

CLASS ID AS466245

Class Title Digital Project Management: Lean Integrated Project Delivery Process.

Ravi Wood
BIM Manager, Gresham Smith

Rina Sahay
Architectural BIM Manager, Fishbeck

Learning Objectives

- Initiate: Development of Digital Execution Plan based on AIA & UK Level 2.
- Plan: Strategic planning during design development or concept design phase.
- Execute: Implementation of BEP during CD and CA phase of project.
- Close: Guidelines for LOD 500 Level BIM data at project handover.

Description

This class will encompass the journey for BIM (Building Information Modeling) managers from the inception of the BIM execution plan and through the various phases of construction. The case studies will illustrate the skills that project managers need to develop, implement, and execute plans across a project. The class will showcase the development of DEP based on AIA and other standards. We will discuss in detail the design development and construction document phases of the project to define the processes that BIM managers can use to excel on projects. The class will showcase case studies from projects across the United States, Europe, and Singapore, and examine how the BIM journey across a project can be excelled. This class is a great resource that can allow all BIM managers and designers to learn from real-life projects across the globe.

Speakers

Ravi Wood is a world-renowned Subject Matter Expert (S.M.E) on Digital Design Leadership and Management of BIM projects across the USA, UK, Middle East, Canada, Mexico, Singapore, and India. He is a Licensed Architect from India VNIT and has a Master's Degree from Kansas State University USA.

Ravi Wood is an Award-winning Guest Speaker at Autodesk University, Hong Kong BIM (HKIBIM), IFMA RICS Sweden, IFMA India, NY Design Expo, AEC Next, and several conferences across the USA, Europe, and Asia. He specializes in Digital Technology and BIM

Leadership across top firms and has completed more than 100 projects worth more than 150 million USD including Airports, Hospitals, Infrastructure, Stadiums, Residential, Commercial, and Retail.

His astute acumen and proven track record in Digital Technology Leadership has set new global Standards based on the premise of doing things “The Right Way”. His passion for innovative processes in Digital Technology continues to help transform “challenges to opportunity” and “problems to successful solutions”.

- Top Rated class for BIM Managers Autodesk University 2019.
- Speaker at Autodesk University 2020, 2019, 2017
- Top-Rated Speaker at Hong Kong BIM (HKIBIM) 2016.
- Top-Rated Speaker at RICS IFMA Stockholm Sweden 2017
- Top-Rated Speaker at IFMA India 2016
- Guest Speaker at AEC Next Los Angeles 2018 at
- Speaker at New York Design Expo 2018.
- Upcoming Lectures at various Ivy League School programs for Architecture across the USA.

Rina Sahay is an Autodesk Expert Elite Team member, a Revit Subject Matter Expert, an Autodesk University Speaker, and a Revit Certified Professional. As the Architectural BIM Manager at Fishbeck, she is responsible for

- creating and maintaining BIM standards;
- project support and troubleshooting;
- training, mentoring, and onboarding of new hires;
- production of construction documents for a variety of entertainment, retail and commercial projects.

Other hats that she wears outside of Fishbeck are

- Expert and Mentor, Autodesk Revit Forum
- Expert, Directly.com
- teaching Revit and Architecture at Kalamazoo Valley Community College,
- regularly judging the Skills USA Michigan State Architectural Drafting competition;
- Chair of the Kent Career Technical Center Advisory Board
- authoring the online blog series “Rina’s Random Revit-isms”

Contents

Digital Project Management	5
Lean Integrated Project Delivery	5
4 Phases of Digital Project Management	6
Initiate: Development of Digital Execution Plan based on AIA & UK level 2	8
Who: Defining Stakeholders	8
Where: Location is Important	9
What: Key Aspects of DEP.	11
Benefits of BEP: “Efficiency” and “Profitability”.	12
7 D’s of Digital Project Management	12
How: Process is Key	13
North America Resources:	14
UK Level 2	15
Plan: Strategic Planning during Design Development or Concept Phase.	18
File Management: “Divide and Rule”	18
Level of Detail	19
Accountability Management	20
Accountability Tracking	21
Sustainability	22
Energy Optimization	23
Generative Design	23
Execute: Implementation of BEP during CD and CA phase of the project	26
Clash detection on 3D coordinated models have the following benefits:	26
BIM and Link with Construction ERP Systems	29
BIM Logistics Planning	30
Close: Guidelines for LOD 500 BIM Data at Project Handover	33
Asset Information Management	33
Data Integrity	34
Streamlined Maintenance	35
Sustainable Buildings	36
Energy Efficiency	37
Economic Retrofit	38

Toolbox for Success	41
1. Cove Tools Source	41
2. Test fit Source	42
Case Study 1	44
Case Study 2	47
Helpful Resources	48

Digital Project Management

Digital Project Management is the culmination of the art of leading, planning, organizing, strategizing, and mentoring the process to ensure the successful delivery of projects on a digital medium. The goal is to set up processes and deliver profitable results. The Purpose of the project has to be achieved and lived through the planning to final closeout.



To successfully deliver a project with minimal waste, the project team must clearly define the customer's expectations. To identify and document the owner's and other project team member's values for a successful project, you can use the following lean practices.

Lean Integrated Project Delivery

LEAN Construction is a production management-based approach to project delivery – a new way to design and build capital facilities. Lean production management has caused a revolution in manufacturing design, supply, and assembly. Applied to construction, Lean changes the way work is done throughout the delivery process. Lean Construction extends from the objectives of a lean production system – maximize value and minimize waste – to specific techniques and applies them in a new project delivery process. As a result: IPD is uniquely suited to put these principles into practice, because we have solved the contractual issues that prevent true collaboration and the sharing of ideas, materials, and manpower.

IPD, perhaps more than any other delivery model, is heavily loaded on the front end in terms of effort. Teams find that enhanced project outcomes are best supported by laying rich foundations of project data and information, management and decision-making processes, communications protocols, financial controls, risk-mitigation strategies, and performance metrics. After project initiation, the team moves through a robust validation process to test possible project outcomes against the owner's business-case objectives. To be successful, this early validation work on a project requires cultural and group process efforts, as well as the application of a range of specific tools and techniques. Teams also grapple with defining how they will work together, establishing organizational structures as well as establishing expectations for how they will work together in a collaborative Big Room environment. Understanding the role of design and managing that process is particularly important in early team efforts. Target Value Design is the process employed by the team to move from inception of validation to completion of project

documentation, allowing the team to optimize value through collective creativity while developing both budget and solution with a methodical approach. A risk register is typically deployed to help identify, quantify, and mitigate risks proactively across the project. Project dashboards are deployed to monitor alignment to project success criteria.

4 Phases of Digital Project Management

The project management life cycle is usually broken down into four phases: initiation, planning, execution, and closure. These phases make up the path that takes your project from the beginning to the end.



In this presentation, we will take the journey to help us understand the process to successfully deliver project delivery. The process to be inquisitive on how and why we do things to ensure we stay constant and focused on purpose and results.

LEAN INTEGRATED PROJECT DELIVERY



Objective 1: Initiate

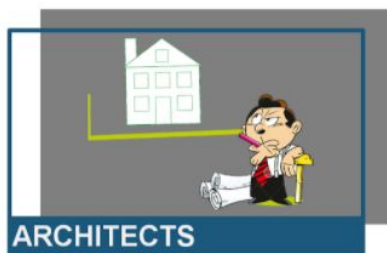
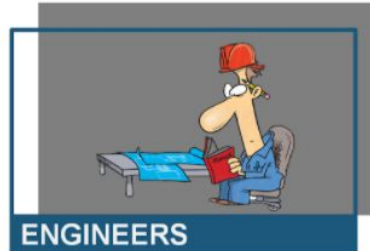
Initiate: Development of Digital Execution Plan based on AIA & UK level 2

BIM Execution Plan (BEP) is one of the project baseline documents and the governing document for the project operation and management that establishes in appropriate terms what will be done to meet the project scope and contractual requirements.

The BEP is to describe a project-specific plan strategically and tactically, addressing the most effective method and maximize efficiency in the project execution, and the project-specific actions complying to project goals and objectives, and the clear scope of work and other critical responsibility as agreed in the contract as well as detailed Project Risk management plan including risk items and mitigation plans which was assessed and evaluated during the proposal stage, and action plans for the project execution following the company risk management procedure. The BEP is developed by the project key participants led by the project manager. The BEP should be approved by company management before publishing or applying. The BEP is a live document and should be updated with current and future project plans and procedures.

Who: Defining Stakeholders

This list is comprehensive and includes Architects, Engineers, contractors, clients, and others. Essentially anyone who has the skin on the game and can impact the outcome of the project should be duly accounted for and set accountability for in the digital environment.



Why: Effective Planning is Organized

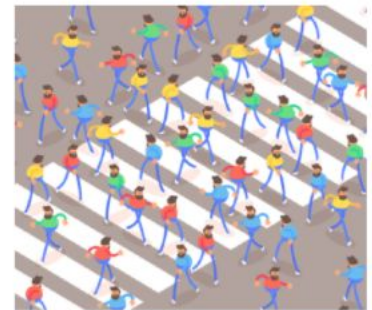
A project without BEP is bound to have “chaos” and not the good kind. There is the only eventuality without a BEP that the project shall be disorganized and full of conflicts.



DISORGANIZED



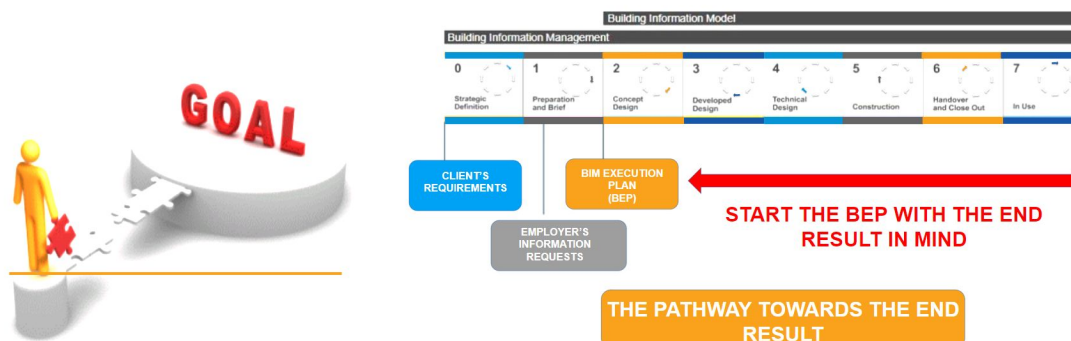
CONFUSED



CHAOTIC

The construction industry loses around 15% in wastage costs due to a lack of organized planning.

“A life without ambition is like a ship without a radar”.



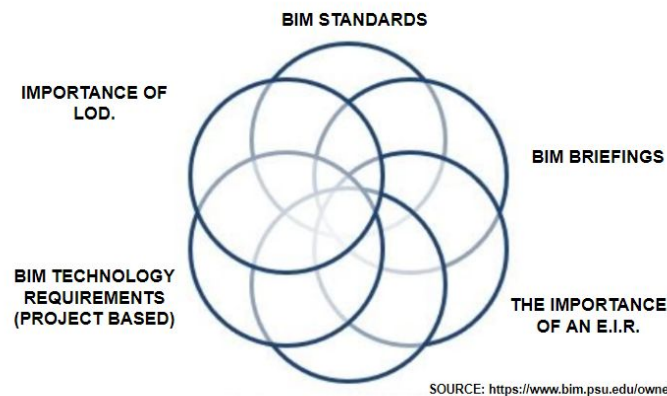
Where: Location is Important

These are some of the resources for getting started in the right direction based on the country. These are some of the links to get started and from experience, the best thing for a Digital Project Manager is to be creative and seek to better the existing standard in Industry.

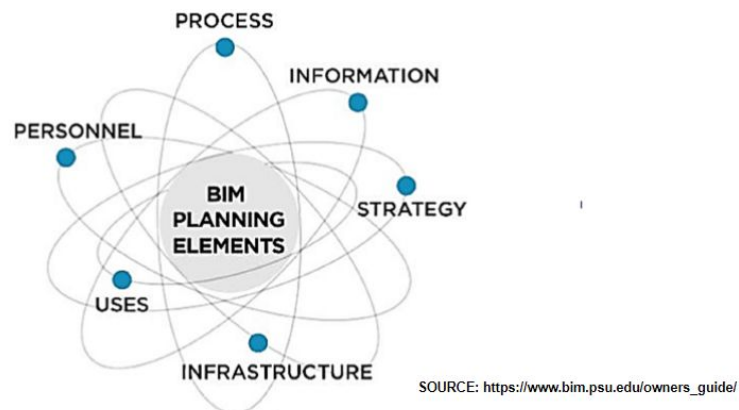
1	Canada	https://www.canbim.com/
2	USA	https://www.gsa.gov/real-estate/design-construction/3d4d-building-information-modeling/bim-guides
3	Scotland	https://bimportal.scottishfuturestrust.org.uk/
4	UK	https://www.thenbs.com/knowledge/what-is-building-information-modelling-bim
5	Portugal	http://www.ptbim.org/
6	Czech Republic	https://www.czbim.org/
7	Sweden	https://www.bimalliance.se/om-oss/in-english/
8	Finland	https://buildingsmart.fi/en/tag/bim-en/
9	Korea	https://www.building-smart.or.jp/old/download/files/20121018_Open%20BIM%20in%20Korea.pdf
10	Japan	https://www.jsce-int.org/node/398
11	India	https://www.ibima.co.in/
12	Hong Kong	https://www.hkibim.org/
13	Australia	https://bim.natspec.org/
14	New Zealand	https://www.building.govt.nz/projects-and-consents/planning-a-successful-build/scope-and-design/bim-in-nz/
15	Singapore	https://www.corenet.gov.sg/general/bim-guides/singapore-bim-guide-version-20.aspx

What: Key Aspects of DEP.

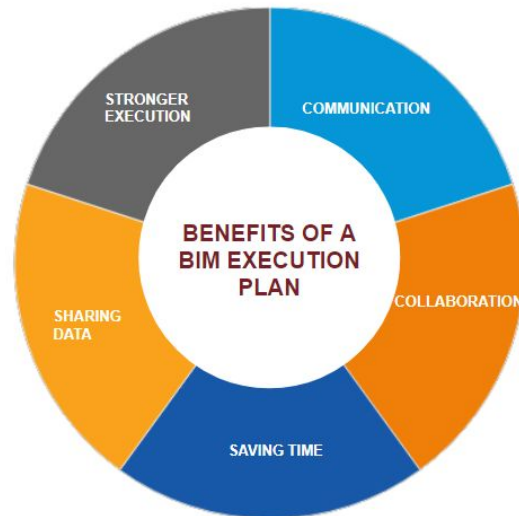
- The relevance of the Digital Execution Plan of BEP is to ensure the following:
- BIM Standards on the project are implemented.
- Importance of Level of Detail (LOD).
- Communication between Stakeholders. (BIM Briefings).
- BIM Technology Requirements.
- The Importance of Employer Information Requirements. (E.I.R)



The components of the BIM Execution Plan should focus on Identifying the uses and building a strategy. The logistics of people, processes, and profits should align with the strategy. Every tactical engagement should stay agile but not lose focus on the holistic goals set at the onset of the project.



Benefits of BEP: “Efficiency” and “Profitability”.

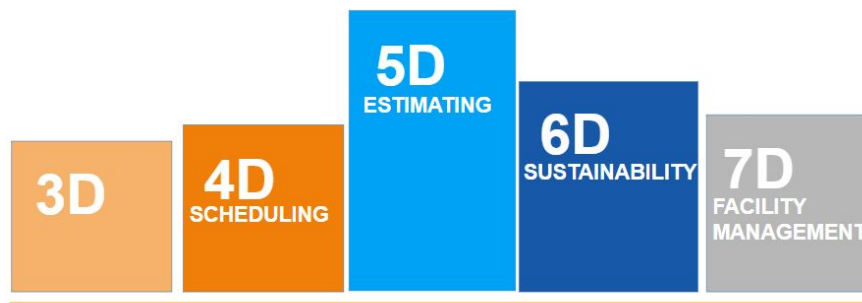


Source: <https://lupiter.co.in/contact-us>

7 D's of Digital Project Management

The 7 D's of BIM are essentially the features that far supersede the definition of BIM for being just a 3-dimensional file.

- 3D: three-dimensional rendering of the artifact
- 4D: duration analysis
- 5D: cost analysis
- 6D: sustainability assessment
- 7D: management phase of what has been achieved



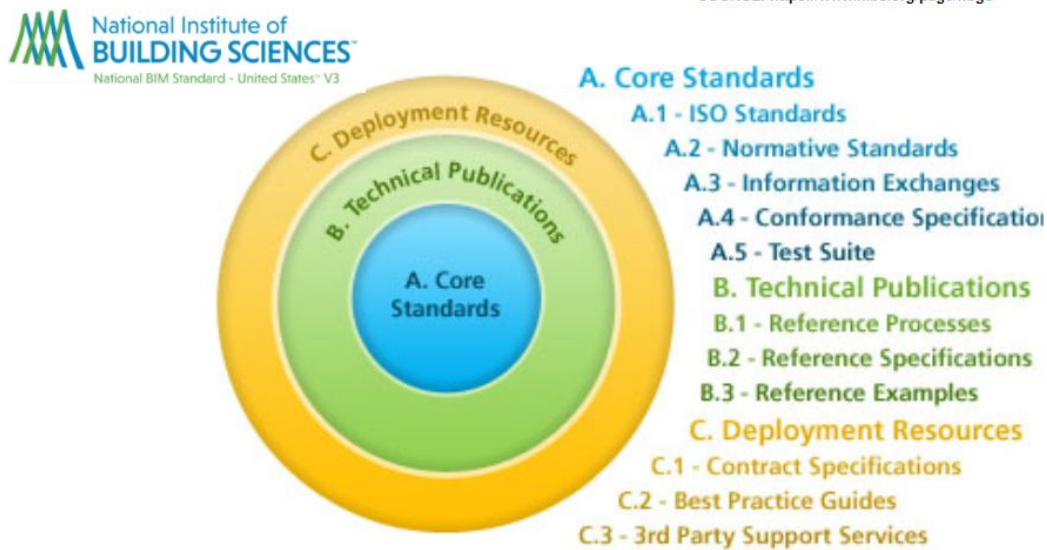
7 DIMENSIONS OF BIM EXECUTION PLAN

How: Process is Key

The process to create BEP or Digital Plans is briefly discussed in this section. The precept to create S.M.A.R.T. goals which are actionable is the key preamble of such a living document. The acronym S.M.A.R.T refers to the following listed below.

- S = Specific
- M = Measurable
- A = Attainable/Achievable
- R = Realistic
- T = Time-Bound

SOURCE: <https://www.nibs.org/page/nbgo>

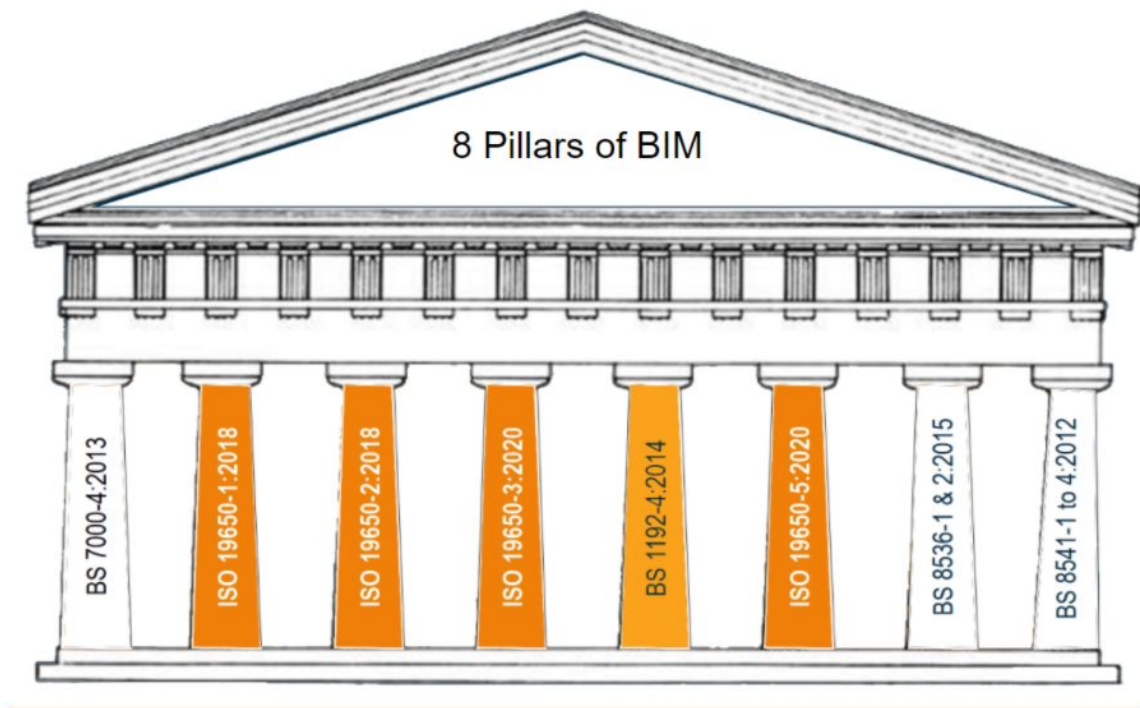


SCOPE OF THE NATIONAL BIM STANDARD-UNITED STATES

North America Resources:

The following are great resources for someone initiating the BEP on a project.

- National Institute of Building Sciences.
- Penn State BIM Execution Plan Handbook.
- CanBIM Council in Canada.
- AIA E202 and E203 protocols.



SOURCE: <https://www.nibs.org/page/nbgo>

UK PILLARS FOR BIM

UK Level 2

There are several 'levels of maturity' of BIM:

- Level 0 describes the unmanaged CAD (Computer-Aided Design).
- Level 1 describes managed CAD in 2D or 3D.
- Level 2 involves developing building information in a collaborative 3D environment with data attached but created in separate discipline models.
- Level 3 has yet to be defined in detail, but it is thought that it will include a single, collaborative, online, project model including construction sequencing, cost, and lifecycle management information.

The processes necessary to achieve level 2 BIM are set out in:

- PAS 1192-2 Specification for information management for the capital/delivery phase of construction projects using Building Information Modelling. (now replaced by BS EN

ISO 19650)

- PAS 1192-3 Specification for information management for the operational phase of construction projects using building information modeling.

UK Standards for BIM

bre

Source:

<https://geospatial.blogs.com/a/6a00d83476d35153ef01b8d08ebfa5970c-popup>

BS1192:2007 PAS1192-2:2013 PAS1192-3:2014 BS1192-4:2014 BS 8541 Series (COBie)



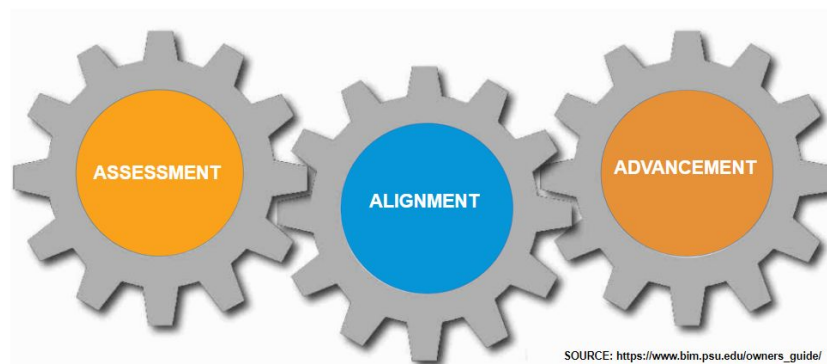
UK LEVEL 2 OVERVIEW

Objective 2: Plan

Plan: Strategic Planning during Design Development or Concept Phase.

This phase is the most critical and crucial juncture in the lifecycle of a building project. On one hand, we find stakeholders who are extremely flamboyant with design ideas and there can be other stakeholders that require more organization.

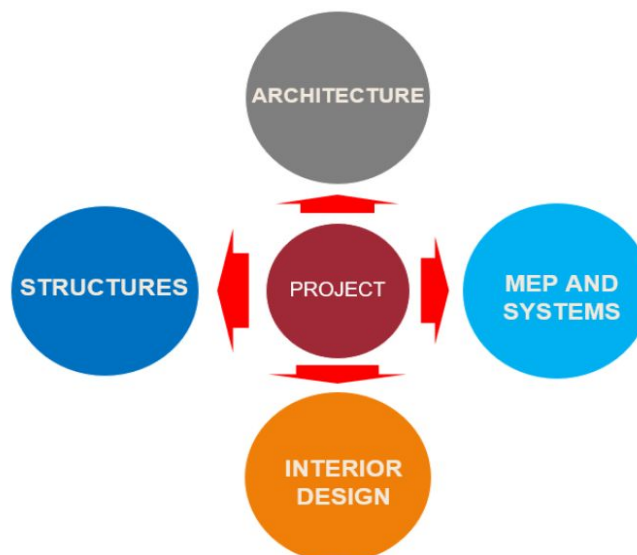
- The key is to reel back and take a moment to do an “**Assessment**” or “**Reconnaissance**”.
- Ensure the Digital Implementation is in “**Alignment**” to the “**Purpose**” of the Project.
- The Digital Manager should ensure to build “**Collaboration**” and “**Advance**” with full-throttle on the pedal once the “**Innovation**” goals are established.



BIM ORGANIZATION PLANNING PROCEDURE

File Management: “Divide and Rule”

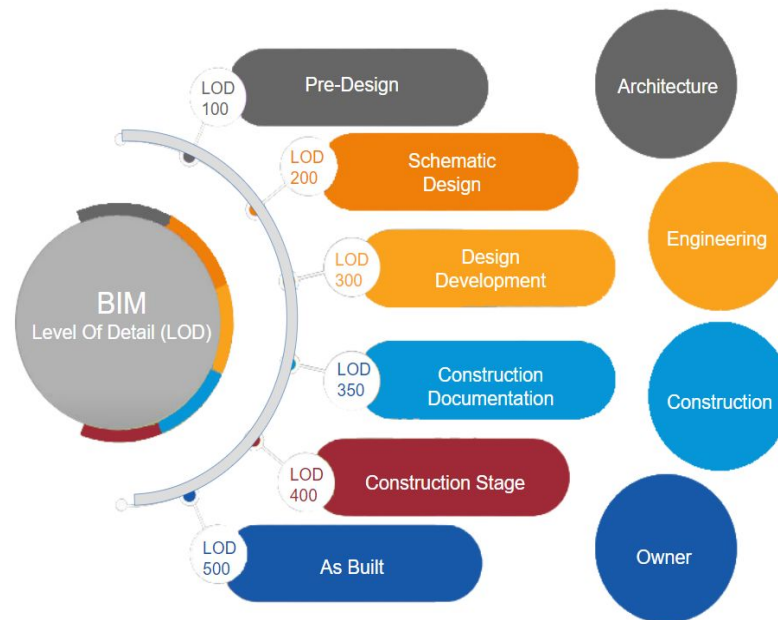
The ability to foresee file performance and judiciously split the files is a crucial part of Digital management. The project performance will deplete resources if the file management is not done the right way and it is imperative to develop the skill to “Divide and Rule” the files in the project.



FILE PLANNING: SPLITTING OF FILES

Level of Detail

The Level of Detail (L.O.D) is still an ambiguous definitive across the Industry. It is of utmost priority to establish the right balance of “Expectation” and “Reality” between the various stakeholders.



Level of Accuracy

The accuracy of files to be managed across the project helps everyone be on the same page. The concept is to be pragmatic in the approach of information in the files and be selective in ensuring the right tools and resources are mapped to the right process.

	Level Of Accuracy				
Upper Range (Imperial)	2"	5/8"	1/4"	1/16"	
Lower Range (Imperial)	2"	5/8"	1/4"	1/16"	0
Upper Range (Metric)	-	5cm	15mm	5mm	1mm
Lower Range (Metric)	5cm	15mm	5mm	1mm	0
	LOA10	LOA20	LOA30	LOA40	LOA50

SOURCE: https://cdn.ymaws.com/www.nysapls.org/resource/resmgr/2019_conference/handouts/hale-g_bim_loa_guide_c120_v2.pdf

Accountability Management

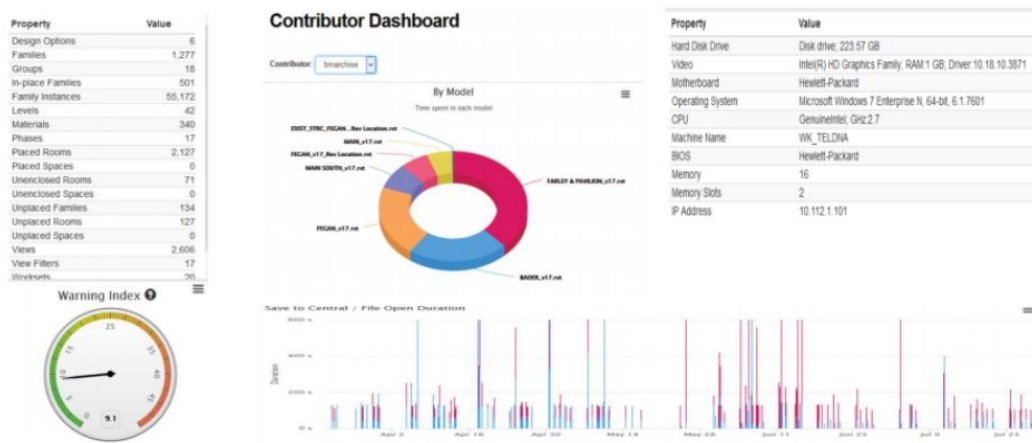
Being accountable means taking ownership, standing by decisions, actions, and the overall well-being of projects. Accountability is also a management process to ensure the Digital Manager defines the right responsibility to the right person at the right time.



SOURCE: Autodesk A 360

Accountability Tracking and Monitoring

Digital Project Management can help bring more efficiency through successful engagement with various stakeholders with Integrity and Transparency. The ability to monitor digitally using tools such as Power BI integrations helps bring a cultural shift to track and monitor actions rather than words.



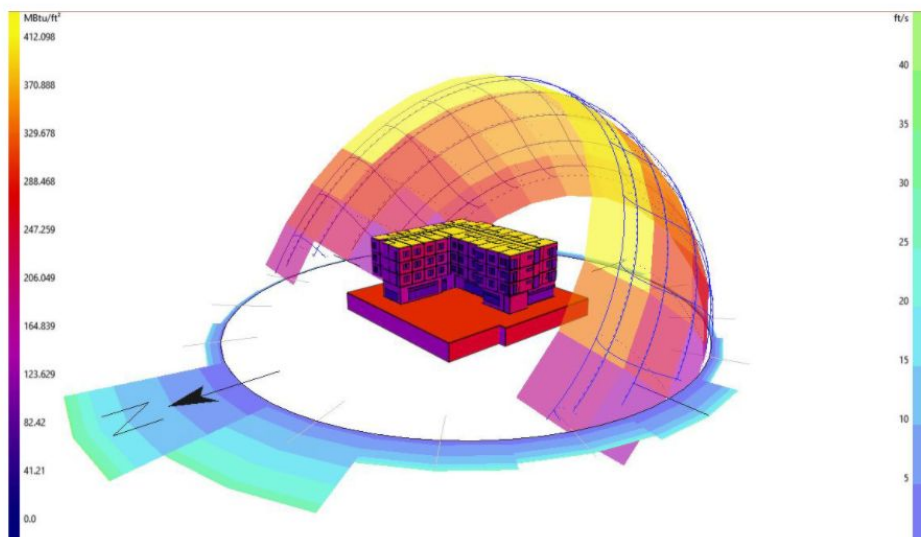
The reconnaissance of digital footprint and date then can be enhanced by alleviating the process. The spearheading of tactical brilliance emanates from

method driven data inferencing. The actional accountability helps bring in automation to replace and replete redundancies. The critical aspect is to maintain an honest/transparent flow of communication and engage with various stakeholders and making a Positive Influence without authority.



Sustainability

The key to good design is finding the sweet spot of collaboration and Innovation. The art of being cognizant of the impact the project footprint will have on nature and resources helps optimize the sustainable achievement of the project.



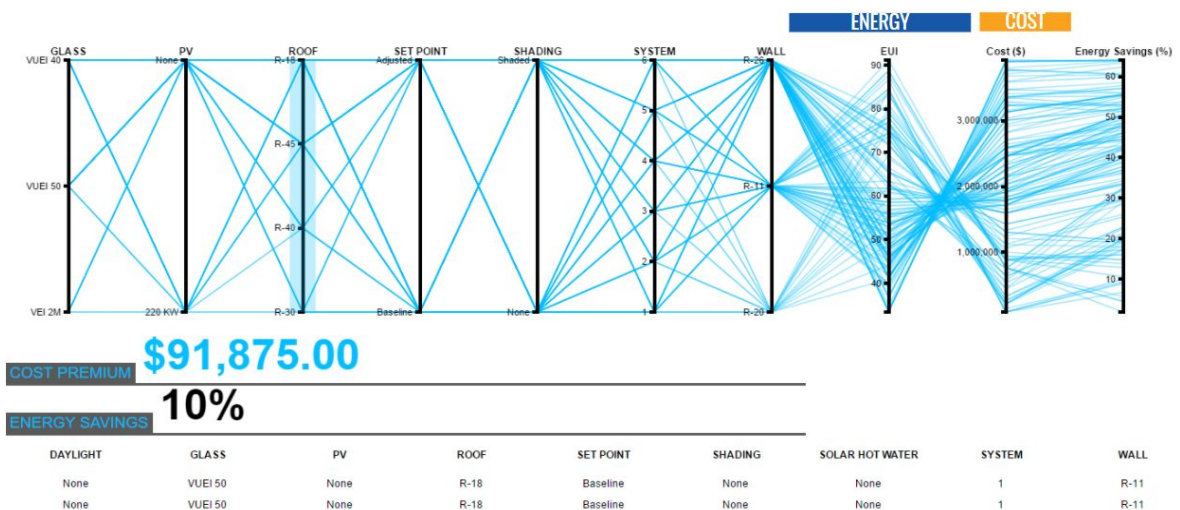
SOURCE: Autodesk. <https://www.autodesk.com/sustainability/overview>

Energy Optimization

This is a massive opportunity for Digital project managers to seize. On one project when the energy analysis was conducted just a mere change on the glass façade U value by .04 brought in the client over 15% savings on energy cost over 5 years. This not only more than justified the Return of Investment(ROI) on the latest technology but create a source of perennial savings.

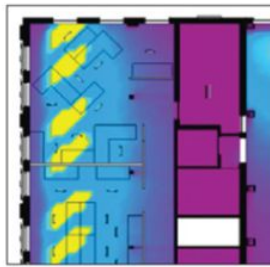
COST VS ENERGY OPTIMIZATION: COVETOOL

Selecting Cheapest Option for Energy Code Compliance

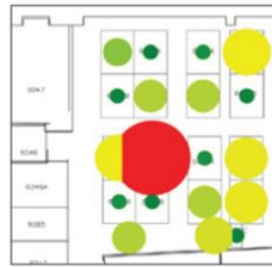


Generative Design

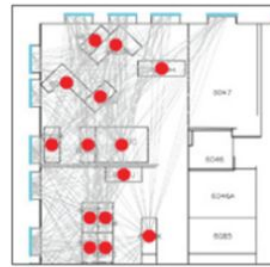
Generative design is a design exploration process. Designers or engineers input design goals into the generative design software, along with parameters such as performance or spatial requirements, materials, manufacturing methods, and cost constraints. The software explores all the possible permutations of a solution, quickly generating design alternatives. It tests and learns from each iteration what sees the program and can be a great resource to tap into better designs for the future. The ability to iterate and commensurate the best design option is a great leap of progress in the Architectural design process.



1. Daylight



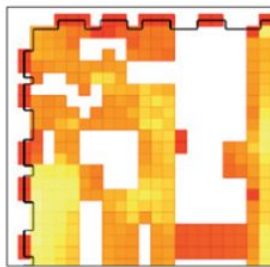
2. Low Visual Distraction



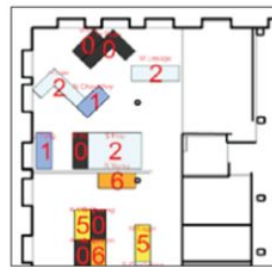
3. Views to Outside



4. Adjacency Preference



5. Circulation



6. Work Styles



7. Low Acoustic Distraction



8. Low Density

Source: Autodesk <https://www.autodesk.com/solutions/generative-design/architecture-engineering-construction>






Objective 3: Execute

Execute: Implementation of BEP during CD and CA phase of the project

Digital project management is a huge time saver during the construction phase, especially in projects with sophisticated designs, as it facilitates the resolution of challenging tasks and complex geometrical problems due to its capacity to offer real-time information in three dimensions that the model provides.

Clashes delay construction until stakeholders coordinate together to fix the issue. This irreversibly impacts project cost and schedule. Clashes occur due to:

- The intersection of components of different disciplines sharing the same space
- Lack of buffer space around the equipment
- The conflict between workflow and equipment scheduling

 Document Management	 Design Collaboration	 Model Coordination	 Project Management	 Field Management
FOLDERS	BIM 360 CLOUD SHARING	MODEL CLASH DETECTION	RFI's	CHECKLISTS
REVIEWS			SUBMITTAL	ISSUES
TRANSMITTAL				
ISSUES				

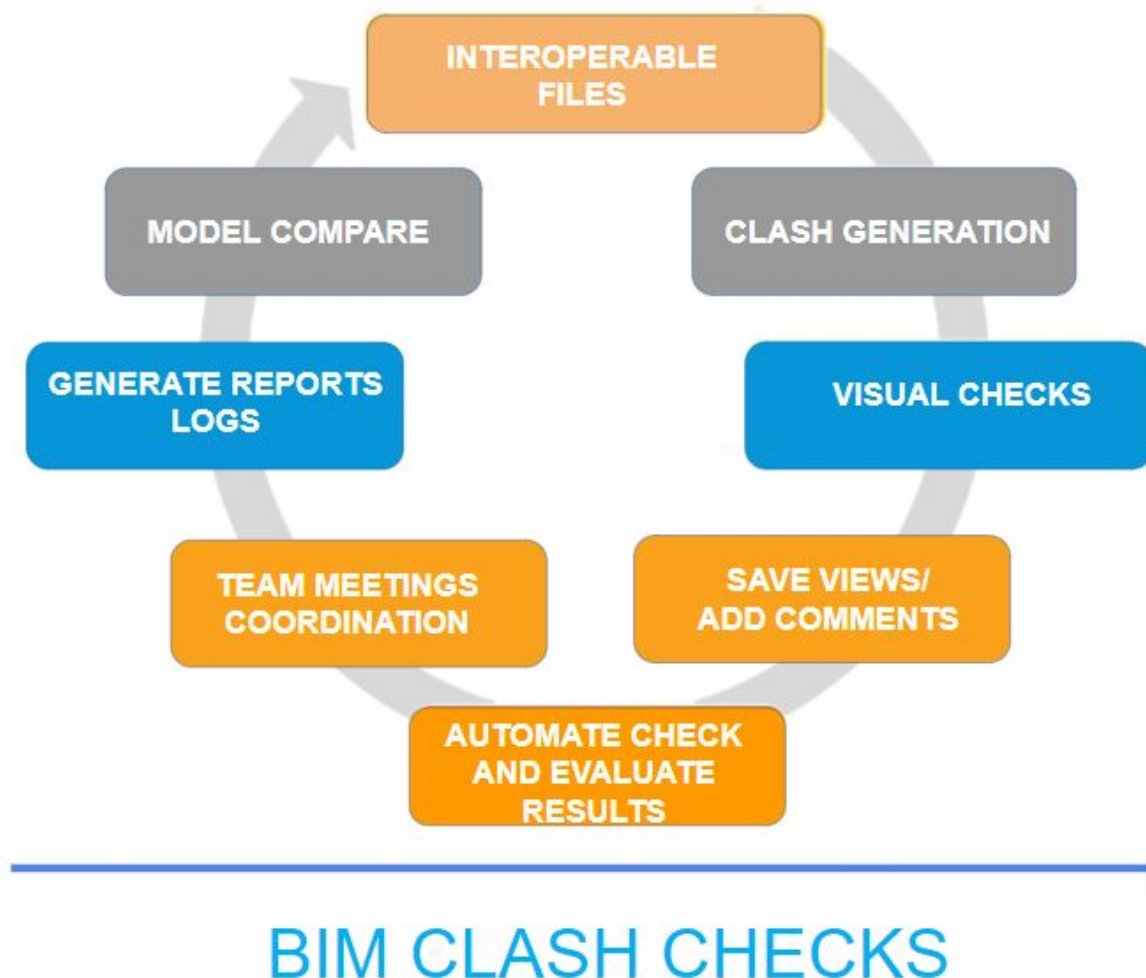
BIM CLASH COORDINATION

The workflow or 4D Clashes involve clashes of contractor scheduling, equipment, and material delivery and general workflow timeline conflicts. Unlike hard and soft clashes, 4D clashes result from scheduling clashes of inter-disciplinary activities that eventually lower the efficiency of the entire construction firm. Since one clash has a cascading effect on several disciplines and can bring work to a standstill, contractors cannot afford 4D clashes; opting for BIM.

Various disciplines like structural and MEP engineers use the architect's model as a starting point to produce their independent model, to avoid clashes during the Design Development Phase.

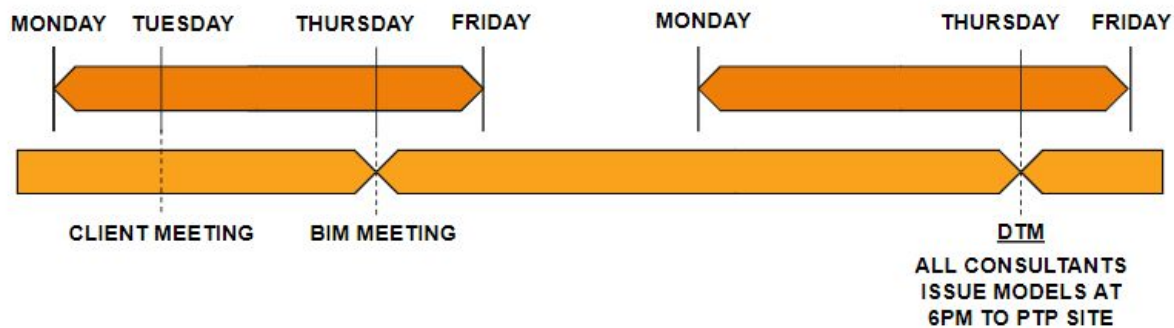
Clash detection on 3D coordinated models have the following benefits:

- Reduction in errors
- A safer construction site due to accurate estimates in all the stages of construction
- Reduction in overall costs, material waste, and Mitigated risk
- Improvement in scheduling and sequencing
- Increase in productivity and quickening of the construction process
- The models and data created by various disciplines can be integrated into a master model or in a common data environment for better collaboration.



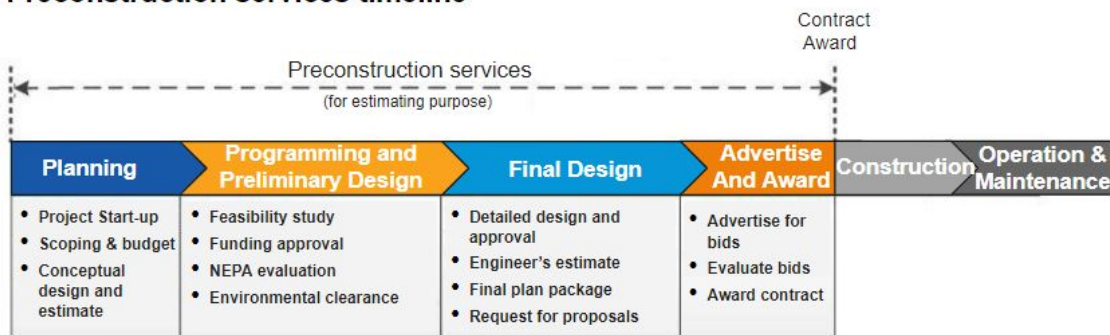
The inclusion of time-related attribute data also enables 3D visuals of a project's development to be created, showing how it will be constructed and how both the structure and surrounding site will appear at each phase. This is hugely beneficial in terms of planning work safely and logically that maximizes efficiency on site.

FORTNIGHTLY COORDINATE CYCLE



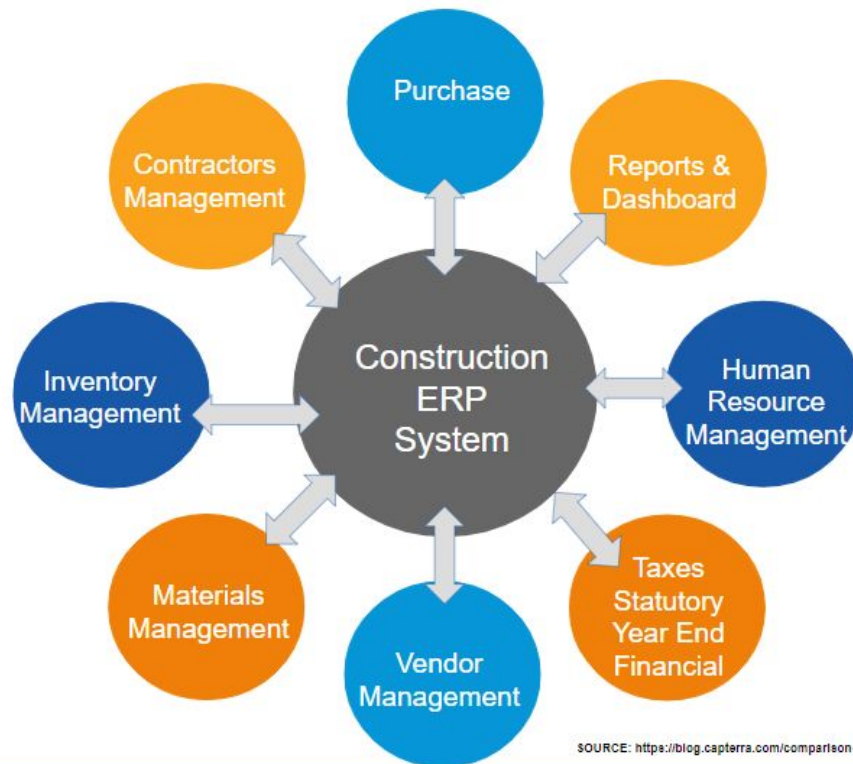
4D BIM is also a powerful tool for communicating the impact of built assets with local Stakeholders during delivery and once completed. Everyone can see and comprehend a clear impression of how the asset will appear, rather than having to envisage that from plans or Gantt charts.

Preconstruction services timeline



BIM and Link with Construction ERP Systems

The main aspect is to create a framework of understanding synergies between Lean principles and BIM functionalities that are applicable to site logistics management. This investigation provides contributions on the process to carry out logistics planning and control at different hierarchical levels, with the support of BIM 4D modeling, aligning this process with the Last Planner System of production control.

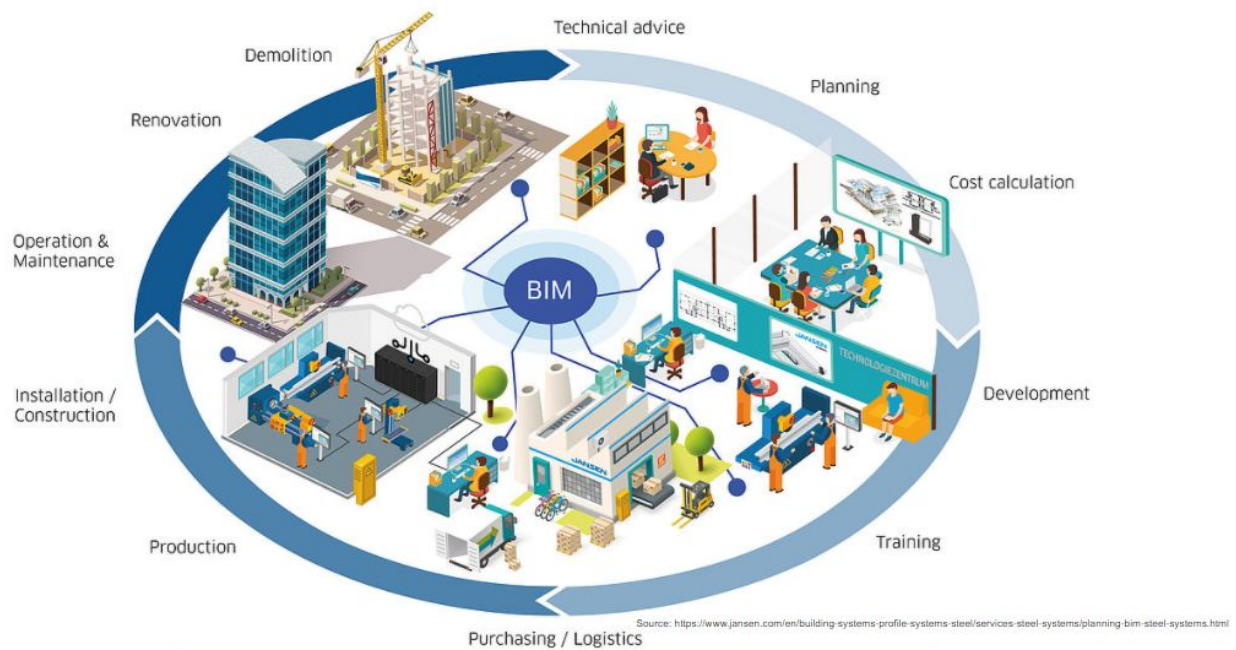


BIM ERP MANAGEMENT

The trick of the trade lies in the Initial plan and process. In BIM like in this world we reap what we sow. The intrinsic attribute of assigning the correct omni class number to families and elements is important. This Omni class can then link to the specs, logistic procurement, and even vendor management.

BIM Logistics Planning

Material logistics planning (MLP) is an important component of supply chain management that promotes tidy construction sites and efficient project delivery. It aims to ensure that the right materials and equipment are delivered to the site at the right time to reduce the idle resources and space requirement on site.



BIM LOGISTICS MANAGEMENT

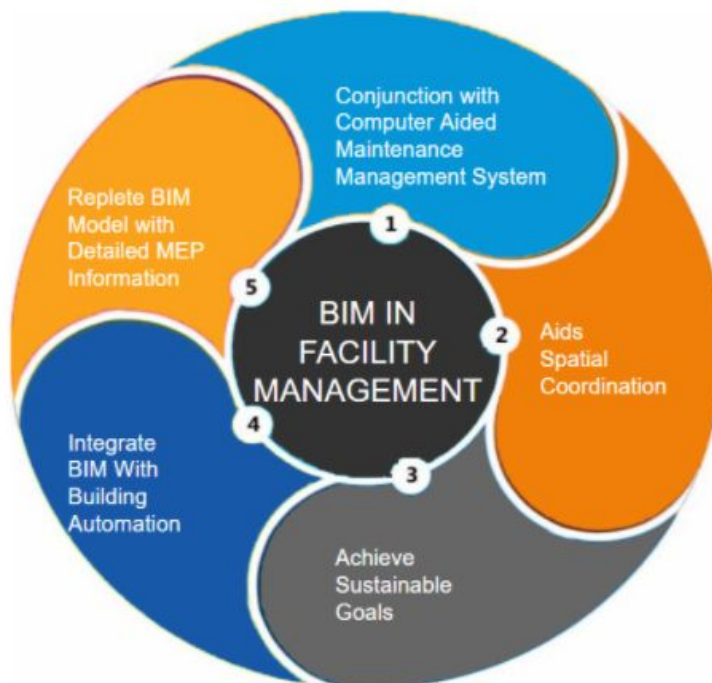
The benefits of Pre-planned Logistics are listed below:

- Fast-paced construction.
- Energy Efficiency.
- Affordable.
- Organized management of critical path items.
- Better cash flow management.

Objective 4: Close

Close: Guidelines for LOD 500 BIM Data at Project Handover

The overall purpose of utilizing BIM for facility management is to enable GSA to leverage facility data through the facility lifecycle to provide safe, healthy, effective, and efficient work environments for our clients. Facility data is created throughout the design and construction process. The maintenance of this data will create greater efficiencies such as: having accurate as-built information to reduce the cost & time required for renovations; increasing customer satisfaction; and optimizing the operation and maintenance of our building systems to reduce energy usage.



SOURCE: <https://www.cadoutsourcingservices.com/blog/how-to-use-bim-in-facilities-management.php>

Asset Information Management

Asset lifecycle information management (ALIM) assures high data integrity across systems and the associated people during the lifecycle of an asset from design, commissioning, handover, operations, and de-commissioning. A key function involves the sharing of information so that all parties have the current document. It also involves governance for authorization to read, edit, or replace with an audit trail.



The AIM delivers a fully-populated asset data set that is interoperable across the Autodesk products. This data set allows facility managers to plan, execute, and monitor activities required to deliver proactive and reactive maintenance, explore space configuration, and manage moves. The information contained within the AIM will need to be updated regularly to ensure any repairs, upgrades, refurbishments, maintenance, or decommissioning will need to be reflected. Assessment information (relating to performance or risk) may also need to be updated from time to time. Changes in the wider environment (including regulations, responsibilities, or ownership) will also need to be reflected.

Data Integrity

The BIM objective is to have a fully integrated, collaborative process with models shared between the project team on an Autodesk platform, as a “single source of information for any given project, used to collect, manage and disseminate all relevant approved project documents”. Autodesk increasingly plays a critical role in successful BIM collaboration as they allow data from many different platforms and on projects across the world. The Scale and Integrity of Autodesk commitment truly reflect the purpose to “Build a Better World”.



IMPROVED SPACE MANAGEMENT

Autodesk BIM 360 OPS:

- Easy to use, mobile-first maintenance management solution with web and mobile clients
- Connects BIM asset data with technicians to achieve day one building operations readiness
- Provides indoor maps to locate tickets and assets, do wayfinding for technicians, and enable more effective ticket triaging and analysis

Streamlined Maintenance

Business profitability requires close attention to detail, reduced inefficiencies, and informed spending decisions. Leveraging technology that streamlines and automates the following tasks can free up valuable time, ease frustration, and drive efficiencies:

- **Scheduling:** Preventive maintenance is a critical piece to extending an asset's useful life, but tracking and scheduling these tasks can be complicated and can be organized digitally.
- **Tracking asset management:** Greater visibility into property assets, including their status, repair history, and required maintenance, gives facility managers the ability to streamline FM

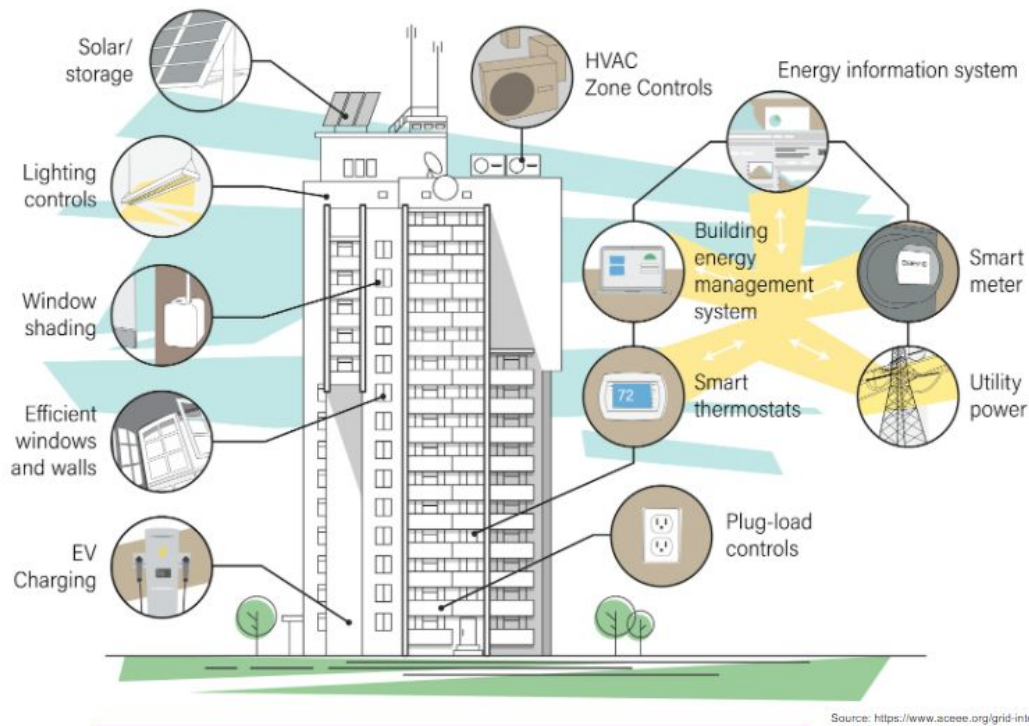
processes and manage risk by staying ahead of necessary upkeep and repairs.



- **Invoicing:** Connecting invoicing and work-order management to FM software can streamline this duty. By managing workflow from a proposal to invoice within a single system, managers can reduce invoice and processing costs and shorten approval time.

Sustainable Buildings

“Sustainable construction aims to meet present-day needs for housing, working environments, and infrastructure without compromising the ability of future generations to meet their own needs in times to come. It incorporates elements of economic efficiency, environmental performance, and social responsibility, and contributes to the greatest extent when architectural quality, technical innovation, and transferability are included.”

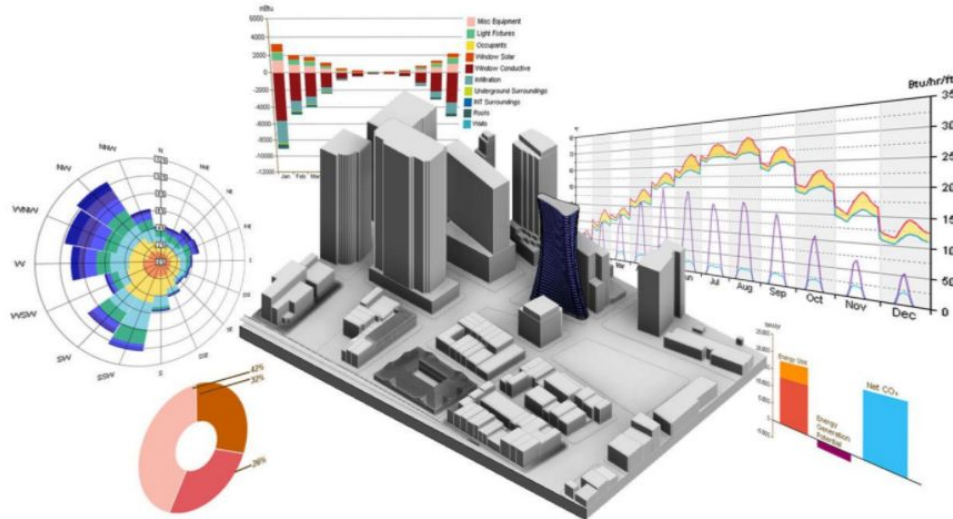


Digital Project Management should commit to the purpose of sustainability on the project to having a far-reaching impact on the project and creating a better future for the world.

There are three main facets between BIM and sustainable construction

- Greater transparency during the design phase
- Greater efficiency during the design and construction phases
- Greater control during the operations phase

Energy Efficiency



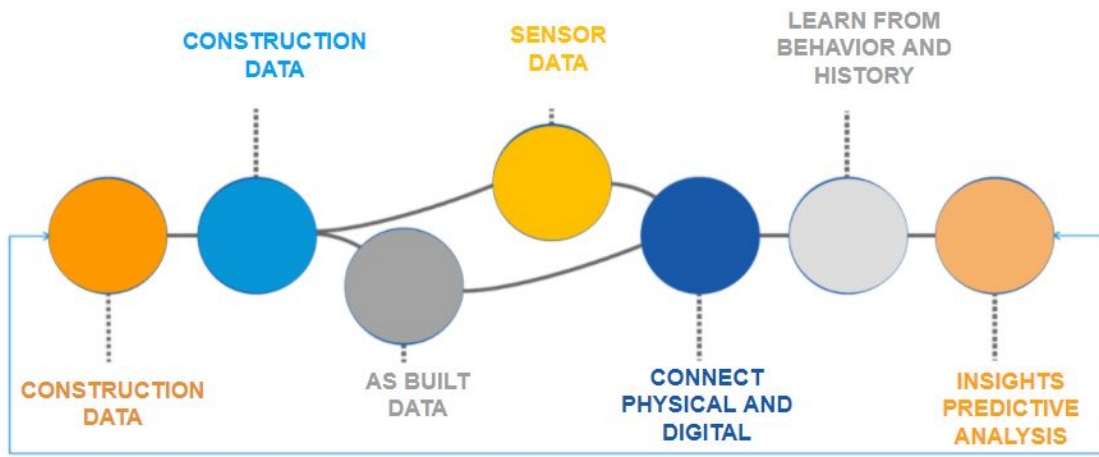
Source: <https://www.aceee.org/grid-interactive-efficient-buildings-qebs>

According to a study by The Boston Consulting Group, digitizing the building sector by using BIM to conduct a building-wide energy analysis can save up to 20% of energy costs. This number increases when looking at renovations of older buildings because of the traditionally energy-inefficient nature of the buildings. Using BIM energy analysis in these situations helps improve energy efficiency and reduce material waste, creating a more sustainable environment and benefiting everyone involved.

Economic Retrofit



Buildings sustain economic losses during their lifecycle due to ordinary maintenance operations and unpredictable events. A BIM procedure is implemented in a case study to improve the feasibility of this process and to deal with a large amount of data concerning the damage to and cost analysis of the components that constitute the facility. Furthermore, this specific BIM tool for the economic loss assessment has been embraced in a wider methodology aimed at optimizing the seismic retrofit strategy, taking into account both safety and economic features.



SOURCE: <https://www.autodesk.com/autodesk-university/article/Forge-BIM-360-Docs-IoT-Hub-2019>

DIGITAL TWIN

Toolbox for Success

3. Cove Tools Source: <https://www.cove.tools/>

Cove.tool helps achieve higher productivity and reduces construction cost



01 Automation

Reduces errors and dramatically increases the number of professionals able to use the software.

02 Speed

Most design decisions need to happen concurrently and in real time. Consultants take weeks to answer questions.

03 Data Driven Design

Data collection increases predictive and generative abilities of the platform.

04 Cost Optimization

Linking all decisions back to a common metric (cost) links together design, construction, and manufacturers.

Save 80 Hours with cove.tool

Compare the **time** saved and **savings** earned to generate the **results** yourself with cove.tool!



Average Billable Rate
\$200/Hour
\$16000 /Report/Project

4. Test fit Source: <https://blog.testfit.io/testfit-home>



Case Studies

Case Study 1

This Case Study is a project that began in 2015, and demonstrates why IPD, perhaps more than any other delivery model, is heavily loaded on the front end in terms of team effort and communication. Teams find that enhanced project outcomes are best supported by laying rich foundations of project data and information, management and decision-making processes, collaboration and communication.



SOUTH SHAW LANE VIEW

MICHIGAN STATE UNIVERSITY Broad College of Business Pavilion East Lansing, Michigan

In this case, Integrated Project Delivery was the vehicle of choice because of -

- The Project size -
 - An approximately 95,000 SF addition to the MSU Business School complex. This addition comprised classrooms, advising Advising and Administration areas.
- A large team -
 - the Project designer was in Seattle
 - the Design Manager, Engineer and Architect of Record was in Michigan
 - the Core Group of the team was made up of the -
 - Owner
 - Lead Designers
 - Design Manager
 - Construction Administrators

- the Design Team included -
 - Landscape
 - Code Consultant
 - Technology Designer
 - Acoustics
 - Lighting Design
 - Environmental Graphics
 - LEED Sustainability
- the Design Assist Team members included Contractors -
 - Foundation
 - Architectural Metals
 - Masonry
 - Tile
 - Casework / Woodwork
 - Precast / Structural Concrete
 - Drywall and Framing
 - Roofing
 - Earthwork

Background documents -

- **Contract Type** - The determined Contract Type was Integrated Project Delivery. Owing to the unique circumstances of the project, this contract type worked well for us. This was organized as follows:
 - Pre-Construction
 - Preliminary Design Model
 - Design Model
 - Construction Model
 - Fabrication Model
 - Construction
 - Post-Construction / Operation
 - non-graphical information required for continued building maintenance, disaster planning, asset management, etc.
- **Digital Project Information Exchange Agreement** - This needed to be framed owing to the size of the Project Team with over arching application above and beyond the electronic model, and included
 - **BIM Execution Plan** - delineates project-specific processes, functions, and requirements; assigns BIM-related responsibilities.
 - **Building Information Model** - a parametric, computable representation of the physical and functional characteristics of the project design, whether the model is prepared by the Architect, Contractor, Sub-contractor, or Consultants.
 - **Construction Documents** - including two-dimensional drawings extracted from the model; any additional two dimensional drawings relevant to the project; and the Project Specifications.
 - **Digital Project Information** - includes all data or information, data, communications, drawings, or designs created or stored for the project in digital form

Challenges -

The size of the Project and the volume and extent of deliverables required generated a need for this method of Project delivery - which was a first time experience for us! Just the Construction Documents were over 1000 sheets!

To ensure appropriate coordination between all stakeholders, a tremendous amount of communication was required. This process required enhanced levels of engagement from all members of the team - in excess of that experienced in a traditional project.

The size and geographical location of the Team members posed another challenge to speedy and effective communication.

The software program used by contractors and consultants was not always Revit. Sometimes it was not possible to bring their output into NavisWorks for coordination because of the different, sometimes proprietary, fabrication software being used by the contractor - as a matter of fact, some contractors had to make the switch to Revit to enable smooth functioning of the Project.

What worked for us?

- **This was a Donor Funded Project!!**

The formal Target Budget was established at the beginning per a previous feasibility study, and it stretched from 57 to 62 million. There was no incentive to save money - all available funds needed to be utilized as they came in. As a result, there was a running list of priorities which shifted as funds became available.

- **An intensely Collaborative approach** - which required

Extensive Communication - to gather information.

Information was gathered via tons of in-person conversations and focus groups to which all stakeholders were invited to contribute and have a voice - even in little details. Meetings were regularly scheduled, which included

Weekly - Initial huddles and Meetings for the Design Team

Every other week - meetings to work out details

Monthly - Steering Committee meetings

Recurring Big Room Meetings - where stakeholders from disciplines across the college were involved, generally including more than 50 participants

Meetings to address specific issues

Deviations from the regular meeting schedules if something untoward happened.

This sequence of in-person interaction caused the development of rewarding working relationships in and across teams. The Owner also felt that they were able to get to know the team very well and found these relationships to be very transparent and rewarding.

Design Collaboration across the teams - a large and complex project with a large team utilizing a newer form of delivery for the first time brought about an examination and re-evaluation of the means of collaboration in use at that time.

Most importantly - **design collaboration via Autodesk A360 was evaluated and implemented** in preference to the preferred method of collaboration via an FTP site at that time.

Design Review and feedback was implemented using BlueBeam Studio.

Communication regarding issues and resolution took place via PlanGrid

Space Coordination and Clash Detection was implemented using NavisWorks manage

Allocation of responsibilities - assigned via the BIM Execution Plan along with the appropriate tools to perform Visual, Interference, and BIM Standards checks to ascertain and enforce model quality control.

- **Established Protocol in the BIM Execution Plan -**

Technology tools required

Model Authoring - Autodesk Revit 2016

Document Review and collaboration - BlueBeam Studio

Resolution of issues - PlanGrid. As a result, instead of the traditional 1000+ RFIs per project, this Project had 200+ RFIs!

CoBIE data exchange was used to capture non-graphic information that was critically important to the application of the BIM by the Owner during the Operation phase

Expected BIM Uses - Expected BIM uses for this Project were split into three categories -

Design - Design Authoring, Coordination, and Review; Analyses (structural, Lighting, etc); LEED Evaluation; Code Validation

Construct - Sit Utilization; mock-ups; existing conditions modeling; construction system design; etc.

Operate - maintenance scheduling; building systems; asset management; record modeling; etc.

Model Data Exchange

Software used; file formats; extensions compatible for file exchange (.rvt, .ifc, etc)

Model Quality Control

Model Accuracy

Clash Detection

Compliance with BIM Standards

File naming conventions

Frequency of model updates

Specified per team member in particular phases

Assigned responsibility for tasks

A Project Model Element table was created for accurate allocation of responsibilities for Substructure, Shell, Interiors, Services, Sitework, etc.

Lessons Learned

The owner is the one who controls the destiny of this delivery process. They must embrace the idea if they want to get the most out of this process. They have to trust their consultants.

Our team's experience was that this is not the easy way, as there is a larger number of teams charged with the responsibility of different aspects of the project. Some of them may not be using the mandated software and tools to get the job done, some may have varying understanding of the principles of IPD and BIM. In this case, it is important to assume an educational role to assist those teams to get them on the same page.

However, it was found to be very rewarding, as this process delivers the most value and time savings (approximately 5-7%) for larger projects with a value in excess of \$5 million. A paradox that was realized - in order to do a project right you have to go slow at the beginning to get things done fast.

This process requires a higher level of engagement from all stakeholders including the owner. Lots of team meetings were required. This gives rise to frank conversations about issues and solutions, and a true interest in improving the work in progress. As a result, working relationships tend to be less adversarial, and decisions are made by consensus.

Finally - Team members should be on the same version and build of the software to minimize coordination issues. Some team members made the switch to Revit to avoid such issues.

Our biggest takeaway from this Case Study was that IPD is intrinsically lean and collaborative to the core.

Case Study 2



Software Campus BIM Manager: Ravi Wood

Case Studies: Global



Helpful Resources:

1. <https://econsultancy.com/how-to-plan-your-digital-strategy-with-the-prosper-framework/>
2. https://www.bim.psu.edu/owners_guide/
3. https://www.bim.psu.edu/owners_guide/
4. <https://lupiter.co.in/contact-us>
5. <https://www.nibs.org/page/nbgo>
6. <https://geospatial.blogs.com/.a/6a00d83476d35153ef01b8d08ebfa5970c-popup>
7. https://cdn.ymaws.com/www.nysapls.org/resource/resmgr/2019_conference/handouts/hale-g_bim_loa_guide_c120_v2.pdf
8. <https://www.autodesk.com/autodesk-university/blog/Top-AU-2019-Classes-CAD-and-BIM-Managers-2020?linkId=82229071>
9. <https://www.autodesk.com/sustainability/overview>
10. <https://www.autodesk.com/solutions/generative-design/architecture-engineering-construction>
11. <https://blog.capterra.com/comparison-of-5-construction-erp-software-options/>
12. <https://www.jansen.com/en/building-systems-profile-systems-steel/services-steel-systems/planning-bim-steel-systems.html>
13. <https://www.cadoutsourcingservices.com/blog/how-to-use-bim-in-facilities-management.php>
14. <https://www.aceee.org/grid-interactive-efficient-buildings-gebs>
15. www.autodesk.com/autodesk-university/article/Forge-BIM-360-Docs-IoT-Hub-2019
16. <https://www.cove.tools/>
17. <https://www.gsa.gov/real-estate/design-construction/3d4d-building-information-modeling/bim-guides/bim-guide-08-facility-management>
18. <https://www.thenbs.com/knowledge/what-is-the-asset-information-model-aim>
19. <https://www.autodesk.com/bim-360/facilities-management-software/>
20. <https://www.sciencedirect.com/science/article/abs/pii/S0926580517309445>