

# TORONTO TRANSIT COMMISSION REPORT NO.

**MEETING DATE:** June 24, 2013

**SUBJECT:** NEW STREETCAR IMPLEMENTATION PLAN

## **INFORMATION ITEM**

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### **RECOMMENDATION**

It is recommended that the Board receive the attached presentation on the introduction of new streetcars to the city of Toronto.

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1-5-5  
Attachment

# STREETCAR RENEWAL PROGRAM





- 1. Fleet Renewal & Growth**
- 2. Fleet Delivery, Facilities & Operations**
- 3. Fleet Deployment and Dependencies**
- 4. Next Steps**





# FLEET RENEWAL & GROWTH





- **End of life replacement of CLRV and ALRV**

Car Type	Date Acquired	30-Year Life	Planned Retirement
CLRV	1979-1982	2009-2012	2015-2018
ALRV	1987-1989	2017-2019	2014-2015

- **Options considered: new or 15 year life extension of existing fleet**
- **Decision to buy new driven by need for accessibility**





- **Larger cars (30 meters) avoid very frequent headways (<3 minutes) improving operations, reliability & efficiency**
- **Common car size manufactured**
- **Equivalent to 2 coupled CLRV's – considered in early 2000's**



# CAR LENGTH & HEADWAYS

## Peak Levels



	Morning Peak		Afternoon Peak	
	Now	New Cars	Now	New Cars
511 Bathurst	4 m 15 s	<b>5 m 00 s</b>	4 m 30 s	<b>5 m 30 s</b>
506 Carlton	3 m 45 s	<b>5 m 00 s</b>	5 m 00 s	<b>6 m 08 s</b>
505 Dundas	5 m 15 s	<b>6 m 45 s</b>	5 m 20 s	<b>6 m 40 s</b>
502 Downtowner / 503 Kingston Road	6 m 00 s	<b>7 m 15 s</b>	6 m 00 s	<b>7 m 30 s</b>
509 Harbourfront	4 m 00 s	<b>5 m 00 s</b>	3 m 30 s	<b>4 m 40 s</b>
504 King / 508 Lake Shore	1 m 42 s	<b>2 m 34 s</b>	2 m 21 s	<b>3 m 18 s</b>
501 Queen	4 m 15 s	<b>4 m 45 s</b>	5 m 08 s	<b>5 m 08 s</b>
512 St. Clair	2 m 30 s	<b>3 m 50 s</b>	3 m 20 s	<b>4 m 45 s</b>
510 Spadina	2 m 30 s	<b>3 m 30 s</b>	2 m 00 s	<b>3 m 23 s</b>



# CAR LENGTH & HEADWAYS

## Off – Peak Levels



	Monday-Friday				Saturday		Sunday-Holiday	
	Midday		Evening		Daytime		Daytime	
	Now	New Cars	Now	New Cars	Now	New Cars	Now	New Cars
511 Bathurst	5 min 00 s	<b>5 min 00 s</b>	6 min 30 s	<b>6 min 30 s</b>	5 min 00 s	<b>5 min 00 s</b>	5 min 40 s	<b>5 min 40 s</b>
506 Carlton	5 min 15 s	<b>5 min 30 s</b>	7 min 30 s	<b>7 min 30 s</b>	6 min 20 s	<b>6 min 20 s</b>	7 min 20 s	<b>7 min 20 s</b>
505 Dundas	6 min 30 s	<b>6 min 30 s</b>	8 min 00 s	<b>8 min 00 s</b>	5 min 30 s	<b>7 min 10 s</b>	6 min 00 s	<b>6 min 20 s</b>
502 Downtowner	16 min 00 s	<b>16 min 00 s</b>	-	-	-	-	-	-
509 Harbourfront	6 min 00 s	<b>6 min 00 s</b>	5 min 00 s	<b>5 min 00 s</b>	4 min 15 s	<b>4 min 45 s</b>	4 min 20 s	<b>4 min 45 s</b>
504 King	3 min 45 s	<b>3 min 45 s</b>	4 min 00 s	<b>4 min 00 s</b>	4 min 15 s	<b>4 min 15 s</b>	5 min 50 s	<b>5 min 50 s</b>
501 Queen – E of Humber Loop	6 min 10 s	<b>6 min 10 s</b>	5 min 30 s	<b>5 min 30 s</b>	5 min 00 s	<b>5 min 00 s</b>	6 min 00 s	<b>6 min 00 s</b>
501 Queen – W of Humber Loop	12 min 20 s	<b>12 min 20 s</b>	11 min 00 s	<b>11 min 00 s</b>	10 min 00 s	<b>10 min 00 s</b>	12 min 00 s	<b>12 min 00 s</b>
512 St. Clair	5 min 00 s	<b>5 min 00 s</b>	6 min 00 s	<b>6 min 00 s</b>	4 min 00 s	<b>4 min 00 s</b>	6 min 20 s	<b>6 min 20 s</b>
510 Spadina	1 min 53 s	<b>3 min 15 s</b>	2 min 15 s	<b>3 min 23 s</b>	2 min 00 s	<b>3 min 30 s</b>	2 min 10 s	<b>3 min 15 s</b>





# PROCUREMENT PROCESS CHRONOLOGY



<b>Board Decision</b>	<b>Jan 2006</b>
<b>RFI, Specification Development and Review</b>	<b>2006-2007</b>
<b>Tendered - No Compliant Bids</b>	<b>Jan 2008</b>
<b>Structured Multi-phase Bid Process</b>	<b>Aug 2008</b>
<b>Tendered - Contract Award to Bombardier</b>	<b>Jun 2009</b>
<b>First Prototype Car</b>	<b>Oct 2012</b>
<b>Second Prototype Car</b>	<b>Mar 2013</b>
<b>Third Prototype Car</b>	<b>Jun 2013</b>
<b>Delivery and Final Acceptance (204 cars)</b>	<b>2013-2019</b>



# CLRV LIFE EXTENSION



- **ALRV's are considerably less reliable than CLRV's and will be retired first**
- **Life extension of 105 CLRV's required to bridge fleet until the arrival of new cars**
- **Capital Program 4.15 - Streetcar Overhaul (\$59 million)**

Structure	Trucks	Body
<ul style="list-style-type: none"><li>• Structural repairs</li><li>• Anti-climber repairs</li><li>• Floor repairs</li><li>• Entrance/exit step well repairs</li></ul>	<ul style="list-style-type: none"><li>• Wheel replacement</li><li>• Traction motor overhaul</li><li>• Track brake block and frame assembly overhaul</li><li>• RE/RE truck assembly sub-components</li></ul>	<ul style="list-style-type: none"><li>• Exterior mid-section corrosion repairs</li><li>• Vehicle body and paint as required</li><li>• Roof leak repairs (on condition)</li></ul>





- **Proof-of-payment (POP) approach required due to enclosed Operator cab - added benefit of permitting all door loading**
- **Phase 1: “*Transition*”**  
Existing fare media + PRESTO cards\* + Cash
- **Phase 2: “*Full PRESTO*”**  
PRESTO cards\* + Cash

Note: The equivalent of existing TTC fare products (passes; tokens; tickets) will be available on the PRESTO card



# SINGLE-RIDE VENDING MACHINE (SRVM)

- **SRVM required to issue POP receipt** (2 per car & up to 75 at busiest stops)
- **SRVM's would:**
  - Accept cash (coins only; no change)
  - Accept credit/debit
  - Accept tokens (Transition only)
  - Issue paper receipt (Transition only)
  - Issue limited use media (Full PRESTO)
  - Support PRESTO card (one PRESTO card reader at each door)
- **SRVM's cannot accept tickets**
  - For transition, need ticket validator (2 per car)



# FARE COLLECTION - CUSTOMER ACTIONS



	<b>TRANSITION:</b> <i>Existing Fare Media + PRESTO + Cash</i>	<b>FULL PRESTO:</b> <i>PRESTO Card + Cash</i>
<b>Passes</b>	<b>Keep Pass as POP receipt</b>	<b>**</b>
<b>Transfers</b>	<b>Keep Transfer as POP receipt</b>	<b>**</b>
<b>Adult (tokens)</b>	<b>Get POP receipt from SRVM</b>	<b>**</b>
<b>Concession tickets</b>	<b>Insert ticket into validator - Keep ticket as POP receipt</b>	<b>**</b>
<b>Cash</b>	<b>Get POP receipt from SRVM</b>	<b>Get POP receipt from SRVM</b>
<b>PRESTO Card</b>	<b>“Tap” card on SRVM - get POP receipt</b>	<b>“Tap” card on reader at door</b>
<b>% of First-Boarding Customers Needing Receipt</b>	<b>≈ 40%</b>	<b>≈ 10%</b>
<b>** Fare product available on PRESTO card</b>		





# FLEET DELIVERY, FACILITIES & HUMAN RESOURCES



# FACILITY REQUIREMENT



- **Low floor cars means equipment traditionally placed under the car floor must move to the roof resulting in new maintenance configuration (ie. overhead platforms)**
  - Ronces (built 1895) and Russell (built 1913) difficult to fully modify due to roof height and maintenance of operations during construction
- **Approximately 50% increase of storage track required**
- **Heavy maintenance functions traditionally performed in Harvey Shops no longer possible due to access constraints (ie. transfer way)**



# FACILITY & SERVICE STORAGE REQUIREMENT



Location	Yard Capacity	Carhouse Capacity	Total Facility Storage	Peak Service Required	Maintenance Spares	Fleet Total
Leslie	100	30	130	90	20	110
Roncesvalles	48	16	64	52	10	62
Russell	60	10	70	26	6	32
Total	208	56	264	168	36	204



# MAINTENANCE ACTIVITIES



	RUSSELL	RONCES.	LESLIE
<b>PRE-SERVICE</b>			
Daily Vehicle Inspection, Sweep and Clean	✓	✓	✓
Carbon Inspection/Replacement and Sand Loading	✓	✓	✓
<b>PROGRAM CLEANING</b>			
Weekly Exterior Washing and Interior Clean	✓	✓	✓
Monthly Interior Cleaning and Annual Undercar Clean			✓
<b>INSPECTIONS</b>			
Monthly Maintenance Inspections			✓
Bi-Annual Wheel Truing			✓
Annual Brake Rate Testing			✓
<b>CORRECTIVE AND PROGRAM MAINTENANCE</b>			
Component Failures (Line Replaceable Unit Exchange)		✓	✓
Collisions (Major and Minor)			✓
Truck and Equipment Overhaul			✓



# DELIVERY AND STORAGE



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>Delivery</b>										
LRV	9	34	36	36	39	36	14			
<b>Totals</b>										
<b>LRV</b>	<b>9</b>	<b>43</b>	<b>79</b>	<b>115</b>	<b>154</b>	<b>190</b>	<b>204</b>	<b>204</b>	<b>204</b>	<b>204</b>
<b>ALRV</b>	<b>52</b>	<b>10</b>								
<b>CLRV</b>	<b>195</b>	<b>195</b>	<b>162</b>	<b>113</b>	<b>67</b>	<b>11</b>				
<b>Roncesvalles</b>										
LRV	9	43	20	33	47	58	62	62	62	62
ALRV	35									
CLRV	73	40	47	27	15					
<b>Russell</b>										
LRV						31	32	32	32	32
ALRV	17	10								
CLRV	112	127	115	86	52	11				
<b>Leslie</b>										
LRV			59	82	107	101	110	110	110	110
ALRV										
CLRV										
<b>*CNE</b>										
LRV										
ALRV										
CLRV		22								
<b>~ Hillcrest</b>										
LRV										
ALRV										
CLRV	10	6								

\*CNE - Temporary/Contingency Storage until Leslie Barn Connection and Facility are complete

~ Hillcrest - CLRV Life Extension Overhaul/Body Repair Program & Non-Program Work







- **Standard Operating Procedures**
  - Ramp Deployment & Wayside Notification
  - Loading Assistance
  
- **Operating Budget**
  - Operators (-)
  - POP Enforcement (+)
  - Car Maintenance (+)
  - Facility/Yard Maintenance (+)



# FLEET DEPLOYMENT



# FLEET DEPLOYMENT POLICY DECISIONS



- **Continuous rollout by route as cars arrive**
  - Ensures full warranty utilization
  - Increases customer expectations initially (ie. cars replaced one for one until threshold met resulting in higher loading standard during route deployment)
  - Vehicle Recovery Implications
- **POP will be implemented by route as new LRV's are deployed (initially)**
  - Minimize upfront costs for POP inspectors
  - Provides opportunities to get model right
- **Assume routes must be fully accessible prior to deployment - Islands/curb cuts completed**



# FLEET DEPLOYMENT SEQUENCE



- **Overhead upgrade most dominant factor**
- **Secondary Factors**
  - Alterations required for accessibility (stops, platforms & curbs cuts)
  - Wayside fare collection (Ticket Vending Machines)
  - ROW's



# OVERHEAD REBUILD REQUIREMENT



- **New cars draw over 50% more current than the old cars**
- **Low voltage problems will result in reduced performance (i.e. no A/C in summer).**
- **New OCS including different hardware and staggered wire arrangement along with pantograph (instead of trolley pole) are required to allow for improved reliability and reduced maintenance.**





# OVERHEAD REBUILD PHASING PRINCIPLES



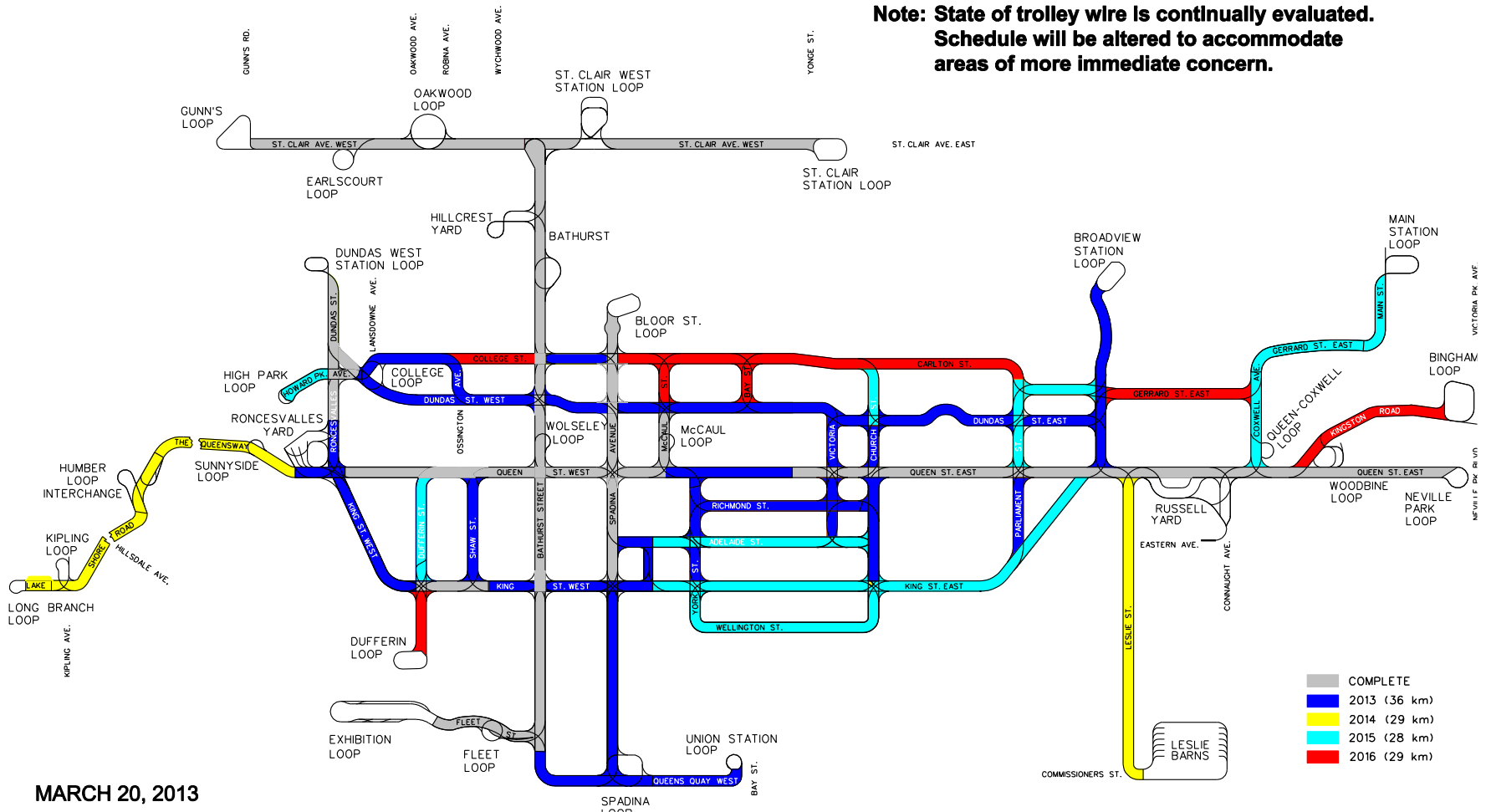
- **First, connect maintenance facilities**
  - Queen (Roncesvalles/Russell/Leslie)
  - Bathurst (Harvey)
- **Then, expand outward with a focus on providing as much alternate routing as possible**



# OVERHEAD SCOPE OF WORK (TROLLEY WIRE REPLACEMENT)



**Note: State of trolley wire is continually evaluated.  
Schedule will be altered to accommodate  
areas of more immediate concern.**



MARCH 20, 2013



# STREETCAR NETWORK UPGRADES (PLATFORMS, CURB CUTS & TVM)



B-Module

E-Module

C-Module

D-Module

A-Module

A-Cab



- Within the D-Module underframe is an electrically powered ramp

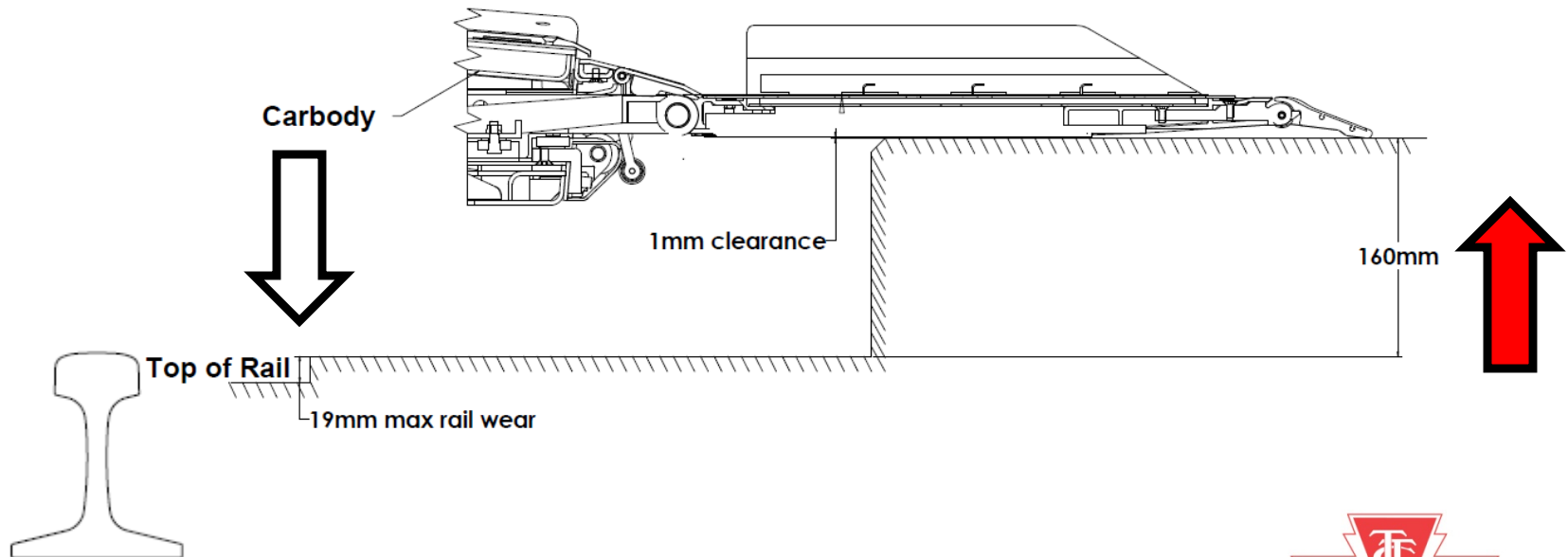


# STREETCAR NETWORK UPGRADES (PLATFORMS, CURB CUTS & TVM)



## Lowest Car – Highest Platform

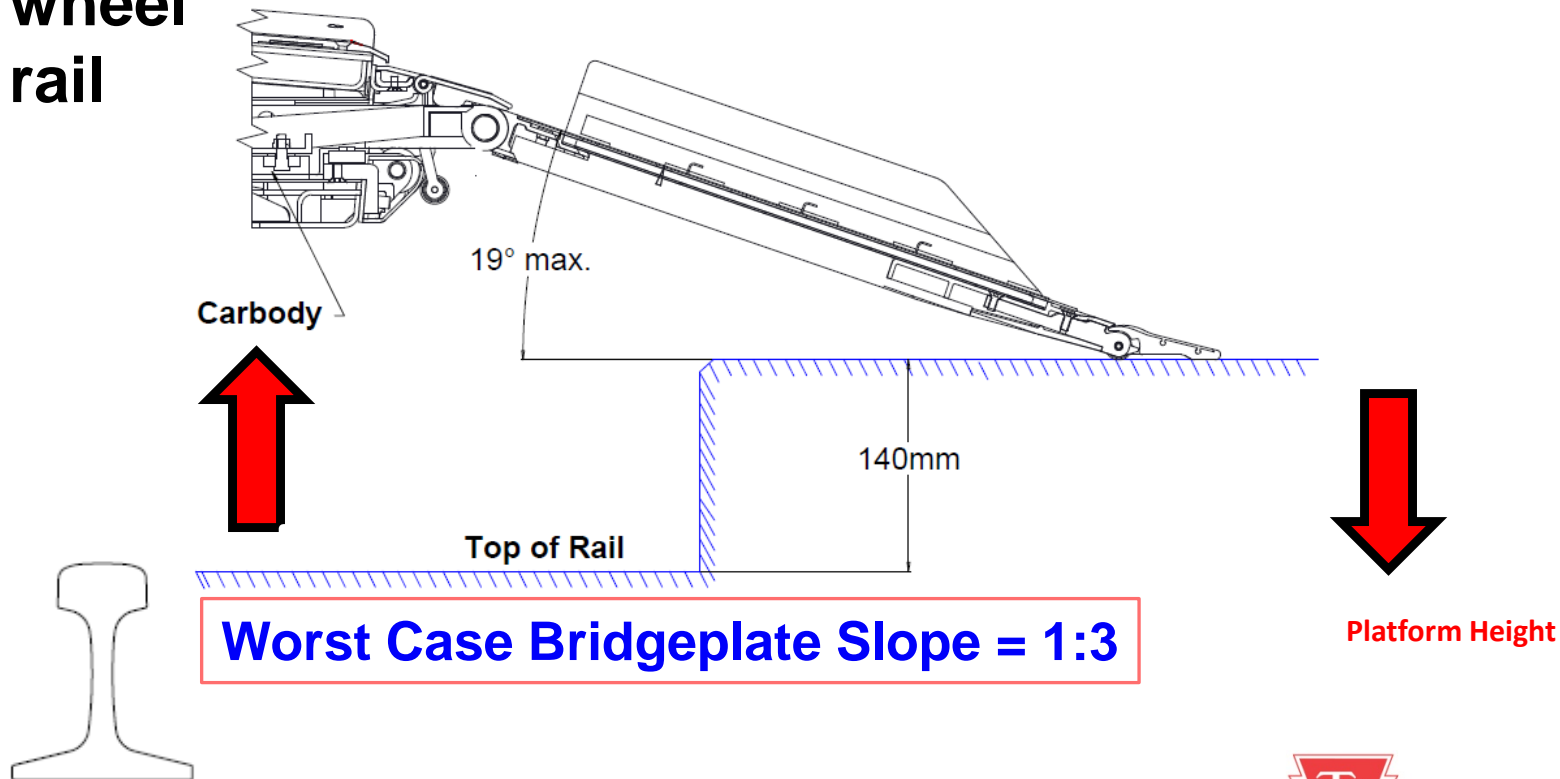
- Full passenger load
- Car production tolerances on low end, negative side
- Worn wheel before shimming
- Worn rail before replacement



# STREETCAR NETWORK UPGRADES (PLATFORMS, CURB CUTS & TVM)

## Highest Car – Lowest Platform

- Few passengers on board
- Car production tolerances on high end, plus side
- New wheel
- New rail



# STREETCAR NETWORK UPGRADES (PLATFORMS, CURB CUTS & TVM)





# STREETCAR NETWORK UPGRADES (PLATFORMS, CURB CUTS & TVM)



		2012	2013	2014	2015	2016	2017	2018	Total Upgrades	Route Total	Upgrade Percentage
<b>ROUTE</b>	<b>UPGRADE</b>										
510 Spadina	Platform/Island	13	12						25	25	100 %
	Curb Cuts									1	0 %
	TVM	5	4						9		
511 Bathurst	Platform/Island		5	4					9	12	75 %
	Curb Cuts		8	7					15	22	68 %
	TVM		6	6					12		
505 Dundas	Platform/Island		1						1	1	100 %
	Curb Cuts		42	41					83	101	82 %
	TVM		12	12					24		
509 (Note 1) Harbourfront	Platform/Island			2	3				5	12	42 %
	Curb Cuts										
501/508 Queen/LS	Platform/Island				3	4			7		
	Curb Cuts			16	16				32	35	91 %
	TVM			71	71				142	180	79 %
504 King	Platform/Island										
	Curb Cuts				68				68	68	100 %
	TVM				15				15		
512 St. Clair	Platform/Island					48			48	48	100 %
	Curb Cuts					1			1	1	100 %
	TVM					6			6		
502 Downtowner	Platform/Island					1	2		3	3	100 %
	Curb Cuts					13	14		27	27	100 %
	TVM										
503 (Note 2) Kingston Rd	Platform/Island										
	Curb Cuts						25		25	25	100 %
	TVM						1		1		
506 Carlton	Platform/Island						4	4	8	8	100 %
	Curb Cuts						63	63	126	126	100 %
	TVM						3	3	6		
<b>TOTALS</b>											
	Platform/Island	13	18	22	19	49	6	4	131	144	91%
	Curb Cuts		50	119	139	14	102	63	487	551	88%
	TVM	5	22	31	28	6	4	3	99		

**Notes:**

- 1) The remainder of the Harbourfront platforms to be completed as part of the Waterfront Toronto Project.
- 2) There are no platforms on Kingston Road.
- 3) The quantities shown above are based on a preliminary survey and may be subject to change.





## **1. Spadina and Bathurst (2014)**

- Shared turns and diversions
- Relatively low number of cars
- Spadina first because ROW

## **2. Harbourfront (2014)**

- Shared infrastructure with Spadina/Bathurst

## **3. Dundas (2014/2015)**

- Shared turns and diversions with Queen
- Few cars
- 1 island





## **4. Queen/Lakeshore (2015/2016)**

- Shared turns and diversions with Dundas
- Long period of mixed fleet
- Substation upgrade in west end prevents earlier implementation

## **5. King (2016/2017)**

- Shared turns and diversions with Queen and stations with Dundas
- Long period of mixed fleet

## **6. St. Clair (2017/2018)**

- ROW
- St. Clair West Stn not accessible





## **7. Downtowner (2018)**

- 12 hour daily operation
- Shares routing with Queen and Kingston

## **8. Kingston Rd Tripper (2018)**

- Peak operation only
- Shares routing with Queen, King and Downtowner

## **9. Carlton (2018/2019)**

- Most routing not shared
- Long period of mixed fleet



# 2014 STREETCAR FLEET PLAN



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Deployment by Location (Including Ridership Growth)				
													Les	Ron	Rus	Total	
<b>LRV</b>																	
510 Spadina			12											12	0	0	12
511 Bathurst			10											0	10	0	10
509 Harbourfront			7											7	0	0	7
505 Dundas			7	7										8	6	0	14
501 Queen / 508 Lakeshore				23	15									15	18	5	38
504 King					15	20								15	10	10	35
512 St Clair						12	5							17	0	0	17
502 Downtowner							6							0	0	6	6
503 Kingston Rd Tripper							5							0	0	5	5
506 Carlton							14	10						16	8	0	24
<b>LRV Total Service</b>		<b>0</b>	<b>36</b>	<b>66</b>	<b>96</b>	<b>128</b>	<b>158</b>	<b>168</b>	<b>168</b>	<b>168</b>	<b>168</b>	<b>168</b>	<b>168</b>	<b>90</b>	<b>52</b>	<b>26</b>	<b>168</b>
<b>LRV Maintenance Spares (20%)</b>		<b>0</b>	<b>7</b>	<b>13</b>	<b>19</b>	<b>26</b>	<b>32</b>	<b>34</b>	<b>34</b>	<b>34</b>	<b>34</b>	<b>34</b>	<b>34</b>	<b>20</b>	<b>10</b>	<b>6</b>	<b>36</b>
<b>LRV Required</b>		<b>0</b>	<b>43</b>	<b>79</b>	<b>115</b>	<b>154</b>	<b>190</b>	<b>202</b>	<b>202</b>	<b>202</b>	<b>202</b>	<b>202</b>	<b>202</b>	<b>110</b>	<b>62</b>	<b>32</b>	<b>204</b>
<b>LRV Procurement</b>	1	8	34	36	36	39	36	14									
<b>LRV Available</b>		<b>9</b>	<b>43</b>	<b>79</b>	<b>115</b>	<b>154</b>	<b>190</b>	<b>204</b>	<b>204</b>	<b>204</b>	<b>204</b>	<b>204</b>	<b>204</b>	<b>110</b>	<b>62</b>	<b>32</b>	<b>204</b>
<b>LRV Contingency</b>		<b>9</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>ALRV</b>																	
ALRV service	38	38	7														
<b>ALRV Maintenance Spares (35%)</b>	<b>14</b>	<b>14</b>	<b>3</b>														
<b>ALRV Required</b>	<b>52</b>	<b>52</b>	<b>10</b>														
ALRV Retirements			(42)	(10)													
<b>CLRV</b>																	
<b>CLRV Service</b>	<b>163</b>	<b>163</b>	<b>163</b>	<b>135</b>	<b>94</b>	<b>56</b>	<b>9</b>										
<b>CLRV Maintenance Spares (20%)</b>	<b>32</b>	<b>32</b>	<b>32</b>	<b>27</b>	<b>19</b>	<b>11</b>	<b>2</b>										
<b>CLRV Required</b>	<b>195</b>	<b>195</b>	<b>195</b>	<b>162</b>	<b>113</b>	<b>67</b>	<b>11</b>										
CLRV Retirements				(33)	(49)	(46)	(56)	(11)									



# CAPITAL COSTS



	<b>PROGRAM COST</b>	<b>Dollars (Millions)</b>
<b>VEHICLES</b>	<b>LRV Procurement</b>	<b>1,186</b>
	<b>CLRV Overhaul</b>	<b>59</b>
<b>FACILITIES</b>	<b>Leslie Barn Facility &amp; Connection</b>	<b>497</b>
	<b>Existing Carhouse Modifications</b>	<b>65</b>
<b>WAYSIDE</b>	<b>Platform/Island Construction</b>	<b>68</b>
	<b>TVM Infrastructure</b>	<b>18</b>
	<b>Reconstruction of Streetcar Overhead</b>	<b>110</b>
	<b>Traction Power Substations</b>	<b>7</b>
<b>Proposed Total</b>		<b>2,010</b>

