BIMCommunityAfrica +
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present

BIM
Harambee
. Africa
2023

BIM Book

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BIM Book

BIM Book

The BIM Book is a collaboration outcome
of the BIMHarambee 2023 Project.

Building the
digital commons for thriving
buildings, cities, communities,
and environments in Africa
together.

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27, 28 July 2023

Dear participant

On behalf of the organising committee, it is our utmost pleasure to welcome you to the **BIMHarambee 2023** conference - dedicated to exploring the **Future of Work** in the context of Building Information Modeling (BIM). As this year's event is student and educator-focused, we are thrilled to witness the enthusiasm and fresh perspectives that you, the future leaders of the industry, bring to the table.

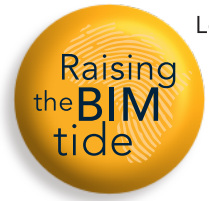
The **BIMHarambee 2023 BIM Book** serves as a platform for sharing knowledge, exchanging ideas and fostering collaboration between people passionate about BIM and its transformative potential. Our goal is to inspire and equip you with the necessary tools and insights to shape the built environment of tomorrow.

Over the next two days we will experience the latest advancements in BIM technology, project execution and its impact on the way we work in the industry. Embracing the conference theme, we aim to explore the exciting possibilities and challenges that lie ahead.

We thank you, all our sponsors and partners for joining us on this exciting journey. Let's engage, learn and grow together as we unravel the endless possibilities that the Future of Work holds in the realm of BIM.

Welcome to BIMHarambee 2023!

Let's build a brighter BIM future, one innovation at a time.



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Welcome!

We're thrilled to have you here! **BIMHarambee 2023** is all about collaboration and learning together. Don't hesitate to ask any questions, as there are no wrong or silly ones. Let's make the most of this event and enjoy ourselves!

Thurs 27 July | Seeing is believing

Real-world BIM learning from industry experts!

Learn about BIM and follow a real BIM process throughout the day, live at Boukunde! We will cover the why and what-for of the BIM project space. We start our day with learning about why we BIM, what is BIM thinking, what technologies, processes, or workflows are necessary, and what matters most to whom in the built environment.

Live Scan-to-BIM of Boukunde

Get ready for an exciting experience at Boukunde, your living laboratory! Join us as we demonstrate the integration of various technologies, including drone flights, SLAM scanning of building interiors and exteriors, and the fundamentals of scan-to-BIM. You'll witness firsthand how these technologies work together seamlessly. Get ready to explore and learn with us!

Boukunde BIM Scavenger Hunt - Yes, Prizes!

In the BIM spirit, we will have a Boukunde BIM Scavenger Hunt! Using the Boukunde models, mobile devices, and digital assets, can you find the clues and win the prize? Find out more at each of our partners' stands.

Fri 28 July | My BIM Journey

Focused Learning Sessions:

Morning Session | AECO Student and Young Professional | 09:00 to 12:00

Afternoon Session | AECO Educator and BIM professionals | 12:30 to 15:30

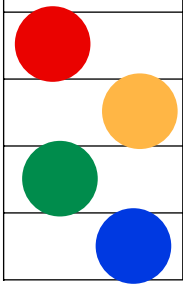
IMPORTANT INFORMATION

After the presentations on Thursday morning, you will get the chance to explore Boukunde and see what exciting tech is available. And also take part in the Scavenger Hunt that some of our partners are hosting. Check out their stand for more info.

Floor by Floor

You will see on your nametag that you have a coloured dot. Each dot represents the group you belong to. Red dots in the red group etc.

Starting at 11h45, you will go to the floor as assigned below. Every hour you will move to the next floor as allocated.



	11h45	12h45	13h45	14h45
	Basement	Ground Floor	Floor 1	Floor 2
	Ground Floor	Floor 1	Floor 2	Basement
	Floor 1	Floor 2	Basement	Ground Floor
	Floor 2	Basement	Ground Floor	Floor 1

Make sure you ask questions, listen to the presentations and exhaust your curiosity!

Refreshments are available for sale from the Vida-e Caffé in the basement, and The Artisan pop-up (both in Boukunde).

For more substantial meals, you can find 'The Artisan restaurant' next to Rautenbach Hall.

BIM Harambee . Africa

27 July 2023

Seeing is believing

8:00	Arrive at Boukunde and check-in	
9:00	**Welcome and scene-setting**	**Calayde Davey** Senior Lecturer, Dept of Architecture, UP
9:10	**Owner and FM Perspective** Buildings outlast us all - how can we take care of our future?	**Calayde Davey** Senior Lecturer, Dept of Architecture, UP
9:20	**Scan To BIM Workflows** A blow-by-blow account of the workflow process and the tech and software that enables it. Who, what, how, why.	**Richard Matchett** Digital Lead, Zutari **+ All partner reps**
11:20	**Live Scan To BIM and scavenger hunt and BIM activities** Explain how the rest of the day will work.	**Calayde Davey** Senior Lecturer, Dept of Architecture, UP
11:45 to 16:45	**DEMO TIME!** Each floor represents a different aspect of the workflow. It's your opportunity to visit each vendor, see how their tech solution fits into the workflow and get the chance to interact with it. There will also be a scavenger hunt with prizes.	

People + Process + Technology = The Future of Work

BIM Harambee . Africa

28 July 2023
My BIM Journey

Morning Session

FOR STUDENTS & YOUNG PROFESSIONALS

8:00	Arrive at Boukunde and check-in		
9:00	**SAPOA: Proptech** Shaping the future of the SA property market through technology - how the real estate sector is engaging technology to bring the built environment into a digital age and delivering a range of positive outcomes for stakeholders.		**Matthew Marshall** SAPOA PropTech Committee Representative
9:15	**What is BIM? No, really?** BIM workflows, core concepts and definitions.		**Machiel Odendaal** Tech Manager, Modena AEC and Infrastructure
9:30	**Boukunde Live-BIM** The outcomes of the live scan-to-BIM of Boukunde and connecting to how BIM is the future of building.		**Richard Matchett** Digital Lead, Zutari
10:15	**Break**		
10:30	**The state of the South African digital built environment**	Before we 'smart city', we need BIM - current environment and possibilities.	**Richard Matchett** Digital Lead, Zutari
		BIM Mandate and ISO19650 (with National Annex)	**Rudd van Deventer** Director, Spaceworx
11:00	**What opportunities are there for BIM professionals?** Opportunities for BIM professionals and how do I start my BIM journey as a young professional?		**Shameemah Davids** Digital Lead - Europe, AECOM
11:30	**Q&A with Industry Professionals**		**All Speakers**
12:00	**End of Morning Session**		

BIM Harambee . Africa

28 July 2023 Afternoon Session

My BIM Journey

FOR EDUCATORS, LECTURERS & PROFESSIONALS

11:45	Arrive at Boukunde and check-in		
12:30	**SAPOA: Proptech** Shaping the future of the SA property market through technology - how the real estate sector is engaging technology to bring the built environment into a digital age and delivering a range of positive outcomes for stakeholders.		**Matthew Marshall** SAPOA PropTech Committee Representative
12:45	**What does BIM mean for the future of work in my discipline?** BIM workflows, core concepts and definitions and important issues for educators.		**Suvaniya Pillay** BIM Specialist, Baker Baynes
13:00	**Boukunde Live-BIM** The outcomes of the live scan-to-BIM of Boukunde and connecting to how BIM is the future of building.		**Richard Matchett** Digital Lead, Zutari
13:20	**Break**		
13:30	**The state of the South African digital built environment**	Before we 'smart city', we need BIM - current environment and possibilities.	**Richard Matchett** Digital Lead, Zutari
		BIM Mandate and ISO19650 (with National Annex)	**Rudd van Deventer** Director, Spaceworx
14:00	**Teaching Case Study - BIM for Circularity, University of Pretoria** Education case study: BIM for Circularity - built environment postgraduate research unit.		**Calayde Davey** Senior Lecturer, Dept of Architecture, UP **Helene Potgieter** Owner and Principal Architect, HP Architects **Johann vd Merwe** Senior Lecturer, Civil Engineering, UP
14:45	**What must graduates be able to do in the professional environment?** Skill sets and learnings for interdisciplinary built environment works		**Gary Mansfield** Digital Innovation Lead, CKR
15:05	**Q&A with Industry Professionals**		**All Speakers**

WHAT THE HECK IS BIM?

What is Building Information Modeling and Management?

Building Information Modeling (BIM) is about improving collaboration, quality, and sustainability of building projects through shared digital workflows. BIM is a fundamental component of Virtual Design & Construction (VDC) - a digital representation of a building projects' physical, functional and process-related characteristics.

BIM provides a platform for creating, managing and sharing the digital representation of a building or infrastructure project while integrating shared project data and information. This allows stakeholders to collaborate, make informed decisions and optimise project outcomes. Compared to traditional project delivery, which is linear and hierarchical, BIM project delivery is collaborative and iterative.

BIM project delivery is therefore a multi-disciplinary collaboration and cooperation where each discipline brings their value contribution, shared perspective and expertise to the holistic BIM development process.

How to understand BIM

BIM can be understood as both a process of doing digital work for built environment works or as data management of built environment works, or both.

BIM as DATA

BIM utilises shared digital models in multiple dimensions, encompassing graphical and non-graphical elements such as drawings, information sheets and data in various formats like 3D, 2D, excel, PDFs and financial models. These models capture crucial design, construction and facility management information, generated by diverse digital tools employed by different stakeholders. The BIM data can be seamlessly exchanged between stakeholders, whether as a single model or a federation of multiple domain models.

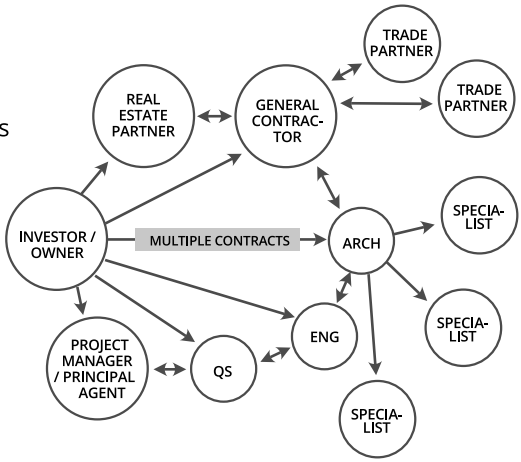
BIM as a PROCESS

BIM is a collaborative and integrated process for designing, analysing, executing, delivering and managing buildings. It involves a highly collaborative project team, including designers, builders and owners. The BIM process emphasises trust, transparency, effective communication and information sharing between participants. By leveraging technology and adopting value-based decision making, BIM aims to improve project outcomes by reducing errors, waste and costs.

In summary, BIM encompasses both the **management of data** in a digital model and the **collaborative process of designing and managing buildings in shared data environments**. By combining data and process, BIM enables effective collaboration, improves efficiency and enhances project outcomes.

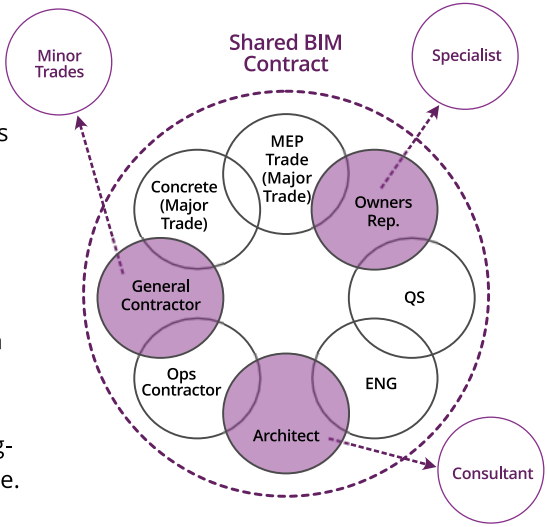
Traditional Project Delivery

Traditional project delivery follows a linear workflow with document-centric communication and strict team hierarchies. It may have limited design exploration and analysis, primarily focusing on construction outcomes. Collaboration and long-term performance considerations are much less emphasised.



BIM + Collaborative Project Delivery

BIM project delivery emphasises collaboration, real-time information sharing, and integrated teamwork amongst stakeholders. It utilises digital models for enhanced communication, clash detection and early design analysis. This approach considers the entire building life-cycle, ensuring long-term efficiency and performance.



In conclusion, **BIM project delivery** emphasises collaboration, real-time information sharing and a holistic life-cycle perspective, while **traditional project delivery** follows a linear workflow with construction-centric focus. Understanding these differences is crucial in selecting the most suitable project delivery method. **BIM project delivery** offers enhanced collaboration and long-term performance benefits, whereas **traditional project delivery** may have limitations in design exploration and analysis.

BIM is future-oriented and service focused

BIM project delivery is a collaborative and forward-looking approach that differs from traditional project delivery practices.

In traditional methods, each discipline and stakeholder works independently, leading to problems like rework, errors, miscommunication and coordination issues. As a result, each discipline and stakeholder works in their own silo of decision-making, information production, data management or model formats. This traditional situation also limits team members' ability to generate improved and integrated ideas, as they are often excluded from the projects' long-term vision and the opportunity to collaborate or innovate together. As a result, valuable resources and opportunities for leveraging innovation are missed.

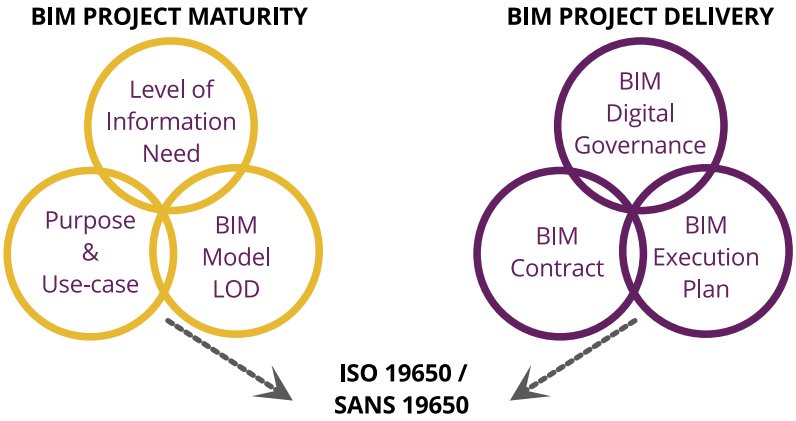
BIM project delivery seeks to address this limitation by fostering a collaborative environment where team members can contribute their insights, expertise and creativity to enhance project outcomes and find innovative solutions together early on. As such, BIM project delivery takes a service-oriented approach, considering future lifecycle and usefulness of the information that is produced during the project works. This perspective may also include lifecycle stages beyond design and construction, such as operations, sustainability or circularity in the built environment.

A BIM project must have purpose and structure

It is important to make a distinction between two key components for any successful BIM project. Both these components are equally important to BIM projects, and the one component helps to shape and inform the other.

The one component is the process of developing the BIM models themselves. This is dependent on how sophisticated the BIM project needs to be. Let's call this the **BIM Project Maturity** process. This process helps to establish 'what to BIM for' and setting shared objectives among the project stakeholders.

The second component is the process of executing BIM project works in useful and collaborative ways. Let's call this the **BIM Project Delivery** process. This process helps to establish 'how to BIM', i.e. how the diverse team-members plan to execute the BIM works together. This process includes the clear articulation of *BIM Digital Governance*, *BIM Contracts* and *BIM Execution Plans*. These two are what make up a BIM project.



Understanding the BIM project ecosystem in simple terms.

Together, these concepts are distinct but very important aspects in BIM projects. Definitions and technical details of these and other concepts are underwritten and defined within the ISO 19650 and SANS 19650 BIM Standards. Let's take a look at these two concepts in more detail.

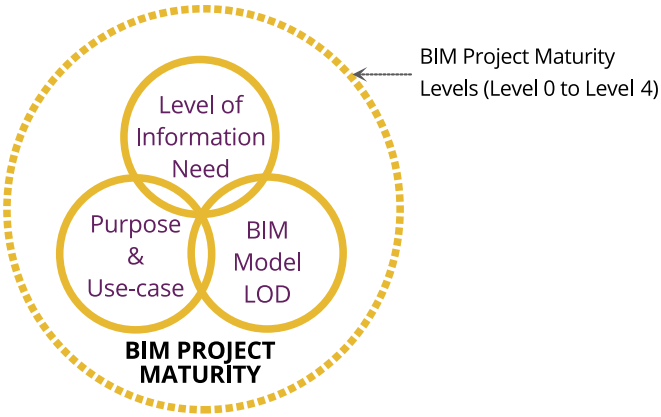
BIM PROJECT MATURITY

BIM Project Maturity

BIM Project Maturity involves creating detailed digital representations of important information regarding building or infrastructure projects throughout their entire life-cycle. BIM models are driven by the project's specific data and information needs, using specialised software and techniques to create comprehensive and multi-dimensional representations for information exchange between all the different stakeholders. BIM models may include many disciplines, such as architectural, structural, quantity surveying, heritage and environmental specialists, project management and engineering information, all in one shared digital space.

Unlike traditional 2D drawings, BIM modeling creates a common reality, a collaborative and information-rich environment. Stakeholders can visualise, analyse, and simulate the project before development, construction or operational processes begins. The BIM model serves as a central hub of information, enabling better coordination, clash detection, and informed decision-making during the design and construction phases. BIM modeling enhances project visualisation, promotes clash-free coordination, and improves overall project efficiency.

To determine the BIM project potential, it is helpful to understand the BIM Maturity Levels that are possible or likely to emerge in the next century (BIM Level 0 to BIM Level 4). Within this framework, it is also important to understand three big ideas to build effective BIM projects and models. These are the project *level of information need*, the *BIM purpose or use-case*, and the BIM model *level of development* (LOD).



Simple framework for core ideas in BIM development.

BIM Maturity Levels

A useful framework for assessing maturity in BIM projects, goals, outcomes or evaluating the capabilities of BIM teams is using BIM Levels. BIM Levels signify a progressive maturity in BIM collaboration, data sharing, and technological integration among project stakeholders. BIM Level 2 is a common target for most BIM projects.

BIM Level 0 Basic 2D work without BIM integration or software.

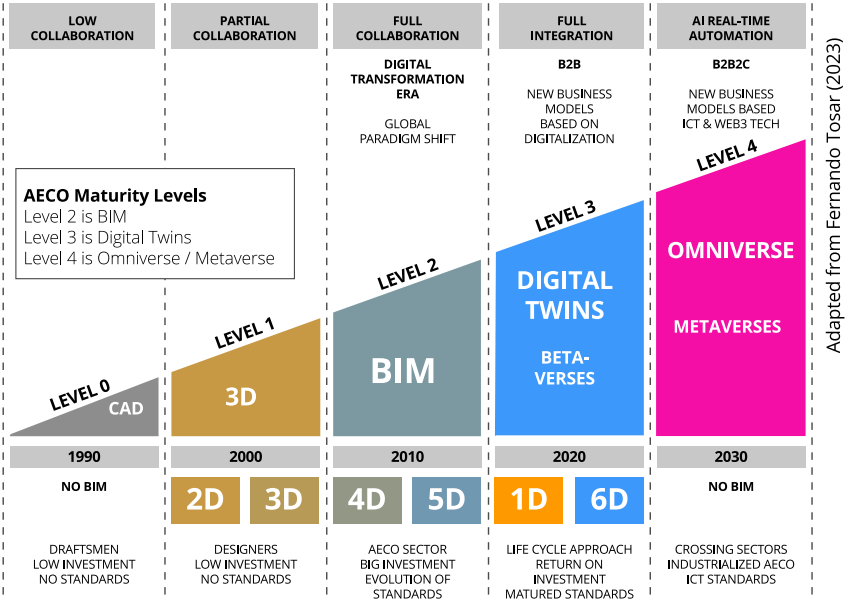
BIM Level 1 Combination of 2D and 3D work for internal use.

BIM Level 2 Collaborative practices with federated BIM models using common file formats and data environments.

BIM Level 3 Fully integrated collaboration between teams and with AI, partial or full digital twins, and real-time cloud-based ecosystems (betaverses)

BIM Level 4 Advanced BIM maturity with comprehensive digital twins and predictive design in the omniverses or metaverses.

The future of BIM sparks passionate debates, particularly concerning its language, definitions, and terminology. BIM, as both a technology and process, is continuously evolving. This dynamic development brings immense potential and promising opportunities for the future of work in the built environment.



BIM projects are driven by the level of information needs

In BIM, *information need* refers to the specific information that stakeholders require during the entire project journey. Architects, engineers, contractors, owners, governments, or consultants all have unique roles to play in the project, and therefore, specific information needs. Each stakeholder needs different information at various levels of detail and at different project stages. It is better to think of BIM as the process of work that fulfils on the *information needs* of the whole project and servicing the *information needs* of stakeholders.

For example, architects may need historical data and 3D building geometry to preserve heritage aspects, while environmental consultants seek energy performance and sustainability metrics for environmental assessments. Contractors rely on construction schedules and cost estimates, and facility managers require maintenance information. Yet, all these diverse information layers converge on the same physical project.

Information need require shared realities

BIM processes address these diverse information needs by providing a centralised digital platform where stakeholders can access and share the specific data they require, promoting collaboration and shared project outcomes. Each stakeholders' unique *information needs* shape the purpose of the BIM project and influence how information is created, managed, and utilised throughout the project life-cycle.

By clearly understanding *information need*, the BIM team can decide on the specific BIM purpose or *use-case* together. This shared reality helps determine the level of detail needed in the BIM models, ensuring that the project work effort aligns with the project's goals.

In traditional projects, stakeholders work independently, resulting in different perspectives and separate realities. However, in BIM projects, all stakeholders articulate a shared understanding, goals, and values from the start, preventing conflicting issues and wasted effort later on. BIM projects do this on shared digital platforms, where stakeholders can access and share the specific data they require from each other in a common data environment. This practice promotes collaboration and aligns project outcomes. Each stakeholders' *information needs* shape the purpose of the BIM project and influence how information or models are created, managed, and utilised throughout the project life-cycle.

The level of information need and ISO 19650 / SANS 19650

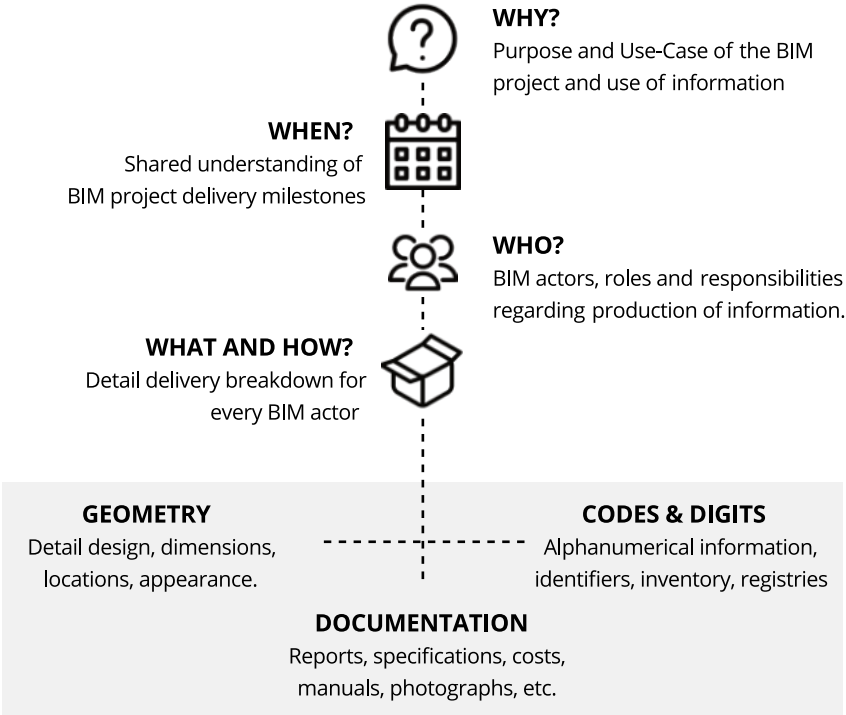
ISO 19650 defines *level of information needs* as the quality, quantity and granularity of information for the BIM project. Additionally, each project information deliverable needs to be determined based on the BIM purpose, or *use-case*. To achieve the precision, efficiency, utility, and value within BIM projects, *information needs* should be delivered along the following principles:

with the proper content

on time

in the right amount

It is important to have a shared information framework to determine the type and richness of *information needs* between the project stakeholders. This helps to reduce the occurrence of errors, insufficient, wasteful, or incorrect information. We articulate these information needs in the *BIM Digital Governance* documents, such as the *BIM Contract* and the *BIM Execution Plan*.



Understanding Level of Information Needs, adapted from Catenda Hub (2023).

BIM use-case development

Every BIM project needs to have a specific purpose so that the work and information is useful to the project stakeholders and broader ecosystem. We determine the BIM project's purpose based on the type of information the BIM models contain. We call this the purpose the BIM *use-case*. BIM *use-cases* depend on what information different people involved in the project need. We call this the *level of information need*. We outline these information needs in our *BIM Governance Documents*, such as the *BIM Contracts* and *BIM Execution Plans*.

Typical BIM use-cases

Traditional project delivery usually only involves only two dimensions, but BIM project delivery can have many more dimensions and uses of information. BIM projects are integrated information models. This means BIM models integrate all sorts of extra layers of information in a project. Articulating clear and specific *use-cases* make the BIM models very helpful to stakeholders and team members over the full lifecycle of the project.

Most BIM projects focus on 3D, 4D, and 5D BIM *use-cases*. 3D BIM shows the projects' three-dimensional context. 4D BIM includes time and processes. 5D BIM includes costs and business decisions. Beyond 5D BIM, we can develop unique *use-cases* based on specific information needs agreed upon by everyone involved in the project. To decide on the *use-case* of a BIM project, we need to know what the project team aims to achieve. These *use-cases* can take different forms, which we define using the concept of "*level of information needs*." Having a common digital *use-case* helps the team understand each other better, and work towards a shared purpose.

Understanding common BIM use-cases.

Unique or advance BIM use-cases

Unique or advanced BIM *use-cases* extend beyond traditional dimensions like 3D, 4D, and 5D. Such *use-cases* encompass a wide range possibilities, such as heritage, operations, facilities management, circularity, prefabrication, or environmental performance. Leveraging technologies like artificial intelligence, machine learning, virtual reality, and augmented reality, advanced BIM enables simulations, predictive analysis, optimisation, or automations. Such BIM projects enhance decision-making, clash detection, energy analysis, or facility management operations, among others. By visualising and simulating complex scenarios, advanced BIM helps stakeholders identify issues early on, improve project coordination, optimise resource allocation, and create more efficient and sustainable built environments.

SUSTAINABILITY PERFORMANCE BIM

ENERGY PERFORMANCE BIM

FACILITIES & OPERATIONS BIM

CONSTRUCTION SAFETY BIM

HEALTH & WELLNESS BIM

LOGISTICS BIM

PROCUREMENT BIM

PREFABRICATION BIM

HERITAGE BIM

RISK & HAZARD BIM

DECONSTRUCTION BIM

LIFE-CYCLE BIM

LEAN DESIGN & CONSTRUCTION BIM

BIM FOR DIGITAL TWINS

INDUSTRY AUTOMATION BIM

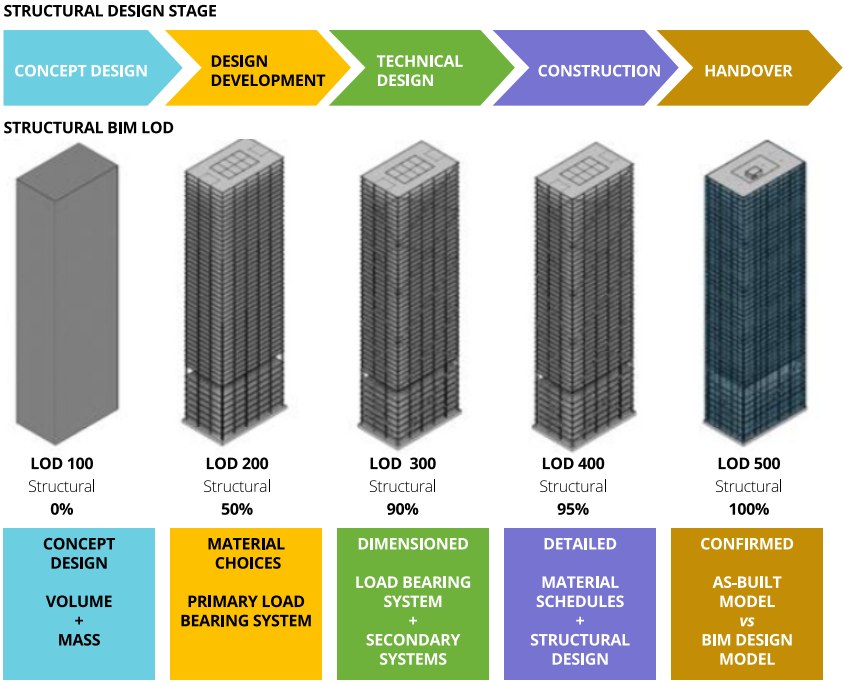
CIRCULARITY BIM

There is limitless potential for BIM *use-cases*, as BIM *use-cases* are based on the unique information needs of the project and its stakeholders.

BIM model levels of development (LOD)

The maturity of a BIM model can be measured against the *information need* of the project. Not all projects have high levels of information needs, but many do. As such, it is common for most BIM projects to coordinate team efforts and delivery models and information to a predetermined *level of detail or development* (LOD). LODs may be vary for different project milestones and information needs of stakeholders. LODs are articulated by the stakeholders together, and confirmed in the *BIM Digital Governance*, such as the *BIM Contracts* and *BIM Execution Plans*.

LODs are used to gauge the level of detail and reliability of information within a BIM model. LODs indicate the completeness, accuracy, and usefulness of elements and objects at various project stages. Most BIM projects range from LOD 100 to LOD 500, where each LOD represents the extent of development, completeness, and detail of the BIM components. Higher LOD levels indicate more comprehensive, refined or unique informational models, as is articulated by the *information need* of a specific project.



Common BIM LODs from Structural Engineering BIM perspective, adapted from Bertin et al (2020).

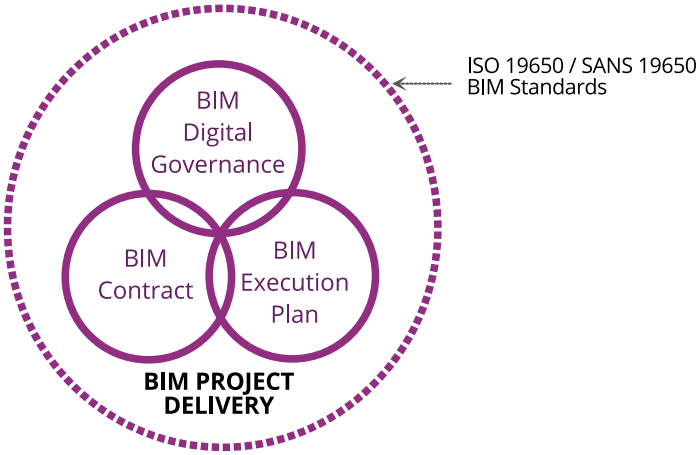
BIM PROJECT DELIVERY

BIM Project Delivery

BIM Project Delivery encompasses the integrated management and execution of built environment projects using BIM. It involves leveraging BIM technology, project governance, and collaborative workflows to enhance communication, coordination, and information exchange among stakeholders. This approach promotes a streamlined project management process, where data-rich models and information are shared and utilised throughout the project life-cycle. Key tasks include creating a *BIM Digital Governance*, *BIM Contracts*, and *BIM Execution Plans*. These help define project requirements and standards, implementing information exchange protocols, and utilising collaborative platforms. The goal of BIM project delivery is to improve outcomes by enhancing coordination, reducing errors, optimising resources, and facilitating efficient construction processes.

BIM Digital Governance and Standards

ISO 19650 is an international standard that guides the management of information in BIM projects. It establishes clear roles, governance structures, and processes for effective information management. The standard emphasises defining information requirements, using common data environments, and ensuring data accuracy and security. By following ISO 19650, organisations can improve decision-making, project outcomes, and efficiency throughout the asset life cycle.



Simple framework for core ideas in BIM Project Delivery.

BIM ISO 19650 Standard

ISO 19650 provides guidelines and procedures for the management of information throughout the lifecycle of a built environment asset using BIM. ISO 19650 is built on the foundations of the UK PAS 1192 (Publicly Available Specifications). PAS documents set out requirements for achieving *BIM Level 2* through a framework for collaborative working and information requirements. The International Organisation for Standardisation developed the ISO 19650 standard from the PAS.

SANS 19650 - Why do we need a South African standard?

When a standard is used in only one country, it's easy to follow. But when a standard needs to be used all around the world, we have to make adjustments to fit different world contexts. This helps each country use its own language, contract forms, and descriptions to explain things in a relevant way. For example, in ISO 19650, they use the term "Appointing Party," which means the same thing as "Client" in our everyday language. In ISO19650, the "Professional Team" is called "Appointed Parties." Therefore, it is important to contextualise ISO 19650 for relevance and consistency with our local built environment culture.

In South Africa, we made a special addition called the National Annex to achieve a SANS 19650 BIM standard. The National Annex is a critical document in putting a South African 'flavour' on how we want to work with ISO 19650 and which systems we adopt for the categorisation of entities, spaces, elements, components, systems, and products. With our own SANS 19650, everyone in South Africa can understand the language and BIM better and use this standard to create common realities among one another.

In summary, ISO 19650 / SANS 19650 helps us build good digital project governance for our BIM projects. Here are some core ideas about ISO 19650 / SANS 19650, why we should use such BIM standards when doing digital project works.

Establishing BIM methods and processes

All projects are unique, but ISO 19650 / SANS 19650 provides a standard methodology that a client (the appointing party) can establish the information requirements for the project. It also helps with establishing the right commercial and collaboration environment within which (multiple) appointed parties can produce information in an effective and efficient manner.

Establishing BIM scope and scale

ISO 19650 is voluntary and applicable to contracts of all sizes. It is recommended that ISO 19650 be applied proportionately and appropriately based on the asset or project's scale and complexity. The standard provides guidance through eight *Information Management Processes* to facilitate the execution of a BIM project. Instead of solely documenting a building or asset using BIM software, ISO 19650 focuses on guiding better data and information management practices, as opposed to using or prescribing particular BIM software to document a building, infrastructure, or other asset.

Establishing BIM roles and responsibilities

ISO 19650 offers an overview of various information models and provides practical guidance on utilising the standard. It describes how different project stakeholders can benefit from following these recommendations, promoting effective implementation and collaboration. In BIM, there is no "one size fits all." It is important that all parties to a BIM contract should be fully aware of the responsibilities they have contracted for. Therefore, ISO 19650 (*Clause 5: Information Management Processes*) emphasises the importance of clearly defining roles, responsibilities, and information requirements of project participants. It emphasises the need for collaborative working and information sharing as both a technical and social environment, which can be reflected in all BIM projects.

Establishing data and intellectual property rights

ISO 19650 allows for articulating intellectual property rights, liability, and dispute resolution mechanisms, which should be addressed in the contractual agreements between all the parties and subcontractors creating or using BIM information.

Establishing BIM execution and delivery mechanisms

In response to the call for from the client/appointing party the service providers/ appointed parties need to propose *BIM Contracts* and *BIM Execution Plans*. ISO 19650 guides the development of the *BIM Contracts* and *BIM Execution Plans* by establishing the need for a structured approach to managing information throughout the project life-cycle. It emphasises the importance of defining information requirements, information models, exchange formats, and protocols for coordination and collaboration. ISO 19650 emphasises the need for establishing clear processes and procedures for BIM model development, quality assurance and information delivery. These issues and needs must be clearly established and agreed upon upfront. These agreements must be described in the *BIM Governance Documents*.

BIM Project Governance

ISO 19650 helps the project team articulate good digital project governance. ISO 19650 provides overarching principles and requirements that influence the content and implementation of a contract that embodies the best principles of building information management. The proposed processes support participants in establishing a collaborative environment, defining information requirements, and implementing effective processes for information management, which are reflected in the contractual and execution documents.

A *BIM Contract* and a *BIM Execution Plan* are two distinct documents that serve different purposes in a BIM project. These documents help the team to govern the project.

BIM Contract (project information protocol)

A *BIM Contract*, also known as an information protocol, is a legal agreement between project stakeholders that outlines the contractual obligations, responsibilities, and rights of each party regarding BIM implementation, management, and production of information.

The *BIM Contract* includes how the common data environment (CDE) and data will be used on the project. The *BIM Contract* establishes the framework for collaboration, data exchange, intellectual property rights, liability, and dispute resolution related to the BIM project's information model. It also includes information security protocols, such as accessing and use for existing asset information, the use of shared resources, non-disclosure agreements on information, and protocols for when and how information can be reused or managed in the event of termination.

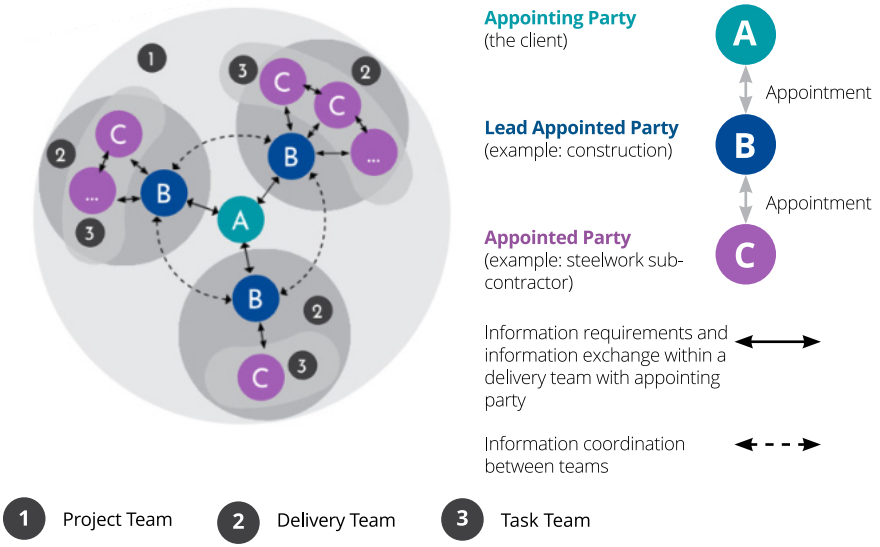
BIM Execution Plan (BEP)

On the other hand, a *BIM Execution Plan* is an agreement between all project stakeholders about project-specific strategies, processes, and methodologies for implementing BIM throughout the project life-cycle. It is a comprehensive document that outlines the project information and data road-map, how the project team will manage, coordinate, and deliver the BIM project information model(s) and confirms the project information protocol.

The *BIM Execution Plan* includes details on the information management strategy. This includes BIM information standards that will be used, roles and responsibilities of task teams, model level of development, coordination procedures, data exchange protocols, and quality control measures.

BIM appointment structures

In a BIM project, the *Lead Appointed Party* can be anybody managing the BIM project. It is not necessarily the architect or principal agents. BIM is not necessarily a principle agents' role. This role can be any appointment by the client and could be the clients themselves. This role is articulated in the *BIM Digital Governance* documentation.



Contract form for BIM Projects, adapted from UK BIM Framework (2023)

In summary, while a *BIM Contract* (*Project Information Protocol*) focuses on the legal aspects and obligations of project stakeholders for information management, the *BIM Execution Plan* focuses on the practical implementation and management of BIM information models within the project.

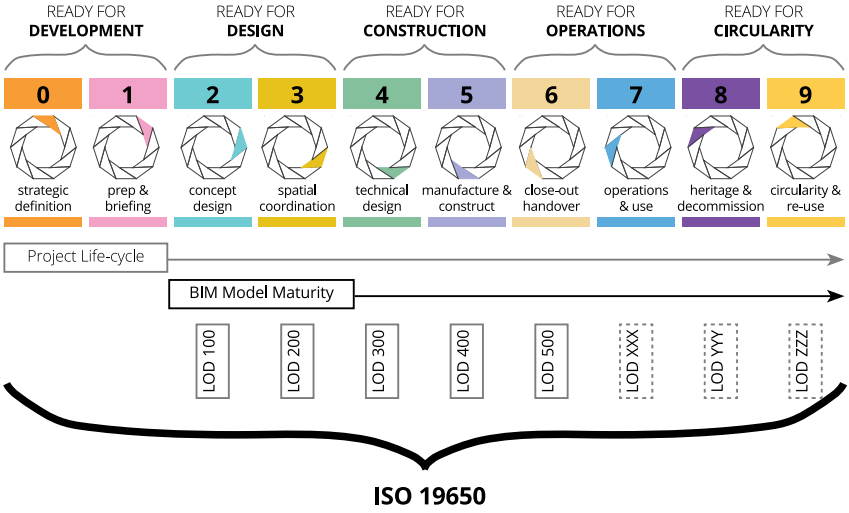
Together, these digital governance documents providing guidance on processes, procedures, and coordination to achieve the beneficial outcomes.

BIM PROJECT MILE-STONES

BIM is future-orientated and service focused

BIM is a future-oriented and service-focused approach that differs from traditional design and construction methods. While traditional methods often prioritise immediate tasks and work in isolated silos, BIM takes a holistic perspective that considers the entire project life-cycle. BIM teams adopt a long- term mindset, prioritising future milestones, sustainability, or circularity. Each BIM stage is carefully designed to prepare the project for the next milestone, in its life-cycle. By embracing this philosophy, projects benefit from a comprehensive approach that ensures readiness for future stages and promotes sustainable practices.

The BIM philosophy is instrumental in guiding projects throughout their life cycles. Each BIM stage is carefully crafted to prepare the project for the upcoming milestone. For example, Stages 0 and 1 focus on preparing the project for design, while Stages 4 and 5 aim to ensure readiness for operations. As the project advances, Stages 8 and 9 shift the focus towards achieving circularity, highlighting sustainability and future re-use. These stages are crucial in promoting a comprehensive and forward-thinking approach to project development.



Understanding BIM Project Milestones and BIM delivery (Davey, 2023).

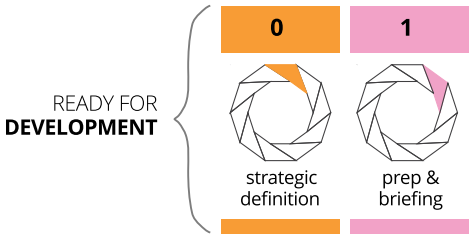
Successful BIM project delivery requires effective management and adherence to *BIM Governance Documents*. To achieve sound BIM governance, it is important to align these documents to the ISO 19650 BIM standards.

BIM project stages and common project milestones

BIM projects align with specific both the *information needs* from stakeholders and corresponding project milestones. However, BIM delivery stages and *levels of development* (LODs) may differ slightly from traditional project delivery stages. For example, in addition to the traditional work stages, BIM projects include four unique stages: Strategic Definitions (Stage 0), Operations and Use (Stage 7), Heritage and/or Deconstruction (Stage 8), and Circularity (Stage 9).

The joint articulation of BIM LODs with *information needs* and project milestones is essential and must be expressed in *BIM Governance Documents*, *BIM Contracts*, and *BIM Execution Plans*. This ensures that the BIM models and team workflows are in alignment with the overarching project objectives and meet the specific requirements of stakeholders throughout the entire project life cycle.

It is therefore more helpful to see LODs and BIM work stages as descriptors of the "completeness" and "usefulness" of BIM models as the BIM process is in service to the project and stakeholders' information needs.

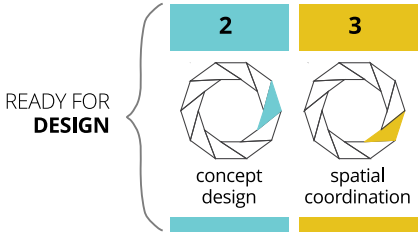


BIM Stage 0 | Strategic Definition

Stage 0 is very important in BIM. During the strategic definition stage, the client's business case and strategic brief are carefully evaluated to define the project's scope. Stage 0 focuses on making strategic decisions and documenting them in a business case, taking into account factors like pros and cons, project risks, and budget considerations. High-level site surveys and planning appraisals may be conducted, followed by a comparative analysis to recommend the most suitable site or design conditions for development. Stage 0 sets the foundation for the project and is followed by Stage 1, which involves further development of the project brief, feasibility studies, and assembling the project team. It is important to establish a solid foundation during Stage 0, including the creation of *BIM Governance Documents* such as *BIM Contracts* and *BIM Execution Plans*. Adhering to ISO 19650 principles during Stage 0 ensures the effective execution of the BIM project, while also confirming that the project aligns with the client's requirements, business case, and project objectives.

BIM Stage 1 | Preparation and briefing

BIM Stage 1 is also a critical phase in BIM. The primary objective is to gather the necessary information that the design team will need to commence the design process in Stage 2. Feasibility studies may be conducted to explore various considerations and ensure that the project's spatial requirements can be successfully accommodated on the site. However, it is important to distinguish these studies from the actual design process itself, commencing in Stage 2. While they may involve creating master-plan visions and making decisions on specific topics, they do not constitute the design process yet. It is essential to carefully assess the spatial and technical requirements of the project and the project team, in relation to the project budget, as there is a direct correlation between the building's area and its cost, and the aligning the capabilities of the project team members. This stage lays the groundwork for a successful design process in the subsequent stages of the project.

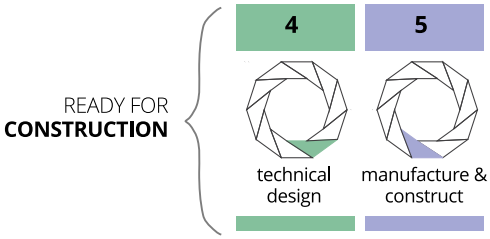


BIM Stage 2 | Concept design

BIM Stage 2 focuses on obtaining client approval and aligning design concepts with the project brief. This stage involves developing strategic architectural or engineering requirements that are in line with the project's cost plan, overall objectives, and specific specifications. It includes seeking client agreement on any changes or variations to the project brief, conducting design reviews with all stakeholders, and obtaining client sign-off through Stage Reports. These activities are captured in BIM models and environments as the models become more mature, coordinated, and detailed according to the *BIM Governance Documents*. Regarding statutory requirements, the stage involves seeking pre-submission planning advice and agreeing on steps to ensure compliance with building or land-use regulations. BIM Stage 2 is essential for refining the project's design concept, aligning the design with project objectives, and ensuring regulatory compliance, ultimately leading to a successful project development.

BIM Stage 3 | Spatial coordination/developed design

BIM Stage 3 focuses on spatially coordinating architectural and engineering information and designs using BIM models and environments. This stage involves conducting design studies, engineering analysis, and cost exercises to ensure a coordinated design aligned with the updated cost plan, project strategies, and outline specifications. This stage is very dynamic, and includes a lot of learning and iteration among team members. It also includes implementing change and quality control procedures, establishing the stage design program, and obtaining client approval through Design Stage Reports. BIM Stage 3 plays a crucial role in achieving a well-coordinated and developed design that meets both project requirements, team requirements, and regulatory standards.

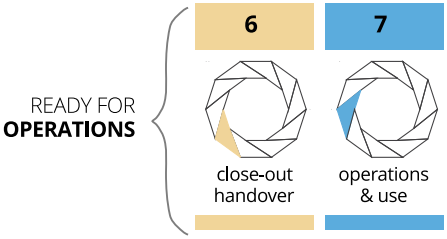


BIM Stage 4 | Technical design and design coordination

BIM Stage 4 is where all technical design and construction information is coordinated and finalised. This stage involves developing detailed architectural and engineering designs and coordinating BIM strategies, team models, and subcontractor BIM. It includes thorough clash-detection and model federation practices to ensure coherence between design, business case, project performance targets, and BIM models. Addressing statutory requirements, such as building regulation submissions and planning conditions, along with construction phase planning, is also part of this stage. The tendering and appointment of an appropriate contractor play vital roles during this phase. BIM Stage 4 establishes the groundwork for successful project construction and implementation.

BIM Stage 5 | Manufacturing and construction, tender and construction

BIM Stage 5 focuses on finalising manufacturing, construction, and commissioning processes. It involves completing site logistics, manufacturing, and installing building systems. This phase may also include digital construction planning or logistics in 4D or 5D BIM, commonly known as digital rehearsals. The construction program is carefully planned, rehearsed, monitored, and construction quality is thoroughly inspected through the use of BIM models. Any site queries are addressed and checked against the BIM models, and the building is commissioned to ensure proper functionality. A comprehensive *Building Manual*, including health and safety information and fire safety details, is prepared. The stage concludes with obtaining the *Certificate of Practical Completion*, creating a defects list, and gathering assets information. BIM Stage 5 is vital for the successful execution of manufacturing, construction, and commissioning activities while upholding high standards of quality and safety.



BIM Stage 6 | Construction handover and closeout

BIM Stage 6 is the pivotal moment when the building is handed over in accordance with its planned design and use strategy. During this stage, thorough aftercare is provided to ensure a smooth transition and successful conclusion of the building contract. The project performance is reviewed, and any necessary seasonal commissioning is undertaken. Defects identified are rectified, and a light-touch *Post-Occupancy Evaluation* is conducted to gather valuable feedback. Finally, the issuance of the *Final Certificate of Completion* signifies the successful completion of the construction phase. BIM Stage 6 focuses on ensuring a seamless handover process, addressing any outstanding issues, and conducting assessments to validate the project's performance and quality.

BIM Stage 7 | Operations and In-use

BIM Stage 7 marks the commencement of building occupancy and the full utilisation and maintenance of the facility. During this stage, facilities and asset management activities begin in full, ensuring the smooth operation and performance of the building. The performance of the building is evaluated through a *Post-Occupancy Evaluation*, providing valuable feedback for future improvements. In addition, project outcomes, including sustainability goals, are assessed to gauge the success of the project. As part of this stage, the *Building Manual* is updated, incorporating essential BIM information such as health and safety guidelines and fire safety protocols. BIM Stage 7 focuses on optimising building performance, maintaining safety standards, and continually improving the facility's operations and sustainability.

BIM Stage 8 | Lifecycle, heritage or deconstruction

BIM Stage 8 is relatively new. This stage of BIM is focused on unique aspects to the project's specific goals or context. BIM can aid in preserving the heritage value of structures by capturing information about their historical features and enabling informed restoration or renovation decisions. Furthermore, BIM could help to support the deconstruction process by facilitating the identification and removal of components for repurposing, recycling, or disposal, ensuring a sustainable approach to the dismantling of structures.

BIM Stage 9 | Circularity and re-use

BIM Stage 9 is also very new, dedicated to the project's specific future goals and greater contextual economic, social, or performance environment. BIM can play a crucial role in supporting circular economy practices by capturing data and information about the building or infrastructure's components, materials, and systems. This enables informed decisions regarding re-use and recycling options, promoting a sustainable approach to construction and reducing waste. By leveraging BIM, stakeholders can identify opportunities for component re-purposing, recycling, or responsible disposal, contributing to a more environmentally conscious and resource-efficient project during its life-cycle.

Helpful BIM Resources

There are thousands of useful and online resources to begin your BIM journey - and many of them are free!

Here are some starting points to get you going:

UK BIM Framework : www.ukbimframework.org

BIMcommUNITY.Africa : www.bimcommunity.africa

BIMHarambee 2023 sponsors : Feel free to visit all the BIMHarambee sponsors' webpages for additional learning and information content.

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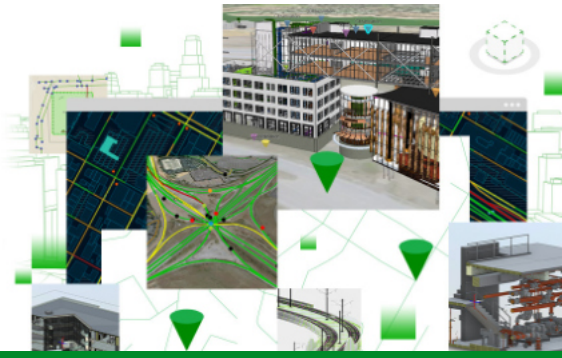
BIM COMM UNITY AFRICA

Raising the BIM tide

ArcGIS GeoBIM

Connecting projects and assets in context



Improving project coordination and delivery

ArcGIS GeoBIM delivers an innovative, easy-to-use web-based experience for teams to explore and collaborate on building information modeling (BIM) projects and issues, using data from multiple systems in a geospatial context. Architecture, engineering, construction (AEC) and operations teams can easily work with linked data and documentation in configurable web apps to simplify communication and collaboration.

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