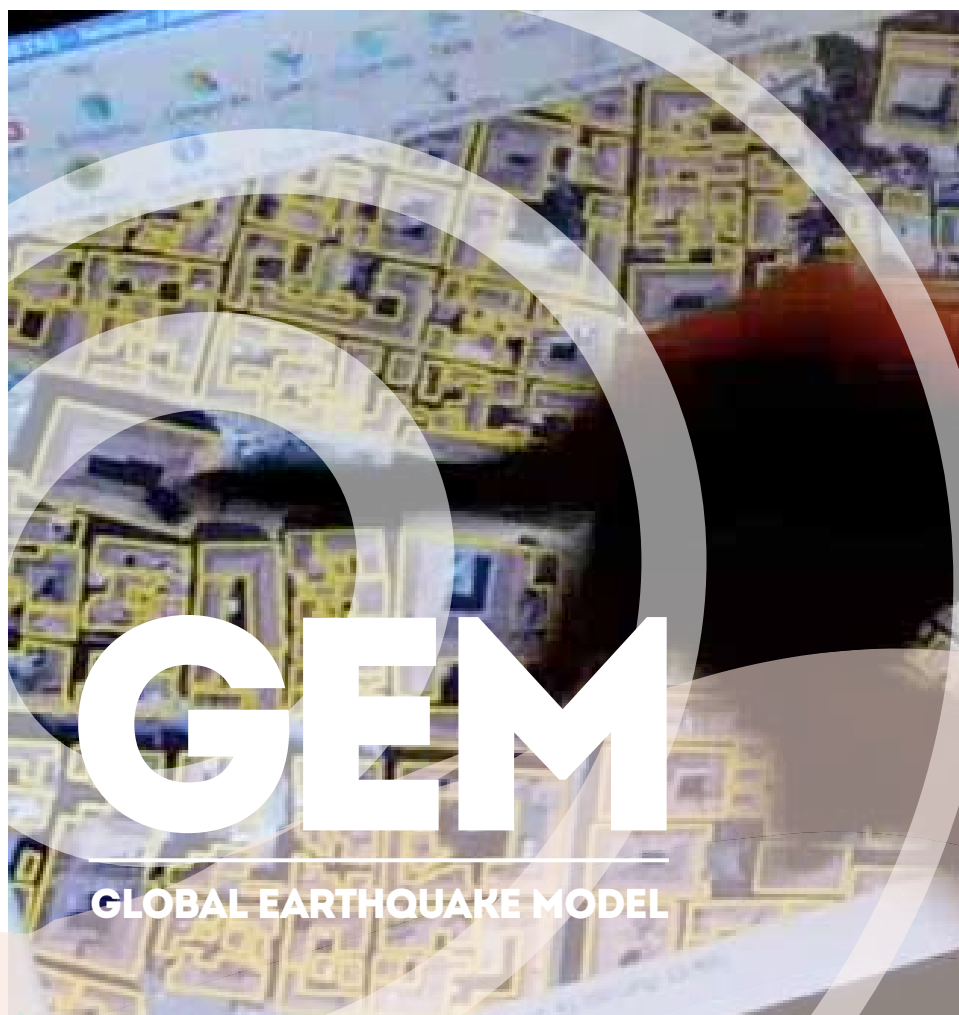


GEM TECHNICAL REPORT
2014-03 V1.0.0

User guide: Android mobile tool for field data collection

Rosser, J., J.G. Morley, A. Vicini

**DATA CAPTURE
TOOLS**



User guide: Android mobile tool for field data collection

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Photo credits

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Small cover image: © James Brown, GEM Foundation

<http://www.globalquakemodel.org/>

ABSTRACT

The Global Earthquake Model (GEM) aims to provide a set of tools and models for hazard and risk analysis. The fundamental aim of the GEM Inventory Data Capture Tools (IDCT) risk global component is to provide a set of software and accompanying user protocols to enable users to collect and modify building exposure information, which can be input into the Global Exposure Database and the Global Earthquake Consequences Database.

This report forms the user guide for IDCT Android Inventory Data Mobile Tool, which is available from Google Play. It details the usage of the mobile tool for setting up data capture, utilising the map interface, marking survey points, capture of building attributes, export of survey data and import of offline map data.

Keywords

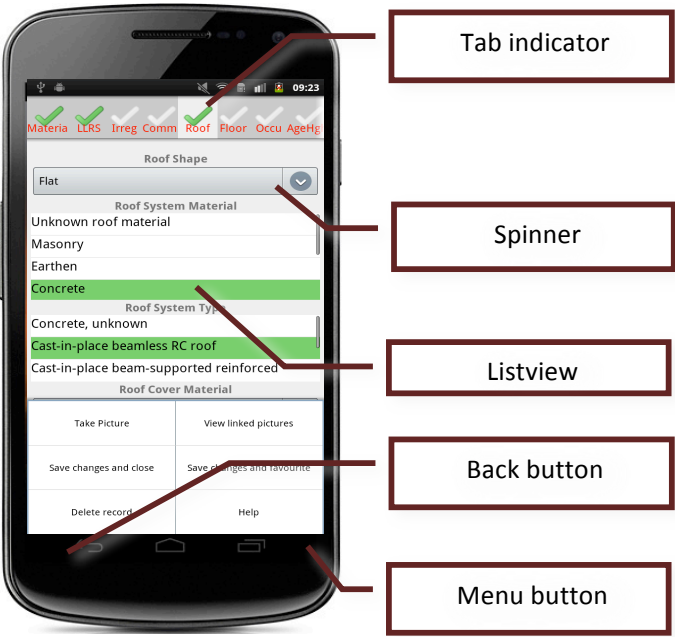
user guide; documentation; mobile app; field data capture; Android

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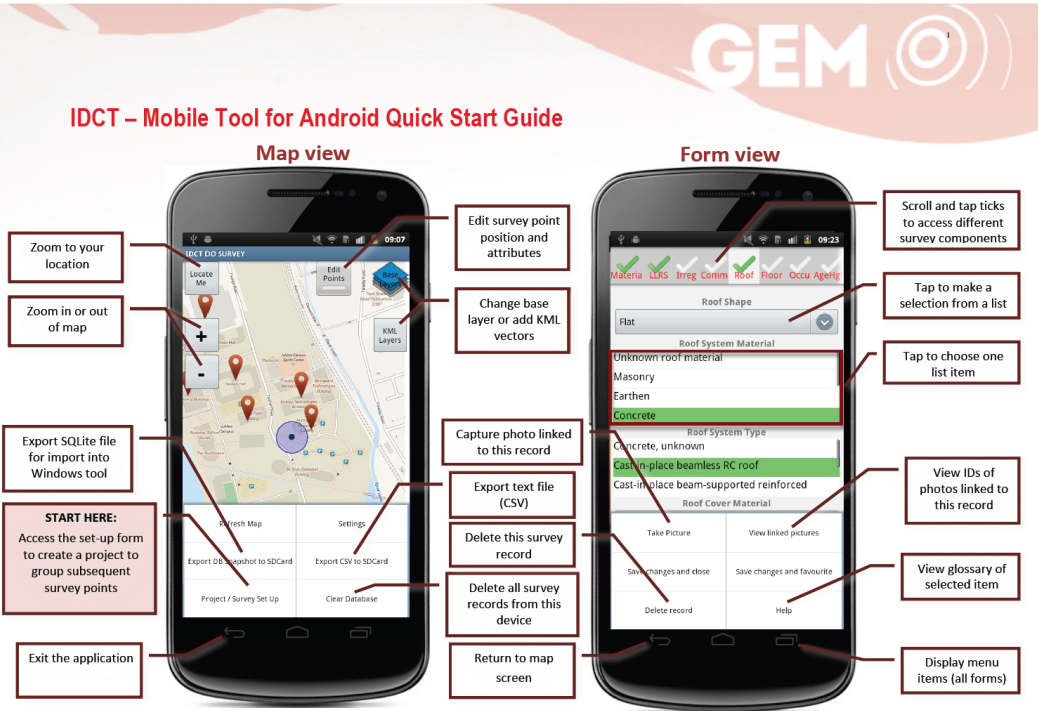
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1 Android Interface Glossary

The first figure below gives the terms used for different graphical user interface elements in the Android system, referred to some on-screen examples:



The second reference image, below, is the Mobile Tool for Android's Quick Start Guide (also shown in a full-page layout in Appendix B for printing), showing the major interface functions of the tool:



2 Set Up and Map Interface

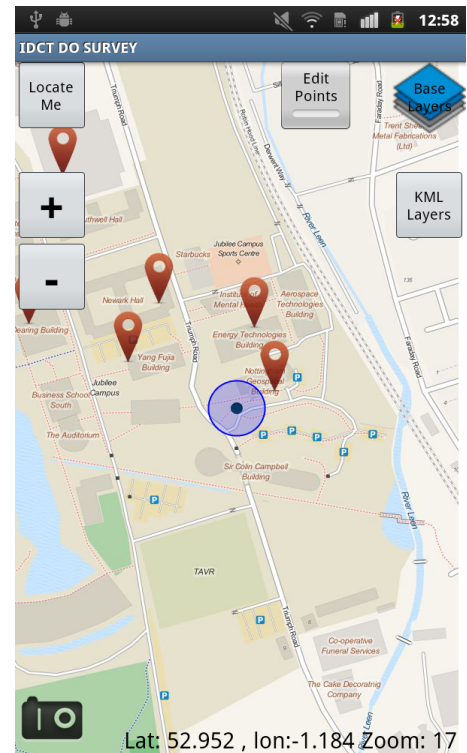
2.1 Map Interface

The main map screen displays base mapping, previous survey points (red pins), user location based on GPS or Network / Wi-Fi positioning (blue dot and circle indicating positional accuracy).

Text data of positioning information including latitude and longitude and current map zoom level is provided at the bottom of the screen.

Access to the device's camera is possible from the map interface to capture general photographs. Photos taken using this feature will *not* be linked to individual survey records. The camera button is located at the bottom left of the screen.

Press the Android menu key (see Quick Start) to access further menus, including for Project Set-Up.



2.2 Project Survey Set Up

Prior to commencing field survey an appropriate project should be set up on the device. This step captures important metadata regarding the survey and allocates a project code to the records being collected. This helps with subsequent merging of records with data collected by other surveyors using other devices and systems. Members of a team assigned parts of a single survey are recommended to use the same project code on each device in the team.

Fields for entering surveyor's name, survey project name, survey date and project summary are provided. After entering and saving these details, the application configures subsequent survey records to be stored against the project code. Users may return to the map interface by pressing the device back button.

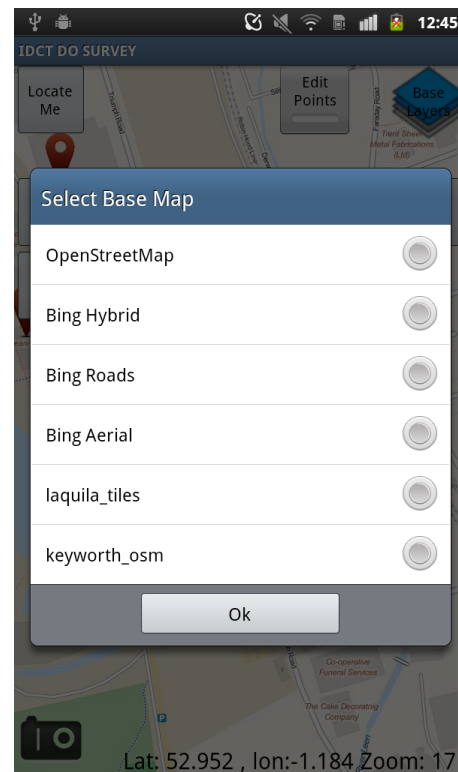
Changing to a previous project code at a later date is facilitated with "Select Project Details" spinner at the bottom of the form.

Selecting a project returns you to the map view.

2.3 Layer Switching

Selection of base-mapping layers is achieved by pressing the Base Layers button in the top right of the screen. A choice of online base maps is available to users including: OpenStreetMap, Bing Hybrid, Bing Road and Bing Aerial.

Where users have loaded offline map tiles onto the device, these maps are listed toward the bottom of the Select Base Map dialog. Please see Section 4 for loading of offline maps onto devices.



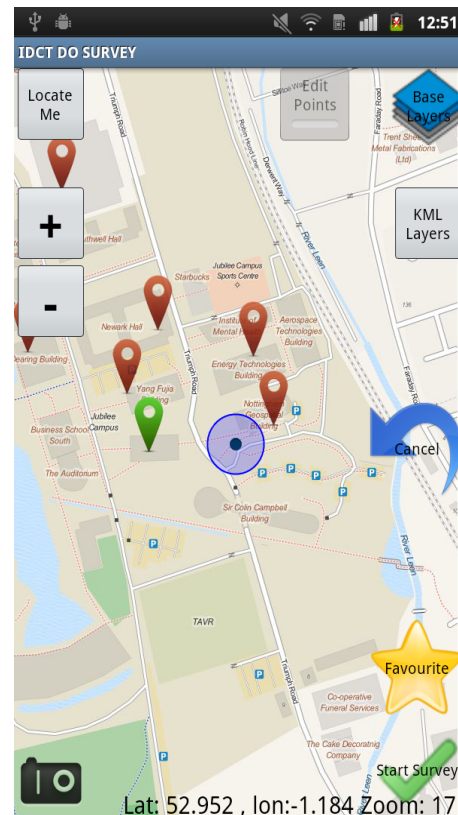
2.4 Adding/ Editing Survey Points

To edit a previously created survey point, press the “Edit Points” button. This activates the editing map mode. A previous point can then be selected, allowing its position and attributes to be adjusted in the same way as if the point was newly added.

Tapping the map places a single survey point at a candidate location. The survey point’s position can be adjusted by dragging the point, or tapping on another location.

After placing a new point, additional elements are added to the interface:

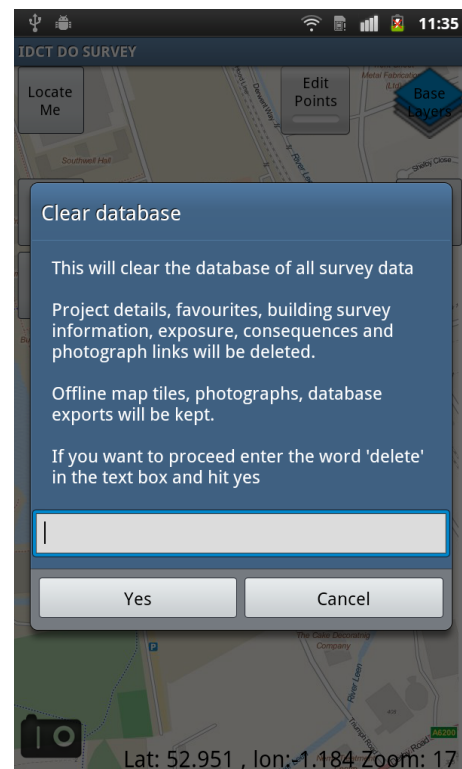
- The Cancel (undo) button removes the point
- The Favourite button allows a previously generated favourite set of attributes to be initially applied to the new survey point.
- The Start Survey button takes the user to survey attribute forms to enter details of the building at the point location.



2.5 Clearing the Database

Previously created survey records may be cleared from the database to reset the system to its initial state. When this operation is completed, project details, favourites, survey records and photograph links (including photograph comments) will be deleted from the database. Files separate from the survey database including photographs, offline maps and previously made database exports are retained.

To clear the database, access the Android menu from the map screen and press “Clear database”. A dialog box will be displayed with information about the procedure and an empty text field. Entering the word “delete” (without quotation marks) and pressing “yes” will complete the operation. The application will then automatically restart and return to the map screen.

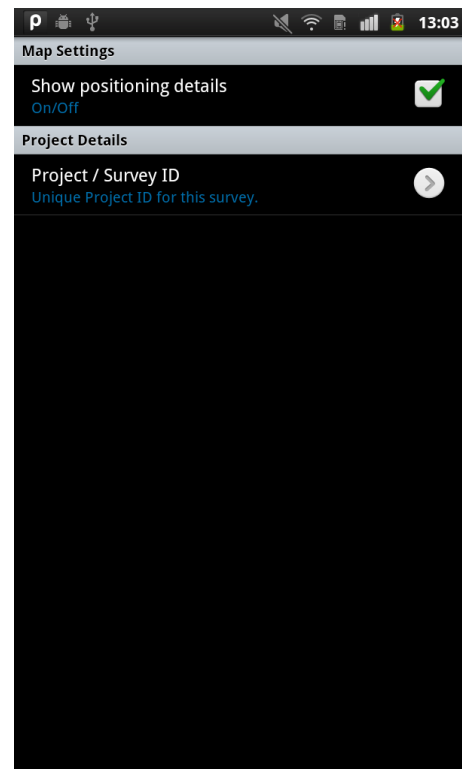


2.6 Settings

The settings menu provides additional features for setting functionality of the app. Firstly, details regarding the GPS or Network / Wi-Fi positioning can be displayed on the map interface. The details show the provider of the positioning data (“Prov”, e.g. GPS or cellular network/Wi-Fi), positioning accuracy (“Acc”, measured in metres), and the time of the last position update.

The settings menu also provides the ability to view and edit the current Project / Survey ID information. The ID can be modified using the text field displayed when the Project / Survey ID button is pressed.

To show the settings menu, access the Android menu from the map screen and press “Settings”. A form screen will appear displaying the “Show Positioning details” checkbox and “Project / Survey ID” buttons.



3 Building Attribute Data Capture

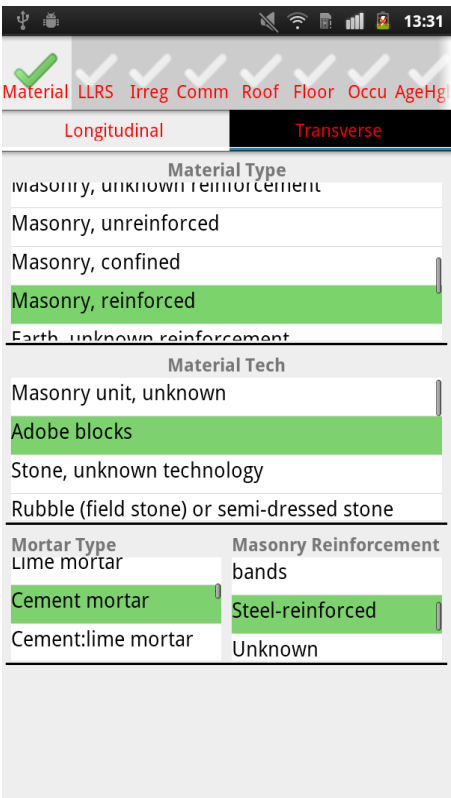
3.1 Survey Point Attribution

Starting a new survey or modifying previous data triggers display of the main set of survey forms. Survey forms are arranged as tabs. The “tick” icon for a tab turns green to indicate that data has been entered in the tab’s form.

Survey form elements may either be list views, spinners or free text / numeric fields.

Press the Android menu button and then select “Save Changes” to save the data for the survey point and return to the map.

Pressing the Android back button and choosing not to save the observation will cancel data entry and return to the map without saving.



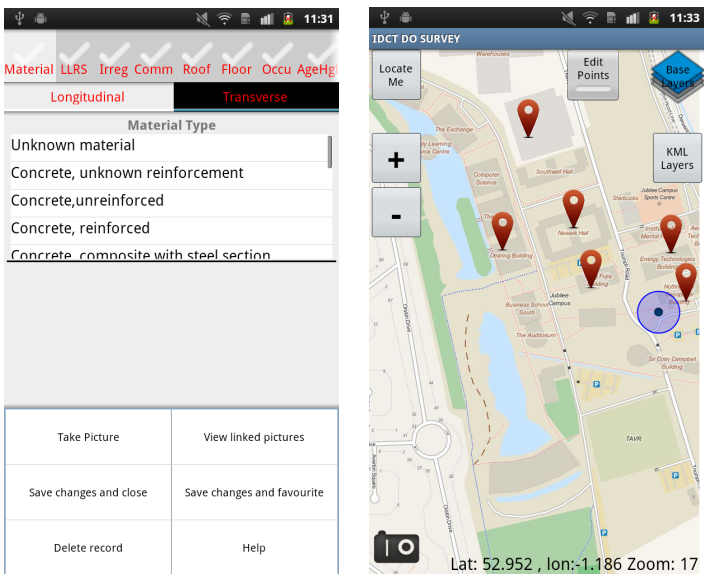
3.2 Photograph Capture

The app can use the device camera to take photographs. These can be linked to individual survey records or captured for general reference.

To take a photograph linked to the current survey point, access the Android menu from any survey form, and tap on “Take Picture” (left image). Comments may be added to photographs linked to survey records. A dialog box is displayed subsequent to capture to facilitate this.

Capture of general, unlinked photographs is carried out from the map view using the camera button (right image).

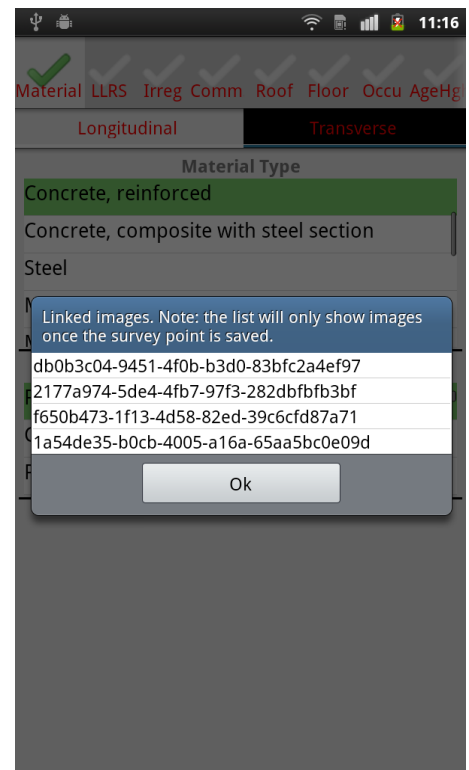
All photographs captured with the tool are stored in the *idctdo/gemmedia* directory.



3.3 View Linked Photographs

The list of photographs that have been linked to an individual survey record can be viewed. This allows users to check that photos and records have been correctly linked. For an up to date list of linked images to be shown, the survey record must be saved first.

To view the list of linked photographs, access the Android menu from the survey forms, and select the menu item “View Linked Pictures”. A dialog box is displayed listing the photographs by name.

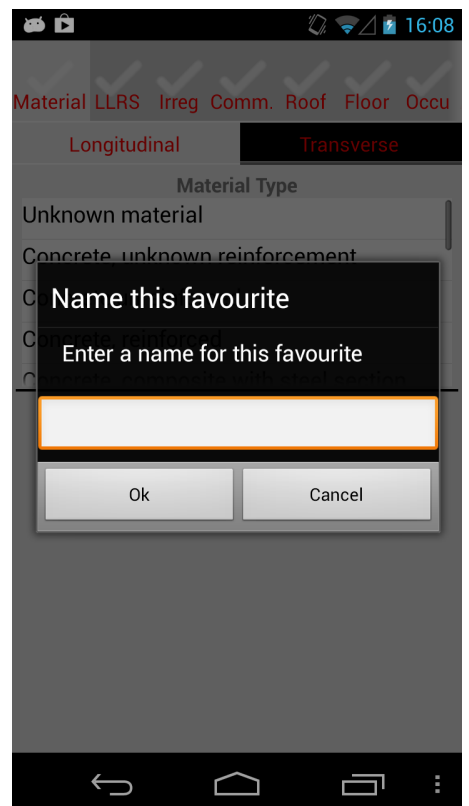


3.4 Favourite Records

The attributes entered for a particular survey point maybe saved as a favourite and used as a template for other survey records.

To create a favourite, access the Android menu from the survey forms, and select the menu item “Save changes and favourite”. A dialog box is displayed to enter a name for the favourite.

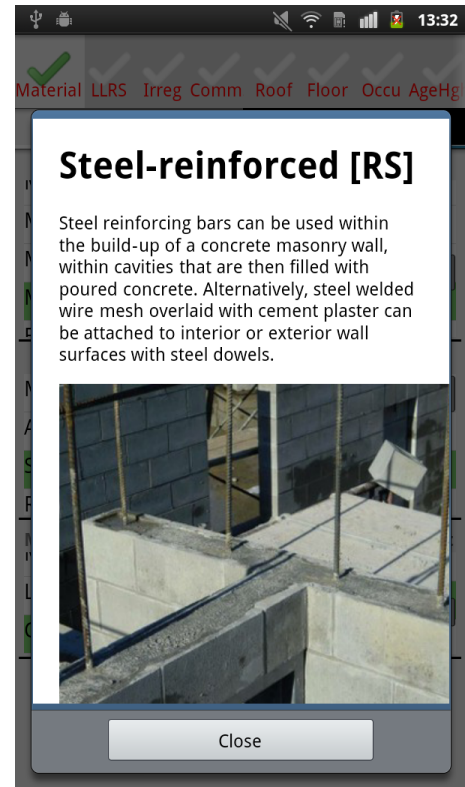
The set of attributes stored in a favourite can be applied to a new survey point from the map interface once the new point has been dropped on the map (see Section 2.4, above).



3.5 Taxonomy Glossary Documentation

When entering building information, glossary documentation may be accessed to help attribution. Glossary information is available for most attribute types.

After selecting a record (i.e. though setting a spinner or highlighting a list item), press the Android menu button and press “Help”. A separate dialog is displayed containing related information and definition of the selected item.



4 Data Import / Export

4.1 Adding Offline Maps and KML

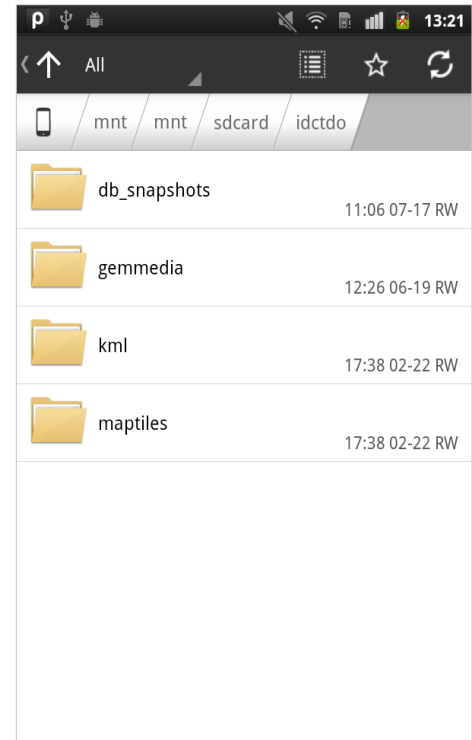
Base map tiles (as *.png files) and KML data may be pre-loaded onto the device. When the application is installed, the directory *idctdo* is created. Within this directory, *maptiles* and *kml* directories are generated into which users can copy directories containing sets of map tiles or individual kml files.

The offline layer will be listed in the map with the same name as the directory containing the tiled map set.

Sets of base map tiles may be generated by freely available software such as MOBAC [1] or MapTiler [2] - see Appendix A for details of this process.

The Mobile Tool for Android supports tile mapping systems defined by the Tiled Mercator System (TMS) and OSM/Google tile indexing. To display TMS tiles, a *tilemapresource.xml* document should be present (it may empty) to indicate the tiles are indexes using the TMS, otherwise the tool assumes OSM / Google style indexing.

Note that the path of the tiles should be: *maptiles/<layer name>/<folder with first number>/<folder with second number>/<number of the tile>*.png.tile*



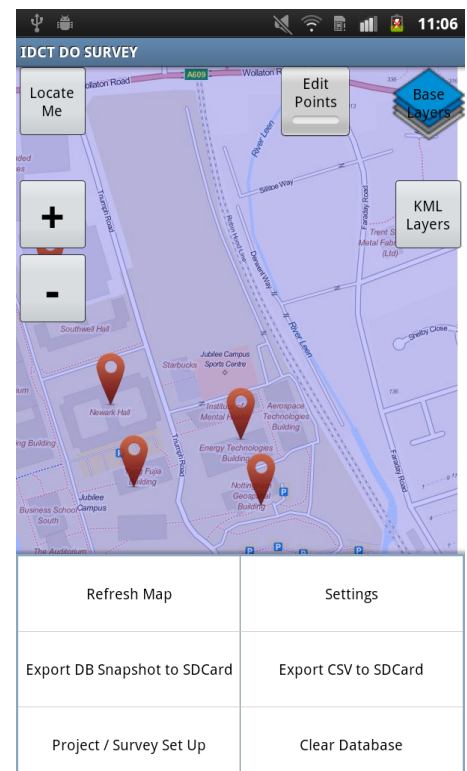
4.2 Data Export

Survey data may be exported as CSV for quick viewing on the device or use on another computer system or application (e.g. spreadsheet or GIS).

Alternatively data may be exported as a SQLite database snapshot.

On the map view, access the Android menu – from there select either the “Export DB Snapshot to SDCard” or “Export CSV to SDCard” items as appropriate.

Once exported, data files can be found in *idctdo->db_snapshots*



REFERENCES

Website references

1. MOBAC Mobile Atlas Creator

Mobile Atlas Creator

(Available at <http://mobac.sourceforge.net>)

2. MapTiler

MapTiler – Map Tile Cutter

(Available at <http://www.maptiler.org/>)

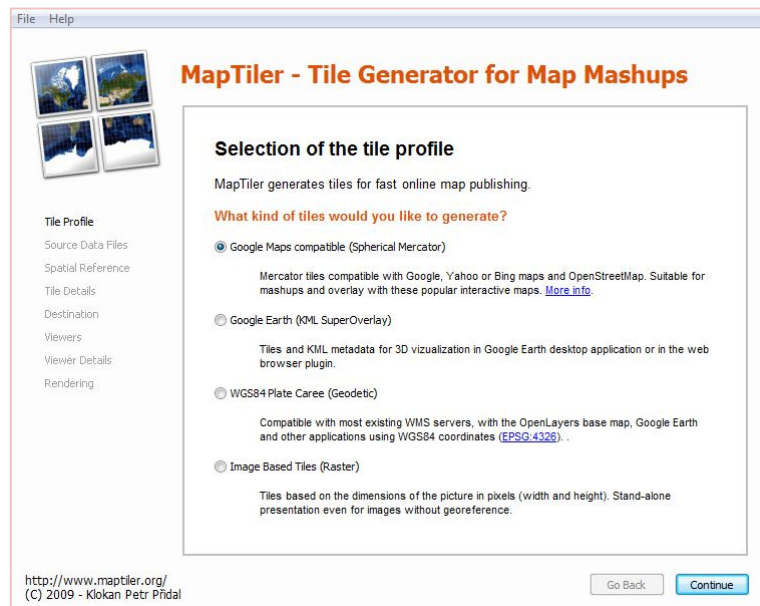
APPENDIX A Preparing Base Maps and Imagery for IDCT Mobile Tools

This section presents a step-by-step protocol to convert remotely sensed imagery to tiles compatible with the tools, using two different pieces of freeware software. MapTiler is used to process satellite (or aerial) images, whereas Mobile Atlas Creator is used to process street map data. Given the large range of devices compatible with the Mobile Tools, the final section covers the process for loading the data on the field deployment device only in general terms.

A.1 MapTiler

MapTiler is freeware software available at www.maptiler.org designed to convert a broad range of image files to tile for fast online map publishing. In this section, a protocol to convert a high-resolution satellite image to a set of tiles compatible with the Mobile Tools is presented, alongside screenshots of the actual procedure.

When starting MapTiler, the first screen defines the tile profile to be used in the conversion; Select *Google Maps compatible* and click *Continue*.



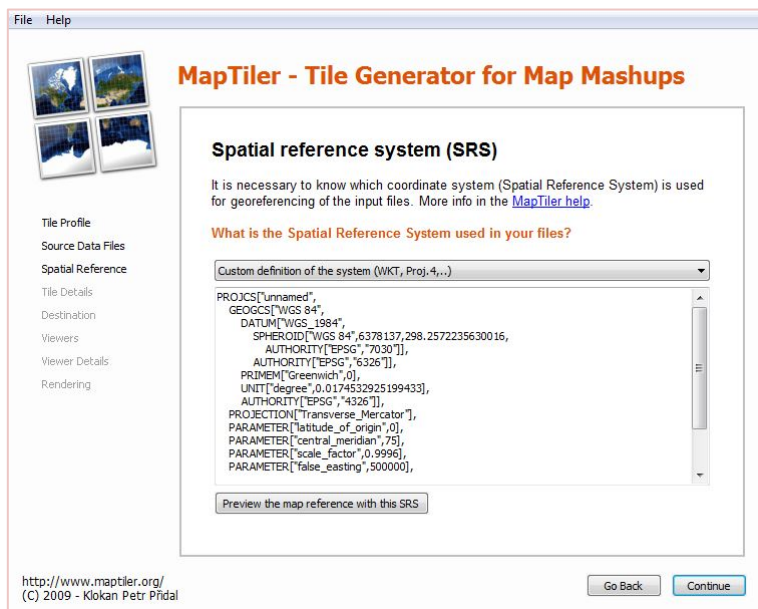
Selection of the tile profile

In the Source Data files window, click *Add* and navigate to the satellite image to be processed.



Source image selection

In the Spatial reference system window, a textbox shows details about the projection of the selected image. An empty textbox means that the software has not been able to recognise the projection, and needs the user to manually select the appropriate one using the relative entry from dropdown menu. This is important to get right to ensure the tiles appear correctly located in the Mobile Tools' map.



Spatial Reference System selection

The following window presents the settings for the creation of the rendered tile pyramid. The *minimum* and *maximum zoom* boxes define the range of tiles zoom levels to be created. The default values are calculated automatically from the selected image. The Mobile Tools allow for a maximum zoom level of 18 and no minimum level.

From the *File format* dropdown menu, select *PNG – with transparency*. Tiles with this format can handle transparency, whereas the JPG format shows black bands around the tile in case of non-standard dimensions.

MapTiler - Tile Generator for Map Mashups

Details about the tile pyramid

In this step you should specify the details related to rendered tile pyramid.

Zoom levels to generate:

Minimum zoom: Maximum zoom:

Note: The selected zoom levels are calculated from your input data and should be OK in most cases.

Please choose a file format

Note: We recommend to [postprocess the produced PNG tiles with the PNGIO utility](#).

<http://www.maptiler.org/>
(C) 2009 - Klokán Petr Pířal

[Go Back](#) [Continue](#)

Pyramid Details selection

In the Destination window select the output folder and click *Continue*.

MapTiler - Tile Generator for Map Mashups

Destination folder and address

Please select a directory where the generated tiles should be saved. Similarly you can specify the Internet address where will you publish the map.

Where to save the generated tiles?

Result directory: [Browse](#)

The Internet address (URL) for publishing the map:

Destination URL:

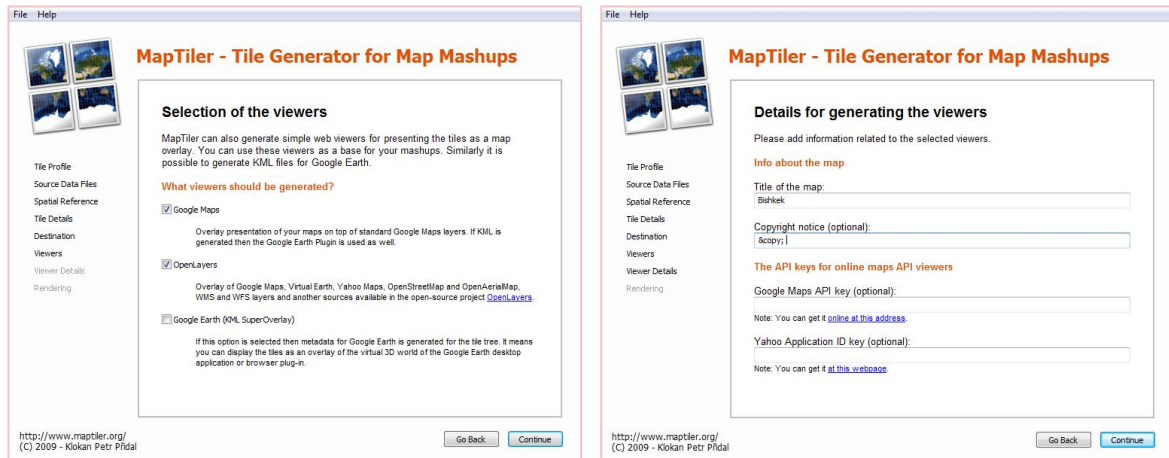
Note: You should specify the URL if you need to generate the correct KML for Google Earth.

<http://www.maptiler.org/>
(C) 2009 - Klokán Petr Pířal

[Go Back](#) [Continue](#)

Destination folder selection

The following two windows define the settings to generate simple web-viewers for the tiles. In the *Selection* window, select *Google Maps* and *OpenLayers*. In the *Details* window, define a title for the map and a copyright notice, if required. Click *Continue*.



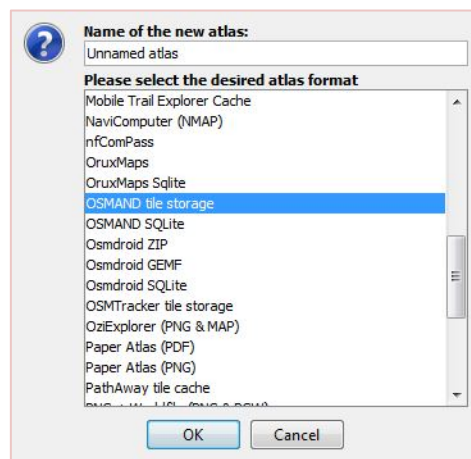
Viewers details selection

Clicking *Render* starts the conversion process. This might take a few minutes to complete, and results in a set of nested folders representing the different zoom levels.

A.2 Mobile Atlas Creator (MOBAC)

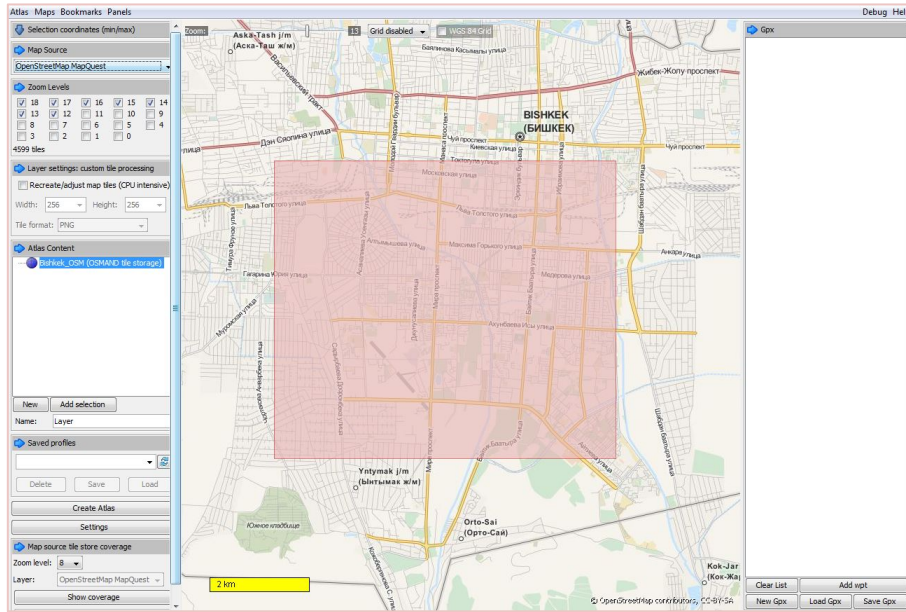
MOBAC is freeware software designed to extract geospatial data for user defined areas from online mapping portals. It is available at mobac.sourceforge.net. In this section, MOBAC is used to extract a street map from OSM Mapquest and convert it to tiles compatible with the Mobile Tools.

Start MOBAC and in the *Settings for new atlas* list, select OSMAND tile storage.



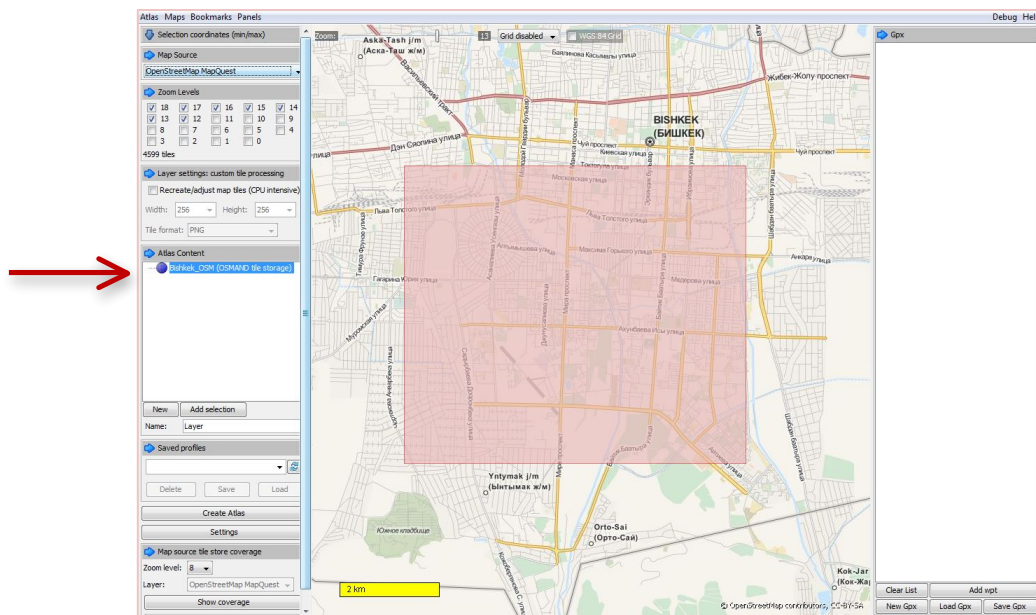
Settings for the new atlas

The main screen presents three main areas: a map tab in the centre, a settings tab on the left and a GPX tab on the right. In the map tab, draw a rectangle to select the area of interest.



MOBAC main screen with an Area of Interest selected

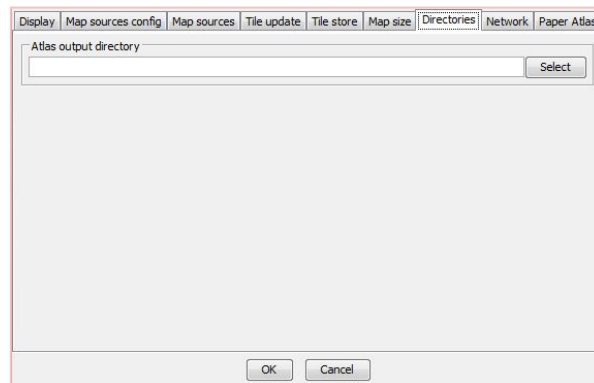
In the *Atlas content* box set a name for the atlas and for the layer (this name will be visualised in the tools). Click on *Add selection* to include the selected area in the atlas.



AOI selection in the map tab

In the *Map Source* dropdown menu, select *OpenStreetMap MapQuest* and tick the boxes relative to the desired levels in the *Zoom levels* box.

In the *Saved profiles* box, click on *Settings* and navigate to the *Directories* tab. Select the output folder for the tiles and click *OK*. Now it's possible to start the process, clicking on *Create Atlas*.



Settings window

A.3 Loading Data into the IDCT Mobile Tools

A.3.1 Windows Tool

The Mobile Tool for Windows is based on a standard GIS system (see GEM Technical Report 2014-04), and can read data from any directory on the field deployment laptop. It is good practice to save all the data in meaningful folders structure such as *../deployment_name/area/type_of_data*.

A.3.2 Android Tool

The IDCT Mobile Tool for Android requires the data to be in specific folders to be recognised by the system (See Section 4). In the field deployment device main memory, navigate to the *IDCTDO* folder. Copy the background maps imagery tiles folder to the *maptiles* folder. Any vector data to be included in the tool need to be copied to the *kmf* folder and has to be in KML file format.

APPENDIX B Minimum Device Specification

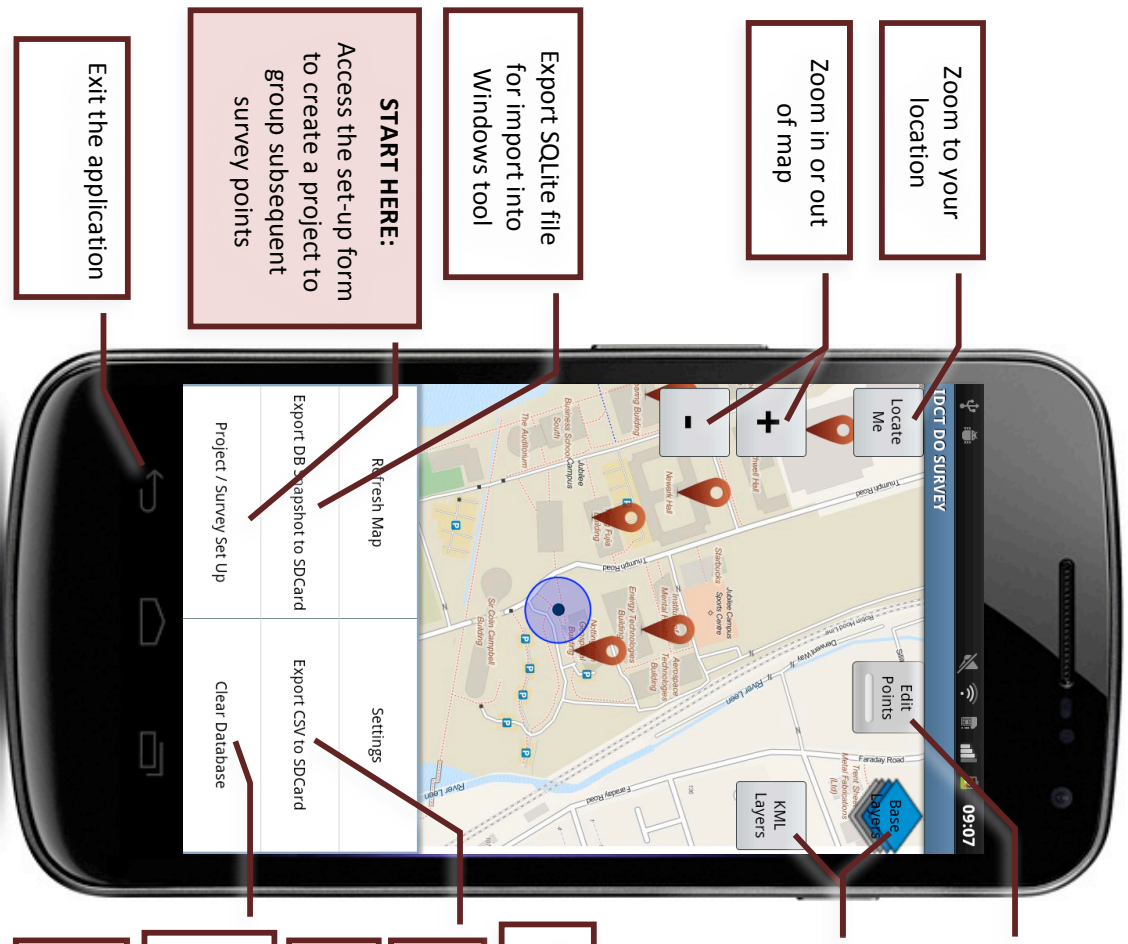
The current minimum specification level for Android devices suited to the IDCT Mobile Tool for Android is maintained at <https://github.com/IDCT/DirectObservationToolsForAndroid/wiki/Recommended-device-requirements>

At the time of writing, this specification was:

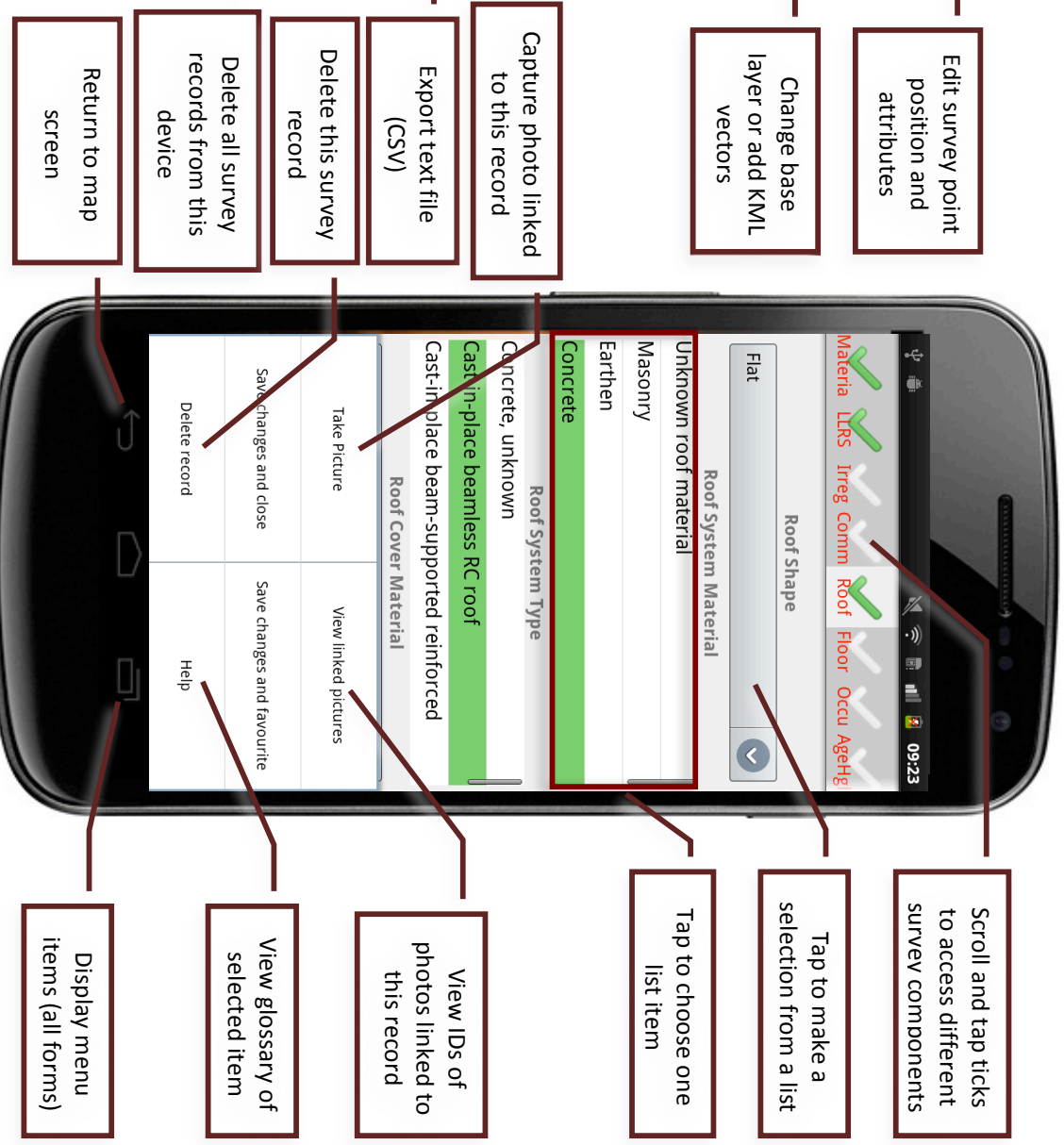
- **Android 3.0 or greater** The best application performance will be achieved when using an Android Operating System for version 3.0 or above. The tool requires 2.3.1 as a minimum requirement.
- **Minimum 7 inch screen size** Data capture forms have been designed for tablet screens sized 7 inches or greater.
- **Rear-facing camera** Some devices such as the Google Nexus 7 only have a front-facing camera. A rear-facing camera makes capture of field photographs easier.
- **3G/4G mobile network connectivity** Some devices such as the Google Nexus 7 tablet will only work on Wi-Fi. It will be preferable for many users to have the option of using mobile data connections
- **On board storage / SD Card** For using offline map tiles some on-board storage or an SD card needs to be available on the device.

APPENDIX C Quick Start Guide

Map view



Form view



THE GLOBAL EARTHQUAKE MODEL

The mission of the Global Earthquake Model (GEM) collaborative effort is to increase earthquake resilience worldwide.

To deliver on its mission and increase public understanding and awareness of seismic risk, the GEM Foundation, a non-profit public-private partnership, drives the GEM effort by involving and engaging with a very diverse community to:

- Share data, models, and knowledge through the OpenQuake platform
- Apply GEM tools and software to inform decision-making for risk mitigation and management
- Expand the science and understanding of earthquakes

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JANUARY 2014

 **GEM**
GLOBAL EARTHQUAKE MODEL
working together to assess risk