














The SURPAC Topographical Module Applications















General Observation File Loading/Editing

[This application is Included in SURPAC "Lite"]

- This is one of the core programmes in SURPAC, as it the primary interface between the Surveyor's field work and the calculation and/or draughting applications within the software.
- Data in an Observation File are required to be in the observation mode, viz :-
 - *Point Name*
 - *Point Description Code*
 - *Observation Code*
 - *Horizontal Angle*
 - *Vertical Angle (If 0°, 90°, 180° or 270°, then the Distance given must be the Horizontal Distance)*
 - *Slope Distance*
 - *Instrument Height*
 - *Target Height*
- The *Point Description Code* is a simple value, 1 through 9, which allows the selected application to identify the function of each Data Line in the Observation file, and to apply the appropriate action.
- Data input into an Observation File is by either :-
 - *Direct Downloading from a Total Station or an Electronic Logger,*
 -  *The currently supported Total Stations and/or Electronic Loggers are :-*
 -  *The Psion Organiser using the "Handi-Data Solutions Booker Ver 5" software,*
 -  *The Psion Workabout, using the "Handi-Data Solutions Booker Ver 6" softwar*
 -  *The Leica/Wild GIF10 data logger,*
 -  *The Leica TC 605/805/905 Series Total Station,*

-  *The Leica TCR 303/305/307 Series Total Station,*
-  *The Nikon DTM-400 Series Total Station,*
-  *The Nikon NPL-300/350/500/700 Series Total Station,*
-  *The Nikon NPL-521/531/551 Series Total Station,*
-  *The Nikon NPL-821/831/851 Series Total Station,*
-  *The Pentax PCS-300/R-300 Series Total Station,*
-  *The Pentax W-825NX Series Total Station,*
-  *The Sokkia SET2C/SET3C Series Total Station,*
-  *The Sokkia SET2100/SET3100/SET4100 Series Total Station,*
-  *The Sokkia SET2110/SET3110/SET4110 Series Total Station,*
-  *The Sokkia SET300, SET500, SET600 Total Station,*
-  *The Topcon GTS-200/210 Series Total Station,*
-  *The Topcon GPT-3000 Series Total Station,*
-  *The Topcon GPT-3100 Series Total Station,*
-  *The Topcon GTS-500/700 Series Total Station.*





-  Downloading from a variety of ASCII file formats,
-  Copying from the Windows Clipboard,
-  Importing from another SURPAC Observation File, or
-  by Manual Data entry.
-  The following SURPAC applications use data extraction from a User selected Observation File :-
 -  Mass Polar reductions, or individual Polar reductions,
 -  Reverse Polar reductions,
 -  "Two Sides and the included Angle" reductions,
 -  Tacheometric reductions,
 -  Field Traverse calculations,
 -  Least Squares Adjustment of Single Point Fixes [Y, X, Z] (or [E, N, H]),
 -  Least Squares Adjustment of [Y, X] (or [E, N]) Networks,

- Least Squares Adjustment of Trigonometrical Height Networks,
- Mining "Double Set-Up" Peg Fixing,
- Mining "Double Button" Peg Fixing,
- Mining Off-Set (direct and/or indirect) reductions.
- Once an Observation File has been generated, various editing/printing functions are available, such as :-
 - Manually modifying, or Deleting, Data Lines,
 - Using the Windows "Cut and Paste" to move blocks of Data around the File,
 - Manually Adding or Inserting new Data Lines,
 - Meaning multiple Point sightings within a Set Up,
 - Auto-detecting any Code inconsistencies in the File,
 - Applying a User selected factor to Distances and/or Target Heights,
 - Changing the "Active" status for individual observations, or Set Ups. The "Active" status of a Data Line determines whether or not that Line is used in a called application,
 - Printing the Observation File in "Raw" format,
 - Printing the Observation File in "Field Book" format,
 - Creating an ASCII file of the Data,
 - Sending the Data to the Windows Clipboard.



Level Observation File Loading/Editing

- This programme Loads and/or Edits Level Observation Files, which are used for input Data in the Level Network Least Squares Adjustment Programme.
- Level Observation File Data are required to be in the format :-
 - *Point Name*
 - *Left Back Sight*
 - *Left Fore Sight*
 - *Right Back Site (Optional, only used for precision Levelling)*
 - *Right Fore Site (Optional, only used for precision Levelling)*
- The Point Description Code is a simple value, 1 through 9, which allows the selected application to identify the function of each Data Line
- The Point Name is used to differentiate between Fore Sight, and an Intermediate Sight. If the first two characters of a Point Name are "I-", then the sight is considered to be an Intermediate Site.
- Data input into a Level Observation File is by either :-

- Direct Downloading from a Total Station or an Electronic Logger,
- The currently supported Total Stations and/or Electronic Loggers are :-
 -  *The Psion Organiser using the "Handi-Data Solutions Levels" ASCII File,*
 -  *The Psion Workabout, using the "Handi-Data Solutions Levels" ASCII File,*
 -  *The Leica/Wild GIF 10 Digital Level*
 -  *The Sokkia SDL Power Level*
- Downloading from a variety of ASCII file formats,
- Copying from the Windows Clipboard,
- by Manual Data entry.
- Once an Observation File has been generated, various editing/printing functions are available, such as :-
 - Manually modifying, or Deleting, Data Lines,
 - Using the Windows "Cut and Paste" to move blocks of Data around the File,
 - Manually Adding or Inserting new Data Lines,
 - Printing the Observation File in "Field Book" format,
 - Creating an ASCII file of the Data,
 - Sending the Data to the Windows Clipboard.



General Observation File Reductions (Polar Reductions)

[This application is Included in SURPAC "Lite"]

- This application carries out an automated reduction of Polar observations held in a User defined Observation File, using the following steps :-
 - It first prompts for the User selection of a number of calculation options,
 - It then searches through the defined Observation File, and determine which of the Set-Ups in the File have both Orientation and Polar data included (this is done via the Observation Coding system),
 - Each relevant Set-Up will then be displayed, with its orientation corrections (a single Set-Up may have multiple orientations, applied at different parts of the Set-Up),
 - Any of the orientation corrections may be manually overridden, if required.

- Calculation of the Polars will then take place. For double, or multi-Polars, the differences will be displayed.
- The calculated Points are stored in the current Co-ordinate File.
- This application can also be used for computing complete Surveys, including the calculation of the Control Points themselves. If required, the programme will compute (where possible) the co-ordinates of the Set-Up Points, if these do not already exist.



General Observation File Reductions (Tacheometric Reductions)

- This application carries out an automated reduction of Tacheometric data held in a User defined Observation File, using the following steps :-
 - The current Co-ordinate File must contain the Control Points (Set-Up Points etc.) to be used for reducing the Tacheometric data.
 - It will first prompt for the User selection of a number of calculation options,
 - It then searches through the defined Observation File, and determine which of the Set-Ups in the File have both Orientation and Tacheometric data included (this is done via the Observation Coding system),
 - Each relevant Set-Up will then be displayed, with its orientation corrections (a single Set-Up may have multiple orientations, applied at different parts of the Set-Up),
 - Any of the orientation corrections may be manually overridden, if required.
 - Calculation of the Tacheometric Points will then take place.
 - The calculated Points are stored in the User defined Tacheometric File.



Tacheometric File (Loading/Editing)

- This application provides Loading, Editing and Output functions for Tacheometric Files.
- Data in a Tacheometric File consist of :-
 - *Point Number,*
 - *Point Y - ordinate (or Easting),*
 - *Point X - ordinate (or Northing),*
 - *Point Height,*
 - *Point Description, and*
 - *Point BreakLine Description*

■ Tacheometric Files are used for :-

- *Generating Contour Files using BreakLines and/or Surface Triangulation,*
- *Generating Digital Terrain Models (DTMs),*
- *Generating Cross Section Files,*
- *Generating Longitudinal Section Files,*
- *Generating General (non-formatted) Section Files,*
- *Generating Underground Off-Set Files.*

■ Tacheometric Files are created by :-

- *Auto Reduction of Observation File Data,*
- *Manual Co-ordinate Entry,*
- *Import of ASCII [Y, X, Z] Files (various formats),*
- *Import from SURPAC Co-ordinate Files*
- *Import from a Civil Designer DAT File*

■ The most important use of the Tacheometric File is to provide the necessary input data required for the *Contour CAD Plotting application* (see below). This application provides a graphic User interface for the development of Contours, DTMs and Sections.



Contour Creation/Plotting CAD

■ This application carries out the functions of :-

- *Plotting of Tacheometric Data in the form of Spot Heights, with attached information,*
- *Point addition, editing or deleting,*
- *BreakLine creation (if required), using manual and/or auto-selection functions,*
- *Background shading for quasi 3D effects,*
- *Generation of Surface and Base model Triangulation,*
- *Dynamic Contour editing through Triangle adding, deleting, or modifying,*
- *Dynamic Contour editing through Point adding, deleting, or modifying,*
- *Importing and manipulation of background graphic images,*
- *Importing of defined SURPAC Plot File data as background information,*
- *Contour labelling at User defined locations (at any positions along Contour Lines),*
- *Erasing Contour Lines within a User defined polygon (such as a building),*

- General Text writing and editing functions,
- Grid and North Point plotting,
- Dynamic Point height determination from an associated DTM,
- Dynamic modification of an existing DTM when the Triangulation is modified.
- When creating Contours, Users have two routes they can follow, namely :-
 - First, Surface Triangulation can be generated with, or without, BreakLine information. Triangles are then User modified, as required. Contours are modified as changes to the Triangulation are made. Normally, a shaded background would be displayed giving a 3D effect and making any errors in the Triangle network easier to detect. Once the Triangulation has been completed, and the Contours stored, a DTM (using the DTM application) may be generated from the Triangulation network. This technique uses Linear DTM interpolation.
 - Alternatively, the User can generate all necessary BreakLines (using the Auto BreakLine function where possible), then generate a DTM (using the DTM application) from the combined Point data and BreakLine data. This technique uses a Least Squares Curvilinear DTM interpolation. Finally, from the Contours can then be generated from the DTM information.
- The first method produces better looking Contours, as Spline curves are fitted to the Contour lines for display and plotting. The second method, however, tends to produce better volume results (volumes are computed in the DTM application), due to its curvilinear interpolation approach.
- Contours, BreakLines and/or Triangulation can be generated separately for a Surface model and a Base model. The existence of Base model data is recognized by the application via reserved Point Description and/or BreakLine Descriptions. Using both model types in one file allows easy volume calculations when using the DTM application.
- The application includes a floating Tool Bar for the rapid selection of the most popular commands.



Digital Terrain Modelling

- This application has the following functions :-
 - Creating a Surface DTM and/or a Base DTM, using either :-
 - Contour Triangulation, or
 - Point data plus BreakLine data.
 - Displaying/Plotting a DTM using various options, such as :-
 - Showing either the Surface or the Base DTM,
 - Showing the DTM as either a solid model, or as a "wire frame" model,
 - Using any Viewing Direction or Tilt Angle,
 - Using various colour options for the display,
 - Setting a defined "water line" height and showing the model above and below this line in different colour variations,
 - Dynamic rotation and tilting of the DTM display using the keyboard arrow keys (requires a fast PC!)

- **Calculating Volumes with the following options :-**
 - Determine the Cut and Fill Volumes between the Surface and Base models,
 - Determine the Cut and Fill Volumes between the Surface model and a defined horizontal plane
 - Determine the Cut and Fill Balance Plane height for a Surface model,
 - Determine the Cut and Fill Volumes between the Surface model and another, User defined, Surface model.
- **General DTM application options include :-**
 - Super-imposing a User defined Surface model onto the current Surface model,
 - Calculating the DTM slope Surface Area,
 - Calculating the Surface Area for a horizontal plane intersecting the Surface model,
 - Define and use a sub-area of a Surface model,
 - Display a Slope Analysis model of the current Surface model (showing slope vectors).
- **DTM grid data, including BreakLine information, may be stored in an ASCII format for export to other applications.**