



Victorian Digital Asset Strategy

Strategic Framework

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Introduction by Victorian Chief Engineer



Victoria is currently the fastest growing state in the country, with more than 2 000 people moving here every week.

We must ensure this population growth is met with investment in world-class infrastructure assets.

World-class assets demand the application and use of engineering and project best practices – such as digital engineering including Building Information Modelling (BIM).

That's why we've developed the Victorian Digital Asset Strategy (VDAS).

The VDAS means a more consistent, integrated and repeatable approach to creating Victorian assets and maximising the many benefits of our asset investments.

The VDAS drives toward a seamless integration with the private sector.

Together we can use digital engineering to develop cost-effective, innovative and value-adding assets for all Victorians for decades to come.

A handwritten signature in blue ink, which appears to read 'Collette Burke'. The signature is stylized and fluid.

Dr Collette Burke
Victorian Chief Engineer

'Victoria is an engineering powerhouse.'

Executive summary

The Victorian Digital Asset Strategy (VDAS) aims to effectively and consistently coordinate many of the elements critical in planning, delivering, operating and maintaining Victoria's critical state infrastructure.

These elements include data, information, assets and decisions across the physical asset's life cycle.

Without the introduction of the VDAS we would continue to use many of these elements in a siloed, paper-based, non-repeatable and non-integrated fashion. The VDAS provides an opportunity to reform information management, processes and elements.

The VDAS seeks to improve the value and utilisation of both physical and digital assets with the use of digital engineering (DE) across the entire asset life cycle: planning, creation, operation, decommissioning and divestment phases. The VDAS applies to all asset types: linear, place-based (vertical) and systems across Victoria.

The VDAS is supported by an international and interjurisdictional precedence. Governments from the United Kingdom, Finland, Norway, Scotland, Singapore, Denmark, New Zealand, United States and the Netherlands have all adopted methods to capture value from DE. New South Wales and Queensland are rapidly progressing DE initiatives. The VDAS collaborates with these jurisdictions and captures learnings to enable successful outcomes.

The VDAS is an innovative way to perceive and manage asset information. At the core of the VDAS is the aim to improve public infrastructure assets, public sector capability, promoting innovation and digital efficiencies, delivering effective and efficient public services, and driving toward more sustainable outcomes.

All stakeholders associated with Victorian public infrastructure assets stand to realise benefits from the use, application and outcomes of the VDAS.

Vision

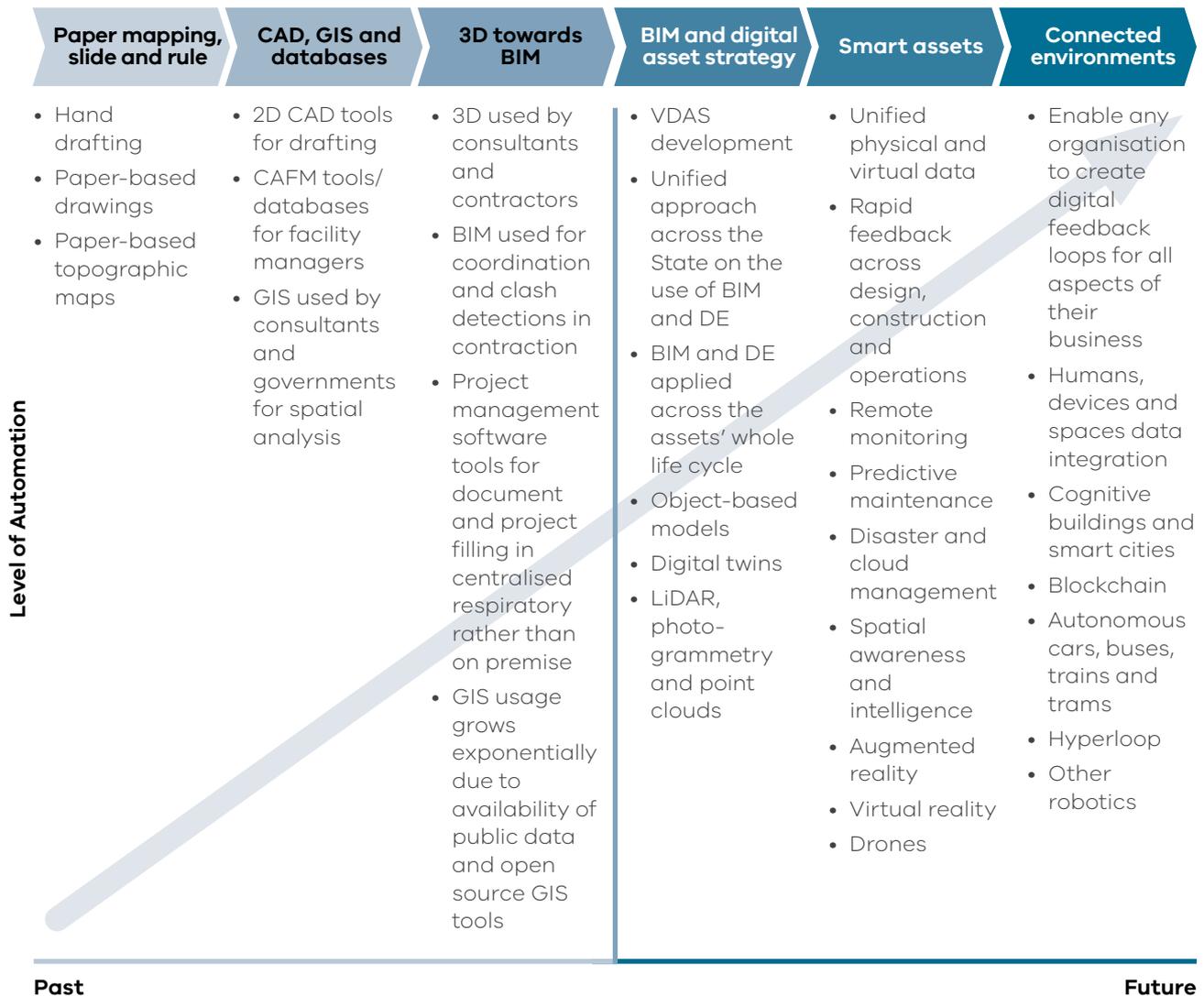
The vision of the VDAS is to:

create, deliver and enhance digital assets that inform the delivery and whole-life management of world-class, effective and efficient physical assets across Victoria to the benefit of current and future Victorians.

This Strategic Framework seeks to achieve this vision by providing overarching direction to government, industry and the Victorian public on the value of DE. The Strategic Framework articulates how DE can integrate many types,

formats, processes and sources of data and information used for, and by, Victorian assets. Further, the Strategic Framework highlights how that data and information can be used to deliver value to the State.

History of digital assets in Victoria



Priorities and key success criteria

The VDAS vision statement is underpinned by the following priorities:

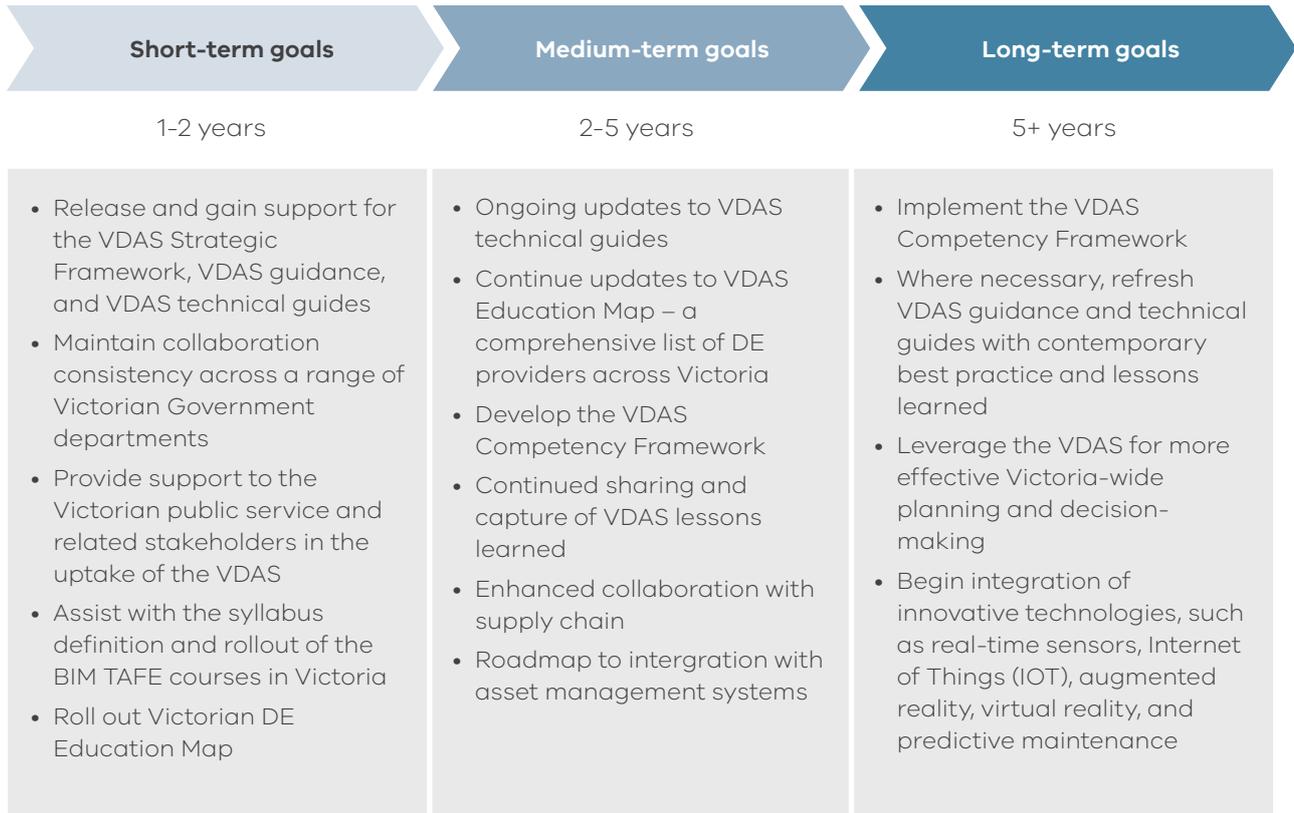
- effective creation and management of DE data and information for efficient and sustainable physical asset creation and delivery across Victoria;
- enable and maximise the utilisation of DE data and information;
- inform and support Victorian Government departments, industry and practitioners on key aspects of DE, including the value of digital data and information creation and management;
- innovate approaches and provide insights to ensure the efficient and effective implementation of DE; and
- embrace DE sustainability through the effective and efficient delivery and management of major assets across Victoria.

To realise the VDAS priorities, the following key success criteria have been developed:

- successful development of comprehensive and considered DE support material for all VDAS stakeholders;
- development of a unified and consistent approach in implementing VDAS among the Victorian Government departments, industry and practitioners;
- perceptions on the value of digital information and data are enhanced by all VDAS stakeholders; and
- additional value from the implementation of VDAS is realised across all phases of the asset life cycle to the benefit of all Victorians.

VDAS goals

The VDAS vision, priorities and key success criteria are underpinned by tangible short, medium, and long-term goals to realise valuable outcomes.



VDAS development

The VDAS approach has been developed to enhance the value and performance of our physical assets and its digital equivalent throughout each stage of the physical asset's life cycle.

The VDAS approach is designed to ensure we maximise the use of data and information for the optimum delivery and asset outcomes.

A consistent approach across Victorian Government assets is critical for effective life cycle management.

The approach and development of the VDAS has been overseen by the VDAS Steering Committee (VDASSC).

The VDASSC comprises individuals representing leading industry bodies, government entities, major designers and educators with expertise in DE, major projects, Victorian Government policy, and best practice across the asset life cycle.

The VDASSC informs and advises the Victorian Government on key items relating to DE.

The VDASSC will continue to develop technical and non-technical DE guidance in a collaborative and integrated fashion. This guidance is to be progressively adopted by major asset owners across the Victorian Government.

The importance and timing of VDAS is elevated by imperatives defined internationally, nationally and within Victoria.

As an engineering powerhouse, Victoria must remain a leader in innovation and best-practice approaches to our physical and digital assets.

Digital engineering is currently being used on major Victorian infrastructure investments.

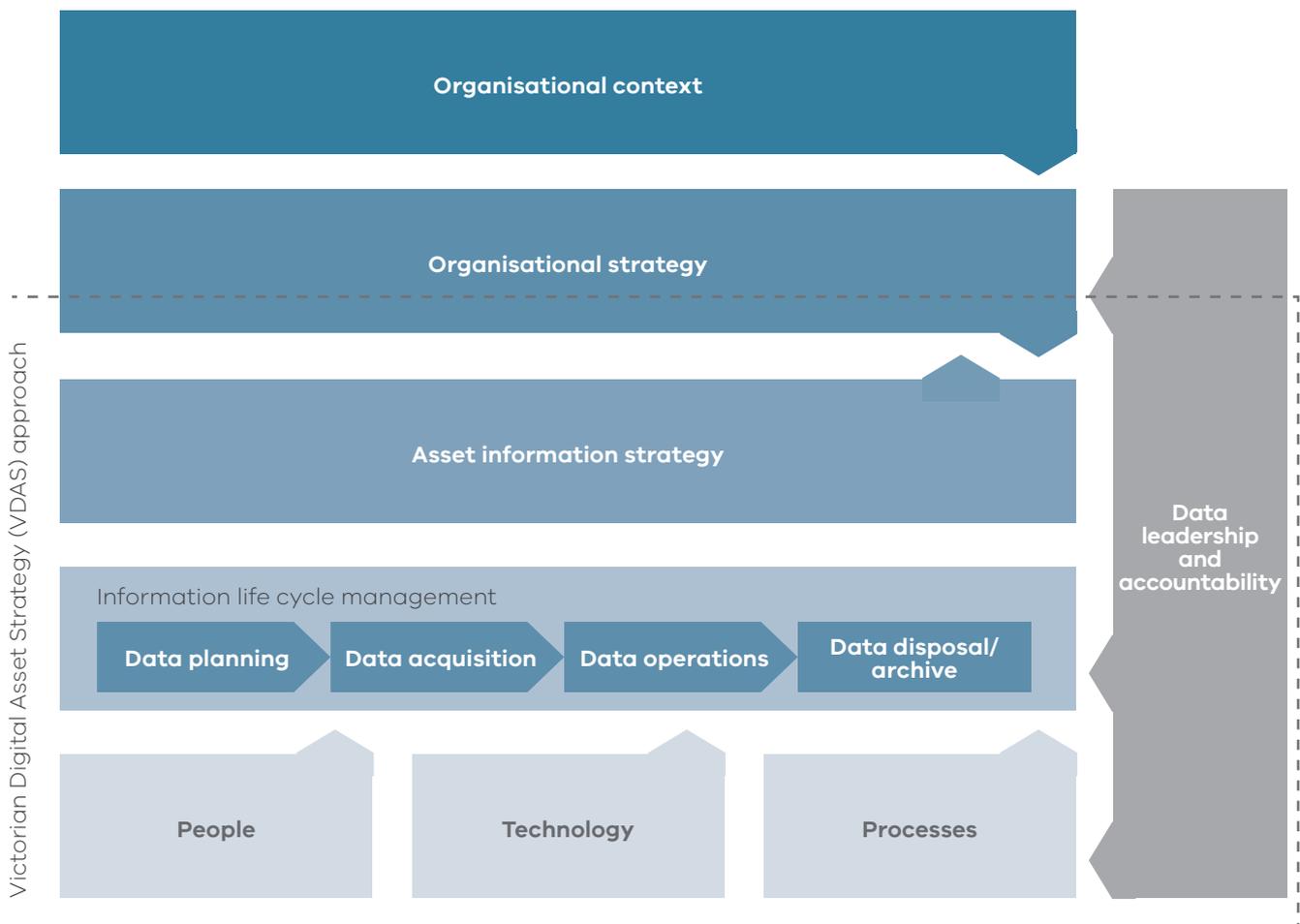


VDAS approach

At the heart of the VDAS is the value of asset information across an asset's life cycle.

The VDAS approach has been developed in collaboration with international best practice and standards, and Victorian Government asset management policies, such as the Asset Management Accountability Framework (AMAF).

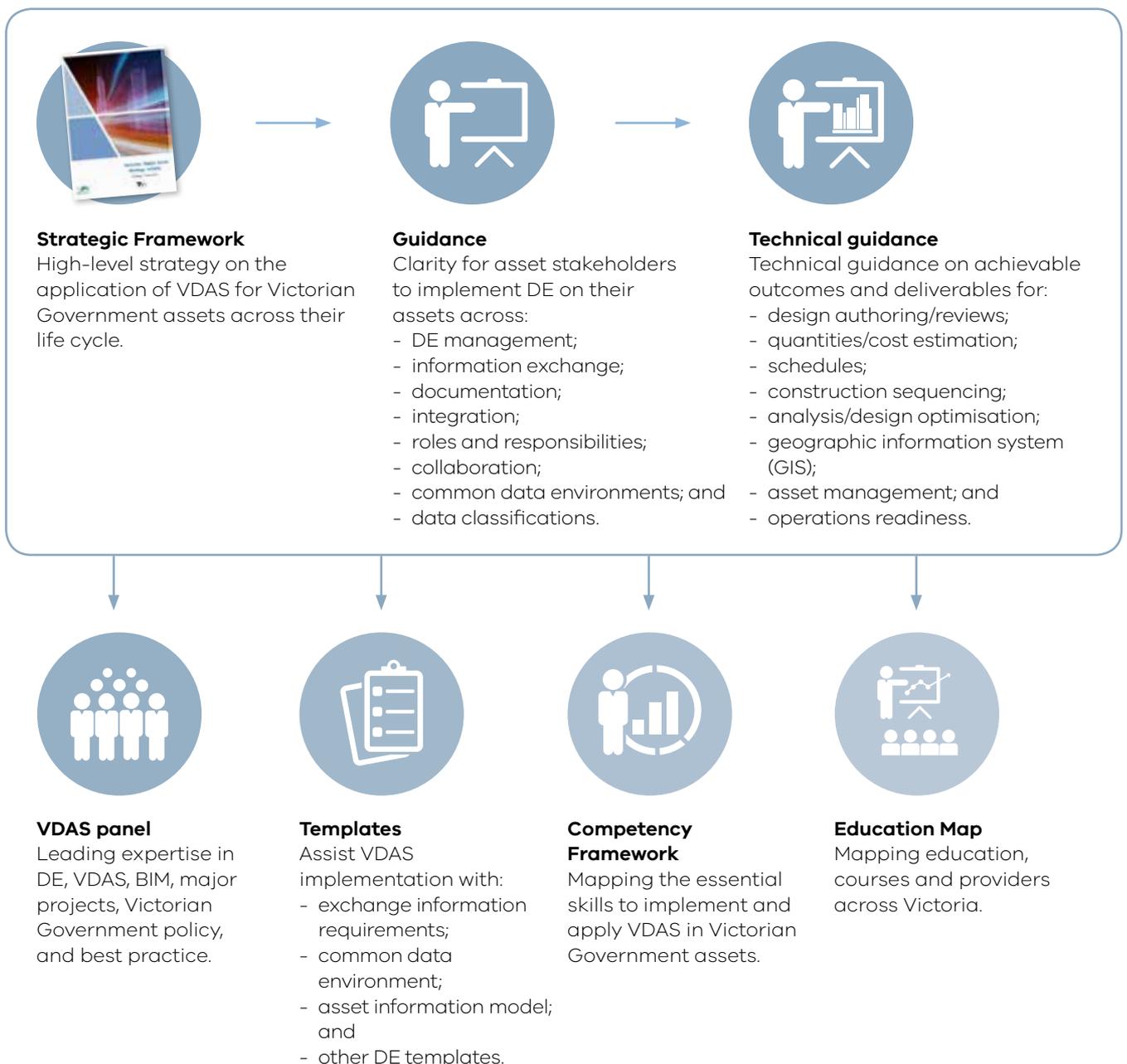
The VDAS seeks to capture information developed across various phases of the asset life cycle, combining people, technology and processes, delivering value to the organisation. The VDAS demands leadership, accountability and clarity in organisational strategy.



The VDAS has been developed as a holistic and strategic approach to apply DE to Victorian Government physical assets.

To aid implementation, the VDAS approach includes both technical and non-technical best practice guides, direction, support and templates.

Below is an overview of the various best practice technical and non-technical guides, direction, support and templates as part of the VDAS approach.



VDAS Strategic Framework

The VDAS Strategic Framework sets out a common and consistent approach for Victorian Government departments and agencies to apply DE to major infrastructure projects and both new and existing physical assets.

The Strategic Framework aligns with international approaches and is intended as a high-level framework for DE when used on Victorian Government assets across their life cycle.

The VDAS Strategic Framework is applicable to a range of stakeholders, including but not limited to, industry, supply chain, project practitioners and project management leaders, asset owners and operators within, or on behalf of, the Victorian Government.

The VDAS Strategic Framework is supported by a suite of documents, guidance, information and best practice across a multi-faceted range of technical and non-technical areas, as described over the following pages.

VDAS guidance

The VDAS guidance will support the VDAS Strategic Framework. The guidance will provide detailed information to Victorian Government asset stakeholders about how to implement DE processes to improve digital asset and information creation, management practices, capability and maturity across Victoria.

The VDAS guidance will deliver value by:

- articulating the benefits of DE and assist government to brief and guide industry on government needs;
- creating a common process and framework to be applied to Victorian Government major projects so all project stakeholders understand what they are being asked to provide and at what point;
- delivering a DE framework that is aligned with other major DE frameworks implemented elsewhere in Australia and internationally; and
- outlining the process that should be followed to deliver benefits to all Victorian Government asset stakeholders, including enhanced value-for-money outcomes.

DE, underpinned with emerging technologies and open data services, will enable 'Smart Cities': the integration and connectivity to support our way of life.

VDAS technical guides

The VDAS technical guides will support the VDAS guidance. The VDAS technical guides will provide Victorian Government asset stakeholders with direction to recommended templates as well as direction and assistance on creating, delivering and operating assets with DE processes.

Competency Framework

The Competency Framework will provide asset stakeholders across the Victorian Government with detailed guidance on skills, qualities, experience and roles required to deliver the VDAS across the State, supporting the VDAS Strategic Framework.

Education Map

The Education Map will also support the VDAS Strategic Framework, providing the Victorian Government's asset stakeholders with specific details on courses, syllabus and contact details of DE educators and providers across the State.

The VDAS frameworks, guidelines and technical guides will be delivered incrementally throughout 2019.

The VDAS Strategic Framework, processes and toolset will be continually reviewed and improved as best practice evolves. This will involve the review of updated standards, processes and applicability within the context of the Victorian Government's major projects.

While Victoria is growing rapidly, DE builds greater confidence that the infrastructure services are made and managed more efficiently.



VDAS application

The VDAS seeks to improve the value and utilisation of both physical and digital assets with the use of DE across the planning, creation, maintenance and divestment phases of linear place-based (vertical) and system assets in Victoria.

The VDAS is a process to effectively and consistently coordinate many elements including data, information and decisions across a physical asset's life cycle.

The VDAS can fundamentally improve the way information is created, developed, distributed, used and maintained. The value and utility of asset information is maximised when this strategy is applied consistently and strategically across all asset phases.

DE is not new – it is already used widely in the design of a variety of Victorian Government physical assets. The purpose of the VDAS is to aid the application of DE more consistently across the entire asset life cycle.

DE is routinely used in private industry across a range of infrastructure assets, including, but not limited to, buildings, mining, oil and gas, and transportation.

DE is typically applied when assets are complex and/or there is an imperative to reduce risk, improve safety or optimise asset management.

The VDAS seeks to apply these learnings with a consistent approach for major Victorian Government infrastructure assets with a view to broader adoption across all asset types.

DE enables utilisation of digital city and regional planning with truly integrated services.



Users, benefits and need

The VDAS is designed to support the effective and consistent coordination of digital information across a physical asset's life cycle for a range of stakeholders, such as government, industry, and the Victorian public.

Public 	Government 	Industry and practitioners 
<p>Enhanced delivery of assets, value for money, and greater confidence that asset delivery, maintenance and operation will meet the service need.</p> <p>Greater confidence that assets will deliver Value Capture and Creation principles via improved visualisation and community consultation processes, which are enhanced with integrated sources of information and modelling.</p> <p>Enhanced sustainability due to reduction of CO2 emissions, energy use and construction waste, achieved through increased efficiency of planning, delivery, operation and maintenance of physical assets.</p>	<p>Enhanced public confidence, value-for-money outcomes, and more effective and efficient decision-making.</p> <p>Assist Victorian Government departments and agencies through a clear and consistent process to procure and manage their asset portfolios and provide better services for Victorians.</p> <p>Beyond the immediate benefits of time, cost and safety, DE can help alleviate a range of challenges during the creation and management of a physical asset, including sustainability, cost overruns, delays, claims and litigation, asset planning, interface management, maintenance, and operability.</p> <p>Provide a map to data compliance, governance and security.</p>	<p>Enhanced clarity and consistency on what, who, when and how Victorian assets are planned, designed, engineered, constructed, operated and maintained.</p> <p>Enhanced insights and decision-making through visualisation, real-time integration with cost and schedule, and innovative technology, through technology such as 4D and 5D modelling, virtual reality and augmented reality.</p> <p>Consistency in approach to design and construct, through design re-use, vertical supply chain integration, clash avoidance and seamless handover of information at each phase.</p> <p>Enhanced construction practice resulting in better safety, reduction in construction time and waste, as well as cost savings.</p>

Beyond benefits to the wider Victorian Government, the VDAS can deliver benefits to a broad range of stakeholders who are engaged across the physical asset life cycle.

Stakeholder	Benefit
Cost estimator	<ul style="list-style-type: none"> • Reliable benchmark data • Automated connection between scope, cost and schedule • Improved estimates and cost planning
Document controller	<ul style="list-style-type: none"> • Improved and more accurate documentation • Less administration and improved 3D review processes • Smoother handover processes between phases
Scheduler	<ul style="list-style-type: none"> • 3D visualisation of the schedule • Integration between scope, schedule and resourcing • Rapid analysis of options • Optimised schedules and programming
Commercial manager	<ul style="list-style-type: none"> • Fewer variations • Greater market confidence • Improved value for money • Enhanced management of commercial risk • Coordination of subcontractors and suppliers
Financial controller	<ul style="list-style-type: none"> • Greater confidence of operating expenses • Improved understanding of capital expenditure-operational expenditure trade-offs • Enhanced financial planning and transparency
Procurement manager	<ul style="list-style-type: none"> • Fewer tender queries (efficient, information-rich tenders) • Improved tender submissions • Faster tendering processes • Integrated supply chain • Increased ability to pre-fabricate/off-site modularisation
Drawing/design manager	<ul style="list-style-type: none"> • Improved design accuracy and quality (including safety in design and hazard assessment) • Coordinated and integrated multidisciplinary design • Increased efficiency by reusing object-based libraries • Faster reviews and approvals • Fewer design queries and greater visibility of constraints • Ensured build-abilities are incorporated into design • Design safety, fewer variations, reduction of redesign • Easier clash avoidance/detection
Assurance manager	<ul style="list-style-type: none"> • Progressive model-based reviews • Faster reviews and approvals • Use virtual reality for operational testing

DE drives toward human-centric design as well as user feedback and consultation processes to better meet the Victorian community's needs.

Stakeholder	Benefit
Project/site manager	<ul style="list-style-type: none"> • Improved communication between builder, sub-contractors and manufacturing • Reduced disputes with a full audit history of material from manufacture to install • Fewer delays with accurate scheduling of material deliveries • Less time wasted with efficient defect/reordering processes • Location and integration with underground services
Engineering manager	<ul style="list-style-type: none"> • Faster project delivery and off-site fabrication • Fewer errors and clashes in the field • Continuous system integration across parties • Data repository for analytics-optimised design
Safety manager	<ul style="list-style-type: none"> • Improved ability to assess constructability and safety • Safer work practices and early identification of issues • Improved construction monitoring and surveillance tools
Asset and operations manager	<ul style="list-style-type: none"> • More seamless digitisation of operations • Automation of existing systems • Faster commissioning • Better and more reliable information • Integrated operating model from design • Enhanced engagement with underground services and utilities providers
Maintenance manager	<ul style="list-style-type: none"> • Information mobility • Greater confidence of site drawings and previous work • Data platform for condition monitoring and predictive maintenance
Quality manager	<ul style="list-style-type: none"> • Improved decision-making with visual and integrated information, such as dynamic simulation of construction • Easier access to specifications/criteria of quality control • Easier identification of critical control points
Sustainability manager	<ul style="list-style-type: none"> • Better integration of sustainable design measures into design practice • Engaging early with the design team, contractor and asset owner to ensure efficient implementation of sustainability plan • Better incorporation of land-use planning in the end-to-end life cycle of the developments • Better project adaptation to new technology/innovation

The VDASSC recognises that implementation of the VDAS, like any innovative transformation improvement process, will require an improvement in skills and competency, a change in the way we work, an enhanced perception of the value of data and information, a dedication to best-practice change management processes, and skilled resources to make it happen. Notwithstanding, this commitment to adopt digital asset best practice will eventually become business as usual. Victorian Government assets using digital asset best practice will yield benefits across the entire State and, most importantly, Victorians. Adaption towards digital asset best practice aligns with guidance provided in the leadership section of the AMAF.

A consistent and aligned approach

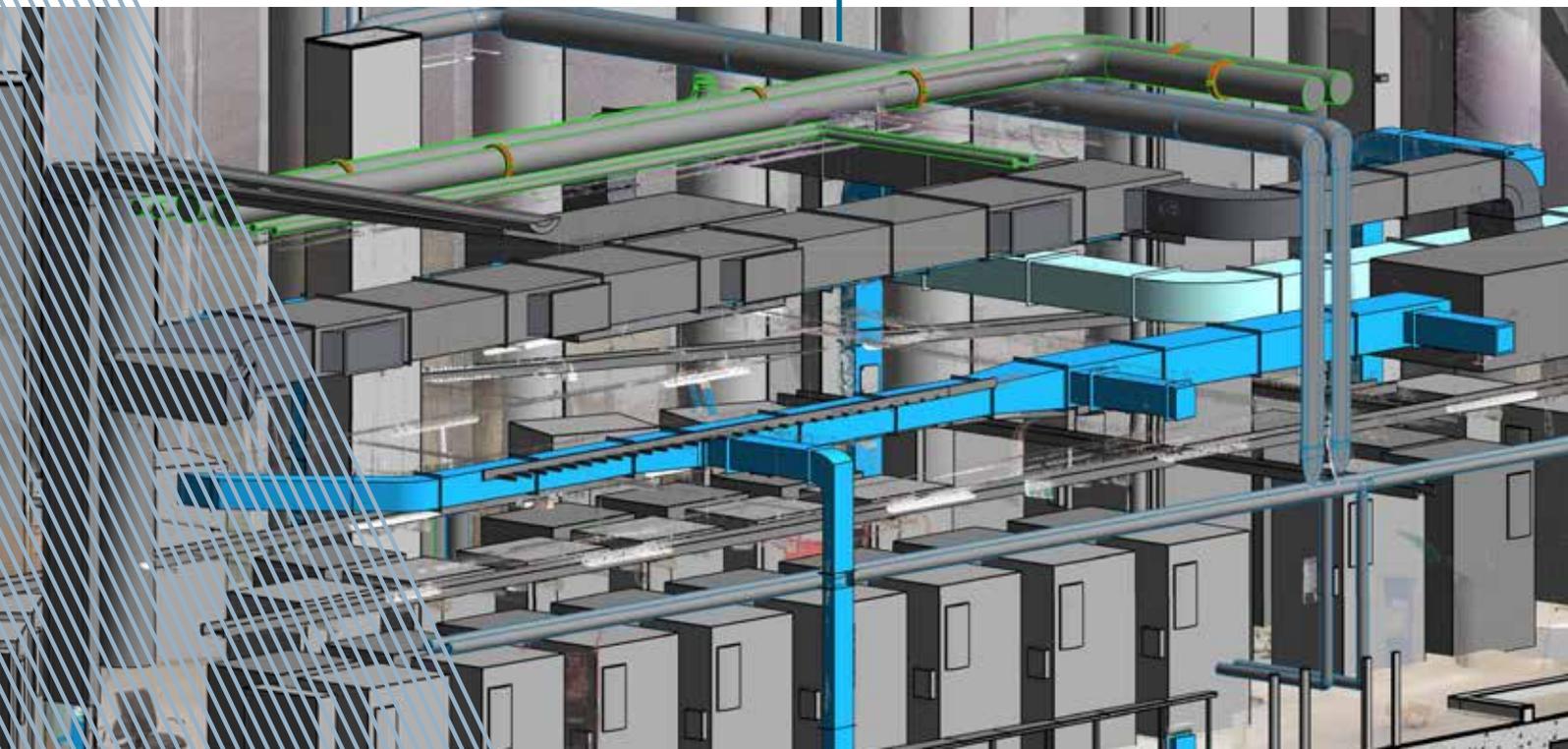
The VDAS recognises the value of an approach that is consistent and aligned across national and international approaches.

The VDAS emphasises and promotes the value of utilising open data formats, consistent asset classification schema, clear information requirements and objectives, as well as a common DE approach across Victoria.

It is for this reason that the VDAS is aligned to the Commonwealth Government's seven National Digital Engineering Policy Principles (NDEPP).

The NDEPP has been collectively developed by governments in Australia in recognition of the benefits that DE can bring to the design, delivery, operation and management of building and infrastructure assets.

Digital engineering is ideal for clash detection and complex systems routing.



Details of the alignment of the VDAS with the NDEPP are provided below:

National Digital Engineering Policy Principles	VDAS application
<p>Consistent application of DE in public infrastructure will be actively encouraged and supported by government at a level appropriate to the size and complexity of the asset.</p>	<p>On 29 August 2018, the Victorian Government announced support for the VDAS for major Victorian projects and assets. The VDAS and application of DE will be scalable commensurate with the project/asset size, complexity, and High Value High Risk (HVHR) assessment.</p>
<p>DE data formats, standards, protocols, systems and tools should be open and harmonised across governments, where possible, to facilitate greater consistency in engagement with industry.</p>	<p>The VDAS promotes the use of open and consistent data formats, standards, protocols and systems. DE and the VDAS are supported by industry groups, as well as major government project delivery agencies.</p> <p>The VDAS advocates for the use of:</p> <ul style="list-style-type: none"> • information management standards, such as ISO 19650; • asset management best practices, such as the AMAF and ISO 55000; and • an ability to adopt, or map back to, an open asset classification system, such as the United Kingdom’s National Building Specification (NBS) UniClass™ 2015 standard.
<p>DE data formats, standards, protocols, systems and tools should be harmonised across whole of asset life cycle management processes, where possible, to ensure data built up through the design and construction phases of a project is fully utilised in the asset management and operations phases.</p>	<p>The VDAS adopts the use of harmonised and consistent data formats, standards, protocols, systems and tools across the asset life cycle.</p> <p>The VDAS promotes the use of open data formats for the purpose of transfer, such as BuildingSMART, Industry Foundation Classes (IFC), Construction Operations Building information exchange (COBie).</p>
<p>Governments will work to ensure DE approaches complement existing project design and development systems and interface with Geographic Information Systems (GIS) to graphically display and visualise relevant information captured as part of the DE process.</p>	<p>The VDAS will complement existing project design and delivery systems, including GIS systems used by the Victorian Government, such as the:</p> <ul style="list-style-type: none"> • Department of Environment, Land, Water and Planning (DELWP) LASSI-SPEAR; • DELWP Survey Mark Enquiry Service (SMES); • DELWP GIS open data formats e.g. GovMap; and • PTV Pass Asset. <p>The VDAS promotes the use of an Australian common coordinate reference system, including the transition to an official national datum (GDA2020), which will replace GDA94 and other older coordinate systems.</p>

National Digital Engineering Policy Principles	VDAS application
<p>Governments will work collaboratively across state and territory jurisdictions and with the private sector to drive best practice in the application of DE in public infrastructure development and management.</p>	<p>The VDAS promotes the harmonisation and collaboration across jurisdictions. The VDAS aligns with the NDEPP and has been developed by the VDASSC in collaboration with Transport for New South Wales (TfNSW), Infrastructure New South Wales (iNSW), the Queensland Government’s Department of State Development, Manufacturing, Infrastructure and Planning, various Victorian Government project delivery agencies (Office of the Coordinator General, Rail Projects Victoria, Level Crossing Removal Program, and North-East Road Link Project, as well as NATSPEC, and the Australian BIM Advisory Board.</p> <p>The VDAS also supports working collaboratively with the private sector, which is supported by the VDASSF, as well as alignment through a common data environment (CDE), clearer specifications, supply chain integration, and consistent formats and tools.</p>
<p>Governments will seek to actively incorporate lessons learned from all sectors and international experiences in the application of DE in public infrastructure development and management.</p>	<p>The VDAS promotes continuous improvement of DE. The Office of Projects Victoria (OPV) will utilise the VDASSC, industry bodies and forums to seek lessons learnt from VDAS deployment, as well as DE deployments in different sectors and jurisdictions.</p> <p>The VDASSC has developed the VDAS with learnings applied from early DE adopters, such as the Scottish Futures Trust, UK Government, and the New Zealand BIM Acceleration Committee.</p>
<p>Governments will work to build capability within the public sector to support DE and, where practicable, enable an increase in private sector capability and capacity to optimise the application of DE.</p>	<p>In collaboration with Victorian Government departments, the VDASSC promotes the strategic development of DE capability and capacity in both industry and the Victorian public service (VPS).</p> <p>The VDAS will be developed and optimised based on this collaboration.</p>

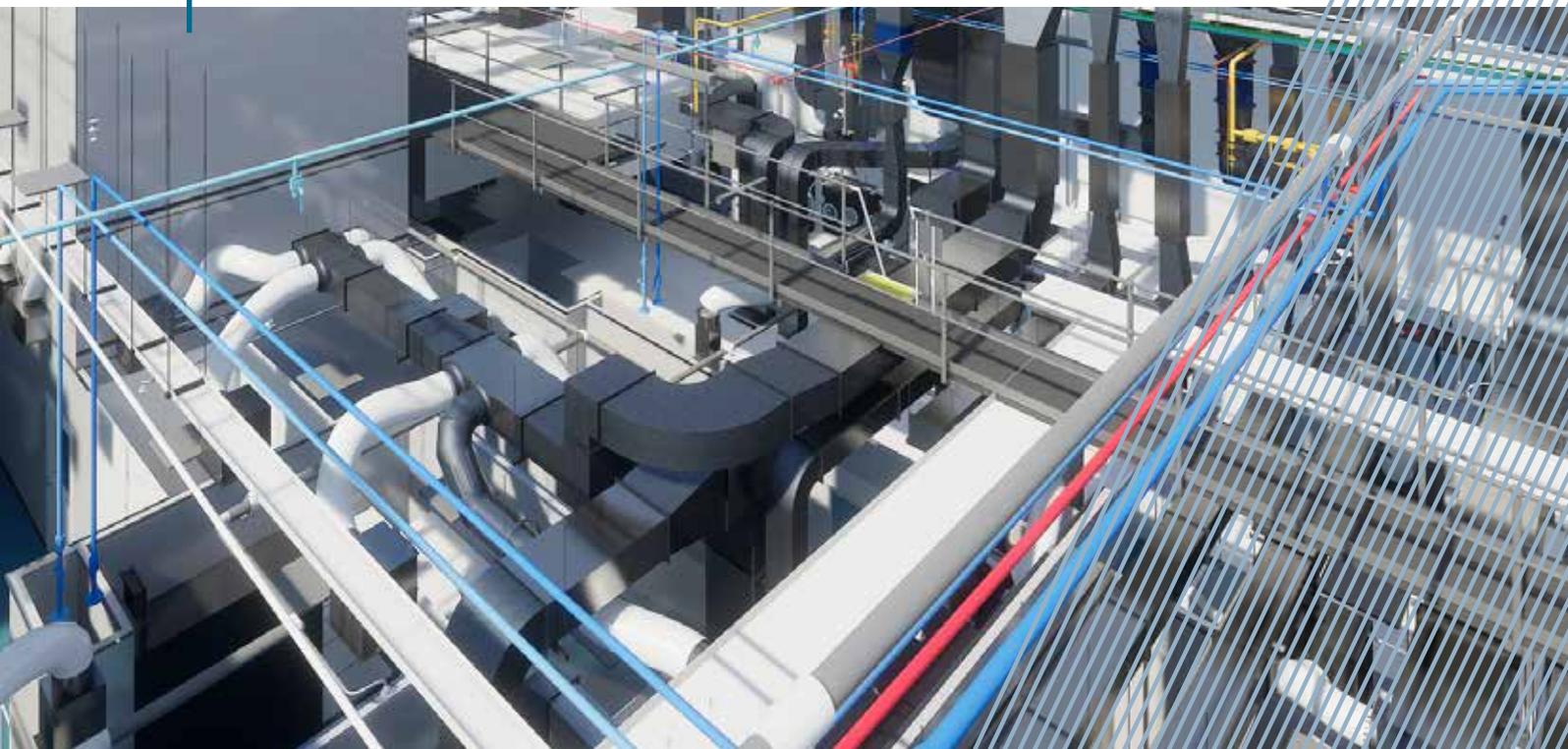
In addition to the NDEPP, the VDAS is designed to complement and enhance existing Victorian Government assurance processes, including the DTF Gateway Review process, High Value High Risk (HVHR) Project Assurance Framework, and the AMAF.

Victoria's physical assets can be mirrored by a digital 'twin'. By creating a digital twin we can create high-quality assets.

Digital twins can also be used to preserve information for future refurbishments in the case of disaster.

This application is used for preserving the historical buildings, monuments and sites of significance in Victoria.

Victoria's most complex assets can be digitally engineered.



Stakeholders and accountability

DE is an innovative and collaborative digital way of working that engages many stakeholders involved in the creation and maintenance of our assets.

These stakeholders all stand to benefit from a consistent and integrated VDAS approach. As part of an integrated responsibly model, each stakeholder has obligations to ensure the VDAS' success.

The Victorian Government and the VPS remain the ultimate 'owners' of Victorian Government assets, accountable for their continuous improvement, and dedication to apply best-practice asset creation and maintenance.

The VDAS is developed with the fundamental goal of serving the Victorian public as the end-users of the State's public services.

The VDAS is primarily intended for use by Victorian Government departments, as well as individuals in Victorian Government project, asset, and facilities management teams or those who are engaged to represent the Victorian Government in such a capacity.

The VDAS will also be relevant to supporting government stakeholders, such as Land Use Victoria, Sustainability Victoria, the Victorian Planning Authority and the Environment Protection Authority.

DE processes embrace and enhance integrated systems that create, capture, share and use digital information. It is for this reason central Victorian Government agencies, such as the Department of Premier and Cabinet (DPC) and Department of Treasury and Finance (DTF), are pivotal VDAS stakeholders.

Digital engineering, through the VDAS, is the way to enhance planning for Victoria's future assets



Industry also stands to benefit from the success of the VDAS. Industry, including the supply chain, must embrace DE processes, systems, tools, and support government-led efforts to embrace digital asset best practices.

By doing so, the creativity and ingenuity of industry will be embraced and effectively incorporated into major government assets, and in turn, drive toward better outcomes for Victorians. Through a consistent approach, this can create cost savings with industry understanding the set framework requirements.

Educators have a responsibility to adopt and teach the most contemporary and industry-relevant syllabus to students. It is these students who will define, engineer, construct, operate and maintain Victoria's assets of the future. Victoria depends on them having the most refined and relevant skills for this task.

Uses

The VDAS is the enabler of vast utility across the asset life cycle.

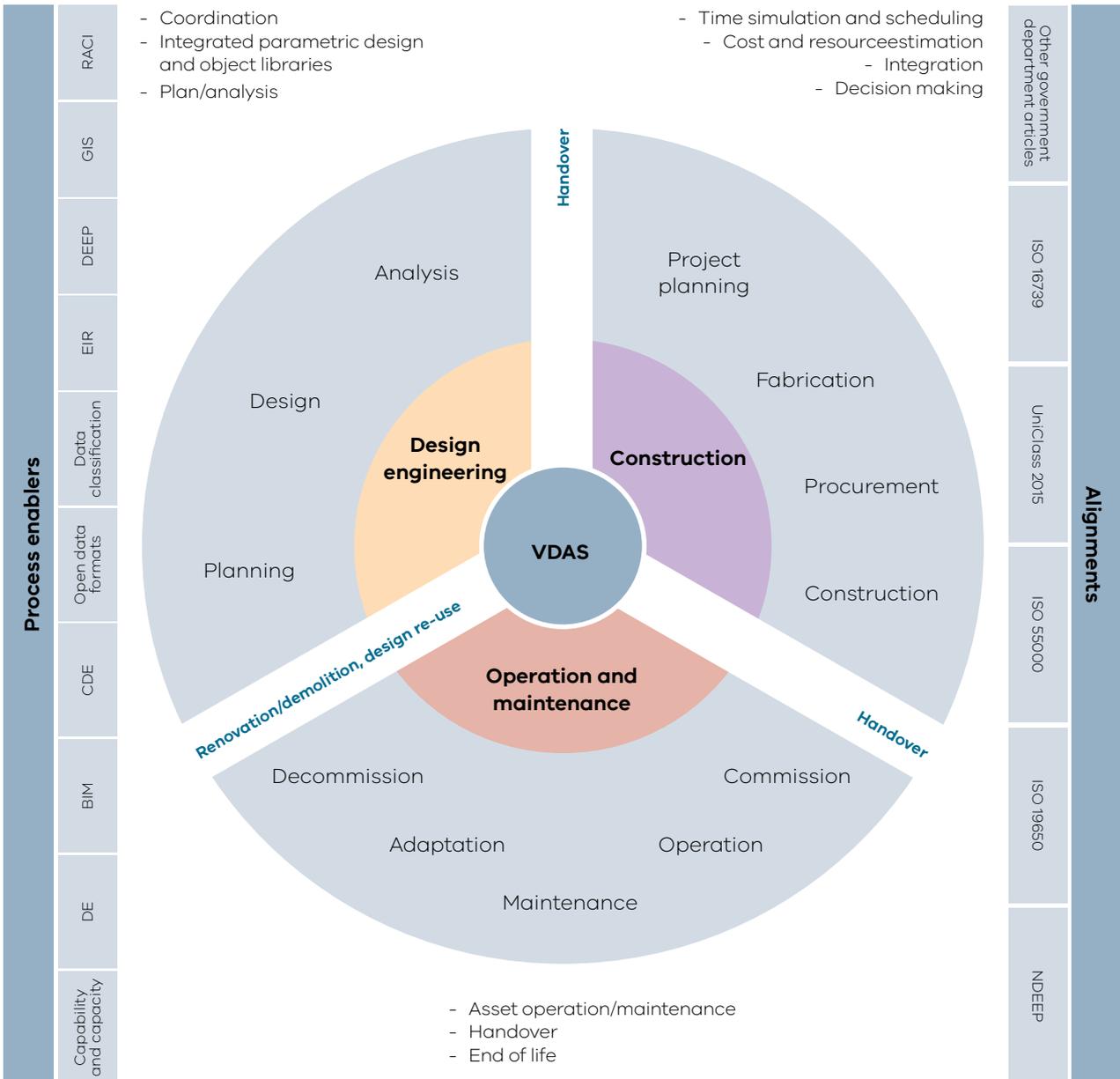
It is expected future uses of DE will be remarkably different and improved to those that are currently in use or imagined today. These may include the routine use of augmented reality, virtual reality, blockchains, environmental product disclosures, seamless integration into emergency management and city-planning processes, smart cities and the ability to plan and optimise development.

The VDAS is enabled by supporting processes and practices such as procurement, governance, validation, people upskilling and collaboration.

The assessment of how and which of these uses are required by the asset owner (i.e. government) needs to be considered and established at the earliest possible time, although can be applied at any point in the asset's life cycle.

For all asset and project phases, defining and agreeing the uses of DE information will reduce risks, improve collaboration and enable data re-use by all participating parties. This agreement is to be captured in the Digital Engineering Execution Plan (DEEP).

Policies					
HVHR guidelines	Front-end engineering and design	Victorian Critical Information Resilience Arrangements	Victorian Government Risk Management Framework	Asset Management Accountability Framework	Value Creation and Capture



Design engineering

Coordination

- CDE as an agreed source of truth used for all decision-making parties enhances integration among asset stakeholders
- Data exchange with project collaboration tools

Integrated parametric design and object libraries

- Integration of design with field data from laser scans
- Capture data for 'lessons learned' or design re-use
- Integrated design with all major disciplines, such as structural, architectural, civil, mechanical, electrical, piping, and instrumentation/controls, constructability and clash analysis

Plan/analysis

- Compare situations and scope
- Value Creation and Capture community engagement
- Gain new insights on community use, free space, traffic, modelling, cost-benefits, etc.
- Benchmarking whole life cycle costing
- Data delivery/integration for performance analysis
- Input to simulation and rapid prototyping
- Data repository for analytics/design optimisation

Construction

Time simulation and scheduling

- Generate program scheduling and construction sequencing
- Create resource level programs according to the site conditions

Cost and resource estimation

- Quantities extracted in real time used for estimation, tendering and procurement
- Physical progress emulated to support progress payments and milestones
- Information-rich tenders

Integration

- Data exchange with construction monitoring and surveillance tools
- Input to entire supply chain and adaptive manufacturing

Decision-making

- Explore and investigate alternatives
- Assess facility elements such as function vs. cost
- Support investment decision-making

Operation and maintenance

Asset operation/maintenance

- Utilise digital information generated throughout the asset creation for asset operation and maintenance
- Information provided supports operations and maintenance decision-making
- Common data environment (CDE) for asset management systems
- CDE for condition monitoring and predictive maintenance

Handover

- Platform for virtual handover and commissioning
- Seamless handover between project and operation

End of life

- Asset information support for renovation, decommissioning and future design re-use

VDAS scope

The VDAS is applicable to all forms of Victorian infrastructure assets and across a wide range of procurement methodologies. It is also applicable to all types of infrastructure: linear, place-based, and system-based assets.



Linear

Multi-modal transport, roads, rail, and crossings



Place-based

Precinct, hospitals, police stations, schools, etc.



System-based

Telecommunications, waste water and water networks, traffic lights, etc.

The VDAS brings new possibilities. With digital engineering, old engineering designs can be 're-used' on new assets. In the process of creating new Victorian assets this reduces the cost and saves time.

The VDAS can be applied to all procurement types: public private partnerships (PPP), alliances, design and construct (D&C), as well as contemporary procurement methodologies, such as engineering, procurement and construction management (EPCM), and early contractor involvement (ECI).

The VDAS can be deployed in all phases of the asset's life cycle, with the value being enhanced when an asset's information is developed early and seamlessly transitioned to the next phase using open data formats, systems and schema.

The VDAS is applicable in creating new physical assets, as well as upgrading and refurbishing of existing physical assets. The VDAS is also applicable to sites with no prior development (i.e. greenfield), as well as existing sites with prior development (i.e. brownfield). The VDAS is also applicable in the decommissioning and disposal of existing assets.

Asset classification system

As part of the Victorian Government's commitment to A Data Reform Strategy for the Victorian Public Service, it is essential the VDAS adopts a standardised asset classification system used in conjunction with the creation and management of assets.

A standardised classification system enables information to be developed, exchanged, leveraged and reliably reused by all parties interacting with the built asset.

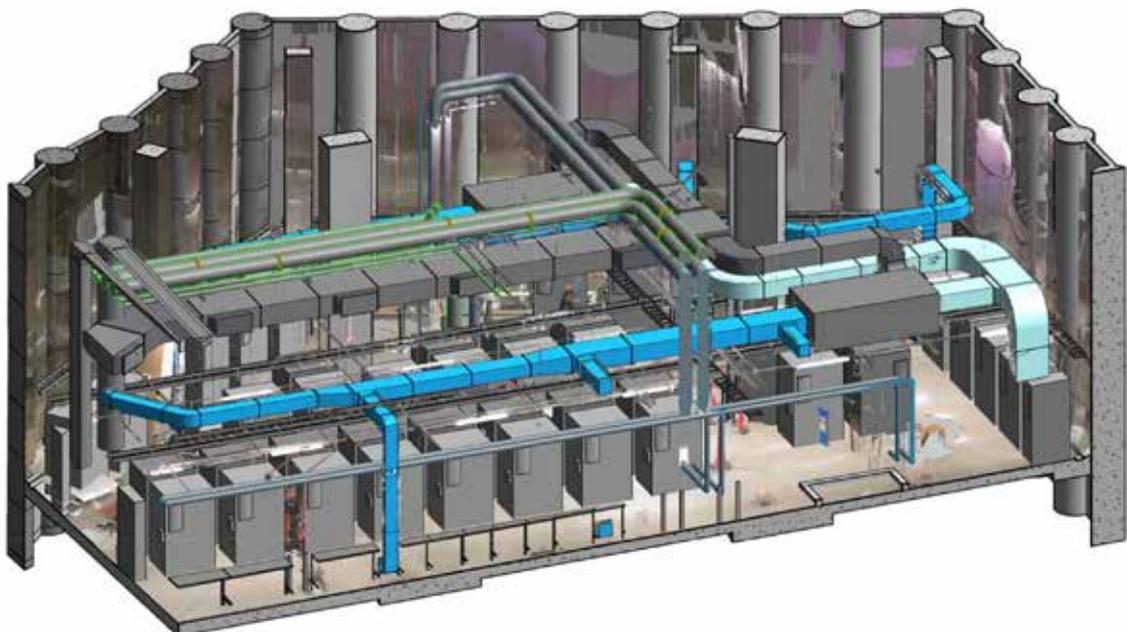
There are many asset classification systems in use today by asset owners and industry. Across Victoria there are several ad hoc, in-house and segregated classification systems in operation with limited integration or ability to exchange data across agencies, asset owners or jurisdictions.

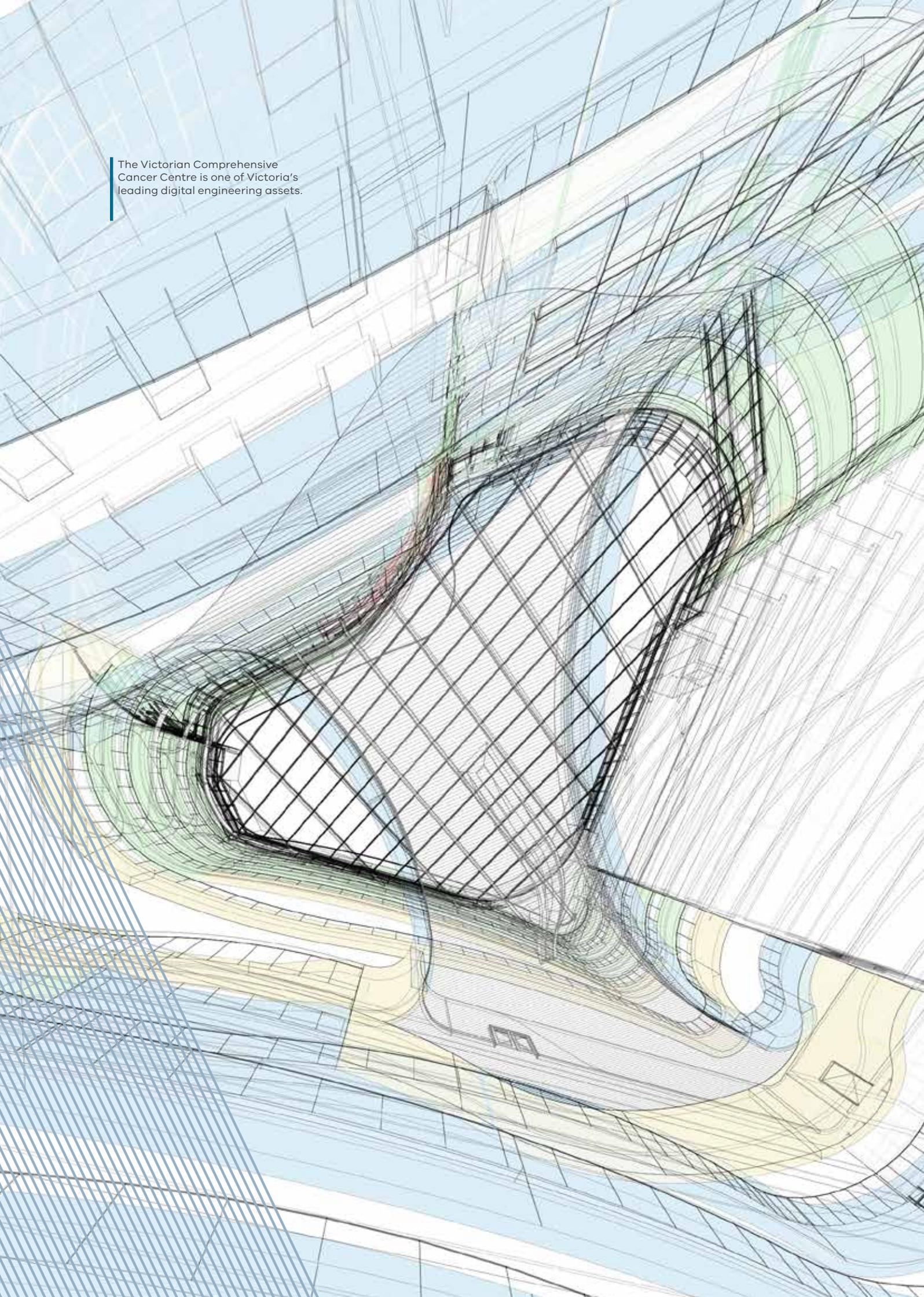
To successfully enable DE, the VDAS, with the support of industry experts, supports the use of, or the ability to map to, the Uniclass2015 classification system.

The VDAS promotes, where possible and necessary, the principle that systems, such as cost-breakdown structure, work-breakdown structure, etc. should also be mapped to Uniclass 2015.

Uniclass 2015 is the foundation of the UK Government's official Level 2 BIM construction sector classification system and is supported by many globally.

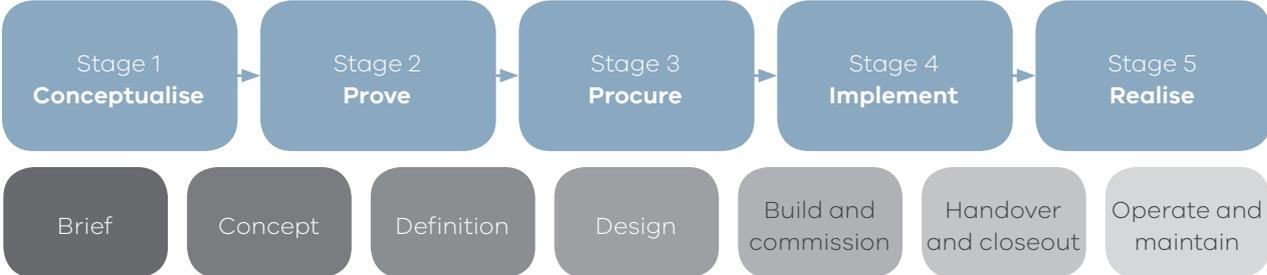
Digital engineering enables project teams to compare different scenarios virtually and make decisions on the preferred design option.





The Victorian Comprehensive Cancer Centre is one of Victoria's leading digital engineering assets.

VDAS and the asset information life cycle



ISO 19650's Seven Phases of Asset Lifecycle aligned with DTF Investment Lifecycle Framework

In the context of Victorian Government assets, a considerable amount of information is required to enable effective decision-making across all phases of the asset life cycle.

Effective decision-making about major projects requires early clarity about what information is required, when, by who, how it is developed, and in what format. To enhance clarity, the use of best practices in the creation and management of information of physical assets are recommended.

The VDAS' value is enhanced when digital information and data is seamlessly transferred from one phase of the asset life cycle to the next. It is for this reason that the VDAS recommends that ultimate accountability for digital data, the DE package, and asset interfaces remain with the asset owner (Victorian Government).

This does not preclude the asset owner from delegating responsibility to parties throughout the asset life cycle; however, it demands the owner maintain ultimate accountability, responsibility and oversight in the best interests of the State.

The asset owner (Victorian Government) may elect to pass the legal accountabilities associated with digital data and information to a third party through a contract. The conditions for this accountability should be defined under the head contract.

For asset operations and maintenance, the VDAS promotes the use of the AMAF to be used in conjunction with internationally-recognised digital information management best practices, such as ISO 55000.

For asset creation and construction, the VDAS promotes the use of exchange information requirements (EIR), as per ISO 19650-1:2018, and ISO 19650-2:2018. The VDAS promotes the early development of EIR on all major Victorian Government infrastructure projects.

Projects are set up to succeed when EIR are aligned to:

- how the asset will be operated in the future and the relevant data required to undertake this task (set out in Asset information requirements); and
- the organisation's key decision points and identification of the relevant information needed at these points to manage the organisation's asset requirements (set out in Organisation information requirements).

EIR should be developed by the asset owner (Victorian Government) and provide clarity about what information and uses of information will be required at what point, and to what level of detail. This information may include costs, number of users, safety information, material information, set points, cost estimating, 3D coordination, handover and asset performance.

It is key guidance for prospective consultants, designers, and contractors to ensure they meet the DE objectives for the project and the client/owner. Prospective consultant designers and contractor should respond to EIR with a DEEP.

DE value is unlocked through collaboration and information-sharing.

For this reason, the VDAS recommends all information generated by consultants and asset owners (excluding data deemed commercial-in-confidence or classified) is shared with all parties, ideally using a CDE. This includes digital information on, but not limited to, survey data, existing CAD drawings, existing 3D models, GIS and Cadastre data, planning documentation, handover/commissioning information, manuals and calculations.

To navigate the roles and responsibilities between parties, the VDAS recommends including a RACI/scope checklist that describes the participation by various functions in completing tasks, deliverables, and scope under the DEEP.

For prove and procure asset interfaces, the VDAS recommends all reference information generated by the owner/employer, where possible, is provided to the tenderer. This is consistent with the Victorian Government Intellectual Property Policy Intent and Principles (IP Policy), whereby the asset owners should manage intellectual property (IP) in ways that are consistent, transparent and accountable, and the asset owners should grant rights to their IP with the fewest possible restrictions.

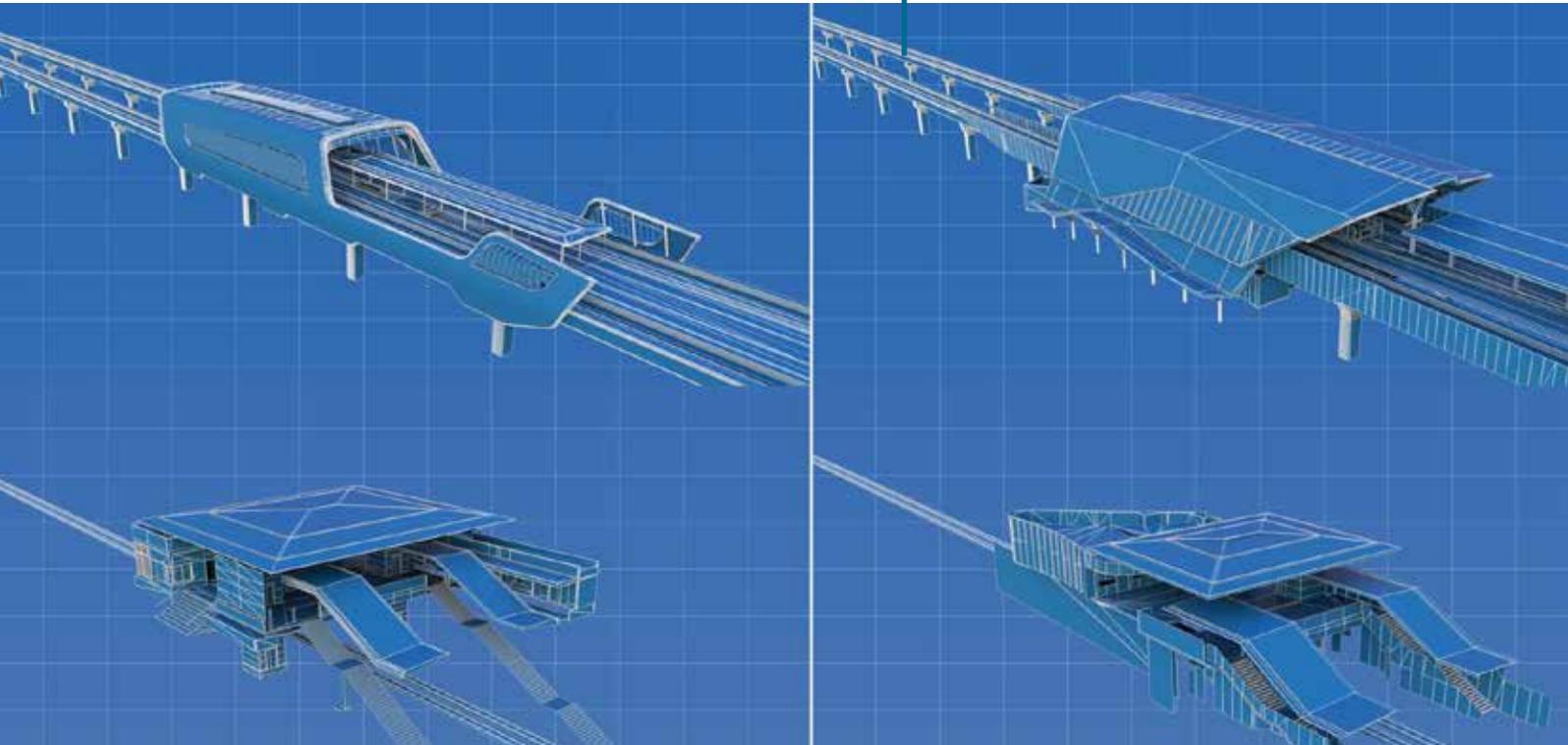
As part of the tender responses, a pre-contract award DEEP should be provided by the tendering party. The DEEP is a formal and contractual response to the EIR. The DEEP must refine the RACI/scope checklist, with greater clarity on supply chain and relationships/interfaces below the main contract holder.

The VDAS recommends all projects request a DEEP as the tendering parties' approach and response to the DE element of the project. The VDAS also recommends the DEEP form part of the evaluation criteria for contract award.

For procure and implement phases, and consistent with the IP Policy, the VDAS recommends all information, where possible, generated by the successful tenderer is provided to and made available to the asset owners. The VDAS recommends this data be retained by the State.

The VDAS recommends that across all phases of the asset life cycle, all digital information, and data for creation, exchange, and use be 'fit for purpose'. Asset owners, across all phases of the asset life cycle, have an obligation to define what 'purpose' is required for the data and information. This should be supported by the RACI/scope checklist and DEEP.

Digital engineering allows project and facilities teams to make complex decisions about scope, approach, timing and cost prior to site mobilisation.



For the transition from implement to realise (construction to ongoing asset operation and maintenance), the VDAS recommends data handovers be in open format, such as industry foundation classes (IFC) or at a minimum, a basic representation of relevant project data in the Construction Operations Building information exchange (COBie) standard, csv, or xml.

To the benefit of operations and maintenance of the asset, open data can be imported directly into appropriate asset management software or a computerised maintenance management system.

For both, the VDAS endorses that data content is generated in line with the Asset information requirements as set out in Section 4 of ISO 55001 and Section 3.4 of the AMAF.

For asset classification, the VDAS promotes the use of UniClass2015 to structure and label assets. For interoperability and data exchange, the VDAS promotes the use of IFC and ISO 16739.

For more information about COBie, refer to: <http://bim-level2.org/en/standards/>

For more information about UniClass2015 asset classification system, refer to: <https://toolkit.thenbs.com/articles/classification>

For more information about buildingSMART and IFC, refer to: <https://www.buildingsmart.org/>

For more information about ISO 16739, refer to: <https://www.iso.org/standard/51622.html>

For more information about the AMAF, refer to: <https://www.dtf.vic.gov.au/infrastructure-investment/asset-management-accountability-framework>

Construction sequencing of the Pakenham depot project was made more effective and efficient with the use of digital engineering.



Legal considerations

This Strategic Framework considers the legal implications that may arise from the adoption of DE.

It is important to note DE does not introduce new legal risks to projects. Instead, DE changes the way we must approach existing risks on traditional paper-based approaches to information management on projects.

It is important to note the VDAS promotes the early identification and planning of DE-specific legal considerations to effectively protect rights under a contract and manage risks, which may emerge during a project. Presented in the following sections are specific legal considerations and VDAS recommendations.

Intellectual property and data and information ownership

The VDAS follows the IP Policy, which is the State's framework for the ownership and management of IP, and for its use of IP belonging to other parties.

In line with the IP Policy, the VDAS recommends the asset owner (i.e. the State):

- manages its IP in ways that are consistent, transparent and accountable;
- grants rights to its IP with the fewest possible restrictions;
- exercise restriction to IP for reasons of privacy, public safety, security, law enforcement, public health, commercialisation and compliance with the law;
- addresses in an agreement (via the EIR and RACI/scope checklist) any rights to IP (including pre-existing) that may arise;
- secure a licence to IP, only to the extent necessary to achieve the information requirements of the asset; and
- acquires ownership of IP if a licence is inadequate in the circumstances.

The VDAS recommends that, in general, just like the State has ultimate accountability and ownership of the physical asset, the State maintains ultimate accountability and ownership of the digital asset, including information and data.

The VDAS recognises this may not be possible in specific cases for designs, solutions, and processes that are protected under licence or IP rights in favour of a specific party.

The VDAS recommends Victorian Government departments and agencies retain created and issued information for future value-adding purposes. These purposes include, but are not limited to, benchmarking, design reuse, user wayfinding, operations and maintenance, asset registers/models, and future project and asset planning.

Where possible, the data and information should also be held by the State within a CDE. This mitigates the risk of information loss and disputes due to current siloed and paper-based information management processes.

The VDAS recognises that during specific asset life cycle phases, such as asset creation, information and the responsibility to update are likely held by third parties (i.e. engineering house, designer or successful tenderer). This includes consideration of the successful tenderer's sub-contractors and supply chain, as well as when a project progresses into operations and maintenance.

The VDAS recommends the roles, responsibilities, ownership and accountabilities be detailed as early as possible in the asset life cycle. Roles, responsibilities, accountabilities, and rights to specific IP should be articulated in the form of a RACI/scope checklist. This document should be informed by the EIR and form part of the contract.

The VDAS recommends the asset owner (Victorian Government) should make all efforts to clarify with the head contractors/tenderers that information and data contributors warrant that they hold the IP rights for the contributions they make.

Specifically, for when DE information and data may be held by third parties, the VDAS recommends document management and assurance best practices be followed as defined in Section 11 of ISO19650-1.

Information and data generated within a CDE should fall within one of four container states: work in progress, shared, published, and archived. The transition of data and information from one container state to another should be subject to definition within the data exchange protocols section of the DEEP.

Digital engineering enables effective planning and management of the assets, leading to optimised operational efficiency and maximised value during their life cycle.



Liability

In the context of DE, the notion of accountability for the correctness of digital information is complex. It is important to note this risk already exists in current non-DE approaches to information management. The introduction of DE and the VDAS does not change this risk.

The concept of liability becomes more apparent with the introduction of DE processes, as model contributions may be perceived as a 'free for all' without process and change management, and thus, be prone to unsubstantiated or incorrect input/changes.

To address this risk, the VDAS recommends projects follow document management and assurance best practices, according to ISO 19650-1, Section 12 and in accordance with AMAF section 3.1.2 Allocating Asset Management Responsibility.

Victoria's major projects must apply the Victorian Public Sector Special Conditions of Contract for use with AS 2124:1992 (August 2018), which should, in turn, be complemented with the EIR, DEEP, and RACI/scope checklist.

As a final level of accountability and transparency, the VDAS recommends the use of digital access control and digital tracking for changes made to digital information.

The VDAS promotes that no data quality liability should be maintained to downstream, non-contractual stakeholders, and non-intended consumers and users of the DE data and information.

Information security

Development and sharing of digital information for key Victorian assets requires careful consideration of access requirements, as well as digital information security. This aligns with the Office of Victorian Information Commissioner's Victorian Protective Data Security Standards (VPDSS), which aim to protect public sector information through a suite of mandatory requirements.

The VDAS recommends the use of ISO 19650-1 as best practice for the management of information within an online environment. The *Victorian Data Sharing Act 2017*, Information Management Framework, and Victorian Protective Data Security Framework are Victorian Government policies that should be applied for data sharing and security.

Victorian Government departments should familiarise themselves with international best practice and policies as it provides advice on measures that can be taken to ensure the online management of their digital built assets, as well as management of new and existing physical built assets, are secure.

The VDAS notes that some Victorian Government departments may have aligned to ISO 27001:2018, which is harmonious with PAS1192-5.

Victorian assets deemed as 'critical' must address legislation, regulations, and ministerial guidelines as per the Victorian Critical Infrastructure Resilience Arrangements. This includes the use of DE and digital information.

Digital engineering can be used with 'Value Capture and Creation' to enhance engagement with Victorians.



VDAS and current Victorian Government policy

The VDAS is compatible with all relevant and current Victorian Government policies. These policies range from project assurance to asset management best practices.

Gateway Review process

DTF's Gateway Review process examines projects and programs at six key decision points in their life cycle.

The process involves using an independent external reviewer team to provide timely and confidential advice about progress and likelihood of delivery success.

The team reviews all project documentation and holds discussions with project team stakeholders. The review is designed to align the project with best practice and present senior executives with findings and actionable recommendations.

As part of the Gateway Review process, projects should be assessed by independent reviewers with specific knowledge and capability in DE and/or the VDAS. This knowledge and capability can be sourced through OPV's infrastructure projects experts panel (IPEP).

For more information about the Gateway Review process, refer to:

<https://www.dtf.vic.gov.au/infrastructure-investment/gateway-review-process>.

For more information about the IPEP, and to engage a DE resource, contact OPV on 03 9651 1690 or IPEP@opv.vic.gov.au.

Victorian design review process

The Office of the Victorian Government Architect's (OVGA) Victorian Design Review Panel (VDRP) offers design advice at key stages of the project through independent peer review by design experts and technical specialists. The OVGA also plays a role in design evaluation panels and processes. This supports value creation by raising design quality, ensuring value for money and identifying lateral opportunities.

For more information about the OVGA and the OVGA's VDRP, refer to: <https://www.ovga.vic.gov.au/victorian-design-review-panel.html>.

Investment management standard, Investment life cycle and HVHR guidelines

DTF's Investment management standard aligns Victorian investment to best practices, such as investment shaping, proposal prioritisation, monitoring and measurement of investment benefits, investment evaluation, and organisational effectiveness.

The Investment life cycle and HVHR guidelines also support the planning and delivery of new asset investments.

The HVHR framework comprises a series of project assurance checks and processes, which provide greater scrutiny of major infrastructure and information and communications technology investments.

The HVHR framework seeks to:

- verify that robust project planning and procurement processes have been followed to support quality project outcomes; and
- provide impartial and informed advice to Government on deliverability risks.

This greater scrutiny increases the likelihood that projects will achieve their stated benefits and be delivered successfully, on time and to budget.

The Investment management standard is of particular relevance to the VDAS as it both informs and is informed by the maturity of the physical and digital asset it develops through its life cycle.

For more information about the Investment management standard and the HVHR guidelines, refer to: <https://www.dtf.vic.gov.au/infrastructure-investment/high-value-high-risk-framework>.

Front-end engineering and design

Early integration of front-end engineering and design (FEED) into the investment life cycle is effective in reducing project risk and increasing certainty of project outcomes. Undertaking detailed due diligence activities prior to awarding contracts reduces uncertainty for prospective bidders. This increases the probability of attracting high-quality teams and improving market responses.

Projects with stronger upfront planning and FEED have greater certainty, which reduces the need to make pricing assumptions.

OPV is championing the rollout of FEED technical guidance, which aims to improve the maturity of technical areas associated with projects prior to contract award. These technical areas include existing conditions, investigations, and scope.

As part of FEED processes, the maturity of DE can be assessed.

For more information about FEED, contact OPV on 03 9651 1690 or enquiries@opv.vic.gov.au.

Victorian Critical Infrastructure Resilience Arrangements

In July 2015, Victoria introduced new legislative and policy arrangements to improve critical infrastructure resilience and reduce disruption of services to the community due to emergencies.

Resilient critical infrastructure is more likely to endure changes or challenges to social, economic and environmental circumstances. If the asset meets the requirement of the registry, then specific information security requirements must be followed.

Emergency Management Victoria (EMV), as part of the Victorian Critical Infrastructure Resilience Arrangements (VCIRA), also maintains the Victorian Critical Infrastructure Register (VCIR), which records infrastructure that is most important to the functioning of the Victorian community.

Infrastructure assets that are being designed, developed, engineered constructed, operated and maintained according to the VCIRA needs to follow relevant legislation, regulations, and ministerial guidelines.

For more information about EMV, VCIRA, and VCIR, refer to:

<https://www.emv.vic.gov.au/our-work/critical-infrastructure-resilience>

Victorian Government Risk Management Framework

The Victorian Government Risk Management Framework (VGRMF) establishes how organisations should plan, implement and operate a risk management framework and meet the annual attestation requirements for risk and insurance.

The VGRMF establishes the need for agencies to have a risk management framework in place consistent with ISO 31000:2018 Risk, and attest to this on an annual basis.

The VGRMF and best-practice risk management is central to effective digital asset management.

For more information about the VGRMF, refer to: <https://www.dtf.vic.gov.au/planning-budgeting-and-financial-reporting-frameworks/victorian-risk-management-framework-and-insurance-management-policy>.

With digital engineering, project teams can make informed decisions on complex design issues and create assets with innovative designs and optimum functional efficiency.



Asset Management Accountability Framework

The AMAF details mandatory asset management requirements, as well as general guidance for agencies responsible for managing assets. The AMAF outlines four key stages of the asset life cycle:

- **Planning:** determination of asset requirements, based on an assessment of both service delivery needs and the capability of the existing asset base to meet these needs.
- **Acquisition:** procurement of assets to meet an identified service need, including the assessment of procurement options.
- **Operation and maintenance:** management and use of an asset to deliver services, including maintenance.
- **Disposal:** treatment of an asset that has either reached the end of its useful life, is considered surplus, or is under-performing.

The AMAF sets out a roadmap to adopt global best practices in asset management, such as ISO 19650 and ISO 55000. As part of that roadmap, the VDAS can assist in the development, management, responsibility, and use of information throughout the asset information life cycle.

For more information about the AMAF, refer to DTF's AMAF policy:

<https://www.dtf.vic.gov.au/infrastructure-investment/asset-management-accountability-framework>.

Value Creation and Capture

In February 2017, the Victorian Government endorsed the Value Creation and Capture Framework, which provides a consistent approach to maximising the public value of government infrastructure investment across priority precincts, the development of public land and for capital investment projects.

Value creation refers to the delivery of enhanced public value in terms of economic, social and environmental outcomes. This enhancement of public value is above and beyond what would ordinarily be achieved as a direct consequence of the relevant government investment. The VDAS is considered a value creation opportunity.

Value capture refers to capturing a portion of the incremental economic value created by government investments, activities or policies.

It is important value creation and capture is considered in the earliest stages of project/precinct development. Wider value can be created by thinking beyond the narrow focus of a project and considering the broader opportunities available.

For more information about the Value Creation and Capture Framework, refer to:

<https://www.dpc.vic.gov.au/index.php/news-publications/value-creation-and-capture-framework>.

More information

For more information about the VDAS contact OPV:

- Email: enquiries@opv.vic.gov.au
- Phone: 03 96511690

'Together we can use digital engineering to develop cost-effective, innovative, and value-adding assets for all Victorians for decades to come.'

Dr Collette Burke

VDAS strategic partners

The Office of the Victorian Chief Engineer would like to thank those on the VDASSC:

AECOM	Hatch	Department of Premier and Cabinet
University of Melbourne	Laing O'Rourke	NATSPEC
Monash University	Swinburne University	Office of Projects Victoria

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Melbourne Airports	McConnel Dowell	MelBIM
Melbourne Water	Probuild	ARUP
Office of Coordinator General	Public Transport Victoria	Melbourne Water
Office of Victorian Government Architect	PwC Australia	Metro Trains Melbourne
Real Serious Games	Roads Australia	Roads and Maritime Services
Victorian Health and Human Services Authority	Transport for NSW	Rail Projects Victoria
VicRoads	Victorian Centre for Data Insights	Victorian Asbestos Eradication Agency (VAEA)
Victorian Planning Authority	Willow Inc.	Data.Vic
Victorian School Building Authority	Water Services Association of Australia	Aurecon
Australasian BIM Advisory Board	Asset Management Council	Sam Cowley
Air Conditioning and Mechanical Contractors' Association	Roads and Maritime Services	Infrastructure New South Wales
Queensland Department of State Development, Manufacturing, Infrastructure and Planning	New South Wales Health Infrastructure	New Zealand BIM Acceleration Committee
City of Melbourne	Ridley	Ausnet

Glossary

Appointed party	<p>Provider of goods or services to an appointing party.</p> <p>Source: ISO 19650-1:2018</p>
Appointing party	<p>See Employer.</p>
Asset	<p>Defined as an 'item, thing or entity that has potential or actual value to an organisation'. Assets can be tangible or intangible through physical and non-physical (digital) assets. Data and information should be considered a digital asset.</p> <p>Source: ISO 55000</p> <p>Victorian major infrastructure assets are large-scale infrastructure assets owned by the Victorian Government.</p>
Asset management	<p>Asset management is the coordinated activities of an organisation to realise value from asset(s). Asset management is a suite of activities that enable physical and non-physical assets to deliver the value they were designed to deliver.</p> <p>Asset management typically involves an asset management system. The system will ensure resources, the competence, the awareness, the communication, the information requirements and the documented information are all enabled and focused on enabling the value that asset management delivers from the assets.</p> <p>Source: ISO 55000</p>
Asset information	<p>Information is defined as 'meaning data'. Source: ISO 22263:2008 and ISO 19650-1:2018.</p> <p>In the context of assets, information relates to the re-interpretable representation of asset-related data in a formalised manner suitable for communication, interpretation or processing.</p> <p>Asset information is a key requirement for the successful creation and management of any physical asset. The value of asset information is enhanced when specified and considered early by the client/asset owner/operator.</p> <p>DE enables and facilitates the integration and sharing of asset information and data requirements across all phases of the asset life cycle.</p>
Asset information requirement (AIR)	<p>Data and information requirements by the appointing party in relation to the operation of an asset.</p> <p>ISO 19650-1:2018.</p>
Asset owner	<p>The individual, entity, or organisation responsible for asset management policy, strategy, planning and decision-making for optimising the cost, risk and performance of assets over their life cycle.</p> <p>Note: ownership of physical and non-physical assets may differ over the life cycle of the asset.</p>

<p>Building information modelling (BIM)</p>	<p>Use of a shared digital representation of a built or to be built asset to facilitate design, construction and operation processes to form a reliable basis for decisions. Source: ISO 29481-1:2016, 3.2.</p> <p>BIM is a subset of DE that integrates technology, process improvements, and digital information to radically improve client and project outcomes and asset operations.</p> <p>BIM is a strategic enabler for improving decision making for both buildings and public infrastructure assets across the whole life cycle. It applies to new build projects and crucially, BIM supports the renovation, refurbishment and maintenance of the built environment.</p> <p>Source: EU BIM Task Group Handbook, 2018</p>
<p>Computer-aided design (CAD)</p>	<p>A geometric/symbol-based computer drawing system that replicates hand-drawing techniques.</p> <p>CAD software can prepare 3D lines, surfaces or solids that are suitable for presentation on hard-copy plots of drawings, and/or as background data for other 3D data or BIM.</p>
<p>Common data environment (CDE)</p>	<p>Agreed source of information for the whole asset life cycle used to collect, manage and disseminate all relevant approved project documents for multi-disciplinary teams in a managed process. Pairing a CDE with DE processes enhances collaborative information flow, which can be readily leveraged from one phase of the asset life cycle to the next.</p> <p>Note: A CDE may use a project server, an extranet, a file-based retrieval system or another suitable toolset.</p> <p>Source: ISO 19650-1</p>
<p>Construction Operations Building information exchange (COBie)</p>	<p>Structured facility information for the commissioning, operation, and maintenance of a project often in a neutral spreadsheet format that is used to supply data to the asset owner or operator to populate decision-making tools, facilities management, and asset management systems. Source: PAS1192.2-2013</p> <p>COBie can facilitate transformation from document-centric to information-centric handover processes to facility and asset operators post-construction.</p>
<p>Data</p>	<p>Information represented in a manner suitable for automatic processing.</p> <p>Source: 701-01-11</p> <p>Reinterpretable representation of information in a formalised manner suitable for communication, interpretation or processing.</p> <p>Information can be processed by human or automatic means.</p> <p>Source: ISO/IEC 2382-1</p> <p>Also known as digital information.</p>

Digital engineering (DE)	<p>A contemporary and collaborative approach to working on assets that allows for a faster and more efficient approach to delivering projects and managing physical assets.</p> <p>It is a convergence of emerging technologies such as BIM, GIS and other related systems for deriving better businesses, projects and asset management outcomes. DE enables a collaborative way of working using digital processes to enable more productive methods of planning, designing, constructing, operating and maintaining assets through their life cycle.</p> <p>The core elements of DE include a standardised classification system, open data format, object-based models, spatially located data, and common data environment across all asset phases.</p>
Digital engineering execution plan (DEEP)	<p>A plan that delivers and explains how the digital information management aspects of the appointment will be carried out by the appointed parties prior to and during contract award.</p> <p>For Victorian Government major projects, a DEEP may integrate with other execution plans, such as project execution plans, detailed contractor's activity proposal, and activity execution plan.</p>
Digital model	<p>A three-dimensional representation in electronic format of infrastructure elements representing a combination of solid objects and specially located data with true-to-scale spatial relationships and dimensions. A model may include additional information or data. Source: ConsensusDocs 301 BIM Addendum, 2008</p> <p>Also known as digital twin/ BIM model / data rich 3D model.</p>
Employer	<p>Individual or organisation named in an appointment or project contract as the employer.</p> <p>Receiver of information concerning works, goods or services from a lead appointed party. ISO 19650-1:2018</p> <p>Note: for Victorian Government projects, this is the project team or asset owner representing the Victorian Government, the Victorian Government department or agency.</p> <p>Also known as appointing party.</p>

Exchange information requirement (EIR)	<p>Specification for data and information by the appointing party that the appointed party is expected to meet during the appointment.</p> <p>Source: ISO 19650-1:2018, 3.19.</p> <p>An EIR provides guidance and pre-qualification documentation for appointed parties and forms the basis of appointment and tender documents on a project using DE.</p> <p>An EIR defines which information is produced at each asset stage – together with the required level of detail and definition.</p> <p>For Victorian Government major projects, an EIR may integrate with other traditional contract documents, such as project scope, technical requirements, and the project agreement.</p> <p>Also known as Employer’s information requirements and Owner’s information requirements.</p>
Fit for purpose	<p>Data is considered fit for purpose when it is appropriate for its intended use.</p> <p>Source: IM-GUIDE-09</p>
Geographic information system (GIS)	<p>A system used for the design, capture, storage, management and analysis of geographic data.</p> <p>Source: Commonwealth Government</p>
Industry foundation classes (IFC)	<p>A specification for a neutral data format to describe, exchange and share information typically used within building and facility management industry sectors.</p> <p>IFC data model consists of definitions, rules and protocols that uniquely define data sets, which describe capital facilities throughout their life cycles.</p> <p>IFC is the only non-proprietary, open global data model specification available.</p> <p>Source: buildingSMART</p> <p>IFC is defined by ISO 16739:2018 – IFC for data sharing in the construction and facility management industries.</p> <p>Note: In some circumstances, where there is a concern about lack of data readability or interoperability with some specific tools or purposes, the native files can also be shared together with IFC files.</p>
Information	<p>Knowledge concerning objects, such as facts, events, things, processes or ideas, including concepts, that within a certain context, have a particular meaning.</p> <p>Source: ISO/IEC 2382-1</p>

Information model	<p>Set of structured and unstructured information containers. This can relate to the operational phase or the delivery phase of a built asset i.e. a project information model or an asset information model respectively.</p> <p>Information models may include geometrical models, schedules, databases, etc. Unstructured information containers may include documentation, video clips, sound recordings etc.</p> <p>Source: ISO 19650-1: 2018</p>
Intellectual property (IP)	<p>The results or output of intellectual activity and creative effort. IP assets are intangible and their economic value exists largely in the set of exclusive rights that an owner has in the asset. IP may be protected through copyright, trademarks, patents, designs, circuit layouts and plant breeder's rights.</p> <p>Source: Department of Treasury and Finance IP Policy, August 2012</p>
Level 2 BIM	<p>Level 2 BIM is a level of maturity in BIM, which is distinguished by collaborative working. It involves developing asset information in a collaborative data-rich 3D environment, but created in separate discipline models. The collaboration is in the form of information exchange processes specific to a project and coordinated between different systems and project participants.</p>
Organisational information requirement (OIR)	<p>Specification for what, when, how and for whom information is to be produced in relation to organisational objectives.</p> <p>Source: ISO 19650-1:2018</p>
Responsible, accountable, consulted and informed (RACI matrix)	<p>A matrix that clearly sets out the roles and responsibility for elements (such as scope, interfaces, information, etc.) of the project at various points of the project's life cycle. Roles and responsibilities of individual team members as well as the schedule of responsibilities for deliverables of the overall team should be defined.</p> <p>The RACI matrix should be a core element of the contractual obligations for all parties.</p> <p>With respect to DE, roles and responsibilities of data, interfaces, information, intellectual property, and assumptions should be clarified early, prior to contract award.</p> <p>Note: Victorian Government major projects may use existing systems and frameworks to define roles and responsibilities more broadly for the project. The RACI matrix for the DE component of works may fall under those existing systems and frameworks.</p>
Uni Class 2015TM	<p>A UK classification system. Uniclass 2015TM is a classification scheme for the construction industry. It is intended for organising library materials and for structuring product literature and project information. UniClass 2015TM comprises tables, each of which represents a different classes of construction information and deal with different scale of information. Each table can be used as a standalone table for the classification of a particular type of information, but, in addition, terms from different tables can be combined to classify complex subjects.</p> <p>Source: UniClass 2015TM</p>

Acronyms

ABAB	Australasian BIM Advisory Board
AIR	Asset information requirements
AMAF	Asset Management Accountability Framework
BIM	Building information modelling
CAD	Computer-aided design
CAFM	Computer-aided facility management
CDE	Common data environment
CFO	Chief Financial Officer
CIO	Chief Information Officer
COBie	Construction Operations Building information exchange
COO	Chief Operating Officer
CTO	Chief Technology Officer
D&C	Design and construct
DE	Digital engineering
DEEP	Digital engineering execution plan
DELWP	Department of Environment, Land, Water and Planning
DET	Department of Education and Training
DPC	Department of Premier and Cabinet
DTF	Department of Treasury and Finance
ECI	Early contractor involvement
EIR	Exchange information requirement
EMV	Emergency Management Victoria
EPA	Environment Protection Authority
EPCM	Engineering, procurement and construction management

FEED	Front-end engineering and design
GIS	Geographic information system
HVHR	High Value High Risk
IFC	Industry foundation classes
iNSW	Infrastructure New South Wales
IoT	Internet of Things
IP	Intellectual property
IPEP	Infrastructure projects experts panel
ISO	International Organization for Standardization
NBS	National Building Specification
NDEPP	National Digital Engineering Policy Principles
OPV	Office of Projects Victoria
OVGA	Office of the Victorian Government Architect
PPP	Public private partnership
RACI	Responsible, accountable, consulted and informed
RPV	Rail Projects Victoria
SMES	Survey Mark Enquiry Service
TfNSW	Transport for New South Wales
VCC	Value Creation and Capture
VCIRA	Victorian Critical Infrastructure Resilience Arrangements
VCIR	Victorian Critical Infrastructure Register
VDAS	Victorian Digital Asset Strategy
VDASSC	Victorian Digital Asset Strategy Steering Committee
VDRP	Victorian Design Review Panel
VGRMF	Victorian Government Risk Management Framework

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