The Theory of Urban Fabrics: Principles and Practices

By
Peter Newman
Professor of Sustainability
CUSP, Curtin University
Western Australia
How did I get from Chemistry to Sustainable Transport....?

PhD in Chemistry 1964-72

Professor, 15 books, 250 articles on sustainable transport...IPCC, IA....
Delft – 1972/73, studying Environmental Science and discovering European cities
Studying Ecology and discovering…
The Hubbert Peak
Sci Amer 1971
Society collapsing….1973
Private Passenger Transport Energy Use per Person, 1995
Urban Density, 1995 (Persons/Ha)

Cities

Urban density (persons per ha)
Fuel Use Decreases as Density Increases

Source: Kenworthy, J. R., 2010, Cities Data Base for 2005, CUSP,
Different parts of the city have very different transport fuel use....
Melbourne....wealthy use cars less, use sustainable modes more...

<table>
<thead>
<tr>
<th></th>
<th>Core</th>
<th>Inner</th>
<th>Middle</th>
<th>Outer/ Fringe</th>
</tr>
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<tbody>
<tr>
<td>% Household earning &gt;$70,000</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Car Use</td>
<td>2.12</td>
<td>2.52</td>
<td>2.86</td>
<td>3.92</td>
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<tr>
<td>Public Transport</td>
<td>0.66</td>
<td>0.46</td>
<td>0.29</td>
<td>0.21</td>
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<tr>
<td>Walk/bike</td>
<td>2.62</td>
<td>1.61</td>
<td>1.08</td>
<td>0.81</td>
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</table>
Sydney....three different cities

Outer suburbs residents, particularly those away from rail lines, drive much more than inner suburbs residents.
Perhaps there are three city types?

The development of a model...
Why transportation priorities shape cities…

MARCHETTI CONSTANT
The average travel time budget is around one hour per person per day….
(i.e. half an hour average for the journey to work). Found to apply across the world and throughout urban history.

This means?
THE CITY IS ALWAYS ‘ONE HOUR WIDE’….
TRADITIONAL WALKING CITY

Up To 1850 In Europe

- High Density
- Mixed Use
- Organic Structure
WALKING CITIES

6-8,000 years old, 5-8 km wide.
Densities 100-200 people /ha. Mixed.
Little other space. Squatter settlements today as well as pre-industrial city centres.
TRANSIT CITY
1850 - 1940 dominant city form in industrial world

- Medium Density
- Mixed Use
- Grid Based
- Centralised

Tram Suburbs

Rail Based Suburbs
TRANSPORT CITIES

Industrial cities meant walking cities had to be rebuilt. Linear infrastructure of pipes and rails enabled city to spread in corridors. Transit city could be 20 to 30km wide. Densities 50-100/ha. Walkable centres at stations.
Tram city fabric
AUTOMOBILE CITIES

From the 1950’s in America and Australia city planners opted for the new frontier of automobile dependence. Cities could now spread 50 km and in every direction, if it is assumed that automobile access is primary.

Automobile cities require the infrastructure of highways, the dispersed housing of land development and the cultural values of suburbia.

All cities are being shaped in some way by these priorities....
THE NEW AMERICAN FRONTIER

MAILED BY
STRICKLAND TRANSPORTATION CO.
WHAT ABOUT HIGHWAYS

THOUGH the nation's highway system is vital to our peace-time economy and our war-time strategy, it has never been adequate. About 2 million miles of roads inherited from the horse-and-buggy age have been widened, rebuilt or just surfaced. While new highways and thruways have been added, increasing traffic volume becomes more of a problem every year. New highways will provide high-speed transport from one point to another, plus carefully integrated access roads.

BUILDING good, modern roads that combine speed with easy access, is a pressing need. Modern highway systems make it possible for America's automobiles, trucks and buses to reach every corner of the nation to carry out their vital services. The President of the United States and Congress recognized the importance of modern highways when they launched the expanded Federal road-building program. And the costs of the Federal government on these great new highways are being paid entirely by the taxes on the vehicles that use them.

BUT GOOD ROADS alone won't solve all of the highway problems. Today, there is more danger on the highways than there ever was on the old rutted trails. Bad and careless driving is more of a menace than the Indians ever were. Though good road design can increase highway safety to a marked degree, it cannot guarantee it. Only skill, courtesy, concentration and common good sense on the part of every driver can make our roads truly safe. Every driver should take a training course, the kind given in high schools and driving schools, the kind given by the trucking industry to its drivers to make sure that they're the safest and most courteous on the road.
THE NEW FRONTIER

IF WE KEEP ON solving our transport problems, we can look forward to an expanding America. We'll move around, develop new industries, enjoy new comforts. There will be many more of us and we'll live longer, be more productive and find life easier.

WE'LL DO MORE with our leisure. We spend more time traveling and enjoy family life. We can look forward to the future as the best fed, best clothed, most prosperous people in history. And as in the past, our prosperity will rest on flexible, low cost, efficient transportation that adapts itself to any need or situation.

THE PURE OIL COMPANY

MEMBER OF

THE AMERICAN TRUCKING INDUSTRY

For additional copies, write to:
The ATA Foundation, 1424 16th Street, N.W., Washington, D.C.
AUTOMOBILE CITY
1940 - Present, US + Australian Cities Mostly

- Low Density
- Separated uses
- Arterial Grid and cul de sac Based
- Decentralised
National City Lines removed transit in 44 cities....
Town planning then adopted the car-based city as its model....neglecting the other types and treating them as though they did not exist....
The Theory of Urban Fabrics

• All cities have a combination of Walking City, Transit City and Automobile City fabrics.

• The elements of the fabric consist of differences in density, mix, road widths, set backs and infrastructure that supports the modes (parking levels, stations, pedestrian and cycling spaces....)

• Understanding the city helps us manage it...
The Theory of Urban Fabrics

- *Recognise* the three city types,
- *Respect* the functionality of the three types, and
- *Repair/Regenerate* each type in its own way...with priorities defined by the outcomes each can give.
- There is not one city but three.
Two inflexion points...help define the three city types
Same can be seen within cities.... not much walking city left

![Activity Intensity and Daily Per Capita GHG Emissions in Sydney and Melbourne](chart.png)

- **Automobile City**
- **Transit City**
- **Walking City**

Mathematical model:

\[ y = 32.321x^{-0.557} \]

\[ R^2 = 0.60157 \]
Urban Fabrics and Wave/Innovation Theory....
Economic waves

The next era of innovation....the Green Economy

Waves of Innovation

1st wave
Iron
Water power
Mechanisation
Textiles
Commerce

2nd wave
Steam power
Railroad
Steel
Cotton

3rd wave
Electricity
Chemicals
Internal combustion engine

4th wave
Petrochemicals
Electronics
Aviation
Space

5th wave
Sustainability
Radical resource productivity
Whole system design
Biomimicry
Green chemistry
Industrial ecology
Renewable energy
Green nanotechnology

6th wave
Digital Networks
Biotechnology
Software
Information technology

© The Natural Edge Project 2004

1785 1845 1900 1950 1990 2020
History of innovation and transport....
Each era changes the city form. Cities keep the best of that era and move on. Next era of city building is electric and renewable gas....
Enter the Finn.....
## Paradigm 1933

**Functional City**

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Traffic</th>
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<tbody>
<tr>
<td>Land Use Based</td>
<td>And Networks as the Connecting Function</td>
</tr>
<tr>
<td><strong>Functions</strong></td>
<td>Road Traffic</td>
</tr>
<tr>
<td>and Environments</td>
<td>- Non Motorized Traffic</td>
</tr>
<tr>
<td><strong>Housing Areas</strong></td>
<td>Rail Traffic</td>
</tr>
<tr>
<td><strong>Employment Areas</strong></td>
<td>Water Traffic</td>
</tr>
<tr>
<td><strong>Recreational Areas</strong></td>
<td>Air Traffic</td>
</tr>
<tr>
<td>The Centre</td>
<td></td>
</tr>
</tbody>
</table>

**Theories of Land Use and Urban Environment**

**Traffic Models and Land Use Models**

**Theories of Co-operation and administration**

## New Models since 1990

**Walking- Transit- and Car City**

A City of *Three Main Systems*

- **"Future City" Model**
- **"Kuopio Model"**
- **ABC Model**

**Models of Three City Systems**

30.5.2013 **UF** Leo Kosonen
So, what does it mean in practice?
Recognise.....

• *Recognise* the urban fabrics by careful mapping and especially where the overlaps and transitions occur.
Outer suburbs residents, particularly those away from rail lines, drive much more than inner suburbs residents.
Accessibility Mapping, SNAMUTS – Doncaster rail, Melbourne
SNAMUTS model showing public transport accessibility - BEFORE
SNAMUTS model showing public transport accessibility - AFTER
Respect....

• *Respect* the urban fabrics as the basis of understanding how the city works and thus how it needs to be planned.
Walking city fabric needs...

- Dense, mixed land use zonings
- Zero setbacks and narrow streets
- Pedestrian priority and infrastructure (plus cycling), eg zero or minimal parking.
Transit city fabric needs...

- Medium densities and some mix in a string or corridor of centres.
- Minimal setbacks and walking city fabric in centres.
- Transit priority and infrastructure. Eg minimal parking.
Automobile infrastructure needs...

• Low density and low mix.
• Large setbacks and space for car/truck storage and management.
• Car and truck priority (only here), eg truck routes and freeways.
ONE LANE - people per hr:
Freeway 2,500
Busway 5000
LRT 10-20,000
Train 50,000

240 Persons travel to work:
-- in 177 Cars
-- in 3 Busses
-- in 1 Tram
• *Regenerate* the urban fabrics to work more effectively in their walking, transit and car-based functions within a sustainability framework.
Restoring a walking city, eg River in Seoul, buried under freeway
Cheonggyecheon Area after Restoration

Shanghai 1990 and 2010
1990’s - Flirting with the American model...
It didn’t work...

So what can be done?
Shanghai Metro... 12 lines, 273 stations, 420km covering 80% of metro area...

Built mostly since 2000; carries 8 million per day
Walk this way

Planner points city, groups toward an unlogged New York

Jan Gehl the walkability magician...
Transformation of Broadway
Melbourne.
Places for People
1994
Report by Jan Gehl

Places for People
2004
Report Gehl
Architects

www.gehlarchitects.dk
Extension and modernization of the Streetcar System
More People living down town.

• = 5 dwellings
More People living down town

• dwellings

5 dwellings
More People living down town

9,895 dwellings

5 dwellings

convenience store
New Street trees

street trees
since 1993
curbside cafes in 1983

Outdoor Cafes
Outdoor Cafes • curbside cafes in 1993
Outdoor Cafes

curbside cafes in 2004
New life in the lane ways
Pedestrian traffic weekdays daytime: +40%
Pedestrian traffic evening: +100%
Stationary activities +200-300%
What about the Automobile City?
New Urbanism experiments in Perth....
- Frankland Springs LN
- Brighton LN
Even with permeable streets and footpaths, the car remains king.

Beaumaris

Landsdale Gdns
So can you do anything?
<table>
<thead>
<tr>
<th>Year</th>
<th>Route Km</th>
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<tbody>
<tr>
<td>1982</td>
<td>42km</td>
</tr>
<tr>
<td>1983</td>
<td>63km</td>
</tr>
<tr>
<td>1993</td>
<td>92km</td>
</tr>
<tr>
<td>2004</td>
<td>96km</td>
</tr>
<tr>
<td>2005</td>
<td>100km</td>
</tr>
<tr>
<td>2006</td>
<td>172km</td>
</tr>
<tr>
<td>Total</td>
<td>172km</td>
</tr>
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</table>
Southern Rail
– built deep into automobile city fabric
78,000 passengers a day, cf 14,000 on buses, 16% growth pa
National and global model...
$17-22$ mill per km. Carrying $8$ lanes of traffic.
Annual Rail Boardings ('000s: Train and Tram)

YEAR


Southern Line

Northern Line

Adelaide
Perth
Will it help build transit city fabric?
New Central Station under government building....

Next development over the sunken rail line
Esplanade Station
New Perth waterfront TOD
New sub centre 33 kms out...
The land value near rail stations on the Southern Rail increased by 42% in 5 years....thus beginning to create transit city fabric....
The Ring Rail, LRT and BRT plus development sites for the next 30 years growth in Perth – all in transit fabric
The growing global demand for walking and transit city fabric....
Car use growth trends in developed cities from 1960 to 2005 using Global Cities Database.

Percentage average increase in car VKT per capita:

- 1960-1970: 41.8%
- 1970-1980: 25.7%
- 1980-1990: 22.9%
- 1995-2005: 5.1%
Peak Car Use - US cities...

- Declining in **car use** – 4.3% in past year, plateau over the past 5 years.
- Increasing **transit use** – 6.5% in past year.
- Cities coming back in...
Australian city car use peaked the same year...
Australian city transit use grew where rail was built...
Public transport – especially rail – is now booming everywhere.
Global growth now in rail...

- 82 Chinese cities building metros and high speed rail between cities
- 16 Indian cities building metros
- Middle east cities building rail for first time
Global demand is now for walking city and transit city fabric with less automobile city fabric...
Why?
1. Price of oil....

Figure 5. Average annual Brent spot crude oil prices in three cases, 1980-2040 (2011 dollars per barrel)
2. Density is going up after 100 years of decline….

<table>
<thead>
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<td>Brisbane</td>
<td>21.0</td>
<td>11.3</td>
<td>10.2</td>
<td>9.8</td>
<td>9.6</td>
<td>9.7</td>
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<tr>
<td>Melbourne</td>
<td>20.3</td>
<td>18.1</td>
<td>16.4</td>
<td>14.9</td>
<td>13.7</td>
<td>15.6</td>
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<tr>
<td>Perth</td>
<td>15.6</td>
<td>12.2</td>
<td>10.8</td>
<td>10.6</td>
<td>10.9</td>
<td>11.3</td>
</tr>
<tr>
<td>Sydney</td>
<td>21.3</td>
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<td>17.6</td>
<td>16.8</td>
<td>18.9</td>
<td>19.5</td>
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<tr>
<td>Chicago</td>
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<td>17.5</td>
<td>16.6</td>
<td>16.8</td>
<td>16.9</td>
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<tr>
<td>Denver</td>
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<td>11.9</td>
<td>12.8</td>
<td>15.1</td>
<td>14.7</td>
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<td>Houston</td>
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<td>12.0</td>
<td>8.9</td>
<td>9.5</td>
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<td>Los Angeles</td>
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<td>24.4</td>
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<td>19.2</td>
<td>18.0</td>
<td>19.2</td>
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<td>Phoenix</td>
<td>8.6</td>
<td>8.6</td>
<td>8.5</td>
<td>10.5</td>
<td>10.4</td>
<td>10.9</td>
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<td>San Diego</td>
<td>11.7</td>
<td>12.1</td>
<td>10.8</td>
<td>13.1</td>
<td>14.5</td>
<td>14.6</td>
</tr>
<tr>
<td>San Francisco</td>
<td>16.5</td>
<td>16.9</td>
<td>15.5</td>
<td>16.0</td>
<td>20.5</td>
<td>19.8</td>
</tr>
<tr>
<td>Vancouver</td>
<td>24.9</td>
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<td>18.4</td>
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<td>25.2</td>
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<td>45.9</td>
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<td>Hamburg</td>
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<td>Munich</td>
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<td>Zurich</td>
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<td>53.7</td>
<td>47.1</td>
<td>44.3</td>
<td>43.0</td>
</tr>
</tbody>
</table>

Table 2. Trends in urban density in some US, Canadian, Australian and European cities, 1960-2005
Sydney is coming back in after a century of going out

Table 1: Population Change in Sydney, 2001 - 2011

<table>
<thead>
<tr>
<th></th>
<th>Population (‘000)</th>
<th>% Change</th>
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<tbody>
<tr>
<td></td>
<td>2001</td>
<td>2011 (provisional)</td>
</tr>
<tr>
<td>Inner Sydney</td>
<td>991</td>
<td>1144</td>
</tr>
<tr>
<td>Middle Sydney</td>
<td>2289</td>
<td>2559</td>
</tr>
<tr>
<td>Far outer Sydney</td>
<td>848</td>
<td>903</td>
</tr>
</tbody>
</table>

*Inner Sydney is defined here as Waverley, Woollahra, Randwick, Botany Bay, City of Sydney, North Sydney, Mosman, Lane Cove, Manly, Willoughby, Ryde, Canada Bay, Strathfield, Ashfield, Marrickville and Leichhardt; Far outer Sydney is defined here as Camden, Campbelltown, Wollondilly, Penrith, Blue Mountains, Hawkesbury, Gosford and Wyong. Middle Sydney is defined as the remaining SLA’s. Source: ABS.*
3. Cultural change, especially in the young...
‘Cars are so yesterday: young and rich leave guzzlers behind’

From 2001 to 2009, car use by 16 to 34 year olds decreased from 10,300 miles to 7900 miles per capita – a drop of 23 per cent.

And increased:

Public transit 100%
Biking 122%, and
Walking by 37%
AND MOVING BACK INTO CITIES
In Central London, traffic fell by 19 per cent between 2000 and 2009.
The Times  Nov 6, 2012

‘café culture replaces car culture ....’
4. Its economically more efficient

We have turned the corner on the car... Decoupling car use and GDP – new paper from Jeff Kenworthy, WTPP
New urban form emerging?
FUTURE CITY
- NODAL/INFORMATION CITY

- Mixed Density - high, medium & low.
  High - urban villages.
  Medium - 800m around transit stops.
  Low - DRT or cycle distance to transit.
- Integrated - residential, commercial, small scale industry.
- Sub-centralised - link by transit and telecommunications.
All cities indicate the three city fabrics...
Do pedestrians need some help in cities like Pune?
Old Jaipur where streets are for people
New Jaipur where streets are for cars and trucks
Indian transit city fabric for 100 years...
Looking after the ‘last mile’...
Helsinki’s urban fabrics...
Building new walking city fabric
Old transit fabric alive and well...
Pikku Huopalahti – new transit city fabric
Automobile city fabric...
Transit in the automobile city fabric
Density in the automobile city fabric does not make it work without cars...
Even hidden in a forest...
Reclaiming automobile city fabric... the Helsinki Model?
Respecting and regenerating walking city and transit city can/must involve new ways of incorporating nature in the city...eg biophilic urbanism