

Building Information Modelling for Work Health and Safety Management

**2B
Guide to Completing
Project Information
Requirement Template**

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Figure 01 Guide Note Document Hierarchy

TABLE OF ACRONYMS AND TERMINOLOGIES

AIR	Asset Information Requirements
BEP	BIM Execution Plan
BIM	Building Information Modelling/Building Information Model Interchangeable with digital model/digital modelling/digital engineering BIM definition:
Digital Twin	Digital Twin definition
ECI	Early Contractor Involvement
EIR	Exchange Information Requirements
HSE	Health and Safety Executive
IDMF	Infrastructure Data Management Framework
ISO	International Organisation for Standardization
OIR	Organisation Information Requirements
PIR	Project Information requirements
WHS	Work Health and Safety

FOREWORD

Construction is one of the most dangerous industries in which to work and many safety incidents, injuries and fatalities could be prevented through improved design, planning and communication. Building Information Modelling (BIM) is an enabling technology for the generation and management of digital design and construction information from which Work Health and Safety (WHS) hazards and related risks can be identified and managed. There is an opportunity for BIM to support the elimination or mitigation of risks. WHS management requires controls to be in place over the entire asset lifecycle including project planning, design, construction, end use, maintenance, decommission and demolition. BIM as an enabler of data and information management provides the opportunity to improve health and safety through better analytics, modelling and simulation with the underlying assumption that this will provide for better insights, decisions and outcomes. Data as an asset to manage is core to this suite of guide notes in the BIM for WHS Management Decision Framework.



Skye Buatava,
Director, Centre for Work Health and Safety

Scientific research is vital to improving our way of life and work health and safety is an important part of our work lives. The research that created these guidelines has the capability to put Australia on the cutting edge of safety practices in our infrastructure projects and highlights the way businesses can use BIM to improve their WHS outcomes. I'd like to thank our research partners who led with project with the Centre and also acknowledge our national and international contributors for sharing your experiences so freely with us.



Claudelle Taylor,
Enterprise Solution Managers, CIMIC

Our industry needs tools to bring BIM and WHS management together and best practice examples are key to this. We are a very competitive sector and we are often looking over our shoulder to see new ways of managing BIM. The best practice examples in this Decision Framework across the six areas give us insights on what to do and also trigger other ways we can adapt to the digital world through WHS.



Prof Kerry London,
Pro Vice Chancellor Research, Torrens Global
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The study is an excellent example of impactful research through involving end users of research. The Decision Framework is also informed from analysis of policies and practices in other countries coupled with international research on Building Information Modelling adoption over the last decade. Australian researchers at different times have led the way in construction IT research and are certainly a leader in construction safety research. I was delighted to lead this research project and chair the Industry Advisory Group. I am deeply grateful to all those who contributed from the advisory group, the researchers at Torrens University Australia, Western Sydney University and the Centre for Work Health and Safety.

ACKNOWLEDGEMENTS

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BACKGROUND CONCEPTS

ABOUT THIS GUIDE NOTE

The Guide Note provides information derived from a research study sponsored by SafeWork NSW Centre for Work Health and Safety and completed by Torrens University Australia and Western Sydney University. The Guide supports the NSW implementation of the Infrastructure Data Management Framework and the ISO 19650 series. This guide sits within an overall Decision Guidance Framework as shown in Figure 1. The purpose of this Guide Note is to provide tips and examples on principles and processes on developing information requirements to support BIM for WHS management. The Guide Note was commissioned for the state of New South Wales, Australia, however it is suitable for other states and other countries.

- Background concepts for information management in BIM environment
- Introduction to Organisational, Asset, Project and Exchange Information Requirements
- Self-assessment matrix on capabilities and capacity to integrate BIM and WHS management

GUIDE NOTE DOCUMENT HIERARCHY

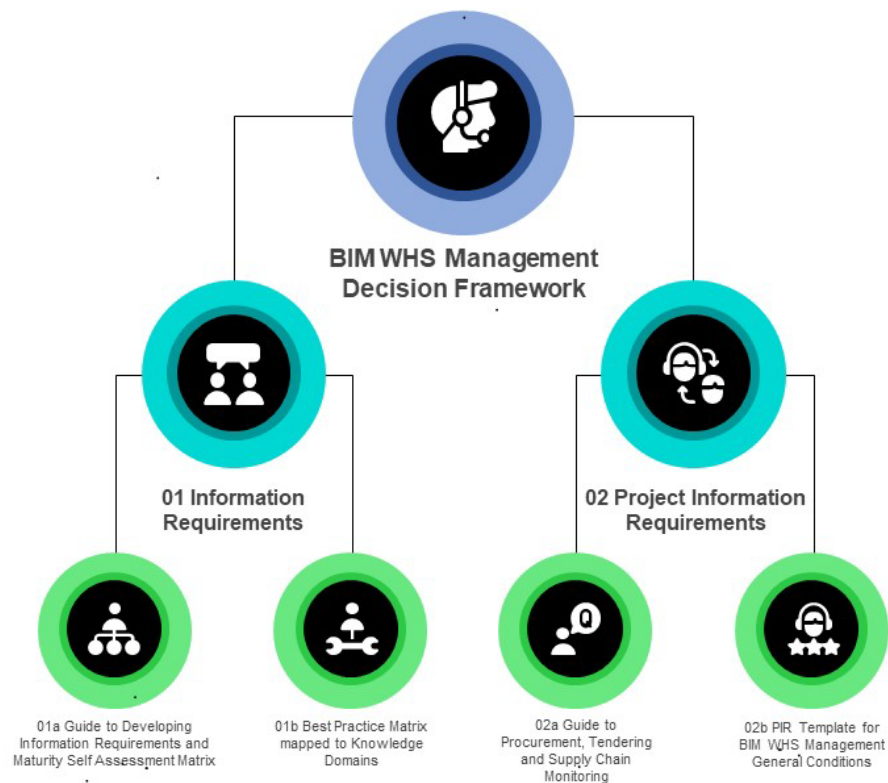


Figure 1 Guide Note Document Hierarchy

WHAT IS THE PURPOSE OF EACH GUIDE NOTE

GUIDE NOTE 01A DEVELOPING INFORMATION REQUIREMENTS

The purpose of this Guide Note is to assist leaders to collaborate to develop quality information for BIM for WHS integration. The self-assessment maturity matrix is useful for clients and the client leadership team including primary contractors and consultants to help to evaluate their own approach to implementing BIM and WHS management integration both individually and as a team.

The Guide acknowledges that such client leadership is achieved through different pathways. Therefore, the Guide presents resources such as a Self-Assessment Matrix and construction project examples that acknowledge different levels of adoption and implementation across the industry, while showcasing possible next steps for supply chains in different stages of maturity.

In construction sectors in Australia and internationally, BIM and WHS are still treated as separate concepts. The opportunity that applying structured digital information requirements in relation to WHS management on projects can play is often overlooked. The Guide showcases case studies and promotes ideas that assist organisations and project leaders to adopt BIM and WHS management.

GUIDE NOTE 01B BEST PRACTICE MATRIX MAPPED TO KNOWLEDGE DOMAINS

The purpose of the Best Practice Matrix mapped to WHS Knowledge Domains is to provide specific examples to showcase different ways other clients and leadership teams have approached integrating BIM and WHS management. The example case studies are mapped across the six Knowledge Domains of Scenario Planning, Requirement Briefing, Risk Assessment, Education and Training, Monitoring and Assurance and Reporting and Analysis. Definitions of each of the Knowledge Domains is provided in the Definitions and Terminologies section of this Guide Note as well as in the Matrix.

GUIDE NOTE 02A GUIDE NOTE TO PROCUREMENT, TENDERING AND SUPPLY CHAIN MONITORING

The purpose of the Guide to Procurement, Tendering and Supply chain monitoring for BIM and WHS management is to provide tips on principles and process.

GUIDE NOTE 02B PROJECT INFORMATION REQUIREMENTS AND GENERAL CONDITIONS

The purpose of the PIR Template for BIM WHS General Conditions is to provide recommendations for developing project specific information requirements.

WHO IS THIS GUIDE NOTE WRITTEN FOR?

PRIMARY STAKEHOLDERS; INFRASTRUCTURE INFORMATION MANAGEMENT

This Guide Note is for individuals and organisations involved in developing information requirements to underpin BIM-supported projects that will pursue the integration of BIM and WHS management. Those individuals and organisation may be operating on behalf of the appointing party, lead appointed party and the appointed parties. The Guide is typically for the leadership team including; clients, facility/asset managers, project directors, project managers, design consultants, contractors and key specialist subcontractors. It is specifically aimed at **senior executive and managers** who make decisions at a strategic level on assets and project design and construction delivery. It is useful for BIM professionals seeking to deepen their understanding of WHS management, as well as WHS professionals seeking to understand the capabilities of BIM.

The Guide is aimed at client organisations who wish to set the right environment and culture in relation to quality information management to support creating safe work environments during design, construction and operations.

PROJECT INFORMATION REQUIREMENTS: GENERAL CONDITIONS AND SPECIFIC CONDITIONS

INTRODUCTION

The Australian Construction Industry generates over \$360 billion in annual revenue, producing around 9% of Australia's Gross Domestic Product. The industry employs over 1.15 million workers and is estimated to grow more than 10% over the next few years.

The construction industry is identified as a national priority to reduce the number and rate of fatalities and serious injury claims in the Australian Work Health and Safety Strategy 2012-2022. The industry accounts for 9 per cent of total employment and includes three sub-industries: building construction (including both residential and non-residential); construction services (including site preparation, installation services, completions services); and heavy and civil engineering construction.

The use of Building Information Modelling (BIM) is identified as an influential way to improve Work Health and Safety (WHS) outcomes by improved design and planning, communication, information flow and risk analysis in all phases of an asset's lifecycle. BIM also provides added potential to include other emerging technologies and related data to better inform building and construction modelling and related WHS risk planning. This includes technologies such as proximity detection, people / plant interaction; artificial intelligence camera data streams; predictive maintenance information and other logistics planning technologies.

This Project Information Requirements (PIR) Template provides information derived from a research study sponsored by the SafeWork NSW Centre for Work Health and Safety and completed by Torrens University Australia and Western Sydney University. As the Component 2(b) of the Decision Framework developed from this research study, this PIR template document is based on a version that is currently under development by the BIM4H&S Working Group; but adopted based on empirical findings. This Template is also aligned with the ISO 19650 International Standards for Building Information Modelling. Ideally the Template should be completed in the early stages of a construction project, through co-operation between the Client, the Principal Designer and the Project Information Manager.

This Template provides Client assistance to define high level Project Information Requirements for design and planning and related Work Health & Safety. The Template provides a consistent way of describing Project Information Requirements, what they are, their source, who is the requirement owner, who verifies compliance and what type of information should be delivered at what stage of the project.

By combining the General Conditions and Specific Conditions for particular discipline issues, this Template identifies how designers from specialist disciplines can co-ordinate their work into the overall design. Complex and Significant Lifts is provided in this Template as a good example of how BIM is used in design and planning of complex and significant lifts to eliminate or minimise WHS risks.

By using this Template, Clients can specify the requirements they need, and be confident the information they require will be available at the right time in the project.

HOW TO COMPLETE THE PIR TEMPLATE

How to complete the General Conditions template

There are eight tabs on the General Conditions template. Firstly, the general conditions should be grouped into five categories including 1) client-initiated design and related risk information such as latent conditions; 2) roles, responsibilities and skills; 3) risk identification; 4) risk information sharing and use; and 5) risk information validation, verification, and generalisation. The second tab is Recommended Information Requirements (RIRs). Detailed requirements for the PIR General Conditions should be developed based on these RIRs.

In reference to Component 1a, the alignment of each RIR to the Themes of the Self-Assessment Matrix is provided. As the Matrix indicates there are three levels of adoption. The following RIRs are all directed at Level 3, which describes innovation initiators, industry leading practices and experimental exceptional adopters. The Requirement Source tab shows the international standards, Australian standards, legislation, codes of practice, compliance codes and policies, and requirements from stakeholders that the project has to benchmark against when a general requirement is developed.

The When Used tab represents when the information related to the specified requirement is essential. The information can be required during a specific stage or during several stages. It is classified into four stages: Planning, Design, Construction, and end use.

An audit should be allocated to help ensure compliance and the audit result is available on the next tab. The last tab 'Requirement Owner' represents who is responsible for fulfilling the RIR. How to complete the Specific Conditions template

There are seven tabs on the Specific Conditions template. Seven Recommended Information Requirements (RIRs) are provided in the first column.

Detailed requirements for the PIR Specific Conditions should be developed based on these RIRs. In reference to Component 1a, the alignment of each RIR to the Themes of the Self-Assessment Matrix is provided.

The Requirement Source tab shows the international standards, Australian standards, legislations and policies, codes of practice and compliance codes and requirements from stakeholders regarding Complex and Significant Lifts that the project has to benchmark against when a general requirement is developed.

The When Used tab represents when the information related to the specified requirement is essential. The information can be required during a specific stage or during several stages. It is classified into four stages: Planning, Design, Construction, and end use.

An audit should be allocated to help ensure compliance and the audit result is available on the next tab. The last tab 'Requirement Owner' represents who is responsible for fulfilling the RIR.

GENERAL CONDITIONS

Category	Recommended information requirements	Alignment to Component 1a	Requirement source	When used				Audited by	Audit result	Requirement owner
				Planning	Design	Construction	End use			
CLIENT-INITIATED RISK INFORMATION	Structure the design and other latent conditions or WHS information provided by the Client and the findings of hazard analysis and WHS review conducted by the Client into a digital format to enable appropriate use by stakeholders and compliance monitoring.	Theme 3 Theme 7 Theme 8 Theme 9	ISO 19650 ISO 45001 The model WHS Act 2011 The model WHS Regulation 2017 The model Codes of Practice / Compliance Codes	[x]	[x]	[x]	[x]			
	Establish a digital Information RACI (Responsibility, Accountability, Consultation, Information) Matrix that is aligned to the information provided by the Client to ensure the participants and service providers have direct access to this information.	Theme 3 Theme 6 Theme 7 Theme 8 Theme 9		[x]	[x]	[x]	[x]			
ROLES, RESPONSIBILITIES AND SKILLS	Maintain a tabulated list of all Service Providers and suppliers that is sufficiently detailed to provide evidence that digital requirements of design and related WHS information has been requested, provided and shared.	Theme 4 Theme 7 Theme 8 Theme 9		[x]	[x]	[x]	[x]			
	Establish and maintain a project specific digital skills and training matrix that details any special training requirements and links to verified copies of certificates.	Theme 5 Theme 7		[x]	[x]	[x]	[x]			
	Format the project specific digital skills and training matrix to allow periodic compliance monitoring using appropriate metrics.	Theme 5 Theme 7		[x]	[x]	[x]	[x]			

RISK IDENTIFICATION													
Develop a project specific Design Plan that includes the approach to design Risk Management and a list of design risk objectives and related construction delivery risk objectives for WHS.	Theme 3 Theme 7		[x]	[x]	[x]								
Develop a project specific Construction Plan that includes the approach to Construction Risk Management, the provisions for emergency events, and a list of construction risk objectives for WHS.	Theme 3 Theme 7		[x]	[x]	[x]			[x]	[x]				
Establish and maintain a comprehensive risk study schedule of all required risk assessments, workshops and reviews including risks in design that have been closed (eliminated or resolved) or that remain open and unresolved that must be transferred to the Construction Delivery Team or other identified owners, e.g., end user and Facility Management.	Theme 3 Theme 6		[x]	[x]	[x]			[x]	[x]				
Develop the Terms of Reference for the design and constructability reviews during planning, design and construction and end use phase.	Theme 3 Theme 10							[x]					
Develop a tabulated list of the surveys and investigations that are required to develop, complete or verify the design or construction solution and enable effective WHS management.	Theme 3 Theme 5 Theme 10		[x]	[x]	[x]				[x]				

RISK INFORMATION SHARING AND USE	Establish a digital data construct within the Common Data Environment to enable the WHS information to be routinely updated and accessed for use as intended.	Theme 4 Theme 7 Theme 8 Theme 9	[x]	[x]	[x]	[x]	[x]	[x]	[x]					
	Establish and use the data construct, tagging convention, application protocol and RACI (Responsibility, Accountability, Consultation, Information) references for the identified elevated risks in a unified manner throughout the project lifecycle.	Theme 3 Theme 8 Theme 9	[x]	[x]	[x]	[x]	[x]	[x]	[x]	[x]				
	Establish the data construct of the structured outputs relating to elevated risks to allow filtering, use-of, analysis and proactive risk management through various metrics.	Theme 3 Theme 8	[x]	[x]	[x]	[x]	[x]	[x]	[x]	[x]				
RISK INFORMATION VALIDATION, VERIFICATION, AND GENERALISATION	Establish a structured standardised data schema that enables the design and related WHS information to be accessed, filtered and used by other participants in planning, managing and controlling WHS risks.	Theme 3 Theme 4 Theme 5 Theme 8 Theme 9	[x]	[x]	[x]	[x]	[x]	[x]	[x]					
	Develop an information schedule of validation and verification by the design team to support the validation of the built asset and verify functional performance in compliance with the design intent.	Theme 4 Theme 5 Theme 8	[x]	[x]	[x]	[x]	[x]	[x]	[x]	[x]				
	Develop and maintain a schedule of as-built records that is sufficiently detailed to track the progressive validation of the built asset.	Theme 4 Theme 5 Theme 8								[x]				
	Structure the data into a digital format to enable continuous learning and knowledge sharing.	Theme 8 Theme 10	[x]	[x]	[x]	[x]	[x]	[x]	[x]					

SPECIFIC CONDITIONS - COMPLEX AND SIGNIFICANT LIFTS

Recommended information requirements	Alignment to self-assessment matrix	Requirement source	When used				Audited by	Audit result	Requirement owner
			Planning	Design	Construction	End use			
<p>Schedule of lifts</p> <p>From design outset, digitally develop 1) a Schedule of Construction Crane Lifts for all lifts that are complex; 2) a Schedule of Asset Operation and Maintenance Lifts for all significant lifts; 3) a Schedule of Mobile Plant for all operational and maintenance tasks that require people, materials and waste to be lifted and lowered associated to work activity purposes of the asset in-use; and 4) a Schedule of Fixed Lifting Appliances for all lifting equipment permanently installed in the asset.</p> <p>Incorporate appropriate metrics into these Schedules relating to the significant lift and immediate locale that can be used for risk treatment by design and to plan and control the lift(s).</p> <p>Maintain the Schedules throughout the work stages.</p> <p>Denote all complex lifts supported with a visualisation on the Schedules and linked to the visualisation.</p>	<p>Theme 3</p> <p>Theme 4</p> <p>Theme 5</p> <p>Theme 8</p> <p>Theme 9</p>	<p>ISO 19650</p> <p>ISO 45001</p> <p>The model WHS Act 2011</p> <p>The model WHS Regulation 2017</p> <p>The model Codes of Practice / Compliance codes</p>			<p>Construction</p> <p>[x]</p>	<p>End use</p> <p>[x]</p>			

Recommended information requirements	Alignment to self-assessment matrix	Requirement source	When used				Audited by	Audit result	Requirement owner
			Planning	Design	Construction	End use			
<p>Buildability and safety: early contractor/subcontractor involvement</p> <p>By collaboration between stakeholders, i.e., designers, principal contractor, sub-contractors, and end-users to develop Plans and 3D or 4D Digital Visualisation progressively throughout design for eliminating or minimising risk.</p> <p>Reducing risk related to slinging and lifting complex lifts as follows:</p> <ol style="list-style-type: none"> 1) each construction complex lift - design and construction complexity, scope of project and scale; 2) modelling of complex lifts including logistics and transport arrival at the site, slinging and lifting of the load including any tailing by another crane; 3) each identified complex lift and crane equipment specific to lifting people in construction, e.g., Workbox; 4) each operation and maintenance complex lift using a portable lifting apparatus, mobile crane or other; 5) each identified complex lift required in the operation or maintenance of the asset; 6) the installation, operational use and dismantling of each Tower Crane; 7) where the design of the permanent works involves complex geometry of structural elements or complex prefabrication installation. 	<p>Theme 3</p> <p>Theme 4</p> <p>Theme 8</p> <p>Theme 9</p>		<p>Planning</p> <p>[X]</p>	<p>Design</p> <p>[X]</p>	<p>Construction</p> <p>[X]</p>	<p>End use</p> <p>[X]</p>			

Recommended information requirements	Alignment to self-assessment matrix	Requirement source	When used				Audited by	Audit result	Requirement owner
			Planning	Design	Construction	End use			
<p>Permit to work</p> <p>Develop a digital Permit to Work for Complex Lifts for implementation prior to construction works commencing. The permit to work system shall:</p> <ul style="list-style-type: none"> • detail information about the complex item to be lifted; • link to lifting plans and visualisations including logistics at the site; • denote any temporary works required or affected by the intended complex lift; • link to the temporary works design register; • include fields that confirm any Lift Plan and design of any associated temporary works have been verified by relevant engineers. 	<p>Theme 3 Theme 8 Theme 9</p>			[X]					
<p>Temporary loading</p> <p>Use 3D or 4D visualisations to examine, co-ordinate and resolve the magnitude, duration and sequence of temporary loading or loaded conditions.</p> <p>These visualisations should include the fully detailed information of the complex lift and placement of structural components, materials or equipment resulting in load transfers, partial load capability, limited permissible deflection, requirements for temporary bracing and other relevant metrics.</p> <p>The impact of wind loads on the complex lift and related temporary works or equipment, items being lifted and partially erected temporary structures or permanent structures in a temporary supported state, such as cladding systems, use visualisations to analyse solutions and communicate safe systems of work.</p>	<p>Theme 3 Theme 4 Theme 8 Theme 9</p>		[X]	[X]	[X]				

Recommended information requirements	Alignment to self-assessment matrix	Requirement source	When used				Audited by	Audit result	Requirement owner
			Planning	Design	Construction	End use			
<p>Lifting Equipment Develop a digital Register of Lifting Equipment, implement it prior to any complex lifts being undertaken, and maintain the Register throughout the construction phase.</p> <p>The Register shall detail the lifting gear and other lifting apparatus or accessories, and include data fields to manage the use, maintenance and quarantine of any lifting equipment.</p> <p>The Register shall include owned or hired-in lifting equipment that is required by any contractor on the project, including any specialist equipment.</p> <p>The Register shall be linked to the Schedule of Construction Complex Lifts and Permit to Work system to ensure alignment of the equipment to the nature and rating of the lift and the gear required.</p>	Theme 3 Theme 8 Theme 9		[X]	[X]	[X]				
<p>Re-apply visualisations for clash detection and buildability purposes, once structural connections are designed and the lifting solution determined.</p> <p>Where risk factors are to remain or additional precautions are identified, detailed information shall be clearly noted on the visualisation and relevant lifting plan.</p>	Theme 3 Theme 8 Theme 9		[X]	[X]	[X]				
<p>Add any lifting requirements identified during the operation or maintenance of the asset in-use that has not been previously identified and/or scoped to the Schedule of Mobile Plant and/or Schedule of Operation and Maintenance Lifts.</p>	Theme 3 Theme 8				[X]				

SOURCE MATERIAL

ISO 19650-1:2018	International Organization for Standardization. (2018). ISO 19650-1:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling – Part 1: Concepts and principles. Geneva: ISO.
ISO 19650-2:2018	International Organization for Standardization. (2018). ISO 19650-2:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling – Part 2: Delivery phase of the assets. Geneva: ISO.
ISO 19650-3:2020	International Organization for Standardization. (2020). ISO 19650-3:2020 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling – Part 3: Operational phase of the assets. Geneva: ISO.
ISO/CD 19650-4	International Organization for Standardization. (2020). ISO/CD 19650-4 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling – Part 4: Information exchange. Geneva: ISO.
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