Powel 3D Terrain

Summary:

Architects, contractors and consultants all need tools able to handle the terrain as it actually is – in three dimensions – for planning, volumetric calculation, visualisation and documentation purposes. This document describes how Powel 3D Terrain meets these challenges. The program supports the entire process from the import of maps and terrain data to the production of stake-out data, drawings and zoning plans, as well as the calculation of mass volumes as a basis for tendering. Naturally, it is also possible to work with several alternative solutions in parallel.

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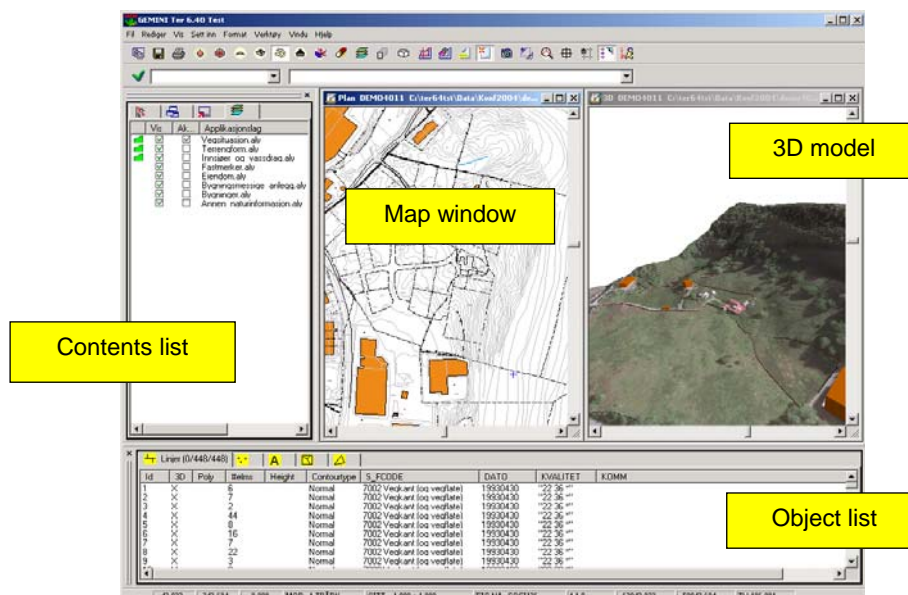
The Need For Three Dimensional Planning

Anyone involved in making changes to the landscape knows how difficult it can be. First, plans and drawings are needed detailing the work to be done. And, since the earth is not flat, the plans must take all three dimensions into consideration. Then there is the need to calculate volumes, in order to know whether material must be removed or added and so that accounts can be settled with the employer. Finally, there is the growing requirement to show as realistically as possible what the terrain looks like both before and after redevelopment – preferably with a selection of alternative solutions. For example, the optimising of a building's positioning, design and height is important to the property owner, the contractor and the planning authorities. The difference between a good solution and a bad one has a significant impact on both the environment and the profitability of the project.

In addition to meeting these challenges, each phase in the process must be documented in the form of professional reports and drawings. How can this be accomplished as easily and efficiently as possible – without major investments in software and equipment?

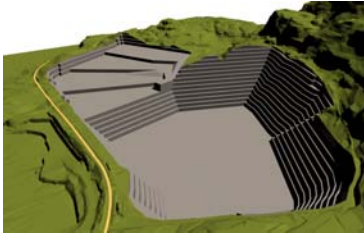# An All-round System For Planning, Project Design And Estimating

In close cooperation with demanding users, Powel 3D Terrain has been developed to meet these challenges. The program reads map data in all the most common formats (DXF, Shape, etc). Images (raster files) can be used as a background for map data, or ortho-photos can be draped around a three-dimensional model. Land survey data can be retrieved directly from Powel Surveyor or from the surveying equipment itself.

Powel 3D Terrain has a graphical user interface with separate windows for a 2D map, 3D model, contents list and object list. Naturally, there is full integration between all these windows: if an object is selected in one window, the corresponding information about the object in the other windows will automatically be highlighted.

Used either on its own or together with the surveying tool Powel Surveyor, Powel 3D Terrain is an effective system for the entire process from planning to as-built.

Volumetric Calculations

An example of an advanced excavation site.

With the help of Powel 3D Terrain it is possible to create excavation sites (theoretical modifications) and calculate the result of such modifications, as well as calculate the volume of material between selected layers in the ground (e.g. between various layers of soil, or between soil and rock).

The excavation-site functionality is suitable for designing projects ranging from individual plots to major industrial sites. Excavation sites will often be based on an excavation or blasting plan. This plan can be imported as a base map in Powel 3D Terrain, allowing the relevant points to be snapped into place.

Volumetric calculation between layers is typically used to find out how much material will have to be moved in a project. 3D models are constructed of the terrain both before and after excavation, and the affected volume is calculated by comparing the two models.

Typical applications requiring volumetric calculation between models:

- topsoil stripping
- mass excavation
- landfills
- gravel pits
- rain and snow volumes
- water reservoirs/dams
- other alterations to the landscape

Designing Construction Projects

Road Construction

Powel 3D Terrain supports the Norwegian standard for the dimensioning of roads, and allows users to define (or incorporate) their own standards. This means that roads can be designed in complete compliance with applicable standards and regulations. Properties such as width, camber, etc. in the normal profile are automatically calculated on the basis of the class of road, vehicle type, projected speed and weight of traffic. Horizontal and vertical curvature (turning radius and gradient) will also comply with the specified road standard. The majority of road types can be designed, from residential side roads to motorways. Road junctions can be designed in a matter of minutes, with radii and coordinates being calculated automatically in full 3D. The completed details of the projected road can be transferred directly to the surveying equipment for stake-out on the ground.

All volumetric calculations in Powel 3D Terrain can generate complete lists of quantities and coordinate reports.

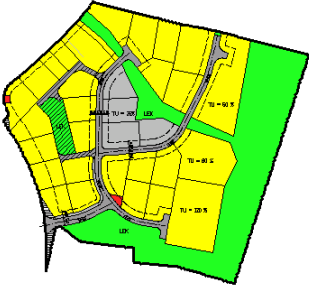### Water/Sewage Installations And Power Lines

Powel 3D Terrain's design module is also suitable for constructing ditches, water and sewage systems, breakwaters and flood barriers. The program contains a predefined setup for water and sewage pipes, including drinking water, waste

water, and storm drainage, with all presentations being made in both horizontal and vertical cross-section. Power lines and the vegetation beneath them can be visualised, or the relationship between water/sewage pipes and manholes can be checked by "going underground" in 3D.

Zoning Plans

Zoning plans determine how an area is to be used and what may be built there. Powel 3D Terrain is recognised as an excellent tool for the generation of such plans, and one of the advantages of the program is its outstanding 3D functionality. A complete 3D plan showing roads and junctions can be generated, as this is often fundamental to a zoning plan. Powel 3D Terrain calculates the consequences of cuttings and fillings, which is particularly important in undulating terrain because the usable area of a site may be significantly reduced as a result of a road cutting.

The completed plan can be exported in most of the common file formats.

Statistical Functions

All information contained in Powel 3D Terrain can be exported to Microsoft Excel or similar software for statistical analysis. Excel can be launched automatically from Powel 3D Terrain, and a number of statistical and other reports have been predefined. Among other things, these reports may be used as a basis for a contractor's status reporting to the employer.

3D Visualisation

Powel 3D Terrain reads map data in 3D and has a separate module for three-dimensional visualisation. Predefined templates allow data in the SOSI (Norwegian standard) format to be presented quickly and easily, and it is a simple matter for users to define their own templates for the presentation of buildings, piping systems or roads. Such visualisations give an excellent indication of the appearance of a terrain both before and after modifications, with all types of planned elements shown: houses, roads, excavation sites etc. There is also a "sunlight" function to show how sunlight/shade conditions may be changed as a result of a planned project. This function gives a correct impression of the sunlight conditions at any time of day or year, and anywhere in the world (at any latitude).

A planned housing development, shown both on a background of maps and plans, and an ortho photo draped over the modeled terrain.
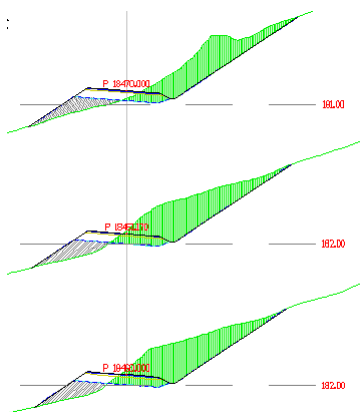

In many situations there is a need to create animations (film clips) to provide the best possible idea of the actual impact of a project. With Powel 3D Terrain an animation can simulate driving along a road or flying over a housing development.

Animation sequences can be shown in "real time" or stored for later presentation on a PC or via the Internet. 3D models can also be exported from Powel 3D Terrain and be viewed by anyone with a VRML viewer. This "virtual reality" function allows the user to move freely around within the model.
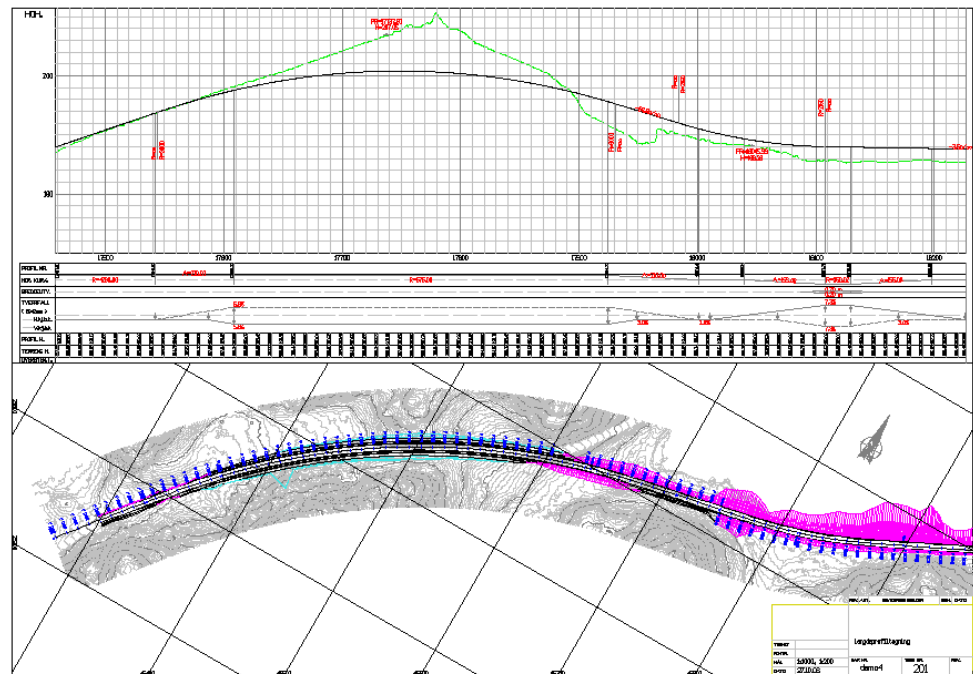
These visualisations increase the value of the plans presented, giving those who are to evaluate planning applications a far better idea of what is being proposed.

Printouts And Plots

Powel 3D Terrain has excellent routines for producing plots, and it is easy to add text and dimensions. Plotting can be done either on predefined forms, or the user/organisation can define their own plot forms. Printing is simple, whether on standard A4 printers or large-scale A0 plotters. A printout can show vertical or horizontal cross-sections, map sections, 3D images, or statistical and/or volumetric material reports.

Horizontal and vertical cross-sections, and a map showing a planned road to a housing development. Yellow hatching shows where masses must be added, while brown shows where masses must be removed.

A report can specify material for cutting and filling, as well as acreages. Separate plots can also be produced to show where the various types of material (soil, gravel, stone, etc) are to be found.

Conclusion

Powel 3D Terrain is an effective program for planning and project design, as well as following up any changes made to the landscape as a result of property development and the construction of roads, water and sewage installations, etc. Projects and their consequences can be visualised in a professional manner using techniques like rendering. When these visualisations are combined with the production of perspective and cross-section drawings, Powel 3D Terrain proves itself to be a valuable tool for consultants, contractors and public authorities.