PEDAL CITY
ALTERNATIVE URBAN SYSTEM OF MOBILITY AND ACCESSIBILITY TO URBAN SERVICES FOR SELF-ORGANIZING ECONOMIC ACTIVITIES IN SLUMS OF LUSAKA, ZAMBIA

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PROBLEM FIELD: PRO-POOR GROWTH

SUSTAINABLE POVERTY REDUCTION WITH RESPECT TO ECONOMIC GROWTH
IN A DEVELOPING FRAGMENTED CITY:
TO ENABLE THE POORS TO ENJOY SELF-ORGANIZING ECONOMIC ACTIVITIES
FRAGMENTED CITY

INFORMAL MARKETS

UNPAVED

DUMPING

SAFETY

FORMAL MARKETS

PAVED

WASTE MANAGEMENT

BY CAR

ON FOOT

UNSAFETY

MULTI- STORY
OBJECTIVE / RESEARCH QUESTION:

HOW CAN WE ENHANCE MOBILITY & ACCESSIBILITY TO URBAN SERVICES IN SLUMS OF LUSAKA FOR THE PRO-POOR GROWTH BY IMPLEMENTING MINIMUM SPATIAL ELEMENTS?
SUB-QUESTIONS:

HOW CAN WE ENHANCE THE POOR'S MOBILITY TO URBAN SERVICES? / MITIGATE THEIR DAILY TRANSPORTATION TIME?

HOW CAN WE ENHANCE THEIR ACCESSIBILITY TO CURRENT URBAN SERVICES? / RESPOND LOCAL, SOCIAL NEEDS FOR THEIR DAILY LIFE?

HOW CAN WE IMPROVE THE ECONOMIC OPPORTUNITIES OF LUSAKA'S POOR IN THE FUTURE? / RESPOND GLOBAL, ECONOMIC NEEDS FOR THE STATE?
DUPUY’S Layer Scheme:
A new opportunity of accessibility in a spatial complexity of slums
A new approach for an socio-spatial integral urban system
CHAPTER 1
3rd level: household
Social analysis on the Poor’s mobility related to their accessibility to current urban services

CHAPTER 2
2nd level: human activity network (current)
Spatial analysis on the Poor’s accessibility to current urban services

CHAPTER 3
1st level: road network (bicycle network)
Creating an integral bicycle network in line with five types of current urban services

CHAPTER 4
2nd level: human activity network (future)
1st level: road network (bicycle network)
Testing to design links and potential nodes of an integral bicycle network

CHAPTER 5
An alternative integral urban system with future urban services

PEDAL CITY: ALTERNATIVE URBAN SYSTEM
Mobility and Accessibility to Urban Services for self-organizing economic activities in slums of Lusaka
CHAPTER 1

1.1 Target group & area: women & youths in slums
1.2 Social analysis on their mobility and current problems in their daily life
STATUS: Capital City

INDEPENDENCE: 1964 (Established 1935)

AREA: 375 sq. km

ALTITUDE: 1,280 m, Flat land

DEMOCRACY: 1991 (Multiparty, Free trade)

GDP GROWTH: 4.3 %, $7 billion (2005)

INDUSTRY: Manufacturing, Finance, Retail businesses, Education

POPULATION: 1,267,458 (2005), 32 % of the total urban population

POPULATION GROWTH RATE: 4 % (1994-2004)

UNEMPLOYMENT: Male: 24.2%, Female 50.0 % (2000)
BROAD BASED WEALTH AND JOB CREATION THROUGH PARTICIPATION AND TECHNOLOGICAL ADVANCEMENT (ICT)

FACILITATING SMEs WITH FACILITIES SUCH AS BUSINESS INCUBATION CENTRES & MULTI-PURPOSE COMMUNITY TELECENTRES ARE SIGNIFICANT ASPECTS

-FNDP (FIFTH NATIONAL DEVELOPMENT PLAN IN REPUBLIC OF ZAMBIA), 2006

MIDDLE-INCOME COUNTRY 2030

It sounds a huge gap between this future national agenda and current local needs
Most people living in Informal settlements are segregated from the main city functions in the east. They could hardly develop their own daily life.

Spatial segregation between east and west

**Source:** Status Quo 1999, P. 5, Edited

**Pedal City: Alternative Urban System**

Mobility and Accessibility to Urban Services for self-organizing economic activities in slums of Lusaka
In addition, rapid urbanization with slums have been still ongoing, particularly, in the south-west. Over 70% of its population of Lusaka live in slums, most of whom are women and youth.

SOURCE: WILLIAMS, J 1986, LUSAKA AND ITS ENVIRONS ZAMBIA GEOGRAPHICAL ASSOCIATION HANDBOOK SERIES NO.9, LUSAKA, P. 141-6, EDITED.
Most expanding slums in the city
Women and youth are flooding and stuck in these slums
They have suffered from socio-spatial segregation from main urban services in the east
Slums are located between fingers of a transport network plan.
The total population is over 200,000, and its density is about 200 people / ha.
In particular, the slums are closed to commerce areas and CBD due to their significant workplaces.
In fact, Sales and craft are very popular occupations because the Poor’s easily work in home. To sell their products, market areas are crucial workplaces for slum dwellers.

**Source:** World Bank 1997, Household Responses to Poverty and Vulnerability

**Source:** World Bank 2006, Zambia Data Profile
Most of their social problems are strongly related to bad mobility and accessibility. Due to long travel to get water, foods or coals by walking, women are scared to crime. Because of bad mobility, women cannot often go to clinics and community forums without their free time. Also, most women and youths cannot continue their education, which causes lack of jobs.

Walking is the major mode of their daily trip. Women are under heavy demands on their daily domestic transport requirements. As a result, this trend seriously affects women’s mobility to access socio-economic activities.


MODE OF ACCESS TO URBAN SERVICES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Time (Hrs/Wk)</th>
<th>Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Men</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

Women Work (Hours/Week), Chawama, Lusaka 1992

Access to Economic and Social Infrastructure: Transportation

- Minibus: 30.6%
- Walk: 69.4%

Women’s Time & Effort of Transport (%), Zambia 1994

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Too expensive to use it daily for the Poor's traffic.

Traffic jams have been brought in the slums areas, which is not a faster mode than expected. Women and youths for their daily trips would become vulnerable than ever.
Lately, 23,000 bicycles will be provided to vulnerable households in Lusaka. Because of a totally flat land of Lusaka, bicycles have been working out for their mobility. But, without bicycle infrastructure, this trend will create another problem such as traffic accidents. Gender sensitive infrastructure services are urgent issues for the Poor.

SOURCE: WBR OFFICIAL WEBSITE, www.worldbicyclerelief.org

DONATE BICYCLES TO VULNERABLE HOUSEHOLDS IN LUSAKA
OBJECTIVE / RESEARCH QUESTION:

HOW CAN WE ENHANCE MOBILITY & ACCESSIBILITY TO URBAN SERVICES IN SLUM AREAS OF LUSAKA FOR PRO-POOR GROWTH?
HYPOTHESIS:

AN ALTERNATIVE URBAN SYSTEM OF MOBILITY & ACCESSIBILITY TO CURRENT & FUTURE URBAN SERVICES:

POLYCENTRIC INTEGRAL BICYCLE NETWORK

COULD BECOME A PARAMOUNT STRUCTURE IN SLUMS FOR PRO-POOR GROWTH
CHAPTER 2

2.1 Five types of current important urban services for women and youths in slums
2.2 Spatial analysis on their accessibility on the five types of current urban services
Based on the social analysis on the Poor, five types of urban services are selected as destinations: Water resource point, market, clinic, school and administrative point.
15 minutes by walking doesn’t cover a whole of area
DESTINATION 1: WATER RESOURCE POINT (R=15 MINUTES BY BICYCLE)

15 minutes by bicycle could cover a whole of area
Its capacity could be double or three times by using bicycle
DESTINATION 2: MARKET (R=15 MINUTES BY WALKING)

15 minutes by walking doesn’t cover a whole of area

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15 minutes by bicycle could cover a whole of area.
Its capacity could be double or three times by using bicycle.
15 minutes by walking doesn’t cover a whole of area
15 minutes by bicycle could cover a whole of area. Its capacity could be double or three times by using bicycle.
DESTINATION 4: CLINIC (R=15 MINUTES BY WALKING)

15 minutes by walking doesn’t cover a whole of area
15 minutes by bicycle could cover a whole of area. Its capacity could be double or three times by using bicycle.
15 minutes by walking doesn’t cover a whole of area
15 minutes and 30 minutes by bicycle could cover a whole of area. Because the Poors do not always access to the administrative points daily, 30 minutes by bicycle could be relevant for their accessibility and mobility.
CHAPTER 3

3.1 How to optimize bicycle routes in a spatial complexity of slums
3.2 How to create an integral bicycle network as a whole
TRADITIONAL ANALYSIS TO OPTIMIZE BICYCLE ROUTES: STAR ANALYSIS

Star Analysis
[Radial patterns for cyclists and pedestrians]

Star Analysis by Bach en Diepens (1988) of potential slow traffic relations in Joure (the Netherlands).

Most cyclists and pedestrians likely take a shortest path or a short cut toward their destinations which means that their mobility patterns would become a star-shape. In this star analysis, it revealed a negligible difference between the generated star-shaped patterns of mobility requirements and real mobility patterns.

Star Network
[Relationships between low traffic routes and destinations]

Star analysis by Bak and Blom (1982) for Soest and other towns (the Netherlands).

Star-shaped patterns are strongly interconnected one to another in line with destinations, and become more dense of patterns in a town scale. In short, a partially radial network near key destinations is more suitable which creates a star network as a whole.

Heterogeneous Star
[Relationship between low traffic routes and clusters]

To analyze macro scale spatial conditions on bicycle routes, two scientific techniques are adapted. One is a star analysis describing a shortest path towards a destination for pedestrians and cyclists. In this, their mobility patterns are more likely to be a star-shape. However, you can hardly optimize bicycle paths because of spatial complexity of slum road patterns. A star-shaped network gradually bends a heterogeneous star which saves cyclists and pedestrians even more time realistically.
The other is a local integration analysis calculating a degree of integration of paths. In this, highly local integrated paths are more likely to be used by pedestrians and cyclists. This modern advanced technique plays a key role in optimizing bicycle paths in spatial complexity of slums. However, a spatial configurative relationship between destinations and paths are not considered.
Therefore, the combination between the two will contribute to optimization of bicycle paths in line with destinations. We could draw bicycle routes with respect to highly local integrated paths and the 'star-shape'.
The form of the bicycle routes for water resource points takes a V-shape based on their locations. The bicycle routes just penetrate through John Laing between water resource points.
The form of the bicycle routes for markets takes a L-shape based on their locations. Because of many markets, the bicycle routes involve in a variety of small radial network patterns.
The form of the bicycle routes for schools takes a T-shape based on their locations. Because of many schools located in the east, the bicycle routes stretch more to the east.
The form of the bicycle routes for clinics takes a heterogeneous T-shape based on their locations. Because of a few clinics outside slums, the bicycle routes just penetrate through the area.
The form of the bicycle routes for administrative points takes a T-shape based on their locations. Because of the locations in the east, the form of bicycle routes is similar as that of schools.
In order to create a bicycle network as a whole, all of the 5 bicycle networks are superimposed.
The integral bicycle network is to mitigate their transportation time and to enhance accessibility to current, highly urgent five types of urban services for Women and Youths.
Dependent on paths, the number of superimposed bicycle routes are different one another. In other words, we could discover its hierarchy of this integral bicycle network.
The integral bicycle network has many potential nodes with small radial network patterns. These potential nodes could be serving for future urban services.
CHAPTER 4

4.1 How to design links of the integral bicycle network in detail
4.2 How to design potential nodes of the integral bicycle network in detail
To design links and nodes of the integral bicycle network in detail, a testing area is selected. The red line could be an alternative route for a city road. This alternative route has a lot of markets, closed to water resource points and schools and clinics. Therefore, the red line could be a friendly path for cyclists, which means a good testing area.
Additionally, the city road is affected by a minibus jam
Again, this alternative route could be livable for cyclists, as well as pedestrians
Based on the locations of urban services, I could define three corridors: market corridor, water corridor, and school corridor. These three corridors could be alternative and interconnecting routes for city roads with traffic jams.
The idea is that an intersection will be a potential node for future urban services: community telecentres. A junction of the school corridor and the market corridor would, therefore, serve a new node...
Most of roads do not have any strong capacity and width. A clear and flexible separation between pedestrians, cyclists and cars should be considered. Due to low finance in the State, interventions should be low cost equipments and labor intensive methods.
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The main functions of these interventions is to promote a slow-down traffic, to create a crossing point for pedestrians and cyclists, and to make a flexible separation between cars and cyclist.
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DESIGNING A POTENTIAL NODE: COMMUNITY GARDEN
Attention should be paid to interdependence between the macro and the micro scale conditions on bicycle routes.

Therefore, to analyze micro scale spatial conditions on bicycle routes, inter-visibility analysis is adapted. Inter-visibility means pedestrian visibility in which highly visibility space is more likely to be used by low traffics. Visibility graph model is calculated saying that market & school corridors and potential nodes have low visibility.
There are three problems around the market & school corridors and the potential node:

First, some housings have occupied streets which are forced to be narrowed.
Second, some street vendors also have occupied streets in a market in the east.
Lastly, some fence has surrounded the empty pocket of land.
Some housings and street vendors are relocated and integrated into the potential node. The potential node has, therefore, two function blocks: housing and community garden with street vendors. Because of serving some space for multi-playground, the two blocks could be located around the node. Based on the analysis, these two blocks could be a linear and slender to make them more inter-visible.
As a result, the market corridor from the west to east could become a more clear segment than ever. The confliction around the node derived from two different urban typologies could be also solved.
A residential block in the north and a community garden block in the west are proposed. Each block has a street vendor unit along the main streets. A multi-playground between the blocks to empower community for the local people. An open space between the residential blocks and existing housings is provided to empower community.
As for a building material of the community garden, a container block is considered. From a self-construction point of view, this material is advantageous due to its clear module and structure. This material is ecological because of recycling retired container blocks. This target area is close to an industrial area and a mining city, Copperbelt, to recycle container blocks. Some world organizations have also donated retired container blocks to Africa for new community facilities.
Due to a tropical climate, a ratio of surface of perimeter to area (S/A) should be considered. To keep air flow into an interior of building, a ratio of public open space to area (P/A) should be considered.

SOURCE: UNITED NATIONS 2006, ECO-HOUSE GUIDELINES FOR TROPICAL REGIONS, UN, BANGKOK, THAILAND

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Mobility and Accessibility to Urban Services for self-organizing economic activities in slums of Lusaka

CHAPTER 4
This unit has a good score of S/A, and its area is one of the minimized models in the study. Most of doors of container blocks could be easily used without operations. This public open space could create a good connection between blocks and units one to another. From a mixed functions point of view, this friendly separation in a unit could be usable.
Main functions of the minimum unit are divided into three parts:
Street trade blocks, community garden blocks and service units blocks
The public open space is divided into two parts
The first one is a passage to interconnect between blocks and halls
The second one is a hall to interact streets with blocks, and to serve a place for events and meetings
The service blocks are divided into three parts
A toilet block is to provide a waterless toilet with powers from solar panels to recycle organic wastes
A water collector is to make use of rain water and to stock in a tank
A electric block is to make use of solar powers to provide energy for the toilet and for the others
A community garden is created by simply expanding the minimum unit: a new ‘container-scape’
A community garden is divided into three parts, based on the concept of multi-purpose community centre
SUPERIMPOSED FUNCTIONS OF A COMMUNITY GARDEN

All of functions of the minimum unit are simply transformed into functions in a larger scale
The passage & hall could become a friendly back street together
The water collector could create a ‘big roof’ to collect rain water
The waterless toilet block could recycle a mass of organic wastes

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5.1 How to define its hierarchy of the integral bicycle network
5.2 How to create an alternative integral urban system
A new integral bicycle network has its hierarchy based on the number of superimposed bicycle routes.
With considerations of higher function paths, we could discover a lace structure from east to west. The lace structure should be respected to allocate future urban services.
According to its agenda from the State, community telecentres would be provided. Based on literature studies, community telecenters have a hierarchy from social to economic levels.

**HIERARCHY OF FUTURE URBAN SERVICES ‘COMMUNITY TELECENTERS’**

- **XXL**  
  **ADMINISTRATION**  
  Lusaka City Council (LCC)  
  Civic Center

- **XL**  
  **BUSINESS TRAINNING (BT)**  
  Business Incubation Centre

- **L**  
  BT > INFORMATION RESOURCES (IR)  
  Community Centre

- **M**  
  IR > BT  
  Community Garden

- **S**  
  IR  
  Information House
‘XL’, a business incubation centre serves applications in the economic levels. The main function is to provide the Poor with business trainings and job opportunities practically.
COMPONENTS OF ‘COMMUNITY TELECENTERS’: L: COMMUNITY CENTRE

‘L’, a community centre serves applications in the more economic levels than social ones. The main function is to provide basic business training, communication resources and educational services.
‘M’, a community garden serves applications in more social levels than economic ones. The main function is to provide communication resources, educational services and basic business training.
COMPONENTS OF ‘COMMUNITY TELECENTERS’: S: i-HOUSE (INFORMATION / INCUBATION HOUSE)

1: NEW FUNCTION BLOCKS
   A: MULTI MEDIA BLOCK
      (TV, RADIO & PHONE)
   B: LIBRARY BLOCK
   C: SUB CLINIC STATION
   D: SUB POLICE STATION

2: TRADE BLOCKS

3: WATERLESS TOILET

4: WATER COLLECTOR

5: SOLAR POWER SYSTEM

6: HALL (EVENT & MEETING PLACE)

‘S’, an i-House serves applications in social levels providing communication resources.
The main function is to provide communication resources and places to empower their community.
The socio-economic hierarchy of future urban services could follow the spatial hierarchy.
PROPOSAL OF AN ALTERNATIVE URBAN SYSTEM FOR THE PRO-POOR GROWTH

PEDAL CITY: ALTERNATIVE URBAN SYSTEM

Mobility and Accessibility to Urban Services for self-organizing economic activities in slums of Lusaka
XL: BUSINESS INCUBATION CENTRE

1: NEW FUNCTION BLOCKS
   1A & 1B: PUBLIC SERVICES
      - POLICE STATION (1A)
      - CLINIC STATION (1B)
   1C & 1D: BUSINESS CENTRE
      - MULTI MEDIA BLOCK (1C)
         (TV, PHONE, FAX & INTERNET)
      - TRAINING CENTRE (1D)
   1E: INCUBATION HOUSE
      - RENTAL OFFICE SPACE (1E)

2: TRADE BLOCKS
3: WATERLESS TOILET
4: WATER COLLECTOR
5: SOLAR POWER SYSTEM
6: HALL (EVENT & MEETING PLACE)

FC: FOOTBALL COURT
1: NEW FUNCTION BLOCKS
   1A & 1B: PUBLIC SERVICES
      - POLICE STATION (1A)
      - CLINIC STATION (1B)
   1C & 1D: BUSINESS CENTRE
      - MULTI MEDIA BLOCK (1C)
        (TV, PHONE, FAX & INTERNET)
      - TRAINING CENTRE (1D)
   1E & 1F: EDUCATION CENTRE
      - WORKING & MEETING SPACE
      - LIBRARY (1F)
2: TRADE BLOCKS
3: WATERLESS TOILET
4: WATER COLLECTOR
5: SOLAR POWER SYSTEM
6: HALL (EVENT & MEETING PLACE)
FC: FOOTBALL COURT

PEDAL CITY: ALTERNATIVE URBAN SYSTEM
Mobility and Accessibility to Urban Services for self-organizing economic activities in slums of Lusaka

CHAPTER 5
1: NEW FUNCTION BLOCKS
   1A: PUBLIC SERVICES
      - POLICE STATION
      - CLINIC STATION
   1B: BUSINESS CENTRE
      - MULTI MEDIA BLOCK
        (TV, PHONE, FAX & INTERNET)
      - TRAINING CENTRE
   1C: WORKING & MEETING SPACE
   1D: EDUCATION CENTRE
      - CLASS ROOM
      - LIBRARY

2: TRADE BLOCKS

3: WATERLESS TOILET

4: WATER COLLECTOR

5: SOLAR POWER SYSTEM

6: HALL (EVENT & MEETING PLACE)

FC: FOOTBALL COURT

PEDAL CITY: ALTERNATIVE URBAN SYSTEM

Mobility and Accessibility to Urban Services for self-organizing economic activities in slums of Lusaka

CHAPTER 5
1: NEW FUNCTION BLOCKS
   A: MULTI MEDIA BLOCK
      (TV, RADIO & PHONE)
   B: LIBRARY BLOCK
   C: SUB CLINIC STATION
   D: SUB POLICE STATION

2: TRADE BLOCKS

3: WATERLESS TOILET

4: WATER COLLECTOR

5: SOLAR POWER SYSTEM

6: HALL (EVENT & MEETING PLACE)
Structure of a new urban system follow the theory of the pro-poor growth:
A coherent scenario from social to economic levels, from local needs to global needs
and from current needs to future needs as a whole
for the poverty reduction in a developing fragmented cities
CHAPTER 6

6.1 Conclusions
6.2 Recommendations

Conclusions & Recommendations

3rd level: household
household in slums (women & youth)

2nd level: human activity network
future urban services: multi-purpose community telecentre
current urban services: water, market, clinic, school, administration

1st level: road network
bicycle network
By adapting the integral bicycle network in line with current urgent urban services for the Poor, their daily transportation time is mitigated, in which their daily timetable is improved. In this, the Poor can put more time into socio-economic activities than ever before. By proposing the integral urban service network with future urban services, the Poor could enjoy self-organizing economic activities now and future; thereby, the middle-income society could be feasible.
To adapt to future changes such as urbanization growth and social needs, monitoring is indispensable. In line with these future changes, bicycle network layers are additionally superimposed, or re-evaluated. In this, the elements of the integral bicycle network such as links, nodes and hierarchies could be changed. The alternative integral urban service network could become a sustainable layered product for the Pro-poor growth.
QUESTIONS & ANSWERS

THANK YOU FOR YOUR ATTENTION!
IMPLEMENTATION PHASES

2010-2015: Implementing bicycle networks

2015-2020: Providing i-houses and completing bicycle networks

2020-2025: Providing community gardens and completing i-houses

2025-2030: Providing community centres & the business incubation centre

PEDAL CITY: ALTERNATIVE URBAN SYSTEM

Mobility and Accessibility to Urban Services for self-organizing economic activities in slums of Lusaka
Road & Traffic Policy in Zambia

SOURCE: ENGINEERING AND CONSULTING FIRMS ASSOCIATION (ECFA), 2006
ZAMBIA-REPORT OF THE STUDY ON NATIONAL DEVELOPMENT, ECFA, JAPAN