New Applications with Dutch Height Dataset

Mapping of Ancient River Channels

The Dutch river delta contains many buried channels of rivers that ran dry in the past. Differences in compaction have led to height differences and subsidence that can result in bumpy roads and damage to dikes. Digital terrain models can prevent such inconveniences by visualizing these channels on a map at an early stage. Dutch geomatics student Boudewijn Possel is working on an automated routine to detect, classify and visualize these dry river beds with the aid of digital height models.

By Eric van Rees

Roderik Lindenbergh (left) en Boudewijn Possel (right)

Height differences in the Dutch river delta can be partially explained as the result of river belts that ran dry as new basins developed during the Holocene. Today, these height differences can lead to bumpy roads and dike subsidence (see Figure 2): at the intersection of river belts and dikes avulsion can occur, a phenomenon where ground water permeates a construction and causes seepage.

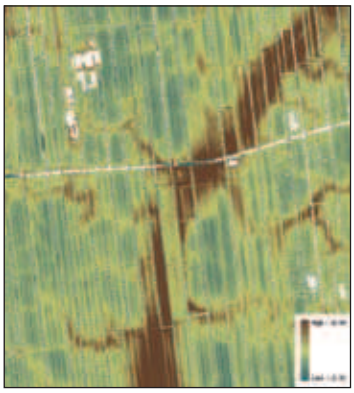
With digital height models it is possible to map these dry river arms. Laser scanning data visualizes in detail where height differences occur in the field, a development that will give even better results with the higher resolutions provided by technological improvements. By noticing these spots in good time, extra inspection, maintenance and fortification can be applied. However, an automated routine to visualize these river channels with laser scanning data does not yet exist. To change this situation, geomatics student Boudewijn Possel is working on a procedure to automatically recognize, classify and visualize these river channels. The key question is, can such a map be generated automatically from height data? Until now, a manual procedure has been used to notate former river beds. An example is the "Map of Berendsen" ("Berendsenkaart" in Dutch), based on ground drillings, that contains an overview of different river beds in the formation of the Dutch and German Rhine Meuse delta.

Dataset

The map that is to be created will be built from laser-scan data from FliMAP, a system developed by Fugro Aerial Mapping. FliMAP was used to acquire data for the Actual Height model in the Netherlands (a detailed elevation model of the whole country using airborne laser altimetry). The procedure to acquire the channel map is as follows: first, all redundant data such as buildings, roads, ditches and other objects is filtered from the dataset. By means of algorithms (like a description of the solution of a problem in a formula), the old river channels can be detected on the remaining pieces of land. To decide whether height data is suitable for replacing manual methods, the mapping results will be validated to the actual situation by means of additional ground drillings and geological maps.

The laser-scan data for this graduate project was provided by the Dutch water board "Rivierenland". It deals with a part of the new current data set that has a resolution of 0.5 by 0.5 meters and achieves an accuracy of two to three centimeters. The surveying results were presented at the end of December 2007: apart from a coastal area in Zeeland, the

Natural speed bumps have appeared in the Vogelweg in Southern Flevoland



An elevantion map clearly shows where the bank is

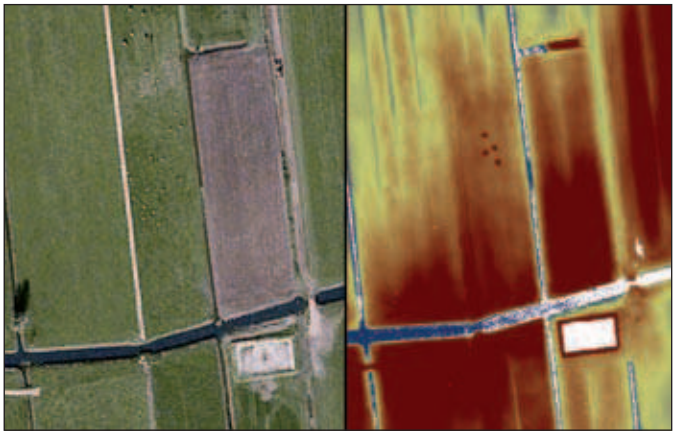
Alblasserwaard, which lies at the east of the city of Rotterdam, has been covered. Height mapping shows clearly where the scenery reaches higher levels, which can also be seen in Figure 3. A comparison with Google Earth shows what a height photo adds to an "ordinary" aerial photo (Figure 4).

ArcGIS

To be able to automatically detect the old channels, new algorithms need to be developed that can be applied to the laser scanning data in ArcGIS. With tools such as plane fitting, template matching and local neighborhood analysis, the river beds can be made visible.

ArcGIS is a convenient tool for performing spatial analysis, but not for developing a new algorithm. "ArcGIS is a software program for end users for whom a standard solution is available. For developing new tools you have to use geo-statistics", states thesis supervisor Roderik Lindenberg of Technical University Delft. For this Matlab, a mathematical software program, is being used,. At this moment Boudewijn is implementing and trying algorithms that are mainly based on image processing and statistics. "All data is in ArcGIS, because for me this works the fastest and the most orderly. As soon as I have found the right method in Matlab I'd like to convert it into ArcGIS. The algorithms are mainly based on image processing and statistics. I often look at existing applications and try to adjust and supplement them so they can be used for my research".

By carrying out ground drillings ourselves and comparing mapping results with the actual situation, we can determine whether or not our assumptions are correct. Roderik Lindenbergh explains: "Soon we will drill to see if what we've done corresponds with what we have on the map. We don't yet have validation of the information on the map". The final mapping model will be presented in September of 2008.



A comparison of an aerial photo with Google Earth

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For more information, have a look at www.flimap.com and www.ahn.nl

Column

'Machine Control is not going away'

"Surveyors should decide what to do with the new Machine Control technologies which are coming their way. Accept them and thrive. Reject them and take your chances", Achiel Sturm of Topcon Europe Positioning states.

Technological advances in precise positioning and measurement have enhanced the art of surveying. However jobs for surveying crews like laying out, staking, and constantly checking grade onsite are now designed, measured and set up by contractors using multi-constellation satellite signals, machine control technology and data controllers. With machine control systems, time is saved, productivity increases, maximum accuracy is assured and precise control on every pass is guaranteed. In addition, labor costs for layout and grade checking are dramatically reduced. Contractors are finishing jobs ahead of schedule and overcoming weather delays.

It may be a harsh reality to traditional surveyors, but machine control systems reduce the need for construction staking and layout. However, machine control systems also offer new opportunities to surveyors as they continue to provide an invaluable service to contractors – obtaining design plans, identifying and calculating the points required to establish feature locations and elevations, and putting them on the ground at the job site. Surveyors can follow a similar process for 3D projects and provide job site control, prepare machine control files, and certify finished grade.

The surveyor's objective is to comprehend the intent of a grading plan and produce a surface that reflects that intent enabling the smooth operation of a machine. The addition of breaklines, interpretation of contour and spot elevations to ensure positive drainage flow, and error checking are part of that process. There is a definite need for precise surface file preparation now and in the future. With the new opportunities that surface file preparation provides, the only real loss is time spent on fieldwork. Now's the time for surveyors to recognize the inevitable trend and make plans to not only survive but grow professionally and thrive.

Achiel Sturm is Product Marketing and Support Group Manager Construction Products ad Topcon.