



UN-HABITAT

SYSTEMATIC LAND INFORMATION AND MANAGEMENT



**A Technical Manual for the
Establishment and
Implementation of a Municipal
Geographic Information System**

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Establishment and Implementation of
a Municipal Geographic Information
System**

Foreword

Purpose and Approach

UN-HABITAT prepared this manual as one of the project activities under the urban management component of the Support to Priority Areas in the Urban Sector (SPAUS) programme and the Urban Development Programme for the Somali region (SUDP).

The Systematic Land Information and Management (SLIM) manual is in line with a methodology that UN-HABITAT developed for the establishment and implementation of Geographic Information Systems (GIS) in municipalities. UN-HABITAT GIS activities in the Somali region have focused on the use of quick and cost-effective methods for acquiring and processing geographic information and making it available to different users in the urban land sector. GIS and remote sensing techniques have been combined with field survey methods to realize the rapid provision of urban land information that is already being used for various land management purposes, e.g. urban planning and design and property taxation.

Systematic Land Information and Management is primarily designed to assist municipal staff to collect data on urban properties and develop a property database that can be used for more efficient and effective urban land management. The manual assumes the presence of the necessary urban land policy, as well as the proper legal and institutional frameworks to enable the full use of the property database in municipal land administration activities. The manual also assumes the availability of financial and technical resources to acquire up-to-date satellite (or aerial) imagery data, conduct ground surveys, develop and maintain large databases, and distribute geographic information. Other users and producers of geographic data in the public and private sectors may also find the manual useful.

How to Use the Manual

The manual is divided into sections, each of which deals with one fundamental component of the municipal GIS development process. The user is advised to follow the step-by-step procedures described in the manual, as all the sections are related.

Systematic Land Information and Management is based on the use of proprietary GIS products and established GIS concepts. The user is not obliged to use the proprietary GIS products described in the manual. The use of different GIS products may, however, imply the adoption of different procedures to obtain similar results. To this extent, the manual may be used as a checklist in the development and implementation of a municipal GIS. This manual is only intended to operationalize the process of GIS development and is not intended to replace existing policies or guidelines.

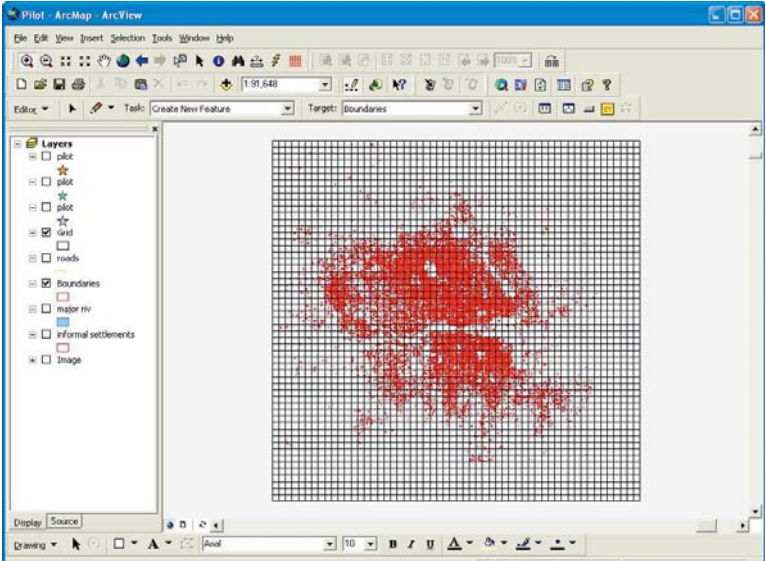
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1. Reference Grid

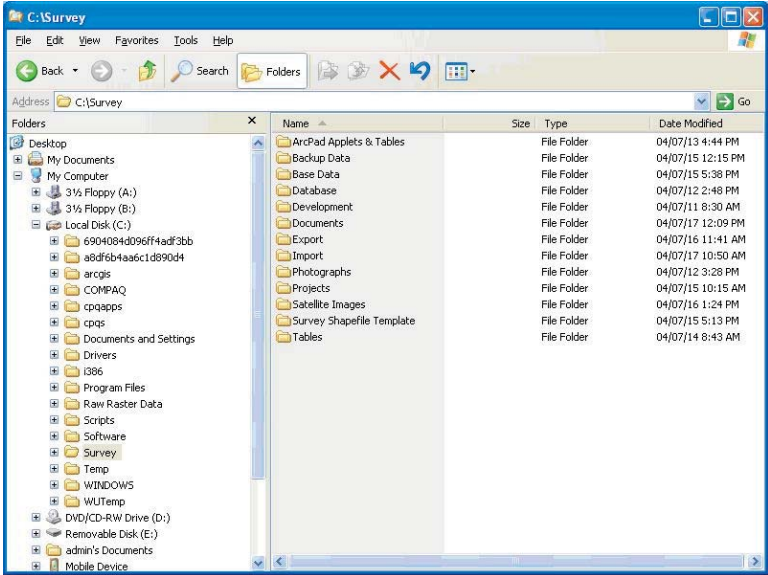
The GIS operator creates a 200 x 200 metre reference grid covering the entire municipal area. The grid will be used for reference purposes as well as highlighting field data capture progress.



2 ArcGIS Data Export Administration Procedures

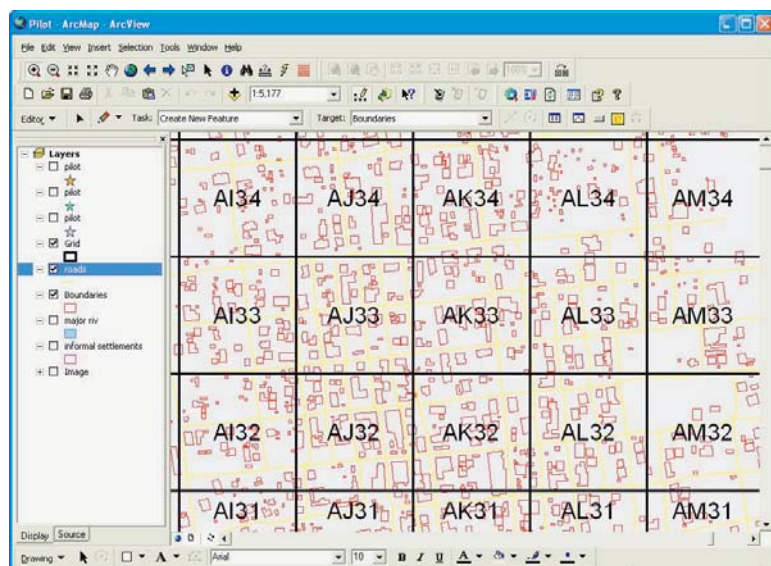
2.1 Create Working Folders

The GIS operator creates daily data capture folders based on the reference grid number. The output data is stored under “Export”, with the captured data stored under “Import”. The subdirectories are the relevant grid numbers.

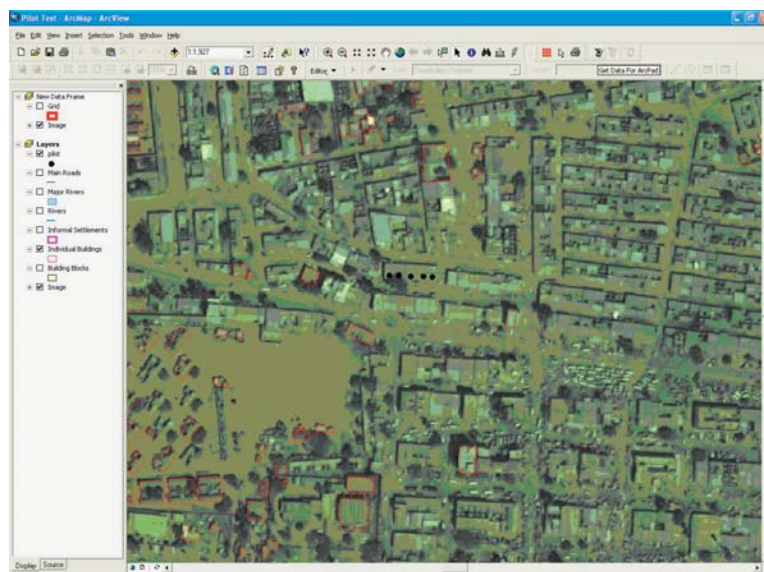



2.2 Export Data

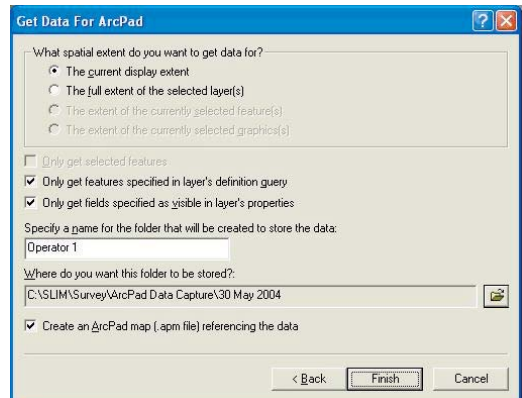
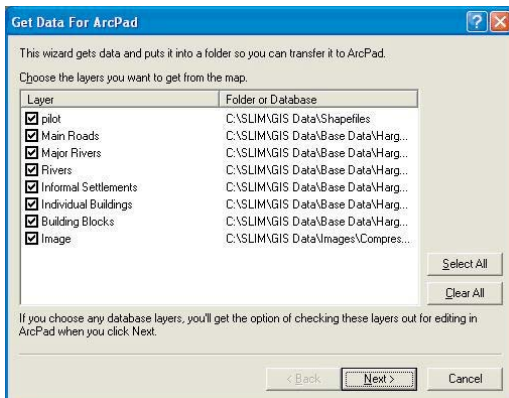
The GIS operator uses ArcGIS software to export the field data and captured data.



The procedure is to add the relevant spatial datasets to ArcGIS and select the data falling in the grid block.



Click on the “Get data for ArcPad” icon  and select the layers that need to be exported, specifying the correct folder path (e.g. surveyor’s name).



3. ArcPad Administration Procedures

3.1 Create Folders

The folder structure is mirrored on the PDA.

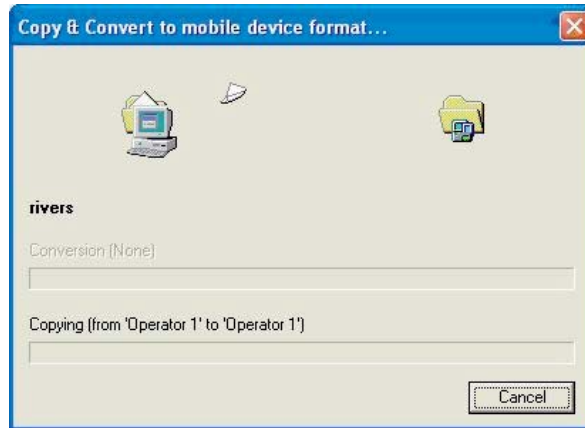
3.2 Synchronize the PDA

The PDA is synchronized using ActiveSync.

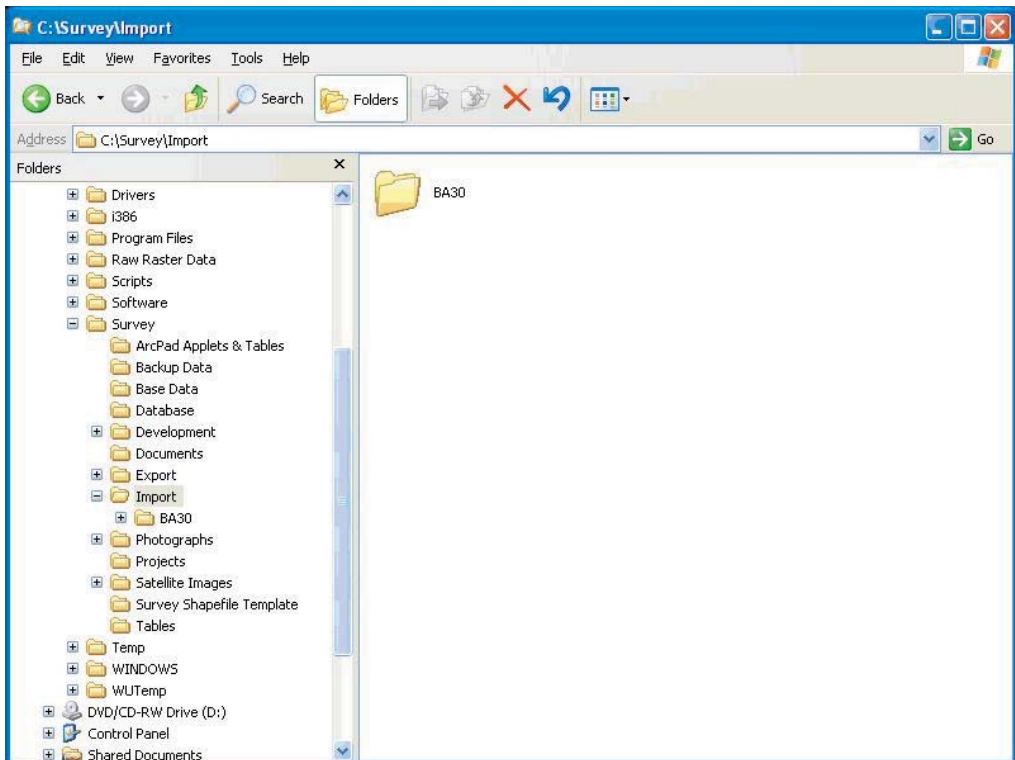


3.3 Copy the Spatial Data to the PDA

1. Copy the data to the synchronized PDA.
2. Copy all the database information under the table directory to the exported grid directory.
3. Copy the grid data to the mobile device by clicking on **Mobile Device/My Computer/Export**.



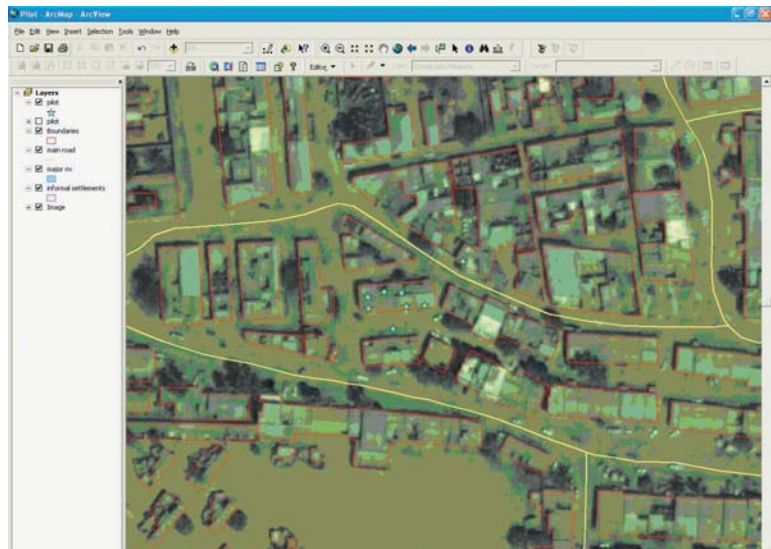
3.4 Copy the Data to the Import Folder



Check that the data is copied to the same folder on the computer.

4. ArcGIS Data Import Administration Procedures

The GIS operator copies the captured data to the “Import” directory under the relevant grid number.



5. Data Collection with the PDA (Panasonic CF-P1)

5.1 Pre-checks

Before starting, it is important to make sure that the PDA is in good condition and the battery is fully charged.

5.2 Start-up

Press the power switch to start the PDA. The screen will light up.



POWER BUTTON

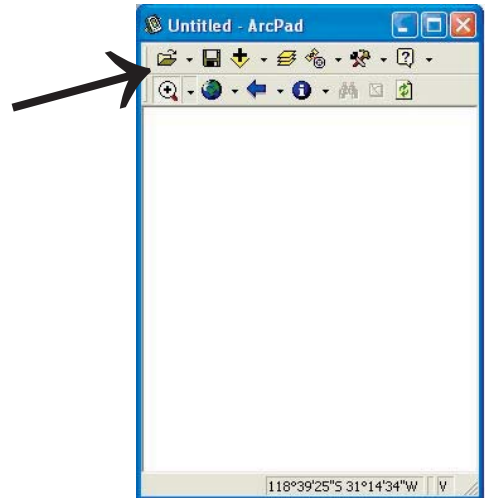
To start ArcPad, tap the **Start Button/Programs/ArcPad 6.03** or press the **F3** button.

5.3 Login

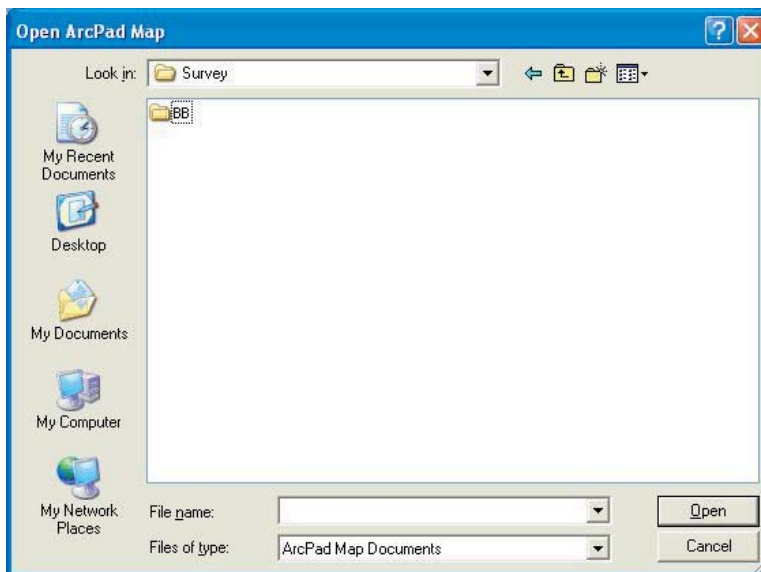
The Login screen opens. Click the select arrow and select your name from the list. Then select **Password** and enter your password.



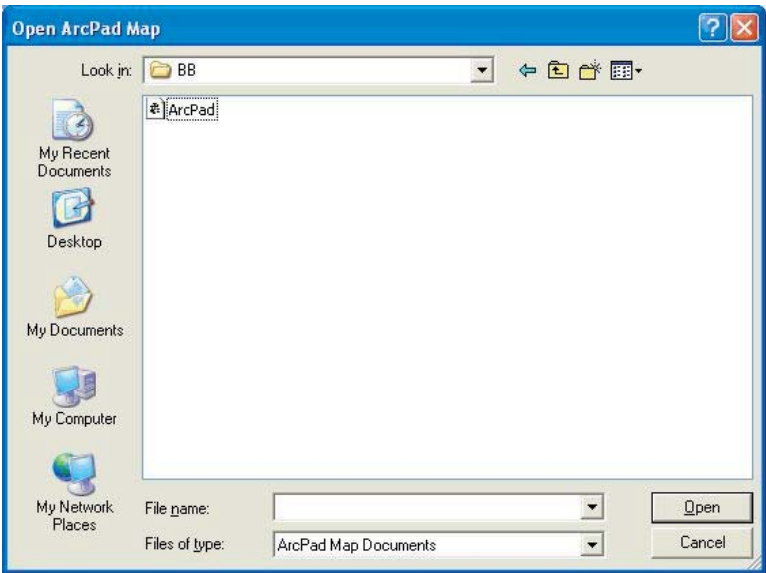
Select **Login**. A blank screen opens.



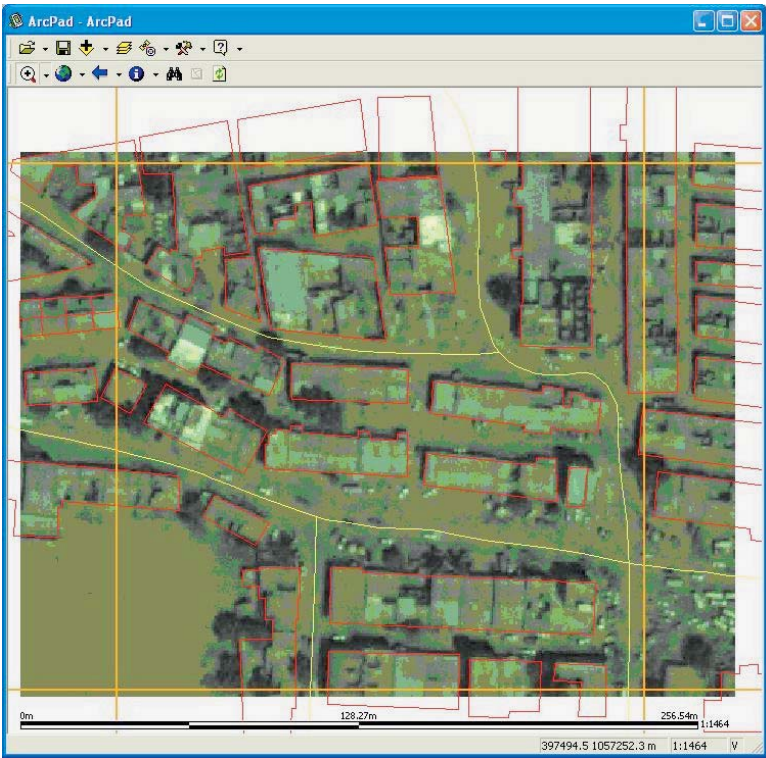
Select **Open File**. A list of grid squares opens, each of which has data already copied to the PDA.







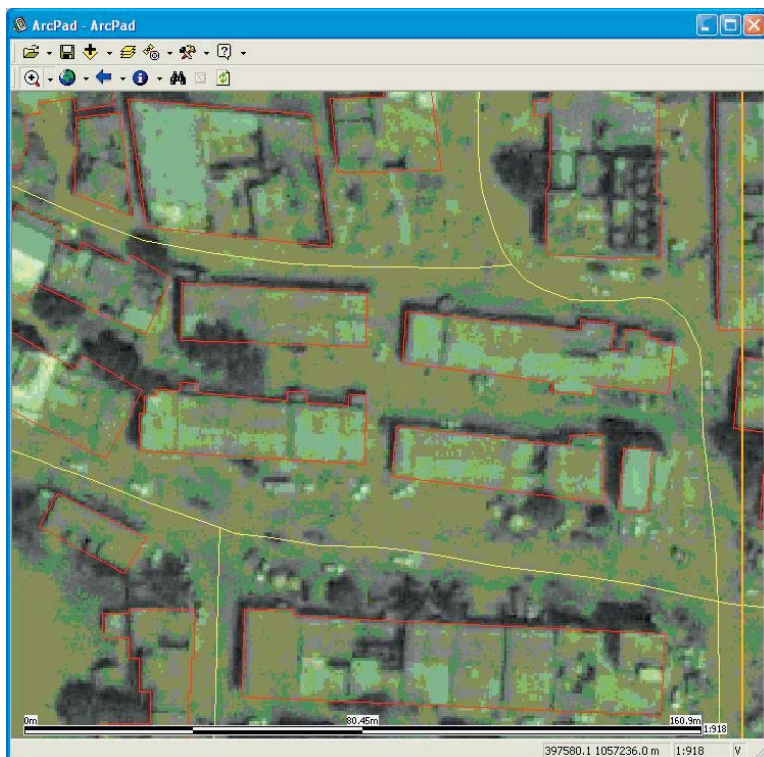
Select the grid you want to survey. A new screen appears, ready to load ArcPad.apm format documents.




Select **ArcPad**. An image of the grid appears, with the building boundaries outlined in red.



You can enlarge the image by selecting **Zoom In** , reduce it by selecting **Zoom Out** , or move the image by selecting **Pan** . These are all selected from the down arrow  to the right of each button. Zooming in enlarges the images but reduces the resolution.



The PDA has a built-in GPS that allows you to see your approximate coordinates. Select the down arrow to the right of the **GPS Position Window** .

To proceed to the next stage, open the **Edit Toolbar** by selecting the dropdown arrow to the right of the **Tools** button . The Edit Toolbar is now visible.



5.4 Locating a Property

When you are happy with your location, select a block to survey. First walk round the block, to get an idea of the number of properties. Then start with one property, preferably at a corner of the block. Select **Point** from the Edit Toolbar. Locate the centre of the property and tap the screen with the stylus. This brings up the first of the screens that are used to capture property data. The questionnaires below are the result of customized design using ArcPad's application builder.

5.5 Screen 1 (General)

Selecting a point brings up Screen 1 (General).



The screenshot shows a software window titled "Test". Inside, there are two tabs: "General" and "Property1". The "General" tab is active and displays a "Welcome" message, the UN HABITAT logo, and two text input fields labeled "Surveyor" and "Grid Cell". At the bottom of the window are "OK" and "Cancel" buttons.

Screen 1 captures general information about:

- the surveyor
- the grid

5.5.1 Surveyor

Your name is displayed in the **Surveyor** box. It is vital therefore that your password is kept secret. You can ask the data manager to change the password at frequent intervals.

5.5.2 Grid Number

This is the number of the grid that will be captured.



The screenshot shows a dialog box titled 'Test' with a blue header bar. It has two tabs: 'General' and 'Property1'. The 'Property1' tab is selected, and an arrow points to it with the text 'Click tab to select next'. The dialog contains the following elements: a 'Welcome' label, the UN HABITAT logo, a 'Surveyor' text box, and a 'Grid Cell' text box containing the text 'BB30'. At the bottom are 'OK' and 'Cancel' buttons.

Click tab to select next

When this screen is completed, tap the tab for the next screen, **Property 1**.

5.6 Screen 2 (Property 1)

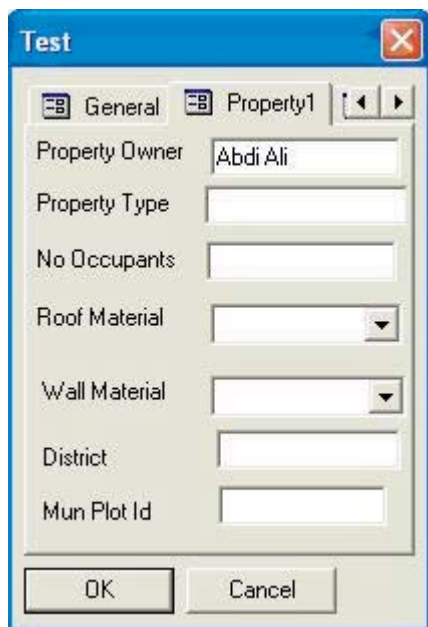
Screen 2 (Property 1) captures information on property type, occupancy, physical characteristics, location, and plot ID.



The screenshot shows the same 'Test' dialog box, but now the 'Property1' tab is active. The 'General' tab is no longer visible. The form contains the following fields: 'Property Owner', 'Property Type', 'No Occupants', 'Roof Material' (with a dropdown arrow), 'Wall Material' (with a dropdown arrow), 'District', and 'Mun Plot Id'. At the bottom are 'OK' and 'Cancel' buttons.

5.6.1 Property Owner

Select **Property Owner**. A soft key drops down. Indicate the property owner's name by tapping the appropriate characters. When finished, move to **Property Type**.




The screenshot shows a dialog box titled "Test" with a close button (X) in the top right corner. It has two tabs: "General" and "Property1", with "Property1" currently selected. The "Property1" tab contains several input fields: "Property Owner" (text box with "Abdi Ali"), "Property Type" (text box), "No Occupants" (text box), "Roof Material" (dropdown menu), "Wall Material" (dropdown menu), "District" (text box), and "Mun Plot Id" (text box). At the bottom are "OK" and "Cancel" buttons.

5.6.2 Property Type

Select **Property Type**. A soft key drops down. Indicate the property type from the property type list by tapping the appropriate characters. The following list indicates the property types:

- Amusement Perm/Temp
- Retail Shop Perm/Temp
- Water Perm/Temp
- Residential Perm/Temp
- Energy Perm/Temp
- Supermarket Perm/Temp
- Cemetery
- Hotels Perm/Temp
- Playground
- Telecommunication Perm/Temp
- Informal
- Restaurant Perm/Temp
- Guest House Perm/Temp
- Cafés Perm/Temp
- Garage Perm/Temp
- Airport
- Light Industry Perm/Temp
- Library Perm/Temp
- Vacant
- Derelict
- Public Admin Perm/Temp
- Manufacturing
- Military Land
- Public Safety Perm/Temp
- Private Education Perm/Temp
- Public Education Perm/Temp
- Private Health Perm/Temp
- Public Health Perm/Temp
- Warehousing Perm/Temp
- Public Service Perm/Temp
- Professional Service Perm/Temp
- Financial Service Perm/Temp
- Religious
- Wholesale Stores
- NGOs Perm/Temp

Select the land use class that is most appropriate for each property.



The 'Test' dialog box has a title bar with a close button. It contains two tabs: 'General' and 'Property1'. The 'General' tab is active. The fields are as follows:

Field	Value
Property Owner	Abdi Ali
Property Type	Wholesale
No Occupants	
Roof Material	
Wall Material	
District	
Mun Plot Id	

Buttons: OK, Cancel

5.6.3 Number of Occupants

Select **Number of Occupants**. A soft key drops down. Indicate the number of occupants by tapping the appropriate digits. When finished, move to **Roof Material**.



The 'Test' dialog box is the same as the previous one, but the 'No Occupants' field now contains the value '2'.

Field	Value
Property Owner	Abdi Ali
Property Type	Wholesale
No Occupants	2
Roof Material	
Wall Material	
District	
Mun Plot Id	

Buttons: OK, Cancel

5.6.4 Roof Materials

Select the dropdown button to the right of **Roof Material**. Select the roof material from the list:



The screenshot shows a dialog box titled "Test" with a blue header bar and a close button (X) in the top right corner. The dialog has two tabs: "General" and "Property1", with "Property1" currently selected. The "Property1" tab contains several input fields: "Property Owner" (text box with "Abdi Ali"), "Property Type" (text box with "Wholesale"), "No Occupants" (text box with "2"), "Roof Material" (dropdown menu), "Wall Material" (text box), "District" (text box), and "Mun Plot Id" (text box). The "Roof Material" dropdown menu is open, showing a list of options: "Concrete", "Iron" (highlighted in blue), "Other", and "None". At the bottom of the dialog are "OK" and "Cancel" buttons.

5.6.5 Wall Material

Select the dropdown button to the right of **Wall Material**. Select the appropriate wall material from the list:



The screenshot shows the same "Test" dialog box as in the previous image, but with the "Wall Material" dropdown menu open instead of the "Roof Material" menu. The "Wall Material" dropdown menu is open, showing a list of options: "Stone", "Concrete", "Clay Bric" (highlighted in blue), "Temporary", "Other", and "None". The "Roof Material" dropdown menu is now closed and shows "Iron" as the selected option. The "OK" and "Cancel" buttons are still at the bottom.

5.6.6 District

Select **District**. A soft key drops down. Indicate the district by tapping the appropriate letter or digit or combination of letters and digits. When finished, move to **Municipal Plot ID**.

5.6.7 Municipal Plot ID

Select **Municipal Plot ID**. A soft key drops down. Indicate the plot ID by tapping the appropriate letter or digit or combination of letters and digits.



The screenshot shows a dialog box titled "Test" with a close button (X) in the top right corner. It has two tabs: "General" and "Property1". The "Property1" tab is selected. The form contains the following fields:

Field	Value
Property Owner	Abdi Ali
Property Type	Wholesale
No Occupants	2
Roof Material	Iron
Wall Material	Clay Bric
District	A
Mun Plot Id	323

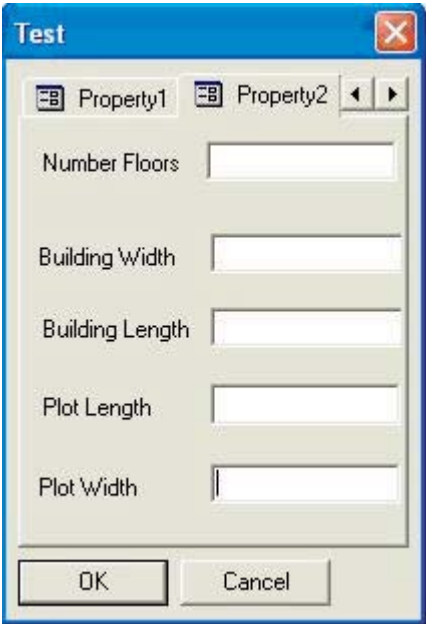
At the bottom of the dialog are "OK" and "Cancel" buttons.

Having completed Screen 2 (Property 1), use the right scroll arrow to reveal Screen 3 (Property 2).



5.7 Screen 3 (Property 2)

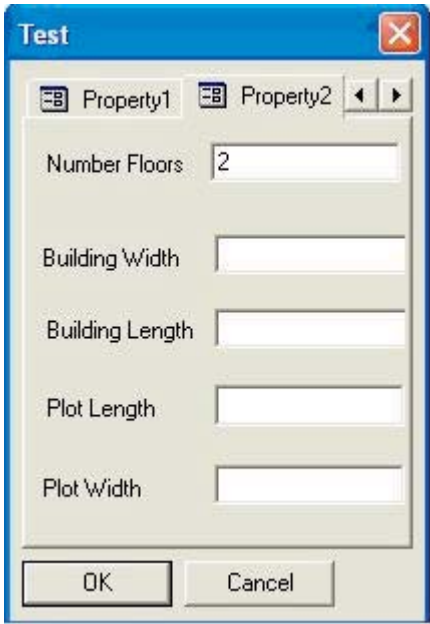
Screen 3 (Property 2) captures information on plot and building size and the number of floors (storeys) in a building. To start Screen 3 (Property 2), select the **Property 2** tab.



The screenshot shows a dialog box titled "Test" with a blue header bar and a red close button. It has two tabs: "Property1" and "Property2", with "Property2" being the active tab. Below the tabs are five input fields: "Number Floors", "Building Width", "Building Length", "Plot Length", and "Plot Width". All fields are currently empty. At the bottom are "OK" and "Cancel" buttons.

5.7.1 Number of Floors

Select **Number of Floors**. A soft key drops down. Indicate the number of floors by tapping the appropriate digits. When finished, move to **Building Width**.



This screenshot is identical to the previous one, but the "Number Floors" input field now contains the digit "2". The other fields remain empty, and the "OK" and "Cancel" buttons are still at the bottom.

5.7.2 Building Width

Select **Building Width**. A soft key drops down. Indicate the building width by tapping the appropriate digits. When finished, move to **Building Length**.

5.7.3 Building Length

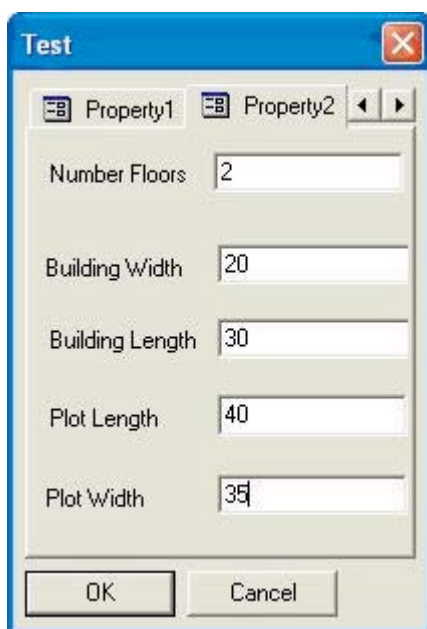
Select **Building Length**. A soft key drops down. Indicate the building length by tapping the appropriate digits. When finished, move to **Plot Length**.

5.7.4 Plot Length

Select **Plot Length**. A soft key drops down. Indicate the plot length by tapping the appropriate digits. When finished, move to **Plot Width**.

5.7.5 Plot Width

Select **Plot Width**. A soft key drops down. Indicate the plot width by tapping the appropriate digits.



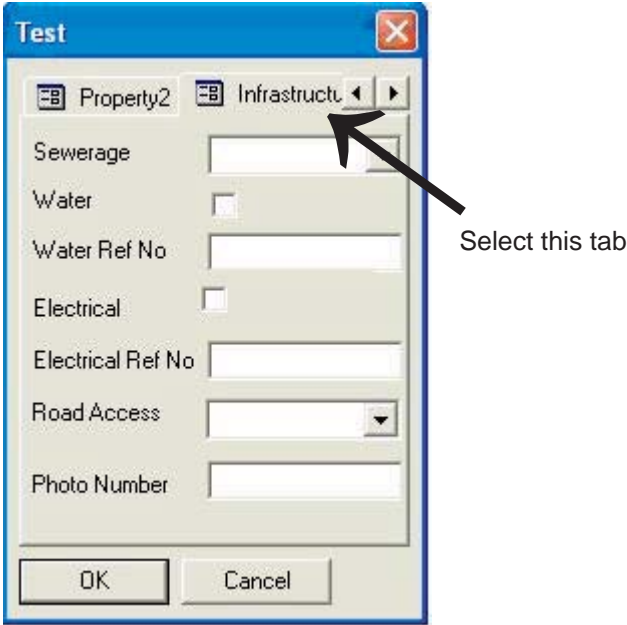
The image shows a 'Test' dialog box with a blue title bar and a close button (X) in the top right corner. Inside the dialog, there are two tabs: 'Property1' and 'Property2'. The 'Property2' tab is selected. Below the tabs, there are five input fields with labels: 'Number Floors' (value: 2), 'Building Width' (value: 20), 'Building Length' (value: 30), 'Plot Length' (value: 40), and 'Plot Width' (value: 35). At the bottom of the dialog are 'OK' and 'Cancel' buttons.

Having completed Screen 3 (Property 2), use the right scroll arrow to reveal Screen 4 (Infrastructure).



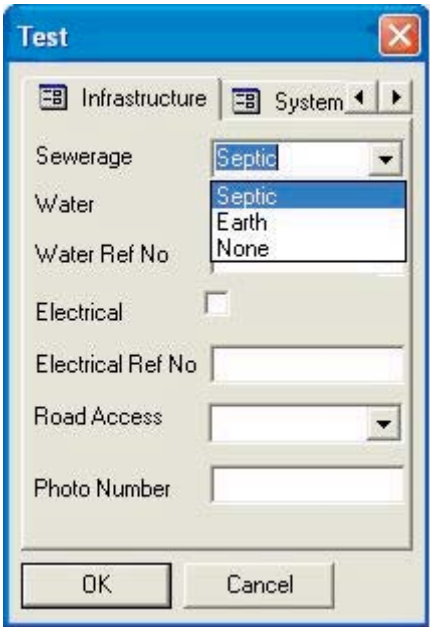
5.8 Screen 4 (Infrastructure)

Screen 4 (Infrastructure) captures the property photo number and the services available to each property. To start Screen 4 (Infrastructure) select the **Infrastructure** tab.



5.8.1 Sewerage

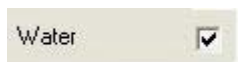
Select the dropdown button to the right of **Sewerage**. Select the appropriate sewerage class from the dropdown list:



“Septic” refers to a pit that accepts, among other waste, liquid waste from a WC. “Earth” is an earth pit. “None” means there is no sewerage system. You will need to ask in order to establish which is appropriate. When complete, move to **Water**.

5.8.2 Water

Tick the **Water** tick box if there is piped water on the property.

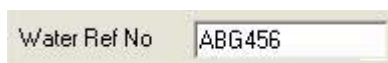
A rectangular button with a light beige background. On the left, the word "Water" is written in a dark font. On the right, there is a small square checkbox containing a black checkmark.

If you make a mistake and tick the box when there is no piped water, simply tick it again to clear. When finished, move to **Water Reference Number**.

5.8.3 Water Reference Number

Select **Water Reference Number**. A soft key drops down. Enter the water reference number by tapping the appropriate characters.


Water reference numbers are normally indicated on property walls by the Water Department.

A rectangular input field with a light beige background. On the left, the text "Water Ref No" is displayed. To its right is a text box containing the alphanumeric string "ABG456".

When finished, move to **Electrical**.

5.8.4 Electrical

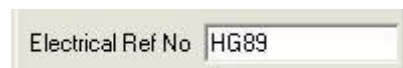
Tick the **Electrical** tick box if there is mains electricity connected to the property.

A rectangular button with a light beige background. On the left, the word "Electrical" is written in a dark font. On the right, there is a small square checkbox containing a black checkmark.

If you make a mistake and tick the box when there is no mains electricity, simply tick it again to clear. When finished, move to **Electrical Reference Number**.

5.8.5 Electrical Reference Number

Select **Electrical Reference Number**. A soft key drops down. Enter the electrical reference number by tapping the appropriate characters.

A rectangular input field with a light beige background. On the left, the text "Electrical Ref No" is displayed. To its right is a text box containing the alphanumeric string "HG89".

When finished, move to **Road Access**.

5.8.6 Road Access

Select the dropdown button to the right of **Road Access**. Indicate the appropriate access type from the dropdown list:

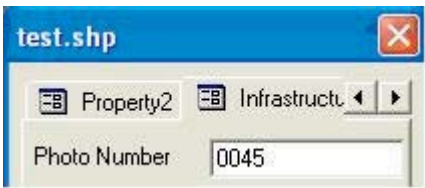


The screenshot shows a window titled "Test" with a close button (X) in the top right corner. Inside the window, there are two tabs: "Infrastructure" and "System". The "Infrastructure" tab is selected. Below the tabs, there are several fields and checkboxes: "Sewerage" with a dropdown menu showing "Septic"; "Water" with a checked checkbox; "Water Ref No" with a text field containing "ABG456"; "Electrical" with a checked checkbox; "Electrical Ref No" with a text field containing "HG89"; "Road Access" with a dropdown menu showing "Earth Road"; and "Photo Number" with a dropdown menu showing "Earth Road", "Hard Road", and "None". At the bottom of the window, there are "OK" and "Cancel" buttons.

“Hard Roads” are asphalt or concrete roads. “Earth Roads” are unsurfaced roads that provide vehicular access to the property. “None” is used where there is no road, or if the road is too narrow to provide vehicular access.

5.8.7 Photo Number (Sony Digital Camera)

Select **Photo Number**. A soft key drops down. Enter the photo number by tapping the appropriate characters. The photo number is obtained by reviewing the photo of the property on the digital camera (see page 28 of the Sony Still Camera handbook). The number is in the form DSC0011. The first three digits are the file number. It is the last four digits that are important. These should be copied exactly as they are shown on the screen. So 0045 is written in the PDA as 0045, *not* as 45.




The screenshot shows a window titled "test.shp" with a close button (X) in the top right corner. Inside the window, there are two tabs: "Property2" and "Infrastructure". The "Infrastructure" tab is selected. Below the tabs, there is a "Photo Number" field with a text input containing "0045".

When **Photo Number** is completed and you are sure that the data collected is correct, you should save the forms.



5.8.8 Saving

To save the forms, click **OK**. Be very careful not to click the exit box .

6. Procedures for Use of the Digital Camera

The role of the surveyor is to go out into the field and record the location of each property, collecting property data that will allow the municipality to obtain an accurate record of properties in the area. The photograph is very important, as it provides a visual impression of the property. You should always aim to take a photograph that represents the main features of the property. It should cover the full height of the building, including the roof.

6.1 Before Starting

Before going out for the day, always check the following:

1. Do I have the right camera?
2. Are the batteries fully charged?
3. Is the data stick empty (i.e. preview mode shows no photographs)?
4. Is the camera in good condition (i.e. clean, with no broken parts)?
5. Do I have a carrying case?

Only proceed if the answer to *all* the above questions is “yes”. If you answer “no” to any questions, see the data manager.

6.2 In the Field

You are required to take a photograph of every building you survey. It is best to do this when prompted by the PDA. However, it is recommended that you ask the occupier of the property for permission before taking the photograph.

The photograph should normally be of the front of the property and should show the main features of the property, including the roof.

After taking the photograph, you should preview it by using the **Quick Review** button, which is part of the **Control** button. You will see a number in the bottom left corner of the LCD screen. This will have the form XXX-XXXX. You should record the last four digits in your PDA when requested to give the photo number.

Please remember *not* to use the same photo number twice.

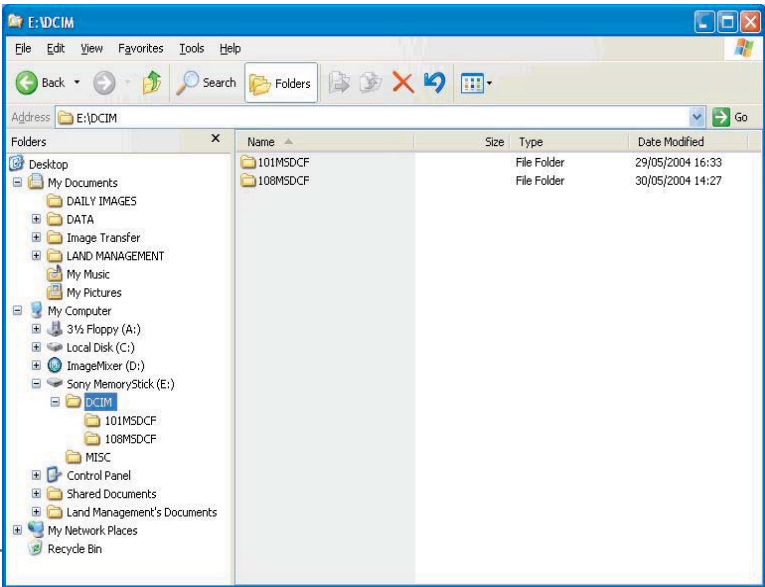
6.3 Back in the Office

When you are back in the office, you should give your camera to the data manager. If you have any problems with the equipment, you should write a short note and attach it to your camera (use masking tape).

6.4 Downloading Camera Data

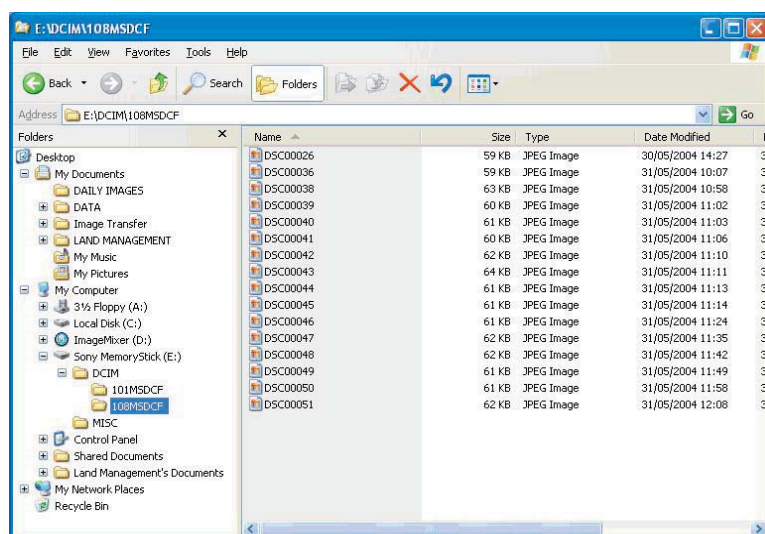
Downloading data from the cameras should be done with only Windows Explorer running on the computer. Each camera is numbered and all data from that camera should be transferred to its own file.

Attach the cable, which connects the camera's USB jack to the computer's USB port. Switch the camera on and ensure that you can see both the E drive (the data stick in the camera) and the file containing the photographs from each surveyor.



You will need to make sure that **Folders** is highlighted. Select the E drive (**E:**) and then the appropriate folder for that camera (this should be the only folder with any data). Ensure that the detailed view is selected. Select all the files (**Edit, Select All**). Then copy the files (**Edit, Copy**), move the cursor to the image file for the appropriate surveyor, and paste the image (**Edit, Paste**).

Ensure that files have been copied into the right folder. When you are certain that this is done, delete the images in the camera by deleting the images in the E drive. To do this, select the E drive and the folder containing the images. Then select all the images and delete them (**Delete** key) or cut them (**Edit, Cut**). Check that there are no images in the camera by looking at the E drive and also by turning the camera on and selecting the review button. If there are images still in the camera, they will be displayed on the LCD.



6.5 Charging the Camera for the Next Day

When you have downloaded the photographs and cleared the data stick, you should clean and charge the camera for the next day.

To clean the camera, use the battery-powered camera vacuum cleaner and brush to remove any sand and dust. To charge the camera, place the camera in the “out” side of the box and connect it, via the “DC in” socket, to the Sony AC-LS5 AC adaptor. Switch on the adaptor and leave it overnight.

6.6 Reviewing and Editing the Photographs

The photographs in the file should correspond to the photograph numbers collected on the PDAs. To ensure that this is correct, you should perform a number of checks. The first is to establish all the photograph numbers collected in this session by the PDA, e.g. numbers 0135 to 0199. First print out the list of photographs. Check that the

photographs collected in the same session cover the same range. Then go through the list. You may find that there are photographs taken that are not recorded by the PDA. This may be due to error, attempts to take better photographs, or using the camera to record other information. You should delete these images by selecting the photographs to be removed and cutting them (right click, **Cut**). If you want to move them to another file, go to that file and paste them (right click, **Paste**).

You should also check 10 percent of the images to ensure that the image collected corresponds to the data on building materials and quality collected by the PDA. If you have any doubts, question the surveyor as soon as possible.

6.7 Set-up

The set-up only needs to be done at the start of the project, if there is a major problem, or when more than 9,999 photographs have been taken on any camera.

6.8 Allocation of Cameras

Each surveyor should be allocated a specific camera. It is his or her responsibility to keep it safe and free from damage. Each camera will be numbered, and when the camera is returned, it should be placed in the appropriate section of the equipment box. PDAs are treated in the same way.

6.9 Formatting Data Sticks

The data sticks can be formatted to provide folders. You can then select which folder will be used to collect photographs. Folders are numbered starting at 001, with a new number being given each time.

To create a new folder:

1. Set the mode selector to **SET-UP**.
2. Select the memory stick tool.
3. Select **Create REC. Folder**.
4. Press ●.

See page 47 of the camera handbook.

Assign a folder for each camera. The folder number should match the camera number. For each camera, select the recording folder to use.

With Camera 1 no action is needed, because the camera automatically uses Folder 001. But for the others, the folder must be specified. The folder to use, then, is the one with the same number as the camera.

Camera	Folder
1	001
2	002
3	003
4	004
5	005
6	006
7	007
8	008

To select the recording folder:

1. Set the mode selector to **SET-UP**.
2. Select the memory stick tool.
3. Select **Change REC. Folder**.
4. Press ●.
5. Select desired folder.
6. Press ●.

See page 47 of the camera handbook.

6.10 What to Do When the Data Stick Reaches 9,999 Photographs


Eventually each surveyor will use up the 9,999 photographs that can be recorded on each file. When this occurs, new files must be created – both data files and files on the digital cameras. Follow the procedure mentioned above for creating data files.

7. Quality Control Procedures

The quality control procedure is as follows:

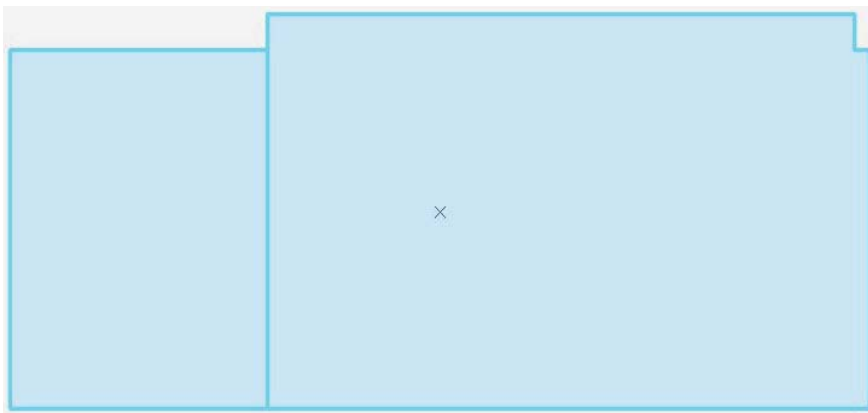
1. Download data from the PDA.
2. Add the relevant field survey point shapefile to ArcMap.
3. Check that the surveyor name has been added to all the records.
4. Check that the grid number is added to all the records.
5. Check that there is a photo number for all the records, and make sure that the format is correct.
6. Check that the date format is correct: year/month/day (08/12/28).
7. Check that all the point features are surrounded by a polygon. If there are points that are not surrounded by a polygon, add one.
8. Split the “properties” polygons as follows:
 - i. Click **Start Editing**.
 - ii. Select the “properties” shapefile as the target.




- iii. Select **Cut Polygon Features** as the task.
- iv. Select the relevant property.
- v. Select the sketch tool .
- vi. Make sure the snapping settings have been activated.

Layer	Vertex	Edge	End
properties	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

- vii. Split the polygon.

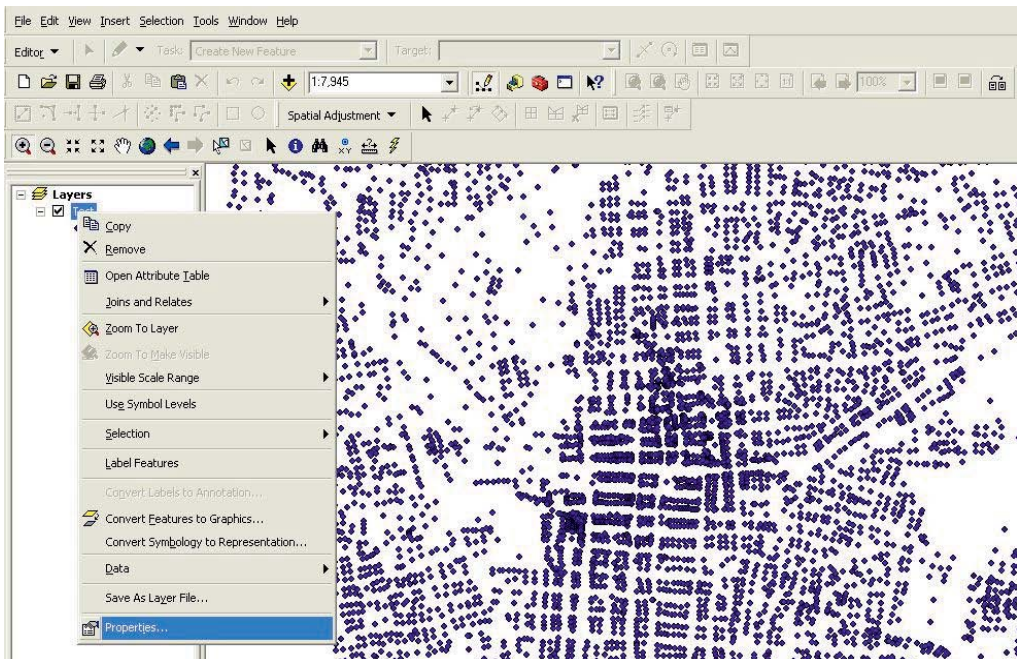


8 Hyperlinking Photos to Related Properties

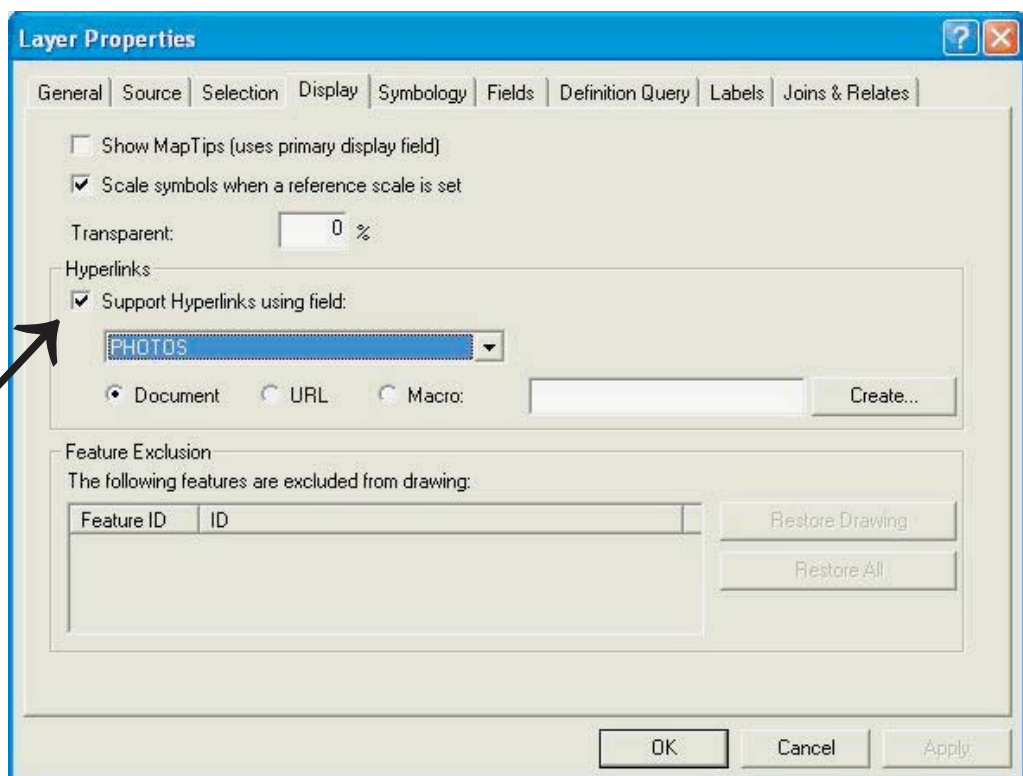
You can access documents or web pages related to features by using the hyperlink tool in ArcMap  .

Making hyperlinks with relative paths:

1. To store the hyperlinked file paths and names, create a text field in the table of the features from which you are hyperlinking.
2. Add the hyperlinked file paths and names to the table.
3. Right click the layer in the table of contents and click **Properties**.



4. Click the **Display** tab.
5. Check **Support Hyperlinks Using Field** and click the dropdown arrow to select the hyperlink field.



6. Click **OK** to close the layer properties.

9. Duties and Responsibilities

9.1 Background

For Systematic Land Information and Management to produce maps and data for successful land management, it is vital that data collection and processing are subject to efficient quality control. The basic premise of quality control is “do it right the first time”. All the procedures, training, and data management should be such that the persons responsible for each stage are fully aware of their duties and responsibilities. This is to ensure that they do their tasks correctly the first time.

As a general rule, correcting a mistake takes ten times longer than getting it right the first time. So time used for training and establishing efficient procedures is time well spent.

9.2 Organizational Structure

The most important link in this chain is the field surveyor. The surveyor visits the buildings, capturing their location and thematic information. Unless the field surveyors are properly trained, motivated, and supervised, this system will *not* work. Although the data manager and the GIS auditor will monitor the surveyor’s work, the field supervisor and the individual surveyors are the most important part of this system.

9.3 Duties and Responsibilities

9.3.1 Individual Surveyors

The individual surveyors will be responsible for locating every property within their assigned grid and collecting accurate thematic data on these properties, including a digital photograph of the front of the property. It is the surveyor’s responsibility to arrive at the collection point on time. If they are unable to attend, they should inform their supervisor well in advance.

Each surveyor will be assigned a grid square or grid squares each day. They will also be assigned their own PDA and digital camera. The surveyors firstly must understand the boundaries of their grid square(s). They must ensure the PDA and camera are in good working order at the start of each day (i.e. fully charged, with adequate memory) and returned in good order at the end of the day. If the equipment has malfunctioned or has been damaged, the surveyor must report the problem to the field supervisor and data manager as soon as possible.

In the field, the field surveyor should follow the instructions in Section 5 (Data Collection with the PDA).

9.3.2 Field Supervisor

The field supervisor is responsible for preparing the PDAs and cameras each day, so that they are fully charged, contain the necessary grid data, and have sufficient

memory. In addition, the supervisor must ensure that all the surveyors are on time, have the equipment they need, understand what should be done, and report any relevant problems to the data manager.

9.3.3 Data Manager

The data manager maintains quality control by ensuring that the data collected follows agreed standards, querying the field surveyors when necessary. He or she will also review the work of the field surveyors in the field by making random checks on previously surveyed properties.

The data manager will supervise the work of the GIS operator to ensure that the data he or she receives from the field surveyors is of the right standard, and that he or she processes the data in line with ArcPad Data Export Administration Procedures and the ArcPad Administration Procedures.

He or she will also produce weekly and monthly progress reports for the municipality. These provide information on the number of surveys done in that period, maintain a running total, give estimates of the time required to complete the project, and draw attention to any problems.

The data manager will also be responsible for general office administration. His or her role is to collect the cameras and PDAs from the surveyors at the end of each day in the field, transfer the data and photographs to the databases, and create data backups. The data manager is also responsible for ensuring that all equipment is in good working order and ready for the following day's fieldwork. The data manager is the link between the field surveyors and the office.

9.3.4 GIS Operator

The GIS operator will be responsible for importing and exporting spatial data to and from ArcGIS and ArcPad. The GIS operator will also clean the captured point dataset by moving the relevant points to correlate with the property boundaries as displayed on the satellite image. Once the data has been checked and moved, the GIS operator will subdivide the block boundaries to display the individual properties. The last task will be to join the point data attributes to the polygon boundaries.

9.3.5 GIS Auditor

The GIS auditor is responsible for reviewing the data sent by the data manager and for visiting the project periodically (two or three times during the field survey) to check that the correct procedures are being followed. This is to ensure that the data is complete and accurate, and that errors are avoided during data collection.

Sample spot checks should be undertaken by comparing the photograph taken in the field to the actual house. The spatial data should also be checked to make sure that the correct point attribute data was transferred to the right property polygon.

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