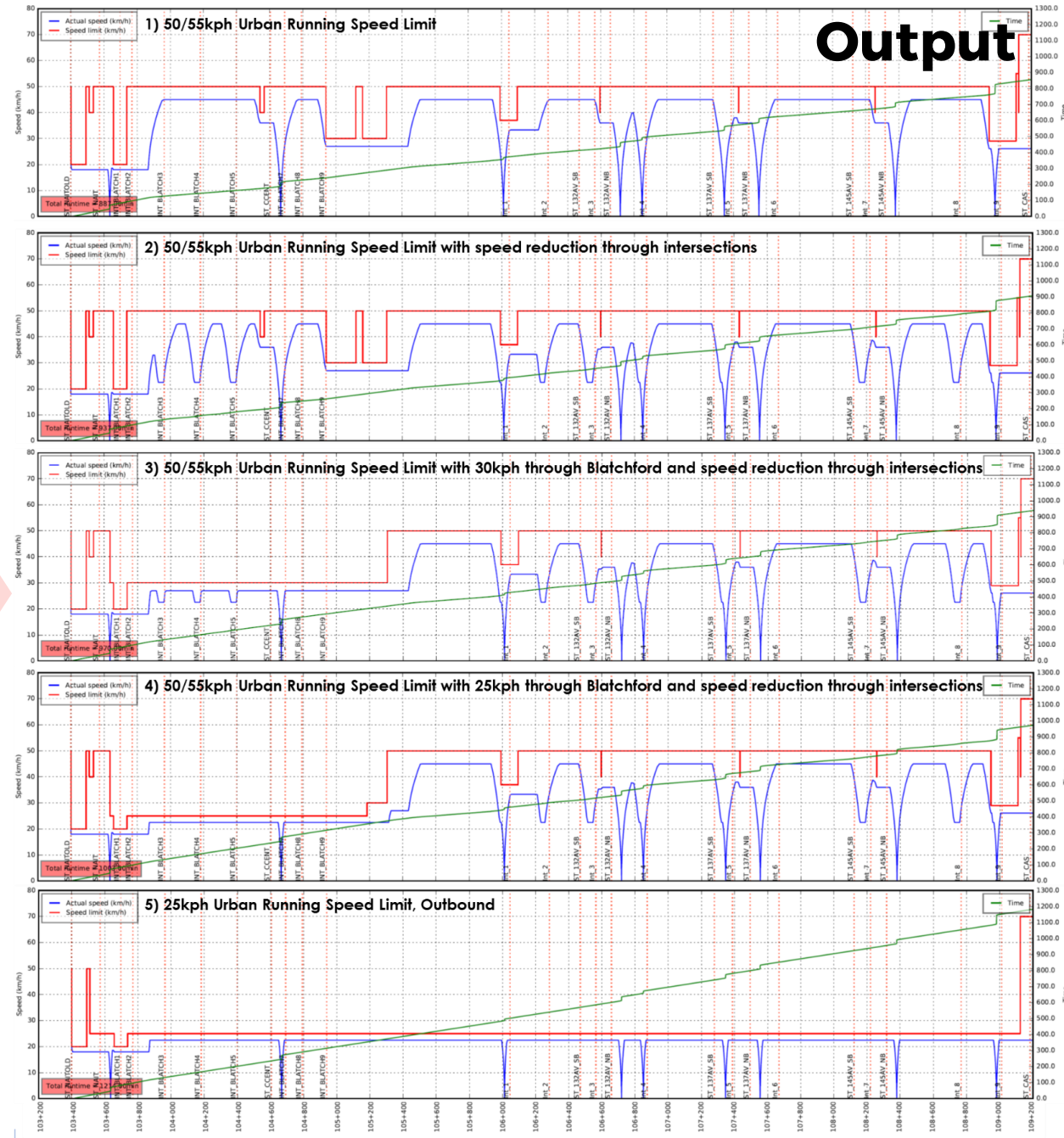
Rail



- Runtime estimation



Output



3

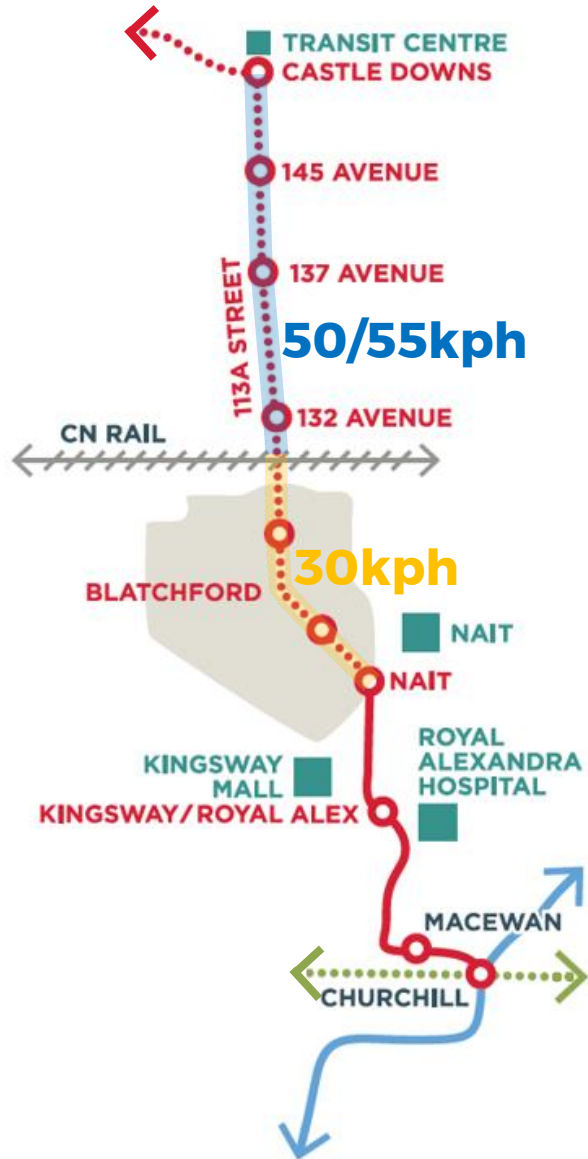
Assess Optimality

Operating Scheme	LRT Performance		Traffic Performance		Urban Development		Cost
	Travel Time (minutes)	Impact on Traffic	Urban integration potential	Fleet Size	Extent of access control		
Existing system speeds	NA	Major	Less	NA	High		
Posted road speed	44	Minor		9			
Posted road speed with defensive driving	46 (+2)	Minor		10			
30kph through Blatchford	47 (+1)	Minor		10			
25kph through Blatchford	48 (+1)	Minor		10			
25kph over corridor	55 (+7)	Minor	More	11	Low		



4

Define Requirements



Operations:

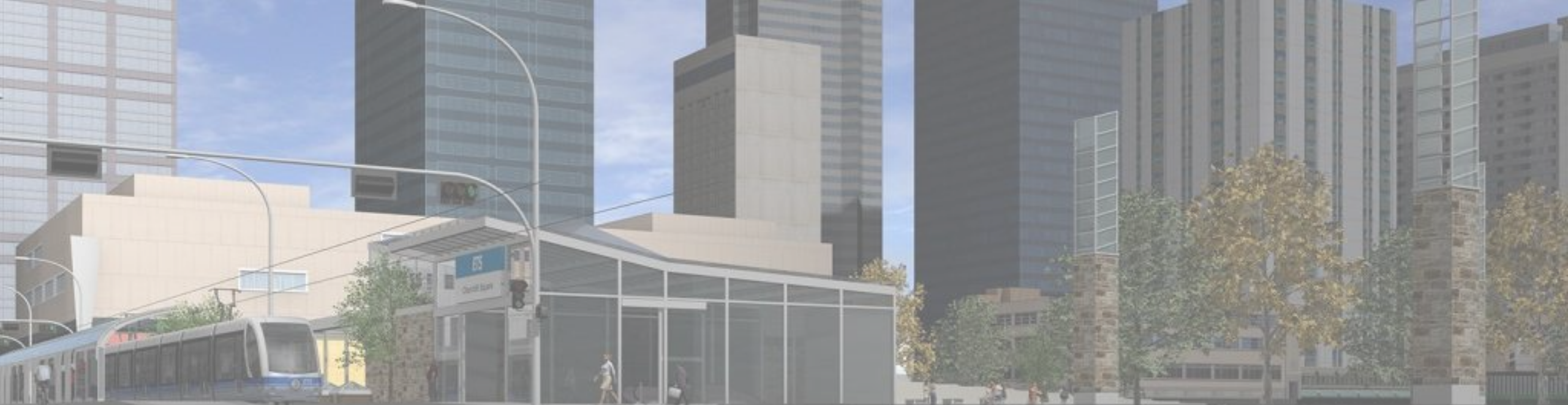
- Speed limits
- Operator training; defensive driving
- Line of sight stopping

Design:

- TSP
- ROW classification according to TCRP
- Potential design treatments

Public

- Training and education



PART 5: KEY TAKEAWAYS



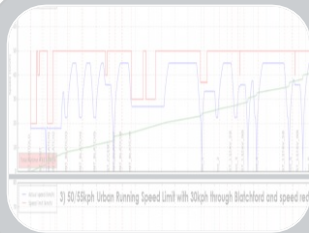


Key Takeaways



Leverage **Existing Research, Designs, and Best Practice** to assess feasibility.

Work Smarter, not Harder.



Multimodal Interactions can be **modelled** to demonstrate evidence of **Optimization**



Optimized Designs through stakeholder engagement:

8min travel time saving, 2 LRV saved

How can efficiency (cost, performance) be maximized while achieving safety?



THANK YOU