



Managing the Ever-Growing Terrain Model

Presented by: Ian Rosam

Session Title

- The new terrain modeling tools simplify terrain modeling and offer enhanced data capturing and precision but the methods for managing are different with the terrain now a part of the DGN. In this session users will learn to manage and distribute digital terrain models across the projects or enterprise. For all Bentley civil users.
- At the end of this training session, an assessment will be given. We will review all assessment questions and answers to see what you have learned.

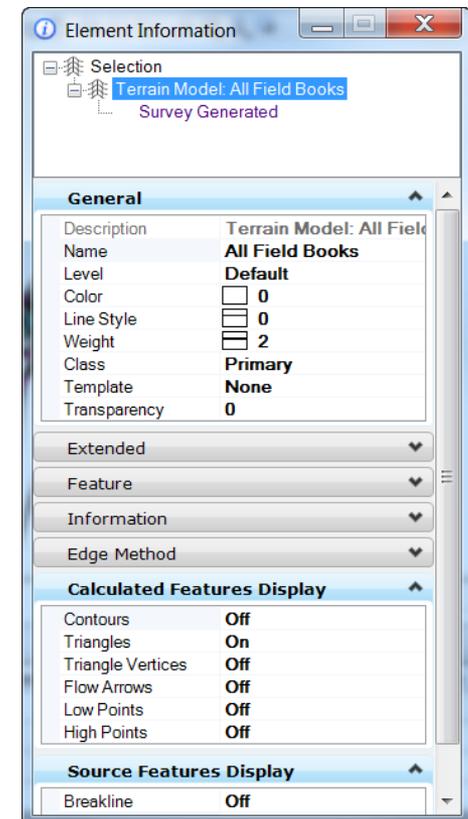
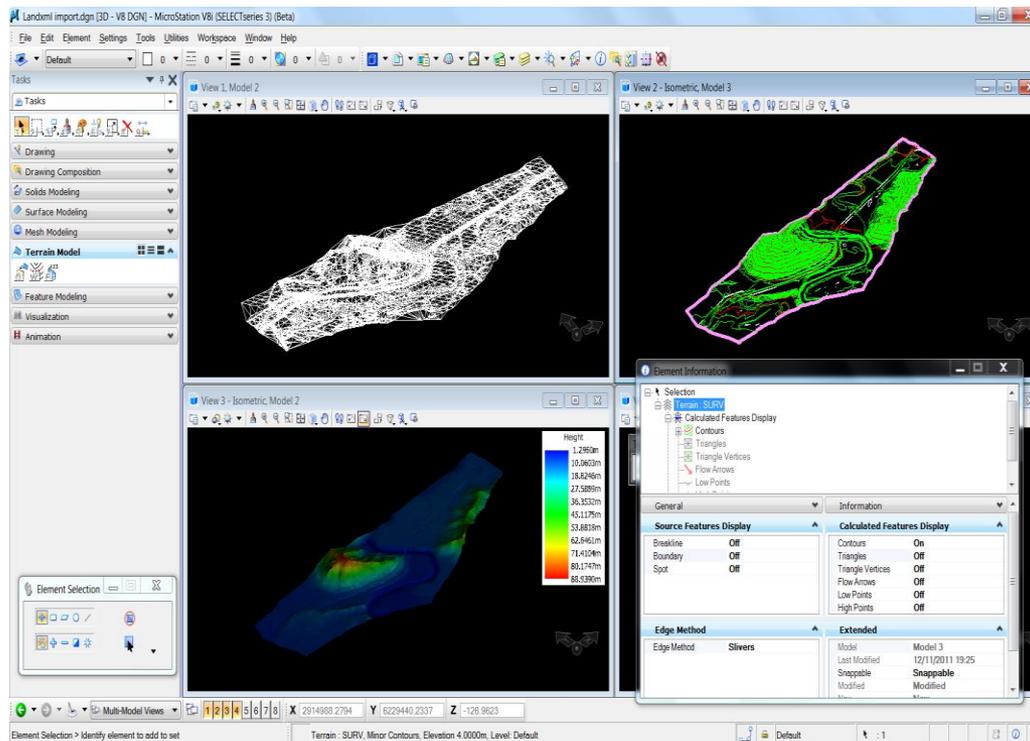
Learning Objectives

After this session you will be able:

- Understand the differences between Ruled Terrains
- Know what commands create Ruled Terrains
- Understand How to Effectively use Large Terrains
- Understand how to optimize Filtering for LIDAR and Point Clouds

MicroStation Terrain Element

- DGN Element with 'Dynamic' Display
- Available in MSTN as a 'published' Terrain

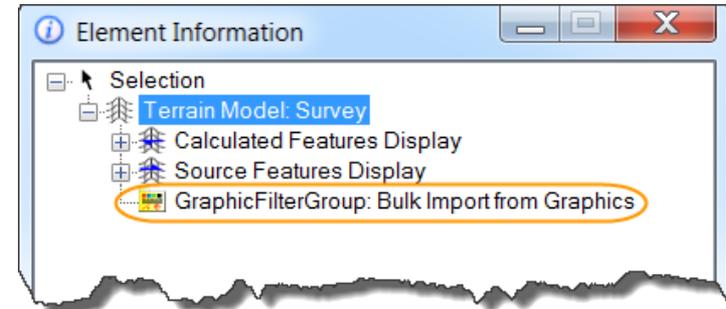
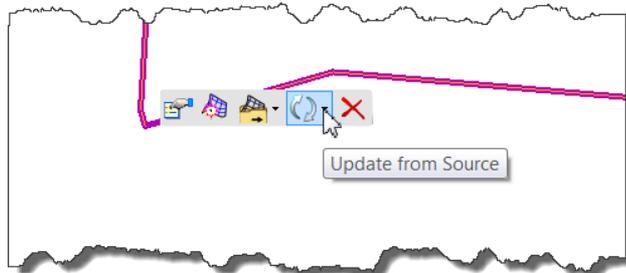


Civil Terrains

- Civil Adds ‘intelligence’ through ruling the Terrain
- Historical Provenance
- Civil Terrains come in multiple ‘flavours’
 - ‘Static’
 - ‘Dynamic’

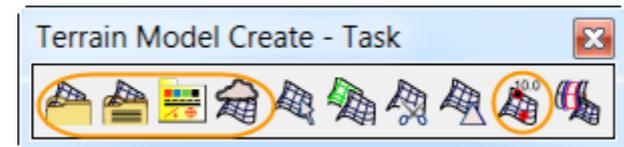
'Static' Ruled Terrains

- Provides a 'user managed rule'



- Created for external source

- Import from file
- Ascii import
- Text Interpolation
- Point Clouds / Lidar
- Graphical Filters #

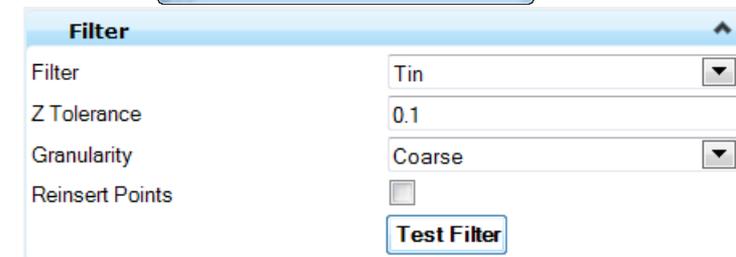
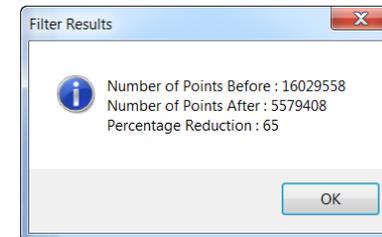
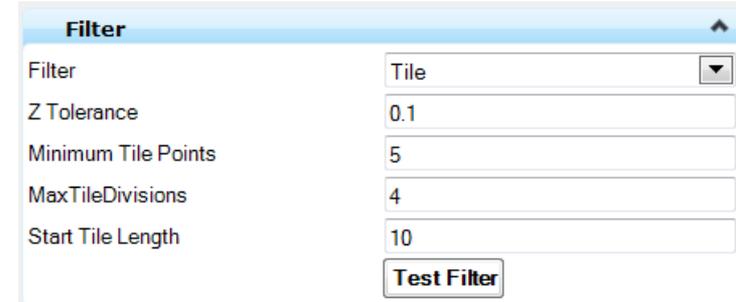
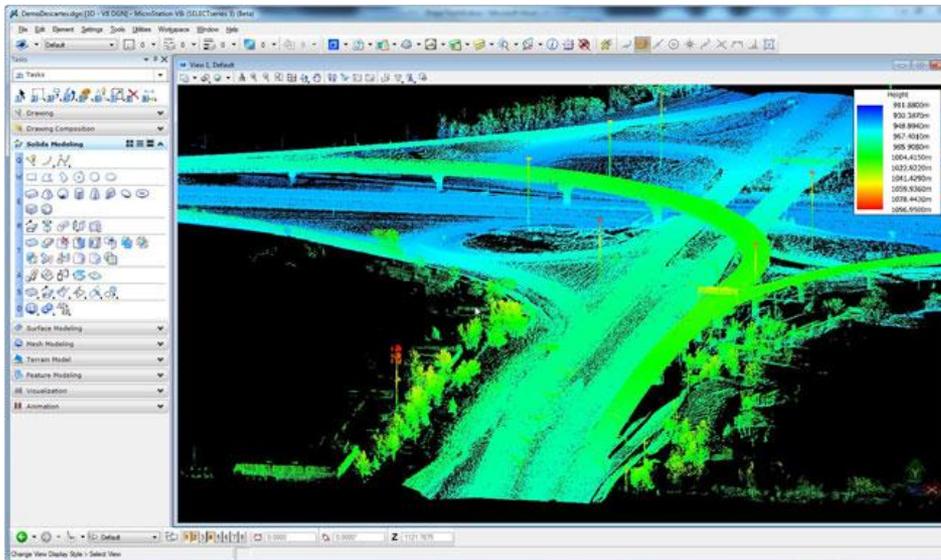


'Static' Ruled Terrains

- Lets Take a Look

Point Clouds / Lidar Filtering

- Use Fence to Clip to area of interest
- Point Cloud - Filter on classification
- Filter methods – Tile or Tin ?



Point Clouds / Lidar Filtering

- Tile Filter

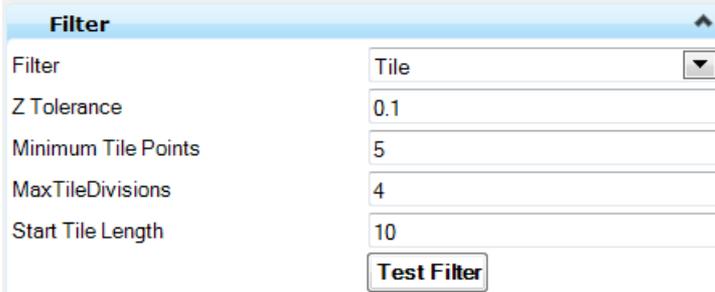
Tiles the data based on the input parameters. A least squares plane is then calculated for each tile from the tile points. Points in the tile that fall within the Z tolerance to the least square plane are filtered out.

- Advantages

- Fast

- Disadvantages

- Trial and error on settings to achieve ‘good’ results
- Typically only 30 – 40 % max reduction



Filter	
Filter	Tile
Z Tolerance	0.1
Minimum Tile Points	5
MaxTileDivisions	4
Start Tile Length	10
Test Filter	

Point Clouds / Lidar Filtering

- **Tile Filter – setup and best practices**

- zTolerance – this is the amount the surface can move up and down in the last squares
 - Consider the accuracy of the data collector
 - Typically 0.05 - 0.1 imperial 0.01 - 0.05 metric
- Minimum Tile Points – prevents tile subdivision when points is reached
 - Typically 5 low – 20 high
- Maximum Tile Divisions – limits tile subdivision
 - Typically 4 low – 10 high
- Start Tile Length
 - Consider trying 1/50 of smaller X/Y ranges
 - Typically 4 low – 10 high

Filter	
Filter	Tile
Z Tolerance	0.1
Minimum Tile Points	5
MaxTileDivisions	4
Start Tile Length	10
Test Filter	

Note - If reduction is less than 30% keep adjusting settings to gain better optimisation (typically max is 40%)

Point Clouds / Lidar Filtering

- Tin Filter

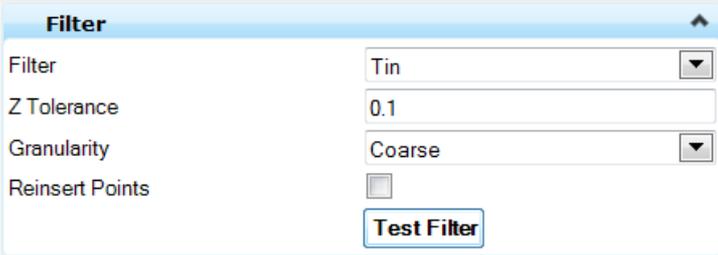
Tiles the data set into 2m tiles and successively re triangulates each tile removing points until it cannot remove any more. For each point in the tin it gets the surrounding points (connecting triangle points) calculates a least square plane and removes the Tin point if it is within the Z tolerance

- ‘Advantages’

- Typically returns a 70 – 80 % reduction

- Disadvantages

- Slower than Tile



Filter	
Filter	Tin
Z Tolerance	0.1
Granularity	Coarse
Reinsert Points	<input checked="" type="checkbox"/>
Test Filter	

Point Clouds / Lidar Filtering

- Tin Filter – setup and best practices

- zTolerance – this is the amount the surface can move up and down in the last squares

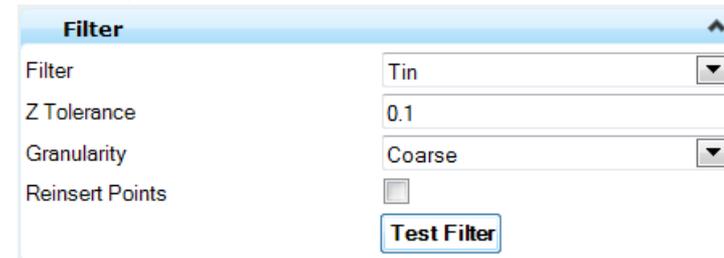
- Consider the accuracy of the data collector
- Typically 0.05 - 0.1 imperial 0.01 - 0.05 metric

- Granularity

- **Fine** – a least squares plane is calculated for a point and connecting triangle points. The point is removed if it falls within the Z tolerance.
- **Coarse** – The connecting points are removed if they are within the z Tolerance. Achieves a higher point reduction

- Reinsert points

- A DTM of the filtered surface is calculated and the filtered points are outside the zTolerance are reinserted. This can help reduce ‘blurring’ around discontinuities.



Note - If reduction is less than 60% keep adjusting settings to gain better optimisation (typically max is 80%)

Point Clouds / Lidar Filtering

- Tile Filter
- Tin Filter

Filter

Filter	Tile
Z Tolerance	0.1
Minimum Tile Points	5
MaxTileDivisions	4
Start Tile Length	10

Test Filter

Filter Results

i Number of Points Before : 16029558
Number of Points After : 5579408
Percentage Reduction : 65

OK

Filter

Filter	Tin
Z Tolerance	0.1
Granularity	Coarse
Reinsert Points	<input type="checkbox"/>

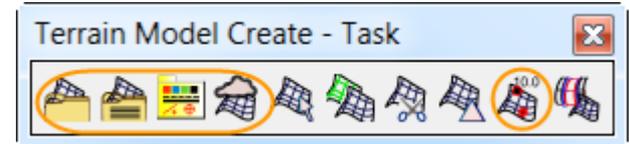
Test Filter

Point Clouds / Lidar Filtering

- Lets Take a Look

'Static' Ruled Terrains

- Typical Use Case
 - Think *'Existing'*
 - Think *'Read only'*
 - Think *'Legacy'*
- Advantages
 - Cool
 - User discretion on update
 - Overcomes overhead for large amount of rules
- Disadvantages
 - Notification of change when not in managed environment

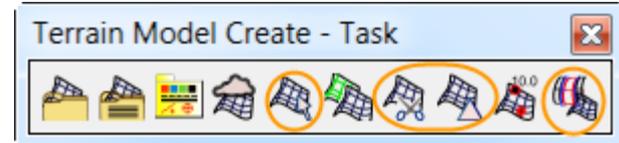


'Dynamic' Ruled Terrains

- Terrain model is 'informed' that a dependent element has changed and automatically updates

'Dynamic' Ruled Terrains

- Always used by
 - Survey
 - Create from Elements
 - Graphical Filters #
- Dependant upon children
 - Complex Terrains
 - Clipped Terrains
 - Delta Terrains



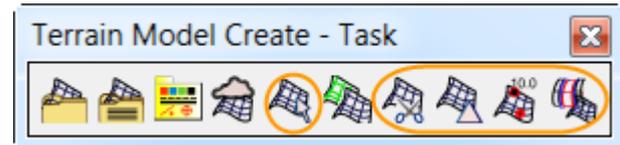
'Dynamic' Ruled Terrains

- Lets Take a Look

'Dynamic' Ruled Terrains

- Typical Use Case

- Think '*Proposed*'



- Advantages

- Cool

- Always up to date

- Essential in site modeling type situations – Corridors / Civil Cells

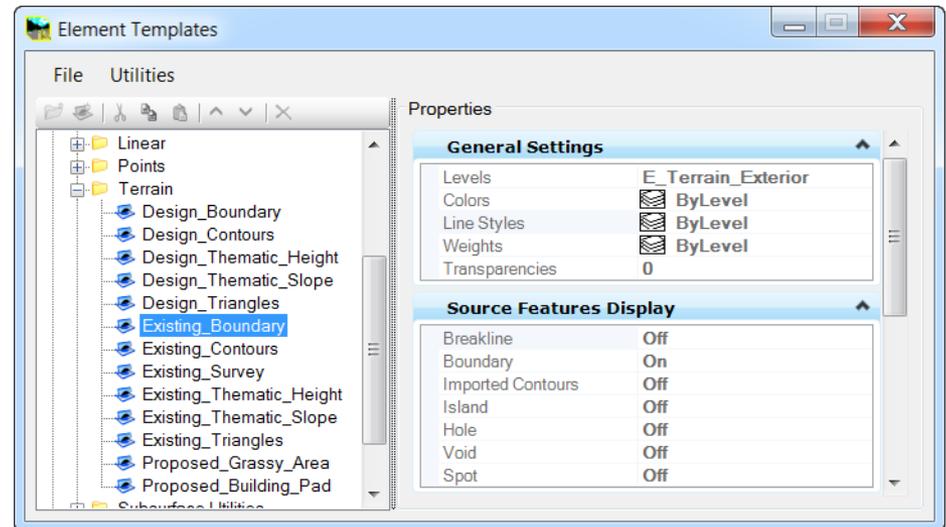
- Disadvantages

- Overhead for large amount of rules (not necessarily data)

- Terrains limited to 10,000 (pre-checked) Individually ruled elements

Large Terrains - Usability

- Influencing factors
 - Available resources
 - Machine memory
 - Machine Operating system
 - Other applications
 - Disk Speed
 - Display representation



Best Practices

- Consider multiple passes for import
 - ‘Dynamic’ Rule what you need
 - ‘Static’ Rule Terrains for bulk data
 - Reference DGN’s
- Consider the native application workflows
 - Tile ‘manageable’ Terrains

Learning Paths: Ready-Made Training Plans

Choose from:

- Bentley recommendations
- Configure your own
 - Organizational
 - Personal

Select:

- Product(s) and version(s)
- Language
- Training type

Enroll team members in:

- One learning path
- Multiple learning paths

Personalize Learning Path

Use this form to personalize a Learning Path. You can enable/disable specific course offerings by expanding the "Find Training" tab, and even add new course blocks into your Learning Path. Click the Help icon for more detailed instructions and a Step-By-Step guide.

Name* Peter's custom lp

Description*

Learning Path Type Personal Learning Path Set as Company Learning Path

Courses

MicroStation Essentials

MicroStation Essentials is designed for the new MicroStation user and builds a solid foundation in the concepts, tools and features found in the MicroStation drawing environment. Starting with setting... [More](#)

Find Training (14)

Live	Title	Language	Generation	Release Label	LU's
<input type="checkbox"/>	MicroStation Essentials	English	V8i	Base Release	8
<input type="checkbox"/>	MicroStation Essentials Basics	English	V8i	Base Release	4
<input type="checkbox"/>	MicroStation Essentials Express	English	V8i	Base Release	4
<input type="checkbox"/>	MicroStation Essentials	English	V8i	Base Release	8
<input type="checkbox"/>	MicroStation for AutoCAD Users	English	V8i	Base Release	8
<input type="checkbox"/>	MicroStation for AutoCAD Users Express	English	V8i	Base Release	4
<input type="checkbox"/>	MicroStation for Mining and Metal Extraction	English	V8i	Base Release	8
<input type="checkbox"/>	MicroStation for AutoCAD Users Express	English	V8i	Base Release	4

On-Demand

Title	Language	Generation	Release Label	LU's	Type	
<input type="checkbox"/>	MicroStation Essentials Lecture Series	English	V8i	Base Release	1	OnDemand eLearning: Lecture
<input type="checkbox"/>	MicroStation Quick Start Guide	English	V8i	Base Release	4	OnDemand eLearning: Hands-on
<input type="checkbox"/>	MicroStation Essentials	English	V8i	Base Release	8	OnDemand eLearning: Hands-on
<input type="checkbox"/>	MicroStation for AutoCAD Users	English	V8i	Base Release	8	OnDemand eLearning: Hands-on
<input type="checkbox"/>	MicroStation for Mining and Metal Extraction	English	V8i	Base Release	8	OnDemand eLearning: Hands-on
<input type="checkbox"/>	MicroStation Essentials	English	V8i	Base Release	8	OnDemand eLearning: Hands-on

Personalize Learning Path

Use this form to personalize a Learning Path. You can enable/disable specific course offerings by expanding the "Find Training" tab, and even add new course blocks into your Learning Path. Click the Help icon for more detailed instructions and a Step-By-Step guide.

Name* MicroStation Technician in a Roadway Setting

Description* 2 year onboarding program. 72 LU's. Multi-product MS, PW, InterPlot, InRoads. Live and on-demand self-study.

Learning Path Type Personal Learning Path Set as Company Learning Path

Manage Master Course List

ProjectWise User Essentials

This course is for individuals who need to manage documents throughout a project cycle and work in the ProjectWise managed environment. It presents techniques for working in the integrated environment... [More](#)

LU's: 0

Find Training (10)

Live	Title	Language	Generation	Release Label	LU's
<input type="checkbox"/>	ProjectWise User Essentials	English	V8i	SELECTseries 2	8
<input type="checkbox"/>	ProjectWise User Essentials	English	V8i	SELECTseries 3	8
<input type="checkbox"/>	ProjectWise Client Start Up Guide	English	V8i	Base Release	4
<input type="checkbox"/>	ProjectWise User Essentials	English	V8i	Base Release	8

Displaying items 1 - 4 of 4

On-Demand	Title	Language	Generation	Release Label	LU's	Type
<input type="checkbox"/>	Design Management Studio	English	V8i	Base Release	1	OnDemand eLearning: Lecture
<input type="checkbox"/>	ProjectWise User Essentials	English	V8i	SELECTseries 2	8	OnDemand eLearning: Hands-on
<input type="checkbox"/>	ProjectWise User Essentials	English	V8i	SELECTseries 3	8	OnDemand eLearning: Hands-on
<input type="checkbox"/>	ProjectWise Client Start Up Guide	English	V8i	Base Release	4	OnDemand eLearning: Hands-on
<input type="checkbox"/>	ProjectWise User Essentials	English	V8i	Base Release	8	OnDemand eLearning: Hands-on
<input type="checkbox"/>	ProjectWise User Essentials	English	V8i	Base Release	8	OnDemand eLearning: Hands-on

Displaying items 1 - 6 of 6

[ADD MORE](#)

MicroStation Essentials

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LU's: 0

This Session's Learning Path:

Here's the name and link to a short learning path that includes this session and recommended modules that you may share with your colleagues:

V8i (SELECTseries 3) OpenRoads Technology Learning Path

<http://learn.bentley.com/app/Public/ViewLearningPathDetails?lpld=104292#.UYkxZxK2r9s.email>

Assessment

1. True / False - Create Terrain from Elements always produces as 'dynamic' ruled Terrain.

Answer True

2. True / False – Complex Terrains are always 'dynamic' ruled Terrains.

Answer True

3. True / False – 'Static' Terrains maintain a rule but require manual update.

Answer True

Thank you



Managing the Ever-Growing Terrain Model

Presented by: Ian Rosam