Outcomes of SBEnrc 2019 National Industry Research Workshops | Industry Challenges and Research Ideas

- **Housing for Population Growth/Urban Intensification** - affordability – at holistic level including transport, health, education, pressures of population growth; failure of people being able to engage with the market; deliver the right forms of housing - how is market provision being shaped? E.g. building techniques, changing patterns around family households, lifestyle trends, space/flexibility/aging in place/person-centred approach; Government role in shaping industry structure through regulation/taxes/funding models - driving new forms e.g. construction of granny flat to get mum/dad to live with you; Urban intensification and high-rise living – consider increasing population e.g. schools, health etc.; Housing as a driver of productivity; Capital constrained environment - other non-traditional sources of funds/international trends; Sweating existing assets – temporary re-use (land or buildings) for weeks or months or years? Mapping assets that the state owns/idle assets; Supply chain issues - town planning, integrated transport, parking (on street and off-street), electric charging points, certification; Climate change impacts/resilience - how is built environment adapting? Need to build in flexibility to homes and infrastructure and climate change resilience. Other attributes of sustainable living – renewable energy etc.

- **Liveable Social and Affordable Housing** - Drivers – aging population, NDIS, market drivers; Development and implementation of housing standards for universal access/designs - e.g. corridor widths, hob-less showers, disability access, door widths, biophilic urbanism etc. Clear guidelines as to what does accessibility mean? Building industry hasn't picked them up as standard; Good built form and urban design and how it relates to social and economic value - wellbeing, mental health outcomes with social and economic benefits; How to encourage/drive adoption? Regulatory context, National Construction Code shortfall (building code stipulates minimum standard) – should be seen as a standard. ABCB looking at it but have view this is an add-on - should be standard. Carrot and stick approaches - case of GBCA Green Star approach e.g. develop a liveability star rating for housing: Electricity, water, bills + accessibility - Building industry associations, investors, consumers; owners and tenants, education for industry to implement - involve industry to make it standard whether it is regulated or not (not regulation), how to ensure those that are built comply, and economic analysis: is there a benefit to community e.g. health; Stamp duty concession for people that have these standards in homes? Costs to government re re-housing after injury and leave hospital as home not suitable. Keeping aging population in homes.

- **Business Case for BIM/DE** - Government Leadership, Technology, Process and People - Business value => BIM Better Information Management; Return on Investment – measurable benefits; Technical specifications of the BIM not central to the business case; Examples of BIM paying for itself over facility lifecycle; Recognise and understand inherent value of the information; BIM cost – what does it cost the client? Need this specification up front. What information should we be getting/giving along the journey; TfNSW Infrastructure and Place Division => prove that Digital Engineering Framework (DEF) (Sept 2018) delivers savings. How?; Project Idea: Valuing BIM/DE across sectors => Desktop research; Quantify risks, productivity, time + cost savings, quality, value - Asset owner, designers, contractors, asset managers; Cross-sectoral (Road, rail, housing, buildings); KPIs for future road/rail projects; apply also retrospectively; Digital Twin; Benefits of BIM for Business Case - Research; pilots – KPIs; lessons learned from recently completed projects where BIM not used vs projects with BIM used; Need business case of why it is a good idea - articulate the 'do nothing'!; departments and organisations facing this issue – what are the operational efficiencies? How many days shorter for construction; why Government should invest in a project; Focus on hindsight of records (not looking forward).

- **Contracting Processes to Realise Value from DE over Project Lifecycle** - project assurance and delivery, and how to leverage off other areas to make life easier; Client engagement - what it's like to be a digitally engaged client? How to articulate supply chain language and roles incl. understanding client asset information management requirements up front. Australia lacking nationally integrated focus: compliance – accountability framework, construction procurement, asset management, semi-government authority, and funding constraints - capex vs opex; Procurement - know what you want up front as client, engaging designers - value? BIM/DE capability should be a 'given'. Existing platforms exist, relationships/responsibilities/legal, client side – constrained by traditional design due to contractual risk, enormous cost to produce special purpose contracts – more cost on legal than design, what are contracting processes/needs using DE over project lifecycle; how could we better engage design consultants (procurement) and what clauses should we be putting into tender docs to extract most value from designers.

- **Freight Transport and Infrastructure Connectivity to Improve Network Outcomes** - Existing successful trial – counterintuitive network benefit in allowing platooning trucks - also benefits car traffic outcomes - heavy vehicles on network work to detriment of traffic, Heavy vehicle prioritisation – stop traffic with intention of controlling how traffic moves has hugely improved, data source to tell us live how many, what size and what total volume does that represent (heavy vehicles)? Freight data sharing to improve overall network performance, bolt on artificial intelligence strategy/technique to prioritise heavy vehicles; Future opportunities - AI supported by numerous data sources – road sensors, telco data => Smart Cities … public transport mix including trackless trams (?), modes; EVs – protocols European study (RMS) – future will have more data sources e.g. vehicle to vehicle, Trackless trams could improve network data, Tie-ins/linking with asset management - can also affect assets eg. know total number of heavy vehicles, what they are doing and where are they going; Big data – all feeding into AI mechanism.

- **Creation and Operation of End Markets for Construction and Demolition (C&D) Waste** - End markets…marketplace – App?; include landfill & regulation; Direct continuation of current research; Recycle and reuse; Industry – how waste product is handled and managed – create a better market place with recycled materials; Harmonisation across states - Seven states with different laws. NATSPEC – industry collaboration existing, Definitions … when does waste become a resource/liability? Levies, Recycling – concrete, plastics, glass, rubber, National specs around usage of materials e.g. glass & plastic in roads, Energy considerations, Chain of influence/responsibilities; Market drivers - off-site manufacture – process of delivery, civil and building sectors have different drivers; economically viable - balance commercial and environmental feasibility, high value re-use, Community expects action!; Waste management & resource recovery input into new infrastructure; Sustainable concrete products, 67 million tonnes of waste generated in Australia - challenge is building capacity to reprocess and remanufacture waste here; on-site waste – programs to maximise what can be reused; Raw materials to manufacturer to builder (design for zero waste) - BIM + offsite – no experimental work – material is tested and ready for use; Photo-voltaic waste.

- **Procurement** – whole-of-life outcomes; objective, defensible drivers to more sustainable procurement; asphalt - environmental impact e.g. embedded carbon, water, TBL; ISCA framework useful only in part - process of getting to the target outcome not defined - more detail required - is it an ISCA add-on?; Other attributes already considered e.g. regional and indigenous businesses, corporate social responsibility; multi-criteria decision; data sources – tools to make better decisions; Decision support system/algorithm – quality of data important; how to extract human knowledge; Strata fees & levies – support strata companies, how that impacts on insurance – how much maintenance is spent weekly on average homes to show strata owners/retail; people put off by strata fees, not necessarily realising how much home owners spend each week on maintenance; TBL - environment, economy, community - how to make procurement decisions not wholly based on cost – making triple bottom line decisions in procurement? E.g. 'fake sustainability' - add crumbed rubber to bitumen which improves durability, but rubber is imported from China – energy & cost of getting rubber here + local waste still stockpiled (not reducing local waste); Regional and indigenous businesses; Quantified approach to evaluate economies of environmental aspect.

- **Supporting Australian BIM/DE Initiatives Through Industry Case Studies** - Australia-wide initiative - QLD strategy => national value linked to international best practice; many voices around this – different bodies equally trying to understand it; Government's role in developing a national approach – each state is doing it their own way; International learning for mandated approach; states have own jurisdiction in mandating BIM/DE; develop under guidance of VDAS, WA guide, QLD mandate; Common Language/information management – standards; framework how to govern information management; Public sector/client and industry leadership roles; Information needs mapping across sectors - realistic LOD – fit for purpose; connected to business outcomes – AIR (asset Information requirements); corporate valuing of asset information; Pilots/demonstration projects/case studies - How to get better outcomes for public asset owners – housing, buildings, infrastructure (existing and new), Scalable – regional and capital city/link to GIS/digital Qld, Differences in BIM maturity across agencies, different methodologies/metrics for managing assets; Update, edit, maintain, archive, search, security, governance, chain of responsibility – digital legacy; link to resilience – what is critical?, Practical impact and uptake; People aspect - automation (people fear loss of jobs); human behaviour change; Education - BIM skills framework exists (ACIF), 1 mil people in construction industry – to move the industry along is educating people and challenge is developing a training program off the back of the framework; skills uptake and confidence; training of staff – make it available and take time out for training, start with very small projects to educate, then build on; Early conversations with asset team – be clear on asset information requirements; Research – develop metric of different methodologies of managing a built asset - methodologies that clients can manage and maintain the data. The cost to maintain could be expensive - could outweigh benefits; Building better information management – take out BIM and insert 'digital record'; Value of information can decrease if not prepared to maintain it; Traffic modelling; Underground utilities – through corridors; management around reserves for other underground facilities e.g. NBN; Flood modelling/disaster resilience - how to use the BIM environment for smart modelling; searchable interactive that's secure, accessible and usable; Whole of project delivery digital integration - Data reuse/common coding across disciplines => standards, Business case, design, construction, asset management => O&M (Capex vs Opex), Learn from other industries; international standards, Digital twin … link clearly through to asset management - Governments (Aust & Intl) investing in digital twins – bridges gap between structured data, open data etc., and links to automation/AI/machine learning; Lack of data reuse at project delivery stage; No common thread of data (structured data) – no common coding through asset lifecycle (handover – O&M); Project data building blocks (1) asset classification; (2) asset location; (3) business type; (4) technical discipline; Challenge: common way of sharing information (TfNSW second framework came out in April); Productivity – do not accept baseline performance – improve productivity – design review takes time. Run workshop using BIM should reduce number of observational responses – shorter review time. Other productivity savings?; Smarten up – client to understand and match smarts of contractor; weaponise SBEnrc's BIM Value tool; Every company should employ BIM/DE Manager; Item based assets – how to create item hierarchy – how do you develop at design stage and carry through to ownership; Value of the asset and how do you depreciate it - design doesn't understand commercial implications e.g. depreciation; strategies of maintaining asset – how to build the model for the asset.

- **Transport and Urban Form Futures** - City/Regional planning; Scenario planning - modes of transport/urban densities – multi-modal mix and integration, Portfolio vision and KPIs, Investment decisions – infrastructure - total costs to public and state - investment models of different modes of transport - real costs of investment decisions (cost to state and cost to consumer), Links to housing and community needs; Define Utopia - vision for roads, walking, cycling; maintain a standard of living - high level thinking: how to achieve quality of life; Business models to support outcomes - Mobility as a service/connected vehicles/AV/EV/agency coordination/ ownership/spinning reserves/grid balancing … uncertainty in future and challenges of locking in fixed investments, How to put together a suite of infrastructure and technologies in community; Benefits … safety, prosperity … how to capture these through policy levers? - Line marking, parking/drop-off zones, charging stations, Significant road safety benefits from AV for short term – identify infrastructure that will facilitate AV e.g. line marking, What outcomes do we want – AV to improve road safety, improve liveability in cities, enhance prosperity, Uncertainty – connected autonomous, AV/EV?; how we allocate road lanes, parking and drop-off zones - re-allocate to green space, charging stations? Human health improvements – how to get people to travel in ways that are beneficial to everyone - if we put electronic charging stations how does that change how people behave; Links to housing and community; portfolio vision and KPIs; Working cross-sector – key corridors; Don't need high density growth in CBD but need blanket growth in suburbia; Climate change; Infrastructure Victoria report (AV vs ICE vs EV); Create centres in the suburbs and infill; Future of Transport - history of research in this space - strategic technology-driven disruptions, big data applications across networks, Blockchain + AI applications; Future research - asset management: sensors/digital management (national/state/local government – impact and sphere of influence); Freight traffic management: AI/blockchain applications; Changing nature of demand/modes/ownership/public vs private/car parking/lifestyle/planned communities - balance/clarity required for future decisions/investments; Show where costs have been incurred that could have been avoided with AI/Blockchain?; Freight traffic management focus – can transport influence roads trucks are on when and where – do most damage to roads; Low agnostic – place rather than mode; What is demand going to look like in the future? Demand is changing; Line marking etc. would be different – what are the effects of changing technologies. How will communities accept change?; AV, EV – ownership of vehicles will change. Car parking – what happens? How people move from A to B to C and back to A again? How to accommodate with modes of transport. Balanced unbiased report; Future prediction – people will choose to travel rather than needing to; Transport Australia conference explored a lot of themes – how do we afford all the things we need to afford – not just now but in future – construction, maintenance etc; How effective is data on movement patterns, what is available on the network?; Technology disruption that is coming is going to change all current data. No history to look at how that's going to impact the system; Future funding of the road infrastructure – e.g. fuel excise? No fuel then no excise?

- **Knowledge Management for Facility Asset Maintenance - Housing, Buildings and Infrastructure** - 10 year plan for 18,000km road across WA (15 maintenance attributes) … needs verification, $300m/yr road maintenance; Database of needs – maintenance attributes; What and why?; From year 2000 => outsourced … Dept loses internal capacity; Human judgement based on experience => need to be supported by knowledge management system/process … automation AI? To SUPPORT human judgement e.g. pavement deterioration models; Supplement reliance on face to face human interface; Loss of knowledge management – transfer knowledge through automation; Understand needs of the regions; Modelling for prediction; Maintenance needs – schools - prioritise spending; data management to assist targeted maintenance decision making; research challenge: data structuring to aid decision support and transfer; End user => owner/occupier/tenant … ongoing costs (add-on?)

- **Social Housing Asset Management** - Managing portfolio of assets – how you make a decision (asset portfolio management) in a capital constrained environment; Tenancy manager – integrating what they do and services and support systems they need – people and place e.g. people come to housing service centres for assistance, not just provision of house – future pathways: opportunities to build capacity to sustain tenancies in the private market; Bringing in commercial not just Govt – brings in BIM/DE over life cycle, capabilities, - trying to embed social housing into a commercial framework; Asset management perspective – not just a matter of looking at how many houses, but also looking at ongoing maintenance, age, etc.; Major investment institutions – superannuation groups (potential community/staff development opportunity for their staff) – and potential PhD's into their organisations; Off-site manufacturing for affordable quality social housing.

2020/21 SBEnrc Board Supported Research Themes and Projects

Theme 1	Theme 2	Theme 3	Theme 4	Theme 5
Housing – as Infrastructure and Human Service	BIM/Digital Engineering across Asset Lifecycle	Disruption to Transport/Land Use	Construction and Demolition Waste	Procurement
Project 1.71: Liveable Social and Affordable Higher Density Housing	Project 2.72: Leveraging an Integrated Information Lifecycle Management Framework – Building and Infrastructure	Project 3.73: Freight Vehicle and Transport Network Connectivity to Deliver Mutual Benefits	Project 1.74: Future Streets and Corridors: A New Economic Assessment Tool Based on Place and Movement	Project 2.76: Sustainable Procurement
			Project 1.75: Creation and Stimulation of End Markets for Construction and Demolition Waste	