

THE BUSINESS CASE FOR BIM

Strategic to Industrial and Manufacturing Projects

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CHANG
INDUSTRIAL





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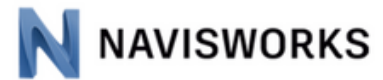
INTRODUCTION

Building Information Modeling is the process of applying information technology to the design, engineering, and construction industries. Modeling software collects data and presents a real-world demonstration of buildings, process equipment, and infrastructure before they are constructed, during construction, and after they are completed. Through this process, project teams develop a **digital database** of project information that is used by designers, builders, OEM's, maintenance, and owners/operators throughout the life-cycle of a building.

DEFINITION

BIM stands for "Building Information Model". BIM is sometimes used to describe the collaborative design and construction process, but BIM, correctly, refers to the virtual, three-dimensional design model. Virtual Design and Construction, or VDC, is the collaborative process performed between members of the project team. BIM is the primary tool used throughout the VDC process. The two key attributes of BIM are model geometry and data. The data embedded geometry is what sets BIM apart from traditional 2D drafting. These two key attributes allow the BIM to serve as an informative, collaborative tool throughout design, construction, commissioning, and building maintenance.

POPULAR BIM SOFTWARE



Model Geometry

Model geometry includes building elements such as foundations, exterior enclosure, interior walls, finishes, ductwork, conduit and pipes for MEP systems. Model geometry may also include vendor-provided geometry such as air handling units, electrical switchgear, vertical and horizontal transportation, and process and packaging equipment.



Data

The second key attribute is data that gets assigned to the model geometry. During the planning stages of a project, the team determines how design, construction, and the owner will utilize the model. The team's list of priorities and uses determines which attributes should be assigned to the model geometry. Different types of data include: material, information submittal data, sub-components, cost, manufacturer information, model number, and O&M information. During the VDC process, project teams take advantage of this data to track design progress, perform takeoffs and estimates, and update budgets. On the back end of design and construction, owners may use the BIM to manage assets and assist with preventative maintenance.

BENEFITS

The application of building information modeling improves work quality, increased speed and productivity, and reduces costs for building industry professionals in the design, construction, and operation of buildings.

Improves Work Quality

Developing and maintaining an accurate, virtual representation of the building improves drawing coordination and reduces errors in the documents. During VDC, the clash detection process detects where, or how building elements (e.g., structure, ductwork, plumbing, walls, etc.) interfere with one another. The design team would normally perform this task through manually. The resulting documents are of higher quality, and thus the costs of changes and coordination are reduced. Building information modeling tools enable the design, construction, and occupancy of the building to proceed with less friction and fewer difficulties than conventional tools.



Increases Speed and Productivity

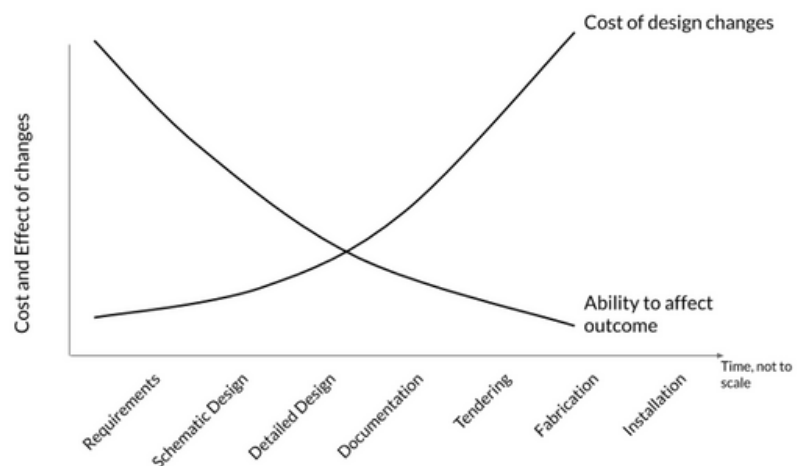
BIM's digital database streamlines collaboration between design and construction teams. Teams manage change through the database so that a change to any part of the BIM is coordinated with other parts. For example, during design, the structural engineer increases the size of roof framing members and columns due to additional rooftop equipment. If the BIM is loaded with data for steel tonnage and cost per ton, the project team can efficiently estimate the impact of the change.



Reduces Costs

By Utilizing a BIM, design teams can create more design content and manage changes with fewer people. A smaller design team results in lower fees and reduces miscommunication. Note, the size of the design team is driven by the size and complexity of the project. In the case of larger, complex projects, the savings may not be a result of reduced personnel, but from improved coordination efforts and communication. Because the documents are coordinated by the computer and therefore can be more complete, the cost-efficient coordination and change management during design helps to reduce labor cost during construction administration.

For construction teams, a cost-loaded BIM facilitates floor area-based (square-foot) budgeting and cost estimating during the early stages of a project. Implementing changes late in the design process to help reduce construction costs are difficult, inefficient, and expensive for the design team. With better cost information available upfront, teams can make informed decisions about design earlier in the process.



FINANCIAL IMPLICATIONS

We have extracted data from 3 vertical (multi-story) manufacturing projects. Vertical projects have an exceptionally high rate of “clashes”, due to the constricted geometry and utility chase areas in the project. A clash is anytime the design doesn’t clearly show the ideal field routing of equipment, structure, architectural path, process routing, or utility routing. The clash must be resolved in the field because that is when the issue is discovered. Brownfield structures present additional complications on project complexity and the potential for clashes between trades. In order to derive the cost advantage of BIM, we are going to simplify the variables and use labor only in our calculation. This statement of savings can be applied in two ways, i) the cost avoided from conventional construction design and planning by using BIM or, ii) the additional cost to the project for not using BIM. For materials, we will assume a nominal constant on top of the labor cost. Our formula is:

$$[\text{Hours per clash} \times \text{number of clashes} \times \$/\text{labor hour}] + \text{Material} = \text{Savings of Using BIM}$$

Estimated Time to Correct

We have analyzed three types of clashes, minor, medium, and major changes. We have weight balanced those changes based on frequency of occurrence and provided a labor hour projection composite for each clash. These hours are saved from the project if the clash is resolved in 3D model coordination in lieu of the field.

Hours Per Clash				
Task	Personnel	Hours (Major Change)	Hours (Medium Change)	Hours (Minor Change)
Field Identification	2	4	4	4
Communication to Design Consultant	5	4	2	1
Design Resolution	3	20	10	4
Order Materials	1	2	2	1
Field Modification	2	80	30	20
Total		110	48	30
Weighted Distribution		10%	25%	65%
Total Weighted Hours / Clash		42.5		

We believe the 42.5 labor hours per clash is a good universal rule of thumb for a project built to international standards.

Labor Hours Saved

We must analyze our historical records to discern a frequency of occurrence of clashes. The projects selected below have the following composition:

- **Project 1** – Greenfield – Vertical beverage factory with 3 stories of processing / manufacturing and ground floor logistics
- **Project 2** – Greenfield – Single level manufacturing with multi-level process and utility structure. Using logistics via a new adjacent distribution building
- **Project 3** – Brownfield – Single level manufacturing for beverage with multi-level material handling and robotics. Logistics handled at ground level.

BIM						
Project Type	Size (M ²)	Clashes / M ²	Total Clashes	Man Hours Lost Per Clash	Total Man Days Mitigated	Total Man Years Mitigated
Project 1	10,000	0.25	2500	42.5	13,281	44
Project 2	40,000	0.1	4000	42.5	21,250	71
Project 3	12,500	0.15	1875	42.5	9,961	33

The labor hours removed from the project are significant. Assume a 2 year project duration and the average humans removed from the project are 16-35 people. Based on an assessment of the design of WINDs, we estimate that the clashes that can be avoided by using BIM are between 1,800 and 2,700. We assume a composite labor hour of \$55/hour for Taoyuan, which is a blended rate as indicated above.

Calculating Savings & ROI

Finally, we need to calculate our savings. For simplicity, we will assume material costs are 10% of labor costs.

[Hours per clash X number of clashes X \$/labor hour] + Material = Savings of Using BIM

Low: $[42.5 \times 1,800 \times \$55] + 10\% \text{ Material} = \$4,630,000$

High: $[42.5 \times 2,700 \times \$55] + 10\% \text{ Material} = \$6,945,000$

Therefore, the anticipated cost advantage of BIM is

\$4,630,000 to \$6,945,000

recorded to the CAPEX of the project. We have not considered the early manufacturing benefit for pulling out the 32 – 48 headcount on the project, which will result in an accelerated project schedule.

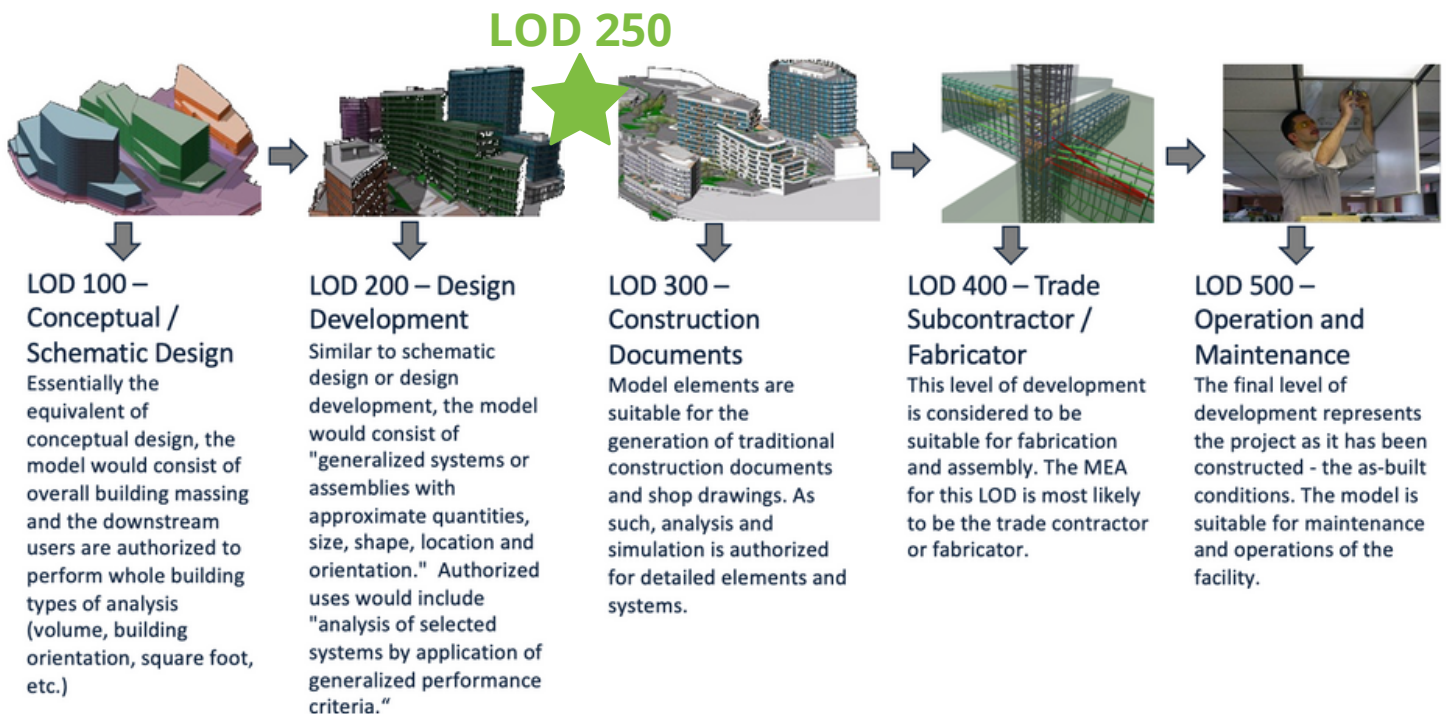
The proposed cost of BIM is a budget of roughly \$750,000 for the recommended LOD service level. Therefore, the ROI is:

600% - 925%

RECOMMENDATION FOR BIM

Level of Design

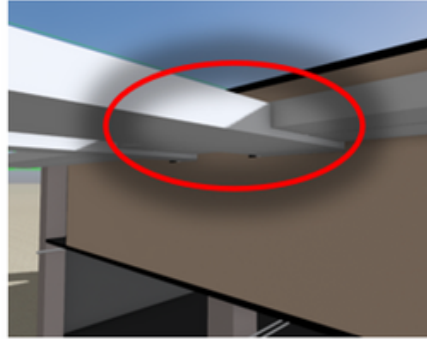
LOD is the level of design that a BIM model can be taken to during the VDC process. This varies widely between industries and there is no “universal standard”. Facilities such as hospitals or museums require more precise LOD than routine facilities like condominium buildings and office buildings. For manufacturing facilities, we have developed a custom criteria we call **LOD 250**. It represents designing some elements to the LOD 300 level and some to the LOD 200 level. The ability of a team to design to a certain BIM LOD is based on the experience of the team and the typical industry design standards. For manufacturing, we are most concerned about the placement and fit of equipment, retrofit to existing building elements, safety / egress, and utility routing.



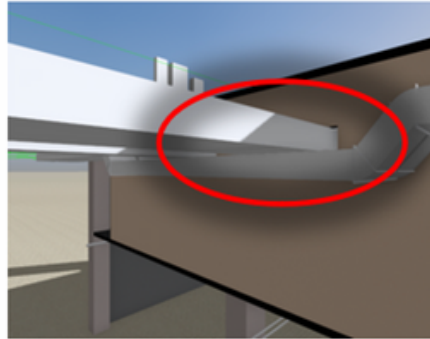
Clash Detection Example

Below are a few examples that showcase how simple “clashes” that would be typical of a complex manufacturing project are identified and avoided in the 3D model space. Subsequent detailed shop drawings and manufacturing drawings produced by vendors and subcontractors can be updated to incorporate the proper routing and alignment as discovered by the VDC team.

EXAMPLE 1



Before

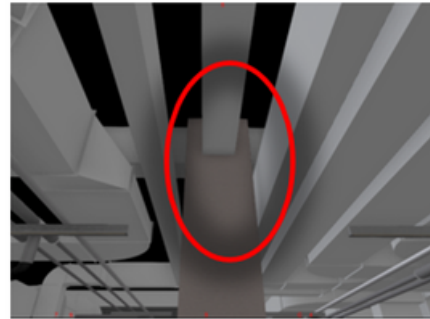


After

EXAMPLE 2



Before



After

EXAMPLE 3



Before



After

CONCLUSION

Building information modeling solutions...

- **create and operate on digital databases for collaboration**
- **manage change throughout those databases so that a change to any part of the database is coordinated in all other parts,**
- **and capture and preserve information for reuse by additional industry-specific applications.**

Through the application of information technology to the problem of describing a building in software, they enable higher quality work, greater speed, and improved cost-effectiveness for the design, construction, and operation of buildings.



APPENDIX

- JBIM Modeling ROI Case Studies PDF
- SEP BMI Introduction PPT



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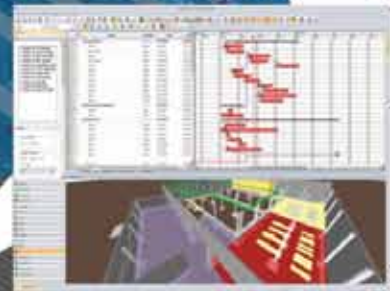
JBIM

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Why would
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No BIM for You: The Case for Not Doing BIM

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BIM Return on Investment: A Case Study

By Brittany Giel and Raja R.A. Issa

THE EVOLUTION OF BUILDING information modeling (BIM) and virtual design and construction (VDC) are fundamentally changing the process by which buildings are designed and constructed. The perceived high initial cost of BIM has, however, deterred many industry professionals from implementing it. In some cases, an owner's willingness to pay for the BIM is crucial in the contractor's decision to use BIM.

This study presents data gathered from three case studies on three sets of two similar projects: one a recently constructed BIM-assisted project and the other an earlier project without BIM to show the return on investment (ROI). The potential savings to an owner choosing to invest in BIM as an additional service were estimated based on the measurable cost benefits associated with reduced schedule overruns and reduced change order costs.

BACKGROUND

Using past project data from a medium-sized commercial construction management firm, a study was conducted to determine BIM's ROI to building owners. In 2007, the subject company began offering VDC as an additional service to its clients. In the BIM-assisted projects described in these case studies, BIM was implemented at an additional cost to the owner after the design phase was completed when the contract was awarded to the contractor.

CASE STUDY ONE

First, two small tilt-up wall commercial warehouse projects were analyzed to determine the cost savings associated with BIM's implementation. The projects are labelled Projects A and B. A general description of both projects is shown in **TABLE 1**. The use of BIM resulted in a 34 percent reduction in requests for information (RFIs) and a 40 percent reduction in change orders. There also was an overall reduction in the total cost of change orders and a reduction in schedule delays on the BIM-assisted project.

Estimated ROI

The estimated ROI that could have been realized by the owner if BIM had been used on Project A was determined based on an analysis of what BIM-preventable conflicts occurred and the proportion of schedule overruns attributed to these issues. BIM was used to create a set of tilt-up panel shop drawings. Thus, a portion of the costs preventable by BIM included the cost of subcontracting out that task. In addition, three of Project A's change orders could have been completely eliminated had BIM been used.

The costs of schedule overruns associated with these BIM-preventable issues were estimated based on four major cost categories: the daily cost of the contractor's general conditions, the daily cost for the developer's administration,

Table 1. Project Description

	Project A (Pre-BIM)	Project B (BIM-Assisted)
Contract value	\$7,128,000.00	\$8,844,073.00
Schedule duration	12 months	12 months
Schedule delay	7 days	0 days
Delivery method	Negotiated Bid	Negotiated Bid
Contract type	GMP	GMP
Square footage	123,000 SF	(3) 81,000 SF bldgs.
Use	Com. warehouse w. leasable mixed-use space	Com. warehouse w. leasable office space
Construction Type	Tilt-up wall with steel framing	Tilt-up wall with steel framing

Table 2. Project A: BIM ROI

Cost Category	Amount
Total direct cost of subcontracting out panel shop drawings:	\$16,650
Direct costs in preventable change orders:	
Embed fix change order	\$928
Girder and joist seat fix change order	\$8,499
Girder and door opening conflict change order	\$5,664
Total:	\$15,091
Indirect costs of 7-day BIM-preventable time overrun:	
Daily cost of contractor time overrun (general conditions) (\$855/day)	\$5,985
Daily cost of 5 percent interest on construction loan for time overrun (\$976/day)	\$6,832
Daily cost of developer administration for time overrun (\$446/day)	\$3,122
Estimated cost of architect's contract administration for time overrun (\$149/day)	\$1,043
Total	\$16,982
Total estimated savings	\$48,723
Cost of BIM (0.5 percent of contract value)	\$35,640
Net BIM savings	\$13,083
ROI	36.7 percent

the architect's construction administration time and the daily cost of interest on the owner's construction loan. For the purpose of this study, a 5 percent capitalization rate was assumed (TABLE 2).

The calculated ROI of Project A was used as a model rubric for BIM-assisted Project B. Due to a lack of recorded cost data, Project B's ROI was estimated based solely on the costs associated with its seven days of prevented schedule overrun and the exclusion of the cost to subcontract the panel shop drawings (TABLE 3).

CASE STUDY TWO

A similar case study was conducted on two three-story assisted living facility projects to determine the cost savings of implementing BIM. TABLE 4 summarizes some of the general information for Projects C and D.

Estimated ROI

There were four specific change orders on Project C which may have been prevented if BIM had been utilized. Due to inaccuracies in the construction drawings, numerous modifications were made to the balconies of two unit types on the second floor resulting in a shell over-estimate for the contractor. Another change order resulted from a clash between the roof scuppers and exterior walls that was uncovered late in the construction process. Additionally, inconsistencies in the construction drawings caused several doors in the mechanical rooms to be resized.

Lastly, during the inspection process it was found that two four-hour, fire-rated walls were missed by the designer in the original drawings. Because this mistake was uncovered so late, Project C's completion was delayed two months. The resulting change order included the cost of the demolition of the existing walls and ceilings and the material and labor costs associated with hanging, reframing and finishing the corrected walls. Most of these issues would likely have been uncovered during the 2D conversion process to BIM in preconstruction, if the technology had been available.

The estimated ROI of using BIM on Project C may have totalled 376 percent, if the technology had been available (TABLE 5).

Table 3. Project B: BIM ROI from Indirect Savings

Cost Category	Amount
Total direct cost of subcontracting out panel shop drawings: (\$0.13/SF X 243,000 SF)	\$31,590
Indirect costs of 7-day BIM-prevented time overrun:	
Daily cost of contractor time overrun (general conditions) (\$888/day)	\$6,216
Daily cost of 5 percent interest on construction loan for time overrun (\$1212/day)	\$8,484
Daily cost of developer administration for time overrun (\$544/day)	\$3,808
Daily cost to architect's contract administration for time overrun (\$181/day)	\$1,267
Total	\$19,775
Total estimated savings	\$51,365
Cost of BIM (0.5 percent of contract value)	\$44,220
Net BIM savings	\$7,145
ROI	16.2 percent

Table 4. Project Descriptions

	Project C (Pre-BIM)	Project D (BIM-Assisted)
Contract value	\$10,701,967	\$11,799,071
Original schedule duration	13 months	14.6 months
Schedule delay	2 months	0
Contract type	Design Assist	Design/Build
Delivery method	GMP	Stipulated Sum
Square footage	120,000 SF	66,926 SF
Use	Assisted Living Facility	Assisted Living Facility
Type of construction	Concrete Block	Conventional Framing
Stories	3	3
Units	131	80

Table 5. Project C: BIM ROI

Cost Category	Amount
Direct costs in preventable change orders:	
Unit 227 and 228 shell overages	\$6,202
Roof scupper re-route	\$6,515
Door re-size at closets/mech room	\$833
4-hour wall rework and construction	\$17,225
Total	\$30,775
Indirect costs of 60-day BIM-preventable time overrun:	
Daily cost of contractor time overrun (general conditions) (\$1410/day)	\$84,600
Daily cost of 5 percent interest on construction loan for time overrun (\$1466/day)	\$87,960
Daily cost of developer administration for time overrun (\$641/day)	\$38,460
Estimated cost of architect's contract administration for time overrun (\$214/day)	\$12,840
Total	\$223,860
Total estimated savings	\$254,635
Cost of BIM (0.5 percent of contract value)	\$53,510
Net BIM savings	\$201,125
ROI	376 percent

Table 6. Project D: BIM ROI

Cost Category	Amount
Indirect costs of 30-day BIM-prevented time overrun:	
Daily cost of contractor time overrun (general conditions) (\$1554/day)	\$46,620
Daily cost of 5 percent interest on construction loan for time overrun (\$1616/day)	\$48,480
Daily cost of developer administration for time overrun (\$706/day)	\$21,180
Estimated cost of architect's contract administration for time overrun (\$235/day):	\$7,050
Total estimated savings	\$123,330
Cost of BIM (0.5 percent of contract value)	\$58,995
Net BIM savings	\$64,335
ROI	109 percent

Table 7. General Project Descriptions

	Project E (Pre-BIM)	Project F (BIM-Assisted)
Contract value	\$41,757,618.00	\$44,400,000.00
Original schedule duration	601 Days	652 Days
Schedule delay	426 Days	0 (60 Days Early)
Contract type	GMP	GMP
Delivery method	Negotiated Bid	Negotiated Bid
Square footage	439,760 SF	456,594 SF
Use	Mixed use- res. condo/ garage	Mixed use- res. condo/ garage
Number of stories	14 Stories	7 Stories
Number of units	311	218
Type of construction	Conv. formwork w. Conv. Reinf.	Conv. formwork w. cast in place tables

The ROI of using BIM on Project D was estimated based on a number of clashes that were uncovered using BIM during preconstruction. Numerous conflicts were resolved between the mechanical and structural disciplines, most

of which were the result of discrepancies between the shaft detail drawings and the interior dimensions referenced in the architectural drawings. Using traditional methods, it is presumed most of these discrepancies would not have been

uncovered until at least one month into the project schedule. On Project D there were also significant conflicts between the ceiling heights of several units and the mechanical and structural disciplines that were revealed during preconstruction using BIM.

Through analysis of these major conflicts, it was estimated that using BIM for coordination saved at least one month of schedule overrun time on Project D (TABLE 6).

Numerous conflicts were resolved between the mechanical and structural disciplines, most of which were the result of discrepancies between the shaft detail drawings and the interior dimensions referenced in the architectural drawings.

CASE STUDY THREE

The final case study compared two mid-rise commercial condominium projects to determine the value of BIM to an owner on a project of greater scale and complexity. TABLE 7 shows a summary of some of the projects details.

In this study, BIM resulted in a 43 percent reduction in the total number



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of RFIs and a 37 percent reduction in change orders. The total cost of change orders on the BIM-assisted project totalled roughly 10 percent of that of a similar project constructed without BIM. Additionally, Project E experienced almost two years of schedule overruns that resulted in several legal disputes. In contrast, BIM-assisted Project F finished roughly two months ahead of schedule.

ESTIMATED ROI

Multiple BIM-preventable issues occurred on Project E. Perhaps the most noteworthy was a major drafting error in the site plan that left the original building's footprint falling outside the existing property lines. This resulted in a substantial change order. There were also several change orders that resulted from 2D errors and discrepancies between drawings.

In addition to the BIM-preventable change order costs on Project E, its schedule was delayed 426 days past its original 601-day duration. Analysis revealed that 221-day delay days were attributed to BIM-preventable issues, including the drafting error in the building's boundary survey, major structural dimension conflicts, conflicts between the foundation and sidewalks, the relocation of columns due to grid misalignment and limited plenum space in the ceilings of most units. Had BIM been used, the projected BIM ROI for Project E was estimated at 1,654 percent (TABLE 8).

The ROI for Project F was estimated at roughly 300 percent based solely on the savings in reference to its 60-day early completion (TABLE 9).

CONCLUSION

The results of this research confirm the overall high return on investment of BIM to an owner, suggesting that regardless of the size and scope of a project, the implementation of BIM can be a vital tool that results in significant cost savings for all stakeholders. ■

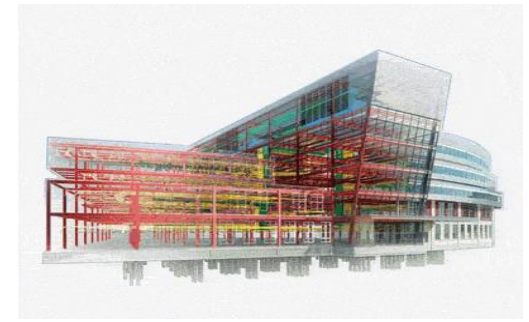
Brittany Giel is a PhD student and Raja R.A. Issa, PhD, JD, PE, FASCE, is a Professor at the M.E. Rinker, Sr. School of Building Construction at the University of Florida, in Gainesville, Florida.

Table 8. Project E: BIM ROI

Cost Category	Amount
Direct costs in preventable change orders:	
Revised boundary survey	\$24,862
Added beam in shear wall	\$787
Shear wall # 1 revision	\$3,396
Movement of (2) columns due to grid mis-alignment	\$419
Addition of (16) 3" deck drains	\$19,158
Readjustment of fire sprinkler heads for ceiling height changes	\$1,777
Window reorder/install due to conflict with exterior columns	\$2,632
Sliding glass doors mislabelled as window type	\$2,208
Revised ceiling heights to conceal drop panels	\$13,062
Additional framing of roof drains	\$19,081
Re-routing of mechanical ductwork around electrical panels	\$2,722
Additional soffits to accommodate return air ductwork	\$14,115
Additional fire sprinkler heads adjustment for dropped ceiling	\$1,285
Demolition and repair of elevator door beams	\$66,812
Materials escalation due to 221-day delay based on survey and structural plan errors	\$300,000
Total	\$472,316
Indirect costs for 221-day BIM-preventable time overrun:	
Daily cost of contractor time overrun (general conditions)) (\$5,425/day)	\$1,198,925
Daily cost of 5 percent interest on construction loan for time overrun (\$5720/day)	\$1,264,120
Daily cost of developer administration for time overrun (\$2466/day)	\$544,986
Daily cost to architect's contract administration for time overrun (\$822/day)	\$181,662
Total	\$3,189,693
Total estimated savings	\$3,662,009
Cost of BIM (0.5 percent of contract value)	\$208,788
Net BIM savings	\$3,453,221
ROI	1653.9 percent

TABLE 9: Project F: BIM ROI of Indirect Time Savings

Cost Category	Amount
Indirect costs saved by 60-day early completion:	
Daily cost of contractor (general conditions) (\$5,425/day)	\$325,500
Daily cost saved in interest (5 percent) on construction loan (\$6,082/day)	\$364,920
Daily cost of developer administration (\$2,466/day)	\$147,960
Daily cost to architect's contract administration for time overrun (\$822/day)	\$49,320
Total	\$887,700
Total estimated savings	\$887,700
Cost of BIM (0.5 percent of contract value)	\$222,000
Net BIM savings	\$665,700
ROI	299.9 percent



BIM INTRODUCTION

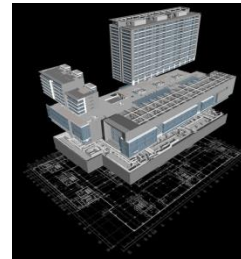


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- + Values of BIM
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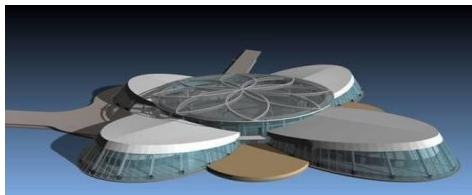
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EXCELLENCE
IN SERVICE

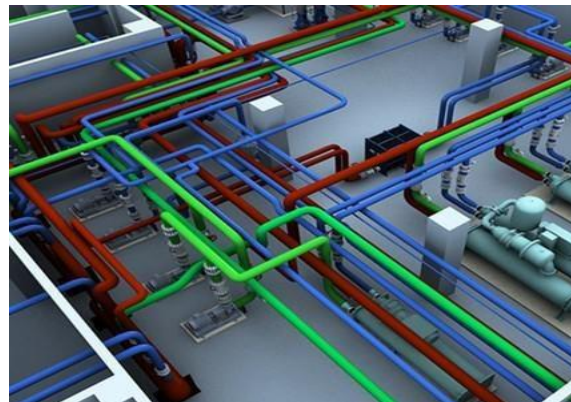


- ⊕ BIM – Building Information Modeling
- ⊕ An intelligent model-based process that provides insight to help plan, design, construct and manage buildings
- ⊕ A process and decision –making tool, not just a 3D model
- ⊕ Drawings are derived from the model

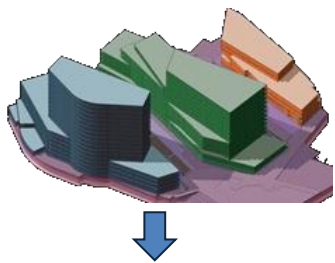
WHAT IS BIM



ONE-STOP
FOR EPCM
SERVICES



LOD - LEVEL OF DETAILS



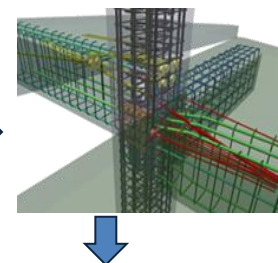
LOD 100 – Conceptual / Schematic Design
Essentially the equivalent of conceptual design, the model would consist of overall building massing and the downstream users are authorized to perform whole building types of analysis (volume, building orientation, square foot, etc.)



LOD 200 – Design Development
Similar to schematic design or design development, the model would consist of "generalized systems or assemblies with approximate quantities, size, shape, location and orientation." Authorized uses would include "analysis of selected systems by application of generalized performance criteria."



LOD 300 – Construction Documents
Model elements are suitable for the generation of traditional construction documents and shop drawings. As such, analysis and simulation is authorized for detailed elements and systems.



LOD 400 – Trade Subcontractor / Fabricator
This level of development is considered to be suitable for fabrication and assembly. The MEA for this LOD is most likely to be the trade contractor or fabricator.



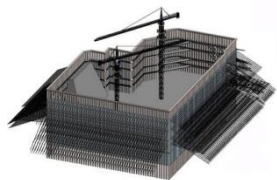
LOD 500 – Operation and Maintenance
The final level of development represents the project as it has been constructed - the as-built conditions. The model is suitable for maintenance and operations of the facility.



- + Visualization
- + Coordination / Collaboration
- + Fewer Errors and Unforeseen Problems During Construction
- + Higher Accuracy / Better Quality
- + Pre-fabrication Opportunities
- + Faster Schedule
- + Safer Jobsites with Less Re-work
- + Model Use in Facility Management

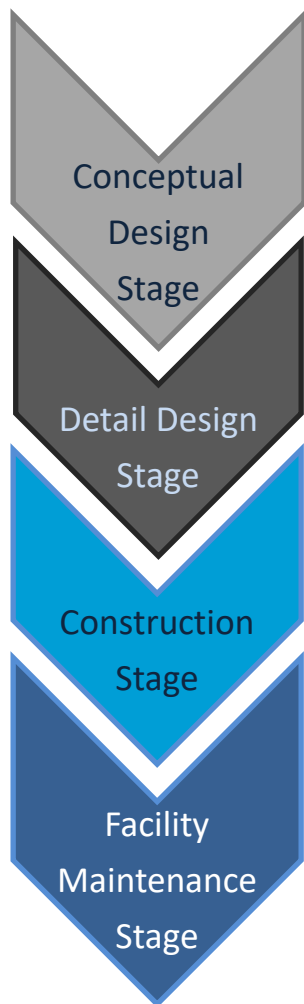
EXCELLENCE
IN SERVICE

Values Of BIM



Values Of BIM

ONE-STOP FOR
EPCM SERVICES



- Building visualization design
- Project demonstration
- Construction site analysis
- Quantity survey (Estimation stage)

- Collaborative design
- Pipeline layout
- Performance analysis
- Quantity survey (Budget)

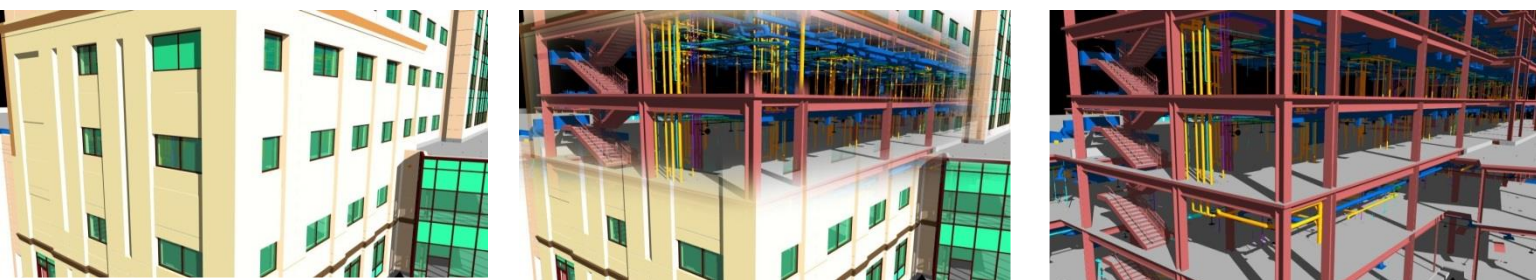
- Construction progress simulation
- Construction organization simulation
- Digitalization construction
- Cooperation in construction site

- Final acceptance model delivery
- Maintenance plan
- Assets management
- Space management
- Building system analysis



- + Reduce risk
- + Resolving major conflicts between disciplines
- + Reduce RFI
- + Minimize the project waste, fewer change orders
- + Less rework

- + Lower prices, less anticipated risk by subcontractors – prefabrication and in time deliveries
- + Maximize clear height
- + Schedule control



Values Of BIM

EXCELLENCE
IN SERVICE

SEP Design Capabilities & Experiences

ONE-STOP FOR
EPCM SERVICES

SEP consists of five designers in the design team:

- + Plumbing Designer (15 years design experience)**
- + Fire Safety Designer (15 years design experience)**
- + HVAC Designer (10 years design experience)**
- + BIM Designer, Civil & Structure, Architectural (6 years design experience)**
- + BIM MEP Designer, (4 years design experience)**

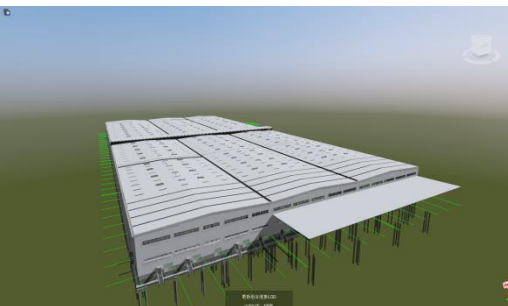


SEP Design Capabilities & Experiences

EXCELLENCE
IN SERVICE

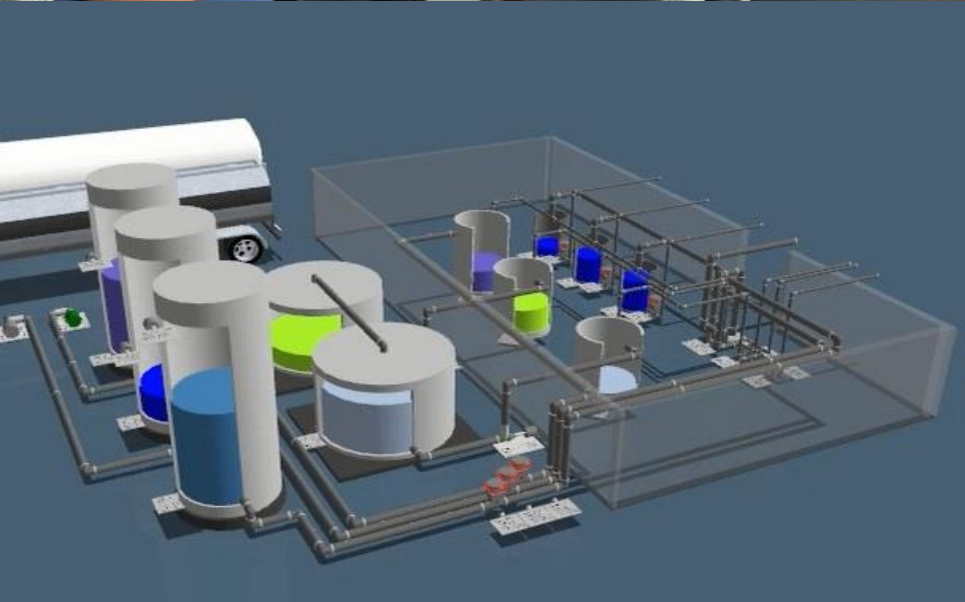
SEP design teams involved in the following projects:

-  CLSA Yanan
-  Mondelez China R&D Center
-  TVC Vibration isolator Co. LTD WUXI Project
-  Unilever Hefei Distribution Center Project





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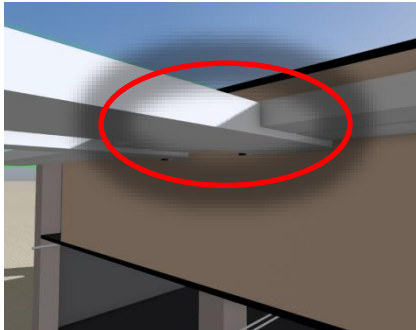


CLASH DETECTION

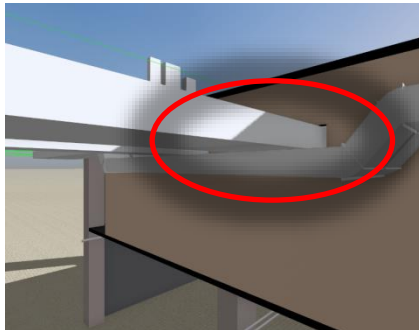
ONE-STOP
FOR EPCM
SERVICES



Example 1

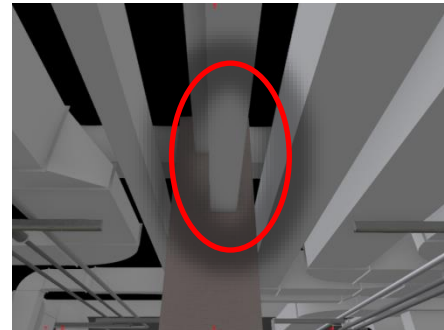


Before

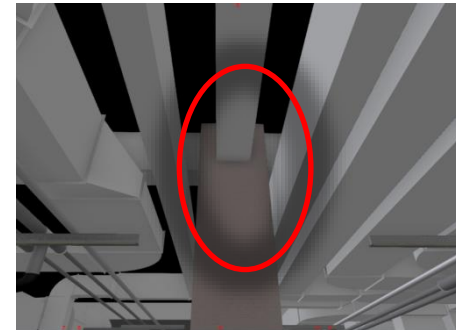


After

Example 2



Before



After

Example 3



Before



After

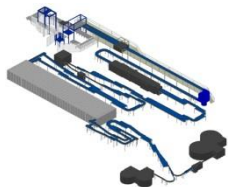
Clash detections resolved drawing inaccuracies and mistakes!

Table below shows the costing for each BIM Level of Detail

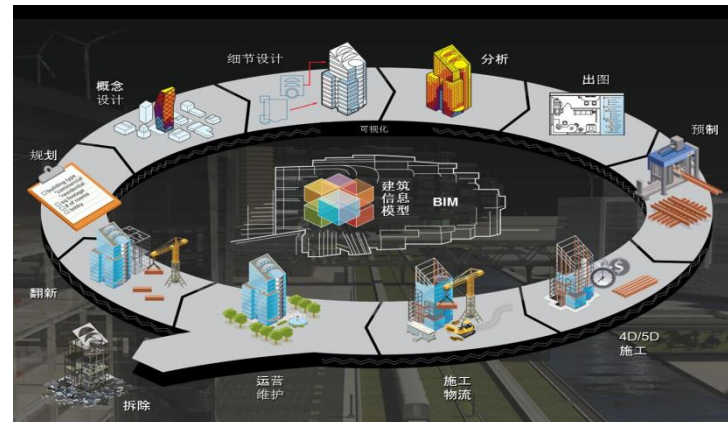
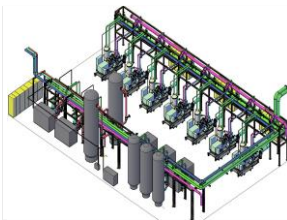
	LOD 200	LOD 300	LOD 400
RMB/m ²	3	7	10
10,000m ²	30,000	70,000	100,000

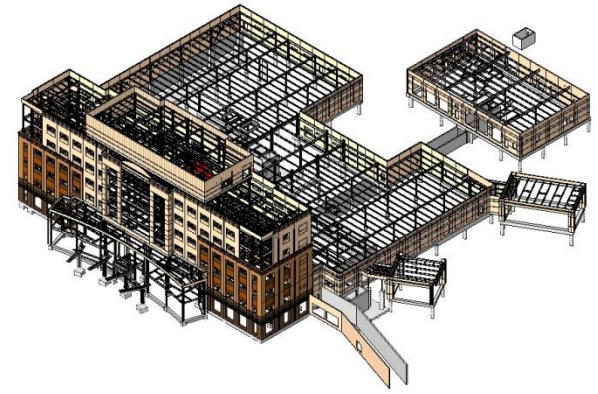
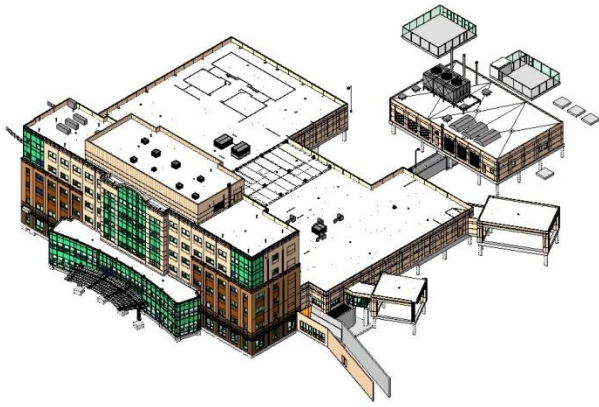
Note: The price above is for Food & Beverage manufacturing plant project

Costing



EXCELLENCE
IN SERVICE

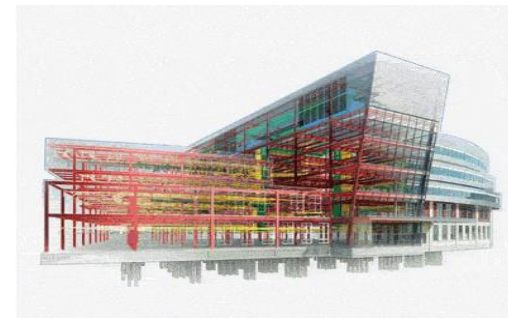




Q & A
THANK YOU



SOLUTIONS ENGINEERING AND PROJECT MANAGEMENT CO., LTD.

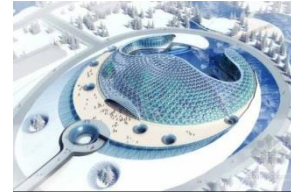


APPENDIXES



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CONCEPTUAL DESIGN STAGE



EXCELLENCE
IN SERVICE

Building visualization design

BIM can transform the professional and abstract 2D building to simplify and visualized 3D model, help owner to check project requirements in a clear and with great efficiency.

Project demonstration

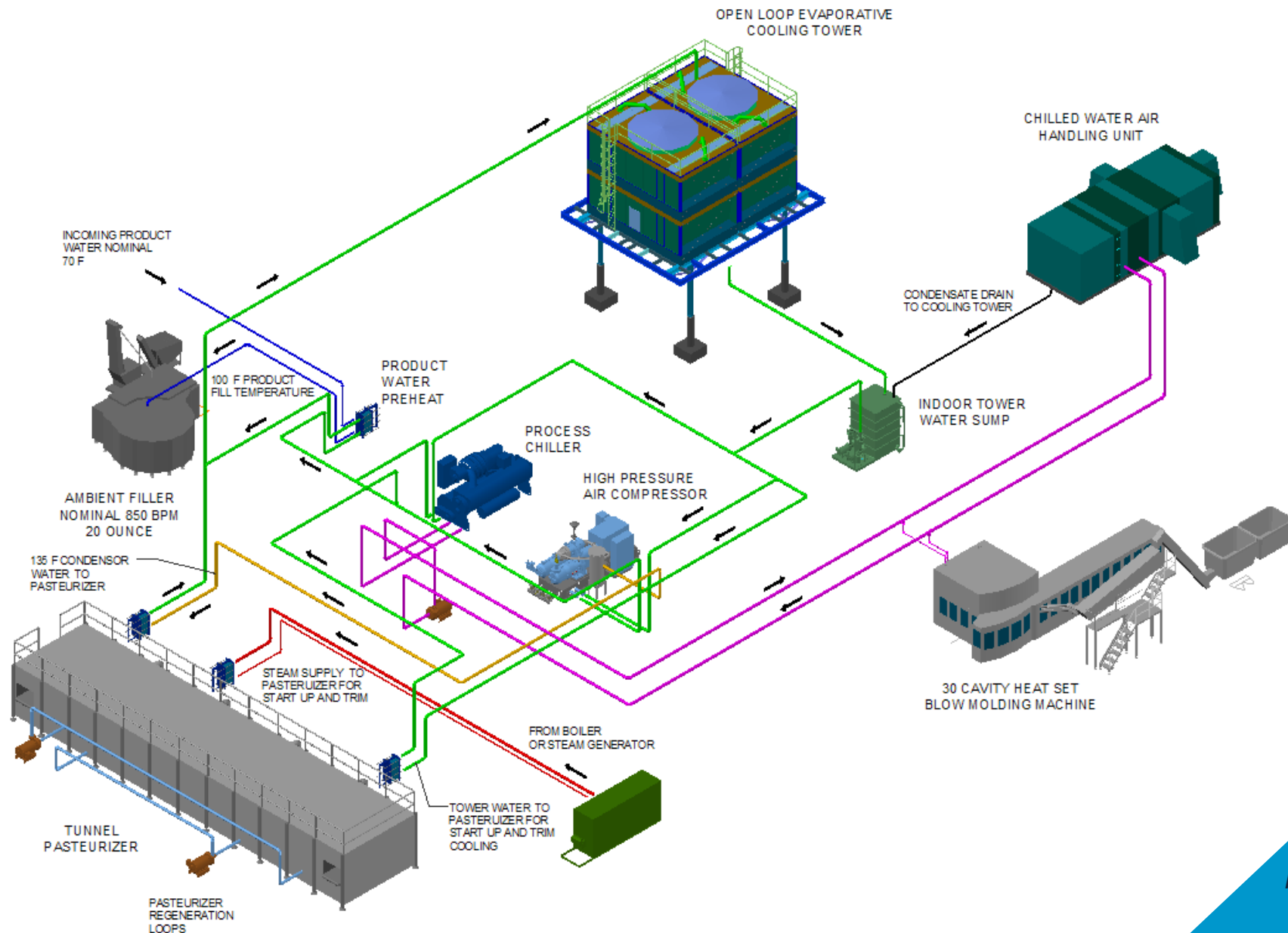
It is more precise to evaluate the design scheme and layout by using BIM, also supplies convenience and lower cost solutions to owner.

Construction site analysis

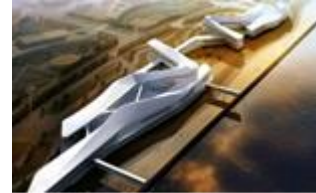
Modeling the space data of construction site and building, assist to evaluate the physical conditions and features in the planning stage, avoid the disadvantages like side effects of subjective factors, lack of quantitative analysis in traditional ways.

Quantity survey (Estimation stage)

The accurate quantity survey statistics which calculated by BIM software can be used in cost estimation during conceptual design stage and help owner to compare different design options in budget scope.



DETAIL DESIGN STAGE



ONE STOP FOR
EPCM SERVICES

Collaborative design

Collaborative design is mostly based on CAD platform currently, which can be extended to the whole construction process by using BIM technology.

Pipeline layout

In virtual 3D environment, BIM can be used as a clash detection tool to remove hidden clash in construction stage and to reduce change order dramatically.

Performance analysis

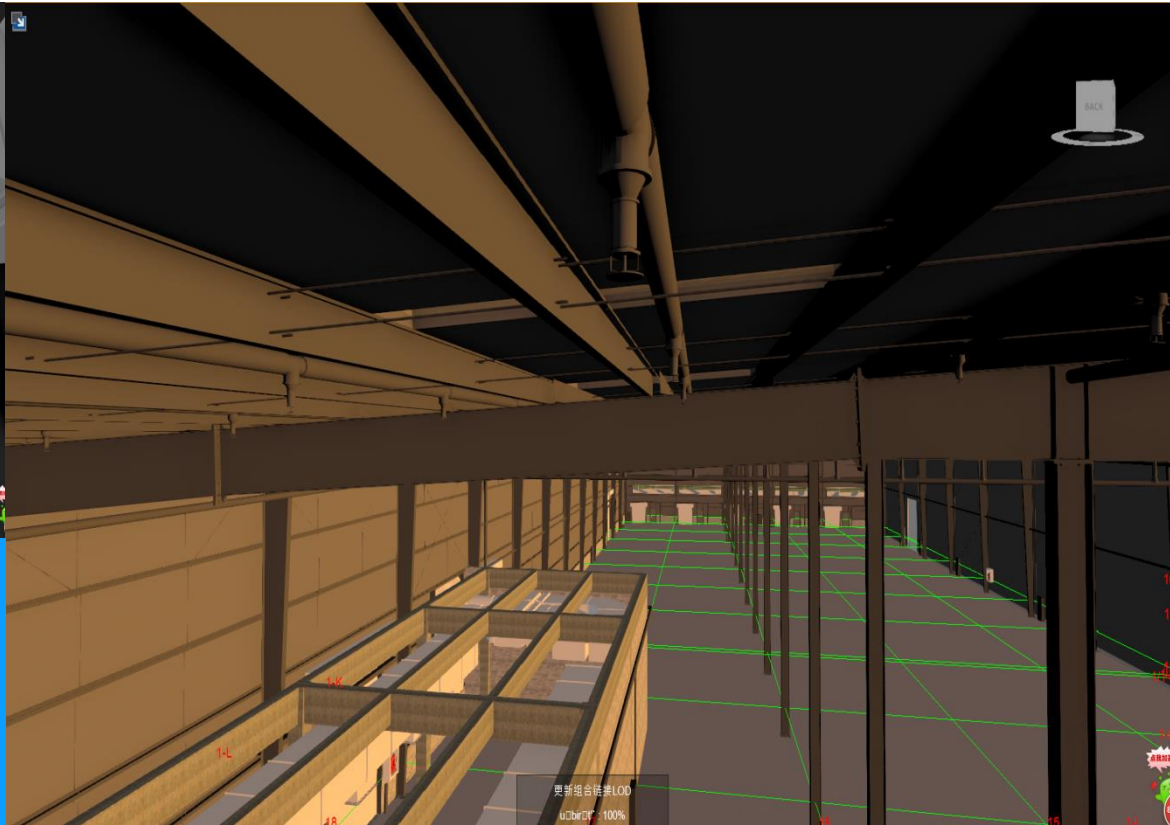
The vast design information contained in virtual building model during design process can be imported into related analysis software and export analysis result automatically, to improve the quality of the design.

Quantity survey (Budget)

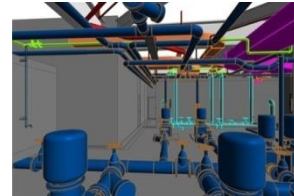
BIM software can analyze and count all kinds of components, reduce complicated manual operation and potential mistakes by using the abundant engineering information data.



Unilever Hefei Distribution Center Project



CONSTRUCTION STAGE



EXCELLENCE
IN SERVICE

Construction progress simulation

Conjoining BIM and construction process plan to integrate the spatial and time information into a 4D model, to reflect the whole construction process directly and precisely.

Construction organization simulation

Feasibility simulation analysis to the important and difficult parts of the project, optimizing construction and installation scheme by month, day and time, to help project management party understand installation timesheet and procedure directly and control the key points.

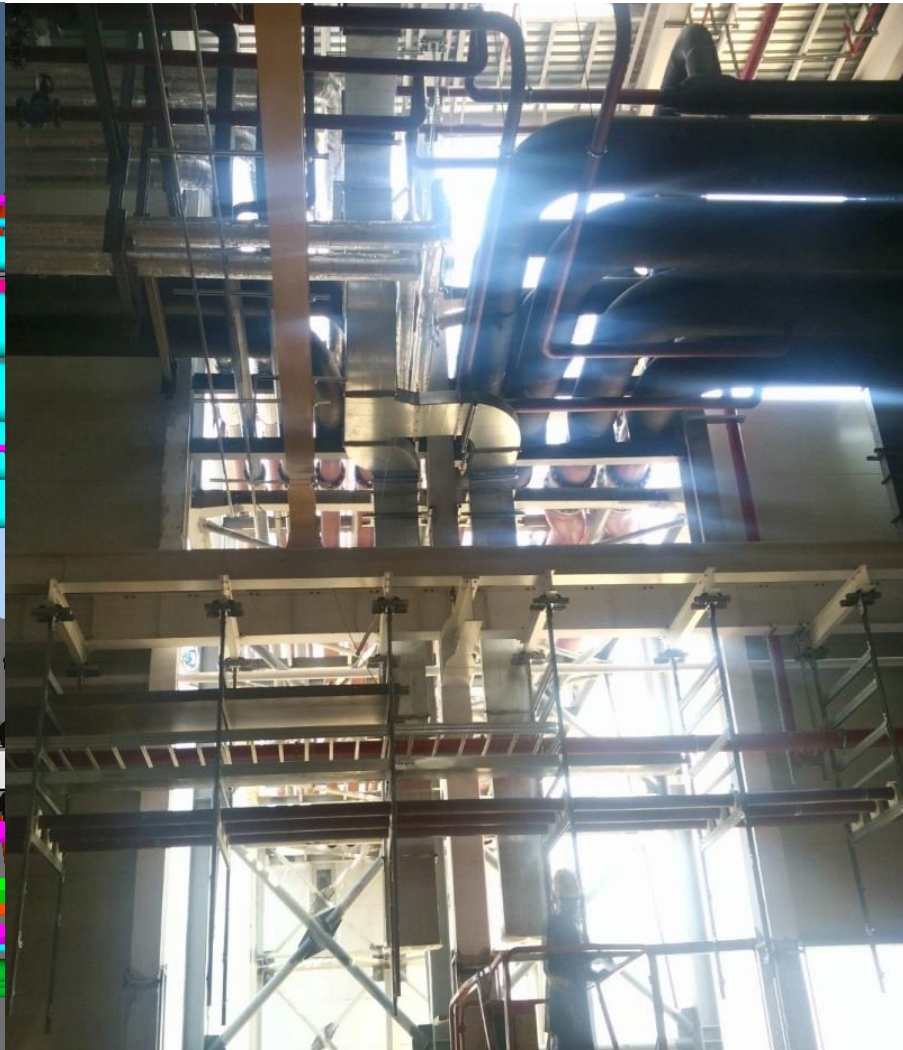
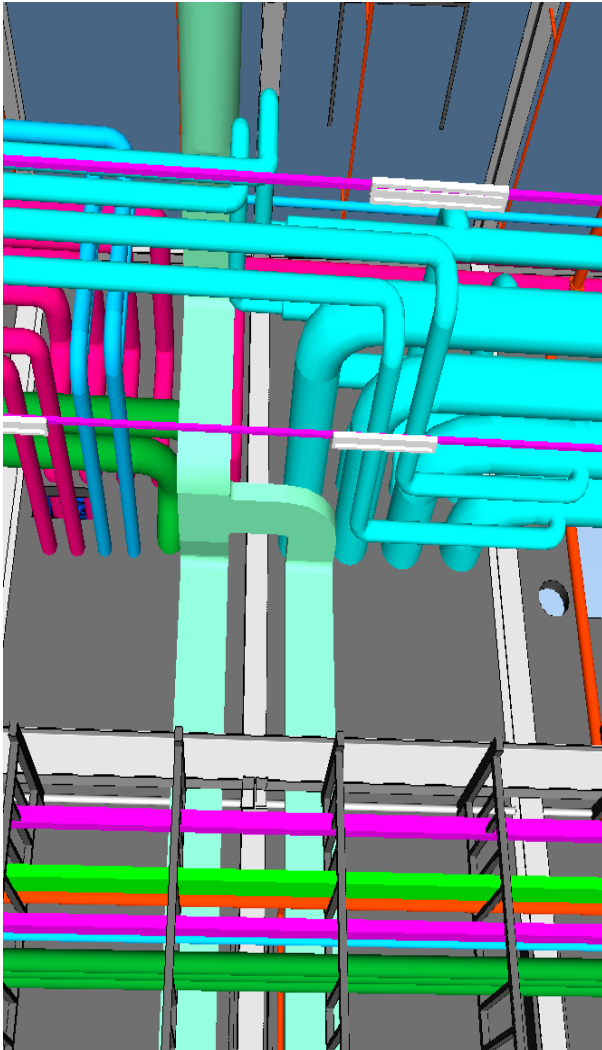
Digitalization construction

The pre-fabrication of the building components can be automatically completed by digitalization construction, improving the productivity significantly to shorten construction period and easier to supervise.

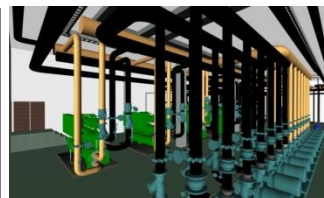
Cooperation in construction site

As a communication platform, BIM can also coordinate all parties in construction site to shorten construction time, lower down cost and enhance productivity.

Unilever Hefei Distribution Center Project



FACILITY MAINTENANCE STAGE



ONE STOP FOR
EPCM SERVICES

Final acceptance model delivery

BIM can integrate the building spatial information and parameter information of facilities, provide owner a channel to figure out the global building information.

Maintenance plan

Combination of operation maintenance management system allows full play to superiority of spatial orientation and data recording, making reasonable maintenance plan and especially assigning tasks.

Building system analysis

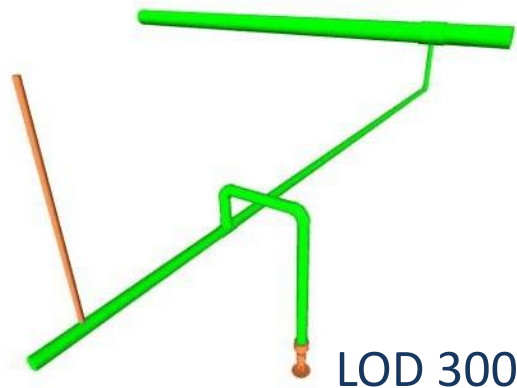
To verify the building that was constructed according to the special design rules and sustainability standards, improve the quality of the whole building.

Assets management

The vast building information contained in BIM can be imported into assets management system, to reduce time and man power investment in data preparation process during the system initiation stage.

Space management

BIM is helpful to analyze current space situation, re-distribute spaces and makes sure of the maximum utilization rate.



Modeled as design-specified size, shape, spacing, and location of duct, dampers, fittings, and insulation for risers, mains, and branches;

Approximate specified allowances for spacing and clearances required for all hangers, supports, vibration and seismic control that are to be utilized in the layout of all risers, mains, and branches;

Actual access/code clearance requirements modeled.

Modeled as actual size, shape, spacing, and location/connections of duct, dampers, fittings, and insulation for risers, mains, and branches;

Actual size, shape, spacing, and clearances required for all hangers, supports, vibration and seismic control that are utilized in the layout of all risers, mains, and branches;

Actual floor and wall penetrations modeled.

Supplementary components added to the model required for fabrication and field installation.



LEVEL OF DETAILS

LOD 400 provides strong on site execution tools, which reduces risks, less rework, minimize material waste and better schedule control



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