

SURPAC Ver 5.06 for Windows 98/NT/2000 - Planimetric Least Squares Adjustment

File General Conversions Least Squares Topographical Engineering Mining Cadastral Help

Compute Options Reload Data Active ON Active OFF Copy Line Paste Line Find Find Next Replace Home End

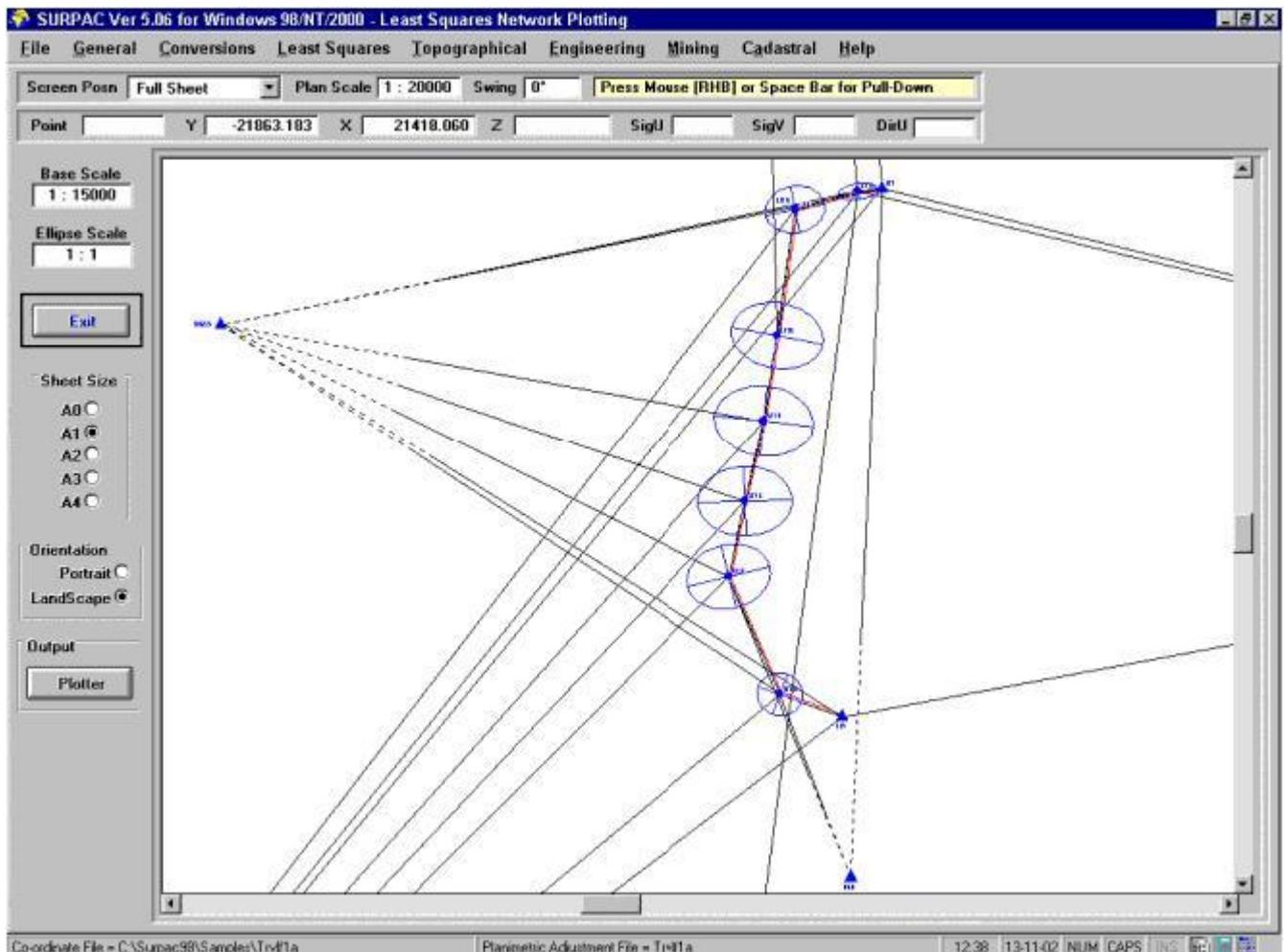
	From	To	Direction	Hor. Distance	Vertical	Active
	LF1	LF1A	288:06:04.4	117.9988	90:12:13.3	Y
		<b>Free Pnts</b>	<b>Y Co-ordinate</b>	<b>X Co-ordinate</b>	<b>Elevation</b>	<b>Active</b>
1	LF1A		-20150.3569	19661.8581	1585.8900	✓
2	LF1B		-19844.9414	19750.2024	1572.9190	✓
3	LF1C		-19758.2120	20365.4028	1583.7200	✓
4	LF1D		-19692.9204	20786.1329	1590.2900	✓
5	LF1E		-19602.0833	21181.9345	1593.4050	✓
6	LF1F		-19522.8892	21551.1614	1597.5080	✓
7	LF1G		-19771.6335	22125.6543	1603.2190	✓
		<b>Fixed Pnts</b>	<b>Y Co-ordinate</b>	<b>X Co-ordinate</b>	<b>Elevation</b>	<b>Active</b>
8	LF9		-20075.1000	22235.3740	1605.3790	✓
9	TRG235		-19430.0900	25190.3200	1653.7420	✓
10	TRG283		-19538.2200	12291.3000	1617.7000	✓
11	TRG221		-17050.9000	20314.1300	1642.4000	✓
12	TRG504		-14979.9000	26120.3300	1711.9000	✓
13	MAR		-20113.5240	23620.8830	1626.8140	✓
14	TRG086		-26134.0800	21107.0700	1660.6000	✓
15	LF1		-20267.3960	19647.0590	1586.2910	✓
	<b>From</b>	<b>To</b>	<b>Direction</b>	<b>Hor. Distance</b>	<b>Vertical</b>	<b>Active</b>
1	LF1	TRG086	129:17:06.0		89:19:52.8	✓
2	LF1	MAR	207:55:12.4		89:21:26.0	✓
3	LF1	TRG504	244:33:05.6		89:11:02.0	✓
4	LF1	TRG221	283:35:36.3		89:04:10.8	✓
5	LF1	LF1A	288:06:04.4	117.9988	90:12:13.3	✓
6	LF1	TRG283	19:38:49.3		89:48:11.0	✓
7	LF1A	LF1	108:05:52.0		89:48:47.5	✓
8	LF1A	TRG086	128:53:06.9		89:20:41.0	✓
9	LF1A	TRG235	212:43:32.2		89:20:42.3	✓
10	LF1A	TRG504	243:59:06.3		89:10:07.8	✓
11	LF1A	LF1B	279:10:13.9	318.0121	92:20:32.3	✓
12	LF1A	TRG221	283:25:17.3		89:01:30.5	✓
13	LF1A	TRG283	20:33:23.1		89:47:46.8	✓
14	LF1B	LF1A	99:09:56.0		87:40:07.5	✓

Current File Printed Pages Pg: 103

SURPAC Calculator 0.

Co-ordinate File = C:\Surpac98\Samples\Trvd1a Net/Work File = Trvd1a 12:43 13-11-02 NUM CAPS

Portion of a Least Squares Planimetric Network file, showing Provisional Point values and Observations



Plot showing Portion of the Planimetric Network with Observed values and Error Ellipses



## **Planimetric Control Network Adjustment [Y, X] or [E, N]**

- The mathematical principle of the Programme is the method of rigorous least-squares adjustment by means of the parametric adjustment, or variation of co-ordinates, technique.
- This principle is, however, modified by employing techniques, such as the Schreiber's Elimination technique, which optimize the use of computer space and time, whilst still maintaining the rigorous nature of the fundamental principle.

- The Programme is composed of five sub-routines, carrying out the following stages :-

1. The creation of the Network File by automatic observation data compilation from a User defined SURPAC Observation File.

The programme is able to handle up to 8 Arcs (or faces) of observations for each Set-up point. Each arc may include up to 50 sighted points. The Multiple Arcs are abstracted and combined in an Abstract Sheet, showing all observed data as well as the Mean and the Standard Deviation. These meaned values are used for the Network adjustment.

The Network File Editor includes an "Active" column, which can be set to Active or Non-Active, for all the data lines displayed and Points in the Network.

A Data Line that is defined as Active is available and will be used in the calculation of the Network. An Active Data Line will have a Green Tick displayed in its "Active" column.

A Data Line defined as Non-Active is data that exists, but which will not be used for the Network calculation. A Non-Active Data Line will have a Red Cross displayed in its "Active" column, and the Observation information will be displayed in red Italic text. A Data Line's Active status can be changed using a single mouse click.

2. The extraction of the Co-ordinates of the defined Fixed points in the Network from the current Co-ordinate\_file.

The provisional Co-ordinates of the Free Points are calculated using the Fixed Points and the network observational data.

3. The main "number crunching stage", in which the least-squares adjustment is carried out.

The [AtWA] and [AtWF] matrices are determined directly from the observations and from the co-ordinates of the Fixed points. All the orientation unknowns are eliminated using the Schreiber technique, and the upper triangle of the [AtWA] is compressed into a vector.

The "Modified Bordering" technique is used to invert the compressed form of the [AtWA] matrix, and the vector of corrections X is calculated from  $X = -[AtWA]^{-1} * [AtWF]$ . In most cases, only a single iteration is necessary as the provisional co-ordinates provide good approximates to the final values.

4. The final adjustments to the provisional co-ordinates are computed and applied to the provisional values. The standard error ellipse parameters for all unknown points are computed using the standard deviation of unit weight.

5. This is the output stage for the observations giving a full listing of observed directions, t-T corrections, plane equivalent directions, the oriented directions, the adjustments and then the final directions.

Distances are treated in a similar manner, with the listing displaying measured horizontal distances, the projection corrections, where applicable, the plane projection distances, the adjustments and then the adjustments and then the final distances. The printout finally displays the adjusted co-ordinate values for the Free Points, with their associated standard error ellipse parameters.

From the screen display of the Network output, it is possible to call for a Plot of the Network, showing all Points, observed an measured quantities and the error ellipses.

- This programme can be used for the computation and adjustment of survey control networks of almost any configuration, for example, Traversing, Triangulation, Trilateration and Triangu-lateration (mixed) networks.
- The individual configuration of a network is immaterial to the Programme, as long as redundant observations exist for each of the Free Points in the network. The strengths, and/or weaknesses, of the network will become apparent from an examination of the resultant error ellipse parameters.
- The size of the control Network being adjusted can vary from a single unknown point up to a network containing 500 Points, with the maximum number of Free Points being 499.