Should Compactness be the driving concept shaping cities?

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Summary

- Measuring compactness: shape or density?
- If compactness equals high density, how compact is compact enough?
- Within cities, large densities variations are necessary
- Do high density cities have shorter commuting travel time?
- What planners usually do about densities and compactness?
- What planners should do
- Case studies: Seoul, Paris, Ahmedabad, Chinese clusters, Silicon Valley
- The transport infrastructure that will accommodate high density core with low density suburbs in large urban clusters
- Compactness of shape should be the outcome of an urban policy focused on mobility and affordability
Measuring compactness

1. Compactness of shape
2. Compactness and high population density

Consult this web site for an update on evolving city shapes of 200 cities world wide
http://atlasofurbanexpansion.org/
The built up area of Abidjan
With an average built-up density of 143 p/ha, Abidjan is a high density city with a fragmented built-up area.
The ultimate compact urban shape would be a circle centered on the CBD.

Abidjan - Developed areas by distance from the city center

- 6.36 km radius absolute compactness
- Built-up Area
Shape and population dispersion
Distribution of densities in Gauteng (South Africa)
If “compact” is synonymous with high density, How compact is compact enough?
Distribution of average built-up density in 60 metropolitan areas

Comparative average population densities in the built-up areas of 60 metropolitan areas

source: "Order Without Design" Alain Bertrand, 2014

file: AB_all_Cities_data.xls
Within a city, large densities variations are necessary
The profile of densities decreases with distance from the center independently of culture, history, or economy.
Densities and commuting travel time
Travel trips reflect the spatial distribution of jobs and housing.

A. The classical monocentric model
B. The polycentric or dispersed model
C. The composite Model
D. The "Urban village" model (doesn't exist in real world)
In Paris Metropolitan area 70% of commuting trips are from suburbs to suburbs.
Commuting time by transport mode: Transit is reaching a limit

Average commuting travel time by transport modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Door to door travel time for commuting trips in minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car - US-MSA</td>
<td>23</td>
</tr>
<tr>
<td>Car - Singapore</td>
<td>25</td>
</tr>
<tr>
<td>Cars - Hong Kong</td>
<td>26</td>
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<tr>
<td>Cars - Dallas Fort Worth</td>
<td>27</td>
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<tr>
<td>Car - Paris</td>
<td>30</td>
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<tr>
<td>Car - New York</td>
<td>31</td>
</tr>
<tr>
<td>Bus - Singapore</td>
<td>43</td>
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<tr>
<td>Transit - Hong Kong</td>
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<tr>
<td>Transit - New York</td>
<td>48</td>
</tr>
<tr>
<td>Subway - Singapore</td>
<td>52</td>
</tr>
<tr>
<td>Transit - Paris</td>
<td>53</td>
</tr>
<tr>
<td>Transit - US-MSA</td>
<td>53</td>
</tr>
</tbody>
</table>

Population 2014:
- Singapore: 5.5 M
- Dallas F.Worth: 6.4 M
- Hong Kong: 7.1 M

Sources:
- US: Commuting in America 2013 US DOT Census Transportation Planning Products Program
- Paris: Deplacements des Franciliens - DREIF 2004
- New York City census 2010 - CTPP Profile
Is the exclusive use of transit the only way to reduce GHG emissions?

CO₂ Tail-pipe emissions for various cars and transit modes

**Transit - US**

- New York Subway: 67
- Urban Bus: 180

**Electric cars - Sweden**

- BMW i3 BEV: 4
- Volkswagen e-Golf: 4
- Nissan Leaf: 4
- Tesla: 5

**Electric cars - Europe 15**

- BMW i3 BEV: 33
- Volkswagen e-Golf: 35
- Nissan Leaf: 35
- Tesla: 37

**Electric cars - US**

- BMW i3 BEV: 51
- Volkswagen e-Golf: 55
- Nissan Leaf: 55
- Tesla: 58

**Standards cars and hybrids**

- Volkswagen Polo 1.4: 56
- Toyota Prius: 63
- Honda Insight: 72
- Average European new car: 81
- Average US car: 151
- Cadillac CTS-V Wagon: 248

Co₂ emissions in grams per passenger kilometer
What planners usually do about densities and compactness?

• Increase land consumption through Land use regulations: limit FAR, minimum plot size, minimum dwelling size, make cities less compact
• But, restrict land supply: Green belts, Urban Growth Boundaries
• Increase in land consumption and decrease in land supply results in high housing prices
What planners should do: Increase mobility and housing affordability

• Develop infrastructure to increase land supply in areas closest to the city center
• Do not restrict land supply
• Select people oriented objectives: housing affordability and mobility,
• optimum compactness will follow
Case studies

Tianjin
Seoul
Paris
Ahmedabad
Chinese city clusters
Silicon Valley and the SF Bay Area
The build-up area of Seoul (25 million p.) and Paris (11.6) represented at the same scale.
Ahmedabad urban built-up area in 2010 (5.2 million people)
Ahmedabad urban built-up area in 2010 and major road network

The only way to prevent sprawl is to build roads in the periphery. The supply of roads increase land supply and make housing more affordable.
The new Chinese government policy of developing urban clusters recognizes an existing spatial reality

Typical trips pattern in a metropolitan area

Expected trips pattern in an urban cluster

population densities

low high
The expansion of Tianjin between 1990 and 2013

Source: http://atlasofurbanexpansion.org/
The urban cluster Beijing Tianjin (32.5 million people) part of the larger urban cluster Beijing Tianjin Hebei (110 million people).
Guangzhou, Shenzhen and Hong Kong have high density core but are surrounded by a lower density interland.
Silicon Valley and the San Francisco Bay Area:
6.2 million people
3.3 jobs spread over a distance of 150 km
The transport infrastructure that will accommodate city clusters with high density core and low density suburbs

A combination of transport modes:
• Rapid rail transit for cross metropolitan trips
• Individual shared transport like Toyota i-road
• Freight self-driving vehicles
The shared door to station, station to door vehicles will replace most feeders buses

Toyota i-Road individual mobility vehicle

The informal precursor of the Toyota i-Road serving the suburban Beijing subway stations

Toyota i-Road electric two seater

Three-wheeler on demand vehicle available at Beijing suburban subway stations
The complementarity of transit and individual “door to station-station to door” vehicles is being tested in Tokyo and Grenoble (France) with Toyota i-Road personal mobility vehicles.

Toyota supplies 70 COMS and i-Road electric vehicles and "Last Mile Mobility Management System" to manage interconnection between users, vehicles, charging stations and the web-based Station Mobile trip planner.
A focus on mobility and housing affordability will result in more compact cities in the future

• The most effective way to avoid the fragmentation of urban areas is to provide a network of roads ‘right of way in the periphery, in advance of development
• High densities are established by the high demand for specific location, not by zoning or planners design
• Large conurbations made of cluster cities are emerging all over the world, infrastructure has to be developed to serve this new urban form
• A reduction in pollution and GHG emissions caused by urban transport will be better achieved by combining fast rail transit with individual shared vehicles
• A focus on mobility and housing affordability will result in more compact cities in the future