Urban form and multi-modal mobility patterns

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Cities require knowledge-based and performance oriented approaches to urban design and planning, involving stakeholders from different backgrounds and domains of expertise, using and sharing multiple levels of information, at multiple scales of analysis and intervention.
BIM levels of maturity
CIM – City Information Modelling

- CIM is more than an amalgamation of all the BIM models
- CIM represents higher level networks of infrastructure, governance and human activity and ultimately forms the structure that holds all BIM models together
- CIM allows the description, visualisation, analysis and monitoring of the urban environment to support urban design and planning from the very local to the regional
- CIM meets the needs of the various stakeholders with specific design and decision support tools
- The backbone of CIM is an integrated, cross-disciplinary, spatial data model based on open standards
CIM levels of maturity

Adapted from Bew and Richards, 2008
Source: http://www.modelur.com/

Source: http://www.holisticcity.co.uk/index.php/en/citycad
Urban form and multimodal mobility patterns

Legend
- Post codes
  - VINEX neighbourhoods
  - Transit tracks
    - tram
    - metro
    - rail
  - Motorways
  - Roads
  - Water
Travel patterns
Integrated multimodal urban network model

Legend

a) Main road
   Road
   Cycle lane
   Pedestrian path

b) Rail
   Metro
   Tram
   Bus

c) Transit interface
   Transit–road interface

e) Buildings

f) Building–road interface

General
Land
Water
The backbone of a CIM

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Integrated multimodal urban network model

Private transport (a), public transport (b), land use (c) systems
### ‘Urban modality’ spatial indicators

<table>
<thead>
<tr>
<th>Measure</th>
<th>Target</th>
<th>Distance Type</th>
<th>Cut-off</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proximity</strong></td>
<td>Distance to nearest feature</td>
<td></td>
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<tr>
<td>Network</td>
<td>Pedestrian areas</td>
<td>Metric</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td>Bicycle lanes</td>
<td>Metric</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td>Main roads</td>
<td>Metric</td>
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<tr>
<td></td>
<td>Motorways</td>
<td>Metric</td>
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<td>m</td>
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<tr>
<td></td>
<td>Local transit stops</td>
<td>Metric</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td>Rail stations</td>
<td>Metric</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td><strong>Density</strong></td>
<td>Size or count of features within catchment</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Network</td>
<td>Pedestrian areas</td>
<td>Metric</td>
<td>400, 800, 1600m</td>
<td>m, n</td>
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<tr>
<td></td>
<td>Bicycle lanes</td>
<td>Metric</td>
<td>400, 800, 1600m</td>
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<td>Metric</td>
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<td>Main roads</td>
<td>Metric</td>
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<td></td>
<td>Motorways</td>
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<td></td>
<td>Cul-de-sacs</td>
<td>Metric</td>
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<td></td>
<td>Crossings (X and T)</td>
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<td>Local transit stops</td>
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<td>Rail stations</td>
<td>Metric</td>
<td>400, 800, 1600m</td>
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<tr>
<td><strong>Reach</strong></td>
<td>Streets with non-motorised access</td>
<td>Angular</td>
<td>90, 180 degrees</td>
<td>m, n</td>
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<td></td>
<td>Motor roads</td>
<td>Angular</td>
<td>90, 180 degrees</td>
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<td>Residential land use</td>
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<td>Work land use</td>
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<td><strong>Accessibility</strong></td>
<td>Activities within catchment (area; utility)</td>
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<tr>
<td>Activity</td>
<td>Active land use by car</td>
<td>Temporal</td>
<td>10, 20, 30 min</td>
<td>m², -</td>
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<tr>
<td></td>
<td>Active land use by transit</td>
<td>Temporal</td>
<td>10, 20, 30 min</td>
<td>m², -</td>
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<td>Work land use by car</td>
<td>Temporal</td>
<td>10, 20, 30 min</td>
<td>m², -</td>
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<td>Temporal</td>
<td>10, 20, 30 min</td>
<td>m², -</td>
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<tr>
<td><strong>Configuration</strong></td>
<td>Network centrality of area (mean; top decile share)</td>
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<tr>
<td>Closeness</td>
<td>Streets with non-motorised access</td>
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<td>Motor roads</td>
<td>Angular</td>
<td>400, 800, 1600m</td>
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<tr>
<td></td>
<td>Local transit stops</td>
<td>Topological</td>
<td>400, 800, 1600m</td>
<td>-</td>
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<td></td>
<td>Rail stations</td>
<td>Topological</td>
<td>400, 800, 1600m</td>
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<tr>
<td>Betweenness</td>
<td>Bicycle lanes</td>
<td>Angular</td>
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</tbody>
</table>

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04/06/2015

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Proximity to transit

Public Transport Access

Rail
- 0 – 400
- 400 – 800
- 800 – 1200
- 1200 – 1600
- 1600 – 2000

Metro
- 0 – 400
- 400 – 800
- 800 – 1200
- 1200 – 1600
- 1600 – 2000

Tram
- 0 – 400
- 400 – 800
- 800 – 1200
- 1200 – 1600
- 1600 – 2000

Bus
- 0 – 200
- 200 – 400
- 400 – 600
- 600 – 800
- 800 – 1000
Integrated accessibility analysis

Car accessibility

Transit accessibility

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Sustainable mobility potential evaluation

Modality types: mean mobility profile

Movement of Parkbuurt Oosteinde (2548)

Performance of Parkbuurt Oosteinde (2548)
Future work

Graph databases

Source: https://github.com/neo4j-contrib/spatial
Conclusions

• Urban design and planning is holistic and knowledge based.

• CIM offers a support instrument: an integrated urban model from different disciplines and stakeholders.

• Topology of the city: representation of linked urban features that is detailed, scalable, analytic, descriptive.

• Multimodal travel has clear spatial patterns. ‘Urban modality’ is a characteristic of different places.

• Statistics, visualisation and data mining are tools for exploring and understanding urban complexity.

• CIM as a tool for thinking and ask questions, instead of giving the one answer or solution.
THANK YOU!

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