CALIFORNIA HIGH SPEED RAIL: PCC—LIFE CYCLE ANALYSIS (MODAL ALTERNATIVE ADDITIONAL LANE MILES)
APPENDIX I

CALIFORNIA HIGH SPEED RAIL: PCC—LIFE CYCLE ANALYSIS
(MODAL ALTERNATIVE ADDITIONAL LANE MILES)

California High Speed Rail: PCC—Life Cycle Analysis (Modal Alternative Additional Lane Miles)

- 40-Year Analysis Period
- All costs are for a one-lane mile
- Pavement shoulders and subgrade preparation are not included.
- Salvage value assumes that 10% of the capital cost of the PCC and LCB and 50% of the capital cost of the aggregate base remains after 40 years of service.
- Net Discount Rate (%) — Inflation rate equals 0

<table>
<thead>
<tr>
<th>Service Year</th>
<th>PCC</th>
<th>LCB</th>
<th>Aggregate Subbase Class 3</th>
<th>Σ</th>
<th>Level Grinding</th>
<th>Replace 1% Joint Sealant</th>
<th>Replace 1% of Slab and Subbase</th>
<th>Engineering</th>
<th>Appurtenant &amp; Supplemental Work</th>
<th>Traffic Delay</th>
<th>Detours</th>
<th>Total Present Value</th>
<th>Total PCC Lane Miles</th>
<th>Total Cost (present Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Σ</td>
<td>$0.3</td>
<td>$7.6</td>
<td>$12.3</td>
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<td>$2.7</td>
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<td>1,990</td>
<td>87,531</td>
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<td>87,531</td>
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<td>$0.6</td>
<td>1,990</td>
<td>87,531</td>
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</tbody>
</table>

Total: 44
Total PCC Lane Miles: 1,990
Total Cost (present Value) 87,531
California High Speed Rail: PCC—Life Cycle Analysis
(Modal Alternative Additional Lane Miles)

<table>
<thead>
<tr>
<th>Item</th>
<th>Present Value ($1000's)</th>
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<tbody>
<tr>
<td>Initial Capital</td>
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<tr>
<td>Maintenance/Rehabilitation</td>
<td>87,531</td>
</tr>
<tr>
<td>Salvage*</td>
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<tr>
<td>Total</td>
<td>87,531</td>
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</table>

* 2970 freeway lane miles 33% AC (980) 67% PCC (1,990).

Sources: Parsons Brinckerhoff (2003)

California High Speed Rail: Asphalt Pavement—Life Cycle Analysis (Modal Alternative Additional Lane Miles)

- 40-Year Analysis Period
- All costs are for a one-lane mile
- Pavement shoulders and subgrade preparation are not included.
- Salvage value assumes that 10% of the capital cost of the asphalt remains after 40 years of service.
- 4.00 = Net Discount Rate (%)—Inflation rate equals 0

<table>
<thead>
<tr>
<th>Service Year</th>
<th>RAC-OG</th>
<th>AC Type A</th>
<th>Aggregate Base Type 2</th>
<th>AC Type A 2% Voids</th>
<th>Crack Sealing in Asphalt Layers</th>
<th>Mill &amp; Fill 1-inch of AC (10% of 1 lane mile)</th>
<th>Rebuild 2% of Pavement [asphalt only]</th>
<th>Engineering</th>
<th>Appurtenant &amp; Supplemental Work</th>
<th>Traffic Delay</th>
<th>Detours</th>
<th>Present Value</th>
<th>Total AC Lane Miles: 980</th>
<th>Total Present Value</th>
<th>Salvage Value ($1000's)</th>
<th>Total</th>
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<td>$4.3</td>
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<td>$2.3</td>
<td>$4.3</td>
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<tr>
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<td>$0.1</td>
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</table>

Summary

Total Cost (present Value) 48,060

U.S. Department of Transportation
Federal Railroad Administration
## Maintenance Cost Estimate for HSR Highway Pavement Types

**Quantity:** 63,360 $F^2$ (One Lane Mile)

<table>
<thead>
<tr>
<th>Pavement Option</th>
<th>Description</th>
<th>Quantity</th>
<th>Units of Measure</th>
<th>Subtotal cost</th>
<th>Unit Price</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PCC Pavement Option</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>1</td>
<td>Level grinding of pavement area¹</td>
<td>634</td>
<td>ft²</td>
<td>$0.52</td>
<td>$330</td>
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</tr>
<tr>
<td>2</td>
<td>Remove &amp; Replacement of joint sealant²</td>
<td>5,280</td>
<td>ft</td>
<td>$1.44</td>
<td>$7,590</td>
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</tr>
<tr>
<td>3</td>
<td>Replacement of PCC, LCB, and subbase in 1% of the paved area</td>
<td>634</td>
<td>ft²</td>
<td>$19</td>
<td>$12,262</td>
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</tr>
<tr>
<td></td>
<td>Saw Cut</td>
<td>79</td>
<td>lf</td>
<td>$3.25</td>
<td>$256</td>
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<tr>
<td></td>
<td>Demo Pavement</td>
<td>634</td>
<td>sqft</td>
<td>$2.50</td>
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<tr>
<td></td>
<td>Excavate &amp; Remove LCB &amp; Subbase</td>
<td>23</td>
<td>cy</td>
<td>$15.00</td>
<td>$346</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 mile haul &amp; Dispose of Demo</td>
<td>45</td>
<td>cy</td>
<td>$19.64</td>
<td>$892</td>
<td></td>
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<tr>
<td></td>
<td>Place &amp; Compact LCB &amp; Subbase (300 mm)</td>
<td>23</td>
<td>cy</td>
<td>$68.93</td>
<td>$1,592</td>
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<tr>
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<td>Replace PCC Section (290 mm)</td>
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<td>cy</td>
<td>$340.00</td>
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<td></td>
<td>Cut grooves inc in PCC above</td>
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</tr>
<tr>
<td>Pavement Option</td>
<td>Description</td>
<td>Quantity</td>
<td>Units of Measure</td>
<td>Subtotal cost</td>
<td>Unit Price</td>
<td>Total Cost</td>
</tr>
<tr>
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<tr>
<td><strong>Asphalt Pavement Option</strong></td>
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</tr>
<tr>
<td>1</td>
<td>Sealing Random Cracks in Asphalt Layers(^3)</td>
<td>1</td>
<td>ln mile</td>
<td>$2,270</td>
<td>$2,270</td>
<td>$2,270</td>
</tr>
<tr>
<td>2</td>
<td>Mill and fill 10% of the upper 1-inch of the asphalt pavement section(^4)</td>
<td>6,336</td>
<td>ft(^2)</td>
<td>$0.67</td>
<td>$4,250</td>
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<tr>
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<td>Grinding 0.08 ft</td>
<td>6,336</td>
<td>ft(^2)</td>
<td>$0.20</td>
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<tr>
<td></td>
<td>binder (1.25 t/1,000sy)</td>
<td>0.88</td>
<td>tons</td>
<td>$158</td>
<td>$139</td>
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<tr>
<td></td>
<td>AC pea gravel</td>
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<td>tons</td>
<td>$75</td>
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</tr>
<tr>
<td>3</td>
<td>Rebuild of the asphalt concrete layers in 2% of the paved area</td>
<td>1,267</td>
<td>ft(^2)</td>
<td>$10</td>
<td>$12,331</td>
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<tr>
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<td>Saw Cut</td>
<td>112</td>
<td>If</td>
<td>$1.75</td>
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<td></td>
<td>Demo Pavement</td>
<td>1,267</td>
<td>sqft</td>
<td>$1.25</td>
<td>$1,584</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excavate &amp; Remove LCB &amp; Subbase</td>
<td>23</td>
<td>cy</td>
<td>$15.00</td>
<td>$346</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 mile haul &amp; Dispose of Demo</td>
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<td>cy</td>
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<tr>
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<td>Place &amp; Compact LCB &amp; Subbase</td>
<td>0</td>
<td>cy</td>
<td>$68.93</td>
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<td>Replace AC Layer Type I</td>
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<td>Replace AC Layer Type II</td>
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<td>tons</td>
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<td>Replace AC Layer Type III</td>
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<td>$75.00</td>
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* Excludes traffic control or lane closures.  
* Cost includes premium for night/off-shift work.  
* Costs exclude traffic striping, or delineators.  
\(^1\) Based on per shift rate for deck grinding machine for profile Anrak assumes 1% grinding of section.  
\(^2\) Based on longitudinal premolded expansion joint.  
\(^3\) Based on one lane mile.  
\(^4\) Based on one lane mile.