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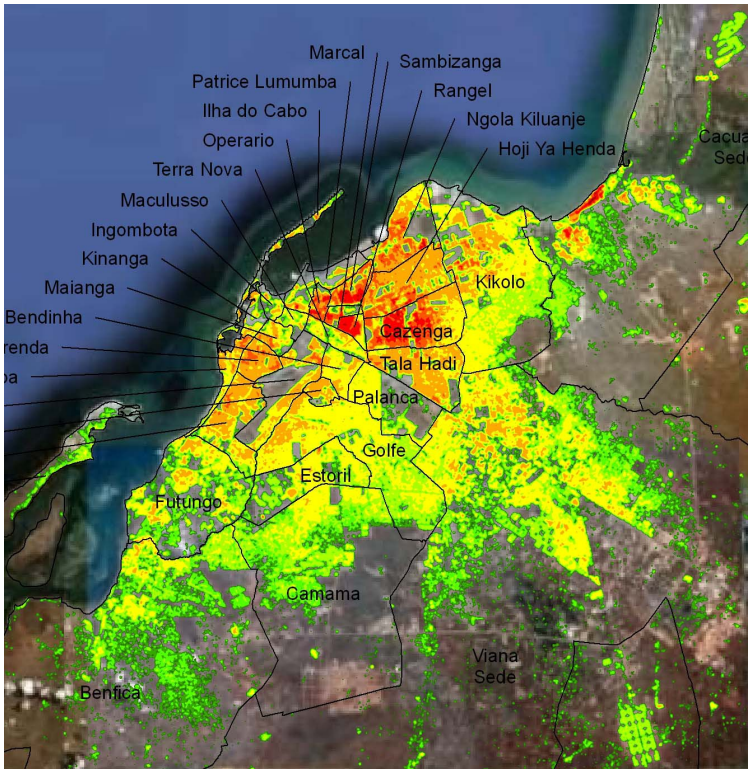
Final Report

Poverty and Environmental Vulnerability in Angola's Growing Slums

City Report for Luanda



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EXECUTIVE SUMMARY

There has been no overall view of urban environmental issues in Angola and little information about spatial aspects of poverty. There has been a particular paucity of data on Angola's second and third-tier cities. This project has used action-research to provide baseline data on five specific aspects of poverty in a first, second and third tier city in Angola, namely land tenure and land markets, environmental burdens, access to basic services (water and sanitation), settlement density, demography and overcrowding and housing quality and location. It has firstly analysed how interactions amongst these five specific aspects of poverty produce specific vulnerability profiles in each city, and secondly how vulnerability profiles differ between the different cities given their specific demographic, geographic and environmental settings. This report focuses specifically on results from Luanda.

Remote sensing was used to carry out a demographic analysis and to identify (also using information from key informants) settlement typologies with similar physical and socio-economic characteristics.

Data collection, Mapping, Analysis

The demographic analysis shows that the population of the Province of Luanda in 2008 was about 5.8 million and is growing at 8% per annum. The growth rate varies markedly between different areas of the city being highest in newly settled areas on the periphery and being low or negative near the centre of the city.

Geographic Analysis of Indicators

One of the main purposes is to geo-reference data for each of the five indicators in Luanda and Huambo in order to be able to measure levels of poverty and monitor the progress towards attaining the MDGs at local levels in these cities. This allows accurate mapping of the socio-economic situation in different areas of the two cities and locating service catchment areas and gaps in access. The information system is particularly useful in the Angolan urban context where there is general lack of other forms of local level socio-economic data. The

will help government administrators and planners at all levels to problem zones and plan investments for areas in need of specific interventions.

The project classified settlement and housing areas according to typologies rather than administrative boundaries and the area of study included the whole of the urban agglomeration as recommended and defined by UN Habitat.[1] This reduces discrepancies that may exist between different administrative units and enables international comparisons of the data with other cities. Using GIS tools, administrative boundaries can later be overlaid on these typology maps so that housing and settlement variations can be assessed within each administrative area. It is important to be able to detect the situation of each indicator for each administrative unit where political decisions are being made. The project has already produced maps with administrative divisions for both Luanda and Huambo which can be overlaid with typology maps in order to enable the evaluation of each indicator according to municipalities, comunas and bairros

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"The urban agglomeration is defined as the built-up or densely populated area containing the city proper; suburbs, and continuously settled commuter areas. This may be smaller or larger than the metropolitan area." UN Habitat, Urban Indicators Guidelines, August 2004.

Remote sensing is particularly useful in the Angolan context due to a lack of demographic data as no national census has been conducted in more than 35 years[2]. Rapid changes in demographics and the socio-economic situation of the population in the post-war years make it increasingly important to regularly monitor such data. GIS is an efficient tool for presenting and analysing geo-referenced data which are necessary for decision-making at the municipal level.

[2] INE (1983) A partial census was carried out in Luanda and Malanje.

1 INTRODUCTION

1.1 Background

There is no overall view of urban environmental issues in Angola. There is little information about the environmental burden in various cities or how much environmental issues contribute to poverty and vulnerability. While there are some pieces of information about these issues in certain cities, Ministries and local governments do not have an overall view. There is also little information about spatial aspects of poverty and a particular paucity of data and information on Angola's second and third-tier cities, despite the fact that they account for half of the country's urban population and a third of its total population.

Strategies for alleviating urban poverty and slum expansion need to take into account the the environmental burdens of cities, the differences between cities (which are often related to the different environments in which they are situated) and spatial aspects of poverty. In order to make sound policy decisions, Angolan urban planners at the moment particularly need reliable information about the specific urban poverty profiles in the half of urban Angola that resides in second and third-tier cities in which land tenure, livelihood subsistence strategies, service demands, and relationships to environment and environmental change, differ significantly from Luanda.

To date most urban research and programme implementation has focused on Luanda, and it has primarily been this data on the capital that has informed the development of new and important urban policy planning and poverty reduction frameworks. The integration of rural characteristics to varying degrees in second and third tier cities introduces important new factors and vectors into vulnerability assessment. Micro-climatic specificities[3], cyclical environmental conditions[4], the contamination of groundwater and finally broader shifts attributable to global climate change all have on different aspects of urban vulnerability ranging from public health (waterborne disease, sanitation and health etc) to food security, to gendered livelihoods. Thus for example, whereas water is a commodity in Luanda, it is only seasonally so in Huambo where for most of the year it remains a free public good. Residents of places like Huambo or Cachiungo generally benefit from more diversified sources of income but are more vulnerable to droughts and other natural disasters. In contrast to Luanda, even very large urban centres such as Huambo contain significant agricultural land within the peri-urban perimeter, and land immediately outside that perimeter is also vital to household survival. This difference between Luanda and second and third-tier cities has wide-ranging implications for urban policy planners.

1.2 Objectives

The key objectives of this project are:

A. to use action research to provide baseline data on five specific aspects of poverty in a first, second and third tier city in Angola, analysing:

1. land tenure and land markets
2. environmental burdens
3. access to basic services (water and sanitation)
4. settlement density, demography and overcrowding

[3] e.g. the difference between the average natural environmental conditions amongst cities-water table, rain amounts, soil fertility, temperature, etc.

[4] e.g. droughts

5 housing quality and location

B. to apply a comparative analytical approach to examine first, how interactions amongst these five specific aspects of poverty produce specific vulnerability profiles in each city, and second, how vulnerability profiles differ between the different cities given their specific demographic, geographic and environmental settings.

C. to make research results accessible for the wider public in general, and urban managers and technicians specifically, producing tailored research outcomes such as a website on urban information and a training module with the aim to influence urban policy and practice on the national level; Development Workshop has employed action based research, in the past, as a way of influencing public policies on land tenure and economic inclusion of the poor in the informal sector. Research partnerships that engage government institutions have provided channels to influence policies in these areas. The present project particularly aims to use research to engage the Institute of Physical and Urban Planning in better understanding urban poverty and environmental issues in order to improve policies and programmes.

D. to enhance DW's own capacity for implementing urban planning projects and to capacitate Angolan policy-makers, urban managers and civil society; and a secondary focus on regional policy-makers and policy researchers in other African contexts that confront rapid and complex urbanization challenges.

1.3 Research Framework

The research is based around data on five specific aspects of poverty in a first, second and third tier city in Angola. The five aspects of poverty are:

1 Land tenure and land markets
2 Environmental burdens
3 Access to basic services (water and sanitation)
4 Settlement density, demography and overcrowding
5 Housing quality and location

The Millennium Development Goals have been used for the initial phases of analysing these aspects of poverty. The MDG 11, developed by UN Habitat, has been accepted by the Angolan Government as a basis for monitoring their performance on their stated policy for post-conflict reconstruction and shelter provision. Similarly the government's programme of providing "Water for All" essentially aims at attaining the MDG standard of equitable access to water. Incorporating MDG compatible indicators into the proposed research will make the research results a useful tool for Government policy influencing and will also greatly facilitate the collection of data which the Government needs for their own planning.

Definition of the Five Urban Indicators

The indicators used in this research and presented in this report include the following five components which have been used by the UN to define precarious settlements and are all included in Millennium Development Goal no 7: Ensure environmental sustainability (targets 10: Halve, by 2015 the proportion of people without sustainable access to safe drinking water; and 11: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers)[5]:

1. *Overcrowding*
2. *Secure tenure*
3. *Durable structures*
4. *Access to safe water*
5. *Access to improved sanitation*

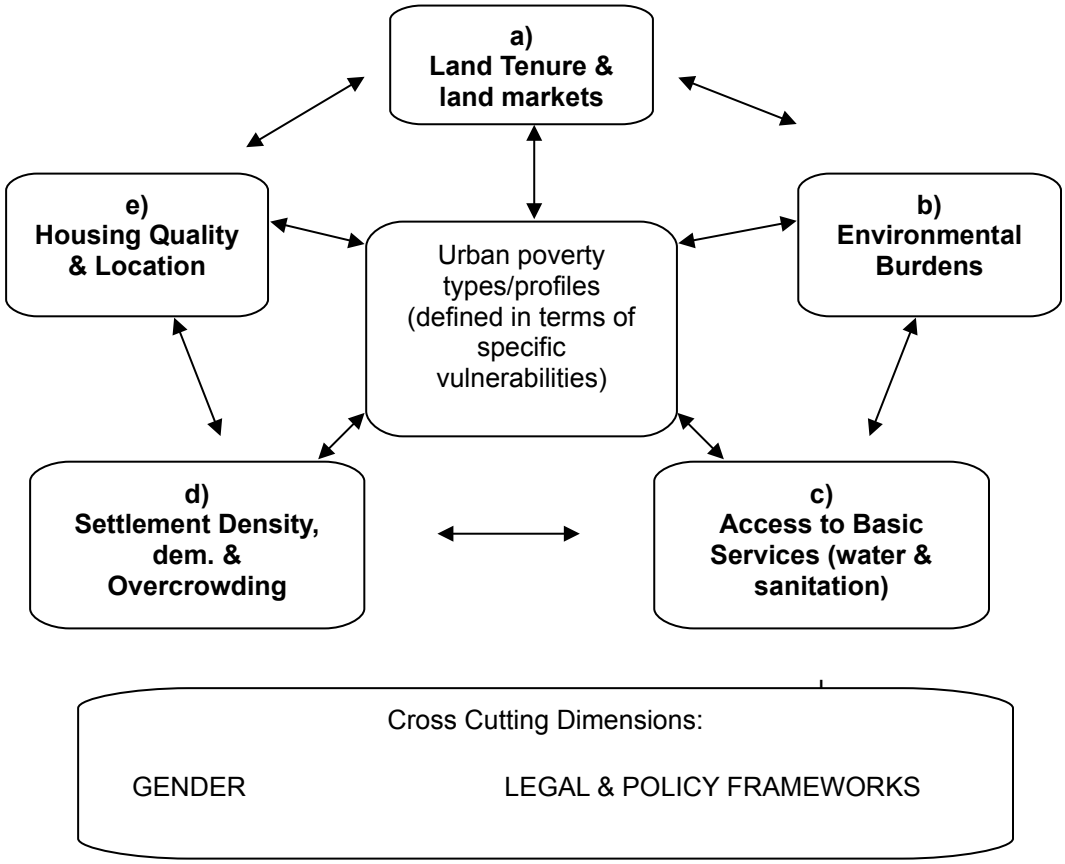
These five components are considered to best reflect conditions that characterize slums. A slum or musseque is a contiguous settlement where the inhabitants are characterized as having inadequate housing and basic services. A slum household is a group of individuals living under the same roof that lack two or more of the five conditions. While accepting the framework of international guidelines to measuring and monitoring the MDGs, these definitions are adapted to the local contexts. Definitions, sources and results should be confirmed via focus groups which can include city planners and city managers, experts in the particular area of water supply, selected key informants in slum and non-slum areas. The following sections will further define each of the five indicators used in this research:

The assumption is that poverty indicators differ, depending on the type of city in question and the specific ways in which vulnerability is constituted in at least these five key indicator areas. More specifically, while all five of these aspects of poverty affect overall vulnerability, they do so through different pathways and in different ways in different types of urban environments. Two levels of comparative analysis will be done in the process of this project. First, the different 'layers' of information (one 'layer' for each aspect of poverty) will be mapped and overlaid in order to create poverty maps of the sample areas, showing how these aspects of poverty vary spatially in each city. Second, these aspects of poverty will be compared between cities with the aim to identify city level specific (first, second, third tier) information and results.

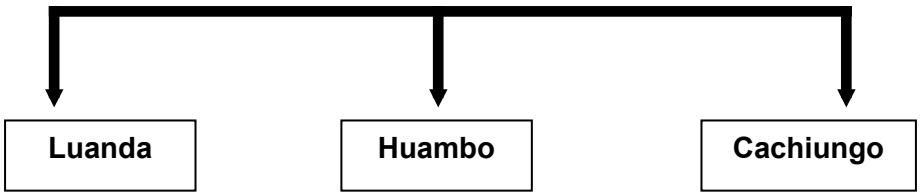
This report documents the five aspects of poverty in Luanda and the way in which they vary spatially and interact in Luanda.

[5] United Nations Human Settlements Programme (2004) *Urban Indicators Guidelines – Monitoring the Habitat Agenda and the Millennium Development Goals.* http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

Analytical Framework - Five domains of urban poverty indicators



(Above) Five domains of urban poverty indicators



1.4 Cities under Study: Luanda, Huambo and Cachiungo

The urban areas of Luanda, Huambo, and Cachiungo were chosen for this study as they were considered to be representative of different types of urban areas in Angola.

Luanda is the capital of Angola. It was founded in 1576 and is one of the oldest cities in Africa south of the Sahara. It is believed to be growing rapidly and to have already reached a population of over 5 million people. It has been the focus of most urban poverty and planning research in Angola. A large proportion of the population lives in self-built slums (musseques) without any kind of infrastructure.

Huambo is the main city in Huambo Province and is sometimes considered as Angola's second city. It was the centre of major conflict during the 1975 too 2002 war period. The growth of the city was never as rapid as in Luanda. Huambo is an example of a second tier city that has hitherto been largely neglected, but shares the socio-economic characteristics of many Angolan and African urban areas.

Cachiungo is a typical third-tier municipal city which has been left neglected in most research. It was largely depopulated during the war, suffering serious damage and like many Angolan municipal centres is trying to rebuild itself as a regional market town in the last post-conflict years.

2 Methodology

2.1 Demographic analysis

A demographic analysis was carried out by calculating the population in different settlement typologies and different administrative areas using remote sensing. Recent QuickBird high resolution (0.80m) was procured and geo-referenced. For 12 months from mid 2008 through 2009 teams of GIS technicians from INOTU and Development Workshop carried out a detailed roof-top mapping of all residential units and built structures in the province of Luanda. This involved delineating over 950,000 individual housing units. In addition to this, field teams were recruited involving municipal administrations, students and local civil society organisations to collect household and demographic information in all of the residential typology areas. This information was geo-referenced by the field researchers who were trained in the use of GPS technology. The field data was later synthesised and mapped. This provides important and relatively accurate information on the population of the two cities in the absence of a census. The demographic analysis also allows detecting approximately how many people are affected by each indicator in each settlement typology.

Three approaches were used to map houses in Luanda:

1. In areas of very high density of single-level houses, roofs that were visible in satellite images were mapped in polygon shapefiles which were than measured in square metres (figure 5). This method was adopted because it is usually impossible to identify individual houses, the edges of the roof on one house often being right next to the edges of the roofs of its neighbours.

2. In areas where individual houses can be identified more clearly we have mapped each house as a dot, and so the resulting data sets consist of point shape files.

3. The boundaries of apartment blocks (*predios)* were mapped as polygons, and the number of apartments in each *predio* was estimated by multiplying the number of levels or floors with the number of apartments on each level. The number of levels and apartments was counted by enumerators who visited each apartment block.

Figure 1: Mapping of roofs

Two methods were used to estimate the number of people living in the houses that were mapped:

1. An estimate was obtained of the number of square metres of roofing per person from data collected at 482 homes where both the number of residents and roof area (in square metres) was reported. The homes were informal structures in Cazenga, Sambizanga and Cacuaco. Processing of these figures gave a figure of 6.6 square metres of roof per person[6].

2. For houses mapped as points and for apartments, the following estimates of the number of people per household, based on previous DW research, were used: 5 people

[6] In fact, there was an average of 8.5 square metres of roof area per resident in the 482 homes. However, the figures were skewed by a small number of homes that had few residents living within large houses with extensive roofing. For this reason, the median figure of 6.6 square meters of roofing per person was adopted as providing a more reasonable estimate.

per apartment, 6 people per house in urban housing types, and 7 people per house in all other housing types.

The number of people in each settlement typology was calculated based on the housing types characterizing each typology and the estimated number of people living in each housing type.

2.2 Definition of settlement typologies

Remote sensing was used to identify settlement typologies with similar physical and socio-economic characteristics for the City of Luanda in order to be able to generalize about the status of each of the five indicators in each typology. All areas of Luanda were mapped into different zones based on satellite images and informants who are familiar with the urban environment of the city were then requested to identify and categorize each type of development.

The typologies have been defined based on urban form and types of housing which reflect different socio-economic conditions that are associated with each type of housing and zoning as well as the levels of access to basic services. For example, zones with similar physical structure which were built during the same period generally have a similar level of population density, tenure security, housing quality and access to urban infrastructure and public services such as piped water and sewage system.

2.3 Data collection

Field Research

Field research was carried out for each of the five indicators in the form of household surveys, focus group discussions with local people and government representatives and field observations. Different types of field research was conducted for each indicator.

Access To Basic Services (Water and Sanitation), Settlement Density and Overcrowding, Housing Quality and Location

Luanda

Information on access to water and basic services, housing quality and location and the number of people per household was collected by carrying out a household survey of more than 700 households in Luanda. Household surveys were carried out in each of the nine typologies and the sample took into account the number of households in each of these typologies.

A minimum of 60 household surveys per typology were selected, and considerably more households were interviewed in the most populous typologies (old musseques and peripheral musseques). Sample areas were identified which are considered representative of each typology in six different municipalities. The data should not be considered as statistically significant for each typology, but give a good indication of the situation in each typology.

Table 1: Number of Questionnaires in Luanda by Typology

Typology	Population	% of Total Population	Research Area (Bairro)	Comuna	Municipality	Number of question naires
Old Urban Centre	165,693	3%		Maculusso	Ingombota	64
New Urban Areas	163,721	3%	Projeto Nova Vida	Estoril	Kilamba Kiaxi	60
Bairro Popular	83,290	1%	Nelito Soares	Terra Nova	Rangel	69
Social Housing Zones	118,380	2%	Luanda Sul	Viana Sede	Viana	61
Owner-built on Planned Sites	396,736	7%	Bita-Sapú	Viana Sede	Viana	60
Transitional Musseque	622,950	11%		Catambor	Maianga	62
Organized Musseques	477,956	8%	Sector 1	Palanca	Kilamba Kiaxi	60
Old Musseques	2,312,701	40%	Bairro Operario	Operario	Sambizanga	172
Peripheral Musseques	1,237,028	21%	Paraíso	Kikolo	Cacuaco	167
Rural Settlements	241,787	4%				
Industrial Zones	2,957	0.05%				
Total	**5,823,200**	**100%**				**775**

Focus group discussions with municipal administration staff and local community representatives were carried out in order to confirm the data collected in the household surveys and obtain more qualitative data on the indicator areas under study. Focus group discussions were held with representatives of the municipal and local administrations in the Municipalities of Cacuaco, Maianga, Rangel, Samba, Sambizanga and Viana to confirm and deepen the information collected through the household survey. It was not considered necessary to do focus group discussions in the municipality of Ingombota which is located in the old urban centre of Luanda and mainly serves as a comparison with peripheral areas.

Field observations were carried out in the following bairros in two of the typologies (old musseques and owner-built on planned sites) in order to verify the results of the household surveys and correct any possible discrepancies in the data. The observations focused on the following components of the three indicators:

Housing quality and location: Building and roof material, whether houses were still under construction and whether they looked like permanent constructions or temporary shelters, and road coverage and conditions.
Water source: Public water taps or private water tanks.
Sanitation: Presence of rubbish heaps and sanitation facilities

Typology	Bairro	Comuna	Municipality
Old musseques	Camuxiba		
	Vila-Nova		Viana
Owner-built on planned sites	Morro Bento II		
	Bita-Sapu		Viana
	Viana II		Viana

2.3.1 Data collection on land tenure and land markets

Structured interviews were carried out with residents of communities in four settlement types (Old *Musseque*, Transitional *Musseque*, Peripheral *Musseque*, and Social Housing Zone) to obtain data on demographic and socio-economic characteristics, formal and informal land use and land market practices, attitudes toward land acquisition and land registration. There was a total sample size of 400. Satellite images were used to map the roofs of houses within each study area and a sample of 4 x 100 roofs was obtained through interval sampling with a random start.

An interview schedule was designed, pre-tested and revised. The questions were partly based on a previous study conducted by DW and Urban LandMark(a regional partner based in South Africa) on Urban Land Markets, a desk review of the media and Angola's Land and Housing Laws. Inputs were obtained from key informants in the public and private sectors. After the first draft was developed by DW staff members, the Director of Urban LandMark travelled to Luanda to exchange experiences with DW on the topic and help finalise the draft of the interview schedule. This draft was then sent to relevant national and provincial government officials for their comments.

In addition a focus group discussion was organized for each study area to obtain information on important issues such as access to and the acquisition of land, history of the *bairro* and living conditions (access to essential services, public facilities available), housing (including willingness and ability to pay), costs and benefits of home ownership, population estimates, land regularization, land conflicts and resolution, documents used in real estate transactions, gender issues, and their perceptions of the principal barriers to achieving their aspirations. Each focus group was composed of 10-20 selected residents (church leaders, representatives of key associations, and the resident's committee. With the assistance of the resident's committee, the research team identified potential focus group participants, and they were then invited to take part in the open discussion. The focus group participants also served as primary sources of information about their respective *bairros,* and the information they provided served to validate the data obtained from the household interviews. Semi-structured interviews were also carried out with key informants linked to the land market.

2.3.2 Data collection on environmental burdens

The following sets of data were used. A digital terrain model of Luanda, obtained from *Shuttle Radar Topography Mission* (SRTM) data, was used to highlight zones of steep terrain where high rainfall and surface runoff might lead to erosion and structural damage to buildings and other structures. The original data were obtained as an XYZ ascii file with 90 metres horizontal resolution. Using Global Mapper (version 12) these data were interpolated and used to extract three categories of slope:

- Less 3 degrees, i.e. relatively flat
- Slight slope between 3 and 10 degrees
- Steep slopes of more than 10 degrees.

The three slope categories were then converted into tif images, then ArcView grid files and finally ArcView shape files. All streams and rivers and their adjacent floodplains was digitized to identify areas that are potentially inundated after heavy rain. The mapping was done from Quickbird satellite images taken in 2007 and 2008. Other areas susceptible to flooding were mapped from the same images and classified as isolated pools, borrow pits or lakes and marshes. The identification of pools was aided by an aerial survey conducted over part of Luanda in 2007, following very heavy rains: observers in a helicopter iddentified flooding from the air and ground teams then plotted their exact

position. Isolated pools mapped as points which were then categorised into small, medium and large sizes. Buffer areas were then produced to reflect their relative expanses: 15 metre radii around small pools, 30 metres for medium ones and 60 metre radii around large pools. The borrow pits, lakes and marshes were mapped out as polygons.

A final set of the data were produced by combining all the stream and river, pools, borrow pits and lakes and marshes into one set of polygons around which a buffer area of 300 metres was mapped. This broad surrounding zone was used to as an approximate area in which malaria may be most prevalent since these areas are relatively close to the breeding sites of *Anopheles gambiae,*[7] the major vector of malaria in Luanda.

Areas of steeper slope, potential inundation and standing water were then analysed in relation to a set of data on population density. These density data allow estimates to be made of the number of people living within risk areas. Estimates were also produced of the number of people within various risk areas living in different types of housing.

The results of a household survey carried out in 2007 (following very heavy rain and flooding in January, February and March of 2007) collecting information from households that were likely to have been affected by flooding and erosion were used to assess the risks that arise from flooding and erosion.

Newspaper reports from 2005 to 2010 and information from community groups was also used to identify where there are large accumulations of solid waste, either active sites or former sites that were originally outside the built-up area but have now become surrounded by housing. Further field visits were made in 2010 to re-check areas of risk identified from maps and images and to carry out semi-structured interviews with residents about risks and impact. *This helped to verify information and to understand more about the processes involved in creating these risks (for example how flooding occurs and why at-risk areas are occupied).*

2.3.3 Data collection on access to basic services (water and sanitation)

Access to Basic Services

A. Water

According to UN Habitat, a household is considered to have access to improved water supply if it has sufficient amount of water for family use, at an affordable price, available to household members without being subject to extreme effort, especially to women and children. Affordable: water should not take an undue proportion of the household income, i.e. less than 10%. A sufficient quantity: water should be available at a quantity of at least 20 litres per person per day. Water should be accessible without excessive efforts and should not take an undue proportion of the household's time (less than one hour a day for the minimum sufficient quantity of at least 20 litres per person per day).

The proportion of households with access to improved water supply includes households with:

- *Direct connection (piped water) to the dwelling or plot;*
- *Access to public stand pipe within 100 meters of the household;*
- *Access to non-piped water from:*

[7] Areas of high mosquito abundance and mosquito distribution in urban areas have been shown to correlate with breeding sites this strongly effects the risk of malaria infection (Gimnig J.E., Hightower A.W., Hawley W.A., 2006. Application of geographic information systems to the study of the ecology of mosquitos and mosquito-borne diseases. *Wageningen UR Frontis Series, 9,* 27-39.

- *Protected bore-hole or dug well with pump;*
- *Protected spring.*

"Not improved" water supply is: an unprotected well, unprotected spring, vendor-provided water, bottled water (based on concerns about the quantity of supplied water, not concerns over the water quality), and tanker truck-provided water.

B. Sanitation

A household is considered to have adequate access to sanitation, if an excreta disposal system, either in the form of a private toilet or a public toilet shared with a reasonable number of people, is available to household members.

Adequate sanitation facilities include the proportion of households with:

- *a direct private public sewer connection (to the dwelling or plot) or a septic system (with sufficient capacity in order not to be clogged);*
- *a pour flush latrine, private or shared between a maximum of two families (not public);*
- *an improved pit latrine, private or shared (not public).*

Inadequate sanitation includes service or bucket latrines (where excreta are manually removed), public latrines, and latrines with an open pit.

UN Habitat also recommends using extensive indicator 9: Regular solid waste collection, defined as the "proportion of households enjoying weekly solid waste collection," to measure the performance of this indicator. Solid waste poses considerable threat to human sanitary conditions by blocking drains and breeding flies which spread diseases such as malaria and dengue. Further, according to UN Habitat "regular solid waste collection is a clear indicator of the effectiveness of a municipal administration." [8] *Stagnant water ponds due to non-existent or deficient sewage and rain water drainage systems also add to sanitation problems in many bairros.*

For this project solid waste removal was divided into three categories:

regular/door-to-door collection,
irregular waste collection from containers or local garbage dumps which is provided in some musseques which are easily accessible by waste removal trucks,
no services.

2.3.4 Data collection on settlement density, demography and overcrowding

Settlement Density and Overcrowding

A house is considered to provide a sufficient living area for the household members if not more than three people share the same room. This is a key indicator measuring the adequacy of the basic human need for shelter. Reduced space per person is often associated with certain categories of health risks and therefore considered as key criteria to define the slum.

Overcrowding is associated with a low number of square meters per person and high occupancy rates with large numbers of persons sharing one room used for cooking, sleeping,

[8] United Nations Human Settlements Programme (2004) *Urban Indicators Guidelines – Monitoring the Habitat Agenda and the Millennium Development Goals.* http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

and other household activities. This indicator can be estimated using National Census data on the number of persons per room.

A room is defined as a space in a housing unit or other living quarters enclosed by walls reaching the floor to the ceiling or roof covering, or to a height of at least two meters, of an area large enough to hold a bed for an adult, that is at least four square meters. The total number of types of rooms therefore includes bedrooms, dining rooms, living rooms, studies, habitable attics, servants' rooms, kitchens and other separate spaces intended for dwelling purposes.

2.3.5 Data collection on housing quality and location

Housing Quality and Location

According the UN Habitat definition of durable structures, "a house is considered 'durable' if it is built in a non-hazardous location and has a structure permanent and adequate enough to protect its inhabitants from the extremes of climatic conditions such as rain, heat, cold and humidity."

A. Housing Quality

The following durability factors should be considered when categorizing housing units:

- *Quality of construction (e.g. materials used for wall, floor and roof);*
- *Compliance with local building codes, standards and by-laws.*

This project will focus on the first of these two components as the majority of housing in the three cities is located in unplanned areas and does not comply with any kind of building codes or by-laws.

B. Housing Location

According to UN Habitat, the following locations should be considered as hazardous:

- *Housing situated in geologically hazardous zones (landslide/earthquake and flood risk areas);*
- *Housing situated on garbage-mountains;*
- *Housing around high-industrial pollution areas;*
- *Housing around other high-risk zones, e.g. railroads, airports, energy transmission lines.*

These factors will mostly be covered by the environmental burden indicator which will map hazardous zones.

Road accessibility is a major problem particularly in Luanda, where road infrastructure was not properly maintained during the war while the city's population grew rapidly at the same time, resulting in an overcharged road system with frequent gridlocks. Roads in the musseques are mostly bumpy dirt roads without any kind of drainage system, which become impassable after a regular rainy season rainfall. This component has to date not been researched as such in Angola. Experiences made by DW's planning and urbanization projects indicate the importance of location for households. While location is intrinsically connected to issues such as access to basic services, the focus here will be on physical structures of

bairros and access ways.

2.4 Mapping
2.5 Analysis

Ranking and Scoring

Specific sub-indicators, based on UN recommendations, existing socio-economic data and focus group discussions, were identified and ranked from 1 (best conditions) to 3 (worst conditions) to measure the level of the following four of the five indicators included in the analysis.

Table Ranking of sub-indicators

Indicator	Sub-indicator	Ranking
Indicator 1: Land tenure and land markets		
Type of settlement depending on level of organization and infrastructure	Planned/organized/titled	**1**
	Upgradeable/organizable/untitled	**2**
	Unorganized/unurbanised	**3**
Indicator 2: Environmental Vulnerability		
It was not considered appropriate to rank this indicator as environmental vulnerabilities vary between different areas and across typologies.		
Site Location	Low risk/Safe	**1**
	Medium risk/Poor drainage/ Limited access	**2**
	High Risk/Flood-prone/Utility Clearance/Hazardous	**3**
Indicator 3: Access to basic services		
A. Water		
Main source of water	Connection to public water pipes	**1**
	Public water taps (chafariz) or Improved wells with manual pumps	**2**
	No access to safe water (the informal water market or traditional wells)	**3**
B. Sanitation		
Sanitation facilities	Connection to sewage system	**1**
	Septic tank (fossa septica) or Improved dry pit latrines	**2**
	None/Inadequate/Public latrine	**3**
Solid waste removal	Regular/Household pickup	**1**
	Irregular/Containers/Deposits	**2**
	None	**3**
Indicator 4: Population density and overcrowding		
Population per km^2	Low density with no areas of overcrowding	**1**
	Medium to high density with some areas of overcrowding	**2**
	High density with large areas of overcrowding (with a density of more than 500 people per hectare)	**3**

Indicator 5: Housing quality and location		
A. Housing quality		
Housing building material	Tijolos (ceramic bricks) or Cement blocks	**1**
	Adobe or Wood	**2**
	Pau-a pique or Corrugated iron (chapas)	**3**
Roof material	Telhas (ceramic tiles) or Concrete	**1**
	Corrugated iron	**2**
	Thatch (capim)	**3**
Floor material	Covered floors (mosaic, wood or taco)	**1**
	Cement floors	**2**
	Dirt floors (*terra batida*)	**3**
B. Location		
Type of road	Asphalt	**1**
	Improved dirt road	**2**
	Bumpy dirt road	**3**
Road conditions	Good	**1**
	Bad	**2**
	Unacceptable	**3**

Research Obstacles and Solutions

The research team ran into some obstacles during the field research, which were later resolved with different methodological approaches.

Some municipal administrations seemed reluctant to collaborate with DW on his project. It was not possible to organize a focus group discussion with a couple of municipalities in Luanda despite numerous attempts by DW. DW representatives also made several trips to some municipal administrations after a meeting had been organized in vain before the meeting actually took place. It also varied between municipalities to what extent the administrations were ready to collaborate with DW, that is the number of representatives invited to the meeting (particularly from the local level), the information shared at the meeting etc. In order for DW to keep the good relations it has built over the last decades with municipal officials, it was deemed unfeasible to approach local authorities without getting the approval of the municipal administration first. Therefore, the research team chose to correct limited and/or possibly skewed information obtained at the municipal level based on its extensive field experience and with field observations.

Another complication that came up after the implementation of the household surveys is the designation of the comuna of Bairro Operario, which represented the old musseque typology in the field research, when it should be transitional musseque. Based on the results of the household surveys where Bairro Operario scored higher on most of the indicators than presumed for the old musseque typology and after scrutinizing of recent satellite images, it was concluded that the bairro rather belonged to the transitional musseque category than old musseques. In order to correct this, data from the municipal profile of Sambizanga was used to compare the three comunas in the municipality (Bairro Operario, Sambizanga and Ngola Kilunaje) as the other two comunas definitely fall under the old musseque category.

On the other hand, Bita-Sapu in Viana, which is the area chosen to represent the owner-built

on planned sites typology for the household survey, was considered to score lower on the three indicators than expected. The observations revealed that the household surveys had in fact been conducted in the poorest part of the bairro, which is very new, where people were living in temporary corrugated iron shacks while they were in the process of building a permanent house made of cement blocks. Thus, the results of the household surveys for this typology were skewed. The proportion of permanent cement block houses versus temporary iron shacks in this typology was determined with field observations in Bita-Sapu and two other owner-built on planned sites areas (Viana II in the Municipality of Viana and Morro Bento II). Access to water, sanitation facilities and road conditions were also observed in these three areas.

3 Demography and Settlement typologies

3.1 Demography

The demographic analysis carried out by remote sensing, calculating the population in different settlement typologies and in different administrative areas, shows that the population of the Province of Luanda in 2008 was about 5.8 million. Comparison with population data for 2000 indicates that the overall population of Luanda is growing at 8% per annum. At that rate of growth the population of Luanda will be over 10 million in 2016. At present about half a million people are being added to the population of the city each year.

Population of Luanda Province

1983	923,000
2000	3,150,000
2008	5,823,000
2016 (projected)	10,778,000

While the overall growth rate is estimated as 8%, this varies markedly between different areas of the city. The growth rate is highest in newly settled areas on the periphery of the city, while some areas near the centre of the city are losing population and have a negative growth rate.

Table 1: Estimated number of people in each comuna and the percentage of the total population in Luanda in 2008

MUNICIPIO	**COMUNA**	Area Ha.	**Population**	**Percen.**	**Density** Pop/Ha
CACUACO	CACUACO SEDE	25 309	243 200	4,2%	10
	FUNDA	27 631	111 200	1,9%	4
	KIKOLO	4 230	506 200	8,7%	120
	Total Municipal	**57 170**	**860 600**	**14,8%**	**15**
CAZENGA	CAZENGA SEDE	1 050	537 700	9,2%	512
	HOJI YA HENDA	950	370 600	6,4%	390
	TALA HADI	1 860	274 300	4,7%	147
	Total Municipal	**3 860**	**1 182 600**	**20,3%**	**306**
INGOMBOTA	ILHA DO CABO	190	22 100	0,4%	116
	INGOMBOTA	150	13 700	0,2%	91
	KINANGA	160	24 500	0,4%	153
	MACULUSSO	140	15 600	0,3%	111
	PATRICE LUMUMBA	320	53 800	0,9%	168
	Total Municipal	**960**	**129 700**	**2,2%**	**135**
KILAMBA KIAXI	CAMAMA	8 285	206 600	3,5%	25
	ESTORIL	1 345	112 600	1,9%	84
	GOLFE	3 062	400 900	6,9%	131
	HAVEMOS DE VOLTAR	189	43 100	0,7%	228
	NEVES BENDINHA	360	64 400	1,1%	179
	PALANCA	1 144	64 600	1,1%	56
	Total Municipal	**14 384**	**892 200**	**15,3%**	**62**
MAIANGA	CASSEQUEL	919	131 400	2,3%	143
	MAIANGA	243	47 800	0,8%	196
	PRENDA	346	129 600	2,2%	375
	ROCHA PINTO	962	220 200	3,8%	229
	Total Municipal	**2 470**	**529 000**	**9,1%**	**214**
RANGEL	MARCAL	120	40 400	0,7%	337
	RANGEL SEDE	160	91 900	1,6%	574
	TERRA NOVA	350	44 300	0,8%	127
	Total Municipal	**630**	**176 600**	**3,0%**	**280**
SAMBA	BENFICA	18 910	204 200	3,5%	11
	FUTUNGO	2 836	196 700	3,4%	69
	MUSSULO	2 596	16 900	0,3%	7
	RAMIRO	9 866	11 900	0,2%	1
	SAMBA SEDE	322	73 300	1,3%	228
	Total Municipal	**34 530**	**503 000**	**8,6%**	**15**
SAMBIZANGA	NGOLA KILUANJE	910	252 600	4,3%	278
	OPERARIO	153	75 400	1,3%	493
	SAMBIZANGA SEDE	355	145 800	2,5%	411
	Total Municipal	**1 418**	**473 800**	**8,1%**	**334**
VIANA	BARRA DO CUANZA	47 390	15 500	0,3%	0
	CALUMBO	21 000	81 100	1,4%	4
	VIANA SEDE	65 940	963 500	17,0%	15
	Total Municipal	**134 330**	**1 060 100**	**18,2%**	**8**
	TOTAL FOR LUANDA	**249 752**	**5 823 200**	**100,0%**	**23,3**

Table 2 Luanda: Annual population growth rates by Comuna between 2000 and 2008

MUNICIPIO	COMUNA	2000 – 2008
CACUACO	CACUACO SEDE	10,3
	FUNDA & KIFANGONDO	61,7
	KIKOLO	28,8
CAZENGA	CAZENGA SEDE	2,8
	HOJI YA HENDA	3,6
	TALA HADI	3,3
INGOMBOTA	ILHA DO CABO	-1,7
	INGOMBOTA SEDE	-13,7
	KINANGA	-4,4
	MACULUSSO	-8,8
	PATRICE LUMUMBA	0,8
KILAMBA KIAXI	CAMAMA	Very high
	ESTORIL	Very high
	GOLFE	11,2
	HAVEMOS DE VOLTAR	Very high
	NEVES BENDINHA	-1,3
	PALANCA	3,3
MAIANGA	CASSEQUEL	5,4
	MAIANGA SEDE	-2
	PRENDA	-12,5
	ROCHA PINTO	Very high
RANGEL	MARCAL	1,1
	RANGEL SEDE	1,2
	TERRA NOVA	-6,4
SAMBA	BENFICA	35,6
	FUTUNGO	8
	MUSSULO	Very high
	RAMIRO	Very high
	SAMBA SEDE	-3
SAMBIZANGA	NGOLA KILUANJE	0,9
	OPERARIO	0,6
	SAMBIZANGA SEDE	-7,1
VIANA	BARRA DO CUANZA	39,4
	CALUMBO	65,2
	VIANA SEDE	41,2

Figure 2 Luanda: Growth in area of the city at different time periods

Figure 3 Luanda: Population density in 2008

Settlement Type		Population	% of total population
A	**Old Urban Centre**	168 100	3%
B	**New Suburbs and Condominiums**	166 100	3%
C	**Bairro Popular**	84 500	1%
D	**Social Housing Zones**	120 100	2%
E	**Owner-built on Planned Sites**	402 500	7%
F	**Transitional musseques**	632 000	11%
G	**Organized musseques**	484 900	8%
H	**Old musseques**	2 346 300	40%
I	**Peripheral musseques**	1 255 000	21%
J	**Rural Settlements**	245 300	4%
K	**Industrial Zone**	3 000	0,05%
	Total	**5,823,200**	**100%**

Table 3 Luanda: Estimated number of people in each housing type

Typology		Category	Population	% of total population
A	Old Urban Centre	Older than 35 years	165 693	3%
B	New Suburbs and Condominiums	New Post-war	163 721	3%
C	Bairro Popular	Older than 35 years	83 290	1%
D	Social Housing Zones	New Post-war	118 380	2%
E	Owner-built on Planned Sites	New Post-war	396 736	7%
F	Transitional musseques		622 950	11%
G	Organized musseques	Post Independence	477 956	8%
H	Old musseques	Older than 35 years	2 312 701	40%
I	Peripheral musseques	Post Independence	1 237 028	21%
J	Rural Settlements		241 787	4%
K	Industrial Zone		2 957	0,05%
Total			**5 823 200**	**100%**

The sample for the survey about land matrkets had an average of 7.3 people per household, of which 3.7 are under the age of 18. About 63% of the respondents reported moving into the bairro from elsewhere; 42% from another municipality within Luanda province and 20% from another province. Natural growth thus accounts for the remaining 37%. Natural growth is an important part of population growth and the growth of new housing areas comes more from migration within the city than from migration to the city. The residents of older housing areas were more likely to have migrated from outside Luanda than residents of newer housing areas, who are more likely to have come from other parts of Luanda. There is no indication that population growth in Luanda has reversed since the end of the war in 2002.

In the early 1960s there were relatively limited peri-urban areas on the upper plains around the central urban area. Overall the city, both formal and peri-urban areas, was limited in size geographically. By the early 1970s there had been some consolidation, but no expansion, of the inner urban core, though informal settlements had begun to spring up beyond the core. Some of these new informal settlements were organised, albeit not fully formalised (*bairros populares*), and others were used for relocation of *musseque* dwellers during inner-city consolidation. By the mid-1980s urban core consolidation had stalled, with a reversion to informal occupation in areas within it as the Portuguese population departed. Widespread informal settlement in the peri-

urban areas had been established, including those in the peripheral areas at Samba in the south of the city, in Cacuaco in the east, and in Viana in the southeast. By 2001 peri-urban settlements were spreading rapidly along the three main routes going out of the city (to the east, south and south-east). Previously outlying settlements had been integrated with the more or less continuous informal settlements, interspersed with condominiums to the south. By 2010 the city was physicallly spreading rapidly. The construction of a ring road from Benfica/Samba in the south via Viana to Cacuaco in the east (some 10 km from the centre) has become a factor in consolidating and stimulating both formal and informal settlement around the city. Resettlement locations based in Viana, more than 20 km to the southeast of the centre, are another factor.

Figure Migration trends and sources of urban growth, 2010

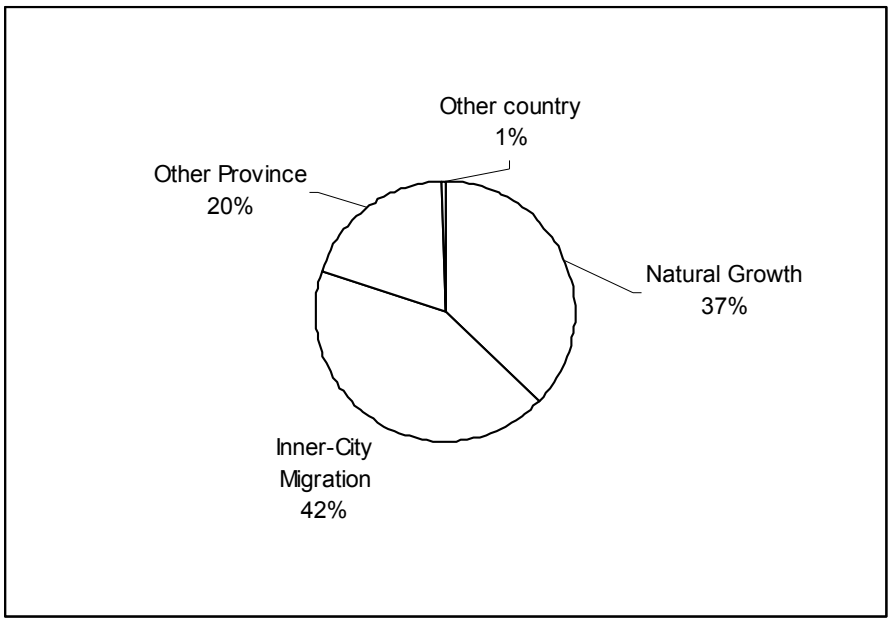
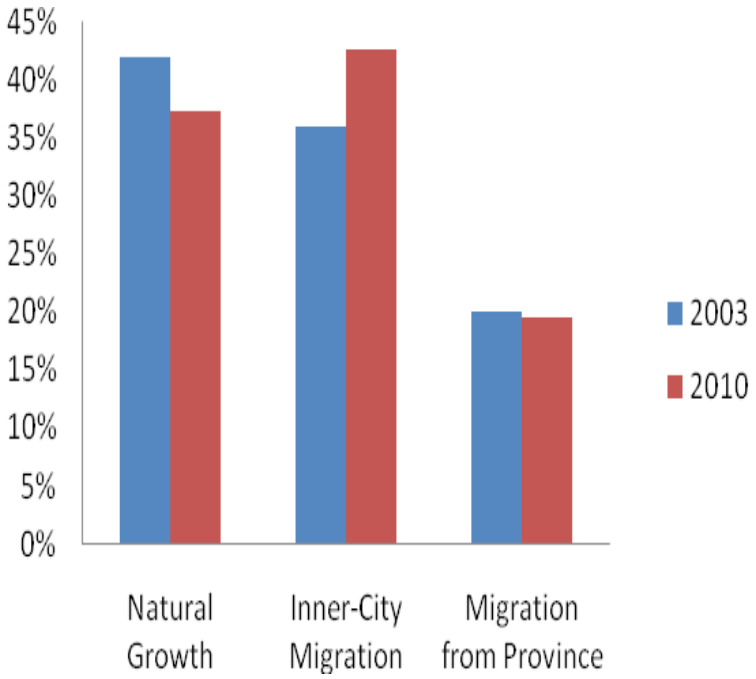


Figure 1. Migration trends and sources of urban growth over two time periods



3.2 Settlement typologies

Ten different typologies were defined in total, one rural and the following nine urban typologies (figure 4):

A. Old Urban Centre:

The old urban centre of Luanda was developed more than 35 years ago, during the colonial period. Areas originally built with an adequate standard of infrastructure, according to a conventional urban model. Service provision has generally deteriorated due to poor maintenance and inadequate supply caused by increasing demand. The city centre has a combination of old and modern architecture, multi-storey housing with the construction of new contemporary high-rise buildings. There is also a notable change in the original use of the buildings (raising of high walls, construction of annexes, infill between buildings and rooftop extensions) in order to maximise the use of space. Examples of neighbourhoods defined as old urban areas are Mutamba and Maculusso.

B. New Suburbs and Condominiums:

New suburban areas are currently under development or were developed less than 10 years ago (mainly after the end of the war in 2002). These areas have an acceptable level of infrastructure and were planned according to a conventional urban model often for real-estate ventures in a public-private partnership. These settlements usually contain zones of single-family housing and zones of apartment buildings and are often characterized by gated compounds.

C. Bairro Popular(s):

Bairro populars were built in the colonial era more than 35 years ago. They were developed for social housing programs, either initiated by the government, or by private companies, for their low and medium income employees. Bairro populars have a regular

street pattern and an acceptable standard of permanent infrastructure, such as Bairro Popular (near the Cemetery) and Marçal in Rangel.

D. Social Housing Zones:
Social housing zones were developed less than 8 years ago (after the end of the war in 2002) by the government with an aligned street pattern. This category includes for example the bairro of Panguila in Cacuaco and Zango in Viana.

E. Owner-built on Planned Sites (auto-construção dirigida):
Owner-built houses constructed less than 10 years ago on sites with an aligned street pattern planned by the government or organized by families with medium to high income. These areas are characterized by single-family houses, such as Capolo.

F. Transitional Musseques:
Transitional musseques were initially informally settled before independence, but have been reconstructed and regularly improved by residents over time. These neighbourhoods were developed by individuals very close to urban areas on land that is considered very valuable. Today these zones receive a great deal of investment and are gradually being transformed into more formal bairros with some urban services, such as Catambor.

G. Organized Musseques:
Settlements developed by residents in the 1980s with an aligned street pattern, but eclectic housing structures and various levels of maintenance, such as Palanca and Mabor.

H. Old Musseques:
Old musseques were constructed more than 35 years ago (before independence). They have informal settlement patterns with an ad-hoc building structure and precarious houses. Most of Sambizanga and Rangel, which are located close to the centre of Luanda, fall into this category.

I. Peripheral Musseques:
Peripheral musseques were constructed less than 10 years ago on the periphery of Luanda. They are unplanned developments with an irregular street pattern, mainly initiated by families with low incomes. The construction standard is quite precarious and the houses poor, such as in Paraiso in Kicolo.

J. Rural Settlements:
Low density peri-rural occupation including irrigated and unirrigated garden plots in the green-belt beyond the city limits, but within the province of Luanda.

Figure 4 Luanda: nine urban typologies, their location in Luanda, urban form and typical housing for each typology

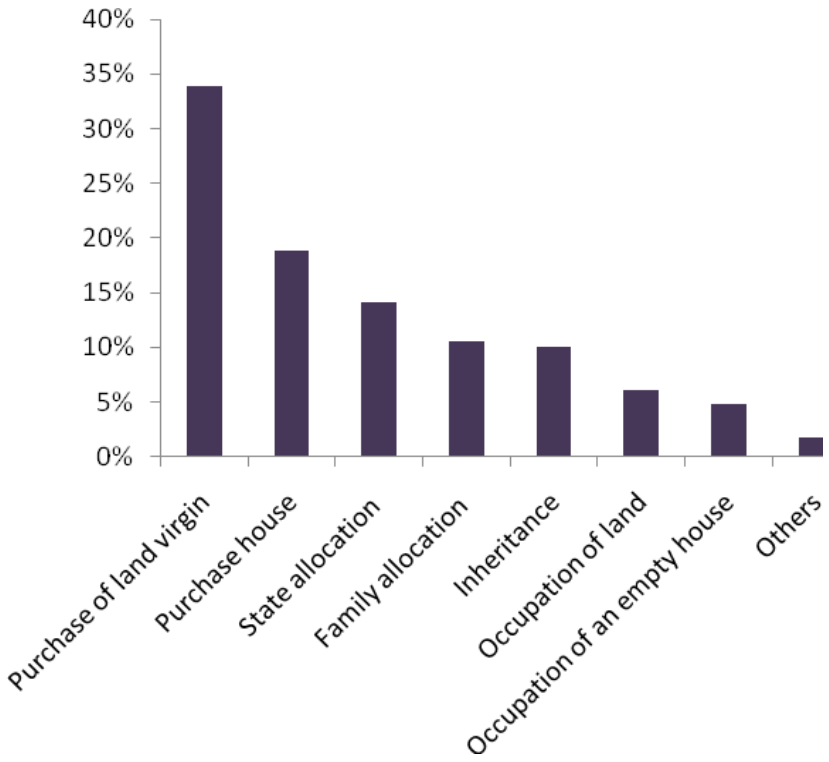
Each typology was then located on a base map of Luanda in order to be able to geo-reference the socio-economic characteristics of each typology (figure 4).

4 Land tenure and land markets

4.1 Access to land and housing

Respondents were asked how they gained access to land and housing. In all settlement types the purchase of vacant land is the most frequent means of access mentioned by about a third (34%) of respondents. In more recently settled areas a higher percentage said that they had purchased land.

Figure . How respondents gained access to real estate property



The second most significant form of property access is house purchase, cited by 19% of the total number of respondents and in all types of settlement this was the second most frequent way that respondents obtained access to property. The third most significant form of access to property (14%) is state allocation ("*cedência do estado*"), but this only has occurred in social housing areas. The majority (53%) of the respondents for this particular study area said they had access to property through state allocation, while this response is close to negligible in the three other study areas. Although *Bairro* Panguila is within a social housing zone, it is important to note that the market also plays a role in allocating property in this neighbourhood and secondary sales of property do occur: 13% of the respondents in this study area had purchased their house. Recipients of housing allocated by the state here are prohibited from selling the property for a period for 5 years. Without this stipulation, it may be expected that the occurrence of secondary sales might have been higher.

The fourth most significant form of access across the sample is “looking after or lending” within the family (“*cedência entre família*”), and the occupant of the property is not the owner, but rather a relative of the owner. This mode of access to property is insignificant in the peripheral *musseque*, but cited by 10 to 16% of respondents in the other three settlement types.

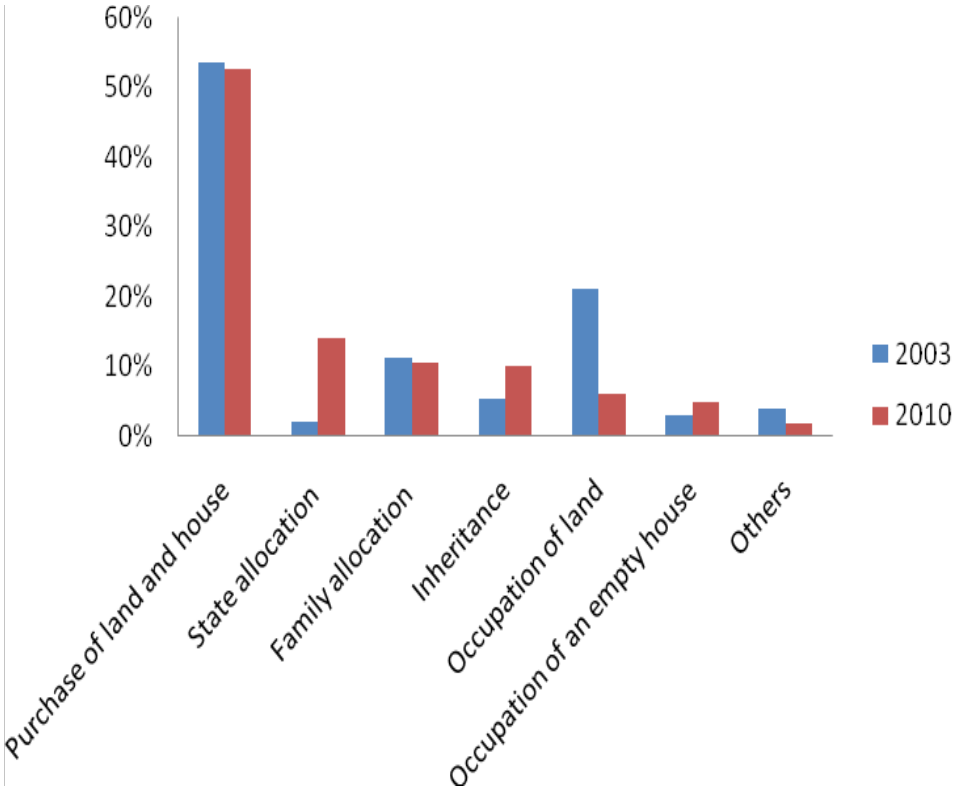
Inheritance is a significant route to access property, in the transitional musseque near the city centre which is an old community (where 37% said they inherited their property), but is negligible in other areas. Generally, the “occupation of land and houses” does not feature very strongly as a means of land access or supply (6% and 5% respectively) among the four settlement types (only 11% of the total respondents mentioned this). It is therefore important to note that, contrary to the common notion, most people are not occupying or “squatting” on land and houses that they have not paid for. Equally important to note is that paying for property emerges as one of the prime reasons for the inhabitants’ perception that their land rights are secure. Most vacant land occupations have taken place in Val Saroca which can be explained by the age of the settlement and the fact that these had occurred more than 25 years ago.

Similar research was carried out in by DW in 2003. In both 2003 and 2010, the purchase of land and houses was the primary means of accessing real property, with only a slight decline between 2003 and 2010. The key differences are a significant increase in access through state allocation (from 2% to 14%) and a significant decrease in the proportion of those who reported having occupied empty land (from 21% to 6%). The dominance of sale as a transfer mechanism (53% in 2010) indicates that a financial market continues to exist., with certain social housng areas now dominated by state allocation as a form of supply of property.

Table 4.1 Research areas in each settlement type

Typology	Population	% of Total Population	Research Area (Bairro)	Comuna	Municipality	Number of question naires
Old Urban Centre	165,693	3%		Maculusso	Ingombota	64
New Urban Areas	163,721	3%	Projeto Nova Vida	Estoril	Kilamba Kiaxi	60
Bairro Popular	83,290	1%	Nelito Soares	Terra Nova	Rangel	69
Social Housing Zones	118,380	2%	Luanda Sul	Viana Sede	Viana	61
Owner-built on Planned Sites	396,736	7%	Bita-Sapú	Viana Sede	Viana	60
Transitional Musseque	622,950	11%		Catambor	Maianga	62
Organized Musseques	477,956	8%	Sector 1	Palanca	Kilamba Kiaxi	60
Old Musseques	2,312,701	40%	Bairro Operario	Operario	Sambizanga	172
Peripheral Musseques	1,237,028	21%	Paraíso	Kikolo	Cacuaco	167
Rural Settlements	241,787	4%				
Industrial Zones	2,957	0.05%				
Total	**5,823,200**	**100%**				**775**

Figure . Comparative mode of access to property over two time periods



4.2 Documents that provide security of tenure

What are the documents that provide people with a sense of security of tenure? The following are documents cited by respondents of this study: _

1) Declaração de compra e venda (purchase and sales declaration): this is a declaration signed by both parties to prove transfer of real estate ownership; this declaration can be signed by witnesses as well, and/or legalized by a notary

2) *Contrato de compra e venda* (contract of sale): this document stipulates the value and terms of purchase of the property and is signed by both parties

3) Licença de arrematação (temporary but upgradable license): this license is the first license issued by the municipal authorities after the concession is made for a plot of land. With this license, further licenses can be obtained for the eventual construction on the land.

4) *Croquis de Localização* (location sketch): this document defines the location of land or property and is issued by the municipal administration. It is one of the required documents that have to be submitted to legalize property ownership

5) *Título de ocupação precária* (precarious occupation title): this title is issued by the provincial authorities to establish precarious (temporary) occupation for up to one year,

and is subject to renewal

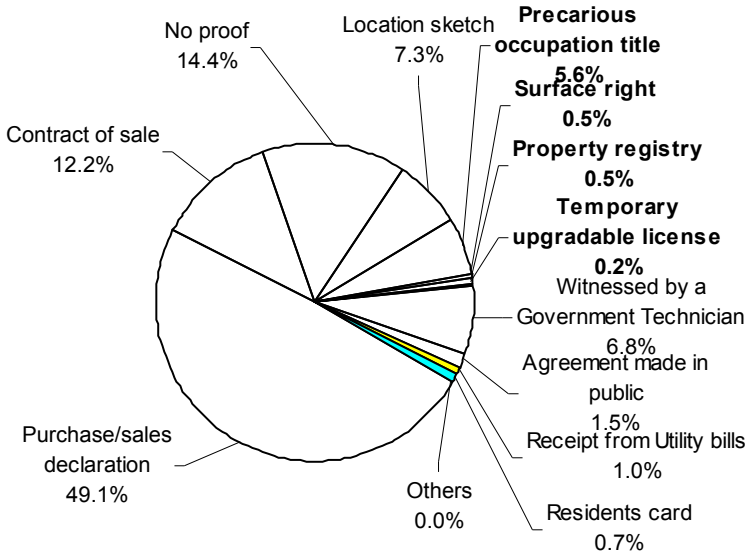
6) *Direito de Superfície* (surface right): this title is granted by the provincial authorities. It constitutes a concession, usually for 60 years, attributing rights and obligations to own and build on land. This land may only be used to construct one's own house or to carry out basic economic activities. When the purpose of the use of the land is defined, information on the land must be requested from the municipal or provincial authorities with regard to the ownership of the land and viability of the project. Only then can the request to issue the surface right be made, i.e., by submitting the request, the *croquis de localização*, proof of a precarious occupation title of the land, copy of ID of the requester (singular or collective) and a brief description of the project that is intended to be developed on the land. Other documents may also be requested by the authorities, if needed.

7) Registo Predial (land/property registry): this document refers to a declaration issued by the Conservatory (local Ministry of Justice office) as proof of property registration

In addition to the above-mentioned documentary forms of evidence, the respondents also mentioned other documents that provide proof of occupation, or the use of verbal agreements witnessed by a third party ("*o acordo foi verbal testemunhado por terceiros"*).

About 86% of the total number of respondents had some kind of documentation that demonstrate that they had a right to occupy the property, but a significant number (14%) of all the respondents said that they did not have any document to prove their right of occupancy. Of those who had documents to demonstrate right of occupancy, "purchase/sales declaration" documents were held by almost one-half (49%) of the total number of respondents. A further 12% of the total respondents indicated that they had a contract of sale. About one-fifth (20%) of the total number of respondents had other significant forms of documented evidence (*Croquis de Localização* and oral evidence testimony at 7% each, and *Titulo de ocupação precária* at 6%).

Figure . Documents that prove the right of occupancy, 2010



Official forms of evidence were barely used -- only 8% (or 28) of the total respondents indicated that they possess any official form of evidence; these documents are:

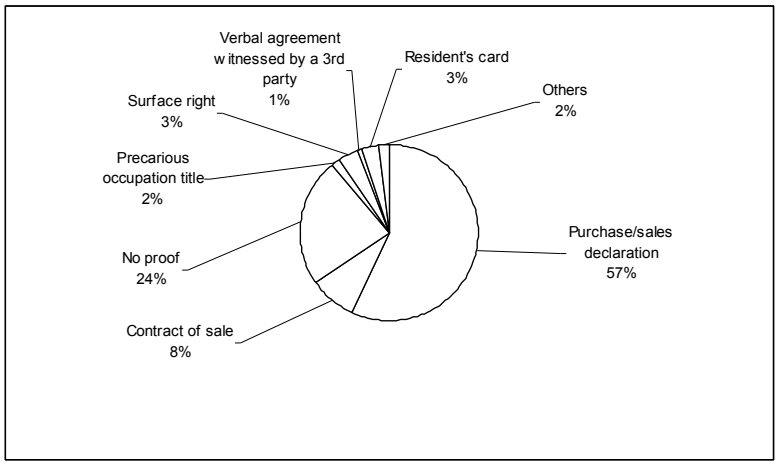
- *Direito de Superfície*: 2 respondents
  Registo Predial: 2 respondents
  Licença de arrematação: 1 respondent
  Título de ocupação precária: 23 respondents

Most of these responsents were in the transitional musseque area.

Those who had *Título de ocupação precária* made up 6% of all the respondents whereas the total number of those who had the first three documents made up only 2% of the total sample. Because the *Título de ocupação precária* is only valid for one year, many of those claiming to hold it may not have renewed this title and may have consequently lost their legal tenure. In addition to this, if the area in question is within a state land reserve covered by decree 50/07 (Article 30 (4), General Regulation on the concession of land), the *Título de ocupação precária* would carry no weight because the decree annuls it.

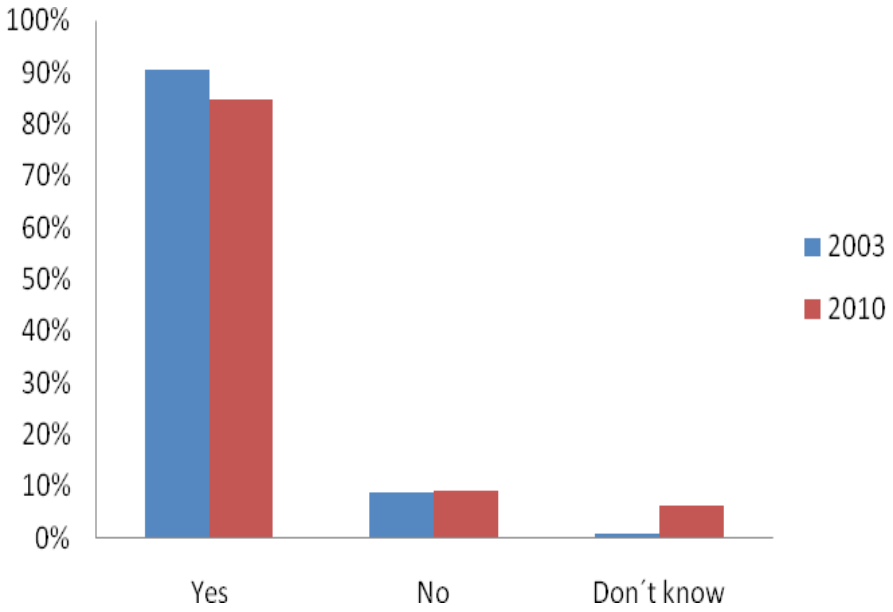
When the data from 2010 is compared to the similar study in 2003, the most striking change is that the proportion of those who had no proof of right to occupancy declined from 24% in 2003 to 14% in 2010. The proportion of those who had precarious occupation title increased from 2% in 2003 to 6% in 2010, and in the same manner, the proportion of those who had verbal agreements increased from 1% in 2003 to 7% in 2010. Other forms of documentation such as surface rights, land registry, etc., were obtained by 2010 -- these were not in the possession of “owners” in 2003.

Figure . Documents that prove the right of occupancy, 2003



An overwhelming majority of the respondents (85%) believed that their rights are protected. The remainder either considered that their rights were not protected (9%) or they did not know if they had security of tenure (6%). This widespread perception of their occupancy rights being protected echoes the findings of the 2003 study. Marginally more respondents indicated more uncertainty (do not know). When considering the weight attached to different forms of evidence there are two perspectives that are brought to bear. The first concerns local practice, and the other concerns the official government position. Despite people's perceptions about their protection the law, as it currently stands, protects their claims to only a limited extent.

Figure . Respondents' perceptions of their security of tenure over two time periods



In most cases respondents believed their rights to be protected because they had documents to prove it (46%), or because their neighbours can provide testimony (36%) that the place belongs to them. This kind of reliance on social relations in property markets in developing cities is not uncommon, even in the absence of customary tenure.

The weight of practice therefore, demonstrates the significance of the declaration and contract of sale as proof of tenure, or evidence that back up people's claims to occupancy rights. Taken together, these two documents were cited by a majority (61% of the respondents).

Market transfers are often backed up by evidence, the large majority of which is documented, so markets cannot accurately be described as "informal". However, although these documents involve official actors, they are not legally defendable especially in a context of any planned large-scale upgrading or demolitions programme. The notaries who act as witnesses to the declarations and contracts of sale are not validating; people are not aware of this.

In the past, in the absence of higher-level physical plans, local officials from municipalities, communes and residents' committees made rational decisions on land allocation that made sense to them at the time. Prior to the clarification of the current land legislation, the perception would have been widespread that it was within their competence to make such decisions. Many people who claimed they had received land from the state would have received it through these mechanisms. We assume that the allocations were made in good faith by local officials. In this context they are not accurately characterised as examples of corrupt practice.

Figure . Respondents' reasons for believing they have security of tenure

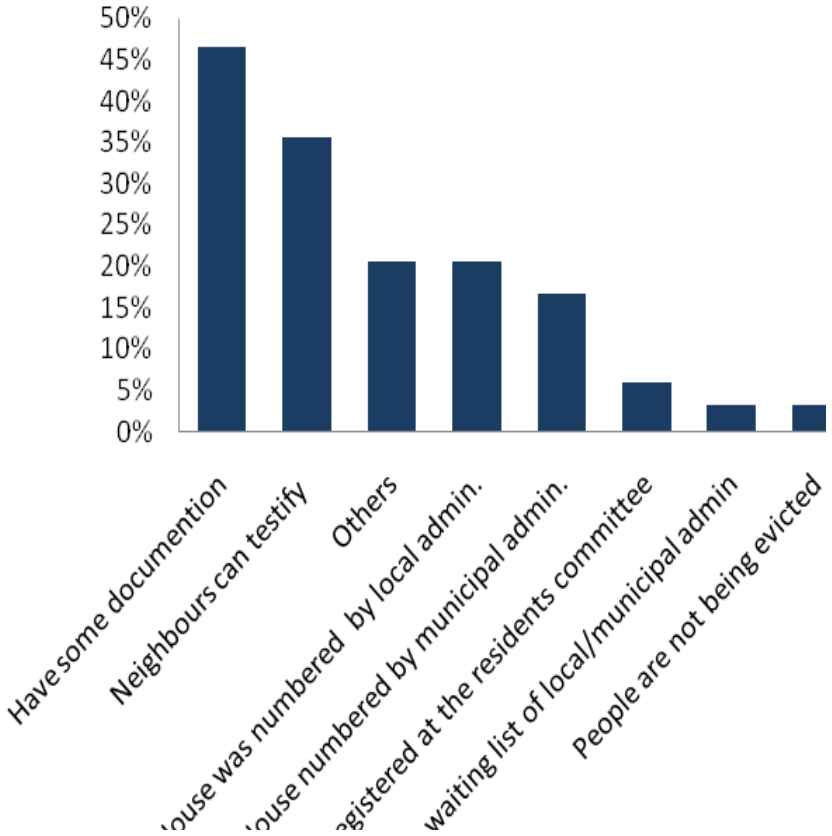
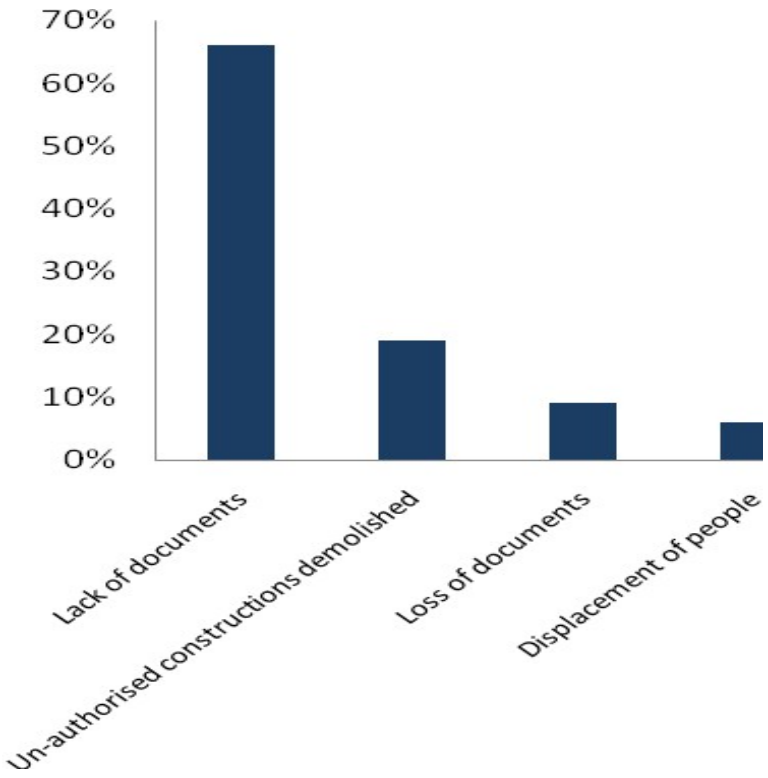


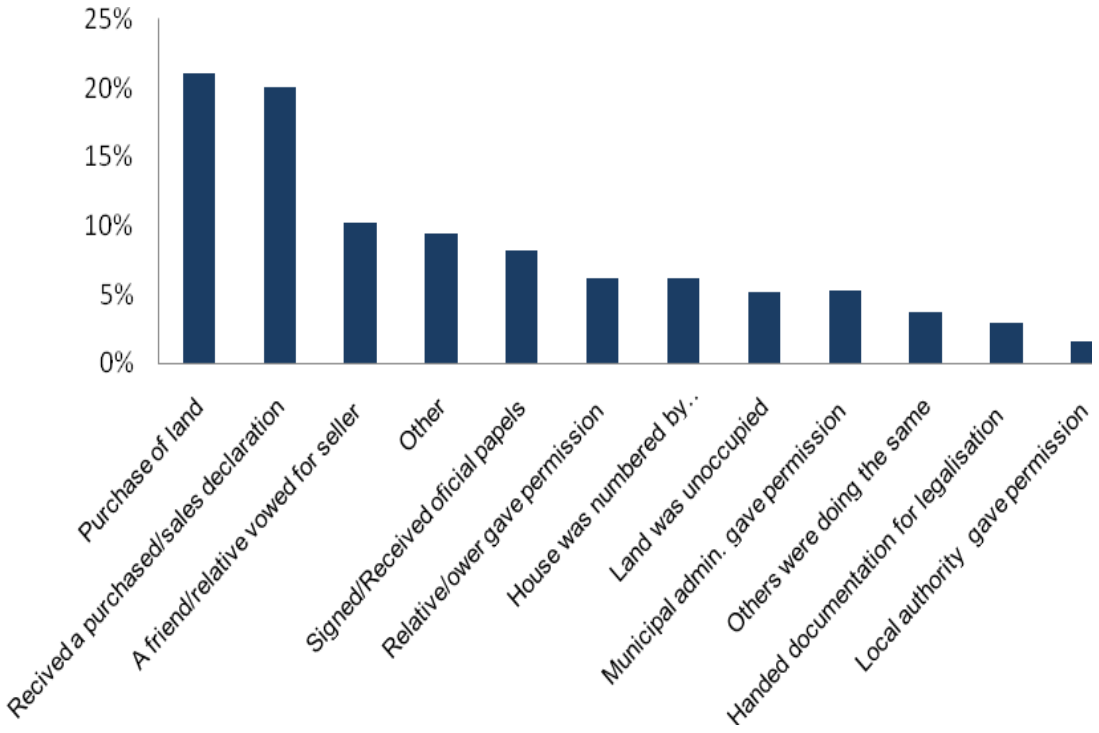
Figure Why respondents believe they do not have security of tenure



It should be noted that in the state-sponsored social housing area a negligible proportion of respondents have official evidence to back up their rights. Even in state allocation processes, the government has yet to provide legal documentation to back up people's new rights .

Regarding the validity of occupation, most of the respondents (41%) indicated that the fact that they purchased the land they live on and that they received a purchase declaration (21% and 20%, respectively), gives them security that their occupation of the property would be valid: the very fact of purchase is perceived to provide security or ensure validity and that declarations and contracts of sales are official in nature.

Figure . What makes the occupation of property valid?



Reasons for moving

Social factors (getting married and the increase in family size) are the dominant reasons that motivate people to move. Being resettled by the government is an important reason in social housing areas (mentioned by all residents of those areas). Economic factors, particularly the availability of land and property prices, play an important role in encouraging moves to peripheral musseques: households can capitalise on inner-city houses and land through sale and relocation.

From those that migrated into the study areas, 64% stated that living conditions were better in the destination bairro, 20% affirmed that living conditions were similar to where they lived before, and 16% said the conditions in the current bairro were worse than where they came from. However more than 30% of those in the peripheral musseque said that their conditions were worse than where they lived before. This, taken together with the high proportion of residents of his type of settlement moving for economic reasons, suggests that people who move to these areas do so to reduce costs even if conditions are more difficult (poorer access to clean water, lack of access of electricity , greater distance from employment opportunities, higher transport cost and more time spent travelling.

Land reserves for housing and conversion of informally-occupied land

The Angolan government has implemented a policy to set aside specific land reserves areas for housing. For Luanda, some of these are in thinly populated areas distant from the city centre and are presumably destined to provide housing to those who migrate outwards from the city centre. Others are closer to the city centre and presumably are aimed at the upgrading of inner-city areas. Mapping these areas and calculating their population suggests that the some of the areas are relatively densely populated.

Bairro Operario and Boa Vista	30,132
Cazenga Antenas	23,641
Kakuxi and Bita Sapu and Benfica	41,188

The identification of land as a land reserve turns it into an area of public utility, and allows for land expropriation. Compensation should correspond to the real and current value of the land (Article 30 (4) General Regulation on the concession of land – Decree 58/07). However, this only applies to those who have a provisional, definitive or full property title; otherwise, the right to precarious/unregistered occupation is annulled (Article 30 (1) Decree 58/07).

In 2001 demolitions of informal settlements located in the *bairro* of Boa Vista took place, marking, the beginning of a process of converting informally-occupied areas into formal urban lands. Those evicted were relocated 35 km away from their original homes. Future upgrading projects in *bairros* such as Sambizanga and Cazenga will necessarily involve demolitions and resettlements, and the conversion of large areas of presently informally-occupied lands. This will contribute to the outward movement of poorer people that is already occurring through market mechanisms, as transitional musseques develop and their population density decreases and poorer people seek cheaper accommodation further from the city centre. This process of land conversion has been driven by the informal land market, with little consideration or even awareness of formal government demarcation of land reserves, plans for sites and services, or social housing.

Dispute resolution

How are disputes about land and houses resolved in the absence of formal regularisation of tenure, and by whom?

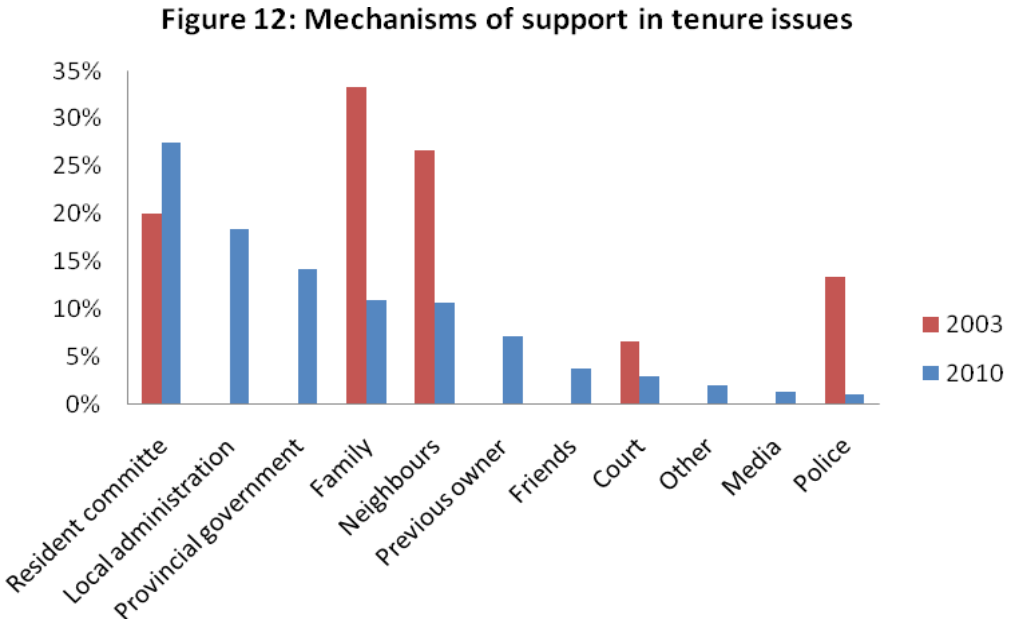
The incidence of conflict over land is very low, with only 2% of all the respondents having experienced any sort of conflict involving the land which they currently occupy. This finding is very similar to the DW 2003 study in which evidence of actual conflicts was found to be almost negligible (4%) and in those few cases where conflict did occur, it tended to relate to disputes over boundaries and conflicting claims over the right to the land (within the family, and with people outside the family).

Of the eight reported conflicts three were with neighbours over boundary demarcation, two occurred were with the local administration concerning construction standards and one was with family members. The occurrence of so few disputes provides an indicator of the functioning local markets, and of the social legitimacy of property transfers, even if the documents used to back them up are of questionable legal status.

Most respondents (28%) would be likely to put their trust in the residents' committees to resolve disputes, while a significant proportion of the respondents would turn to either the local administration (18%) or provincial government (14%). The perceived role of the state emerges as important as the two entities together seem to enjoy the trust of almost one-third (32%) of the respondents. Only 7% of the respondents would turn to the former owner for a resolution to the conflict.

The findings of the DW study in 2003 show that the family (33%) followed by neighbours (27%) would likely be asked to resolve issues on tenure. The residents' committees were preferred as the third option (20%) followed by the police (13%). This suggests a significant shift in the values and attitudes of property owners: property owners now prefer a more formal approach to conflict resolution (i.e., the local government administration officials to help in resolving land conflicts), as opposed to seven years ago, when the preference seemed to be a more interpersonal and informal process of dispute resolution.

Figure Who would likely be asked to intervene to resolve land conflicts?



Brokers, agents and intermediaries

Almost 90% of those who paid to obtain land or a house paid directly to the previous owner. Very few paid an intermediary. There are however intermedaries and brokers, though they are paid by the sellers to locate clients and do not becomed intermediaries in payment. Few agents involve themselves in the actual transfer of property. Their activities are mostly limited to bringing the seller and buyer together. In the high-end market this is a highly lucrative business in itself where the commission can be one month's rent. The informal land market is characterized by individualized direct purchase.

Existing studies indicate that the real estate sector is still in an incipient stage. It lacks structured financial products, partly due to the inefficiency of cadastre and land registration, and the lack of legislation on 'horizontal property' to provide for warranties. This inhibits access to credit for housing and the development of a mortgage market. Studies carried out on the Angolan real estate sector only emerged in 2008, but there is still a lack of information relevant to and on the sector. As a result, speculation in and informalization of the sector have been able to thrive as little or no qualifications were required for people to enter the profession and call themselves real estate brokers or intermediaries. In the words of a formal real estate broker:

Land Tenure and Land Markets

Indicator 1: Land Tenure and Land Markets

Definition of indicator: Level at which secure tenure is ensured for households and individuals.

According to the Angolan Constitution and Land Law, land is the property of the State. After independence, land owned by Portuguese colonialists could be nationalized by the state 45 days after it had been abandoned by the owners. In practice, citizens have the right to settle on land and with the passing of time acquire de-facto occupation. Angolan cadastral and property title records have not been systematically updated since independence in 1975 and during the war, the legal framework, which governed the use of land, was weak. People occupied any area that appeared to be empty, and then informed the bairro authorities, the administration or the Soba (traditional chief), depending on the location (figure 10). [9]

[9]

Figure 2: Marking of land and granting of land titles in peri-urban areas

However, according to a new land law that was approved in 2004, only those who own land in the few areas where an urban development plan exists and have gone through the expensive and arduous process of obtaining formal title from the provincial government, have legal rights. Further, according to a new regulation on land titles from 2007, all residents of the country have to legalize their tenure before 2010 or otherwise risk being expropriated without any compensation. Thus, land owners who have acquired their land by occupation, do not in fact have a secure tenure even if they feel that they have regularised their occupation and have a notarised bill of sale from the local government. Informal land markets exist in all urban and peri-urban districts in all provinces of Angola and approximately 30% of residents in peri-urban districts have purchased their land on the informal real-estate market (figure 11).[10]

This indicator area looks at three main aspects, these being; i) the rural link of peri-urban residents, ii) peri-urban residents' involvement in land markets, and iii) occupancy rights

i) The rural link of peri-urban residents
Observation and existing evidence strongly suggests that a large percentage of peri-urban residents in second and third tier cities are engaged in agricultural activities within and outside the city perimeter. Agriculture therefore does seem to provide an important contribution to the livelihoods of peri-urban residents. To date, no research has been undertaken in Angola on this specific aspect of urban livelihoods.

ii) Peri-urban residents' involvement in land markets
At the periphery of expanding cities, local actors are part of a dynamic informal land market. Residents of peri-urban areas that own still unoccupied land beyond the city limits are negotiating their parcels with those urban residents that are pursuing land for housing. While not having done any specific research on this issue, DW has been involved as an actor in this land market through its layout planning projects in Huambo. In these areas, DW has negotiated the concession of these occupancies to DW for the implementation of its projects, compensating the occupants with urbanized parcels in the same area. One of the key results of this negotiation was that occupants of previously low valued rural parcels were compensated with high value urbanized parcels. Compensated occupants were free to sell all or some of their urbanized parcels to an interested third party, providing them with important capital for their household economy. The observation that many of those compensated with urbanized parcels cashed these to improve their household economy (through investing for example in a home based informal business) led DW towards a basic understanding of the important relation of land markets and poverty reduction. This research therefore aims to systematically approach this topic not only in Huambo (where first observations were made as mentioned above), but compare it with land markets at urban peripheries in a mega city (Luanda) and a third tier town (Cachiungo).

iii) Occupancy rights
DW's land research program implemented together with CEHS from 2002 to 2005 showed how few residents (less than 1% of those interviewed) of peri-urban settlements are in the possession of official occupancy rights. More research and policy influencing on this topic is an absolute

[10] Development Workshop, *Housing Finance in Angola*, April 2009.

priority, because based on the current land legislation in Angola, all urban and rural residents that will not have initiated their land regularization process by July 2010 will loose any occupancy right.

Secure Tenure is the right of all individuals and groups to effective protection by the State against forced evictions. Women should have full and equal access and rights to inheritance and to ownership of land and other property.

Individuals who have secure tenure have:

1. *Documentation that can be used as proof of secure tenure status, such as:*
    - *formal title deeds to either one or both of land or residence;*
    - *enforceable agreements or any document as a proof of a tenure arrangement;*
    - *formal rental contracts (tenant households);*
    - *customary tenure;*
    - *tax payment documents (property tax, municipality tax, etc.);*
    - *customary tenure who possess utility bills.*

2. *Evidence of de facto or perceived protection from forced evictions which is the proportion of household-heads who believe that they will not be evicted from their present residence within the next five years.*

3. *Angolan regulations specify that urban land tenure can only be conceded on the basis of the existence of urban physical plans. Current state policy indicates that settlements that are not urbanized should be "requalified" and tenure is unlikely to be granted before this process of urbanization takes place. Master plans do not exist for all urban areas in Angola at the time of writing this paper. For the purpose of measuring this indicator therefore, housing that is in already existing urbanized zones may be considered to have secure tenure and settlements that can easily be "requalified" or can be "urbanized" without evicting existing residents may also be considered to have an intermediate level of tenure security. Informal settlements that do not demonstrate patterns that can be easily urbanized can be considered to have insecure tenure.*

People who have acquired their land on the informal land market are all at risk of expropriation by the state or even commercial developers who have secured clear legal concessions to tracts of urban land. Only those owner occupiers with legally registered land titles are able to secure bank loans for housing construction. In the face of the great shortage of housing, the majority of the population have opted to build their own houses, sometimes in hazardous locations such as steep hillsides, causeways, flood drainage, etc. The State reluctantly grants construction permission or ignores these constructions and in many cases ends up demolishing houses built on supposedly unauthorised areas. [11]

According to UN Habitat, if a high proportion of the urban population is housed illegally without title to the land and building permits, this "is a sign that housing development is proceeding without proper government controls, and that government is either tolerant of housing which does not comply with its regulations or is unable to prevent trespasses." It is also emphasized that settlements should be planned and that land should be accessible and available at reasonable prices for individuals and the private sector. A sufficient supply of affordable land "shows if the local government is able to respond to the growing needs by developing infrastructure in undeveloped parts of the city or providing incentives for new developments." [12]

No statistical information is available on land titles in Angola, although it is evident that there is a lack of affordable land with regularized land titles due to the weak legal, administrative, technical and investment capacity of the government at all levels in urban development. Thus, national urban policies need to focus on the social and economic inclusion of the majority of citizens and modify policies and regulations that exclude. [13]

Security of land tenure generally varies according to settlement layout. Organized and planned settlements are much more likely to have secure tenure than unorganized ones. Thus, this indicator was measured by dividing land into the following three settlement types according to the level of organization and infrastructure:

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[11] Ibid

[12] United Nations Human Settlements Programme (2004) *Urban Indicators Guidelines – Monitoring the Habitat Agenda and the Millennium Development Goals.* http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

[13] Development Workshop, *Terra – Urban Land Reform in Post-war Angola: Research, Advocacy & Policy Development*, 2005, p. 23.

Table 2: Ranking of Indicator 2: Secure Tenure

Ranking	Type of settlement	Description
1	Organized/planned settlements	Planned settlements that generally have access or allowances for public infrastructure and where the majority of the population already has secure or provisional tenure (for example, Central Urban Areas, newly planned subdivisions, condominiums and existing Bairro Populars). People living in these areas also have more tenure security than residents of zones which are at risk of being demolished "for public use" such as the construction of major streets or because they are located in environmentally hazardous areas.
2	Upgradable settlements	Organized musseques with an aligned street pattern where public infrastructure, such as sewers, water pipes and electricity, can easily be installed. Residents in these areas can be considered to have more secure tenure, as these zones are generally well organized, and can be upgraded and urbanised without demolition of housing.
3	Unorganized settlements	Settlements with an unorganised urban layout and built without an aligned street pattern are difficult to upgrade with urban services. These settlements often need reorganization before the instalment of service infrastructure and have a higher risk of demolition therefore tenure is not secure. If such zones are located in environmentally hazardous locations their tenure is highly insecure.

A significant proportion of Luanda's settlements are unurbanised musseques and are destined for upgrading, re-ordenamento or demolition. Their insecure tenure status puts at risk the savings and assets of the poor that have been invested in their housing over many years. The upgrading of urban services and infrastructure should be planned in a way that minimalizes forced removals of existing occupants and families and the demolition of their housing. Existing occupants' tenure rights should be protected whenever the public-good is not under threat.[14]

Indicator 1: Land Tenure and Land Markets

During the colonial period Luanda's peri-urban areas were mostly sparsely occupied garden plots, scattered peasant cultivations or areas set aside for future development. Land occupation was demarcated by the colonial-era cadastre. With independence, some peri-urban and peri-rural colonial occupations were abandoned and the cadastre ceased to be updated regularly. Due to an absence of the traditional neighbourhood chiefs or Sobas in most parts of Luanda, members of the local administration or coordinators of residents' commissions who are respected in the neighbourhood are usually responsible for overseeing land transactions.[15]

The opportunity to formally receive a plot of land in Luanda from the state is very limited. On the one hand, there is very weak institutional capacity to effectively respond to requests for land, and on the other, a widespread lack of confidence exists in the government's capacity to deliver urbanised housing plots. Defending the argument of "public interest", the government forcibly removed thousands of people from inner-city areas of insecure tenure, to make way for new housing developments and infrastructure such as roads and drainage channels. The displaced population was resettled on the margins of the city in new areas, often far from their previous

[14] Ibid p. 23.
[15] Development Workshop, *Housing Finance in Angola*, April 2009.

homes and places of employment. [16]

DW's 2004 study of peri-urban Luanda indicates that over 80% of land is informally occupied and the residents do not have any means of regularising their occupation. Thus only 20% of land was accessed through formal means and has a clear title.[17] Even in the city centre, which has the biggest proportion of secure tenure, a considerable number of house-owners are in different phases of the acquisition process with the Government Commission for the Selling of Housing Patrimony (Comissão para venda do Património habitacional do Estado). Thus, many areas are illegal settlements according to the law, although they have a planned urban structure with an aligned street pattern that greatly facilitates the regularizing of land titles.

The following table shows the Secure Tenure ranking of typologies according to settlement type.

Table 3: Ranking of Indicator 2: Secure Tenure in Luanda

Typology		Type of settlement	Population	% of total population	Tenure Ranking
A	**Old Urban Centre**	Planned/organized	168 100	3%	**1**
B	**New Suburbs and Condominiums**	Planned/organized	166 100	3%	**1**
C	**Bairro Popular**	Planned/organized	84 500	1%	**1**
D	**Social Housing Zones**	Planned/organized	120 100	2%	**1**
E	**Owner-built on Planned Sites**	Planned/organized	402 500	7%	**1**
F	**Transitional musseques**	Upgradeable	632 000	11%	**2**
G	**Organized musseques**	Upgradeable	484 900	8%	**2**
H	**Old musseques**	Unorganized informal settlement	2 346 300	40%	**3**
I	**Peripheral musseques**	Unorganized informal settlement	1 255 000	21%	**3**
J	**Rural Settlements**		245 300	4%	**3**
K	**Industrial Zone**		3 000	0,05%	**1**
	Total		**5,823,200**	**100%**	

[16] Development Workshop, *Housing Finance in Angola*, December 2009.
[17] Development Workshop, *Housing Finance in Angola*, December 2009.

5 Environmental burdens and urban – rural linkages

Environmental issues

The following issues were identified as the main environmental issues affecting urban areas in Angola:

Flooding
Erosion
Inadequate solid waste disposal
Extraction of sand and stone as building materials
Quality and quantity of groundwater

In the case of Luanda, water supply is from rivers and not from ground water. The question of the quality of water is dealt with in the section on basic services. The extraction of sand and stone as building materials occurs at some distance from the city: the impact of this is dealt with in the section on urban-rural linkages. Inadequate solid waste disposal is a wide-spread issue with many areas experiencing solid waste left uncollected: this is dealt with in the section on basic services. This section mainly deals with the main environmental burdens in Luanda of flooding and erosion, with an emphasis on pinpointing more exactly these environmental hazards, their location, their impacts and the processes that cause them.

Rainfall in Luanda and its impllications for flooding and erosion risk

Luanda Observatory is the only meteorological station in Angola which has a long continuous record of rainfall reading, beginning in 1901. It is one of the few stations that existed before the large-scale expansion of meteorological stations in Angola in the early 1940s and that continued to take measurements after the collapse of the network of stations in 1975. Unlike other stations with a long record of measurements (such as Namibe and Lubango) there has never been a gap in data collection and readings appear to be reliable.

Angola is part of the relatively dry coastal belt of Angola, with a longer dry season than areas further from the coast. The mean annual rainfall is 340 mm per year. The wet season runs from November to April, and in an average year more than half of the annual precipitation falls in March and April. The cold Benguela Current, flowing northwards along the Atlantic coast, inhibits rainfall and it is only late in the rainy season that sea-surface temoperatures are conducive to rainfall.

Rainfall in Luanda is, however, highly variable from one year to the next (as it is in many places in Angola). The annual total per calendar year has been as low as 52 mm (1982) and as high as 860 mm (1984). Most rainfall is in short, heavy storms, particularly in March and April: when these storms do not develop rainfall is low. This variability is partly due to year-to-year variability of the Benguela Current and in the position of the Inter-Tropical Convergence Zone.

Information is available for certain years about the maximum rainfall in a 24 hour period, for the years 1943 to 1972. This indicates that in 50% of years there is a day on which more than 70 mm of rainfall occurs, and in 20% of years there is a day on which more than 120mm of rain falls. These days almost always occur in March and April. There have been seven months in the 105 year period in which more than 300 mm of rain fell in one month. Thus while Luanda is in a relatively dry region, with an average of 340 mm of rain per year, there is a high variability and it

is not unknown for that amount to fall in one month (six times in the last 100 years, one of which (1969) had 680 mm in two months). It is also fairly common for large amounts of ran to fall in one day.

Large amounts of rain in a short period are conducive to erosion: the size of the raindrop is high and the impact of the raindrops closes the pores on the soil surface and moves particles of soil down a slope. The large amount of rain at one time means that rainfall rapidly exceeds the absorption capacity of the soil and the loss from evaporation and transpiration. Surface run-off is thus common. Water from such storms flows as sheets and then begins to concentrate in rills and gullies. The quantity and velocity of water has a significant erosive power that scours the earth and deepens the gullies into ravines.

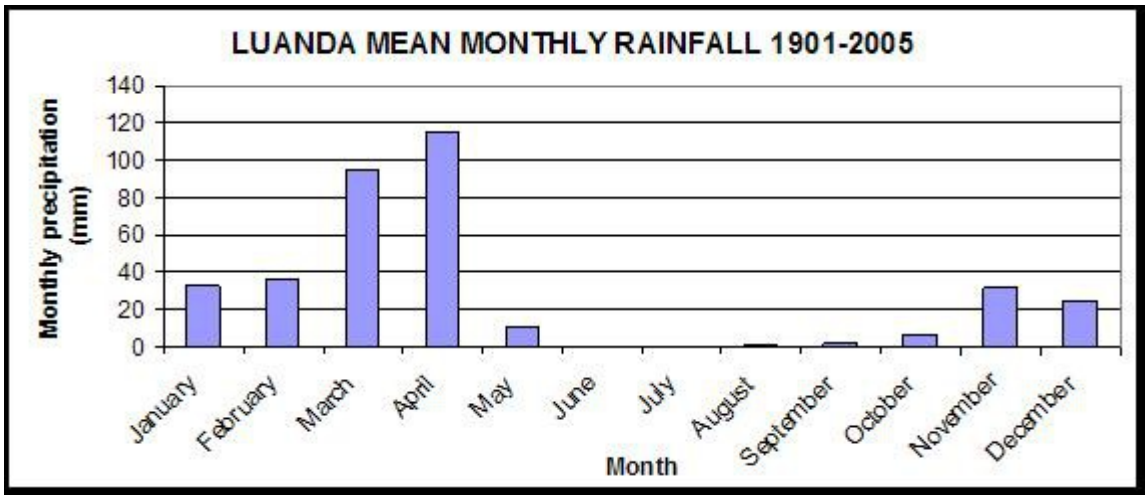
In Luanda, rubbish has often been dumped in gullies, and there is often sediment from previous erosion: these can create dams in gullies or blockages in culverts under roads. When sufficient water has built up behind these blockages, they may give way rapidly, causing a very high flow of water with considerable erosive power that can damage bridges, as well as causing collapse of the sides of the gullies and damage to buildings near their edge.

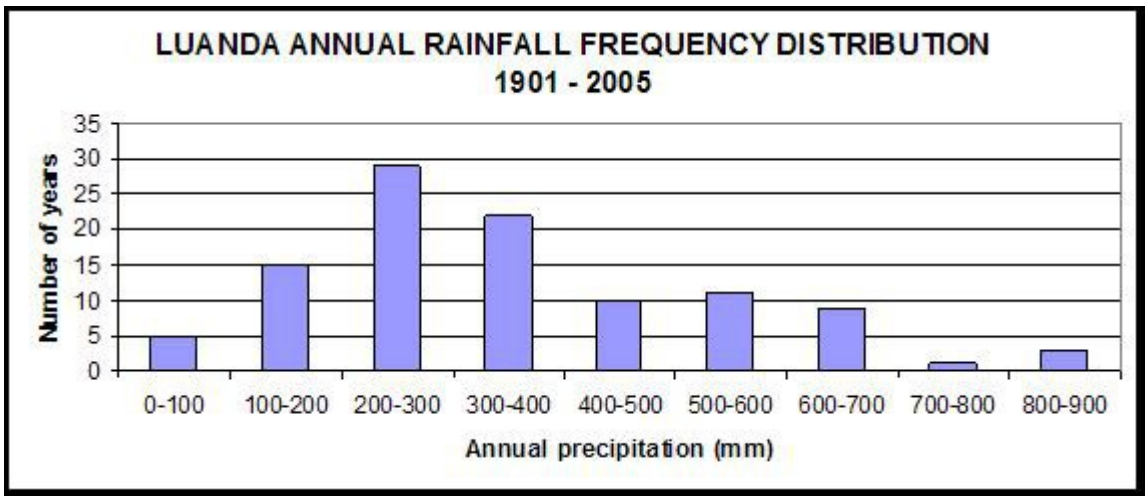
There is no clear information about trends in rainfall and the possible effects of climate change. The high variability in rainfall between years makes it difficult to pick out long-term trends from short-term cycles and year-to-year variability. There are believed to be long-term changes occurring in sea-surface temperatures in the Benguela Current and other parts of the Atlantic Ocean which may have implications for rainfall and its variability in Luanda.

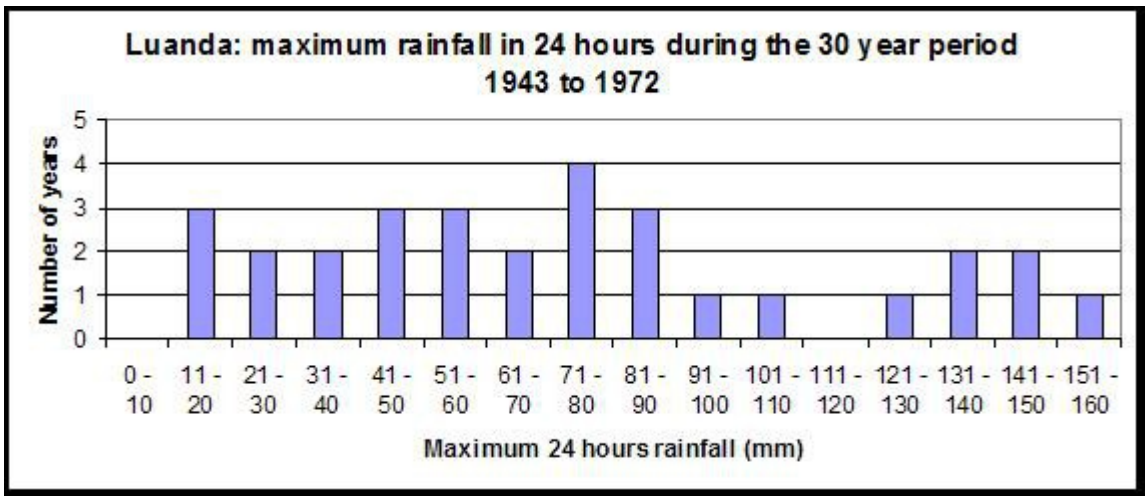
Luanda Rainfall: Maximum monthly totals 1901 to 2005

Year	Month	Monthly total	Max daily total In that year	Month
1916	April	341 mm	NA	
1935	April	302 mm	NA	
1955	April	404 mm	149 mm	April
1969	March	361 mm	100 mm	March
1969	April	319 mm	see previous entry	
1970	March	398 mm	130 mm	March
1996	April	321 mm	NA	

NA data not yet located


LUANDA MEAN MONTHLY RAINFALL 1901-2005
Monthly precipitation (mm)
140
120
100
80
60
40
20
0
January
February
March
April
May
June
July
August
September
October
November
December
Month


LUANDA ANNUAL RAINFALL FREQUENCY DISTRIBUTION
1901 - 2005
Number of years
35
30
25
20
15
10
5
0
0-100
100-200
200-300
300-400
400-500
500-600
600-700
700-800
800-900
Annual precipitation (mm)


Luanda: maximum rainfall in 24 hours during the 30 year period
1943 to 1972
Number of years
5
4
3
2
1
0
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 - 100
101 - 110
111 - 120
121 - 130
131 - 140
141 - 150
151 - 160
Maximum 24 hours rainfall (mm)

In the heavy rains that occurred in Luanda in early 2007, structural damage mainly occurred in places of steep relief near the coast, for example in Sambizanga Municipality, or where homes had been built close to rivers or man-made drainage canals. As would be expected, most homes that were physically damaged were ones with rudimentary foundations and flimsy walls.

Construction has also occurred in *borrow pits, old excavations from which building sand was removed previously. These have pools of water at the bottom after heavy rain. Some also have steep walls, immediately above or below which homes have been built and these are at risk of collapse after heavy rains.*

Ponds of standing, stagnant water occur in some flatter areas more distant from the coast, in the municipios of Cazenga, Viana and Kilamba Kiaxi, after heavy rains. Clay soils predominate in these flat areas, whereas sandy soils through which water drains more rapidly occur closer to the coast. In Cazenga, housing was built in the colonial era in areas subject to this type of flooding and, although a few houses have been abandoned, housing subject to this form of flooding continues to be occupied. Some roads are badly flooded after rains and completely impassable after heavy rains. In Viana and Kilamba Kiaxi, areas that have mainly been occupied in the last 10 years, the pressure on land is not as yet so great so housing has often not yet occupied these patches of land subject to flooding. However informal housing does appear to be gradually moving into these areas.

As the occupied area of the city has grown eastwards and southwards in the last 10 years, it has begun to encroach onto the floodplain of streams that flow into the sea at Cacuaco and a network of streams that reach the sea south-west of Luanda. The variability of rainfall leads to significant and rapid changes in the level of streams in certain years, amplified by rubbish and sediment blocking drainage channels and culverts. This leads to flooding of properties built closer to streams, where construction has not taken account of the possibility of high rainfall. This flooding may not lead to damage to the housing but does damage the contents.

Households say flooding leads to higher incidence of sickness, especially where there is stagnant water. The most commonly reported disease is malaria. The consequences of flooding are aggravated by the volume of garbage close to residential areas, and by poor sanitation. Stagnant pools tend also to having refuse around them. Refuse may include faecal material, as some households report defecating in plastic bags which are discarded with other domestic waste (on the street, in drainage lines or around permanent pools).

The impact of flooding in Luanda is therefore:-

- Flooding of homes and commercial premises.

- Structural damage to buildings. This is localized near to faster flowing drainage lines and near borrow pits.

- Severe disruption to traffic, both locally and to the broader flow of traffic in the city.

- Increased incidence of diseases.

Better maintenance of drainage lines would enable some storm water to flow away rapidly. Improvements to sanitation and refuse collection could reduce the health impact of flooding, and could reduce the blocking of drainage lines, which contributes to flooding and also to water surges when the blockages give way. Some stagnant pools could be filled in.

The main results are provided in the following table, which shows the number of people estimated to live in each type of risk area in relation to the type of housing concerned.

Type of housing	Potential 'flood area'	Potential 'malaria area'	Slope more than 10°	Slope 3 -10°
Rural	10,600	66,000	2,000	26,300
Owner-built on planned sites	9,800	184,000	0	4000
Bairro Popular	100	11,300	0	0
Social housing zones	1,300	19,500	0	2,400
Old urban centre	100	2,700	1,600	24600
New suburbs and condominiums	2,900	53,500	500	8500
Zona Industrial	0	300	0	0
Old musseques	*53,000*	*901,000*	*23,000*	*282,000*
Transitional musseques	*5,500*	*190,000*	*1,100*	*16,500*
Organized musseques	*4,800*	*159,000*	*500*	*16,700*
Peripheral musseques	*43,100*	*613,000*	*3,700*	*196,000*
TOTAL	**131,200**	**2,200,300**	**32,400**	**577,000**
Total in musseques	*106,400*	*1,863,000*	*28,300*	*511,200*

A total population of about 131,200 people was estimated to live within potential flood risk areas surrounding rivers, pools and borrow pits, mainly within Cazenga, Cacuaco and Kilamba Kiaxi (Figure 2). Of these people, approximately 106,400 live in musseque housing which is characterized by its informal nature and high population density, flimsy building construction and general absence of services, such as safe water, sanitation and refuse removal.

A total population of 577,000 people was estimated to live in the gradient zone between 3 and 10 degrees while only 32,400 people were estimated to live in steep gradient zones of greater than 10 degrees. The majority people in both slope categories live in Old Musseques; 282,000 and 23,000 respectively in areas of moderate and steep slope. Areas most affected by slope with high densities of people are in Sambizanga and Mainga (Figure 3).

The broad and approximate area where inhabitants may be more susceptible to malaria was estimated to house about 2,200,300 people, of which about 1,863,000 are inhabitants of informal low-income musseque areas. These figures are of course rough estimates, but the concentration of high densities of people in certain areas (Figure 4) could be used to target activities to reduce the risk of malaria infection.

Since these broad areas are also within reasonable proximity of flood and standing water, they may also be used to focus on places where other water-borne diseases may be prevalent.

Figures 2, 3 and 4 focus on the most densely populated areas of the city and where low-income housing with poor services is concentrated. However, the same data on population density housing types and risks from flowing are available for the whole province and other areas can therefore be examined in detail.

Figure 2. Densities of people in areas most likely to be flooded after heavy rain, which are around permanent pools of water, borrow pits, river flood plains and lakes and marshlands. The map focuses on the most densely populated areas, outside of which problems of flooding affect relatively few people.

Figure 3. Densities of people in areas where the slope is greater than 3 degrees.

Figure 4. Densities of people in areas within 300 metres of standing water in pools, along rivers and in marshes and lakes.

the consequences of flooding merit special attention because large pools of water accumulate and remain stagnant in shallow depressions in which there are also substantial accumulations of domestic rubbish and other waste. Furthermore, several major arterial roads transect the three *municipios*, with the result that flood waters disrupt the movement of both residents and people living elsewhere.

Overall assessment of flooding in Luanda

Four main kinds of direct damage were identified.

Flooding of homes and commercial premises. Floodwaters generally disappeared from flatter areas of sheet flooding after several days or a few weeks, whereas homes close to depressions, often filled with stagnant water, remained flooded for much longer.

Structural damage (in Portuguese *desabamento*) to buildings. While comparatively few homes were affected, the costs of repairing or replacing those that were largely destroyed or damaged were substantial.

Road blockages, most of which lasted a few weeks but caused severe disruption both locally and to the broader flow of traffic in the city.

Increased incidence of diseases, mainly malaria, cholera and gastro-intestinal infections. Some immediate deaths were reported, but the debilitating effects of these diseases are likely to have lasted many months after the heavy rains.

The remnants of sheet flooding as pools of water lying in roads. The houses around these roads would have been flooded after the heaviest rains.

A typical stagnant pool surrounded by massive accumulations of rubbish and growths of algae on the water surface

Many houses built along steep slopes in Sambizanga suffered structural damage

Blockages along drainage lines led to surges of water causing severe erosion which undermined the foundations of nearby homes.

The main results of this work for the greater part of the city are depicted in Figure 2, which shows that the majority of ponds of standing, stagnant water images (shown as dots in the map) are in the flatter areas away from the coast in the *município* of Cazenga and further south in Viana and Kilamba Kiaxi. Clay soils predominate in these flat areas, whereas sandy soils through which water drains more rapidly occur closer to the coast. It is in these flat, clay areas that most roads were flooded and where most disease attributable to standing water was to be expected. In addition to the standing water found during the aerial survey or on satellite images, other kinds of inundation are reflected on the map as places identified as sheet flooding, structural damage, and areas where there was a combination of structural damage and sheet flooding, and borrow pits (locally called *buraco*). These old excavations, from which building sand had been removed years previously, are now often inhabited and pools of water lie at the bottom of pits. Many of the borrow pits have steep walls, immediately above or below which homes have been built.

Figure 2. An overall assessment of the locations where flood damage occurred early in 2007, and where flooding is likely to be most hazardous.

Structural damage mainly occurred in places of steep relief, as in Sambizanga, or where homes had been built close to rivers or man-made drainage canals, especially where the drainage lines had been blocked by garbage.

This caused water to dam up and then surge down hill once the blockages gave way to the pressure of accumulated water. As would be expected, most homes that were physically damaged were ones with rudimentary foundations and flimsy walls. A combination of sheet flooding and structural damage was observed in Cacuaco where some homes were flooded in low-lying flat land near the coast. Other structural damage occurred to houses lining the many small drainage lines that transect the coastal plain.

It would appear that relatively few homes have been built (and were thus flooded) in the broader river valleys in Luanda. Most damage from flooding along the many rivers and streams in the eastern and south-western areas of the city were likely to be structural as a result of erosion of the banks of the drainage lines.

Household survey results
Each household survey area was classified according to the kind of flooding to which it had been exposed (see Figure 2), and the analyses that follow are based largely on that classification and comparisons between the *municípios*.

More houses were vacated as a result of flooding than those that remained occupied (Figure 3). This was true for all types of flood areas except for sheet flooding, presumably because water levels were lower than elsewhere and these homes suffered less structural damage (Figure 4). Of those houses that were vacated, 17% were left for less than 5 days, 19% for between 5 and 15 days, 12% for 15 to 30 days, and more than half (53%) for more than a month. These percentages did not vary significantly between *municipios* or types of flood areas.

.Figure 3. Percentages of surveyed homes that were vacated or that remained occupied after flooding.

Figure 4. Percentages of surveyed homes that reported different degrees of damage to their property as a result of flooding.

Deaths were reported in 49 (4%) of all houses surveyed, but there was no discernible trend to indicate that more deaths occurred in association with certain kinds of flooding. In response to the question of whether members of households fell ill as a consequence of the floods, about 65% reported yes, and 35% said no. The highest percentages of disease were reported in homes around pools of stagnant water (74%) while the lowest was in areas affected by structural damage (48%). This may be due to the fact that most structural damage was in Sambizanga, where only 41% of households reported flood-relate disease compared to 62% and 69% in Cacuaco and Cazenga, respectively (Figure 5).

Figure 5. Percentages of households reporting disease due to flooding.

Three main illnesses were reported: malaria (69%), cholera (16%) and diarrhea (in 17% of all homes) (Figure 6). In addition, 31% of households said that people had suffered from other diseases, such as respiratory problems, flu and colds and skin diseases. The greatest difference in occurrence between the *municipios* was for malaria, which was reported in 48% of homes in Cazenga, 43% in Cacuaco and only 25% in Sambizanga. This suggests that it was the difference in malaria affections that caused the lower overall incidence of disease in Sambizanga. It is also probable that mosquitoes carrying malaria are more abundant in Cazenga and Cacuaco where there are many more pools of stagnant water (Figure 2).

Figure 6. Percentages of households reporting the occurrence of malaria, cholera, diarrhea and other diseases as a result of flooding.

While excessive amounts of flood water were obviously a problem, the consequences of flooding are aggravated by (a) the volume of garbage in the city and (b) poor sanitation, especially in the informal *musseque* settlements. As mentioned above, massive volumes of refuse clog drainage lines, and the large and amounts of organic waste in stagnant pools must contribute to these pools of water being reservoirs of disease. This includes faecal material, since 22% of all households were noted as not having any toilet facility. People in these homes are reported to normally defaecate in plastic bags which are discarded with other domestic waste, which is normally placed on the street (Figure 7).

For example, 86% of households had no rubbish removal system, and of those having no system for removal: 57% and 39%, respectively, either placed their rubbish in the street or burnt it in the street. The remaining 4% of homes deposited their refuse in containers.

Figure 7. The percentages of households associated with different types of flooding depositing their household rubbish on the street, in a container or burning it on the street.

Mounds of rubbish being burnt along a road, a method used to dispose of domestic waste by 39% of the homes surveyed.

Returning to the small number of households that do have a rubbish removal system, all of these were in Cazenga, which is the only *município* where a few homes were recorded as having toilets linked to a piped sewage system. A small number of households in Cazenga were also the only ones that reported having their own water supply system, all other homes obtaining their water from public taps or tanks owned by water vendors.

Cacuaco, Cazenga and Sambizanga

As mentioned earlier, six *comunas* in these *municipios* were selected for additional study because so many people live there: over two million. Most homes belong to people who are not well off, with the result that they may not have ready access to services and facilities that would protect them from disease and other effects of flooding. In addition, the flat landscape covering much of Cazenga *municipio* and Kikolo *comuna* results in extensive sheet flooding and the accumulation of water standing in stagnant poolsfor long periods. For example, many of these pools still contained substantial amounts of water in October 2007, which was at the end of the dry season and many months after the heavy rains earlier in the year.

Figures 8 and 9 present the main assessments of risk in relation to population density for areas prone to sheet flooding and for areas that surround stagnant pools, respectively. Estimates are given on the maps for the number of people that live within those areas, thus making it possible to identify places where more people are at risk than others. An estimated 237,000 people live within all the areas of sheet flooding in Figure 8.

Figure 8. Population densities, the boundaries of comunas *and estimates of the number of people living within each area of sheet flooding.*

Figure 9. Population densities, the boundaries of comunas *and estimates of the number of people living within 100 metres of pools of stagnant water.*

A total of about 33,600 people live within the surrounds of stagnant pools shown in Figure 9, which only shows population estimates for those areas where there are more than 500 people. While it may be more difficult to diminish the effects of extensive sheet flooding, impacts to people living in areas close to stagnant pools would be easier to reduce, and the information given in Figure 9 could be used to prioritize pools for immediate remedial action. For example, more than 20,000 people would benefit if measures were taken to fill-in the 13 pools which are each surrounded by more than 1,000 people.

Finally, Figure 10 provides a comparison of population density and areas close to river drainage lines and those with steep gradients where structural damage is most prevalent. The only area where large numbers of people live

in steep areas is Sambizanga.

Figure 10. Population densities, boundaries of comunas*, areas surrounding rivers and streams and places where slopes change more than 45 metres within a distance of 250 metres.*

CONCLUSIONS

This study provides a first assessment of the impacts and risks of flooding in Luanda, especially within the *municipios* of Cazenga, Sambizanga and Cacuaco. However, much more information is needed for other areas of the city, and especially on the effects of road blockages. This was an aspect that could not be included in this study. While the heavy rains were unexpected and caused substantial damage of the kind described in this study, it seems obvious that the impacts of flooding were exacerbated by poor urban planning and poor maintenance. Indeed, it could be argued that it is really the effects of bad planning and maintenance – rather than flooding – that caused much of the damage.

For example, with better planning (and control) many informal and structurally weak houses would not have been built in places where they were vulnerable to flows of water or severe erosion. Likewise, better maintenance of drainage lines would have enabled much of the storm water to flow away rapidly. But more than anything else, it is probably the lack of sanitation and garbage removal that aggravated the impacts of flooding, particularly around the large stagnant pools. The cost of filling in these pools would seem to be low, but the benefits are likely to be considerable. The filthy nature of the pools is hard to describe, and it is also difficult to know the volumes of organic waste, faecal material and even inorganic poisons that have settled in these depressions. I hope the last photographs in this report give a better idea of their condition, and the circumstances under which nearby residents live.

Years of rubbish are piled up in this pond of stagnant water (top) while children use sheets of cloth to net tiny fish and shrimps from a pool that remains filled with water months after the heavy rains early in 2007.

Environmental Burdens

Environmental burdens vary significantly between urban areas, depending on their geographical situation, the size of the town or city, the population density and the topography. It is likely that environmental factors impact on livelihoods in a variety of ways and this varies between urban areas. In large urban areas such as Luanda, floods and erosion disrupt communications and urban economic activities and destroy housing. In smaller urban areas, in addition to this, the environment impacts on livelihoods through agriculture. Little is known about the impact of environmental factors on urban areas in Angola, and information on this has not been gathered in one place.

The research will assess the environmental burdens in different urban areas, possible impacts on local livelihoods and any trends in these factors, for example due to climate change. This will feed into an increasingly active debate around the effects of climate change in Angola, currently being led by the Ministries of Environment and Urbanism and their Provincial Departments.

Information will also be gathered on urban-rural linkages. Agricultural linkages are less frequent in Luanda than in other Angolan cities: very few people have an agricultural activity and the bulk of food continues to be imported. Use of wood and charcoal as fuel in Luanda has probably declined, but the population of Luanda is now almost 6 million so charcoal use, even by a small proportion of households and by commercial establishments, can contribute to significant deforestation as far away as Huambo Province. The past use of charcoal has also contributed to deforestation at a considerable distance from the city.

Luanda: Numbers of people in risks zones

	Total pop.	Flood Area	Malaria area	Slope >10°	Slope 3° to 10°
Old urban centre	165693	100	2700	1600	24600
New subsurbs and condominiums	163721	2900	53500	500	8500
Bairro popular	83290	100	11300	0	0
Social housing	118380	1300	19500	0	2400
Owner-built on planned sites	396736	9800	184000	0	4000
Transitional musseques	622950	5500	190000	1100	16500
Organised musseques	477956	4800	159000	500	16700
Old musseques	2312701	53000	901000	23000	282000
Peripheral musseques	1237028	43100	613000	3700	196000
Rural	241787	10600	66000	2000	26300
LUANDA TOTAL	5823200	131200	2200300	32400	577000

Indicator 2: Environmental Vulnerability

Floods and landslides caused by heavy rains are the main geological hazards that occur in Luanda. DW in collaboration with the Luanda Provincial Health Department (DPSL) has mapped the main areas susceptible to flooding and erosion which threaten the city's residents.

Figure 3: Areas affected by environmental hazards in Luanda

The environmental situation in Angola's peri-urban districts has progressively deteriorated during the several decades of conflict. These peri-urban areas can be considered to be in a chronic public health crisis. Rural populations which migrated to Luanda in search of a safe-haven did not settle in an organised way and in some cases occupied environmentally risky sites such as those along river banks or drainage courses susceptible to severe erosion.

According to a field study in the Municipalities of Cacuaco, Cazenga and Sambizanga, an estimated total of 237,000 people live within all the areas of sheet flooding and a total of about 33,600 people live within the surrounds of stagnant pools in these municipalities.

While the heavy rains, such as took place during the rainy season of 2007, are unexpected and can cause substantial damage, it seems obvious that the impacts of flooding are exacerbated by poor urban planning and poor maintenance. With better planning (and control) many informal and structurally weak houses would not have been built in places where they were vulnerable to flows of water or severe erosion. Likewise, better maintenance of drainage lines would enable much of the storm water to flow away rapidly. But more than anything else, it is probably the lack of sanitation and garbage removal that aggravate the impacts of flooding, particularly around large stagnant pools. The cost of filling in such pools would seem to be low, but the benefits are likely to be considerable.

Luanda: percentage of population in risk zones

	Flood Area	Malaria area	Slope >10°	Slope 3° to 10°
Old urban centre	0,06	1,63	0,97	14,85
New subsurbs and condominiums	1,77	32,68	0,31	5,19
Bairro popular	0,12	13,57	0,00	0,00
Social housing	1,10	16,47	0,00	2,03
Owner-built on planned sites	2,47	46,38	0,00	1,01
Transitional musseques	0,88	30,50	0,18	2,65
Organised musseques	1,00	33,27	0,10	3,49
Old musseques	2,29	38,96	0,99	12,19
Peripheral musseques	3,48	49,55	0,30	15,84
Rural	4,38	27,30	0,83	10,88
TOTAL	2,25	37,79	0,56	9,91

Indicator 2: Environmental Vulnerability

Definition of indicator: Proportion of housing units built on hazardous locations (per 100,000 housing units). The following locations are considered hazardous:

Housing settled subject to disaster at more than the once in a hundred years level (disasters include flooding, earthquakes, volcano, storm surge, landslip or avalanche);

Housing not adequately protected against cyclones or bushfires which occur at this frequency;

Housing settled on garbage-mountains;

Housing around high-industrial pollution areas;

6 Access to basic services

Indicator 3: Access to Basic Services (Water and Sanitation)

Water

Definition of indicator: Proportion of the population with sustainable access to an improved water source, that is, the percentage of the urban population that uses any of the following types of water supply for drinking: piped water, public tap, borehole or pump, protected well, protected spring or rainwater.

The indicator of safe water access depends on multiple factors, including quality of the water, price and distance from the water source. According to UN Habitat, water should be affordable (less than 10% of the household income) and available in sufficient quantities (at least 20 litres per person per day) without excessive physical effort and time (less than an hour a day to collect water for the household at 20 litres per person). It is emphasized that "improved water sources do not include vendor-provided waters, bottled water, tanker trucks or unprotected wells and springs." [18] Thus, neither households who are connected to public water pipes that only function occasionally, nor households who have access to water in abundant quantities from an unprotected well, nor people who have the financial means to regularly fill their private tank with water from a cistern truck, are considered to have a sustainable access to an improved water source. Furthermore, most people in Angolan urban areas, particularly in Luanda, use more than one source of water.

It is possible to estimate the number of people with access to public water pipes and taps quite

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accurately by using satellite images illustrating the extent of the public water pipes and location of standpipes. However, it should also be considered that these water sources often do not function properly and therefore people who have a domestic connection to public water pipes or live close to a standpipe often have to resort to a secondary water source. DW has compiled extensive data on public water sources through various projects, although it has not been possible to achieve public data on the location of public water pipes for security reasons. Overlaying such data with the population map makes it possible to calculate how many people have access to standpipes within 100 meters of their homes when the standpipes are functioning. The GIS projection of the public water network against settlement typology can be used to determine quite accurately the level of access to safe water in each typology.

Figure 4: Line of jerry-cans marking places in a queue for a water point

Although, such mapping of water sources can be useful in order to determine the number of people with access to each water source, it does not communicate the percentage of each household's total water use which comes from each source, since these sources are often variable. However secondary sources of water are normally from what would be classified as "unimproved" sources using UN Habitat criteria. It is also complicated to get such data from household studies as people are often not aware of the exact quantity of water they are using, particularly through public water pipes. It can also be problematic to gather precise information on the price and quality of water collected from each source, as well as the distance from water source as such information is based on personal interpretations and varies over time and between different water sources. These factors also tend to vary within the same typologies based on the distance from the city's main water sources.

Therefore, the ranking of this indicator is based on the main water source, although existing detailed information gathered by DW on water price and location of water sources will also be examined. A research on water quality in all three cities is being carried out which will reveal more information on the quality of water from different sources.

Table 4: Ranking of Indicator 4: Access to Safe Water

Ranking	**Water source**	**Description**
1	Connection to public water pipes	Households in Luanda, located close to the centre of the city, obtain water through their own piped connections to the formal water supply network. These households often pay very low or flat rate fees to the water company even though they have better access than people who have to buy water through the informal sector. The public water company EPAL *(Empresa Pública da Água,* Luanda) does not actively enforce payment because it recognizes that the service is poor and water meter reading and billing is expensive. Therefore, income for the maintenance and expansion of the system is limited.[19] Illegal connections to the public water pipes are quite common in areas located close to the city centres. While illegal connections can not be considered sustainable a larger proportion of the population gains access to clean water through these connections than the 8% of households that have formal contracts with EPAL.

[19] Development Workshop, *The Informal Peri-Urban Water Sector in Luanda*, June 2009.

2	Public water taps (chafariz) or Improved water pipes with manual pumps	Public water taps or standpipes in Luanda and manual pumps in Huambo are built by the public water company EPAL, EPHAS or NGOs within neighbourhoods that have an available connection to the water pipeline. Access to standpipes tends to be in pockets as standpipe projects usually cover only very limited geographical areas and serve about 1,000 people each within 100 meter radius. Sometimes people walk relatively long distances with heavy loads of water in order to get water from a standpipe. The water from these pipes is normally paid for through the committee which manages and maintains the manual pump and collects a contribution from the consumers to maintain and sustain the system.
3	No access to safe water (the informal water market or traditional wells)	According to UN Habitat the informal water market, which sells water from cistern trucks or private water taps or tanks for market price, and unprotected wells with low quality water, can not be considered sustainable or improved sources of safe water. The informal peri-urban water market in Luanda is estimated to turn over almost 250 Million US Dollars per year. It provides almost 20 litres or water per person per day to almost 4 million people at a price of about US $ 0.01 per litre. The water for the informal water supply system comes from *girafas* (supply points where cistern trucks fill up), from illegal connections to the pipeline and from the re-sale of water by households with domestic connections. [20] Cistern trucks supply water to private tanks and sometimes to public water taps in Luanda. Prices vary greatly between areas depending on distance and access from the pumping stations. Due to fluctuating prices and supply of water provided by cistern trucks, this can not be considered a sustainable water source. Traditional wells are the main source of water for the overwhelming majority of households in Huambo. This is an easily accessible source of water that supplies sufficient water for most of the year. However, the wells are unprotected and the water can not be considered safe.

The first two categories, connection to the public water pipes and public water taps are considered sustainable according to UN Habitat and the last one, the informal water market and unprotected wells, is unsustainable. However, public water pipes and standpipes become unsustainable when they are not working which in many cases happens frequently, so that people have to resort to a secondary (unsustainable) water source. Further, sometimes people have to travel a considerable distance in order to get water at public water taps and even pay for the water, although the price is generally very low, around 5 Kwanzas for 20 litres in Luanda, and thus considered affordable for most households. The informal water market is an unsustainable source of water both because of the price people have to pay, the effort and time spent on accessing water and because people can not depend on this source as a stable source of water. Traditional wells are not found in Luanda due to the very deep water table, but in Huambo they often supply low quality or easily contaminated water and are therefore considered unsafe.

Sanitation

Definition of indicator: Proportion of the population with access to adequate sanitation, or percentage of the population with access to facilities which, in hygienic terms, separate human excrements from human contact, animals and insects

[20] Development Workshop, *The Informal Peri-Urban Water Sector in Luanda*, June 2009.

The main sub-indicator applied in order to measure access to improved sanitation is the type of sanitation facilities used by residents, as recommended by UN Habitat. It is also important to take into account the condition of the sanitation facilities and the number of households using each facility. For example, a sewage system or septic tank which does not have sufficient capacity and easily gets interrupted or a sanitation facility that is used by more than two households is not considered improved sanitation. Sanitation facilities were divided into the following three hierarchically ranked categories:

Table 5: Ranking of Indicator 5: Access to Improved Sanitation

Ranking	Sanitation Facilities	Description
1	Connection to the sewage system	The Luanda sewage system covers a very limited part of the city close to the city centre and is in need of repair. In some areas the system does not work due to lack of maintenance. A sewage system which works properly without getting clogged is considered the most hygienic type of sanitation facilities. There exists no sewage system in Huambo or Cachiungo
2	Septic tanks (fossa septica)	Septic tanks which are considered to be improved sanitation facilities are very common in Angolan urban areas
	Improved dry pit latrines (latrina seca)	Improved pit latrines such as poor-flush latrines and ventilated improved pit latrines are considered to be adequate sanitation facilities.
3	Inadequate or No facilities	Uncovered pit latrines and public latrines are considered inadequate. In some areas people do not have access to any kind of sanitation facilities and are therefore forced to using measures such as a bucket or an open pit in the ground ('poço roto'), or sometimes use rubbish deposits or vacant lots or a grassy field, which poses serious public health risks to the neighbourhood.[21]

UN Habitat also recommends using extensive indicator 9: Regular solid waste collection, defined as the "proportion of households enjoying weekly solid waste collection," to measure the performance of this indicator. Solid waste poses considerable threat to human sanitary conditions by blocking drains and breeding flies which spread diseases such as malaria and dengue. Further, according to UN Habitat "regular solid waste collection is a clear indicator of the effectiveness of a municipal administration." [22] Stagnant water ponds due to non-existent or deficient sewage and rain water drainage systems also add to sanitation problems in many bairros.

Figure 5: Solid waste in the musseques

Solid waste collection was ranked into the following three categories:

[21] Information obtained from sample inquiries on the access to water and basic sanitation conditions for a baseline study for the urban observatory (Estudo de base do observatório urbano).

[22] United Nations Human Settlements Programme (2004) *Urban Indicators Guidelines – Monitoring the Habitat Agenda and the Millennium Development Goals.* http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

Table 6: Ranking of Indicator 5: Access to Improved Sanitation

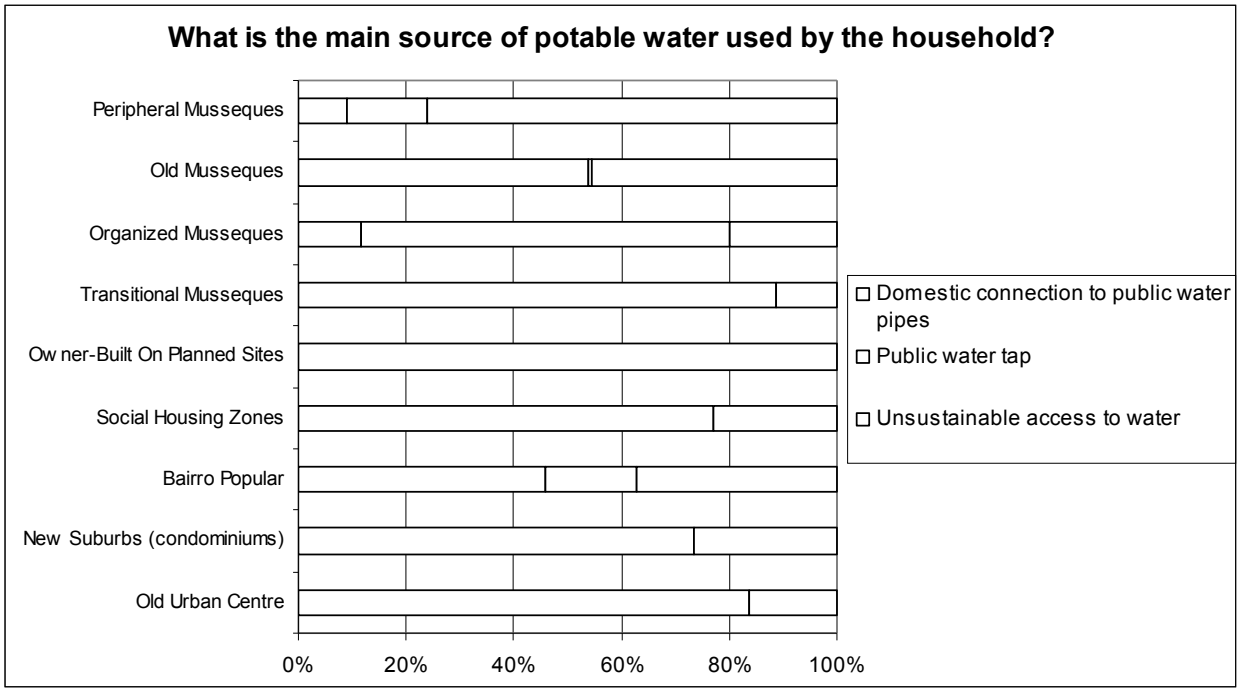
Ranking	Solid Waste Collection	Description
1	Regular	Regular waste removal services at least once a week are only available for populations located in planned urbanised areas of the two cities.
2	Irregular	Communal rubbish deposits in the form of neighbourhood level containers and "irregular" waste removal services are offered in some aligned musseques which are easily accessible by waste removal trucks. However, these are usually not door-to-door services and people normally have to carry their rubbish a distance to deposits on main streets where the trucks pass by.
3	No services	In most of the unaligned musseques there is no solid waste collection and rubbish piles up and breeds insects which pose sanitation risks to the population. In these areas people have to take care of their garbage themselves, either by burying it, burning it or by simply leaving it out on the street in informal rubbish deposits (lixeiras salvagems).

Indicator 3: Access to Basic Services (Water and Sanitation)

Water

Source of water varies significantly between different areas of the city, for example recently developed settlements south and east of the city are more dependent on the informal sector for water supply than other areas. However, there are no areas of the city where the informal water sector is completely absent. There are also differences between bairros in the same comuna. [23]

The following graph illustrates the results of the household surveys for this indicator.



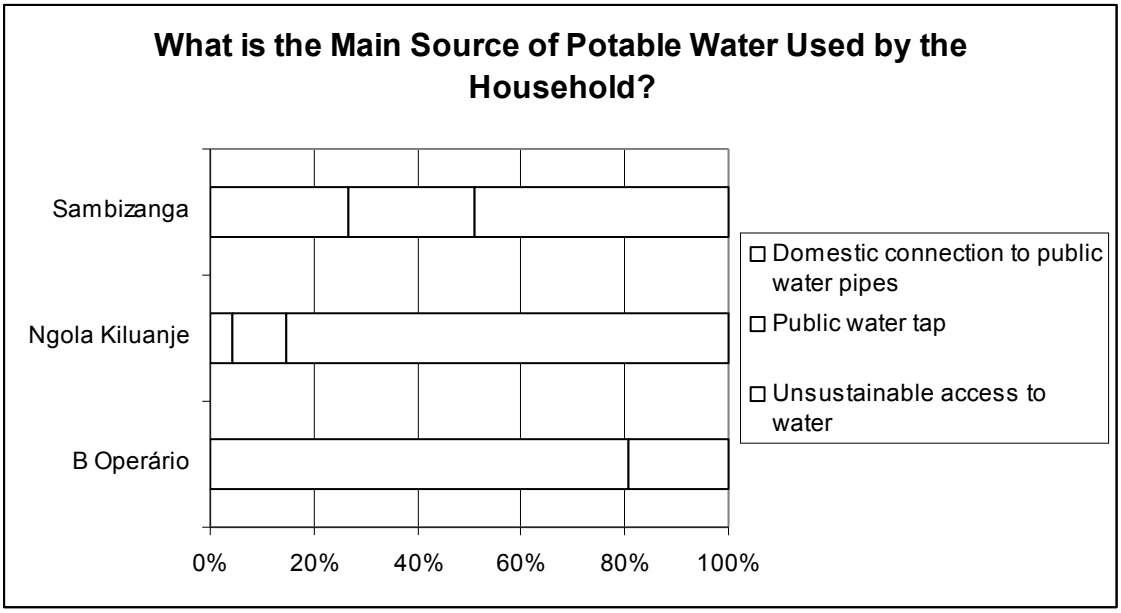
[23] Development Workshop, *The Informal Peri-Urban Water Sector in Luanda*, June 2009.

As illustrated on this graph, the typologies that are located furthest away from the city centre (owner-built on planned sites and peripheral musseques) have the least sustainable access to water. The owner-built on planned sites areas have been settled very recently and some are still under construction. These areas have been organized into plots with an aligned street pattern which will facilitate the installation of public infrastructure in the future. Some peripheral musseques do have some public water taps (chafarizes), but the residents often have to resort to the informal water market as the public water taps often do not function properly. These areas were built in an ad-hoc manner without any kind of planning, which makes it difficult to add public water pipes without some kind of reconstruction.

Transitional musseques, on the other hand, rank surprisingly high on this indicator, even higher than the old city centre and new suburban areas. This indicates that the public water pipes, which many of the residents have illegal connections to, were functioning well in Catambor, Maianga at the time of the household study. For example, it was the same number of households (6) that were using a neighbour's tank for water in that typology as in the old musseque typology. Another reason why transitional musseques ranks this high might be due to the fact that residents of these areas are less likely to use bottled water for drinking than residents of the old city centre and particularly residents of the new suburbs. Although, bottled water is considered very safe to drink, it is not a sustainable source of water because of the high cost. However, it is interesting to see that Bairro Operario, which falls under the same typology, did not score as high as Catambor, which indicates that the transitional musseque typology should rank lower than suggested by the household surveys in that area.

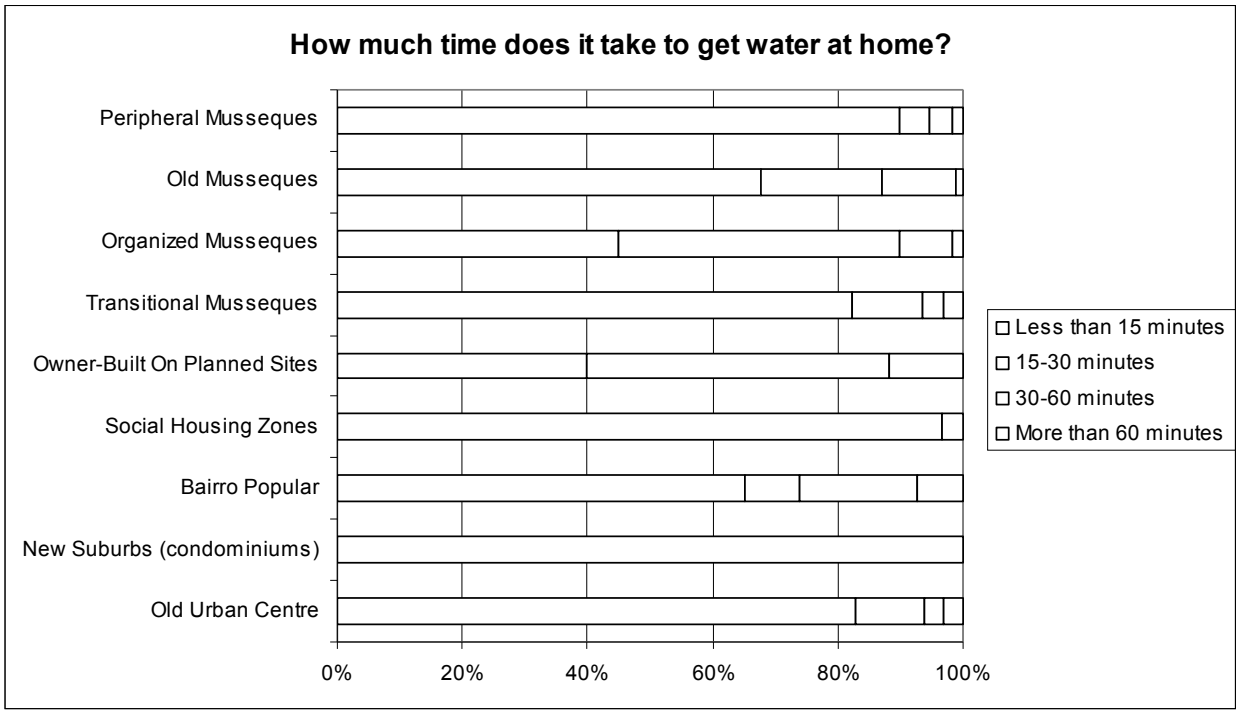
As has already been explained, Bairro Operario, which was chosen to represent old musseques should rather fall under the transitional musseque typology. In order to verify the situation in old musseques, the three comunas in the municipality of Sambizanga were compared (see graph below), two of which have been categorized under the old musseque typology (Sambizanga and Ngola Kiluanje) and Bairro Operario which has been defined as transitional musseque.

According to the graph below, Bairro Operario scored much higher in that study with around 80% of the population using water from public water pipes, which is similar to Catambor, the other transitional musseque where household surveys were conducted, than in the household surveys (just over 50%). This can be explained by the dysfunction of water pipes at the time of the household surveys, which is not uncommon particularly where people have illegal connections to the water pipes and can not formally complain to the water company. However, the old musseque areas rank even lower than Bairro Operario did in the household surveys, particularly Ngola Kiluanje where more than 80% of the population had to resort to unsustainable water sources. Therefore, old musseques should rank lower than indicated by the household surveys.

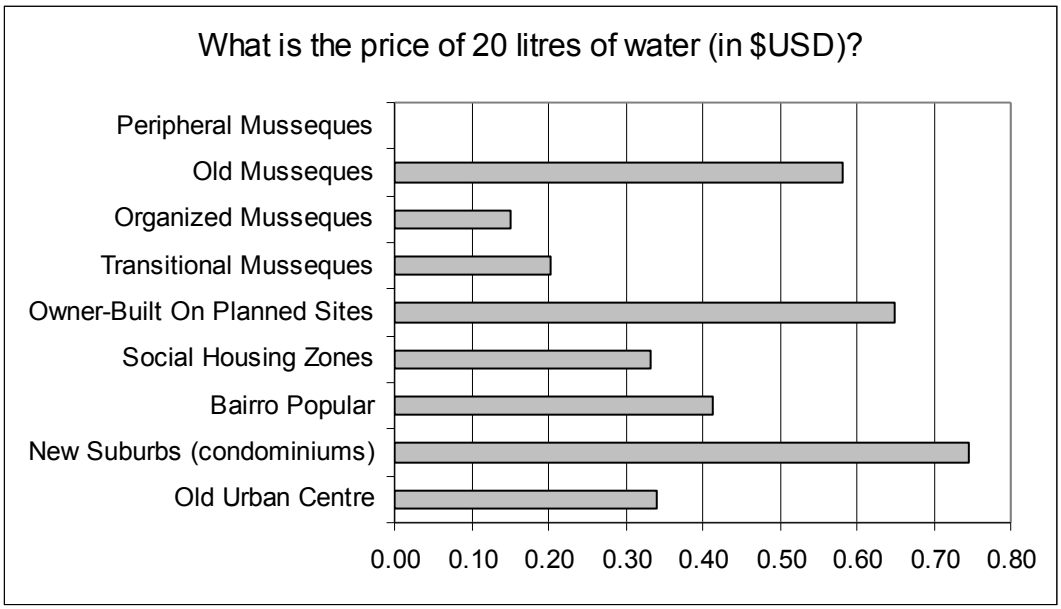


The following map shows the main water pipe lines running from the Bengo River in Kifangondo, Cacuaco towards the city centre and public water taps which have been mapped in previous DW projects.

The time it takes to access water depends on the water source. Thus, households in the owner-built on planned sites and organized musseque typologies which largely rely on the informal market for water appear to spend most time getting water. Surprisingly, peripheral musseques which also rely heavily on the informal water market score quite high on this indicator. However, it has to be kept in mind that this data is based on the personal estimation of the interviewees and has to be interpreted with caution.



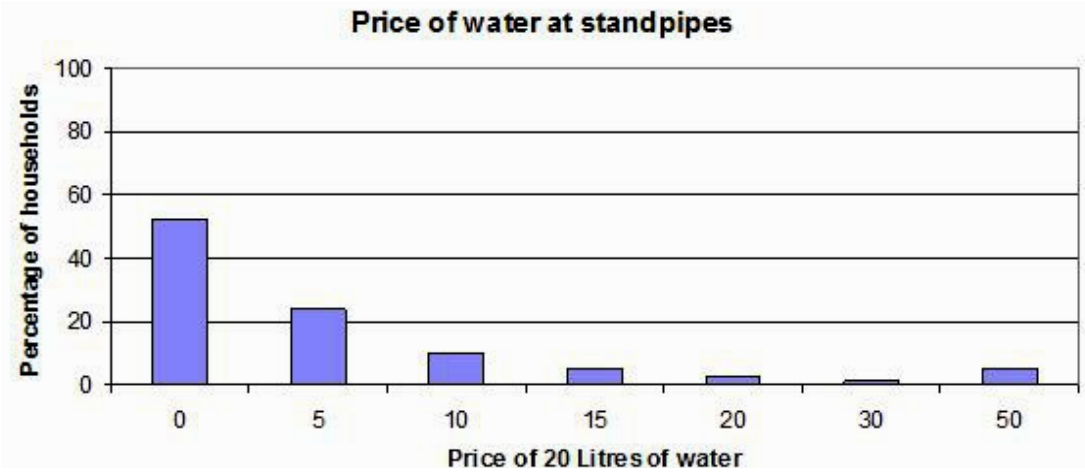
Data on the cost and quantity of water from the household surveys is not very useful since most people who have domestic water pipes did not indicate how many litres of water they used per month and the price seems to vary a lot within each typology. Price per 20 litres of water also varies a lot between typologies and seems to be particularly expensive in the new suburbs, owner-built on planned sites and old musseques (see graph below). In new suburban areas a small minority of people indicated how many litres they used so the average for that typology is based on very few cases. The reason for the high price in old musseques and owner-built on planned sites is probably that people are using water from private tanks. During the household surveys in Bairro Operario, which was supposed to represent the old musseque typology, the research team noticed a lot of people carrying water containers to and from private water tanks in the neighbourhood because the public water pipes were not functioning at the time. Moreover, we do not have information on the number of litres used in the peripheral musseque typology.



According to a study of the informal water market from 2009, the average price of water purchased from a standpipe is quite low at 0.32 Kwanzas per litre or about 5 Kwanzas per bucket, although the price of water at a standpipe varies between areas of the city[24] Thus, water at standpipes seems to be affordable for most people who rely on this source of water in Luanda and can therefore be considered sustainable as long as it does not require too much time and effort to collect the water which ideally should be within 100 meters from the household.

[24] Development Workshop, *The Informal Peri-Urban Water Sector in Luanda*, June 2009.

Figure 6: Price of Water at Standpipes in Luanda



Price for water from cistern trucks varies more than prices for water at standpipes. Water purchased from trucks is generally less expensive close to the EPAL pumping stations (girafas) on the River Bengo at Kifangondo and at Kikuxi on the River Kwanza and in areas where trucks can draw water from the piped network. According to the study on the informal water market in Luanda, the water purchased from private tanks that have been filled by cistern trucks (0.86 kwanzas per litre) is around 6.6 times more expensive than it was when it was bought at the source. The price also tends to fluctuate depending on the road conditions and distance the trucks have to travel.[25] The following map illustrates the price of 20 litres of water in each bairro in Luanda.

Figure 7: Average price of water (kwanza per 20 litres) in Luanda

Based on the household surveys and mapping of water sources, the following table demonstrates the score of each settlement typology on this indicator.

Table 7: Ranking of Sub-Indicator: Access to Safe Water in Luanda

Typology		Water Source	Population	% of total population	Ranking
A	**Old Urban Centre**	Connection to public water pipes and cistern trucks	165 693	3%	**1**
B	**New Suburbs and Condominiums**	Connection to public water pipes and cistern trucks	163 721	3%	**1**
C	**Bairro Popular**	Cistern trucks, standpipes and connection to public water pipes	83 290	1%	**2**
D	**Social Housing Zones**	Connection to public water pipes and cistern trucks	118 380	2%	**1**
E	**Owner-built on Planned Sites**	Cistern trucks and standpipes	396 736	7%	**3**
F	**Transitional musseques**	Illegal connection to public water pipes and cistern trucks	622 950	11%	**2**
G	**Organized musseques**	Illegal connection to public water pipes, standpipes and cistern trucks	477 956	8%	**3**
H	**Old musseques**	Illegal connection to public water pipes, standpipes and cistern	2 312 701	40%	**3**

[25] Development Workshop, *The Informal Peri-Urban Water Sector in Luanda*, June 2009.

		trucks			
I	**Peripheral musseques**	Illegal connection to public water pipes, standpipes and cistern trucks	1 237 028	21%	**3**
J	**Rural Settlements**		241 787	4%	**3**
K	**Industrial Zone**		2 957	0,05%	**2**
Total			**5,823,200**	**100%**	

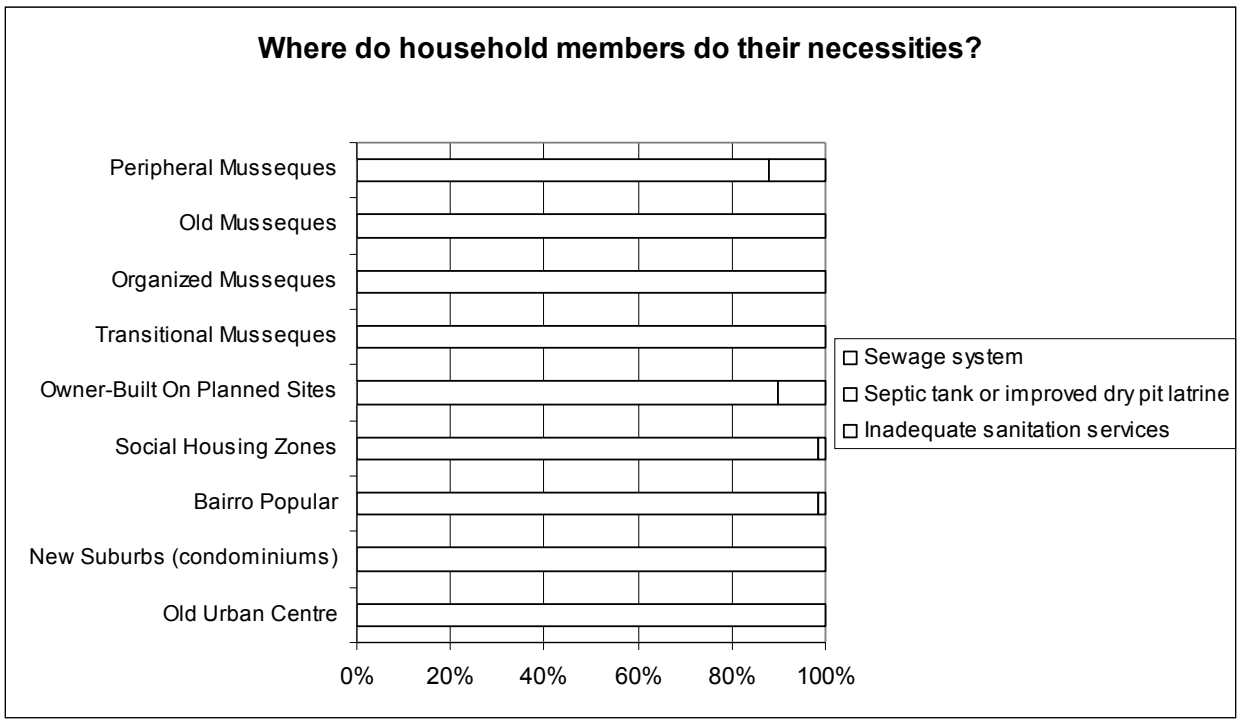
Sanitation

Precarious sanitation conditions are a serious problem in most of Luanda's musseques. According to a study on the peri-urban rental housing market in Luanda, perceptions of sanitation conditions vary considerably between typologies. In the recent comuna of Ngola Kiluanje, which is located far from the city centre, 34% of tenants consider that they have a very poor level of sanitation while it is 7% in the pre-independence musseque of Maianga.[26] Even though households may have sanitation facilities that are considered to be improved, bathrooms are often located in the back yard or shared by several households.

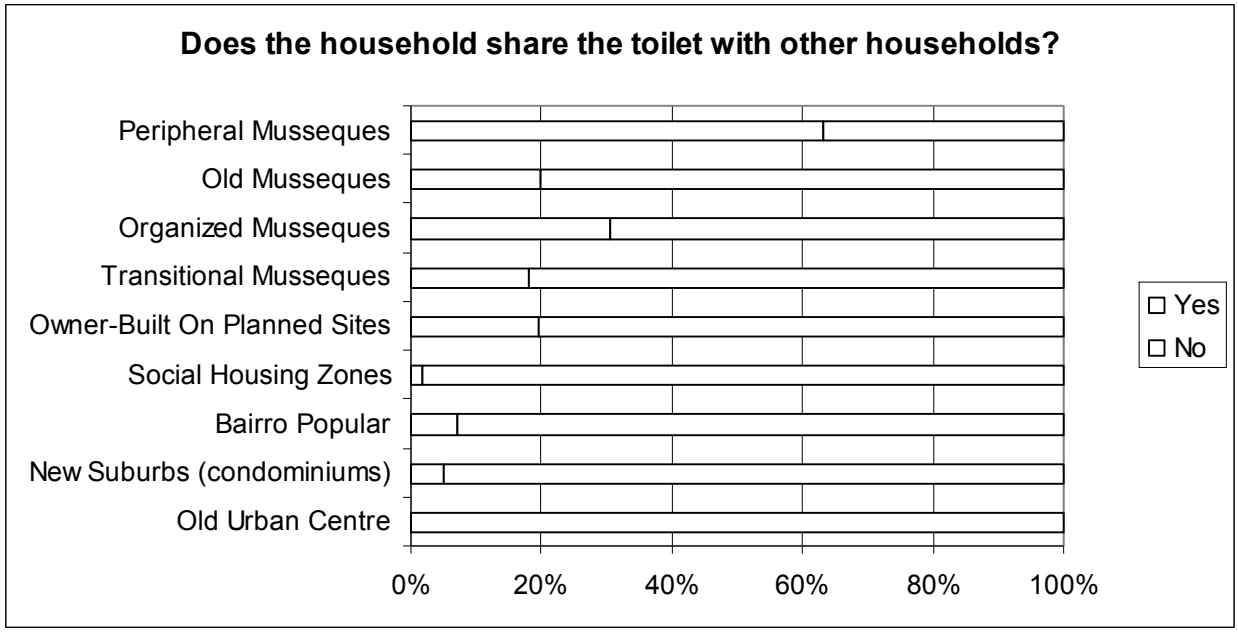
According to the household survey, residents in most typologies appear to have acceptable sanitation facilities (see graph below). Many people seem not to know the difference between a sewage system and septic tank and although a large majority of the residents in the musseque typologies claimed to have a connection with a sewage system, it is known that there are no such connections in these areas. This misunderstanding is partly due to the phrasing of the question which linked white porcelain sanitas with the sewage system. It can be assumed that households which claimed to have such sanitation facilities in the musseque typologies all have septic tanks, which are also considered improved sanitation facilities. This was therefore corrected in the following graph.

The proportion of households which have inadequate access to sanitation facilities was lowest in the owner-built on planned sites typology because the household survey for this typology was conducted in an area which is still under construction and where people live in temporary corrugated iron shacks while they are building a more permanent construction. This percentage was corrected based on field observations in other areas which are more developed and fall under this typology.

[26] Development Workshop, *Peri-urban Private Renting Housing Market in Luanda*, 2008

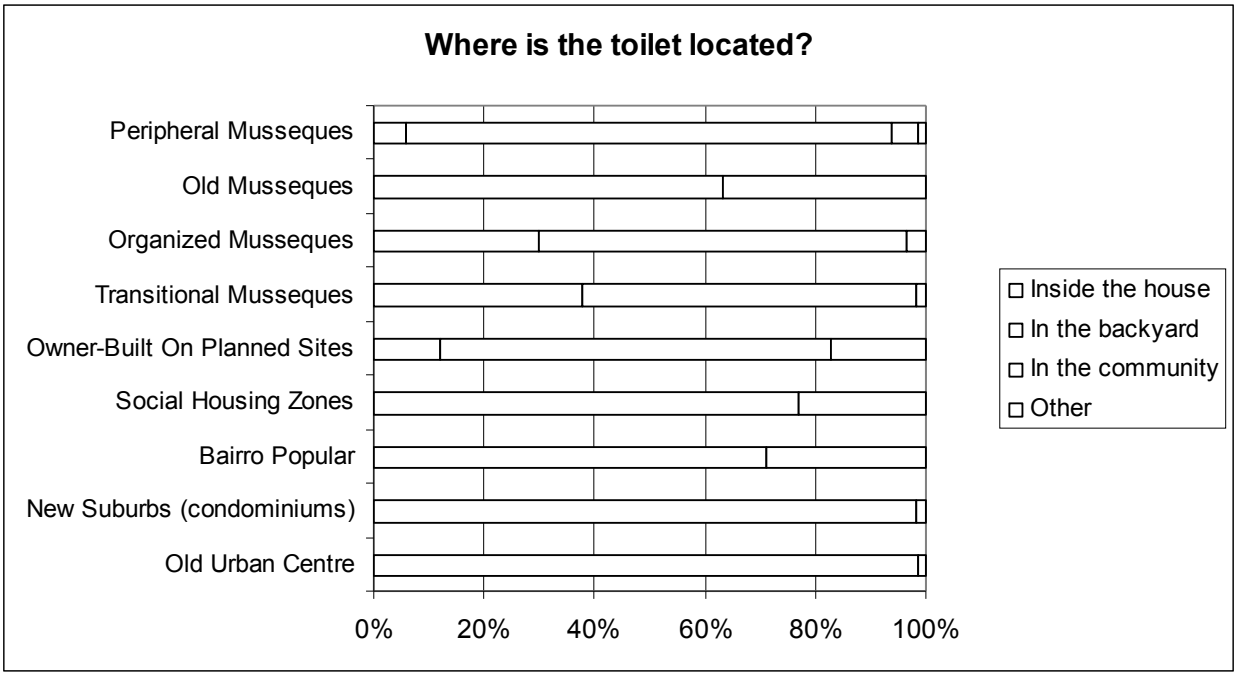


As has already been mentioned, sanitation facilities are not considered adequate if they are shared by many households. As illustrated in the graph below, a proportion of households in all typologies besides the old urban centre shares sanitation facilities. Again old musseques score higher than expected (with fewer shared toilets) because the area where the household surveys were conducted should be defined as transitional musseque. The majority of sanitation facilities are only shared by two or three households, although some are shared by more, particularly in old and peripheral musseques.



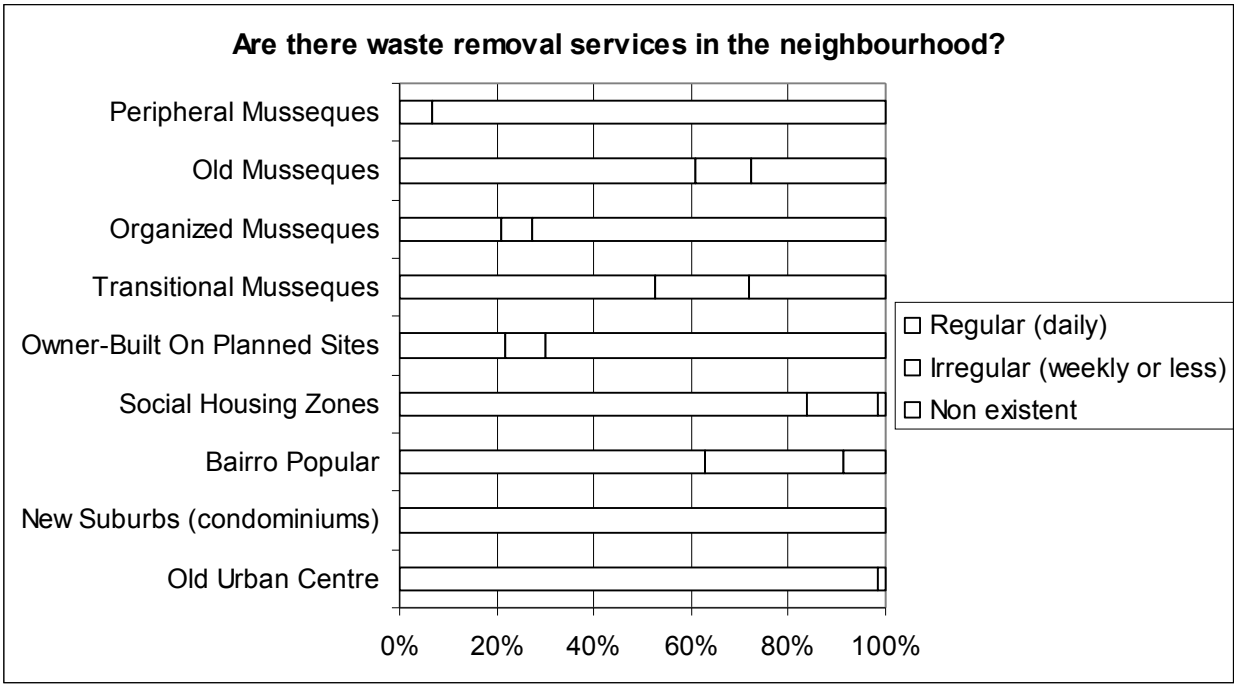
The location of the sanitation facilities is also important. It is considered particularly problematic if the toilet is public (located in the community). Again, old musseques score higher than expected and owner-built on planned sites lower due to discrepancies in the household surveys. Observations

in other areas which fall under these typologies revealed that old musseques should in fact score lower and owner-built on planned sites higher than indicated in the graph.



Solid waste is one of the main sanitation problems in Luanda, although rubbish collection has been improving in the last few years. Drainages, where they exist, often get clogged because of rubbish and in some musseques mountains of rubbish are spread throughout the bairros. The deficient environmental situation in most of Luanda's musseques can partly be blamed on the municipalities' lack of initiative and cooperation. Rubbish is mainly collected in organized areas which are easily permeable by private solid waste collection trucks and around critical areas such as markets and grocery stores. A lack of proper sanitation facilities or public bathrooms also forces some people to do their necessities outdoors. One possible way to tackle the issue of rubbish in Luanda`s musseques is to involve the population in the solving of this problem, for example by creating micro-companies to collect waste in the bairros, composed of residents and directed by comunal administrations.

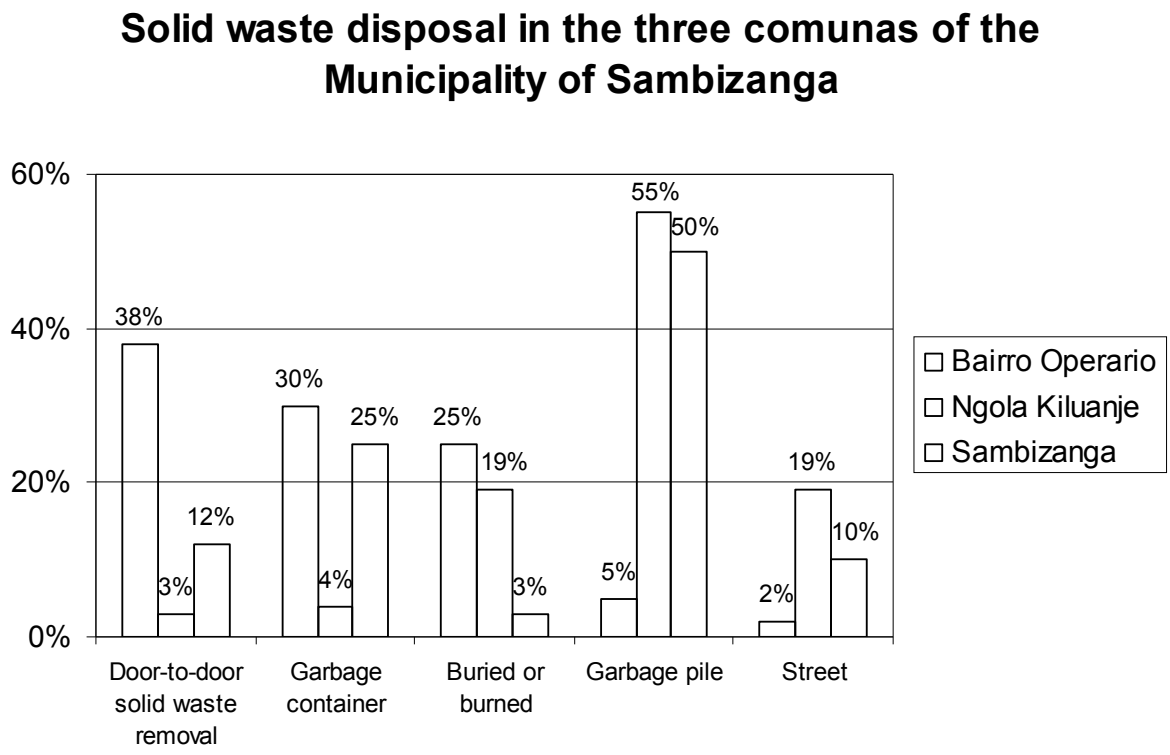
The following graph shows the proportion of households which have rubbish collection services in each typology. The owner-built on planned sites typology ranks low on this indicator as it does on other indicators that measure service levels. This percentage is considered quite accurate, as services are limited in these newly constructed areas which are located far from the city centre. However, the aligned street pattern of the planned sites will make it easier to establish waste collection services in these areas in the future.



Once again, the old musseque typology is not properly represented in the graph above where it ranks very similar to transitional musseques as it should, since the designation of Bairro Operaio has been changed to that category. In order to verify this discrepancy, data from the three comunas of Sambizanga was examined, which revealed that indeed Bairro Operario scores considerably higher on this indicator than the other two old musseque comunas in the Municipality. In fact, Bairro Operario scores even higher according to this study than it did in the household surveys for the current project. Observations in the field have revealed that the densely populated old musseques have been faced with sanitation problems due to waste that has been piling up in these areas over a long period of time.

According to the same sample study that was carried out in the Municipality of Sambizanga, the majority of residents in the old musseque comunas (Ngola Kiluanje and Sambizanga) appear to leave their waste in garbage piles or on the street where there is no regular waste removal (see graph below). Around 10-20% of residents in these same comunas either buries or burns waste.

Figure 8: Solid Waste Disposal in the Three Comunas of the Municipality of Sambizanga



The following table demonstrates the scores of each sub-indicator used to measure access to improved sanitation, in each settlement typology in Luanda. In order to calculate the overall ranking the score on each sub-indicator was added up for each typology, the sum divided by two and approximated to the next whole number.

Table 8: Ranking of Sub-Indicator: Access to Improved Sanitation in Luanda

Typology		**Sanitation facilities**	**Ranking**	**Solid waste removal**	**Ranking**	**Overall ranking**
A	**Old Urban Centre**	Connection to the sewage system	1	Regular	1	**1**
B	**New Suburbs and Condominiums**	Connection to the sewage system	1	Regular	1	**1**
C	**Bairro Popular**	Connection to the sewage system or septic tanks	2	Regular	2	**2**
D	**Social Housing Zones**	Septic tanks or pit latrines	2	Irregular	1	**2**
E	**Owner-built on Planned Sites**	Septic tanks or pit latrines	2	Irregular	2	**2**
F	**Transitional musseques**	Septic tanks or pit latrines	2	Irregular	2	**2**
G	**Organized musseques**	Septic tanks or pit latrines	3	No services	3	**3**

H	**Old musseques**	Septic tanks or pit latrines	2	Irregular	2	**2**
I	**Peripheral musseques**	Pit latrines or no facilities	3	No services	3	**3**
J	**Rural Settlements**		3		3	**3**
K	**Industrial Zone**		2		2	**2**
Total						

The overall ranking for this indicator was calculated based on the weight of each of the sub-indicators (water and sanitation) relative to the other three indicators that were ranked (land tenure, population density and housing quality and location) based on focus group discussions with local people in several of Luanda's musseques. These two indicators (water and sanitation) were rated as the most important issues by the residents of these areas; with water weighing 40% and sanitation 25% (land tenure and housing quality and location each at 15% and population density at 5%). The overall weight for basic services was calculated based on this weighting relative to one another with water at 62% and sanitation at 38%.

Table 9: Ranking of Indicator 3: Access to Basic Services (Water and Sanitation) in Luanda

Typology		Water	Ranking	Sanitation	Ranking	Overall ranking
A	**Old Urban Centre**	Connection to the sewage system	1	Adequate	1	**1**
B	**New Suburbs and Condominiums**	Connection to the sewage system	1	Adequate	1	**1**
C	**Bairro Popular**	Connection to the sewage system or septic tanks	2	Intermediate	2	**2**
D	**Social Housing Zones**	Septic tanks or pit latrines	1	Intermediate	2	**1**
E	**Owner-built on Planned Sites**	Septic tanks or pit latrines	3	Inadequate	3	**3**
F	**Transitional musseques**	Septic tanks or pit latrines	2	Intermediate	2	**2**
G	**Organized musseques**	Septic tanks or pit latrines	3	Inadequate	3	**3**
H	**Old musseques**	Septic tanks or pit latrines	3	Inadequate	3	**3**
I	**Peripheral musseques**	Pit latrines or no facilities	3	Inadequate	3	**3**
J	**Rural Settlements**		3		3	**3**
K	**Industrial Zone**		2		2	**2**

Total					

Newly settled areas furthest away from the city centre (musseques perifericos and auto-construcao dirigida) seem to have the worst access to basic services, such as water, sewer system and electricity.

7 Population density and overcrowding

Indicator 4: Population Density and Overcrowding

Definition of indicator: Proportion of households with more than three persons per room

The last national census for Angola was conducted in 1973 and only a partial census in Luanda and Malanje in 1982. Projections on Angola's current population vary greatly, with the most realistic (2008) estimate being around 18 million people nationally. Overall population density in the country is quite low at 8.6 persons per km^2, but the density in some parts of the main cities where a large majority of the population lives as a result of the war, is very high, particularly in some of Luanda's musseques. During the armed conflict, many of those living in the rural areas fled to the relative safety of the urban centers, particularly Luanda, where most of them still live today.[27] There are no signs of overcrowding in Huambo and Cachiungo.

Further, due to population migrations and limited housing construction during the war, there is a lack of adequate housing in Angola's urban areas. According to a report on Housing Finance carried out by DW in 2009, "it is estimated that Angola's shortfall of housing is over 875,000 units[28] and that 65% of existing housing lacks basic services such as water and sanitation[29] and is in need of major upgrading." The Angolan Government estimated that one million houses will need to be built in four years (2009-2012) as part of their housing programme.[30] However, instead of talking about housing units, the government has now started talking in terms of demarcated plots (fogo) and the number of new housing units had been reduced to 200,000 in the president's New Year's speech of 2010.

UN Habitat recommends monitoring the population growth of a city in order to prevent unmanageable densities and promote a sustainable development of the urban area in harmony with its environment and the overall system of settlements. According to UN Habitat, "high population growth without accompanying infrastructure development, adequate supply of basic services, accessible and affordable land and shelter, sufficient employment and economic opportunities is conducive to urban disorder and environmental degradation."[31]

UN Habitat defines "overcrowding" as the "proportion of households with more than three persons per room," including "bedrooms, dining rooms, living rooms, studies, habitable attics, servant rooms, kitchens and other separate spaces intended for dwelling purposes." [32] According to previous studies carried out by INOTU/DW, the average number of people per room in Luanda is

[27] Development Workshop, *Housing Finance in Angola*, December 2009.

[28] Ministry of Urbanism & Environment, "*Défice habitacional sobe para 60%"*, Jornal de Angola, 18.05, Luanda 2007

[29] Ministry of Urbanism & Environment, *Perfil Urbano em Angola*, Luanda 2005.

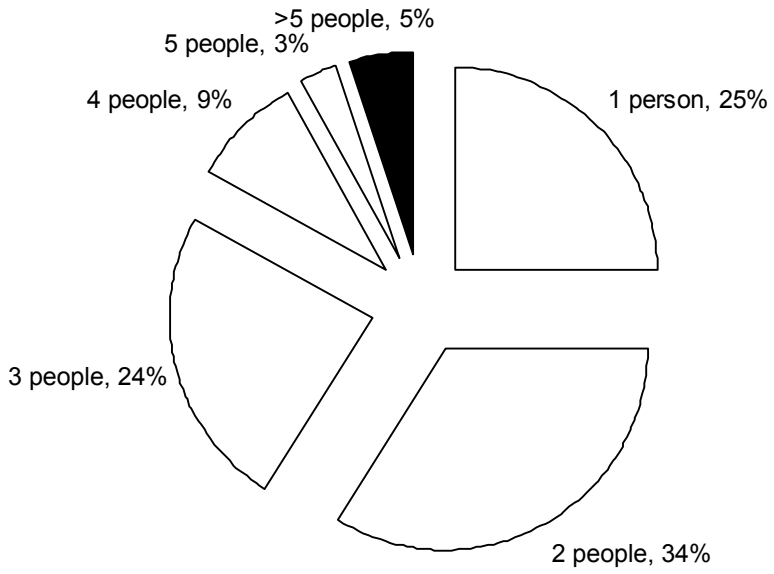
[30] Development Workshop, *Housing Finance in Angola*, April 2009.

[31] United Nations Human Settlements Programme (2004) *Urban Indicators Guidelines – Monitoring the Habitat Agenda and the Millennium Development Goals.* http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

[32] United Nations Human Settlements Programme (2004) *Urban Indicators Guidelines – Monitoring the Habitat Agenda and the Millennium Development Goals.* http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

approximately three (figure 9).

Figure 9: Number of people per room in Luanda[33]



Due to lack of demographic data in Angola, it was necessary to develop an information model on population density (number of people per hectare). Demographic information for each typology was collected by using satellite imagery as described in the section on demographic analysis above. Such precise geo-referenced information on population density is very rare, particularly in African cities. This is the sort of basic information which will greatly facilitate the definition of problem zones and public decision-making in all sectors and allows measuring MDG indicators with a good degree of precision.

Population data was divided into the following three groups and ranked from low to high density (table 11). In order to accurately measure population density for each typology, it is necessary to take on the arduous task of defining all open spaces, vacant lots and commercial or industrial areas. This has yet to be done. However, specific areas within certain typologies can be identified with a density of over 500 people per hectare, which has been defined as overcrowding. No typology has been identified as overcrowded in its entirety.

Table 10: Ranking of Indicator 1: Overcrowding

Ranking	Population per km^2	Density pop/Ha.	Description
1	Low density	< 100	Peri-Rural, New Peripheral Settlements, Sub-Urban & Condominiums, Social Housing, Self Built Planned Settlements
2	Medium density	100 – 300	Very high density areas located close to the city centre: Organized & Transitional Musseques
3	High density	300 >	Some Old Inner-City Musseques which include areas with a population density of more than 500 people per hectare

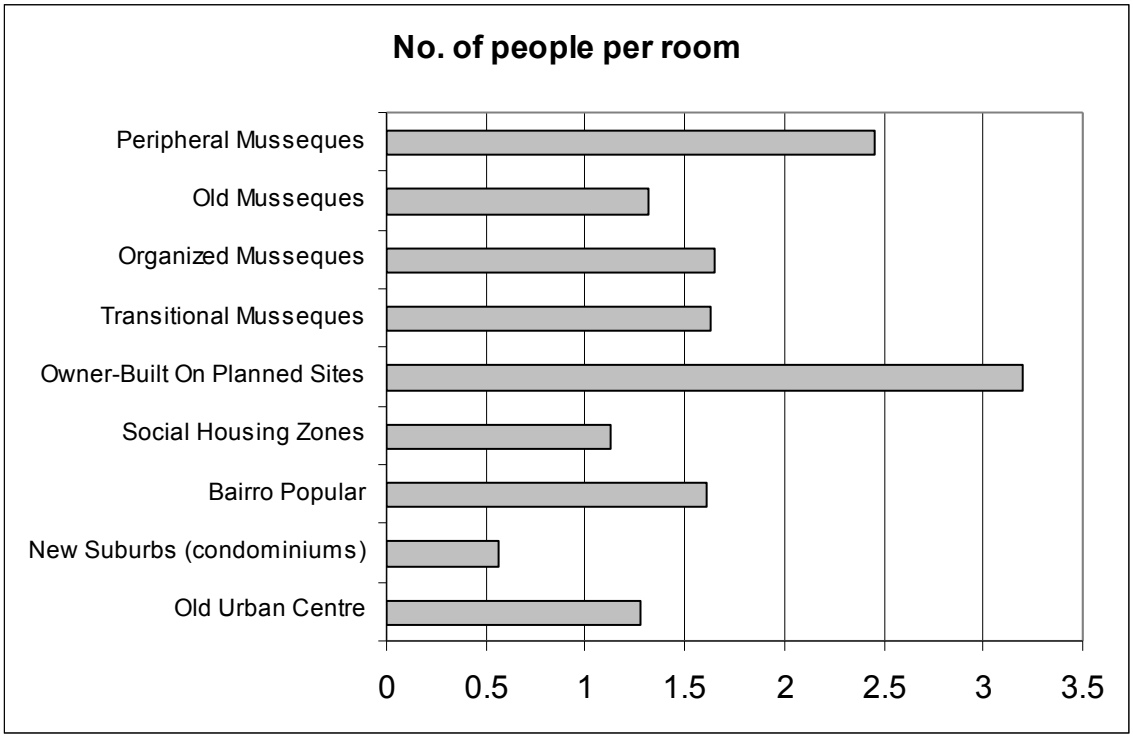
[33] Source: Inquiry of households in the Municipalities of Maianga, Sambizanga e Cacuaco in the Province of Luanda.

It should be emphasized that low density is not necessarily the most desirable form of settlement, since residents of such areas often need to travel long distances in order to reach services such as water, schools and grocery stores. On the contrary, most sparsely populated European and North-American cities are striving to increase population density. Medium to high density zones are often located close to city centres with access to a large range of services and are therefore popular areas to live in. However, when settlements have reached population density which can be considered as overcrowding, the advantages linked to high density are diminished by factors such as competition for scarce resources and health risks due to a lack of sanitation facilities and services.

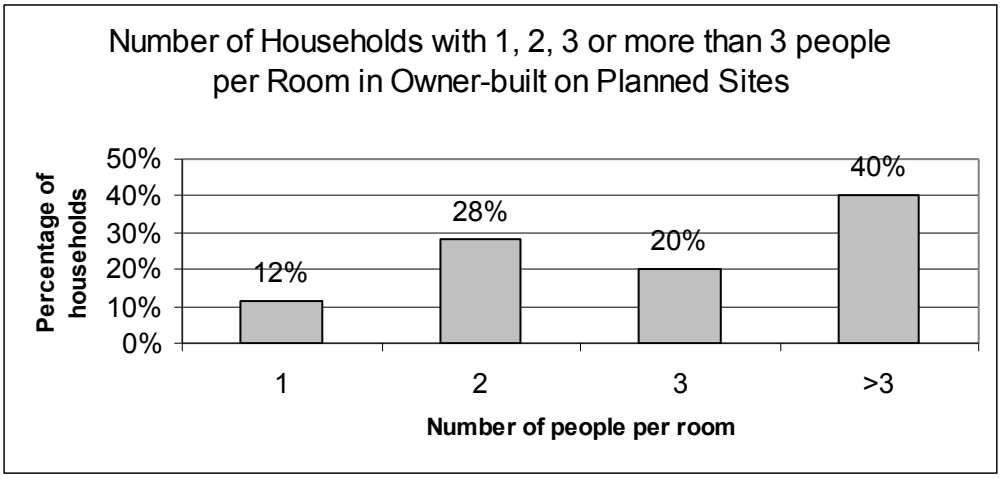
Indicator 4: Population Density and Overcrowding

The population estimates for Luanda (approximately 5,823,200 people) support estimates made in previous studies carried out by DW. This means that about one-third of the Angolan population is concentrated in the capital city. With a population of almost 6 million and a population growth rate of about 7% per annum, the population of the city is increasing by at least 400,000 per year. If it is assumed that the average household size is 6.7 persons, it can be assumed that almost 60,000 new households are being formed in the city of Luanda each year and that this is the number of new homes that need to be constructed to keep pace with population growth.

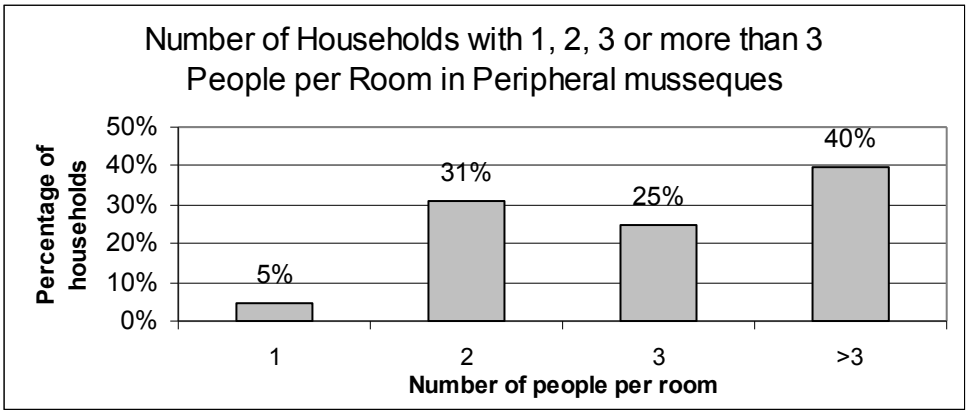
UN Habitat defines overcrowding as the proportion of the population that has more than three people per room. The following graph shows the results of the household surveys for this indicator. The only typology that ranks as overcrowded (with more than three people per room) is the owner-built on planned sites typology, where the majority of the people interviewed still lived in houses made of chapa and were in the process of building a permanent house. These areas are generally not very densely populated in the sense that the houses are not located as close to one another as in older musseques which are closer to the city centre.



Further analysis of the data for the owner-built on planned sites typology revealed that in fact 40% of households in the area that was surveyed live in overcrowded conditions. However, field observations in other areas which fall under this typology revealed much lower population densities than indicated by the household survey.



According to the household surveys, the second most overcrowded typology in Luanda and the only other typology that comes close to having three people per room are peripheral musseques. Further analysis of the data for this typology indicated that the same percentage of households live in overcrowded conditions as in the owner-built on planned sites typology (40%).



As number of people per room is not considered to give a very accurate image of overcrowding in Luanda, it was decided to use the detailed population density maps in order to rank this indicator.

Analysis of satellite images revealed that around 76% of Luanda's population of 5,823,200 lived in old and peripheral musseques in 2008. Approximately 1,039,000 people (18% of the total population) lived in areas designated as overcrowded with a density of more than 50,000 people/km^2, almost all of them (more than 90%), in old or peripheral musseques (figure 16). These numbers correspond to calculations made by the Ministry of Urbanism and Housing, which estimates that 80% of the urban population lives in informal settlements, or in compounds considered as precarious.[34]

[34] Development Workshop, *Housing Finance in Angola*, April 2009.

Figure 10: Old and peripheral musseques and areas with a density of more than 50,000 people per km²

Population density in Luanda was estimated for each typology using satellite imagery, as described in the section on demographic analysis above, to determine the number of people in each typology and the overall surface of each typology in square kilometres. However, these numbers should be interpreted cautiously since open spaces and areas with other land use than housing have not been identified. Furthermore, as already mentioned, high density is not negative unless it includes areas of overcrowding and low density is not necessarily desirable in urban areas. Areas of overcrowding were identified and located on a map of typologies. Population density was then ranked from low to high density mostly based on the presence or absence of overcrowded zones (table 13).

Table 11: Ranking of Indicator 1: Overcrowding in Luanda

Typology		Area Km²	Population	Density Pop/Ha	Overcrowding	Ranking
A	**Old Urban Centre**	16	165 693	103,78	No areas of overcrowding	**1**
B	**New Suburbs and Condominiums**	128	163 721	12,74	No areas of overcrowding	**1**
C	**Bairro Popular**	5	83 290	178,38	No areas of overcrowding	**1**
D	**Social Housing Zones**	22	118 380	54,34	No areas of overcrowding	**1**
E	**Owner-built on Planned Sites**	110	396 736	36,16	No areas of overcrowding	**1**
F	**Transitional musseques**	97	622 950	64,04	Some areas of overcrowding	**2**
G	**Organized musseques**	21	477 956	229,20	Some areas of overcrowding	**2**
H	**Old musseques**	82	2 312 701	280,61	Large zones of overcrowding	**3**
I	**Peripheral musseques**	229	1 237 028	54,05	No areas of overcrowding	**1**
J	**Rural Settlements**	1,760	241 787	1,37		**1**
K	**Industrial Zone**	22	2 957	1,34		n/a
	Total	**2,492**	**5 823 200**			

8 Housing quality and location

Indicator 5: Housing Quality and Location

Definition of indicator: Proportion of households living in a housing unit considered as 'durable', i.e. built on a non-hazardous location and has a structure permanent and adequate enough to protect its inhabitants from the extremes of climatic conditions such as rain, heat, cold, humidity.

Housing Quality

According to the UN, the right to adequate housing is an important factor in order for people to have an acceptable standard of living as promoted by the Universal Declaration of Human Rights in 1948 and the International Covenant on Economic, Social and Cultural Rights from 1966. Non-durable structures, which do not provide adequate protection from the elements, and expose residents to high morbidity and mortality risks, are one of the components that define a slum. [35]

It is not easy to define durable structures, since this indicator depends on many different factors such as building material, maintenance and climate. A building that may be durable in one area might not be durable in another area that is prone to geological or climate related hazards such as earthquakes or floods. Further, some of these factors, such as construction quality and maintenance are not easily measurable.

Figure 11: Cement blocks are the most common building material in Luanda

Thus, the main sub-indicator used to determine the status of durable structures was housing building material as recommended by UN Habitat. Manufactured cement blocks, which are the most common building material in Angola, are considered quite durable. Other materials that are used are: ceramic bricks (tijolos), adobe bricks, wood, corrugated iron and traditional cement (pau-a-pique). Building material was divided into the following three hierarchically ranked categories:

Table 12: Ranking of Indicator 3a: Durable Structures

Ranking	Building material	Description
1	Tijolos (ceramic bricks)	The most expensive building material, traditionally used in high-rise buildings in the city centre
	Cement blocks	The most common building material in Luanda which provides adequate protection from wind and rain
2	Adobe (un-burnt clay bricks)	A common building material in the provinces outside of Luanda, which, if used in the right way, provides sufficient protection from wind and rain
	Wood	An uncommon building material, except in old musseque houses, that varies

[35] United Nations Human Settlements Programme (2004) *Urban Indicators Guidelines – Monitoring the Habitat Agenda and the Millennium Development Goals.* http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

		in quality depending on timber resistance to termites.
3	Pau-a-pique	A traditional mixture of wood and clay, which, if properly maintained, provides sufficient protection from wind and rain, but rarely used in recent construction due to the lack of resistant wood.
	Corrugated iron	Low quality building material that is not durable and does not provide sufficient protection from wind and rain.

Roof material, which is also considered an important indicator of the durability of dwellings and the financial means of its inhabitants, was ranked separately and divided into the following three categories:

Table 13: Ranking of Indicator 3b: Durable Roofing

Ranking	**Roof material**	**Description**
1	Ceramic tiles (telhas)	The most expensive roof material, traditionally used in high-rise buildings in the city centre
2	Corruaga ted iron (chapas de zinco ou de lausalite)	The most common roof material in Luanda, which, if well maintained, provides moderate protection from wind and rain. Asbestos cement sheets are known to be a health risk.
3	Thatch roofs (capim)	Low quality roof material that is not durable and does not provide sufficient protection from wind and rain unless it is maintained very regularly. Thatch roofs are a clear indicator of limited financial means and are rarely used in Luanda

The same was done for floor material, which people put a lot of effort into improving, and is therefore considered a good indicator of poverty.

Ranking	**Floor material**	**Description**
1	Covered floors (mosaic, wood or taco)	Paved floors are a good sign of well-being. The most common floor material is mosaic.
2	Cement floors	Most people try to put together enough money to cover their floors with cement in order to provide some insulation from the weather and to keep insects and other pests from entering the house.
3	Dirt floors (terra batida)	Dirt floors are common in corrugated iron shacks and houses made of cement blocks or adobe on the periphery of the city. Dirt floors do not provide any kind of insulation from rain and cold and can therefore cause health risks for household members.

Location

In order to better analyse the indicator on durable structures, the UN Habitat guidelines also include an extensive indicator on houses in hazardous locations, as dwellers may not have adequate protection in such areas even though their houses are built with strong building materials. The definition of this indicator is: “Proportion of housing units built on hazardous locations (per

100,000 housing units).” Some zones are hazardous due to geological reasons such as landslides, earthquakes and floods, where settled housing is subject to disasters with less than a hundred year interval. This also includes housing settled on garbage mountains, high-industrial pollution areas or other high-risk zones such as railroads, airports, energy transmission lines etc. [36]

The safety of site location could be ranked according to the following three categories:

Table 14: Ranking of Indicator 3c: Durable Structures

Ranking	Site location	Description
1	Low risk/Safe	Low risk areas are located far from flood zones and have proper infrastructure to protect them from environmental hazards such as drainage systems and roads.
2	Medium risk/Poor drainage/Limited access	Areas which lack sufficient infrastructure such as proper drainage systems, solid waste removal and roads and thus are under risk of flooding and have limited access to services.
3	High Risk/Flood-prone/Utility Clearance/Hazardous	Sites in areas which are located close to still ponds or rivers or have a declination of more than 30 metres and are in risk of flooding and land slides.

These components are mostly covered by the environmental vulnerability indicator. Location, both in terms of environmental hazards as well as proximity to markets and services, is considered a very important factor in determining poverty, particularly in Luanda where the road infrastructure is overloaded and has not kept up with the rapid growth of the city. Therefore, it was decided to add accessibility (road conditions) to this indicator. Road conditions are very important, both to provide access to work and services and because flooded streets can cause sanitation problems.

UN Habitat recommends looking at travel time to work in order to measure the performance of transportation systems. This is definitely a problem in Luanda where the road infrastructure is in need of repair and overloaded with traffic resulting in bottlenecks on the outskirts of the city centre that can last for hours. However, the time it takes to go to work is not a good indicator of poverty in Angola because it is usually the middle-class population, that lives on the periphery of the city, but has formal employment in the city centre, which suffers most because of traffic jams. This reflects another major problem in the country, which is that the majority of people does not have formal employment. Those who work on the informal market normally choose to work closer to home than those who have a formal employment and have more flexible work hours so they can avoid the worst traffic. Therefore, it was decided to focus more on the road infrastructure itself rather than travel time in order to measure this indicator, both by mapping roads and road conditions with remote sensing and with questions in the household surveys.

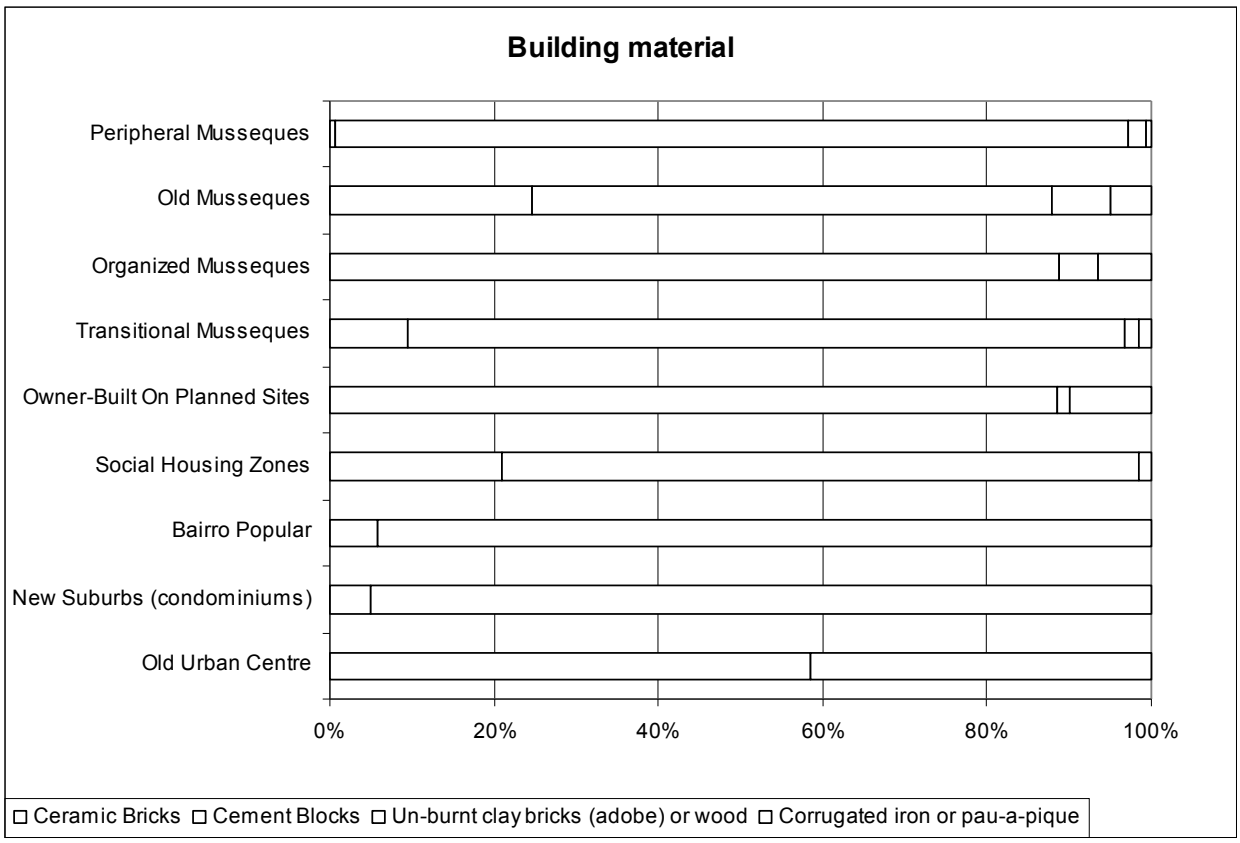
[36] United Nations Human Settlements Programme (2004) *Urban Indicators Guidelines – Monitoring the Habitat Agenda and the Millennium Development Goals.* http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

Ranking	Type of road	Description
1	Asphalt	Most roads in urban areas and the main access roads to the musseques are made of asphalt.
2	Unpaved road	Some major roads in the musseques are unpaved.
3	Bumpy dirt road	Most of the streets inside the musseques are bumpy dirt roads. Some of the access roads are made of old and worn asphalt with large holes in it.

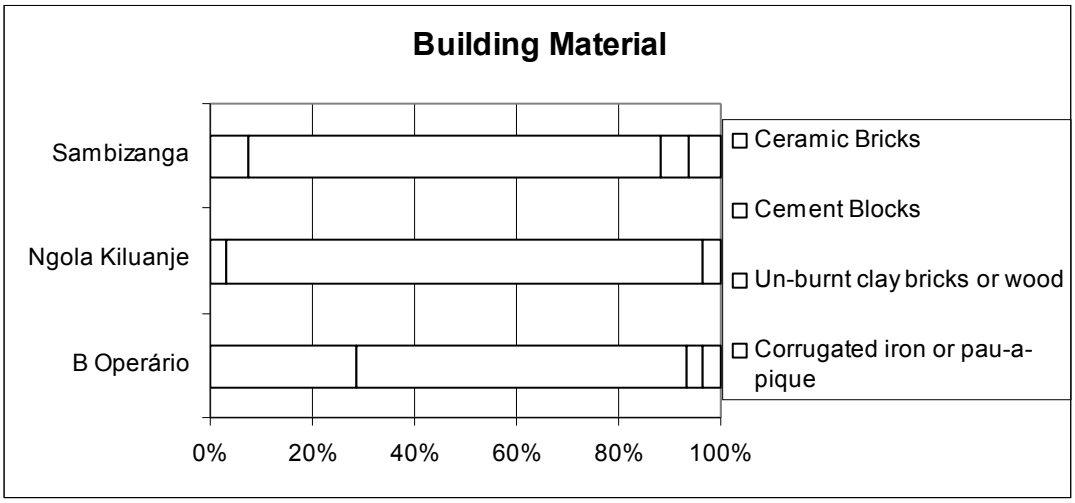
Indicator 5: Housing Quality and Location

Housing Quality

Cement blocks, which is considered adequate building material, are the most common building material in Luanda (see graph below). The second most common building material is ceramic bricks which are considered of higher quality than cement bricks even thought these two building materials were ranked under the same category. These two building materials are used by the majority of residents (over 80%) in all typologies and have been separated in the graph in order to show the proportion of each one of them. This indicates that a large majority of the population in Luanda lives in houses made of durable building material. Other lower-quality building materials are very rare in Luanda, the most common being corrugated iron which is sometimes used for the construction of temporary shacks in order to lay claim on a plot of land on the outskirts of the city (such as in the owner-built on planned sites typology). Occasionally these become more permanent dwellings in the poorest musseques. The numbers for the owner-built on planned sites typology has been corrected in the graph below based on field observations in other more established areas which fall under this typology where only a small fraction of the population still lives in temporary corrugated iron shacks.

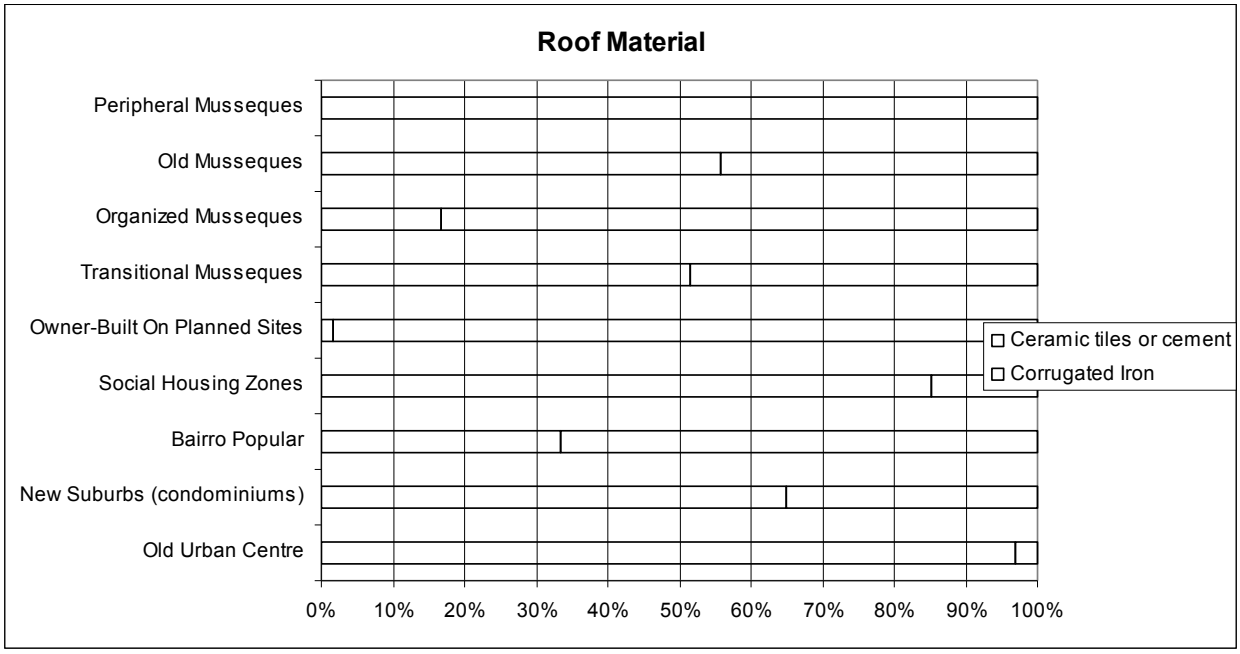


Data from the Sambizanga study was examined in order to verify if the data for old musseques is correct (see graph below). It appears that there are more houses made of ceramic bricks in Bairro Operario than in the old musseque comunas (Sambizanga and Ngola Kiluanje), but this would not change the ranking of the typology as ceramic bricks and cement blocks have the same ranking. For other building materials Bairro Operario seems to rank very similar to the other two comunas, even a bit lower than Ngola Kiluanje. According to observations in the field the same applies to roof material.

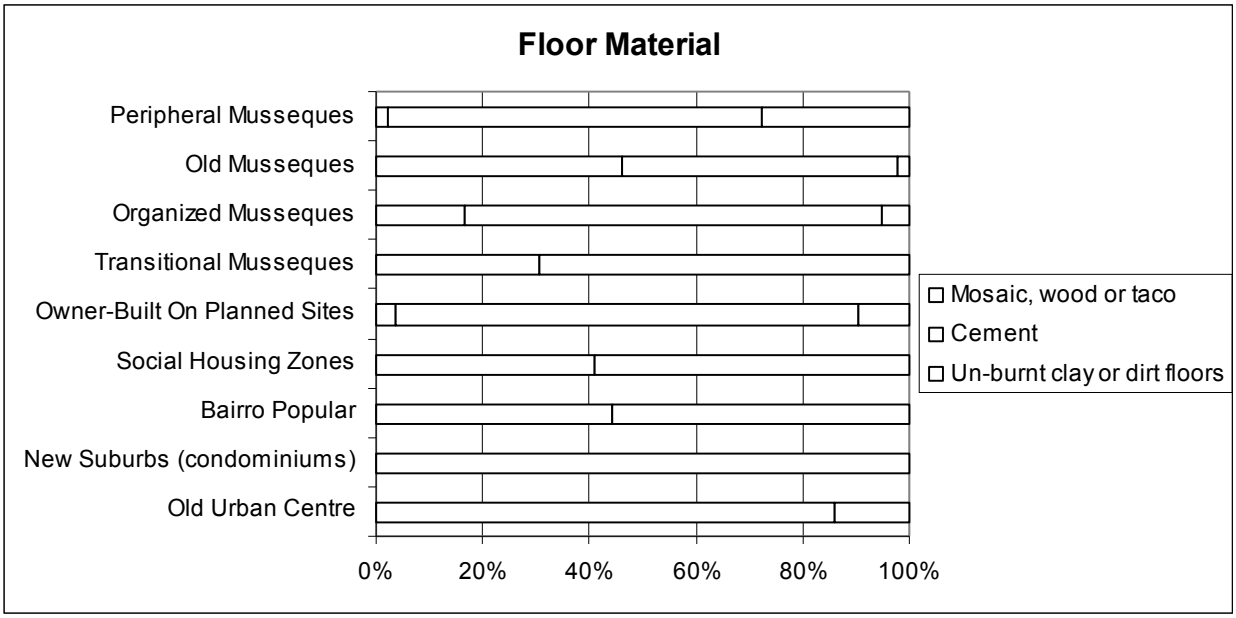


Corrugated iron is by far the most common roof material in Luanda. However, the state of these roofs varies greatly, some are well maintained and have weather proof insulation while others have started to rust and have holes in them. Corrugated iron reflects sun rays and can therefore get very

hot during the warmest season unless it is well insulated. Therefore, it is difficult to estimate the durability of a structure based on roof material only. It mainly helps to identify the most durable dwellings that have roofs made of ceramic tiles or cement and the poorest dwellings with grass roofs from the rest. There are no houses with thatched roofs in Luanda and the houses with roof made of ceramic tiles or cement are mostly located in and around the old city centre and in middle- to upper-class areas on the periphery (new suburbs and social housing zones). Generally, roof material in Luanda is of acceptable quality. In fact, roof material might not be such a good indicator of poverty since chapa is generally considered a durable roofing material. It might give more indication of the poverty situation in rural areas where a considerable number of houses have thatched roofs (capim).



Floor material might give a better idea of the poverty situation in each typology than roof material. Angolans put a lot of emphasis on insulating their floors with cement in order to provide protection from pests and the elements. Most also try to invest in some kind of paving, such as mosaic, if they have the means to do so. The numbers for the owner-built on planned sites typology were adjusted based on field observations in other areas which fall under this typology using the same percentage as was used for building material since it is assumed that those who have houses made of cement blocks usually cover their floors with cement as well. Observations in the field revealed that building and roof material in Bairro Operario is similar to that of other old musseque areas. Therefore, it is assumed that this applies to floor material as well, although for obvious reasons it was not possible to include floor material in field observations. In general, it seems that paved floors are most common in the more affluent areas, such as new suburbs and the old city centre and then become more uncommon as one goes further away from the city centre.



The following table demonstrates how durability of building and roof material was ranked for each typology. The overall ranking was calculated by adding up the score on each sub-indicator for each typology, dividing the sum by three and approximating to the next whole number.

Table 15: Ranking of Indicator 3: Housing Quality in Luanda

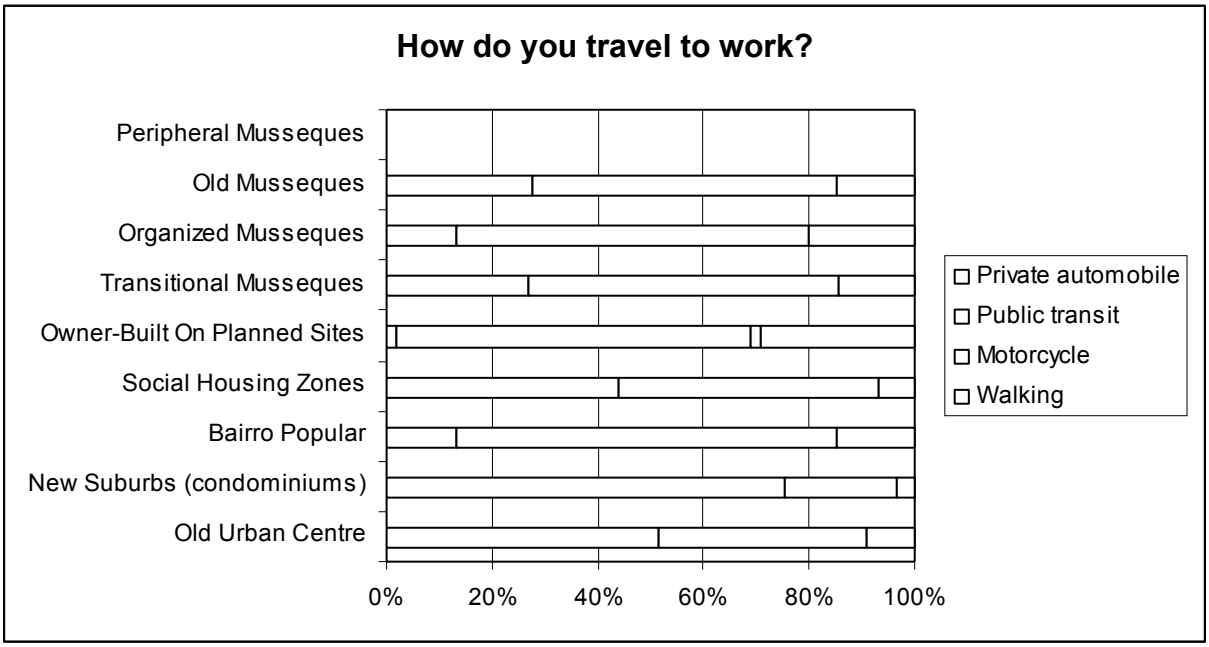
Typology		Building Material	Rank	Roof Material	Rank	Floor material	Rank	Overall ranking
A	**Old Urban Centre**	Ceramic bricks and cement blocks	1	Ceramic tiles and concrete	1	Covered floors	1	**1**
B	**New Suburbs and Condominiums**	Cement blocks and ceramic bricks	1	Ceramic tiles and concrete	1	Covered floors	1	**1**
C	**Bairro Popular**	Cement blocks and ceramic bricks	1	Corrugated iron and ceramic tiles	2	Covered or cement	2	**2**
D	**Social Housing Zones**	Cement blocks and ceramic bricks	1	Corrugated iron and ceramic tiles	2	Covered or cement	2	**2**
E	**Owner-built on Planned Sites**	Cement blocks and corrugated iron	2	Corrugated iron	2	Cement or dirt	3	**2**
F	**Transitional musseques**	Cement blocks	2	Corrugated iron	2	Covered or cement	2	**2**
G	**Organized musseques**	Cement blocks and or Adobe clay blocks	2	Corrugated iron	2	Cement	3	**2**
H	**Old musseques**	Ceramic bricks, Adobe, corrugated iron and Pau-a-Pic	2	Corrugated iron	2	Covered or cement	2	**2**
I	**Peripheral musseques**	Cement blocks, corrugated iron	3	Corrugated iron	2	Cement or dirt	3	**3**
J	**Rural Settlements**		3		3			**3**
K	**Industrial Zone**		1		1			**1**
Total								

Location

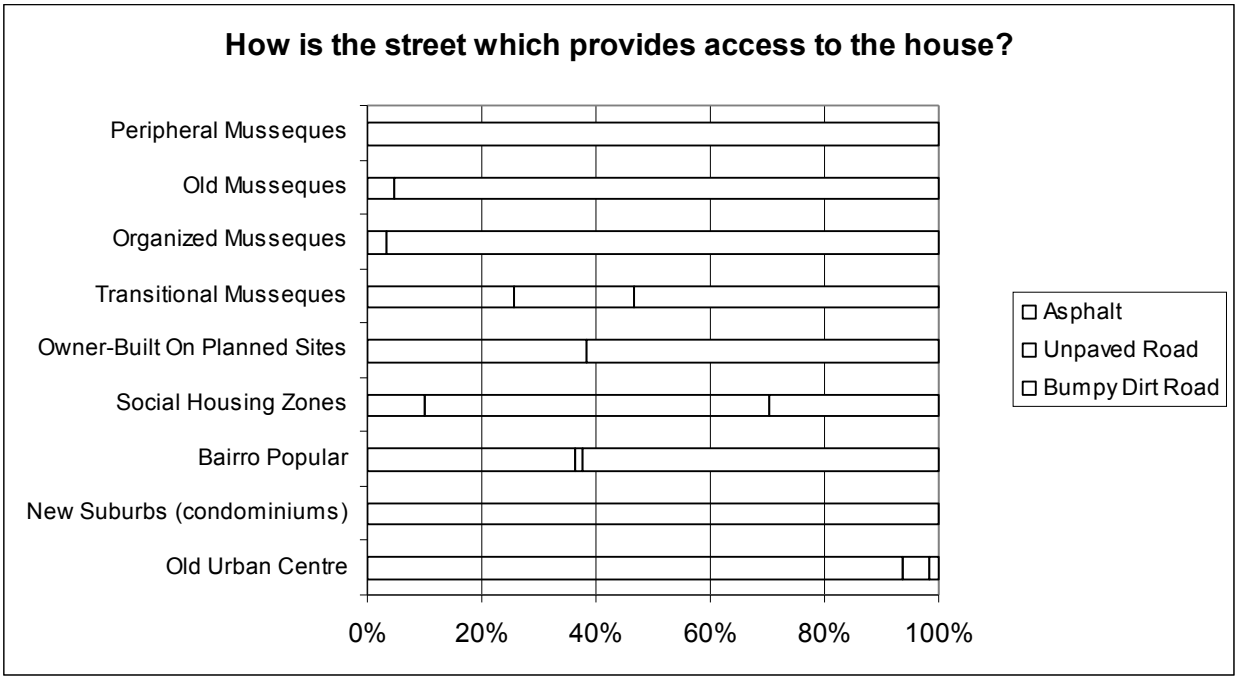
Transportation is a major problem in Luanda because development of the road infrastructure has not kept up with the rapid population growth in the city in the last few decades. During the war there were large population flights to the relatively safe haven of Luanda, but at the same time there was

little or no expansion and maintenance of the road infrastructure which was originally built by the colonial authorities for a city of 3-400.000 people. Today, it is estimated that almost 6 million people live in Luanda and its musseques and reconstruction of the road infrastructure has mostly taken place in the last decade since the end of the civil war in 2002.

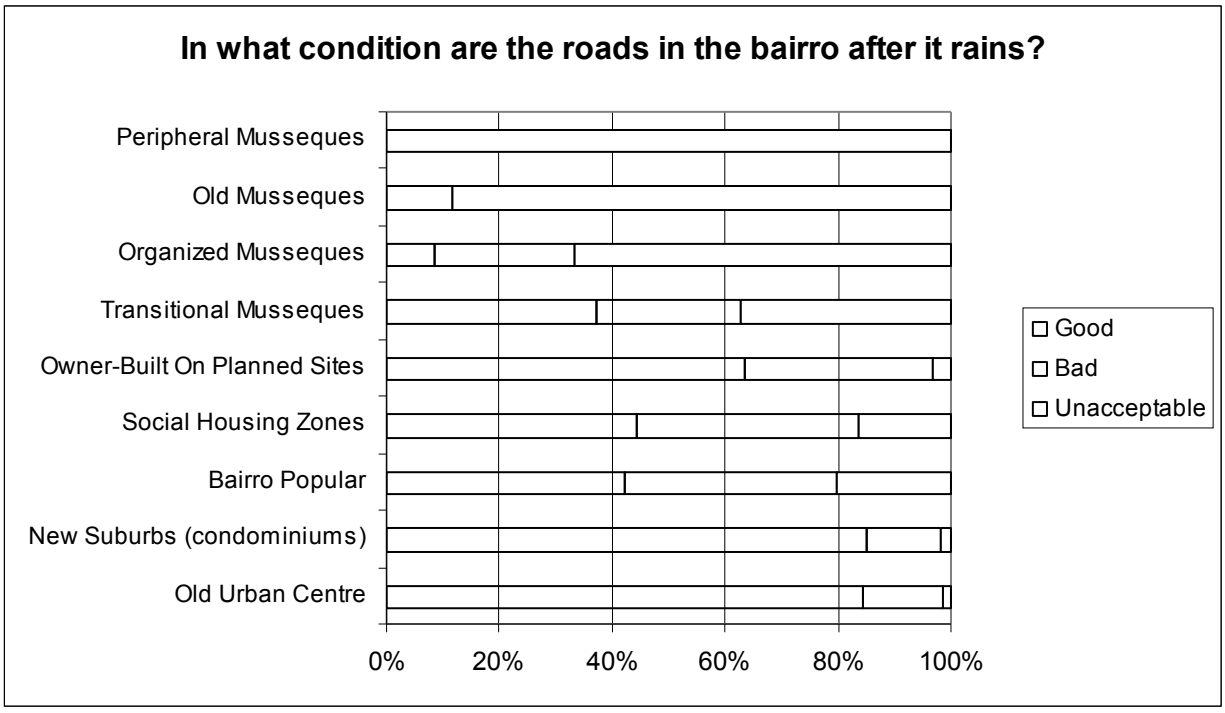
The most common mode of travel to work for residents of all typologies besides the old city centre and new suburbs, is public transit (train, bus or mini-van taxi), the most common of these being private mini-van taxis (called kandungeiros in the local lingo), which, thanks to the risky driving techniques of their drivers, are the fastest means of transport in the city. A proportion of residents in each typology walks to work. This probably applies to street vendors or merchants at the local market. Information on travel mode to work is not available for peripheral musseques, but observations in the field indicate that the majority of people travel by foot or mini-van taxis.



In general, the state of the streets in Luanda is very bad (see graph below). The majority of streets outside the urban core are dirt roads without any kind of drainage system. This greatly complicates the lives of residents in areas outside the city centre and can also cause health threats during the rainy season. The owner-built on planned sites typology scores relatively high on accessibility, but low on other indicators. These are new neighbourhoods, some are still under construction, that lack basic infrastructure and services, but are well organized and may be improved in the future. The residents of these areas are gradually building their houses and might become more affluent later on.



The bad road conditions in Luanda's musseques are further aggravated during the rainy season when dirty ponds and mud cover the dirt roads that lack drainage making them impassable both to pedestrians and vehicles. This does not only make it impossible for the residents of these areas to move around, but also intensifies the traffic jams on main roads as the local musseque roads are often used as a short-cut, particularly by drivers of private mini-vans, which are the main means of transport for many people.



Housing location was ranked based on road coverage and road conditions after the rain (see table below). Each sub-indicator weighs 50% in the overall ranking for housing location.

Table 16: Ranking of Indicator 5: Housing Location (accessibility) in Luanda

Typology		Road coverage	Ranking	Road conditions after rain	Ranking	Overall ranking
A	**Old Urban Centre**	Asphalt	1	Good	1	**1**
B	**New Suburbs and Condominiums**	Asphalt	1	Good	1	**1**
C	**Bairro Popular**	Asphalt/Improved dirt roads and bumpy dirt roads	2	Acceptable	2	**2**
D	**Social Housing Zones**	Asphalt/Improved dirt roads and bumpy dirt roads	2	Acceptable	2	**2**
E	**Owner-built on Planned Sites**	Asphalt/Improved dirt roads and bumpy dirt roads	2	Good/Acceptable	1	**2**
F	**Transitional musseques**	Asphalt/Improved dirt roads and bumpy dirt roads	2	Bad	2	**2**
G	**Organized musseques**	Bumpy dirt roads	3	Unacceptable	3	**3**
H	**Old musseques**	Bumpy dirt roads	3	Unacceptable	3	**3**
I	**Peripheral musseques**	Bumpy dirt roads	3	Unacceptable	3	**3**
J	**Rural Settlements**	Bumpy dirt roads	3	Unacceptable	3	**3**
K	**Industrial Zone**	Asphalt/Improved dirt roads and bumpy dirt roads	2	Acceptable	2	**2**
Total						

In order to calculate the overall ranking of this indicator the sum of the two sub-indicators was divided by two and the result rounded to the next whole number.

Table 17: Ranking of Indicator 5: Housing Quality and Location (accessibility) in Luanda

Typology		Housing Quality	Ranking	Location	Ranking	Overall ranking
A	**Old Urban Centre**	Adequate	1	Good	1	**1**
B	**New Suburbs and Condominiums**	Adequate	1	Good	1	**1**
C	**Bairro Popular**	Adequate	2	Acceptable	2	**2**

D	**Social Housing Zones**	Adequate	2	Acceptable	2	**2**
E	**Owner-built on Planned Sites**	Intermediate	2	Acceptable	2	**2**
F	**Transitional musseques**	Intermediate	2	Acceptable	2	**2**
G	**Organized musseques**	Intermediate	2	Unacceptable	3	**3**
H	**Old musseques**	Intermediate	2	Unacceptable	3	**3**
I	**Peripheral musseques**	Inadequate	3	Unacceptable	3	**3**
J	**Rural Settlements**	Inadequate	3	Unacceptable	3	**3**
K	**Industrial Zone**	Adequate	1	Acceptable	2	**2**
Total						

9 Overview of urban environmental issues and spatial aspects of poverty

Poverty Mapping Based on the Combined MDG Indicators

The ranking of all five MDG indicators combined was calculated for each city in order to be able to detect the settlement typologies which are most severely affected (see the following table).

These calculations have revealed that it is usually the same typologies that rank low on all five indicators (the musseques in Luanda and informal settlements in Huambo), while other ones rank high on all of them (organized urban areas in Luanda and formal areas in Huambo).

This allows overlying the maps ranking each indicator and creating an integrated poverty map where the poorest settlement typologies in urgent need of better services can be located.

Municipal Poverty Maps can be developed for each urban municipality and be used in preparing municipal development plans and contribute to the annual budgeting processes in these municipalities.

The typologies vary greatly in size and population. Generally the typologies that are lacking basic services and score low on all or most of the five indicators are the most heavily populated ones. Therefore, the ranking of each indicator has to be population weighted in order to be able to see the general score of each city. According to these calculations, all the indicators score 1.9 or higher in both cities and three of them (secure tenure, access to safe water and access to improved sanitation) score very high (2.5 or higher), which indicates very poor conditions

Relationship between Different Indicators

All the indicators intersect in some way and therefore it is assumed that a low score on one indicator usually entails a low score on the other ones.

Indicator	Land Tenure	Environmental Vulnerability	Basic Services (Water and Sanitation)	Overcrowding
Environmental Vulnerability	Housing settlements in environmentally hazardous locations are considered illegal. Residents do not have any rights and government can relocate at will (Boa Vista)			

Indicator	Land Tenure	Environmental Vulnerability	Basic Services (Water and Sanitation)	Overcrowding
Basic Services (Water and Sanitation)	Areas with basic infrastructure such as water pipes and sewage system have been properly planned and therefore residents have more tenure security	Basic services are often lacking in overcrowded areas and many people share same sanitation facilities.		
Overcrowding	People in overcrowded (and usually unplanned) areas (often located close to city centre where people want to live) have less tenure security.	Often environmental degradation in overcrowded areas caused by rubbish heaps, wastewater etc. People sometimes cut down trees to make more space.	There is more competition for scarce resources such as water and sanitation in overcrowded areas. Often too many people use the same sanitation facilities.	
Housing Quality and Location	People build more permanent structures where they have tenure security (corrugated iron shacks used to lay claim on a plot of land)	Houses in environmentally hazardous areas need to be particularly durable, but people who do not have tenure security tend not to build durable houses in such areas	Basic infrastructure is located in well organized areas with good road infrastructure. People want to live close to areas with access to public water pipes and sewage system (transitional musseuqes)	Overcrowding is particularly prevalent in areas on the outskirts of the city centre, which are located close to markets and services. People accept to live in overcrowded precarious houses in these areas

Maps which rank the performance of each indicator in each typology were prepared for Luanda and Huambo (see next two chapters). Each indicator that was ranked (all besides environmental vulnerability) was weighted against the others according to their priority for the peri-urban population based on focus group discussions with local people:

Indicator	Weight
Land Tenure	15%
Access to Water	40%
Access to Improved Sanitation	25%
Overcrowding	5%
Housing Quality and Location	15%
Total	**100%**

Then the overall performance of the Millenium Development Goal indicators was calculated and the ranking maps for each weighted indicator overlayed in an Urban Poverty map to identify the lowest ranking typologies.

In order to be better able to analyse the relationship between the different indicators within each city, the more detailed maps of environmentally vulnerable areas, water sources, population density and road conditions, were overlayed with each other and with ranking maps for other indicators. This allowed identifying particularly vulnerable areas within the typologies.

Intersect Analysis for Luanda

Intersect maps illustrating the relationship between the different indicators.

Mapping the relation between different indicators in Luanda

Indicator	Land Tenure	Environmental Vulnerability	Basic Services (Water and Sanitation)	Overcrowding
Environmental Vulnerability				
Basic Services (Water and Sanitation)				
Overcrowding				
Housing Quality and Location				

Cross Cutting Dimensions: Gender and Legal Framework

Table 18: Luanda urban poverty indicator matrix

Settlement Typology		INDICATOR 1 Ranking	INDICATOR 2 Ranking	INDICATOR 3 Ranking	INDICATOR 4 Ranking	INDICATOR 5 Ranking	MD
		Overcrowding (People per km^2)	Secure tenure	Durable structures (Building and roof material)	Access to safe water (Source of water)	Access to improved sanitation (Sanitation & solid waste removal)	O
A	Old Urban Centre	1	1	1	1	1	1
B	New Suburbs and Condominiums	1	1	1	1	1	1
C	Bairro Popular	1	1	1	2	2	1
D	Social Housing Zones	1	1	1	2	2	1
E	Owner-built on Planned Sites	1	1	1	2	2	1
F	Transitional musseques	2	2	2	3	3	2
G	Organized musseques	2	2	2	3	3	2
H	Old musseques	3	3	2	3	3	2
I	Peripheral musseques	1	3	2	3	3	2
J	Rural Settlements	1	3	3	3	3	2
K	Industrial Zone	n/a	1	1	2	2	1

Population Weighted Average	**2.0**	**2.5**	**1.9**	**2.8**	**2.8**	**2**

Table 19: Huambo urban poverty indicator matrix

Settlement Typology	INDICATOR 1 Ranking	INDICATOR 2 Ranking	INDICATOR 3 Ranking	INDICATOR 4 Ranking	INDICATOR 5 Ranking	MDG URBAN INDICATORS
	Overcrowding (People per km^2)	Secure tenure	Durable structures (Building and roof material)	Access to safe water (Source of water)	Access to improved sanitation (Sanitation & solid waste removal)	Overall ranking
Formal	**1**	**1**	**1**	**1**	**1**	**1.0**
Semi-formal	**1**	**2**	**2**	**3**	**2**	**2.0**
Informal	**2**	**3**	**3**	**2**	**3**	**2.6**
Population Weighted Average	**1.9**	**2.8**	**2.8**	**1.9**	**2.8**	**2.5**

Existing documents containing information related to the five indicators in the two cities under study were revised. DW has carried out numerous studies on poverty related issues, notably on access to water and land tenure including the following:

- *Study on the informal supply and demand for land (Estudo sobre a offerta e procura informal da terra) in Luanda, 2003;*
- *TERRAS, a study of the land tenure situation in peri-urban Luanda, Huambo, Benguela and Namibe, 2005;*
- *Mapping of Environmental Risks in Luanda, 2007;*
- *Report on Beneficiary Willingness & Ability to Pay Assessment for Water Services in Huambo, 2008;*
- *Study of the Peri-urban Private Renting Housing Market in Luanda, 2009;*
- *Report on Housing Finance in Angola, 2009;*
- *Report on The Informal Peri-Urban Water Sector in Luanda, 2009;*
- *Municipal profiles for the Municipalities of Sambizanga and Cacuaco in the Province of Luanda containing information on the situation of the five indicators in each municipality.*