

Advanced Use of 4D & 5D in Project Management

MAISARA AL RAIS



Agenda

- Introduction.
- 4D and 5D Advanced Usage.
- The Integration Framework.
- Data Structure Alignment.
- Data Collection, Synchronisation, Visualisation.
- Auto-Matching the 3D objects with the WBS/CBS



Introduction

- Embracing the future of construction, 4D and 5D BIM seamlessly integrate with AR, VR, IoT, and AI, revolutionising project visualisation, real-time data integration, and intelligent decision-making.
- A Common Breakdown Structure serves as the foundational blueprint for integrating 3D (physical model), 4D (time), and 5D (cost) dimensions in (BIM) and being able to connect data.
- Advanced use of 4D and 5D

Dynamic Data Integration:

- Incorporating real-time data from construction sites into BIM models, ensuring they are always up-to-date.

Version Control:

- Tracking changes over time (4D) and cost implications (5D) to maintain a historical record of project iterations.

Data Consistency:

- Ensuring uniformity in data representation across different project phases, enhancing accuracy and reliability.

Centralised Repository:

- Storing all project-related data, including time schedules and cost estimates, in a single, accessible location.

Internet of Things (IoT):

- **Data Collection:** Sensors on construction sites provide real-time data on equipment status, environmental conditions, and material usage.
- **Resource Management:** Tracking equipment and material usage, optimising allocation, and reducing waste.
- **Predictive Maintenance:** Using data to predict when machinery or equipment might fail or need maintenance.
- **Energy Efficiency:** Monitoring energy consumption in real-time and optimising for sustainability.

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4D/5D Usages

- FIELD TRACKING
- PROJECT MANAGEMENT COMMUNICATIONS
- PROJECT CONTROLS AND MONITORING
- HEALTH AND SAFETY
- SUSTAINABILITY AND ENERGY EFFICIENCY
- FACILITY MANAGEMENT

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The use of 4D/5D in Construction Delivery

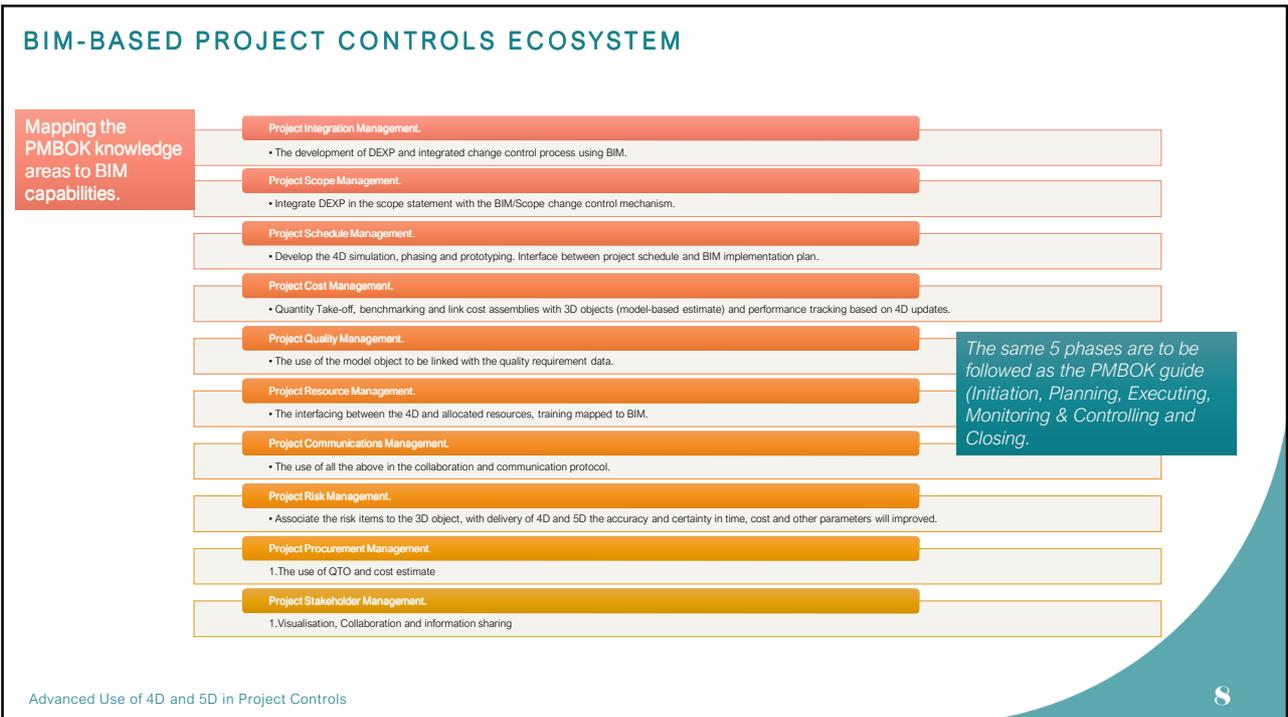
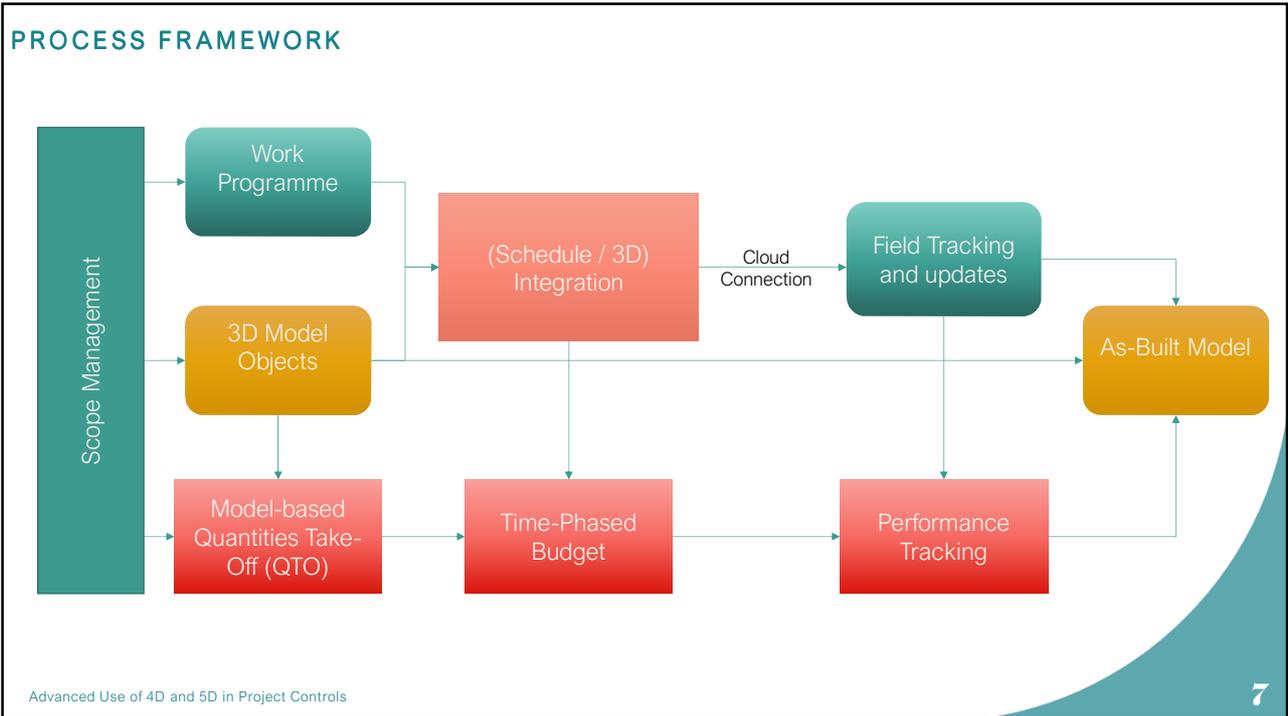
Usage	4D / 5D	Explanation
Connect with the site equipment through IOT to collect the site information and calculate the progress	✓	Using Internet of Things (IoT) devices, data is collected from site equipment to monitor and compute the construction progress in real-time.
Simulate the Environmental Impact and give a real-time material quantities update	✓	This involves creating a virtual representation to assess the environmental effects of the construction. Additionally, it provides live updates on material usage.
Site Progress Tracking	✓	This function allows stakeholders to monitor the ongoing construction activities and compare them against the planned schedule.
Use the simulation for safety review and rehearsal the construction	✓	Before actual construction begins, a virtual simulation is used to review safety protocols and rehearse construction processes, ensuring a safer work environment.
Performance Review	✓	After construction, the project's performance is evaluated against the initial goals and objectives to identify areas of improvement.
Operations & Maintenance (O&M) and Facility Management	✓	Post-construction, this function aids in the efficient management and maintenance of the facility, ensuring its longevity and optimal performance.

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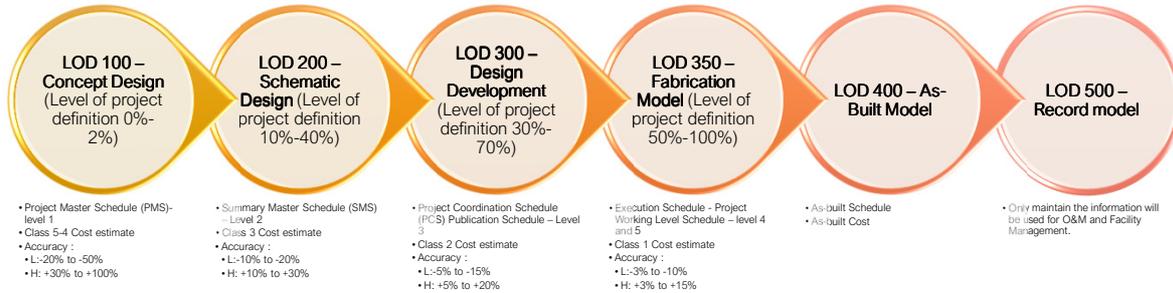
Integrated Framework

- PROCESS FRAMEWORK
- MAPPING PMBOK KNOWLEDGE AREA TO DIGITAL CAPABILITIES
- LEVEL OF DEVELOPMENT
- SYSTEM ARCHITECTURE

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INTEGRATION BETWEEN BIM WORKFLOW AND 4D/5D WORKFLOW

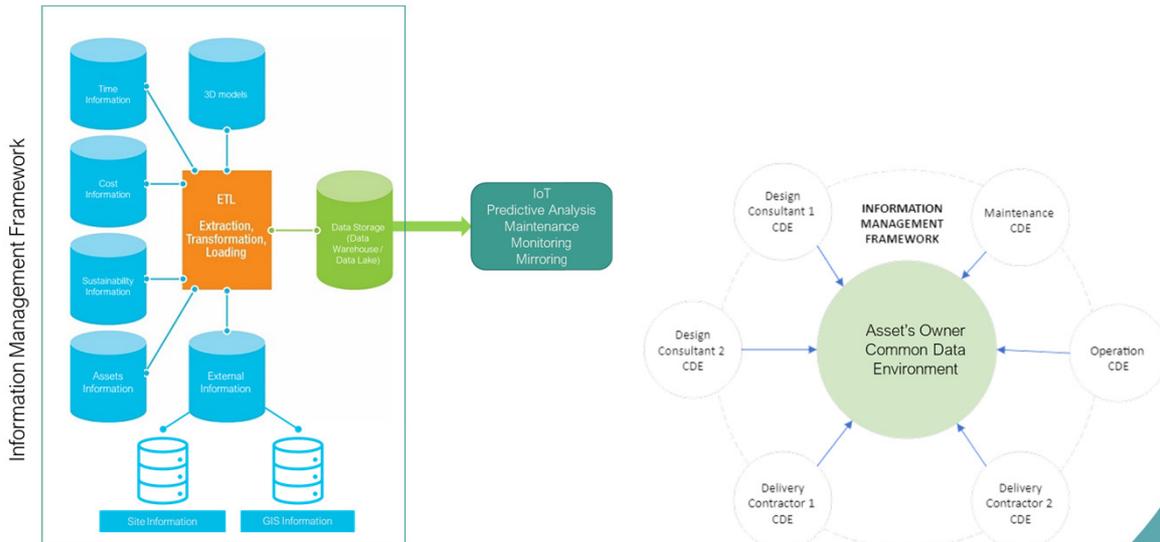


* Cost estimate level following the AACE International Recommended Practices No. 18R-97 (could be converted to the equivalents in different practices).

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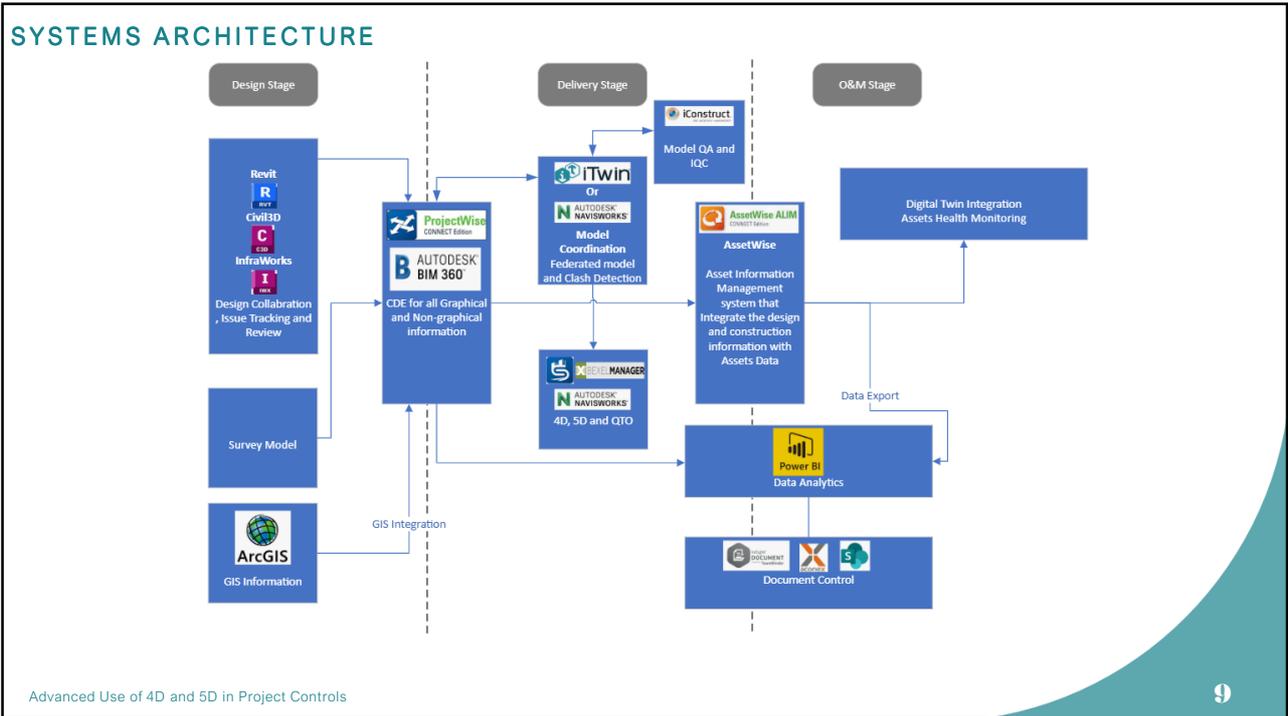
INFORMATION MANAGEMENT WORKFLOW



Reference: BIM and Data Science - Rashid Siddiqui

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Data Structure Alignment

- DATA INTEGRATION IN THE RELATIONAL DATABASE
- COMMON WORK BREAKDOWN STRUCTURE
- AUTO-MATCHING (3D - SCHEDULE - COST)

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DATA INTEGRATION IN THE RELATIONAL DATABASE

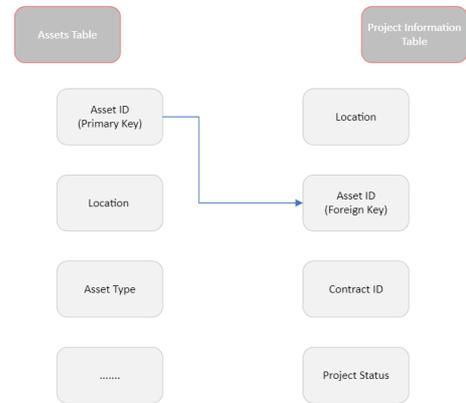
Foreign Key and Primary Key in Relational Databases:

Primary Key (PK):

- A primary key is a unique identifier for a record in a table.
- Each row must have a different primary key value.
- It ensures that each record within the table can be uniquely identified, making data retrieval more efficient.
- A table can have only one primary key consisting of single or multiple columns.

Foreign Key (FK):

- A foreign key is a column or set of columns in one table that refers to the primary key in another table.
- It establishes a link between data in two tables, creating a relationship between them.
- The table containing the foreign key is called the "child" or "referencing" table, while the table containing the primary key is called the "parent" or "referenced" table.
- A table can have multiple foreign keys depending on its relationships with other tables.



DATA TYPES

Structured Data:

This data type is highly organized and quickly and efficiently processed within relational databases. It's typically found in rows and columns in databases and spreadsheets.

Semi-Structured Data:

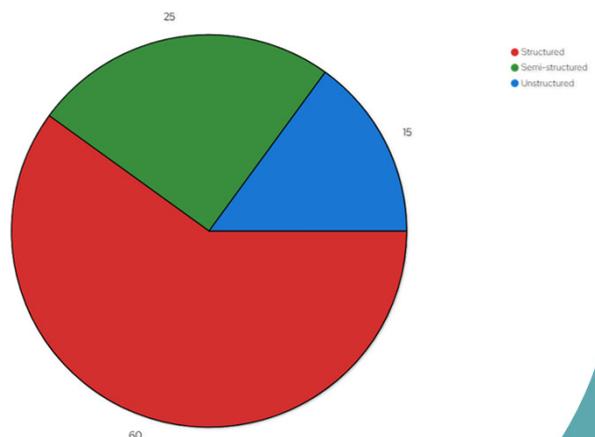
While this data type might not reside in relational databases, it has some organizational properties that make it easier to analyse. It often includes tags, hierarchies, and other markers to semantically categorize information.

Unstructured Data:

This data type doesn't have a specific form or structure, making it more complex to analyse and process. It can be textual or non-textual, and it's often generated from diverse sources like social media, multimedia content, and web pages.

Data Type	Examples
Structured	Relational databases, Tables, CSV
Semi-Structured	JSON, XML, YAML
Unstructured	Emails, Videos, Audio files

Distribution of BIM Data Types

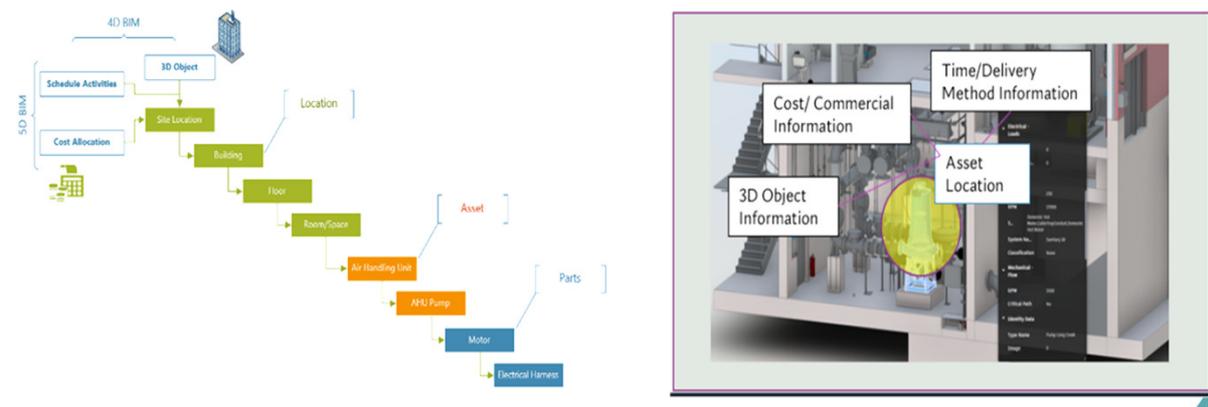


Distribution of different types of BIM data.

IFC "INDUSTRY FOUNDATION CLASSES" MODEL HIERARCHY

	Breakdown Level	Definition
CO - Complex	Complex	A combination of multiple systems forms a more extensive, intricate system. <i>Examples:</i> Entire buildings, infrastructure networks.
EN - Entity	Entity	A distinct unit within the complex with a specific function or role. <i>Examples:</i> Structural entity, architectural entity.
EL - Element	Element	Individual components that make up an entity. <i>Examples:</i> Walls, floors, and roofs in an architectural entity
SS - System	System	A set of interconnected elements that perform a specific function. <i>Examples:</i> HVAC system, electrical system, plumbing system.
PR - Product	Product	Specific items or materials used within an element or system. <i>Examples:</i> Air conditioner unit in an HVAC system, light fixtures in an electrical system.

IFC "INDUSTRY FOUNDATION CLASSES" MODEL HIERARCHY – WITH THE RELATION



AUTO MATCHING TO ALIGN 3D OBJECTS WITH WBS

The image shows two software windows. The left window, titled "Auto Matching (Resources to Tasks)", has a "Rules" section with buttons for "Import", "Export", "New", "Edit", "Delete", and "Delete All". Below this is an "Operations" section with "Appearance Profile" and "Install" buttons, and a "Search" section with "Search", "Clear", "Assign All", and "Close" buttons. The main area contains a table with columns for "#", "Resource", "Task", and "Appearanc...". Below the table are "Resource Tree", "Task Tree", "Resource Attributes", and "Task Attributes" sections.

The right window, titled "Add New Term...", has a "Name" field set to "User Rule". It includes "Summary options" (checkboxes for "Use only Selected Resources", "Ignore Assigned Resources", "Merge Similar Groups", "Use only Selected Tasks", "Ignore Tasks with Assignments", "Ignore Summary Tasks") and "Relations" (radio buttons for "None", "One-to-One", "Many-to-Many"). The "Expression" section has "Add", "Save", and "Cancel" buttons. The "Operator" section has radio buttons for "AND", "OR", "AND NOT", "OR NOT", and a checkbox for "True if Undef". The "Term" section has a "Resource attribute" dropdown (highlighted with a yellow circle and labeled "3D Object ID") and a "Task attribute" dropdown (highlighted with a blue circle and labeled "WBS/ID"). The "Type" section has checkboxes for "Equipment", "Location", "Human", and "Material". The "Algorithm" section has radio buttons for "Exact" and "Substring", and a checkbox for "Longest Common Substring". The "Options" section has checkboxes for "Separators" and "Case Sensitive". The "Min Length" is set to 1 and "Min Digits" is set to 0. Buttons for "OK", "Cancel", and "Help" are at the bottom.

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Thank You

- Maisara Al Rais
- Maisara.alrais@wsp.com
- <https://www.linkedin.com/in/maisaraalrais/>

