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# **URBANISME ET TRANSPORTS DURABLES**

**Curitiba: 2.5 m**



**Transmilenio  
Bogota: 9 m**





Pourquoi la population se soulève contre les Transports Publics a Bogota?

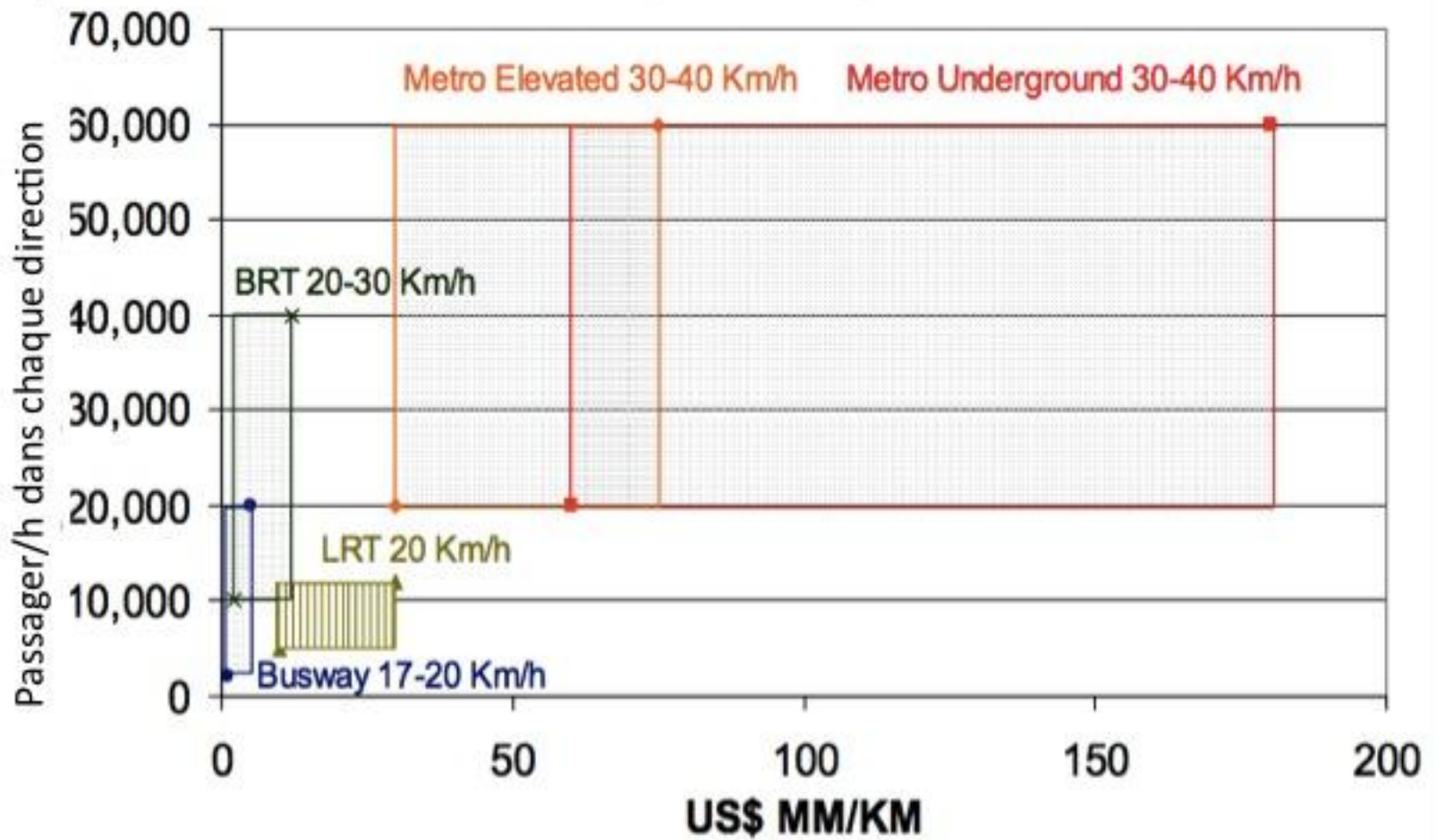


## Why Are People Rioting Over Bogota's Public Transit System?

ERIC JAFFE MAR 20, 2012 31 COMMENTS



### Investissement par km et capacité





## Principales villes plus peuplé d'Afrique 2010

	City	Country	2010 Calculation
1	Lagos	Nigeria	9,968,455
2	Kinshasa	DR Congo	8,900,721
3	Cairo	Egypt	8,105,071
4	Ibadan	Nigeria	5,175,223
5	Alexandria	Egypt	4,388,219
6	Abidjan	Ivory Coast	4,123,208
7	Cape Town	South Africa	3,648,807
8	Durban	South Africa	3,512,243
9	Giza	Egypt	3,438,401
10	Addis Ababa	Ethiopia	3,315,108
11	Casablanca	Morocco	3,299,179
12	Nairobi	Kenya	3,246,384
13	Dar es Salaam	Tanzania	3,212,040
14	Luanda	Angola	2,644,318
15	Dakar	Senegal	2,583,028
16	Umm Durman	Sudan	2,568,590
17	Accra	Ghana	2,449,922
18	Khartoum	Sudan	2,431,323
19	Benin	Nigeria	2,406,697
20	Kano	Nigeria	2,376,372
21	Algiers	Algeria	2,239,613
22	Douala	Cameroon	2,131,832
23	Port Harcourt	Nigeria	2,100,711
24	Kaduna	Nigeria	2,061,175
25	Johannesburg	South Africa	2,058,044
26	Conakry	Guinea	2,007,310
27	Kumasi	Ghana	1,928,196
28	Rabat	Morocco	1,819,812
29	Yaounde	Cameroon	1,812,169
30	Soweto	South Africa	1,801,772
31	Bamako	Mali	1,793,730
32	Harare	Zimbabwe	1,725,976
33	Pretoria	South Africa	1,724,533
34	Antananarivo	Madagascar	1,687,748
35	Lubumbashi	DR Congo	1,630,186
36	Lome	Togo	1,628,431
37	Aba	Nigeria	1,597,296
38	Muqdisho	Somalia	1,579,041
39	Mbuji-Mayi	DR Congo	1,559,073
40	Kampala	Uganda	1,514,301

**2.5 m**

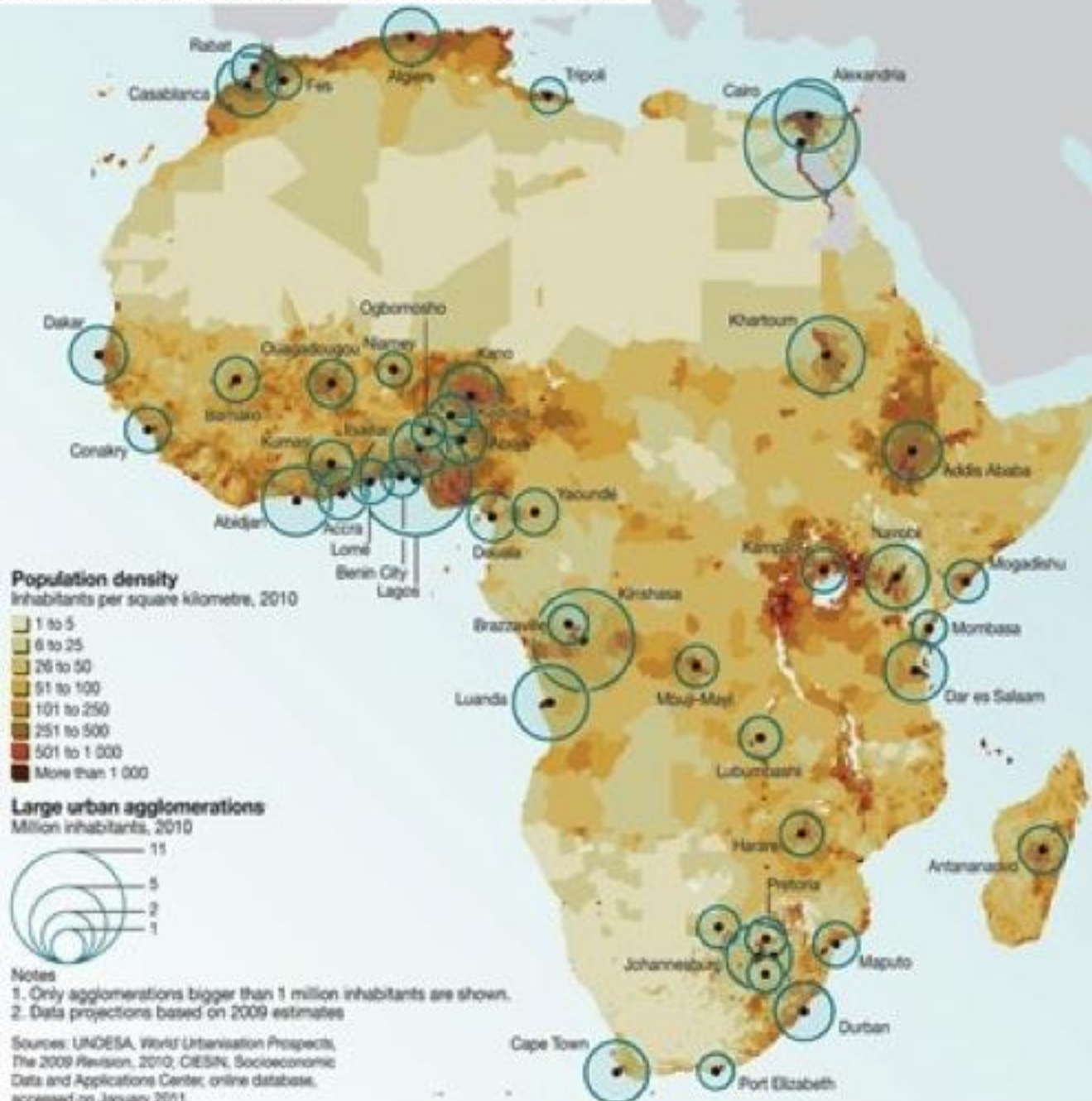
**1.5 m**

## Croissance des Villes en Afrique (max: 8,93%)

FASTEST GROWING SUB-SAHARAN AFRICAN CITIES					
	City, Country	Annual city growth rate 1995-2010 (%)	Share of city in national population (%)	Share of city in national pop. in 2025 (%)	City density (Pop./km2)
1	Abuja, Nigeria	8.93	1.2	1.4	9,100
2	Ouagadougou, Burkina Faso	7.02	11.3	17	5,600
3	Luanda, Angola	5.87	24.4	29.08	9,990
4	Yaoundé, Cameroon	5.45	8.9	10.07	9,100
5	Kumasi, Ghana	5.04	7.5	8.2	5,200
6	Dar es Salaam, Tanzania	4.77	7.4	8.7	6,600
7	Lilongwe, Malawi	4.75	5.4	7.3	1,479
8	Douala, Cameroon	4.56	42.9	11.8	11,000
9	Mbuji-Mayi, Dem. Rep. Congo	4.47	2.2	2.7	29,689
10	Lusaka, Zambia	4.3	10.9	10.8	8,200
11	Brazzaville, Congo	4.19	35.1	33.7	10,540
12	Kinshasa, Dem. Rep. Congo	4.18	12.7	15.7	15,300
13	Nairobi, Kenya	4.08	8.5	10.5	7,700
14	Lubumbashi, Dem. Rep. Congo	4.06	2.3	2.8	9,300
15	Lagos, Nigeria	3.93	6.6	6.8	10,700
16	Kampala, Uganda	3.72	4.7	6.09	3,300
17	Accra, Ghana	3.7	9.5	10.4	3,900
18	Dakar, Senegal	3.66	22.2	24.1	14,000
19	Conakry, Guinea	3.3	15.9	20.3	10,500
20	Abidjan, Cote d'Ivoire	3.29	19	23.3	12,900
21	Cotonou, Benin	2.82	21.8	21.2	4,400
22	Khartoum, Sudan	2.53	11.9	13.07	6,400
23	Cape Town, South Africa	2.52	6.7	7.1	5,000
24	Ibadan, Nigeria	2.39	1.7	1.6	7,900
25	Johannesburg, South Africa	2.38	7.3	7.6	2,900
26	Durban, South Africa	2.33	5.7	6	3,500
27	Kano, Nigeria	2.23	2.1	2.2	15,600
28	Addis Ababa, Ethiopia	2.06	3.5	4.3	13,100
29	Maputo, Mozambique	1.37	6.9	9.8	7,000
30	Harare, Zimbabwe	1.3	12.8	14.8	2,800

Source: World Bank

# Distribution de la population en Afrique





## Accra, Ghana



T<sub>1</sub>: 6-Mar-85



T<sub>2</sub>: 4-Feb-00

0 5 10 15 20 km



1:350,000

-  Water
-  Excessive slope
-  Built-up area

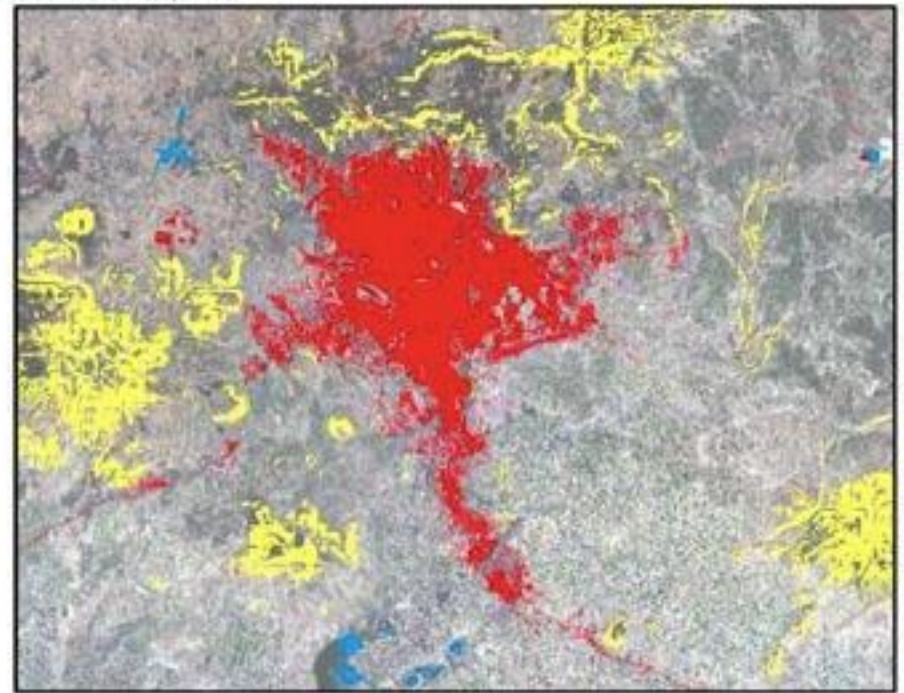


Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	1,882,990	2,789,380	2.67%
Built-Up Area (sq km)	133.35	344.26	6.56%
Average Density (persons / sq km)	14,120.39	8,102.64	-3.66%
Built-Up Area per Person (sq m)	70.82	123.42	3.79%
Average Slope of Built-Up Area (%)	3.11	3.11	0.01%
Maximum Slope of Built-Up Area (%)	12.28	12.28	0.00%
The Buildable Perimeter (%)	0.71	0.73	0.15%
The Contiguity Index	0.69	0.80	1.01%
The Compactness Index	0.68	0.61	-0.75%
Per Capita Gross Domestic Product	\$1,325.50	\$1,836.23	2.21%

## Addis Ababa, Ethiopia



T<sub>1</sub>: 21-Jan-86



T<sub>2</sub>: 5-Dec-00

0 6 12 18 24 km



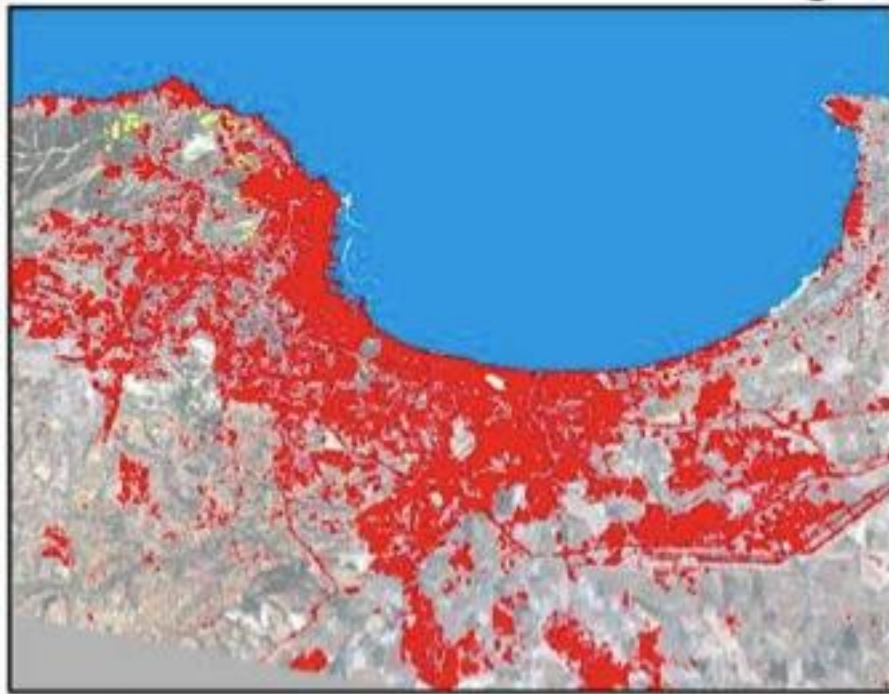
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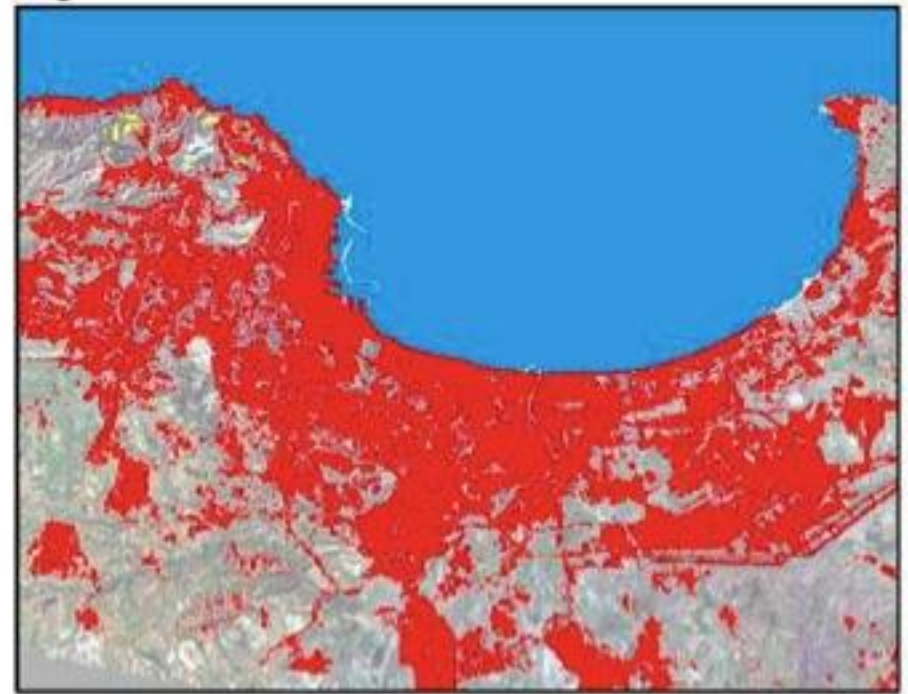
Measure	T <sub>1</sub>	T <sub>2</sub>	Annual
			% Change
Population	1,653,379	2,510,904	2.85%
Built-Up Area (sq km)	82.25	119.03	2.52%
Average Density (persons / sq km)	20,101.46	21,093.93	0.32%
Built-Up Area per Person (sq m)	49.75	47.41	-0.32%
Average Slope of Built-Up Area (%)	5.04	5.59	0.70%
Maximum Slope of Built-Up Area (%)	22.77	25.00	0.63%
The Buildable Perimeter (%)	0.88	0.88	0.04%
The Contiguity Index	0.86	0.94	0.55%
The Compactness Index	0.42	0.31	-2.07%
Per Capita Gross Domestic Product	\$562.98	\$626.03	0.72%



## Algiers, Algeria



T<sub>1</sub>: 21-Jun-87



T<sub>2</sub>: 25-Feb-00

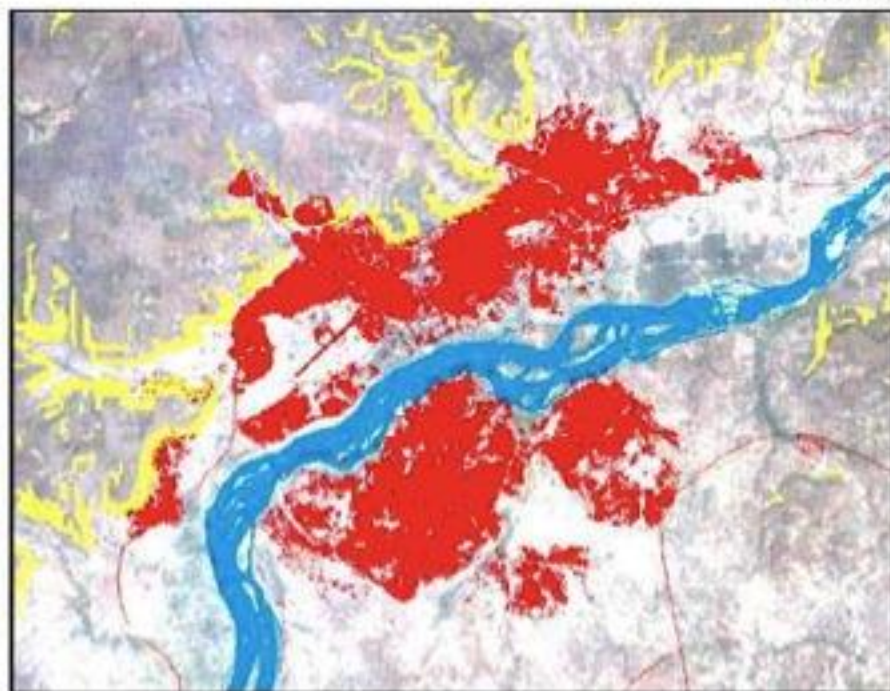


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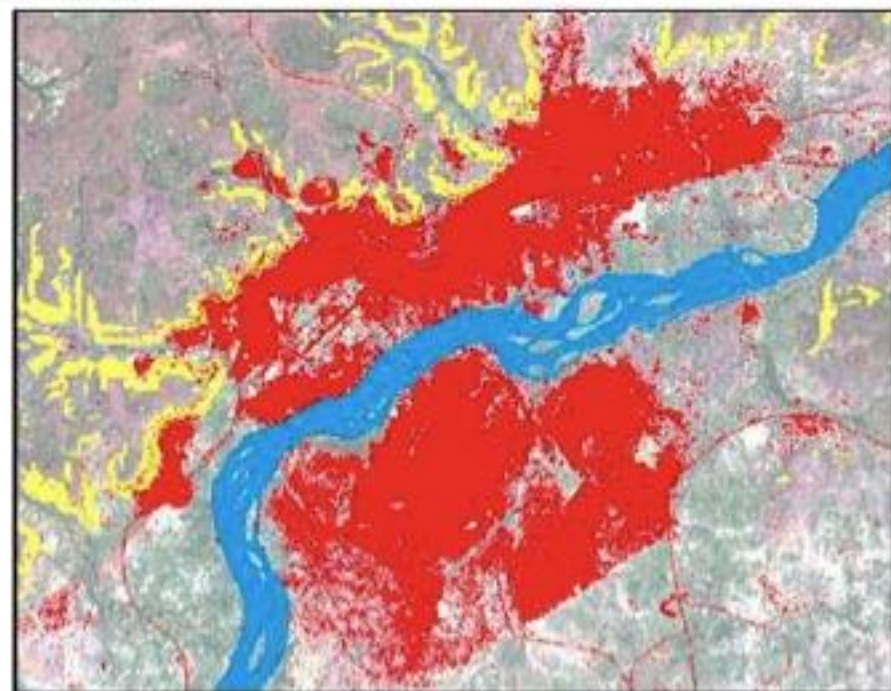


Measure	T <sub>1</sub>	T <sub>2</sub>	Annual
			% Change
Population	2,604,758	3,539,564	2.45%
Built-Up Area (sq km)	139.46	229.12	3.99%
Average Density (persons / sq km)	18,676.91	15,448.19	-1.49%
Built-Up Area per Person (sq m)	53.54	64.73	1.51%
Average Slope of Built-Up Area (%)	5.56	6.44	1.17%
Maximum Slope of Built-Up Area (%)	40.96	42.00	0.20%
The Buildable Perimeter (%)	0.83	0.89	0.54%
The Contiguity Index	0.53	0.43	-1.55%
The Compactness Index	0.34	0.32	-0.37%
Per Capita Gross Domestic Product	\$5,048.95	\$5,000.78	-0.08%

## Bamako, Mali



T<sub>1</sub>: 14-Nov-86



T<sub>2</sub>: 25-Oct-99



1:200,000



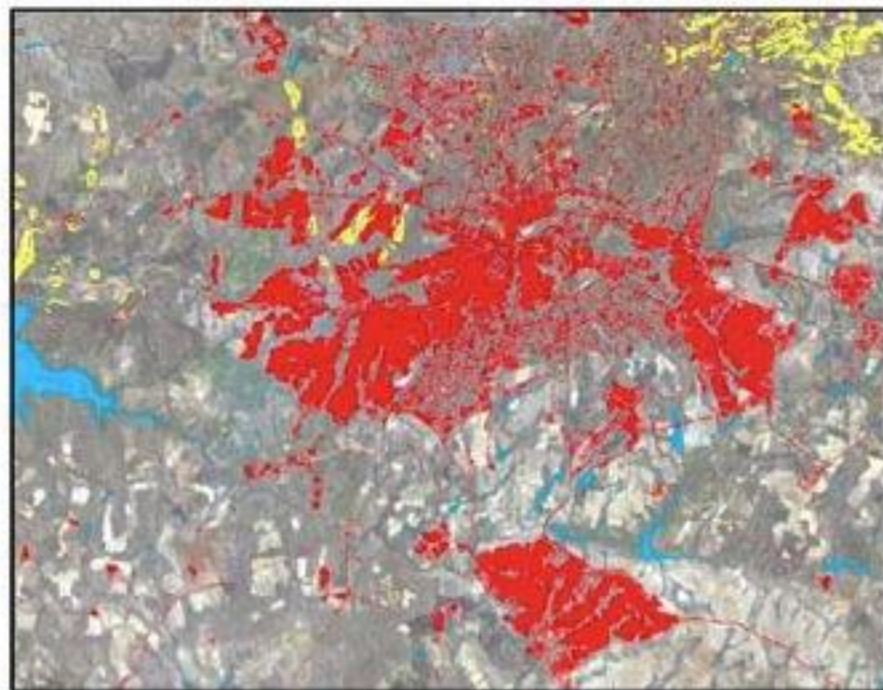
Measure	Annual		
	T <sub>1</sub>	T <sub>2</sub>	% Change
Population	791,817	1,183,697	3.15%
Built-Up Area (sq km)	63.60	121.37	5.12%
Average Density (persons / sq km)	12,449.35	9,752.54	-1.87%
Built-Up Area per Person (sq m)	80.33	102.54	1.90%
Average Slope of Built-Up Area (%)	2.96	2.83	-0.34%
Maximum Slope of Built-Up Area (%)	21.13	21.05	-0.03%
The Buildable Perimeter (%)	0.83	0.80	-0.27%
The Contiguity Index	0.85	0.89	0.36%
The Compactness Index	0.41	0.45	0.89%
Per Capita Gross Domestic Product	\$591.40	\$722.11	1.55%



# Harare, Zimbabwe



T<sub>1</sub>: 19-May-89



T<sub>2</sub>: 30-Sep-00

0 6 12 18 24 km



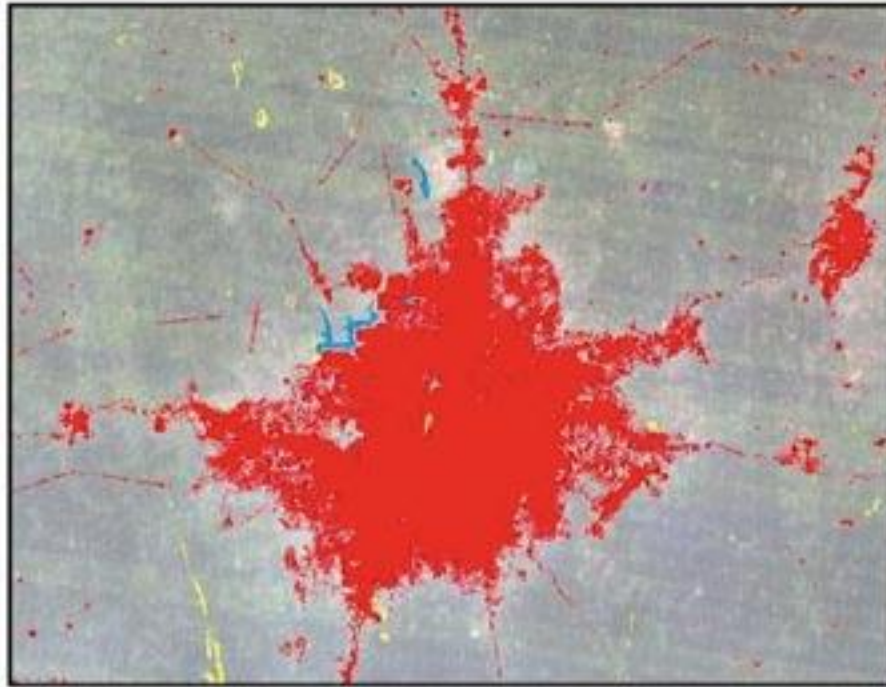
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- Water
- Excessive slope
- Built-up area

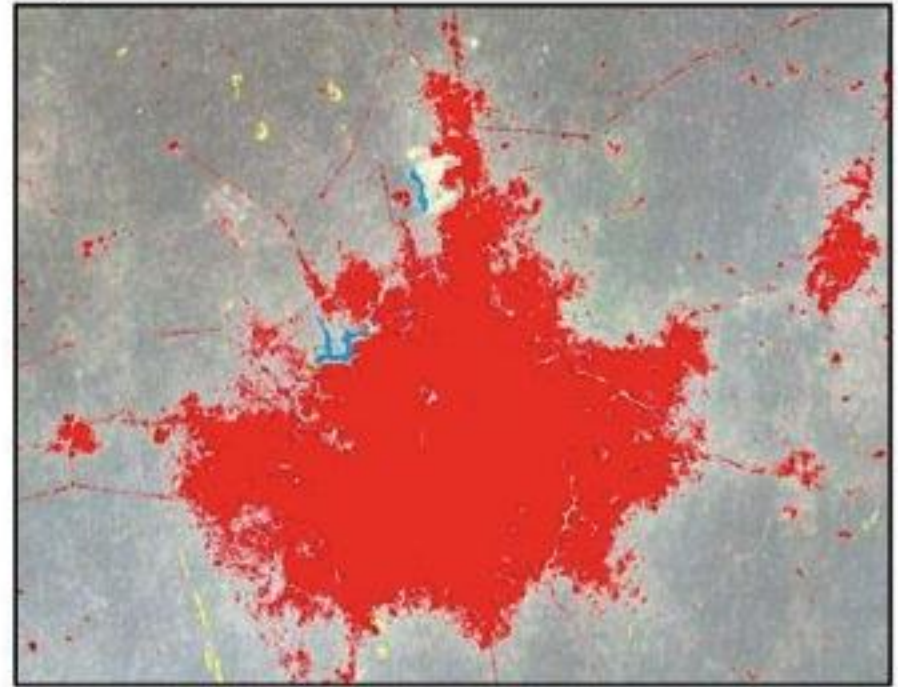


Measure			Annual
	T <sub>1</sub>	T <sub>2</sub>	% Change
Population	838,775	889,421	0.52%
Built-Up Area (sq km)	165.07	243.10	3.46%
Average Density (persons / sq km)	5,081.47	3,658.59	-2.85%
Built-Up Area per Person (sq m)	196.79	273.33	2.93%
Average Slope of Built-Up Area (%)	2.06	2.14	0.34%
Maximum Slope of Built-Up Area (%)	11.04	11.10	0.04%
The Buildable Perimeter (%)	0.95	0.95	-0.01%
The Contiguity Index	0.30	0.35	1.48%
The Compactness Index	0.30	0.34	1.08%
Per Capita Gross Domestic Product	\$2,518.30	\$2,367.62	-0.54%

# Ibadan, Nigeria



T<sub>1</sub>: 18-Dec-84



T<sub>2</sub>: 6-Feb-00

0 5 10 15 20 km



1:350,000



Measure	T <sub>1</sub>	T <sub>2</sub>	Annual
			% Change
Population	1,565,805	2,421,369	2.92%
Built-Up Area (sq km)	209.18	299.95	2.41%
Average Density (persons / sq km)	7,485.48	8,072.69	0.50%
Built-Up Area per Person (sq m)	133.59	123.87	-0.50%
Average Slope of Built-Up Area (%)	4.97	5.02	0.07%
Maximum Slope of Built-Up Area (%)	17.63	17.54	-0.03%
The Buildable Perimeter (%)	0.98	0.98	-0.03%
The Contiguity Index	0.91	0.94	0.18%
The Compactness Index	0.41	0.47	0.97%
Per Capita Gross Domestic Product	\$824.10	\$808.67	-0.12%



# Kigali, Rwanda



T<sub>1</sub>: 20-Jun-84



T<sub>2</sub>: 8-Jul-99

0 2 4 6 8 km



1:150,000



Measure	T <sub>1</sub>	T <sub>2</sub>	Annual
			% Change
Population	296,879	354,273	1.18%
Built-Up Area (sq km)	15.19	45.13	7.51%
Average Density (persons / sq km)	19,549.74	7,849.33	-5.88%
Built-Up Area per Person (sq m)	51.15	127.40	6.25%
Average Slope of Built-Up Area (%)	7.14	10.24	2.42%
Maximum Slope of Built-Up Area (%)	36.3	40.77	0.77%
The Buildable Perimeter (%)	0.91	0.93	0.12%
The Contiguity Index	0.71	0.94	1.91%
The Compactness Index	0.35	0.30	-0.89%
Per Capita Gross Domestic Product	\$1,147.52	\$1,010.36	-0.84%



# Ouagadougou, Burkina Faso



T<sub>1</sub>: 18-Nov-86



T<sub>2</sub>: 14-Jul-01

0 3 6 9 12 km



1:175,000

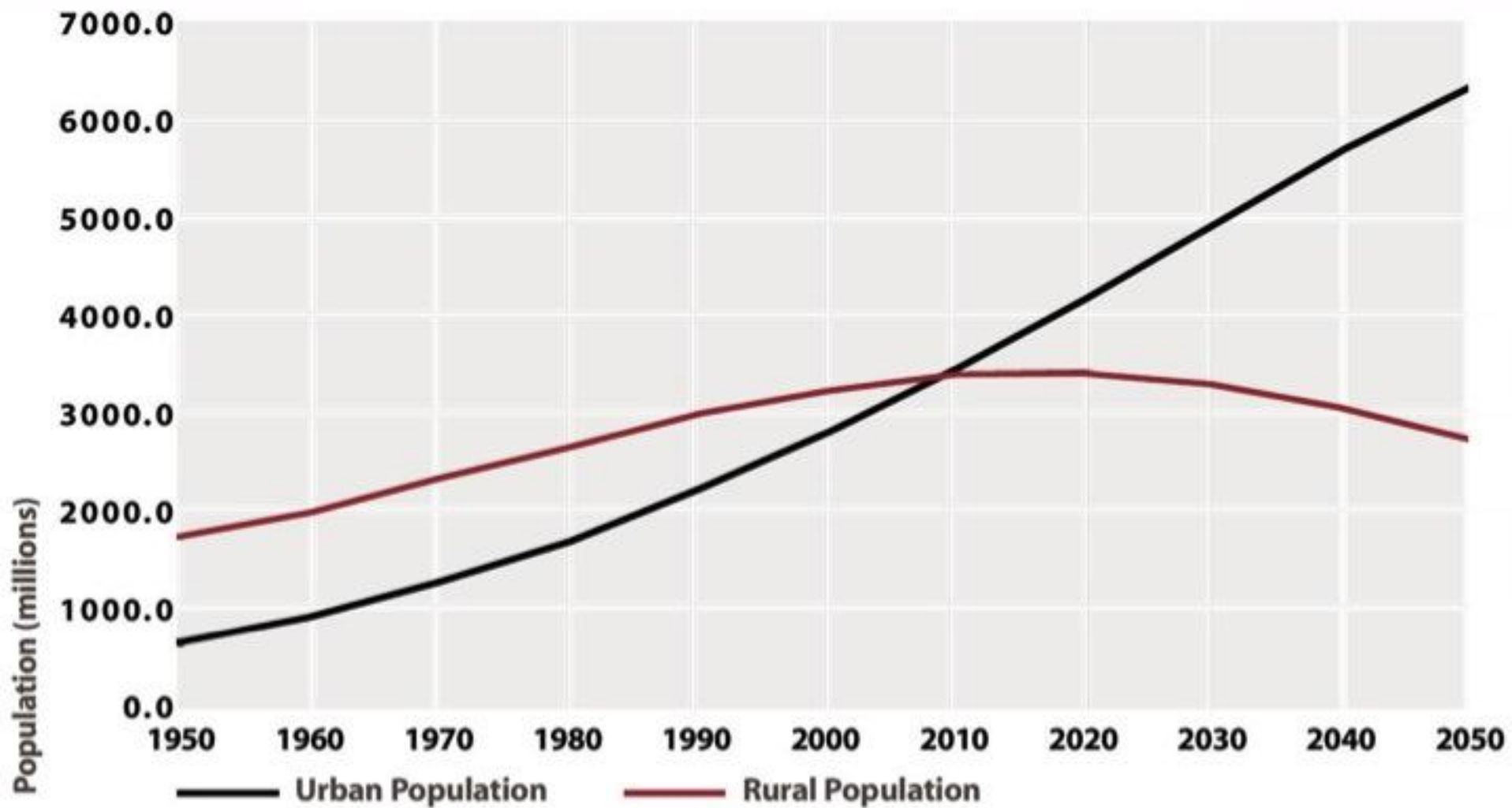
- Water
- Excessive slope
- Built-up area

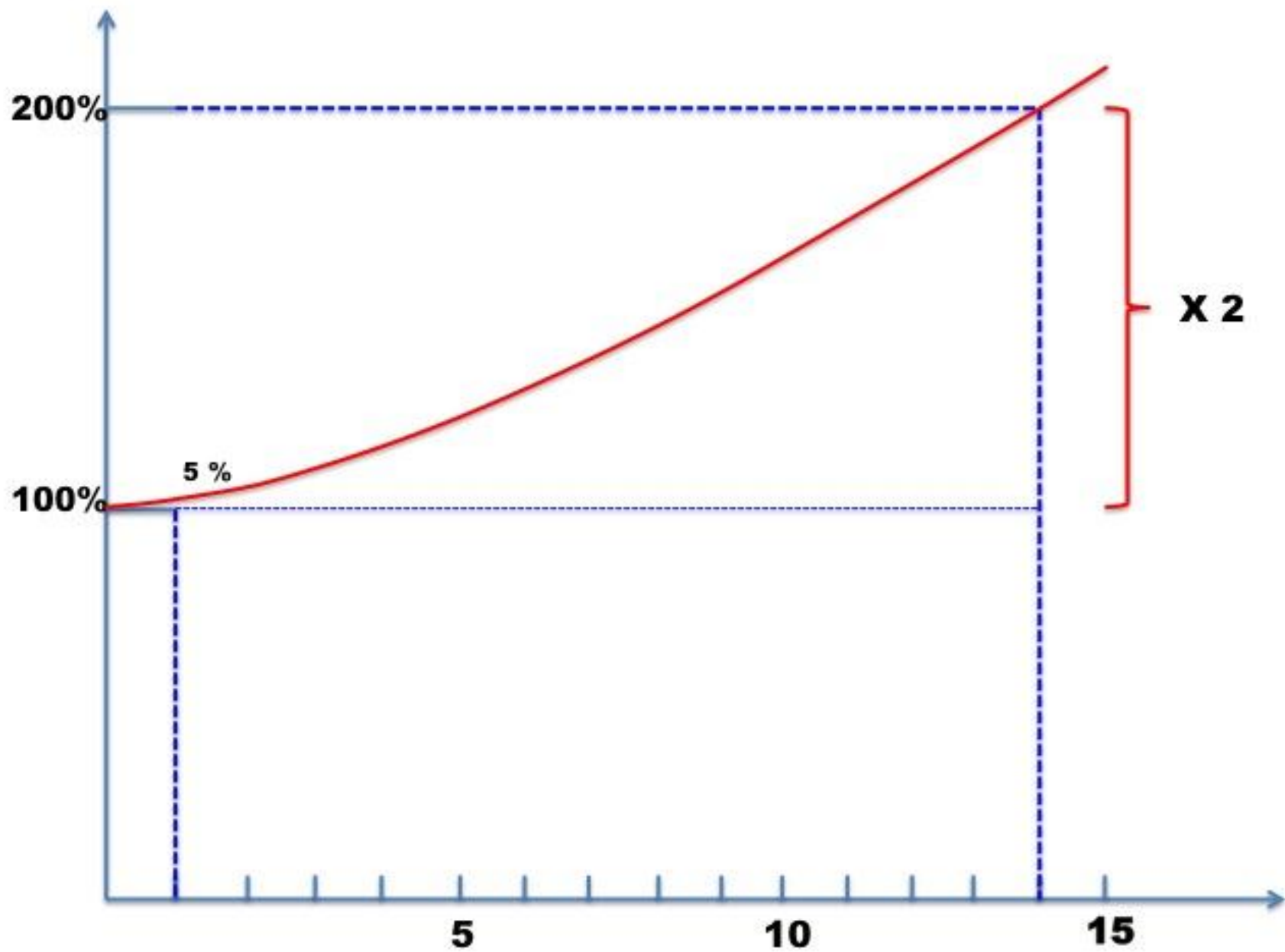


Measure	T <sub>1</sub>	T <sub>2</sub>	Annual
			% Change
Population	614,722	878,034	2.46%
Built-Up Area (sq km)	60.27	137.46	5.79%
Average Density (persons / sq km)	10,199.92	6,387.57	-3.14%
Built-Up Area per Person (sq m)	98.04	156.55	3.25%
Average Slope of Built-Up Area (%)	1.85	1.95	0.36%
Maximum Slope of Built-Up Area (%)	7.44	7.67	0.21%
The Buildable Perimeter (%)	0.95	0.99	0.26%
The Contiguity Index	0.84	0.95	0.83%
The Compactness Index	0.39	0.50	1.72%
Per Capita Gross Domestic Product	\$755.21	\$950.91	1.58%



Population urbaine et rurale dans le monde (1950 – 2050)







**Ville de New York**  
**Surface construite: 80 km<sup>2</sup>**  
**Devrais doubler tous les 14 ans**







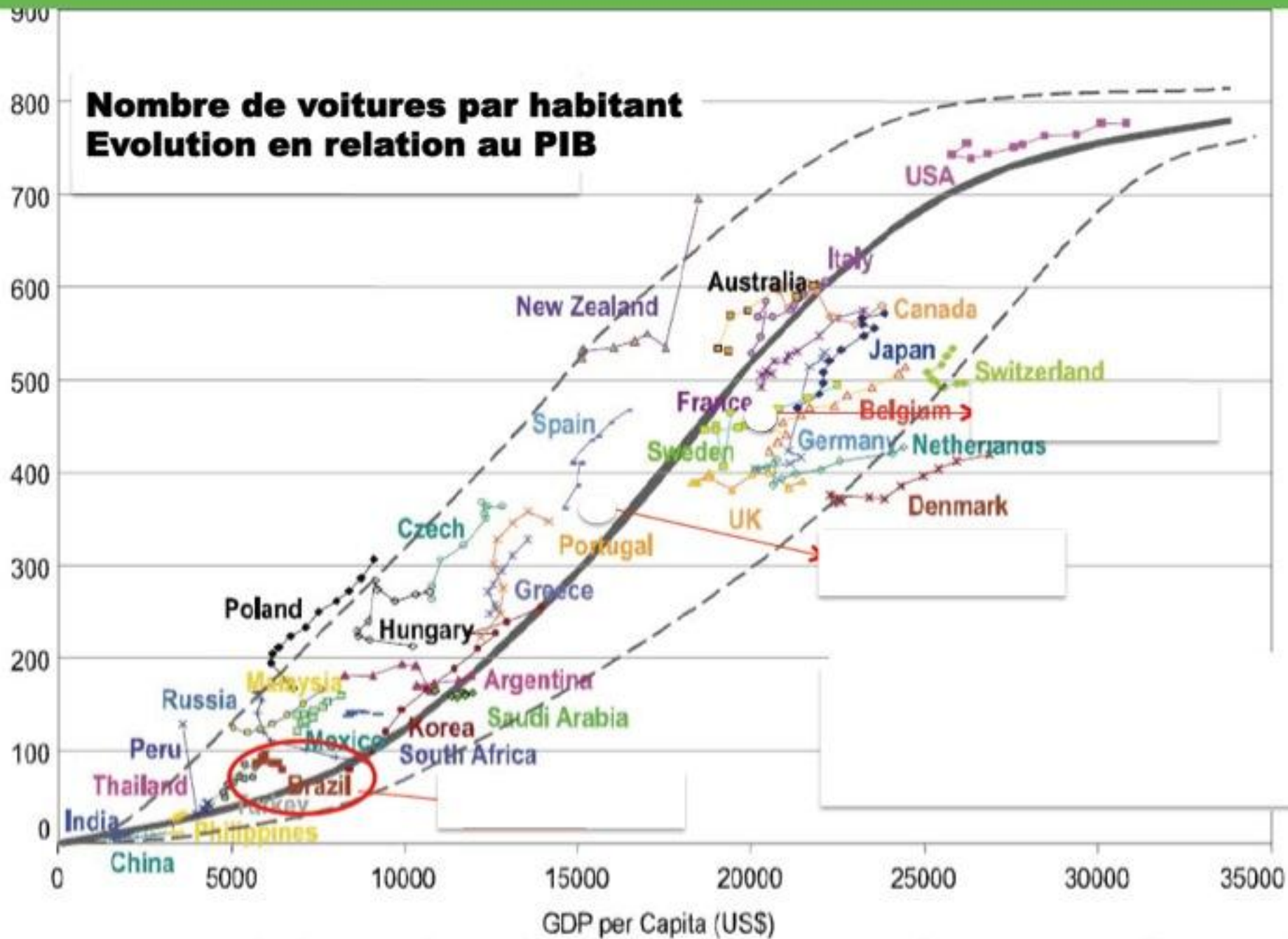
## NY City Built Area: 800 km<sup>2</sup>

800 km<sup>2</sup> en 10 ans =

21 Hectares par jour =

10 pattés de Manhattan par jour

# Nombre de voitures par habitant Evolution en relation au PIB







Dodowa

Neawam

Dawhwa

Ashiaman

Madina

Dome

Tema

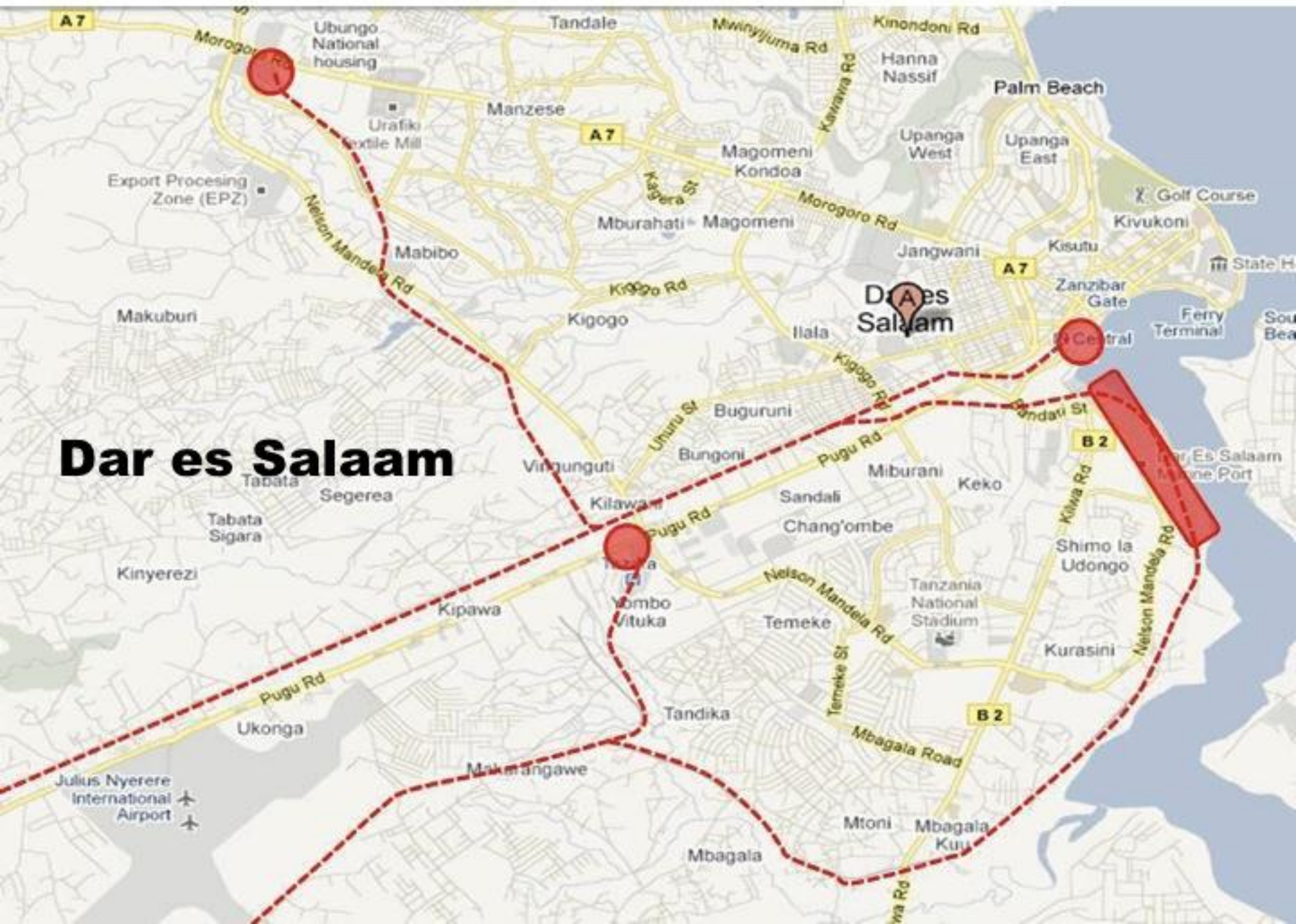
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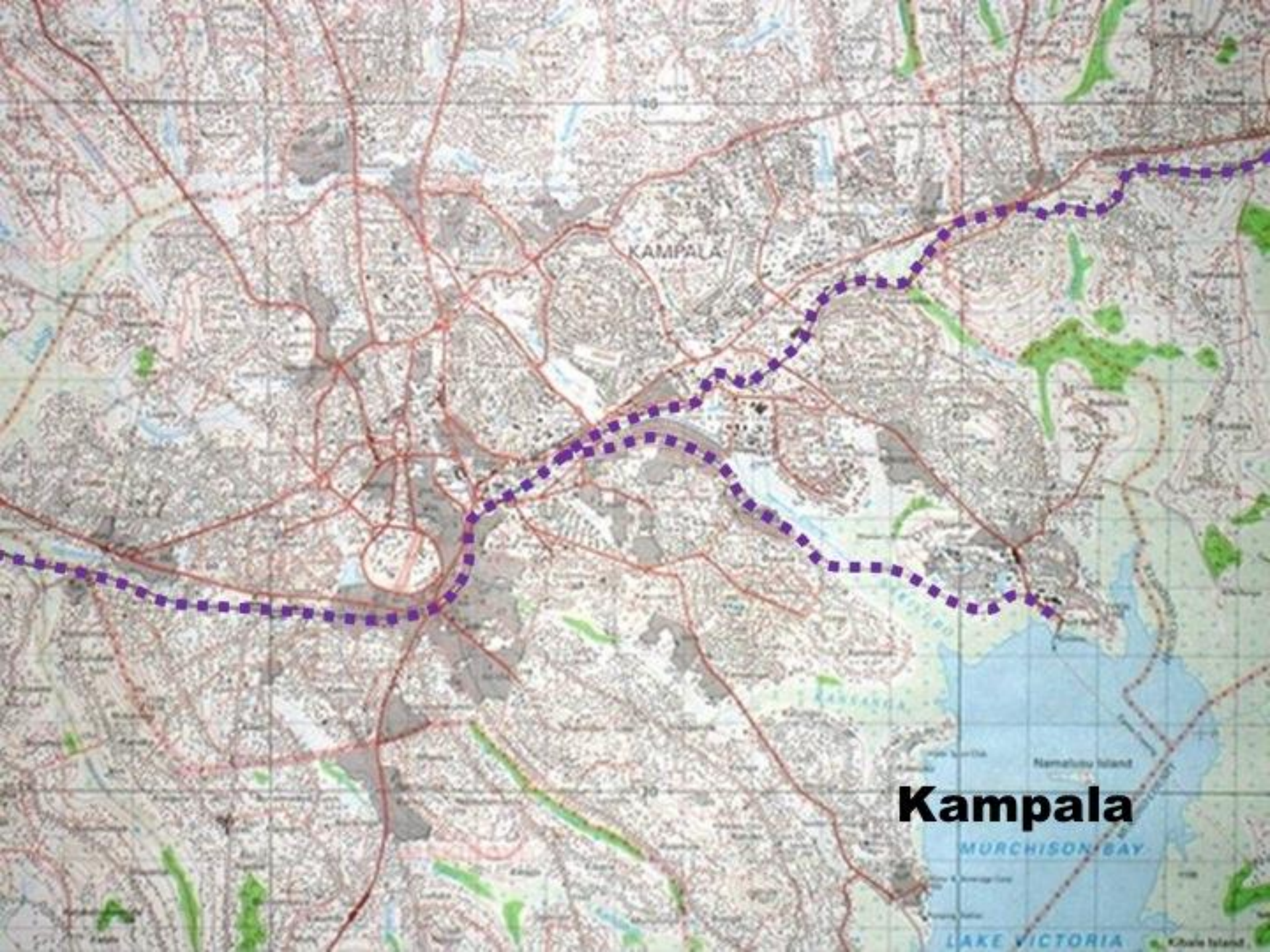
Accra



# Dar es Salaam







KAMPALA

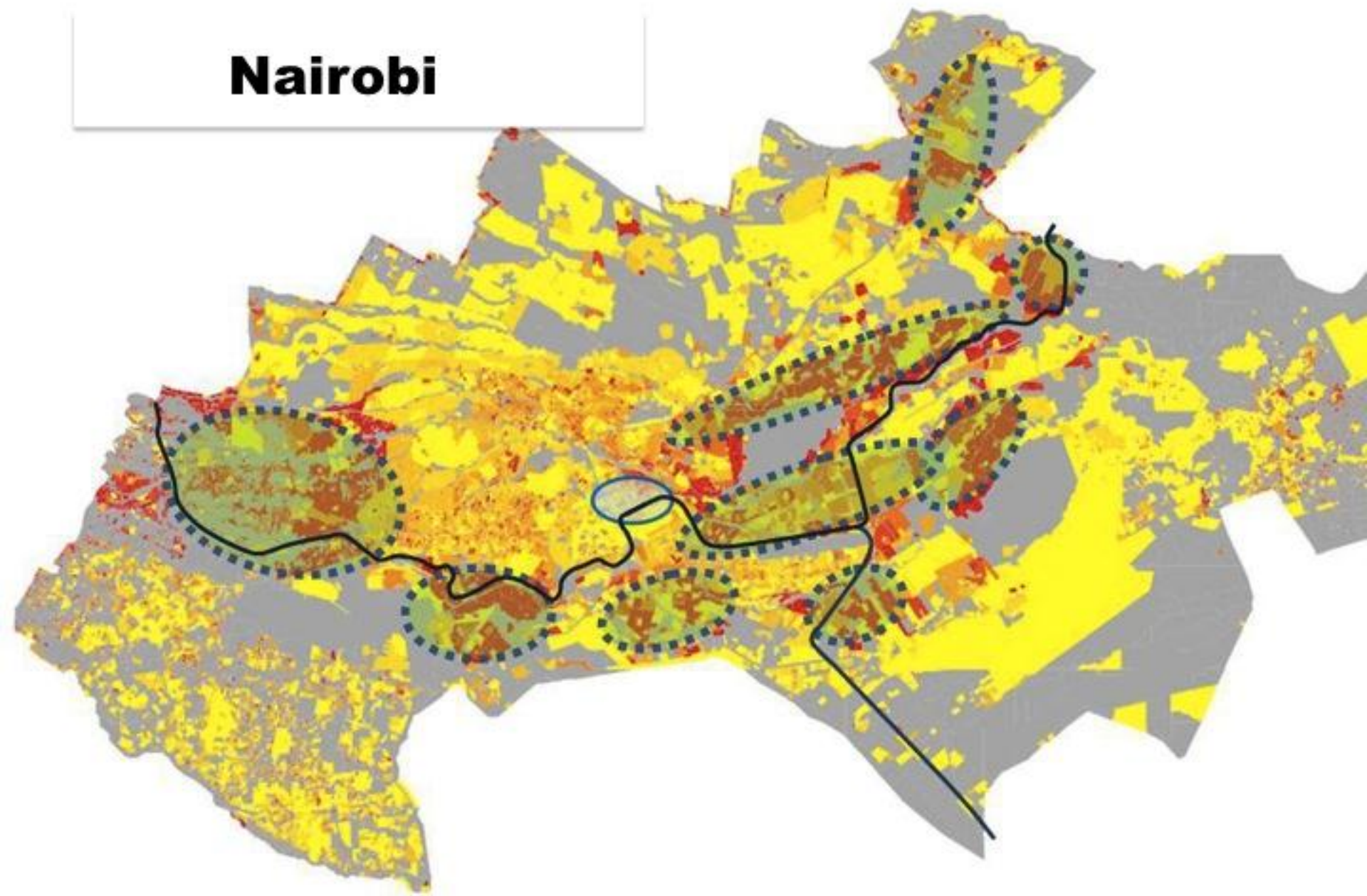
**Kampala**

MURCHISON BAY

LAKE VICTORIA



# Nairobi





# Addis Abeba

Kolfe Keranio

Lideta

Addis Ababa Golf Club

Cherros

Urael

Bole

Gofa Sefer

Nefassik Lafto

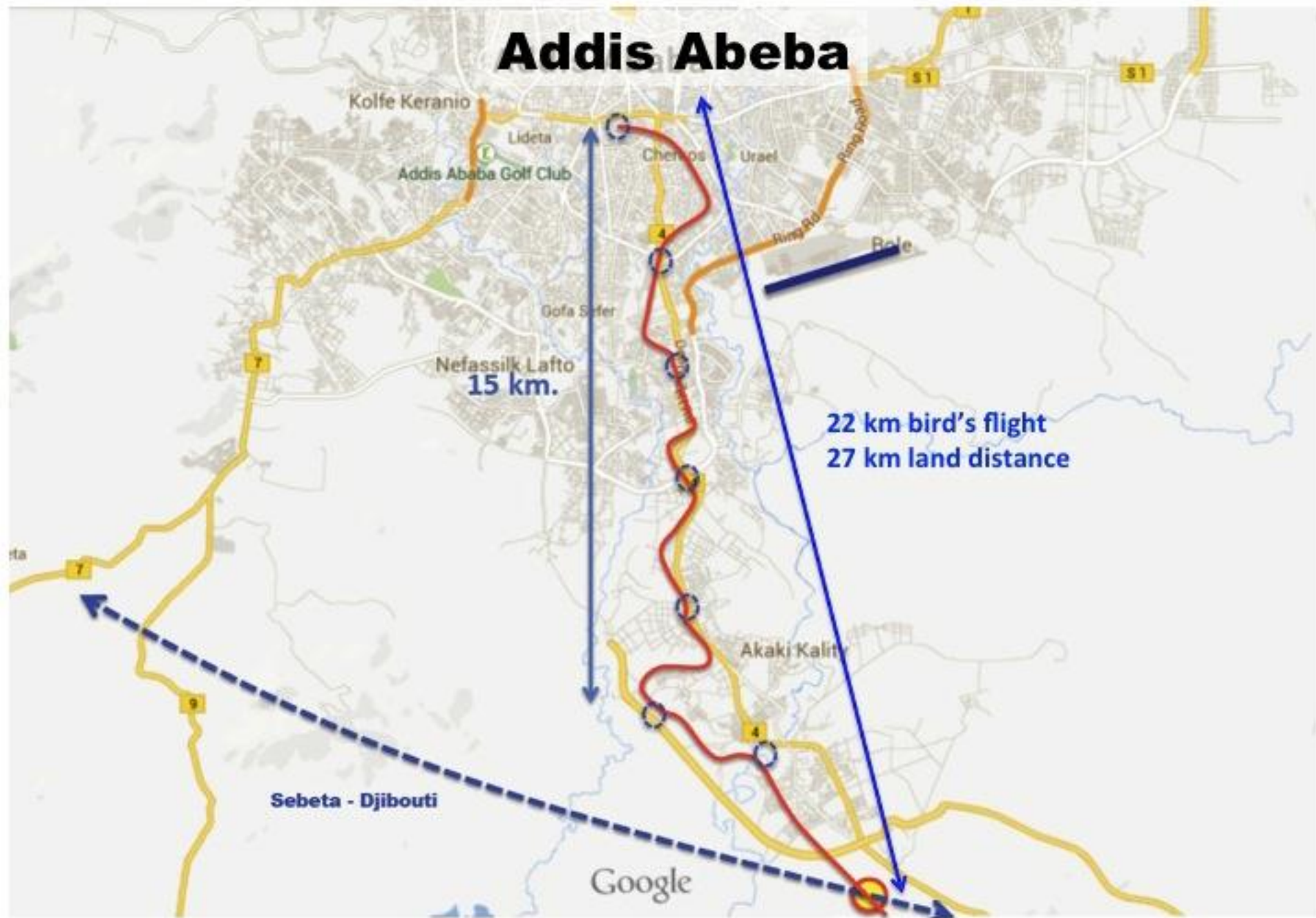
15 km.

22 km bird's flight  
27 km land distance

Akaki Kaliti

Sebeta - Djibouti

Google



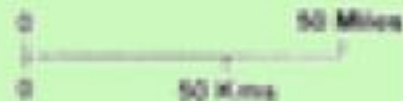


# Khartoum



- 1 Mano River Railway
- 2 Bong mine Railway
- 3 Lamco Railway

# Monrovia - Liberia



Robertsonport

Monrovia

Buchanan

1

2

3

Bambata

Lubmantung

Kome hills

Kaakla

Lanserville

San

Harveyville

Bong

Kaakla

Lanserville

San

Harveyville

Buchanan

Dibi

Gbarnga

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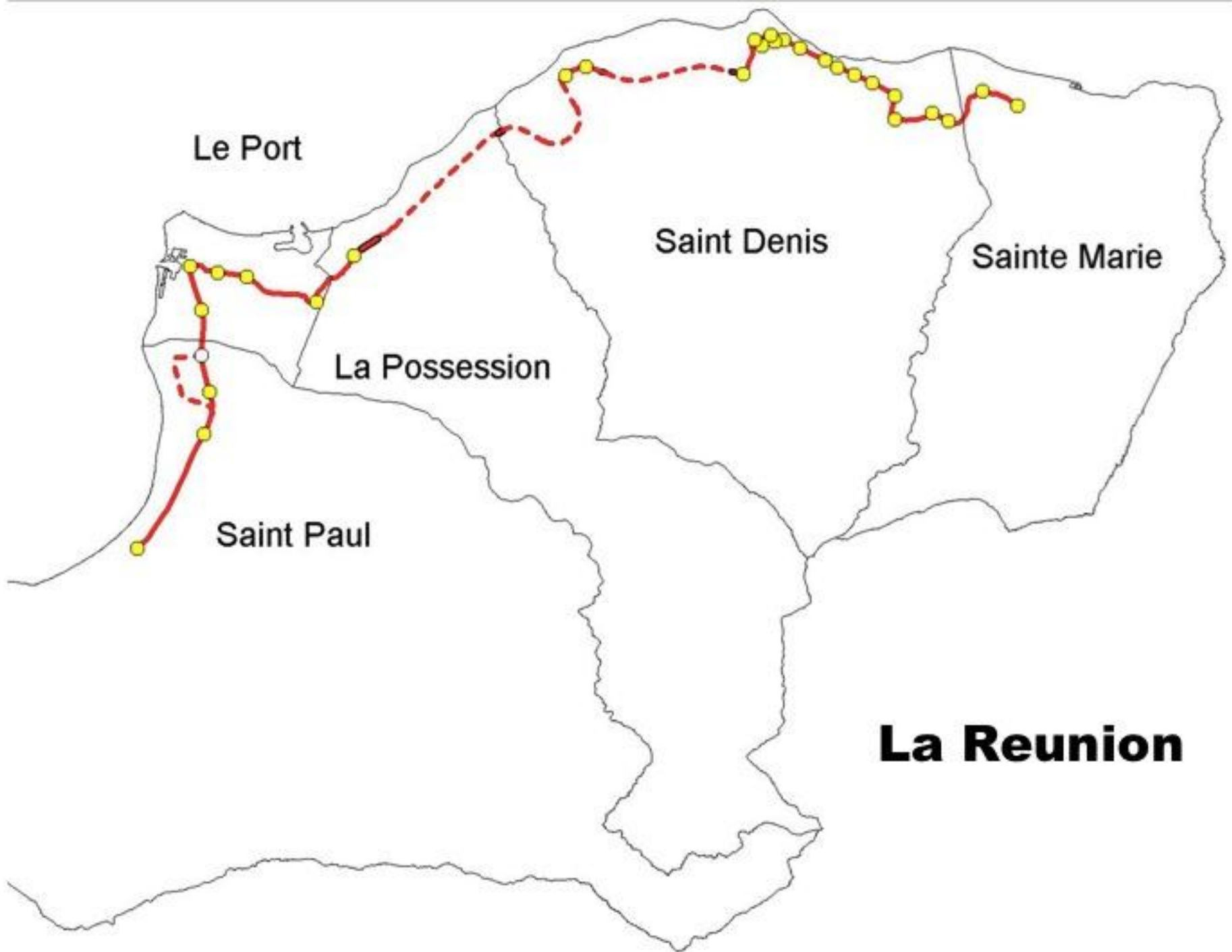
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Le Port

Saint Denis

Sainte Marie

La Possession

Saint Paul

**La Reunion**





Kigali Rwanda

Kigali

Kigali

Remera

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Image © 2012 GeoEye  
Image © 2012 DigitalGlobe

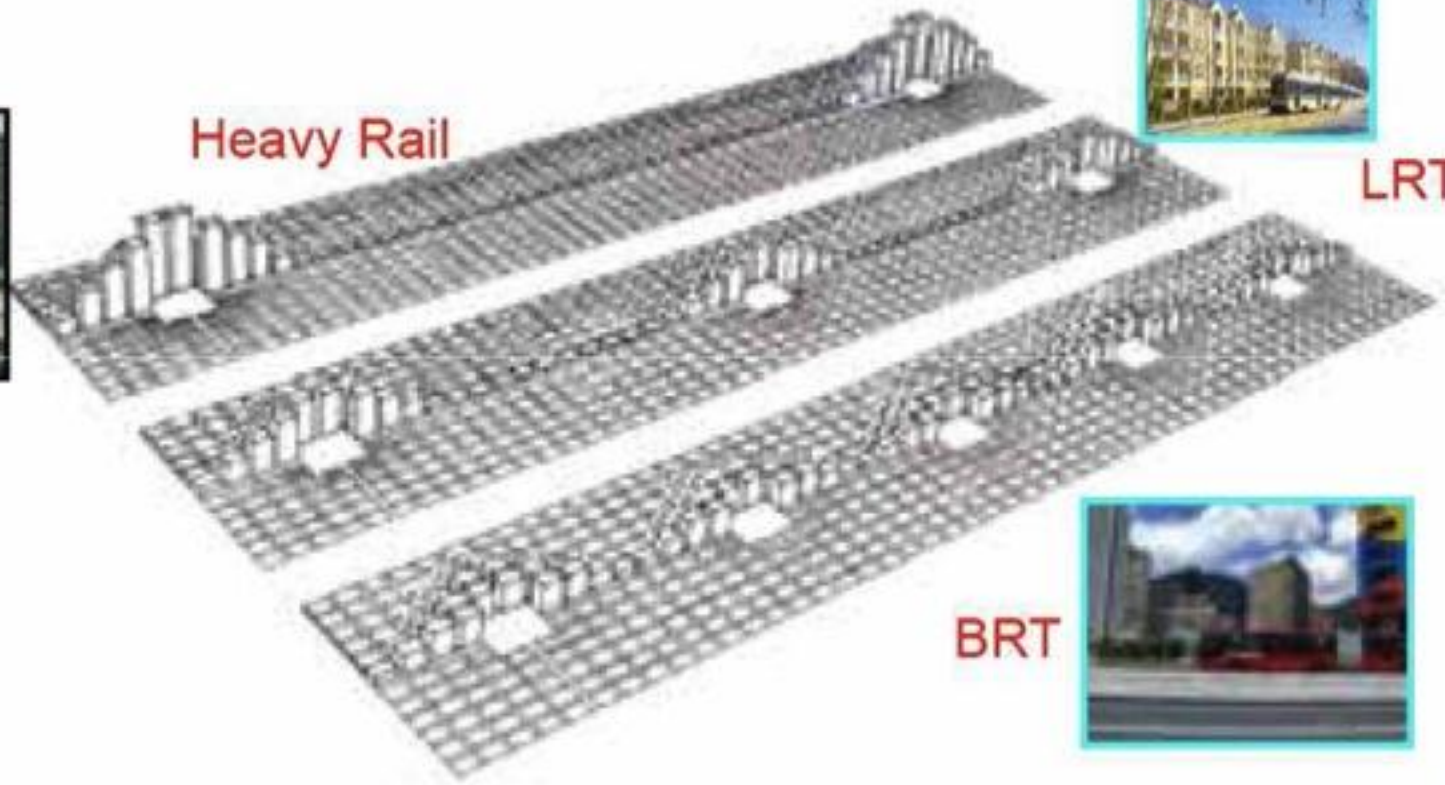
**Kigali**  
Google earth

Imagery Date: 3/10/2011

1°57'34.23" S 30°06'13.19" E elev. 4805 ft

Eye alt. 11.42 mi

# Relation entre mode de transport et structure urbaine



LRT



BRT



# Développement Urbain Equilibré: distribution d'usages

Train de Banlieue - Metro

Industrie lourde  
(train-route)

Réseaux de Voiries  
Primaires et secondaires

Noyau Historique

Expansion résidentielle

Infrastructures  
métropolitaines  
et services publics

Réseaux verts  
interstitiels compensés

Nouvelles habitations

Equipements sociaux

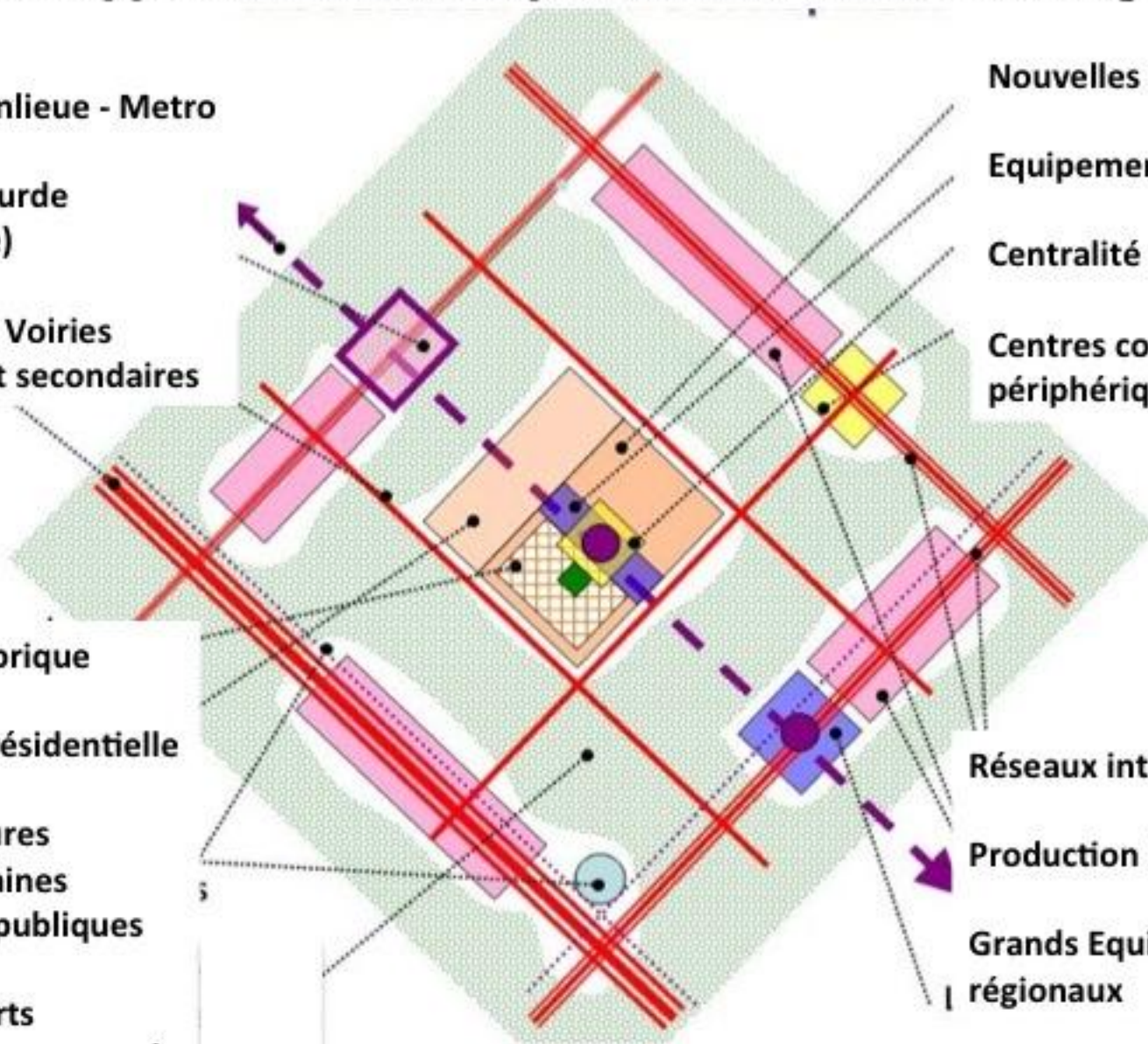
Centralité urbaine

Centres commerciaux  
périphériques

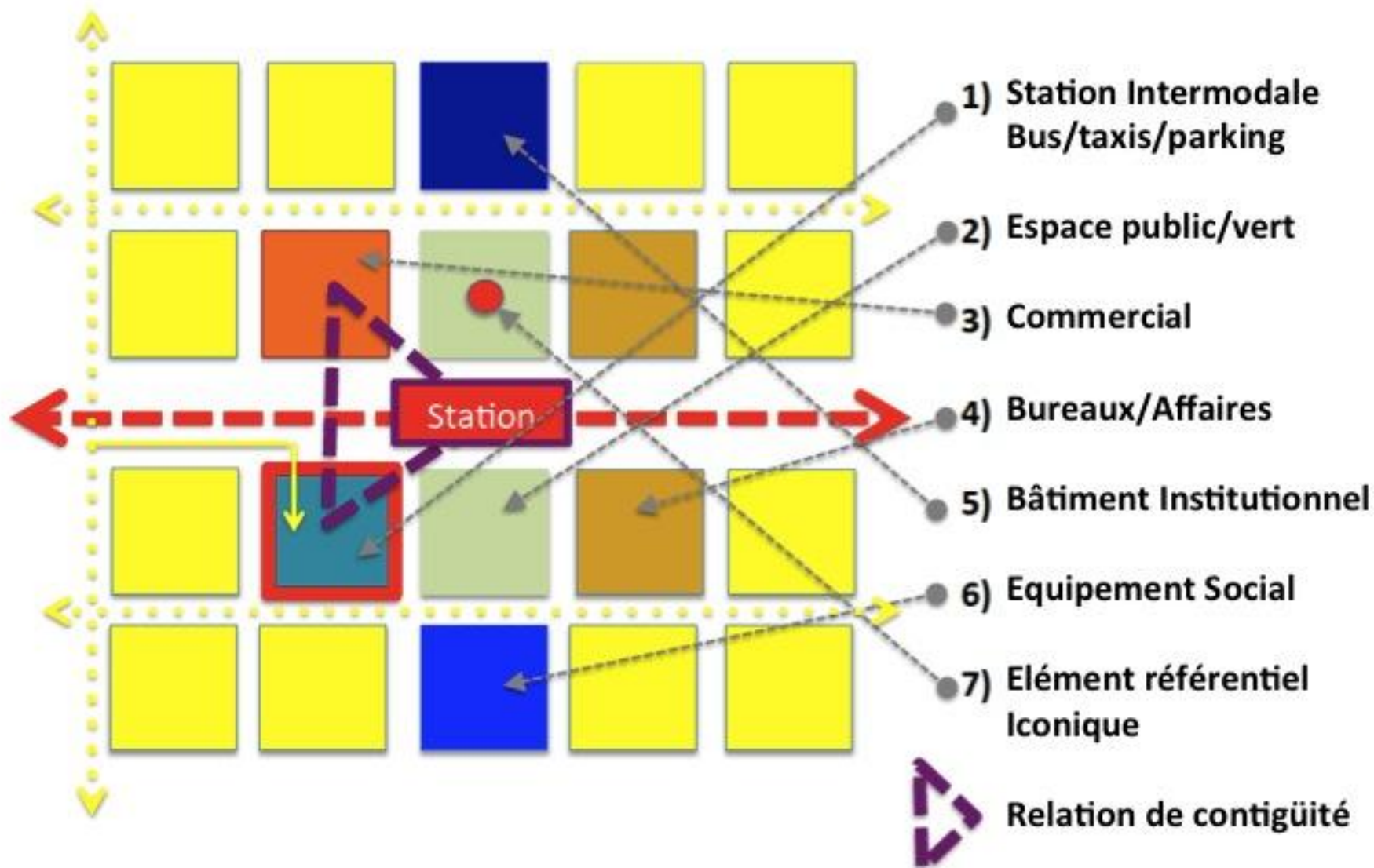
Réseaux interurbains

Production industrielle

Grands Equipements  
régionaux



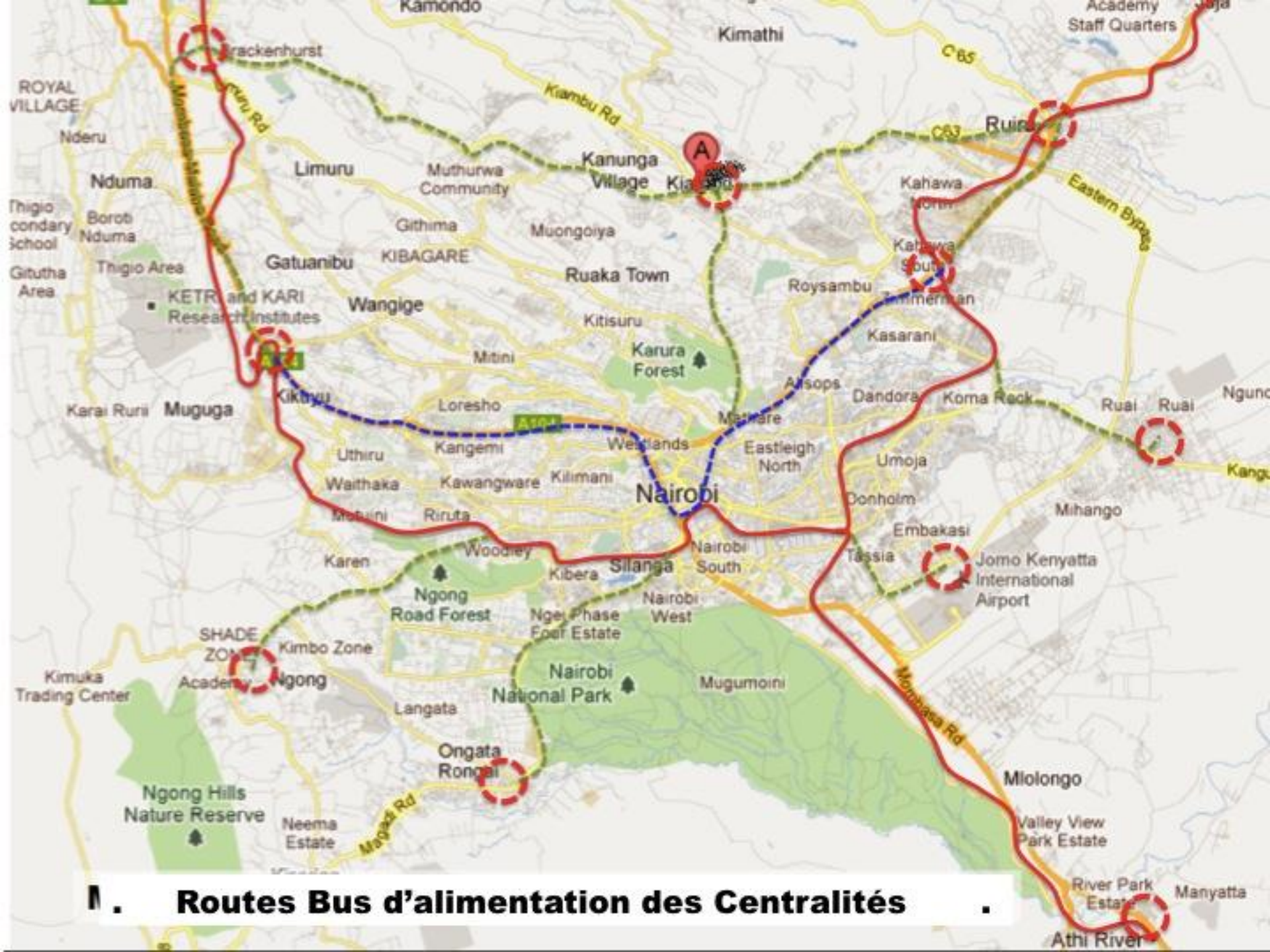
# Stéréotype de Centralité









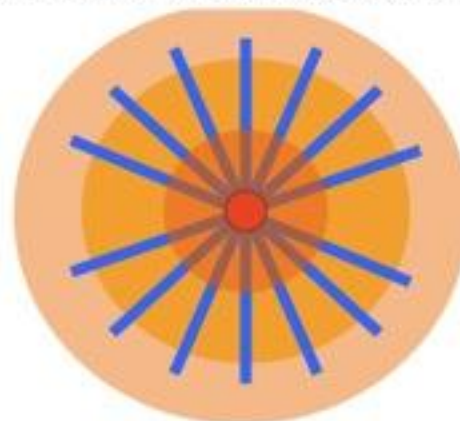


**1. Routes Bus d'alimentation des Centralités**



# Modèles Alternatifs: Radial/Central contre Linéaire/Réticulaire

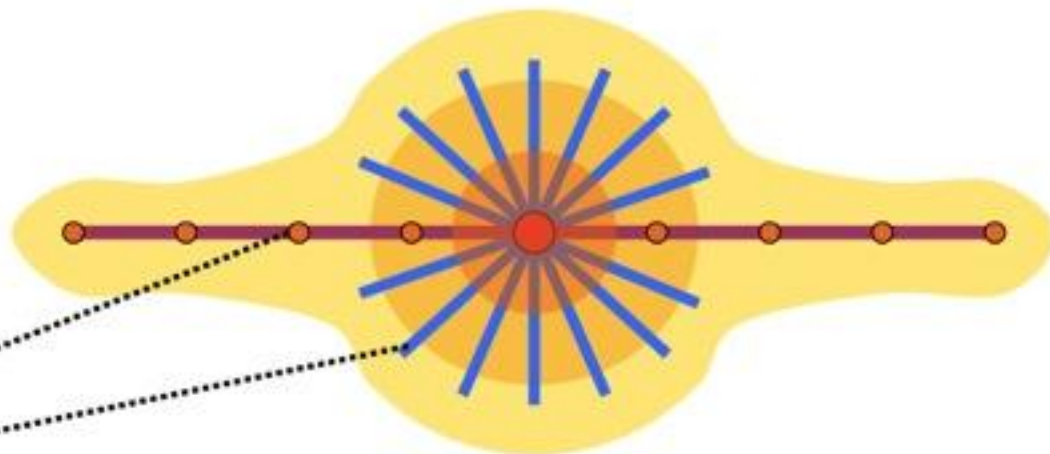
**Modèle congestif actuel de Nairobi**



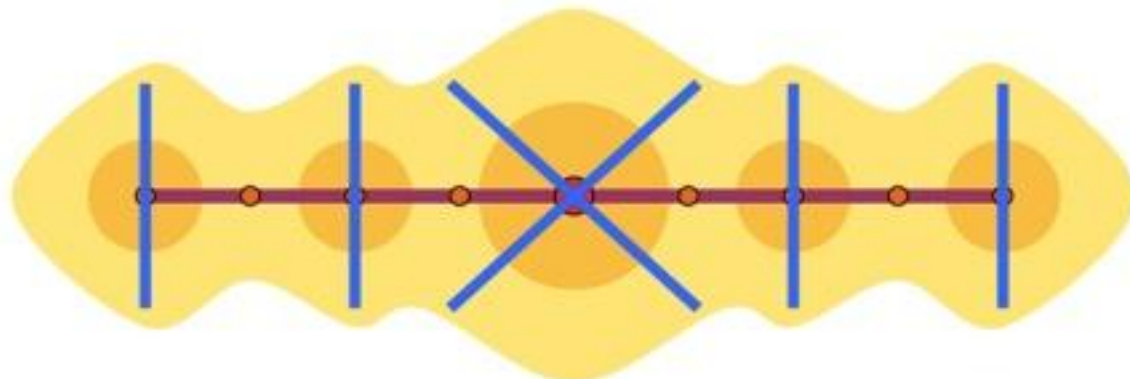
**Modèle Décongestif**

**Première Phase**

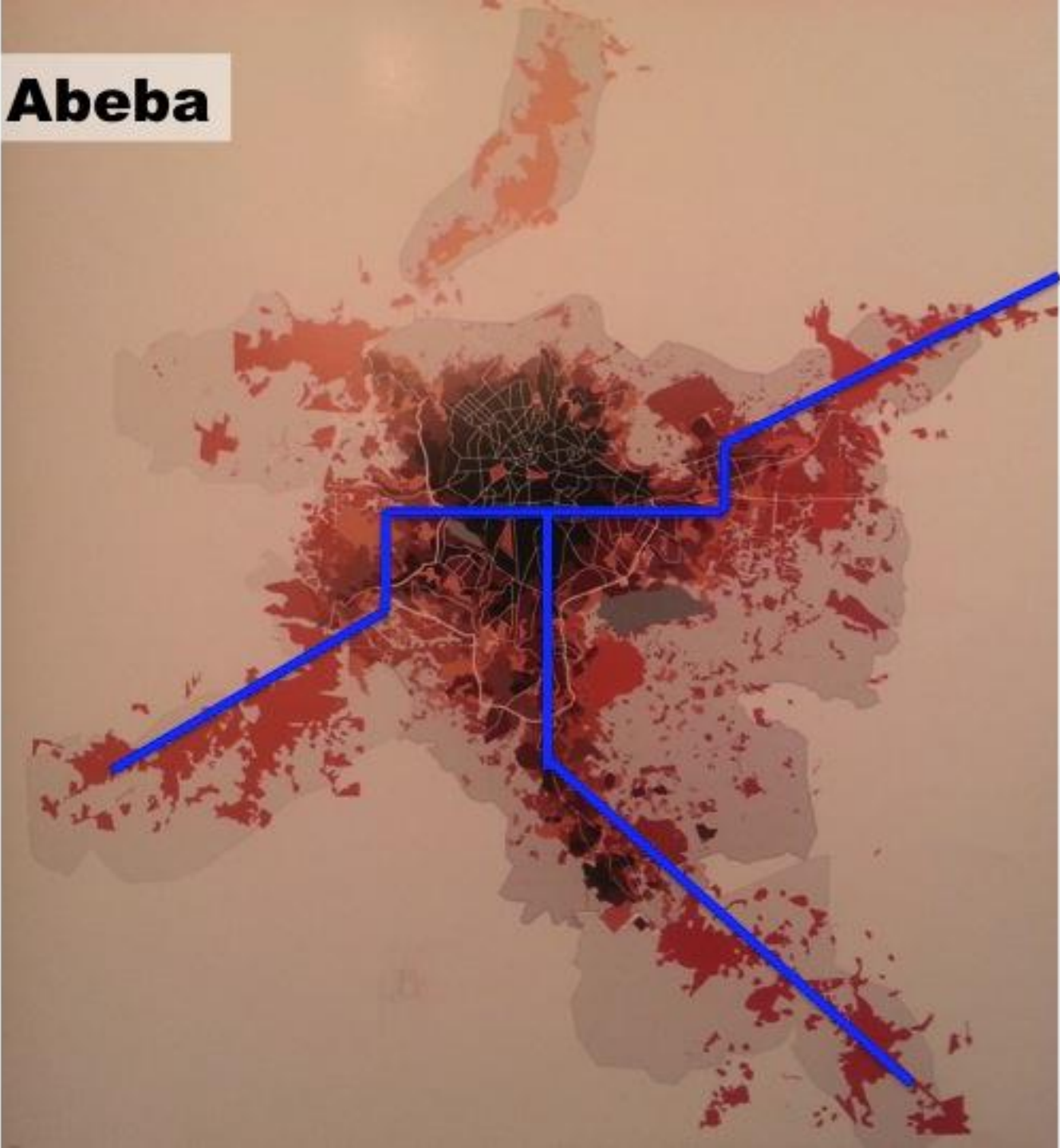
Train Banlieue  
Lignes BRT-LRT



**Deuxième Phase**

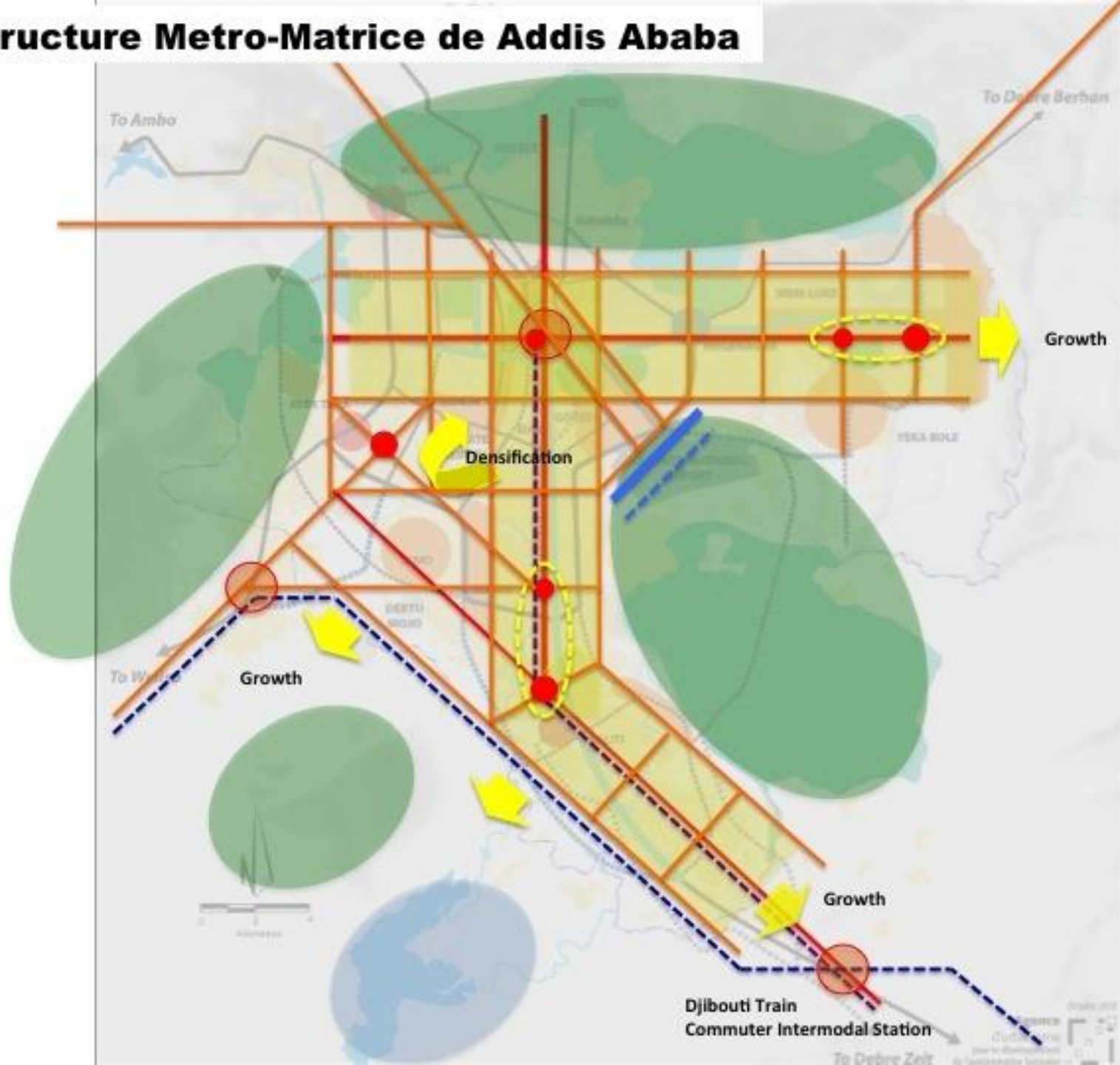


# Addis Abeba

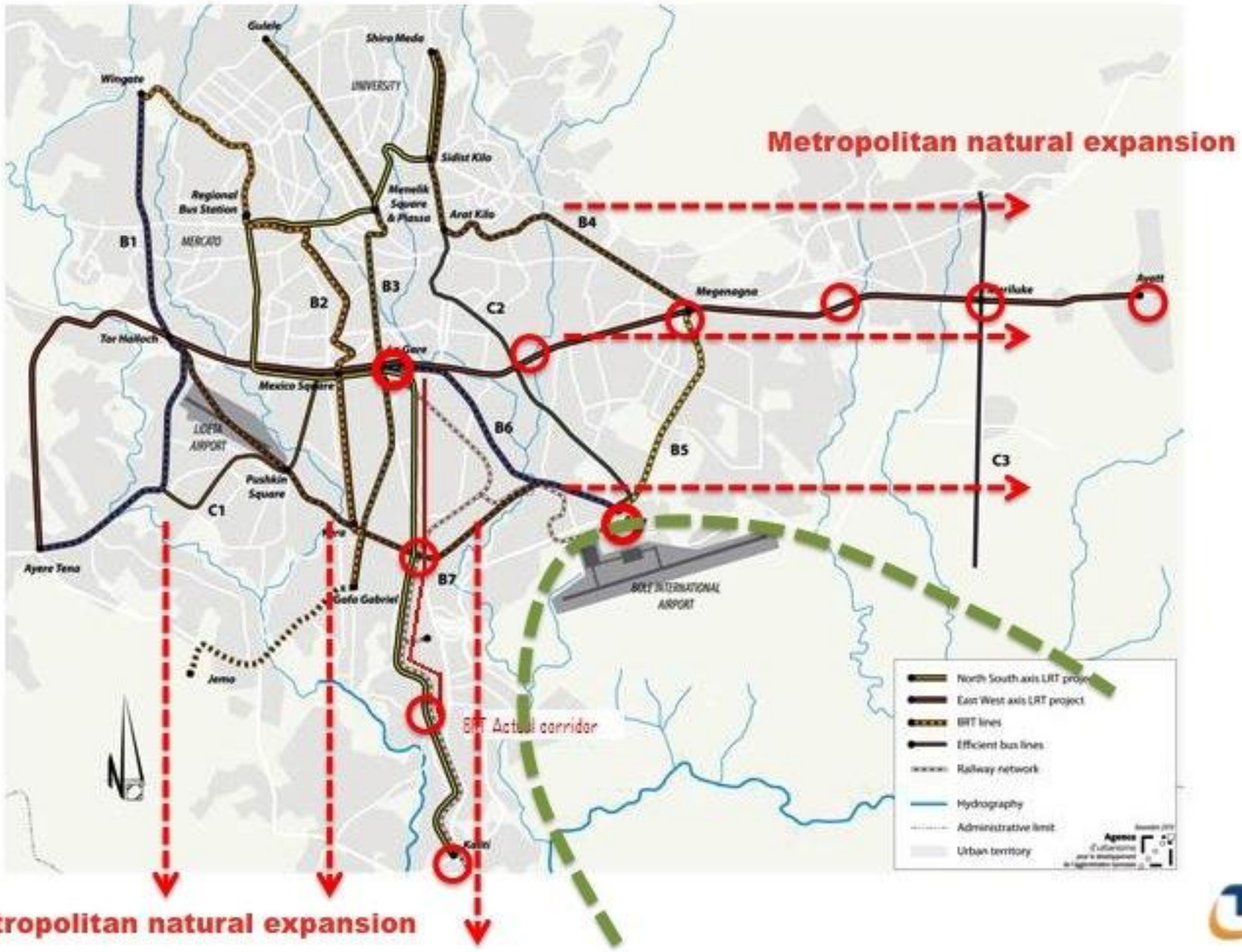




# Structure Metro-Matrice de Addis Ababa



# Plan des Transports publics de Addis Abeba

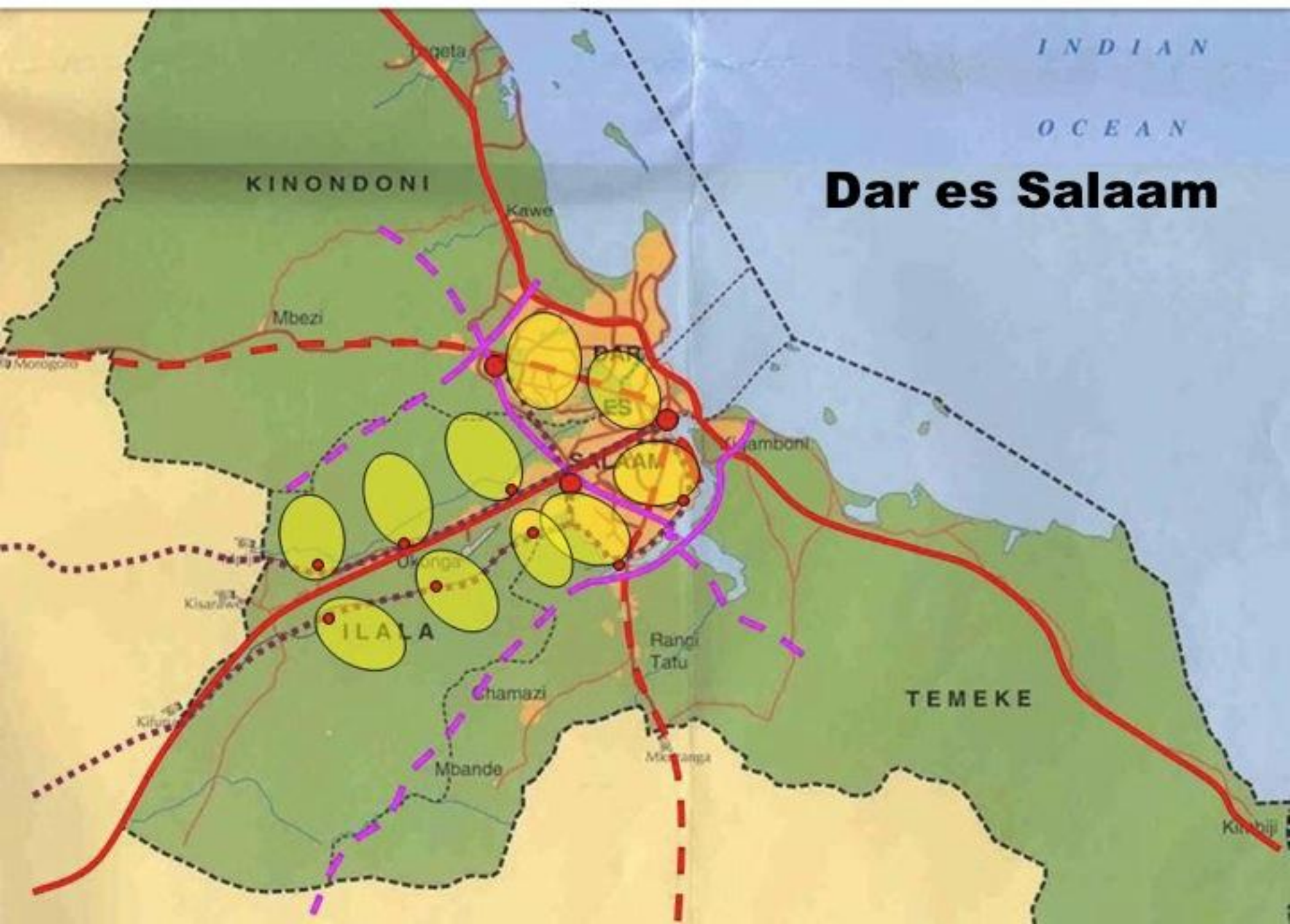




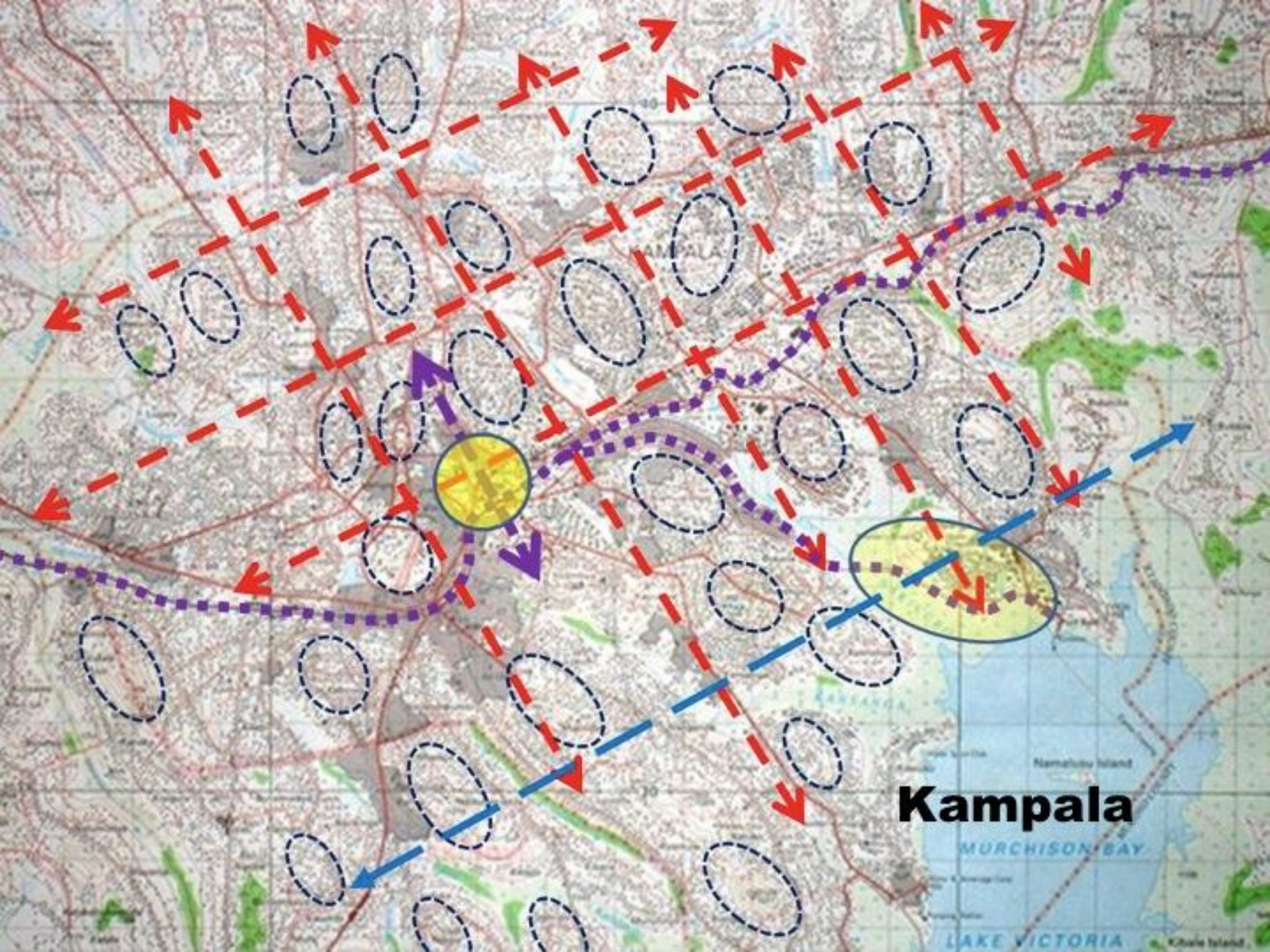


INDIAN  
OCEAN

# Dar es Salaam







**Kampala**

MURCHISON BAY

LAKE VICTORIA





Kigali, Rwanda

Kigali

Kigali

Remera

Nyanza Kibungo

# Kigali

© 2012 Google  
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Image © 2012 DigitalGlobe

Google earth

Imagery Date: 3/10/2011

1°57'34.23" S 30°06'13.19" E elev. 4805 ft

Eye Alt 11.42 mi





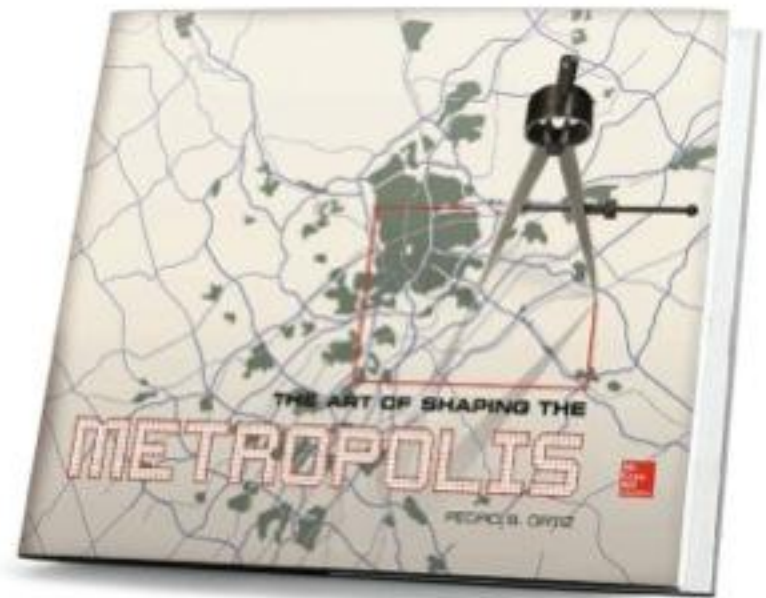
# Monrovia



# Dakar







**The Art of Shaping the Metropolis**  
(L'Art de Conformer les Métropoles)

**Pedro B. Ortiz**

**Amazon.com**

**Merci**