



Conférence UMI-CODATU XVII

Mobilité Intelligente, Inclusive et Durable

4 - 6 Novembre 2017, Hyderabad / India

**171104 Pedro B. Ortiz**

# **A NEW DIMENSION FOR MOBILITY: METROPOLISES**

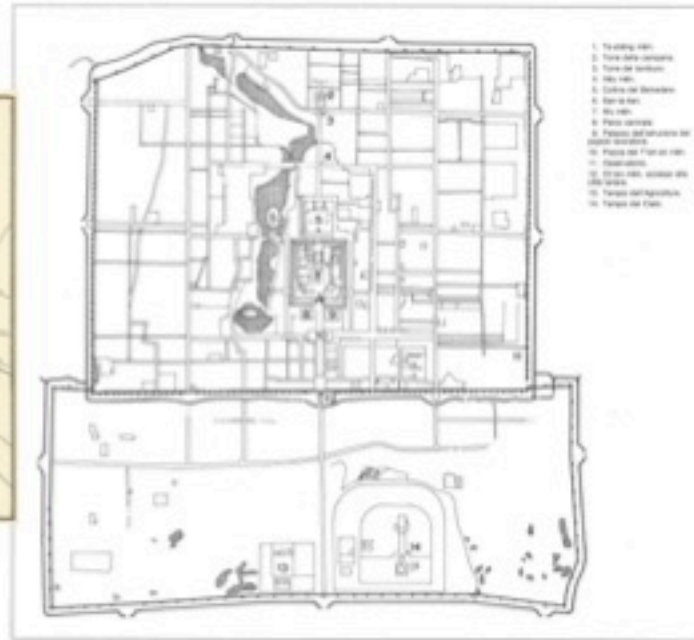
- 1) The metropolitan dimension**
- 2) Transport in the metropolitan dimension**
- 3) Bordeaux-Rennes-Lyon reticular approach**
- 4) Hyderabad metropolitan issues**

# 1) The New Metropolitan Dimension

Roma  
1m.



Beijing  
700.000



Londres  
600.000/1m.



# Cities of more than 750,000 people

1800

2025

Map

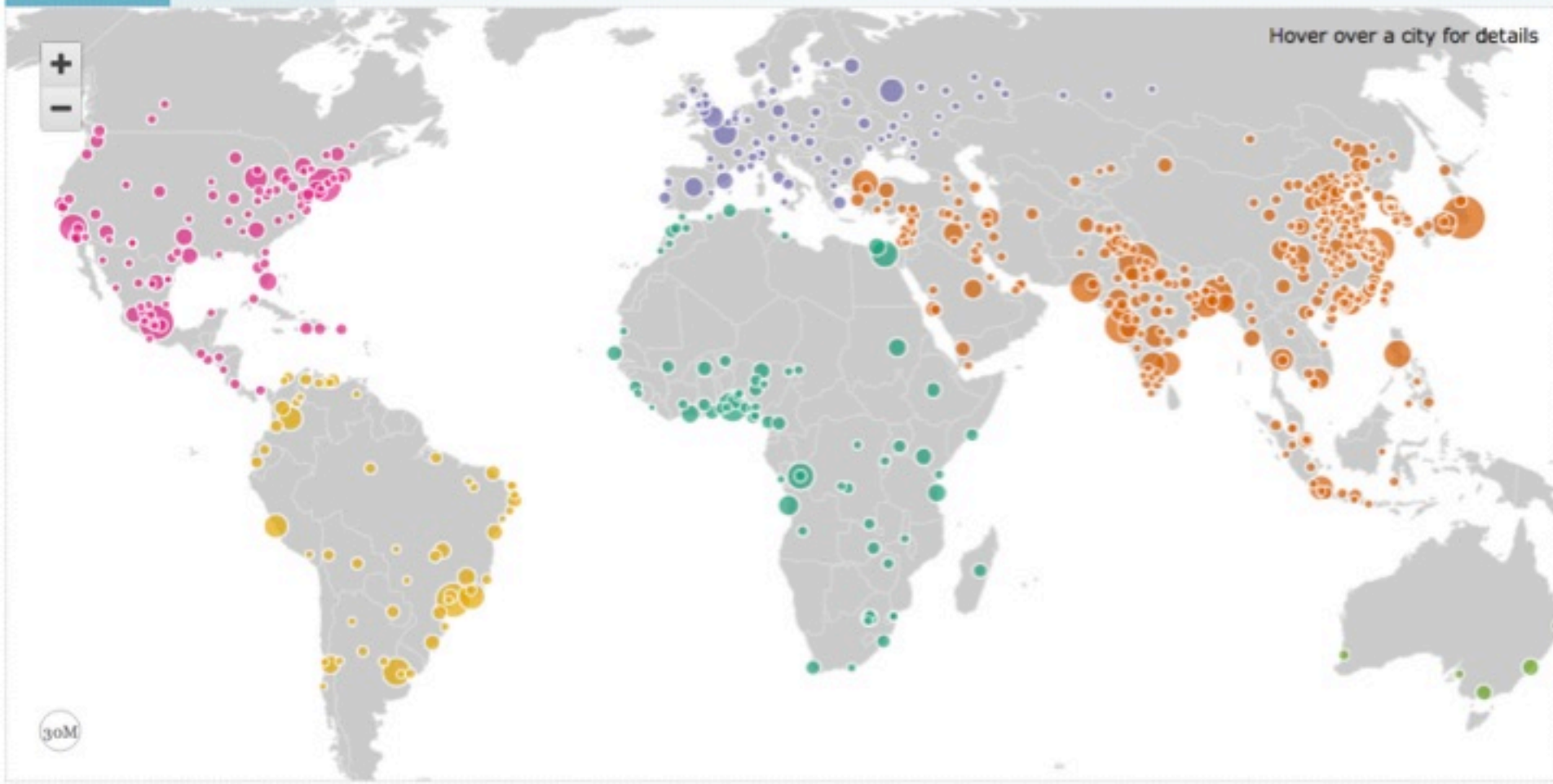
Grid

Info

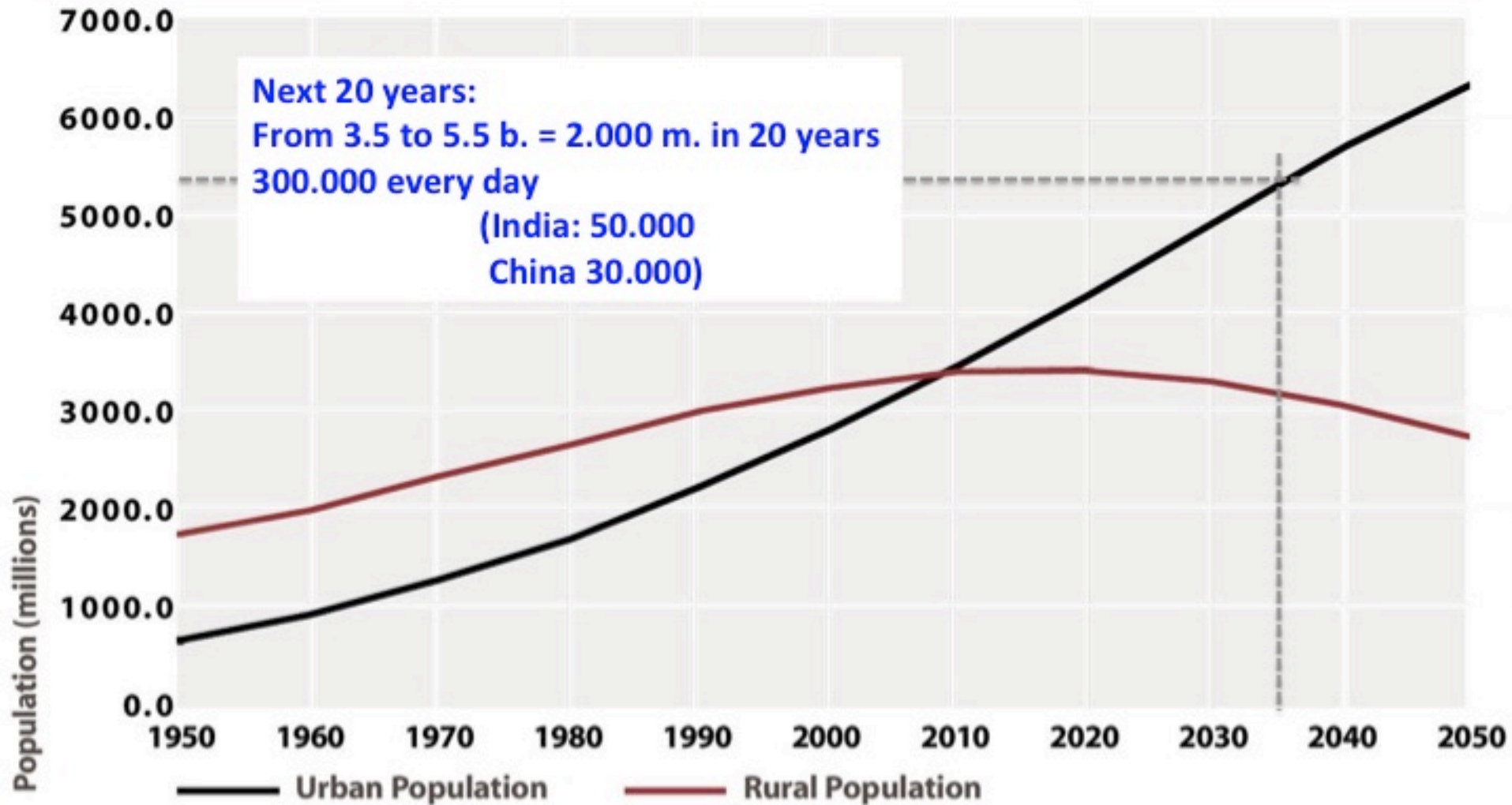
2025

?  
cities of  
750,000+

If the projected populations of cities prove accurate, by 2025 Tokyo will have 38 million inhabitants; Delhi will have 33 million and Shanghai, Mumbai, Mexico City, New York-Newark, São Paulo, Dhaka, Beijing and Karachi will have 20 million+. Africa is much more prominent in the scale and concentration of large cities and will have three mega-cities: Lagos, Al-Qahirah (Cairo) and Kinshasa.



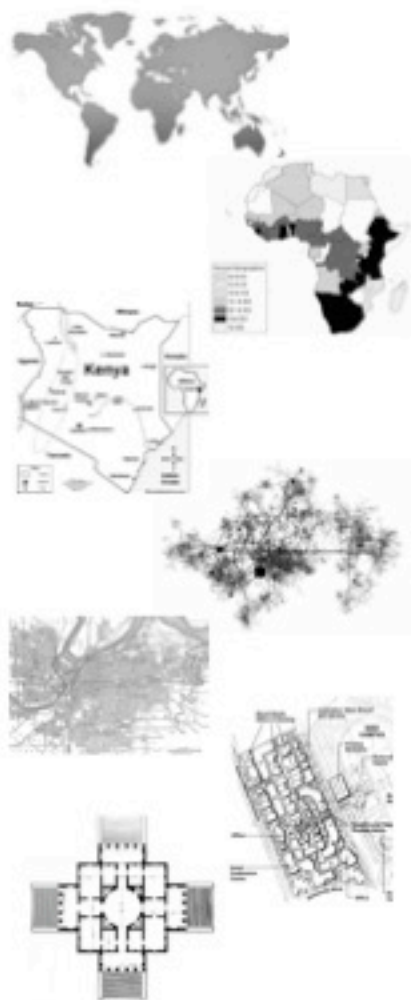
## URBAN AND RURAL POPULATION OF THE WORLD 1950 - 2050

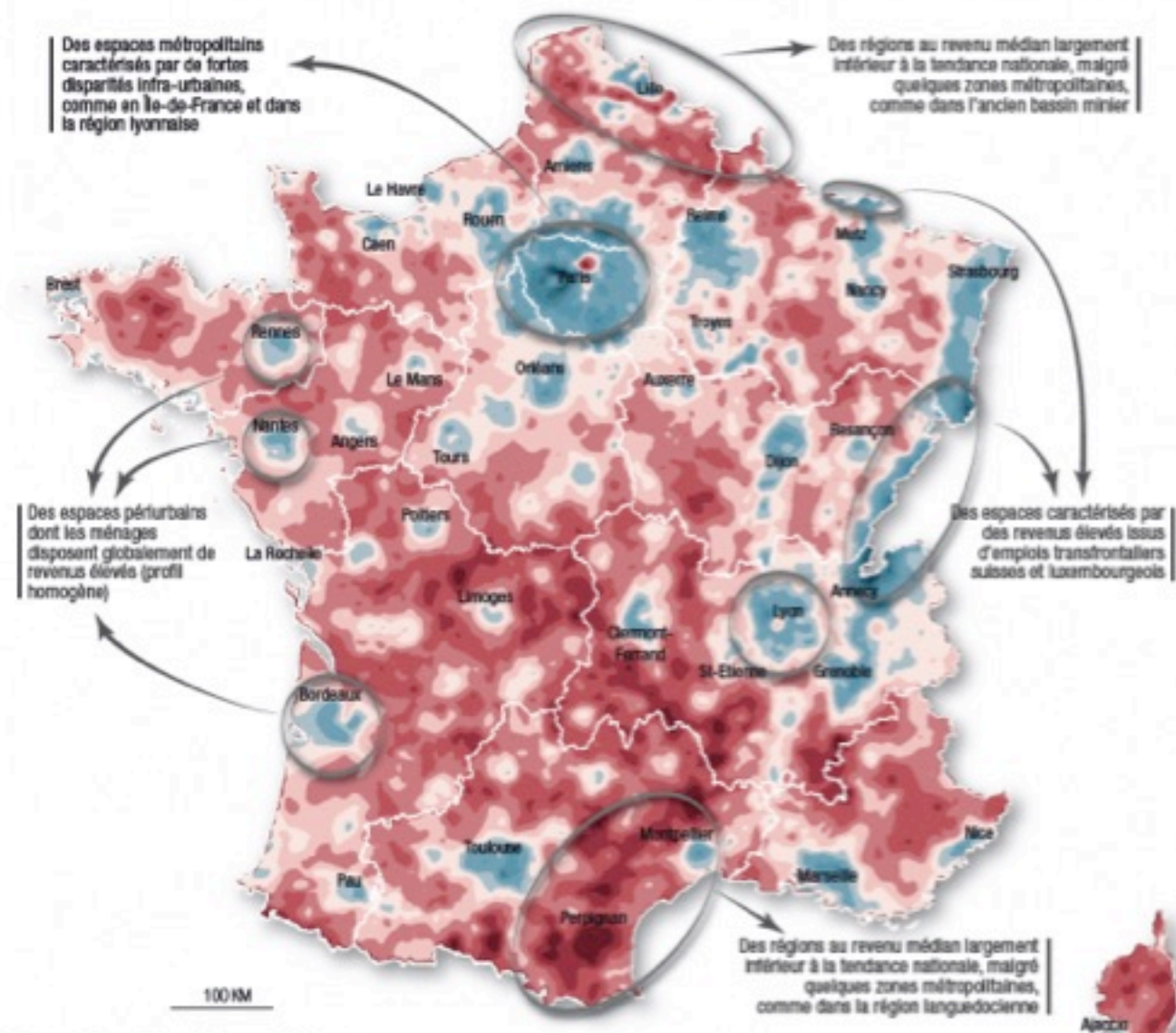


# Metropolitan Scale

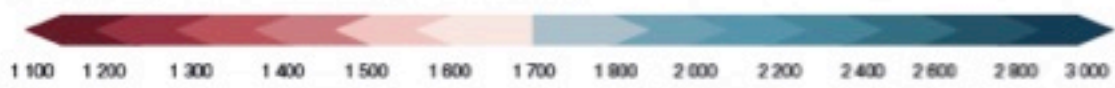
## Spatial Scales and Disciplinary approach

Scale	Discipline	Knowledge areas
1: 50.000.000	Geopolitics	UN. NATO. US. EU. IMF, OPEP,
1: 5.000.000	'Regional' (Continental) Politics	UN. OAS. WB. BID. ADB. AFDB.
1: 500.000	National Development	Politics, Economics, Sociology, Environment, Geography
1: 50.000	Metropolitan Planning	Economics, Sociology, Infrastructure, Environment, Utilities
1: 5.000	Urban Planning	Housing, Industrial, Services, Commerce, Transport, Environment
1: 500	Urban design	Space, Volume, Semiotics, Engineering,
1: 50	Architecture	Light, Space, Texture, Materials, Structure, Installations, Budget

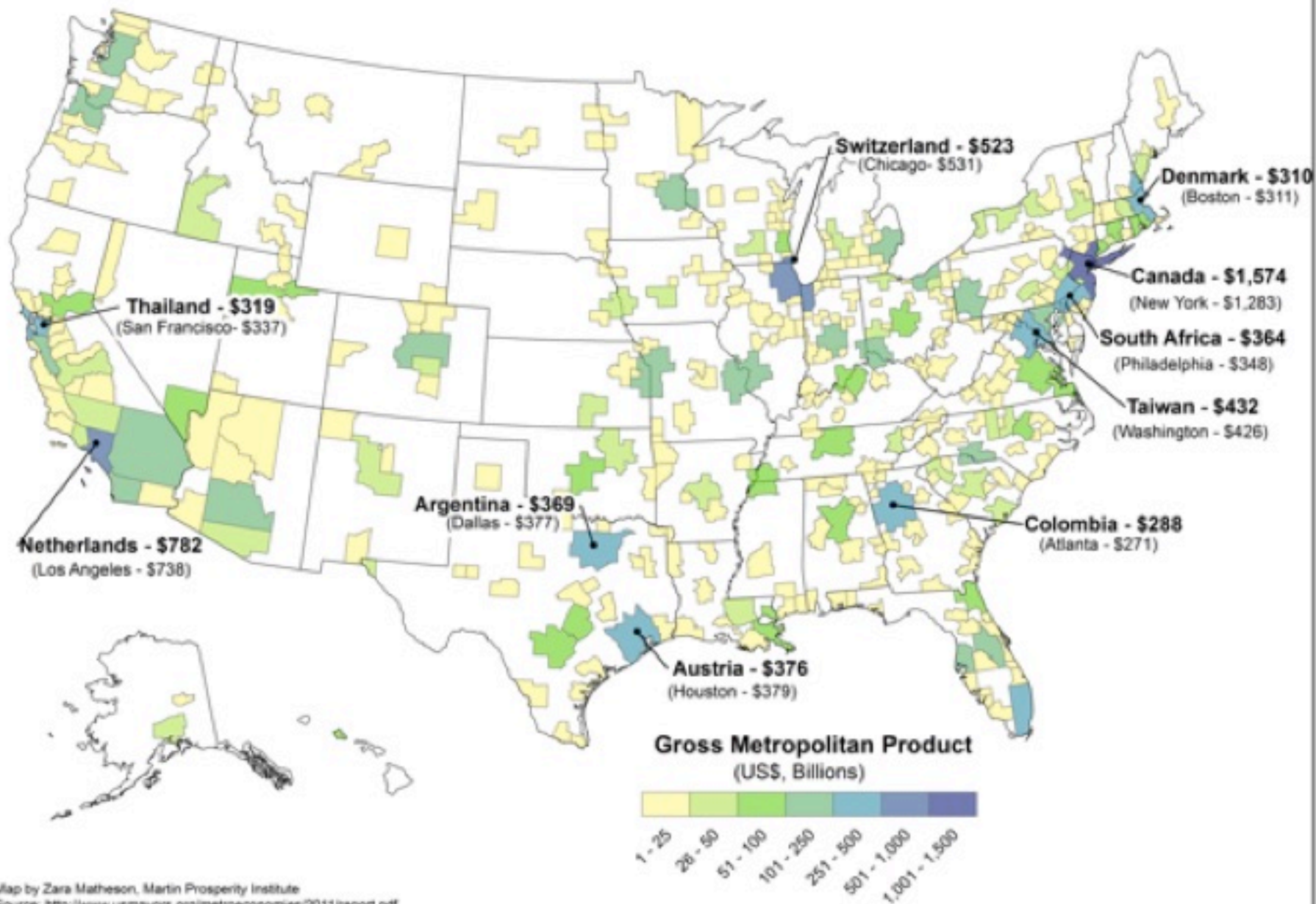




**Revenu disponible médian en 2013**  
 En euros, par mois, données communales lissées par méthode de krigeage



# Countries & US Metros: Nearest GDP Equivalents



# The United Metro/Nations

Among the top 100, 45 metros



	GDP in US Billions	(% of National (Σ = Sum of larger)			
<b>0 Europe (Confederation)</b>	<b>18495</b>		<b>34 Washington DC</b>	<b>\$ 433</b> (Σ 21%)	
1 United States	15094		<b>35 Houston</b>	<b>\$ 420</b> (Σ 24%)	<b>68 Shanghai China</b>
2 China	7298		<b>36 Osaka Japan</b>	<b>\$ 417</b> (Σ 33%)	69 Egypt
3 Japan	5869		37 Austria	417	70 Philippines
4 Germany	3569		38 South Africa	408	<b>71 Frankfurt Germany</b>
5 France	2774		<b>39 Dallas-F. Worth USA</b>	<b>\$ 401</b> (Σ 27%)	72 Ireland
6 Brazil	2476		<b>40 Mexico City Mexico</b>	<b>\$ 390</b> (33%)	73 Algeria
7 United Kingdom	2416		<b>41 Sao Paulo Brazil</b>	<b>\$ 390</b> (15%)	74 Czech Republic
8 Italy	2198		<b>42 Philadelphia USA</b>	<b>\$ 388</b> (Σ 30%)	<b>75 Sydney Australia</b>
<b>9 India</b>	<b>1897</b>		43 United Arab Emirates	371	<b>76 Mumbai India</b>
10 Russia	1857		<b>44 Boston USA</b>	<b>\$ 363</b> (Σ 32%)	77 Pakistan
11 Canada	1739		<b>45 Buenos Aires Argentina</b>	<b>\$ 362</b> (80%)	<b>78 Rio de Janeiro Brazil</b>
12 Spain	1492		46 Thailand	345	<b>79 Phoenix USA</b>
13 Australia	1483		47 Denmark	333	80 Iraq?
<b>14 Tokyo Japan</b>	<b>\$ 1479</b> (25%)		48 Colombia	333	<b>81 Minneapolis USA</b>
<b>15 New York USA</b>	<b>\$ 1406</b> (10%)		<b>49 Moscow Russia</b>	<b>\$ 321</b> (17%)	<b>82 San Diego USA</b>
16 Mexico	1154		<b>50 Hong Kong Hong Kong</b>	<b>\$ 320</b> (100%)	83 Romania
17 South Korea	1116		51 Venezuela	317	84 Kazakhstan
18 Indonesia	846		<b>52 Madrid Spain</b>	<b>\$ 308</b> (20%)	<b>85 Istanbul Turkey</b>
19 Netherlands	837		<b>53 Atlanta USA</b>	<b>\$ 304</b> (Σ 34%)	<b>86 Barcelona Spain</b>
<b>20 Los Angeles USA</b>	<b>\$ 792</b> (Σ 15%)		<b>54 San Francisco USA</b>	<b>\$ 301</b> (Σ 36%)	87 Peru
21 Turkey	773		55 Greece	299	<b>88 Melbourne (Australia)</b>
22 Switzerland	637		<b>56 Miami USA</b>	<b>\$ 292</b> (Σ 38%)	89 Qatar
23 Saudi Arabia	576		<b>57 Seoul South Korea</b>	<b>\$ 291</b> (26%)	<b>90 New Delhi India</b>
<b>24 Chicago USA</b>	<b>\$ 574</b> (Σ 18%)		58 Malaysia	278	<b>91 Beijing China</b>
<b>25 London UK</b>	<b>\$ 565</b> (23%)		59 Nigeria	272	<b>92 Denver USA</b>
<b>26 Paris France</b>	<b>\$ 564</b> (20%)		60 Finland	266	93 Ukraine
27 Sweden	537		<b>61 Singapore</b>	<b>\$ 259</b> (100%)	94 New Zealand
28 Poland	514		<b>62 Toronto Canada</b>	<b>\$ 253</b> (15%)	95 Kuwait
29 Belgium	512		<b>63 Detroit USA</b>	<b>\$ 253</b> (Σ 40%)	<b>96 Manila Philippines</b>
30 Iran	499		64 Israel	243	<b>97 Montreal Canada</b>
31 Norway	485		65 Portugal	237	<b>98 Cairo Egypt</b>
32 Taiwan	467		<b>66 Seattle USA</b>	<b>\$ 235</b> (Σ 41%)	<b>99 Rome Italy</b>
33 Argentina	446		67 Chile	234	<b>100 Guangzhou, China</b>
					<b>\$ 143</b> (Σ 7.5%)





**United Metro-Nations**

> 2.5

Rank	UA	State/Territory	Population (2011)	Population (2001)
1	Mumbai	Maharashtra	18,414,288	16,434,386
2	Delhi	Delhi	16,314,838	12,877,470
3	Kolkata	West Bengal	14,112,536	13,205,697
4	Chennai	Tamil Nadu	8,685,010	6,560,242
5	Bangalore	Karnataka	8,499,399	5,701,446
6	Hyderabad	Andhra Pradesh	7,749,334	5,742,036
7	Ahmedabad	Gujarat	6,240,201	4,525,013
8	Pune	Maharashtra	5,212,500	3,760,636
9	Surat	Gujarat	4,585,367	2,811,614
10	Jaipur	Rajasthan	3,073,350	2,322,575
11	Kanpur	Uttar Pradesh	2,920,067	2,715,555
12	Lucknow	Uttar Pradesh	2,901,474	2,245,509
13	Nagpur	Maharashtra	2,583,911	2,129,500

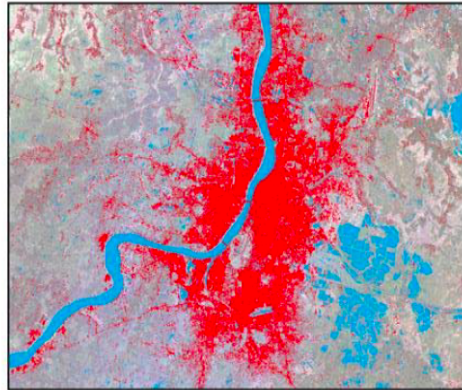
> 1.5

14	Ghaziabad	Uttar Pradesh	2,358,525	968,256
15	Indore	Madhya Pradesh	2,210,447	1,506,062
16	Coimbatore	Tamil Nadu	2,151,466	1,461,139
17	Kochi	Kerala	2,117,990	1,355,972
18	Patna	Bihar	2,046,652	1,697,976
19	Kozhikode	Kerala	2,030,519	880,247
20	Bhopal	Madhya Pradesh	1,883,381	1,458,416
21	Thrissur	Kerala	1,854,783	330,122
22	Vadodara	Gujarat	1,817,191	1,491,045
23	Agra	Uttar Pradesh	1,746,467	1,331,339
24	Visakhapatnam	Andhra Pradesh	1,730,320	1,345,938
25	Malappuram	Kerala	1,698,645	170,409
26	Thiruvananthapuram	Kerala	1,687,406	889,635
27	Kannur	Kerala	1,642,892	498,207
28	Ludhiana	Punjab	1,613,878	1,398,467
29	Nashik	Maharashtra	1,562,769	1,152,326
30	Vijayawada	Andhra Pradesh	1,491,202	1,039,518

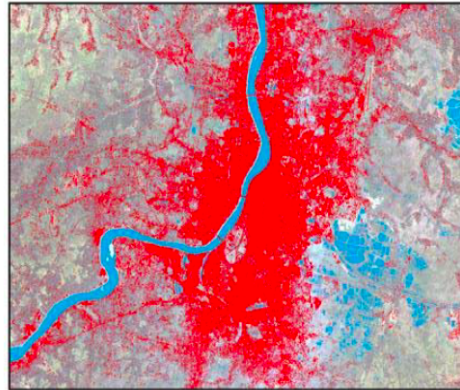
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31	Madurai	Tamil Nadu	1,462,420	1,203,095
32	Varanasi	Uttar Pradesh	1,435,113	1,203,961
33	Meerut	Uttar Pradesh	1,424,908	1,161,716
34	Rajkot	Gujarat	1,390,933	1,003,015
35	Faridabad	Haryana	1,404,653	1,055,938
36	Jamshedpur	Jharkhand	1,337,131	1,104,713
37	Srinagar	Jammu and Kashmir	1,273,312	988,210
38	Jabalpur	Madhya Pradesh	1,267,564	1,098,000
39	Asansol	West Bengal	1,243,008	1,067,369
40	Allahabad	Uttar Pradesh	1,216,719	1,042,229
41	Dhanbad	Jharkhand	1,195,298	1,065,327
42	Vasai-Virar	Maharashtra	1,221,233	NA
43	Aurangabad	Maharashtra	1,189,376	892,483
44	Amritsar	Punjab	1,183,705	1,003,917
45	Jodhpur	Rajasthan	1,137,815	860,818
46	Ranchi	Jharkhand	1,126,741	863,495
47	Raipur	Chhattisgarh	1,122,555	700,113
48	Kollam	Kerala	1,110,005	380,091
49	Gwalior	Madhya Pradesh	1,101,981	865,548
50	Durg-Bhilainagar	Chhattisgarh	1,064,077	927,864
51	Chandigarh	Chandigarh	1,025,682	808,515
52	Tiruchirappalli	Tamil Nadu	1,021,717	866,354
53	Kota	Rajasthan	1,001,365	703,150

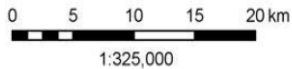
### Kolkata, India



T<sub>1</sub>: 14-Nov-90



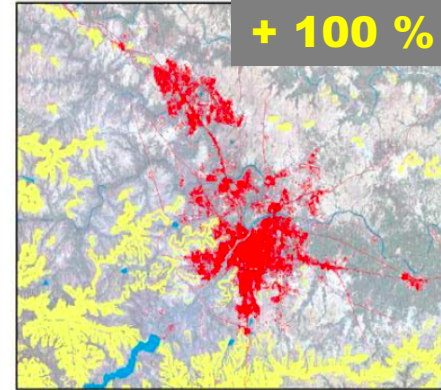
T<sub>2</sub>: 17-Nov-00



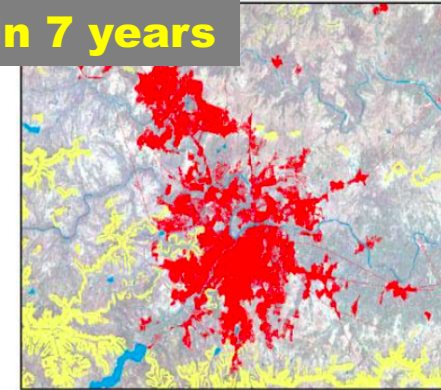
Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	6,646,114	7,833,709	1.66%
Built-Up Area (sq km)	288.22	483.54	5.31%
Average Density (persons / sq km)	23,058.87	16,200.59	-3.47%
Built-Up Area per Person (sq m)	43.37	61.73	3.59%

### Puna, India

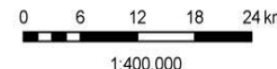
**+ 100 % in 7 years**



T<sub>1</sub>: 4-Dec-92

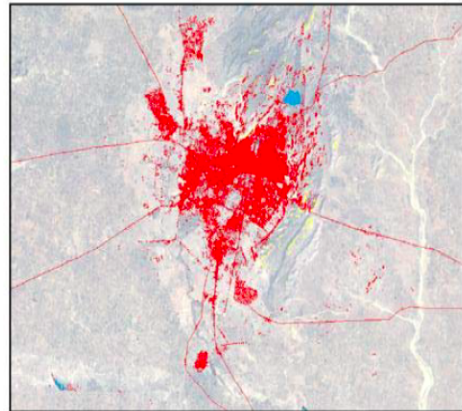


T<sub>2</sub>: 14-Nov-99

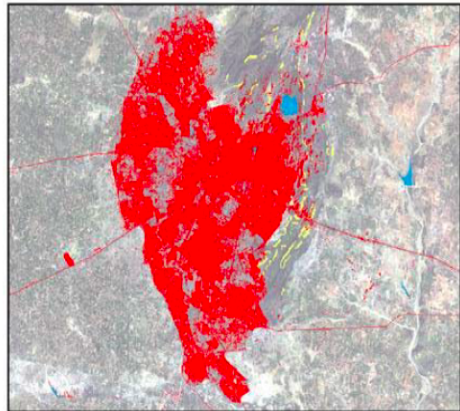


Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	3,508,945	4,041,868	2.06%
Built-Up Area (sq km)	92.54	191.20	11.02%
Average Density (persons / sq km)	37,916.96	21,139.08	-8.07%
Built-Up Area per Person (sq m)	26.37	47.31	8.78%

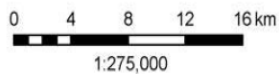
### Jaipur, India



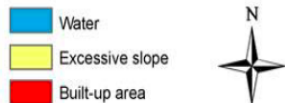
T<sub>1</sub>: 9-Oct-89



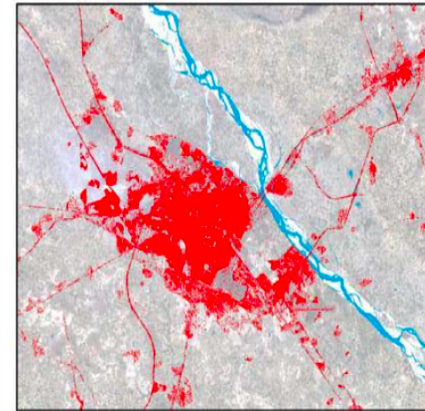
T<sub>2</sub>: 13-Sep-00



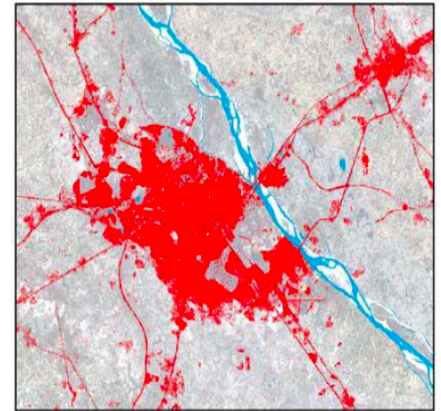
Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	2,115,566	2,779,119	2.53%
Built-Up Area (sq km)	58.69	140.84	8.34%
Average Density (persons / sq km)	36,044.00	19,732.56	-5.36%
Built-Up Area per Person (sq m)	27.74	50.68	5.67%
Average Slope of Built-Up Area (%)	3.56	3.35	-0.56%
Maximum Slope of Built-Up Area (%)	49.66	43.86	-1.13%
The Buildable Perimeter (%)	0.94	0.93	-0.10%
The Contiguity Index	0.81	0.99	1.86%
The Compactness Index	0.42	0.35	-1.54%
Per Capita Gross Domestic Product	\$1,535.18	\$2,252.37	3.57%



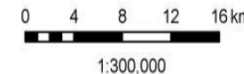
### Kanpur, India



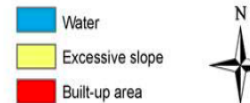
T<sub>1</sub>: 21-Nov-89



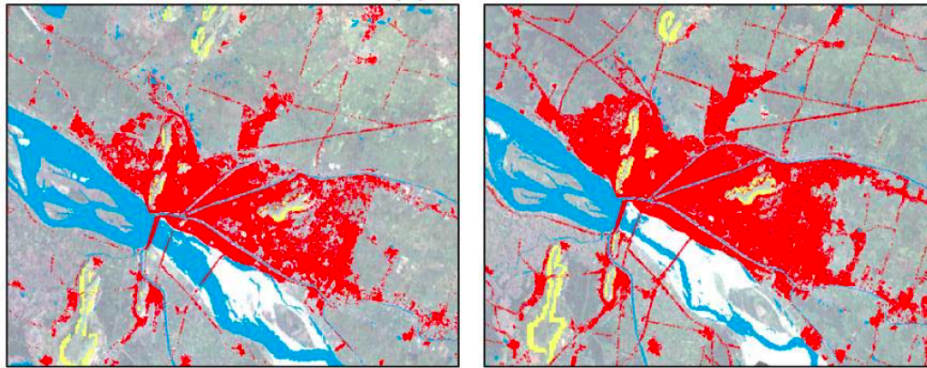
T<sub>2</sub>: 11-Nov-00



Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	1,124,030	1,441,952	2.30%
Built-Up Area (sq km)	33.51	59.50	5.37%
Average Density (persons / sq km)	10,987.14	7,938.25	-2.92%
Built-Up Area per Person (sq m)	91.02	125.97	3.01%
Average Slope of Built-Up Area (%)	1.66	1.69	0.13%
Maximum Slope of Built-Up Area (%)	8.32	8.32	0.00%
The Buildable Perimeter (%)	0.97	0.97	0.06%
The Contiguity Index	0.71	0.61	-1.33%
The Compactness Index	0.30	0.29	-0.33%
Per Capita Gross Domestic Product	\$1,541.53	\$2,265.17	3.57%



### Vijayawada, India



T<sub>1</sub>: 10-Nov-90

T<sub>2</sub>: 28-Oct-00

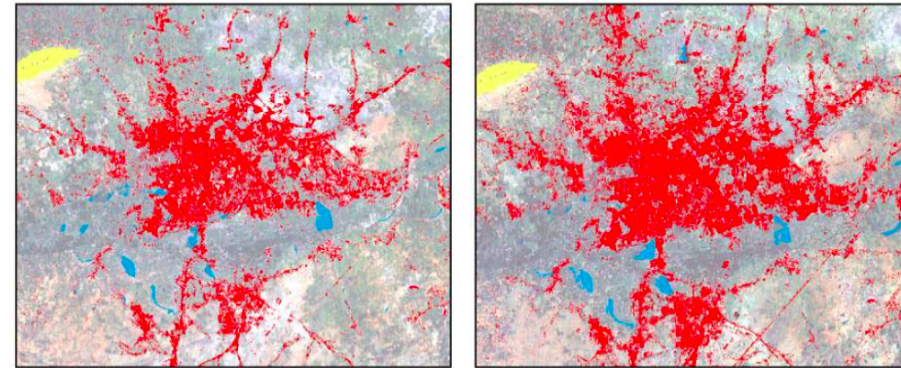


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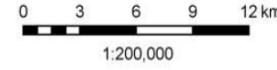
Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	981,395	1,117,042	1.31%
Built-Up Area (sq km)	40.30	62.33	4.47%
Average Density (persons / sq km)	24,350.90	17,920.82	-3.03%
Built-Up Area per Person (sq m)	41.07	55.80	3.12%
Average Slope of Built-Up Area (%)	3.35	2.97	-1.20%

### Coimbatore, India



T<sub>1</sub>: 21-Nov-89

T<sub>2</sub>: 9-Nov-99

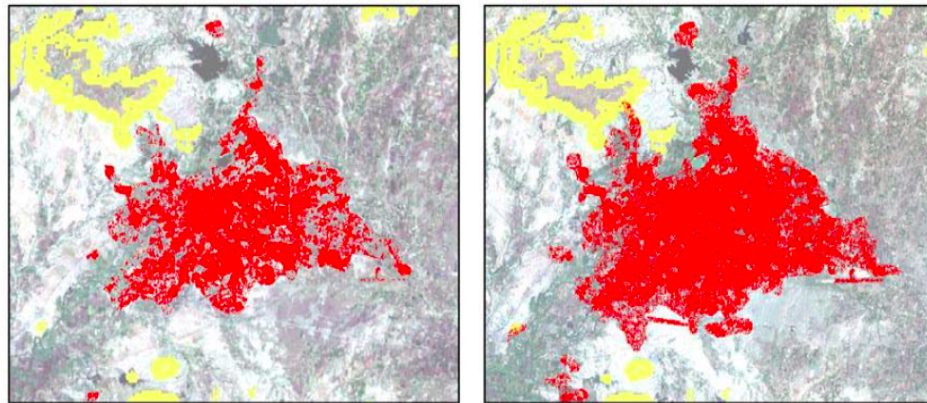


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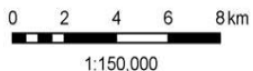
Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	551,696	613,264	1.07%
Built-Up Area (sq km)	98.98	155.95	4.67%
Average Density (persons / sq km)	5,573.90	3,932.47	-3.44%
Built-Up Area per Person (sq m)	179.41	254.29	3.56%
Average Slope of Built-Up Area (%)	1.56	1.61	0.32%

### Jalna, India



T<sub>1</sub>: 18-Oct-89

T<sub>2</sub>: 24-Oct-00

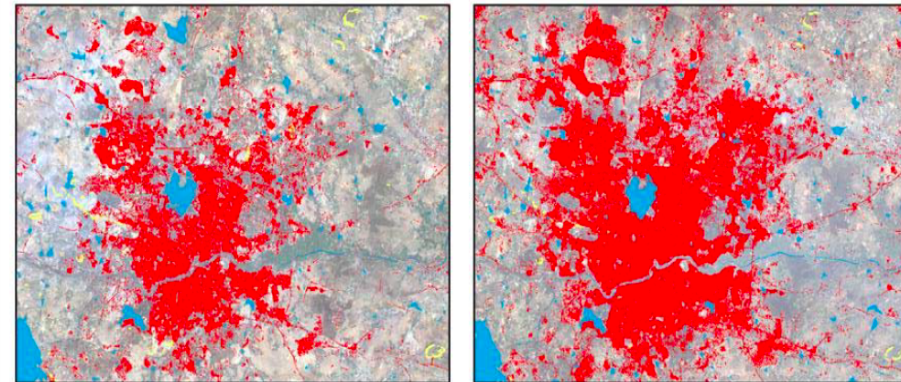


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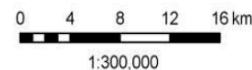
Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	444,551	556,362	2.06%
Built-Up Area (sq km)	11.25	24.90	7.47%
Average Density (persons / sq km)	39,500.36	22,343.87	-5.04%
Built-Up Area per Person (sq m)	25.32	44.76	5.31%
Average Slope of Built-Up Area (%)	2.00	2.00	0.03%
Maximum Slope of Built-Up Area (%)	9.03	9.71	0.66%
The Buildable Perimeter (%)	0.95	0.81	-1.43%
The Contiguity Index	0.42	0.56	2.66%
The Compactness Index	0.25	0.43	5.23%
Per Capita Gross Domestic Product	\$1,536.51	\$2,261.26	3.57%

### Hyderabad, India



T<sub>1</sub>: 21-Nov-89

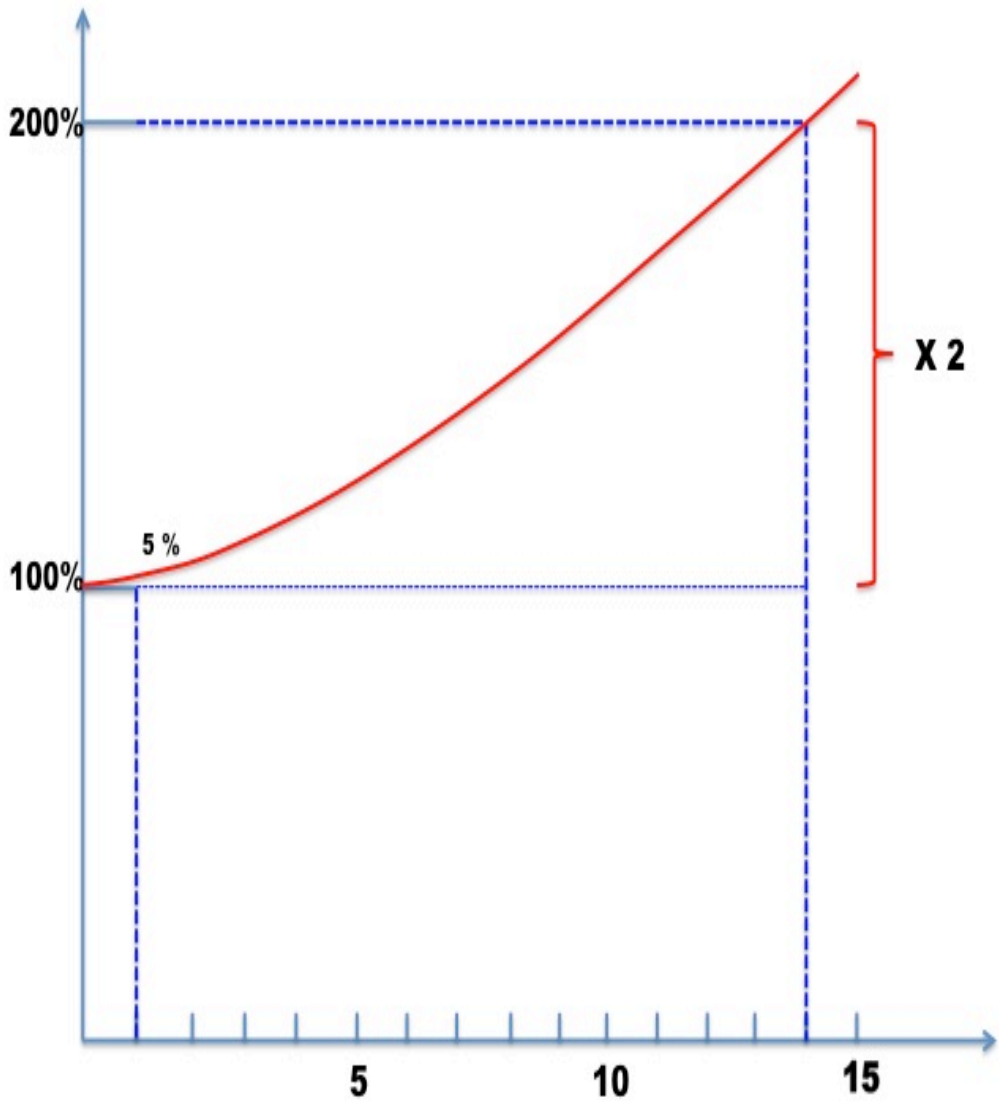
T<sub>2</sub>: 29-Oct-01



1:300,000



Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	4,887,789	5,707,677	1.31%
Built-Up Area (sq km)	166.96	301.89	5.09%
Average Density (persons / sq km)	29,275.98	18,906.43	-3.60%
Built-Up Area per Person (sq m)	34.16	52.89	3.73%
Average Slope of Built-Up Area (%)	2.82	3.12	0.84%
Maximum Slope of Built-Up Area (%)	14.43	17.16	1.46%
The Buildable Perimeter (%)	0.94	0.93	-0.04%
The Contiguity Index	0.75	0.88	1.36%
The Compactness Index	0.37	0.38	0.22%
Per Capita Gross Domestic Product	\$1,541.53	\$2,343.04	3.57%



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# Size Matters: Same linear Morphology...

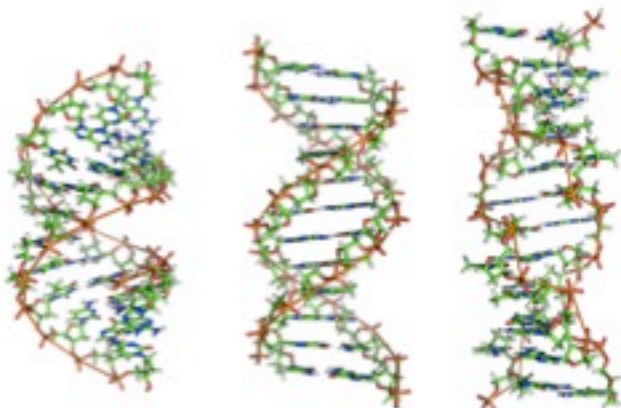
**Worm**



**Snake**



**...but different DNA**

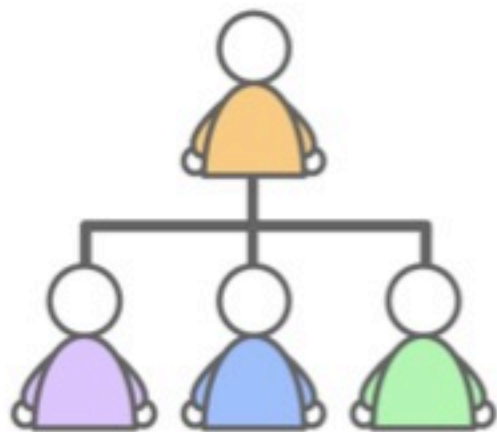


**Do not try to handle them the same way...  
... or you will learn the hard way**

# TERRITORIAL GOVERNANCE

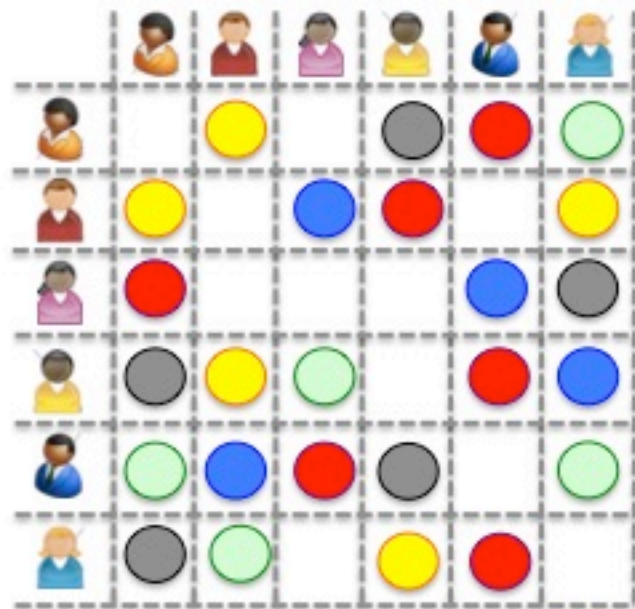
## City Hierarchical/Orbital Governance

Citizens/Municipality Dialogue



## Metropolitan Matrix Governance

Inter/administrative Dialogue

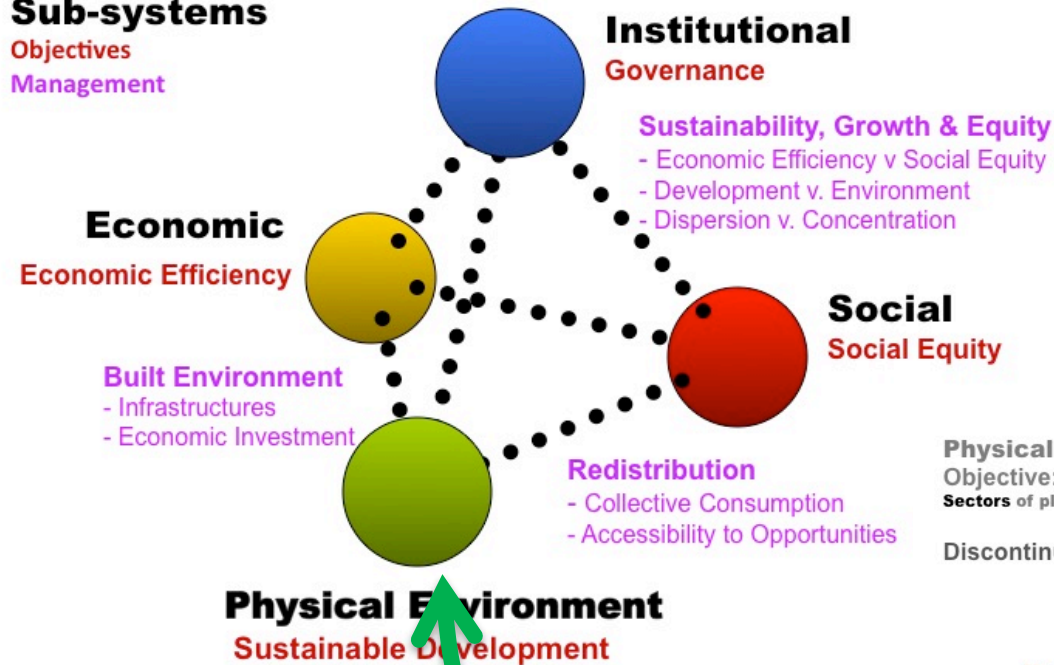


# 2) Transports metropolitan dimension

## METROPOLITAN GOVERNANCE

### Sub-systems

Objectives  
Management



### Physical Component

Objective: Sustainability  
Sectors of planning

Discontinuous Systems

**Housing**  
- Density  
- Typology/Program  
- Accessibility  
- Price/Finance

### Productive Activities

- Industry
- Offices
- Commerce

**Social Facilities**  
- Health  
- Education  
- Sports  
- Leisure  
- Gender  
- Young  
- Old  
- Culture

Continuous Systems

### Environment

- Green Infrastructure
- Ecosystems
  - Waterways
  - Biodiversity transfers

### Transport

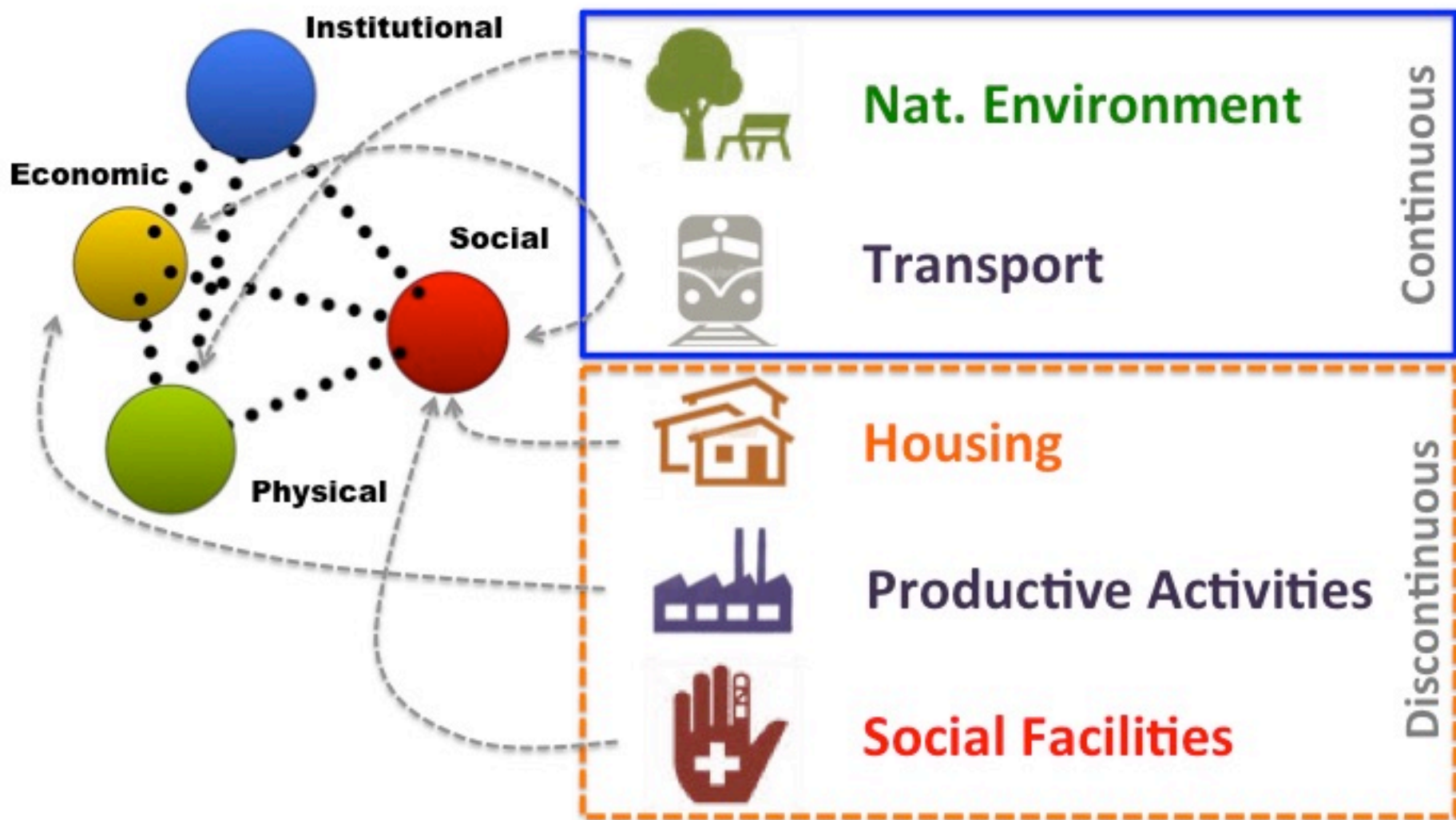
- Gray Infrastructure
- Rail
  - Road
  - Pipes
  - Wires
  - Intangible

Source: [www](http://www)



# METROPOLITAN MANAGEMENT

## Components and Physical Sectors



# Green Infrastructure

**National Park**



**Regional Park**



**Metropolitan Park**



**Interurban Park**



**Urban Park**



**Semipublic Garden**

# METROPOLITAN INTERMODAL TRANSPORT STRUCTURE

**RANK and scale**  
Modes

**INTERNATIONAL**  
Aviation

**NATIONAL**  
Trains

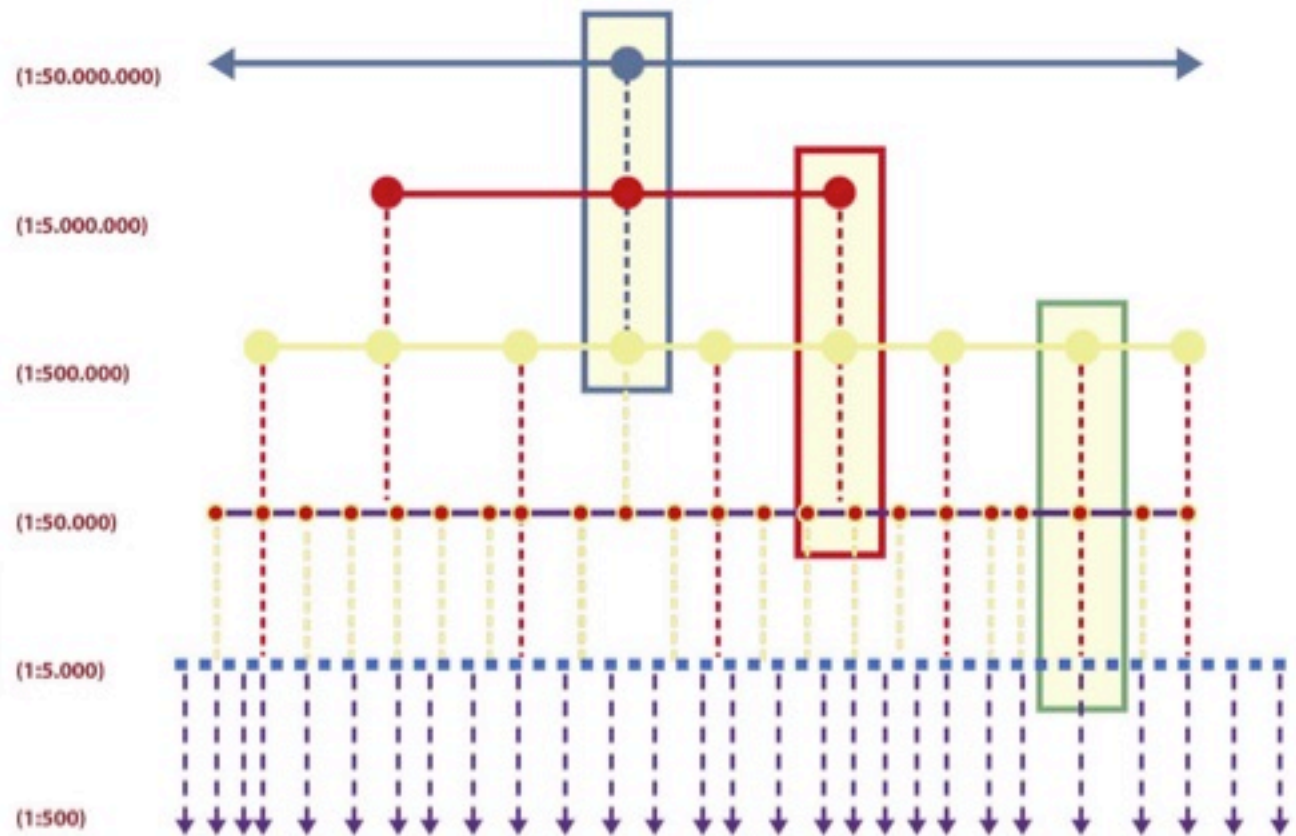
**REGIONAL**  
Commuter

**METROPOLITAN**  
Metro

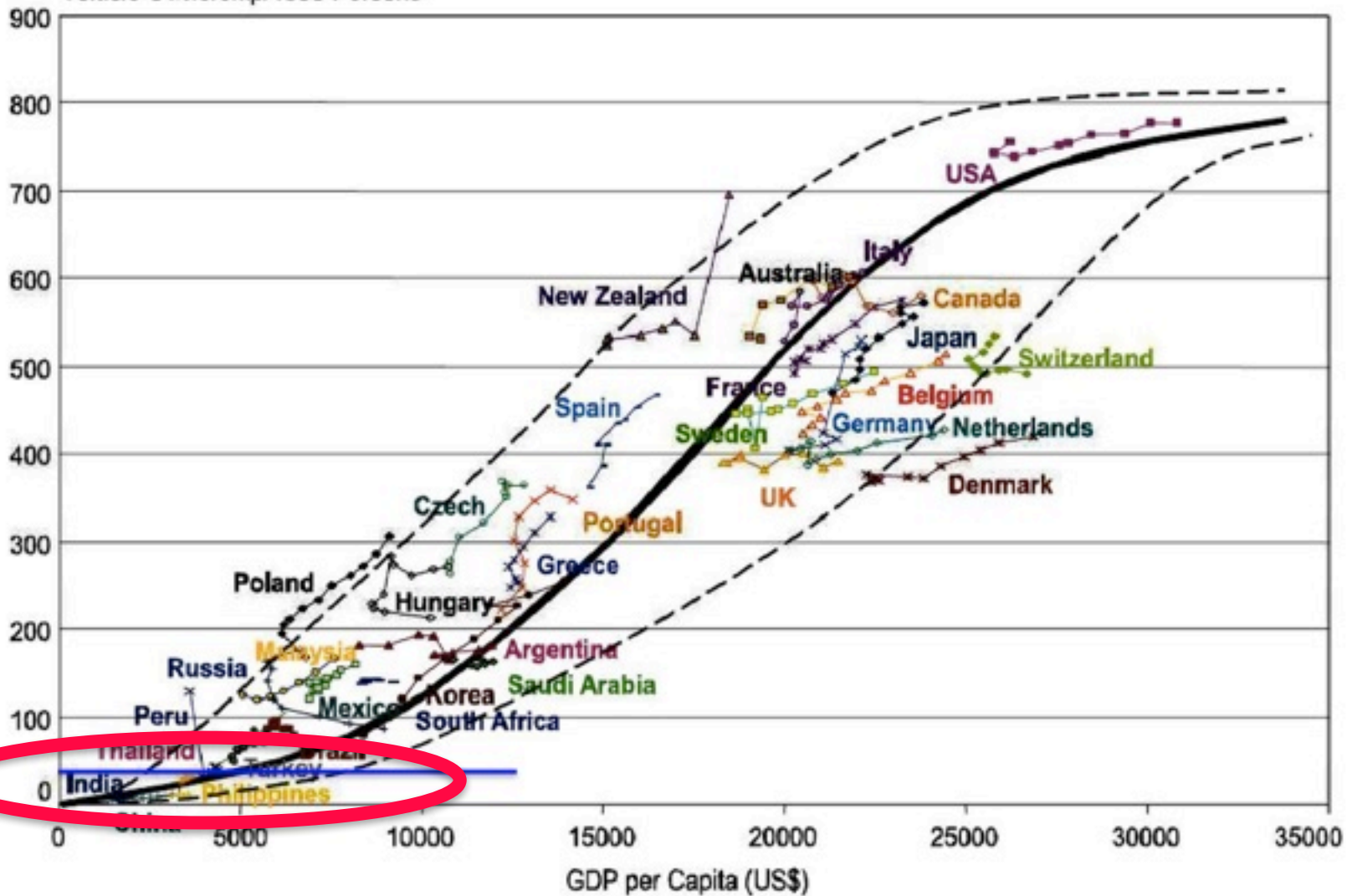
**URBAN**  
BRT - LRT - Bus - Taxi

**MICRO - URBAN**  
Bicycle - Pedestrian

'Base' Intermodal  
 Metropolitan Intermodal  
 Urban Intermodal



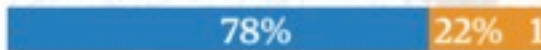
Vehicle Ownership/1000 Persons



# Rail and bus rapid transit (BRT) infrastructure

■ National level   ■ State level   ■ City level   ■ Private sector  
■ Outside boundary / data unavailable   ■ Shared responsibility

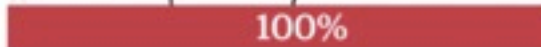
Delhi



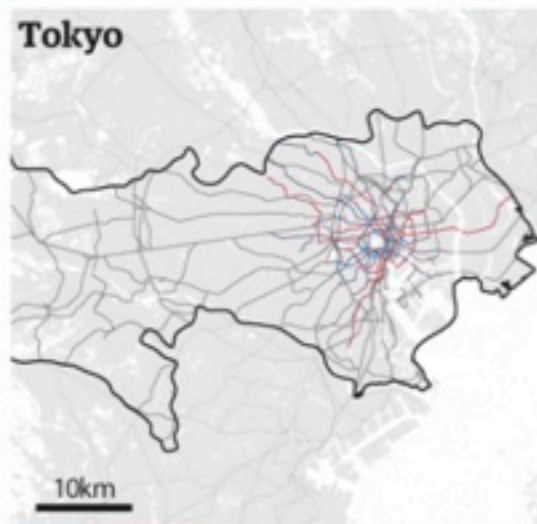
London



Bogota

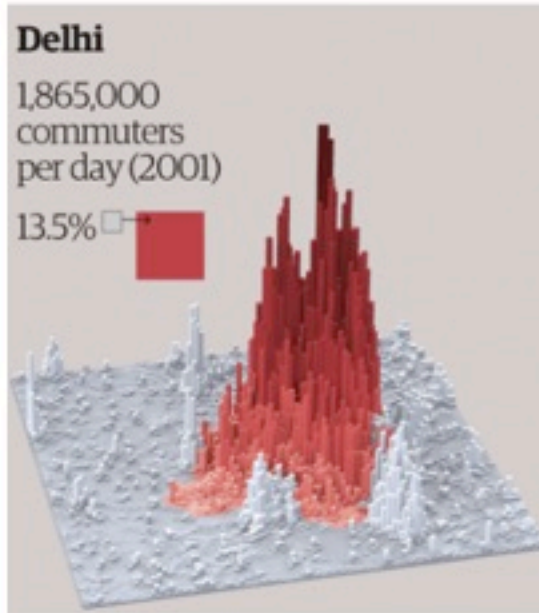


Tokyo

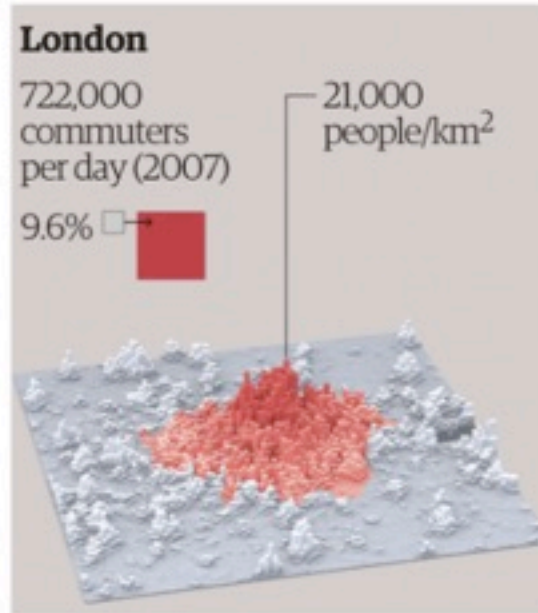


## Measuring density

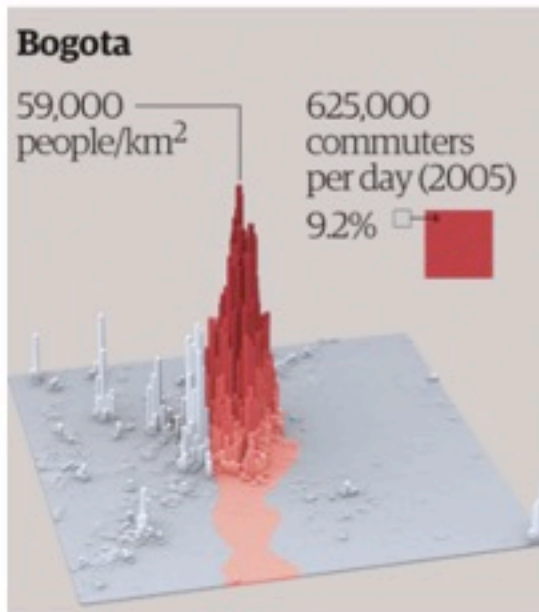
6.000 USD/Cap



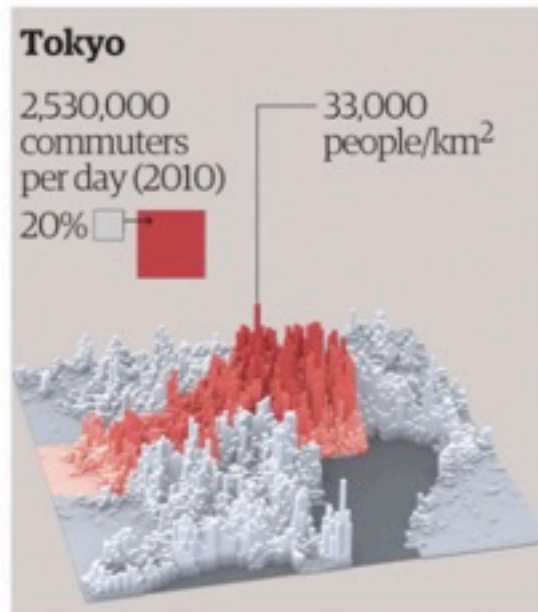
153.000 USD/Cap

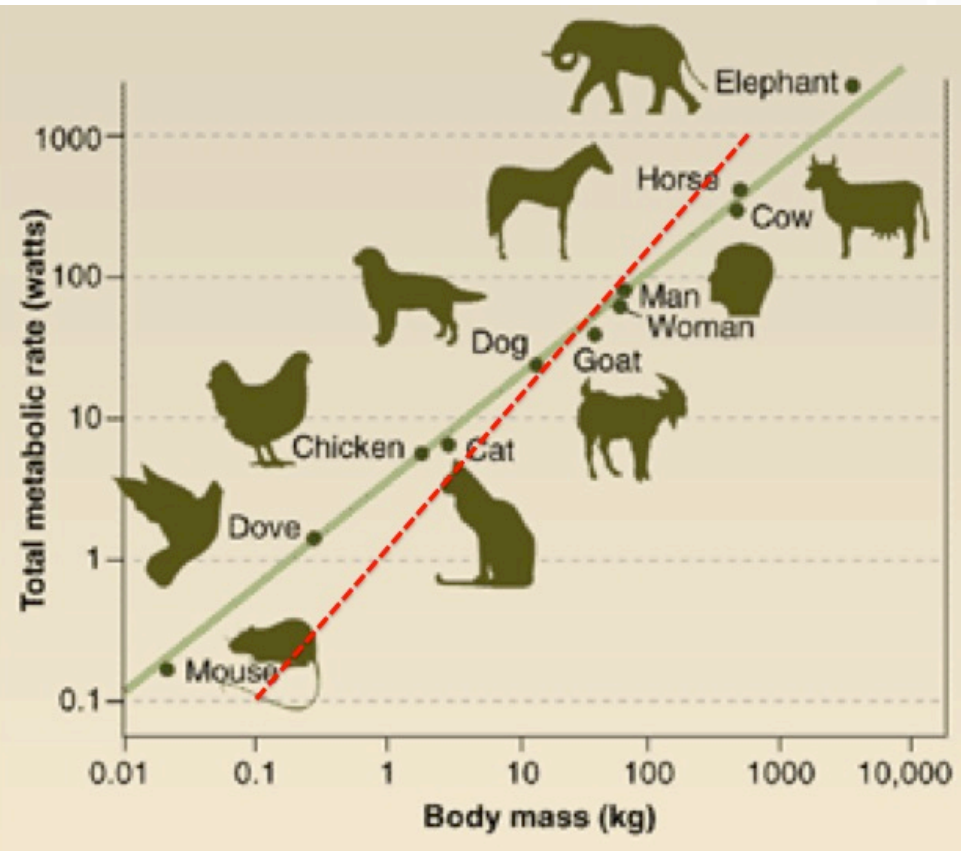


17.497 USD/Cap

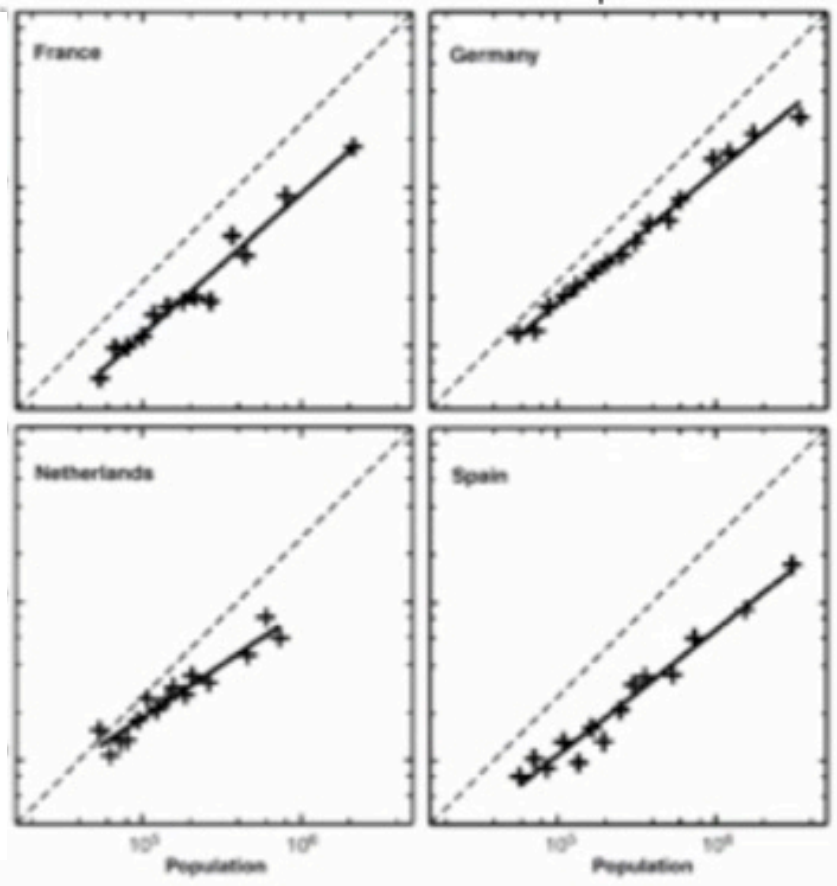


43.664 USD/Cap





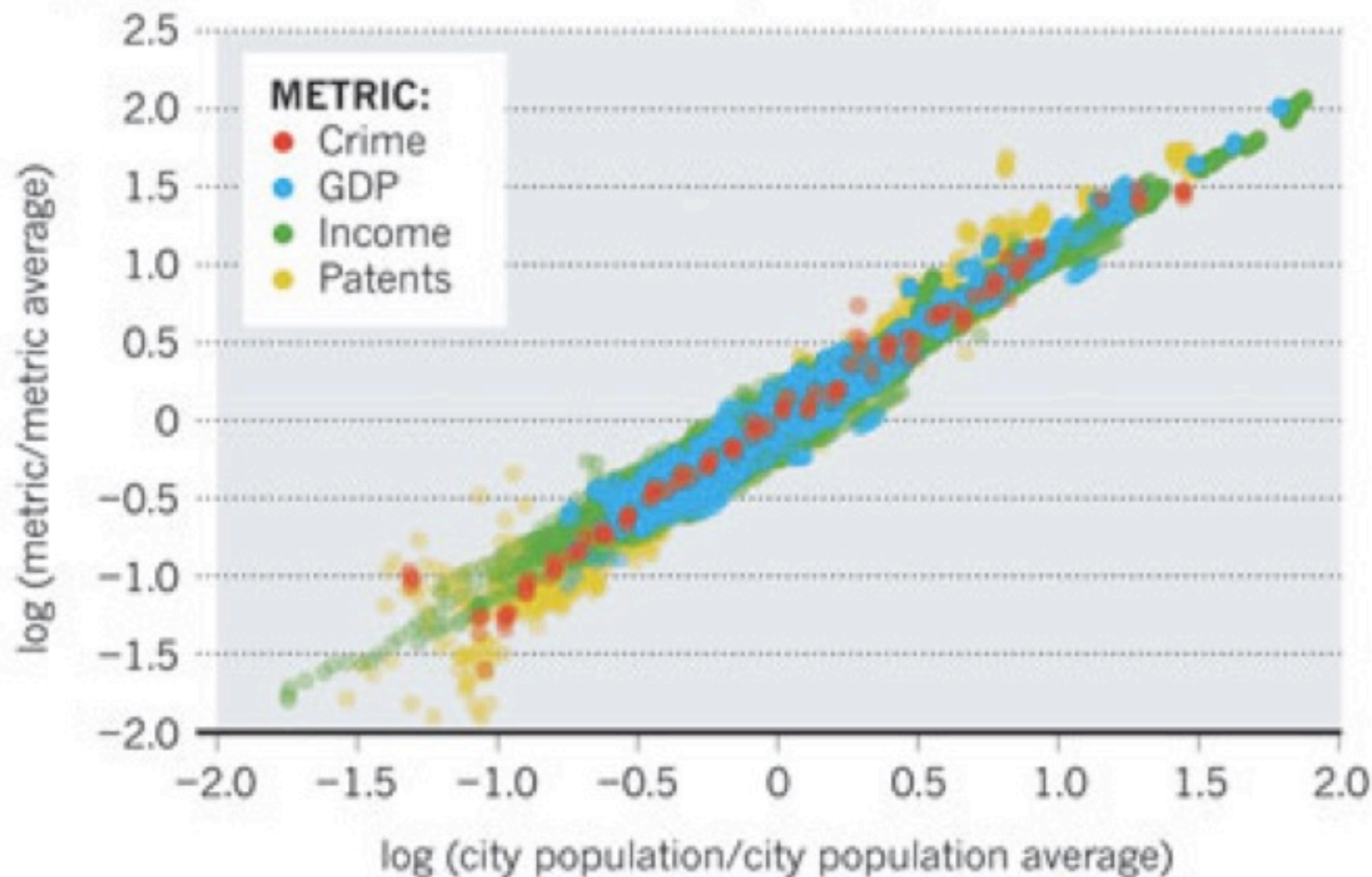
petrol stations



Kuhnert, Helbing & West, Physica A363, 96-103 (2003)

# PREDICTABLE CITIES

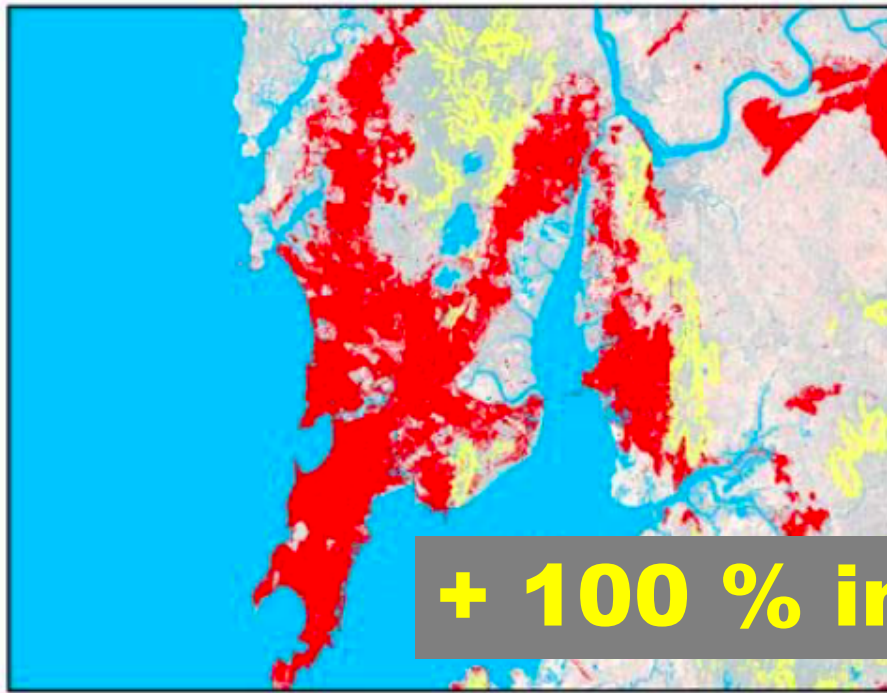
Data from 360 US metropolitan areas show that metrics such as wages and crime scale in the same way with population size.



Source: Geoffrey West



# Mumbai, India

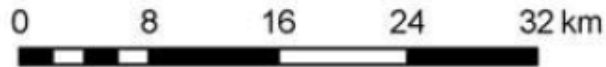


T<sub>1</sub>: 9-Nov-92



T<sub>2</sub>: 25-Oct-01

**+ 100 % in 23 years**



1:475,000



Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	14,223,505	17,069,993	2.06%
Built-Up Area (sq km)	344.33	450.60	3.05%
Average Density (persons / sq km)	41,307.79	37,882.69	-0.96%
Built-Up Area per Person (sq m)	24.21	26.40	0.97%
Average Slope of Built-Up Area (%)	3.65	3.68	0.11%
Maximum Slope of Built-Up Area (%)	22.81	23.86	0.51%
The Buildable Perimeter (%)	0.70	0.78	1.27%
The Contiguity Index	0.69	0.65	-0.75%
The Compactness Index	0.46	0.53	1.77%
Per Capita Gross Domestic Product	\$1,710.64	\$2,342.15	3.57%

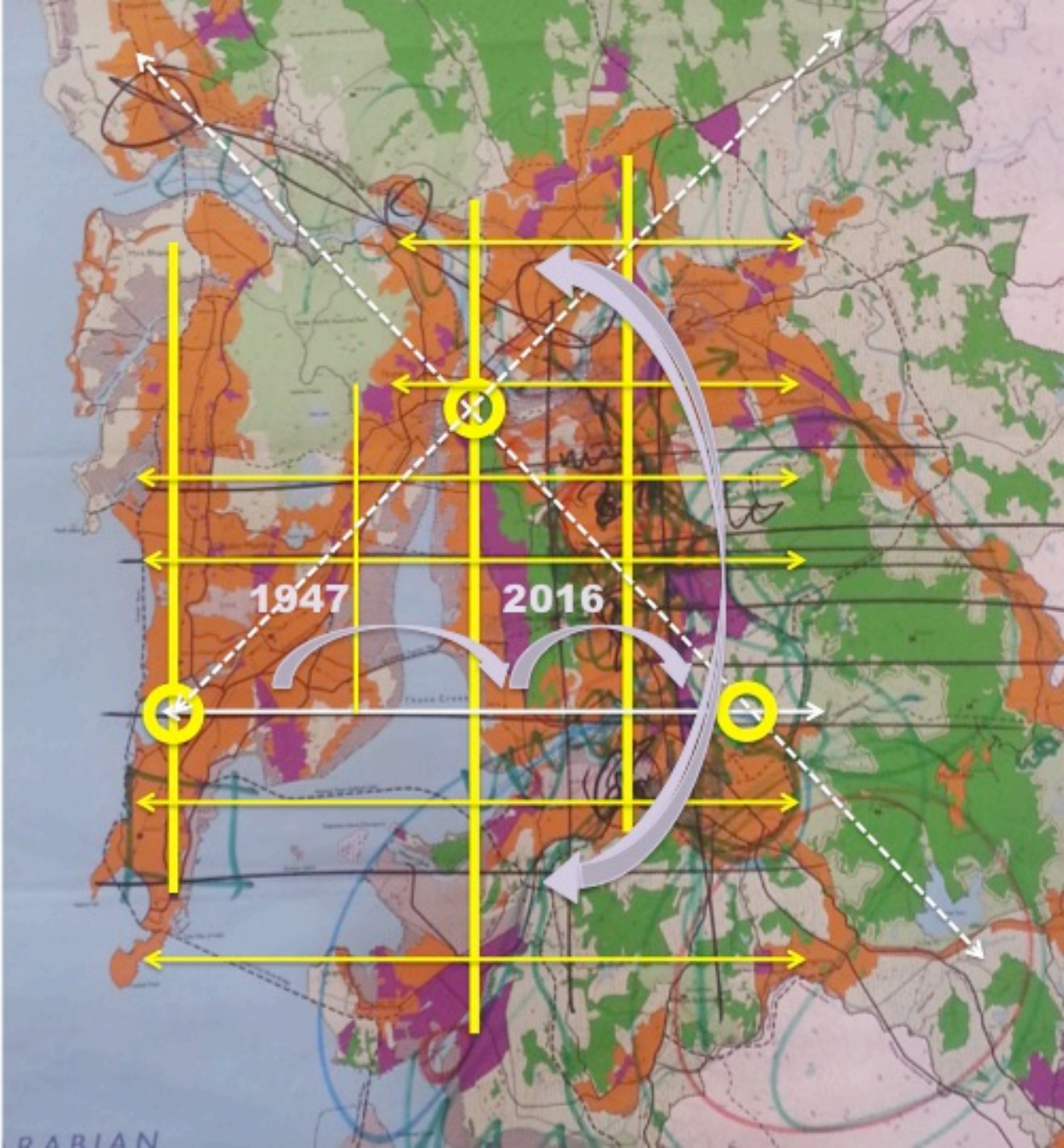
# Metropolitan Brainshops



# Agreement, Disagreement Knowledge, Experience, Decision making, Collective



# MAHARASHTRA ECONOMIC CAPITAL REGION



## Green Infrastructure

**Green connectivity**  
Environmental continuous system

**New Environmental Capital:**  
Increase environmental assets

**Transversal connectivity**  
Decongest central Mumbai

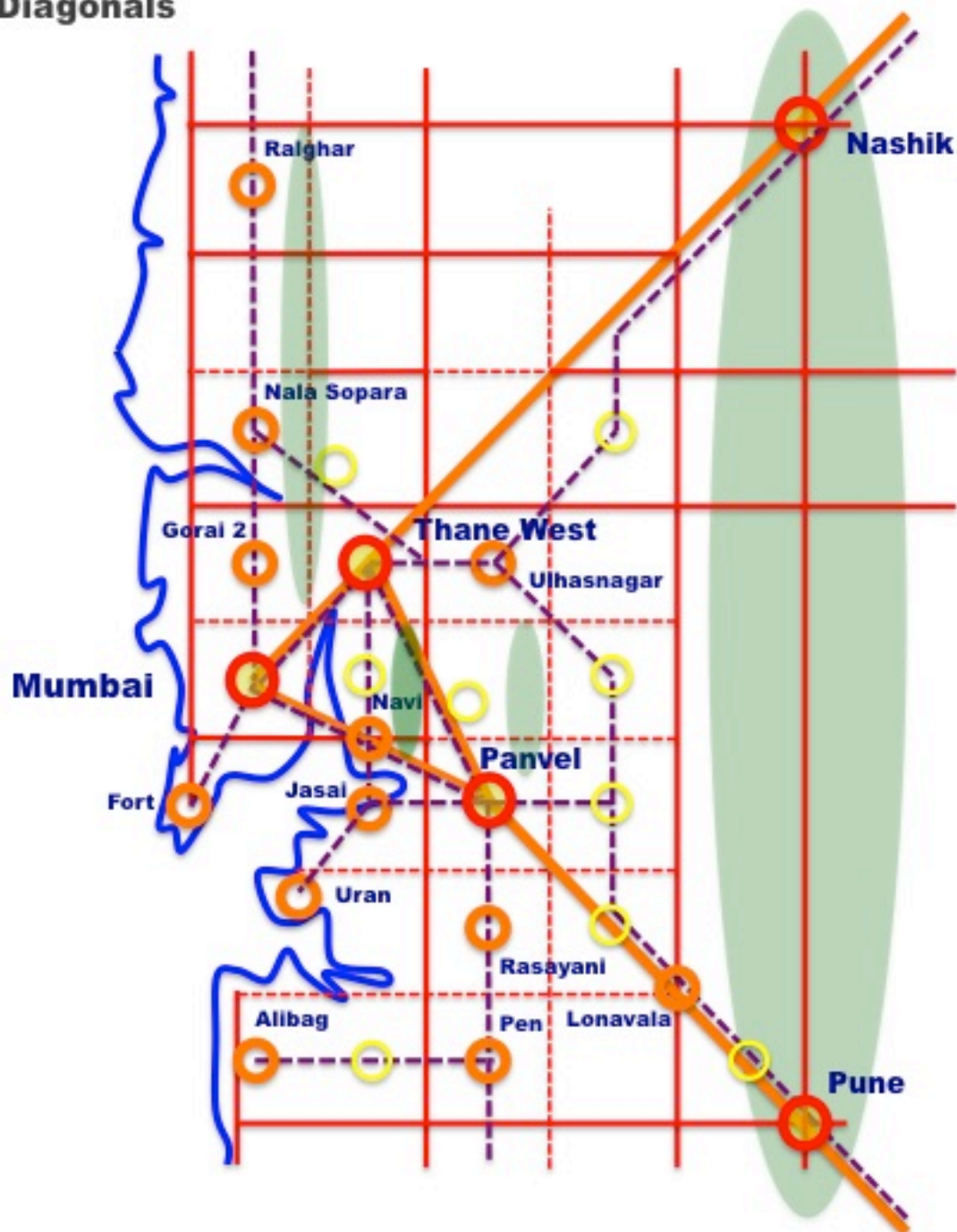
**River blue/green corridors**  
Water management and green connectivity

## Gray Infrastructure

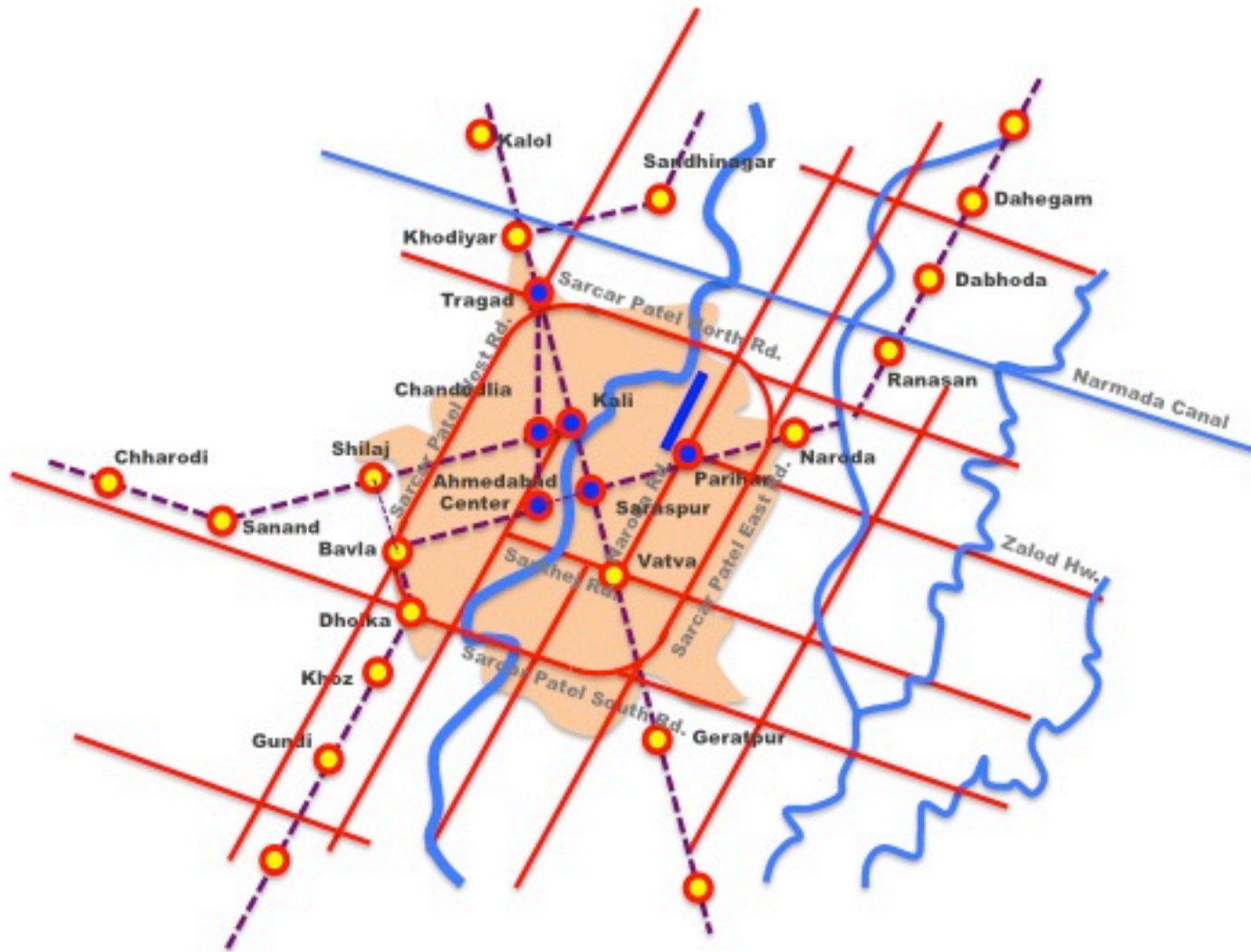
**Extend mass rail services**  
Expansion areas in Saraswati Valley

**Housing and jobs connectivity**  
North-south services away from Mumbai central

# Mumbai's National Diagonals



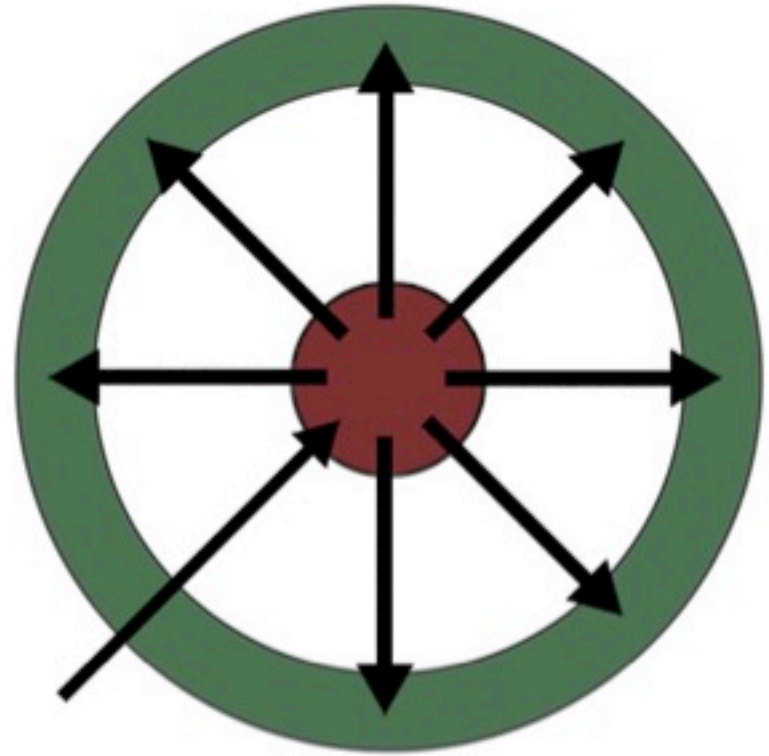
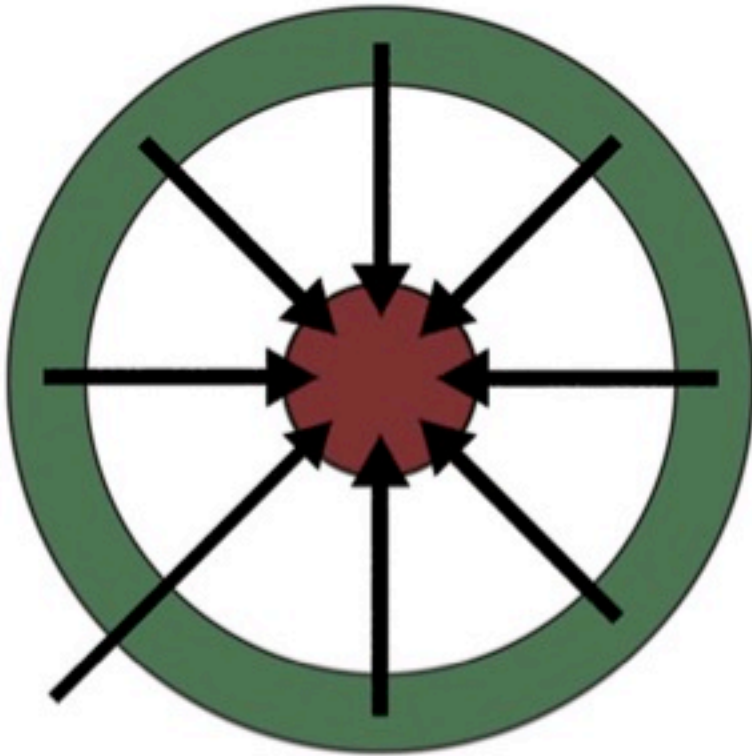
# Ahmedabad inner-metropolis Mental Map



**ECONOMIC EFFICACY**

v.

**SOCIAL JUSTICE**



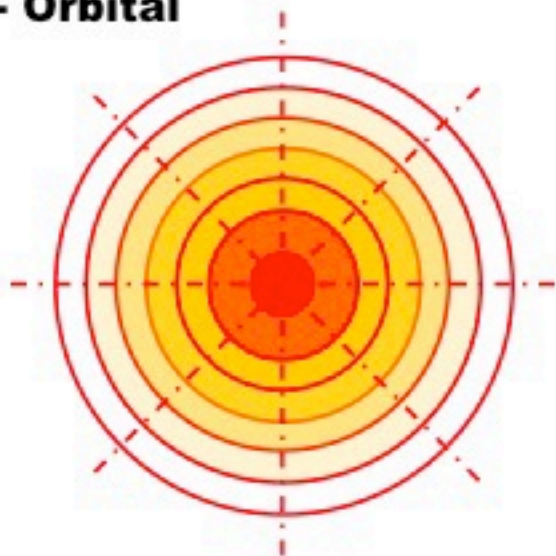
**EFFICACY = CONCENTRATION**

**DISPERSION = REDISTRIBUTION**



## Two Systems

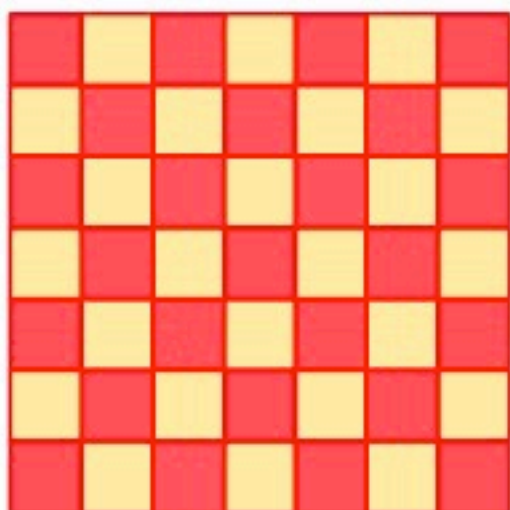
### Radial - Orbital



### Radial - Orbital Features

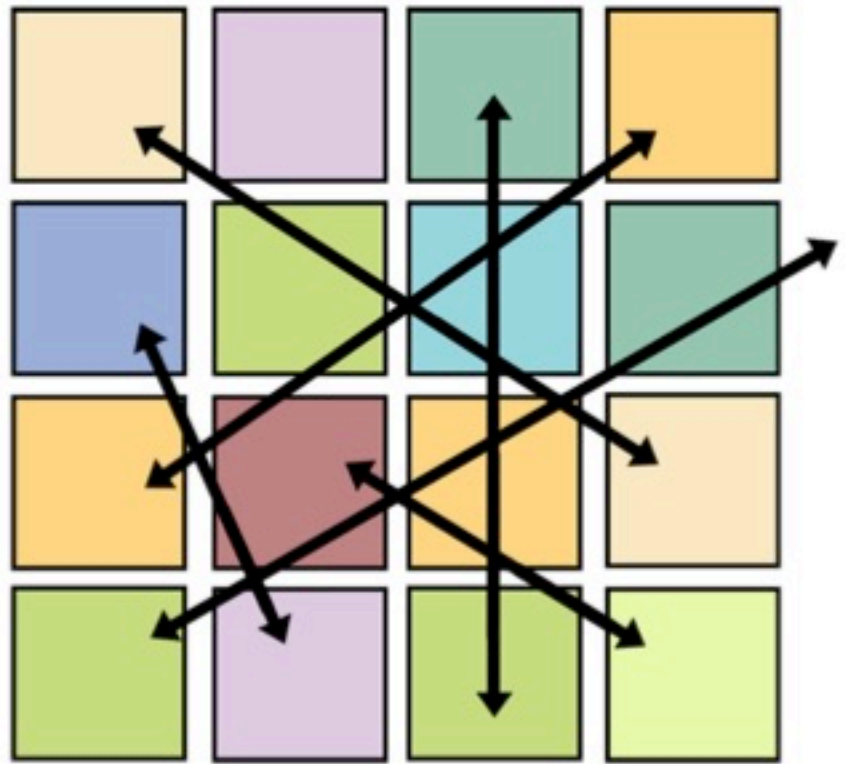
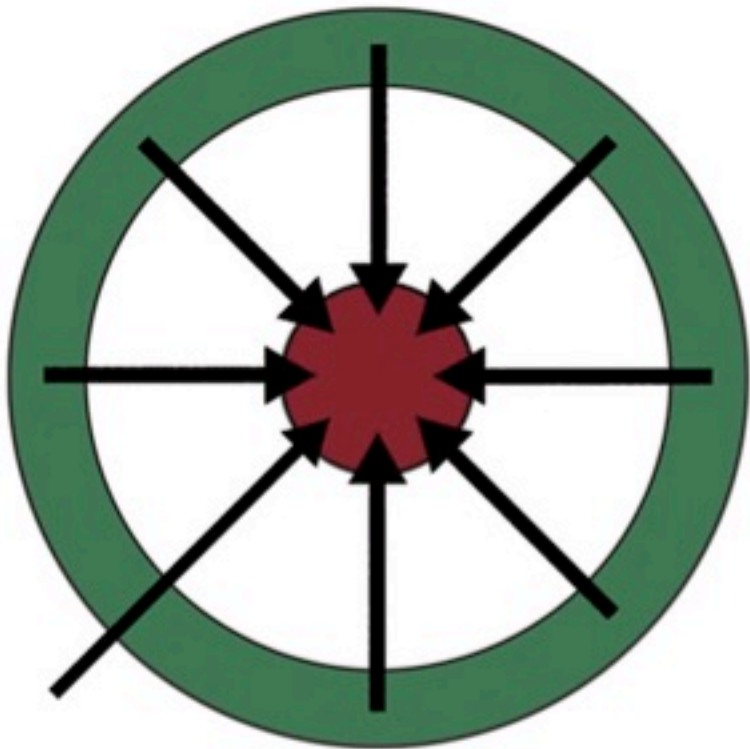
- Market controlled by Supply
- Speculation
- Cost of land
- Congestion
- Unstable traffic equilibrium
  
- Centrality inaccessible to lower incomes
- Centrality = power: Centralized power

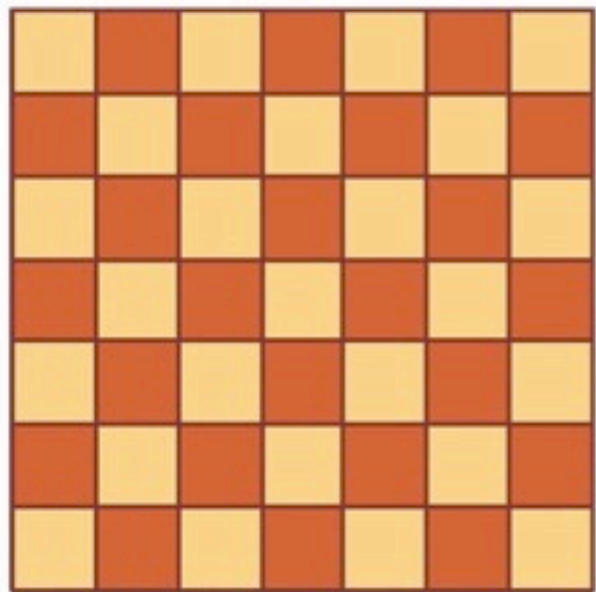
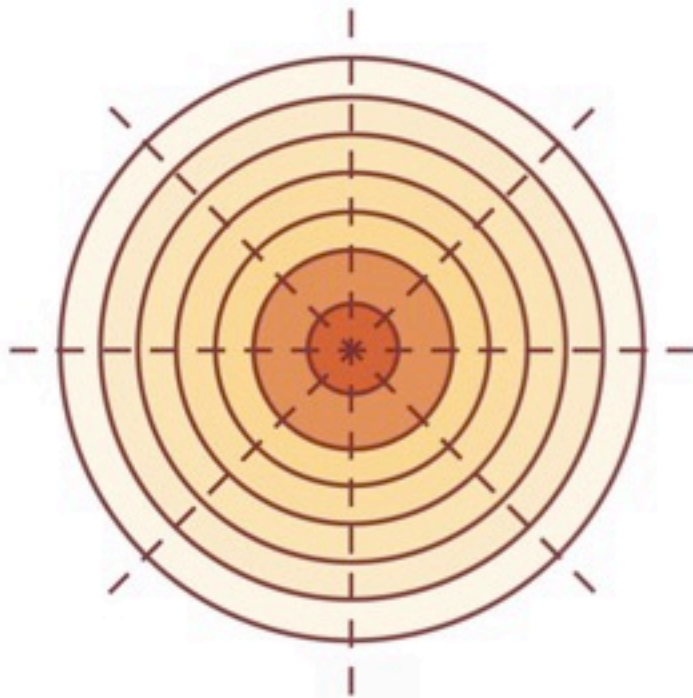
### Reticular - Matrix



### Reticular - Grid Features

- Market controlled by Demand
- Competition in cost of land
- Trip Alternatives
- Stable equilibrium traffic
  
- Multiple centralities
- Distribution of power: Peoples empowerment





**King:** Essential piece, game objective.  
Limited movement but determines all the strategy.

**Queen:** The most strategic piece. The one that  
articulates and supports the essential strategy of the game.

**Bishop/Elephant:** Functional piece,  
Long distance transversal articulation. Strategic connections

**Knight:** Territorial piece, articulates an area around it.  
Does organize and provides backing for secondary pieces.

**Rook:** Edge piece, controls the borders of the game.  
Develops long-range strategies on the sides.

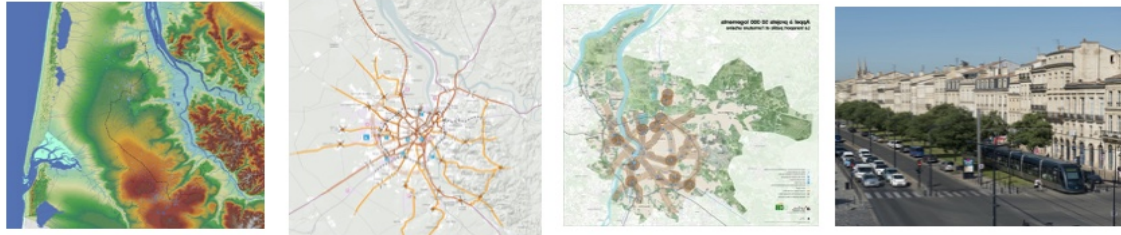
**Pawn:** Complementary piece. Tactical  
Functions. Can determinate the outcome





 Comunidad de Madrid  
Comunidad de Madrid  
Comunidad de Madrid  
**Madrid 2017**  
10 / Noviembre / 1987

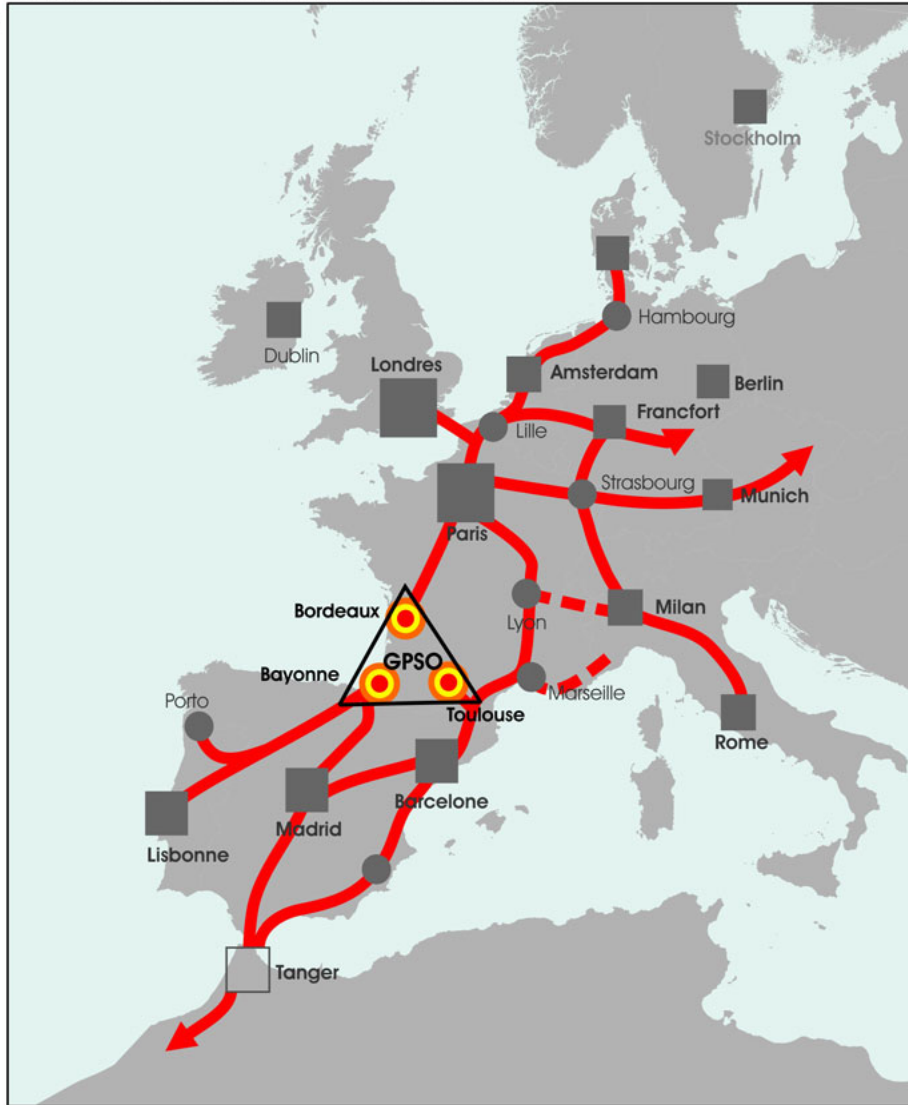
# 3) Bordeaux-Lyon-Rennes Benchmark



## Urban planning and transportation in Bordeaux *From master plan to urban design*

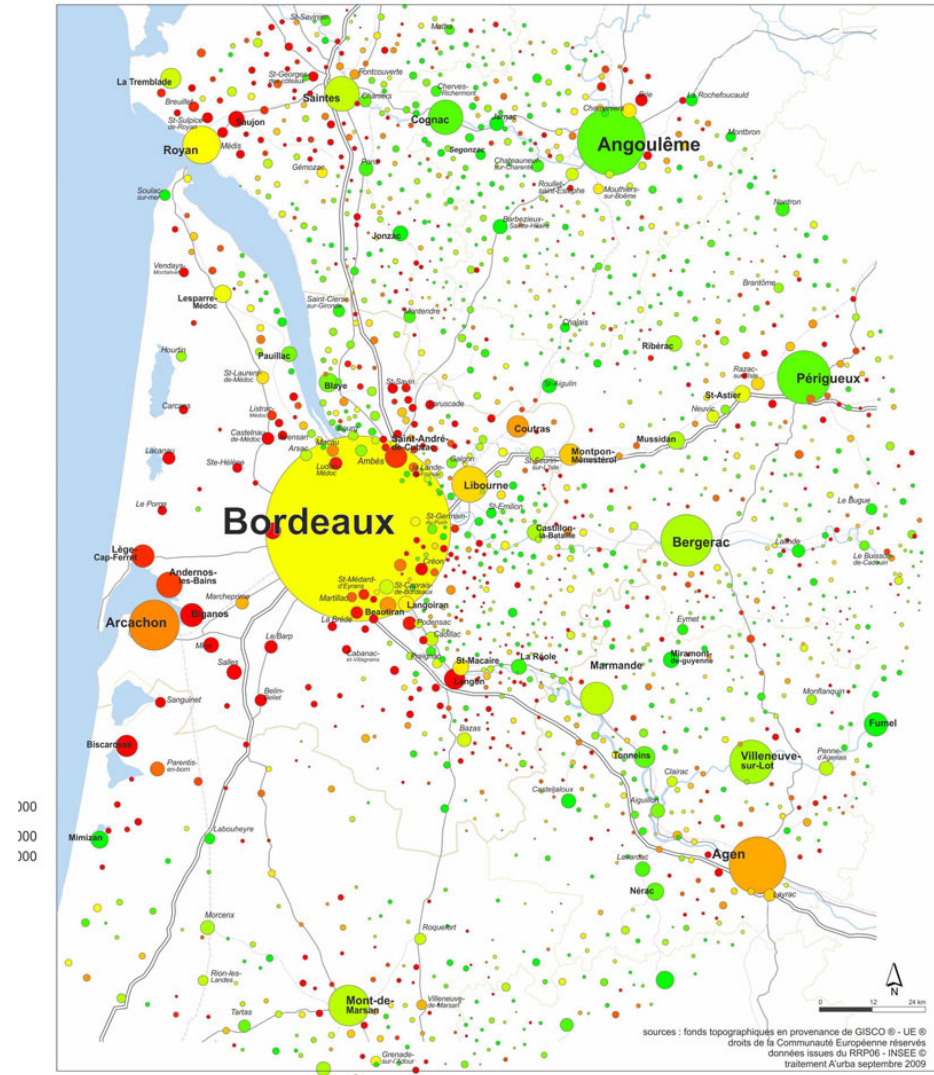
A presentation by Antonio Gonzalez  
Urban Planning Agency of Bordeaux

**GPSO, futur Hub du Grand Sud Ouest à l'horizon 2030**

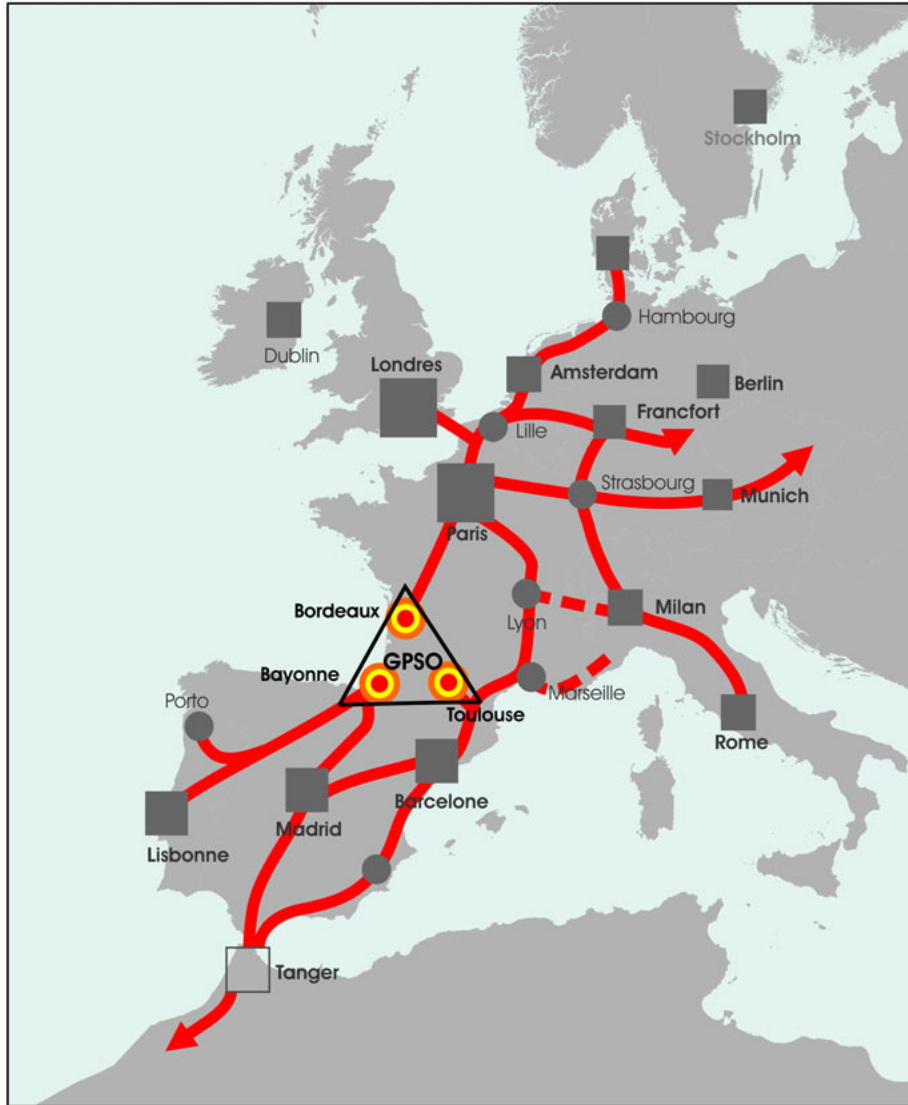


**Bordeaux et son espace environnant**

Evolution de la population entre 1999 et 2006 (agglomérations et communes)

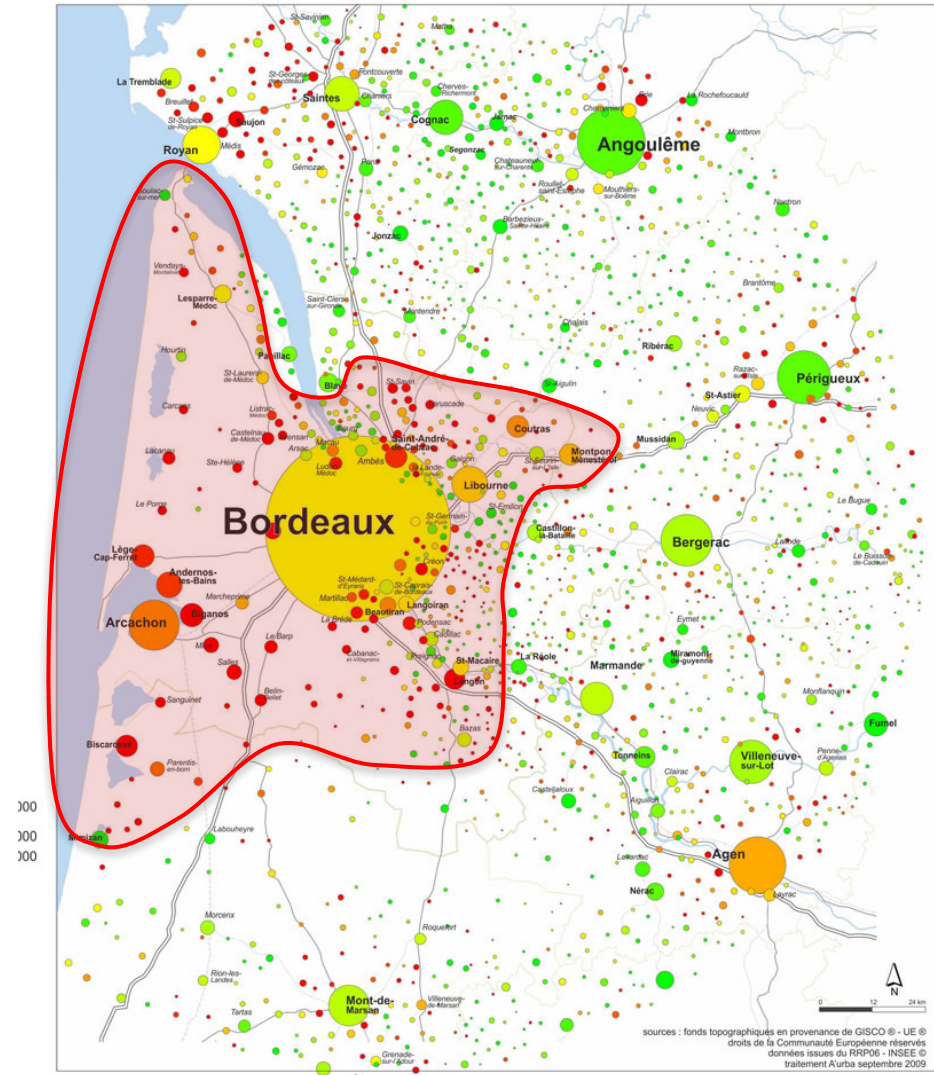


GPSO, futur Hub du Grand Sud Ouest à l'horizon 2030



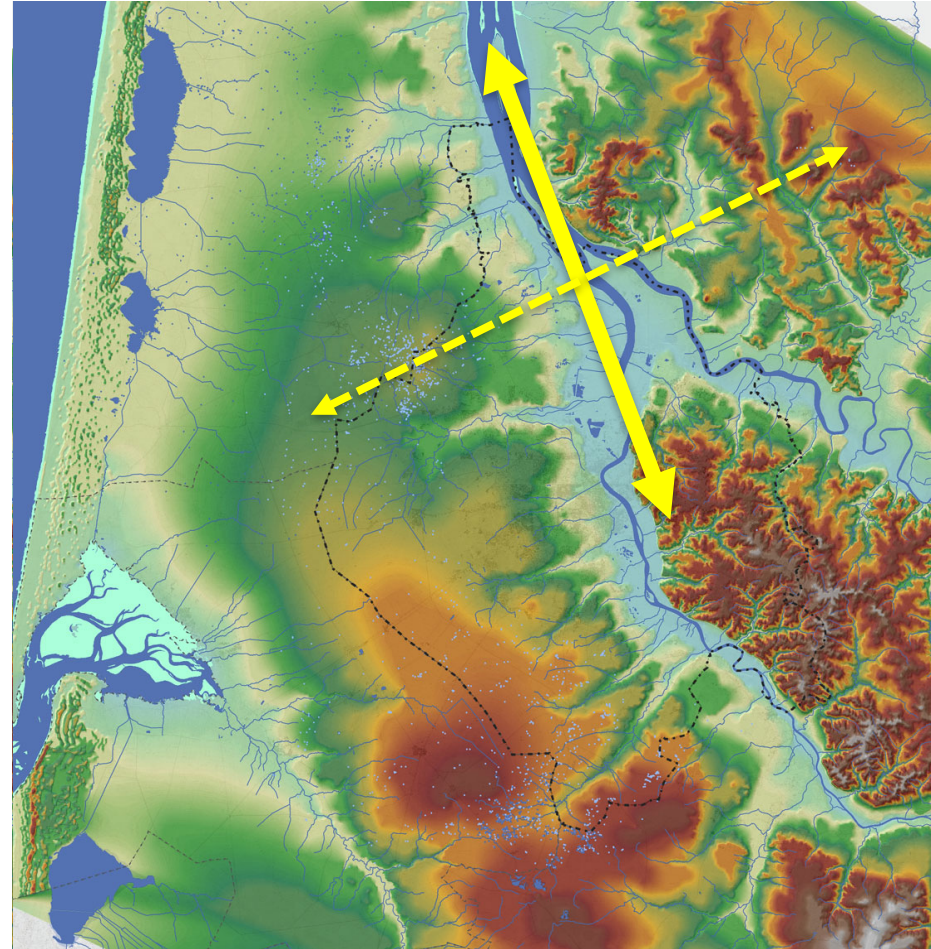
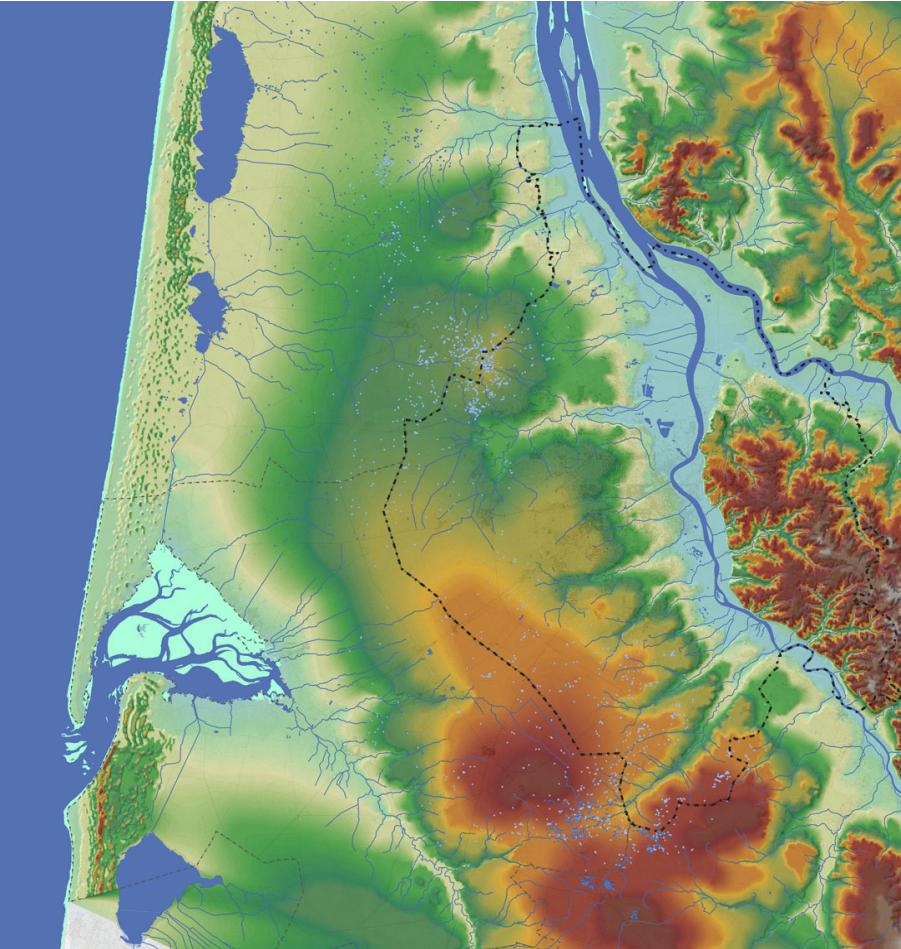
Bordeaux et son espace environnant

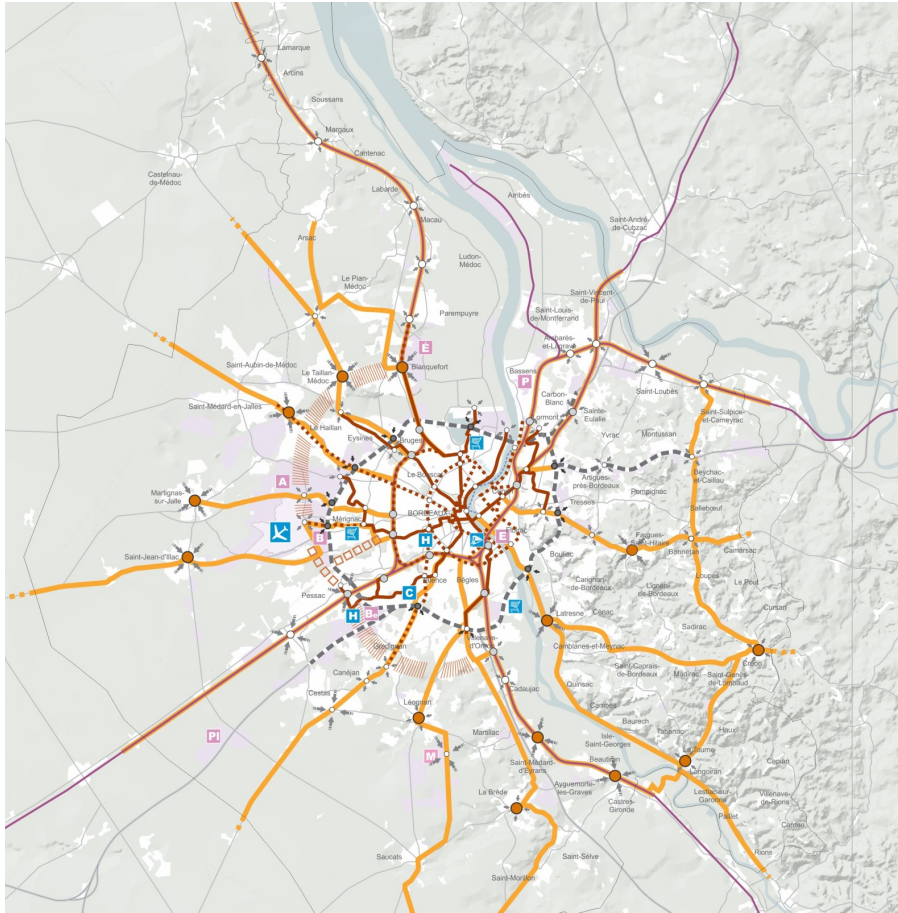
Evolution de la population entre 1999 et 2006 (agglomérations et communes)



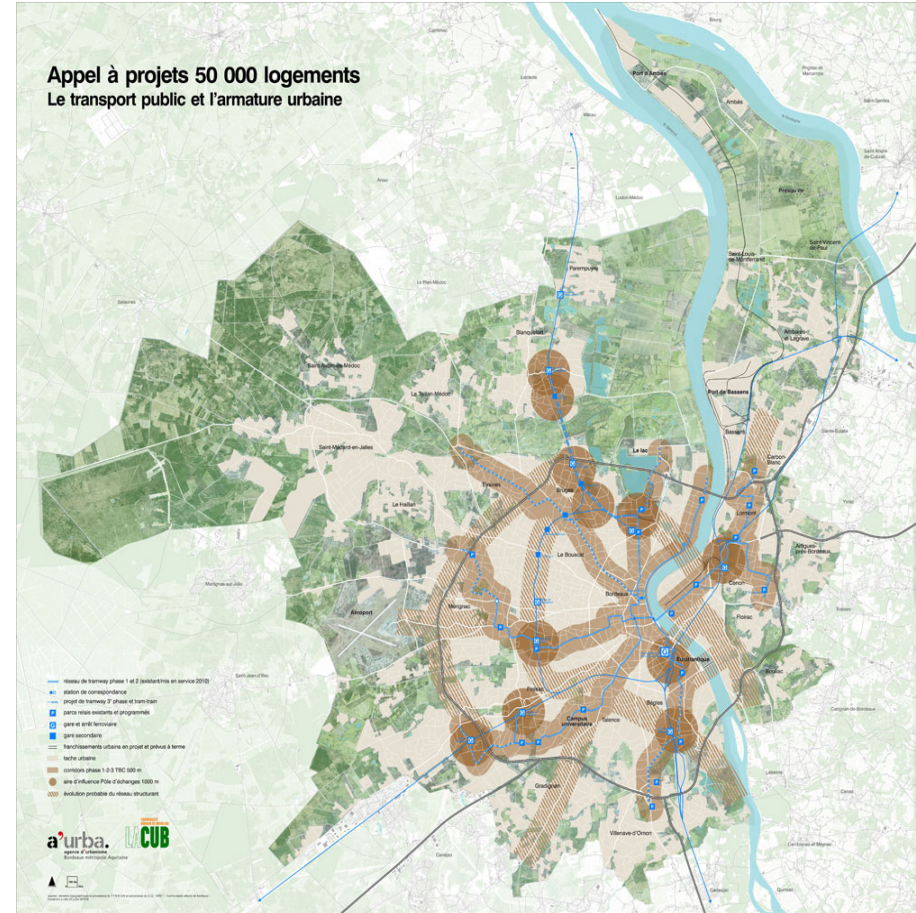


Topography as a result of





Building the metropolis around a large public transport network



# The Euratlantic project

PERSPECTIVE GÉNÉRALE DU DOMAINE SAINT JEAN BELCIER



LA COMPOSITION URBAINE ET PAYSAGÈRE



15 000 dwellings

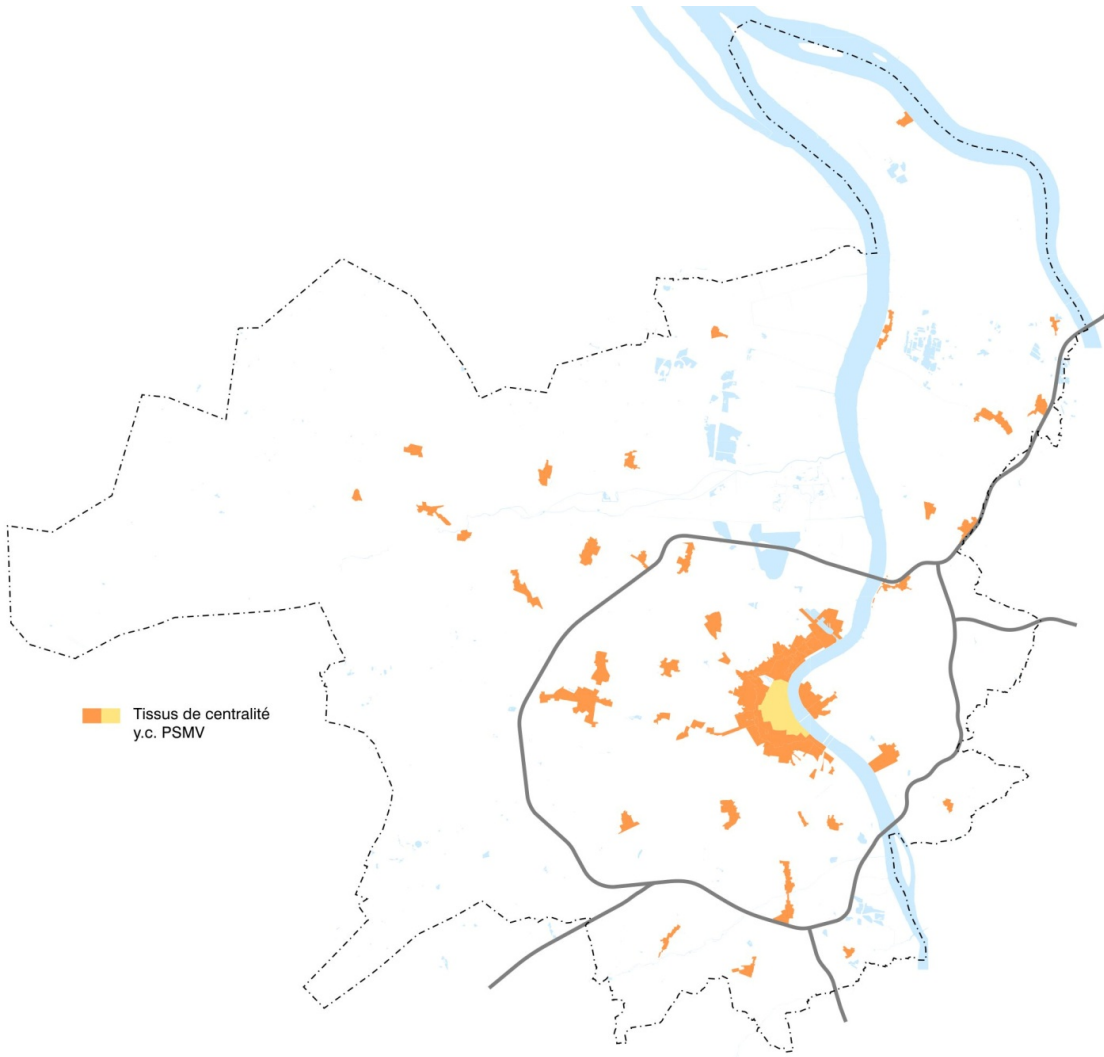
500 000 m<sup>2</sup> offices

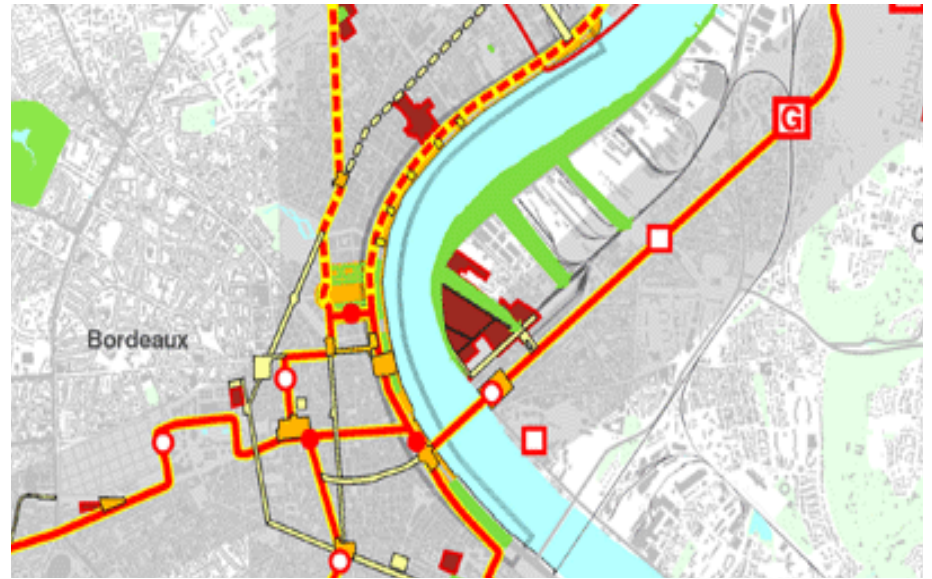
140 000 m<sup>2</sup> local shops and hotels

200 000 m<sup>2</sup> public facilities

# Diversity of living spaces

## Central area





Bastide urban project on the right bank



Tram as an unique opportunity to transform public spaces

**Echelle Territoriale**  
**≈ 1:500.000**

Lacanau

Ribérac

E606

A99

Libourne

Bordeaux

A63

Bergerac

Gujan-Mestras

A62

Aquitaine

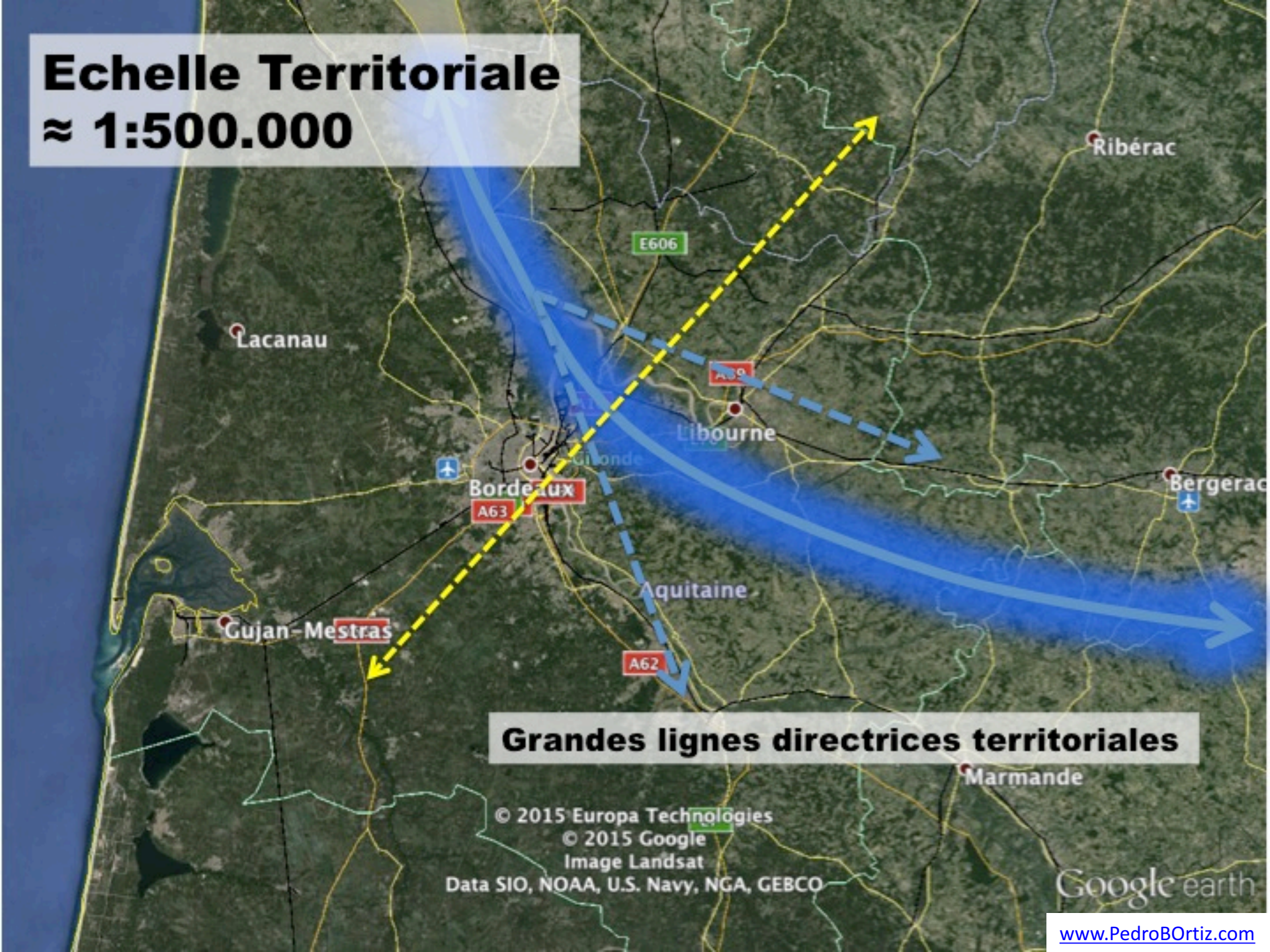
**Grandes lignes directrices territoriales**

Marmande

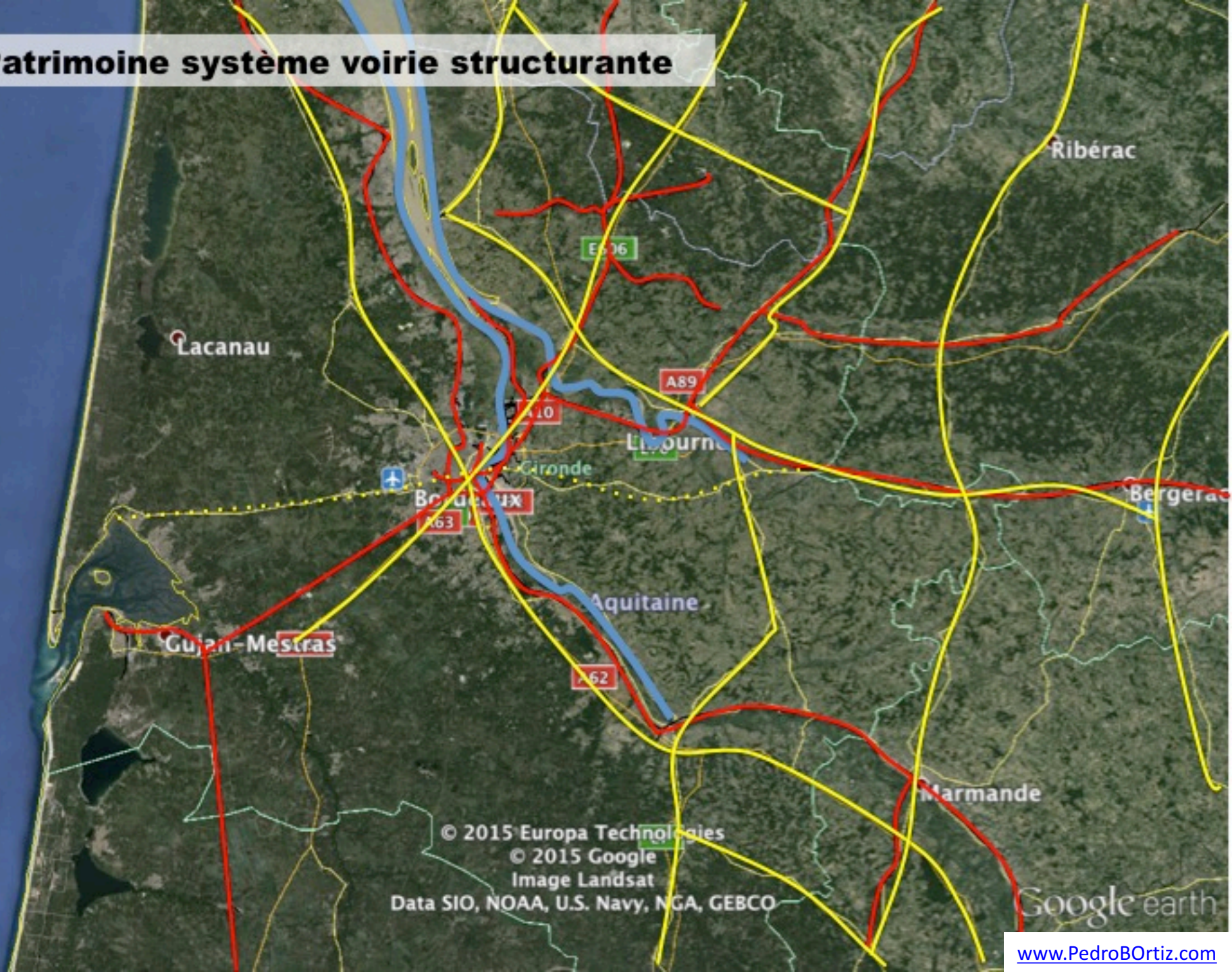
© 2015 Europa Technologies  
© 2015 Google  
Image Landsat  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

[www.PedroBortiz.com](http://www.PedroBortiz.com)



# Patrimoine système voirie structurante

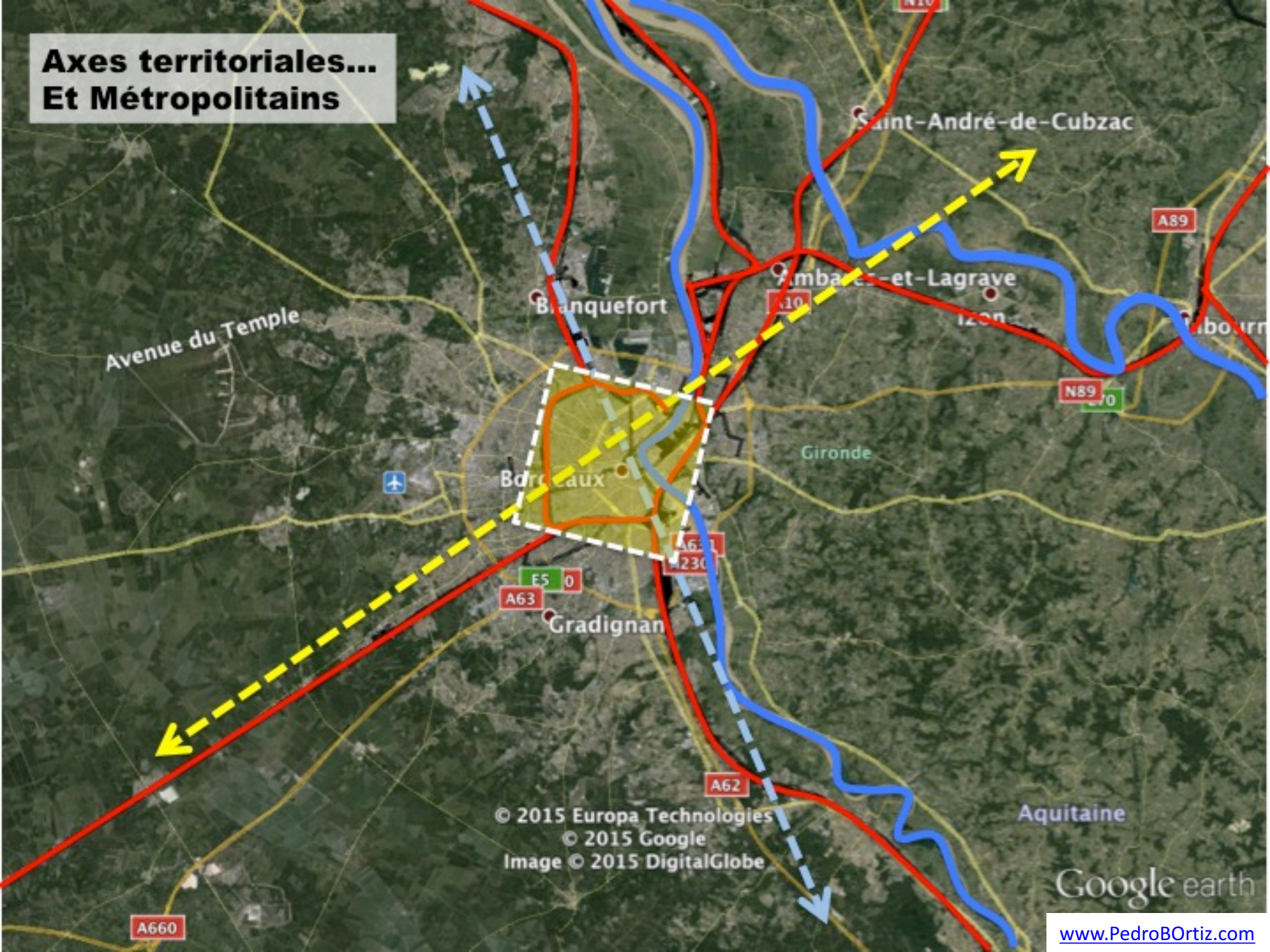


© 2015 Europa Technologies  
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Image Landsat  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth



# Axes territoriales... Et Métropolitains



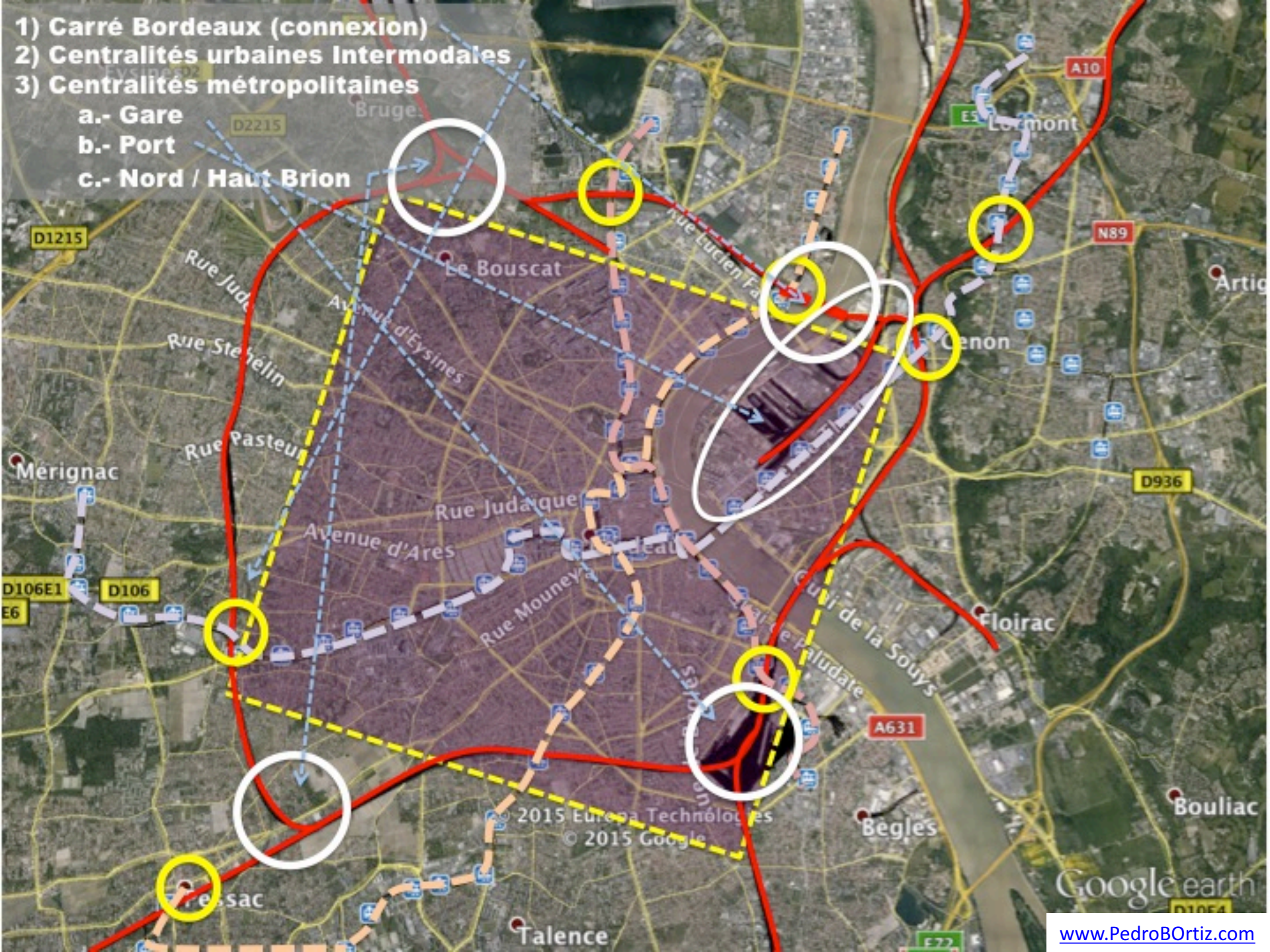
© 2015 Europa Technologies  
© 2015 Google  
Image © 2015 DigitalGlobe

Google earth

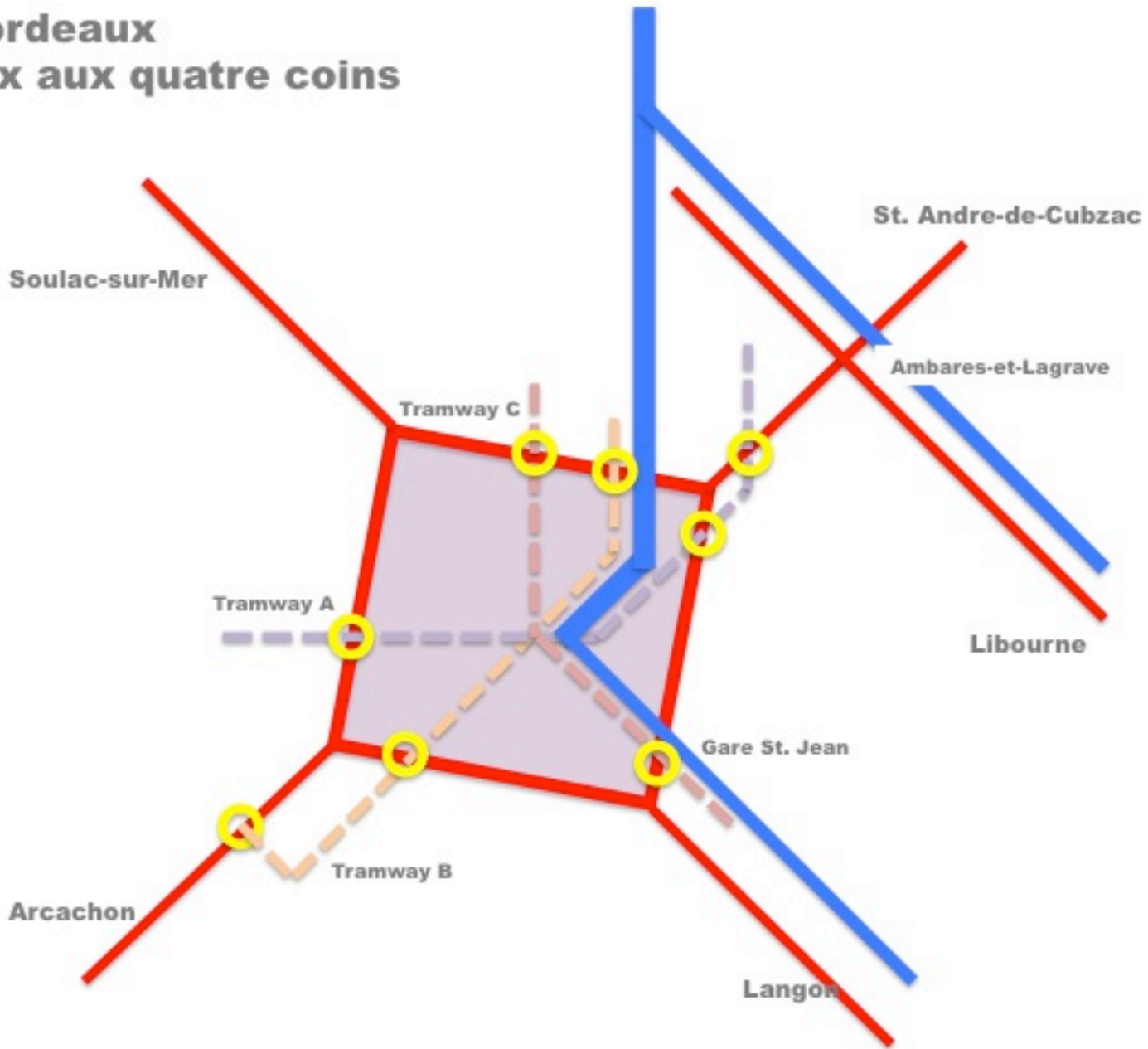
[www.PedroBOrtiz.com](http://www.PedroBOrtiz.com)

- 1) Carré Bordeaux (connexion)
- 2) Centralités urbaines Intermododiales
- 3) Centralités métropolitaines

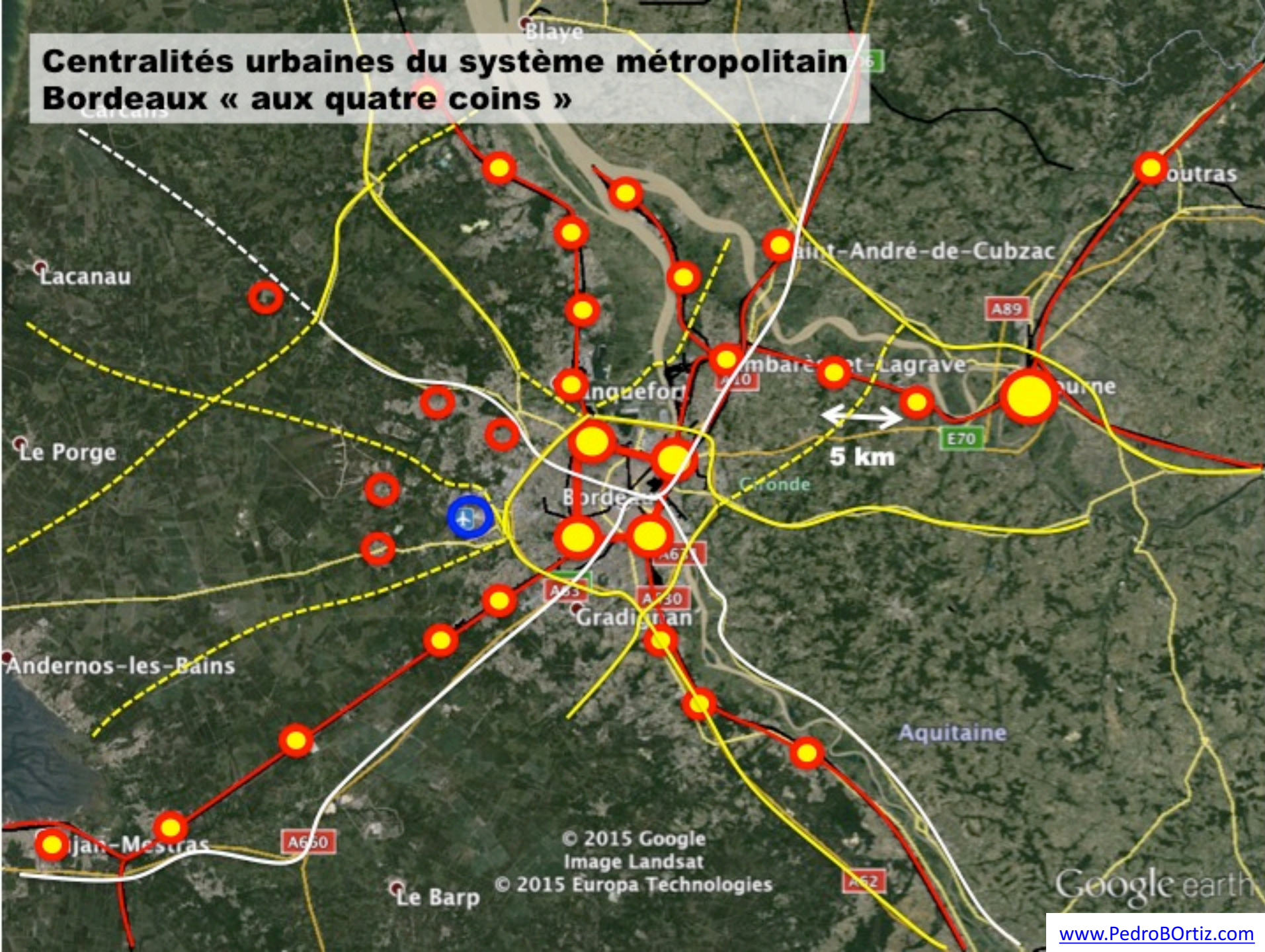
- a.- Gare
- b.- Port
- c.- Nord / Haut Brion



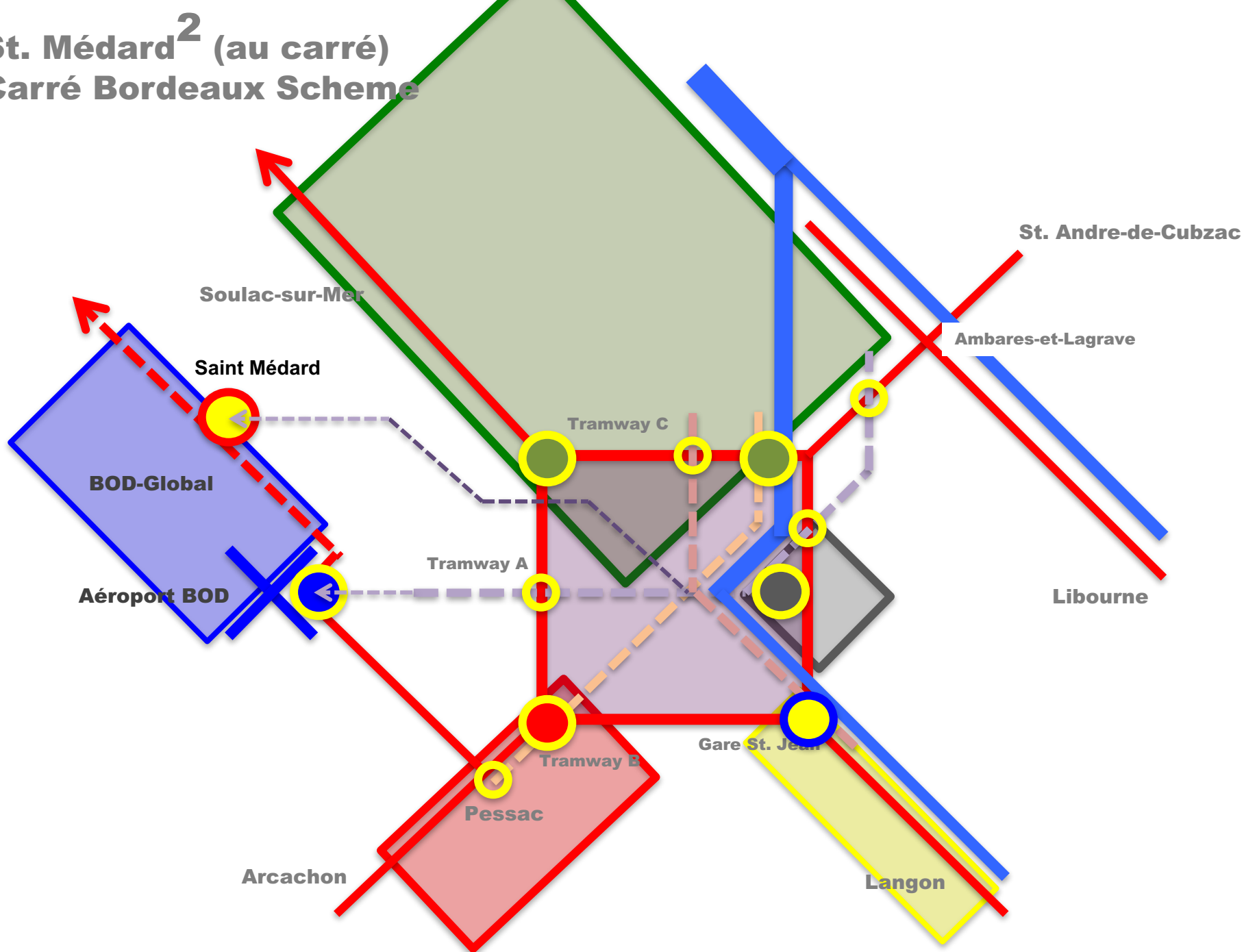
# Carré Bordeaux Bordeaux aux quatre coins



# Centralités urbaines du système métropolitain Bordeaux « aux quatre coins »



# St. Médard<sup>2</sup> (au carré) Carré Bordeaux Scheme



SCOT



fond cartographique Institut  
 sources : données topographiques en provenance du F.T.N © IGN S.I.C. SIGMA-  
 communauté urbaine de Bordeaux - orthophoto IGN 1998 2009 - SYGARD ©  
 traitement à l'urban © 13 février 2014  
 SCOT de l'aire métropolitaine bordelaise approuvé le 13 février 2014



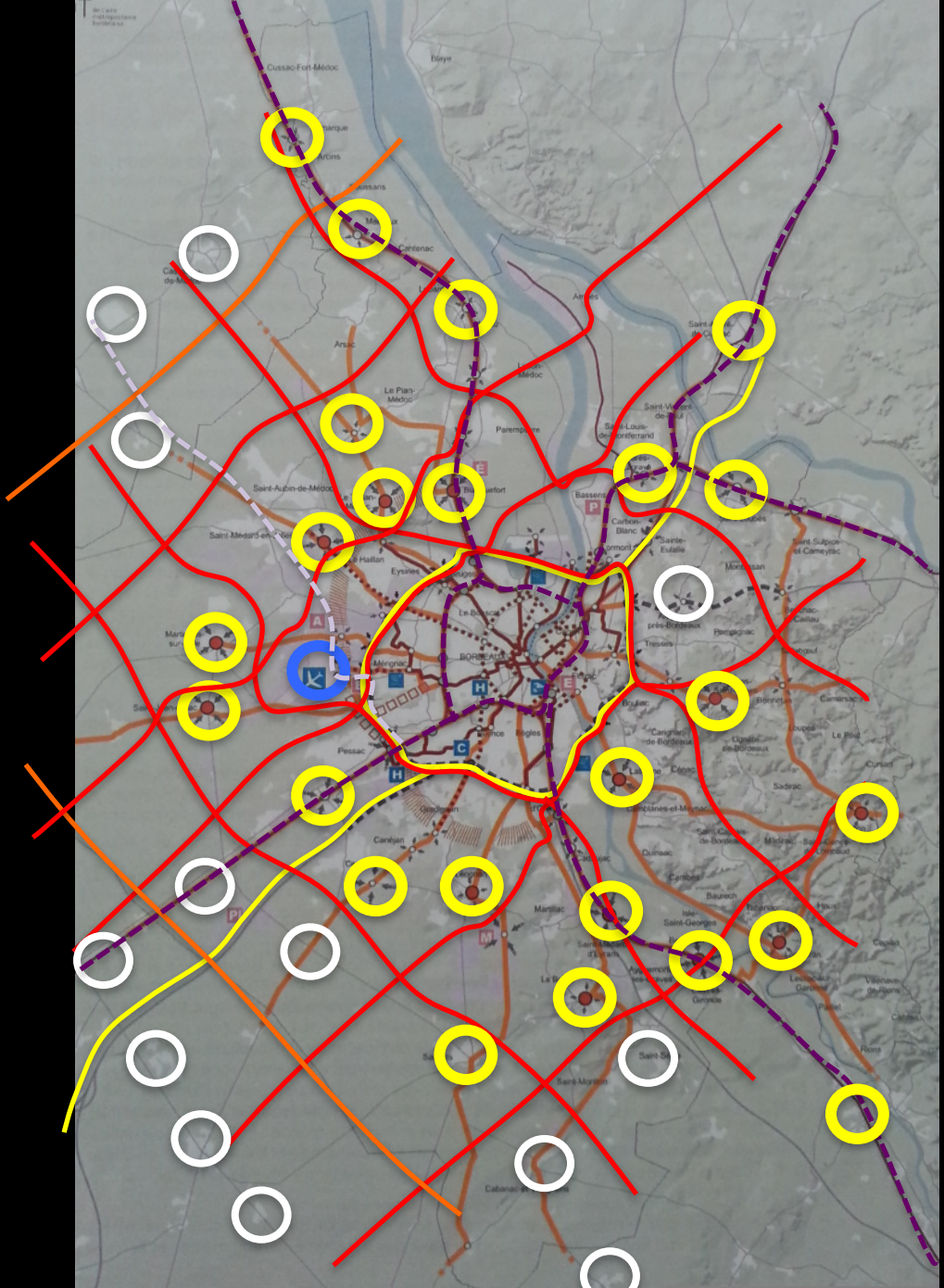
SCOT



fond cartographique intégré  
sources : données géographiques en provenance du F.T.N © IGN  
communauté urbaine de Bordeaux - orthophoto IGN 666 2009 - DIVISION D  
traitement à l'urbanisme © 13 février 2014  
SCOT de l'aire métropolitaine bordelaise approuvé le 13 février 2014

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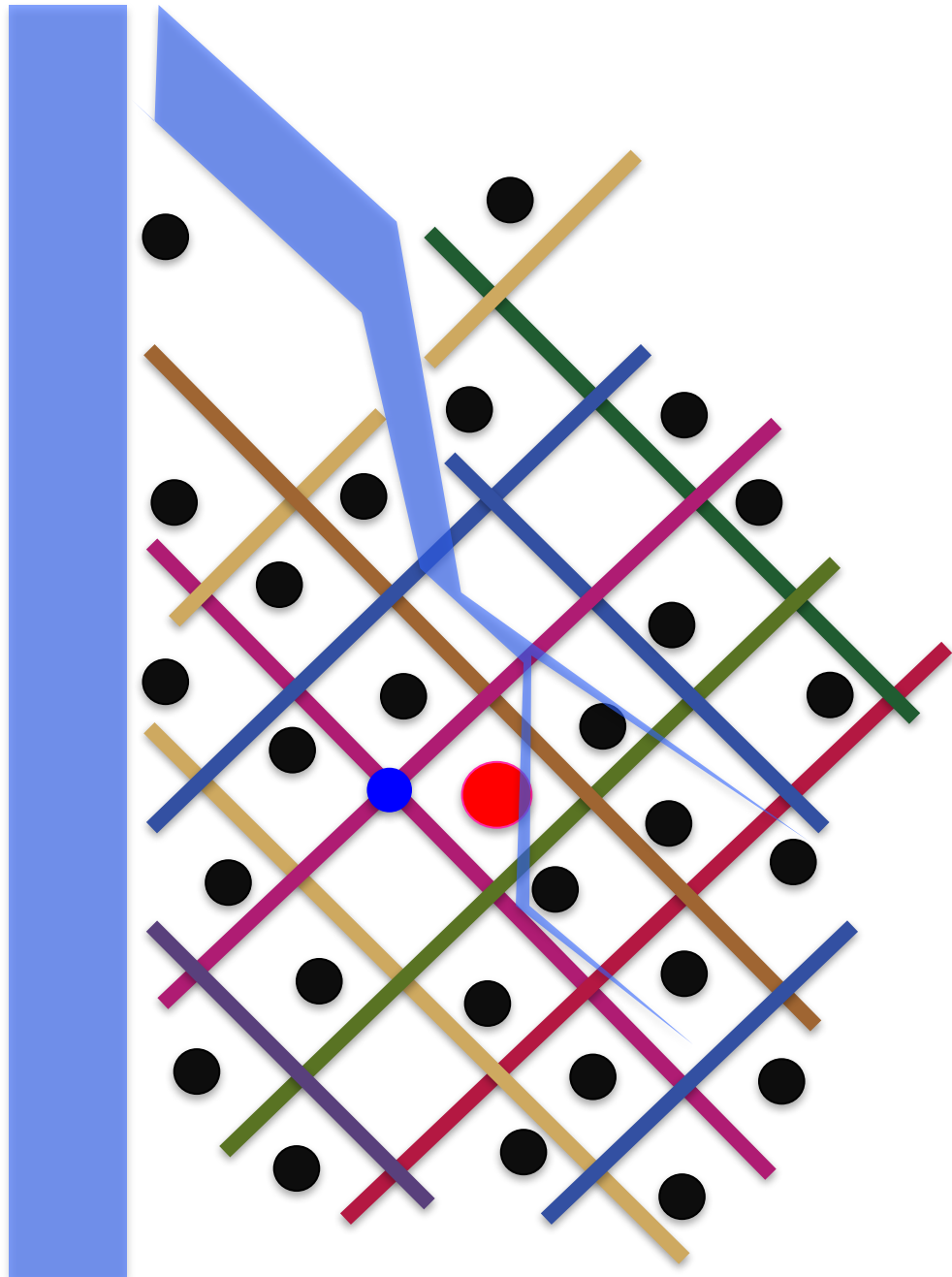


ford cartographie de l'Institut géographique national  
 acuppt : données topographiques en provenance de FTN © IGN SIG «SIGMA»  
 communauté Urbaine de Bordeaux - orthophoto IGN (M 2006) - SYSDAU ©

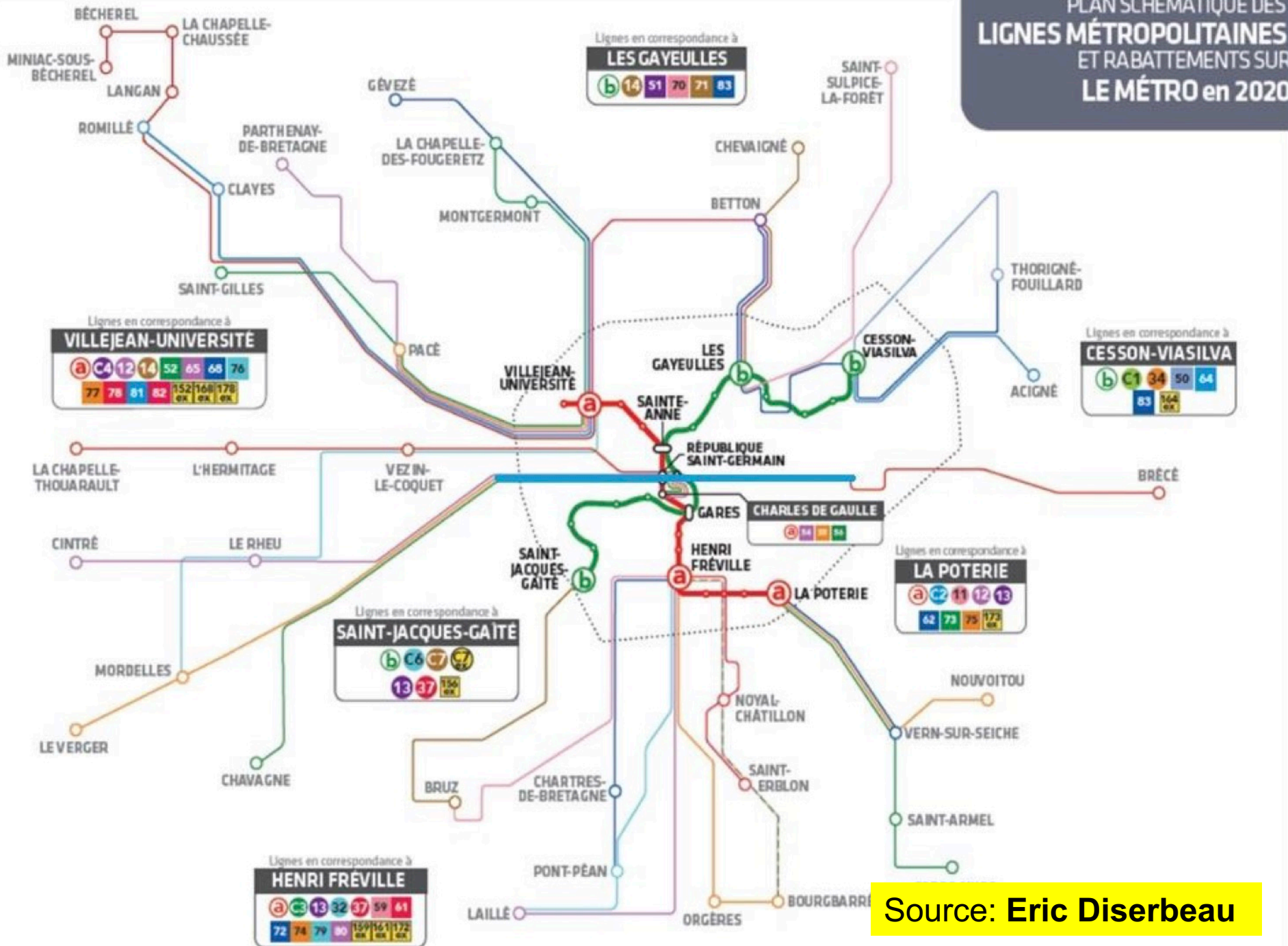


# BORDEAUX MÉTROPOLE

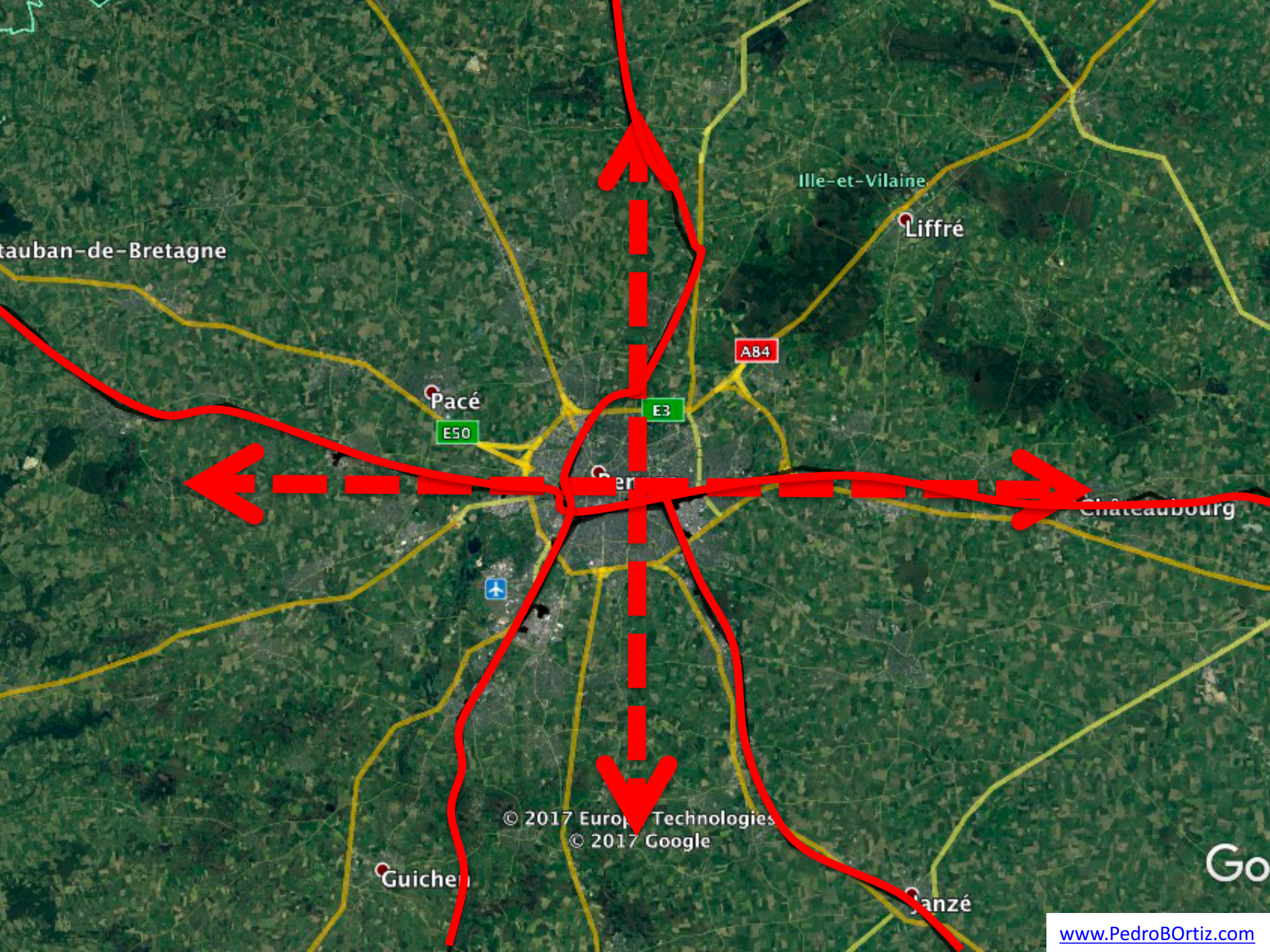
PARADIGME SHIFT



# PLAN SCHEMATIQUE DES LIGNES MÉTROPOLITAINES ET RABATTEMENTS SUR LE MÉTRO en 2020



Source: Eric Diserbeau



tauban-de-Bretagne

Ille-et-Vilaine

Liffré

A84

Pacé

E50

E3

Rennes

Chateaubourg



© 2017 Europe Technologies  
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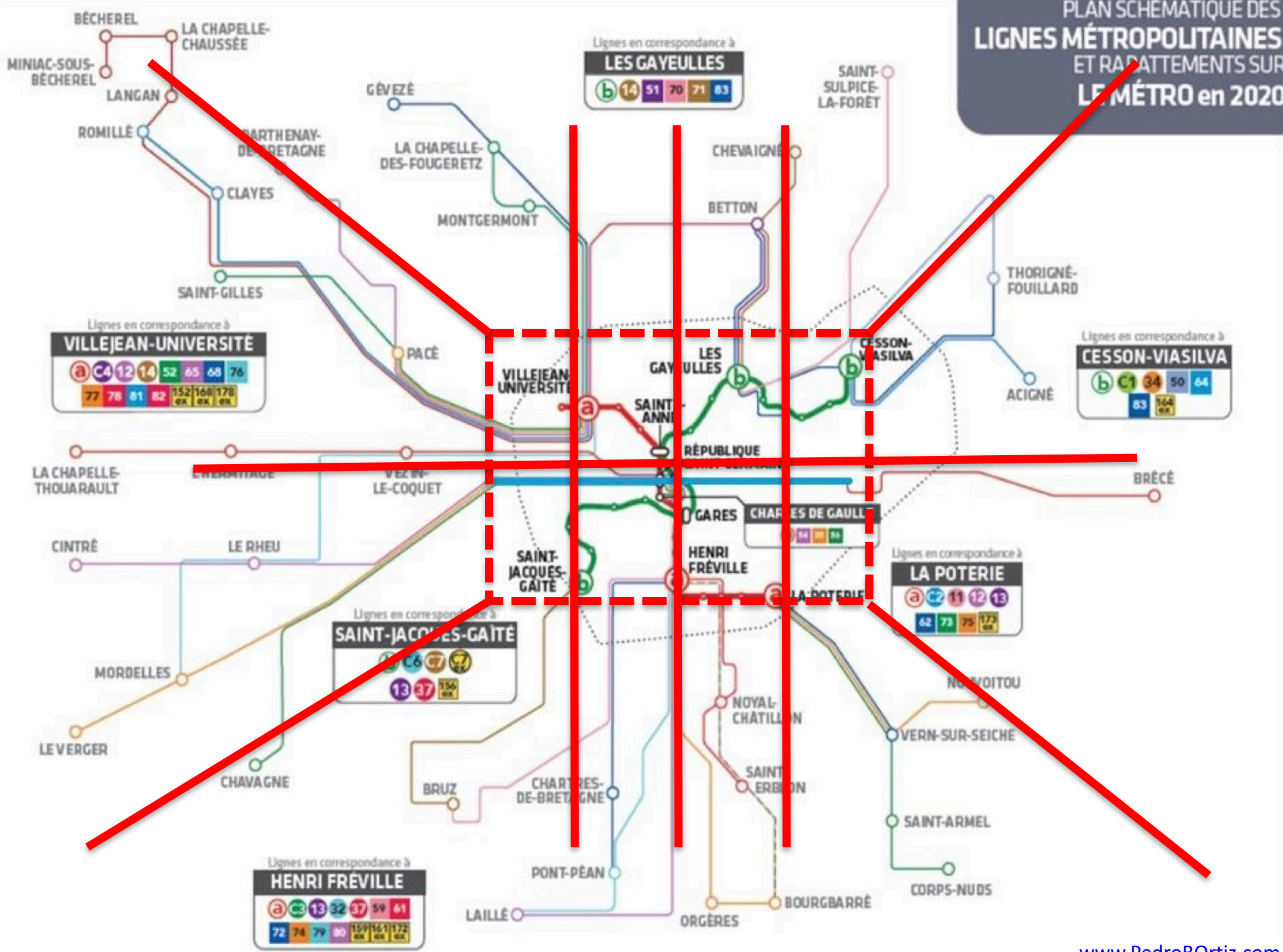
Guichen

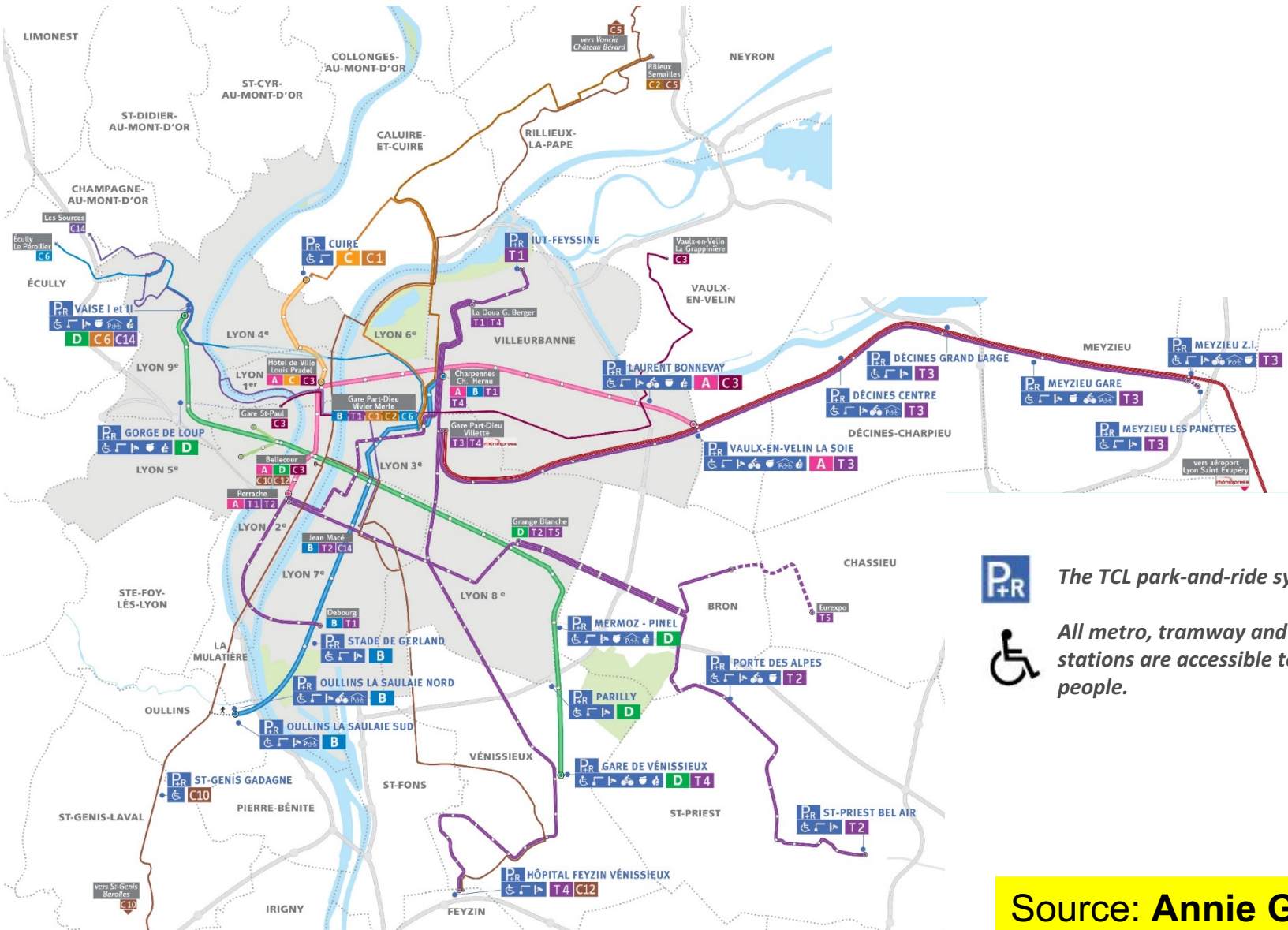
Sanzé

Go

[www.PedroBOrtiz.com](http://www.PedroBOrtiz.com)

# PLAN SCHEMATIQUE DES LIGNES MÉTROPOLITAINES ET RADATTEMENTS SUR LE MÉTRO en 2020





*The TCL park-and-ride system*



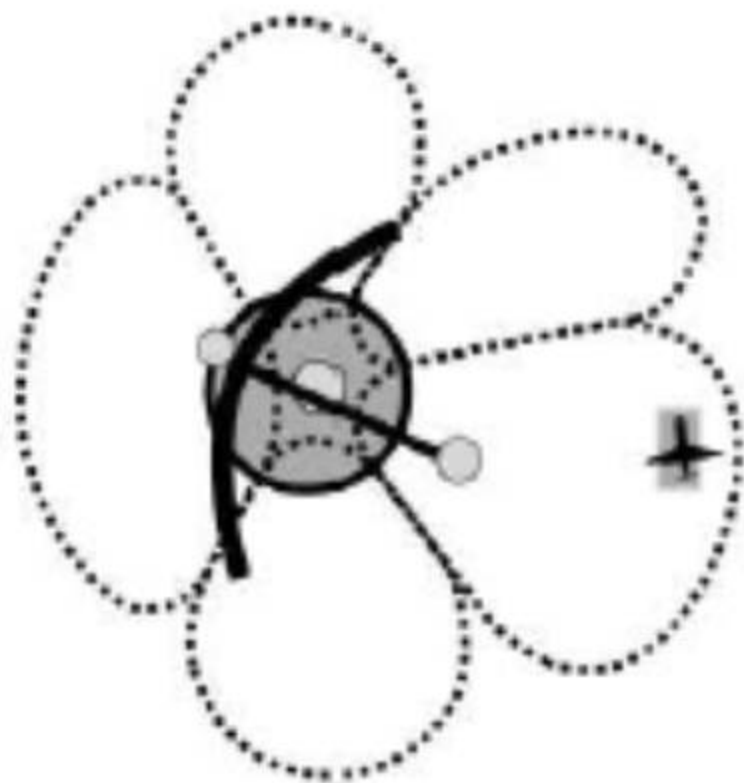
*All metro, tramway and trolleybus stations are accessible to disabled people.*

**Source: Annie Guillemot**



## SDAL Lyon 2010

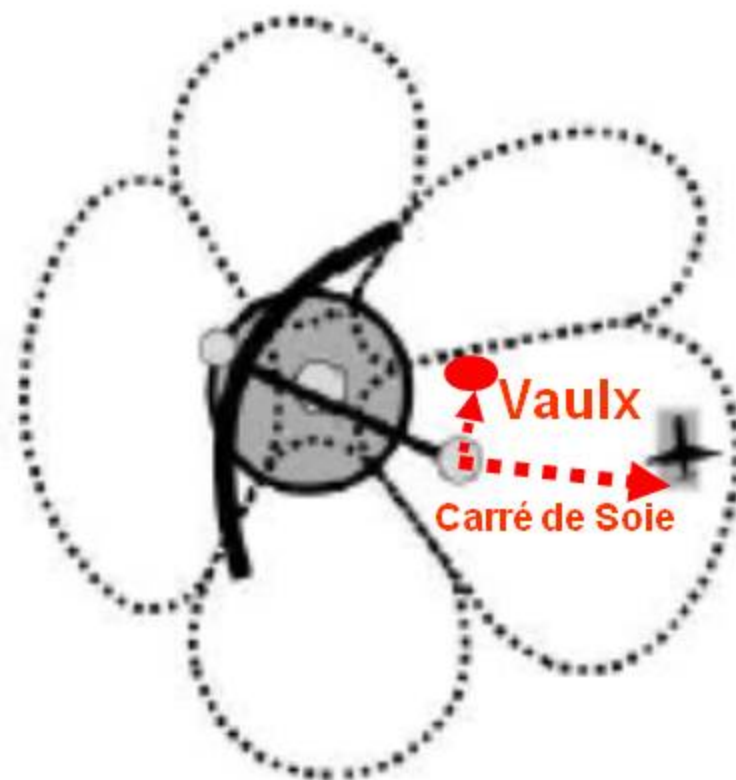
L'arc et la flèche



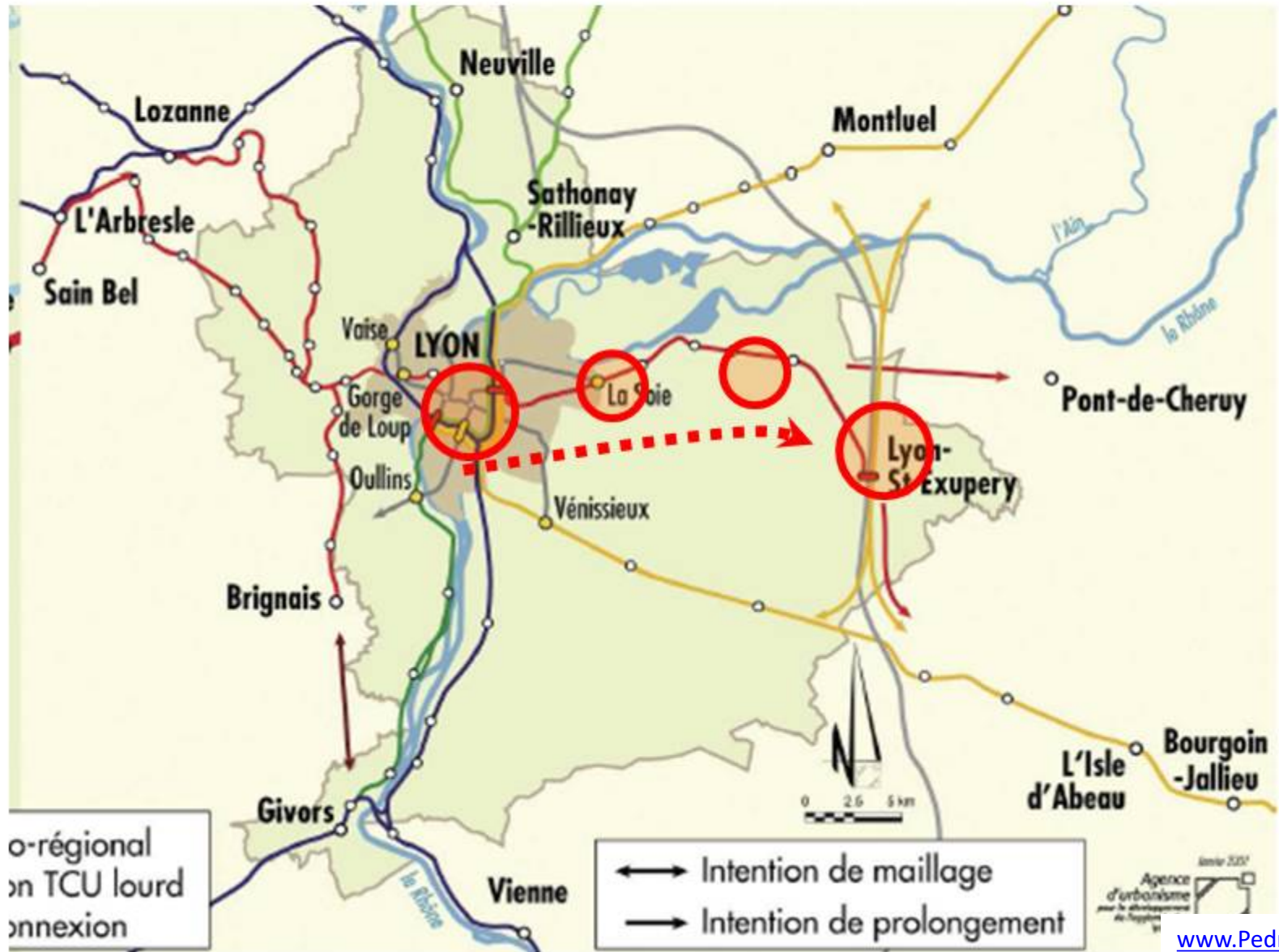
**NOUVEAU**

SDAL Lyon 2010 ~~20~~

L'arc et la flèche

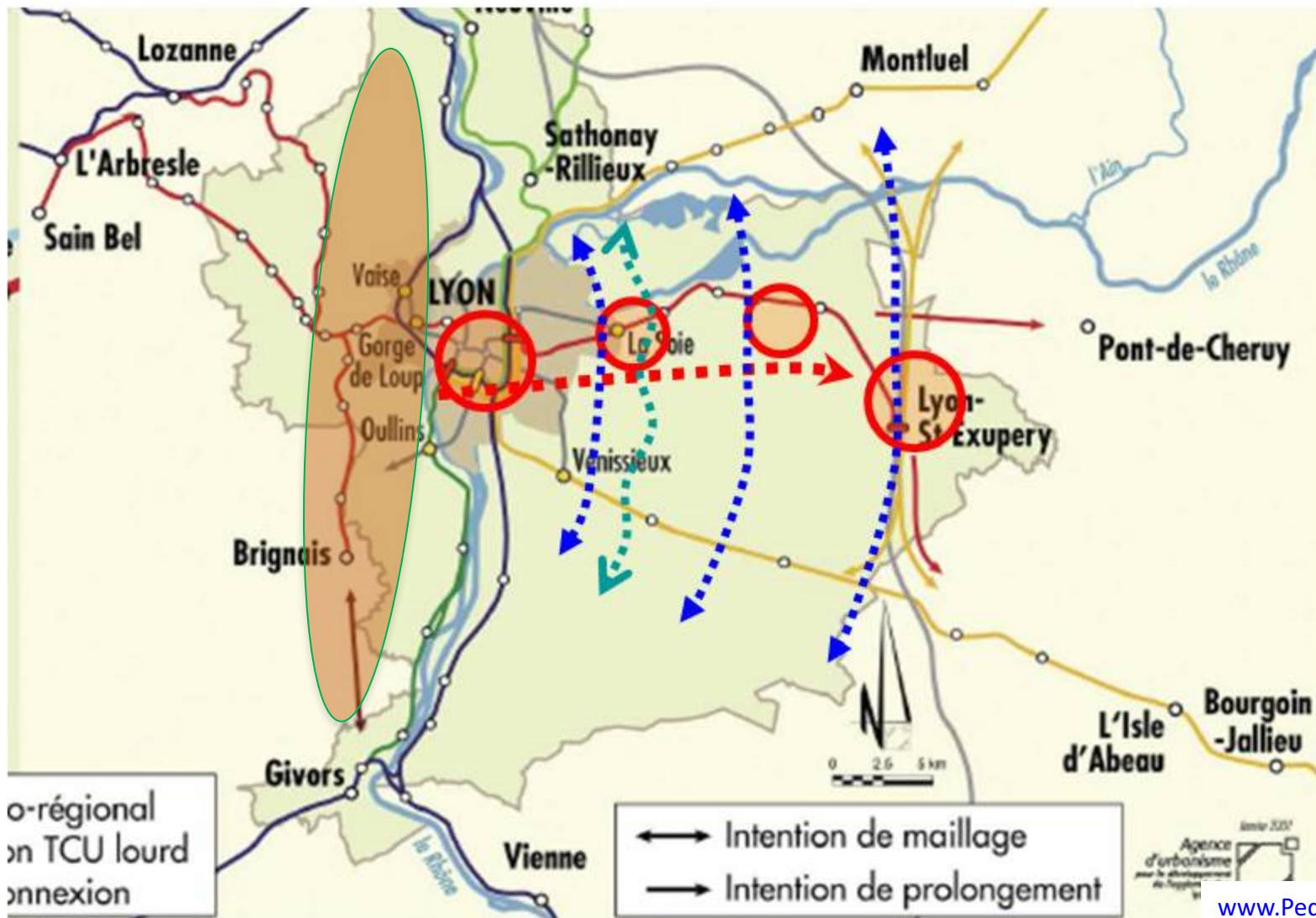


# Axe de Développement des relations économiques internationales

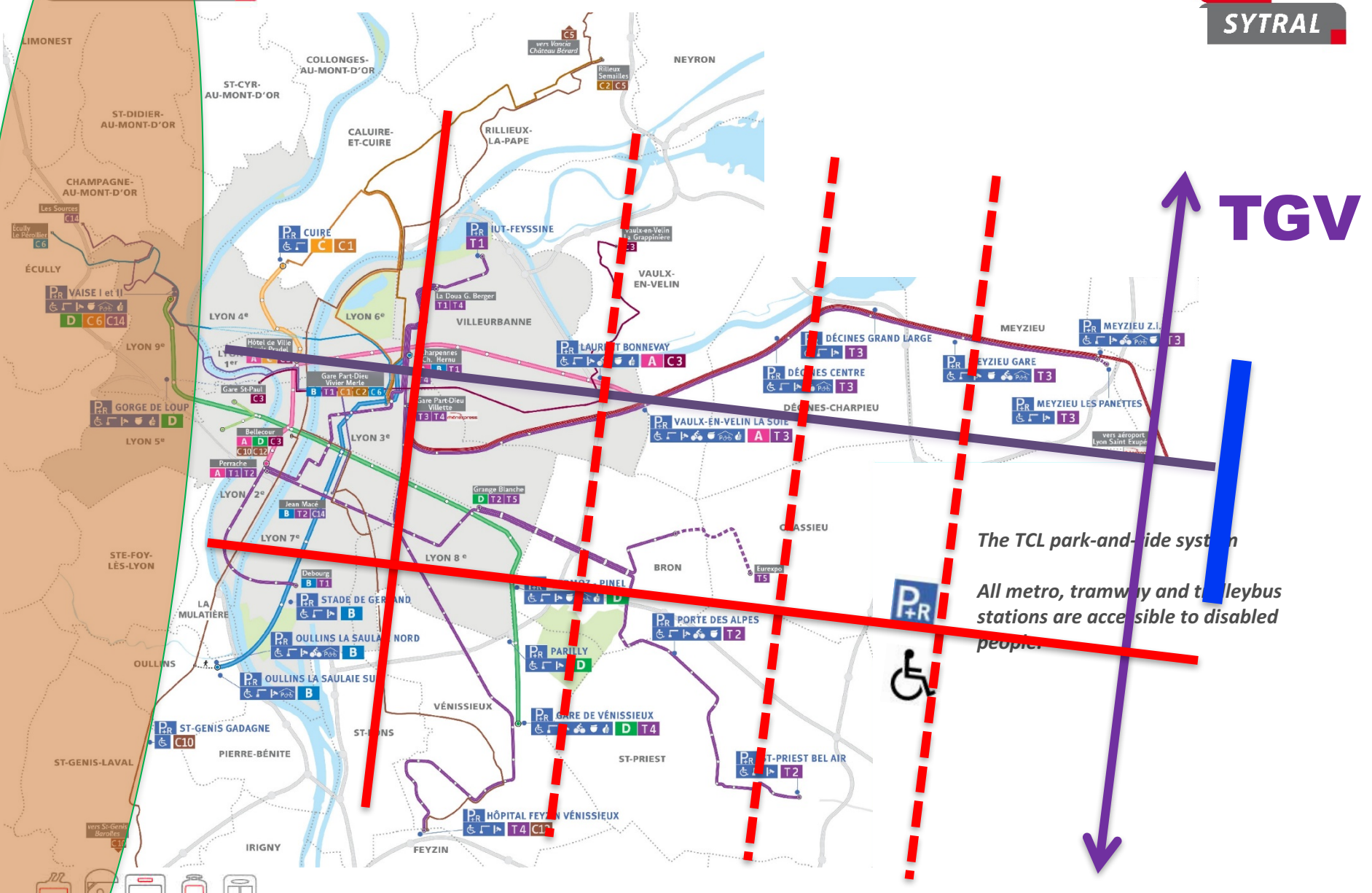


# Axe de Développement des relations économiques internationales

## Articulation réticulaire de l'Est – Centralité de Vaulx-Soie





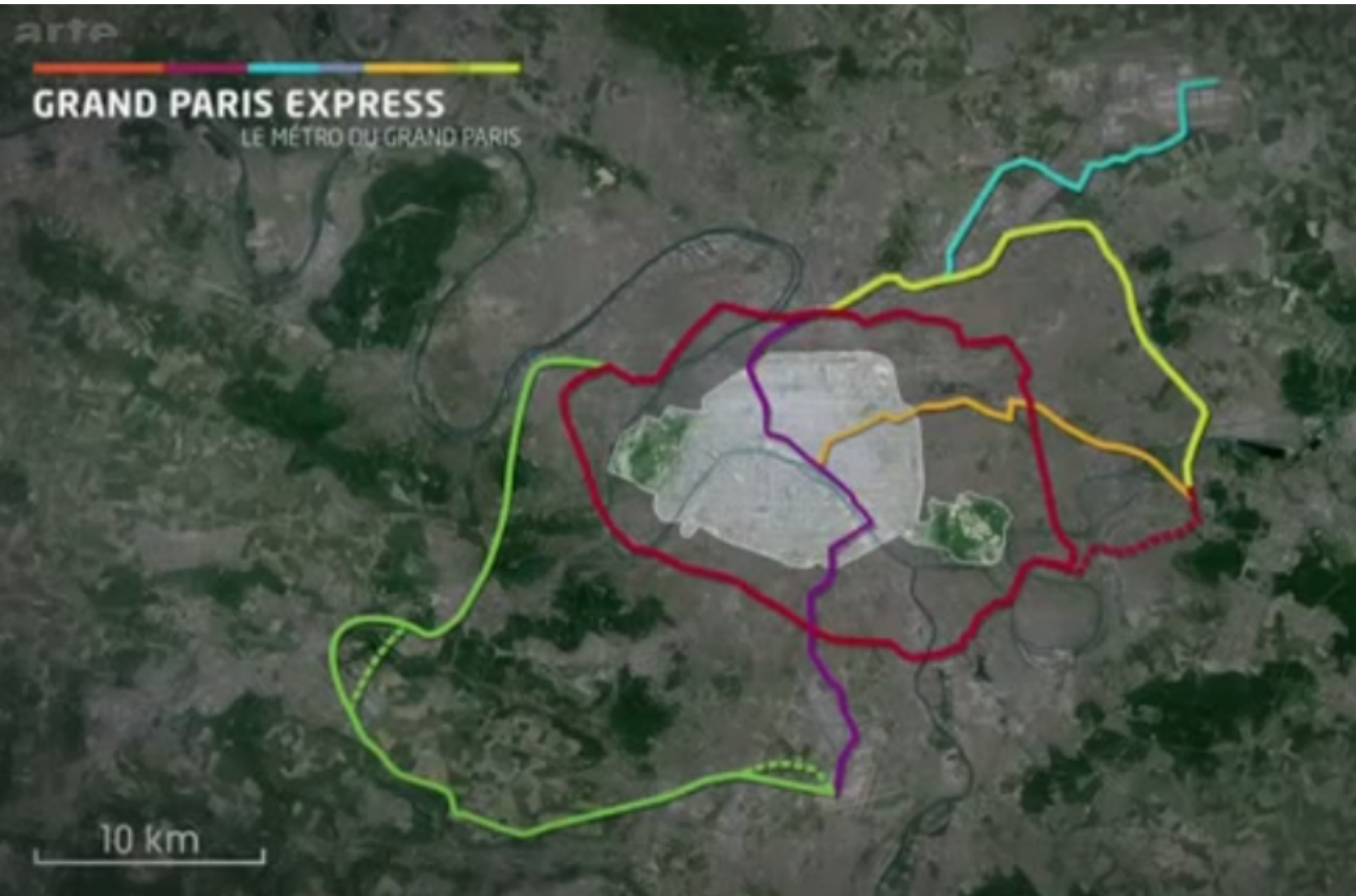


The TCL park-and-ride system

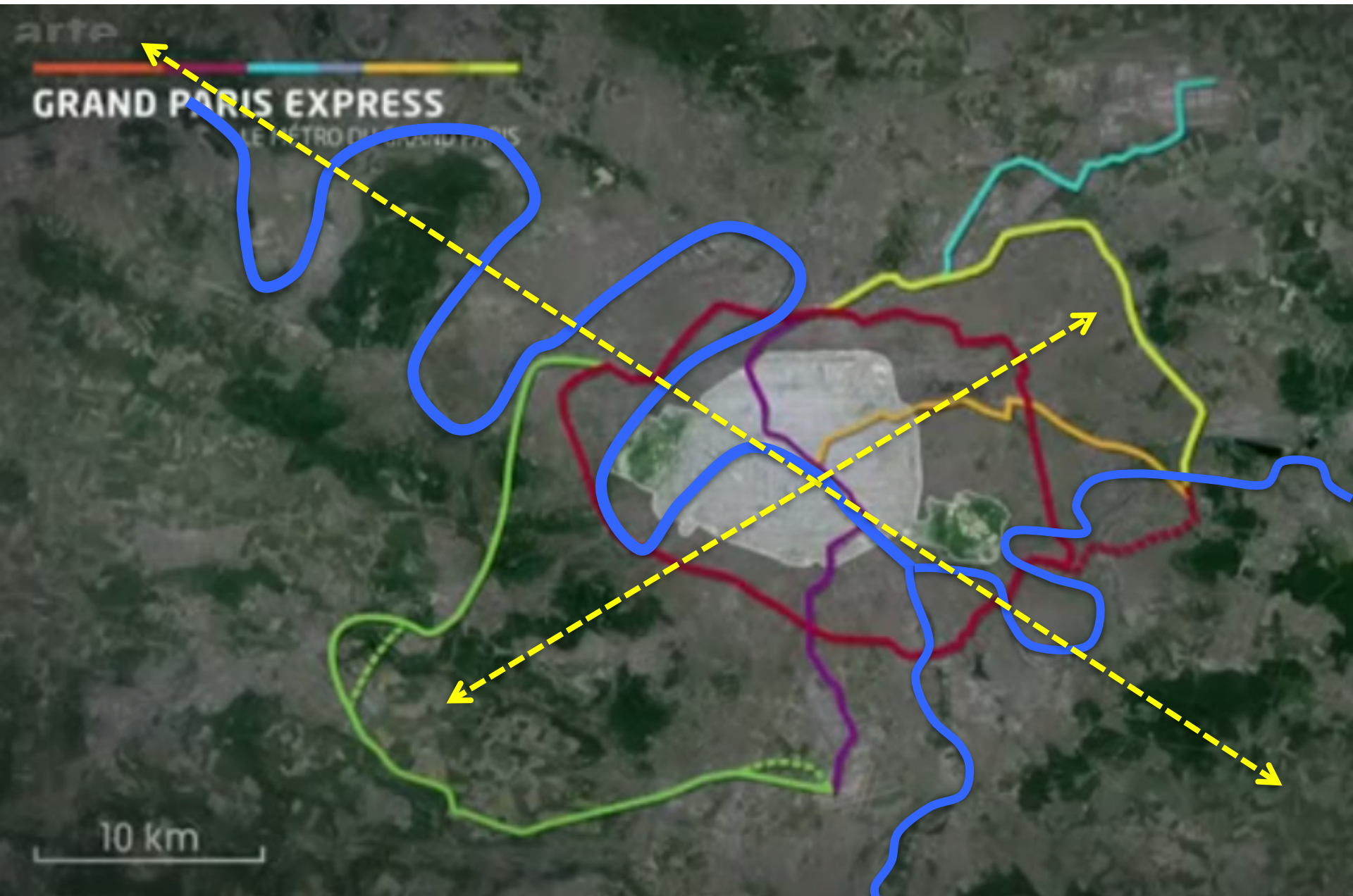
All metro, tramway and trolleybus stations are accessible to disabled people.



# Metro-Matrix Grand Paris



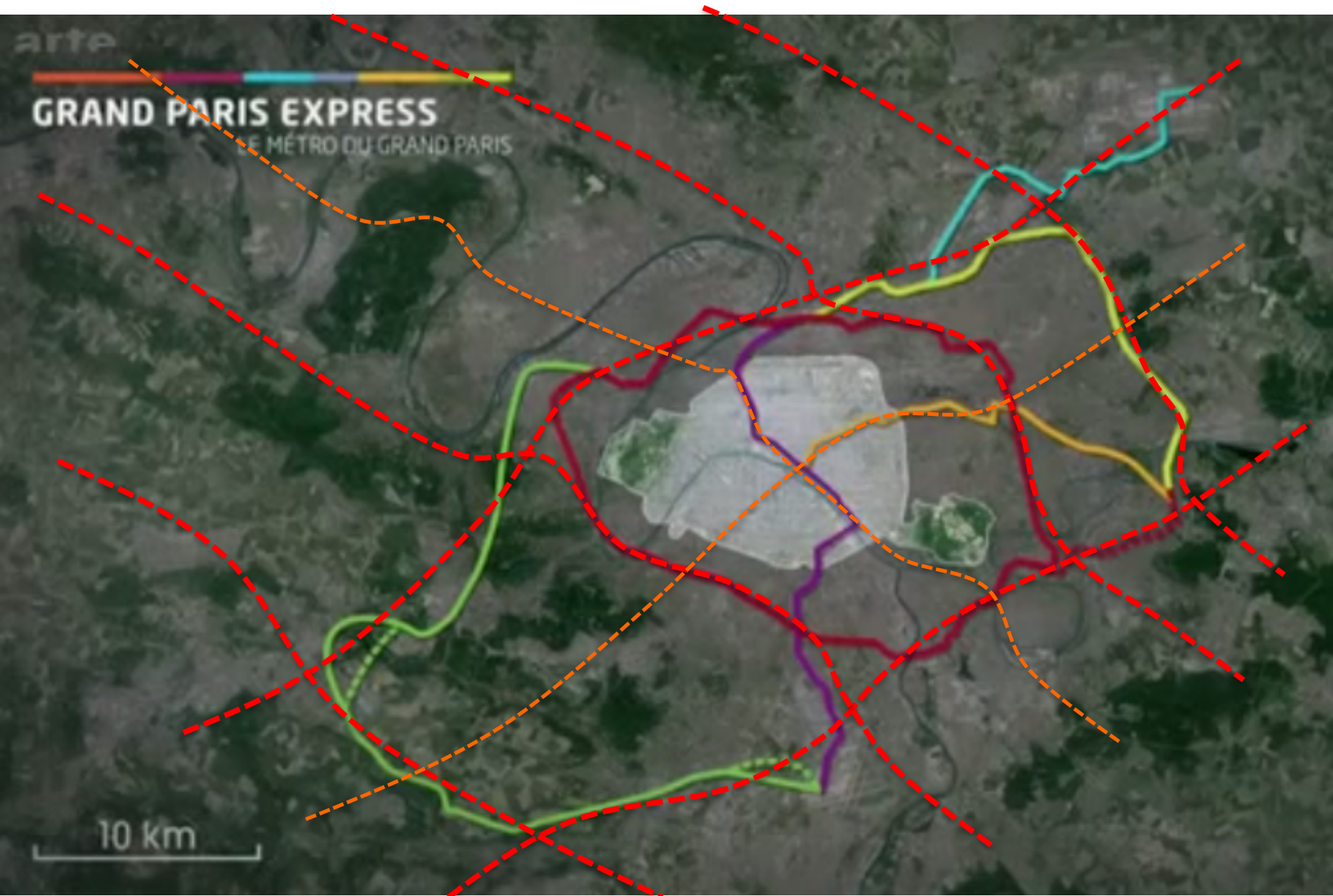
# Metro-Matrix Grand Paris



Will Descartes inspire French intelligentsia?

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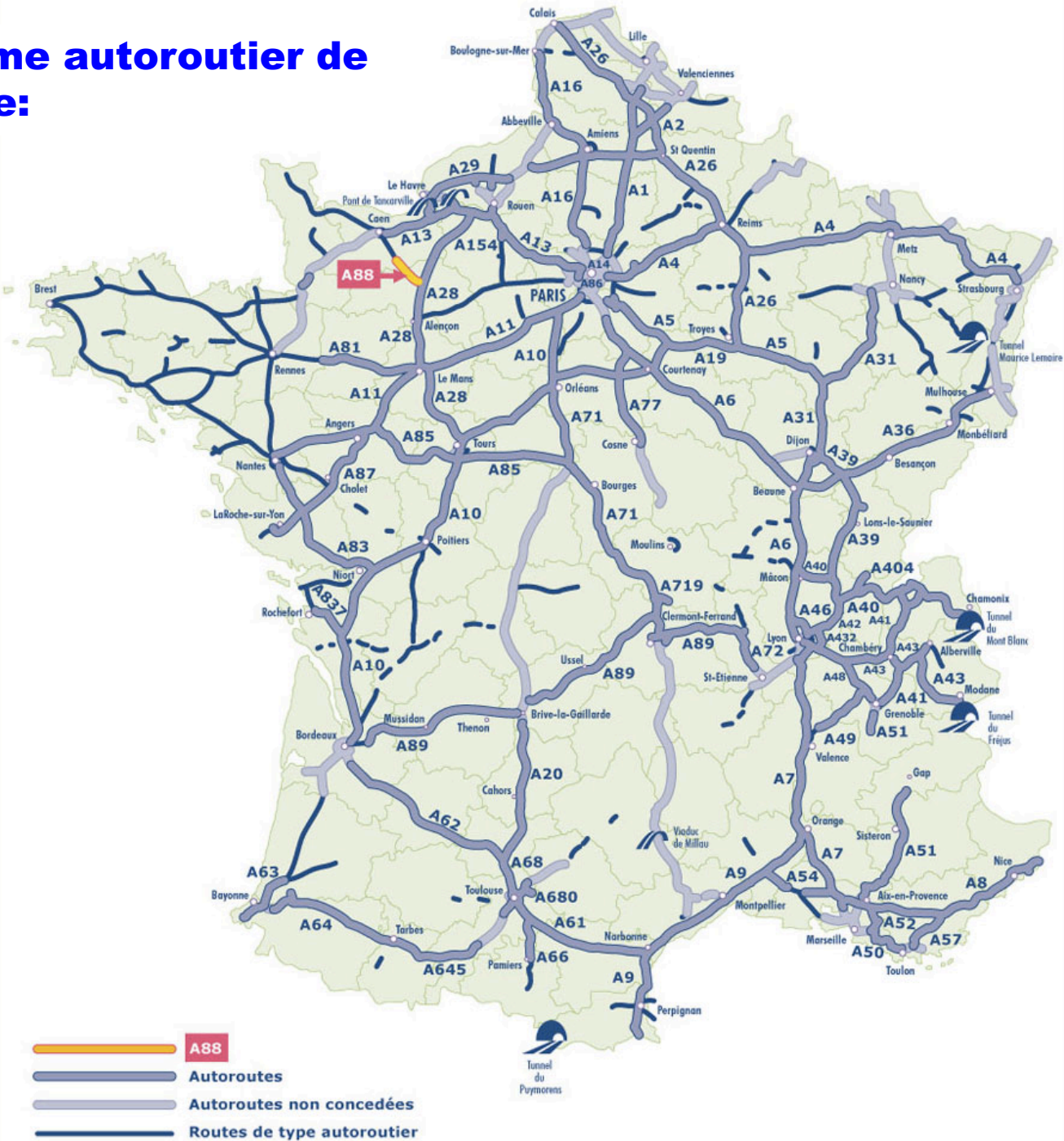
# Metro-Matrix Grand Paris



Will Descartes inspire French intelligentsia?

© [www.PedroBOrtiz.com](http://www.PedroBOrtiz.com)

# Le système autoroutier de La France:



# La France: L'hexagone

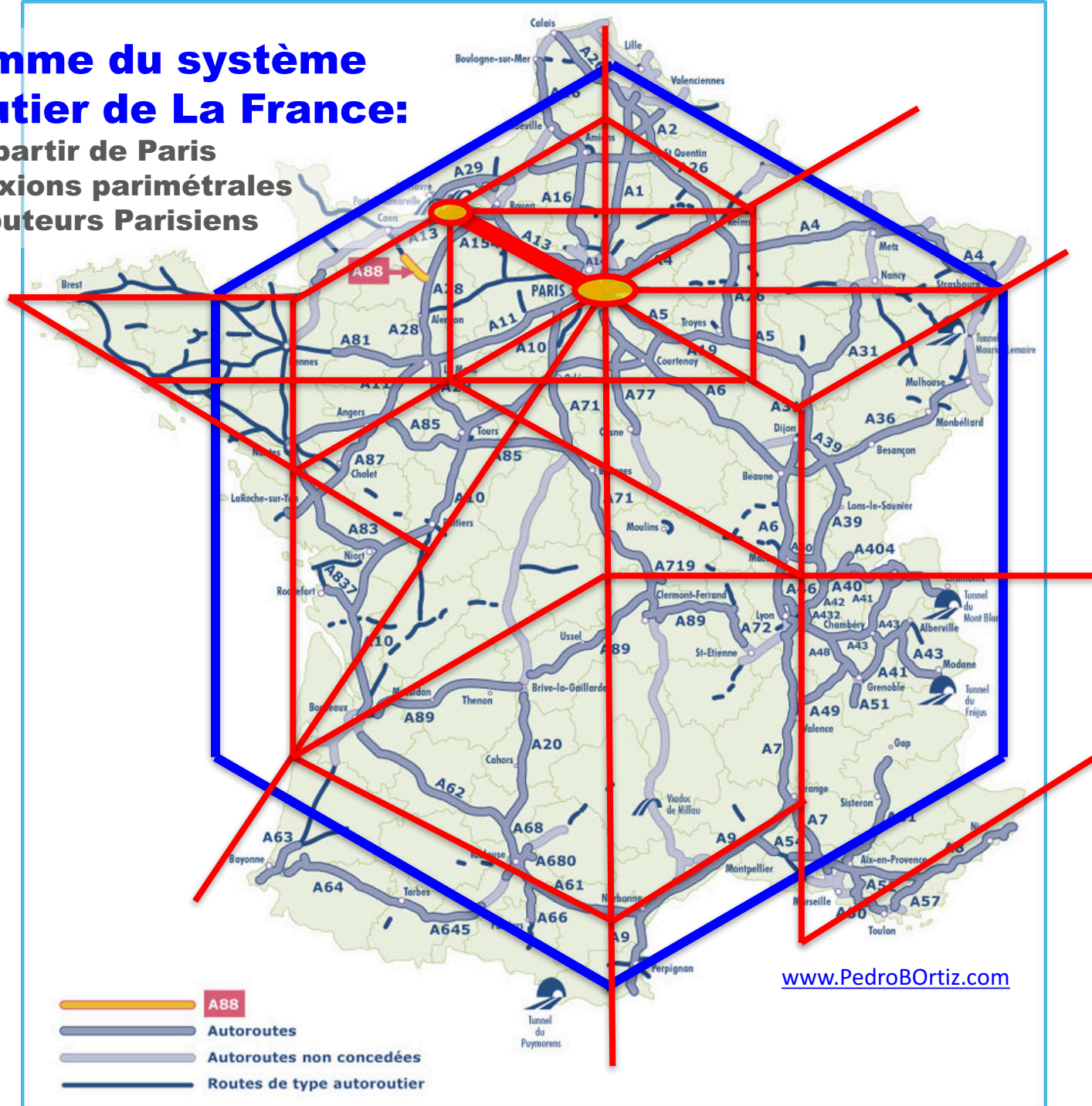


# Diagramme du système autoroutier de La France:

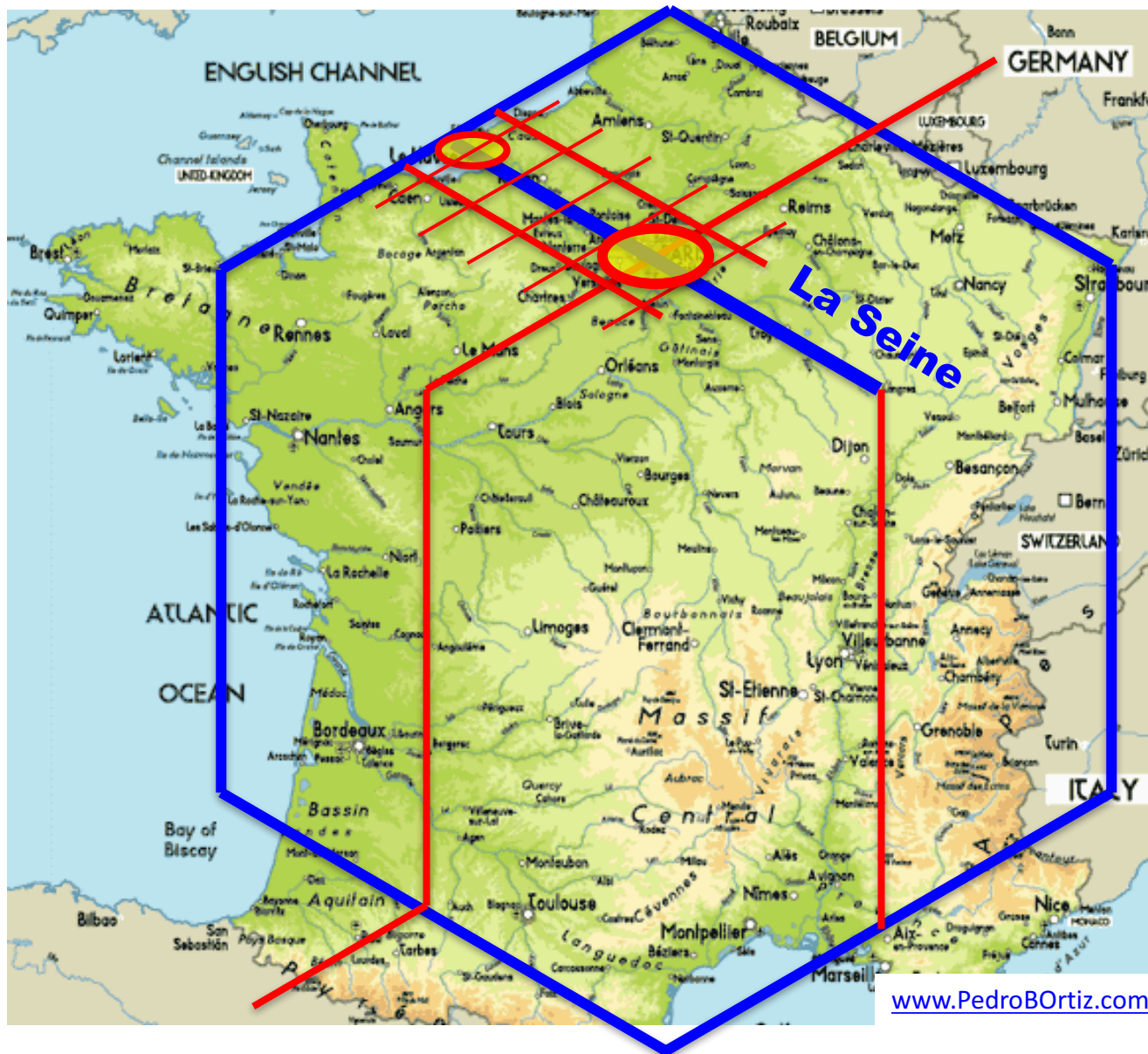
L'étoile a partir de Paris

Les connexions parimétrales

Les distributeurs Parisiens



# L'axe Paris-Le Havre dans le contexte National





# Paris: Le nœud du cadeau de la France

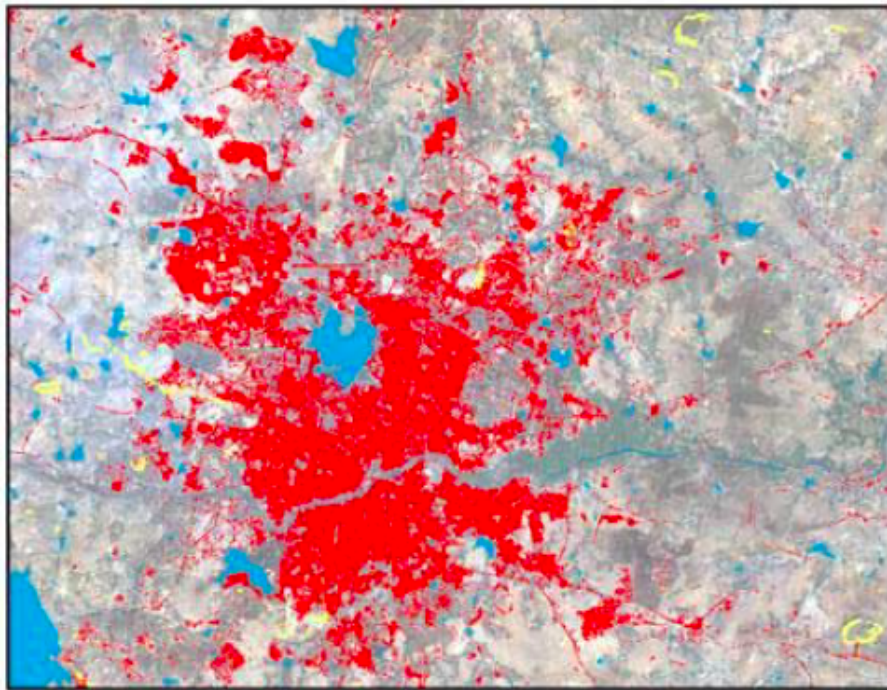


## 4) Hyderabad metropolitan issues

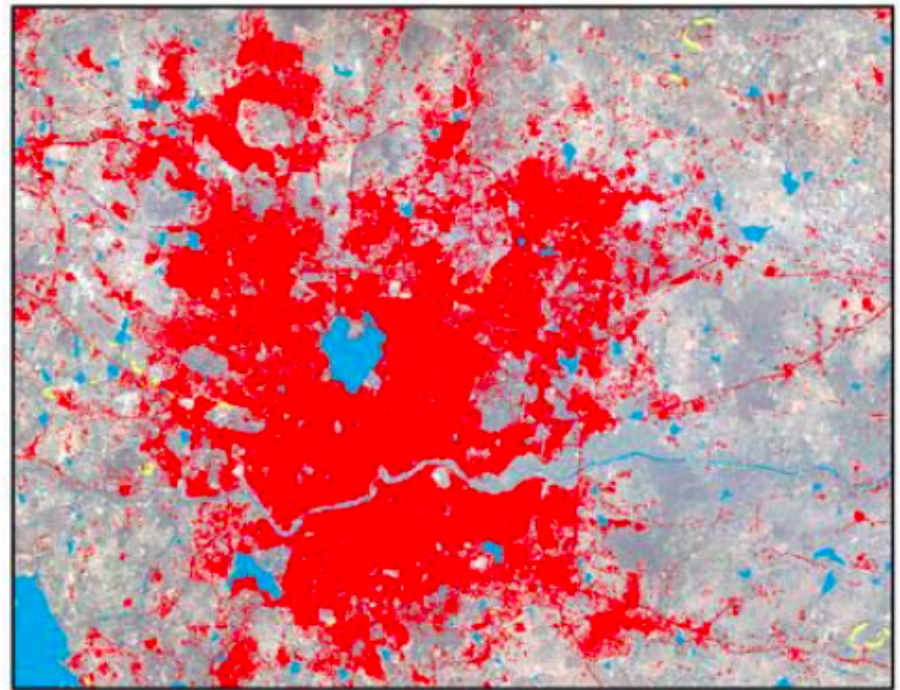
### **Integration**

- Metropolitan **grand scale** integration
- Scalar **intermodal** integration
- Green/Grey **network** integration

# Hyderabad, India



T<sub>1</sub>: 21-Nov-89



T<sub>2</sub>: 29-Oct-01

0 4 8 12 16 km

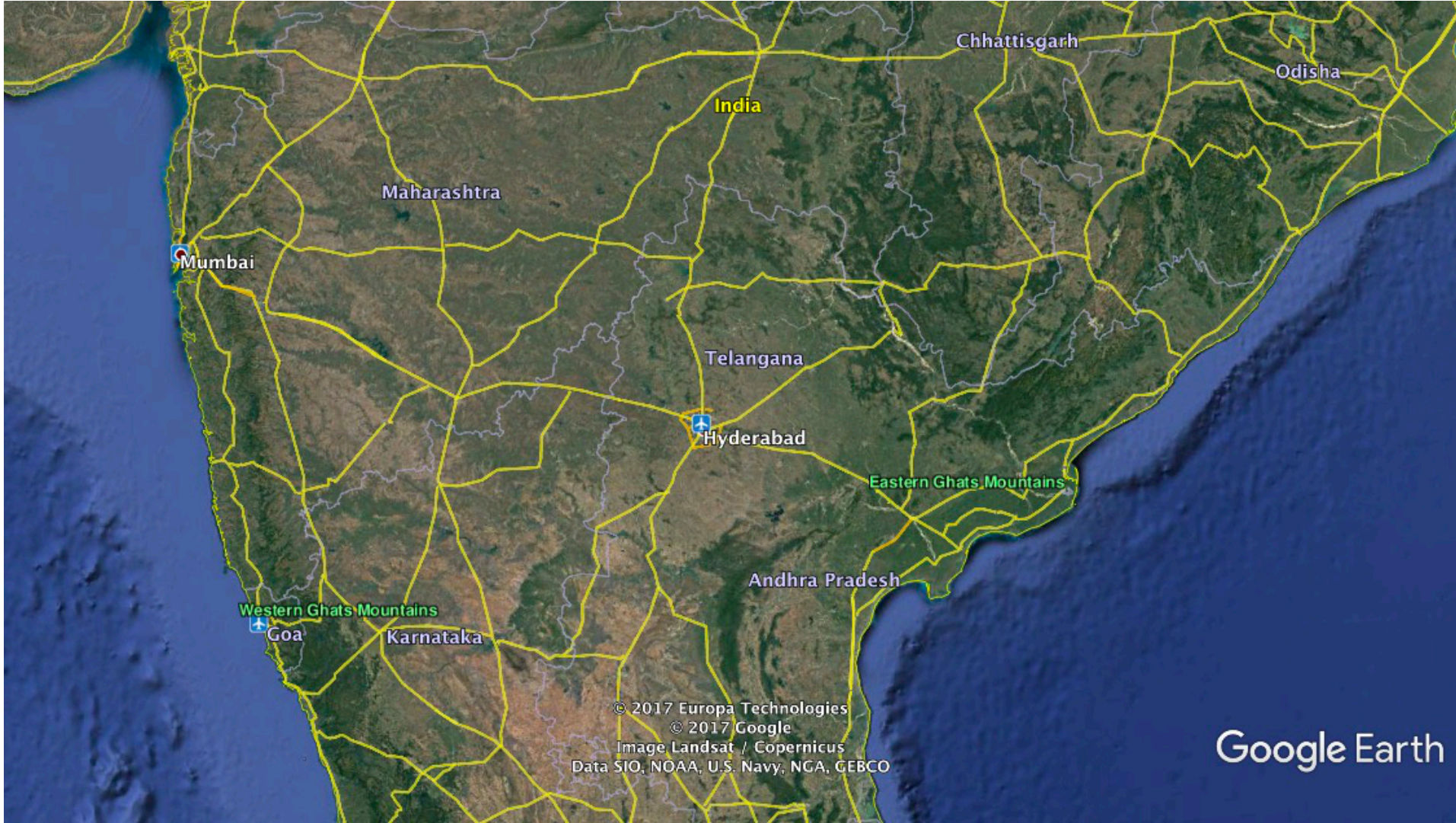


1:300,000

-  Water
-  Excessive slope
-  Built-up area

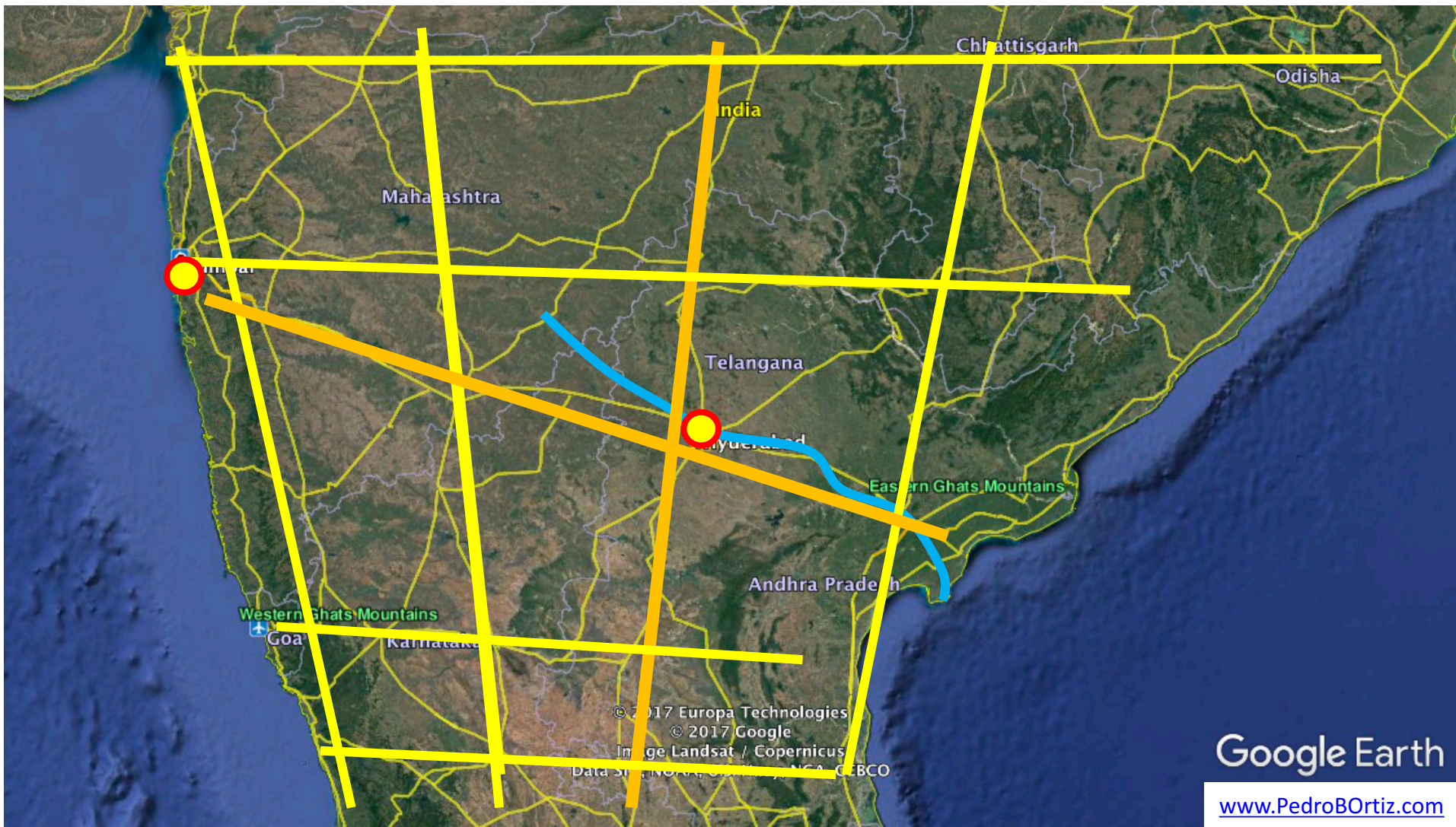


Measure	T <sub>1</sub>	T <sub>2</sub>	Annual % Change
Population	4,887,789	5,707,677	1.31%
Built-Up Area (sq km)	166.96	301.89	5.09%
Average Density (persons / sq km)	29,275.98	18,906.43	-3.60%
Built-Up Area per Person (sq m)	34.16	52.89	3.73%
Average Slope of Built-Up Area (%)	2.82	3.12	0.84%
Maximum Slope of Built-Up Area (%)	14.43	17.16	1.46%
The Buildable Perimeter (%)	0.94	0.93	-0.04%
The Contiguity Index	0.75	0.88	1.36%
The Compactness Index	0.37	0.38	0.22%
Per Capita Gross Domestic Product	\$1,541.53	\$2,343.04	3.57%



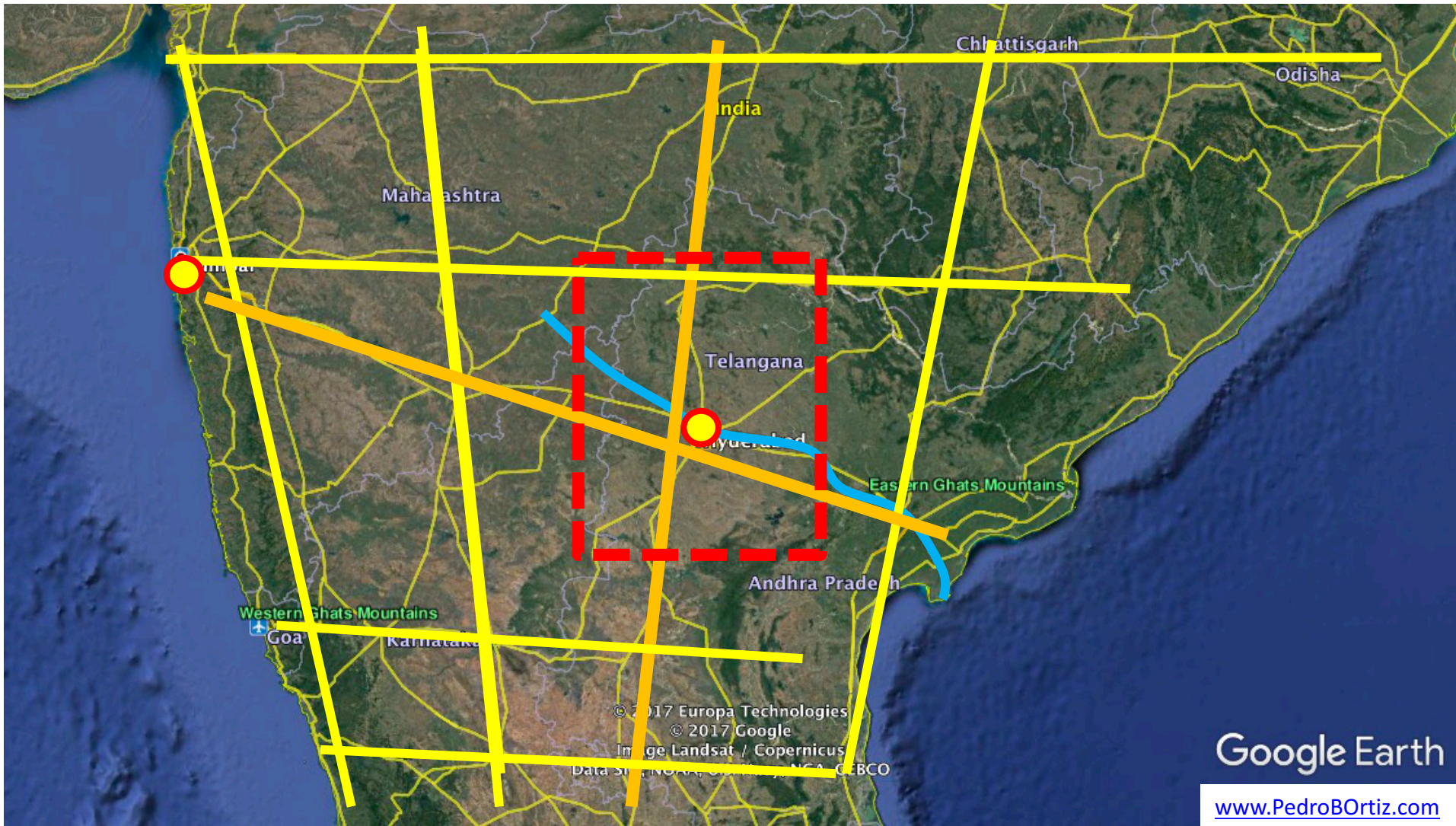
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Google Earth



Google Earth

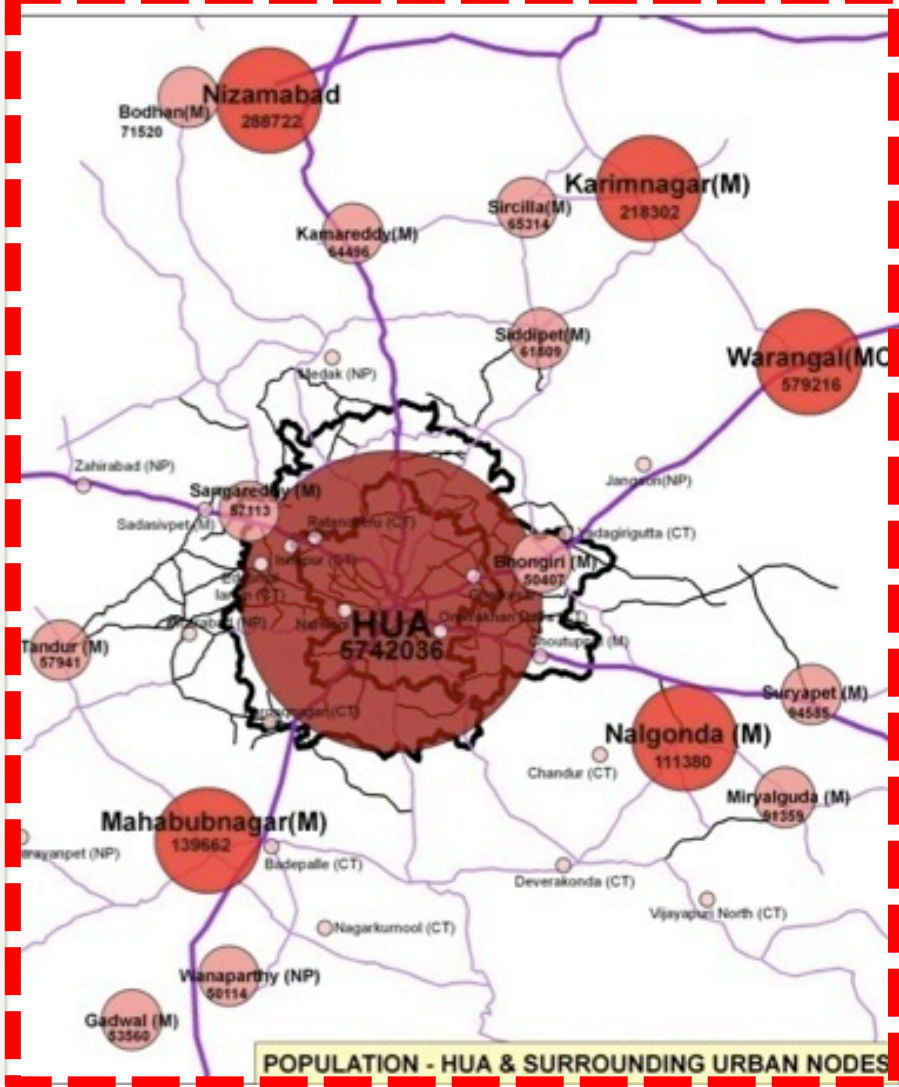
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Google Earth

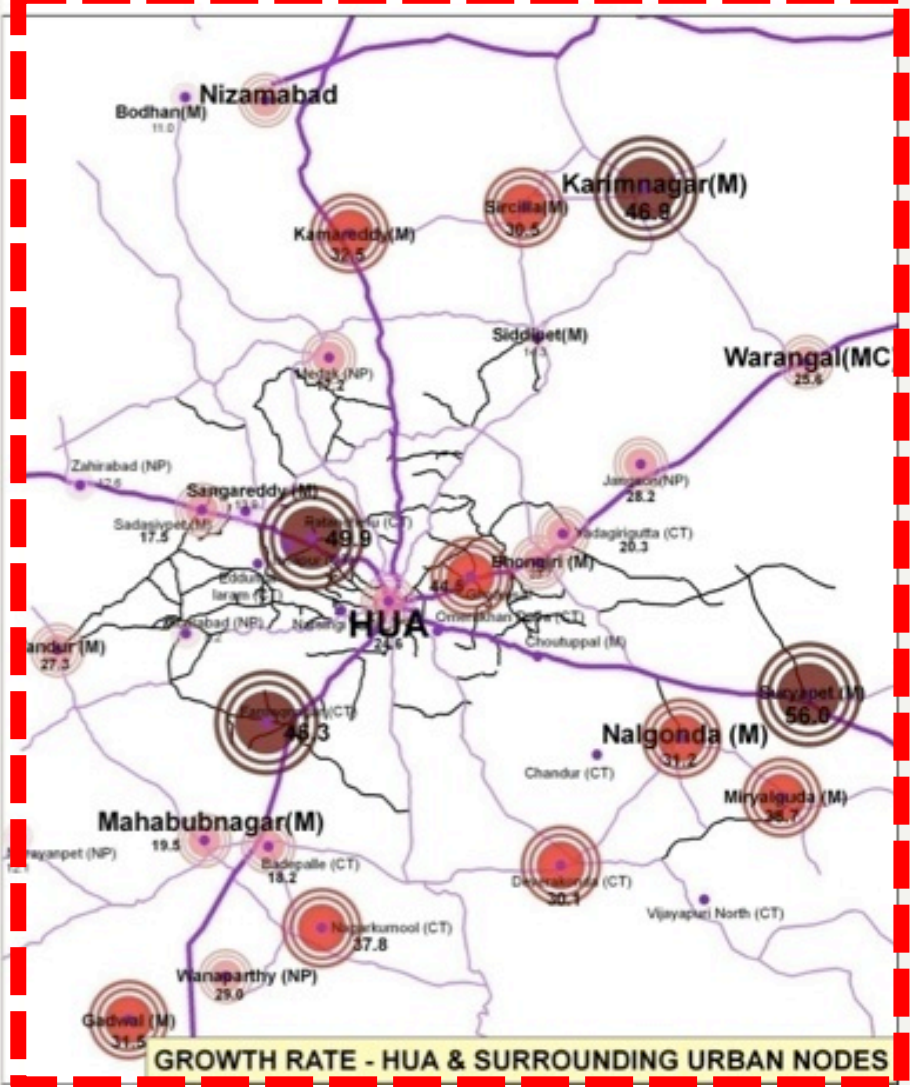
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Population

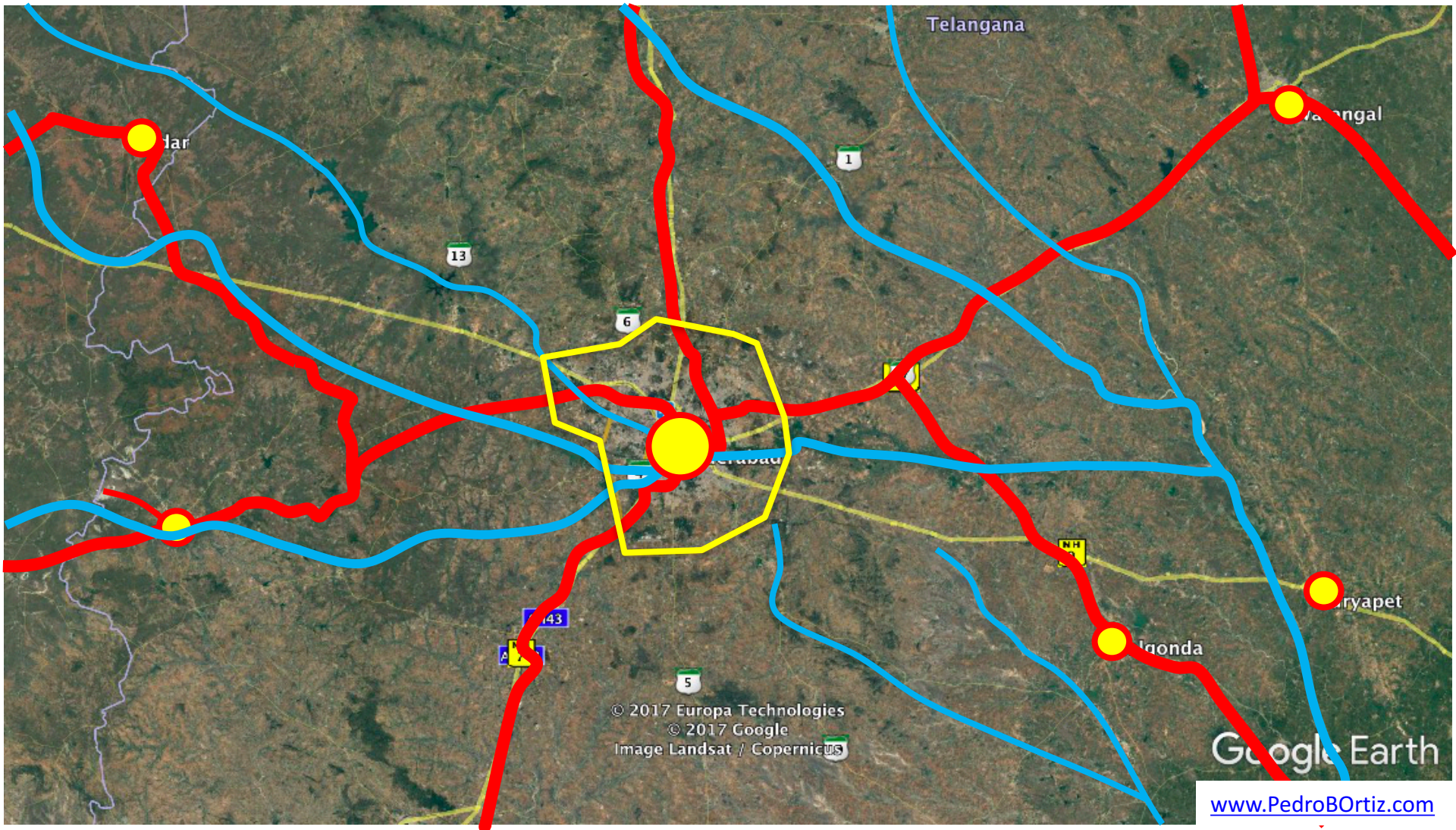


POPULATION - HUA & SURROUNDING URBAN NODES

Growth rate



GROWTH RATE - HUA & SURROUNDING URBAN NODES



Telangana

Narayanpet

Miyapur

NH 13

NH 6

NH 1

Hyderabad

NH 9

Kondapur

Konda

NH 43

NH 5

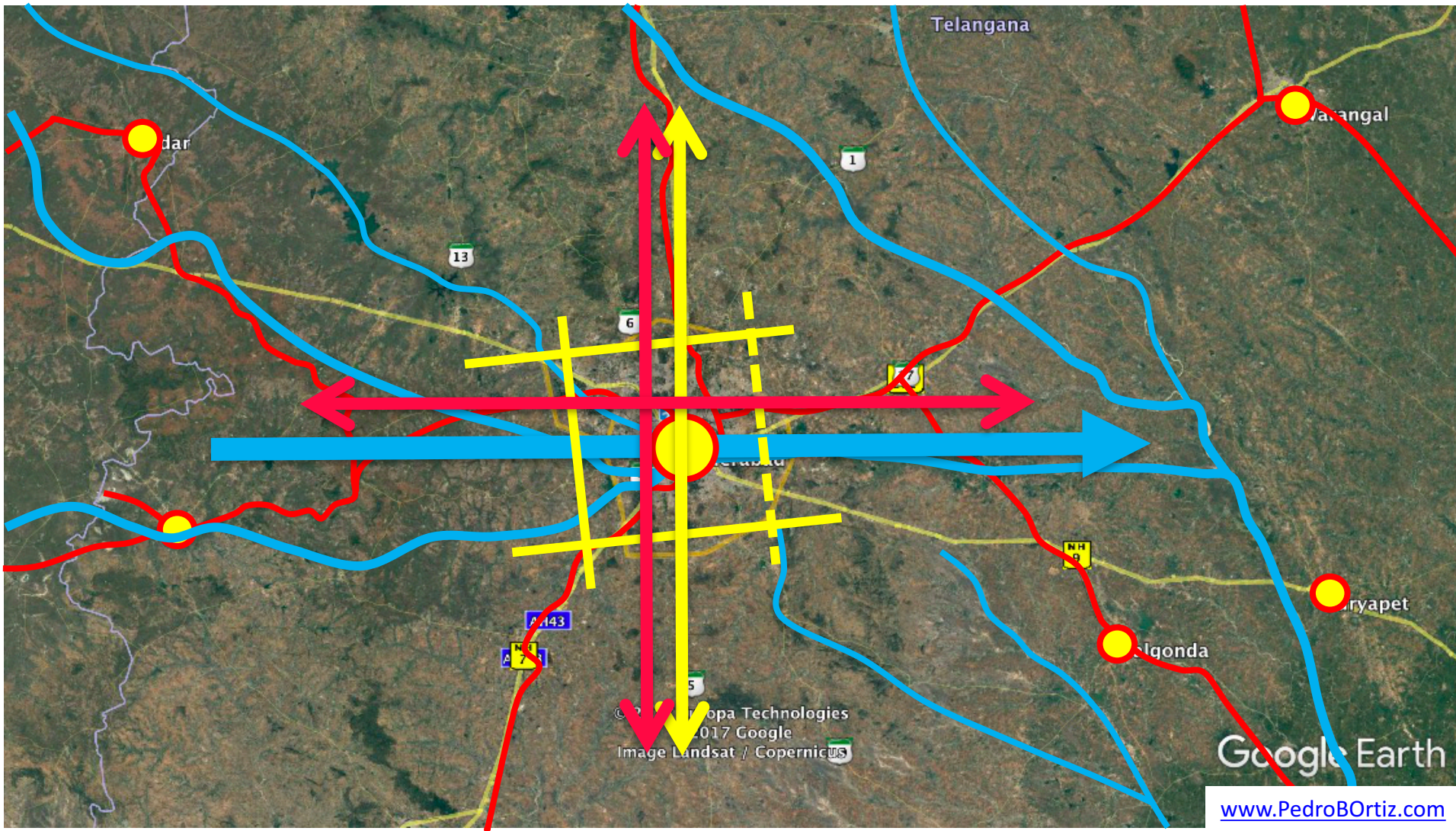
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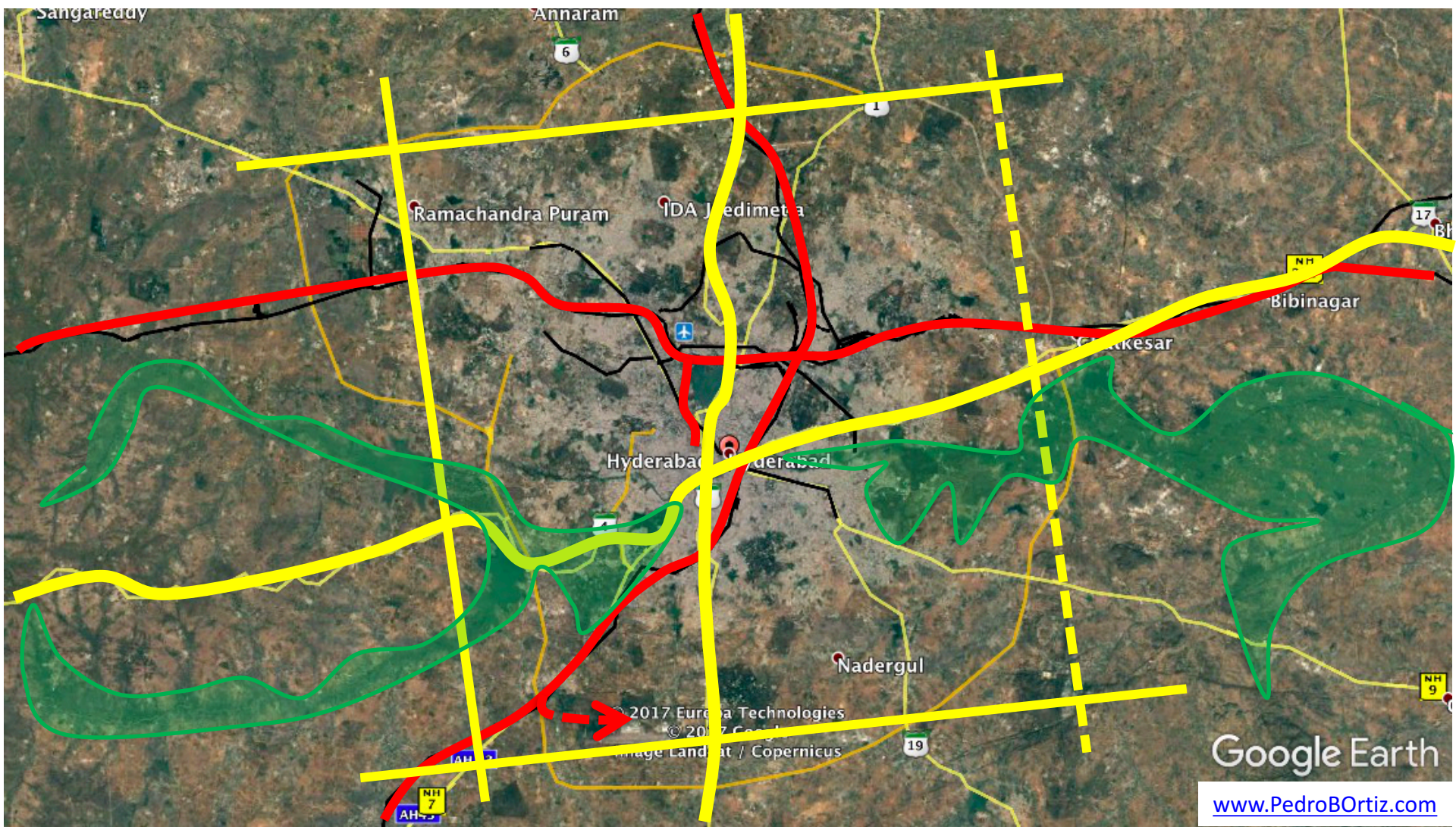
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- Metropolitan **grand scale** integration

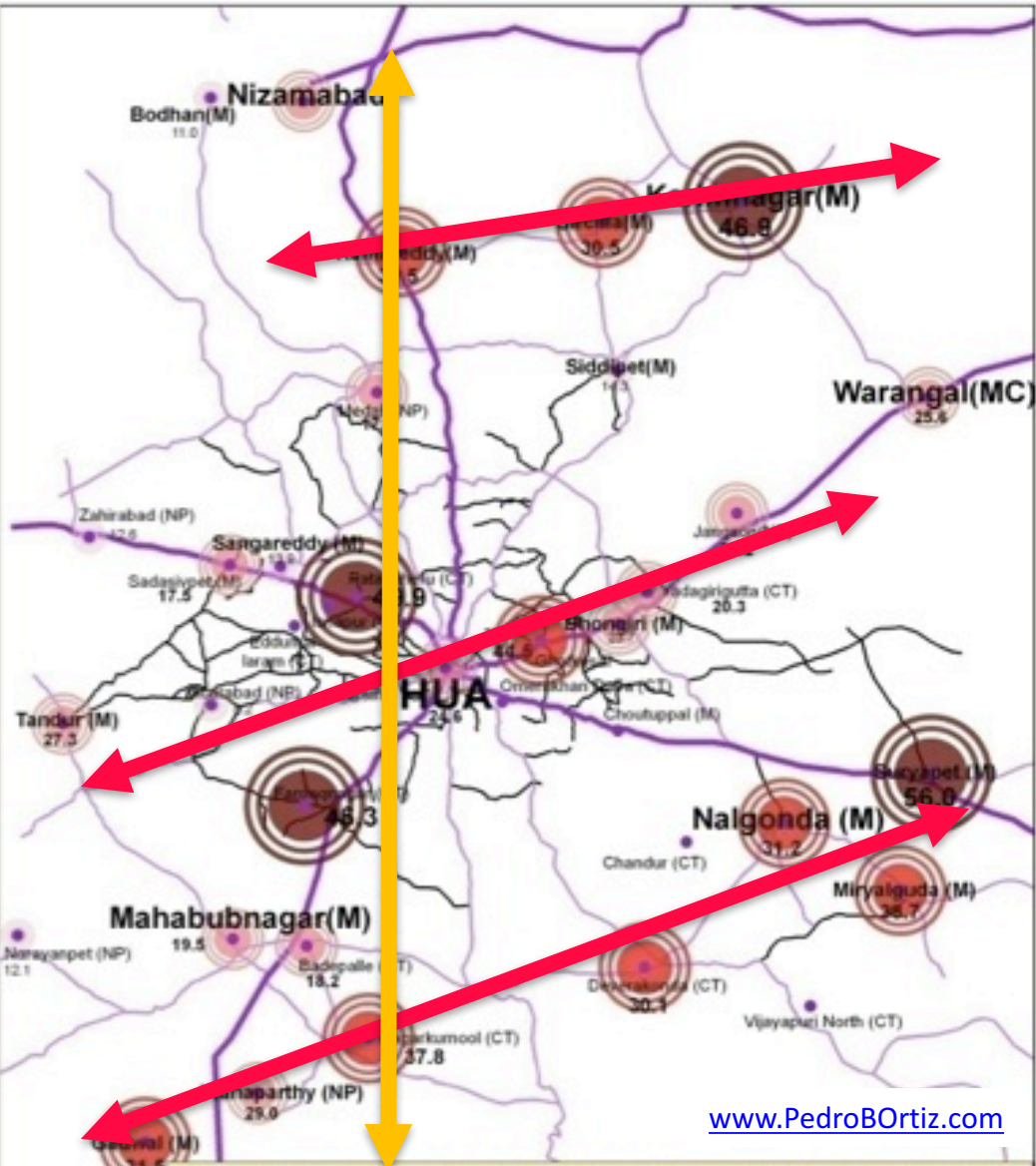




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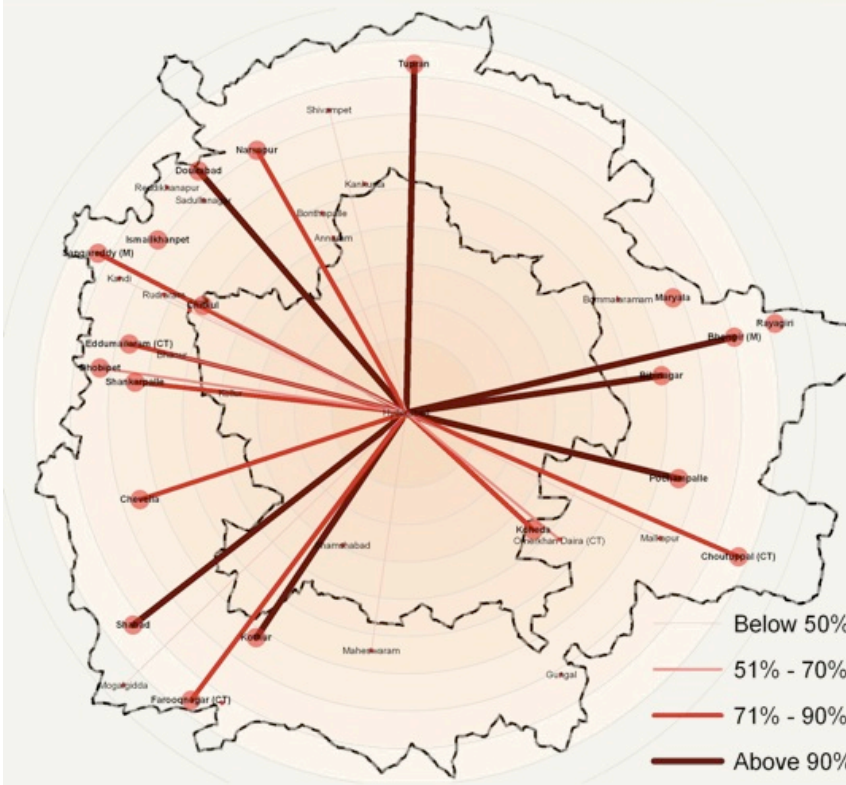
Growth rate



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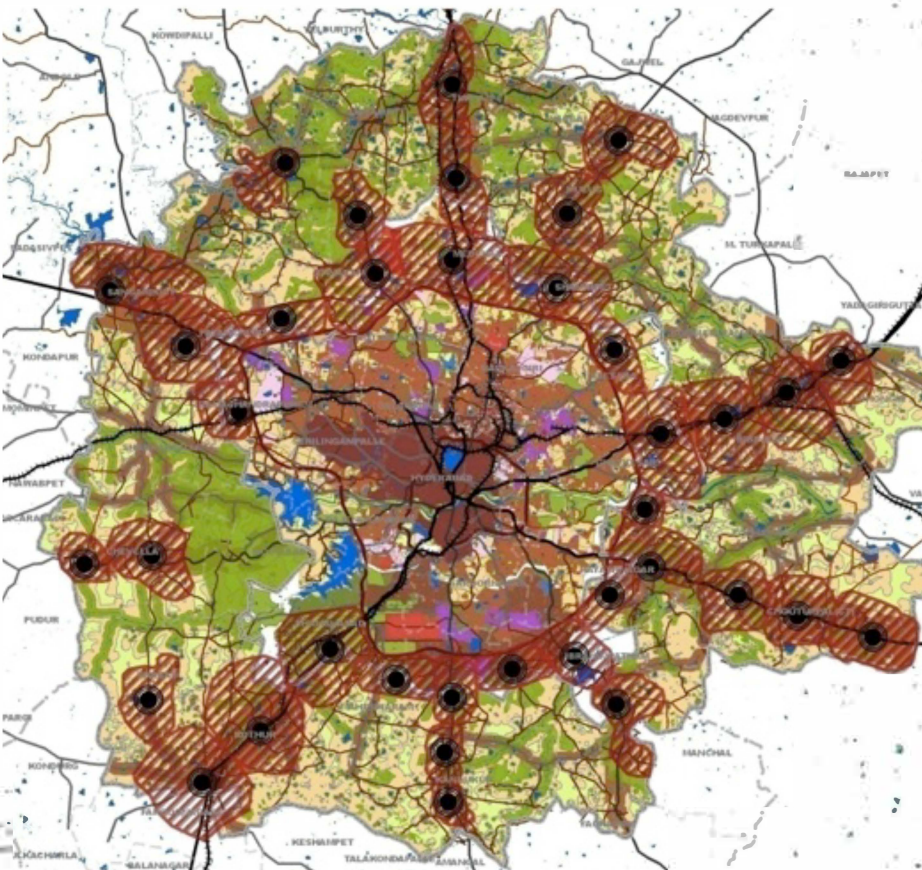
GROWTH RATE - HUA & SURROUNDING URBAN NODES

Traffic And Transportation- Household Survey Outcomes

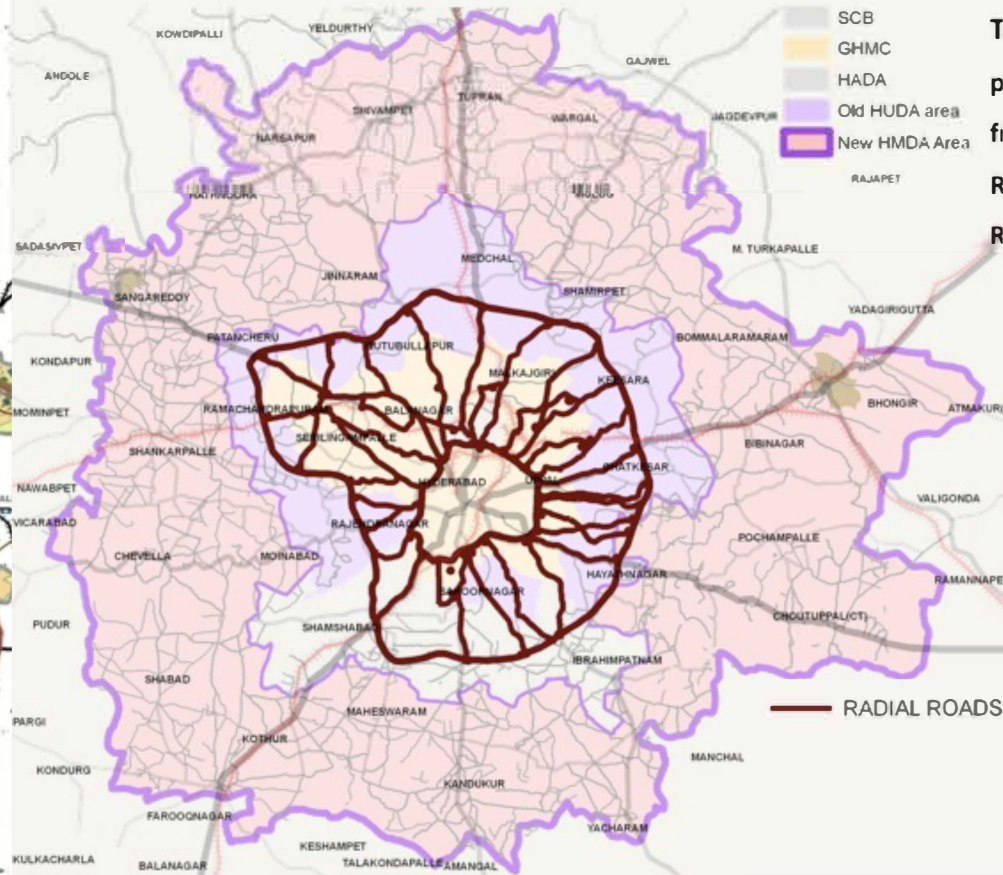


Source: Vishal Dubey

**PROPOSED ALTERNATIVE – II : Transit oriented development**



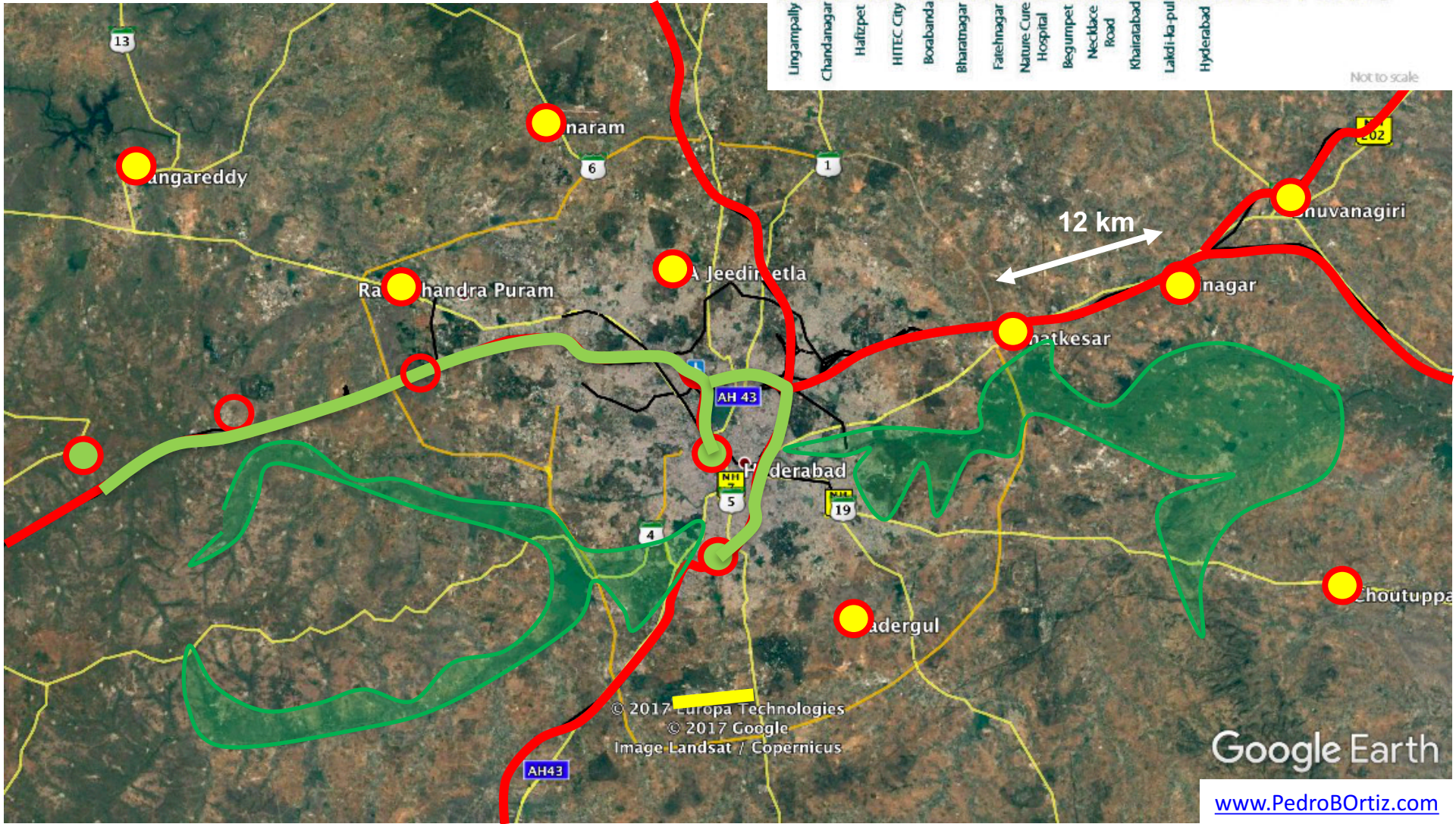
**Traffic And Transportation- Radial Roads to ORR**

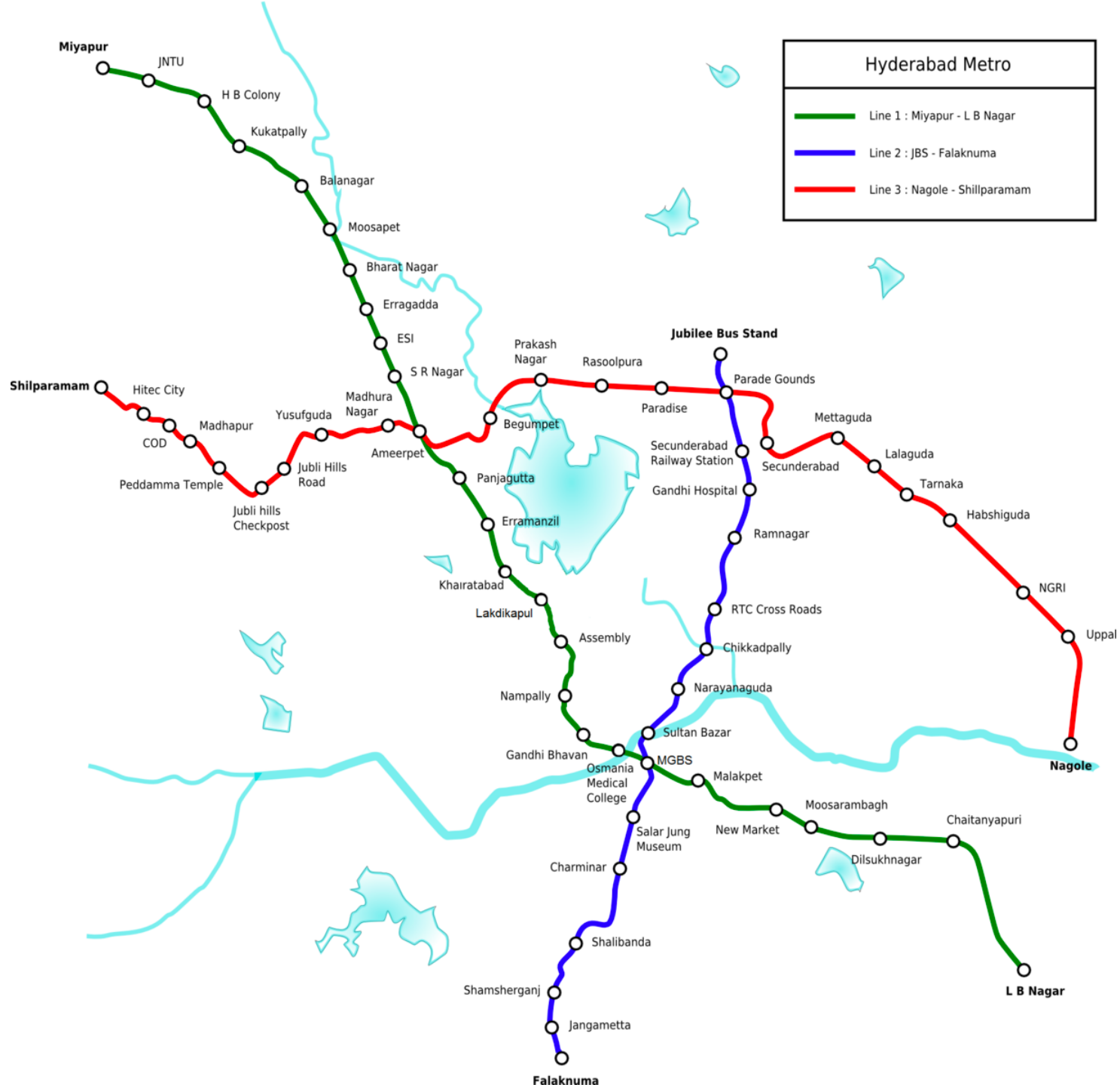


- Scalar **intermodal** integration

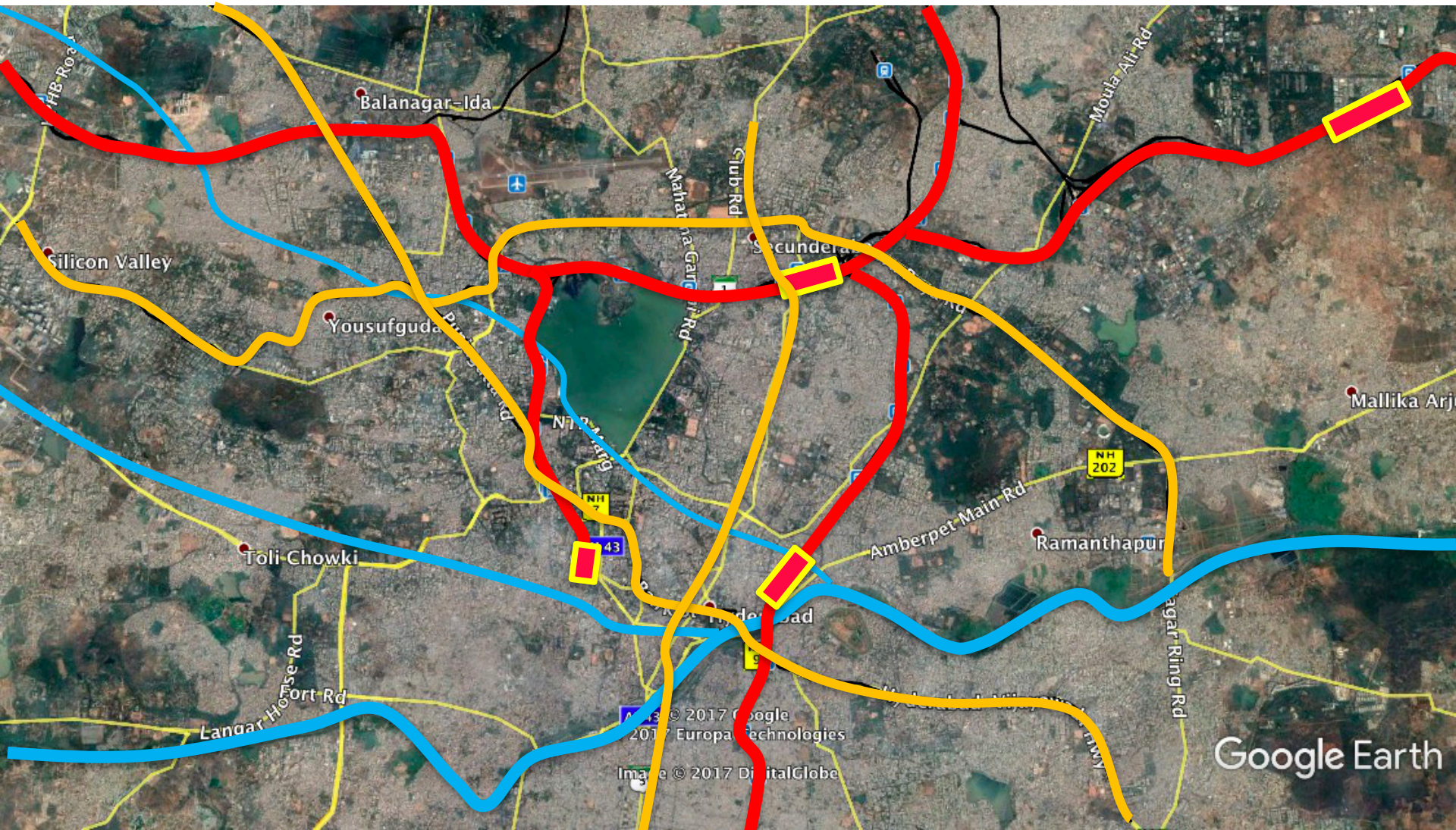
# Hyderabad Commuter Train services

<http://www.mmts.in>





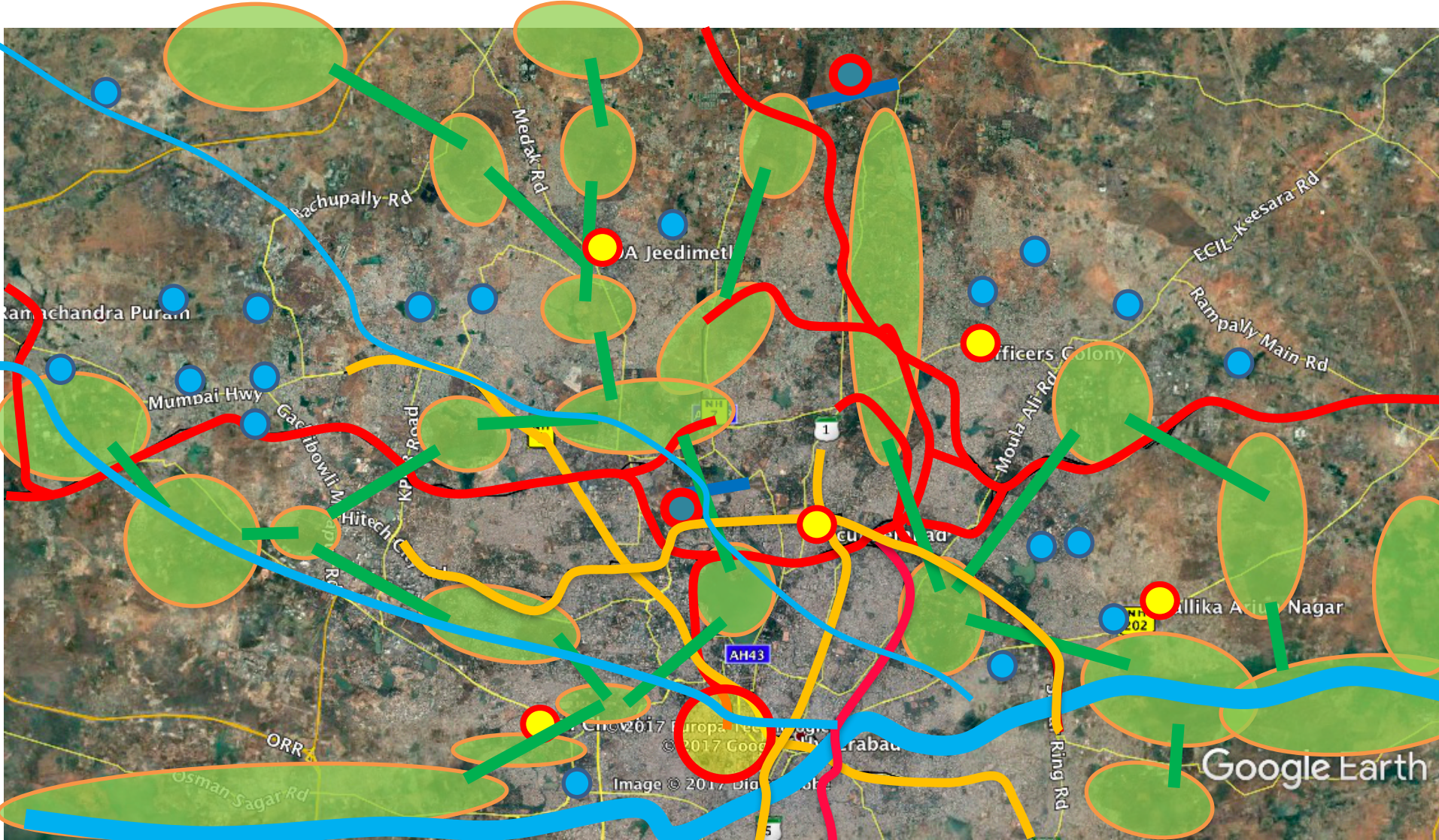
- Scalar **intermodal** integration







- Green/Grey **network** integration



**Merci Beaucoup**  
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