Steep Gradient Overtopping Facility Configured to a 4ft Channel Width and Conveying a 1/3 Capacity Discharge

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Variable Gradient Overtopping Facility Conveying a 4ft Overtopping Test
Colorado State University has three Overtopping Testing Facilities, which are part of a unique research center designed for hydraulic model studies, testing, and calibration in the fields of open channel and closed conduit hydraulics.

Common overtopping studies performed in any of the Mild Gradient Overtopping Facility (MGOF), Variable Gradient Overtopping Facility (VGOF) or the Steep Gradient Overtopping Facility (SGOF) include:

- Embankment erosion protection
  - Articulated Concrete Blocks (ACB)
  - Synthetic groundcover
  - Vegetative systems
  - Pour-in-place systems
  - Riprap
  - Rolled erosion control products
- Spillway examination
- Dam foundation erosion
- Energy dissipation techniques

All three overtopping facilities are supplied with water from Horsetooth Reservoir by a 36-inch diameter pipeline. Average static head to the system throughout the year is approximately 200 feet. Reservoir water quality has a very low turbidity and a water temperature ranging from 40 to 55 degrees Fahrenheit.

Each overtopping facility permits a wide variety of testing configurations. Table 1 displays capacities for the three overtopping facilities.

<table>
<thead>
<tr>
<th>Facility</th>
<th>MGOF*</th>
<th>VGOF*</th>
<th>SGOF*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width (ft)</td>
<td>Up to 6.3</td>
<td>4</td>
<td>Up to 10</td>
</tr>
<tr>
<td>Length (ft)</td>
<td>75</td>
<td>65</td>
<td>120</td>
</tr>
<tr>
<td>Slope</td>
<td>13%</td>
<td>65</td>
<td>50%</td>
</tr>
<tr>
<td>Maximum Discharge (cfs)</td>
<td>160</td>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td>Overtopping Depth (ft)</td>
<td>Up to 6</td>
<td>Up to 6</td>
<td>Up to 5</td>
</tr>
<tr>
<td>Embankment Height (ft)</td>
<td>Up to 9</td>
<td>Up to 10</td>
<td>Up to 60</td>
</tr>
</tbody>
</table>

*Not all combinations of configurations are possible.

ACB testing facilities and procedures conform to current testing standards as follows:

- Specify and classify soil type
  - Grain size distribution (mechanical)
  - Grain size distribution (hydrometer)
  - Standard proctor analysis
  - Atterberg limits
- Construct embankment
- Test embankment for compaction specifications
- Install protection scheme
- Prepare for testing
- Test protection scheme
  - Each test includes a 1-foot, 2-foot, 3-foot, and 4-foot overtopping depth.

- Each overtopping depth includes 4 hours of continuous testing with data collected each hour
- Bed and water surface elevations along with one-dimensional velocities are collected for each hour
- Tabulate data for a data report

An example of the VGOF with an ACB system prepared for testing is shown below.

Variable Gradient Overtopping Facility with a Standard Overtopping Test Configuration