


 Ministry of Transportation  
 Ontario


G.W.P. 4058-01-00

# Highway 417 Bridge Replacement

West of Maitland Avenue to East of Island Park Drive

**Canadian Society of Value Analysis  
 2006 Conference  
 October 24, 2006**








 Ministry of Transportation  
 Ontario

G.W.P. 4058-01-00  
**Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive**

## Presentation Outline

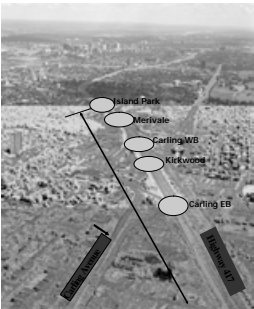
- Description of Project
- Heavy Lift / Rapid Replacement Technology
- Risk Assessment Process








 Ministry of Transportation  
 Ontario

G.W.P. 4058-01-00  
**Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive**

## Overview of Project Area

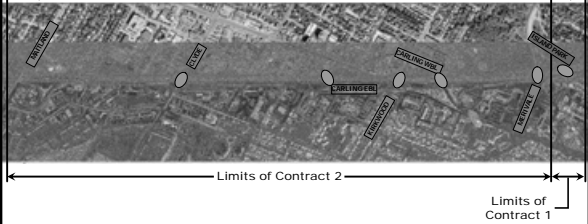








 Ministry of Transportation  
 Ontario

G.W.P. 4058-01-00  
**Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive**

## Overview of Project Area






Island Park Drive Bridge – South Side



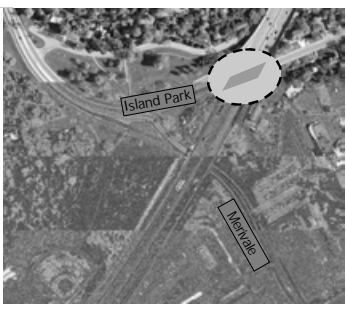
Island Park Drive Bridge – North Side






Island Park Drive Bridge


 Ministry of Transportation G.W.P. 4058-01-00  
**Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive**


### Description of the Work – Contract No. 1










 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Construction Staging Area










 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00


## Heavy Lift Technology

- ◆ Use of Rapid Replacement Technology is new to MTO
- ◆ Save \$\$\$
- ◆ Reduce congestion during construction
- ◆ Reduce overall project duration
- ◆ Pave the way for future projects








 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Heavy Lift Technology






- ◆ SPMT – Self Propelled Modular Transporters.
- ◆ Adaptable.
- ◆ “Turns on a dime”.
- ◆ Transports over uneven surfaces.
- ◆ MAMMOET – Heavy Lift Specialist.






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

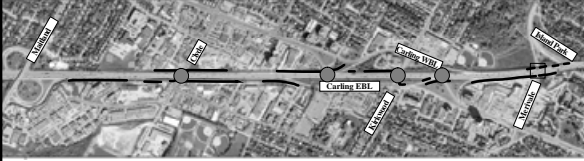
## Mammoet Animated Video










 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Description of the Work – Contract No. 2





- Heavy Lift Replacement
- Rehabilitation
- Retaining Walls






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Description of the Work – Contract No. 2


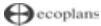
- ◆ Bridge replacement using heavy lift for:
  - Carling Avenue westbound;
  - Kirkwood Avenue;
  - Carling Avenue eastbound; and
  - Clyde Avenue.
- ◆ Bridge rehabilitation:
  - Merivale Road.






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Description of the Work – Contract No. 2



- ◆ Widening 417 for construction continued...
  - Storm sewer replacement (median if required);
  - New storm sewer for outside widening (new construction);
  - Overhead signs; and
  - Upgraded illumination.






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Description of the Work – Contract No. 2



- ◆ Widening 417 for construction continued...
  - Retaining walls;
  - Three (3) lanes in each direction;
  - Additional lane width constructed for staging;
  - Ramp modifications;
  - Median barrier replacement;






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

### Local Roadways Construction – Contract No. 2



- ◆ Lowering of profiles to maintain bridge clearances – staged construction;
- ◆ Rehabilitation of underground plant (as required):
  - ◆ Storm and sanitary sewers;
  - ◆ Watermains;
  - ◆ Illumination / traffic signals; and
  - ◆ Bell, hydro, gas, etc.
- ◆ Reinstatement of roadway elements.






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

### Risk Assessment - Objectives



- ◆ Comprehensive risk assessments for both contracts
- ◆ Increase confidence in project development
- ◆ Identify project risks and their impact on the project cost and schedule
- ◆ Determine mitigation measures and responsibilities for addressing the project risks
- ◆ Particular emphasis to be given to rapid-lift issues

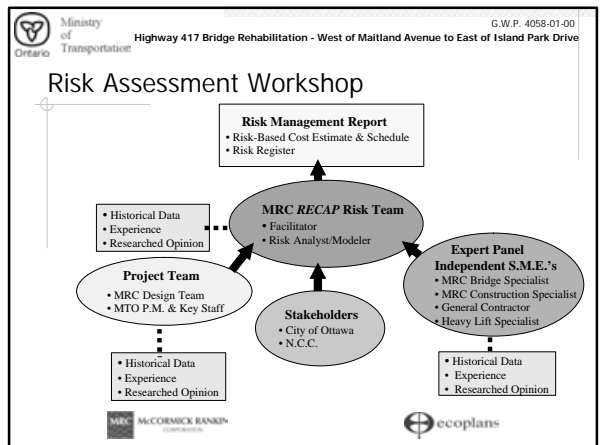





 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

### MRC's Project Risk Management Process -*RECAP*

- ◆ Risk Management Planning
- ◆ Risk Identification
- ◆ Qualitative Risk Analysis
- ◆ Quantitative Risk Analysis
- ◆ Risk Response Planning
- ◆ Risk Monitoring & Control




 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00



## Project Risks


Variations in project costs

- ◆ Project Scope Creep – Add-ons
- ◆ Economic changes – inflation, market conditions
- ◆ Unknown/Changed Conditions (Geotechnical, Environmental, Structural Etc)
- ◆ Third Party Approvals
- ◆ Quantity under runs / overruns
- ◆ Property Impacts
- ◆ Utilities
- ◆ Planning or Design Errors & Omissions
- ◆ Schedule Delays (weather, labour, material / equipment supply)

Variations in project schedule



- ◆ Schedule Delays (weather, labour, changed conditions, material/equipment supply)






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

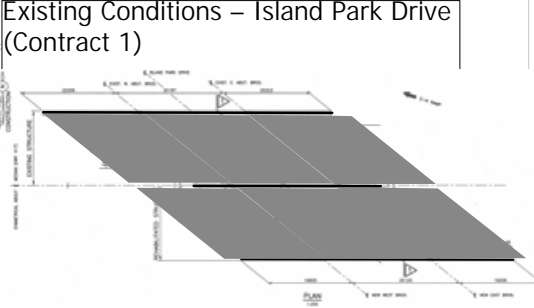
## Results of Risk Assessment



1. Risk-Based Construction Schedule for Rapid Lift Operation
2. Risk-Based Cost Estimates for Contracts 1 and 2
3. Risk Assessment, Risk Register and Risk Management
4. Summarize Key Benefits of Risk Assessment





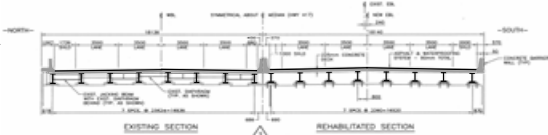

 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Existing Conditions – Island Park Drive (Contract 1)









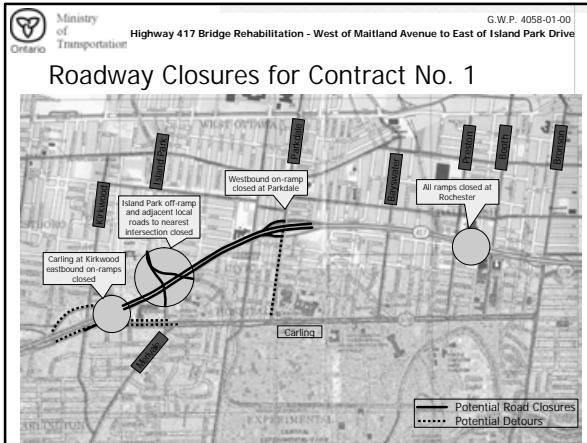

 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00



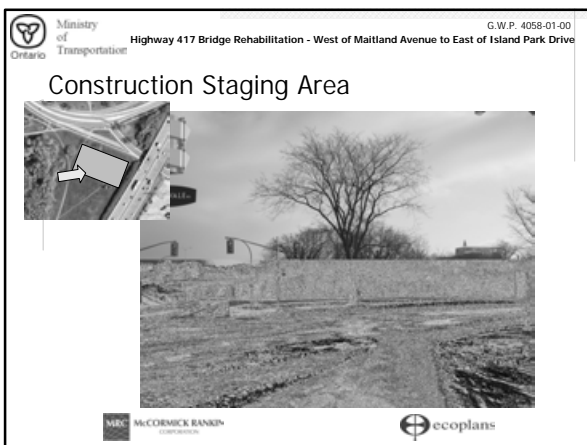
## Island Park Drive Bridge – Cross-Section



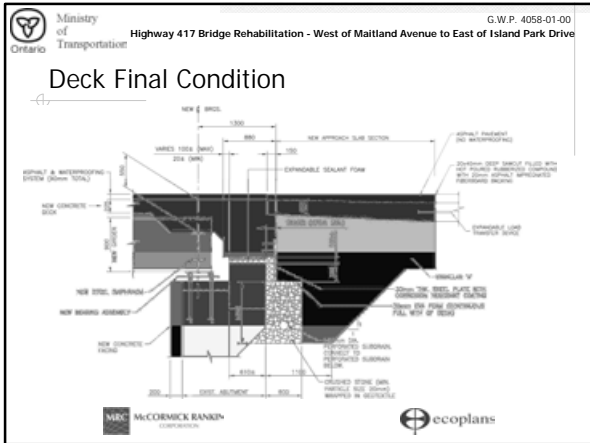


- Ministry of Transportation Ontario Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive G.W.P. 4058-01-00
- ### Description of the Work – Contract No. 1
- ◆ Rehabilitation of Island Park Drive Bridge
    - ◆ Superstructure replacement;
    - ◆ Abutment refacing;
    - ◆ Removal of existing sound barrier and installation of new sound barrier;
    - ◆ Replacement of sidewalks and curbs;
    - ◆ Removal of old connection to Merivale Road from Island Park Drive;
    - ◆ Deck construction / demolition within construction staging area; and
    - ◆ Reinstatement of construction staging area.
- MBC MCCORMICK BANKS ecoplans



- Ministry of Transportation Ontario Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive G.W.P. 4058-01-00
- ### Risk Assessment
1. Risk-Based Construction Schedule for Rapid Lift Operation
    - Hwy 417 Closure Duration ?
    - Ministry Preference - ASAP
- MBC MCCORMICK BANKS ecoplans





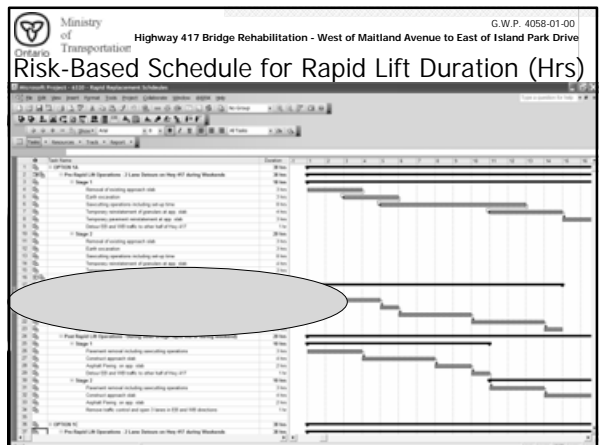
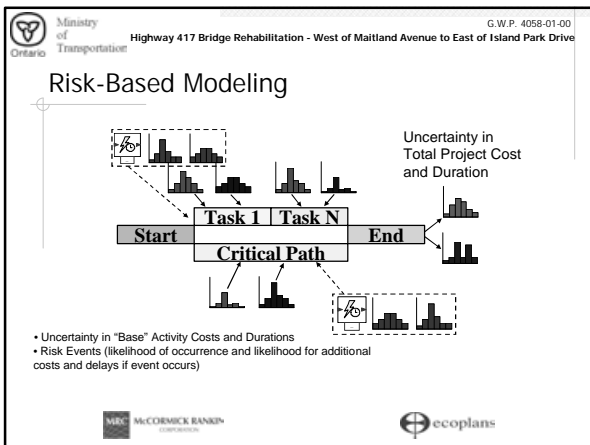
Ministry of Transportation Ontario Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive G.W.P. 4058-01-00

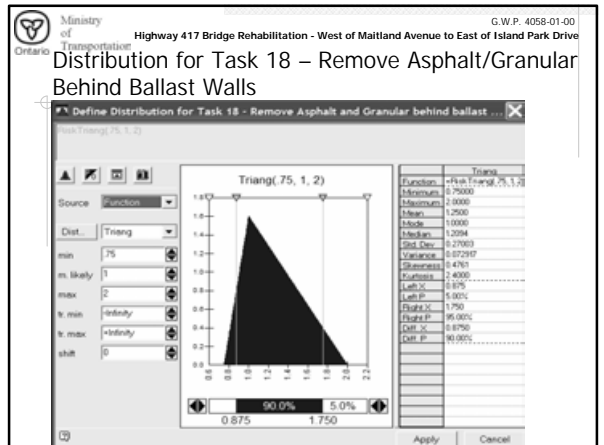
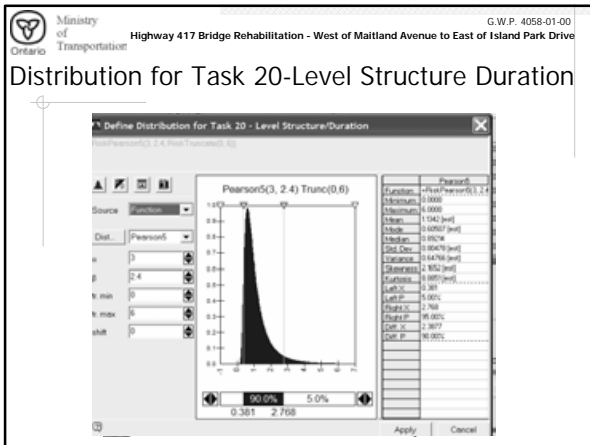
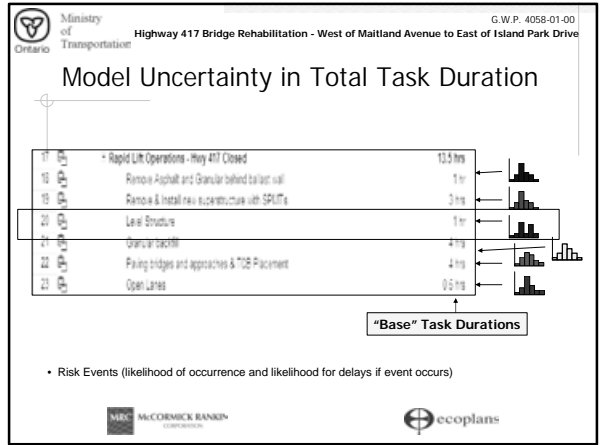
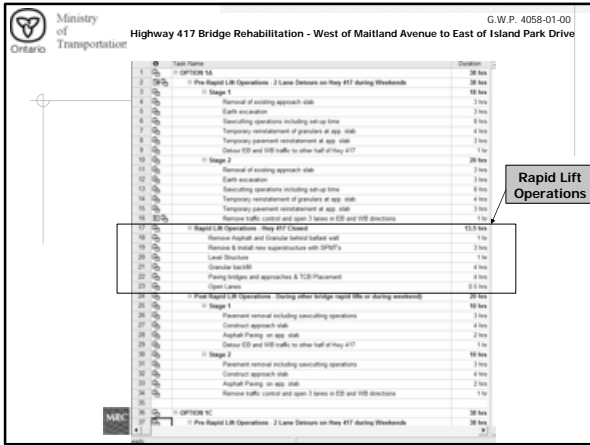
### Project Team Estimates of Duration of Operations (Hrs) \*

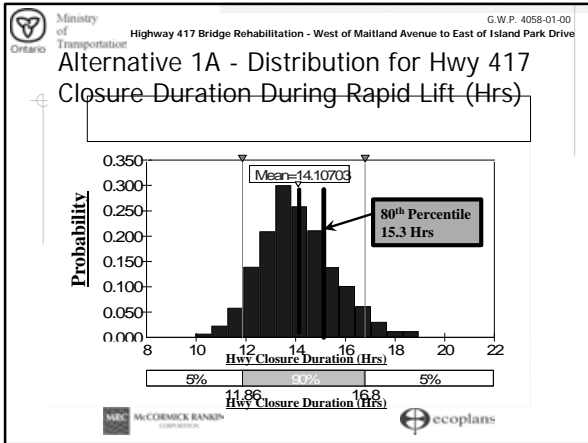
Option	Pre-rapid Lift	Post-Rapid Lift
1a	38	20
1b	38	9
1c	38	
3	-	43
5		47 & 22

\* Excluding time to close down 2 lanes or all lanes on the Queensway

McCREMICK BANKS CORPORATION ecoplans







Ministry of Transportation Ontario G.W.P. 4058-01-00  
Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive

### Risk-Based Estimates for Duration Of Operations (Hrs) \*

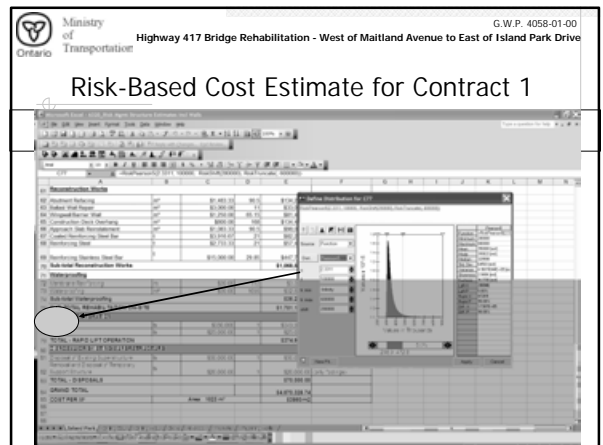
Option	Pre-rapid Lift**	Rapid Lift***	Post-Rapid Lift**
1a	38	12 (15.3)	20
1b	38	13	9
1c	38	(12.8)	
1b	38	13	9
3	-	13 (13.7)	43
5		13	47 & 22

80<sup>th</sup> Percentile

\* Excluding time to close down 2 lanes or all lanes on the Queensway  
\*\* Lane reductions on weekends \*\*\*Highway closures on weekends

MBC MCCORMICK BANKS ecoplans

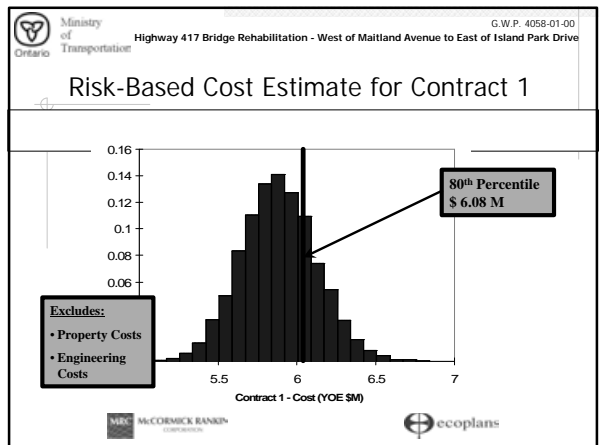
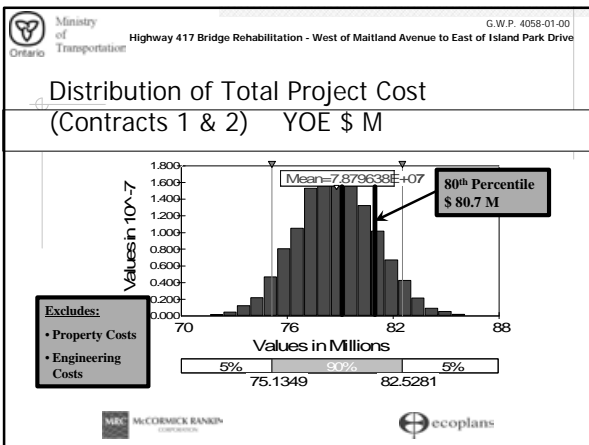
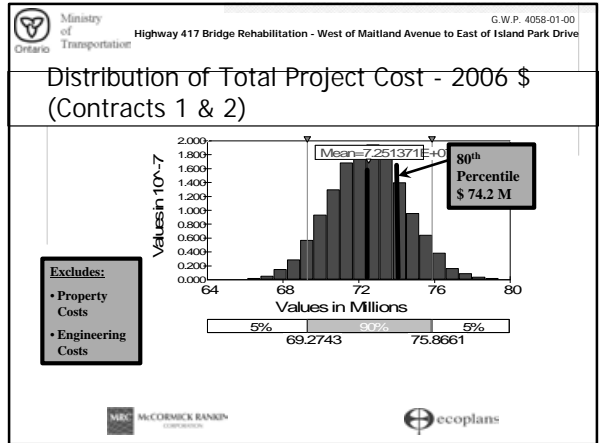
- Ministry of Transportation Ontario G.W.P. 4058-01-00  
Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive
- ### Results of Risk Assessment
- Risk-Based Cost Estimates for Contracts 1 and 2
- Base Cost Estimate**
- ◆ Level of Detail – early in design process
  - ◆ 2006 \$
  - ◆ No contingency
  - ◆ No escalation
  - ◆ No engineering costs
  - ◆ No property costs
  - ◆ Validated by Risk/Cost Team
- MBC MCCORMICK BANKS ecoplans



Ministry of Transportation Ontario Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive G.W.P. 4058-01-00

### Base Cost Estimate (Contracts 1 & 2)

Item No.	Description	Total Price	Remarks
1	Highway Component (Grading, paving, etc...)	\$20,819,638.40	Includes storm sewer replacement, highway illumination & ATMS
2	Side Road Grade Lowering - Clyde Avenue	\$2,063,163.42	Side road cost estimates assume full utility relocations
3	Side Road Grade Lowering - Carling EB	\$1,648,855.02	
4	Side Road Grade Lowering - Kirkwood Avenue	\$2,600,858.32	
5	Side Road Grade Lowering - Carling WB	\$1,164,696.35	
6	Side Road Grade Lowering - Merivale Road	\$543,173.64	
7	Side Road Grade Lowering - Island Park Drive	\$535,118.90	
8	Retaining Walls (Conventional)	\$8,543,900.00	Low Cost Alternatives = \$7,710,735.00
9	Bridge Replacement - Clyde Avenue	\$4,113,270.00	
10	Bridge Replacement - Carling EB	\$5,151,650.00	
11	Bridge Replacement - Kirkwood Avenue	\$4,987,120.00	
12	Bridge Replacement - Carling WB	\$4,733,950.00	
13	Bridge Widening/Rehabilitation - Merivale Road	\$1,105,230.00	
14	Bridge Replacement - Island Park Drive	\$3,948,450.00	
<b>Total Construction Base Cost Estimate</b>		<b>\$61,959,074.05</b>	





 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Risk Assessment

### 3. Risk Register and Risk Management

- ◆ 34 Risks / Opportunities Identified
- ◆ Risk Register Populated By Risk Team - Spreadsheet
- ◆ Risks/Opportunities Ranked By Risk Team
- ◆ Preliminary Response Strategy Identified
- ◆ Monitoring & Control By Project Design Team








 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Risk Register

**RISK REGISTER**  
 Project: Highway 17 Bridge Rehabilitations  
 Date: 5/16/2006



ID	Description	Risk Category	Risk Level	Qualitative Analysis	
				Impact	Probability
1	...	...	...	...	...
2	...	...	...	...	...
3	...	...	...	...	...
4	...	...	...	...	...
5	...	...	...	...	...






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Risk Register.. Cont'd



ID	Description	Risk Category	Risk Level	Response Strategy		Monitoring and Control	
				Response Strategy	Monitoring and Control		
...	...	...	...	...	...	...	
...	...	...	...	...	...	...	
...	...	...	...	...	...	...	






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Key Risk/Opportunity Areas – Contract 1



- ◆ Prequalification of Contractors
- ◆ Traffic Management & Communication Plans
- ◆ The construction schedule, including lead time for steel supply / fabrication, is challenging and consideration of an acceleration of the design / tendering process is recommended;
- ◆ Incentive / Disincentive clauses should be tied to realistic expectations of the duration of the rapid lift replacement
- ◆ Subsurface conditions in staging area (Geotechnical investigation not complete).
- ◆ Consideration of advance work required for Contract 2 (WM, Road Lowering, Storage of Granular for Staging Areas)
- ◆ Approvals (N.C.C., City of Ottawa)






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

### Key Risk/Opportunity Areas – Contract 2



- ◆ Overall Project Cost;
- ◆ Additional cost escalation due to labour shortage (Ottawa LRT Project);
- ◆ Traffic Management & Communication Plans;
- ◆ Prequalification of Contractors;
- ◆ Additional cost escalation due to labour shortage (Ottawa LRT Project);
- ◆ Subsurface conditions @ Structure Widening / retaining walls;
- ◆ Constraints imposed by utilities incl. major 1200 dia WM;
- ◆ Constraints imposed by Hydro One Towers & high-voltage conductors;






 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

### Key Risk/Opportunity Areas - Contract 2 ..Cont'd



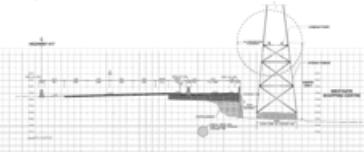
- ◆ Need to stage / limit number of local road closures at same time;
- ◆ Utility relocations in local roads;
- ◆ Likelihood that overnight Hwy 417 closures will be in 13- 15 hrs range;
- ◆ Need for additional stand-by equipment
- ◆ Depth of existing asphalt on bridge decks;
- ◆ Property impacts;
- ◆ Remote location of Clyde Avenue staging area and utilities on route;
- ◆ Approvals (N.C.C., City of Ottawa)








 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

### Examples of Contract 2 Risk Areas

- ◆ (WM & Hydro Towers)
- ◆ Retaining walls










 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00


### Examples of Contract 2 Risk Areas .. Cont'd

- ◆ Remoteness of Clyde Avenue Staging Area
- ◆ Overhead Utilities on Clyde Avenue

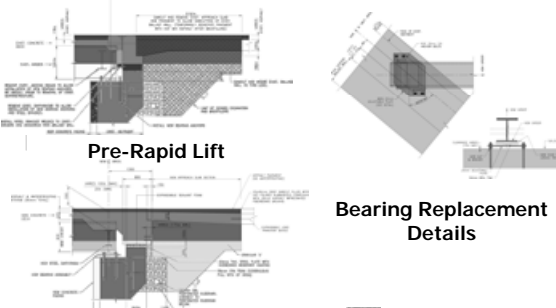



Clyde Avenue - South Portal








 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Improved Design Development



**Pre-Rapid Lift**  
**Bearing Replacement Details**  
**Final**









 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

## Risk Assessment

### 4. Summary - Key Benefits of Risk Assessment

- ◆ Risk management plan has been implemented (mitigation, elimination, acceptance of key risks)
- ◆ Design development for Rapid Lift has been significantly improved
- ◆ Risk-based cost estimates for Contracts 1 & 2 Developed
- ◆ Risk-based Hwy 417 closure duration (14-15 hrs) for Rapid Lift defined for contact planning/approvals
- ◆ Risk-based Schedules for both Contracts 1 & 2 developed


 Ministry of Transportation  
 Highway 417 Bridge Rehabilitation - West of Maitland Avenue to East of Island Park Drive  
 G.W.P. 4058-01-00

# Questions?

