Bechtel Lecture - Highlights of 4 Special Projects
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Arial View of the Carlsbad Desalination Plant
144-inch Diameter RCCP Bay Subaqueous Aqueduct from Saddle Island to the Main Land
144-inch Diameter RCCP for the 600 MGD Bay Aqueduct near Las Vegas
12 inch wall, 5/8 inch steel cylinder and three reinforcement cages
Triple 144-inch RCCP assembly weighing 180 tons with two temporary bulkheads in the launch way saddles on rails. The assembly is ready to be launched into the water.
The floating assembly was pulled by a tug from the launching site up to the laying barge.
The assembly was positioned in the laying barge.
The hoisting frame and saddles were positioned on top of the assembly. One bulkhead would later be removed and the assembly lowered into 90-ft. deep water for installation.
Laying Barge and Hoisting Frame and Saddles
Test Pipe with deflection and radial tension monitors
The hoisting frame and saddles were positioned on top of the assembly. One bulkhead would later be removed and the assembly lowered into 90-ft. deep water for installation.
Radial tension and diagonal tension shear crack at the first test pipe
Arrowhead Tunnels- A 144-Inch-Diameter Composite Steel-and-Concrete Tunnel Liner Designed For External Heads Up to 1200 feet.
Initial Concrete Gasketed-Segmental Liner
Final Lining Installation
Arrowhead East Tunnel 1999
Components of the composite wall tunnel liner

- CONCRETE CORE
- NELSON STUD
- OUTER CAGE
- INNER CAGE
Reinforcing Cages and Nelson Studs Inside The Steel Cylinder
Hauling Two Pipe Sections into Tunnel
Load Deflection Tests with Some of the Instrumentation Shown
### Measured vs. Calculated Deflections

#### Measured Deflections

<table>
<thead>
<tr>
<th>Core Thick.</th>
<th>Deflections at 50% Impact Load, in.</th>
<th>Deflections at First Crack Load, in.</th>
<th>Deflections at 0.01” Crack Load, in.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Horizontal</td>
<td>Vertical</td>
<td>Horizontal</td>
</tr>
<tr>
<td>10 in.</td>
<td>0.024</td>
<td>0.02</td>
<td>0.081</td>
</tr>
<tr>
<td>12 in.</td>
<td>0.01</td>
<td>0.007</td>
<td>0.044</td>
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</tbody>
</table>

#### Calculated Deflections

<table>
<thead>
<tr>
<th>Core Thick.</th>
<th>Maximum Deflection, in.</th>
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<tbody>
<tr>
<td></td>
<td>Uncracked</td>
</tr>
<tr>
<td></td>
<td>Horizontal</td>
</tr>
<tr>
<td>10 in.</td>
<td>0.041</td>
</tr>
<tr>
<td>12 in.</td>
<td>0.031</td>
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</tbody>
</table>
Olivenhain-Lake Hodges 120-inch Diameter Penstock
Figure 1. Allowable Lowest and Highest Vertical Alignments
Material Selection Challenge - Voestalpine Steel Producer in Leinz, Austria
Leinz, Austria
Fabrication Challenges