



PANETTA LAW FIRM

# *”CHALLENGES AND RISKS USING BIM”*

## What is BIM?

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- ❑ Building information modeling (BIM) is one of the most promising recent developments in the architecture, engineering, and construction (AEC) industry. With BIM technology, an accurate virtual model of a building is digitally constructed.
- ❑ This model can be used for **planning, design, construction, and operation** of the facility.
- ❑ It helps architects, engineers, and constructors to visualize what is to be built in a simulated environment, to identify any potential design, construction, or operational issues.
- ❑ BIM represents a new paradigm within AEC, one that encourages integration of the roles of all stakeholders on a project.

## BIM STAGES

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- ❑ **DESIGN AND PLANNING STAGE:** BIM is crucial in supporting prototyping and analysis, because, at this stage, it supports **data storage** which consequently can be used to analyze performance. At this stage, incompatibilities can occur, when, for instance a pipe meets other elements, but the use of BIM helps in ensuring that there is adequate solution and identifying potential problems that might arise, thus allowing for early intervention to take place.
- ❑ **CONSTRUCTION STAGE:** BIM provides a visual display of the issue that might take place during the construction and thus provides a way of seeing **reality from expected**. When this happens, it means that elements of a project that interferes with its progress tends to be identified and remedial measures can be put in place. BIM has also been found to improve decision making and hence reduce cases of litigations, and these benefits can be seen during the construction stage. This thus meets the important need of keeping costs.
- ❑ **MAINTENANCE STAGE:** BIM has been found to provide maintenance predictability, by anticipating changes and problems and hence preparing the project management team in being able to tackle the problems as and when they arise.

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# APPLICATIONS OF BUILDING INFORMATION MODELING

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- ❑ A building information model can be used for the following purposes:
    - ❑ Visualization: 3D renderings can be easily generated in house with little additional effort.
    - ❑ Code reviews: Fire departments and other officials may use these models for their review of building projects.
    - ❑ Cost estimating: BIM software has built-in cost estimating features.
- Material quantities are automatically extracted and updated when any changes are made in the model.

# APPLICATIONS OF BUILDING INFORMATION MODELING

- ❑ Construction sequencing: a building information model can be effectively used to coordinate material ordering, fabrication, and delivery schedules for all building components.
- ❑ Conflict, interference, and collision detection: all major systems can be instantly and automatically checked for interferences. For example, this process can verify that piping does not intersect with steel beams, ducts, or walls.
- ❑ Forensic analysis: a building information model can be easily adapted to graphically illustrate potential failures, leaks, evacuation plans, ecc.
- ❑ Facilities management: facilities management departments can use it for renovations, space planning, and maintenance operations.

## BIM RISKS

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- ❑ BIM risks can be divided into two broad categories: **legal (or contractual) and technical**.
- ❑ The first risk is the lack of determination of ownership of the BIM data and the need to protect it through copyright laws and other legal channels.
  - ❑ For example: if the owner is paying for the design, then the owner may feel entitled to own it, but if team members are providing proprietary information for use on the project, their proprietary information needs to be protected as well. Thus, there is no simple answer to the question of data ownership; it requires a unique response for every project depending on the participants' needs.
- ❑ To prevent disagreement over copyright issues, the best solution is to set forth in the contract documents ownership rights and responsibilities.

## BIM RISKS

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- ❑ Another contractual issue to address is establishing who will control the entry of data into the model and be responsible for any inaccuracies.
- ❑ Requests for complicated indemnities by BIM users and the offer of limited warranties and disclaimers of liability by designers are essential negotiation points in order to use the BIM technology.
  - ❑ A solution could be: Many sophisticated contracting teams require subcontractors to submit detailed critical path method schedules and cost breakdowns itemized by line items of work prior to the start of the project.
  - ❑ The general contractor then compiles the data, creating a master schedule and cost breakdown for the entire project.

# BIM CHALLENGES

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- ❑ Finding an appropriate time to include and engage project's participants into BIM process will be a serious challenge for owners.
  - ❑ In fact, the changes in business practices to support BIM process is the most significant challenge in the prefabrication.
- ❑ Changing CAD technology to BIM needs more investment in BIM software, also hardware and training are other two challenges.
- ❑ BIM requires comprehensive knowledge of construction processes, methods and extensive resources.
- ❑ Legal and collaborative issues are known as barrier of using BIM in construction projects since using BIM contrasts to assign the responsibility to each party and to define liability issues between the parties.
- ❑ In addition, applying BIM in building projects increases the complexity of the model of intellectual property rights.
- ❑ Difficulty in reengineering the current existing process and adaptation to the BIM process is a challenge.

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## FOR THE FUTURE...

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- ❑ Implementing BIM requires enough national and international standard practices, comprehensive practical and technical knowledge in the construction industry.
- ❑ It is necessary to expand BIM adoption through **education** in such a way that construction companies can fully use this technology.
  - ❑ So, governments must encourage companies to use this modelling tool, especially in projects where governments are the client.
- ❑ BIM is helpful for the owners, contractors and designers: It has been indicated that, although as a modelling tool, BIM is used by a number of stakeholders. A clear definition of how these stakeholders can use BIM is the first step in countering risky projects.

## NOT ONLY BIM

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- ❑ There is an increasing need to apply building information modeling to low (or zero) energy buildings.
- ❑ Nowadays, a computer simulation of a building's thermal behaviour is an almost mandatory tool for making informed decisions.
- ❑ Code compliance, green certification, qualification for tax credits and utility incentives as well as real-time building control constitute new priorities in the construction or renovation of buildings.
  - ❑ To satisfy such priorities, a possible solution could be to exploit an existing BIM model and to automatically generate an accurate and flexible Building Energy Modeling (BEM) one.

# BIM-BASED BUILDING ENERGY MODELLING APPROACH

- ❑ BEM is software simulation of building energy use.
  - ❑ A BEM program takes as input a description of a building including geometry, construction materials, and lighting, refrigeration, water heating, and renewable generation system configurations, component efficiencies, and control strategies. It also takes descriptions of the building's use and operation including schedules for occupancy, lighting, plug-loads, and thermostat settings.
- ❑ A BEM program combines these inputs with information about local weather and uses physics equations to calculate thermal loads, system response to those loads, and resulting energy use, along with related metrics like occupant comfort and energy costs.

# BIM-BASED BUILDING ENERGY MODELLING APPROACH

- ❑ BEM has experienced significant growth in recent years.
- ❑ Its application within the construction industry by architects and engineers allows building energy consumption reduction by supporting informed choices of effective low (zero) energy-consuming strategies.
- ❑ There are several software that enable whole-building performance simulations (BPS), both commercial and open-source.

# BIM-BASED BUILDING ENERGY MODELLING APPROACH

- ❑ The implementation of such building models is often complex and time-consuming, furthermore, design or construction firms use BEM only at an advanced stage of the project which reduces its potential benefits.
- ❑ Indeed, BEM technologies have the capability of improving design from the point of view of the end-use energy consumption if adopted in the early phase of the design, following an Integrated Design Process.
- ❑ In this framework, building information modelling (BIM) is fundamental to streamline project management and integrate all involved professionals and stakeholders.

# BIM-BASED BUILDING ENERGY MODELLING APPROACH

- ❑ Digitalisation of the project information in a unique BIM model introduces an important simplification for interoperability between the different project areas, such as architects, civil and mechanical, electrical, and plumbing (MEP) engineers, general contractors, etc.
- ❑ Therefore, energy modelers may also benefit from a BIM database to develop BEM models, avoiding redundant building model creation and speed up the design.
- ❑ This methodology, called BIM-based BEM or BIM to BEM, has been investigated in literature and is becoming a common practice in the industry.

# BIM-BASED BUILDING ENERGY MODELLING APPROACH

- ❑ The BIM to BEM approach was tested as a useful tool for the maritime industry to improve the implementation of effective energy-saving measures.
- ❑ Attention to ecological issues has increased significantly in the maritime sector for both ports and ships.
- ❑ As stated in the 2020 Environmental Report, the European Sea Ports Organisation (ESPO) has ranked air quality, climate change, and energy efficiency as the top three of its ten environmental priorities.

# BIM-BASED BUILDING ENERGY MODELLING APPROACH. CASE STUDY

- ❑ The project of the Molo Beverello is part of a wider plan of “Redevelopment of the monumental area of the port of Naples” which follows the idea of improving the interaction and integration of the urban and port resources. The project, approved in 2018, consists of two parts:
  - ❑ The construction of a Commercial Area directly connected with the metro station of “Piazza Municipio”;
  - ❑ Re-arrangement of the “Molo Beverello” area, directly connected to the Commercial Area and to the pedestrian tunnel coming from the adjacent subway station. This project includes the construction of a new passenger terminal station for the fast sea lines to the islands of the Gulf of Naples.



# **BIM-BASED BUILDING ENERGY MODELLING APPROACH. CASE STUDY**

- ❑ The latter consists in the passenger terminal building of the maritime station of “Molo Beverello” in Naples, analysed by means of the developed methodology to identify energy efficiency strategies and reduce the overall primary energy consumption of the facility.
- ❑ Specifically, a detailed BIM model of the building was developed in order to automatically generate a reliable energy model exploiting the information included in the BIM database.

# BIM-BASED BUILDING ENERGY MODELLING APPROACH. CASE STUDY

- ❑ Several energy-saving strategies were simulated by the developed workflow to evaluate their conveniences, such as:
  - ❑ water- source heat pump, heat recovery from chiller condensers, replacement of window facade with special photovoltaic glass, and replacement of shading systems with photovoltaic canopies.
  - ❑ The proposal to install a photovoltaic system allows a PES (MWh/year) value of about 40%. The dynamic analysis conducted on the incoming and outgoing energy fluxes shows a substantial saving of the energy required.
- ❑ The adoption of the selected measures always showed interesting outcomes from an energy, economic, and environmental points of view.



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