ZAMBIA ACCESS TO ACT INITIATIVE SURVEY 2009

Manual for Basic Map Reading for Statistical Surveys

IMPLEMENTING FIRMS: PALM ASSOCIATES AND GEO-HYDRO

1.0 What is a map?

A map is simply a plan of the ground on paper. The plan is usually drawn as the land would be seen from directly above**.**

A map will normally have the following features:

- The names of important places and locations
- Standard symbols to show the location of key land marks and features
- A key, or a legend, to explain what the symbols on the map mean
- A scale or scale bar to allow you to measure distance on the map and convert it to the actual distance on the land
- A grid system of lines which allows you to pin point your location, orient your map to the land and quickly estimate distances.

1.1 Basic map Features:

There are some basic features that most maps will include:

- **Roads** tend to be marked in different colours depending on the type of road depicted. Roads on the map range from thick red lines showing main roads to dashed lines indicating minor or motorable roads**.**
- **Footpaths** are marked as small dashed lines on census maps
- **Woods** are shown in green with a coniferous on non coniferous tree shape printed over the top
- **Buildings** are marked by small Black Square. However, some particular buildings have their own special symbols such as churches, towers, and wind mills. Any of these buildings can be useful landmarks helping you to check your position on the map.
- **Rivers and streams** are shown as lines, usually blue if you are using a topo sheet or just a black not straight line on our field maps. The width of the line is representative of the water course width (if the width of a river is more than 8 meters it shown as two lines with a light blue shading in between. Rivers and streams are extremely useful in determining your position on the map.
- **Scale** tells you how much the land has been scaled down to fit on the paper. If the scale of the map is 1:50,000 then everything on the map will be 50,000 times smaller than it is in reality.
- **Your Census maps** contains other features and information that will be explained, along with the features above, in the key of the map.

1.3 Organization of the Census Data Collection Geography

For the purpose of data collection and aggregation the CSO has devised a coding scheme that encompasses the national administrative boundaries and survey clusters or SEA that are demarcated within the administrative areas. The data collection geography consists of:

- National
- Province
- Constituency
- Ward
- Census Supervisory Area (CSA)
- Standard Enumeration Area (SEA)

Each of the geography above has a code which when combined will give a unique identification to each enumeration area in the country. For the purpose of this survey the frame from 2000 census of population and housing will be used to draw a sample in the relevant districts. The frame has 16,800 SEAs nationwide.

The following is the Hierarchy of our Census Coding

- 9 Provinces
- 72 Districts
- 150 Constituencies
- 1615 Wards
- Census Supervisor Areas
- Standard Enumerator Areas

The basic geo-code is constructed according to the geographic frame. It reflects the geographic frame and administrative hierarchy of the country. The 2000 Census SEA frame consists of out of 12 digits and adhere to the following structure:

Geographic Frame	**Province**	**District**		**Constituency**			**Ward**		**Region**	**CSA**		**SEA**
Digit	1	2	3	4	5	6	7	8	9	10	11	12

- **Provinces** are arranged in the alphabet and numbered from 1 - 9 Central (1) - Western (9)

- **Districts** are also arranged in the alphabet within a province and serially numbered. The district is uniquely distinguished by a province code e.g 101 represent Chibombo (the first district in central province) and 904 for Mongu (the fourth district in western province)

- **Constituency.** There are 150 constituencies the country. The Constituency code has three digits starting from 001-150.

- **Ward.** There are currently 1,614 wards in Zambia. The lowest administrative unit in the country is a ward. But a ward is too big an area for one person to canvass during censuses and surveys. It is for this fact that the Central

Statistics Office has divided wards into Census Supervisory Areas (CSAs) which is a combination of Standard Enumeration Areas. A ward code is two digits written as 01, 02 or 15.

- **Region:** for the purpose of disaggregating data by rural or urban a code is used to uniquely identify the SEA as rural or urban (1 and 2 is used respectively)

- **A Census Supervisory Area (CSA)** is a grouping of Standard Enumeration Areas and is meant to be assigned to one supervisor during census or survey data collection. It is designed to comprise two to three SEAs in rural areas and three to five areas in urban. It is given a two digit code eg CSA 01, 02 or 03.

- **SEA**. A SEA is a small unit of about equal population size, each of which will be assigned to a single enumerator to enumerate its total population. A SEA has distinct boundaries that are describable. An SEA is demarcated with population ranging between 300-500 people and 600-800 people in rural and urban areas respectively. This is given a 1 digit code- 1,2,3 or 4.

From this coding scheme the following string of numbers make up a unique identity of an SEA for instance an SEA in serenje district has this unique identity number: 106014132054 this number will be indicated on the top left hand side of the field map and it means the following;

Geographic Coding	**Province**	**District**		**Constituency**			**Ward**		**Region**	**CSA**		**SEA**
Digit	1	0	6	0	1	4	1	3	2	0	5	4
Geography	Central	Serenje		Serenje			Ibolelo		Urban	CSA		SEA

2.0 Understanding Map Elements

In order to effectively carry out a survey you should first understand how to 'read' the various base maps that you will be using. In this context you should know what the scales on the maps mean as they relate to the distances on the ground. You should also understand the legend on the maps and how to interpret them for effective data collection during surveys.

2.0.1 Scale:

Map scale can be defined as *"the ratio that the distance between any two points on a map bears to the horizontal distance between the same two points on the ground, all expressed in the same unit of measure".* In other words, the "scale" of the map is the proportional relationship between distance on the map and distance on the ground.

The principle of map scale can also be explained another way. On a 1:250,000 map we are "squeezing" 250,000 units on the ground into 1 unit on the map, but on a 1:50,000 map we are only having to "squeeze" 50,000 ground units into 1 unit on the map. Therefore, everything is going to be more spread out on the 1:50,000 map, so we can say that the 1:50,000 map has a 'larger scale' than the 1:250,000 map.

Scales are shown in three different ways:

- ***Word Statement:***

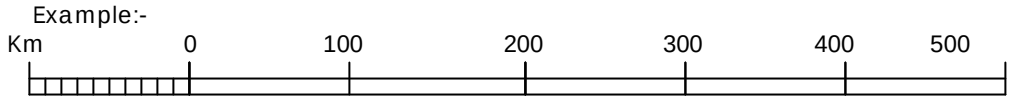
This explains the map ground relationship; for example, 'one centimetre to one kilometre' means that a distance of one centimetre on the map is equal to a distance of one kilometre on the ground.

- ***Ratio or Representative Fraction:***

This states the ratio between distances on the map and the ground. Both sides of the ratio should be in the same units (e.g. centimetres, inches etc), for example, 1:50,000. This means that a distance of one centimetre on the map equals 50,000 centimetres on the ground

- ***Graphic Form:***

A bar scale shows the way the distance on the ground is represented on the map by means of a line that is divided into standard lengths. This is a ruler like line which has been accurately divided in such a manner that distances measured on the map can be converted to actual ground distances. Sometimes bar scales can be of a compound nature in that more than one unit of measurement may be shown i.e. miles and kilometers. A bar scale may begin at zero (0) but can also have an extension to the left of the zero which facilitates the measurement of short distances which are fractions of the unit. An illustration of a bar scale is shown below:



Map Scales and their Equivalents

Map Scale:	One centimetre (cm) on the map is represented on the ground by:	One kilometre (km) (1,000m) on the ground is represented on the map by:
1.1,000	10 metres (m)	100 cm (1 metre)
1:1,250	12.5 m	80 cm
1:2,000	20 m	50 cm
1:2,500	25 m	40 cm
1:5,000	50 m	20 cm
1:10,000	100 m (0.1km)	10 cm
1:12,500	125 m	8 cm
1:20,000	200 m (0.2 km)	5 cm
1:25,000	250 m	4 cm
1;50,000	500 m (0.5 km)	2 cm
1:100,000	1 km	1 cm
1:125,000	1.25 km	8 millimetres (mm)
1:200,000	2 km	5 mm
1:250,000	2.5 km	4 mm
1:500,000	5 km	2 mm
1:1,000,000	10 km	1 mm

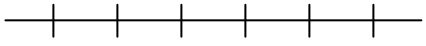
2.0.2 Map Legend or Key

On every map you find a legend. This is a list of conventional signs and symbols which are used to depict and locate natural and man-made features. The type and number of symbols used on a map will depend on the purpose for which the map is to be constructed and the scale at which it is produced. In particular, the correct alignment and symbols of all administrative as well as CSA and SEA boundaries are important, in order that census data may be allocated to the correct administrative units. The symbols on maps are generally broken into three categories; Dot or Point Symbols, Line Symbols, and Area Symbols or Patterns.

Dot or point symbols are used to indicate the location of features of no significant dimensions relative to the map scale. These can indicate a house on a large scale map or an entire city on a small scale map.

Example: - Permanent structure  Rural hut  Church 

Line Symbols indicate a feature with one significant dimension, which is length. They represent features such as rivers, roads, railway lines etc.

Example: Railway line  Road

River

Boundary

Area Symbols or Patterns indicate area covered by particular characteristics or phenomena such as Swamps, Urbanized areas or Lakes. These symbols include patterns, stippling or crosshatching.

Boundaries and other legend items you may come across include the following:

1) *Main Roads:*
It is very important that all the main roads are on the census maps as they help in map orientation. However, because the census maps are often very old, some of the the main roads already shown may not be in the right alignments. New roads, which may have been constructed after the census maps were produced should be noted on the map.

2) *Minor Roads:*
These are also very important. You will find that some new all-weather feeder roads are not shown on the old maps, particularly in densely populated rural areas, or they have been upgraded from tracks and follow the mapped alignment.

3) *Tracks or Footpaths:*
It is sometimes difficult to distinguish between tracks and footpaths in rural areas. Many tracks and footpaths can only be used by motorcycles and/or bicycles, and these are shown as footpaths on the maps, with single-dashed lines.

4) *Railway Lines:*
The old railway lines are already shown on your base maps.

5) *Bridges:*
Bridges provide reference points on census maps, and any major new ones you come across should be used to help you locate villages.

6) *Permanent Buildings:*
Permanent buildings are shown with small squares on the SEA maps and ward maps e.g. *Educational Institutions: All university colleges, secondary schools, primary schools, adult education centres and Teacher Training Colleges, whether government owned are marked as permanent building(s) and named (or abbreviated) on the maps. The same applies for health centres and other prominent land marks*

7) *Traditional Housing*:
These are shown with small hut dots on the SEA maps and ward maps.

8) *Rivers or Streams:*
All perennial and intermittent water-courses are already shown on the base maps. You may, however have to add or correct the names of some of them.

9) *Marshes:*
All the large marshy areas and swamps will already be shown on the base maps.

10) *Lakes:*
All the lakes should already be shown on the base maps but you should add or correct the names where required.

11) *Mountains, Hills or Hilly Areas:*
All the mountains and hills will already be accurately shown on the base maps, but you should add or correct the names where required.

12) *International Boundary:*
The alignment of the international boundary is already shown on the base maps. If you find a local variation being used, plot it carefully and inform your Supervisor.

Example: **++++++++++++++++++** International boundary

13) *Provincial Boundary*
There are 9 provinces and the boundaries of these will be shown on the census maps and we do not expect any changes. If you find a local variation, plot it and inform your Field Supervisor.

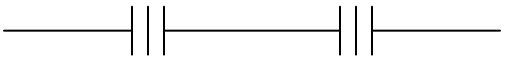
Example: ▬ · ▬ · ▬ · ▬ · ▬ · ▬ · ▬ Provincial Boundary

14) *District Boundaries:*
There are 72 districts and all their boundaries (except where the topographic sheets have not been revised) are shown on the base maps. Any local variations and difficulties should be reported to your Supervisor.

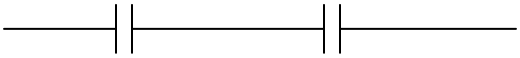
Example: ▬ · · ▬ · · ▬ · · ▬ · · ▬ · · ▬ · · ▬ · · ▬ District Boundary

The non conventional symbols used by the CSO for constituency, ward, CSA and SEA boundary lines.

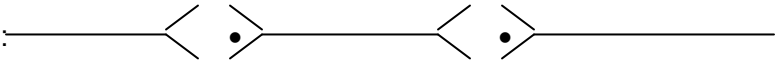
15*) Constituency Boundaries*
There are 150 Constituencies and their boundaries are shown on the Electoral Commission of Zambia's Poling District maps. The Constituency boundaries have been incorporated on census maps and harmonized with our CSA and SEA boundaries. The Constituency boundaries have, in most cases, been altered on census maps to ensure that they follow identifiable features. Constituencies are demarcated within the district boundaries. Avoid discussing the alignment of constituency boundaries with non CSO staff**.**

Example:  Constituency Boundary

16) *Ward Boundaries*:
There are currently 1,615 wards in the country. Wards are demarcated within constituencies and boundaries do not overlap into the next constituencies. Equally avoid discussing these boundaries with non-CSO staff.

Example:  Ward Boundary

17*) Census Supervisory Area Boundaries:*
CSA boundaries are demarcated within a ward and do not cross ward boundaries. They usually contain two to five SEAs and are used for supervisory work allocation during censuses

Example:  CSA Boundary

18) *Standard Enumeration Area (SEA) Boundary:*
The SEA boundaries are the most important boundary of all for survey purposes. They are demarcated within the CSA and do not cut across the CSA boundary.

Example: ..... SEA Boundary

Where you are unsure of the boundary make use of the local people to help you out. This is common where you have invincible boundaries for national, province and district administration. Do your best to show the irregularities on the map. If there is a serious boundary problem where confusion might arise in enumeration, then contact your supervisor and with him/her try to sort out the problem.

Identifying an Imaginary Boundary
Boundaries of Census Supervisory Areas sometimes follow administrative boundaries which are usually imaginary and therefore, do not follow any distinctive features such as roads or rivers. It is important that these are identified correctly in the field. Township and city boundaries are the most common and are usually marked by sign posters (See below).

WELCOME TO
GREATER CITY OF LUSAKA

If there are no signs marking these imaginary boundaries use the following procedures to locate the boundary:

- Identify the nearest landmark on the map, which you can locate with certainty on the ground such as an intersection of two roads or a confluence of two streams. Measure the distance on the map between the two points.
- Using the graphic scale on your map, determine the ground distance from the landmark to the boundary.

At times you may not be able to locate the boundary on your map. This may be due to changes in names or non-existence of certain features such as roads or power lines that may have been relocated. If you cannot verify a boundary satisfactorily you should consult local residents who are familiar with the area and inform your supervisor about the problem as early as possible. Do not change the boundary of your CSA or SEA under any circumstances.

3.0 Map Orientation:

Now that you have a basic skills and knowledge to read and understand a map the next step is to learn how to orient your map to the land so that you can use it to navigate your way around the SEA. The process of aligning or adjusting a map so that features on the map correspond with actual features on the ground is known as 'map orientation'. You can use your sight to orient a map. This method works well in an area with visible prominent land marks on the map and on the ground.

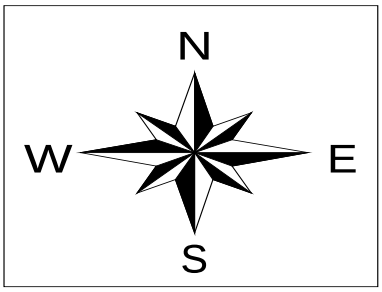
The first step when trying to orient a map is to lay it flat so that the whole map is clearly visible. It is better to begin orientation on a major road or street junctions since these are readily identifiable both on the map and on the ground. Other features such as houses, rivers, hills etc. can be checked against changes that have taken place on the ground but have not been shown on the map. The map should be held in such a way that major map features are lined up (oriented) parallel with ground features.

Locate yourself next to a feature or landmark and place your finger on the map at the point where you are standing. Then begin to rotate the map so that other features and landmarks on the map begin to line with the actual ones you can see. The map is now oriented with the land.

3.0.1 The North Arrow

By convention, North is at the top of the census maps, West is to the left, East is to the right and South is at the bottom (see illustration below). It is important that you remember these main compass points when in the field.

The North Arrow Illustration



4.0 Approximate Measurement of Distance

There may be instances where you want to estimate your position on the map especially when examining the area extent of the SEA you intend to cover. Therefore, you should understand how to interpret the Census Map Bar Scales as it helps locate village localities in the field. You will either be riding in a vehicle, bicycle or walking. The most common method is the paper strip method:

4.0.1 Paper Strip Method

This is the simplest method to use when one wants to measure distances. As previously discussed the graphic scale is subdivided into uniform measures of the same unit and to use it the procedure is as follows:

Let us suppose that you want to measure the distance between villages A and B on your map. Take a straight edged piece of paper and lay it on the map so that the straight edge joins villages A and B. On the paper strip mark A and B then place the paper just below the bar scale. The ground distance between villages A and B can be read off from the scale.

In actual situations roads and streets are not always straight. To measure distances on curved roads the same procedure is followed and the distances between points on each leg (straight section) of the road individually measured. The distances are then added to get the total distance.

4.0.2 Riding in a Vehicle:

On the instrument panel of each vehicle is the speedometer dial, and the needle tells you how fast you are moving in kilometres per hour (kph). At the bottom of the speedometer dial is the distance recorder (odometer), which indicates the total number of kilometres the vehicle has covered since it was new, and the trip recorder, which can be reset to zero when required and

indicates the number of kilometres covered since resetting. The right hand digits measure distances down to a tenth of a kilometre, i.e. 100 metres. These last figures are sometimes in a different colour to the others. You can use the trip recorder to help locate yourself on the map.

4.0.3 Walking:

You should first orientate the map and check the time. Walking speed can vary from about 3 to 5km per hour depending on the persons and the terrain, but a speed of 4km per hour on a rough track would be about average. If you have taken, say, 15 minutes to walk from the vehicle to a stream, this means that you have walked about one km. You then measure off one km on the bar scale and mark your position on the map.

And Finally…….

Now that you know how to understand and read a map you are ready to get yourself out and about your field work. But before you put your boots and pack your questionnaire bag, take time to read through handy tips and safety points to ensure that you get the most from your data collection:

- **Pre-plan your route-** before you set out take time to plan your route by marking your chosen route on the map. This will ensure that your eyes are immediately drawn to the correct part of the map, otherwise you may find your self having to spend time searching for you location on the ground.
- **Make sure you have the right equipment-** make sure you always carry the map of the area you are enumerating and protect your map from bad weather. Carry a pencil to make updates on the map to show features that are new and those that have been abandoned or are non-exiting.
- **Abide by the enumerating codes-** be safe, plan ahead and follow any signs. Leave gates and property as you find them. Always return the field copy to the provincial office