# Virtual Design and Construction (VDC)

## for Australian Infrastructure Projects

Sustainable Built Environment National Research Centre

# Virtual Design and Construction

Virtual Design and Construction (VDC) can be considered as the infrastructure equivalent of Building Information Modelling (BIM). BIM has seen a rapid increase in use for building design, construction and operation over the last decade. Using 3D, 4D (construction simulation) and 5D (estimating) technology, BIM allows construction projects to be created and managed more quickly, more safely, more economically, and with less environmental impact.

The technical development underlying BIM, and the processes developed by companies to exploit it, are now spilling over into the infrastructure area. Some of the drive for this change in infrastructure procurement is through the spillover of BIM-based methods within firms that undertake both building and infrastructure projects. Other drivers for change are the recognition that the benefits of BIM for buildings are just as relevant for infrastructure projects, and the increased availability, and capabilities, of professional staff and software that supports infrastructure procurement.

While BIM is well known for its productive use on commercial and residential buildings, its use also provides significant benefits for infrastructure projects, in particular reduction of project costs. This reduction is through improvements to process, such as pioneered by the Center for Integrated Facility Engineering (CIFE) at Stanford University on infrastructure projects, and the reduction in errors through the application of techniques such as clash detection, estimation and construction sequencing under the VDC approach.

Internationally BIM is being widely used. Recently the United Kingdom Government announced that all government projects will be required to use fully collaborative 3D BIM as a minimum by 2016. They recognise that using BIM will drive greater innovation and integration by their suppliers. The Governments of Singapore, the United States, Norway, Denmark and Finland are also stimulating the use of BIM through government procurement and facility management processes. This indicates the expectation by these governments of significant benefits from the use of BIM within their countries.

It is expected that Australian Governments will move in the same direction, with a recent report[1] by the Built Environment Industry and Innovation Council (BEIIC), stating *the adoption of digital models and technology within the built environment offers significant productivity and environmental gains for the industry. [BIM's] accelerated widespread adoption would make a significant difference to national economic performance.* Applied research projects carried out by the CRC for Construction Innovation (the predecessor to SBEnrc) and the SBEnrc are helping to advance these industry initiatives.

The planning, design and construction of infrastructure, such as roads and bridges is highly complex. Increasingly, VDC is becoming an essential factor in the efficiency and international competitiveness of the Australian built environment industry, as it provides an opportunity for planners, designers, constructors and clients to improve the productivity of infrastructure delivery.

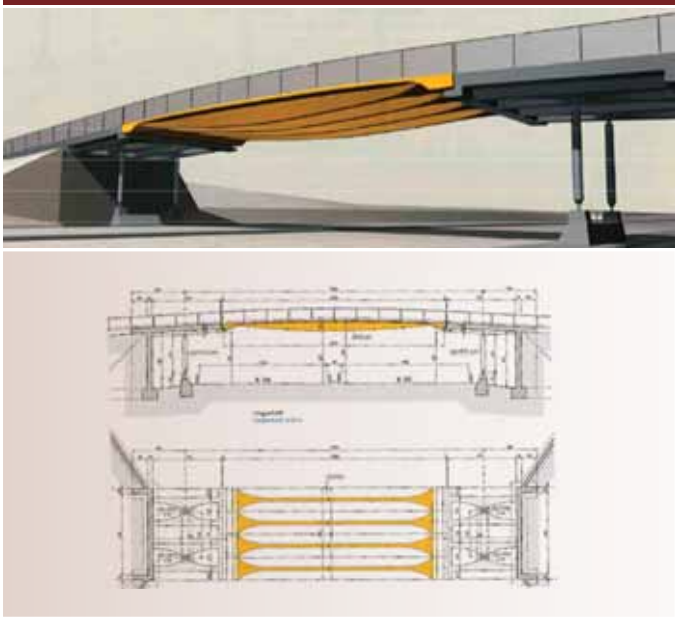
[1]Built Environment Digital Modelling Working Group, 2010, Issues Paper: Digital Modelling and the Built Environment, BEIIC, Canberra

# Existing SBEnrc Initiatives

Work on VDC has been undertaken in a number of projects by the CRC for Construction Innovation and SBEnrc, including:

- structural analysis of bridge models
- automated take-off of concrete and steel quantities
- construction planning workbench/4D modelling
- micro-climate analysis
- object libraries supporting the facility lifecycle
- combining sensors and asset information models.

**VDC Bridge model** (top) 3D view (bottom) side/top plan view



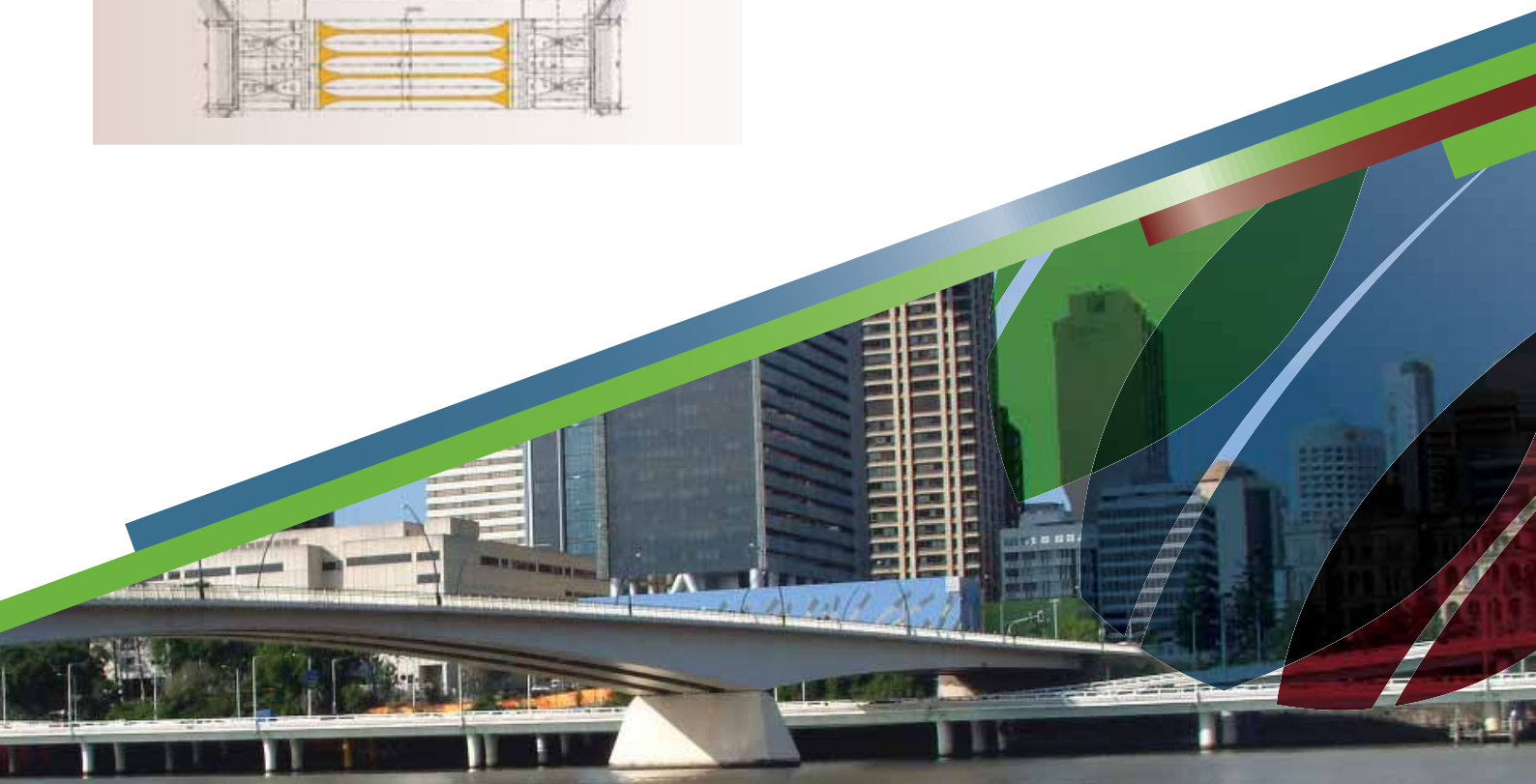
# Benefits of using VDC for infrastructure projects

The overarching benefit of using VDC is that it allows infrastructure projects to be completed more quickly and generally with reduced costs. By incorporating physical, commercial, environmental, operational and maintenance data at every stage of the project, VDC can provide many benefits to the construction supply chain, including the client, the designers and the constructors.

From an infrastructure perspective, using VDC enables users to:

- Build computer models of structures, products, components or systems
- Apply operating loads or other design performance conditions
- Study physical responses, for example stress levels and temperature distributions.
- Optimise a design early in the development process to reduce production costs and feed into the production process
- Prototype testing in environments where it otherwise would be undesirable or impossible.

Research undertaken by the SBEnrc and CRC for Construction Innovation has shown that VDC has significant potential to be applied to infrastructure projects such as roads, rail, tunnels and bridges and to offer significant advantages over the current practice.



**The *Sustainable Built Environment* National Research Centre (SBEnrc)** is the successor to Australia's CRC for Construction Innovation. The SBEnrc is a key research broker between industry, government and research organisations servicing the built environment.

The SBEnrc is continuing to build an enduring value-adding national research and development centre in sustainable infrastructure and building with significant support from public and private partners around Australia and internationally.

Benefits from SBEnrc activities are realised through national, industry and firm-level competitive advantages; market premiums through engagement in the collaborative research and development process; and early adoption of Centre outputs. The Centre integrates research across the economic, social and environmental sustainability areas in programs respectively titled Driving Productivity through Innovation, People, Processes and Performance, and Greening the Built Environment.

## This research wouldn't be possible without the ongoing support of our industry, government and research partners:

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