Applying the CSIR Urban Simulation Platform in support of the Nelson Mandela Bay Long Term Financial Sustainability Plan

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Aims and objectives

The NMBM and the CSIR have since December 2009 been collaborating on a project sponsored by the Department of Science and Technology to establish an Urban Simulation Model for the NMBM to study urban growth patterns 30 years into the future (See Pieterse, A. 2015. *Applying the CSIR Urban Simulation Platform: A Nelson Mandela Bay Case Study*. CSIR document. Available on http://stepsa.org/). The model simulates the dynamic interaction between government policies, economic cycles, where people live, where they work and how they commute between home and work across various networks over extended periods of time. This allows planners and decision-makers to assess the likely outcome of various policy scenarios and improve long term planning for the provision of social facilities and major investment decisions such as proposed mass transit schemes. More recently the NMBM formed the Long Term Financial Sustainability Working Group (LTFSWG) and appointed the CSIR to update the Urban Simulation Model and integrate the work done by the CSIR, SHISAKA and BIGEN AFRICA in a way that will allow the LTFSWG to assess the potential outcome of policy/investment scenarios to support the long term financial sustainability of the NMBM.

How the urban simulation platform was applied

The proposed approach involves feeding the housing strategy developed by SHISAKA/HDA into the Urban Simulation Platform to guide the simulation of residential developments and adapting the output such that it provides the number of SDTs (Standard Dwelling Types) for each of the 13 demand zones to BIGEN AFRICA as an input to their Demand Model. This will result in the Demand Model taking spatially explicit growth projections from the Urban Simulation Model rather than from their own Growth and Economic Development Model (GEDM), thereby avoiding duplication without affecting the rest of the process that translates growth into infrastructure requirements, optimization, costing, design and financing.

The primary reason for the updates required to the Urban Simulation Model is that all the previous work was based on Census 2001. The upgrade involves using the Census 2011 data to update demographic and employment control totals and to, accordingly, update the synthetic population used in the platform. It was also necessary to improve the public transport model because there are so many uncertainties about the real influence of congestion on the behaviour of households, an alternative approach based on OpenTripPlanner was developed (funded by DST) to determine high resolution accessibility to employment from lowest cost routes considering all modes of transport, including limited distance walking and cycling, private vehicles, minibus taxis, bus and rail with unlimited transfers between modes.

Based on the May 2014 version of the Urban Network Strategy (Figure 1), certain urban network elements were used in the simulations (Figure 2) that covers 20 462 parcels with an area of 18 136ha at an average density of 7.8 du/ha in 2011.

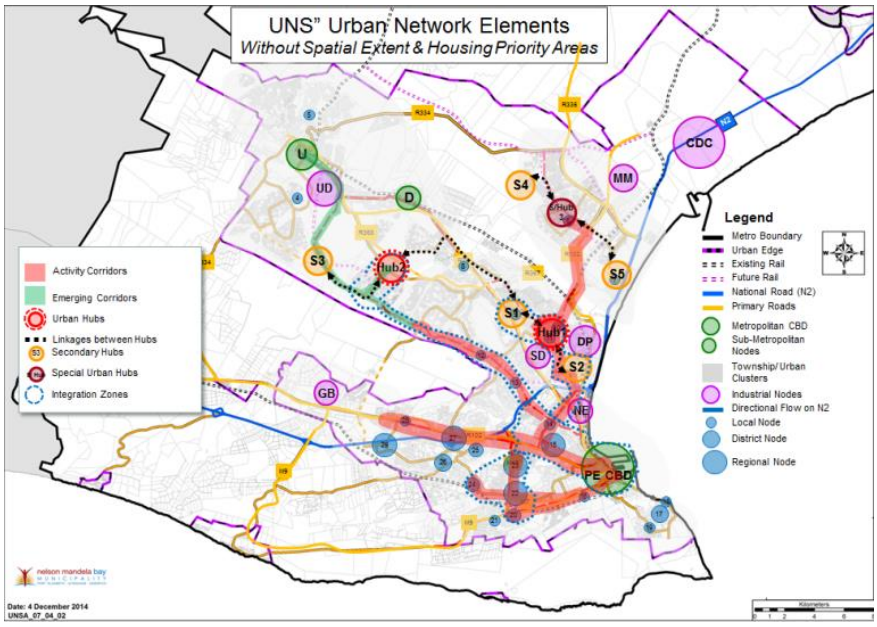


Figure 1: Urban Network Strategy elements for Nelson Mandela Bay

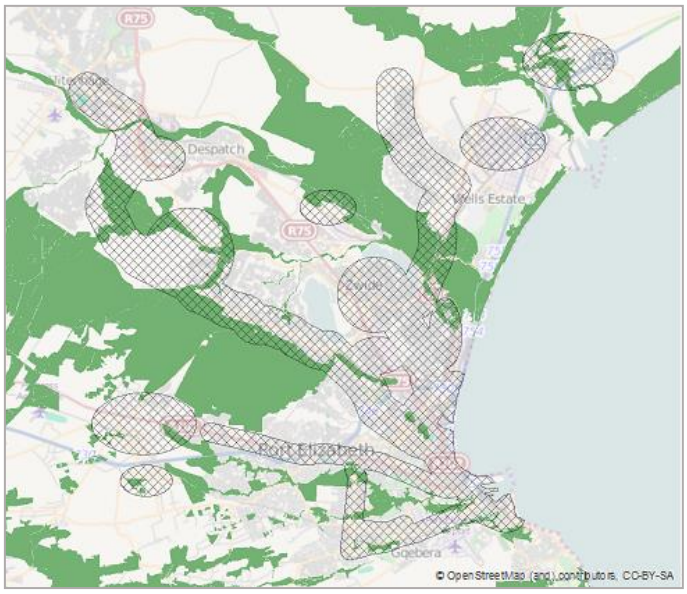
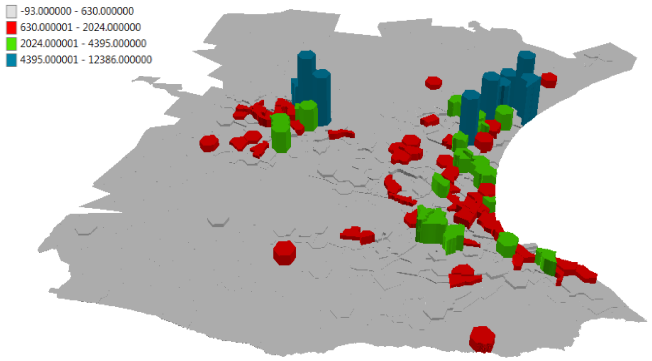
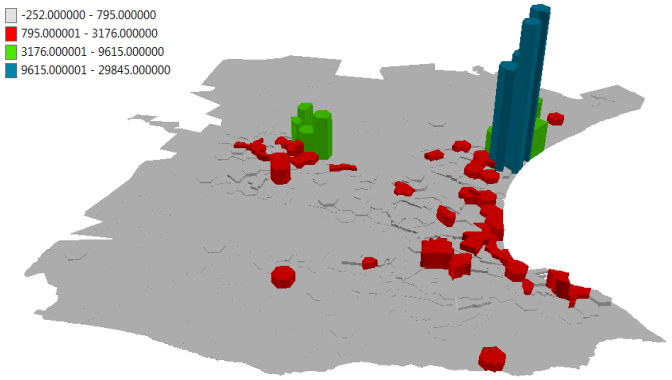
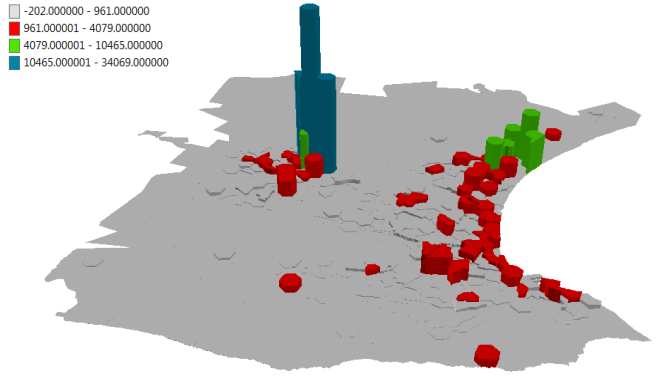
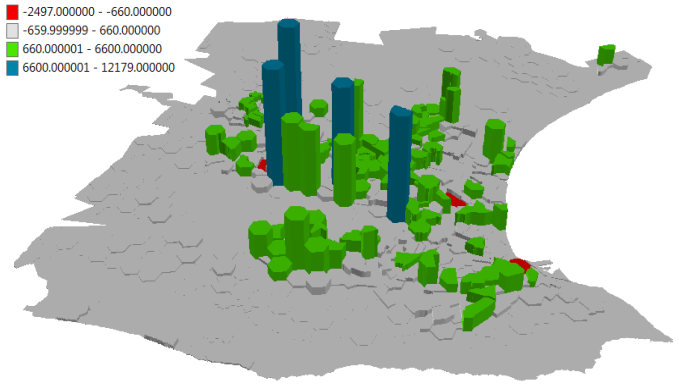
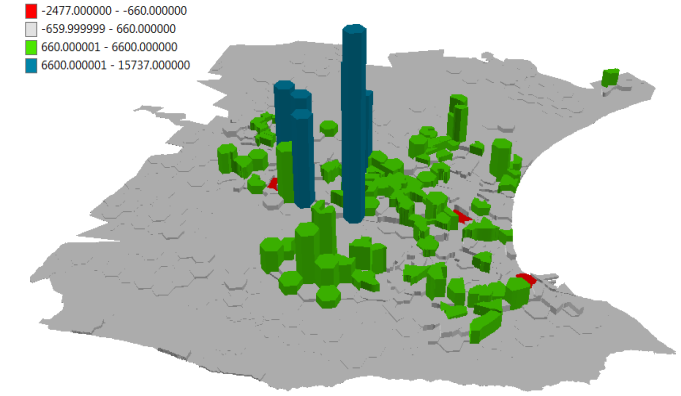
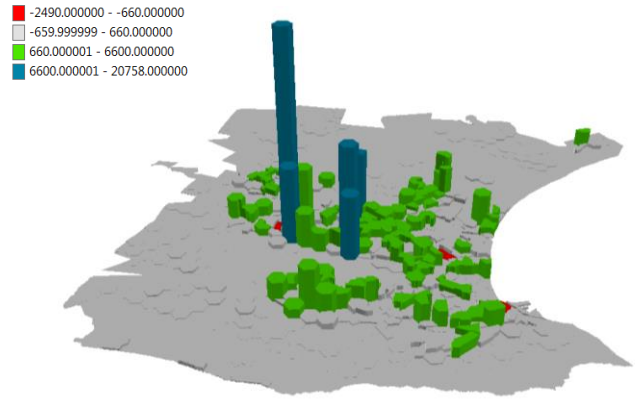
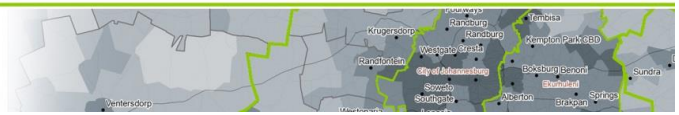


Figure 2: Urban network elements used in the simulations

The outcomes and outputs of the exercise

Trend policy option	Coega policy option	Chatty/Jachtvlakte policy option
Based on optimistic demographic and employment growth in the spirit of Walking Together for Growth Scenario. The 'corridor' templates allow 201% higher densities.	This is much the same as the trend policy option but industrial buildings with a total floor area of 5.8 million m^2 were included, without assigning any jobs.	This is much the same as the trend policy option but industrial buildings with a total floor area of 4.08 million m^2 were included, without assigning any jobs.
Growth in jobs 2011 to 2030 	**Growth in jobs 2011 to 2030** 	**Growth in jobs 2011 to 2030** 
Growth in households 2011 to 2030 	**Growth in households 2011 to 2030** 	**Growth in households 2011 to 2030** 



For the Trend policy option, the model could not be run without releasing land into the system. In the absence of land use schemes for the area, land was classified according the 10 Knowledge Factory clusters and released randomly into the system. It took 3 iterations of this exercise before the supply of land met demand. For the Jachtvlakte policy option, densities in the 'corridor' increased by over 60% from 7.8 to 13 du/ha. This was largely a function of the way in which the land was 'released' during the simulation but it still illustrates the effectiveness of land use controls, such as release schedules. The lack of developer up-take in the Coega policy option was rather counter intuitive and it might be because of the difference between stated and observed preferences or because of the consequences of mass transit. The possible answers to this will be investigated further as the project progresses.

References

Waldeck, L. 2014. *Progress with update of urban growth simulation model for the NMB Long Term Financial Sustainability plan*. Unpublished CSIR report.

Waldeck, L. 2015. *Progress with update of Urban Growth Simulation Model for LTFSP.* Presentation made to the NMB Metro on 1 April 2015