Dynamic Test of Mass Concrete with Shapai Dam Cores

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Email: wanghb@iwhr.com
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• 132 m in height, 260.25 m in crest length
• Normal water level is EL. 1866m
• Storage capacity is 18 million cubic meters
• 36 MW installed capacity
• Design PGA is 0.138g
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• Landslides near the dam accessing road

• No strong motion recording at the dam site

• Estimated ground motion 0.26g

• The behavior of the dam attracts considerable attention
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- Cylindrical cores of 200mm in diameter
- Static & dynamic compressive tests
- Static & dynamic split tests
- Static & dynamic direct tensile tests
- Direct tensile tests with cyclic loads
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Dynamic
200 με/s
30% static preload + Dynamic 1200 με/s
60% static preload + Dynamic
1200 µε/s
<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Maximum strain rate ($\mu\varepsilon/s$)</th>
<th>Section average strain rate ($\mu\varepsilon/s$)</th>
<th>Tensile strength (MPa)</th>
<th>Eccentricity at 30$\mu\varepsilon$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZL1-1</td>
<td>2.25</td>
<td>1.34</td>
<td>1.39</td>
<td>0.01</td>
</tr>
<tr>
<td>ZL1-2</td>
<td>1.45</td>
<td>1.22</td>
<td>1.66</td>
<td>0.09</td>
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<tr>
<td>ZL1-3</td>
<td>1.29</td>
<td>0.99</td>
<td>2.05</td>
<td>0.08</td>
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<tr>
<td>ZL1-4</td>
<td>1.16</td>
<td>0.79</td>
<td>1.76</td>
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<td>ZL2-1</td>
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<td>322.1</td>
<td>2.39</td>
<td>0.12</td>
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<tr>
<td>ZL2-2</td>
<td>518.3</td>
<td>307.9</td>
<td>1.76</td>
<td>0.15</td>
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<tr>
<td>ZL2-3</td>
<td>166.7</td>
<td>129.1</td>
<td>2.75</td>
<td>0.10</td>
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<tr>
<td>ZL2-4</td>
<td>212.0</td>
<td>182.8</td>
<td>1.85</td>
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<tr>
<td>ZL3-1</td>
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<td>1119</td>
<td>1.87</td>
<td>0.05</td>
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<tr>
<td>ZL3-2</td>
<td>1338</td>
<td>933</td>
<td>2.43</td>
<td>0.10</td>
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<td>ZL3-3</td>
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<td>960.7</td>
<td>2.74</td>
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<td>ZL3-4</td>
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<td>1217</td>
<td>1.84</td>
<td>0.07</td>
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<tr>
<td>ZL4-1</td>
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<td>3165</td>
<td>2.41</td>
<td>0.03</td>
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<tr>
<td>ZL4-2</td>
<td>3404</td>
<td>3178</td>
<td>2.68</td>
<td>0.07</td>
</tr>
<tr>
<td>ZL4-3</td>
<td>5642</td>
<td>4005</td>
<td>2.39</td>
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<td>ZL4-6</td>
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<td>ZL5-2</td>
<td>5638</td>
<td>5356</td>
<td>3.02</td>
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<tr>
<td>ZL5-3</td>
<td>11083</td>
<td>9448</td>
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<td>0.07</td>
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<td>ZL5-7</td>
<td>8003</td>
<td>7039</td>
<td>2.59</td>
<td>0.02</td>
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<td>ZL5-8</td>
<td>9402</td>
<td>7629</td>
<td>1.95</td>
<td>0.03</td>
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<tr>
<td>ZL6-1</td>
<td>1264</td>
<td>1066</td>
<td>1.68(40%)</td>
<td>0.11</td>
</tr>
<tr>
<td>ZL6-2</td>
<td>1187</td>
<td>1057</td>
<td>2.90(23%)</td>
<td>0.11</td>
</tr>
<tr>
<td>ZL6-3</td>
<td>1168</td>
<td>1099</td>
<td>2.40(28%)</td>
<td>0.05</td>
</tr>
<tr>
<td>ZL6-5</td>
<td>1692</td>
<td>1325</td>
<td>1.90(35%)</td>
<td>0.10</td>
</tr>
<tr>
<td>ZL7-1</td>
<td>2090</td>
<td>1215</td>
<td>2.40(55%)</td>
<td>0.10</td>
</tr>
<tr>
<td>ZL7-2</td>
<td>1623</td>
<td>1169</td>
<td>2.30(57%)</td>
<td>0.08</td>
</tr>
<tr>
<td>ZL7-3</td>
<td>1950</td>
<td>1862</td>
<td>2.31(57%)</td>
<td>0.06</td>
</tr>
<tr>
<td>ZL7-4</td>
<td>1468</td>
<td>1813</td>
<td>2.11(63%)</td>
<td>0.05</td>
</tr>
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- Cylindrical cores of 200mm in diameter
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- Direct tensile tests with cyclic loads
Strain rate: 200 $\mu$e/s

ZL9-1

ZL9-7
450mm cylindrical specimen
Strain rate: $100 \mu \varepsilon / s$
Stress (MPa) vs. Strain (µε)

- **ZL8-2**
- **Calculate2**
Residual strain ($\mu$ε)

Unload strain ($\mu$ε)

- ZL8-1
- ZL8-2
- ZL8-3
- ZL8-4
- ZL9-1
- ZL9-4
- ZL9-7
- ZL9-8
Thank you