



Survey and GIS Manual
Leica Series 1200 Robotic Total Station
Second Edition

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Contents

	<u>Page</u>
<u>Introduction</u>	4
<u>Protocols for Setting up the Leica 1200 TST</u>	5
– A few notes	5
– <i>Survey Book</i>	5
– <i>End of survey</i>	5
– <i>Weather conditions</i>	5
– Survey Setup	6
– <i>Setting up the Total Station</i>	6
– <i>Setting up the Remote Control</i>	9
– <i>Creating a new Job</i>	10
– <i>The Setup procedure (after job creation)</i>	10
– <i>Setting up the Backsight-Prism</i>	11
– Surveying	13
– <i>Start of survey</i>	13
– <i>General Survey</i>	14
– <i>A rough guide to coding and point IDs</i>	15
<u>Creating points files with co-ordinates and uploading them into the Total Station</u>	16
<u>Setting out</u>	18
<u>Troubleshooting on site</u>	20
– <i>Survey Errors</i>	20
– <i>Problems encountered with the Total Station</i>	21
– <i>The EDM and ATR default settings in the Total Station</i>	22
– <i>Establishing a connection between the 1205 Total Station and the Remote Control</i>	23
– <i>In case the Remote Control Unit is not working or unavailable</i>	25
<u>Protocols for downloading the Leica 1200</u>	26
<u>Protocols for inputting data into GIS</u>	30
– <i>The Project Manager</i>	30
– <i>The data you will deal with</i>	32
– <i>Point and line data</i>	33
– <i>Merging and updating the line data</i>	35
<u>Editing Shapefiles</u>	37
<u>Adding Tables / Events Layers to gvSIG</u>	40
<u>Joining tables</u>	43
<u>Printing in gvSIG</u>	45
<u>Georeferencing</u>	48

<u>Problems encountered with gvSIG</u>	53
<u>Appendix 1:</u> Control Co-Ordinates:	54
<u>Appendix 2:</u> Survey Codelist	55
<u>Appendix 3:</u> Metadata	56
<u>Appendix 4:</u> Drawing of Plans	59

Introduction

The first edition of this manual was produced by Oxford Archaeology North after development of new on-site survey and GIS methodologies applicable to any archaeological project. The second, revised edition was produced in March 2010 after the release of the gvSIG OA Digital 2010 Edition.

It is intended to supply an easy-to-understand but comprehensive guide to survey and GIS, from setting up survey equipment to downloading and processing survey data. It excludes the initial setup of control stations and any preliminary preparation work.

The manual is meant to speed-up, or annihilate the training procedure and provide a guide to survey to field staff in case no professional surveyor is on site.

Procedures are explained in great detail with screenshots and photographs where appropriate and guides to troubleshooting and examples for data maintenance are provided. An inexperienced member of field staff should, by following this manual step-by-step, be able to set up a Total Station, conduct survey and download and process the survey data, given a certain amount of time.

Chapters of this manual have been extracted or adapted from older manuals and adjusted to fit into this guide's sequence and been updated. The previous authors have been credited.

The present copy of the manual has been adjusted for the use on any site using a robotic Leica TCR1205 Total Station together with a remote control unit.

The manual is written in such manner that it can easily be adjusted for individual sites' survey requirements.

Chapters can be extracted easily and supplied individually.

Soft- and hardware described in this manual are flexible, although it is recommended to acquire copies of the following:

- gvSIG OADE 2010 - open source GIS software
download from: <http://oadigital.net/software/gvsigoad/gvsigoad2010beta>
- Inkscape open source vector editing software
download from: <http://www.inkscape.org/>
- And a copy of Leica GeoOffice or the equivalent downloading software for the Total Station used on site – this should be provided by the manufacturer.

Anna Hodgkinson, the author of this manual, would be grateful for further feedback on its usability, contents and layout. She is employed by OA North as a Supervisor in Geomatics and contactable via email: anna.hodgkinson@thehumanjourney.net

Anna Hodgkinson, March 2010

Protocols for Setting up the Leica 1200 TST

by Anne Kilgour Cooper, adapted by Anna Hodgkinson

Any problems, call the Geomatics representative for your project.

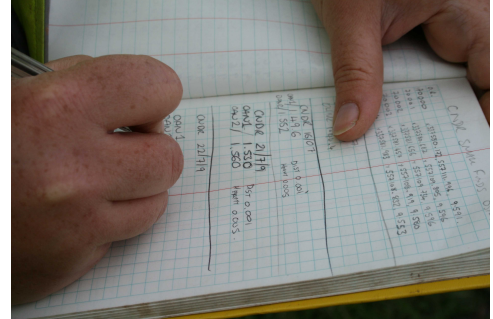
The locations of Station- and Backsight points should be known to you.

Ensure that the station co-ordinates are written down clearly and stored in the Total Station.

A few notes:

Survey Book

- You must write your setup information into the survey book – this will be:
- **Job identification:** In the format: *Projectddmmyy*
- **Machine height:** measured from the top of the station point to the small carved groove on the side of the machine. You must measure accurately to the nearest millimetre. It has proven useful to attach a metal bracket to the top of the station point which enables vertical measurements and avoids inaccuracies through bending the tape measure (see p. 8ff.)
- **Station used**
- **Backsight used:** This should preferably be a station point located at a considerable distance (~100m+) from the Total Station, as this achieves more accurate overall measurements.
- Your numbers must be clear and unambiguous and your writing legible, as it may not be you who processes the data.



End of survey

- Hit “ESC” a number of times to exit the survey interface and return to the main menu on the remote control.
- Then press and hold “ESC” to turn off the remote control.
- Press and hold “ESC” on the Total Station to turn it off as well.
- Ensure that the Velcro or clip on the tripod is done up properly, otherwise it poses a health and safety risk.
- Remove the batteries from the Total Station the remote control and the big red external battery and charge them using the Leica charger in the survey cabin so everything is charged for use the following day

Weather conditions

- If it rains there is a yellow cover to put over the machine when it is not in use. This will then be folded and rolled up and put in the anti-glare cover (the black plastic cylinder).



- After a day out in the rain, the machine **must** be taken out of the box to dry out, the yellow cover and the box also need drying out.
- If the Total Station is in danger e.g. blowing over in the wind, being knocked over by passing vehicles, then take it down. It should not be left unattended on site. If everyone goes in for lunch and the machine is out of sight of the cabin, take it down. If you are in a public place (park, city centre etc.) and you go in for lunch, take it down.

Survey Setup

Setting up the Total Station

Remember to set up the survey equipment to your own / a person's average height – make sure you can see through the viewfinder whilst stood on all sides of the instrument.



Step 1: Go to *the station point* to set up the Total Station



Spread the legs over the point so that the plate is level, and the hole of the screw over the point. Please note that the plate does not have an actual level, but that this is only for initial judgement by the eye.



Press the pointy ends of the legs firmly into the ground, ensuring the tripod stays level

Undo the tripod legs and raise to roughly chest height.



Tighten the screws / clips.



Open the red box, and take the machine out by the handle. Do not let go of the machine until it is firmly attached to the plate!

Line the base of the machine with the plate and screw up the screw on the underside of the plate.



Clip the big red external battery to the tripod

Clip the black radio transmitter to the tripod and connect them using the black cable: the larger of the three ports goes into the battery and the other two into the Total Station and the radio.

Line up the face of the machine so that it is parallel with one of the feet and the back of the machine has two feet spreading from its centre-point.



Press the 'prog' button to switch on the Total Station



Press 'shift' - 'F12'. This will activate a laser plummet in the form of a red dot on the ground. Twist the feet on the tribrach to position the Total Station directly in the centre of the station point.



Now look at the bubble above the screen. By adjusting the height of the legs, one at a time, get the bubble roughly in the middle of the spirit level. Have a look at the laser, you may need to twist the wheels again as the laser plummet can move off the nail.



Now use the feet to make fine adjustments to the bubble.



The front two feet are turned together, but in opposite directions, the back foot is turned by itself. Watch the screen as it will give you a numeric value to your machine tilt as well as having a useful picture to watch.

Once the machine is within acceptable levels of tilt (around 0.003 in each direction), check the laser again. Now check the level one more time.

Press 'cont'.

Measure the height of the station point by taking a reading from the top of the station point at a 90° angle to the metal bracket attached to the screw to the groove in the side of the instrument (above the Optical Sticker in the image below). You must measure accurately to the nearest millimetre. Write this value into the survey book.



Step 2: Setting up the remote control

Ensure the black antenna is attached firmly to the handset.

Turn on the instrument by pressing and holding the “prog” button.

The radio link is between the Total Station and the remote control is activated instantly.

You can **no longer** use the Total Station's keypad (except for checking the level by pressing shift + F12), everything is now done from the remote control.

The following only applies when you intend to use a 360° prism:

- Take the detail-pole with the black platform attached to it and clip the green handset onto the panel by clipping the back to it and pushing it down. The red button is pushed upwards to secure the handset on the panel.
- It is worth considering the use of a small circular Leica prism with a constant of 17.5mm, as this can be lowered so it closer to the ground and thus easier to level.
- In this case one carries the remote control with the black elastic strap attached to its back (unless it is preferred not to use this strap).



You can either use the arrow keys to highlight an option, and press enter, or press the corresponding number (not the F keys though)

Use the arrows to highlight ‘1 Survey’ and press enter, or press ‘1’

The job line is highlighted. Press Enter (the red button)

Now press ‘F2’ - ‘New’.



Creating a new Job:

- **The Name** is the job title, 'Project', followed by the date, eg *Project 050609*
- **Creator** is your initials

You will notice near the top of the screen that there are several tabs. The page - F6, button will switch between the different tabs.

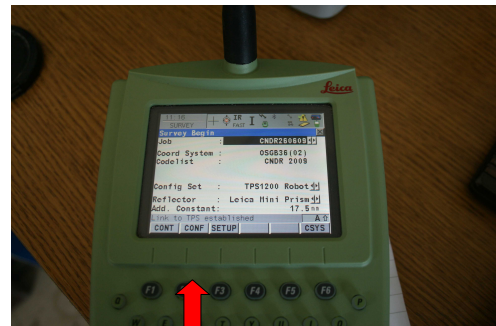
- press 'Page'
 - ensure that the codelist the one you were assigned to use on your project. Use the left and right arrows to select the correct one
 - Press 'Page' again
 - ensure the Coord system is OSGB36 (2)
 - Press 'Store'
-
- You will see a list of jobs stored in the machine.
 - Make sure your job is highlighted
 - Press 'F1'

Ensure that the EDM / ATR settings are set to the same default as described on p. 22.

The Setup procedure (after job creation)

Now you must press 'setup'

This will take you to a page where you set up the station information



Choose the method "Known BS point" and the Station Coord. "From Fixpoint Job" - this is the job from which you retrieve the station information. The station information for your job should be stored on a job called 'Project_Control'.

Type in the instrument height just measured off the Total Station after writing it into the survey book.
Press cont.



Station Coord - From Fixpoint Job

Station ID - chose OANI

Instrument Height - measure from the top of the station point to the groove on the side of the machine, just below the word *Leica* (see above).

Computd Scale – 0.9996012717

The "Computd Scale" is a factor that needs to be taken into account on any site. Should the site in question be a large one, such as a long roadscheme, the coordinate system has to be defined as OSGB32 (02) and the scale should be 0.9996012717.

If, however, the site is small, the coordinate system does not even necessarily have to be defined, and the scale should be 1.000000.



The next page is the **Backsight** page.
With the 'Backsight ID' line highlighted, press enter
Choose your backsight

Go to the backsight point and set up the prism.

Step 3: Setting up the Backsight Prism

You need one tripod and the orange box containing a circular prism and tribrach.

Undo the tripod legs and raise them.
Tighten the screws.

Spread the legs over the point so that the plate is level, and the hole of the screw over the point

Push the pointy ends of the legs firmly into the ground, ensuring the tripod stays level



Open the orange box, and remove the circular prism. Turn the prism to face the Total Station on the station point.

Line up the base of the prism (tribrach) with the plate.

Do not let go of the prism until it is firmly attached to the plate.

Look through the small viewfinder to the side of the tribrach and move it so the target is directly over the backsight point.

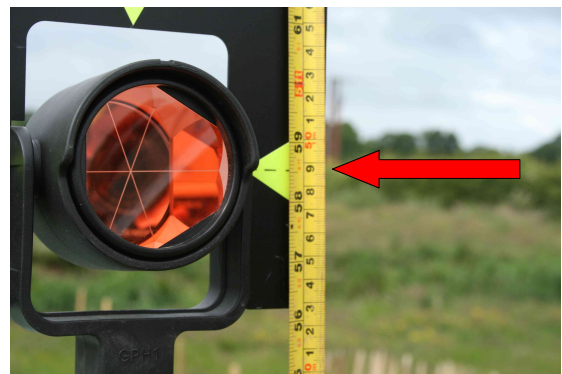


Do up the screw on the underside of the plate.

Now level the prism using the wheels at the base of the tribrach, ensuring the prism remains over the backsight point.

The procedure described above is basically exactly the same as that for setting up the Total Station, using the feet on the tribrach and the legs for levelling and positioning.

Measure the height of the station point by taking a reading from the top of the backsight point to the midpoint of the prism. You must measure accurately to the nearest millimetre. Write this value into the survey book. In this case, again, it is worth attaching a horizontal bracket to the point.



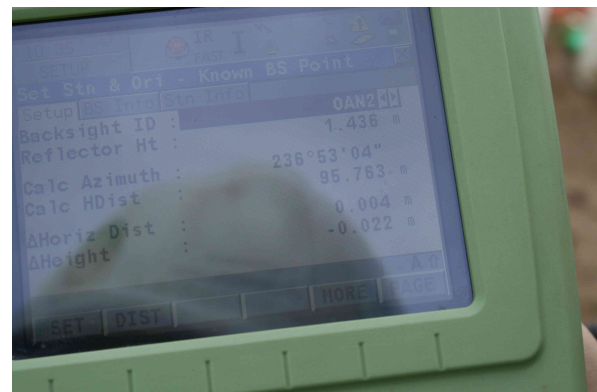
Now look at the remote control:

After last pushing “cont” a page was brought up that allows you to shoot to your backsight. Select your backsight point as your Backsight ID from the submenu.

Now enter the Reflector height – this is the height you measured off the prism.

Press ‘Dist’

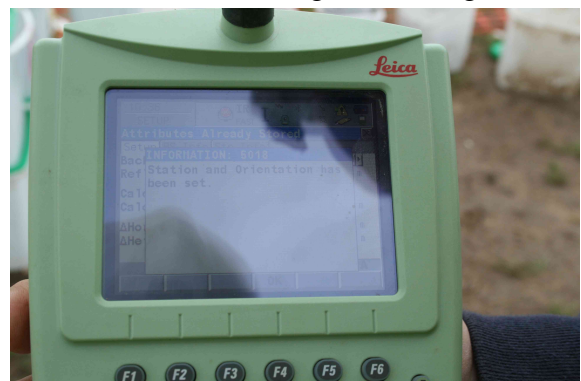
Check that the Horiz Dist and Ht Diff are within acceptable levels. Ensure that you are aware of the acceptable range before you accept any values – some projects require a higher level of survey accuracy than others. In any case, the values displayed should never exceed 0.015.



The given example (above) is too large a residual. In this case the station height, levelling for both station has to be re-checked!

Write these numbers into the survey book and Press ‘Set’

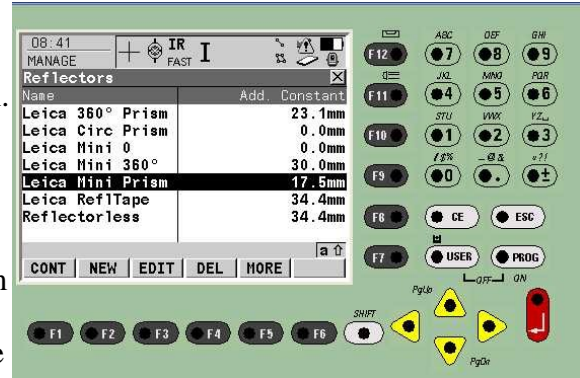
A message “**Station and Orientation set!**” will be displayed.



Surveying

Start of survey

- The type of prism used will change automatically to the Leica round miniprism (constant 17.5) (the prism symbol at the top bar on the display changes). The tracking and automatic prism search (ATR) settings will also change. For these and how to change them, push **F8** and see p. 22. In case F8 does not take you to the prism-menu, push and hold **F8** – you will be able to define shortcuts for any “F” button
- The first point to survey in is the backsight. This should be done automatically by the Total Station. If this is not the case, change the point_ID to “1000” and use the code BCK (as described below).
- Change the target height to the height of the backsight point as noted earlier. Change the prism to a Leica Circ Prism (Add. Constant 0.0mm).
- Press F1 “All” to record this point and change the prism type back to “Leica Mini Prism” (Add. Constant 17.5mm).
- The Total Station will still recognise the large round prism, therefore **replace the prism cap** so the Total Station cannot find it any longer and accidentally shoot to it!



Page to the **Code Tab**. This is the screen that allows you to define Point_ID and code and can display the eastings, northings and height of any point you take.

You will have to press “**F12**” - the yellow button on the remote control in order for the Total Station to find you! This is called a “Power Search”.

Change the **Reflector height** when beginning the survey, from the height of the backsight to the height of the prism! - If this is not done, the heights in the survey output will be incorrect!



- If you need to write down a value to check a point before recording it, or for temporary points, press ‘dist’. Write down the values. Then press ‘rec’ in case you choose to record it.
- You can retrieve, edit and delete all data by entering the data menu. This can be found by pushing the **USER** button, then selecting “**Data manager**” (see p. 20).
- The data from your current job will be displayed and it will be grouped in points, lines and areas. The points which make up your lines will be listed as well, but without a code. The ‘**Page**’ **button** switches between different bits of information, including a map of what has been surveyed in. You can see what page you’re on by the tabs at the top - Survey, Offset, Code, Map

Code Tab – use only this for survey

Scroll down to the Code line. Press enter. Select the code according to the codelist and data, either by scrolling down to it, or pressing the left arrow and typing it in.

Press enter. Ensure the Point_ID is accurate. Check the codelist-page (**Appendix 2**)

Press F1, “all”.

General Survey:

Points

- You need to type in the point ID. See **Appendix 1**: Codelist – for examples!
- Page to the Code tab.
- Use the left and right arrows to select the correct code.
- Drawing points and Levels will be surveyed using the appropriate codes:
- An example is given here, but please refer to the **Appendix 1**
- **Drawing Points for plans:** Code: DP P – Point_ID: DP"Plannumber".1 and DP"Sectionnumber"S for sections etc. See **Appendix 4**.



- **Context (and other) Levels:** Code: CTXTLVL – Point_ID: Context number
- Small Finds: Code: SF – Point_ID: 70000.0001 etc. - remember the four digits and switch to the Finds Job!

Lines

- **NO** closed area polygons are surveyed. Use line codes at all times!
- Use the left and right arrows to select the correct code. You are able to use the code screen to get all the codes, and therefore open lines and areas from here. Press cont when you've selected the correct code.
- **Feature outlines:** FEP
- **Intervention lines:** INT
- **Internal limits of excavation:** INT
- **Limit of excavation:** LOE

ALWAYS Press **SHIFT + F7** when you've finished your line or area.

In the case of errors during survey: see p. 20

In case the Remote Control Unit is not working or unavailable: see p. 25

A rough guide to coding and point Ids – please see [Appendix 1](#) for a complete list of codes

Type of survey	Code	Point ID	Notes
Level (general) (Grid top) (Grid Base)	LVL### LVLGTOP LVLGBASE	LVL_####, LVL_456 LVL_456	There are five different types of level in the codelist – choose the appropriate!
Plan drawing point	DP P	70002.3 and .4 (Planning point)	Planning points .1 and .2 are usually the section points and will be surveyed in the DP S code. They are not labelled with the plan number, whilst the plan points .3 and .4 are.
Section drawing point	DP S	70002.1 (Section point)	Section Points will be marked on site with labels clarifying that they mark a Section rather than being the planning points!
Block plan	FE	FEA1.1	Start at 1 and use consecutive numbers.
Station	STN	OAN1	When you to set up – code up station points as Stations
Small Find	SF		
Georectification Point	RP		

Creating points files with co-ordinates and uploading them into the Total Station

You may be asked to set out points from known co-ordinates on site. The points should exist as a shapefile in your GIS project.

Ensure each point has an individual point ID.

Ensure you have the X and Y information within the shapefile's .dbf file. You can apply this manually by using the field calculator:

Start editing the shapefile containing the information of the points you wish to set out and open its attribute table.

Now select: "Table – Manage Fields" and add two columns named "Easting" and "Northings".

Choose "Double" as data type. - two new columns will appear in the attribute table.

Click on the "Easting" column and open the "Field calculator" tool

Highlight the "Easting" column on the left hand side, and on the right, scroll down until you find "x". Double click only on "x" and confirm this.



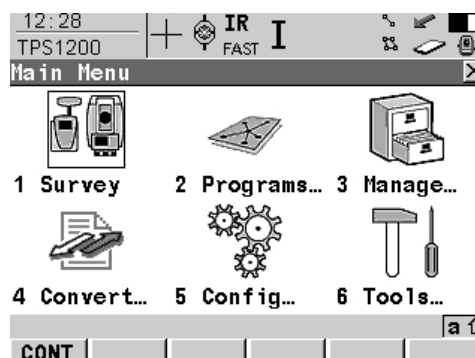
Repeat the above for the "Northings" column, selecting "y" in the field calculator.

The shapefile's .dbf file now contains Eastings and Northings, i.e. X and Y data.

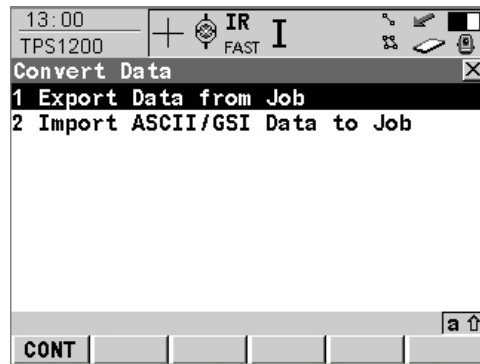
Open the .dbf file from its stored location (right-click on the shapefile in gvSIG and select "properties" - the filepath will help locating the .dbf file). Save the file as a .csv (comma delimited) file in a logical location.

Now plug the Total Station's CF card into the computer and navigate to its "Data" folder. Paste a copy of the .csv file into this "Data" folder.

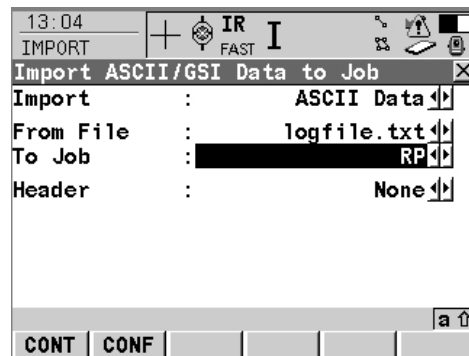
Replace the CF card and turn the Total Station on.



Select "4 – convert"



Select “2 – Import ASCII/GSI Data to Job”



Select:

Import: ASCII Data

Folder: the *Data* folder on the *CF card*

From File: *the .csv file you uploaded onto the card earlier*

To job: *The job you wish to use as your setting out job – create a new, empty job, called “STKE_ (with a reference to what is being set out)”*

Header: “1” (The .dbf file has a header, therefore you have to specify that row 1 of the .csv file contains the information, rather than standing for its own point)

Hit “CONT” and a message will be displayed, informing you that the points have been imported.

Setting out

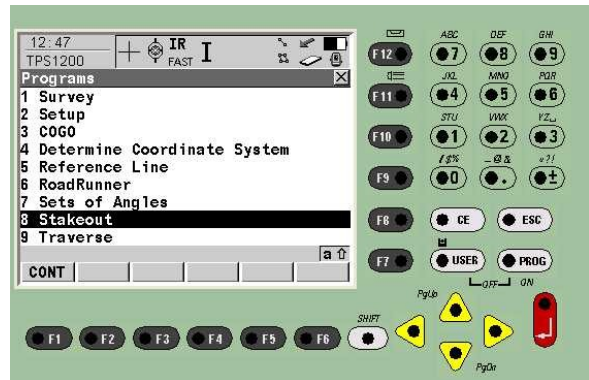
You may be asked to set out new points created in GIS or retrieve previously surveyed points. In any case, the co-ordinates of the points to be staked out must be known and stored on the Total Station.

For uploading points created from a shapefile, see p. 16.

Make a list and sketch-map of the points to be staked out for orientation and take this to site.

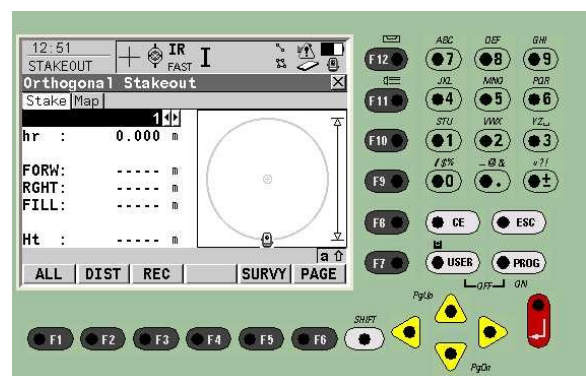
From the main screen on the remote control, choose “2 – Programs”, then “8 – Stakeout”

Ensure you select the job the points have been stored to and set it up following the setup instructions prior to survey if this job has not been set up yet.



A screen entitled “Orthogonal Stakeout” will show up.

Select the point to be staked out by its Point ID and position yourself with the prism in the vicinity of the target point.



Hit “Shift”, then “Conf” and ensure the option “Prefix” (this being “STKE”) is selected – this differentiates the original points from the points staked out.

Hit “Dist”.

Values will be displayed for “Forw” (forward) and “Rght” (right) - this is the distance to the target point.

These directions are from the viewpoint of someone standing behind the Total Station, and will therefore mirror-image your movements.

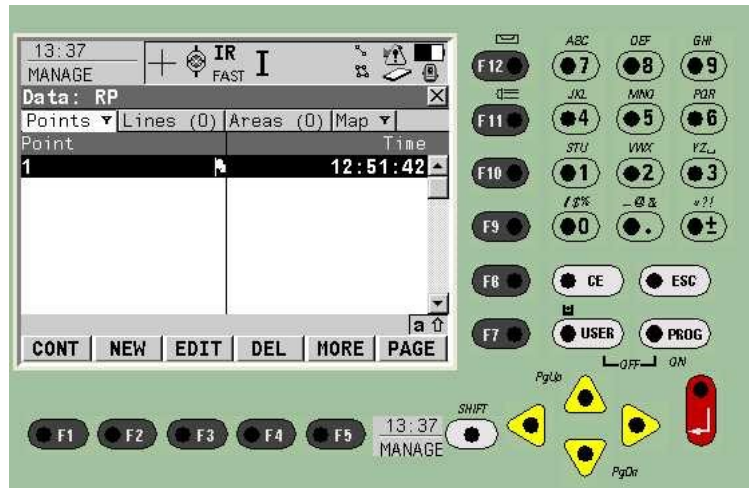
Estimate the distance the instrument ask you to move and follow its instructions.

The values will change as you move, but DO NOT rely on these – it is better to push “Dist” more often.

Once the target point is as close as possible – preferably within less than 0.003m in either direction, mark this spot with a peg, gridnail or survey flag.

Now re-position the prism on the centrepoint of the target (not the nails!), check it once again by pressing “Dist” and then hit “All” to record the point.

If you now check the Data Manager, the point just recorded will show up as “STKE##” and the point initially selected as a target will show up with a small flag next to it.



The STKE points will be surveyed without a code – use the data manager to change this manually. RP is the code that should be used.

Write the number on the tags in a white space and make people aware of them – it is necessary that they stay in place until the photographs have been taken.

Troubleshooting on site

Survey Errors

Errors can be corrected on site, or in the office, so make sure all errors are clearly written in the survey book.

To correct mistakes while you're surveying, press **User** and then **Data Manager**

Highlight the point and press "edit".

You can change the Point ID, code and reflector height.

Each reflector height must be done separately, so if there's ten in a row, you'll have to do all ten.

Once it's altered, press store

To change lines, page to the lines tab.

Select the line and press enter. You can remove points surveyed in by mistake.

N.B. These will be downloaded as a NOCODEPOINT shapefile, but saved only as separate points.



Once you're done, press cont.

Otherwise, write down your errors on your survey sheet and ensure the person who is dealing with the download knows about them. It may be quicker to correct in LGO or gvSIG.

Problems encountered with the Total Station:

Problems with coding:

In case the codelist shows only point- or only linecodes when coding up:

- From the Main Menu select “3 Management”
- Select “5 Configuration Sets”
- Highlight “TCRP_1205_Robot” and hit “EDIT”
- A Wizard screen is displayed – press “CONT” (F1) until you reach a page entitled “Coding and Linework”

On this screen highlight the line reading: “Show Codes:” and ensure that “All Codes” is selected (rather than only point- or line codes).

The EDM and ATR default settings in the Total Station:

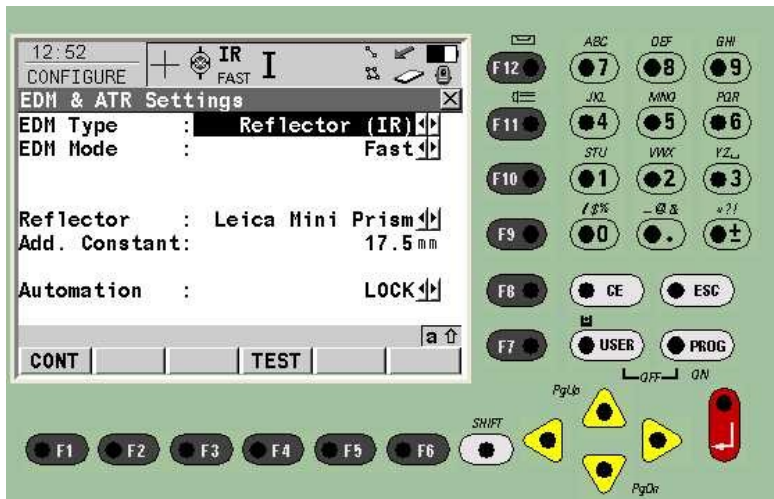
Press “User” - “EDM & ATR settings” to call up the EDM & ATR settings

Please note that the 1205 Total Station displays two tabs: one for setup and one for survey settings.

The **SETUP** tab displays the following settings:



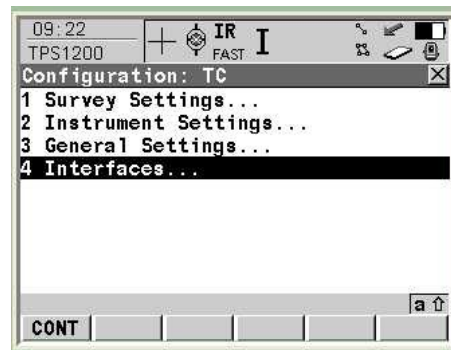
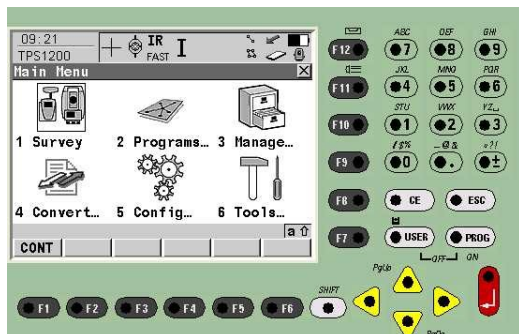
The **SURVEY** tab displays the following settings:



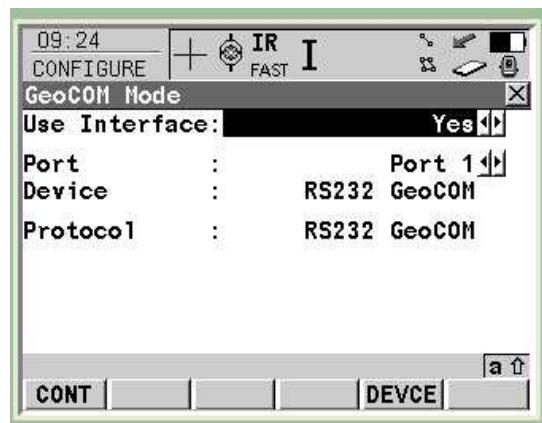
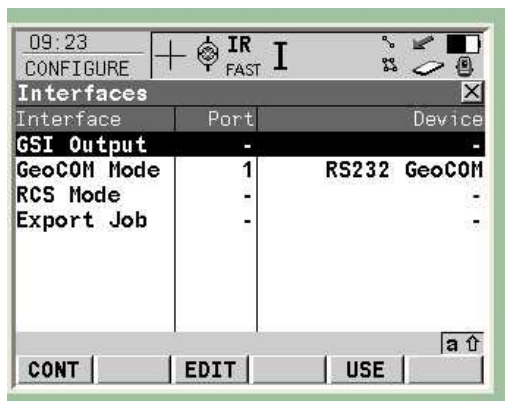
Establishing a connection between the 1205 Total Station and the Remote Control

Set up the Total Station and turn it on as usual.

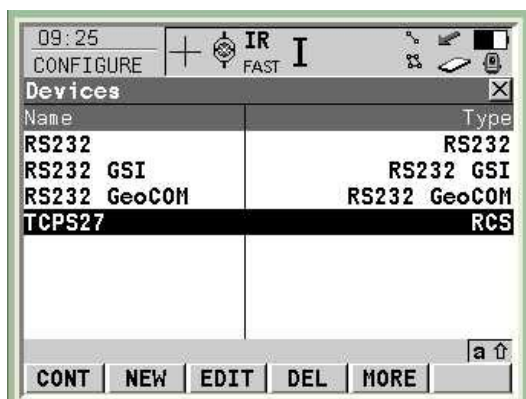
Go to “5 Config” on the main screen and choose “4 Interfaces”:



Highlight “GeoCOM Mode” and choose “EDIT”:



Select “Yes” to use the Interface and choose “Port 1”. Now hit “DEVCE”: Select TCPS27 – this is the name of the black radio transmitter attached to the tripod.



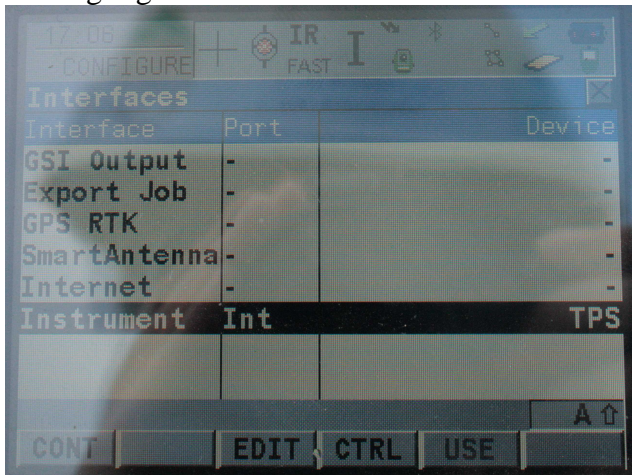
Hit “Cont” which returns to the main screen – Hit “CTRL” and ensure you note the line number. Set the Total Station to “Remote”.

Return to the main menu and do not touch the Total Station.

Now turn on the Remote Control.

From the Main Menu select “5 Config” and choose “4 Interfaces” (see above)

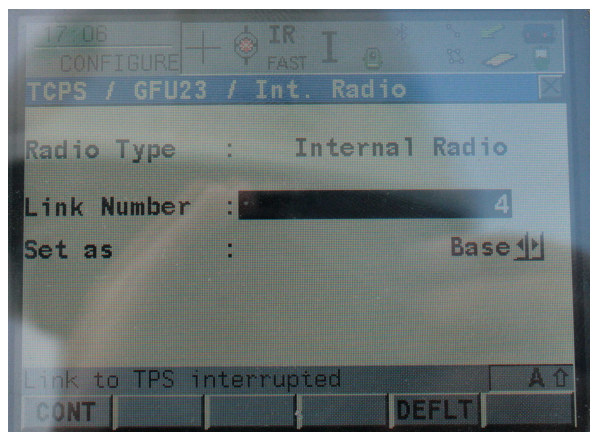
Now highlight “Instrument” and hit “EDIT”



For the port, select “Internal Radio”



Hit “CONT” which returns to the main screen – Hit “CTRL” and ensure you note the line number – this has to be the same as that on the Total Station. Set the Remote Control to “Base”.



The link between Total Station and Remote Control will be established automatically.

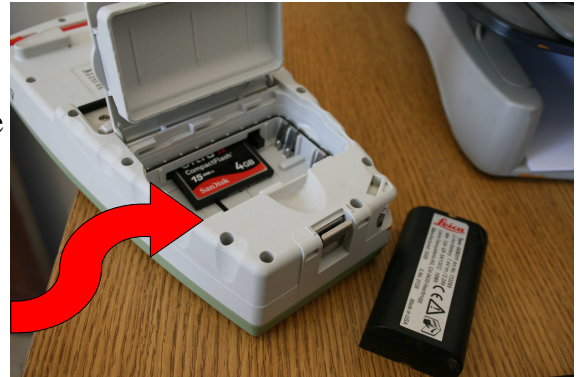
In case the Remote Control Unit is not working or unavailable:

Unplug the external radio and remove it from the tripod.

Re-level the Total Station.

The radio link will be interrupted and the Total Station will work standalone.

Open the remote control unit at the back and remove the battery and push onto the black square next to the card. Push again – remove the card



The setup procedure is the same as on the remote control:

The screen-layout is exactly the same whilst the keypad is slightly different: it works in a way very similar to that of a mobile phone.

Often the buttons will produce text when you want numbers and vice versa – push CE to delete, then F6 to change between numbers and letters and start typing again.



Points are logged by pushing F1 (“All”)

As the survey is now a 2-person job, there is a set of walkie-talkies which eases communication on site.

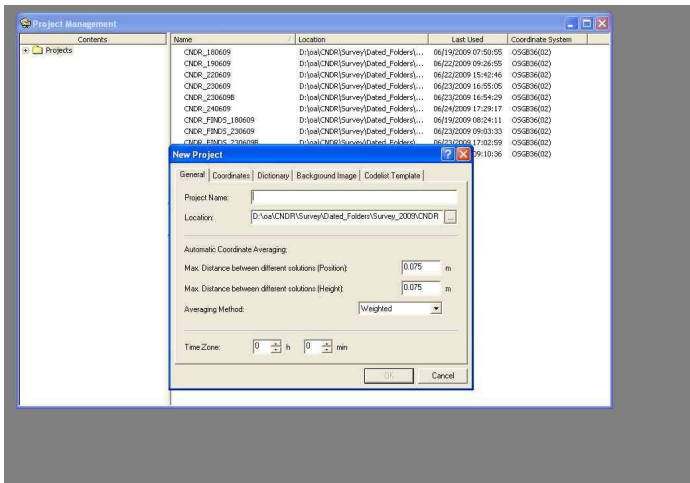
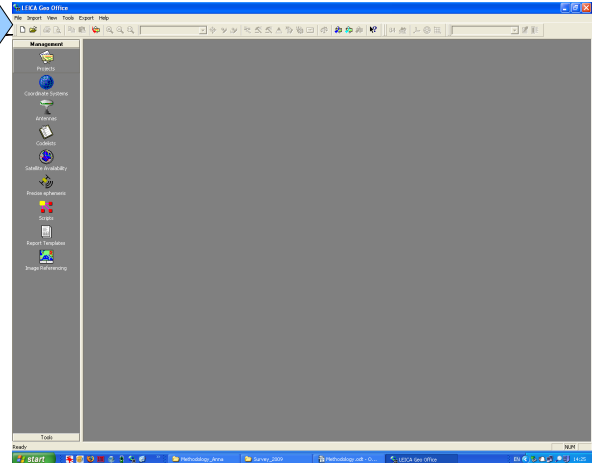
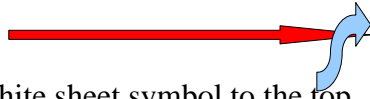
Make sure only to push “All” once you are certain your surveypartner is holding the prism straight.

Establish a system of communication: use the walkie-talkies to communicate metadata, and a system of waving and other hand-symbols for confirmation when points have been logged etc.

Protocols for downloading the Leica 1200

by Anne Kilgour Cooper, adapted by Anna Hodgkinson

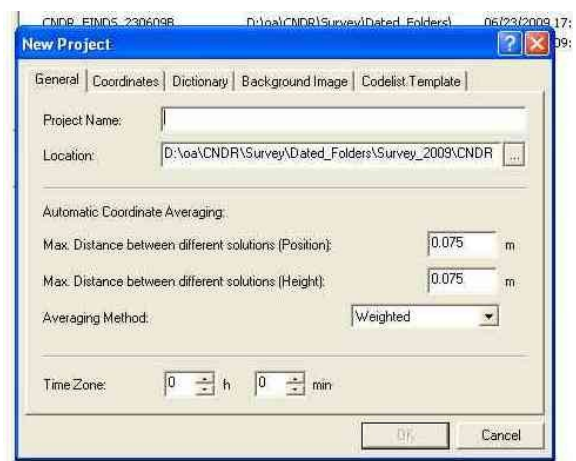
- Navigate to *Project\Survey\dated folders\Survey*
- Copy the folder called **TST_DATE_Template** and paste it into the same folder. Rename it with the date of your survey job. (*Project_TST_#####*)
- Open LEICA Geo Office Combined
- select "Projects"
- Select **New project** (white sheet symbol to the top left)



In the General Tab:

Project Name: *Project_##### (date)*

Location: *Project\Survey\Dated folders\folder with correct date\LGO Project*



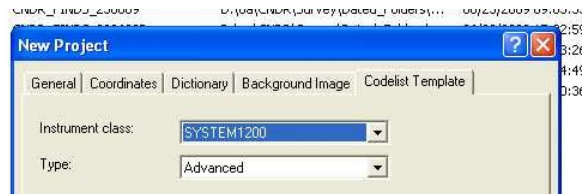
Coordinates Tab:

Coordinate system: OSGB36



Codelist Template:

Leica System 1200 – Advanced

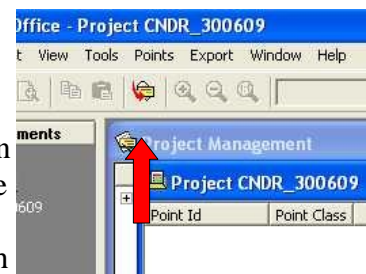


Hit “OK”

Now you need to import the raw data.

Ensure that the card is in the card reader.

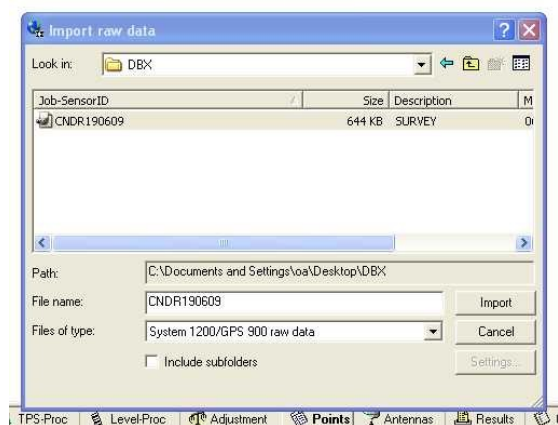
Usually the CF card will have to go straight back into the Total Station on site to ensure survey coverage. Therefore it is advisable to copy the data from CF card\DBX to a folder on the PC (e.g. Temporary_Survey_Download on the desktop). Copy all the files with the job's name to this folder.



Go to Import - Raw data or hit the equivalent button on the toolbar.

Locate to the CF card\DBX\the project you want to import or to the folder on the PC containing the raw data copied across earlier (Temporary_Survey_Download on the desktop)

Click import.



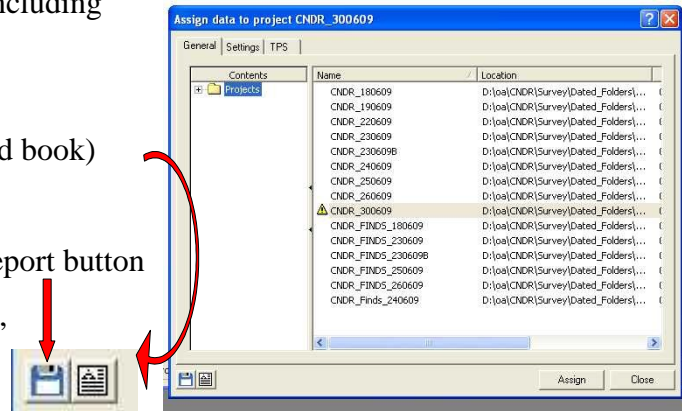
A screen will pop up with a list of projects, including yours, make sure it is highlighted.

Click the icon with the text on it (display field book)

Click the floppy disc next to the Fieldbook report button – this saves back the raw data.
It is saved into the folder “Backup_raw_data” in the Dated Folder.

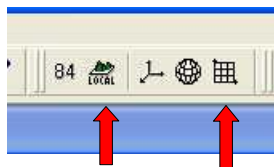
Now click “Assign”

Now click “Close” to close the dialogue.



Leica GeoOffice will show a series of points as text.

Click **Local** then **Grid** (top right)

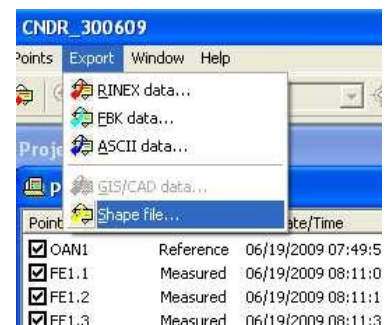
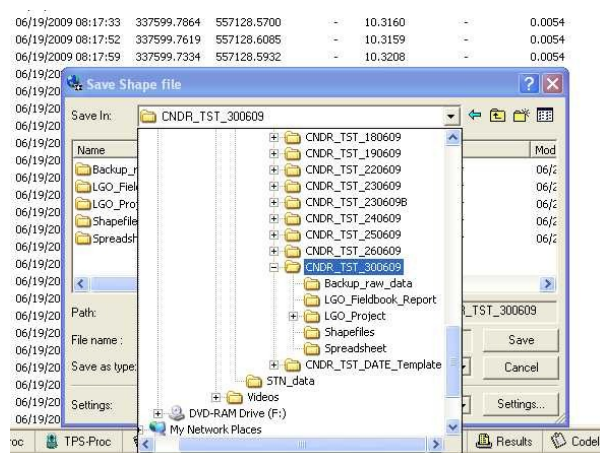


Point Id	Point Class	Date/Time	Easting	Northing	Ell. Hgt.	Ortho. Hgt.	Geoid Sep.	Posn. + Hgt.	City
QAN1	Reference	06/19/2009 07:49:51	337597.2960	557165.3970	11.7560	10.0000	0.0000		
FE1.1	Measured	06/19/2009 08:11:05	337600.1503	557128.5283	-	10.3121	-	0.0054	
FE1.2	Measured	06/19/2009 08:11:19	337600.1158	557128.5626	-	10.3150	-	0.0054	
FE1.3	Measured	06/19/2009 08:11:36	337600.0856	557128.5346	-	10.3100	-	0.0054	
FE1.4	Measured	06/19/2009 08:11:45	337600.0996	557128.5023	-	10.3121	-	0.0054	
R0101	Measured	06/19/2009 08:12:23	337600.1266	557128.5334	62.8159	10.3131	52.8028	0.0054	
FE3.1	Measured	06/19/2009 08:17:33	337599.7864	557128.5700	-	10.3160	-	0.0054	
FE3.2	Measured	06/19/2009 08:17:52	337599.7619	557128.6085	-	10.3159	-	0.0054	
FE3.3	Measured	06/19/2009 08:17:59	337599.7334	557128.5932	-	10.3208	-	0.0054	
FE3.4	Measured	06/19/2009 08:18:06	337599.7223	557128.5526	-	10.3170	-	0.0054	
FE3.5	Measured	06/19/2009 08:18:13	337599.7593	557128.5328	-	10.3182	-	0.0054	
FE2.1	Measured	06/19/2009 08:19:38	337599.7393	557128.0264	-	10.3149	-	0.0054	
FE2.2	Measured	06/19/2009 08:19:46	337599.7141	557128.0325	-	10.3191	-	0.0054	
FE2.3	Measured	06/19/2009 08:19:52	337599.6889	557128.0168	-	10.3197	-	0.0054	
FE2.4	Measured	06/19/2009 08:20:00	337599.6910	557127.9837	-	10.3208	-	0.0054	
FE2.5	Measured	06/19/2009 08:20:07	337599.7294	557127.9894	-	10.3188	-	0.0054	
FE4.1	Measured	06/19/2009 08:20:38	337599.5949	557128.5703	-	10.3207	-	0.0054	
FE4.2	Measured	06/19/2009 08:20:44	337599.6501	557128.6159	-	10.3218	-	0.0054	
FE4.3	Measured	06/19/2009 08:20:50	337599.6435	557128.6607	-	10.3217	-	0.0054	
FE4.4	Measured	06/19/2009 08:20:57	337599.5853	557128.6890	-	10.3230	-	0.0054	
FE4.5	Measured	06/19/2009 08:21:04	337599.5535	557128.6480	-	10.3220	-	0.0054	
FE4.6	Measured	06/19/2009 08:21:11	337599.5492	557128.5915	-	10.3207	-	0.0054	
FE4.7	Measured	06/19/2009 08:21:18	337599.5918	557128.5700	-	10.3221	-	0.0054	
FE5.1	Measured	06/19/2009 08:21:43	337599.4993	557128.5411	-	10.3243	-	0.0054	
FE5.2	Measured	06/19/2009 08:21:49	337599.5400	557128.5910	-	10.3211	-	0.0054	
FE5.3	Measured	06/19/2009 08:21:54	337599.5190	557128.6379	-	10.3204	-	0.0054	
FE5.4	Measured	06/19/2009 08:22:01	337599.4558	557128.6198	-	10.3254	-	0.0054	
FE5.5	Measured	06/19/2009 08:22:07	337599.4530	557128.5685	-	10.3240	-	0.0054	
FE5.6	Measured	06/19/2009 08:22:12	337599.4830	557128.5502	-	10.3241	-	0.0054	
FE5.1	Measured	06/19/2009 08:22:36	337599.4618	557128.7305	-	10.3259	-	0.0054	

The next step extracts the data that will be input into GIS :

Select:

– Export - Shape file



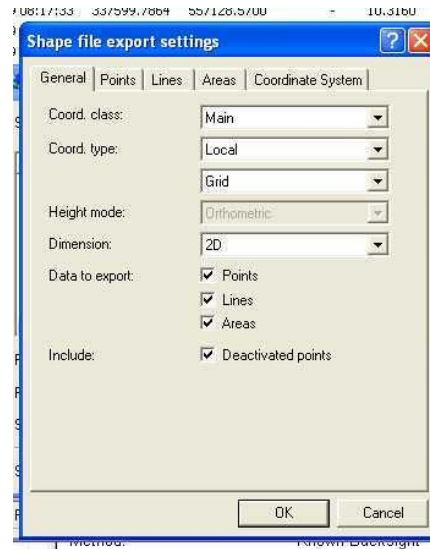
Navigate to your D:\oa\Project\Survey\Dated_Folders\Project_date\Shape file\2D
Go into “settings” and ensure that 2D is selected.

In case you are running LGO for the first time since installation, use the tabs at the top to determine exactly what type of data will be embedded into each type of survey object.
This should, by default be defined as:

Points: Point code
Attribute 1
Point ID

Northing/Lat
Easting/Long
Height

Lines: Line Code ID
Attribute 1
Line ID

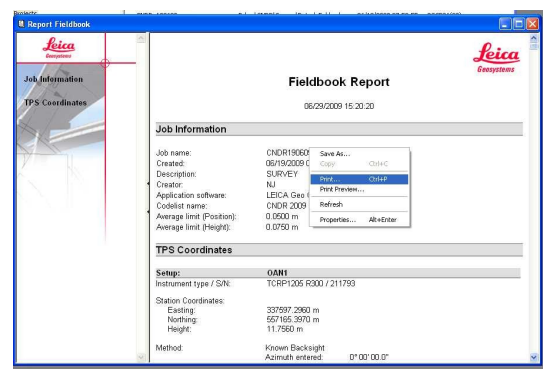


Repeat the above for 3D shapefiles. (using the 3D folder)

Click “Save”.

Export ASCII data in the same manner, saving it into the “Spreadsheet” folder.

Now right click on the fieldbook report in Leica GeoOffice and print it as a PDF using the PDFCreator. It will be called the same as the job and save it in your dated folder\LGO_Fieldbook_Report.



Ensure you name each saved item (or group of items in the case of shapefiles) with the name of the job and save it in the dated folder/appropriate folder!!!

Please ensure you name everything appropriately and in the same way as the previous survey!

Close Leica Geo Office.

Protocols for inputting data into GIS

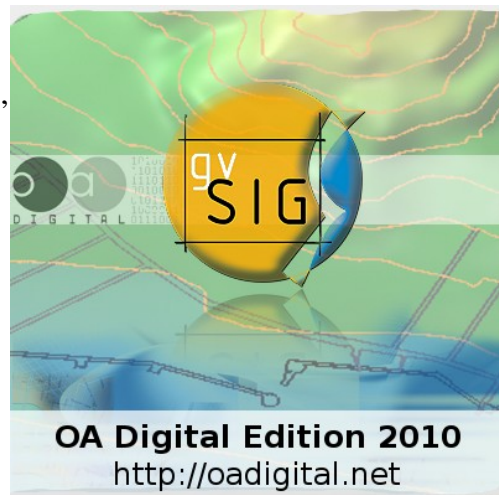
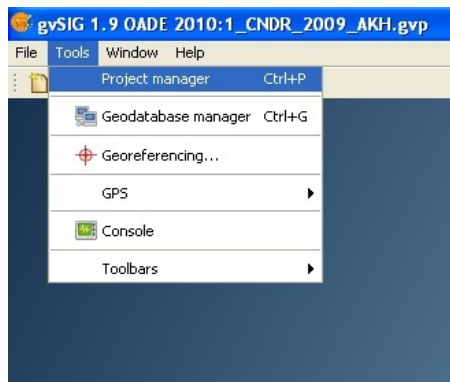
by Anna Hodgkinson

with extracts from Ducke, B. 2008, “An Introduction to gvSIG Open Source GIS on Windows”

The GIS software package used is called gvSIG. It is an open source program developed by the Government of Valencia, Spain. The particular package we use is the OA Digital 2010 Edition, based on gvSIG 1.10, adapted by Ben Ducke.

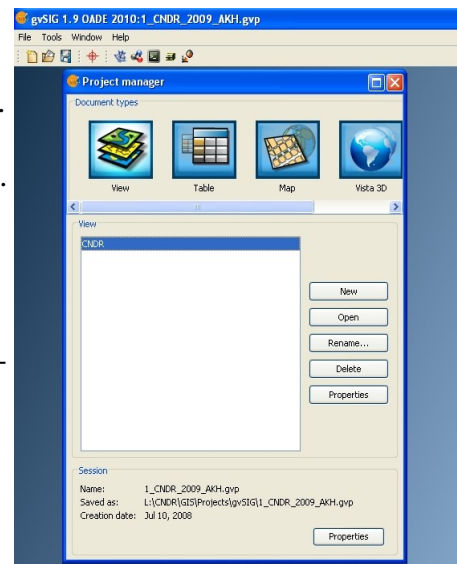
The following instructions are based on the assumption that the user is operating a Microsoft Windows computer.

- Open the current gvSIG project, usually stored in D:\Project\GIS\projects\gvSIG
- Open the project by double-clicking – gvSIG opens
- If no map is displayed go “Show – Project Manager”

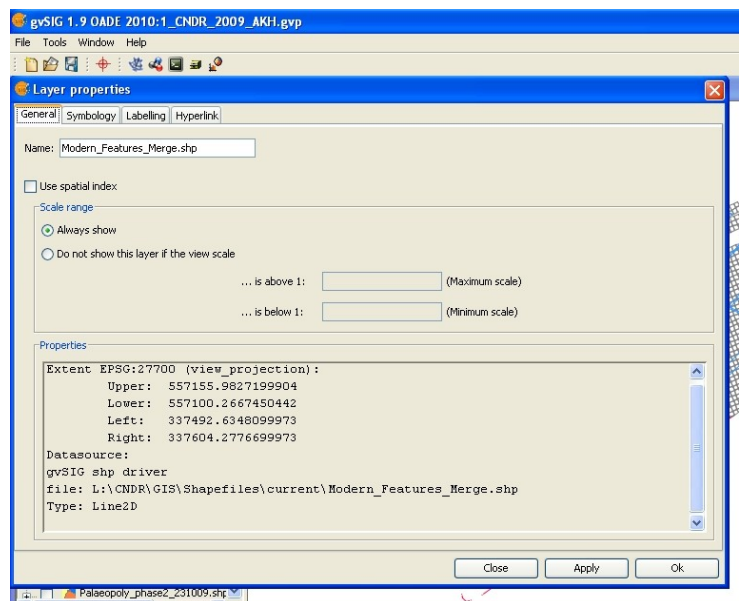
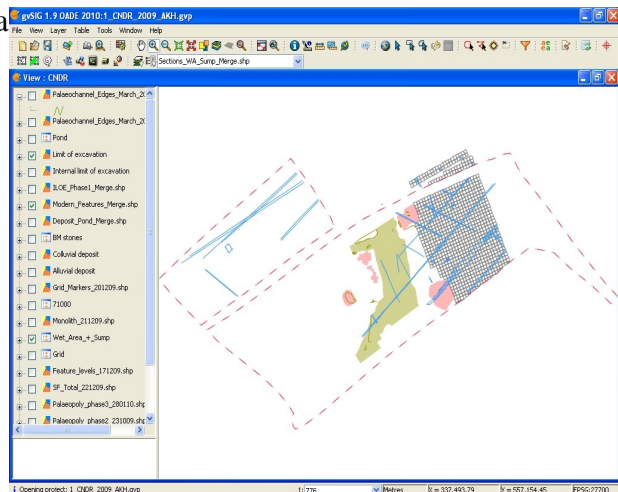
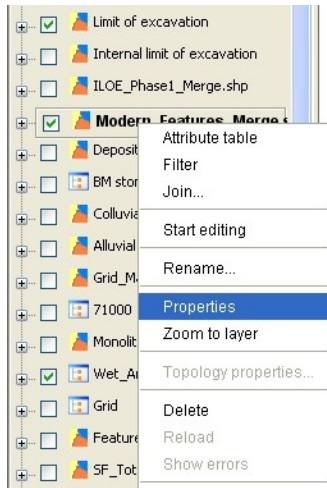


The Project Manager

- The Project Manager provides a way of working with several data views and map layouts within one project. It contains the sections “View”, “Table” and “Map”.
- You will need to get back to the project manager often. To do so, choose “Window - Project manager” from the main menu.
- Select “**View**” and highlight the view you wish to see - click “open”: The view will be displayed.



- The view usually contains all the relevant data from the present fieldwork.
- The data is displayed in layers, which are saved as shapefiles and referenced externally:
- Highlight (by clicking onto) one of the layers and right-click. Select “Properties”: This will show you, amongst other information, the filepath that this file is stored at.



- The filepath for all the current layers in the GIS project are stored in **Project\GIS\shapefiles\current!**
- ONLY the current layers can be stored here, the old ones are to be removed to the folder **Project\GIS\shapefiles\old** as soon as the update has been undertaken
- The file may be listed under a different name in gvSIG – this is because it is possible to rename the individual layers once they have been imported into GIS:

“Archaeological Features is the layer name, whilst the shapefile is called “Arch_features_240609”

The tabs at the top of the “Properties” Window give the options to change a particular layer's appearance in the “Symbology” tab and also to display attribute data in the “Labelling” tab.

The data you will deal with:

The survey data which will be input into the current GIS project will have the same format as the existing data and it will consist of the shapefiles you produced during survey (see above).

Check your dated survey folder – shapefiles for what data you have actually imported:

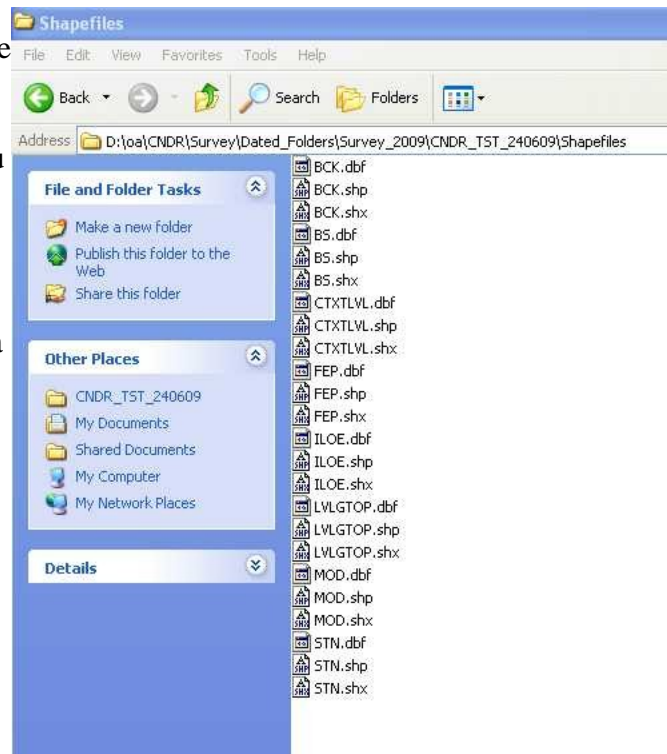
Remember:

There are three files (at least) to every shapefile (.shp, and .dbf are always present)

The files are named exactly as the CODES you used during survey – therefore you should be able to recognise these names from the features, finds etc. you surveyed.

As mentioned above, you survey only line data and point data. Therefore take a moment to look at your data and take a note at what's what.

ONLY the line data gets imported directly into the GIS, the point data is added manually.



Delete the old layers from the project once the new ones have been uploaded!

Point and Line data:

Open the main view of the gvSIG project (unless, of course, it is already open).

The codes used for this have a description each: eg. ILOE = Internal Limit of excavation, relating to a layer in the GIS project (see [Appendix 2](#)).

Your survey data will (probably) include archaeological features. These will be on the “FEP” code in the Total Station, therefore downloaded into your dated shapefiles folder as “FEP” and the GIS project will include a layer called “Archaeological_features_110609” (the shapefile is dated).

The date does not have to be that of the previous day – it depends on whether any archaeological features were surveyed that day or not.

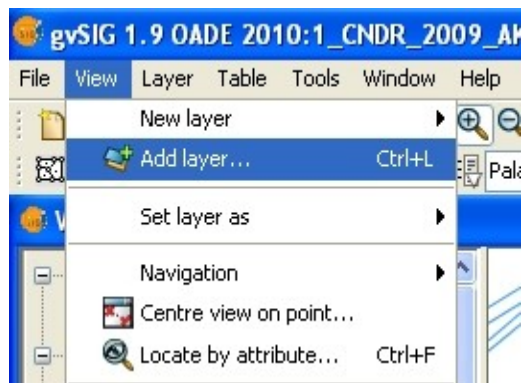
The following point-shapefiles from your survey folder will not be included in the update and do not need to be updated:

- **STN** – as these remain constant
- **BCK** – is for reference only in case the survey data looks wrong after it has been imported into GIS (in which case import the BCK point – one should be taken at for each survey setup – and check whether it is in the same location as your backsight-point)
- **NOCODEPOINT**: open the .dbf file of the NOCODEPOINT shapefile and check whether it contains any finds or other point data you might have forgotten to code up. Open the file with *scal*c (OpenOffice Spreadsheet), **NOT** with Microsoft *Excel*!!! If you surveyed following the above instructions, you should have no data on wrong layers!!!

Now: add the fresh survey data.

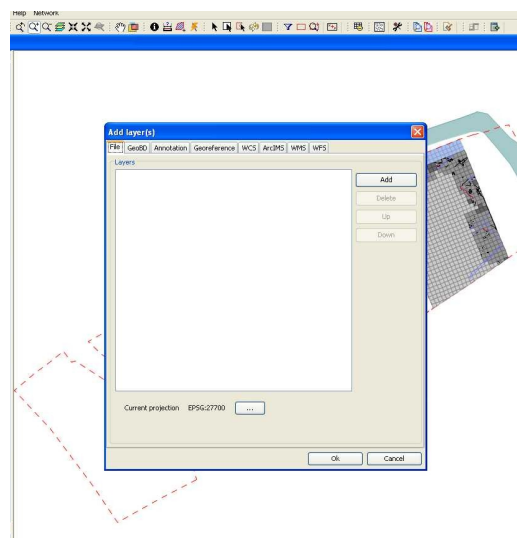
Shapefiles are imported **ONE AT A TIME** and dealt with separately to avoid errors!!!

Choose “View - Add layer” from the main menu or click on the layer icon in the icon bar.



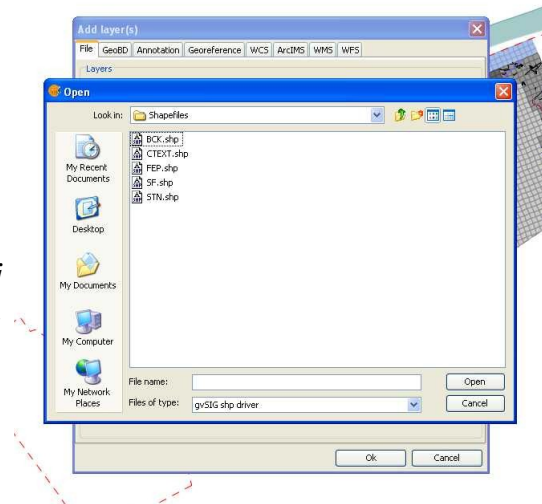
The “Add layer” dialog will pop up.

Make sure the “File” tab is selected and choose “Add”.

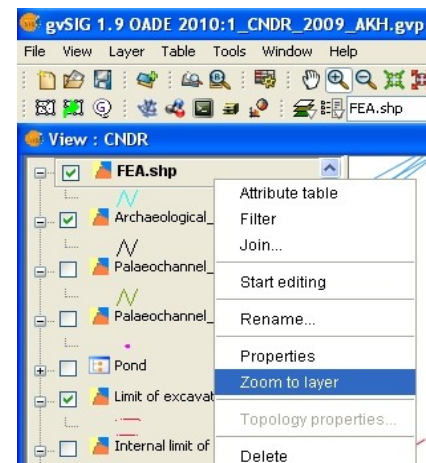


Ensure the option “Shapefile” is selected.

Navigate to
D:\oa\Project\Survey\Dated_Folders\Survey_2009\Project_TST_DATE\shapefiles\2D and select one line layer.
Then click “OK”. The shapefile will now be added to the layer list of the active view.



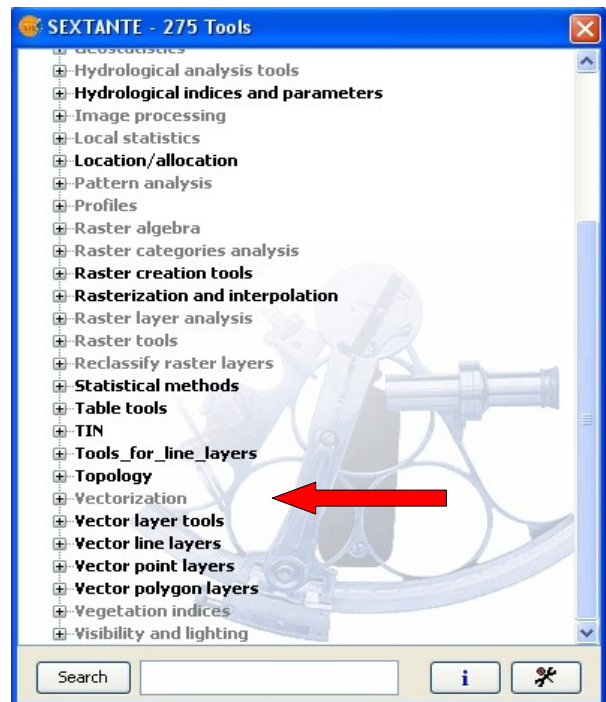
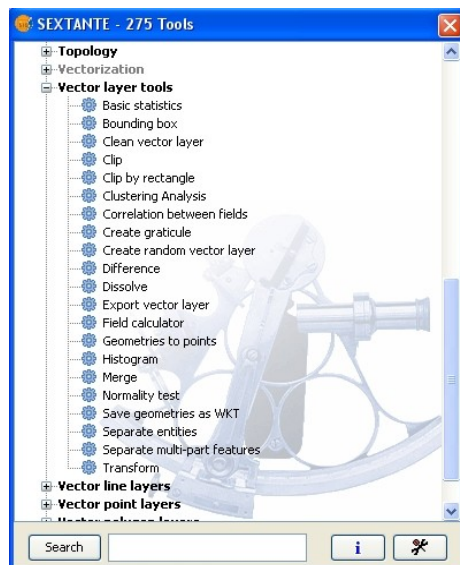
If you cannot see anything: Use “zoom to layer” from the layer context menu (right mouse button) to zoom to the extents of a specific layer .



Merging and updating the data:

Open the Sextante Toolbox by clicking on the small icon at the top left of the gvSIG toolbar.

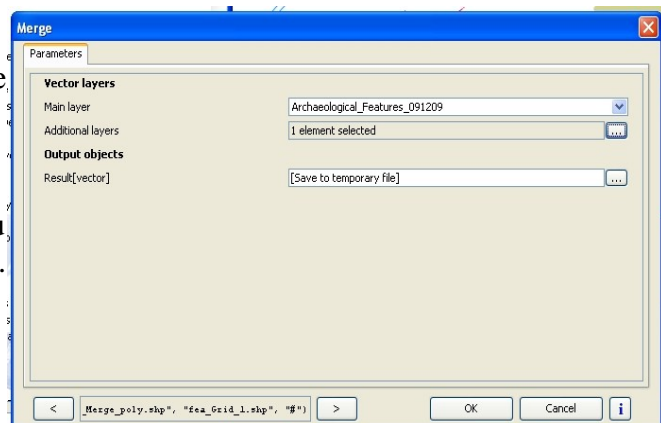
The toolbox will pop up displaying a list of functions. Click on the “+” in front of “Vector Layer Tools” and then double-click on “Merge”



Another window will pop up, asking you to specify the main / source layer: This will be the shapefile already existing in your project with a date, eg “Archaeological Features”.

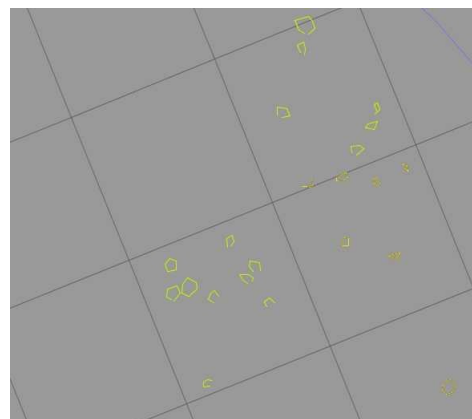
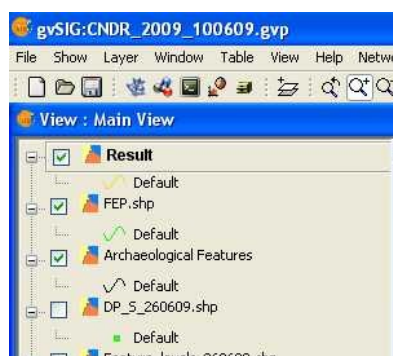
Select your input layer: select the shapefile you have just imported - “FEP” and click “Accept”.

The output should be saved as a temporary file initially, for the sake of security.



Click “Okay” - a layer will be produced that contains all the features you surveyed today plus all those features surveyed at earlier dates.

Make sure that everything appears in the correct place.



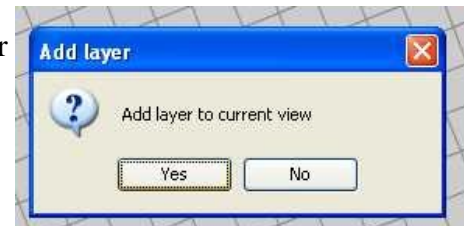
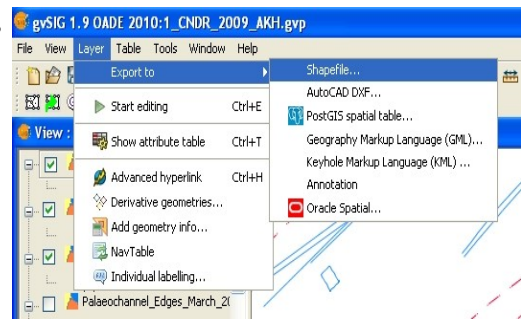
NOW save this result:

Highlight the layer called “Result” and go “Layer – save as – Shapefile” in the gvSIG toolbar.

Navigate to the *Project\GIS\shapefiles\current* folder and click ONCE on the previous layer which you just merged with your survey data.

The name will be displayed on the input bar, so all you need to do now is change the date (instead of overwriting the original file) and save it.

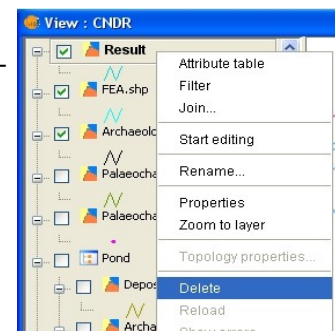
gvSIG will ask you whether you would like to add the new layer to the view - “Yes”



Now – Delete the **Result**, the **surveyed** shapefile you added to the project AND the **shapefile** you merged it with from the project by right-clicking onto each layer when highlighted and selecting “Delete layer” and confirming this.

Repeat this procedure for each shapefile you downloaded.

Close the project and save the changes.



Now go to *Project\GIS\shapefiles\current* and select the three files off each shapefile you have updated. Cut them and paste them into *Project\GISshapefiles\old*

This practise ensures that all layers are up-to-date and clean, and all original survey data remains untouched and safe.

FOR AN EXAPLE SET OF METATADA SEE Appendix 3

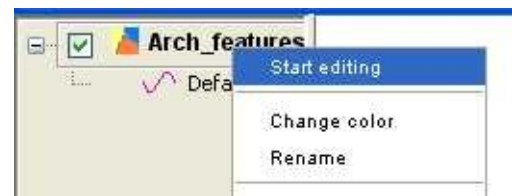
Editing Shapefiles

It can happen that survey data looks slightly messy when exported. This is due to the fact that we survey to a millimetre's accuracy and the end- and mid-points of lines do not always snap together.

This is only applied to the merged shapefiles which are edited, the original survey data remains untouched and backed-up, in case it may have to be re-imported.

The tools described in the following are also used whilst digitising plans, but only represent a limited choice of editing tools – in fact only those used for very basic edition. For more options, please consult further documentation.

Highlight the layer you wish to edit and select “Start Editing”.



The layer's name turns red and the view will be halved by a command line that pops up at the base. You can minimise this by clicking onto the arrow pointing downwards to the top right of this bar – usually it is not required.

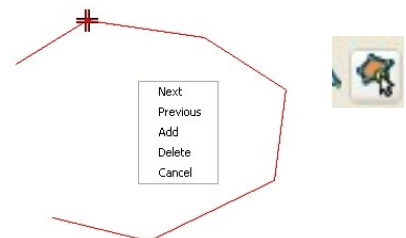


Close your open polygons by selecting to draw a polyline. Snap these to the end points of your open feature.

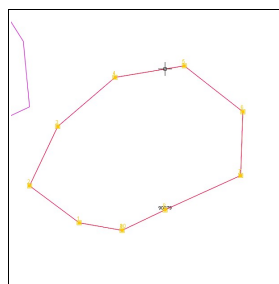


Should you have taken a point in the wrong position choose “edit vertex”, click once onto the point you wish to remove, then right-click onto it and select “Delete”.

You can also add further vertices by choosing “Add”.



The “Selection” button on the toolbar will enable the editing and re-placing of individual nodes.

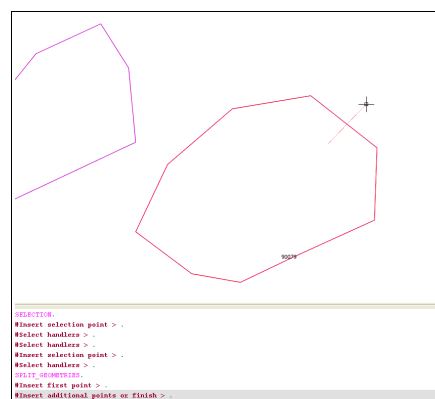


Line data can be split by using the “Split Geometries” tool:

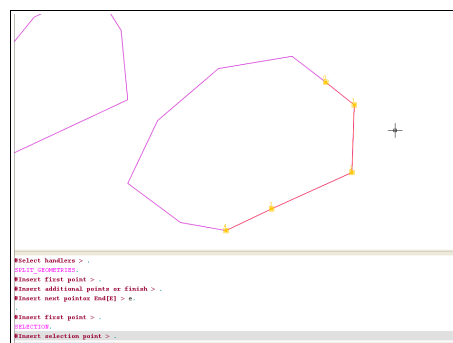


Select the feature to be edited and select the “Split geometries” tool.

Draw a line from a point not on the feature you wish to edit to the point you wish to break it at and then another point on the same line (or a line with two points crossing over the breaking point).



Then type “e” and hit “enter”. The line will be split at the point defined and two separate geometries will have been created.



Closed polygons are produced with tools found in the Sextante toolbox, such as the “Polygonize” function.

Editing and attaching attribute data:

The following can be applied for a whole range of attribute data editions, the example represents the attaching of context numbers to surveyed features.

Levels with context numbers attached will have been surveyed in the field and these points will be displayed within the archaeological feature layer. Label these points with the “point_ID” field.

Start editing the shapefile and open the attribute table. Select “Table” (top toolbar) - “Manage fields” and add a column to the table re-naming it “Context”.

Now highlight one feature in the attribute table by clicking on it and “Zoom to selection”:



Note the context number of the level within this feature.

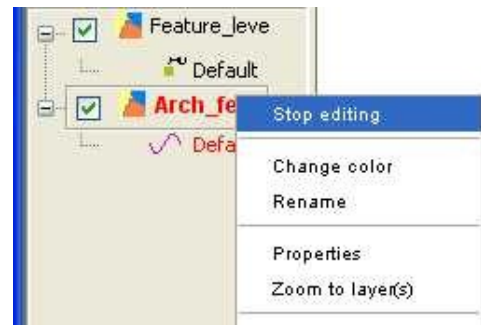
Enter the context number in the first column of the attribute table of the highlighted feature and hit enter.

Attribute	Line_Code	Line_ID	Excavate
90098	FEP	Line0004	False
90097	FEP	Line0005	False
90096	FEP	Line0006	False
90099	FEP	Line0007	False
90100	FEP	Line0008	False
90095	FEP	Line0009	False
90103	FEP	Line0011	False
90104	FEP	Line0012	False
90110	FEP	Line0013	False
90107	FEP	Line0014	False
90108	FEP	Line0015	False
90109	FEP	Line0016	False
90111	FEP	Line0017	False
90112	FEP	Line0018	False
70057	FEP	Line0021	true
90114	FEP	Line0022	False
90113	FEP	Line0023	False

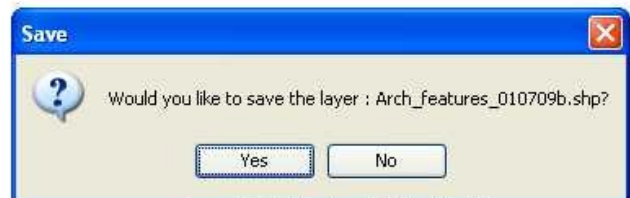
90108

When finished editing:

Do not forget to right-click on the layer again and select “Stop editing”.



A dialogue will appear asking whether you would like to save the edits – Select “Yes”. The edits to the shapefile will be saved externally.



If you are uncertain and would rather keep a copy of the old shapefile, create a copy of the main shapefile (appropriately named) and practice editing data in this.

Adding Tables / Events Layers to gvSIG

This methodology describes how to create tables of points with known co-ordinates and how to load them into gvSIG. It is for example useful for merging existing points shapefiles with additional surveyed ones, or for creating lists of points for reference.

The described sequence deals with the merging of new survey data with the main datasets after two different types of survey equipment were used on site and the data could no longer be merged using the Sextante Toolbox in gvSIG. It is, nevertheless, applicable to a broad range of data management methodologies.

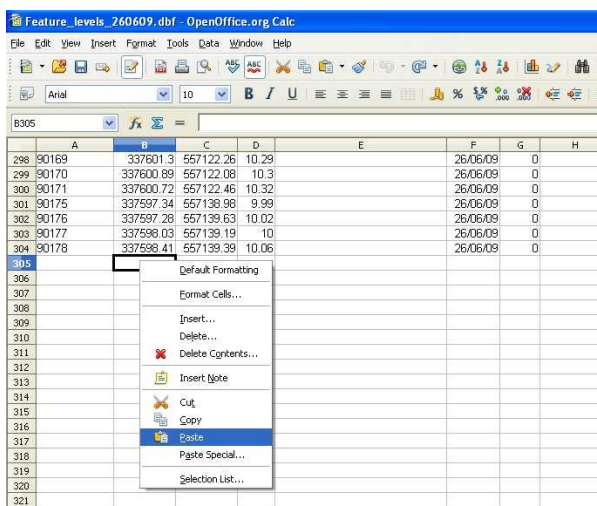
Open, in separate explorer windows, both the dated shapefile folder and the *Project\GIS\shapefiles\current\CSV_current* folder

Now open one of your .dbf files from your dated shapefile folder.

Open the equivalent .dbf file in *Project\GIS\current\CSV_Current* folder. Open both using *scal* (OpenOffice spreadsheet tool).

Copy the point ID, the Eastings and Northings and Elevations of the dated shapefile and paste and arrange them in the main spreadsheet. Highlight the Easting, Northing and Elevation columns in the main spreadsheet by clicking onto their letters “B,C,D” at the top. Right-click and go “format cells”. Now specify to display 3 decimal places.

CTXLVL.dbf - OpenOffice.org Calc											
File Edit View Insert Format Tools Data Window Help											
<div>Standard toolbar icons: Undo, Redo, Cut, Copy, Paste, Find, Print, Insert, Format, Bold, Italic, Underline, Bulleted List, Numbered List, Table, Merge, Sort, Filter, etc.</div>											
B2:D19 fx 10.29952											
	A	B	C	D	E	F	G	H	I		
1	Date Time C,254	Easting	Lo	Northing	L	Ortho	Point	O	Point_Co	Point	3D_Coord,N,16,8
2	06/19/2009 14:03:34	337548.69	557125.22	8.5	MEAS	CTXLVL	70057	0.01			
3	06/19/2009 08:28:00	337599.72	557128.56	10.32	MEAS	CTXLVL	90093	0.01			
4	06/19/2009 08:29:03	337599.75	557128.56	10.32	MEAS	CTXLVL	90094	0.01			
5	06/19/2009 08:30:09	337599.86	557128.92	10.32	MEAS	CTXLVL	90095	0.01			
6	06/19/2009 08:29:51	337599.48	557128.78	10.32	MEAS	CTXLVL	90096	0.01			
7	06/19/2009 08:29:36	337599.49	557128.58	10.32	MEAS	CTXLVL	90097	0.01			
8	06/19/2009 08:29:22	337599.59	557128.62	10.32	MEAS	CTXLVL	90098	0.01			
9	06/19/2009 08:28:48	337599.96	557128.69	10.31	MEAS	CTXLVL	90099	0.01			
10	06/19/2009 08:28:33	337600.02	557128.77	10.31	MEAS	CTXLVL	90100	0.01			
11	06/19/2009 08:12:23	337600.13	557128.53	10.31	MEAS	CTXLVL	90101	0.01			
12	06/19/2009 11:13:49	337588.06	557146.73	10	MEAS	CTXLVL	90103	0.01			
13	06/19/2009 11:13:33	337588.52	557146.79	10	MEAS	CTXLVL	90104	0.01			
14	06/19/2009 11:55:47	337600.66	557129.53	10.31	MEAS	CTXLVL	90107	0.01			
15	06/19/2009 11:55:53	337600.75	557129.68	10.28	MEAS	CTXLVL	90108	0.01			
16	06/19/2009 11:55:57	337600.78	557129.79	10.3	MEAS	CTXLVL	90109	0.01			
17	06/19/2009 11:56:01	337600.22	557129.77	10.31	MEAS	CTXLVL	90110	0.01			
18	06/19/2009 11:56:05	337600.33	557130.16	10.3	MEAS	CTXLVL	90111	0.01			
19	06/19/2009 11:56:09	337600.35	557130.3	10.3	MEAS	CTXLVL	90112	0.01			



	A	B	C	D	E	F	G	H
298	90169	337601.3	557122.26	10.29		26/06/09	0	
299	90170	337600.89	557122.08	10.3		26/06/09	0	
300	90171	337600.72	557122.46	10.32		26/06/09	0	
301	90175	337597.34	557138.98	9.99		26/06/09	0	
302	90176	337597.28	557139.63	10.02		26/06/09	0	
303	90177	337598.03	557139.19	10		26/06/09	0	
304	90178	337598.41	557139.39	10.06		26/06/09	0	
305								
306								
307								
308								
309								
310								
311								
312								
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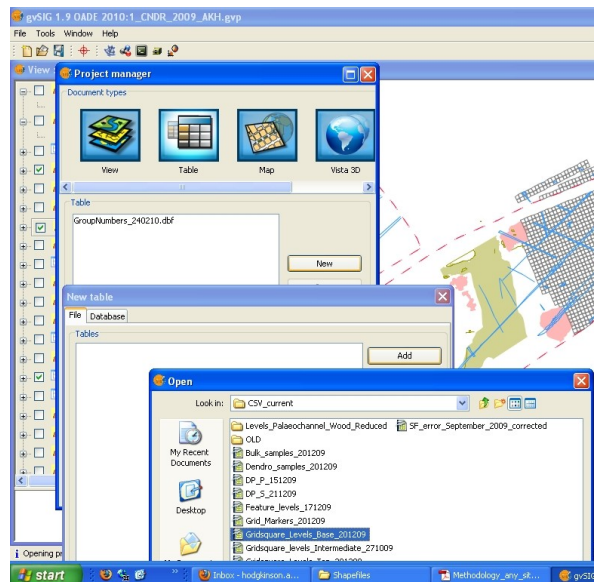
Once the old main .dbf file has been updated, hit “file – save as” and save it in the CSV_Current folder with the **same name but current date**.

Cut the old .dbf file and paste it into the “Old” folder in CSV_Current.

Repeat the above for each points layer, not altering the dated survey shapefile's .dbf file.

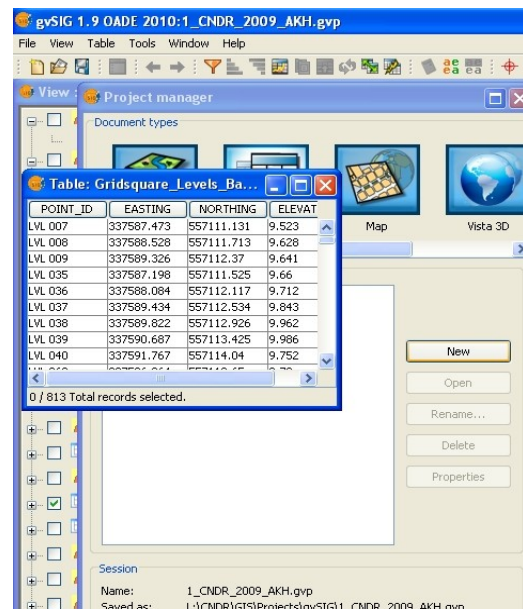
Hit “Show – Project manager” and highlight the “Tables”. Click “new”.

Navigate to the new current .dbf file you just stored in CSV_current and hit “open”.



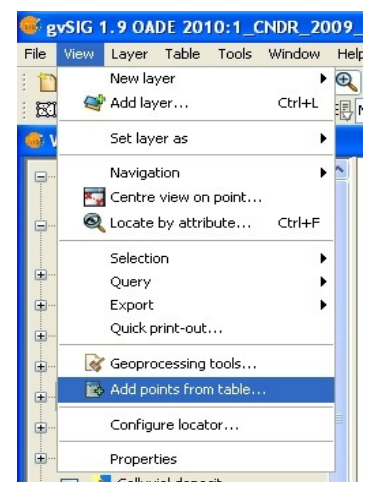
Once you have clicked “Okay” the table should open, displaying a list of points – in fact the same points contained in the .dbf file.

Close this table and close the Project Manager.



Open the main view of the gvSIG project (unless, of course, it is already open).

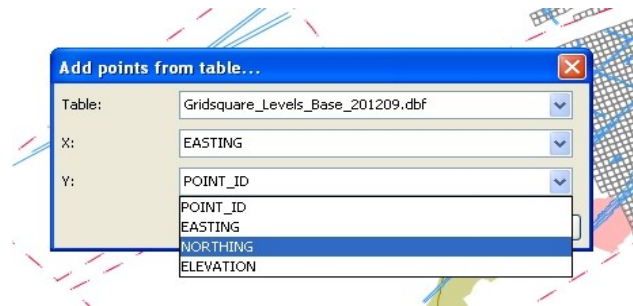
The following step allows one to add the points file as a layer: Go to “View” - “Add points from table”



Now select the table you just added to the project from the drop-down menu.

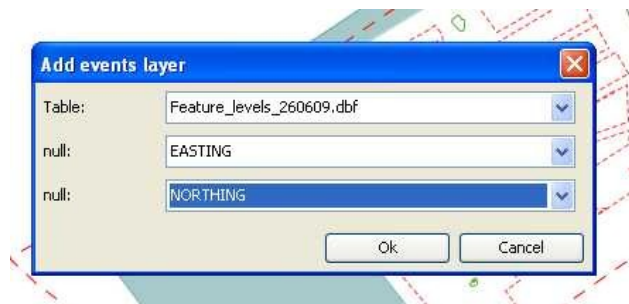
Define “Easting” and “Northing” as input locators and hit “OK”

The points contained in the data-table will be displayed as a layer in gvSIG



Activate this function and select the table you just added to the project from the dropdown menu. Define “Easting” and “Northing” as input locators and hit “OK”

The points contained in the data-table will be displayed as a layer in gvSIG



Now save this data as a shapefile:

- Highlight the layer created which ends in “.dbf” and go “Layer – save as – Shapefile” in the gvSIG toolbar
- Navigate to the *Project\GIS\shapefiles\current* folder and click ONCE on the previous layer
- Change the date (instead of overwriting the original file) and save it.
- gvSIG will ask you whether you would like to add the new layer to the view - “Yes”
- Now – Delete the old complete shapefile AND the .dbf layer from the project by right-clicking onto each layer when highlighted and selecting “Delete layer” and confirming this.
- Now go to *Project\GIS\shapefiles\current* and select the three files off each shapefile you have updated. Cut them and paste them into *Project\GISshapefiles\old*

Joining tables

The following description is based on data tables exported from a MS Access database and therefore the exporting procedure forms the first part of this chapter. It is, however, possible, to link any .dbf file to a layer file in gvSIG, as long as

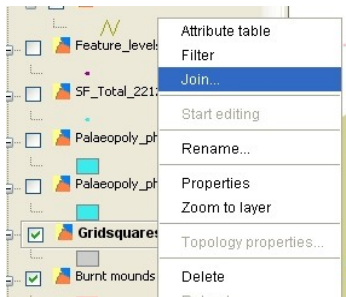
- a) they share a common field usable as a linking field, such as a key and
- b) this common field is of exactly the same data type in both tables.

Exporting the data-table from MS Access

- Open the MS Access database and the table you wish to join with a layer in gvSIG.
- Do “File – Save as/Export” to export this table as an XLS (3) file. Save it and then open the XLS file (in either OpenOffice or MS Excel) and save it as a DBase (.dbf) file.

Creating the join

- Open the Project Manager in gvSIG and add the .dbf file just created to the project (using the “Table” tab)
- Ensure the shapefile/layer you wish to link to the data-table is uploaded.
- Open its attribute table.
- Right-click on the layer in the TOC and select “Join”. This activates the “join-table” function.

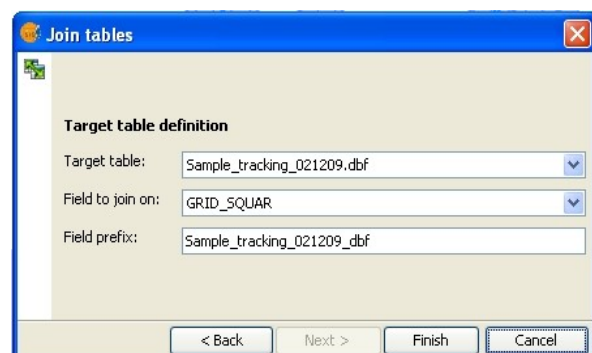


ADMAPKEY
13.0
14.0
15.0
16.0
17.0
35.0
36.0
37.0
38.0
39.0
40.0
63.0
64.0
65.0
66.0
67.0
68.0
69.0
70.0
71.0
72.0
91.0
92.0
93.0
94.0
95.0
96.0
97.0
98.0
99.0
100.0
101.0
102.0
103.0

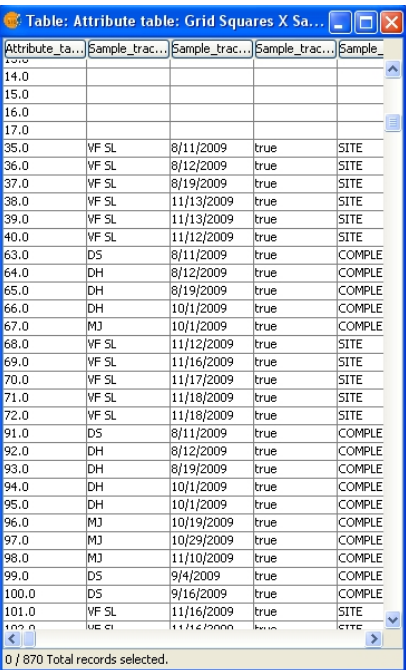
- A dialogue will pop up asking you to specify the main layer: This will be the attribute table just opened.
- Specify the field to join to: This is the field both tables have in common.
- The Field Prefix for the first field is defined automatically, but can be changed if wished.
- Hit “Next”



- Then select the target table: this is the table you wish to add to/join into the source table
- Select the field to join to: This, again, is the field both tables have in common.
- Hit “Finish”



- The external table's fields will now have been appended to the layer's attribute table:



Attribute	Sample	Date	Status
14.0			
15.0			
16.0			
17.0			
35.0	VF SL	8/11/2009	true SITE
36.0	VF SL	8/12/2009	true SITE
37.0	VF SL	8/19/2009	true SITE
38.0	VF SL	11/13/2009	true SITE
39.0	VF SL	11/13/2009	true SITE
40.0	VF SL	11/12/2009	true SITE
63.0	DS	8/11/2009	true COMPLE
64.0	DH	8/12/2009	true COMPLE
65.0	DH	8/19/2009	true COMPLE
66.0	DH	10/1/2009	true COMPLE
67.0	MJ	10/1/2009	true COMPLE
68.0	VF SL	11/12/2009	true SITE
69.0	VF SL	11/16/2009	true SITE
70.0	VF SL	11/17/2009	true SITE
71.0	VF SL	11/18/2009	true SITE
72.0	VF SL	11/18/2009	true SITE
91.0	DS	8/11/2009	true COMPLE
92.0	DH	8/12/2009	true COMPLE
93.0	DH	8/19/2009	true COMPLE
94.0	DH	10/1/2009	true COMPLE
95.0	DH	10/1/2009	true COMPLE
96.0	MJ	10/19/2009	true COMPLE
97.0	MJ	10/29/2009	true COMPLE
98.0	MJ	11/10/2009	true COMPLE
99.0	DS	9/4/2009	true COMPLE
100.0	DS	9/16/2009	true COMPLE
101.0	VF SL	11/16/2009	true SITE
102.0	VF SL	11/16/2009	true SITE

0 / 870 Total records selected.

- You can now highlight the layer in the TOC and save it as a shapefile (Layer – Export as - shapefile)

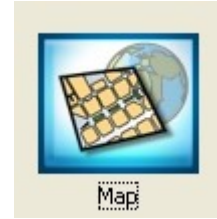
The attribute table of the new shapefile will contain both its original information and the information contained in the joined table!

Printing in gvSIG

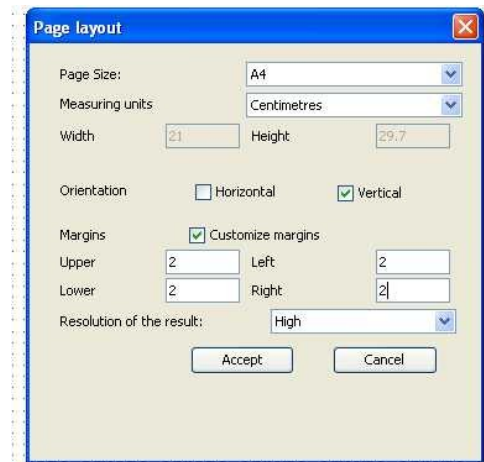
Open the Project manager, and click on “Map” - A list of printable maps will be displayed

Now either

- highlight an existing map and click “open” or
- click “new”, then highlight the new map at the bottom of the list and click “open”



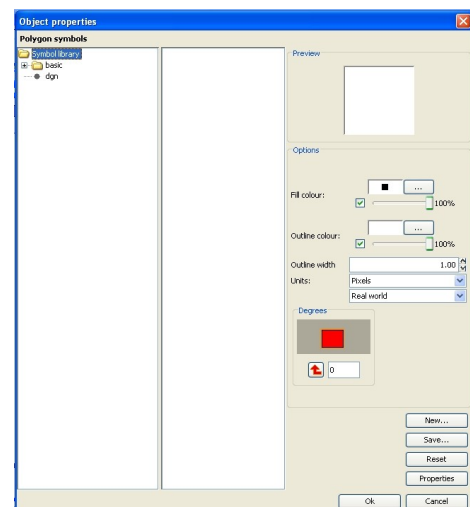
Go to “Map – page layout” and specify page layout. The following is recommended:



Draw a black rectangle onto the margins which will be your boundary for the View.

Draw the line by clicking onto the margin's top left corner, releasing the mouse button and then clicking again directly onto the bottom right corner.

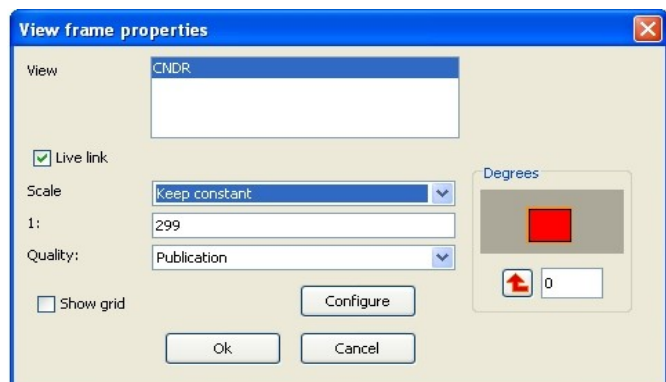
Right-click and “Properties” will allow you to edit this line's appearance:



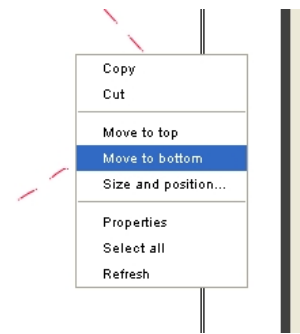
Insert a View, selecting the active view and a “constant” scale – this allows you to define the zoom level manually.



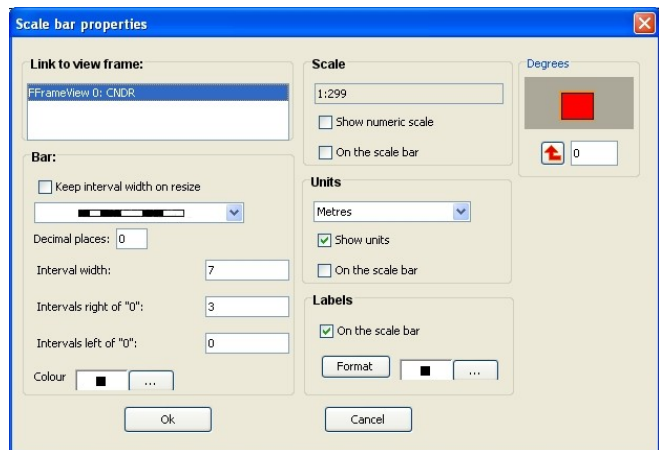
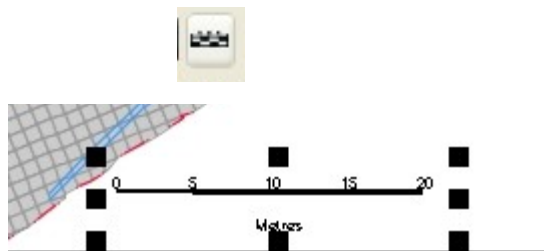
The view is drawn by keeping the mouse button held down whilst drawing the rectangle.



Once the view has been inserted, right-click onto it and move it to the bottom of the map – the line previously drawn will re-appear.

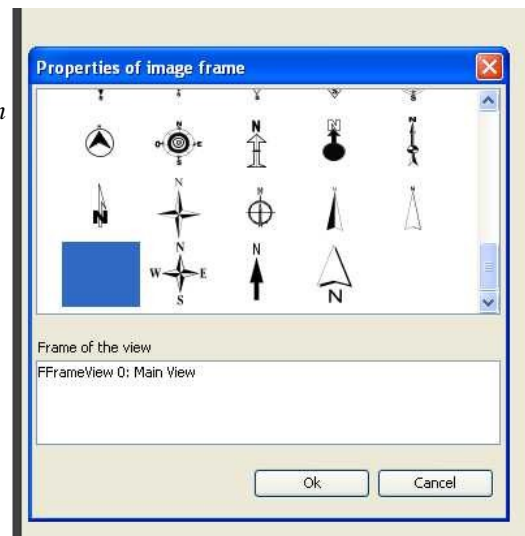
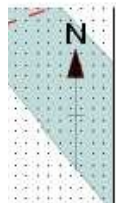


Insert a scalebar and edit its properties. This can sometimes be a little temperamental in gvSIG and requires some patience:

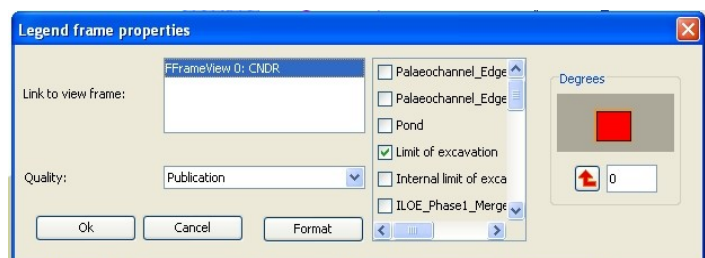


Insert a North Arrow:

OA employees: use the OA North Arrow specified by a blank space in the list of North Arrows.



Insert a legend:



A dialogue will pop up, allowing you to choose from layers you wish to name in the legend – Generally everything shown on the map should be in the legend. You will have to highlight the active view in order to activate the list of options.

The key will generate layer names according to what they are called in the main view – therefore it is sensible to name them appropriately in the TOC before opening the map (right-click – “Rename”).

Draw white rectangles (white fill without transparency) for the Scalebar, North Arrow and Legend if they are on a multicoloured background.

Print your map as a PDF – save in *Project\GIS\Daily_PDF* - make a dated folder and name your map appropriately.



If the map is meant to be included into a report or supposed to serve any other official purpose, the open source vector editing software **Inkscape** is highly useful for editing of PDFs:

- Open the .pdf file in Inkscape
- Then select everything by hitting “ctrl” + “A”
- Go: “Object” - “Ungroup” - repeat this until everything has been ungrouped:
Objects can be moved individually
- Ensure to separate the numbers from the scalebar!
- Draw white rectangles over the margins and arrange items in an appropriate order (“Object” - “Raise” or “Lower”), so that overlapping items are not printed in the margins
- Save the drawing as both .svg and .pdf!

A detailed guide to producing layouts in Inkscape is also available on www.openarchaeology.net.

Georeferencing

These instructions apply to georectified photography and plans drawn on site, which have to be georeferenced prior to digitising.

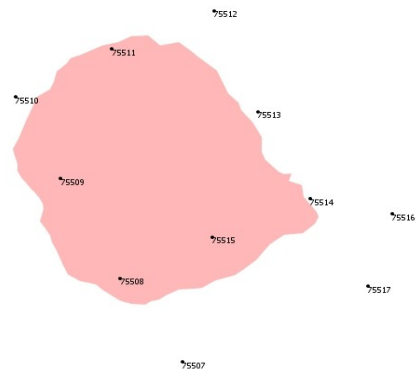
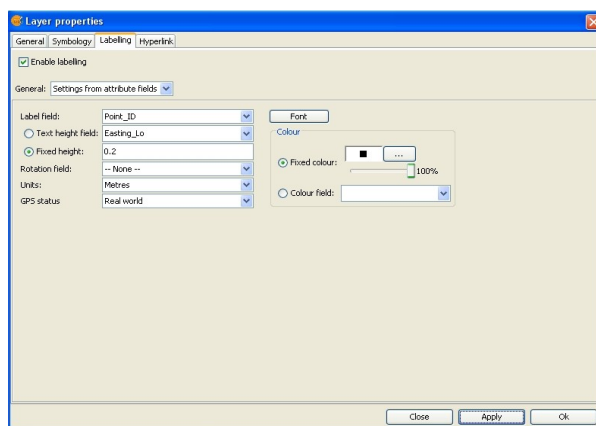
General notes:

- When placing survey target tags in the ground, ensure not to pierce the tag in the centre of the target, but secure it on both sides, leaving the centre of the target, the cross-hairs, clear and accurate. Furthermore, each photograph requires at least four targets placed at the same level, evenly spaced and the photograph must be taken as vertically as possible.
- It is better to use more points rather than less for each georectification in order to achieve the highest level of flexibility and accuracy. The RMS error displayed during the process of georeferencing is an indication of control point placement consistency, **not** the quality of the rectification itself. The georectification should be accurate enough as long as the RMS does not get higher than the required accuracy, (e.g. 0.05 for 5cm). 3 is the minimum for the rectification to actually work, and ideally, control points should be distributed evenly throughout the image. For images that have significant internal "warping" (e.g. old scanned maps, photos of very "curvy" surfaces), at least 7 points should be used. The formula for figuring out the minimum number of control points for a selected order "n" of transformation is: $((n + 1) * (n + 2) / 2) - \text{So } 1\text{st order} = 3, 2\text{nd order} = 6$

Instructions

Open the gvSIG project and ensure that the shapefile containing the surveyed georectification tags has been added as a layer.

Label the points with the point ID – this is done via the properties box of the shapefile in gvSIG. The second tab “symbols” in the properties will allow the labelling style to be defined.



Acquire a copy of the photography or plan register and locate the photographs or plans that are to be rectified.

Open the individual photos using either GIMP or Irfanview and crop them so that the tags form the outer boundary of the picture and there is not too much overlap. Save these photos in a nominated folder with the appendix “b” behind each file's name.

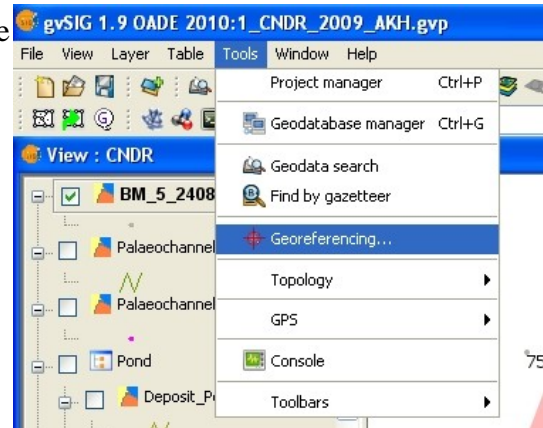
The register will usually tell which rectification points were used for which photograph. The points

used for planning should be obvious from the plan where drawing- or gridpoints should have been labelled.

Normally several shots will be taken per view, which will also be logged in the register, but it will have to be decided which photograph is of the highest quality to be used.

The following uses georectified photography as an example, but is just as applicable to plans:

The “Georeferencer” tool in gvSIG is used to place the pictures. This is activated by selecting “Tools - Georeferencing”



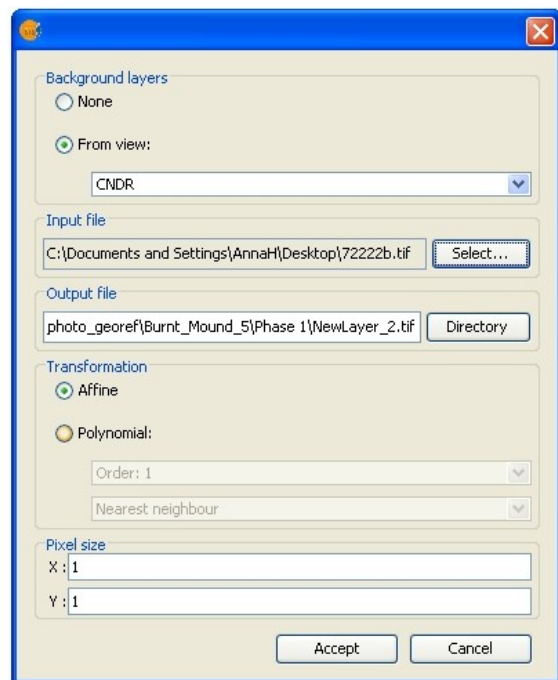
This window will pop up:

Background layers:
Select the active view

Input file:
Select the image you wish to georeference.

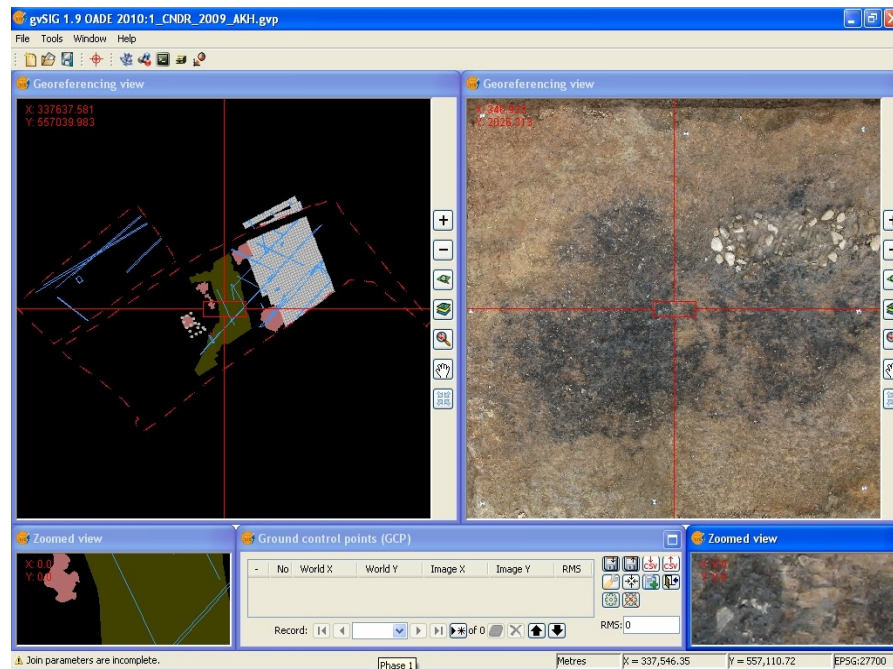
Output file:
Can be identified, but if nothing is chosen, the metadata is attached to the Input file.

Transformation:
Affine is the most commonly used transformation and requires a minimum of three control points. Refer to the text below “*General notes*” at the start of this chapter for further information on transformations.

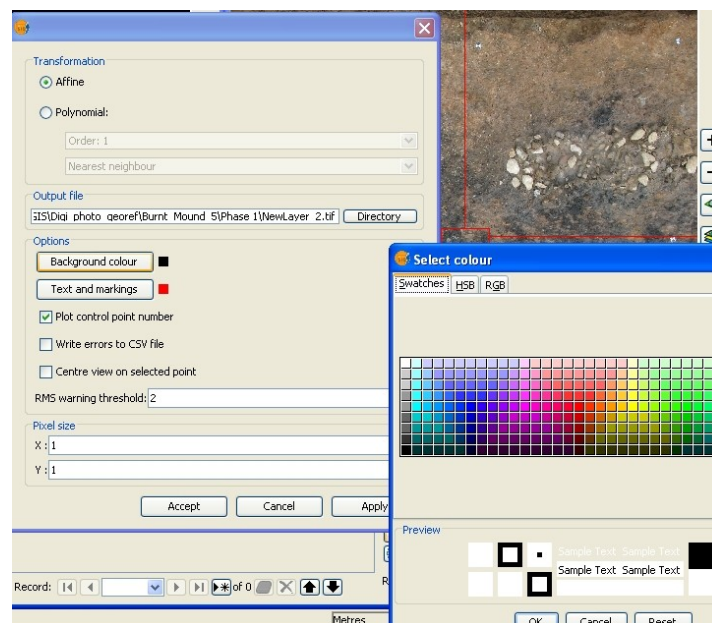


Hit “Accept” and the following screen will appear:

The active view will appear in the left window, zoomed to its full extent, whilst the right window shows the file to be georeferenced. The red crosshairs centre onto a zoomed view of either window, appearing at the base.



The “Settings” tool will allow you to change several settings, such as background colours and transformations:



A black background is not always a convenient working background, especially as labels are often displayed in black and thus not legible

Using

- The information on the photography register,
- the existing survey data,
- any previously georeferenced photographs of the same area and
- one's knowledge of the site,

familiarise yourself with the points on the ground and in the image. Be sure to know the image's rotation and orientation.

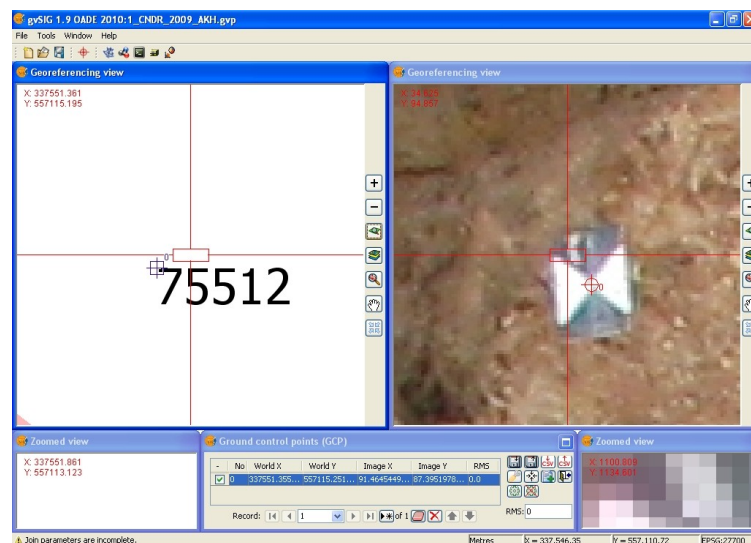
Then select the first set of points and use the “Zoom to select area” tool to zoom into the first source and target points in both windows.



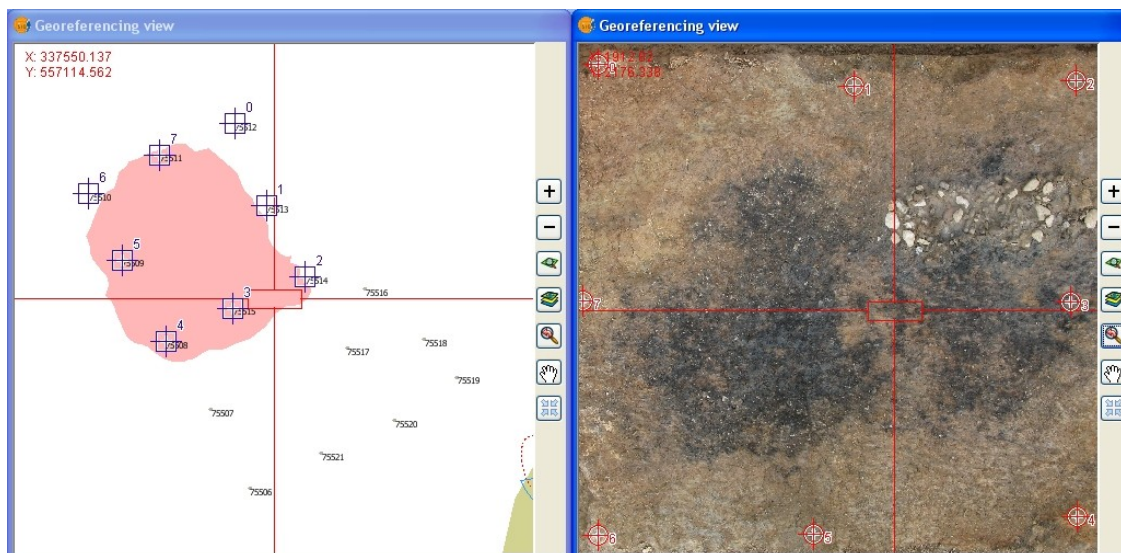
Once zoomed in, hit the black arrow pointing to the right - “New”.



Place the source point onto the target in the image (right window) and then drop the point onto the equivalent in the left window:



Use the “Previous zoom” or “-” tools above and below the “Zoom to select area” tool to select further points and repeat the above several times – at least three points are required, but a higher number increases the accuracy:

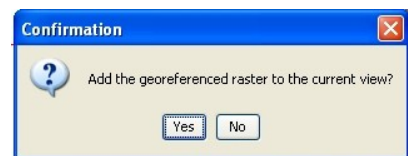


The RMS error (see *General notes*, above) will change, and points can be deactivated in the list in order to decrease this error.

Once all points have been placed, hit the following button:

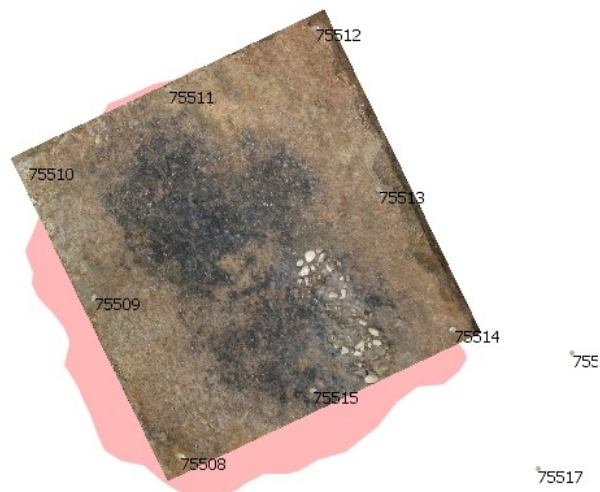


And select “Yes” in the following three windows:



The file will be loaded into the active view as a raster layer.

Position the layer below some survey data in the TOC and check for errors and inaccuracies. Note them down and possibly raise problems with site staff in order to make the next set of photographs even better.



Problems encountered with gvSIG:

Please see the OA Digital website's section on common gvSIG errors and bugs and troubleshooting:
<http://oadigital.net/software/gvsigoad/gvsigbugs>

Appendix 1:**Control Co-Ordinates:**

These should be written down clearly. Use the space below for reference:

Station:	Easting	
	Northing	
	Elevation	
Backsight:	Easting	
	Northing	
	Elevation	

Appendix 2:

Survey Codelist:

This is a codelist designed and produced for basic site survey. The black writing is the code name, the red writing shows the desired format for each point's point ID. This codelist can be used, and naturally altered for each project's individual survey requirements.

- **STN:** Station point: **0AN1**
- **BCK:** Backsight check: **0AN2**
- **DP P:** four per plan – two of these labeled as section points for recognition. Surveyed at ground level for height accuracy – **DP70002.1**
- **DP S:** For each Section. Surveyed at ground level for height accuracy – **DP70002.1S**
- **LVLGTOP:** Levels taken on top of gridsquares – **LVL_765**
- **LVLGBASE:** Levels taken on base of gridsquare – **LVL_765**
- **LVL:** general spotheight – **LVL1.1, LVL1.2** etc.
- **GP:** Gridnail – **GP1, GP2**
- **MONO:** Monolith: **Sample Number**
- **DEND:** Dendrochronological Sample: **Sample Number**
- **CTXTLVL:** Level taken on top of a feature. - **70001**. Also valid for base of feature – **70001B**
- **BS:** Bulk Sample: Taken at the base of the sample intervention: **Sample Number**
- **WD:** Wood-numbers: Taken on top of each piece of wood: Wood Number – **75032**
- **SF:** All finds are recorded by context and have four digits behind the “.”– **70000.0001**
- **RP:** Georectification Point: 75004
- **FEP:** Archaeological Feature – **FEP1.1, FEP1.2** etc.
- **DEP:** Edge of Deposit – **DEP1.1, DEP1.2** etc.
- **MOD:** Modern feature – Lines. **MOD1.1, MOD1.2** etc.
- **INT:** Intervention through feature, also used for post-ex planning – **INT1.1, INT1.2** etc.
- **ILOE:** Internal limit of excavation – **ILOE1.1, ILOE1.2** etc.
- **LOE:** Limit of excavation – **LOE1.1, LOE1.2** etc.

Appendix 3:

Metadata:

This example can be followed for setting up a logical, easy-to-maintain file-structure and set of GIS data

D:\oa\project\GIS\Shapefiles\current

Arch_features_old_270709.shp

Features exported and turned off due to becoming invalid. This is an Archive only. Features may be re-instated from this layer. Not to be mistaken for layer above!!!

Arch_Intervention_230609.shp

Surveyed interventions through features – post-ex. Only the edges of the slots are surveyed. **INT**

Arch_stones_120809.shp

Extracted from the Archaeological_features layer – where stones have been surveyed individually.

Archaeological_features_250709.shp

Current Features layer. Contains all archaeology, except for that archived due to being on a higher level or voided. **FEP**

Bulk_Samples_290609.shp

Current total of bulk samples taken. **BS**

Dendro_samples_050809.shp

Dendrochronology samples as surveyed. **DEND**

Deposit_230709.shp

Edge of deposits. **DEP**

DP_P_230709.shp

Plan – Drawing Points. Levels on ground surface. **DP P**

DP_S_260609.shp

Section – Drawing Points. Levels on ground surface. **DP S**

Feature_levels_300609.shp

Levels with context numbers taken on top of each feature. **CTXTLVL**

Haul_Road_polygon.shp

Haul Road as surveyed.

ILOE_300609c.shp

Current Internal Limit of Excavation – dated. “Internal Limit of Excavation” in GIS. **ILOE**

ILOE_old_300609.shp

Cropped and old extents of the Internal Limit of Excavation

Levels_General.shp

Levels surveyed for other purposes than those listed below. **LVL**

Modern_features_300609.shp

Modern features, such as field-drains and trackways. **MOD**

Monolith_240709.shp

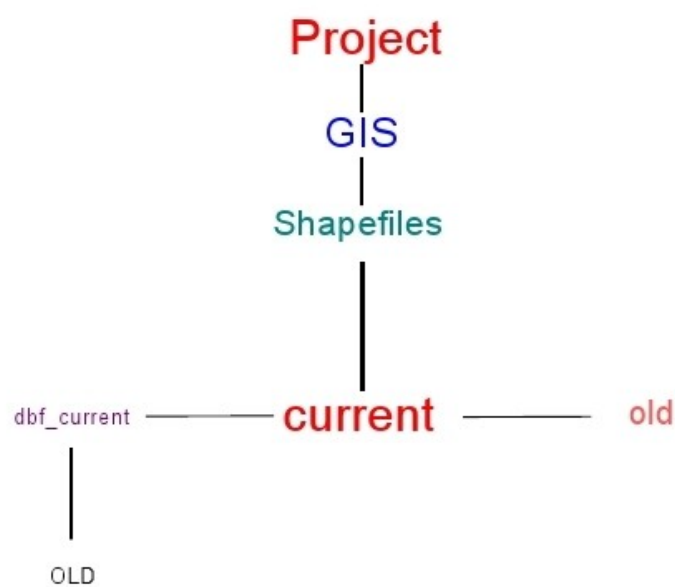
Monoliths as surveyed by location – centrepont **MONO**

Site_boundary_LOE_100609b.shp

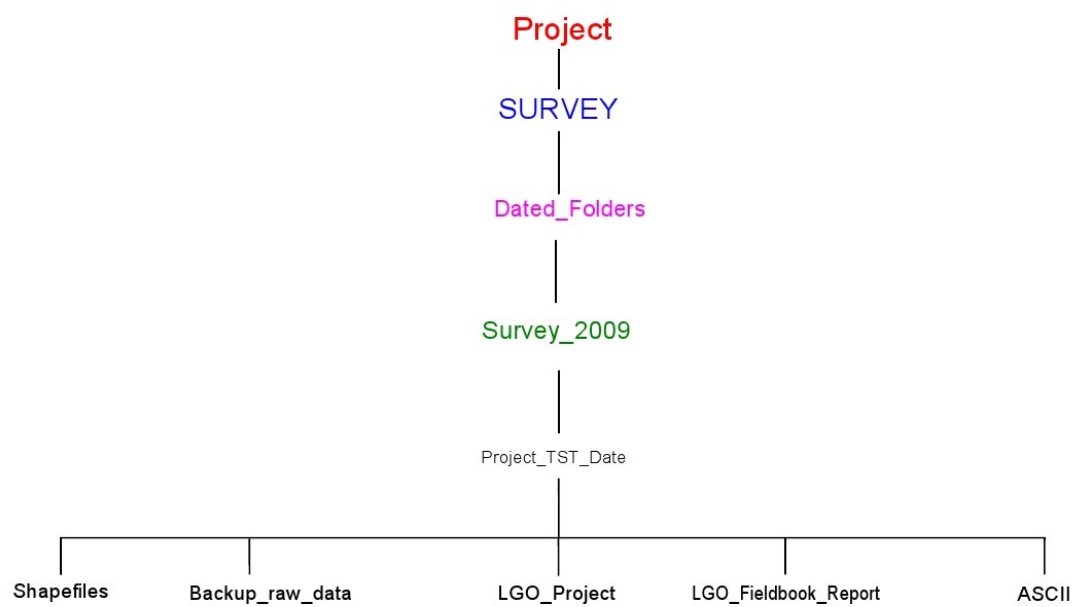
Extreme external limit of site - “Limit of Excavation” in GIS. **LOE**

Metadata Matrices – useful examples for data maintenance

a) GIS:



b) Survey:



Appendix 4:

Drawing of Plans

Use these rules to plan features and to explain the planning of features to others, ensuring that the plans produced by fieldwork staff are all drawn to the same standard of quality!

gvSIG requires at least three reference points per plan in order for it to be georeferenced (see p. 48). Georeferencing of plans works best with four points, evenly spaced around the feature and measured accurately on the plan.

