METROLINX

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Better Cost Outcomes for Transit Projects

CSVA Conference Keynote
November 15, 2011

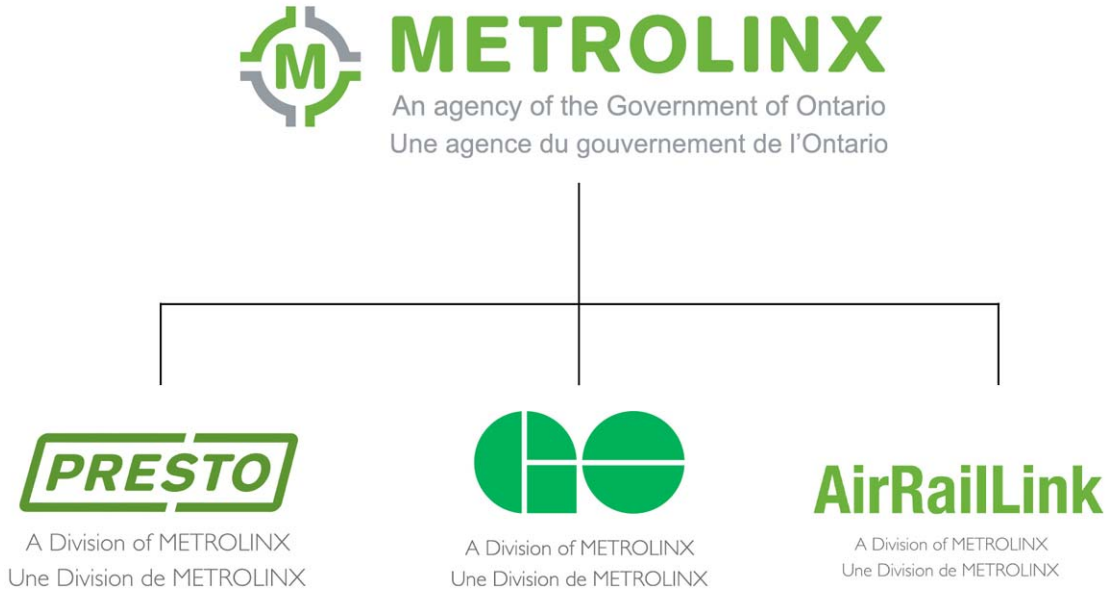
Jack Collins
Vice President, Rapid Transit Infrastructure

Who **is Metrolinx?**

Created in 2006 for the purpose of providing residents and businesses in the GTHA a transportation system that is modern, efficient and integrated

We plan. We deliver. We integrate.

Divisions of Metrolinx



Transforming transportation in the GTHA

A 25-year integrated transportation plan **across the region**

Double transit mode share

Triple length of rapid transit

Put transit within 2 km of 75% of population

Reduce commuting times and greenhouse gas emissions

A 25-year Plan

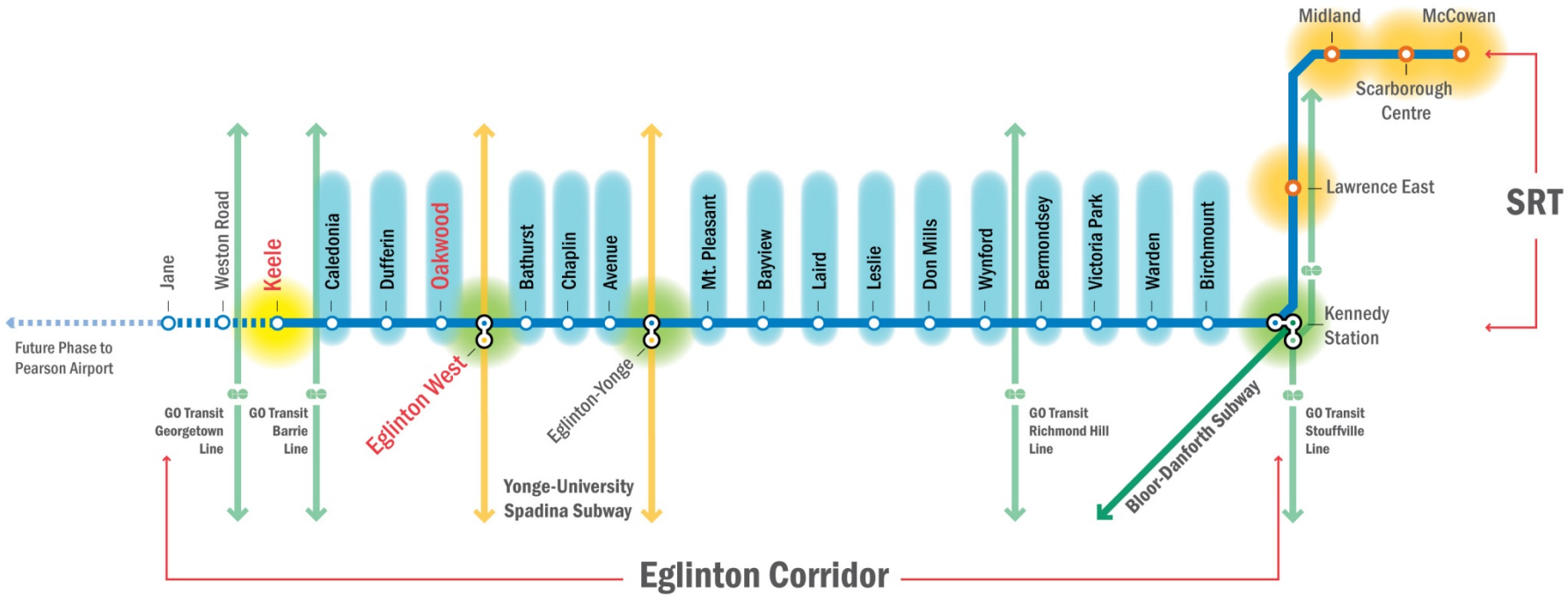
We’ve already started

Implementing the
biggest transit expansion plan
in Canadian history

Projects underway

Conceptual map – not to scale
Map does not include regional GO rail or bus expansions or improvements

EGLINTON–SCARBOROUGH
CROSSTOWN



- Interchange Stations (3)
- Terminal Stations (1)
- SRT (3 Elevated, 1 at-grade)
- Inline Stations (16)

Note: Final number of station and locations will be determined as part of Environmental Assessment updates.

York VIVA

completion in 2019 • phases in service in 2014

Union Station

Completion in 2016

These projects represent a $16.5 billion investment by the provincial, municipal and federal governments.
But we need much more.
An additional $2 billion a year over the next 25 years will be required to implement The Big Move.

Metrolinx is developing an Investment Strategy to fund this program.
Equally important is delivering projects within initial estimates to keep faith with taxpayers.

Funding it all

Underestimating Costs

- In summer of 2002 Bent Flyvbjerg published a paper entitled “Underestimating Costs in Public Works Projects-Error of Lie?”
- The study of over 258 completed transportation infrastructure projects worldwide concluded that “….members of the public who value honest numbers should not trust cost estimates and cost-benefit analyses produced by project promoters and their analysts.”

Underestimating Costs-How Badly?

Inaccuracy of transportation cost estimates by type of project (fixed prices)

Project type	Number of cases (N)	Average cost escalation (%)	Standard deviation	Level of significance (p)
Rail	58	44.7	38.4	≤ 0.001
Fixed-link	33	33.8	62.4	≤ 0.004
Road	167	20.4	29.9	≤ 0.001
All projects	258	27.6	38.7	≤ 0.001

Underestimating Costs

- Many dispute the 2002 study, since the final cost variance is calculated from the initial estimate used to justify project implementation….too early for accurate estimates
- Flyvberg defends using this metric since it is the key decision making stage in the project and therefore should not be underestimated
- He concluded that project underestimation occurs on 9 out of every 10 transit projects
- Not a very comforting statistic if you are a project proponent

Are Estimates Getting Any Better?

- In fall of 2003 the US Federal Transit Administration (FTA) published a paper entitled “Predicted and Actual Impacts of New Starts Projects”
- The study of 21 transit infrastructure projects concluded that ….
  - Cost of completed projects averaged 21% higher than estimate used for selection of locally preferred alternative
  - Accuracy of early planning estimates for transit projects improving
  - FTA processes had a positive impact on controlling project costs
- Still room for improvement !

Are Estimates Getting Any Better?

As-Built Project Costs as Percent of Estimate at Alternative Analysis

Project type	Number of cases (N)	Average cost escalation (%)	Number Under Estimate
Heavy Rail/AGT	7	32.3	1
Light Rail	10	17.9	4
BRT	4	30.0	0
All projects	21	20.9*	5

*** Alternative Analysis estimate adjusted for inflation**

Transit Estimate Risk Factors

- So what makes transit projects difficult to estimate?
  - Change in alignment
  - Change in the number of stations
  - Change in technology
  - Change in elected officials and policy
  - Delay in starting construction
  - Change in regulation
  - Change in Park and Ride facilities
- Project team often cannot control these outcomes

Initial Silicon Valley Light Rail Experience

- The first project, the Guadalupe Corridor LRT was completed 48% percent over the Alternative Analysis/Draft Environmental Impact Study estimate
- The initial project team had roadway experience but no light rail experience
- Alignment changes (politically driven) and unforeseen regulatory requirements drove up cost from initial estimates
- Inadequate contingencies for 21 mile long linear project
- No cost database

Current Silicon Valley Light Rail Experience

- Four extensions after the Guadalupe Corridor averaged 2.2 % under initial estimates
- Project team had established design criteria and standards

- Initial estimates had two levels of contingency
- Allocated contingencies ran 4.2% over but
- Unallocated contingencies were sufficient to cover the unforeseen cost increases
- Detailed cost database and monthly project trend reports

Current Silicon Valley Light Rail Experience

Valley Transportation Authority Project Delivery Performance

Rail Expansion Program

Project	**Schedule**	**Actual**	**Mos.**	**Budget** [1] (Millions)	**Actual** [2] (Millions)	**Over/ (Under)**
Tasman West Light Rail	Dec. 2000	Dec. 1999	12 mos. early	$ 327.8	$ 327.8	$0
Tasman East - Baypointe	Feb. 2000	Dec. 1999	2 mos. early			
Tasman East to Hostetter	July 2004	June 2004	1 mo. early	$ 287.4	$ 272.6	($ 14.8)
Capitol Light Rail	July 2004	June 2004	1 mo. early	$ 166.5	$ 156.9	($ 9.6)
Vasona Light Rail	Jan. 2006	Oct. 2005	3 mos. early	$ 320.4	$ 313.2	($ 7.2)
100-Low Floor Vehicles				$ 298.4	$ 298.4	($ 0.0)
Totals				**$ 1,400.5**	**$ 1,369.9**	**($ 31.6)**

Final costs average of 2.2% under estimates

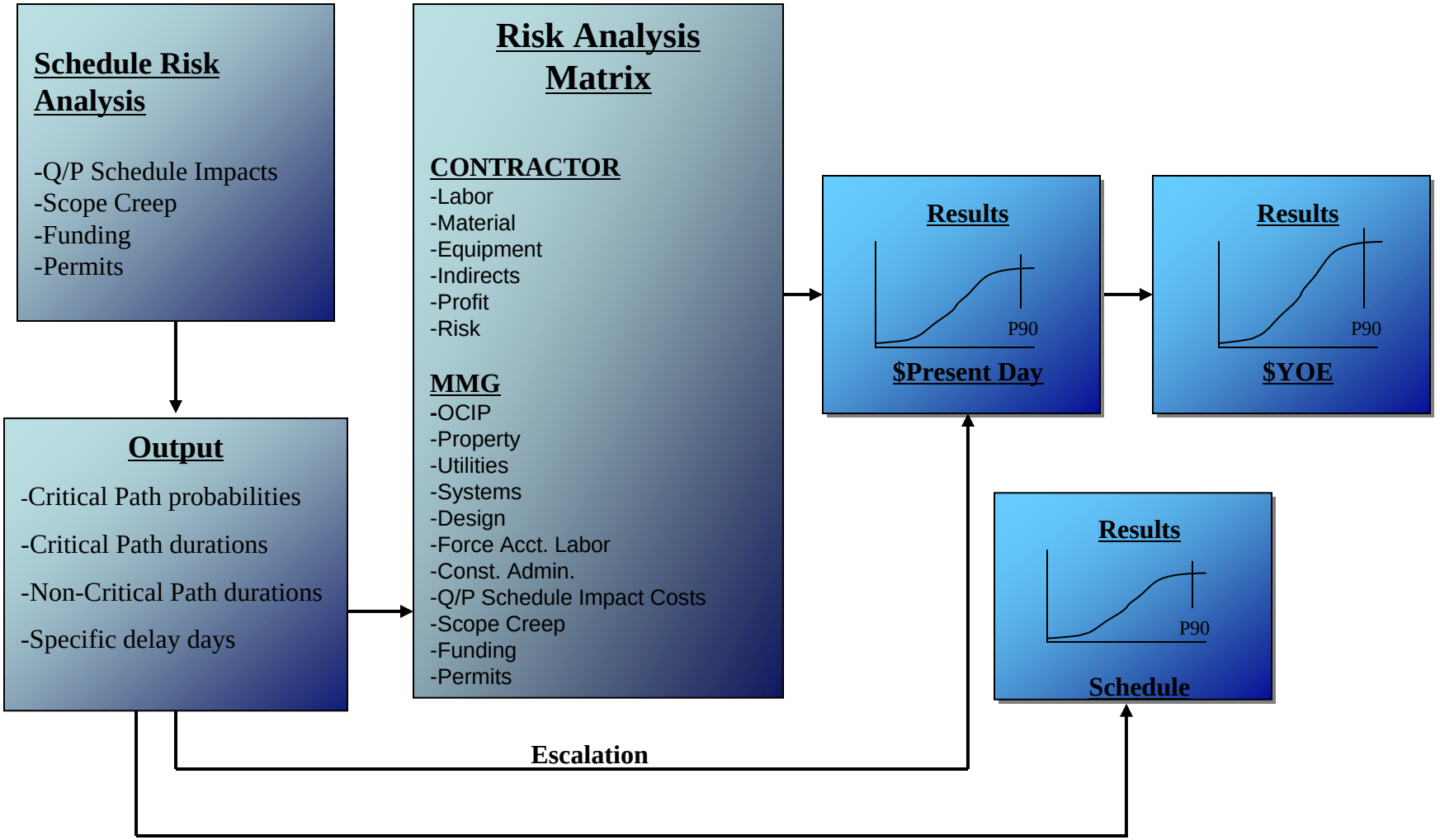
Silicon Valley Transit Cost Drivers

	$'s in $1,000's
Category	**Attributable Cost Change**
CONSTRUCTION	
Utility Relocations	$36,712
Unforeseen Conditions	$35,861
Unfavorable Regulatory Decisions	$10,754
Systems / Bulk Procurement	($20,970)
REAL ESTATE	$11,670
DESIGN AND MANAGEMENT	$25,360
PROJECT CONTINGENCY	($44,188)
TOTAL CHANGE IN COST	**$55,199**
	4.2%

Better Estimates- Owner Responses

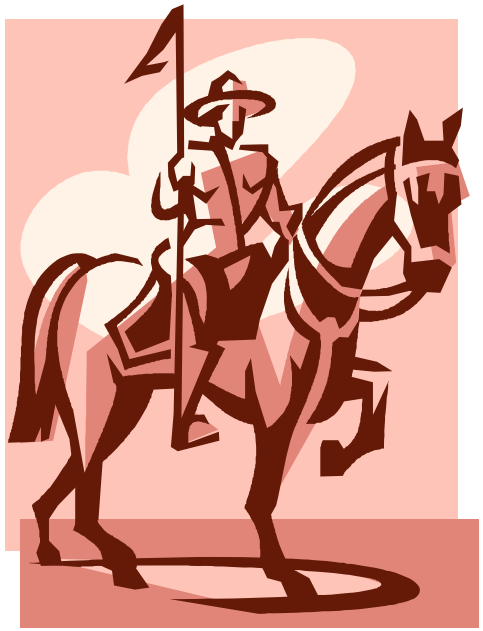
- Washington State DOT adopted Cost Estimate Validation Process (CEVP) –a probabilistic cost and schedule model to estimate ranges of cost and schedule to complete each project
- FTA adopted updated Risk and Contingency Review Requirements in 2010 with estimate beta range factors by Risk Category and other guidance
- Metrolinx and TTC using Risk Assessments and Risk Registers on Eglinton-Scarborough Crosstown Project

Better Estimates-Risk Assessments



Better Estimates- Call in the Mounties!

- Formal establishment of Risk and Contingency Management Plan (RCMP) for project
- Sets framework for early involvement of stakeholders, control strategies and protocols early in program life cycle
- FTA reports much better estimate and schedule accuracy on projects utilizing these tools



Better Estimates and Cost Control

- Start Value Engineering Early in Preliminary Engineering

Example: BART Extension to Silicon Valley

Item	Description	Source	Supplemental EIS/EIR	Potential Savings ($ Millions)
1	Delete One Downtown Station	VE	Y	-75 to -100
2	Defer Alum Rock Garage	VE	Y	-20 to -30
3a	Montague Area U-Wall Cost Trend	PC	N	+20
3b	Montague Aerial Alternative	VE	Y	-22
4	Montague Station VE	VE	Y	-0 to -12
5	Crossover Structure	VE	N	-15
6	Delete mid-tunnel vent shafts	PC	N	-0 to -10
7	Reconfigure Yard and Shops	VE	Y	-5 to -10
8	Cross Passage Spacing	BT	Y	+15
9	Tunnel Diameter	BT	N	+25 to +15
10	Station Platform Width	BT	N	+15 to +0
11	Newhall Yard Real Estate Value Engineering	VE	Y	-$50
	Total Potential Range of Savings - $2001			-$160 to -$210

Better Estimates and Cost Control

- Keep VE and Scope Cost Trends Visible to Decision Makers

Example: BART Extension

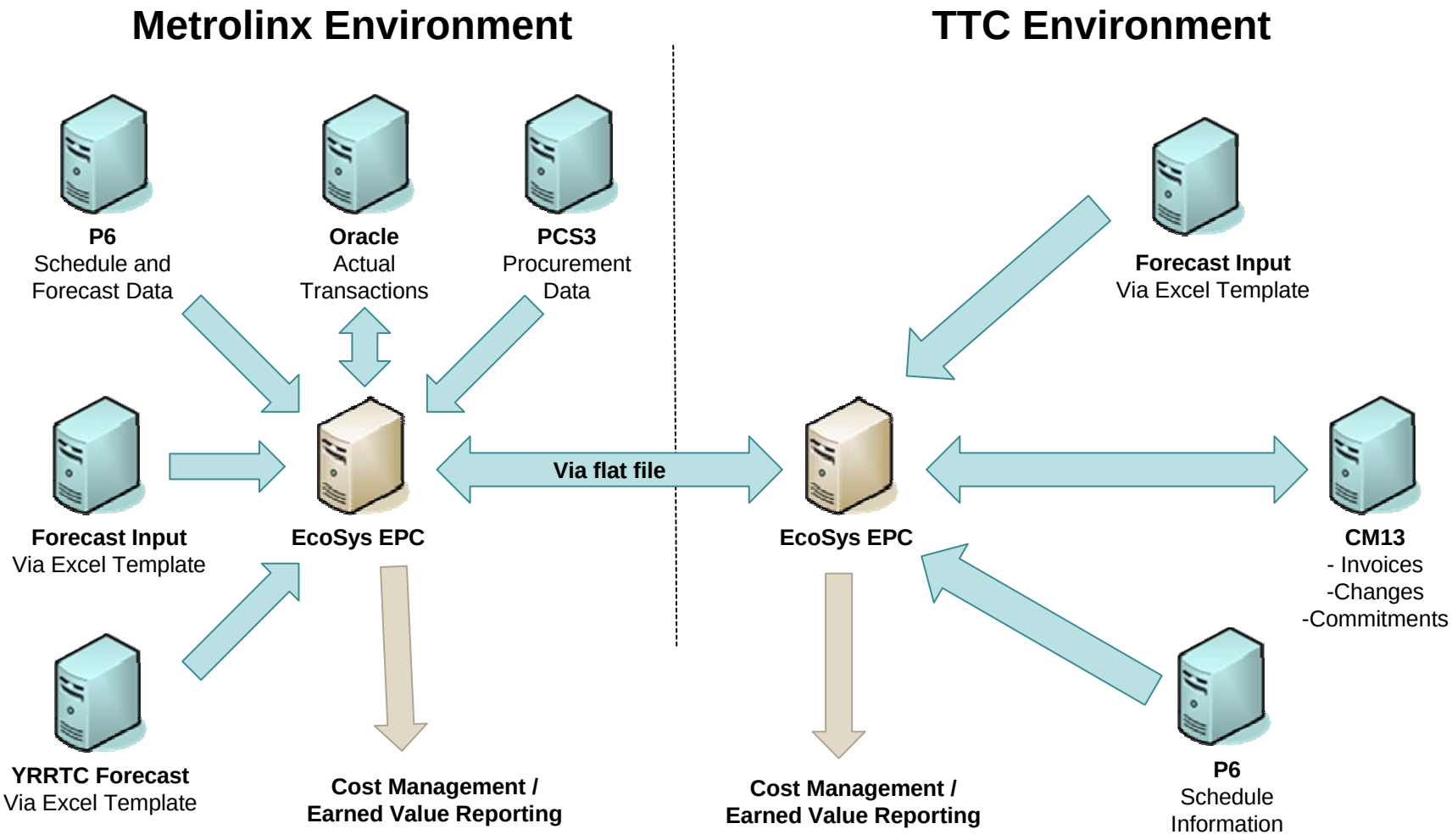
Description	(2003$ in Millions) Original Budget	(2003$ in Millions) Current Forecast	Difference
Guideways-At Grade and Elevated	327	295	-32
Tunnels	581	648	67
Stations	607	487	-120
Systems	357	375	18
Sitework and Special Conditions	63	63	0
Yards and Shops	217	212	-5
Design, PM, CM and Start-up	660	620	-40
S/T Design and Construction	2,812	2,700	-112
Revenue Vehicles	403	433	30
Right of Way	595	543	-52
Project Reserve/Change Order Allow	382	516	134
Total	$4,192	$4,192	$0

The estimates and information contained in these reports are preliminary. Continuing review and design development will change these estimates.

Better Estimates and Cost Control

- Where is the Information?
- Best information on cost trends, change order status, progress payments—in the field office on CM-13
- Submittals, correspondence, due dates—in the field office on CM-13
- Budget/cost reporting performance-Oracle and EcoSys
- Schedule performance-P6
- Link program team and information-web based Project Control Software Tools

EcoSys Configuration



PCST Portal used at VTA in Silicon Valley

Risk Transfer Delivery Models

- Alternative Financing and Procurement (AFP) is an innovative way for the government to deliver on its commitment to maintaining and expanding public infrastructure

- The premise is to strategically use private financing to build and renovate vital infrastructure, on time and on budget, while ensuring appropriate public control and ownership

Benefits of AFP

- Faster, more efficient delivery of public infrastructure projects
- Increases effectiveness by allowing flexibility in retaining specialized, most competent companies given requirements of each specific project
- Enhances on-time & on-budget performance during transaction and construction phases
- Reduces risks for the public organization in charge by sharing risks with other project parties
- Reduces costs to the public by driving project costs down through competition on delivering public infrastructure projects

The AFP Process

- Metrolinx partners with Infrastructure Ontario to conduct projects using AFP
- Infrastructure Ontario (IO) is a crown corporation of the Province of Ontario with responsibility for managing the AFP process with Metrolinx
- Process begins with a value-for-money (VFM) assessment of using an AFP process rather than a traditional delivery model
- AFP ensures open, competitive, transparent procurement
- All project decisions are endorsed throughout by the owner (Metrolinx) and the agent (IO)
- IO's involvement is primarily during the project initiation and transaction phases (retaining consultants, preparing RFQ and RFP, evaluating submissions
- IO retains an oversight role during project implementation

Metrolinx Projects

- Mixed model - traditional sources of funding plus AFP on some

- Examples:
  - Metrolinx Air Rail Link project is being delivered via AFP
  - Viva Bus Rapid Transit design-build project implementation – current phases are being delivered by a Design-Build arrangement, future phases could add Finance or Finance and Maintain to the delivery model
  - GO Transit East Rail Maintenance Facility
  - Parts of the Eglinton-Scarborough Crosstown Project

- Metrolinx analyzes each of its planned projects to determine whether there would be demonstrable value for money with an AFP delivery model and is investigating the possibility of future AFP projects

Conclusions

- Transit projects are tough to estimate….they are long with many stakeholders and a high potential for change
- We must do a better job in preparing early estimates and keeping this information in front of decision makers
- Canada can benefit from the discipline of Risk Assessment tools being used by FTA and Washington DOT in preparing better estimates and monitoring risks and contingency as projects are developed
- Owners need to look at advantages of transferring risks to AFP proponents that are better able to manage risk

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Thank you