Risk Evolution from Planning to Construction on the LA Metro Crenshaw/LAX Light Rail Transit Project

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Crenshaw/LAX Light Rail Transit
Project Overview - North/South Line

- 8.5 miles Light Rail
- 8 Stations
- $2,058.0 Million (Board approved revised LOP)
- Neighborhoods: Crenshaw, Inglewood, Westchester

Division 16
Southwestern Yard Maintenance Facility
Crenshaw/LAX Light Rail Transit Project
Risk Methodology and Approach

• FTA compliant Risk Management Program developed during the Planning Phase.
• Risk Workshops held at significant key project milestones.
• Register developed and maintained as a management tool throughout the project.
• Project elected to conduct an independent schedule assessment after 35% completion.
## Crenshaw/LAX Light Rail Transit Project
### Risk Register Evolution

<table>
<thead>
<tr>
<th>Risk ID</th>
<th>Risk Description</th>
<th>Environmental Planning</th>
<th>Procurement</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Damage of existing utilities during construction</td>
<td>12 12 12 12</td>
<td>12 12 12</td>
<td>10 10 10</td>
</tr>
<tr>
<td>72</td>
<td>Utility relocation costs and construction duration may be greater than that included in the baseline estimate.</td>
<td>10 10 10 10</td>
<td>8 8 8 8</td>
<td>10 10 10</td>
</tr>
<tr>
<td>76</td>
<td>Utility relocation, including design and construction activities, delays construction activities. This is particularly significant under a design/build contracting scenario.</td>
<td>14 14 14 14</td>
<td>9 9 9 9</td>
<td>11 11 11</td>
</tr>
<tr>
<td>171</td>
<td>Temporary suspension of night time construction variance for one segment may impact the project schedule and cost.</td>
<td>14 14 14 14</td>
<td>9 9 9 9</td>
<td>11 11 11</td>
</tr>
<tr>
<td>209</td>
<td>Construction operations exceeding allowable noise levels</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
<td>6 6 6 6</td>
</tr>
<tr>
<td>70</td>
<td>Cut and Cover at MLK Station Box; pedestrian, traffic and business disruptions.</td>
<td>10 10 10 10</td>
<td>10 10 10</td>
<td>6 6 6 6</td>
</tr>
<tr>
<td>172</td>
<td>Differing Site Conditions, such as Excessive caving/cobbles/groundwater treatment, cobbles, abrasive soils, H2S and CH4 gasses.</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
<td>6 6 6 6</td>
</tr>
<tr>
<td>262</td>
<td>Tunneling issues: Muck handling with limited storage areas available onsite. Breakdowns &amp; supporting equipment, launching TBM, ground settlement.</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
<td>6 6 6 6</td>
</tr>
<tr>
<td>141</td>
<td>Potential for added scope to the project due to community demands.</td>
<td>11 11 11 11</td>
<td>7 7 7 7</td>
<td>6 6 6 6</td>
</tr>
<tr>
<td>250</td>
<td>Changes due to design comments during design review process.</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
<td>6 6 6 6</td>
</tr>
<tr>
<td>319</td>
<td>68th St Station - Metro future station accommodation.</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
<td>6 6 6 6</td>
</tr>
<tr>
<td>71</td>
<td>Cut and Cover at Harbor Sub/Crenshaw box; pedestrian, traffic and business disruptions.</td>
<td>12 12 12 12</td>
<td>6 6 6 6</td>
<td>6 6 6 6</td>
</tr>
<tr>
<td>143</td>
<td>Unintended interfaces between Design-Build Contract, Rail Operation Center, Maintenance Yard construction could add cost and schedule exposure.</td>
<td>12 12 12 12</td>
<td>6 6 6 6</td>
<td>6 6 6 6</td>
</tr>
</tbody>
</table>

### Cost and Schedule Probabilities

<table>
<thead>
<tr>
<th>Risk Rating</th>
<th>Cost</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt; $10,000</td>
<td>&lt; 1 month</td>
</tr>
<tr>
<td>2</td>
<td>$10,000-$100,000</td>
<td>1-3 months</td>
</tr>
<tr>
<td>3</td>
<td>$100,000-$1,000,000</td>
<td>3-6 months</td>
</tr>
<tr>
<td>4</td>
<td>$1,000,000-$10,000,000</td>
<td>6-12 months</td>
</tr>
<tr>
<td>5</td>
<td>$10,000,000</td>
<td>&gt; 12 months</td>
</tr>
</tbody>
</table>
Crenshaw/LAX Light Rail Transit Project Risk Metrics

Risk Evolution

<table>
<thead>
<tr>
<th>Project Phases</th>
<th>March-2011 Environmental Phase</th>
<th>June-2012 Commence Procurement Phase</th>
<th>December-2013 After Notice to Proceed</th>
<th>February-2017 At 50% of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Risks</td>
<td>141, 25, 156</td>
<td>96, 28, 86</td>
<td>297, 47, 156</td>
<td>72, 8, 31, 33</td>
</tr>
<tr>
<td>High Risk</td>
<td>20</td>
<td>42</td>
<td>94</td>
<td>33</td>
</tr>
<tr>
<td>Medium Risk</td>
<td>25</td>
<td>28</td>
<td>47</td>
<td>8</td>
</tr>
<tr>
<td>Low Risk</td>
<td></td>
<td></td>
<td></td>
<td>31</td>
</tr>
</tbody>
</table>

Total Risk: 141, 96, 28, 47, 72
High Risk: 20, 42, 94, 33
Medium Risk: 25, 28, 47, 8
Low Risk: 156, 86, 156, 31, 33
Crenshaw/LAX Light Rail Transit Project
Risks – Interfaces

Connection to Existing Rail Line

Future Metro Rail and LA International Airport Intermodal Station at 96th Street
Crenshaw/LAX Light Rail Transit Project
Risks – Interfaces

- Untimely interfaces between the Main Line DB, Yard DB, and Metro Rail Operation Center could add cost and schedule exposure.

- Cutover to the existing Metro Rail Line delays the project.

- Impact to construction due to accommodating the future 96th St Rail Station for connection to LAX Airport.
Crenshaw/LAX Light Rail Transit Project Lessons Learned

- Address integration issues early after contract award; proactive Owner in issuing Change Orders if warranted.
- Develop the Systems Integration Testing Plan well in advance (e.g., 2+ years)
- Apply a fresh perspective and collaborate with all stakeholders to determine the solution, even for late changes.
Crenshaw/LAX Light Rail Transit Project
Risks – Stakeholder Management
• Potential for added scope to the project due to community demands.

• Changes due to design comments during design review process.

• Utility Relocation costs and construction duration may be greater than that included in the baseline estimate and schedule.
Crenshaw/LAX Light Rail Transit Project Lessons Learned

• Work closely with key elected officials to monitor scope requests.
• Escalation ladder that includes upper management from the Agency and Cities.
• Higher level of design; sign-off of scope by stakeholder representatives with authority.
• Design progress must be sufficient to allow third party to estimate value to work.
Crenshaw/LAX Light Rail Transit Project
Risks – Underground Construction
Crenshaw/LAX Light Rail Transit Project Risks – Underground Construction

- Caving/cobbles/Groundwater and other issues with piling will impact critical path.
- Laydown yard and traffic control limitations may impact production.
- Muck handling – landfill closures from bad weather and off hours can halt tunneling.
- Equipment Breakdowns.
Crenshaw/LAX Light Rail Transit Project Lessons Learned

• Engage the Engineer-of-Record for Geotechnical Baseline Report, for periodic site visits and to log soils during excavation. Collaborated with Contractor’s Geotech/team.

• Approved traffic control plans and haul routes in contract can reduce risk to Project.

• Specify requirements for redundant back-up equipment.
Crenshaw/LAX Light Rail Transit Project
Risks – Tunneling Construction
Crenshaw/LAX Light Rail Transit Project
Risks – Tunneling Construction

- Tunneling risks are usually high stake and impact both schedule and budget.
- Ground loss/settlement
- Differing Site Conditions – excessive cobbles or abrasive soils.
- Hydrogen Sulfide/Methane gasses
- There are others...
Crenshaw/LAX Light Rail Transit Project Lessons Learned

- Monitoring for ground loss tied directly to tunnel boring activities and in real time; best managed by the Contractor.
- Potholing, test pits, and additional bore holes will contribute to a tighter Geotechnical Baseline Report (GBR).
- Prescriptive requirements for ventilation at tunnel heading.
Crenshaw/LAX Light Rail Transit Project

Questions?