

Land Use and Transport for Low Carbon Cities

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UNCRD - Environmentally Sustainable Transport (EST) Forum

October 2018, Ulaanbataar, Mongolia

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Urban structures

THE MOST COMMON URBAN SPATIAL STRUCTURES

The Classical Monocentric Model, - strong high density center with high concentration of jobs and amenities - radial movements of people from periphery toward center

- The "Urban Village" Model
- people live next to their place of employment
- people can walk or bicycle to work
- this model exists only in the mind of planners, it is never encountered in real life



Α

"Order Whithout Design" Bertaud 2006 (unpublished)







- Random movement of people across the urban area

The Composite Model - A dominant center , some subcenters

- Simulateneous radial and random movement of people across the urban area





Urban Transport Planning Approach

Traditional Approach

- Focus on automobiles
- Expand road networks
- Predict and Provide
- Parking is a need for cars

Sustainable Approach (nontraditional?)

- People centred planning
- Focus on green areas
- Walking, Cycling and Public Transport
- Car restraint measures

Experience from Traditional Approach

- High demand for space
- High impact on health and environment
- High impact on traffic
- High demand to travel
- Urban sprawl
- Increased trips and lengths



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Is the use of space efficient?





Car-oriented planning



Delhi: current situation

Is this the future we are heading to ?



Car-oriented planning: indicators

- > Sources:
- 1. Colorado Springs, Colarado, USA Source: <u>http://en.wikipedia.org/wiki/File:Suburbia</u> <u>by David Shankbone.jpg</u>
- 2. Houston, TX, USA Source: <u>http://www.photohome.com/pictures/tex</u> <u>as-pictures/houston/downtown-houston-4a.jpg</u>
- 3. Ontario Highway 401, Canada Source: <u>http://en.wikipedia.org/wiki/File:Highway</u> 401.png



Low density

Segregated zoning





Excessive road infrastructure



Tale of two cities



Atlanta, GA, USA

- > Population: 5.25 million
- > Urban area: 4,280 km²
- CO2 Emissions from urban transport: 7.5 T CO₂ /ha/yr (public + private transport)
- > About 500,000 public transport trips / weekday

> Population: 5.33 million

> Urban area: 162 km2

- CO2 Emissions from urban transport: 0.7 T CO2 /ha/yr (public + private transport)
 - > About 2.6 million trips / day
 - > 953 million boardings/year



Barcelona, Spain



Way we move

Cities with similar population and the use of private transport





23.5 pop/ha 5.1 m/pers

79%





Public Transit and urban density

Country Australia 65.00% 0 Austria Bogot a Belgium 2008 60.00% Canada Paris China 2010 Colombia 55.00% Denmark 0 France 0 Mumbai Germany 50.00% Tokyo 2011 Hungary Ó 2008 Moscow 0 Delhi India O Singapore Budapest 2011 45.00% Indonesia O Stockholm 2011 2011 Italy 2004 0 Japan 40.00% Milan 0 Ó Lithuania oLondon Public Transport 35.00% 30.00% 2007 Barcelona Netherlands 2016 0 0 2013 New Zealand Jakarta 0 Norway Stuttgart _O 0 0 2011 Madrid Bilbao Osaka Poland Shanghai 2004 2006 2004 2000 Oslo 2011 Russia 2013 000 Berlin O 0 Singapore 2012 Amsterdam 0 Brussels 0 0 0 2014 Spain O Bremen C 25.00% 2010 Vilnius Sweden 2004 2011 Switzerland Ø 0 0 0 Vancouver Taiwan 0 20.00% Munich 2016 0 0 Malmö United Kingdom 2011 0 OMelbourne 2011 Pune-Pimpri Chinchwad United States 2016 ത 2011 15.00% Indore 0 0 0 Chicago 0 0 2011 🔾 Boston 2016 0 8 Rajkot 2016 00 2011 0 10.00% 0 San Jose 0 2016 Eindhoven O^{Turin} 2004 Ó 0 2004 5.00% 8 0 0.00% 0 0K 1K 2K 3K 4K 5K 6K 7K 14K 16K 17K 18K 19K 20K 21K 22K 8K 9K 10K 11K 12K 13K 15K Urban Density

Sum of Urban Density vs. sum of Public Transport. Color shows details about Country. The marks are labeled by City and sum of F9.

Source: Kodukula and Rat, 2018

Urban Density vs Public Transport use

Urban density and energy

Transport-related energy consumption Gigajoules per capita per year





Sustainable approach

Integrating Land Use and Transport!





Integration is not rocket science

- To increase access to Public Transport, Walking and Cycling so as to reduce dependency on personalized modes.
- To encourage people to travel short distances and make fewer trips.
- To encourage compact mixed use development near new or existing public transportation infrastructure that provides housing, employment, entertainment and civic functions within walking distance of transit.
- To reduce the fuel and energy consumption in the motorized forms of transport, reducing pollution and adverse impact on natural environment.

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What carries how much?

Equivalency road width: In order to carry 20,000 automobile commuters PHPD, a highway must be at least 18 lanes wide. (assumption 1.2 passengers per automobile)

achieved



Source: Manfred Breithaupt (2016) based on Botma & Papendrecht, TU Delft 1991 and own figures



Accessibility + Mobility

Accessibility: the ease of reaching a desired destination

Mobility: Movement required (type of movement..)

Transport

Transportation
 Policies, investments
 affect the accessibility,
 mobility and also the
 connectivity

Landuse

 The kind, size and location of a particular land can have direct effect on transport system



The 3Ds of land-use

> Density
> Diversity / mixed land use
> Design

> Destinations (availability of jobs etc.)

> Distance to transit



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High density / compact development



Barcelona, Spain – Source: <u>http://www.indie-holidays.com/destinations.php?city=2</u>

- High density does not necessarily mean highrise
- > High rises require large setback that result in similar density as low rise development
- Mid-rise development (say 80% residences in 6-10 storey apartments) is optimal.
- > It is important to note that most S. Asian cities already have high densities



Density: How not to...

- >Inhuman scale
- >Not integrated with transit
- >Segregated zoning
- > What is the problem with a downtown?



Source: http://travelingcolors.net/post/24217917137/urban-sprawl-las-vegas-nevada-by-cocoim

Houston, TX, USA – Source: http://www.photohome.com/pictures/texas-pictures/houston/downtown-



Diversity

> Is this diversity?





Diversity

- Mixed Land-use reduces the necessity to make some trips
- Distance travelled is greatly reduced
- Complemented by a good public realm with space for walking and cycling





Design: Who do we give the space?





Who do we design the spaces for



Intersección Gascón, Costa Rica y J. Álvarez - Antes y después

Source: City of Buenos Aires, 2015



Design of services

Not just urban space





Pedestrian friendly connections

to encourage walkability









Transit Oriented Development (TOD)

Transit line High-density commercial and residential Transit station		
Transit users benefits	Transit operator benefits	Benefits to society
 More destinations near transit stations Better walking conditions Increased security near transit Source tation 2006 	 Increased ridership Lower costs per rider Better image 	 Reduced traffic Reduced public infrastructure / service costs Community liveability Increased property values / business activity / tax



Copenhagen

Concept of 1947
Over 170 kms of s-tog train lines

Over 400 km of bicycle lanes





Superblocks Model Current Model PRIVATE VEHICLE PASSING PUBLIC TRANSPORT NETWORK DUM PROXIMITY AREA BICYCLES MAIN NETWORK (BIKE LANE) RESIDENTS VEHICLES ACCESS CONTROL URBAN SERVICES AND EMERGENCY BASIC TRAFFIC NETWORK BICYCLES SIGNPOSTS (REVERSE DIRECTION) DUM CARRIERS FREE PASSAGE OF BICYCLES SINGLE PLATFORM (PEDESTRIANS PRIORITY)

Barcelona

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Superblocks benefits





We know it is bad...but

>Why do people still drive?

Average time spent commuting to work in selected metropolitan areas in Brazil and other countries^{1,2}



Source: Brazil - National Household Sample Survey (PNAD/IBGE); Santiago (Chile) – data available at: <http://www.sectra.gob.cl>; data from all other metropolitan areas from Toronto Board of Trade (2012).

Notes: ¹ Tokyo: 2005; Santiago and Europe: 2006; Brazil: 2009; Australia, Canada, Shanghai and USA: 2010.

² Commute time data from Eurostat is available only at the regional level. However, the delimitation of these boundaries is not strictly defined and may vary greatly across European MAs. Data from the USA is based on Metropolitan Statistical Area.

Source: Pereira and Schwanen, 2013



How do we do it?

- >Integrate land use and transport
- Don't focus on single corridor solutions
- >Integrate, integrate, integrate
- Don't control land prices but guide urban development

>Know what kind of city you want!





Thanks for the attention

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