An Alternative to HEC-GEORAS:
Overview & Comparison of AutoCAD River & Flood Analysis Module

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Overview

- Hydraulic Modeling History
- San Pedro Creek Improvements Project (SPCIP) Background Summary
- AutoCAD River & Flood Analysis Introduction
- Basic Tool Step-by-Step
- River & Flood Analysis Tool vs HEC-RAS
- Implementation with SPCIP
- Summary
Hydraulic Modeling

History & Evolution

- Timeline of hydraulic model development
  - HEC 2: First hydraulic modeling program released by USACE in 1990.
  - Six versions released up to the latest approved version 4.1.
  - HEC-GeoRAS: Released in 2006 for ArcGIS 3.2.

- Software available for San Pedro Creek Improvements project:
  - DFIRM HEC-RAS hydraulic model
  - Survey and design in AutoCAD
  - XPSWMM model developed to study area.
San Pedro Creek Improvements Project

Project Background

Project Area:

- Urbanized area located in Downtown San Antonio
- Project approximately 10,350 linear feet
- Includes approximately 1.1 mile tunnel diversion system.
  - Inverted siphon.
  - 24 foot diameter conduit approximately 150 feet below ground.
  - Diverts approximately 4,600 cfs during the 100-year event.
San Pedro Creek Improvements Project

Project Area & Approach

Project Approach:

- Phased modeling approach selected due to time constraints.
- Interim “early design” HEC-RAS developed concurrently with XPSWMM model development.
- HEC-RAS model used to make critical channel design and bridge replacement decisions and build proposed conditions surface.
- XPSWMM model is restudy of area to define new baseline existing conditions and assess project improvements.
Surface and Grid Coordinates

Difficulties

- What's the difference?
- Why does it matter?
  - Time and data storage between AutoCAD and GIS
- Relation to San Pedro Creek Project
  - Opportunity to reduce data processing.

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AutoCAD River & Flood Analysis Module

Introduction

- Available with AutoCAD Civil 3D 2012 and included in Infrastructure Design Suite 2016
- Advanced river modeling software supports HEC-RAS within Autodesk AutoCAD Civil 3D
- Automates HEC-RAS cross section cutting, analysis, flood plain modeling, and modeling tasks
- Imports and exports HEC-RAS model files, ready for agency submission
- Terrain processing capability enables use of numerous digital terrain data formats

Quick overview of tool capabilities
Create Section
Different Options
Create Section
3D Section Cut
Create Section
Section Cut by Object
Create Section
Configure Elevation Data
Cross Section Profile
Recut Sections
Updated surface
Section Assign Tools
Bank Stations and Reach Lengths
Bank Stations and Reach Lengths
Select Polylines
Profile Views
Section Description
Manual entry and verification
Export HEC-RAS Project
Export HEC-RAS Project
Creates a .prj file for use in HEC-RAS and agency submission
Compute Hydraulic Analysis
Performs HEC-RAS analysis within AutoCAD
Flood Plain Mapping
Add Section Results

- Water surface elevation shown on cross section profiles
- Could readily be incorporated into design sheets
Results Profile View
Profile Summary Output

Detailed Output
Hydraulic Results Comparison

- Minor differences in downstream channel length
- Minor variation in calculated flow areas
- Resulting water surface elevations differ by less than 0.01 ft.

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| AutoCAD River and Flood Analysis
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AutoCAD River and Flood Analysis
HEC-GeoRAS
Difference
San Pedro Creek Improvements Project
Design Team & Approach

- Multiple disciplines working simultaneously on design.
- All design and plan construction performed in AutoCAD.
- Anticipating multiple iterations of design, the River & Flood Analysis Module was the most suitable approach for developing H&H geometry data.
- Eliminate multiple steps between design software (AutoCAD) and modeling software (XPSWMM).

Data Processing

AutoCAD Surface

\[ \times \]

GEO-RAS

\[ \times \]

HEC-RAS

\[ \times \]

XPSWMM

River & Flood Analysis Module

Import XS

Architect

Civil Design

H&H Analysis
San Pedro Creek Improvements Project

Channel Design Process

“Early Design” developed in steady-state HEC-RAS but ultimately modeled in XPSWMM.

1. Refined PER proposed conditions HEC-RAS model.
2. Develop proposed grading surface.
3. Re-cut cross sections based on new surface and imported into HEC-RAS.
4. Incorporated architectural features in HEC-RAS and evaluated impacts.
5. Revised channel geometry in HEC-RAS to meet design criteria.
6. Refined proposed surface to include geometry changes and significant architectural features.
7. Continue iteration process until a balance between flood mitigation needs and architectural elements is found.
San Pedro Creek Improvements Project
Conversion to XPSWMM Model

- Final HEC-RAS model geometry imported into XPSWMM.
- XPSWMM used to fully capture local storm drain system impacts and channel storage using a dynamic solution.
- With proposed channel linework, surface, and cross sections in one software, it was much easier to capture all detail during XPSWMM model development.
River & Flood Analysis Tool

Summary

- Another useful tool with AutoCAD.
- Same capabilities as GEO-RAS for developing hydraulic model.
- Can simulate model within AutoCAD.
- Great for design purposes.
  - Can reduce data processing effort and iteration time
- Work within one software system.
- Alternative to GIS
- Not the best option for all projects.
  - Type of project
  - Available data
  - Local experience
San Pedro Creek Improvements Project

Status

- 40% Design has been approved by Commissioner’s Court.
- Continue on with 70% Design.
  - R & F Analysis tool will continue to be used as further detail will be added and phasing will be evaluated.
- For more information on the SPCIP, visit http://spcproject.org/
Questions?

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