Terrasolid – Software for LiDAR processing
Terrasolid

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Terrasolid Ltd.

- Founded in 1989, privately held
- 25+ years of software development on MicroStation
- 15+ years of point cloud software development
- Last fiscal year revenues 4 M€
- Based in Finland
Kanavaranta 7B, Helsinki

Upseerinkatu 3C Espoo
Terrasolid Ltd.

- Over 4500 TerraScan licenses sold
- Customers in over 90 countries
- Global market leader in airborne and mobile laser scanned point cloud processing with an estimated 85% market share
- Bentley Platform Partner Agreement
Terrasolid products

LiDAR processing

- TerraScan
- TerraMatch
- TerraPhoto
- TerraModeler
- TerraSurvey
- TerraStereo
Terrasolid products for Infrastructure

Infrastructure design

- TerraStreet
- TerraPipe
- TerraGas
- TerraHeat
- TerraBore
City of Jyväskylä, Finland

Video
Platforms

- MicroStation V8i SS2/SS3 or V8 2004 Edition
- Bentley Map
- Bentley Map PowerView
- Bentley PowerCivil
Laser scanning

- Terrestrial
  - Static tripod
- Airborne
  - Aeroplane
  - Helicopter
- Mobile
  - Car
  - Train
Airborne LiDAR

- Laser scanner and digital camera mounted into an aeroplane or a helicopter
- Up to 300,000+ points per second
- Scanner mirror rotates to create a scanning pattern
- Digital photographs every 1 to 3 seconds
- Precise location and position tracking with GPS and IMU (Inertial measurement unit)
What do you do with Terrasolid's applications?

- After the flight or drive the point clouds are pre-processed with the hardware vendors specific application
- After that the point clouds are calibrated and the precision is improved with Terra applications
- Once calibrated you can produce different feature extractions such as automatic building vectorization
LiDAR processing

Import RAW laser data and trajectories
Calibrate and align point clouds from multiple flightlines
Classify the points with rules
Process airborne images and produce orthos
Produce delivery products

- Surface models with breaklines
- Accurate 3D road and bridge models for design purposes
- Contours
- Building models
- True orthos
- Digitized transmission power lines for efficiency calculations
- Digitized transmission lines for vegetation maintenance
- Flood models
- etc.
TerraScan

- Read the points into the correct coordinate system
- Divide the points into blocks
TerraScan

- Classify the points by flightline
TerraMatch

- Match the multiple flight passes by tie lines
- Tie to ground control

Before matching the flight lines

After matching the flight lines
TerraScan

- Point classification
  - Ground
  - Vegetation by height from ground
  - Buildings
  - Model keypoints

- Manual editing
TerraPhoto

- Create and rectify ortho mosaic
- TrueOrtho-production
- Supports the point classification process
- Laser point coloring
- Building wall texturing from oblique images
- Visualizations and animations
TerraPhoto

- Draping an ortho on to the ground
High density airborne point cloud

20 points / m²
Automatic building vectorization
TerraScan

- Automatic building vectorization
- 33 km wide
- 51 km high
- 3 billion points
- Automatic building classification
- Automatic building vectorization
- 72,000+ buildings
- 6 hours vectorization

Terre
3D-building model
Demo
Rectify / Wall rasters

• Creates visualization rasters for walls

• First version produces reasonable results from oblique airborne images
City of Nagoya in Japan
Nakanihon Air Service

- Very high density point cloud, 40 points/sq.meter
- 3 camera oblique image system
- Automatic vectorization
- Automatic wall texturing
- 5000 wall textures in 5 minutes
City of Nagoya, Japan
City of Bergen in Norway
Blom A/S

- Fairly low density point cloud, 2,5 points/sq.meter
- Roof vectors collected by stereo
- Midas 5 camera oblique image system
- Automatic vectorization
- Automatic wall texturing
- 19200 wall textures in 20 minutes
City of Bergen, Norway
Video
Mobile LiDAR mapping

- GPS / IMU location/orientation
- 2 rotating LiDAR sensors
- Up to 1,000,000 points/second
- Multiple cameras

- Data collection at highway speeds
- Very accurate, efficient and safe surveying method
Georeferencing the point cloud

- The initial precision of the point cloud is poor due to only relying on GPS/IMU
- Ground signaling is needed to achieve survey precision
- A fluctuating correction is applied to the point cloud to meet the ground control measurements
- Resulting point cloud location precision is 2-3 centimeters
Point cloud classification

Raw point cloud  Classified point cloud  Colored point cloud
Feature extraction
Automatic rail and wire vectorization
Geometry Component Fitting

- Finds design geometry built from lines, arcs and clothoids which best match surveyed alignment of a road or a railroad
- Fitting for both horizontal and vertical geometry
- Goals:
  - View current geometry of road/railroad/pipeline in design software such as Bentley InRoads, Bentley Track etc passing geometry as LandXML file or similar
  - Is curvature right for this category of road?
  - Do component changes follow design principles?
  - Find long span deformations
Horizontal Geometry

Fitted components and differences to survey

Fitted components

Surveyed alignment

Exaggerated difference
Summary

- Mobile LiDAR is the most efficient, safe and cost effective way to survey railways
- The resulting point cloud is a precise 3D model of the railway corridor
- It is possible to vectorize features and populate your asset management system
- You can automatically vectorize the rails and overhanging wires and with component fitting obtain the rail geometry in design format
Helsinki Tram LiDAR Survey
Helsinki Tram Network

- About 200,000 passengers per day
- Lines 1, 1A, 3T, 3B, 4, 4T, 6, 7A, 7B, 8, 9, 10
- 85 kilometers of commuter track
- 97 kilometers of track in total
Helsinki Tram Survey

1. Obtain precise data for maintenance system
2. Simulate new trams
3. ”High-asphalt” calculation
Data Collection

- Carried out by 3D Laser Mapping
- StreetMapper mounted on a tram
  - 2 * 200 000 Hz scanner
  - Forward looking 2144 * 1424 camera
- Tram installation 29\textsuperscript{th} May 2011
- Data collection drives 29\textsuperscript{th} - 31\textsuperscript{st} May 2011
- Some images collected with system mounted on a car 1\textsuperscript{st} June 2011
Data Volume

- 14 603 216 184 laser points collected
  - 462 GB as .las files

- 19 628 forward looking images recorded
  - 15 GB as .jpg images
Airborne Positioning

Fairly uniform satellite visibility

Fairly uniform positional accuracy
Mobile Trajectory Solution

Satellite visibility varies
Positioning accuracy varies
Automatic Search for Signal Markers

• Automatic search for known pattern control points
• Software finds location (and rotation) with biggest intensity difference between bright and dark polygons
• Rotation can be fixed or come from closest trajectory travel direction
How to Define a Signal Marker

• Draw signal pattern in a top view window
• Draw polygons for bright areas
• Draw larger polygon for dark surrounding
• **Settings** tool and **Signal markers** category
• Select all polygons
• Select **Add**
• Click at location of the control point
Fluctuating Corrections

- Xy correction vectors for drive pass in difficult city environment
Automatic rail detection

• Define rail section template
• Detect rails
Video
Welkom bij het Actueel Hoogtebestand Nederland (AHN)

• Het Actueel Hoogtebestand Nederland (AHN) is een bestand met voor heel Nederland gedetailleerde en precieze hoogtegegevens. Een digitale hoogtekaart, als het ware. Voor heel Nederland is van elke vierkante meter bekend wat de hoogte is. De waterschappen, provincies en Rijkswaterstaat laten het AHN maken voor hun dagelijks werk, met name voor waterbeheer en waterkeringbeheer. Maar ook voor andere toepassingen wordt het AHN gebruikt.

• Op deze website kunt u de hoogtekaart verkennen met de viewer, de hoogte voor een bepaalde postcode opvragen en voorbeelden van het AHN bekijken. Verder geeft deze website meer informatie over het AHN, de organisatie daarachter en de verschillende hoogtebestanden.

• Sinds 6 maart 2014 zijn AHN1 en AHN2 beschikbaar als Open Data. Dat betekent dat iedereen gratis en zonder restricties gebruik kan maken van de hoogtedata. De data wordt, als webservice en als download, beschikbaar gesteld via PDOK en het NationaalGeoregister.
Delivered in two files

- Fairly high density data, ~12 points / sq.meter
- 5 cm Z-accuracy
- Ground points
- Other points, unclassified
- Free
Ground class

The ground class has got quite a few water points also.
The other points, unclassified
Demo