Title: Improving Your InRoads DTM

Mats Dahlberg
Consultant Civil

www.bentley.com

Improving Your InRoads
Digital Terrain Model (DTM)

Digital Terrain Model – A digital representation of a surface topography or terrain composed of triangles calculated from points and breaklines.

Types of Digital Terrain Models

1. Existing Ground surfaces
   1. Walking surface (top of ground)
   2. Sub stratum surfaces
      1. Rock
      2. Clay
      3. Sand
   3. Water elevations

2. Proposed surfaces
   1. Finish surface
      1. Roadway (including slopes, ditches shoulders and pavements)
      2. Bridge
   2. Sub-grade surface

3. Utilities

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Existing Ground Digital Terrain Models
Data source varies from firm to firm and job to job

Sources of Proposed Digital Terrain Models

- Photogrammetry

- LIDAR

- Field collected Survey

- Contour Drawings

- Sub Stratum Soil Borings

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Existing Ground Digital Terrain Models
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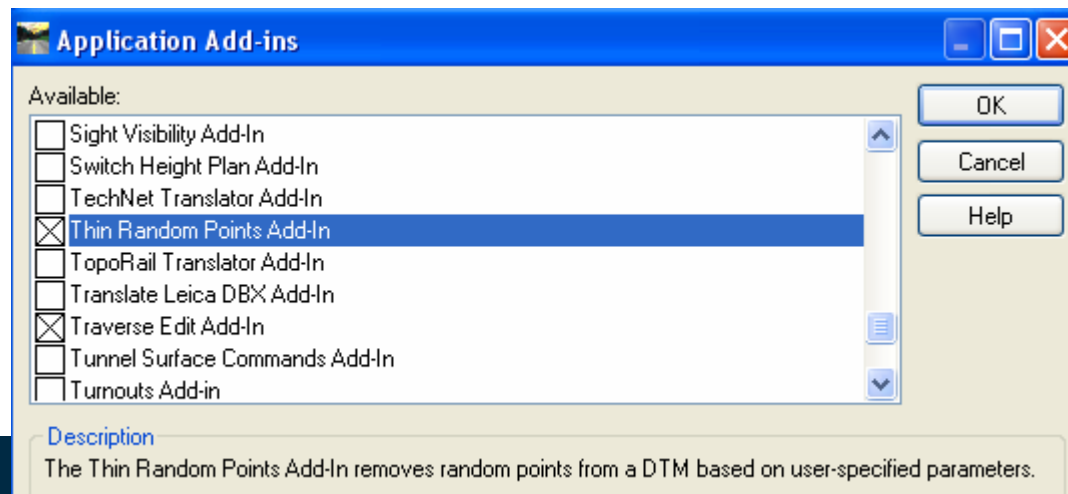## Sources of existing ground Digital Terrain Models

- Photogrammetry (aerial photography)
  - Be certain data was collected for creating DTMs
  - Filter data based on feature type
    - Not all data should be triangulated, i.e. roof tops
  - Watch spacing of vertices on breaklines
    - Isometric triangles are the goal
    - Change **Point Density Interval** to correct/improve
      - Surface > Feature > Feature Properties
  - Verify that obscured areas are not triangulated
    - Utilized **Interior** Feature Type to maintain obscured areas
      - Surface > Feature > Feature Properties
    - Do not rely on Surface > Edit Surface > Delete Triangle...
  - Validate Digital Terrain Model with field run survey

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Sources of Existing Ground Digital Terrain Models

- LIDAR (Light Detection and Ranging)
  - Massive amounts of redundant point data
  - Thin LIDAR data with Thin Random Points Add-In
    - Surface > Edit Surface > **Copy Portion of Surface**…
    - <u>DO NOT</u> get confused with the **Thin Surface**… function
  - Clip Limits of LIDAR DTM to remove extraneous data.
    - Surface > Edit Surface > **Copy Portion of Surface**…
  - Drape breakline graphics if available.

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Sources of Existing Ground Digital Terrain Models

- **Field collected Survey** (raw data, graphics, text)
  - From **InRoads Survey** utilize **Curve Stroking Mode:**
  - Survey data in graphical form (must be 3D file) utilize **File > Import > Surface Advanced...**
    - Not all survey data should be triangulated, i.e. Fire Hydrants
  - Survey data in ASCII format (text)
    - Ask for more than XYZ coordinate list
    - Import into InRoads Survey for more editing options
    - Be aware of dual coded points

- Regardless of delivery format
  - Adjust triangle length to coincide with data interval
  - Define **Exterior Boundary** to limit triangulation
  - Add interior obscured areas as needed

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Sources of Existing Ground Digital Terrain Models

- **Contour drawings** – worst existing data source

- Verify 3D file. If not copy to 3D model and move contours to correct elevation with your favorite MicroStation tool or use InRoads **Set Elevation** command

- Close gaps in contour lines

- Import graphics with **Contour** as the **Point Type:**

- **Generate Inferred Breaklines** to eliminate flat spots and create ridges and valleys

- Look at creating alternate DTM based on **Gridded Model** utilizing **Inferred Breaklines**

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Existing Ground Digital Terrain Models
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Sources of Existing Ground Digital Terrain Models

- **Digital Elevation Model** (DEM)
  - ASCII **Random Point** data on a regular gridded interval
  - Take it for what it is. Don't try to make chicken soup from chicken feathers.

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Sub stratum Digital Terrain Models

- **Topsoil** definitions often based on uniform depth
  - Utilize **Surface > Edit Surface > Transform Surface…** to create a sub-grade surface to define topsoil depth
    - Feather data if needed

- **Sub Stratum** surfaces based on soil borings.
  - Limited number of boring locations presents problems
  - Sub Stratum surfaces based on one feature
  - Manipulate graphical display of Existing Walking surface with MicroStation commands to warp to match boring data
  - Load surface from graphics

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Proposed Ground Digital Terrain Models
Inroads generated data

Sources of Proposed Digital Terrain Models

- Roadway Designer

- Design Surface tools

- Import Graphics
  - Breaklines
  - Contours
  - Random

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Proposed Ground Digital Terrain Models
Inroads generated data

Methods of creating Proposed Digital Terrain Models

- **Roadway Designer**
  - Begin with good template definitions
    - Avoid vertical faces
    - Avoid breaklines that define the same coordinate space
    - Define and maintain point naming scheme
    - Utilize 'Over then Down' point constraints
    - Avoid large distances between points
      - Define all lanes of roadway
    - Ensure End Conditions are constrained to Backbone
  - Template Drops at appropriate intervals
    - How will the surface be utilized?
  - When defining Point Controls enable **Use as Secondary Alignment** when appropriate

Proposed Ground Digital Terrain Models
Inroads generated data

Methods of creating Proposed Digital Terrain Models

- **Roadway Designer** (cont)
  - Create Surfaces
    - Enable **Include Critical Sections** settings Tools
    - Utilize **Add Exterior Boundary** option
    - Densify **Horizontal** and **Vertical** alignments when applicable
    - Utilize **Add Transverse Features** option on final DTM creation
    - Always **Remove Loops**
  - When multiple Corridors are utilized to create a composite Finished design surface ensure that template intervals in all corridors are approximately equal.

Proposed Ground Digital Terrain Models
Inroads generated data

Methods of creating Proposed Digital Terrain Models

- **Design Surface** tools
  - Be consistent with intervals in **Generate Transverse Feature**, **Generate Longitudinal Features**, **Generate Sloped Surface** and **Apply Template** commands.
  - Set **Point Density Interval** on features not created with methods listed above to match design interval
  - Utilize *MicroStation* **Create Complex Shape** command to create and added exterior boundary from graphics if designed using multiple tools.

Proposed Ground Digital Terrain Models
Inroads generated data

Methods of creating Proposed Digital Terrain Models

- **Import Graphics**
  - Utilize **Maximum Segment Length** for consistent triangle intervals.
  - Always review the **Results** after importing data
  - Import graphics according to feature for well defined DTM
  - Investigate usage of **Import > Surface Advanced** if standard design process is utilized

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Miscellaneous Tips

- To strengthen weak areas in DTM's create gridded models of the entire surface. Use a fence in conjunction with **Copy Portion of Surface** command to add gridded section to weak area.

- When breaklines are not present, drape graphics then add as breaklines to strengthen DTM

- Add inferred breaklines to gridded model to form more manageable and editable DTM

Summary

- Know your data and/or the limitations of your data

- Be consistent in your design

- Develop standard repeatable processes

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Questions ?
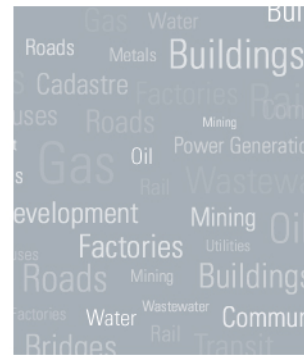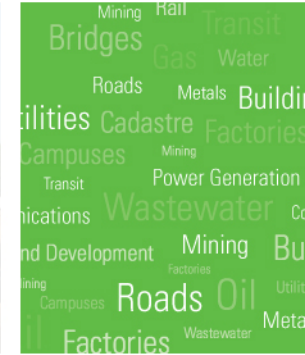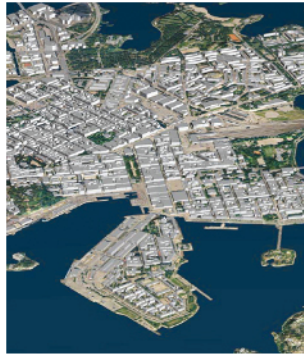
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