A Presentation for
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By
Scott Hogan
FHWA Resource Center
Lakewood, CO
Primary interests: Transportation related hydraulics
Bridge hydraulics
Bridge scour
Culvert hydraulics
Multiple openings
Roadway encroachments
Floodplain impacts (FEMA requirements (no-rise / CLOMR / LOMR))
Hydraulic Modeling Tools

Http://www.fhwa.dot.gov/engineering/hydraulics/ - Software

Hydraulic Toolbox
Hydrology: WMS / HY-12 (& Pump station design)
Culvert Hydraulics: HY-8
1D Modeling: HEC-RAS
2D Modeling: SRH-2D/SMS
SA Publications / Guidance Documents


DS 5, Hydraulic Design of Culverts - 2012
DS 7, Hydraulic Design of Bridges - 2012
C 17, Highways in the River Environment-Floodplains, Extreme Events, Risk and Resilience 2016
C 18, Evaluating Scour at Bridges -2012
C 20, Stream Stability at Highway Structures - 2012
C 23, Bridge Scour Countermeasures – 2009
Table 4.1. Bridge Hydraulic Modeling Selection.

<table>
<thead>
<tr>
<th>Bridge Hydraulic Condition</th>
<th>Hydraulic Analysis Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One-Dimensional</td>
</tr>
<tr>
<td>Small streams</td>
<td>✔️</td>
</tr>
<tr>
<td>In-channel flows</td>
<td>✔️</td>
</tr>
<tr>
<td>Narrow to moderate-width floodplains</td>
<td>✔️</td>
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<tr>
<td>Wide floodplains</td>
<td>✔️</td>
</tr>
<tr>
<td>Minor floodplain constriction</td>
<td>✔️</td>
</tr>
<tr>
<td>Highly variable floodplain roughness</td>
<td>✔️</td>
</tr>
<tr>
<td>Highly sinuous channels</td>
<td>✔️</td>
</tr>
<tr>
<td>Multiple embankment openings</td>
<td>✔️/O</td>
</tr>
<tr>
<td>Unmatched multiple openings in series</td>
<td>✔️/O</td>
</tr>
<tr>
<td>Low skew roadway alignment (&lt;20°)</td>
<td>✔️</td>
</tr>
<tr>
<td>Moderately skewed roadway alignment (&gt;20° and &lt;30°)</td>
<td>✔️</td>
</tr>
<tr>
<td>Highly skewed roadway alignment (&gt;30°)</td>
<td>✔️</td>
</tr>
<tr>
<td>Detailed analysis of bends, confluences and angle of attack</td>
<td>✔️</td>
</tr>
<tr>
<td>Multiple channels</td>
<td>✔️</td>
</tr>
<tr>
<td>Small tidal streams and rivers</td>
<td>✔️</td>
</tr>
<tr>
<td>Large tidal waterways and wind-influenced conditions</td>
<td>✔️</td>
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<tr>
<td>Detailed flow distribution at bridges</td>
<td>✔️</td>
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<tr>
<td>Significant roadway overtopping</td>
<td>✔️</td>
</tr>
<tr>
<td>Upstream controls</td>
<td>✔️</td>
</tr>
<tr>
<td>Countermeasure design</td>
<td>✔️</td>
</tr>
</tbody>
</table>

- ✔️ well suited or primary use
- ✔️/O possibly unsuitable depending on application
- ○ unsuitable or rarely used
- ✔️ possible application or secondary use
VA Training

http://www.fhwa.dot.gov/engineering/hydraulics/ - Training

I 135090 Hydraulic Design of Safe Bridges
I 135041 One-dimensional Modeling of River Encroachments with HEC-RAS
I 135056 Culvert Design
I 135046 Stream Stability and Scour
I 135048 Countermeasure Design
I 135095 Two-dimensional Hydraulic Modeling of Rivers at Highway Encroachments
VA Technical Challenges

Getting people trained in the current technology
Supporting untrained users
Keeping up with the latest developments
Addressing FEMA floodplain requirements

• No-rise in 2D models?
• Floodway delineation?
• Maintaining effective FEMA models with a mix of models
• Resistance of floodplain administrators to change
VA Areas of Improvement

Updated and improved modeling guidance (hard keeping up with latest developments)
Transition to 2D modeling (reporting requirements)
Guidance for FEMA requirements / submittals
Education for floodplain administrators
2D floodway delineation
WA Future Developments

2D floodway delineation tool
SRH-2D 2D sediment transport custom SMS interface
Community version of SMS for SRH-2D

FHWA Every Day Counts Initiative
• Increased training opportunities
• Workshops to train others about 2D modeling
• 2D bridge hydraulic modeling guidance
• 2D floodplain modeling guidance
One for CHANGE!

Hydraulics: Advancing to the Next Generation of Engineering
Questions?

Scott Hogan
FHWA Resource Center
Lakewood, CO

scott.hogan@dot.gov
(720) 963-3742