MotionDesk

Terrain Generation

For MotionDesk 4.8

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dSPACE

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Important Notice

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About This Document

Contents

This document introduces you to the terrain generation with MotionDesk. It describes how to built a terrain 3-D object using a height map file and a texture or land class. You can also embed a road model that is generated by ModelDesk.

Symbols

dSPACE user documentation uses the following symbols:

Symbol	Description
DANGER	Indicates a hazardous situation that, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a hazard that, if not avoided, could result in property damage.
Note	Indicates important information that you should take into account to avoid malfunctions.
Tip	Indicates tips that can make your work easier.
	Indicates a link that refers to a definition in the glossary, which you can find at the end of the document unless stated otherwise.
	Precedes the document title in a link that refers to another document.

Naming conventions

dSPACE user documentation uses the following naming conventions:

%name% Names enclosed in percent signs refer to environment variables for file and path names.

< > Angle brackets contain wildcard characters or placeholders for variable file and path names, etc.

Special folders

Common Program Data folder A standard folder for application-specific configuration data that is used by all users.

`%PROGRAMDATA%\dSPACE\<InstallationGUID>\<ProductName>`

or

`%PROGRAMDATA%\dSPACE\<ProductName>\<VersionNumber>`

Documents folder A standard folder for user-specific documents.

`%USERPROFILE%\Documents\dSPACE\<ProductName>\<VersionNumber>`

Local Program Data folder A standard folder for application-specific configuration data that is used by the current, non-roaming user.

`%USERPROFILE%\AppData\Local\dSPACE\<InstallationGUID>\<ProductName>`

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dSPACE Help (local) You can open your local installation of dSPACE Help:

- On its home page via Windows Start Menu
- On specific content using context-sensitive help via **F1**

dSPACE Help (Web) You can access the Web version of dSPACE Help at www.dspace.com/go/help.

To access the Web version, you must have a *mydSPACE* account.

PDF files You can access PDF files via the icon in dSPACE Help. The PDF opens on the first page.

Basics and Instructions

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Basics of Terrain Generation 8
Provides basic information on terrain generation.

Workflow of Terrain Generation 10
Explains the workflow for terrain generation.

How to Select the Height Map File 11
The height of a terrain is specified by a height map file.

How to Select the Texture of the Terrain 12
The texture of a terrain can be specified using an image file or a predefined texture of a land class.

How to Specify a Subregion 13
If you use files with geographic data, the entire area might be very large. You can select a subregion of the area that is considered for terrain generation.

How to Select a Road File and Specify the Road's Start Position 14
You can select a road model to be considered when the terrain is generated.

How to Start Terrain Generation 15
When all settings are specified, you can start terrain generation.

Basics of Terrain Generation

Introduction

This topic provides basic information on terrain generation.

Terrain generation

A feature of MotionDesk that provides an environment for a large 3-D world. It generates a 3-D object for the ground that can base on real world or artificial data. It is possible to embed a road model created by the ModelDesk Road Generator.

The following illustration displays an example of a terrain.

Height map file

You can specify the height map for a terrain using two types of files: a bitmap or geodata.

Geographic height map (geodata) The height map can be specified by a bitmap file that contains geographic data in the GeoTiff format. Terrain generation supports only the GeoTiff format in the WGS 84 UTM (world geodetic system 1984 ellipsoid) coordinate system.

Because the geographic data set is included in these bitmap files, no further settings are required for the height map.

Simple height map (bitmap) The height map can be specified by a simple bitmap file in JPG, BMP, PNG, or TIF format that contains no geographic data (files in the TGA and GIF format are not supported).

Because a simple height map contains no geographic data, you must specify additional properties. The grid spacing specifies the number of meters that are assigned to one pixel. The minimum height specifies the height that is assigned to a black pixel. The maximum height specifies the height that is assigned to a white pixel.

The following illustration displays an example of a simple height map.

Textures

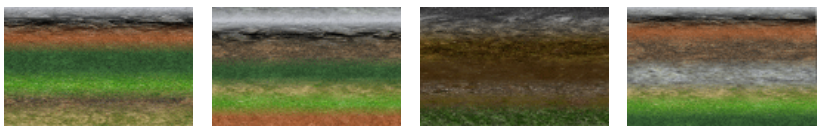
Textures specifies the appearance of the terrain. You can select the texture on three ways: A simple texture, a file with geographic data, or a land class.

Simple bitmap file You can use any bitmap file in JPG, BMP, PNG, TIF, TGA, or GIF format as texture. You can stretch the image across the entire terrain, or repeat the image several times.

File with geographic data You can use a file that includes geographic data in TIF format. This can be satellite images, for example. For these files, no further settings are required. It is possible to ignore the geographic data and use it as simple bitmap.

Land class You can use a predefined land class as a texture for the terrain. A land class contains multiple images. Each of them is related as the texture to a certain altitude range, i.e., when the terrain is generated, the images are used depending on the height of the terrain.

The following table shows some examples of land classes.



`AlpineSteppe` `Cordillera` `MixedForest` `Shrubland`

Road model

A road model and its scenery that is modeled in ModelDesk can be considered for the terrain generation. If this adjust feature is enabled during terrain generation, the road reference points are read in to deform the terrain along the road course to avoid overlapping between road and terrain.

A generated terrain does not contain the road model nor its scenery. You can add the road afterwards using scene synchronization. Refer to Basics of Synchronizing the Scene in MotionDesk (ModelDesk Scene Synchronization 🕮).

Managing the configuration data

When a terrain is generated, the 3-D object is saved in the scene of a MotionDesk experiment. However, the MotionDesk project or experiment does not contain the files that are used for terrain generation, for example, the height map file or satellite image. A MotionDesk experiment does also not contain the configuration settings, you have specified for terrain generation, but you can save the configuration to a file. This file is helpful if the road model changes and you want to generate the terrain 3-D object again. This file is not stored in the MotionDesk project.

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Workflow of Terrain Generation

Introduction

Terrain generation requires some steps. This topic gives an overview on the workflow.

Prerequisites

To generate a 3-D terrain object, the following files are required:

- Height map file (with or without geographic data)
- Optional: Bitmap file with or without geographic data for the texture
- Optional: Road model specified with ModelDesk

Workflow

To get a terrain 3-D object, you must perform the following steps:

1. The height map for the terrain is specified by a file. You can use height map files that contains geographic data or simple bitmaps. Refer to How to Select the Height Map File on page 11.
2. The texture of the terrain can be specified by a file with or without geographic data or you can select a predefined texture for the terrain. Refer to How to Select the Texture of the Terrain on page 12.
3. Height map file that contains geographic data usually covers a large area. In these cases, you can specify a subregion to only use a part of the height map for terrain generation. Refer to How to Specify a Subregion on page 13.

4. Generally, you want to use a road model on the generated terrain. Therefore, you can select the road model specified in ModelDesk and specify its start position. When the terrain is generated, the geometry of the road can be considered to adapt the terrain to the road. Refer to How to Select a Road File and Specify the Road's Start Position on page 14.
5. When you have completed all the settings, you can start the terrain generation. Refer to How to Start Terrain Generation on page 15.

How to Select the Height Map File

Objective	The height of a terrain is specified by a height map file.
Supported geodata file	The terrain generation supports only geodata file in the GeoTiff format with the WGS 84 UTM (world geodetic system 1984 ellipsoid) coordinate system.
Preconditions	MotionDesk is started and a project and experiment is created.
Method	**To select the height map file** **1** On the ribbon, click Scene – Terrain – Create. The Terrain Height Map dialog opens. **2** Select the height map file. MotionDesk reads the file and automatically sets the bitmap or geodata option depending on the file contents. If possible, the dialog displays a preview of the terrain. If the image is too large to be displayed, a simple rectangle is displayed that has the same dimensions but no picture. If you have a geographic file, you can also see the coordinates of the height map in the UTM coordinate system in the preview. **3** If you use a simple bitmap, specify grid spacing, minimum height, and maximum height. According to the specified value of the grid spacing, the values of the axes are adapted in the preview. Thus, you get information on the size of the terrain. **4** Click Next.
Result	The height map for the terrain is specified.
Next steps	You can select the texture of the terrain, see below.

Related topics

Basics

Basics of Terrain Generation....8
Workflow of Terrain Generation....10

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Terrain Height Map Dialog....20

How to Select the Texture of the Terrain

Objective

The texture of a terrain can be specified using an image file or a predefined texture of a land class.

Preconditions

The Terrain Texture Dialog must be open.

Possible methods

You can select a file (with or without geographic data) or a predefined land class as texture for the terrain:

- To select a file, refer to Method 1 on page 12.
- To select a predefined land class, refer to Method 2 on page 12.

Method 1

To select the texture of the terrain using a bitmap file

1. In the Terrain Texture Dialog select Select the bitmap file.
2. Click the Browse button and select the bitmap file.
   MotionDesk reads the file. If it contains geographic data, the Geographic image data option is automatically selected. Otherwise, the Simple texture option is selected.
3. If the file contains geographic data and you do not want to use them, select Simple texture.
4. If the Simple texture option is selected, specify the properties.
5. Click Next.

Method 2

To select the texture of the terrain using a land class

1. In the Terrain Texture Dialog select Select the landclass.
2. From the Landclass list, select a land class.
3. Click Next.

Result	The texture is specified.
Next steps	If you have selected an image file with geographic data, you can select a subregion, see below. Otherwise, you can select a road model to be embedded into the terrain. Refer to How to Select a Road File and Specify the Road's Start Position on page 14.
Related topics	Basics Basics of Terrain Generation....8 Workflow of Terrain Generation....10 References Terrain Texture Dialog....22

How to Specify a Subregion

Objective	If you use files with geographic data, the entire area might be very large. You can select a subregion of the area that is considered for terrain generation.
Subregion	If you have the height map specified with a file that contains geographic data, you can specify limits for the terrain to be generated.
Preconditions	The Terrain Subregion Dialog must be open.
Method	**To specify a subregion** **1** In the Terrain Subregion Dialog, select Select a subregion. **2** Press the `Ctrl` key, and drag the mouse in the Preview. In the Preview, a green rectangular is drawn. This marks the subregion that is used for terrain generation. **3** If you want to specify the subregion more accurately, enter the UTM coordinates or the coordinates in degrees.
Result	The subregion is specified.

Next steps

You can select a road model that is used on the terrain, see below.

Related topics

Basics

Basics of Terrain Generation 8
Workflow of Terrain Generation 10

References

Terrain Subregion Dialog 23

How to Select a Road File and Specify the Road's Start Position

Objective

You can select a road model to be considered when the terrain is generated.

Road adjustment

You can select the road model that is placed on the terrain to be generated. The road is not actually inserted into the terrain, but its geometry is considered during terrain generation.

Road file

ModelDesk stores the road file in the Pool of the project in the following folder:

`<ModelDesk_Project>\Pool\Environment\Road`

Tip

You can read the location of the road file in the tooltip of the road in ModelDesk's Project Navigator.

Preconditions

The Road Adjustment Dialog must be open.

Method

To select a road file and specify the road's position

1. Select Adjust the road on terrain.
2. Click the Browse button and select the road file.
3. Click Next.
   The Terrain Position Dialog opens.
4. In the Preview, drag the road to the correct start position. You can also specify the numerical values of the start position.

5 When the start position of the road is specified, all required settings for terrain generation are complete. Save the configuration so you can generate the terrain with the same configurations again. This is helpful if you have modified the input parameters, for example, change the road course:

Click **Save Config** to specify a name for the configuration and save it to a file.

Note that the configuration file is not included into the MotionDesk project or experiment.

Result

The road model is selected and its start position is specified.

Next steps

You can start terrain generation, see below.

Related topics

Basics

Basics of Terrain Generation....8
Workflow of Terrain Generation....10

References

Road Adjustment Dialog....25
Terrain Position Dialog....25

How to Start Terrain Generation

Objective

When all settings are specified, you can start terrain generation.

Preconditions

All the configuration for the terrain must be set.

Method

To start terrain generation

Note

Depending on the size of the terrain, the terrain generation can take several minutes or hours.

1 You can start terrain generation directly after configuration or you can load an existing terrain configuration.

- To start terrain generation directly after configuration:
  In the Terrain Position dialog, click **Generate**.

- To load a existing terrain configuration:
  - On the ribbon, click **Scene – Terrain – Open** to open the **Terrain Configuration** dialog.
  - Select the terrain configuration file.
  - Click **Generate Terrain**.

The terrain generation starts.

Result

The terrain 3-D object is generated and inserted in the scene in the 3-D View.

Related topics

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Workflow of Terrain Generation....10

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Commands

Where to go from here

Information in this section

Create 18
To create a terrain configuration.

Open 18
To open a terrain configuration file.

Create

Access

You can access this command via:

Ribbon	Scene – Terrain
Context menu of	None
Shortcut key	None
Icon	None

Purpose

To create a terrain configuration.

Result

The Terrain Height Map dialog opens that lets you specify a terrain configuration.

Related topics

References

Terrain Height Map Dialog 20

Open

Access

You can access this command via:

Ribbon	Scene – Terrain
Context menu of	None

Shortcut key	None
Icon	None

Purpose

To open a terrain configuration.

Result

The Terrain Configuration dialog opens and lets you select a terrain configuration file.

Description

The terrain configuration file contains the settings for the terrain generation. You can modify the settings and generate the terrain.

Related topics

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Terrain Configuration Dialog.....27

Dialogs

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Terrain Height Map Dialog....20
To select the height map file for terrain generation.

Terrain Texture Dialog....22
To specify the texture of the terrain.

Terrain Subregion Dialog....23
To select a subregion of a geographic height map for terrain generation.

Road Adjustment Dialog....25
To select a road model for the terrain.

Terrain Position Dialog....25
To specify the road start position on the terrain, save the configuration, and start terrain generation.

Terrain Configuration Dialog....27
To select a terrain configuration file.

Terrain Height Map Dialog

Access

To open the dialog, select the **Create** command or select the **Open** command and modify the configuration.

Purpose

To select the height map file for terrain generation.

Result

The height map file is selected and a preview is displayed in the dialog.

Description

In this dialog you specify the height map of the terrain. There are two file types that you can use for the height map:

- Bitmap as height map: This is a file with a gray-scale image. It should have no colors. Pixels that have the black color (RGB value: 0, 0, 0) are assigned to the minimum height. Pixels that have the white color (RGB value 255, 255, 255) are assigned to the maximum height. Pixels that have a gray color are assigned to a height interpolated linearly between the minimum and maximum height.

  As the geographic data is missing, you must specify the number of meters per pixels, the minimum height, and the maximum height.

- Geodata: This is a file with geographic data in DEM or GEOTIFF file format. As these files have all the information for the height map, no further settings are required.

  The area in the file can be larger than the area that is used for terrain generation. A subregion can be defined later.

Dialog settings

Select the height map file Lets you select a file that contains the information on the height of the terrain. You can select a bitmap file as the height map or a geodata file to be used as the height map.

Bitmap file as height map Is selected if you selected a bitmap without geographic information.

Grid spacing (only for a bitmap file) Lets you specify the number of meters per pixel. This value and the number of pixels in the bitmap specifies the size of the terrain 3-D object.

If you specify a large value, the terrain is coarser and its deformation can be unrealistic but a large terrain are can be generated faster.

Min height (only for a bitmap file) Lets you specify the height in meters that is related to the black pixels.

The value of the minimum height must be smaller than the value of the maximum height. You can use this value to adjust the height of the terrain to the minimum height of the road.

Max height (only for a bitmap file) Lets you specify the height in meters that is related to the white pixels.

The value of the maximum height must be greater than the value of the minimum height. You can use this value to adjust the height of the terrain to the maximum height of the road.

Geodata (dem or geodiff) Is selected if you selected a bitmap that has geographic data.

Preview Displays a preview of the terrain. The coordinates of the preview are displayed at the bottom and left side of the preview in the UTM coordinate system. You can control the preview of the terrain using the following buttons:

To move the visible area of the preview.

 , and slider

To zoom in and out of the preview.

To display the entire terrain in the Preview.

Related topics

Basics

Basics of Terrain Generation....8
Workflow of Terrain Generation....10

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How to Select the Height Map File....11

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Terrain Texture Dialog

Access

This dialog opens if you click **Next** in the **Terrain Height Map** dialog or **Back** in the **Road Adjustment** dialog.

Purpose

To specify the texture of the terrain.

Result

The texture of the terrain is specified.

Description

In this dialog, you can select the texture for the terrain. You can select a bitmap file as texture or use a land class that is a predefined texture. If you select a bitmap file, you can use a bitmap file with or without geographic data.

In this dialog, you can select the texture for the terrain. You can specify the texture in three ways:

- Geographic image data file: You can select a bitmap file with geographic data, for example, a satellite image. You can evaluate the geographic data and place the image in the position specified in the file or you can ignore the geographic data and use the image like a simple bitmap.
- Simple bitmap file: You can select a bitmap file that hast no geographic data. The image can be stretched across the whole terrain or repeated several times.
- Predefined land class: You can use the texture of predefined land classes. A land class is a collection of several images. The image that is used for texturing depends on the height of the terrain.

Dialog settings

Select the bitmap file Lets you specify to use a bitmap file as texture.

Simple texture Is selected if you have selected a bitmap file that contains no geographic data. You can manually select this option if you selected a geographic image file but do not want to evaluate the position information.

Texture parameters - Stretch to whole terrain (Only for simple textures) Lets you specify to stretch the bitmap to the whole terrain.

Texture parameters - Repeat texture (Only for simple textures) Lets you specify to repeat the bitmap x times in x-direction and y times in y-direction.

Geographic image data Is selected if you have selected a bitmap that contains geographic data.

Select the landclass Lets you specify a land class to be used as texture.

Choose landclass Lets you select a land class.

Preview Displays a preview of the terrain. The coordinates of the preview are displayed at the bottom and left side of the preview in the UTM coordinate system. You can control the preview of the terrain using the following buttons:


To move the visible area of the preview.

 , and slider
To zoom in and out of the preview.


To display the entire terrain in the Preview.

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Terrain Subregion Dialog

Access

This dialog opens if you have a geographic height map and click **Next** in the **Terrain Texture** dialog or **Back** in the **Road Adjustment** dialog.

Purpose

To select a subregion of a geographic height map for terrain generation.

Result

A subregion is selected for terrain generation.

Description

Because the geographic height map can be very large, you can reduce the area that is used for terrain generation in this dialog.

You can enter the coordinates of the subregion in Earth geographical coordinates (longitudinal/latitude values) or in Universal Transverse Mercator (UTM) coordinates.

You can also specify the subregion by holding the **Ctrl** key and dragging the mouse on the preview.

Dialog settings

Select a subregion Lets you enable/disable the specification of a subregion. If the checkbox is not selected, the entire area is used for terrain generation.

Degrees Displays and lets you enter the coordinates of the subregion in degrees.

UTM Displays and lets you enter the coordinates of the subregion in UTM coordinates.

Preview Displays a preview of the terrain. The coordinates of the preview are displayed at the bottom and left side of the preview in the UTM coordinate system. You can control the preview of the terrain using the following buttons:

To move the visible area of the preview.

 , and slider

To zoom in and out of the preview.

To display the entire terrain in the Preview.

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Road Adjustment Dialog

Access

This dialog opens if you click **Next** in the **Terrain Subregion** or **Terrain Texture** dialogs or **Back** in the **Terrain Position** dialog.

Purpose

To select a road model for the terrain.

Result

The road model is selected and is considered during terrain generation.

Description

In this dialog, you can select the road that is used on the terrain. During terrain generation the road model is considered, so the boundaries of the road and its scenery transition smoothly to the terrain. In addition, the height profile of the road model is considered.

The terrain generation considers only the geometry of the road model, the generated terrain 3-D object does not include the road model.

Dialog settings

Adjust the road on terrain Lets you enable/disable the road adjustment.

Road file Lets you select the road file.

Related topics

Basics

Basics of Terrain Generation....8
Workflow of Terrain Generation....10

HowTos

How to Select a Road File and Specify the Road's Start Position....14

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Terrain Position Dialog....25
Terrain Subregion Dialog....23
Terrain Texture Dialog....22

Terrain Position Dialog

Access

This dialog opens if you have a geographic height map and click **Next** in the **Road Adjustment** dialog.

Purpose	To specify the road start position on the terrain, save the configuration, and start terrain generation.
Description	You can specify the coordinates of the road's start position by specifying the values or you can drag the road inside the Preview. Before you start the terrain generation, you can save the terrain configuration to a file. When you saved the terrain configuration, you can load the settings later to modify the settings and repeat the generation.
Result	The road start position is specified.

Description

Specify the Road Start Position on the Terrain Is enabled if a road file is selected.

X-Position (Only if a road file is selected) Lets you specify the x-coordinate of the road's start position.

Y-Position (Only if a road file is selected) Lets you specify the y-coordinate of the road's start position.

Fly to Road Origin (Only if a road file is selected) Moves the visible area so that the origin of the road is displayed.

Fly to Terrain Origin Moves the visible area so that the origin of the terrain is displayed.

Fit to Terrain Zooms the visible area so that the entire terrain is displayed.

Fit to Road Network (Only if a road file is selected) Zooms the visible area so that the entire road is displayed.

Fit to All Zooms the visible area so that the entire terrain and the entire road is displayed.

Preview Displays a preview of the terrain. The coordinates of the preview are displayed at the bottom and left side of the preview in the UTM coordinate system. You can control the preview of the terrain using the following buttons:

 To move the visible area of the preview.

 To zoom in and out of the preview.

 To display the entire terrain in the Preview.

Save Config Saves the configuration to a file.

Generate Starts the terrain generation.

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Terrain Configuration Dialog

Access

This dialog opens when the Open command is called.

Purpose

To select a terrain configuration file.

Result

The setting of the terrain configuration file is loaded.

Dialog settings

When the terrain configuration file is loaded, you can start the generation or modify the configuration.

Generate Terrain Starts the terrain generation.

Modify Configuration Opens the Terrain Height Map dialog. Starting with this dialog, you can modify the settings for the terrain configuration and then start the generation.

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Limitations

Limitations of Terrain Generation

Introduction	The following limitations apply for terrain generation.
No feedback during generation process	Terrain generation can take a long time and MotionDesk does not display any feedback on the progress.
Non-smooth terrain on road borders	The terrain might not merge smoothly with the road borders. It can appear when the terrain passes the batter or the embankment of the road.
GetTiff file	Terrain generator supports only the GeoTiff format in the WGS 84 UTM (world geodetic system 1984 ellipsoid) coordinate system.

Troubleshooting (Terrain Generation)

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Problem: The terrain is higher than the road or the road is higher than the terrain.

Information in other sections

Troubleshooting (Scene Creation) (MotionDesk Scene Creation 🕮)

Troubleshooting (General) (MotionDesk Basics 🕮)

The Height of the Terrain Does Not Match the Height of the Road

Problem

The terrain is higher than the road or the road is higher than the terrain.

Description

The height profile is specified in the road model. If the height profile does not match the height map of the terrain, the terrain 3-D objects looks unnatural.

Solution

Raise or lower the height map by adapting the minimum height. Refer to Terrain Height Map Dialog on page 20.

If possible, modify the height profile of the road model. Keep in mind that this also modifies the road that is simulated. Refer to How to Specify the Horizontal Profile of a Road Element (ModelDesk Road Creation 🕮).

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