

gps rt 3d p – GPS and Real-time 3D Planning

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Abstract. GPS is the abbreviation for NAVSTAR GPS, which stands for Navigation System with Time And Ranging Global Positioning System. RT means Real Time. The research project is looking at the application of GPS and RT in Landscape Architecture.

Keywords. Global Positioning System, Real Time

Already in 1788 the famous English landscape gardener Humphrey Repton used business flyers to promote his services. „Completely engraved, it shows an elegant Repton with a theodolite, directing labourers within an ideal landscape that is derived from Milton’s L’Allegro.” (G. Carter, P. Goode, K. Laurie: Humphry Repton Landscape Gardener 1752-1818. Sainsbury Centre for Visual Arts Publication, 1982, S. 12/13). 1000 copies of the flyer were made. This image also proofs that long before dozers, graders and other machines became regular landscape construction tools, surveying instruments were the first high tech tools in Land-

scape Architecture.

Repton was not only innovative in marketing and the use of surveying equipment but also in the visualization of projects. The Landscape Architect was the inventor of the Red Book. The name derives from the cover of the book which is red leather. Opening it you will first read a text which describes the landscape project. On the following page is a painting in watercolours of the existing situation. But it is not a normal painting. Part of it is painted on a piece of cardboard which is removable. If you take it away the proposed situation can be seen. Repton always presented his projects with a Red Book. Very often the clients were so impressed that he was immediately hired.

In recent years new developments in surveying and visualization took place, which should also affect how we receive data and visualize terrain in Landscape Architecture

GPS

GPS is a satellite based system. With the help of a constellation of 24 satellites any position can be located worldwide. The initial purpose of GPS



Humphry Repton, Landscape Gardener 1752-1818,)

was to provide an exact location for the military. In 1987 Leica-Geosystems was the first company which introduced GPS technology in surveying. Today the applications range from usage in the automotive industry to construction machines.

Basically a GPS station is a continuing development of a total station with the advantage of GPS like flexibility and a one person operation. It uses the wireless data connection to transfer the satellite data from a reference station to the rover. There the exact calculations and display of coordinates are shown.

RT

High Tech Graphic Cards are the standard in all personal computers. The graphic card calculates processes on hardware basis, which otherwise have to be done by the software or the CPU. With the help of these cards real time is possible. Real

time means 25 images per second. The very tedious rendering time of animations is no longer necessary. Not many years ago real time visualizations were only possible on high end computer systems. The driving force behind the development of fast graphics is the computer game industry and the huge consumer market asking for speed and realism. The gamers are the consumers who exchange their old pc, which would be more than fast enough for word processing and internet for a new one with more graphic power. Real time applications outside the game sector profit from this development. Also in Landscape Architecture real time can be applied.

gps rt 3d p

The research project “gps rt 3d p – gps and real time 3d planning“, which was funded by the Commission for Technology and Innovation (KTI) of Schweizer Bundesamt für Berufsbildung und Technologie and other partners looked into pos-



In the driver's cab one can see the terrain model on the machine operator's display unit. The planning data is combined with the clear guidance data from real-time GPS positioning providing the machine operator with all the necessary details for the excavation, graphically and digitally, accurate to within a centimeter – more quickly, more comprehensively and more precisely than marker poles

sibilities using GPS and RT in Planning and Landscape Architecture

With digital terrain models becoming part of every CAD package more and more a need for digital surveying data will arise in Landscape Architecture.

Today the workflow is as follows: The surveyor provides the data, the planning office utilizes this data using GIS and CAD, the project data is given back to the surveyor to be staked out. On the basis of the stake out the construction company models the terrain. This workflow is time and cost consuming, additional reasons for the application of GPS by Landscape Architects are, that for small surveying Jobs a surveyor is too expensive and cadastral Information which is provided is often incomplete. With the usage of GPS by non surveyors the fol-



The construction machine is equipped with a Leica Dozer system, which determines the 3D position of the blade in real time to the nearest centimeter. The driver of the machine receives all guidance details directly from the system.



Screenhot of the overall TerrainView real time model with the golf course Bad Ragaz

Following questions arise:

- What functions should an easy to use GPS for Planners and Landscape Architects have?
- Could 3D-guidance of the construction machinery work also in Landscape Architecture?

Successful planning needs acceptance in the public. This is essential, especially in Switzerland. Every public project with a construction sum of above 10 million Swiss Francs has to be voted on. A convincing project presentation in the public therefore is extremely important. Plans are not very accessible for everyday person. They use abbreviations and symbols which not everybody understands. Usually the plan exhibitions are in city halls which people do not visit in their spare time. Analog 3D models also demand a high level of ab-

straction by the viewer. In brief when at home kids play with a Game Boy which has best 3D graphic quality then it is also for the parents no longer enough to look at a black and white overhead presentation or having to study a difficult to read plan at the wall in a city hall.

Internet is another platform for presenting projects. Some cities and towns have started to put their 2D plans on the net, combined with general planning information. What is missing and what one should expect today are realistic 3D presentations of the project, with the ability to view the project from all sides in a playful way.

A tool for real time based 3D internet plans is TerrainView from the Swiss company ViewTec (www.viewtec.ch). It is a virtual reality solution

which comes from the high end area (military, medicine). As part of the project certain adaptations were made in order to open TerrainView to the market for public presentations of planning projects. The ViewTec technology also allows presentations of large projects in real time. TerrainView can be used on and offline. With the two worlds Game and Planning coming closer to each other, the research question in this part of the project is:

- Which demands have different user groups like computer kids, parents / lay men, planners using this tool?

To answer the three research questions an experimental research approach was chosen and the pilot project Golf Course Bad Ragaz (Harradine Golf) was used.

In Bad Ragaz a start-to-finish digital landscaping process was applied. A surveyor's office collected the data for the golf course by means of GPS. The planners recorded further terrain and vegetation data by means of the Leica GS20 professional data mapping device. Based on the 2D-CAD data a 3D digital terrain model using Autodesk's Civil 3D was created. As a result of an optimized interface between the programs 3d max and TerrainView, the data was made available for an interactive virtual fly through of the planned site. After the landscape architects had made some adjustments on the basis of the real-time 3D inspection tour, the planning data was transferred to the Leica Dozer 3D GPS system for terrain modeling with an appropriately equipped bulldozer on site. This removed the necessity for time-consuming measuring and stake out on site. At the end of October 2004, as part of a workshop in front of experts, a construction company modeled the terrain on a 10,000 sq m section of the Public Golf Course with a small Liebherr bulldozer.

To sum up, one can now say that GPS machine automation can also be employed outside its traditional areas of application such as mining or road-building. The relevant technologies and technical components are available and are already sup-



Ergonomic test of Terrain-View



Ergonomic test of Leica GPS-20

ported by the machines currently in use on construction sites. This is with the condition that the planners hand over their designs and plans to the building contractor as three-dimensional data records, based on an elevation model of the existing terrain produced by the surveyor.

The two other research questions were:
- What functions should an easy to use GPS for Planners and Landscape Architects have
- Which demands do different user groups like computer kids, parents, planners using TerrainView have.

The HSR research team organized workshops in order to answer these two questions. Ergonomie & technology, a company being specialized on ergonomic research, was a partner in the two workshops. In these meetings the invited participants had to fulfill various tasks like navigating with the TerrainView program to the golf club house where a train timetable is located at the wall and one had to find out when the next train leaves to Zürich. In the GPS workshop the invited professionals were introduced to Leica-Geosystems GS 20 and later had to locate certain points on the HSR Campus. All results were evaluated by the research team and presented to our economic partners. They are documented in written forms and as DVD films.

Final results are available under <http://l.hsr.ch/forschung/it-la/it-la-frameset.htm>

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