FLEXIBLE SURVEY SOFTWARE FOR A CHANGING WORLD

Trimble's powerful Terramodel® software is an integral component of the Trimble Office software suite. The system provides a complete solution for survey data processing, site and infrastructure design, plus construction project data management. Used internationally by surveyors, engineers, and contractors alike, Terramodel software seamlessly communicates with all Trimble instruments and data collectors, as well as many third-party data collection systems, design software, and CAD packages. Terramodel software is a system comprising multiple modules that can be purchased individually or as solution paks combining several modules.

The Terramodel Field Data Module (FDM) is the entry level Terramodel system. Data can be transferred to and from Trimble instruments in addition to a wide range of third-party instruments and software systems. Tools are provided for the computation, display and analysis of survey data; graphical preview; survey drafting; report generation; and data queries. FDM can be upgraded, by the addition of other Terramodel modules, to meet a wide range of survey tasks.

The following table shows the modules and recommended Solution Paks for surveyors.

Modules	Recommended Solution Paks		
	Survey	**Design**	**Survey and Engineering**
Field Data Module	•	•	•
CAD Module	•	•	•
Contour Module	•	•	•
COGO Module	•	•	•
Site Design Module		•	•
Road Design Module			•
ASAP Module (Automated Sheet Assembly and Production)			•
Sewer Design and Analysis Module			
Hydrology Module			
Image Manager Module			
Terramodel Visuzlizer Module			•

◆ Trimble®

TERRAMODEL SOFTWARE DELIVERS SIGNIFICANT TIME-SAVINGS for survey tasks, CAD, and drafting within a single integrated system. Data can flow from the original survey through design to construction stakeout or machine control, without the need for data exchange or the reformatting of information. This eliminates errors and improves quality and traceability, increasing productivity at the same time. The system's modular approach allows you to use only the components required at a given time, but provides the flexibility to expand and meet new needs as they arise. Terramodel software is the ideal package for all survey, design, and construction work. These Technical Notes focus on how the Terramodel software can be used for survey applications.

SURVEYING

The Terramodel software is ideal for a range of survey work including the processing of topographic surveys and control networks, as well as CAD editing, and digital terrain modeling. The Terramodel software is built around the concept that 3D points form the basis of a surveying project. Each point has properties of position, elevation, layer, color, name, and a unique point number/I.D.

The benefits of the Terramodel software's unique dynamic database for the surveyor are enormous. Creating a project is simple and straightforward. Raw survey data is automatically reduced to points and lines and is contained in a single project file. The final drafting is a reflection of your actual survey data.

Terramodel provides the following features for surveyors:

- Data reduction and control network computations
- Deformation monitoring tools
- Automated drafting
- CAD editing, plotting, and digitizing
- Legal, cadastral, and boundary surveying tools
- Surface measurement, volumetrics, and contouring tools
- Large data set processing e.g., Lidar or Swath bathymetry

- Profile and cross-section creation
- Building interior, elevation and architectural surveys
- 3D Visualization—rendered scenes and AVI movies
- Earthworks, mine, and waste cell design
- GIS support—Terramodel data can be used in GIS systems such as ArcView™
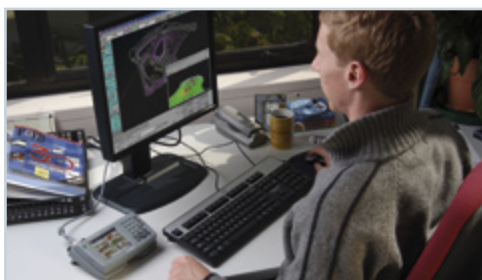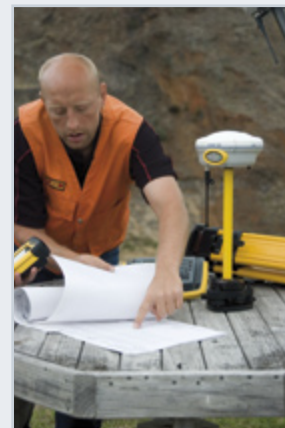
DESIGN

Terramodel software gives civil engineers a complete tool set for design that enhances capabilities and productivity from the initial survey to final construction. Whether designing roads, bridges, railways, sewers, surfaces, commercial or residential sites, or new infrastructure, Terramodel software provides advanced design concepts by modeling a project using plan, profile and cross-section views of the project.

CONSTRUCTION

Terramodel software is ideal for construction applications also. The software uses a single-file, project-model database that supports all aspects of heavy construction—from estimation to the finished project. It provides a single tool that can be used for surveying and engineering tasks as well as construction tasks such as calculating cut/fill volumes, creating stakeout data and reports, calculating mass haul and construction phasing, preparing data for machine-controlled construction, and producing as-built survey records during the construction phase. Because the software uses true models rather than just drawings, designs are straightforward to construct on site, allowing for work to be completed faster and more accurately.

DATA COMPATIBILITY

Terramodel software provides all the tools needed for data exchange in one package.

Data can be imported from a wide range of third-party systems including:
- Raw survey data
- ASCII coordinate data
- Road geometry data
- Graphical exchange files (DXF, DWG, DGN)
- Geo-referenced and normal image data files (BMP, TIF, JPG)
- MX (MOSS) files, SDMS files, HecRas files

The following data can be exported to third-party systems:
- Raw survey data
- ASCII coordinates
- Stakeout information
- Road design
- Image data
- Graphical exchange files (DXF, DWG, DGN, MX)

## SURVEY DATA REDUCTION AND COMPUTATIONS

As well as traditional survey reduction computations, Terramodel provides automated least squares network adjustment for control and monitoring projects.
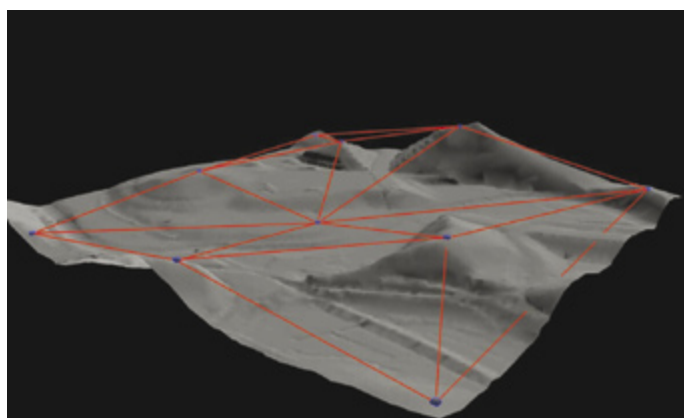
PLAN AND ELEVATION DRAWING PRODUCTION

Building surveys have never been faster to carry out. Terramodel software creates plans from data captured using Trimble total stations such as the Trimble S6.

Data in the plan view is rapidly converted into elevation drawings. Digital imagery of architectural detail can be incorporated to provide the finishing touch.
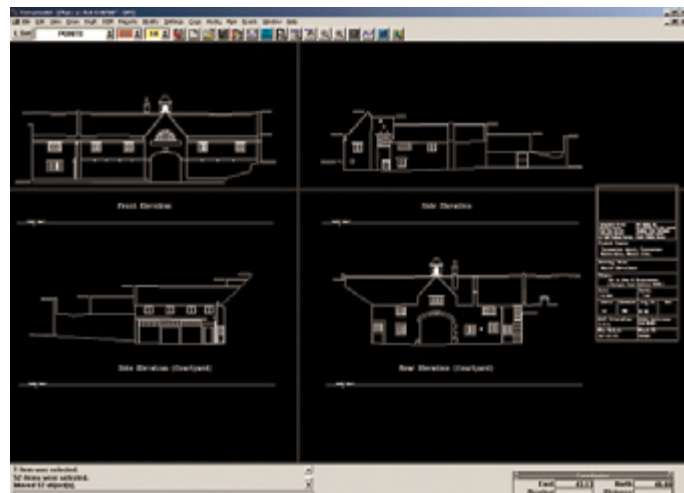
ANNOTATION AND LEGAL PLAN PRODUCTION

Terramodel software is the ideal tool for producing cadastral or legal plans, and boundary surveys. Lot lines can automatically be labeled with bearings and distances and the annotations dynamically update as points are moved or edited. Closed lots can be labeled with the enclosed area and boundary length. These automatically update to reflect changes within the database.

Terramodel software automatically creates tables of lot corner positions, lot lines, and other important features. Terramodel software will even create legal description reports of boundary surveys, eliminating time consuming tasks.

REPORTING

Terramodel software provides all the reporting tools needed to maintain quality. Standard reports include:

- Control computations and adjustment
- Detail reduction and coordinate listings
- Geometry reports
- COGO: Areas, distances, and bearings

- QA checks
- Stakeout control and cut sheet reports
- Volume reports

CAD DRAFTING AND ANNOTATION

Terramodel software includes CAD tools for easy and professional plan production. The standard CAD interface includes layers, colors, and linestyles. However, unlike most CAD systems, Terramodel software stores attribute and feature code data with each point. This allows for global editing, enquiries, listing, or drafting. Additionally, attribute data can be used to create text annotations. The raw survey data, design data, and CAD data are integrated parts of the same database contained within a single project file. Changes to the survey data are immediately reflected in the DTM and CAD graphics, and point-associated text is updated automatically.

CAD editing tools include trim, extend, join, connect, break, move, rotate, and offset.

CAD drafting tools include sheet layout, drawing annotation, sheet titles, hatching, digitizing, and plotting.

Reference files allow for multiple projects and previous surveys to be displayed as background data to the current survey. Objects can be selected and copied from one project to another, or simply used as a basis for measurements or reports.
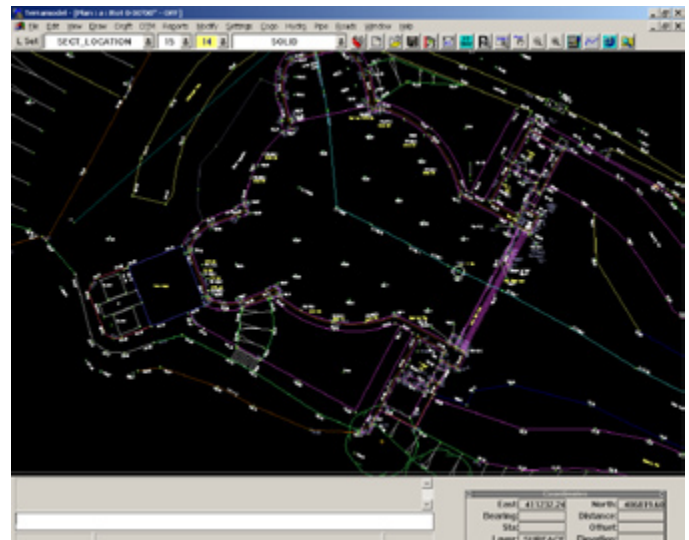
Image management tools organize background data, digital map tiles, quad sheets, and aerial and terrestrial photography.

Creation of fully annotated survey drawings is easy with the automated drafting tool AutoDraft. AutoDraft produces drawings from feature-coded survey data based on a feature code library and associated attributes.
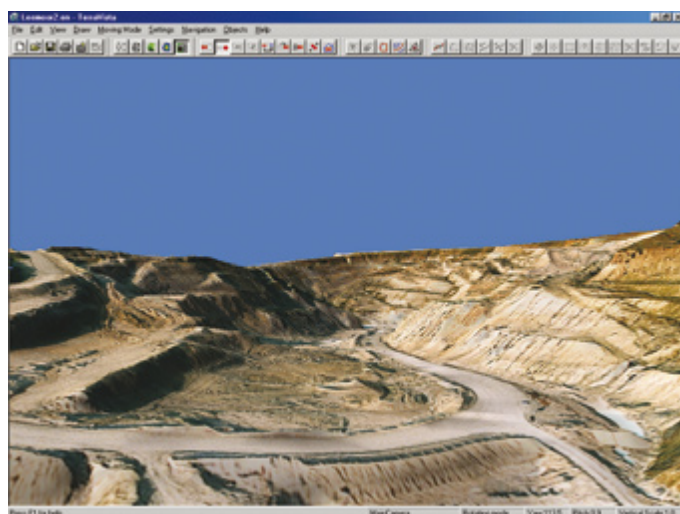
## 3D INTERACTIVE VISUALIZATION

With Terramodel software a DTM can be viewed interactively from any position and distance. Surface color is controlled by point color—features can be colored differently resulting in realistic visualizations of the survey. Even more realistic 3D views can be created using surface rendering techniques and the placement of 3D objects in the scene. Alternatively, georeferenced aerial photography can be draped over the model as shown.

Plan view georeferenced images can be generated in the visualizer and superimposed on the CAD graphics providing a color relief model.

DIGITAL TERRAIN MODELING

Terramodel software provides superior Digital Terrain Model (DTM) creation and manipulation tools for large projects— Terramodel is capable of forming TIN DTMs with up to 8 million points. This makes it the package of choice for manipulating data from airborne or terrestrial laser scanners, photogrammetry projects, and hydrographic multibeam bathymetry systems.
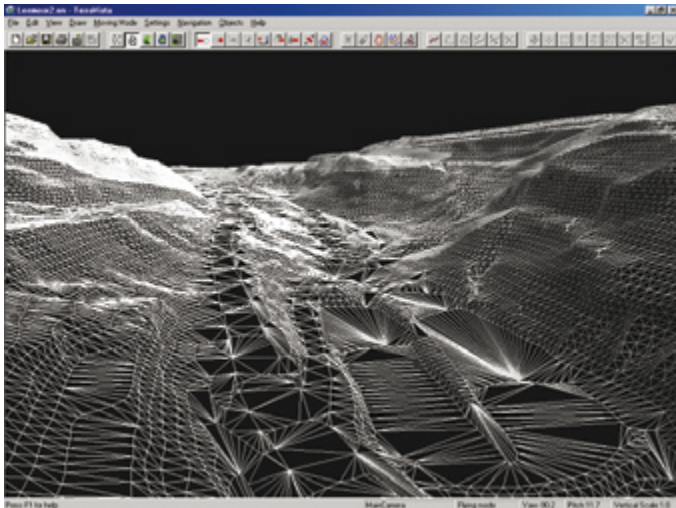
The intelligent DTM tools provide flexibility when needed and also save time by automating the creation of DTMs and the sub-setting of large projects.

The DTM formation process works with the following controls:
- 3D breaklines
- DTM boundaries
- Dead zones of the model
- Link distances, flat triangles and edge angles

New DTM boundaries can be formed, and triangles deleted or switched to form a terrain model that is more representative of the surface.

DTM features include:
- Each layer can be an independent DTM
- Multiple layers can be grouped to form a multi-layer DTM
- Single step, curve fitted contours with automatic or manual annotation
- Quick Profile for terrain evaluation
- 3D visualization of the surface model
- Surface area computation
- Volume measurements can be made between DTMs or to a datum, with or without breakdown by elevation slice or depth of cut
- Fully annotated cross/long sections through multiple surfaces
- Terramodel automatically creates the cross-section view and a sheeted layout of multiple cross-section drawings
- Cross-sections are created against a horizontal alignment and cross-section locations placed at critical points and regular intervals along the alignments
- Cross-sectional areas and volumes can be computed
- Underground and overhead utilities can be automatically placed in the cross-section drawings, for example, pipes and cables.
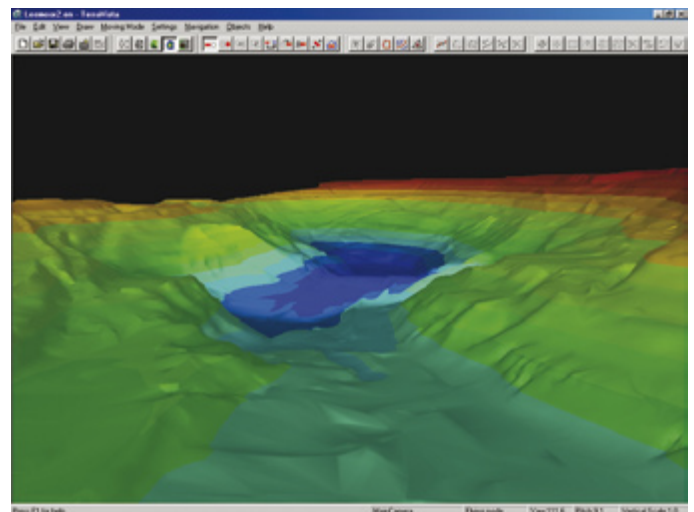
GIS SYSTEMS COMPATIBILITY

Terramodel software comes with a set of tools that allow Terramodel data to be used in the ArcView environment. In ArcView, the data can be modeled, contoured, and visualized in 3D. It can also be listed, queried, and edited with standard ArcView tools.

CONCLUSION

Terramodel software provides a complete solution for survey data processing, design, and drafting by automating tasks for time and cost savings. The flexibility of being able to add modules when required allows for all types of survey work to be completed without having to use multiple software packages. The single software system also prevents data loss that is typically associated with transferring information between software packages.

MINIMUM SYSTEM REQUIREMENTS
• Windows 98, ME, NT 4.0, 2000, or XP
• 800 x 600 resolution and 256 colors

Computer-aided design and visualization are extremely demanding on a computer's processor, memory and graphics adapter. For huge data sets, Trimble recommends the fastest processor, the maximum amount of memory, and fastest graphics adapter available.

RELATED TRIMBLE PRODUCTS
• Trimble CU and TSC2 controllers are graphical field computers that utilize Terramodel software data. Field data (conventional and RTK GPS) from these systems can be downloaded into Terramodel.
• For GPS data reduction, baseline processing, RTK data manipulation and geodetic transformation, Trimble Total Control™ software and Trimble Geomatics Office™ software are additional products in the Trimble Office suite of software.
• Trimble systems such as the Trimble R8 GNSS and Trimble S6 Total Station use Terramodel software data in the field for fast, accurate, single-person stakeout work. Field data (conventional and RTK GPS) from these systems can be downloaded into Terramodel.
• Design data from Terramodel software can be used by the Trimble Survey Controller™ software.
• When Terramodel software is coupled with the Trimble HYDROpro™ software, you have a complete turnkey solution for marine surveying and construction.
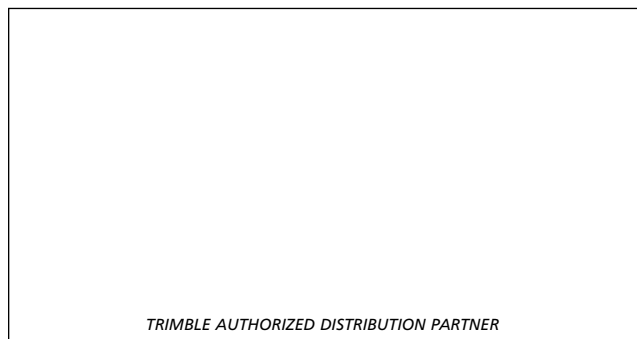
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