AUTODESK.

Public Infrastructure Inquiry
Productivity Commission
LB2 Collins Street East
Melbourne VIC 8003
Australia

4 April 2014

Dear Sir/Madam,

We are extremely grateful for the opportunity to respond via a public submission to the Productivity Commission's Public Infrastructure Inquiry. Recognizing that the Inquiry seeks to address a range of issues, our submission focuses on addressing the following key issues as laid out in the Inquiry's terms of reference:

- Provide advice on ways to improve decision-making and implementation processes to facilitate a reduction in the cost of public infrastructure projects, including in relation to: measures to improve flexibility and reduce complexity, costs and time for all parties.
- Comment on other relevant policy measures, including any non-legislative approaches, which would help ensure effective delivery of infrastructure services over both the short and long term.

The key perspective that Autodesk hopes to bring to the Commission's Inquiry is that upwards of 25% of infrastructure project costs are tied to change orders, requests for information ("RFIs"), rework and design clashes that are not found until construction begins due to a silo approach to project delivery. Use of BIM is able to substantially reduce these costs. While private sector use of BIM offers significant benefits and costs reductions, it is only through a public procurer-led approach that these benefits and cost reductions will fully accrue to public funding. When there is only fragmented adoption in the market the benefits will likely be taken wholly by the private sector, potentially to the detriment of the cost of public infrastructure.

THE GLOBAL INFRASTRUCTURE CHALLENGE

A recent report, "Strategic Transport Infrastructure Needs to 2030," released by the Organization for Economic Cooperation and Development (OECD), found a need to invest $53 trillion in infrastructure over the next 20 years worldwide – the equivalent of three times the European Union's $18 trillion GDP. Over $11 trillion alone will be required for ports, airports, and key rail routes.

Other items highlighted in the report from the OECD included:

- The greatest amount of investment, $17.7 trillion, needs to be made in water infrastructure, followed by $10.9 trillion in telecom.
- By 2030, roads will require $7.5 trillion in investment, while electricity will need $6 trillion.
- Asia has the most airport investment planned, at $135 billion, followed by North America at $128 billion.
- North America has the most gas supply infrastructure investment planned, at $1.7 trillion, followed by Eastern Europe at $1.2 trillion.

Architects, engineers and contractors agree that the most important aspect of project delivery beyond safety, is delivering a project on time and on budget. Numerous studies show upwards of 25% of project costs are tied to change orders, requests for information ("RFIs), rework and design clashes that are not found until construction begins due to a silo approach to project delivery. In an era where tax and private dollars are scarce and intolerance for waste is at an all-time high, to be successful we have to look at doing things differently, in a more sophisticated way and more accurately. With policy makers globally wrestling with how to finance needed transportation and other infrastructure investments, there is little dispute about the importance of ensuring every dollar must be invested wisely, to aid in attracting the funding needed.

Technology to Support Future Infrastructure Project Design & Delivery

Better collaboration on designs by all team members - designers, contractors and owners during all phases, planning, preliminary and detailed design - is needed, not just simple coordination. This has proven to dramatically reduce the up to 20% or more of project costs that are associated with rework. By doing so, requests for information (RFIs), associated change orders and general errors and omissions are reduced through early detection and better understanding of conflicts and the ability to resolve them before construction. There are many causes and none are intentional, but one key contributing factor is managing hundreds, if not thousands of sheets of paper or 2D CAD files with millions of bits of information looking for conflicts or missing information, even transposed numbers. The task is daunting and most of the time nearly impossible to make error proof, no matter how many QA cycles, tight timelines, or strict budgets. Factor in a change in design scope and it multiplies the challenge dramatically, maybe even exponentially.

This is where Building Information Modeling (BIM) comes in. Designing with intelligent 3D models, and using a BIM workflow to facilitate cost, time and sustainability related decisions. BIM is a technology process, whereas the integrated project delivery methods such as IPD (Integrated Project Delivery) and PPPs (Public Private Partnerships) are behavioral and legal processes that allows teams the framework to foster better collaboration and set the stage for more efficient design and construction process overall. BIM can therefore been characterized as an enabling technology and process that supports the legal structure of IPD and PPP.

BIM is included in many IPD/PPP forms of contracts, and is seen as a value-adding component, for example, for example the McGraw-Hill Smart Market BIM for Infrastructure Report). It is all about a convergence of tools, computing power, knowledge requirements and the need to do things smarter, more cost effective and more efficiently. Other significant findings in the McGraw-Hill report include:

- **67% of current users of BIM for infrastructure report a positive ROI on their BIM investments**. Greater experience contributes to higher ROI—over 40% of the users who identify themselves as experts in BIM and use it for infrastructure projects report an ROI of 50% or greater.

The Business Value of BIM for Infrastructure 2012 Smart Market Report. Source: McGraw-Hill Construction

- Most current users already enjoy reduced conflicts and changes, improved project quality, lower cost of planning approvals and reduced timeframes for delivery of projects **and believe that the emerging benefits of lower project risk and greater predictability of project outcomes** will motivate them to increase their use of BIM in the future.

Having this technology process is helping to enable a rethinking of the behavioral process towards more integrated project approaches like IPD and PPP in order to provide more predictable, accurate and responsible outcomes. The combination of BIM with IPD & PPPs is a great improvement on the process by itself; however neither can achieve full success in collaboration without the synergy provided in combination with the other.

Simply put, BIM helps engineers, planners, especially owners and investors gain valuable insight across the lifecycle of a project from early planning through to construction and operations. The use of BIM, which has helped to positively transform the building industry for a number of years, is now increasingly being used for infrastructure projects. Because everyone involved in a BIM project works from the same 3D model, they share the same reliable, coordinated and consistent information to support more informed decision making.

BIM Is a Standard of Practice

With BIM, the entire process of developing and executing infrastructure projects can be streamlined, from initial surveying and data collection through to environmental review, public participation, design, contracting, construction and operations and management. The associated efficiency gains can help stretch limited infrastructure investment dollars further and deliver tremendous benefits to stakeholders. With BIM, key decisions are moved from the field to the computer screen where they are relatively easy and cheap to resolve. Another benefit of BIM and the capability to simulate an unlimited number of scenarios, is the ability for contractors to work with designers early in the process to optimize construction approaches. Stakeholders can explore "what-if" scenarios with project investors to test alternatives and simulate real-world performance to better understand cost and scheduling. Three dimensional models can also be used to assess the sustainability of a project by incorporating social, political, cultural, and economic information. The 3D models can also be used to provide the public with more accurate visualizations of the completed project and how the project will impact driving routes while under construction. Modeling in 3D also enables the use of automated GPS machine guidance technologies during construction that link the model with heavy equipment to improve precision and accuracy, and greatly reduce construction time and fuel and material waste while increasing the safety of people working on the project.

There has been some discussion in the Australian government as noted in the Commission's draft report that the benefits of BIM are captured by market participants, and therefore there may be minimal justification for government involvement in the absence of major impediments to its adoption. However, it is Autodesk's view that In order for the cost of infrastructure to reduce, it is critical that public procurers also capture some of the savings derived from the market use of BIM. This has been a central principle of the UK Government's adoption of BIM as part of its 2011 Construction Strategy. The UK Government requirement for BIM on all public infrastructure projects by 2016 is targeted to lower costs to public projects by 20% by 2016.

The UK government recognizes (attached BIM Strategy) that without public client leadership the market may not invest in the technical standards, legal protocols and common processes that are required to fully realize the benefits of BIM. Our recommendation to the Commission is to take a public

procurement leadership role to drive better performance from the construction sector. When public clients specify BIM for public works the market will find the most economic and sustainable solutions to deliver lower cost infrastructure deliverables.

As a case in point – in the *Business Value of BIM in Australia and New Zealand SmartMarket Report (2014)* by McGraw Hill, it noted the following in percentage of contractors 'always or often' receiving BIM models from designers:

- Canada - 89%
- South Korea - 50%
- Brazil - 50%
- US - 44%
- UK - 29%
- **Australia/New Zealand - 9%**

Also stated was the fact that almost half (55%) of infrastructure companies report a very positive ROI versus only 30% from building firms. What this shows is the upside potential for the Australian infrastructure industry when governments such as Canada, South Korea, Brazil and the US work directly with industry to help define standards of best practice and associated policy and is subsequently leverages on all government projects in all sectors. Consider these examples of BIM standards being applied to all infrastructure projects both social as well as civil:

- UK BIM Mandate: "*The UK Government is now recognized by its peers as one of the leading nations in the exploitation of BIM technology and processes with an internationally respected centrally-led programme. It has embarked with industry on a four year programme for sector modernisation with the key objective of: reducing capital cost and the carbon burden from the construction and operation of the built environment by 20%. Central to these ambitions is the adoption of information rich* ***Building Information Modelling*** *(BIM) technologies, process and collaborative behaviours that will unlock new more efficient ways of working at all stages of the project life-cycle"*
- Singapore BIM Mandate: *"In Singapore, the Building and Construction Authority (BCA) implemented the BIM Roadmap in 2010 with the aim that 80% of the construction industry will use BIM by 2015. This is part of the government's plan to improve the construction industry's productivity by up to 25% over the next decade"*
- China- Innovative Technologies in Construction: "*BIM will be the future IT solution in China; the Chinese Government is strongly supporting BIM"* - Tsinghua University, Beijing. ***MOHURD*** *and* ***CRC*** *are developing BIM Guidelines for China's 5-year plan*
- NATSPEC - Standardized Australian Practice for Exchange of Digital Building Information: "*NATSPEC believes that digital information, including 3-D Modelling and Building Information Modelling, will provide improved methods of design, construction and communication for the industry"*
- *US Department of Transport Federal Highways Administration: "Three-dimensional (3D) modeling in transportation construction is a mature technology that serves as the building block for the modern-day digital jobsite. The technology allows for faster, more accurate and more efficient planning and construction. As the benefits are more widely recognized, many in the U.S. highway industry will transition to 3D modeling over the traditional two-dimensional (2D) design process."*

- New York City Department of Design & Construction: *"Managing the design and construction for New York City's capital projects is an increasingly collaborative process. Because of this, DDC continually looks for ways to improve the collaborative process. One way to do so is by using Building Information Modeling. BIM strengthens collaboration by allowing all members of the design team to accurately add to a shared database of information about how a building looks and functions."*

Other countries in the process of implementing BIM include:

- ***Finland:*** *BIM on all Finland Public Projects* ***by 2014***
- ***Japan: Japanese Ministry of Land Infrastructure, and Transportation*** *(MLIT) has indicated it will consider adopting BIM (CIM)*
- ***Korea:*** *The* ***Korean government*** *obligates state-run agencies and offices to apply Building Information Modeling on projects worth more than 50 million Won*
- ***Brazil: Brazil Dept. of Infrastructure and Transportation*** *(DNIT) has indicated it will adopt BIM*
- ***Qatar: Qatar Rail*** *has specified BIM deliverables on all projects.*

Australia BIM Case Study: Ipswich Motorway: Dinmore to Goodna, Queensland, Australia. *Eight kilometers of the Ipswich Motorway from Dinmore to Goodna (D2G) in South East Queensland, Australia, was upgraded to increase safety for users, improve transportation efficiency, and reduce congestion, with a budget allocated of AUD1.95 billion. In May 2012, the upgraded and widened motorway was fully opened to traffic, six months ahead of schedule and ten percent under budget. Using BIM processes to link 2D geographic information systems (GIS) and 3D design and construction data enabled teams working on the project faster access to current information and faster, better communication of that information. This integrated environment provided significant cost, time, and quality savings. A more detailed explanation of this case study and the value derived from the use of BIM processes is attached to this submission.*

Australia BIM Case Study: Laing O'Rourke, Rio Tinto Mine, Pilbara Region, Western Australia. *With over 20% of the world's iron ore, Western Australia has been experiencing a boom especially in Cape Lambert port. An important objective was to expand the Cape's iron ore export capacity from 86 million to 139 million tons per annum. In line with its Design for Manufacturing and Assembly (DfMA) initiative, Laing O'Rourke is heavily leveraging BIM in the process of fabricating approximately 3,500 tons of structural steel. Using 3D models, Laing O'Rourke utilized virtual coordination to drive fabrication of large pre-assemblies by partners in Thailand including integrated transport and lifting for safe and efficient installation. "It allows us to build projects twice, first in a digital environment and then onsite creating efficiencies in project delivery and operational performance."*

These examples illustrate a critical point: The 2D processes that have been in place for over 100 years are no longer adequate and many countries and associated governments around the world are changing how they allocate infrastructure budgets and mandating BIM as part of the infrastructure vision of the future. Technologies such as BIM need to be a part of the solution to a nation's building and infrastructure challenges, and more importantly, called out specifically in its public policy and professional practice. This will help accelerate and standardize the adoption and use of these technologies.

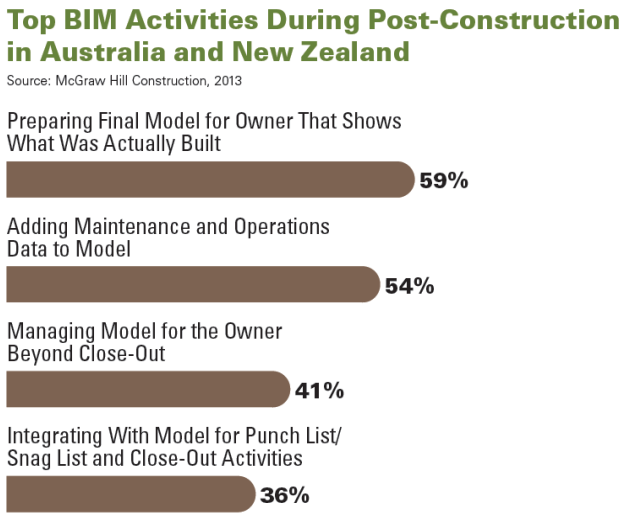
Coupling infrastructure investments with a strategic use of BIM will not only provide investors and owners with a better understanding of the scope and complexity of the investment, but it will also enable them to route efficiency gains made from technology towards financing future projects.

Rethinking Planning

The planning process is meant to define community desires and determine what systems are needed and is a critical step in ensuring that infrastructure is delivered effectively. While it's well understood that every community should have roads, utilities, water and wastewater services, parks, schools and other public facilities, the underlying premise of planning has evolved from community building to an exercise of balancing varying interests and priorities. By using BIM, government officials and community stakeholders have an opportunity as part of the planning process to look at the "future community" and consider how best to coordinate infrastructure systems, public facilities and land use to maximize a more collective benefit. In order for a city to thrive economically, environmentally and socially, planning should be the fundamental best practice for considering the triple bottom line – people – planet - profit.

The field of sustainable community indicators and performance metrics is steadily gaining traction, but it is largely occurring outside the planning profession. Improved criteria for measuring and comparing sustainability considerations are being incorporated into current planning practices and that must accelerate. New standards and design criteria are emerging and are expected to be embedded within comprehensive planning approaches from the beginning for communities and their infrastructure. But a key success factor will be how this information is gathered and shared amongst stakeholders.

The desire for sustainable infrastructure can most likely be achieved only if measured, monitored, and acted upon. High-speed information technology is essential to performance-based planning about existing and planned infrastructure assets. This relatively new form of public infrastructure can help to reliably gather information from many diverse sources and provide real-time data to help better inform public policy and decision making. This data can be collected, analyzed, and monitored to provide important feedback on the use and condition of infrastructure systems.



Business Value of BIM in Australia and New Zealand SmartMarket Report (2014) Source: McGraw-Hill Construction

Rethinking Design, Project Delivery and Operations

To thrive, cities must provide reliable systems and services that attract business investment. This means carefully balancing 10 to 20-year capital budgets to include both deferred maintenance projects and new investments that support growth, as well as funding projects that will help reduce any vulnerability their cities face as a result of natural or manmade events. There is an immense amount of information that must be gathered, sorted, analyzed and understood in order to make the best decisions that balance economic, social and environmental needs. Beyond the design and construction, infrastructure owners especially Governments can leverage this information for more efficient operations and

maintenance. As noted in the McGraw Hill report, accurate final as-builts, maintenance and operations data added to the BIM model are leading benefits from this approach.

MODERNIZING TOOLS AND PROCESSES

Advanced modeling tools for infrastructure planning, design and construction include visualization, simulation and analysis capabilities to assist in outcome based understanding of options. For example, growth modeling is an important practice for anticipating demand. Growth models should account for changes in externalities (such as future cost of energy, regional impacts of climate change, and social considerations) and take a long-term view of local impacts of the various infrastructure alternatives, and their true lifecycle costs.

BIM is an intelligent model-based process that delivers more accurate, actionable and accessible insight over the lifecycle of city infrastructure projects. BIM can support more holistic planning, design and delivery by enabling advanced visualization, simulation and analysis of proposed or existing systems. With the intelligent model-based approach, sustainability, economic and other community objectives can be more easily considered and optimized. Performance-based outcomes can be better predicted, driven through project delivery and monitored over time.

With this approach, policy makers, owners, and public stakeholders could stipulate the desired performance not only on a project basis, but at a community level. BIM-based design and construction then helps planners and engineers to innovate and solve problems more holistically.

SUMMARY – DESIGNING AUSTRALIA'S FUTURE

Autodesk's customers are the architects, engineers and contractors creating the world's infrastructure and are using BIM to better manage costs, schedules and sustainability issues. BIM offers these benefits but only through a public procurer-led approach will these benefits fully accrue to public funding and the government. While there is only fragmented adoption in the market the benefits will likely be captured by the private sector potentially to the detriment of the cost of public infrastructure and provision of government funding.

Many of the challenges and opportunities that will define our 21st century will happen in our cities. It is apparent that given the challenges that the planet faces, infrastructure, as it is defined, designed and constructed, needs to evolve from the practices of the earlier century. Cities can now be modeled and viewed in 3D, and not as an abstract drawing on paper. Today's technologies help create a visual representation of how this city is at full scale, how it works, the interaction of its systems and what it will be like dealing with holistic approaches in planning, design and construction.

As we move forward as a society and collaborate to work towards overcoming challenges, we must understand what is possible with today's technology - which can help us plan, visualize and take the best ideas to create tomorrows thriving cities.

The Australian government has an opportunity to set a global bar in regards to better planning, design, building, and maintenance of its cities by taking a leadership role in encouraging the infrastructure sector to remove waste and inefficiencies and derive better value for public monies by leveraging BIM technology for better outcomes. By implementing the best practices of BIM requirements from other countries, Australia can set the new standard for infrastructure development.

FURTHER INFORMATION

We at Autodesk are firmly convinced of the value BIM can generate for the development of public infrastructure as envisaged within the scope of the Productivity Commission's Inquiry. BIM contributes to improved decision-making outcomes, reduced complexity, costs and time lost over the lifecycle of a public infrastructure project, and also higher-quality public policy outcomes and greater stakeholder buy in. We remain at the Commission's disposal to provide further information, including follow-up meetings or presentations, as required.

Yours sincerely

(signed)
Roger Somerville
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