

Creating a RAS Terrain for 2D Modeling

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Overview

- Types of Terrain Models
- Building a Terrain Model
- Key Feature Considerations
- Cell Size Considerations
- Importing Terrain Information to RAS





A good model starts with good terrain ...







Terrain Model Types

- Triangulated Irregular Network (TIN)
- Triangulated points define surface allows Single value at regular intervals. Cell for higher density in important areas.
- Grid
 - size determines surface resolution.
- User-defined triangulation through points
 Fast mathematical computations and break lines









Building a Terrain Model

• Important to have imagery.





Building a Terrain Model Verify and Process Points



- Start with raw data
- Remove 1st return data for vegetation, power lines, cows, etc.
- Bare earth terrain







Building a Terrain Model Verify and Process Points

- Remove of points that are not necessary/incorrect in representing the ground surface
 - Redundant points (more points = more processing)
 - Bridge deck elevations
- Make sure to add important features
 - Top of roads
 - Top of levees
 - Top of floodwalls
 - Bridge approaches
 - Hydraulic structures
- Replace over-water returns with bathymetric data



Building a Terrain Model Bare Earth Points





Building a Terrain Model Bare Earth Points





Building a Terrain Model Bathymetry Points



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Building a Terrain Model Bathymetric Data Added





Building a Terrain Model Problems?







Building a Terrain Model Breaklines

- Breaklines are used to enforce triangle edges and elevations. They ensure that interpolation is done "correctly" along linear features.
 - Channel banks
 - Steep drops (drop structures, waterfalls)
 - Roadways
 - Levees
 - Bathymetry points





Building a Terrain Model **Breaklines**

 Breaklines with elevations insert points to enforce elevations and triangle edges





Bridges

- Removal of bridges from terrain data is important for 2D modeling.
- High ground directs flow determined directly from ground surface model.
- 1D modeling place cross sections at appropriate locations as work around.







Terrain Cell Size Considerations

- Purpose scale of model
 - Detailed bridge analysis requires piers be represented
 - Riverine model requires flow opening is represented
- Small enough to represent the land surface accurately, NOT any smaller
- Terrain model needs to accurately reflect linear features that direct flow. HEC-RAS uses a 2D computational grid as the underlying representation of terrain. 2D cell faces should be aligned with linear feature in the terrain.





Raster Cell Size







Raster Cell Size



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HEC-RAS Terrain Fixes







Hydraulic Structure Elevations







Terrain Model Development Summary

- Terrain models are developed as TINs
- Model is typically exported to a Grid for visualization and analysis
 - TINs are more difficult to render
 - TINs are more expensive to store
 - Calculations with TINs more difficult than with rasters
- Grid-cell size determines the effective accuracy of the resulting terrain model
 - How are you going to represent a levee in a raster with a 20ft grid cell?





Terrain in RAS Mapper

- Uses GeoTIFF format
 - Tiled data for more efficient storage
 - Compressed data for efficient storage
 - Pyramided data for fast visualization
 - Allows for on-the-fly inundation mapping
- One Layer for Multiple Terrain Models
- No file size limitations BigTiFF supported







Terrain in RAS Mapper

- Various formats are supported
 - Binary Floating Point Raster (FLT)
 - Esri Arc/Info Grid format
 - GeoTIFF (still rounds and compresses)
 - Others (e.g. USGS DEM, etc)
- Imported data is rounded to based on precision selected
 - Default is 1/32 (~0.03 ft) (1/128 for metric)
- Recommended that a projection is defined for the RAS Mapper project first.





Projection

- Data used in RAS Mapper must be a common coordinate system.
- Projection will be used to reproject Terrain data that is imported into RAS Mapper.
 - Defined using esri PRJ file.
- Web Imagery will be projected on-the-fly to RAS Mapper coordinate system.

🚟 RAS Mapper Options		×
Project Settings	Coordinate Reference System	
Projection		1 🖂
General	Definition	
Render Mode	PROJCS["NAD_1983_StatePlane_California_III_FIPS_0403_Feet",GEOGCS	
Mesh Tolerances	[] [] GCS_North_American_1983", DAI UM]['D_North_American_1983", SPHEROID [] GRS_1980", 6378137, 298.257222101]], PRIMEM[] "Greenwich", 0], UNIT [] "Degree" 0.01745292519842205513 PRO LECTION	
Global Settings	["Lambet_Conformal_Conic"],PARAMETER	
General	["False_Northing", 1640416.666666667], PARAMETER["Central_Meridian",- [120.5], PARAMETER["Standard_Parallel_1", 37.066666666666666667], PARAMETER	
RAS Layers	[]]	





Projection Files

- Not all PRJ files are the same
 - PROJCS["NAD_1983_StatePlane_Pennsylvania_South_FIPS_3702_Feet", GEOGCS["GCS_North_American_1983", DATUM["D_North_American_1983", SPHEROID["GRS_1980",6378137,298.257222101]], PRIMEM["Greenwich",0], UNIT["Degree",0.017453292519943295]], PROJECTION["Lambert_Conformal_Conic"], PARAMETER["False_Easting",1968500], PARAMETER["False_Northing",0], PARAMETER["False_Northing",0], PARAMETER["Central_Meridian",-77.75], PARAMETER["Standard_Parallel_1",39.9333333333333], PARAMETER["Standard_Parallel_2",40.966666666666667], PARAMETER["Latitude_Of_Origin",39.33333333333333], UNIT["Foot_US",0.30480060960121924]]
- PROJCS["NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet", GEOGCS["GCS North American 1983", DATUM["D North American 1983", SPHEROID["GRS 1980",6378137.0,298.257222101]], PRIMEM["Greenwich",0.0], UNIT["Degree",0.0174532925199433]], PROJECTION["Lambert_Conformal_Conic"], PARAMETER["False_Easting",1968500.0], PARAMETER["False Northing",0.0], PARAMETER["Central Meridian", -77.75], PARAMETER["Standard Parallel 1", 39.93333333333333], PARAMETER["Standard_Parallel_2",40.96666666666667], PARAMETER["Latitude Of Origin", 39.33333333333333], UNIT["Foot_US",0.3048006096012192]], VERTCS["NAVD_1988", VDATUM["North_American_Vertical_Datum_1988" PARAMETER["Vertical_Shift",0 0], PARAMETER["Direction ,1.0], UNIT["Foot US",0.3048006096012192]]





Terrain Importer

- Add files allows user to select rasters for import
- Order raster files based on Priority on what cell value should be used if there is overlap by the terrain models.
 - Highest Priority to the top

New Terrain Layer					
Set SRS					
Input Terrain Files					
+ Filename		Projection	Cell Size	Rounding	Info
channel.tif				None	i
muncie_base:	fit		7.77160527153095	(na)	i
Output Terrain File					
Rounding (Precision):	1/32 🔽 🔽 Create Stitches		Merge Inputs to Sing	le Raster	
Vertical Conversion:	Use Input File (Default)				
Filename:	C:\Temp\2D RAS\1.5 WS - DTM and 2D Mesh\RAS_M	odel\Terrain\Wi	thChannel.hdf		<u> </u>
			C	ireate	Cancel





Terrain Importer

- Rounding Precision which data is stored
- Terrain Filename and Folder
 - name.tilename.tif file for each imported terrain tile
 - name.hdf file contains "stitch" information for data gaps
 - name.vrt file contains statistics info and color ramp info

ew Terrain Layer				
Set SRS				
+ Filename	Projection	Cell Size	Rounding	Info
Channel.tif		5	None	i
muncie_base.flt		7.77160527153095	(na)	i
Outout Terrain File				
Rounding (Precision): 1/32	s 🗆	Merge Inputs to Sing	le Raster	
Rounding (Precision): 1/32 Create Stitche Vertical Conversion: Use Input File (Default)	s 🗆	Merge Inputs to Sing	le Raster	
Rounding (Precision): 1/32 Image: Create Stitche Vertical Conversion: Use Input File (Default) Image: C:\Temp\2D RAS\1.5 WS - DTM and 2D Mesh\RAS_M Filename: C:\Temp\2D RAS\1.5 WS - DTM and 2D Mesh\RAS_M	s T Model\Terrain\W	Merge Inputs to Sing ithChannel.hdf	le Raster	- 2





Terrain Importer

- Data is projected (translated) and rounded for all data
- Data is pyramided and compressed
- TIN is created for overlapping regions
- Terrain.hdf is the single layer loaded to RAS Mapper

Compute Window - Creating Terrain 'Terrain'				
Importing 1 of 2: BEC_20ft.flt				
tep 1 of 4: Translating to GeoTiff with SRS	1			
tep 2 of 4: Rounding and/or Generating Statistics	7			
tep 3 of 4: Generating Histogram	2			
tep 4 of 4: Adding Overlays	2			
EC_20ft.flt Import Complete.	14			
mporting 2 of 2: BEC_DEM.flt				
tep 1 of 4: Translating to GeoTiff and reprojecting	26			
tep 2 of 4: Rounding and/or Generating Statistics	1:05			
tep 3 of 4: Generating Histogram	11			
tep 4 of 4: Adding Overlays	13			
EC DEM.flt Import Complete.	1:56			
inal Processing: Terrain.hdf				
tep 1 of 3: Creating Terrain.vrt	0			
tep 2 of 3: Creating Terrain.hdf	1:17			
tep 3 of 3: Creating Stitch-TIN for merging rasters	6			
errain Complete	3:34			

Close

Questions?

