Approach to Evaluate Foundation Reuse

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Approach to Evaluation Foundation Reuse

Highway 401 Toronto, Ontario, Canada

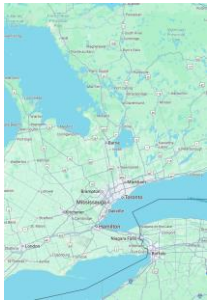
Morning Session:

- Ministry of Transportation Ontario's Position on Foundation Reuse
- Site and Project Description
- Overview of the Evaluation Process
- Evaluation Process Step 1) Preliminary Foundation Assessment

Afternoon Session:

- Evaluation Process Step 2) Risk Assessment

Site Location



MTO's Foundation Reuse Evaluation Guideline

Step 1 Preliminary Foundation Assessment
Step 2 Risk Analysis
Step 3 Life Cycle Cost Assessment
Step 4 Estimation of Remaining Service Life
Step 5 Environmental and Social Considerations

Step 1) Preliminary Foundation Assessment

Scope of Work:

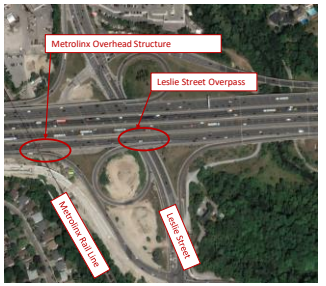
- To assess pile capacity, integrity, and durability
- Preliminary foundation assessment:
  - A. Review of subsurface conditions
  - B. Review of existing foundation design, construction and past performance
  - C. Assessment of geometric compatibility and constructability
  - D. Evaluation of existing pile capacity
  - E. Evaluation of existing pile integrity and durability

Conclusions:

- Sufficient axial geotechnical resistance for the structural loading conditions
- Sufficient remaining service life and pile section loss is not likely to compromise the piles
- Reuse of the existing piles is feasible.

Step 2) Risk Assessment

- Identification of engineering design uncertainties and risks for foundation reuse
- Assessment of risks, and development of risk responses / mitigation measures.
- Identification of constructability / construction advantages and disadvantages.



Step 2) Risk Assessment

Uncertainties and Risk:

1. Pile length / pile tip elevations
2. Pile size
3. Pile cut-off elevation
4. Pile spacing and batter
5. Pile integrity / extent of corrosion
6. Potential for continued pile degradation due to corrosion
7. Corrosion protection system impacts to nearby structures or utilities

RISK RATING						
Likelihood	Very High	Medium	High	Very High	Very High	Very High
	High	Low	Medium	High	Very High	Very High
	Medium	Low	Medium	Medium	High	Very High
	Low	Very Low	Low	Medium	Medium	High
	Very Low	Very Low	Very Low	Low	Low	Medium
		Very Low	Low	Medium	High	Very High
			Consequence			

Step 2) Risk Assessment

RISK	Without Response/ Mitigation: Likelihood	Consequence	Risk	RISK RESPONSE / MITIGATION	With Response/ Mitigation: Likelihood	Consequence	Risk	Selected Risk Response
Uncertainty in pile length / pile tip elevations resulting in uncertainty of geotechnical capacity of the existing piers.	M	VH	H	Option 1) Use lower geotechnical resistance factor	M	VL	L	X
				Option 2) Use geotechnical resistance equal to the original design load	M	VL	L	
				Option 3) Augmenting the existing foundations with additional piles. Include NDT or PDA testing of piles at time of construction to confirm if warranted.	M	VL	L	

Step 2) Risk Assessment

RISK	Without Response/ Mitigation			RISK RESPONSE / MITIGATION	With Response/ Mitigation			Selected Risk Response
	Likelihood	Consequence	Risk		Likelihood	Consequence	Risk	
Uncertainty of the extent of corrosion of existing piles.	L	VH	H	Option 1) Conduct detailed corrosion assessment	VL	VL	VL	x
				Option 2) Conduct structural assessment to determine section loss of pile that would result in lowering of structural capacity.	M	VL	L	x
				Option 3) Include corrosion protection in current design to cease additional corrosion.	M	L	L	x
				Option 4) Visually assess and test piles at time of construction	M	NG	NG	x
				Option 5) Include augmenting of the existing foundations in current design.	M	VL	VL	

Step 2) Risk Assessment

Disadvantage:
- Installation and maintenance of corrosion protection system(s)

Advantages:
- Limit working near rail and road
- Limit working in constrained construction access/space on highway corridor
- Improvements to construction schedule and cost

Step 2) Risk Assessment

Conclusions:
- For all risks and uncertainties identified, there were adequate responses / mitigation measures such that all risks could be decreased to a negligible, very low, or low rating.
- Some mitigation include:
  - Non-destructive testing to confirm pile length
  - High-strain dynamic testing to confirm pile capacity
  - Exposure of upper portion of selected piles to examine pile corrosion conditions via visual assessment and ultrasonic thickness testing
  - Provision to add additional foundation elements to augment existing piles if warranted
- Construction advantages significantly outweigh the construction disadvantages.
- Pile reuse is feasible

Thank you

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