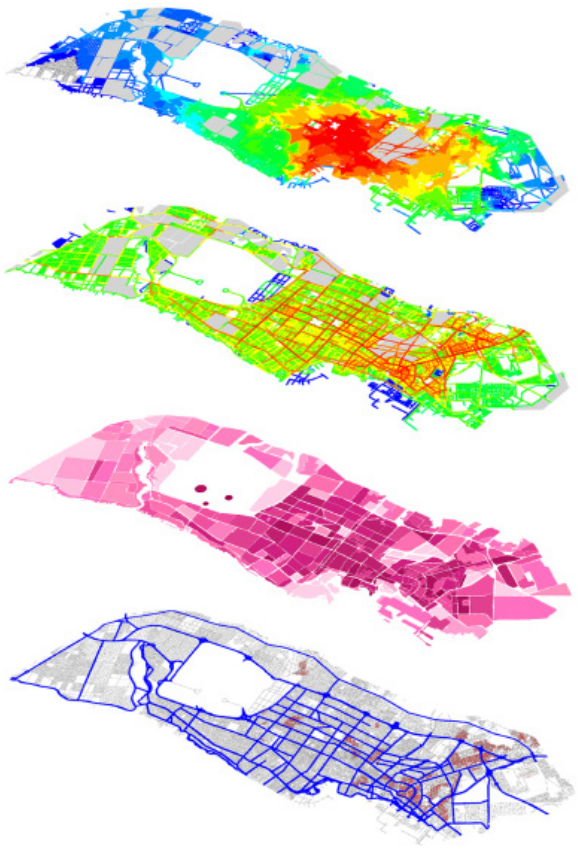
Integrated Urban Modelling

A tool for evidence-based planning, design and scenario testing

“Space Syntax is the go-to consultancy for architects, masterplanners and local governments trying to avoid creating unsustainable and unliveable new neighbourhoods.”
FX magazine, May 2014



Why use an Integrated Urban Model?

Cities are complex combinations of physical form, infrastructure systems, human networks and economic activities.

Physical changes to the city may have unexpected impacts on these systems, and on the day-to-day functioning of the city.

To de-risk the unexpected impacts of planning or large scale design, Space Syntax has developed the “Integrated Urban Model” (IUM) methodology.

The IUM allows existing conditions to be described quantitatively and objectively, it provides a tool to use during design and policy development and sets a consistent baseline to test the impact of future scenarios against.

How is an IUM made?

The IUM is a digital spatial model that links people to and through urban space.

It combines movement systems, land use, population and employment data sets. Additional data sets can be spatialised and added if required.

What output will it produce?

The model provides analysis of the multi-scale impact of changes to infrastructure, public transport, population or employment distributions.

Analytic outputs include the impact on the existing city, key parts within the existing city, or studying relationships within a specific layer of the model.

The model can also provide policy orientated urban indicators relevant to a specific city, such as access to employment opportunities.

How can it be used?

The IUM has been developed to make the following contributions to planning and design projects:

- Provide quantitative analysis of existing and future scenarios
- Enable the impact of population or employment growth to be measured before spatial design proposals exist
- Support the development of infrastructure or public transport proposals through an evidence-based and iterative process
- Measure and compare the impact of scenarios against each other, or against an existing condition
- Inform option selection decisions by demonstrating the impact of proposals on urban indicators

Space Syntax

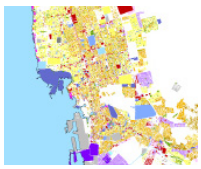
info@spacesyntax.com
www.spacesyntax.com

Methodology
Spatialising and combining data sets

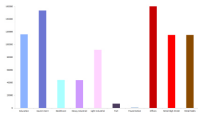
Inputs

Streets and Spaces

Public transport



Land use



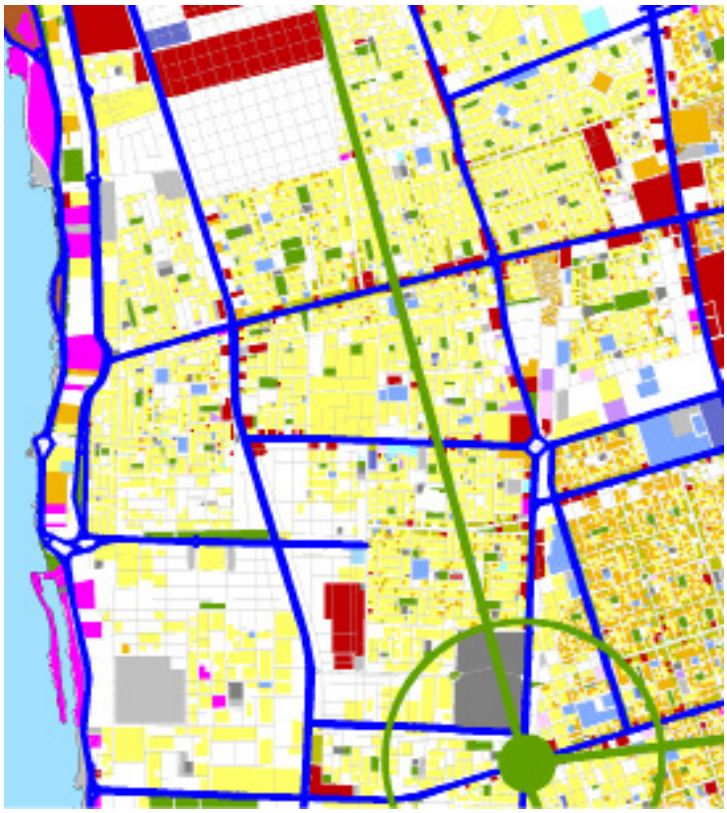
Demographic and Economic data

Spatialised data sets

Combined Network Model

Employment density

Integrated Urban Model



Spatialised data sets linked through Combined Network Model

Data sets

Strategic planning or large scale urban design requires a simultaneous understanding of movement networks, population densities and employment distributions.

Incorporating these components into a single urban model allows each to be adjusted individually and the combined impact measured. This allows existing conditions to be objectively described, and ensures that proposals can be produced to create positive impacts.

These data sets often come from multiple sources having been produced for a different purpose. Combining them into a single model requires the translation and coordination of data into a suitable form.

Space as a framework for data

Academic and practice-based research over the last 25 years has identified fundamental links between spatial layout and the social, economic and environmental performance of places.

Spatial layout has been found to directly affect: movement (pedestrian and vehicular), land use, safety, land value, and carbon emissions.

As such an influential contributor to urban performance, space is used as the basis to combine additional population and employment data sets.

Spatialising data sets

Incorporating data sets in the spatial model requires the spatial distribution of numeric data.

This could involve distributing city level employment sector data to the street, the plot or urban block.

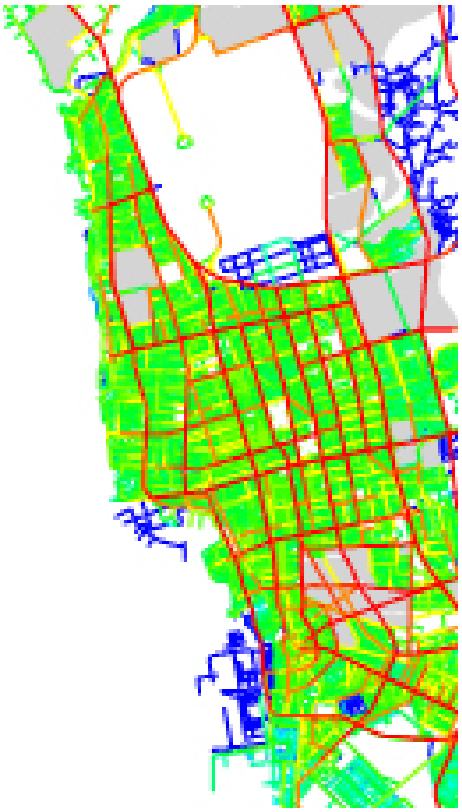
To allow this distribution to take place, a specific methodology has been developed to spatialise and distribute data sets that are often non-spatial.

Whilst the primary purpose of this process is to incorporate the data in the IUM, the newly spatialised data can also be analysed in its own right.

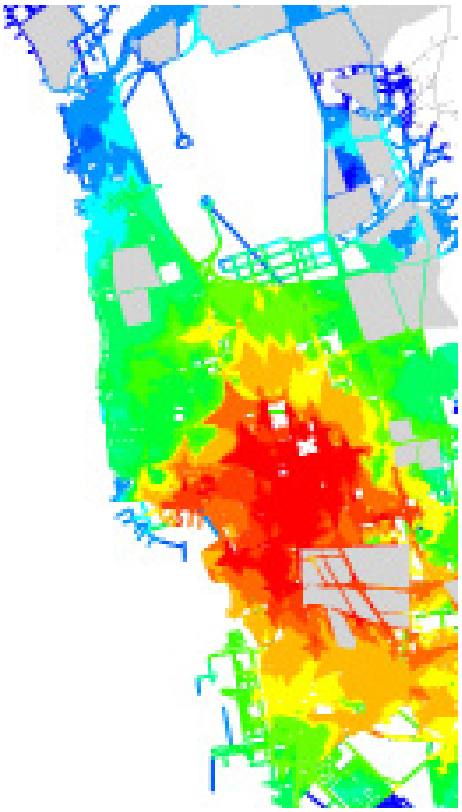
info@spacesyntax.com
www.spacesyntax.com

Analytic outputs
Quality of Life indicators

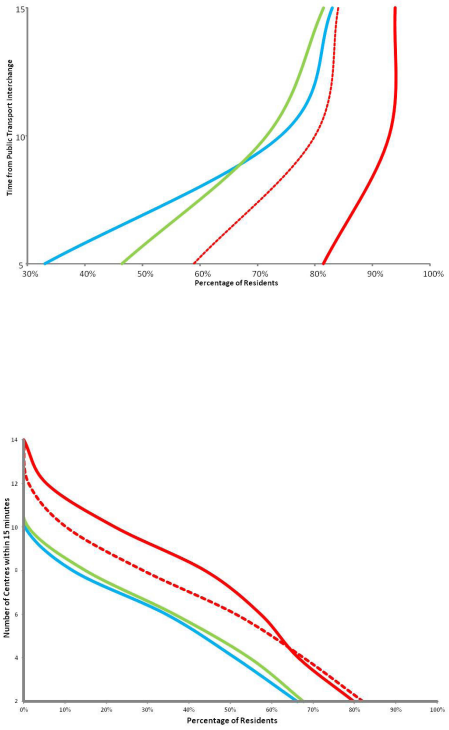
Outputs



Urban Activity Index



Employment opportunities within 15 minutes



Statistical comparison of scenarios

Analytic output

The major strength of the IUM is that multiple data sets can be combined into a single model.

This allows the combined impact of changes to the spatial network, the distribution of population or jobs to be analysed.

Two main types of analysis are typically produced:

• Multi-scale spatial network analysis can be combined to produce an Urban Activity Index and a Centrality Index

• Catchment-type analyses can be combined to provide Quality of Life indicators

These analyses can be visualised as thematic maps or analysed statistically.

Urban Activity Index

The Urban Activity Index describes the numbers of people passing through the street as part of a wider journey (driving, walking or cycling) with people occupying the surrounding plots as their place of work or residence.

The streets and spaces recording higher values will be required to provide levels of infrastructure that can accommodate more multi-modal movement and pedestrian activity.

Centrality Index

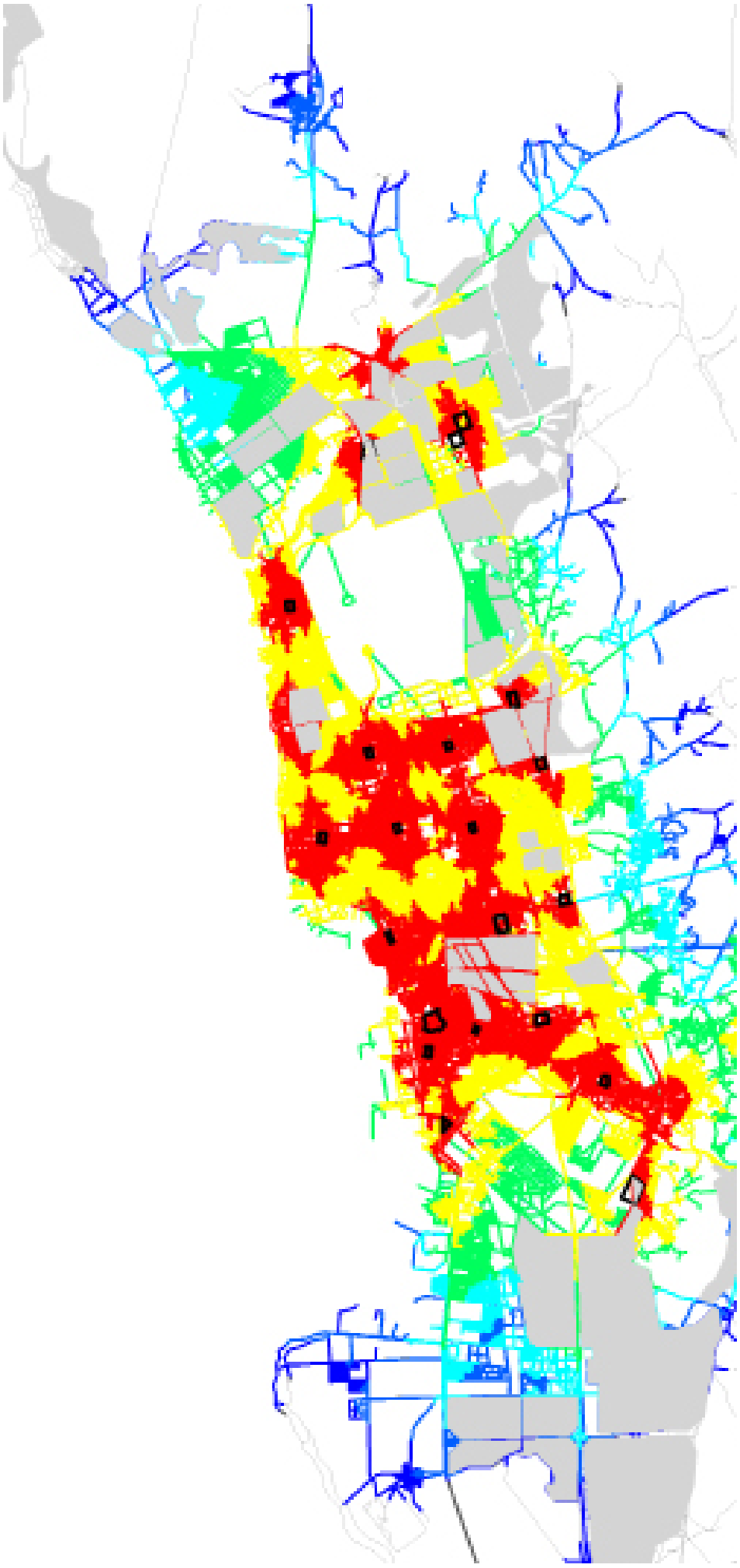
The Centrality Index identifies the areas which are easiest to get to from all other places, using all modes of transport. Spaces which are easier to get to have been seen to correspond with the active functions of a city which are found in centres.

Quality of Life indicators

Access to specific land uses by all residents can be extracted from the model.

As a development on traditional crow-flies or metric-distance catchment measures, isochrones can be calculated using journey times.

Typical Quality of Life indicators include the number of employment opportunities, or community facilities within a 30 minute journey of all residents, or the percentage of the population living within 15 minutes of a public transport station.



25 + minutes
20 - 25 minutes
15 - 20 minutes
10 - 15 minutes
5 - 10 minutes
0 - 5 Minutes

Time to public transport station

Access to proposed Public Transport
Spatial network coloured to show areas within a 15 minute journey time from proposed public transport stations - equivalent to approximately 80% of proposed population distribution.

Space Syntax

info@spacesyntax.com
www.spacesyntax.com