

# MINISTRY OF HERITAGE AND CULTURE CAPACITY BUILDING PROJECT

# **"DOCUMENTATION AND REHABILITATION OF HISTORIC SETTLEMENTS"** Documentation Guidelines

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COMMISSIONED BY MINISTRY OF HERITAGE AND CULTURE SULTANATE OF OMAN COMMITTEE FOR THE REGISTRATION AND PROTECTION OF HISTORIC BUILDING CLUSTERS

DEVELOPED BY

NOTTINGHAM TRENT UNIVERSITY

CENTRE FOR THE STUDY OF ARCHITECTURE AND CULTURAL HERITAGE OF INDIA, ARABIA AND THE MAGHREB

## **NOTES ON EXECUTION OF WORK**

## WHO / WHAT

- ✓ The team will be working on-site in pairs, possibly at any time on the same cluster. Members of each pair will sequentially:
  - carry out a reconnaissance tour (see "on-site work\_METRIC SURVEY\_STEP 1") of the building units\* they will document, in order to understand the spatial organization and their relationship, if any;
  - sketch simultaneously separate building units belonging to the same cluster (see "on-site work\_METRIC SURVEY\_STEP 2");
  - photograph what they have sketched (see "on-site work\_PHOTOGRAPHIC SURVEY");
  - 4. take measurements of what they have sketched, *together* if using tape and *individually* if using laser measurer) (see "on-site work\_METRIC SURVEY\_STEP 3").
- ✓ Remote sensing activities will be carried out individually by expert team members.

\* Building units include both private and public structures: dwellings, sablahs, mosques, wells, ablution blocks, towers etc.

## WHEN

Working time will be arranged as follows.

## On site:

- 1. sketching;
- 2. taking photographs;
- 3. taking measurements;
- 4. carrying out remote sensing;
- 5. interviewing (audio and video recording).

## Off site:

- 1. downloading photographs and recordings;
- backing up corresponding files on portable storage devices (memory sticks and hard drives);
- 6. naming corresponding files (see "off-site work\_DOCUMENTATION\_Step 4").

## **RECONNAISSANCE AND REMOTE SENSING**

## **STEP 1** \_ Reconnaissance

→ OBJECTIVE: assess the size and nature of the task and decide how best to tackle it, working from the whole to the part.

Notes:

- ✓ <u>At the settlement scale</u>, *altogether*, walk around the whole settlement in order to get an idea of its fabric, the street pattern and hierarchy, the location of open spaces, public buildings and water facilities, the location of falaj and palm crops with relation to the built fabric;
- ✓ <u>at the building scale</u>, *in pairs*, go from ground floor to top floor in order to understand its structure and spatial organization.

## STEP 2 \_ Taking GPS points

→ OBJECTIVE: precisely mapping larger features and areas, as well as pin-pointing individual features within a broader context, in order to provide a visual aid to site analysis.

## $\rightarrow$ EQUIPMENT

With a Garmin 550 T GPS or similar one can take waypoints with an accuracy of up to 3m.

- 1. Before starting at a new site it is worth making sure that the altimeter and compass of your unit are calibrated correctly, particularly after a flight. For this you should have to select the "calibrate altimeter" option in the setup window, and leave the unit lying in the open for about 90 minutes. This is important as all waypoints you store are imported into the pc in 3D, so inaccuracies of up to 30m will show if the unit is not correctly setup. The same should be done with the compass. Both, altimeter and compass can be calibrated simultaneously.
- 2. When taking waypoints, stand in an open environment and check the satellite coverage by pressing on the "coverage bar" at the bottom of the screen. Store the point by

navigating to the Mark Waypoint window, then press "Save and Edit". The unit will automatically store points by numbers, so press "change name" and assign it a unique name. Always make sure you have labelled the waypoint correctly.

- 3. For increased accuracy take several points at the same location. For this you should mark the exact spot of your first recording, move away about 20 meters for about 2 minutes to re-calibrate the unit, and then return to your marked spot to store a further reading. Make sure each point is stored with its own name. These points can later be "averaged" with your GIS software on the pc, increasing accuracy up to 1m.
- 4. The GPS waypoints are stored in your Garmin in the Garmin/GPX folder. The unit automatically opens a new folder for each day (i.e. every 24 hours) meaning that you will have *all points* from one day in one folder. This may make it tricky to distinguish the various points you took, therefore make sure you labelled them comprehensively and distinctly. It is recommended that you rename the folder-name to something more specific than just the date (i.e. burials, perimeter walls, dwelling units 4-7, etc.).



Garmin Oregon 550T, home screen

## STEP 3 \_ Taking geo-referenced photos

→ OBJECTIVE: to provide a precisely located visual record which can be reconstructed at any time.

## → WORK SEQUENCE

Take a photograph of the feature or structure you are interested in. Remember, **this** stores the location of the unit and not of the object you are picturing.

Notes:

 ✓ this is useful for taking wide angle panoramic pictures as not only the location is stored, but also the direction in which the camera faces; ✓ it is also useful for recording small features which might be difficult to locate from context on a standard photograph.

## **METRIC SURVEY**

## STEP 1 \_ Sketching plans, elevations, sections, details

- → **OBJECTIVE:** zoom into each building unit in order to document:
- the plan layout
- the sectional layout
- the façade architectural composition
- the construction details

## $\rightarrow$ WORK SEQUENCE

Proceeding from top floor to bottom floor and from inside to outside, sketch with pencil on A3 plain or graph paper and roughly true to shape, but not to scale:

- 1. plans;
- 2. details;
- 3. sections;
- 4. elevations.

Notes:

- Plans/Sections must have all features and measurements clearly shown without crowding or ambiguity;
- Elevations do not need to be drawn in detail (fully detailed elevations will be drawn in CAD out of stitched and rectified pictures); they must be quickly sketched so as to later note width and height of at least 2 openings, which will serve as control measurements for the scaling of façade photographs.
- ✓ Details must be named with letters ("a", "b", "c" etc.) and indicated in plans, by means of an arrow coming out of them. Where detail is too small or too elaborate to show up clearly on the main sketch, larger detail sketches should be made on the same sheet of paper, suitably referenced with the assigned number, so that they may be referred later.

## $\rightarrow$ DRAWING METHODOLOGY

#### Plans

Each floor, including the roof, must be drawn, proceeding from top floor to ground floor.

✓ <u>Floor plans</u> are drawn looking down on the floor being drawn, as if the building has been sliced through horizontally at about 1/1,5 m above the level of the floor concerned; ✓ <u>roof plans</u> must include gutters, direction of falls, covering materials, parapets, skylights, stacks, rainwater heads, etc..

## Elevations

Each elevation need not be completed in its entirety where detail is repetitive, i.e. identical openings, niches, decorative features etc.

## Sections

Each section of the building needs to show what would be visible if the building was cut vertically.

- ✓ A section need not be in one straight line across the building in plan (or vertically), it may be stepped if it is more appropriate for the job. In such cases the section actually becomes a combined section and elevation in effect;
- $\checkmark$  the section lines should be shown on the plan sketches.

## Details

Details to be shown in plans include:

- ✓ wall openings (doors, windows, screens, niches, arched openings and recesses, decorative patterns, etc.);
- ✓ changes in floor thickness, changes in floor levels (steps, stairs, ramps, etc.), construction (materials, span directions, etc.);
- ✓ service installations, fixtures and fittings (water, electricity, ventilation, power, lighting, communication, cooking, sanitation, washing, drainage, etc.).

Details to be shown in elevations and sections include:

- ✓ sills, lintels, external piping, etc.;
- ✓ any detail which is visible on elevation but cannot be shown on plans.

MINISTRY OF HERITAGE AND CULTURE PROJECT DOCUMENTATION AND REHABILITATION OF HISTORIC SETTLEMENTS on-site work \_ METRIC SURVEY



UNDER-STAIR ARCHED

Sketching guidelines of typical architectural features

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## STEP 2 \_ Taking measurements

→ OBJECTIVE: zoom into each building unit and element in order to record linear measurements (length, width, height, depth).

#### Notes:

- ✓ take every possible diagonal measurement within rooms;
- ✓ measure every wall (walls may vary in thickness throughout their length and height, particularly at intersections with cross walls and partitions);
- ✓ never assume buildings and rooms to be rectangular (the fact that two diagonals of a notionally rectangular room are equal does not mean that the room is rectangular).

## $\rightarrow$ WORK SEQUENCE

- 1. Take targeted measurements;
- 2. book the measurements on sketches.

## → SURVEY TECHNIQUES AND EQUIPMENT

Linear measurements (**horizontal distances**) may be carried out by use of a 20 or 50 m steel or synthetic tape (for accuracy reasons, taping is carried out with the tape held at chest height). Measurements to be taken include:

- room diagonals;
- distances between opposite room walls;
- wall lengths;
- wall thickness;
- position and dimensions of openings.

#### Notes:

- ✓ all measurements are conventionally taken from left to right, i.e. anti-clockwise around the outside of the building and clockwise around the interior of rooms, since in this way the figures on the tape will be the right way up and errors in reading will be minimized;
- ✓ when measuring door openings in internal walls, the measurement along the wall is made to the edge of the actual door, all architraves, facings and so on being ignored;
- ✓ wall thickness must be measured at every opening in internal and external walls, so that an unnoticed change of thickness may be detected (it must be measured as the actual total thickness of materials - rendering, brick, plaster and all).

Linear measurement (**heights**) may be carried out by use of a 2 *m* rod or a tape, which can be dropped for very long or overall heights. Measurements to be taken include:

- height of at least 2 openings;
- wall height (top to bottom) at each corner

Heights must always be related to a level line across the elevation, which serves as a baseline from which all the measurements can be taken, either above or below it.

The level line can be represented by a selected suitable datum surface, such as the line of a visible damp-proof course, a plinth or a string course etc.

- Notes:
- ✓ where it is considered that the selected datum surface is not horizontal, this may be checked using the surveyor's level and staff (when the level is set up, the same staff reading should be obtained from all points on the datum surface if it is level);
- ✓ when the surveyor's level and staff are not available, a level line can be created by sticking two self-adhesive targets (one at each end of the elevation) onto the pointing at the same height, with a string stretched between them and a measuring tape alongside, its end on the left-hand nail.

## $\rightarrow$ BOOKING THE MEASUREMENTS



Sample sketches of plan, section and elevation, including partial horizontal measurements

- ✓ Single or skeleton line booking is used;
- ✓ measurements should be booked, on one straight line, as sequential sets of single



#### Sample sketches of construction and architectural details

partial measurements;

- ✓ measurements are written in the direction of measurement;
- ✓ offsets and plus measurement may be entered either right or left of the line as space permits, provided there is no ambiguity;
- ✓ floor-to-ceiling heights should be written in the centre of the floor plan of the area covered, the figures being encircled to indicate that they are not horizontal dimensions.

## STEP 4 \_ Recording change

→ OBJECTIVE: document current uses of the different urban and building spaces and identify traces of any change in the building's *original use*, *users*, *layout* and *construction* in relation to social, cultural, economic and political change.

#### → WORK SEQUENCE

1. Sketch floor schemes next to corresponding floor plans and note *changes in usage and ownership* (if available) on them;

- 2. note changes in layout (additions, demolitions etc.) using different colours;
- 3. note changes in construction (alterations, repairs, adaptations etc.).

## **PHOTOGRAPHIC SURVEY**

## STEP 1 \_ Bird's eye views

→ **OBJECTIVE:** have 3D visual references for a better understanding of settlement structures and for helping in drawing up plans.

- 1. Take bird's eye views from roofs, were viable, towards different directions, starting from the north-eastern corner of the roof and proceeding clockwise;
- 2. note viewpoints on urban plans provided.



Sample bird's eye view

## STEP 2 \_ Street views

→ **OBJECTIVE:** have perspective views for a better understanding of settlement patterns, building distances and sequence, street size and patterns etc.

## $\rightarrow$ WORK SEQUENCE

- 1. Take photographs from opposite ends of the street, starting from the north-eastern corner of the building and proceeding clockwise;
- 2. note viewpoint on urban plans provided.



Sample street view

## STEP 3 \_ Façade/wall photographs

→ OBJECTIVE: obtain photographic panoramic sequences of façades in order to measure or check them off-site.

- 1. Take sequential photographs of *External Façades*, proceeding clockwise around the building;
- 2. take sequential photographs of *Terrace Façades* (if façade does not fit all in camera angle), proceeding clockwise around the courtyard/terrace;
- 3. take sequential photographs of *Room Walls* (if wall does not fit all in camera angle), proceeding clockwise around the room.



Sample external façade (left), room (right) and courtyard façade photograph (bottom)

## STEP 4 \_ Detail photographs

→ **OBJECTIVE:** identify and analyse details in order to provide abaci (e.g. of doors, niches, floors, walls, roofs etc.) showing *architectural features*, *decorative patterns* and *construction techniques*.

#### $\rightarrow$ WORK SEQUENCE

Take photos of *details*, proceeding clockwise around the building and the room.



ON-SITE WORK

Sample details photos

## DOCUMENTATION

## STEP 1 \_ Storing and editing waypoints

→ OBJECTIVE: download waypoints from the handheld into the pc and how you can use the points to rectify images and mark features, etc..

- 1. In *Global Mapper 12* (GM12) GIS software, drag and drop the GPX files from the GPX folder of your Garmin onto your workspace. They will automatically find their place in 'the world'. This is useful when geo-referencing or rectifying plans, maps and orthophotos. To do this, when you drag and drop a plan or image onto the workspace, GM12 will ask you whether you want to rectify the image. Select "yes" and follow the instructions. Use the already imported GPX points to "nail" their location on the image, selecting "add point" after each one. Remember, the more points you have in an image the greater the accuracy will be. For aerial photographs, make sure they are as vertical as possible, otherwise the distances between features on the ground will not be reflected by the distance between the same features on the photographs.
- 2. In Global Mapper 12 you can assign and edit "point styles" to the various features that you have recorded with your GPS. This will make it easier to distinguish types of points. To do this simply right-click the point you want to edit on your work space, and select "Edit point style". Using the "digitizer tool" (icon is a pencil with a wavy line on the toolbar) you can draw features such as lines, areas and polygons onto your workspace, with values being displayed in the bottom left corner.
- 3. Develop a clear and precise referencing system for labelling the various points you have taken. This may be added-to as work progresses, but should be exported and updated on a regular basis to avoid calamity if something happens to the GPS unit.

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Erite Image	Zooned Yeev (Click for Pose Zoordnates)	Reference Images (Load into Main View First)	
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Point Name   Pixel X   Pixel Y   Projected X   Projected Y   Longitude   Latitude		Error Delete	
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			Cancel

Global Mapper 12: image rectifying screen

## STEP 2 \_ View shed analysis

→ OBJECTIVE: to reconstruct the visual context of a site or feature and placing it accurately within the landscape.

- 1. Import a DEM (Digital Elevation Model) in *Global Mapper 12*. These tend to be in a GEO-tiff format and are therefore already rectified. If not, follow the same steps as with a normal map, plan or photo outlined above.
- 2. Once you have loaded your DEM, drag and drop the GPS points from which you want to calculate the view shed onto your DEM. These will be marked automatically as black dots with their names beside them. Select a dot and press the View Shed Tool button on the toolbar (icon is a transmission tower).
- 3. In the View Shed Setup window you will be able to choose the parameters and style of your view shed. Make sure you select a "transmitter elevation" that represents the location from which you want to calculate a view shed, i.e. if from the top of a ruined tower, add the hypothetical original height of this tower. For visual radius, the average line of sight without visual aids such as telescopes or binoculars lies around 13-15 km, depending on atmospheric conditions and the size of the what one is trying to see.

4. Change the sample spacing values along X/Y axis to increase or decrease the accuracy of the viewshed. The default is set to 0.00027 for either axis. Decreasing this value will increase accuracy but significantly lengthen calculation time.



Global Mapper 12: View Shed Setup screen

## STEP 3 \_ Drawing up settlement plans

→ OBJECTIVE: draw up settlement plans.

## $\rightarrow$ WORK SEQUENCE

- Import in *AutoCAD* the aerial photographs provided, which have been previously scaled, and trace out line plans on them (scale 1:2000), proceeding clockwise by grid squares;
- 2. add appropriate scale bar;
- 3. number the grid squares at the top of the plan, from left to right (1, 2, etc..);
- 4. name the grid squares on the left-hand side of the plan, from top to bottom (A, B, etc.),
- 5. number the properties within each grid square proceeding clockwise from the northeastern corner of each square (1, 2, etc.).

Notes:

✓ properties falling in two adjacent grid squares will be considered as belonging to the square where the entrance to the property is located.

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Sample settlement plan with overlapping UTM grid and with properties already numbered

## STEP 4 \_ Drawing up plans, elevations, sections, details

 $\rightarrow$  **OBJECTIVE:** draw up architectural drawings of surveyed buildings.

## $\rightarrow$ WORK SEQUENCE

## Plans

1. Draw up plans (**scale 1:200**) as per survey sketches with the help, when necessary, of photographs to better visualize the building's features.

## **Elevations/Sections**

- Import the files of the façade sequential photographs in *HUGIN 2010.2.0* (downloadable free from <u>http://hugin.sourceforge.net/download/</u>);
- 2. stich them together obtaining one single photograph (see Fig. 1);
- 3. save the photograph file as specified in "off-site work\_DOCUMENTATION";
- 4. import the stitched photograph in *Perspective Rectifier 3.3*;
- correct perspective distortion and scale the photograph by using the control measurements previously taken (i.e. width or height of 1 opening) (see Fig. 2);

 import the rectified and scaled photograph in *AutoCAD* and trace out elevation or section on it (scale 1:200).



Fig. 1 - Key steps in stitching multi-row handheld photographs together into a single image

## Details

- 1. Import in *Perspective Rectifier 3.3* the file of the detail photograph;
- 2. correct perspective distortion and scale the photograph by using the control measurements previously taken (i.e. width or height of detail) (see Fig. 2);
- import the rectified and scaled photograph in *AutoCAD* and trace out detail on it (scale 1:20/1:10).

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Fig. 2 - Key steps in removing perspective distortion from a photograph using both horizontal and vertical control measurements

STEP 5 \_ Laying out the survey on the sheet

 $\rightarrow$  **OBJECTIVE:** organize the drawings in suitable layouts.

## $\rightarrow$ WORK SEQUENCE

- 1. The ground floor plan should be placed at the bottom left-hand corner of the sheet, with the front of the building towards the bottom of the sheer;
- 2. the <u>first floor plan</u> and the <u>other floor plans</u> should be placed alongside the ground floor plan with the same orientation;
- 3. the front elevation should be placed immediately above the ground floor plan;
- 4. the <u>other elevations</u> should be placed across the sheet in a row and level with the front elevation;
- 5. the sections should be placed alongside the elevations;
- 6. the site plan should be placed with north towards the top of the sheet.

## STEP 6 \_ Filing sketches, drawings and photographs

→ OBJECTIVE: create a constantly updated electronic archive of documentation material, adequately named, saved and backed up.

## → WORK SEQUENCE

#### Files of sketches

- 1. Scan sketch and save it as .jpg, colour, 300 dpi resolution;
- 2. name file in either of the following ways:

NAME OF SETTLEMENT/name of harat\_grid square\_property sketched.jpg (i.e., BAHLA\_al-'Aqr\_A3\_1\_01.jpg will be the file name of sketch no. 01\* of property no. 1, which falls into grid square A3 of Harat "al-'Aqr" in "Bahla") or NAME OF SETTLEMENT/name of harat\_property\_property sketched.jpg (i.e., IZKI\_al-Yemen\_A1\_01.jpg will be the file name of sketch no. 01\* of property A1, that is property no. 1 of character zone A, of Harat "al-Yemen" in "Izki").

\*The numbering of sketch scans will proceed sequentially from bottom up (01 will indicate sketches of the basement floor, if any, or ground floor, 02 will indicate the upper floor and so on).

#### Notes:

✓ If two or more adjoining properties are sketched on the same paper, sketch files will be named, for example, as follows: BAHLA\_al-'Aqr\_A3\_1-2\_01.jpg will be the file name of sketch no. 01 of properties no. 1 and 2, which fall into grid square A3 of Harat "al'Aqr" in "Bahla" or **IZKI\_al-Yemen\_A1A2\_01.jpg** will be the file name of sketch no. 01 of properties A1 and A2, that is property no. 1 and property no. 2 of character zone A, of Harat "al-Yemen" in "Izki".

#### Files of CAD drawings

- 1. Save file as AutoCAD 2004/LT 2004 Drawing (\*.dwg);
- 2. name file in either of the following ways:

NAME OF SETTLEMENT\_name of harat\_grid square\_property.dwg (i.e., BAHLA\_al-'Aqr\_A3\_1.dwg will be the file name of drawings of property no. 1, which falls into grid square A3 of Harat "al-'Aqr" in "Bahla") or NAME OF SETTLEMENT\_name of harat\_property.dwg (i.e., IZKI\_al-Yemen\_A1.dwg will be the file name of drawings of property A1, that is property no. 1 of character zone A, of Harat "al-Yemen" in "Izki").

#### Notes:

✓ files of CAD drawings will be property-related and will include all relevant drawings (plans, elevations, sections, details).

#### Files of photographs

- 1. Download photographs;
- 2. name file as follows:

#### **BIRD'S EYE VIEWS**

**NAME OF SETTLEMENT\_BEV number** (i.e., **BAHLA\_BEV01.jpg** will be the file name of Bird's Eye View no. 01 of "Bahla");

## STREET VIEWS

NAME OF SETTLEMENT\_name of harat\_grid square\_SV number.jpg (as previously named in urban plans provided) (i.e., BAHLA\_al-'Aqr\_A3\_SV01.jpg will be the file name of Street View no. 01 of grid square A3 of Harat "al-'Aqr" in "Bahla") or NAME OF SETTLEMENT/name of harat\_property\_SV number.jpg (i.e., IZKI\_al-Yemen \_A\_SV01.jpg will be the file name of Street View no. 01 of character zone A of Harat "al-Yemen" in "Izki");

<u>ALL OTHER PHOTOGRAPHS (including façade/wall photographs and detail photographs)</u> **NAME OF SETTLEMENT\_name of harat\_grid square\_property\_sequential no. of photo.jpg** (i.e., **BAHLA\_al-'Aqr\_A3\_1\_001.jpg** will be the file name of photo no. 001 of property no. 1, which falls into grid square A3 of Harat "al-'Aqr" in "Bahla") or **NAME OF SETTLEMENT\_name of harat\_property\_sequential no. of photo.jpg** (i.e., **IZKI\_al-Yemen\_A1\_001.jpg** will be the file name of photo no. 001 of property A1, that is property no. 1 of character zone A, of Harat "al-Yemen" in "Izki").

#### **Files of GPS points**

- 1. Download GPX files;
- 2. name file in either of the following ways:

NAME OF SETTLEMENT\_name of harat\_grid square\_feature name\_01.gpx (i.e., BAHLA\_al-'Aqr\_A3\_SEsablah\_01.gpx will be the file name point no. 01 taken at the south-east sablah, which falls into grid square A3 of of Harat "al-'Aqr" in "Bahla") or NAME OF SETTLEMENT\_name of harat\_character zone\_feature name\_01.gpx (i.e., IZKI\_al-Yemen\_Z\_SEtower\_01.gpx will be the file name point no. 01 taken at the south-east tower, which falls into zone Z of Harat "al-Yemen" in "Izki").