

Streetcars: The Missing Link?

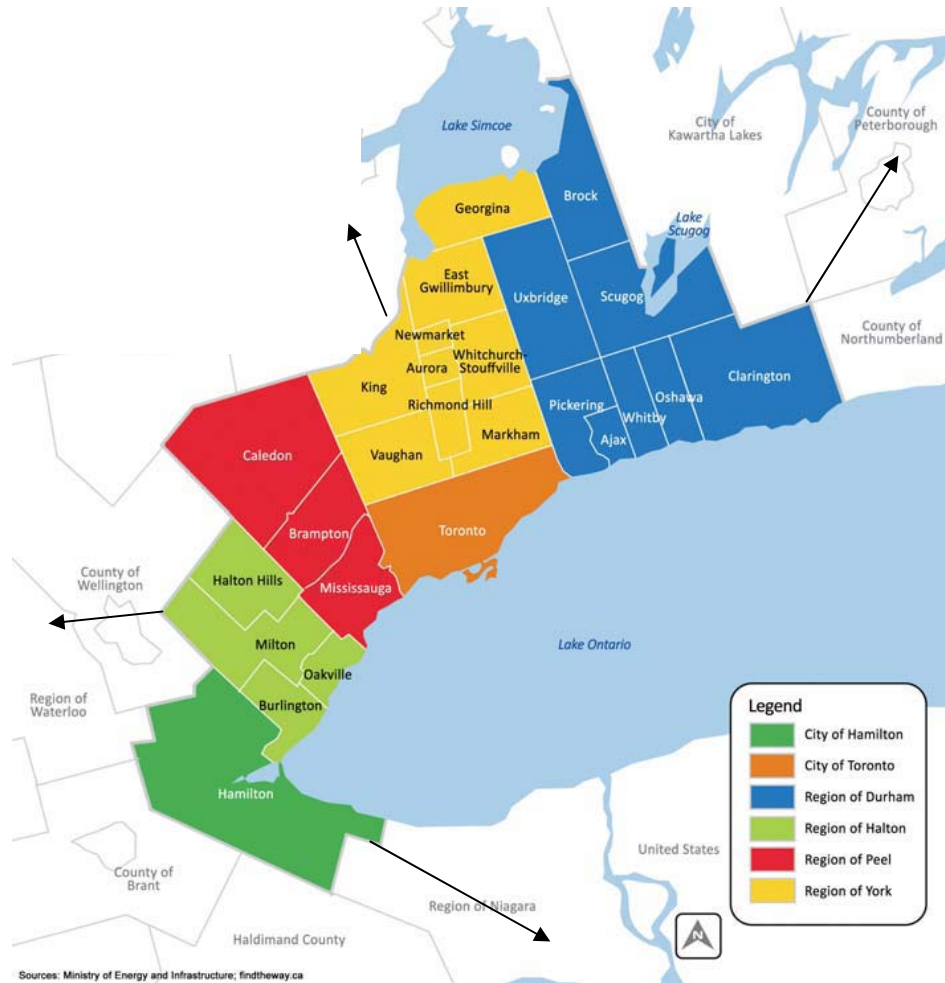
Jack J. Collins
Vice President, Metrolinx

University of British Columbia
September 29, 2010

Topics

- What is Metrolinx?
- Metrolinx Big Move Projects
- What is new with Toronto Streetcars?
- Resurgence of Streetcars in United States
- Things to keep in mind when considering Streetcar vs. Light Rail
- Getting it Right
- Questions?

A Tremendous Opportunity for Growth and Prosperity



27 municipalities

**6 million people
now, growing to
9 million by 2031**

Metrolinx Vision and Mission



Vision – Working Together to Transform the Way the Region Moves



Mission – To Champion and Deliver Mobility Solutions for the Greater Toronto and Hamilton Area (GTHA)

The Big Move



In 2008 we produced a plan – The Big Move – a unanimously supported common vision

- 25-year integrated transportation plan
- \$50 billion capital need
- Plan vision
 - Double transit mode share
 - Transit lines would triple in length
 - Despite growth, commuting times would not increase
 - 75% of people living within 2 km of rapid transit
 - GHGs per capita decline significantly



Economic Benefits of The Big Move

Cost of congestion - \$6 billion, and could grow to \$15 billion
in 2031

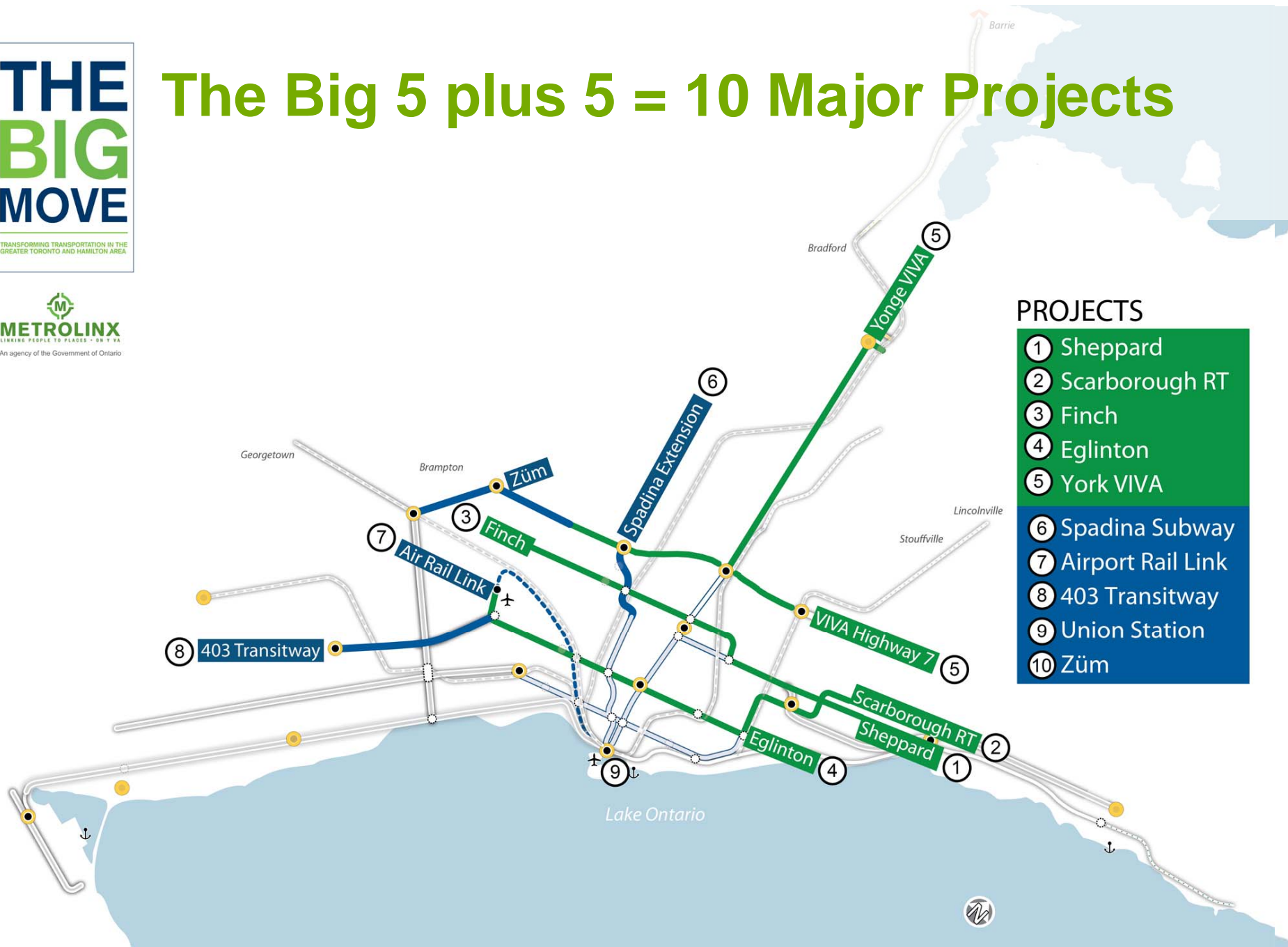
Jobs created building the projects	430,000
Expenditure within Ontario	71%
Employment Income	\$ 21 billion
GDP Growth	\$ 31 billion
Total Tax Revenues	\$ 15 billion

Metrolinx Priorities

1. Get the first five transit projects and Union-Pearson Air Rail Link built. Get these projects done and get them done well.
2. GO Transit – good as it is, it needs to be even better. Make citizens an offer so good, they can't refuse. Expand and improve GO.
3. Develop investment strategy so we never have to play catch up again. Get best ideas on table, get debate going and citizens engaged. Make a recommendation by June 1, 2013.



The Big 5 plus 5 = 10 Major Projects



PROJECTS

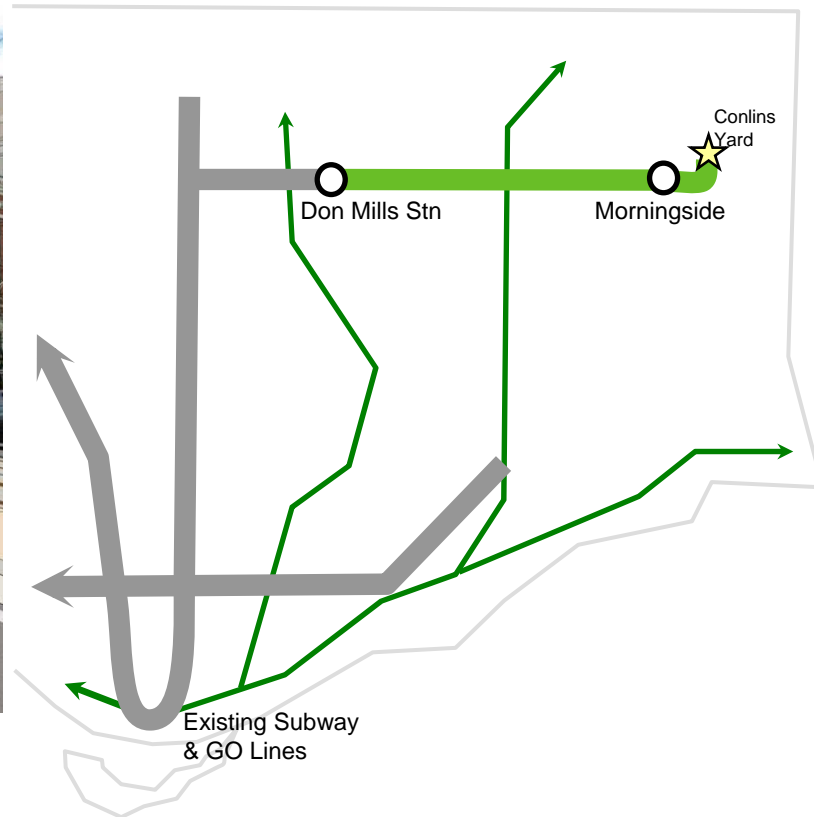
- ① Sheppard
- ② Scarborough RT
- ③ Finch
- ④ Eglinton
- ⑤ York VIVA
- ⑥ Spadina Subway
- ⑦ Airport Rail Link
- ⑧ 403 Transitway
- ⑨ Union Station
- ⑩ Züm

Metrolinx Big 5 Projects Moving Forward

**On June 14, 2010
Metrolinx ordered 182
Bombardier LRV's for
\$770 million**



Moving Forward – Sheppard LRT



Metrolinx Big 5 Projects Moving Forward

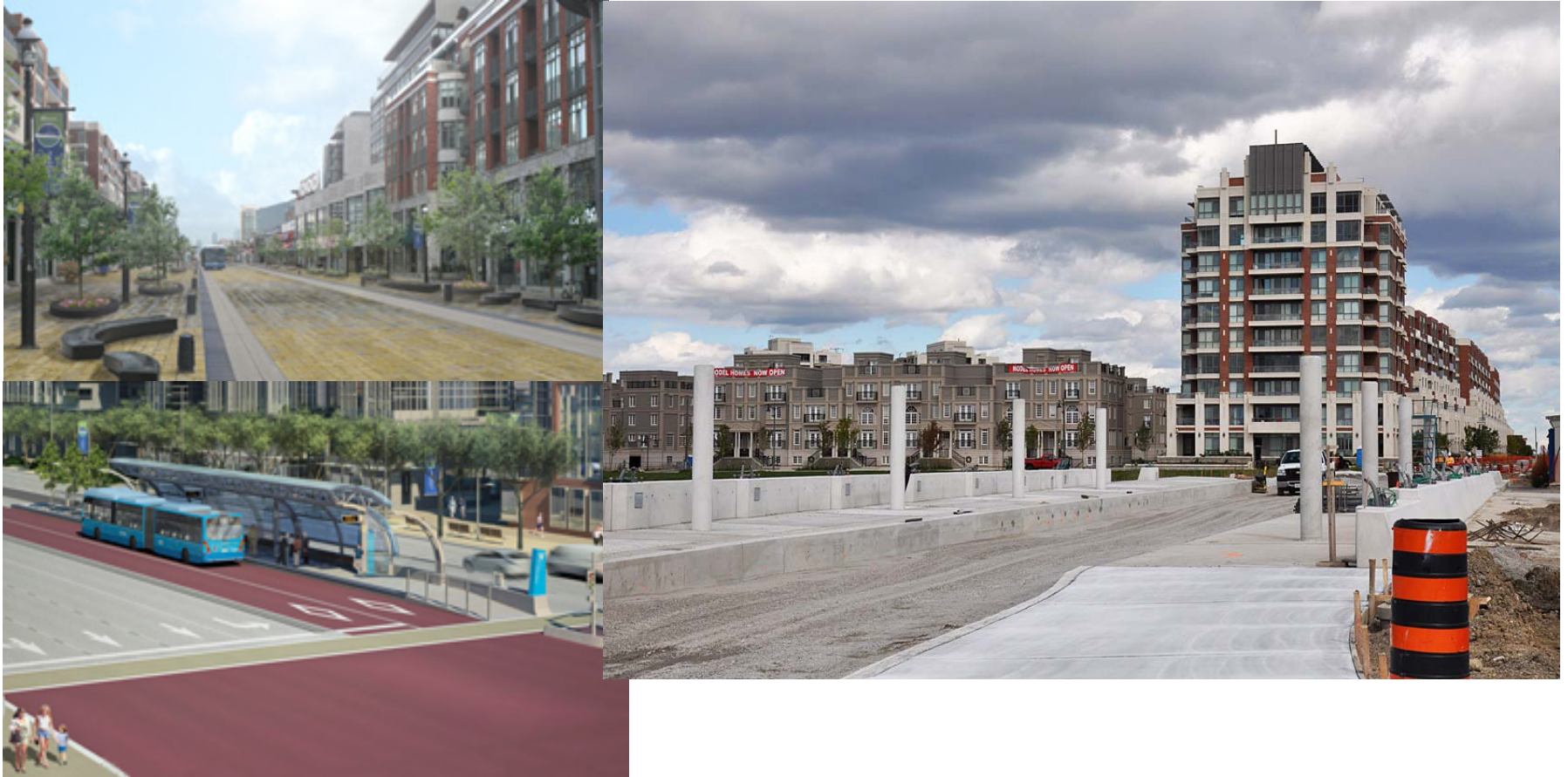
**4 Tunnel Boring
Machines**

\$54 Million

**Toronto-Based
Lovat Inc.**



Moving Forward – York VIVA



Moving Forward – Union-Pearson Air Rail Link



Other Major Projects Moving Forward



What's New With Toronto Streetcars?



CLRV 1978 – Present

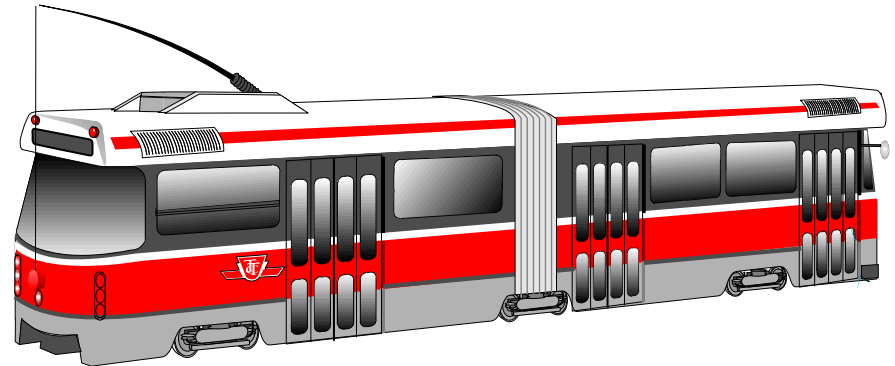
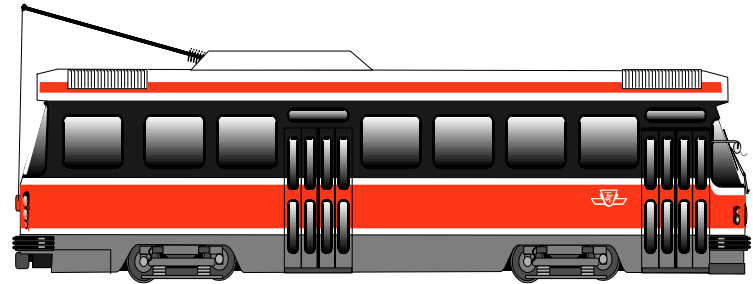
What's New With Toronto Streetcars?



ALRV 1987 – Present

Streetcar Facts-Current System

- Annual Streetcar
Passenger-trips ~ 80 million
- Vehicles:
 - 196 CLRVs (Car 1 – 1977)
 - 52 ALRVs (Car 1 – 1987)
- Tracks:
 - 85 double track km
 - 89 special track work
- Service Routes:
 - 11 Routes total
 - 3 Semi-Right-of-Way



Toronto Streetcar Challenges

- Tight Loop and Curve Radius
(11m vs. 25m)
- Grade Requirements (8% vs. 5%)
- Ground-borne Vibration
- Overhead Wire Capacity
- Buff Load (Collision Strength)
- Fare Collection

The New Toronto Streetcar



New Toronto Main Features

- 30.2m long (CLRV = 15.4m; ALRV = 23.2m)
- Single ended, 4 doors, air-conditioned
- ~ 250 passenger crush load (CLRV = 132; ALRV = 205)
- Customer input driven design
- Accessible – 2 wheelchair positions, bike rack, audio/visual stop announcement
- Secure – cameras, advance warning to motorists about impending stops, anti-microbial coating on stanchions
- Safe – performance, crash energy management, outward visibility, meet SSP

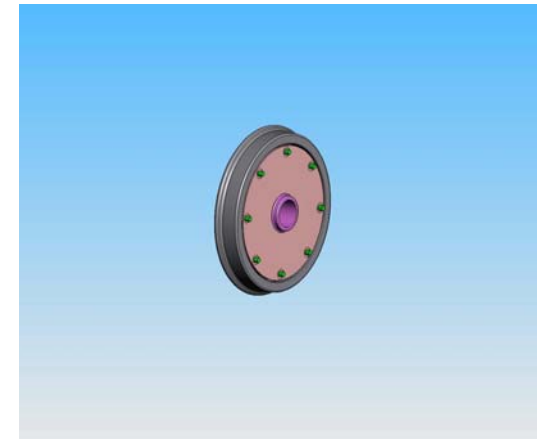
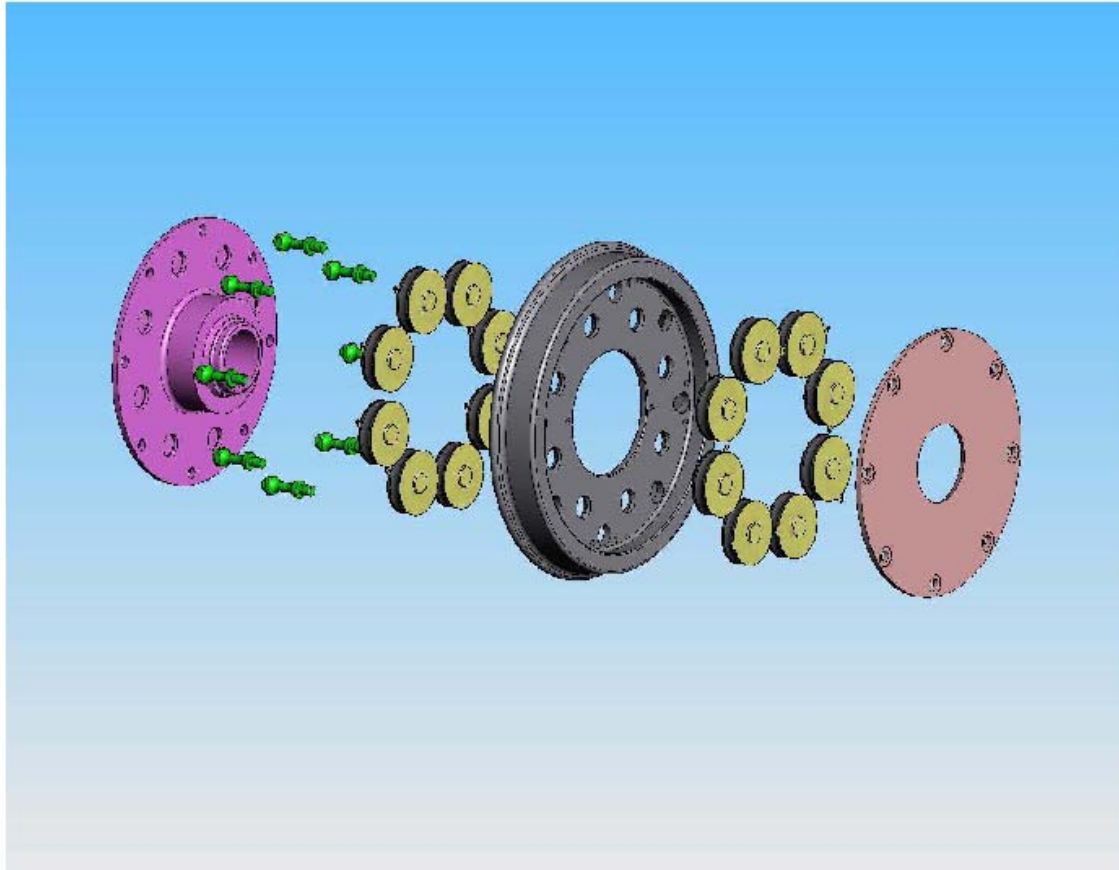


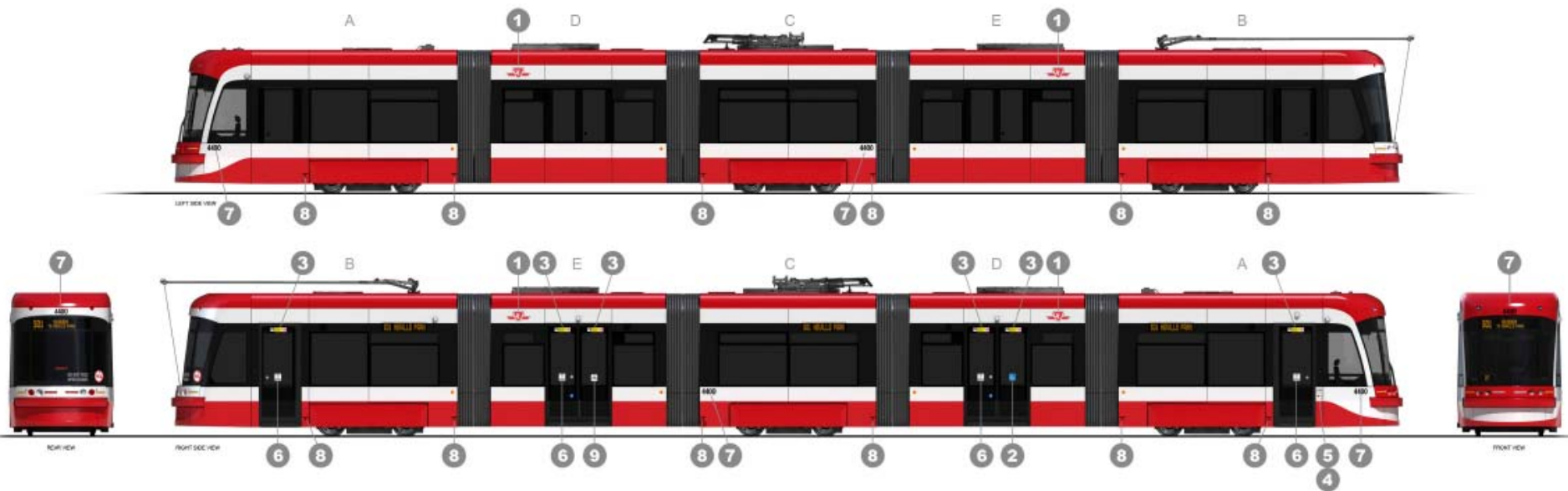
New Toronto Main Features

- Environmental impact mitigation:
 - Regenerative braking
 - Equipment right-sizing
 - L.E.D. exterior lighting and intelligent auxiliary power control
 - Energy efficient glazing and insulation
 - Non-ozone depleting air conditioning freon
 - Aggressive weight and end-of-life recyclable material management programs
- Enclosed cab - ticket vending & validation machines
- Go anywhere – steep grades, tight curves, extended tunnel operation
- High reliability and maintainability
- Easy adaptation for Transit City vehicles



Super Resilient Wheels





Preliminary Interior & Seat Style and Fabric



Preliminary Interior Layout & Seat Style and Fabric



BOMBARDIER

Resurgence of Streetcars in USA

MISSOURI

Project: St. Louis Loop Trolley Project (Urban Circulator)

Sponsor: City of St. Louis

Length: 2.2 miles (3.5 km)

Planning Stage: Final Design

Expected Cost: \$44,000,000

Cost per km: \$12,600,000

Grant Amount: \$24,990,000

Resurgence of Streetcars in USA

NORTH CAROLINA

Project: Charlotte Streetcar Starter Project (Urban Circulator)

Sponsor: City of Charlotte

Length: 1.5 miles (2.4 km)

Planning Stage: Preliminary Engineering

Expected Cost: \$37,000,000

Cost per km: \$15,400,000

Grant Amount: \$24,990,000



Resurgence of Streetcars in USA

OHIO

Project: Cincinnati Streetcar Project (Urban Circulator)

Sponsor: City of Cincinnati

Length: 6 miles (9.6 km)

Planning Stage: Preliminary Engineering

Expected Cost: \$128,000,000

Cost per km: \$13,300,000

Grant Amount: \$24,990,000



Resurgence of Streetcars in USA

TEXAS

Project: Forth Worth Streetcar Loop (Urban Circulator)

Sponsor: The City of Fort Worth and the Fort Worth Transportation Authority

Length: 1.4 – 3.2 miles (2.2 – 5.1 km)

Planning Stage: Alternatives Analysis

Expected Cost: \$69,900,000 - \$138,300,000

Cost per km: \$27,000,000 - \$31,000,000

Grant Amount: \$24,990,000

Resurgence of Streetcars in USA

TEXAS

Project: Olive/St. Paul Street Loop (Urban Circulator)

Sponsor: Dallas Area Rapid Transit Authority (DART)

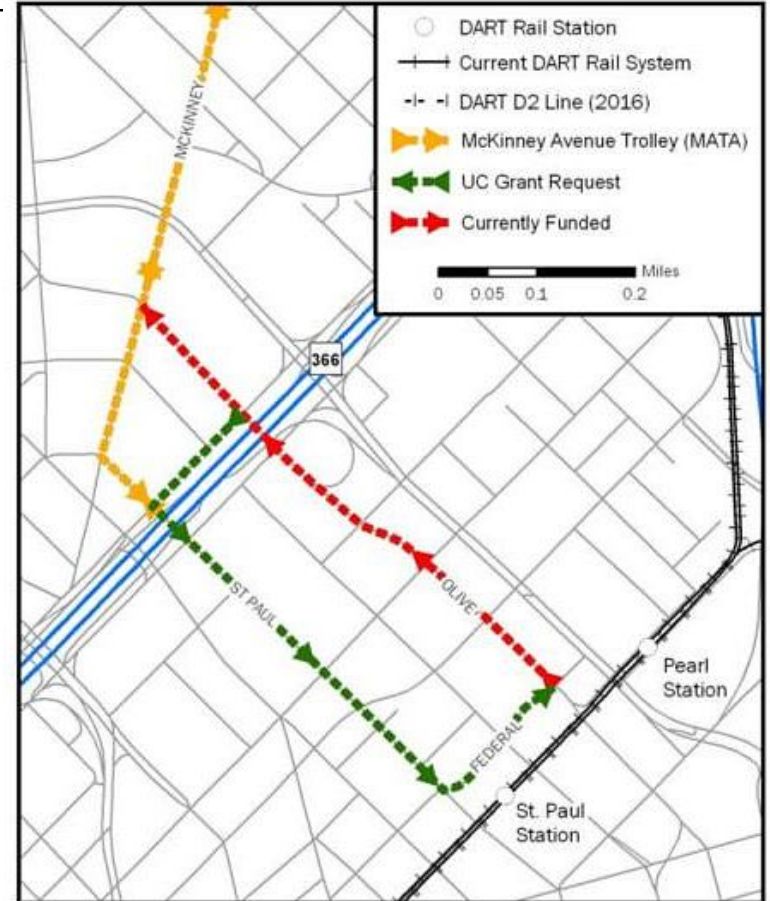
Length: 0.65 miles (1 km)

Planning Stage: Final Design

Expected Cost: \$10,000,000

Cost per km: \$10,000,000

Grant Amount: \$4,900,000



Resurgence of Streetcars in USA

OREGON

Project: Portland Streetcar Loop (Urban Circulator)

Sponsor: TriMet & City of Portland

Length: 3.3 miles (5.3 km)

Planning Stage: Design

Expected Cost: \$128,273,000

Cost per km: \$24,156,000

Grant Amount: \$75,000,000 (federal)

Streetcar Project Trend in USA

- Urban Circulators that tie into other line haul light rail transit lines
- Portland Streetcar ties into MAX LRT
- Dallas Streetcar to tie into DART LRT
- Charlotte Streetcar to tie into Charlotte LRT

Modal Choices: Streetcars vs. Light Rail



Modern LRT in North America



Phoenix



Seattle



Houston



Edmonton



Toronto Streetcar Debate

Typical Opinions on Toronto Streetcars:

- Too slow, competes with traffic
- Don't like sharing road with streetcars
- Wait for a long time and then 2 or 3 arrive at the same time
- Better than diesel buses, better for air quality downtown
- Like them, they part of Toronto Urban fabric
- Too expensive

Streetcars versus LRT

Existing Streetcars

Shares lane with cars

- ex. St. Clair, Spadina-Harbourfront

Slow boarding

- Front door only (one door)
- Payment after entry, in queue
- High floor with steps

No trains - max. length 24m

Unidirectional, needs loops

Close stop spacing

- Queen downtown: 180m
- St. Clair: 250m

Lower line capacity

LRT

Never shares lane

- Sometimes fully segregated (tunnel or elevated)

Faster boarding

- All-door boarding (four per car)
- Payment before entry
- Level boarding, no steps

Trains of 1-3 cars - up to 90m

Bidirectional, no loops

Longer stop spacing

- Sheppard LRT: 450m
- Eglinton tunnel: 850m
- Typical North America: 1,000 - 2,000m

Medium-high line capacity

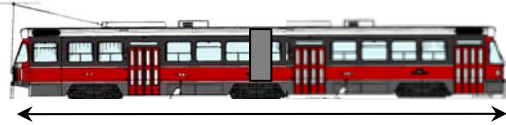
LRT versus Streetcars

- Streetcar service design is much slower
 - St. Clair: 13 km/h
 - Sheppard LRT: 22 km/h
 - Eglinton tunnel: 30-32 km/h
 - Subway: 32 km/h
- Streetcars are less reliable
 - Mixed traffic hurts reliability
 - Slow boarding also hurts reliability

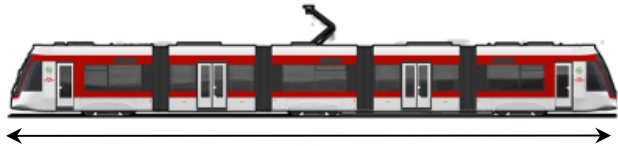
Train Length



Streetcar (CLRV, TTC legacy system)
16m



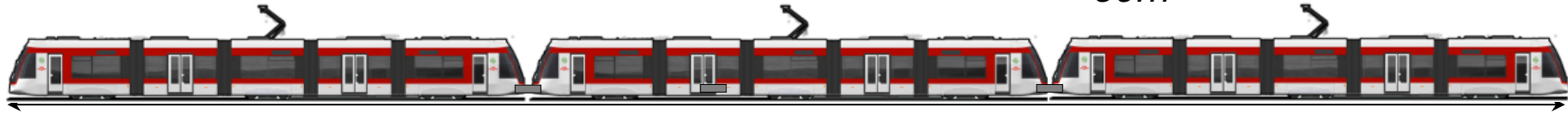
Streetcar (Articulated ALRV, Queen St.)
24m



Sheppard and Finch LRTs
30m



Eglinton (opening day)
60m



Eglinton (max) 90m
Scarborough RT
(opening day)

Sheppard Subway: 92m
Yonge Subway: 140m

Factors That Affect LRT Capacity

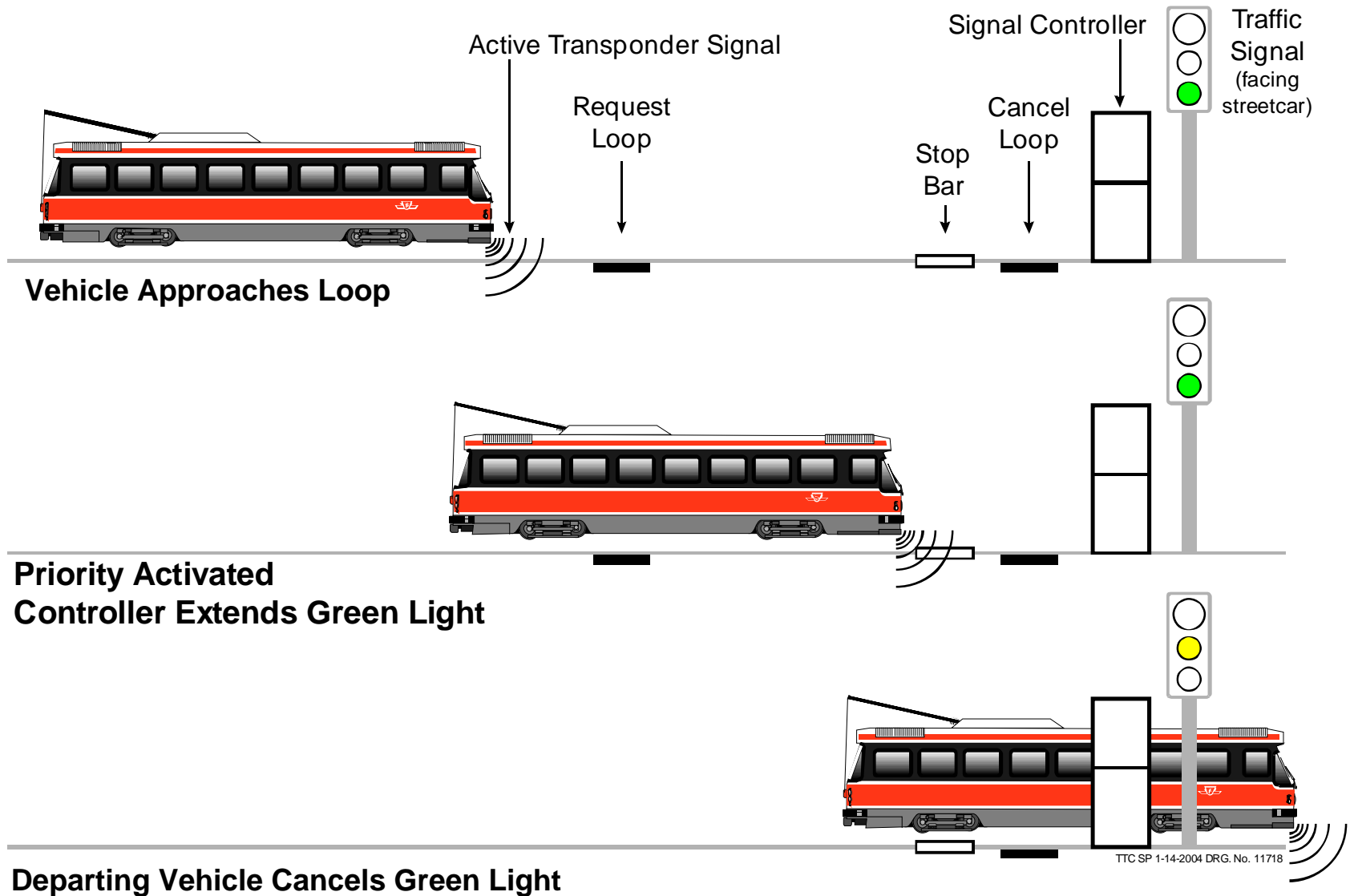
“Transit line capacity” is product of:

- **Train capacity**
 - Each car carries 130-190 persons under normal conditions
 - A 3-car train can carry 480 persons
- **Train frequency**
 - Every 3 – 4 minutes on surface is the limit (15 - 20 trains per hour)
 - Every 2 minutes in tunnel or elevated guideway is the limit (up to 30 trains per hour)
- Three-car train every three minutes
= 9,600 persons per hour per direction (pphpd)
 - Up to 14,500 pphpd for a line that is fully elevated / tunneled (e.g., Scarborough RT)
- For comparison,
 - Sheppard subway service is currently about 9,000 pphpd
 - Sheppard could be expanded to 20,000 pphpd
 - Yonge subway service is currently about 30,000 pphpd

Other Capacity Factors-Best Practice

- Double ended LRVs (no loops at end of line to turn vehicles around increases travel times and efficiencies)
- Ability to accommodate 3 LRV cars in one train consist (increased capacity with minimal additional operating cost)
- Traffic signal priority (TTC working closely with traffic engineers to provide a rolling wave of green signals to the extent possible)

Signal Priority - Green Light Extension



Light Rail Cost 2008 CAD

Metrolinx LRT projects

Sheppard East LRT	\$ 57,000,000 / km
Finch LRT	\$ 58,000,000 / km
Eglinton Crosstown	\$214,000,000 / km
Scarborough RT LRT conversion & extension	\$158,000,000 / km

Other Reference Projects

VTA, San Jose	\$ 56,000,000 / km
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All costs in C \$2008. Costs include line and vehicles, but exclude maintenance yards.

Eglinton project is 65-75% tunnelled.

Scarborough RT project is 100% grade separated, including tunnels and elevated sections

Streetcar Project Cost

New USA projects estimated USD

St. Louis Loop (Urban Circulator-3.5 km)	\$ 12,600,000 / km
Charlotte Streetcar (Urban Circulator-2.4 km)	\$ 15,400,000 / km
Cincinnati Streetcar (Urban Circulator-9.6 km)	\$ 13,300,000 / km
Fort Worth Streetcar (Urban Circulator-2.2-5.1 km)	\$ 27 to 31,000,000 / km
Dallas Olive/St. Paul Loop (Urban Circulator-1.0 km)	\$ 10,000,000 / km
Portland, OR (Streetcar Loop-5.3 km)	\$ 24,156,000 / km

Canadian Reference Projects actual CAD

Toronto St. Clair Streetcar (6.8 km)	\$ 15,600,000 / km*
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* St. Clair Project does not include cost of streetcars, part of existing fleet

GETTING IT RIGHT



Mode, capacity, speed, cost, urban fit, these are all important considerations



Rail transit is a fixed investment that should last for decades with proper maintenance



Today's workshop is a important step



Get the facts....Deliberate on the mode choice and new technology



Get it right for future generations!

Downtown Circulator?



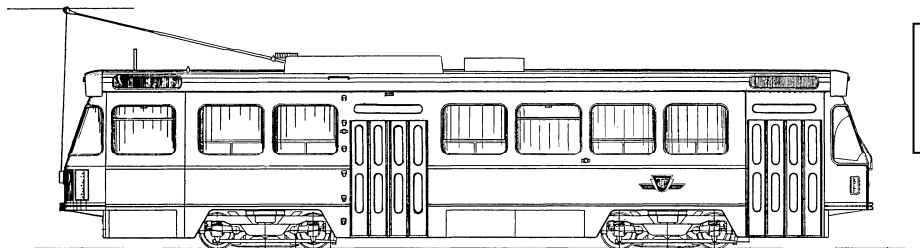
QUESTIONS?

Other Capacity Factors-Best Practice

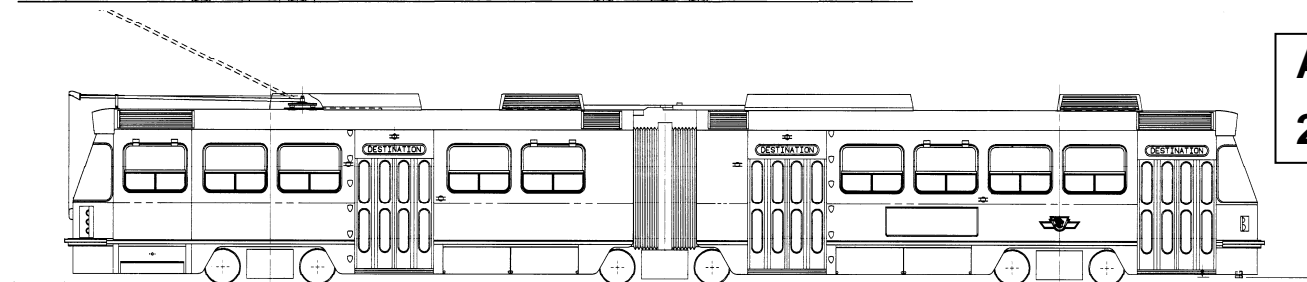
TTC Legacy LFLRV Delivery Schedule

Year End	Delivery	Running Total
2011 (Aug/Sept/Dec)	3 Prototype Vehicles	3
2012	1	4
2013	27	31
2014	36	67
2015	36	103
2016	36	139
2017	36	175
2018	29	204

Dates are subject to Change



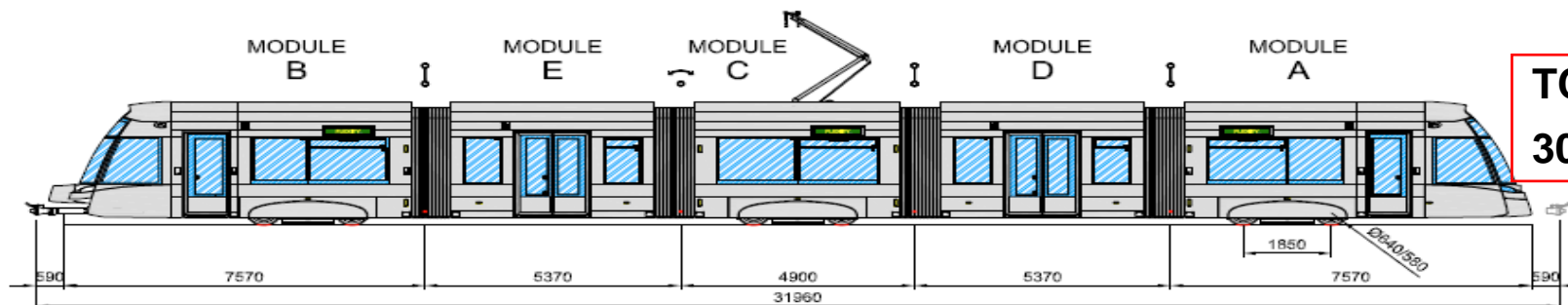
CLRV
15.4m



ALRV
23.2m



Legacy LFLRV
30.2m



TC LFLRV
30.8m

