TUSC
TOOL FOR URBAN SUSTAINABILITY.
CODE OF PRACTICE.

A WEB-BASED SUSTAINABILITY ASSESSMENT TOOL STREAMLINING LOCAL GOVERNMENT PRACTICE: TUSC

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ABSTRACT

TUSC (Tool for Urban Sustainability: Code-of-Practice) is a web-enabled design and analysis tool for assessing the sustainability of residential buildings and neighbourhoods. TUSC was launched at the inaugural New Zealand Society for Sustainable Engineering and Science (NZSSES) inaugaural conference 2 years ago, and the TUSC tool has now been incorporated into Waitakere City Council development remissions policies.

This paper will discuss the need for computer-based tools to assist in integrating local government land development planning and practice, and will chart the progression of the TUSC project. It will present new opportunities for this approach, and discuss the potential for TUSC in an expanding marketplace of sustainability rating tools.

The actual web-based prototype will be demonstrated in this session, together with a preview of the next phase of this project. It is intended that feedback be received from this demonstration.

1 INTRODUCTION

New Zealand's Resource Management Act (RMA) 1991, Building Act 2004, and Local Government Act 2002 provide a complex legislative context for urban development. With extensive powers and responsibilities within this legislative framework, local authorities attempt to clarify standards for development with an array of policies and plans, and technical standards, guidelines, and Codes of Practice, including Long-Term Council Community Plans (LTCCP), District Plans (DP), Engineering Codes of Practice, subdivision standards, and so on. This approach struggles to align sustainability policies at a high level with implementing sustainable development of urban centres in the long-term. The many codes and guidelines tend to represent traditional technical approaches that cannot deliver on the wider multiple bottom-line and sustainability objectives that may be articulated in higher level planning policy and legislation. Policy and strategy is not able to be fully enacted solely by regulatory techniques.

Therefore, although there has been a great deal of worthwhile philosophical debate on sustainability, New Zealand needs to make real progress towards sustainable development. This technical failure between policy and regulation holds as much for developers as for local councils. In the urban context, one of the major barriers is that decision makers, developers, and design practitioners do not have the decision support tools for the adequate implementation of innovative technical solutions that lead to sustainability in urban development.

Developers' frustration with this complicated mix of documentation is further exacerbated by the lack of consistency across territorial boundaries. Without a 'level playing field' regionally, developers tend towards a lowest common denominator approach and may rely on council consenting departments to improve their designs – further burdening the already over-stretched resources of Council consenting staff and adding to consenting timeframes. The consenting risk compounds the commercial risk, and so the resulting development tends to reflect developers' desire to reduce the upfront costs, even though this usually means higher running costs for the homeowner, particularly in terms of water and energy use – an environmentally unsustainable result.

Other shortcomings include the lack of knowledge and awareness of sustainability issues, and a lack of detail for urban planners on practical outcomes to achieve sustainable management. Fortunately, these two aspects are beginning to change, with recent research investment beginning to result in better dissemination of knowledge to practitioners and the wider public. Research issues also include agreeing definitions, indicators, techniques and design parameters for urban sustainability; and the shortage of implemented technologies as case studies to prove and monitor performance and progress towards more sustainable communities.

Once linkages become better established between resource and land use planning, there is an opportunity to develop new approaches to urban form that will lead to sustainability in urban development, informed by tools to assess cumulative effects on infrastructure, transportation, the water cycle, waste, the energy cycle, and building design and construction. The cost/benefit of various land options can then be evaluated in terms of social, cultural, economic and environmental outcomes. This approach has become even more timely with the requirements of the Local Government (Auckland) Amendment Act (LG(A)AA) (2004), in particular Schedule 5, paragraphs (a) and (d) which provide for "*(a) providing increased certainty in the assessment of resource consents, designations, and plan changes related to transport and urban form, and ensuring that transport and land use patterns are aligned to achieve sustainability, efficiency, and liveability in the Auckland Region; and …(d) supporting compact sustainable urban form and sustainable urban land use intensification (including location, timing and sequencing issues, and associated quality, character, and values of urban form and design)"*.

The concept driving the development of the TUSC Tool for Urban Sustainability is to be a single tool for developers and regulators alike, to understand, inform, and measure urban sustainability.

2 BACKGROUND

The aims of this project are in accordance with the objectives of the Department of Prime Minister and Cabinet, *Sustainable Development for New Zealand, Programme for Action*

(January 2003). The project aims to develop an interactive Code of Practice for sustainable urban engineering, suitable for adoption and use widely throughout the country across the local government sector. The Code of Practice is to be provided as a user-friendly web based toolbox system that includes linkages to models.

It will improve sustainable management by raising awareness and understanding of sustainability issues by providing practitioners and decision-makers with appropriate tools, and by ensuring cost-effective sustainable urban development.

The toolbox provides a framework for decision-making based on analysis at four stages as follows:

1. The performance standards required. These will be geographically contextualized to reflect local environmental sensitivities coupled with community priorities;

2. At macro and micro levels, neighbourhood or community land use, amenity and infrastructure planning. Typically could eventually be used in conjunction with District and Structure Plans for resource consents.

3. Site specific planning, such as land use and subdivision consents.

4. Building planning, at the building consent stage, to enable designs to consider the water use, energy use, ecology, transport, and associated dependence on public infrastructure.

At each of the stages, the toolbox will analyse and set out sustainability criteria to establish cumulative effects and best practice solutions, taking into account the range of toolbox components, residential densities and mixed land use activities. The toolbox models also seek to balance urban design form and public open space, energy and greenhouse gas emissions (primarily CO2), impact on the water cycle, transport and public infrastructure requirements. The project will enable the impact of the ecological footprint of urban development to be modelled and the measures (both soft and hard) that can be implemented to minimise the footprint. The measurements of key sustainability indicators such as water and energy use per person equivalent can be easily incorporated into Quadruple Bottom Line evaluations as required by the LGA (2002) and using the Code of Practice can be used to achieve improvements to these indicators.

A key outcome is to ensure dissemination of the project, involvement and acceptance by stakeholders. Users will be informed through workshops, publications and conference presentations. The project will deliver a graphical user interface, and a series of integrated modules working at different scales. It is proposed to make the modules available to stakeholders progressively, so as to achieve uptake. The project will also develop highly innovative information technology interfaces. The first module (building scale) is complete, and work is progressing on neighbourhood scale module, complete by June 2007.

With research outputs and new sustainability tools steadily being released, a key performance requirement for TUSC is to be able to easily adapt, link, and incorporate new knowledge without major reprogramming of server software and web interface being required.

Benchmarking of the outputs will be achieved by reference to Territorial Authorities, Regional Councils, developers, designers, architects, engineers, surveyors; urban, resource and strategic planners; iwi, economists and the community.

The project sponsors envisage a number of key benefits of this approach. By providing practitioners with interactive user friendly tools, land-use planning instruments such as District Plans and Structure Plans can become more versatile and fine-grained, alternative zoning options better compared, and the true (lifecycle) costs of infrastructure servicing could be significantly reduced with smaller-scale new infrastructure and better use of limited capacity in downstream road and pipe networks. This in turn gives potential for reducing RMA (1991) compliance costs for developers, Councils and the community. This is becoming increasingly important with Council Development Contributions, Consent processing fees and others costs and charges starting to be blamed as a major contributor, along with land prices, for the lack of affordable and entry-level housing in our major cities.

3 DISCUSSION

3.1 TECHNICAL DEVELOPMENT

The primary medium for distribution and use of TUSC is the internet via a single multi-functional website available on www.tusc.org.nz. A prototype *TUSC* building rating tool has been established. This will be tested and refined on a series of case studies this year.

Users can access a specific location of interest via an online version of GIS interactive mapping medium. This integrates existing local government spatial data held on asset databases directly into TUSC models. These geographic information systems are widely used by local authorities and TUSC leverages the significant ongoing investment in maintaining up-to-date GIS databases to give accurate current site-specific data to developers and home-owners. Layers in this GIS include environmental data, planning constraints (including target TUSC score for area) goal, local networks and existing development information, existing lot boundaries, existing building floorplans and site coverages, etc.

The integrated GIS technologies have been made possible by utilizing Digital Earth protocols. Digital Earth is a worldwide movement aiming to globally increase interoperability of geographic software and tools and link these through an advanced world-wide-web to make key environmental data more freely available to the public. Examples of this movement are Google Earth and other Nasa and Microsoft earth portals.

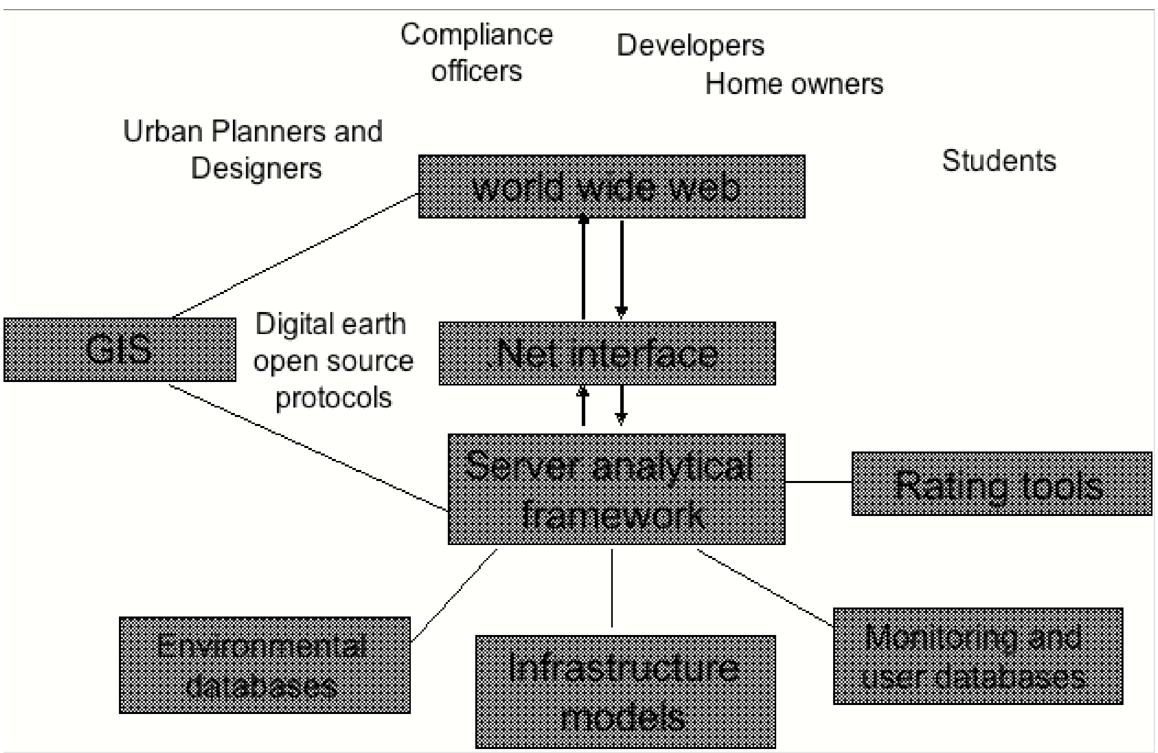
Via a series of 'wizards' and graphical tools, users are able to 'design' or specify their development plans, which will then be scored in an iterative fashion. The user is prompted with options to improve the development proposal score by using various sustainability techniques and technologies appropriate to the scale of development proposed.

The toolbox models and objects (infrastructure, buildings, treatment devices, environmental data, etc) link and operate seamlessly within the user interface to analyse and score the development proposal within location-specific criteria. Advanced users may be able to view, moderate and add objects within limits, so TUSC can serve as a powerful research and design tool.

A key advantage of a web interface is centralised data management that ensures currency of data to users whilst avoiding pitfalls associated with use of outdated versions. This web interface is also highly adaptable, such that new models and resources for the toolbox can be progressively added or improved, without major rewriting of web software, providng transparency and currency of data and analytical methodologies.

It is important to stakeholders that this is not "black-box" software. The web interface has been designed only to translate information from models in standard Microsoft tools such as Excel, which in turn links to other energy and hydraulic design tools, and GIS, within their native formats. This means that desktop models are not replicated in the web server environment (i.e. software functions are not rewritten in HTML or Java), thereby reducing bugs and ensuring far greater flexibility for updating. This approach also releases the far greater analytical power of existing spreadsheet and database software.

This approach is presented in the figure below.



3.2 RESEARCH AND TECHNICAL LINKS

TUSC is not intended or funded to carry out research, but rather seeks to deliver and link existing research and tools into a useful planning, assessment, and design tool. As such, it relies on other research, current best practice techniques, and computer tools and software to reach its objectives.

Recent central government research funding administered through the Foundation for Science Research and Technology (FRST) has focused on Sustainable Development. Two important FRST projects have been identified as directly relevant to TUSC. These projects and their relevance to TUSC are:

1. *Beacon*, which is made up of a consortia of two Crown Research entities, two industry partners and Waitakere City Council. Beacon's scope focuses on the residential built environment and has stated goals to improve the sustainability of 90% of all New Zealand's housing stock by 2012; and
2. LandCare's *Low Impact Urban Design and Development (LIUDD)* project, which focuses on water sensitive urban design and works primarily at a site and catchment level rather than buildings per se.

TUSC has fostered good working relationships with this research to ensure that the framework and data used in TUSC can be updated with the results of the these and other research projects once data becomes available.

TUSC is also designed to integrate with existing industry standard software tools such as computer-aided draughting (CAD) packages, and geographic information systems (GIS), as well as a variety of water and energy models, databases, and spreadsheets. A central principle of TUSC technical development is flexibility to adapt and integrate with existing Council datasets, websites, and industry tools to avoid duplication of effort.

3.3 DEMONSTRATION PROJECTS

Physical projects with measurable results will be vitally important. Several potential applications for TUSC have already been identified, sponsored primarily by Waitakere City Council. The project hopes to include other Auckland councils such as North Shore City Council, as well as projects at various scales and localities around New Zealand. Further opportunities for demonstration projects are likely to be identified as prototype TUSC versions are released to Management and Liaison Team parties.

Results from these demonstration projects will be built into the TUSC work programme, and ultimately a repository of projects and results will be continually added to on the TUSC website which will serve to provide design ideas, raise awareness, educate, and engender the confidence of stakeholders.

The Prototype and Draft versions of TUSC are making use of the demonstration projects for verification and calibration of the outputs of the TUSC models, to refine and improve interfaces and to fully test the framework across a number of scenarios and applications.

3.4 MONITORING AND QUALITY CONTROL

Monitoring and Quality Control are planned to be undertaken on three levels:

1. Monitoring of TUSC performance against stated objectives and goals
2. Use of demonstration projects to verify TUSC outputs and refine results
3. Use of external peer reviewers especially on technical components of the TUSC framework.

Monitoring and Quality Control will incorporate Users Forums, ongoing updating of models, technologies, environmental research, results, demonstration projects, and links into the TUSC website.

4 CONCLUSIONS

TUSC provides a useful first step towards developing a flexible and integrated system to assist regulators and communities achieve better sustainability outcomes. More research and information access is needed to add more power and dimensionality to the tools, and TUSC is equipped to easily accommodate this knowledge and continue to adapt to the evolving community expectations and environmental imperatives. The goal of sustainable urban development is worthy of collaborative effort and pooled resources between all agencies, the public and private sector, and the wider community. In beginning to define and measure the comparative sustainability of developments, TUSC also provides a mechanism to apply research, implement policy, and effectively bridge the gap between public regulator and private developer to reach this goal.

4.1 WORKSHOP FEEDBACK SOUGHT

Of particular interest is whether District Plans can benefit by allowing for the use of the TUSC tool, and whether uptake should be voluntary or mandated, as is the case with the BASIX framework in New South Wales, Australia.

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