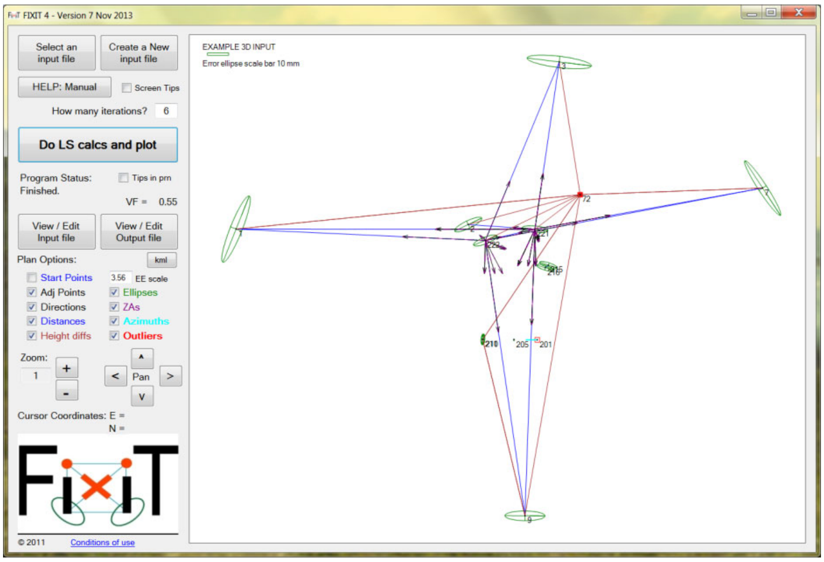
FULL USER MANUAL FOR FIXIT4

FIXIT aims to be easy to use for beginners. Pull down menus are intentionally not used. Warning messages are generated if users make mistakes similar to previous students. A short version of this user manual is available within the program by pressing the [HELP: Manual] button. The small but powerful program is designed to help students learn about the least squares analysis of surveying observations. There are many options available that are not needed when students start using the program. FIXIT is for educational purposes and is not a competitor for the powerful commercial programs available on the market. It does not aim to efficiently process data from specific instrument formats or very large data sets.

Please advise the program's author, Dr Bruce Harvey at B.Harvey@unsw.edu.au if you find any errors or can suggest improvements to this user manual or the program.

Reference book: Harvey, B.R. (2009) Practical Least Squares and Statistics for Surveyors, Monograph 13, Third Edition, School of Surveying and Spatial Information Systems, UNSW. 332 + x pp. ISBN 0-7334-2339-6

CONTENTS



1. USING FIXIT4

Using program FIXIT4 on a Windows Operating system computer requires one input file. If necessary, log in to your computer account. Create a text only file e.g. TestRun.inp, or use the built in file creator, or get an existing FIXIT input file. Any word processor or text editor can be used to create or modify the input file or to view the output files. If you use a word processor, make sure the input file is created as a text only (ASCII) file. More details about input files are given below. Then run the FIXIT4 program (usually via a shortcut icon on the desktop). This produces the file: TestRun.prn which is the FIXIT4 program printout and any error messages. Output files are found in the same folder as the input file, and you can also view or edit them via a button on the FIXIT4 interface.

Users can specify how many iterations are done in the Least Squares calculations. The default value is 4, some data sets require more. If the iterations value is set to 0, then FIXIT will calculate and output the differences between the observed values and corresponding values from the starting coordinates and will not do an adjustment. That can be useful when debugging problem data sets.

The maximum limits for the student version of FIXIT are 200 points, 100 orientation parameters with a total of 400 parameters, and 750 observations.

Installing FIXIT4

If FIXIT4 is not already installed in your computer, then get the FIXIT4.exe file. It is a small file (<500kB). Students may use it for free – but only for learning purposes, not for commercial surveys. The program should be installed on Windows XP, Vista, Windows 7 or later operating systems. It requires the computer to already have the Windows

.NET environment installed or else it will automatically download it as FIXIT4 is installed. It is only a small download, and it is not required to download it again with any later updates of FIXIT4. If you want to separately download the standalone .NET Framework 4 installer go to www.microsoft.com/downloads/.

The only file required for installation of FIXIT4 is the standalone FIXIT4.exe, which can simply be copied by USB memory etc. You can put the FIXIT4.exe file wherever it suits you on your computer. Perhaps on the desktop, or in some other folder and create a shortcut on your desktop. Versions of FIXIT4 prior to July 2024 had an expiration date so that users were forced to seek out the latest version.

FIXIT4 was written in the VB2010 language in the Microsoft .NET environment so that it should work on the latest Microsoft Windows operating systems as well as Windows XP. The source code is significantly different to that used in FIXIT3, but users of FIXIT3 should be able to use FIXIT4 with no additional learning required. However FIXIT4 does include new features that FIXIT3 users can read about in this manual. Older versions of FIXIT were written in different languages, starting with Fortran, and for different operating systems (VAX, Dos, Mac,…)

2. INPUT FILE FOR FIXIT4

There are two easy ways for beginners to create a FIXIT4 input file. One is to use the built in button to "Create a New input file". The other way is to edit changes to an existing input file with a text editor such as Notepad. The input file for FIXIT4 contains lines (records) to control options and enter coordinates and observations. Each record or observation uses one line. The sequence of records is arbitrary. You don't have to use all the options.

It is important to place content in the correct column in each input line. This is the way programming used to be done years ago and is still used in this program. It can be frustrating for beginners but does have advantages over using database or comma separated entry. The exception in FIXIT is for reading coordinate observations such as for RTK GNSS files which are csv formatted (more details below).

Note: * Do not use TABs when creating the input file with a text editor
* Data must be entered in correct columns, using spaces, as described below.

All input files created by word processing software should be saved as TEXT ONLY files or ASCII files prior to use by FIXIT4. Files can be edited while running FIXIT4 using Notepad Editor.

FIXIT4 should read any input file created for its predecessor programs FIXIT, FIXIT2, FIXIT3 and emt. However there a few differences to old files;

- For observation lines if you wish to overwrite default standard deviations enter standard deviations in columns 41-50, before June 2004 we used to enter variances.
- Since 2020 we can add short comments at the end of Coordinate, Direction and H Distance observation lines. These comments are carried to the output prn file.

Example input files:

```
TITLE     1988 Morpeth point recovery 2D traverse
COMMENT   These observations were made by a group of students at a survey
COMMENT   camp at Morpeth in 1988.  They used a Wild T16 theodolite, 100m
COMMENT   steel band and siting tripods with plumb bobs.

COMMENT   <dist mm ><dist ppm><dir "   ><dircntmm><dH mm   ><ZA     "><Hi Ht mm>
DSD             6.00      0.00    4.50      1.50

COMMENT    <pt> ENH <point name   > <E m          > <N m          > <H m          >< optional comment >
COORDINATE    9 EN      T9              58132.08       76981.69                     local datum
COORDINATE   24 EN      24D             58171.94       77339.56
COORDINATE   36 EN      36C             58020.58       77392.58
COORDINATE    1          A              58211.         77389.
COORDINATE    2          B              58169.         77448.
COORDINATE    3          C              58114.         77501.
COORDINATE    4          D              58063.         77465.
COORDINATE    5       POINT REC         58112.         77502.

COMMENT    <fr> <to><arc> ddd mm <secs ><sdv sec >< optional comment >
DIRECTION    24    9        0 00 00.0
```

```
DIRECTION    24    1      211 52 52.0
DIRECTION     1   24        0 00 00.0
DIRECTION     1    2      106 25 56.0
DIRECTION     2    1        0 00 00.0
DIRECTION     2    3      168 43 16.0
DIRECTION     3    2        0 00 00.0
DIRECTION     3    4      101 26 53.0
DIRECTION     3    5      175 32 29.0                  short radiation
DIRECTION     4    3        0 00 00.0
DIRECTION     4   36      155 43 06.0
DIRECTION    36    4        0 00 00.0
DIRECTION    36    9      134 15 33.0

COMMENT    <fr> <to>     <dist         ><sdv mm  >< optional comment >
H DISTANCE    3    5          1.749       3.0     downweighted
H DISTANCE   24    1         63.575
H DISTANCE    1    2         72.854
H DISTANCE    2    3         75.832
H DISTANCE    3    4         61.556
H DISTANCE    4   36         84.805

TITLE             EXAMPLE LEVELING NET
COMMENT     Default standard deviation of observations
COMMENT   <dist mm ><dist ppm><dir "   ><dir cent><dH mm   >
DSD                                                  0.3
COMMENT    <pt> ENH <point name   > <E m         > <N m         > <H m         >< optional comment >
COORD         1     FENCE POST 1                                       54.
COORD         2     SHED 2                                             52.
COORD         3     TREE                                               51.
COORD         4     CULVERT SE 9                                       50.
COORD         5     CULVERT SW 10                                      50.
COORD        72   H NAIL ON SEWER                                      50.0
Comment    Height Diff is ground mark to ground mark, ie HI + VD - Ht
COM        <fr> <to>     <  dH         ><sdv mm  >< optional comment >
HEIGHT D     72    4      -0.9554
HEIGHT D      4    3      -0.0016         1.0
HEIGHT D      3    4      +0.0016
HEIGHT D     72    1       4.7784         1.0
HEIGHT D      5    2       1.9874        1000.
```

2.1 INPUT RECORD FORMATS

Each option is selected by a keyword as described below. The keyword is the first word in the record (line). The first 3 columns are used to define the line type. They can be upper or lower case. It is important that nothing except a keyword lies in the first 10 columns, so the rest of a record starts at column 11, not before. Cols 3-10 can be blank or contain the rest of keyword text.

FIXIT input lines can be in any order. It is not necessary to use all the keywords available. Just include those that you wish to use.

TITle   Title / Description of survey, Col. 11+ This record contains the title of the job which is being processed. You may enter more than one TITle line, all will be written to the output file. The first Title line is also written to the top left of the plan.

COMment   Comments. Put any comment after column 11, the line is ignored by FIXIT4.

DSD   Default Standard Deviation values.
All values must include a decimal point. If any term is blank the default value of 1.0 is used. Use only one DSD line per file.

Column	Description
1 - 3	DSD
11 – 20	Constant part of Distance Std. Dev. Includes precision of distance instrument (e.g. EDM) and centring of instrument and target. In mm.
21 – 30	Distance dependant part of Std. Dev. In ppm.
31 – 40	Direction Std. Dev. In seconds.
41 – 50	Centering error for Directions in mm. Assumes same error at both ends of a line.

51 – 60 Std. Dev. Of height difference (ΔH) in mm.
61 – 70 Std. Dev. Of zenith angles in seconds.
71 – 80 Std. Dev. Of height of instrument (HI) and height of target (HT) in mm. Assumes Std dev HI = Std dev HT, used for ZA obs.

Template and example:

```
COM       <dist mm ><dist ppm><dir “   ><dir cent><dH mm   ><ZA     “><Hi Ht mm>
DSD         3.0         1.0      5.0       1.0       1.0       9.0       2.0
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678890
```

SIM
Simulate network results without observations. Coordinate and Observation records are entered in the usual way; except that a measurement value is not included (any entered value will be ignored). The final print-out will show the simulated observation as computed from coordinates.

COOrdinate Station (site, point) approximate, starting values or fixed coordinates.
Col
12 – 15 Station ID number, 1 – 9999 (not zero 0 or blank)
17 – 19 Flag saying what you want fixed: ENH, EN, EH, NH, E, N or H Blank means not fixed.
20 Flag saying if you want to plot the point in the initial plan window or not. X makes it not plotted, blank plots the point.
21 – 35 Station name, used in printout but not in processing.
37 – 50 E coordinate
52 – 65 N coordinate
67 – 80 H coordinate
81 – 100 Optional comment

Template and example:

```
COM        <pt> ENH <name         > <E           > <N           > <H           ><com
COORDINATE   36 EN     36C              58020.58       77392.58
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123..
```

Two points should not have identical input coordinates. Restrict the station/point number to a maximum of 4 digits. It is suggested that your station ID number be similar to or a truncated version of a station’s real number. For example SSM 123456 could be called 3456; traverse point 3 could be called 3. Station ID numbers do not have to start at 1 and do not have to be sequential. If a point has no observations to it, then a warning message will be displayed and a new input file written out with COMMENT in front of all COORDINATE lines of points with no observations connected to them.

The output file’s listing of adjusted coordinates is in the same format as for input file, so the adjusted coordinates can easily be copied into the input file.

DIFference Printout differences between original and final coordinates. Useful for deformation studies and to spot large changes such as poor starting coordinates.

CAD Printout a list of points and their adjusted coordinates in comma delimited format for entry to CAD or spreadsheet programs

END Any record in the input file after this keyword is ignored.

More FIXIT4 keyword options are described in sections 2.2 and 5 below.

2.2 OBSERVATIONS

Observation lines can also be in any order. The output file will place the observations in the same order as in the input file. Some people prefer to place all directions then all distances, others prefer to place directions from a point followed by distances from that point, then directions from the next point as in traversing. The choice is yours; it makes no difference to a FIXIT4 solution.

If forward and backward distances are measured and entered in the input file it can be useful for error checking purposes to include them one after the other e.g.

H DISTANCE   1   2   ...

H DISTANCE   2   1   ...

But that is not essential. The same idea can be useful for Height Dif observations, where of course forward and backward observations have opposite signs.

DIRection DIRECTION OBSERVATION

Col

12 - 15 Instrument station number

17 - 20 Target station number

21 - 25 Arc (=set) number   (optional if there is only one arc)

27 - 29 Degrees

31 - 32 Minutes

34 - 40 Seconds. If performing a simulation run can leave cols 27 - 40 blank.

41 - 50 (optional) Standard deviation in seconds. Include allowance for centring errors. If blank, a value will be computed from the details on the DSD record.

51 – 70   Optional comment

There CANNOT be just one direction from a station, they are not traverse bearings and they are not angles. In traverses etc, the back sight direction can be 0 or equal to the bearing set or be any arbitrary value, but a value must be entered for the backsight.

Template and example:

```
COM        <fr> <to><arc> ddd mm <secs ><sdv "   >< optional comment >
DIRECTION     1    2    1 350 12 34.5
DIRECTION     1    3    1 141 32 36
1234567890123456789012345678901234567890123456789012345678901234567890
```

AZImuth AZIMUTH OBSERVATION

Col

12 - 15 Instrument station number

17 - 20 Target station number

27 - 29 Degrees

31 - 32 Minutes

34 - 40 Seconds. If performing a simulation run can leave cols 27 - 40 blank.

41 - 50 (optional) Standard deviation in seconds. If blank, a value will be computed from the standard deviations given for directions in the DSD record.

If you wish to use a fixed azimuth to orient your survey then include just one azimuth obs and one fixed point.

Template and example:

```
COM        <fr> <to>      ddd mm <secs ><sdv "   >
AZIMUTH       1    2       91 00 00
12345678901234567890123456789012345678901234567890
```

ANGle ANGLE OBSERVATION

Col

12 - 15 Back Target station number

17 - 20 Instrument (occupied) station number

21 - 25 Forward Target station number

27 - 29 Degrees

31 - 32 Minutes

34 - 40 Seconds. If performing a simulation run can leave cols 27 - 40 blank.

41 - 50 (optional) Standard deviation in seconds. If blank, the standard deviations given for directions in the DSD record will be used but not the centring components.

Angles may be useful for simple traverses with no radiations or network linking, or for comparisons with other software or textbooks. Note that angles in FIXIT4 are assumed to be not correlated with other angles (or any other observation). So if more than 2 targets are observed from one site the angles need to be observed independently not by calculation from direction arcs/sets.

Angle 'observations' may also be used when constraining points to be on-line, i.e. to maintain straight lines so they don't bend at points placed supposedly along a straight line. To do that, enter an angle of 0° (at one end) or 180° (at points along the line) with a very small std dev (e.g. 0.1").

Template and example:
```
COM        <BS> <AT> <TO> ddd mm <secs ><sdv "   >
ANGLE        99    1    2 123 45 06.
12345678901234567890123456789012345678901234567890
```

H Distance Horizontal or map grid distances used in adjustments and simulations. If working on a map projection, users need to calculate the grid distances before entry to FIXIT4. FIXIT4 does NOT apply or calculate map grid projection corrections.

Col
1 - 3 H D
12 - 15 Instrument station number
17 - 20 Target station number
26 - 40 Horizontal distance in metres. If performing a simulation run can leave blank.
41 - 50 (optional) Standard deviation in millimetres. If blank, a value will be computed from the details on the DSD record.
51 – 70 Optional comment

Template and example:
```
COMMENT    <fr> <to>     <dist         ><sdv mm  >< optional comment >
H DISTANCE    1    2             67.890
1234567890123456789012345678901234567890123456789012345678901234567890
```

S Distance Slope distances, used in 3D adjustments and simulations.

Col
1 - 3 S D or SLO
12 - 15 Instrument station number
17 - 20 Target station number
26 - 40 Slope distance in metres. If performing a simulation run can leave blank.
41 - 50 (optional) Standard deviation in mm. If blank, a value will be computed from the details on the DSD record.
51 - 60 HI in metres
61 - 70 HT in metres

Template and example:
```
COM        <fr> <to>     <dist         ><sdv mm  ><  HI    ><  HT    >
S DISTANCE    1    2             67.890             1.234     0.211
1234567890123456789012345678901234567890123456789012345678901234567890
```

ZA Zenith Angles

Col
1 - 3 ZA or ZEN
12 - 15 Instrument station number
17 - 20 Target station number
27 - 29 Degrees
31 - 32 Minutes
34 - 40 Seconds. If performing a simulation run can leave cols 27 - 40 blank.

41 - 50 (optional) Standard deviation in seconds. Include an allowance for errors in HI and HT. If blank, a value will be computed from the details on the DSD record.
51 - 60 HI in metres
61 - 70 HT in metres
Note FIXIT4 does NOT correct ZA for earth curvature or refraction

Template and example:
```
COM        <fr> <to>      ddd mm <sec   ><sdv "   ><  HI    ><  HT    >
ZA            1    2       93 45 56.5              1.615    0.0
1234567890123456789012345678901234567890123456789012345678901234567890
```

HEIght dif Height Differences (ΔHeight)
Col
12 - 15 Instrument station number
17 - 20 Target station number
26 - 40 Height difference in metres. If performing a simulation run can leave blank.
41 - 50 (optional) Standard deviation in millimetres. If blank, a value will be computed from the details on the DSD record.
51 – 70 Optional comment

Template and example:
```
COM        <fr> <to>     <  dH        ><sdv mm  >< optional comment >
HEIGHT DIF    1    2       -3.456                 by total stn
```

3. THE PLAN

The program when loaded is designed to maximise the form to your full window and make the plan as large as possible. It is possible to reduce the size of the form by pressing the maximise button again and dragging sides of the form as you wish. The plan will then be smaller but you can see other files etc on your monitor at the same time. If you do reduce the size after already doing a calculation and plan, then simply repress the main calculation button again if you wish the plan to occupy the new drawing space. The form should fit on most small laptop screens.

A picture box is used to draw a plan with North up, at a scale that just fits the network into the box. Error ellipses and error bars are drawn at about true scale (i.e. a 5mm error ellipse is 5mm on screen) though it depends on your screen set up. If you want it adjusted for your screen/monitor change the value in the text box beside EE scale, 3.56 is the default value because that works on my monitor ☺. To plot the standard deviation of adjusted height, a green line is drawn from the point vertically up for the length of one standard deviation. Note standard deviation is really + and - from the point but is drawn this way for heights to avoid confusion with the semi major and semi minor axes of the error ellipses. Both axes of the error ellipses are drawn so that the point they refer to can be identified (sometimes error ellipses overlap with those of nearby points).

The Error Ellipses that FIXIT4 draws are standard error ellipses, not 95% confidence error ellipses, and not scaled by the Variance Factor. The same applies to relative error ellipses produced by the JOIN function.

Plan Option boxes control what is plotted. Sometimes a plot is clearer if you turn off some of the features or if you zoom in and pan. Fixed points have a red square plotted around them. If all coordinate components of the point are fixed (i.e. H in 1D, E and N in 2D, E N and H in 3D) then a filled-in red square is drawn. If only one of the components is fixed and one or two are solved for then an empty red square is drawn.
Directions are plotted in black for 1/3 of the distance from the "At" point to the "Target" point, with an arrow head.
Distances are plotted in blue for the whole line but may be covered for the start or end thirds by direction observations. The middle third of the line will show distances.
Height differences (e.g. levelling or EDM Heighting) are drawn the full length of the line if EN coordinates are entered.
ZAs are drawn for the first 1/3 of the line similar to directions but in purple and are dashed.
Azimuths are drawn for the first 1/2 of the line in cyan colour and thicker than other lines.

Outlier observations are highlighted by a thick red line. The program chooses observations with |v/s| > 3.5 to flag as outliers. This is a somewhat arbitrary limit; proper statistical tests are not applied.

Deformation vectors and relative error ellipses can be plotted if the JOIN feature is used, see below.

Low r. This checkbox highlights observations with a redundancy number < 0.1 with thick maroon lines. These observations have the potential to hide gross errors.

Zoom, pan, coordinates: The programming of the picture box (the zoom and pan features) is new in FIXIT4. To ZOOM in (i.e. enlarge the plan) press the button labelled + and the adjacent textbox will show the scale factor which doubles with each press of the button (e.g. 2 means double size). Similarly, press – to ZOOM out. To Pan press the arrow buttons which move half a screen width sideways or half screen height up or down. Hovering the mouse cursor anywhere in the picture box will give the E and N coordinates of its position. That can be useful for determining better approximate coordinates for points or locations of new points etc. If you zoom and pan too far (due to overflow limits we can only move so far in Visual basic) then press the "Do LS calcs and Plot" command button again.

Export: A bitmap copy of the plan can be obtained via a simple screen capture. We do not produce .bmp or .dxf files in FIXIT4. The screen capture bitmaps can be used as drawing in reports (e.g. word or ppt documents). Also, the coordinates of points can be obtained in comma delimited format for use in CAD or spreadsheet software by adding a CAD line to your input file, and then copying the relevant text out of the prn file.

3.1 kml button: 

Reads the input file (not the prn file), so it uses the input coordinates of points. It does not use the adjusted coordinates – this can be an advantage if there is a problem in the data set that causes an adjustment to crash. If the points' input coordinates are in MGA (Australia's UTM) or ISG then we can also produce .kml files that can be imported into Google Earth or Nearmap, to show the points and lines observed there. [If you have AMG or some other coordinate system and you want FIXIT4 to produce kml files for Google Earth, simply let me know.] The input coordinates need to be in MGA or ISG, not a local datum for Google Earth or Nearmap viewing. The kml button asks some questions about the coordinates and whether you wish to plot lines as well as points. It then creates a kml file in the same folder as the input file with the same name as the input file but different extension. The .kml file can be opened by Google Earth or Nearmap. For Nearmap, open and login, then on the tool bar there is a layers button/icon. Select it and choose Import kml, this uses standard Windows browser to select a kml file. In Nearmap click on the red balloons and in Google Earth click on the info icon, to see the name and coordinates of the points. If the Nearmap or Google Earth image is not suitably aligned with your network, you can use the fudge factor shifts in E and N when you create the kml file to better graphically align the overlays. Also, if your input coordinates are not very accurate then replace them with the adjusted coordinates – that is a simple copy and paste from the prn file to the inp file.

3.2 Tips

The "Screen Tips" button on the main FIXIT screen allows users to see a description of a part of the screen when your mouse hovers over that part of the screen.

The "Tips in prn" button adds comments to the output prn file with a heading: -------- Coach's Tips ---------------------
The suggestions labelled 'Tip' in this file are designed to help you learn and to improve your analysis. With experience you should be able to work without them. These tips are offered without guarantee of relevance or accuracy. Do not rely on them.

Cursor coordinates feature shows the coordinates in your datum of the position of the cursor in the plot window. This can be used to estimate or confirm approximate coordinates of points or new proposed points.

4. APPLICATIONS AND DESIGN FEATURES OF FIXIT4

FIXIT4 is a least squares program to adjust survey networks: levelling, 2D or 3D. The program was written by Dr Bruce Harvey at UNSW. It is copyright protected and should not be distributed without the consent of the School. It is designed primarily to assist the education of university students. Intentionally, it does not include automatic download of instrument specific data formats as would be useful to surveyors in "a production environment".

Direction, horizontal distance, slope distance, zenith angle (ZA), azimuth, and height difference (ΔH) observations are allowed. Adjustments can be 3D, or 2D with only directions, azimuths and/or horizontal distances. Levelling (or EDM height traversing) nets can be adjusted by using just height difference observations in a 1D adjustment, so the E and N coordinates of all points held fixed. Similarly, EDM Baseline observations can be adjusted by keeping N and H coordinates fixed and using E to represent distances along the baseline. Bearings and distances from plans (e.g. cadastral DPs) can be entered to calculate coordinates of points.

FIXIT4 input files follow the same format as the predecessor programs FIXIT2, FIXIT3 and emt, but with extra features added. Examples of FIXIT files and how to interpret the output are given in the book Practical Least Squares and Statistics for Surveyors, Monograph 13, Third Edition, by Bruce R. Harvey 2009, UNSW.

FIXIT4 uses a plane right handed CARTESIAN coordinate system with Easting (E), Northing (N) and Height (H). The E, N, H definition is used in the print outs. The origin is defined at coordinates (0, 0, 0). The program assumes that directions are measured clockwise and that azimuths are defined as clockwise from North.

Computations are performed on a plane, zenith angles are not corrected for the effect of earth curvature or atmospheric refractive effects. The program does not correct any observations into a true earth based Cartesian system. The coefficient of refraction is not considered in any way and the direction (and azimuth) measurements are not corrected for arc to chord on a UTM projection or the "dislevelment" caused by the angle between the normals at the stations. The zenith angles facility in FIXIT4 is only intended to be used in short range 3D intersections such as in indoor industrial surveys. For networks with lines longer than about 40m it is recommended that instead of entering ZA the corresponding height difference be calculated and entered. If reciprocal ZAs are observed, calculate the two height differences (ΔH) for each line and enter their mean ΔH into FIXIT4.

FIXIT4 is not designed to adjust GPS *vector* observations or handle any type of correlated observations. I have other programs for that. However point coordinates such as those from RTK GPS can be entered into FIXIT4.

5. ADVANCED AND OTHER USER RECORDS

If you want further assistance or example input/output files for any of the following features, simply contact the author.

5.1 EDM Calibration

EDM CAL
EDM CALIBRATION for one multi pillar baseline, one instrument. Specifically coded for use on UNSW campus but might be useful elsewhere too.
* This does not apply map grid (eg MGA, AMG or ISG) scale factors.
Assumes atmospheric refraction corrections have already been applied to the data. Also assumes that cyclic errors are not significant, have already been corrected for, or that the distances are multiples of the unit length.

In a 3D adjustment enter slope distances with HI & HT. A single global scale factor (in ppm) and a single global additive constant parameter will be determined from all slope distances. Generally two points have ENH fixed and the other points have NH fixed. Starting values for the two parameters are set to zero. A choice is available to correct (or not) the distances for slope and elevation before solving for the parameters. This correction uses formula by JM Rueger (given below in the section INSIDE FIXIT).

In a 2D adjustment enter horizontal distances, either from a baseline where all points are at the same height or by using JMR formula as a pre-calculation. A single global scale factor (in ppm) and a single global additive constant parameter will be determined from all distances. Generally two points have ENH fixed and the other points have NH fixed. Starting values for the two parameters are set to zero.

The signs of the parameters determined are as Corrections (not errors).
So true dist = msd dist + AC + (SF/1000000) * dist

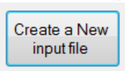
5.2 Point position observations

EPP, NPP and HPP
Remember that FIXIT4 is a "flat earth program", so apply this feature with caution. It is intended to allow users to enter independent observations of E or N or H coordinate of a point (or any 1, 2 or all 3 of these). Such observations may for example, be from hand held GPS point positioning or RTK GNSS positioning or from another control survey but not sufficiently accurate to be held as fixed coordinates. In GNSS based data the program assumes that your GPS is set to the map grid coordinate system compatible with the fixed coordinates in your input file and that any H Dist obs in the input file have been corrected to grid distances (by the user before putting in the input file, it is not done by FIXIT4). Also the program assumes that all heights and height differences are in the same datum, either all orthometric or all ellipsoidal. No geoidal corrections are applied by FIXIT.

This feature in FIXIT4 is not intended for full GPS vector analysis. However, if GPS vectors were adjusted in a separate network program on a Map Grid coordinate system then those adjusted coordinates could be entered into FIXIT4 but correlations between the adjusted GPS coordinates are not entered. Transformation parameters, scale and rotations, are not determined. For a good rigorous adjustment of a mix of GPS and total station observations use a program designed for that purpose, not FIXIT4.

Another use for these EPP, NPP and HPP observations is when independently measured coordinates for a point are available but not perfect, e.g. from a Lands Dept list with lower quality position or from another survey, but you wish to give them a standard deviation and let least squares "move them around" rather than being held fixed. This method will have the effect of a weighted stations solution, but only approximates a rigorous Bayesian adjustment (because no correlations and no strict degrees of freedom calculations are done). See Monograph 13 for more information.

Each point with an EPP, NPP or HPP observation should also have a COORDINATE record. If an EPP line is used then the E value in the COORDINATE line for that point should not be held fixed. (similarly for N and H with NPP and HPP lines).

EPP, NPP and HPP observations can be typed into an existing FIXIT input using the formats below. An easier way is to download your GPS data to a text file and use the 

button in FIXIT and the 

button within that to read the coordinate observations and convert them to a FIXIT input file. The Read GNSS RTK button opens and reads a text based RTK file (or other data source) and writes COORDINATE lines and EPP NPP HPP lines in FIXIT input format. This is also useful if you want lats and longs of RTK GPS (see kml file) or to show the points on Google Earth. The format of the RTK text file is shown in this example data file:
name or number, E, N, H in MGA
18, 686450.676, 6394691.817, 283.793
19, 686525.492, 6394582.889, 277.677
If H is unknown enter a value, eg 0 not just ,, There can be extra information on the line after H, it is not read.

EPP Observed Easting Coordinate (similarly NPP for Northing and HPP for Height)
Col
12 - 15 Station number
26 - 40 Coordinate in metres. If performing a simulation run can leave blank.
41 - 50 Standard deviation in millimetres. It is recommended that a value is entered. If blank, the mm component of the standard deviation of distances in the DSD record will be used.
Template:

```
COM        <pt>          <  E          ><sdv mm  >
EPP         101            321456.789      25.0
12345678901234567890123456789012345678901234567890
```

5.3 Coordination of Cadastral survey plans

PBG Plan Bearing "OBSERVATION"

PBG can be used to enter cadastral plan (DP) bearings so that points in the plan may be coordinated prior to fieldwork. Different cadastral survey plans are often on different azimuths, some may be on magnetic meridian, others may be on MGA or they could be on ISG. Having plans on more than one azimuth becomes a problem when combining them in least squares. Combining cadastral survey plans that are supposedly on the same datum may also be a problem because the plans may state that they have the same azimuth but they may have small differences. If a plan is used where bearings are not on the same system as the coordinates, then a swing or an orientation parameter must be introduced. Data from one or more plans can be entered in a 2D adjustment. A cadastral plan might be on a different azimuth to the coordinate system so a single orientation parameter is determined by FIXIT4 for each plan. The best fit orientation / swing for each plan is displayed as well as the residuals, adjusted coordinates, etc. A typical application might have coordinates of State Survey Marks on say MGA and plan data for each line i.e. bearing (on the plan datum) and H Dist (usually a ground level horizontal distance).

FIXIT4's AZIMUTH observations assume the azimuths are on the same datum as the coordinates being held fixed. The input type PBG allows the entry of plan bearings that are not on the same datum as the coordinates system being used.

PBG Bearings are entered one way only for each line. If plan distances are entered then they need to be converted to the datum of the fixed coordinates by applying scale factors for each line or a GSF (see above). If the fixed point coordinates are on a local plane datum eg arbitrary values then no scale factor needs to be applied to the distances.

Col
12 - 15 From station number
17 - 20 To station number
21 - 25 Plan number, must be between 0 and 24. This number is to be entered with each bearing from the same plan.
27 - 29 Degrees
31 - 32 Minutes
34 - 40 Seconds
41 - 50 (optional) Standard deviation in seconds. Include allowance for centring errors. If blank, a value will be computed from the details on the DSD record for directions.

Template and example:
```
PBG         <fr> <to><pln> ddd mm <secs ><sdv "    >
COMMENT        DP 260454
PBG           90    1    1  96 50 55.      30
H DIS         90    1          3.41
PBG           89    8    1  89 48 20.      30
H DIS         89    8          93.42
      etc
COMMENT        DP 700213
PBG           59  150    2  91 30 50.
H DIS         59  150          2.73
PBG           60  152    2 289 10 55.
H DIS         60  152          31.56
```

When PBG are entered the output file displays the swing applied for each plan. The swing is displayed in degrees minutes and seconds and can be either positive or negative depending on whether the plan datum is above or below the coordinate datum, ie a positive swing would be added to the plan's bearing to bring them on to the coordinate's bearings. For example:

Plan 1 orientation / swing - 3 00 04.6 D M S
Plan 2 orientation / swing + 2 00 04.6 D M S

5.4 MISCLOSES

MISCLOSE

Template and example:

```
COMMENT...123456789012345678901234567890
MISCLOSE       4    5   11    3    4
MISCLOSE      11    6    7   11
```

Adding a misclose line to a FIXIT4 input file gets the program to calculate some loop mistakes from the input data. These calculations are done while reading the input file and before any least squares calculations. Calculating miscloses may help users to verify the quality of their data or to find problems with parts of their data. There can be any number of misclose lines in the input file and they can be anywhere in the file.

The numbers in the first example above are the point numbers around a loop starting at point 4. Note that point 4 needs to be included at the end of the list to close the loop. The point numbers take 5 columns each, eg 11-15, 16-20. No tabs. There can be up to 30 points in a loop (if you want more contact the program author).

If the file has direction observations then the angular misclose is calculated around the loop from the Dir observations. Angle, azimuth, bearing observations and coordinates are not used. Enter the points clockwise around the loop (the program can handle anticlockwise loops). The program calculates the angle at each point from the direction observations. If there is more than one arc at some points then FIXIT4 uses the first direction observation it finds in the input file and does not check arc status. While going around the loop FIXIT4 also checks that the forward and reverse H Distances for each line agree with each other within 0.3 metres, if there are distances both ways for a line. FIXIT4 does not calculate linear miscloses around loops because that requires minimal angular misclose, and because experience shows new users have more problems with directions and angles in traverses and networks than with distances.

If the file has height difference observations (from levelling or EDM) then the height misclose is calculated around the loop. Enter the points clockwise around the loop (the program can handle anticlockwise loops). If there is more than one observation of height difference between two points (A to B) then FIXIT4 uses the first observation it finds in the input file. If there are no observations from A to B, FIXIT4 searches for B to A and uses that (with sign correction). While going around the loop FIXIT4 also checks that the forward and reverse Height Differences for each line agree with each other within 0.3 metres, if there are observations both ways for a line.

Angular or traverse distance miscloses between two points is not currently possible in FIXIT, only loops. However height miscloses can be either between two points or loops. For height closes it is also possible to calculate misclose between two points using their input heights, instead of a closed loop back to the starting point. If the list of points does not form a loop, FIXIT4 calculates the height misclose using the observations and the input (unadjusted) heights of the first and last point in the list. It does not check, or care, whether those points' heights are fixed or not.

5.5 JOINS (BEARINGS, DISTANCES and ΔH BETWEEN ADJUSTED COORDINATES) AND RELATIVE ERROR ELLIPSES

JOIN

Calculates the Join Line between two points specified. You can have one or more Join records, each specifying one line at a time, anywhere in the input file. The program uses the adjusted coordinates and the associated full VCV matrix to calculate adjusted distance and its standard deviation, adjusted bearing and its standard deviation, and the relative error ellipse of the line. Note that the line does not have to be a measured line, it is possible to calculate the join between any two points in the data set.

JOIN is also useful for deformation studies. If a point (e.g. 5) has two or more different coordinates (e.g. remeasured in separate epochs) and is given a different number in each epoch (e.g. 105 and 205) then the join line can be calculated (e.g. 105 to 205) and the distance, bearing, their standard deviations and relative error ellipses will be included in the output (prn) file. If the distance of the join line is less than 10cm (as with typical deformation applications) then it will be plotted in a thick black line from the "fr" point (e.g. 105) at the same scale as the point error ellipses. The join lines displacement and relative error ellipses are not plotted if the error ellipses plot option is not checked.

Template and example:
```
COM        <fr> <to>
JOIN        105  205
12345678901234567890
```

5.6 OTHER FEATURES

GSF

A grid scale factor or global scale factor. It multiplies all input horiz dists by this factor. It can be used for entering cadastral distances with one combined scale factor for the whole site. GSF is applied to H Dist observations only and converted values are shown as the measurements. Note this option applies a scale factor it does NOT solve for a scale factor (as is done in EDM calibration).

Col
1 - 3 GSF
11 - 20 Scale factor

Template and example:
```
COM       < factor >
GSF        1.000140
12345678901234567890
```

In multiplying all the distances by the one scale factor we are making the assumption that the scale factor is equal for all points and all lines, but over large areas scale factors can change significantly. A more accurate way to do calculations on a map projection grid is to calculate the proper conversion for each individual line independently and before entry to FIXIT4.

When you view the output file from an adjustment that uses the scale factor input GSF, the observation horizontal distances are displayed with the scale factor having been applied.

L1R

Performs a robust L1 Norm solution as described in Monograph 13. It minimises |v/s| and is not a least squares adjustment. It can be useful to study outliers or other problems in a data set. It reads the same input file that the rest of FIXIT uses. It produces adjusted coordinates that may be useful for some data analysis purposes. But for a clean data set I would use the coordinates from a least squares adjustment in preference to those from a robust L1 Norm solution. L1R has existed in research versions of FIXIT for quite some time but is now available to users in FIXIT4.

FREE NET

FIXIT4 reintroduces freenets (or inner constraints) and now follows the equations given in Caspary's UNSW SSIS Monograph 11. There is no need for a control card in the input file. If users do not hold fixed any point's coordinates (i.e. any combination of ENH is not used in any COORD line) then a Freenet adjustment will be performed. Partial datums are not currently implemented, so the starting coordinates of all points are used as the datum. For 1D data a single datum parameter (shift in H) is used. For 2D data three datum parameters (Shift in E, Shift in N and rotation) are used if there are distance observations. For 2D data with no distance observations then four datum parameters (Shift in E, Shift in N, rotation and scale) are used. For 3D data users have a choice of datum parameters. (Free net calculations by transformation of coordinates into a free net was implemented in FIXIT2 but not in FIXIT3.)

EIGEN

It is recommended to try this option if a solution crashes while trying to invert the N matrix. It computes the eigenvalues and condition number of the normal matrix N. There should be no zero eigenvalues. If there is 1 or more eigenvalues equal to zero, then you need to hold that number of additional parameters fixed, or find some other datum defect in the network.

COV

Prints out the variance-covariance (VCV) matrix of coordinates (part of Qx matrix). The terms in the matrix are not multiplied by the variance factor from the FIXIT4 calculations. Coordinate lines can be in any order. However if the COV option (see below) is used to get the VCV matrix of coordinate parameters (Qx) then the matrix is in same order as the input COORD cards. Fixed point coordinates and orientation parameters are not included in the matrix. Large matrices will wrap so if you wish to see part of the matrix for a few points put them at the top left of the matrix by putting their COORD cards at the top of the input file.

APP

Since the start of 2012 FIXIT4 can generate approximate / starting coordinates for 2D survey control networks. The method FIXIT4 uses is briefly described in the reference book in sections 4.7 and 8.5.3. I have also written some notes for students that describe the process in detail with worked examples.

Surveyors using modern electronic instruments with data recording and electronic transfer to computer files can fairly easily set up input files containing the observations for Least Squares analysis. The user simply enters the observations and then the coordinates of known points. But how can we get starting values (approximate coordinates) for the other points?

Before I describe the method that is programmed in FIXIT4, what are ways to find starting coordinates?

1) From investigation of a topographic map, or site plan with overlaid coordinates, or Google earth.
2) From GNSS observations in the field (assuming you are not underground or indoors). A simple hand held navigation mode GPS is usually sufficient since coordinates within a few metres are usually good enough.
3) By calculations from the observations using CAD, calculator or other survey software. You don’t need to distribute miscloses for this purpose so you can often take short-cuts. Work in a sequential way through the net from one point to the next. However a gross error in the data may yield subsets of the points with grossly incorrect coordinates and this is a time consuming method.
4) By carrying bearings and carrying coordinates in your total station instrument as you conduct the survey. This requires you to start on points with known coordinates and a known backsight observation or ‘free stationing’ to points with known coordinates.

Each of these methods is somewhat labour intensive and usually requires you to type the values into your input file. When the number of points becomes larger you probably want an easier method. Though the slower methods above are useful independent methods that can help isolate gross errors in your data.

In a 1D levelling or EDM height traversing network the partial derivatives (in the A matrix) are linear (i.e. constant) and not a function of the parameters, so the Least Squares adjustments can be done without starting values. The heights of all points, except the fixed known points, can simply start at zero. FIXIT4 then only requires that you have a COORDINATE line for each point; the actual height can be left blank – except for the points with fixed heights.

The APP feature in FIXIT4 is designed for 2D networks with a pair of distance and direction observations for each observed line. This type of data is commonly available from total station surveys. The directions and distances can be entered in any order, as usual. You don’t have to enter them in pairs. If you enter mean distances for each line, so that the forward and reverse distance are not in the input file, that is fine FIXIT4 will cope. For approximate coordinates in 3D networks you might simply assume the slope distances are horizontal. For any points that can't be estimated by this method consider just using the mean of fixed points or even guesses for starting coordinates.

To calculate approximate coordinates in FIXIT4; place your observations in the input file, include a line that starts with APP, and include COORDINATE lines for each of your fixed points or any other points you might have good coordinates for. You do not need to enter COORDINATE lines for all the other points. From the FIXIT4 application, select your file, then press the DO LS and Plot button. This will divert to the App code. Only one iteration is required (you don’t have to specify that). No plan or plot will be produced. You can then edit the output prn file and read the coordinates and some diagnostics about the quality of the solution. These coordinates are usually remarkably accurate and you can then copy / paste them into your input file. Remove the APP line from the input file and run a normal LS solution.

If your network contains very few direction observations and mainly distances, or very few distance observations and mainly directions, then you should contact the author for further assistance.

A practical check on the approximate coordinate generator solution is to plot the network using the starting coordinates to see if the plan looks "reasonable".

6. INSIDE FIXIT4

When you use a program that you didn't write you don't know what formulas, approximations, assumptions the author has made. If the source code is available (though it rarely is) you might be able to find out but even then it depends on being able to read the programming language and following it through out an often lengthy path. So to help the users of FIXIT know what is inside we give the following information. The reference book has many examples of the application of the formulas below. The key solution part of the Least Squares adjustment is a simple inversion of a full matrix. There have been many sophisticated solution methods developed over the years but they are not needed in FIXIT for use on modern computers with the small data sets it is usually applied to.

Given a line observed from A to B, corrections or reductions to observations, observation equation elements (Partial derivatives or coefficients and Obs-Calc terms), and equations for calculating default standard deviations are shown.
Measurement = X

DE = EB - EA
DN = NB - NA
DIST = SQRT(DN^2 + DE^2)
for slope dist and ZA obs: DH = HB + HT - HA - HI
for delta height obs: DH = HB - HA
SDIST = SQRT($DIST^2$ + DH^2)

Note that for many of the partial derivatives and standard deviation calculations the DIST comes from approx (starting) coordinates, so if coordinates are poor then partials and standard deviation will also be poor. Generally this is not a major concern, however if large corrections to coordinates are found in the adjustment then the input file's coordinates should be improved and the solution rerun. The output file's listing of adjusted coordinates is in the same format as for input file, so the adjusted coordinates can easily be copied into the input file.

The default standard deviations equations below use the following values from the DSD record, with units converted appropriately.

	Col	
S1:	11 - 20	Constant part of Distance Std. Dev.
S2:	21 - 30	Distance dependant part of Std. Dev. in ppm.
S3:	31 - 40	Direction Std. Dev.
S4:	41 - 50	Centring error for Directions.
S5:	51 - 60	Std. Dev. of height difference (delta H).
S6:	61 - 70	Std. Dev. of zenith angles.
S7:	71 - 80	Std. Dev. of height of instrument (HI) and of target (HT)

DIRECTIONS:
On first use Orientation = X - BEARING (DN,DE) (+360 degs if nec)
Partials:
AE = -DN/$DIST^2$ BE = +DN/$DIST^2$ AN = +DE/$DIST^2$ BN = -DE/$DIST^2$ AOrientation = -1

Where AE means the partial derivative of direction with respect to the Easting of A i.e. $\frac{\partial Dir_{AB}}{\partial E_A} = -\frac{DN}{DIST^2}$

O-C TERM = (X - Orientation) - BEARING (DN,DE) (+ or -360 degs if nec)

Default standard deviation = sqrt($(S3)^2$ + 2 * $(S4/DIST)^2$) or is overridden if user enters a standard deviation for that observation.

DIST here comes from the input starting coordinates, so if those coordinates are poor then the calculated standard deviation will be unreliable, especially if the distance is short. In that case update the input file with adjusted coordinates and readjust.

HORIZONTAL DISTANCES:
Partials:
AE = -DE/DIST   BE = +DE/DIST   AN = -DN/DIST   BN = +DN/DIST
O-C TERM = X - DIST
Default standard deviation = S1 + S2 * Distance observed (i.e. not distance from coordinates) or is overridden if user enters a standard deviation for that observation. Note that no increase is made to this standard deviation based on centring errors. So S1 should include centring errors.

If EDM calibration is requested the extra partials are:
A Add const = -1
A Scale factor = -DIST/1000000
O-C TERM = X - (DIST - AC - SF*DIST/1000000)

SLOPE DISTANCES:
Partials:
AE = -DE / SDIST   BE = +DE / SDIST   AN = -DN / SDIST
BN = +DN / SDIST   AH = -DH / SDIST   BH = +DH / SDIST
O-C TERM = X - SDIST
Default standard deviation = S1 + S2 * obs Slope Dist
FIXIT4 does not add a term for hi ht errors to slope distance standard deviation

If EDM calibration is requested and JMR correction is not applied then the extra partials are:
A Add const = -1
A Scale factor = -SDIST/1000000
O-C TERM = X - (SDIST - AC - SF*SDIST/1000000)

If EDM calibration is requested and JMR correction to Horizontal is applied then the extra partials are:
A Add const = -1
A Scale factor = -DIST/1000000
R = 6370100
HM = (HI + HA + HT + HB) /2
K2 = - (DH * DH) / (2 * D) - (DH^4) / (8 * D^3) - (DH^6) / (16 * D^5)
K3 = - HM / R * (K2 + D)
Corrected Horizontal Measurement X = (D + K2 + K3) * (1 + Href / R) where Href is the height of the first coordinate point
O-C TERM = X - (DIST - AC - SF*DIST/1000000)

ZENITH ANGLES:
ANGLE = ACOS(DH/SDIST)
Partials:
AE = -DE * DH / $SDIST^2$ / DIST   BE = +DE * DH / $SDIST^2$ / DIST
AN = -DN * DH / $SDIST^2$ / DIST   BN = +DN * DH / $SDIST^2$ / DIST
AH = +DIST / $SDIST^2$ BH = -DIST / $SDIST^2$
O-C TERM = X - ANGLE (+ or -360 degs if nec)
Default standard deviation = sqrt($S6^2$ + 2*$S7^2$/$DIST^2$)

HEIGHT DIFFERENCES:
Partials: AH = -1   BH = +1   O-C TERM = X - DH
Default standard deviation = S5

AZIMUTHS:
Partials: AE = -DN/$DIST^2$ BE = +DN/$DIST^2$ AN = +DE/$DIST^2$ BN = -DE/$DIST^2$
O-C TERM = X - BEARING (DN,DE) (+ or -360° if nec)

Default standard deviation = S3

EPP:
Partials: AE = 1
O-C TERM = Observed E coordinate - Starting E Coordinate (in COORD record)
Default standard deviation = S1

NPP:
Partials: AN = 1
O-C TERM = Observed N coordinate - Starting N Coordinate (in COORD record)
Default standard deviation = S1

HPP:
Partials: AH = 1
O-C TERM = Observed H coordinate - Starting H Coordinate (in COORD record)
Default standard deviation = S1

Freenet:
$Qx_F = (N + DD^T)^{-1}N(N + DD^T)^{-1}$ and $\Delta x = Qx_F(A^T Pb)$
For 2D data sets with datum parameters are in the order scale, rotation, Te, Tn then the D matrix has two rows for each point and then a row of zeros for each orientation (or other) parameter, e.g. :

$$D = \begin{pmatrix} e_1 & n_1 & 1 & 0 \\ n_1 & -e_1 & 0 & 1 \\ e_2 & n_2 & 1 & 0 \\ n_2 & -e_2 & 0 & 1 \\ \vdots & \vdots & \vdots & \vdots \\ e_p & n_p & 1 & 0 \\ n_p & -e_p & 0 & 1 \\ 0 & 0 & 0 & etc \end{pmatrix}$$

7. Differences to previous programs FIXIT, FIXIT2, emt, and FIXIT3

* FIXIT4 should read any input file created for its predecessor programs FIXIT, FIXIT2, FIXIT3 and emt. Though there are small changes in input formats for versions before FIXIT3. For example, former program versions used keyword ERRORS, FIXIT3 and FIXIT4 prefers DSD for the default standard deviations.

* In previous versions of the program before 2004, observations could overwrite the default standard deviations by entering a variance on the line of the observation after the measurement. The same columns in the input file are now used to enter a standard deviation.

* Since 2020 we can add (optional) short comments at the end of Coordinate, Direction and H Distance observation lines. These comments are carried to the output prn file.

* ZA standard deviation calculation in FIXIT3 and FIXIT4 is different to previous version. FIXIT3 and FIXIT4 do NOT correct ZA for earth curvature or atmospheric refraction. It is up to user to make those corrections themselves. It is suggested that the user might wish to calculate mean of forward and reverse ZAs or ΔHs and enter the mean value free of curvature and atmospheric effects.

* FIXIT4 now does not automatically print O-C values before adjustment, to see differences between observed values and approximate or starting coordinates set the number of iterations to 0 (zero).

* FIXIT4 does not use the Keywords LARGE (no longer needed) or ITERATION any more. Number of iterations is now set on the program main screen, not in the input file. Keywords 1D, 2D and 3D are also no longer read in an input file, the program decides what type of adjustment is required based on the observation types entered.

* FIXIT and FIXIT2 used a FREE control card and solved for transformation parameters to freenet after a minimally constrained solution. FIXIT4 follows Caspary’s method as described above but doesn’t need a keyword – it decides from the input if you haven’t held any coordinates fixed then it does a FreeNet solution.