**Objective**
Formulate innovative alternative project management strategies for the ongoing preliminary activities on 78 Ave., pertaining to the construction of a car underpass and pedestrian tunnel for the future Green Line LRT project in Calgary, AB.

**Project Scope**
Utilize current site construction drawings provided by Graham Construction Inc. to develop the following project deliverables:
- Produce Work Packages
- Create a Work Breakdown Structure
- Conduct Quantity Takeoffs
- Develop two alternative project plans consisting of schedules and site layouts
- Cost Estimate for the chosen project plan
- Project Risk Management Plan
- 3D Site Modelling and VR Site Representation
- Sustainable Project Solutions
- Quality and Safety Report

**Project Constraints**
- Allow for CPKC Trains to continue operations without interruptions for the duration of the project
- Meet the 6-month (pedestrian tunnel) and 9-month (car underpass) CPKC diversion track schedule restrictions

**Schedule**
- Simultaneous construction schedule best meeting project constraints
- Total Duration 445 Days
- Minimized winter work
- Increased project flexibility due to two simultaneous work fronts
- Increased labor and equipment efficiency from the ability to share resources between both project components

**Risk Management Plan**

<table>
<thead>
<tr>
<th>#</th>
<th>Top Risks</th>
<th>Description</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety on site</td>
<td>Accidents related to the proximity of the railway &amp; heavy machinery</td>
<td>- Safety training, safety inspection, &amp; emergency plan. - Engineering controls (e.g. guardrails), qualified personnel to alert workers of incoming trains PPS, in a last resort.</td>
</tr>
<tr>
<td>2</td>
<td>Delays in obtaining permits</td>
<td>Many approvals are needed for this project.</td>
<td>- Apply to approvals early, effective communication. - Ensure approval requirements are met.</td>
</tr>
<tr>
<td>3</td>
<td>Structural &amp; Geo-technical Design Risk</td>
<td>Poor design and/or insufficient quality control can result in a structural or geotechnical failure.</td>
<td>- Concrete testing, soil testing, drainage system. Consulting professionals.</td>
</tr>
<tr>
<td>4</td>
<td>Weather changes</td>
<td>Calgary’s harsh winters.</td>
<td>- Schedule to avoid winter. - Monitor the daily weather. - Use durable equipment &amp; materials.</td>
</tr>
</tbody>
</table>

**Sustainability**

- Economic
  - Designing a site layout to minimize travel distance improving efficiency
  - Utilizing local material
- Social
  - Prioritizing health and safety measures for workers and the public
  - Creating easier mobility within the community
- Environmental
  - Implementing erosion controls, reducing noise pollution and soil contamination on site
  - Implementing a construction waste management program on site

**Cost Estimation**

<table>
<thead>
<tr>
<th>Code</th>
<th>Area</th>
<th>U Of M</th>
<th>Material</th>
<th>Equipment</th>
<th>Labour</th>
<th>Sub-Contract</th>
<th>Bare Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Indirect</td>
<td>LS</td>
<td>$341,504.06</td>
<td>$63,443.20</td>
<td>$1,034,136.00</td>
<td>$410,000.00</td>
<td>$1,595,763.26</td>
</tr>
<tr>
<td>1</td>
<td>78th Avenue Underpass</td>
<td>LS</td>
<td>$724,404.00</td>
<td>$458,781.58</td>
<td>$583,138.41</td>
<td>$4,050,000.00</td>
<td>$3,077,544.02</td>
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<td>2</td>
<td>Ogden Pedestrian Tunnel</td>
<td>LS</td>
<td>$2,774,706.65</td>
<td>$410,846.38</td>
<td>$147,910.09</td>
<td>$0.00</td>
<td>$3,353,483.12</td>
</tr>
</tbody>
</table>

Total Cost: $3,468,824.91

**3D Modelling**

- **Pedestrian Tunnel**
- **Car Underpass**

**Acknowledgments:**
Special thank you to our advisors who supported and guided us throughout this project!
Dr. Estacio Pereira - Academic Advisor
Angela Doig - Industry Advisor
Graham Constructing & Engineering Inc.