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Infrastructure Delivery and Operations

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MEMORANDUM

TO: All ADOT and Consultant Design Personnel

FROM: Syed Alam, P.E., ADOT Chief Drainage Engineer

CC: Michael DenBleyker, P.E., ADOT State Roadway Engineer

DATE: December 15, 2020

RE: 2D Modeling Guidance for Bridge, Culvert and Channel Hydraulics

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1D hydraulic modeling has been successfully used in the design of highway drainage elements. ADOT continues to utilize programs such as HEC-RAS to evaluate hydraulic properties at specific roadway and bridge features. Recent improvements and developments in modeling software and hardware have provided engineers with 2D modeling capabilities, which have proven to be a viable alternative for the engineering design and analysis of bridge, culvert and channel hydraulics. To aid engineers in performing a hydraulic analysis for bridge and scour designs on its projects, the use of SRH-2D hydraulic modeling should be used as a computer based modeling tool on ADOT projects, where and when appropriate. ADOT follows the guidance provided in "Hydraulic Design Series No. 7 (HDS 7, April 2012), which provides a rating system for selecting a type of model based on the application situation. See "Table 4.1 Bridge Hydraulic Modeling Selection" (below):

Table 4.1. Bridge Hydraulic Modeling Selection.		
Bridge Hydraulic Condition	**Hydraulic Analysis Method**	
	One-Dimensional	Two-Dimensional
Small streams	●	◗
In-channel flows	●	◗
Narrow to moderate-width floodplains	●	◗
Wide floodplains	◗	●
Minor floodplain constriction	●	◗
Highly variable floodplain roughness	◗	●
Highly sinuous channels	◗	●
Multiple embankment openings	◗/○	●
Unmatched multiple openings in series	◗/○	●
Low skew roadway alignment (<20˚)	●	◗
Moderately skewed roadway alignment (>20˚ and <30˚)	◗	●
Highly skewed roadway alignment (>30˚)	○	●
Detailed analysis of bends, confluences and angle of attack	○	●
Multiple channels	◗	●
Small tidal streams and rivers	●	◗
Large tidal waterways and wind-influenced conditions	○	●
Detailed flow distribution at bridges	◗	●
Significant roadway overtopping	◗	●
Upstream controls	○	●
Countermeasure design	◗	●
● well suited or primary use ◗ possible application or secondary use ○ unsuitable or rarely used ◗/○ possibly unsuitable depending on application		

Hydraulic Design Series No. 7 - *Hydraulic Design of Safe Bridges*

Prior to initiating their work, engineers should consult with ADOT's Drainage Section to confirm the appropriate hydraulic analysis method, along with required project documentation.

We recognize that various 2D modeling software tools exist. However, the SRH-2D computer based modeling tool shall be used on ADOT projects, where and when appropriate. Engineers and designers shall refer to the SRH-2D User's Manual for guidance on specific modeling techniques and parameters. Further guidance may be developed and incorporated into future editions of the ADOT Hydraulics Manual.