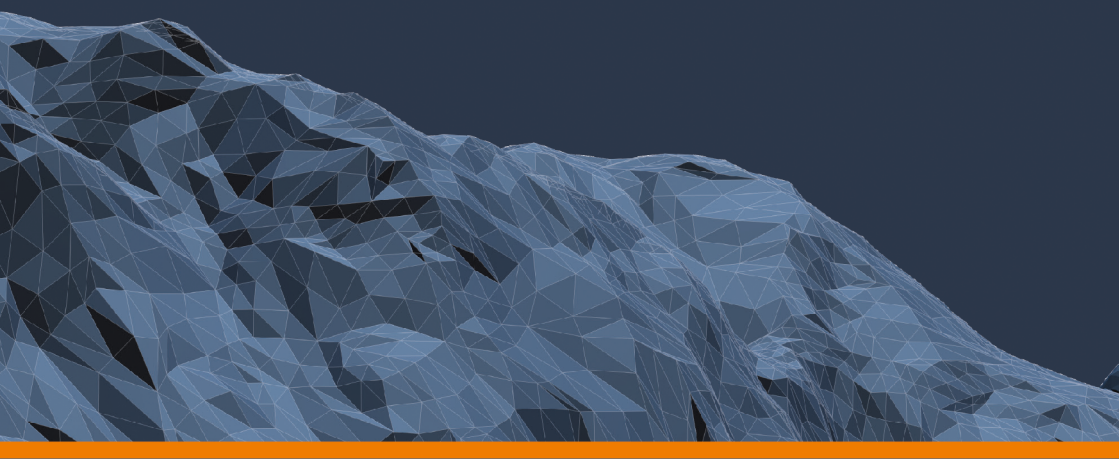
TRIAN3DBUILDER

Database Generation System



Trian3DBuilder
Product Information
Version 6.5

Modules

- **Trian3DBuilder Core** – all basic functionalities for generating geospecific terrains including export to OpenSceneGraph, OpenFlight/MetaFlight, 3DS, OBJ and Collada.
- Trian3D **Geotypic Module** – extension for generic and geotypic terrains.
- Trian3D **Roads Module** – extension for the construction of profile streets and crossings.
- Trian3D **Roads Plus Module** – includes Roads Module, arc/clothoid curves, tram tracks and OpenDRIVE Exporter.
- Trian3D **Airport Module** – automatic generation of airports from extensive database with airport descriptions.
- Trian3D **Maritime Module** – import ENC data, create Delaunay triangulated seabed and place fully featured buoys.
- Trian3D **Sensor Module** – create material classification textures for night vision or thermal imaging cameras.
- Trian3D **FBX Exporter** – exporter for Autodesk's FBX format.
- Trian3D **VBS Exporter** – exporter for Bohemia Interactive's VBS format.
- Trian3D **Havok Vision Exporter** – exporter for Havok's Vision Engine.
- Trian3D **Steel Beasts Pro Exporter** (incl. Sensor Module) – export to eSim Games' Steel Beasts Pro format.
- Trian3D **GDB Exporter** – exporter for MÄK's CGF format.
- Trian3D **Titan Vanguard** – export to Calytrix Titan Vanguard Engine.
- Trian3D **HERE RDF Import** – import of road networks from HERE RDF Databases.
- **Software Development Kit** (SDK) to extends Trian3DBuilder with PlugIns for special demands.

System Requirements

- Standard PC with Microsoft Windows 7, Windows 8/8.1 Windows 10
- Works on 64 bit systems
- CD-ROM / DVD drive
- 1.5 GB free space on the hard disk
- Keyboard
- 3-key mouse with wheel
- Free USB port for dongle
- Minimal requirements:
  - 2 GHz Pentium 4 or AMD Athlon with 1GB RAM
  - 3D graphics card e.g. NVIDIA Geforce 6600 with 256 MB RAM
- Recommended:
  - Intel Core I-Processor with 8 Cores or equivalent AMD Athlon
  - 16 GB RAM
  - 3D graphics card NVIDIA Geforce (e.g. GTX260 etc.) with 1024 MB RAM

Terrain Types

Generation of various types of terrain

- Geospecific terrains:
  - Create terrains based on satellite data and aerial images.
- Geotypical terrains (Geotypic Module):
  - Replacement of terrain classes with typical photo realistic textures.
  - Structure preserving blending between terrain classes.
  - Heterogeneous tiling in every terrain class.
  - Object placement matching underlying texture.
  - Climate zones - define several regions with various land class definitions.
  - Set up a fully featured, densely populated terrain in minutes.
- Generic terrains (Geotypic Module)
  - Create Geotypic textures with height and slope dependent texturing.
- All terrain types can be combined.

General

- Supports terrains of arbitrary size optimized for real-time rendering.
- Supports a multitude of industry standard formats.
- Native OpenSceneGraph support.
- About 40 target projections (Geographic, UTM, Geocentric, ..).
  - Additional projections from .prj file can be loaded.

Handling and Editing

Ease of use

- Standardized, configurable user interface.
- Fast access to libraries.
- Immediate visualization of all data with WYSIWYG editing.
- Simultaneous views for 2D and 3D.
- Support for multiple monitors.
- Integration of external texture and geometry editors.
- Optional auto save function.
- Project Wizard to quickly produce terrains:
  - Importing street data (OpenDRIVE, HERE RDF), nautical data (7Cs), data from OpenStreetMap,...

WYSIWYG-Editing

- Generate and edit points, lines and areas in 3D and 2D.
- Immediate feedback showing models, line and area objects.
- Work synchronously in 2D and 3D.
- Edit vector attributes with immediate visual feedback.

Road WYSIWYG-Editing

- Adjust lane count and lane width along the route with direct visual feedback.
- Edit crossing outline and offset.
- Perfectly match underlying satellite imagery.
- Edit AI splines.

Comprehensive Vector Editing

- Import, create and edit vector data with supported types:
  - Points
  - Lines
  - Bezier lines
  - Clothoid/ Arc lines
  - Areas
  - Bezier areas
- Vector groups to organize and split files for multiple user support.
- Reorder vectors via drag-and-drop.
- Extensive transformation tools.
- Visibility and activation states for all data.

- Various tools for optimization of vector data:
  - Automatically place bridges on intersecting lines.
  - Merge points dependent on distance or angle.
  - Refine vector in certain distance.
  - Combine lines with same endpoints and attributes.
  - Populate area with random footprints (e.g. for building extrusion).
  - Verify vectors - find and fix corrupted vectors.
  - Convert point lists to line.
  - Insert points on lines/area outlines.
  - Split lines/areas.
  - Conversion between lines/areas and Bezier lines/areas.
  - Conversion between lines and areas.
  - Revert point order of lines/areas.
  - Extend, connect lines.
  - Rectify vectors.
  - Create outlines.
- Assign generation attributes using libraries.
- Automatic FACC assignment to vectors.
- ESRI-Shape export of vector data.
- Assign imported vector attributes e.g. taken from shapefile attributes.
- Hide/unhide selected vectors.
- Assign local attributes to a vectors.
- Snap to vertice points.
- Merge vector (.vec) data to existing project.

Misc GUI Features

- Height editing:
  - Create and edit elevation data in 2D and 3D.
  - Brush for 2D or 3D with adjustable size and misc. functionalities e.g. height up/down, smooth, specific height, load shape bitmap.
- Undo / Redo:
  - Undo and redo all user changes.
  - Adjust number of undo steps.
- Auto save option

Data Management

- Management of re-usable data in libraries.
  - Texture, geometry and vector attributes.
- Definition of data sets e.g. for various seasons or regions.

- Definition of groups with several elements.
- Definition of landcover features.
  - Texture, alpha mask and object placement.
- Generation attributes for vector data.
  - Stack of combined modifiers.
  - Add /edit attributes for textures and objects entries.

Levels of Detail (LOD)

- LODs for each tile:
  - Definition of high detail insets possible.
  - Various attributes can be assigned for each terrain tile.
    - LOD count with switch-distances, mesh resolution, texture resolution.
    - Geotypic object placement.
  - Fast switching and assignment of local settings to tiles.
- LODs for Objects:
  - Size dependent LOD switching of objects groups.
- Multiple grids:
  - Define multiple grids and export each as a databases.
  - Overlapping grids can be integrated.

Vector generation templates

- Create /assign / edit vector generation templates and user vectors.
- Simple generation functions are represented as a Modifier.
- Combine different Modifiers to create complex generation rules.
- Define multiple rules for a vector via the Modifier stack to achieve complex settings.

Modifiers for vector generation templates

- **Basic Modifiers**
  - Modifier 'Outline' generates contours from vector data, e.g. for build geometry or RenderInTexture.
  - Modifier 'Border' generates border contours, e.g. for RenderInTexture and mesh manipulation.
  - Modifier 'Height Type' defines the height calculation.
  - Modifier 'Mapping' to define direction and tiling of the texture.
  - Modifier 'Multi Texture' supports the stacking of textures.
  - Modifier 'Layer' for setting planar objects upon terrain.
  - Modifier 'Point Link' to logically link features, e.g. crossing points or signals to roads.

  - Modifier 'Level Of Detail' to automatically activate or deactivate Modifier stacks in respect to the viewing distance.

- **Generation Modifiers**
  - Modifier 'Insert' for cutting objects and regions into the ground mesh.
    * Supports also inserts with inner islands.
    * Insert objects can be rendered to texture in low-res LODs.
  - Modifier 'Geometry' to build plane objects from outlines.
  - Modifier 'RenderInTexture' for painting vector data into the terrain's texture. Seamless transitions by blending border region.
  - Modifier 'Extrude' for the generation of fences and hedges for example.
  - Modifier 'Extrude Path' to extrude a geometry profile with surfaced textures.
  - Modifier 'Object Extrude' to process model templates and extrude them along a path.
  - Modifier 'Sign' for taxiway and text signs.
  - Modifier 'Building' to generate extruded 3D buildings from outlines with:
    * Various levels,
    * Miscellaneous roof types (flat, hip, gable, shed, dome, onion).
  - Modifier 'Building Interiors':
    * Generate generic building interiors due to various generation templates (apartment, office...).
    * Generation of various LODs.
    * Façade elements (windows, stucco elements, oriels etc.).
  - Modifier 'Shading' to define normal shade mode (flat, smooth).

- **Object Placement Modifiers**
  - Modifier 'Point Object Placer' to assign a geometry to point vectors.
  - Modifier 'Point Offset' to place models with an offset relatively to the point position.
  - Modifier 'Contour Object Placer' places objects along contours with side offset.
    * Variable geometry assignment, size and rotation.
  - Modifier 'Area Object Placer' to place geometries inside areas.
    * Variable geometry assignment, size and rotation.
  - Modifier 'Geotypic Object Placer' can use geotypic object placement definitions.
  - Modifier 'Object Eraser' to suppress objects with lower priority.
  - Modifier 'Collision' for flexible collision calculations between objects.
  - Modifier 'Object Connector' e.g. for power lines.
  - Modifier 'Light Point' for defining light points, e.g. at airports, in tunnels,...
  - Modifier 'Vector Template' to place vector data (including generation rules), such as lettering or arrows, on roads.
  - Modifier 'Billboard' places a billboard geometry on an vector with an object placer Modifier.

- **Attribute Modifiers**
  - Modifier 'Vector Attribute' to add/edit vector attributes.
  - Modifier 'SurfaceAttribute' to define surface attributes.
  - Modifier 'Node Name' to set a name to special nodes or switches.
  - Modifier 'Comment' to add text description to objects.
  - Modifier 'Object Layer Name' to define object layers, e.g. MetaFlight Export.
  - Modifier 'Sensor Attributes' to assign specific materials to objects for sensor calculation.
  - Modifier 'Delaunay' to define how vectors are handled for Delaunay triangulation.
  - Modifier 'Fringe Geometry' to add a fringe for transitions e.g. from land to water.

- **Format specific Modifiers**
  - Modifier 'GDB Vector Attribute' to define vector attributes for MAK VR-Forces Export.
  - Modifier 'GDB-Face Attributes' to define attributes for geometry surfaces for the export to Open-Flight or MAK GDB databases.
  - Modifier 'VBS2 Surface' to define special VBS surface attributes used for scattering.
  - Modifier 'VBS2 Object' to define objects with various attributes, like weight and hit points.
  - Modifier 'Havok Vision Surface' to define attributes and clutter objects of surface layer.
  - Modifier 'Havok Vision Physics' to set up the physical properties of objects.
  - Modifier 'Havok Vision Landmask' to generate vector based land masks.
  - Modifier 'Havok Vision Light' to set light points for Havok Vision.
  - Modifier 'Format Stack' restricts the execution of the actual Modifier Stack to the defined export formats.

- **Road Modifiers**
  - Modifier 'Profiler' to define profiles for complex roads.
  - Modifier 'Crossing' to build crossings and transitions for several road constellations.
  - Modifier 'Tunnel' to define tunnel shapes.
  - Modifier 'Bridge' to define bridge shape and poles.
  - Modifier 'Signal' to export signal settings to OpenDRIVE.
  - Modifier 'OpenDRIVE Object' to add objects to the OpenDRIVE Export.
  - Modifier 'RoadSign' to place signs of informative nature.
  - Modifier 'Marking' to supplement the automatically generated road marks.

- **Rail Modifiers**
  - Modifier 'RailProfiler' to create rail profiles with several lanes, such as tracks or stops.
  - Modifier 'Rail Junction' to generate switches from intersecting rail profiles.
  - Modifier 'Rail Powerline' to generate power lines above the tracks.

Modules

Geotypic

- Various terrain types:
  - Generic, geotypical
  - See section Terrain types for further information.

Roads

- **Roads**
  - Generation of roads and rivers from profiles.
  - Various lanes.
  - Road markings.
- **Crossings**
  - Fully automated generation of crossings.
  - Arbitrary number of roads and alignments.
  - Roundabouts.
  - Transition between various lanes.
- **Generation of tunnels and bridges**
  - Crossings and transitions supported.
- **Rails**
  - Streetcar rails.
  - Automatic rail switches.
  - Create automatic power transition lines.

Roads Plus

- All features of the Roads Module.
- Roads according to road construction rules.
  - From arcs/clothoids.
  - Smooth height progression through polynomials.
  - Cross-fall in curves.
- Import
  - Direct OpenStreetMap and OpenDRIVE data Import.
  - Convert Shape data to profiled roads.
  - HERE RDF databases via Project Wizard.
  - Automatic assignment of road templates to real-world data.
    - Use xml settings to control template generation due to country rules etc.
- OpenDRIVE export

Airport

- Import
  - Free database of over 35,000 airports worldwide.
  - Runways with with different types of markings and lighting.
  - Taxiways with lighting.
  - Apron
- Editing
  - Possibility to edit and create runways.
  - Conversion into editable vector data.
  - Generation attributes configurable using .xml file.
- Generation
  - Approach lighting:
    - ALSF_I, ALSF_II, CALVERT, CALVERT_ILS,
    - SSALR, SSALF, SALS, - MALSR, MALSF, MALS,
    - ODALS, RAIL
  - Edge lights - LIRL, MIRL, HIRL
  - Runway light indicator – PAPI, VASI
  - Runway marking code – Visual, non-precision and precision approach markings.
  - Taxiway signs
  - Placement of airport objects, e.g. tower, windsock.

Maritime

- Import ENC Data: S57, S63, 7CB, 7CC, 7CX,...
- Seabed Triangulated from Depth Contours/Lines and Soundings.
- Coastline with Quay Walls, Shoreline Constructions and Piers.
- Buoys/Beacons with Topmarks:
  - Automatic placement from comprehensive library.
  - Lights with Blink Code, Color, Direction, Range, Intensity etc.

Sensor

- Raster map with Material classification.
- ClassIDs with arbitrary physical attributes.
- Each pixel can mix several materials.
- IR, LIDAR, Night Vision

Software Devlopment Kit (SDK)

- API to extend Trian3DBuilder with Plug-Ins.
  - Import/Export Plug-in: for image formats, geometry formats, geographical raster formats, vector formats.
  - Generation Plug-ins: to broaden the generation capacity, e.g. render to texture or texture filtering.
  - ExportTerrain Plug-in: addition of new export formats.
  - GUI Plug-in: extend the software with your own menu items and dialogs.
  - Modifier Plug-in: extend custom Modifiers.

Scope of supply

- Detailed manual
- Comprehensive libraries with textures, objects and vector attributes
- Detailed introduction with getting started document and advanced tutorials
- Various example projects

Generation

Object Placement

- Various methods of geometry integration (internal reference, external reference, copy, inherit, relative).
- Rotation, scale and object closeness with variance.
- Collision testing.
- Classify your objects with name and size.

Object Generation

- Create rivers, lakes and further hydroponic systems for your terrain.
  - Rivers can flow downwards and have taper settings.
- Powerlines and Forests
  - Place different types of power poles and power lines; power pole models are delivered with Trian3DBuilder.
  - Create canopy forest geometry with texture on roof.
  - Clutter individual tree objects with definable variance.
- Create hedges and fences.

Building Generation

- Buildings from outlines with misc. roof types.
- Simple GUI to flexibly define façades.
- Add various façade elements and oriels.
- Automatically create building interiors from various templates (apartment, office etc.).

Geometry integration

- Cut objects, lines or areas into the terrain mesh.
- Height adaptation (specific height, dependent on relief, river behavior (continuous decline), average height, ClipOnSurface).
- Border for smooth transition to environment.
- Cut isle contours.

Comprehensive database optimization

- Tiling and LOD switching of database.
- Novel polygon saving edge algorithm.
- Optimized scenegraph.
- Geometry simplification using TIN-algorithm.

- Export of indexed geometry or tri-strips if requested.
- Texture sharing between objects.
- Compressed texture support (dds).
- Definition of different texture and mesh resolutions for tiles.
- Size dependant LOD switching of objects.
- Paging supported.
- Enhanced paging support for individual LODs and object groups.

Verification of databases in internal 3D viewer

- High performance visualization.
- Tree view of scenegraph.
- Adjustment of render parameters: camera clipping, fog, lighting.
- Various cameras for individual navigation.
- Save camera positions.
- Statistics of frame rate, number of triangles,...

Further Features

- Parallel export with individual format and generation settings.
- Cutting in external databases as high-resolution insets.
- Optimized performance through multi-core/multi-CPU support.
- Filters for terrain textures (snow, shadow from relief).
- Define your own file path and naming output.

Supported Formats

Elevation

- Arc/Info ASCII Grid (.asc)
- Arc/Info Binary Grid (.adf)
- Arc/Info Export Format (.e00)
- Bathymetry Attributed Grid (.bag)
- VTP Binary Terrain (.bt)
- DTED Level 0, 1, 2 (.dt0, .dt1, .dt2)
- SRTM (.hgt)
- USGS ASCII DEM (.dem)
- Geotiff Elevation (.tif, .tiff)
- ASCII Gridded XYZ (.xyz)
- GeoSoft Grid eXchange (.gxf)
- HF2/HFZ heightfield raster (.hf2)
- Japanese DEM (.mem)
- Terragen(TM) Terrain File (.ter)
- SDTS Raster (.ddf)
- ESRI / ENVI hdr (.hdr)
- Erdas Imagine Raw (.raw, .bl)
- NTF Grid/Contour (n.tf)
- Netpbm (.pgm, .ppm)

Landcover

- Geotiff (.tif, .tiff)
- Portable Network Graphics (.png)
- JPEG (.jpg)
- JPEG 2000 (.jp2)
- ENVI BIL, BIP, BSQ (.bil, .bip, .bsq)
- ECW (.ecw)
- Erdas Imagine Raw (.img)
- NITF (.ntf)
- ADRG Digitized Raster Graphics (.thf)
- BSB Nautical Chart (.bsb)

Satellite

- Geotiff (.tif, .tiff)
- Portable Network Graphics (.png)
- JPEG (.jpg)

- JPEG 2000 (.jp2)
- ENVI BIL, BIP, BSQ (.bil, .bip, .bsq)
- ECW (.ecw)
- Erdas Imagine Raw (.img)
- NITF (.ntf)
- ADRG Digitized Raster Graphics (.thf)
- BSB Nautical Chart (.bsb)
- Web Map Service (.xml)

Vector data

- Trian3D vector file (.vec)
- Arc/Info ASCII (.E00)
- Arc/Info BINARY (.E00)
- SDTS (*.catd.ddf)
- ESRI shape (.shp)
- Keyhole Markup Language (.kml)
- Keyhole Markup Language Compressed (.kmz)
- MapInfo (.mif, .tab)
- AutoCAD DXF (*dxf)
- VMAP Database (.lht)
- Atlas BNA (.bna)
- Comma Separated Value (.csv)
- GeoJSON (*.geojson)
- Microstation DGN (*.dgn)
- S-57 (.000)
- GPS Exchange Format (.gpx)
- GMT ASCII Vectors (*.gmt)
- GPSTrackMaker (.gtm, .gtz)
- X-Plane/Flightgear aeronautical data (.dat)
- GeoConcept text (.gtx)
- VRT - Virtual Datasource (.vrt)
- UK National Transfer Format (.ntf)
- U.S. Census TIGER/Line (.rt1, .rta)
- OpenStreetMap XML (*.osm)

Textures

- Windows Bitmap (.bmp)
- DirectX (.dds)
- GIF(.gif)

- PIC (.pic)
- PNG (.png)
- SGI RGB (.rgb, .rgba)
- Targa (.tga)
- TIFF (.tif)

Objects

- OpenFlight(*.flt)
- OpenSceneGraph(*.osg, *.osga, *.osgb, *.osgx, *.ive)
- Autodesk 3D Studio File (*.3ds)
- DirectX (*.x)
- Lightwave Object(.lwo)
- Autodesk (*.dxf)
- Autodesk (*.fbx)
- Carbon Graphics Geo (*.geo)
- Wavefront OBJ (*.obj)
- Terrex TerraPage (*.txp)
- Collada (*.dae)
- AC3D (*.ac)
- ESRI Shape (*.shp)
- CityGml (*.xml)

Terrain Exporters

OpenFlight / MetaFlight Exporter

- Export to various versions of the industry standard format OpenFlight.
- Supports all different object types.
- Supports Metaflight:
  - Hierarchy types ADDITIVE and SUBSTITUTIVE.
  - Supports Virtual texture.
  - Supports Object Layer.
  - Supports multiple sub databases.
  - Write individual file structure.
  - Create .mft files.

GDB Exporter

- Export in MÄK's GDB format for VR-Forces and Stealth.
- Export terrain and vector data.
- Export faces and vector attributes.
- Generation of gdb project (.mtd) and material (.mtl) files.
- Define vector and face attributes with Modifier.

FBX Exporter

- Export to Autodesk FBX format.
- Supports ASCII and binary export.
- Import script to convert in Unity® scene.

Havok Vision Exporter

- Static Terrain Export
  with automatic LOD generation for efficient rendering.
- Automatic Prefab Generation
  load whole scene into editor or engine.
- Import/Export Vision Models (vMesh, prefab...)
  work with Vision assets or own models.

VBS®3 Exporter

- Simply create VBS terrain with Trian3DBuilder's usual simple workflow.
- Export to VBS 1.6 - 3.9.
- Support of geospecific and generic/geotypic texturing.

- Full support of all Modifiers for texturing, object placement and generation.
- Manipulate elevation with Modifier 'Insert', 'Border' and the height brush.
- Export all supported 3d model formats to VBS .p3d format.
- Import and place Bohemia VBS .p3d models.
- Definition of all VBS surface types with one or more clutter layers.
- Generation of VBS roads.
- Generation of VBS river.
- Use all supported generation geographical data (sat image, shape files,..) in VBS Tools.

Steel Beasts Professional® Exporter

- Support generic/geotypic texturing and easy assignment Steel Beast Textures types.
- Full support of all Modifiers for texturing, object placement and generation.
- Support of different road types.

OpenDRIVE Exporter (included in Roads Plus Module)

- Open file format for the logical description of road networks.
- AI vehicles drive smoothly by following clothoid/arc constructed AI splines.
- Export road, crossing, signal and object information.

OpenDRIVE Importer (included in Roads Plus Module)

- Import highly accurate OpenDRIVE representations of roads to visual database.

More Exporters

- Wavefront OBJ (.obj)
- Collada (.dae)
- Stereolithography (.stl)
- DirectX (.x)
- Autodesk 3ds (.3ds)

Dependent Exporters

- Add dependent exporters to a full export format to get secondary generation data:
  - OpenDRIVE
  - Text Dump Data
  - Shape Export

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