BIM's Strategic Return on Investment (ROI)

In Indian Infrastructure Projects

Produced by

GEOSPATIAL WORLD
ADVANCING KNOWLEDGE FOR SUSTAINABILITY

In association with

AUTODESK

Executive Summary

Worldwide thousands of architecture, engineering and construction firms in both public and private sectors have incorporated Building Information Modelling (BIM) into their lifecycle. However, in India, where technology use in infrastructure projects is still at a nascent stage, the adoption of BIM across infrastructure lifecycle, can add significant value to the US$ 1.4 trillion infrastructure spending proposed by the Government of India for 2019-2023. In the past, and in projects where BIM has been implemented in India, BIM's return on investment (RoI) generated across infrastructure projects ranges from schedule reduction and compliance to productivity improvement, to rework reduction to name a few.

6 Benefits of BIM-based Value Engineering in Construction Workflow*

33%
Reduction in project duration

33%
Reduction in construction cost and whole lifecycle of built assets

36%
Reduction in construction rework

43%
Increase in labour productivity

50%
Reduction in Greenhouse Gas emissions in the built environment

64%
Reduced document errors and emissions

*This report provides BIM's Strategic Return on Investment (RoI) in Indian Infrastructure Projects, namely, transport infrastructure projects, buildings and campuses, industrial construction and water infrastructure projects.

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Introduction

Countries, worldwide are seeking to address infrastructure gaps, build infrastructure resilience in alignment with the 2030 Agenda for Sustainable Development and the Paris Agreement. The **Architecture, Engineering and Construction (AEC)** industry globally is the biggest violator in terms of sustainable practices, and therefore, the industry has the largest room to make an impact. We are at the cusp of a climate emergency and need to urgently reduce our carbon footprints whilst at the same time improve productivity.

Need for Digital Transformation

The world is on the cusp of an unprecedented opportunity to utilize digital technologies for more productive infrastructure development – empowering architects, designers, engineers and contractors around the globe to create sustainable infrastructure. The use of BIM, in particular, represents the creation and use of a three-dimensional (3D) virtual model that amplifies the design, construction and operation of a building. It improves efficiency, productivity and sustainability from the early design phase throughout the lifecycle of infrastructure projects, playing a significant role in integrating sustainable practices into operational workflows.

Need for Digitalization in Infrastructure Projects – Global Trends

80%
Projects overshoot their primary budgets

35%
Weekly labour-hours are spent managing rework and handling conflicts

20%
Projects are not completed on time

39%
AEC industry accounts for 39% of total Energy Consumption

42%
Buildings are under-utilized and jobs are unproductive

30%
Construction materials are wasted in on-site; costing time, money and natural resources

Building Information Modelling (BIM): Foundation of Digital Transformation

Building Information Modelling or BIM is the foundation of digital transformation in the architecture, engineering and construction (AEC) industry. It is the holistic process of creating and managing information for built assets. Today, based on an intelligent model and enabled by a cloud platform, BIM integrates structured, multi-disciplinary data to produce a digital representation of an asset across its lifecycle, from planning and design to construction and operations.

BIM's Definition

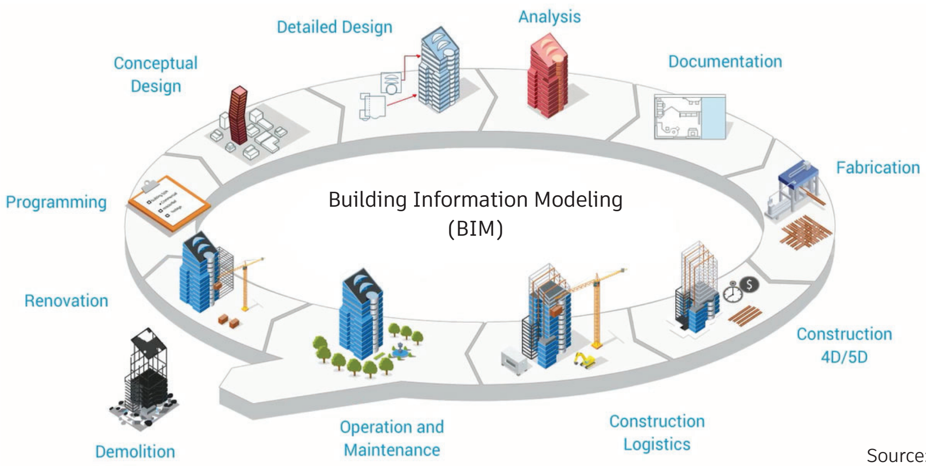
1 ISO 19650:201933

BIM is the use of a shared digital representation of a built asset to facilitate design, construction and operation processes to form a reliable basis for decisions

2 UK BIM Task Group

BIM is essentially value creating collaboration through the entire lifecycle of an asset, underpinned by the creation, collation and exchange of shared 3D models and intelligent, structured data attached to them

BIM Application Across Project Lifecycle



Source: Advenser

BIM data when integrated with other technology solutions like Geographic Information Systems (GIS) enables project stakeholders to gain more insight of the natural condition of the site such as understanding how the flood sensitivity of an area can impact decisions about the location, orientation, and construction materials required for infrastructure projects.

Functions of BIM

The complete process of producing and managing information for a constructed asset is known as Building Information Modeling (BIM). The following analysis visualizes the various important functions derived from BIM solutions that is gradually attracting the stakeholders of the AEC ecosystem to adopt digitalization in their ongoing and upcoming construction and infrastructure projects.

Analysis

BIM enables designers and architects to create a three-dimensional model of the construction project which can be utilized to perform analytical functions such as material tracking, delivery, energy modelling, and facility management. It helps to determine the impact of the building, or the structure on the immediate environment.

Management

BIM solutions support creation and management of documents and information across the entire lifecycle of all construction projects by federating all multi-disciplinary design and construction documentation into a common dataset.

Visualization

Utilizing the power of immersive visualization, BIM models enable stakeholders to explore the design model and develop an accurate understanding of the final product before starting construction.

Information Control

BIM processes accumulate construction information through model data. This enables easy standardisation and management of all the physical assets of the building or structure.

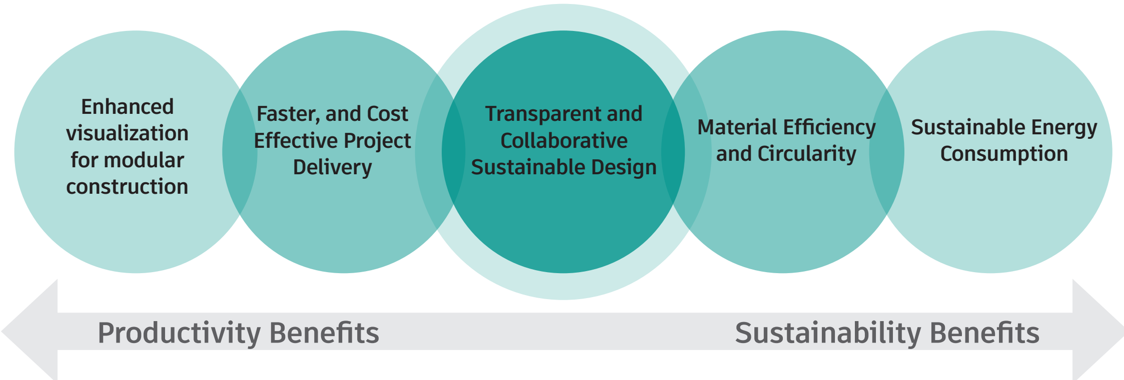
Communication and Collaboration

BIM models enhance communication and collaboration between multiple stakeholders by allowing to share relevant and accurate information among them. This provides extreme clarity to contractors on how to proceed with construction and reduce maximum errors to avoid rework.

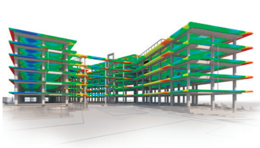
Impact of BIM on Construction Projects

BIM represents a new paradigm within the AEC ecosystem – one that encourages integration of the roles of all stakeholders on a project. Implementation of BIM across AEC projects brings significant impacts for different stakeholders associated with the projects. BIM solves some of the key issues associated in each phase of the project lifecycle in an efficient way.

Impact of BIM on Construction Projects



Benefits of BIM across Project Lifecycle



1 Plan & Design

- Cost Estimation
- Clash Detection
- Enhance Visualization
- Energy Modelling
- Reduce Litigations
- Develop Green Building Assessment

2 Build

- Material Management
- Reduce Carbon Footprints
- Schedule Time and Cost
- Develop Simulation Models for Environmental Impact
- Catalyze Lean Project Delivery

3 Operate

- Predictive Maintenance
- Cost Optimization
- Change Documentation
- Monitor and Maintain Sustainability Performance

4 Renovations and Retrofits

- Enhanced visualization and data management
- Increased Energy Efficiency
- Resource, cost, and time optimization

The Indian Construction and Infrastructure Sector

Over the past couple of years, the Government of India has been extremely proactive in launching significant nation-wide investment budgets, and plans and strategies which will enhance infrastructure development within the country. Launched in August 2020, the National Infrastructure Pipeline (NIP) is a first-of-its-kind, whole of government exercise to provide world-class infrastructures to citizens and improve their quality of life. Further, it aims to improve project preparation and attract investments (including FDIs) into infrastructure. Under NIP, the Indian government has allocated a budget of USD 1.4 trillion on infrastructure wherein each Ministry/ State/ Implementing Agency is expected to add new projects and update their respective project details so that NIP remains a living repository with widespread access.

India's Growing Building and Construction Sector

3rd Largest
Construction market in the world by 2025

USD 1.4 tn
Indian construction market by 2025

80%+
Indian project owners, contractors believe project risks rising rapidly
(Source: KPMG)

70%
Of infrastructure for 2030 is yet to be build

5-7x
Productivity boost expected by using BIM and other documentation technologies in construction processes

Need for BIM

The Indian construction and infrastructure sector is one of the major contributors to the Indian economy and the socio-economic growth of the country. Currently, the sector is undergoing a major transformation – including significant urbanization and economic development, contributing approximately nine percent to the country's GDP.

Use of BIM can boost productivity in the Indian infrastructure sector by at least 25-30%.

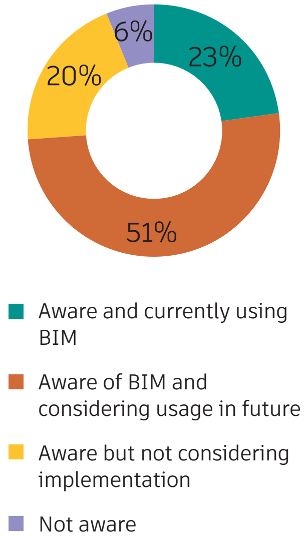
- Rethinking design
- Enabling better collaboration in real time
- Improving on-site execution and reducing risks
- Improving material efficiency and ensuring sustainable energy consumption
- Simplifying integration of design and construction information
- Supporting green building assessment and certification

Source: GW Consulting Analysis

Current State of BIM Adoption in Indian Construction and Infrastructure Sector

BIM Awareness and Usage: In terms of awareness and implementation of BIM in India, at most only 20 percent of the stakeholders of the Indian construction and infrastructure ecosystem are currently implementing BIM technology. Most of these users are architects and designers who use BIM for design simulations, enhanced visualization, and better coordination and collaboration. Simultaneously, more than 50 percent of the AEC stakeholder ecosystem are aware of BIM as an extension of CAD and are considering it's usage in the future.

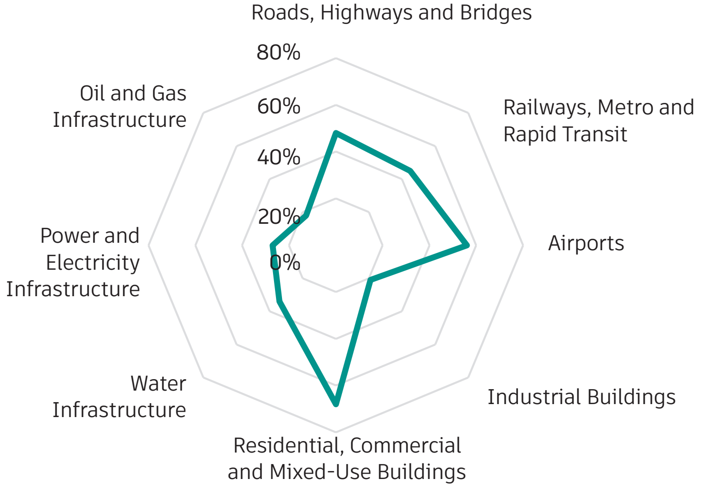
Further, the use of BIM across the engineering and construction phase is significantly less. Most of these organizations are aware of the benefits of BIM but are not considering its implementation due to lack of knowledge on RoI. Alternatively, there are certain section of stakeholders who are not aware of BIM and its value proposition across infrastructure projects but would be interested in knowing more.



Source: GW Consulting Analysis
N=90

Projects with BIM Implementation

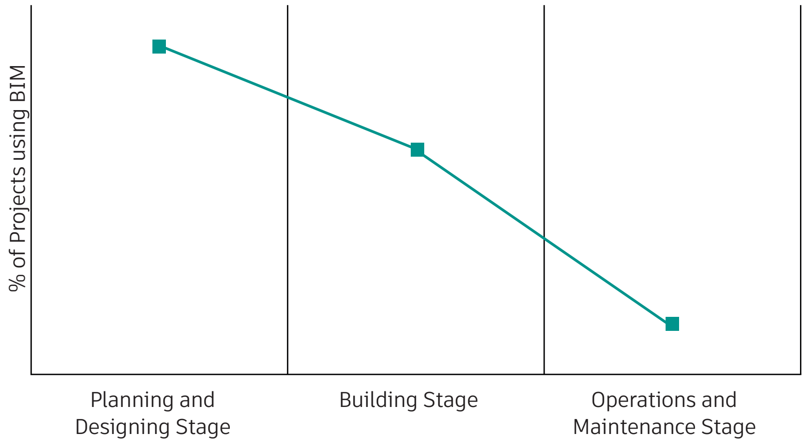
Currently, BIM is being utilized in a varied range of subsectors of the built environment in India. Analysis suggests that there is significant inclination of adopting BIM particularly in residential, commercial, and mixed-use building construction, followed by airport terminals and facilities projects. At present, the highway and bridge construction projects are not deploying BIM extensively in any of the project lifecycle.



Source: GW Consulting Analysis
N=90

BIM Maturity Across Construction and Infrastructure Lifecycle: BIM maturity in the Indian infrastructure projects is at a nascent stage and is used mostly in the planning and designing phase which includes feasibility study, schematic design development and for tendering and procurement documentation. Furthermore, the level of BIM implementation is the lowest in the operations and maintenance stage of the project. One of the major reasons for the same is that the RoI of using BIM solutions across the building and operations and maintenance phase is still not realized. This establishes a strong need to assess the qualitative and quantitative RoI of implementing BIM solutions across different phases of the construction and infrastructure lifecycle.

BIM Maturity Across Construction and Infrastructure Lifecycle



Source: GW Consulting Analysis
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BIM's RoI in Indian Construction and Infrastructure Projects

Roads and Highways and Bridges

Qualitative Return on Investment

Plan and Design

- Design optimization through early visualization
- Error reduction and decrease in construction time by early clash detection
- Integration with Augmented and Virtual Reality (AR/VR) for accurate visualization of the design

Building

- Accurate project scheduling and cost estimation
- Real time progress tracking and clashes increases efficiency of construction process
- Accurate estimation of total project budget using features like quantity take-offs, etc

Operations and Maintenance

- Serves as a shared knowledge resource for information about the as-built infrastructure asset
- Accurate assessment of maintenance requirements

Quantitative Return on Investment

35%
Average Design Time Saved

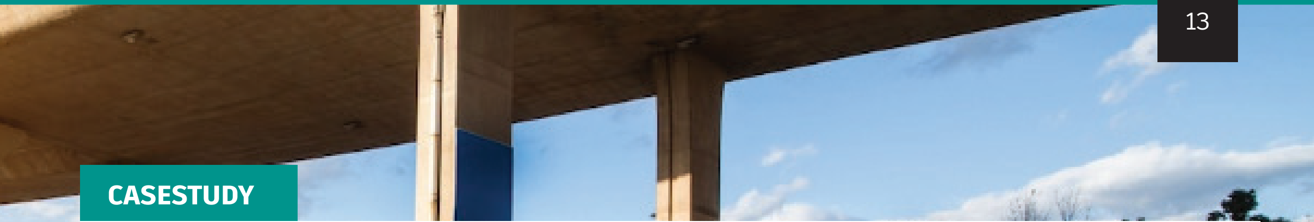
45 Days
Average Construction Time Saved

30%
Average Project Cost Saved

175 Hours
Resource Hours Saved

20%
Material Saved

Source: GW Consulting Analysis
N=12



CASESTUDY

Project Name: Jabalpur Flyover and Railway Overbridge Project

The congested city of Jabalpur, Madhya Pradesh, is situated on the two sides of the existing railway line and the railway overbridge (ROB) was the only bridge connecting both sides, leading to heavy traffic at peak hours. This overbridge was deemed incapable of and insufficient for catering to the current and estimated future traffic. These challenges made it necessary to widen the overbridge to a four-lane road with footpaths for pedestrians for catering to the level of service required for estimated traffic.

Challenges

- Site constraints due to existing operations on-site
- Challenge of maximum disruption to existing facilities
- Challenge to ensure improvements within the right-of-way (ROW)
- Huge dependency on 2D models
- Non-collaborative environment and siloed work approach

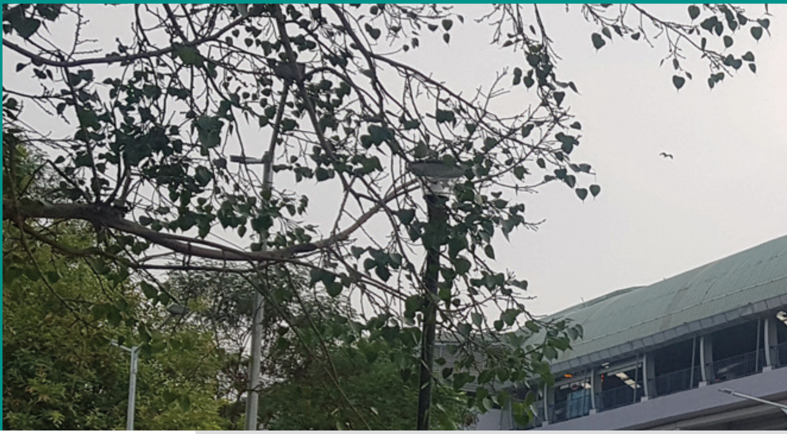
Solution

TPF Engineering Private Limited (TPFEPL), part of the worldwide TPF Group, is one of India's oldest civil engineering consulting firms. For this project, TPFEPL resolved all the challenges foreseen in the project using Autodesk AEC collection tools. Using Autodesk suite, the consultant prepared 3D plans and profile drawings in conformation with the Indian Railways Coraporation (IRC). Additionally, Revit and Dynamo scripts were extensively used for Box Girder Modelling for the railway overbridge. At the same time, these files were imported into InfraWorks to prepare for 3D visualization, improving decision-making and sustainability in the design delivery of the project corridor.

Value Proposition

- Automated workflow processes ensured cost efficiency and faster decision making in project delivery
- Accurate and precise visualization using Revit and Civil3D files in InfraWorks
- Integrated workflows in one single 3D model improved collaboration and coordination
- Project plan of 2-3 days reduced to single day
- Enhanced productivity and faster speed of execution and delivery
- With the flyover bridge in place, it was found that about 30-35% of all traffic volumes diverted to the bridges, and time delay reduced by 30% over the same period.

Railway, Metro and Rapid Transit



Qualitative Return on Investment

Plan and Design

- Faster collaboration among multiple stakeholders associated with the project
- Increased building performance and quality using energy modelling
- Extraction of cost estimates during design stage

Building

- Use of design model as basis for prefabricated components
- Quick and efficient reaction to design changes
- Discovering design errors and clashes before construction is initiated

Operations and Maintenance

- Improved commissioning and handover of facility and asset information
- Easy integration with facility operations and management systems

Quantitative Return on Investment

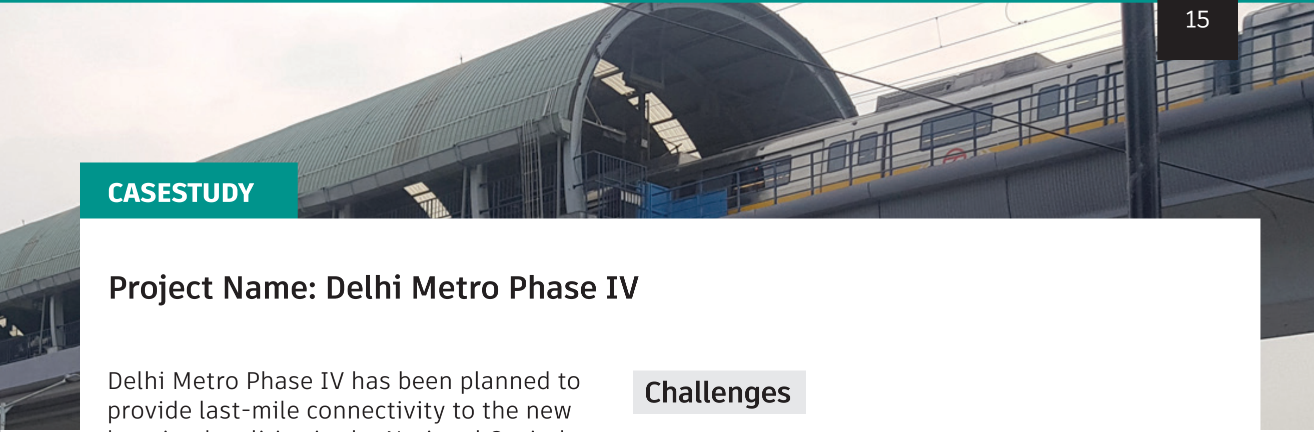
26%
Average Design Time Saved

40 Days
Average Construction Time Saved

15%
Average Project Cost Saved

375 Hours
Resource Hours Saved

Source: GW Consulting Analysis
N=10



CASESTUDY

Project Name: Delhi Metro Phase IV

Delhi Metro Phase IV has been planned to provide last-mile connectivity to the new housing localities in the National Capital Region (NCR). Delhi Metro Rail Corporation proposed 103.93 km long corridor in Phase IV which is likely to come up by 2022. Of this, 61.679 kms across three lines (priority corridors) with 45 stations were approved in 2019. The length of the silver line (one of the priority lines) was increased in 2020, making the priority corridor project length 65.1 km long.

Solution

The Delhi Metro Rail Corporation (DMRC) set up an online collaboration platform to use a common data environment (CDE) via Autodesk BIM Collaborate Pro, which helped fast-track the project. Techture, one of the consultants on the projects, adopted Autodesk BIM Collaborate for project delivery. This enabled designers to visualize the complex geometry and complete designs for timely delivery. Engineers accurately developed advanced rebar models and achieved parametric modeling for structures of viaducts and stations to adhere to the challenging timelines. The implementation facilitated sustainable project outcomes through digitisation measures like creating rebar models in a virtual environment. This optimized design helped in reducing CO_2 emissions in the environment, subsequently reducing GHG emissions. Also, such accurate structural models enabled the contractor to optimize the lengths of rebar to reduce wastage.

Challenges

- Expansion of project area/ length
- Challenging project timeline for creation of complex structural geometries
- No active collaborations between remote stakeholders
- Detailed parametric modelling of viaducts
- Advanced rebar modelling
- Development of complex structures incl. U-Girders, T-Girders, Pier Caps etc

Value Proposition

- Accurate design & construction modelling (incl. LOD 400/500 BIM model)
- Efficient stakeholder collaboration (Remote/ Off-site)
- Efficient digitisation with parametric design and rebar modelling
- Sustainable design and construction
- Accurate quantity estimation for reduced project costs
- 4D/ 5D simulation for planned vs. actual assessments

Airports

Qualitative Return on Investment

Plan and Design

- Centralized access to the data model helps the project team members at multiple sites leverage the data models regardless of their physical location
- Optimized visualization of the design for the air terminal for all stakeholders associated at the planning and designing stage
- Increased terminal building performance and quality using energy modelling

Building

- Efficient estimation of required resources and materials help in saving cost and time
- Use of design model as basis for prefabricated components
- Discovering design errors and clashes before construction is initiated

Operations and Maintenance

- Improved commissioning and handover of facility and asset information
- Easy integration with facility operations and management systems
- Serve as a shared knowledge resource for information about the as-built infrastructure asset

Quantitative Return on Investment

40%
Average Design Time Saved

90 Days
Average Construction Time Saved

15%
Average Project Cost Saved

20%
Material Saved

Source: GW Consulting Analysis
N=8

CASESTUDY

Project Name: Kempegowda International Airport, Bengaluru

Bangalore International Airport Limited (BIAL), was tasked with completing the design and construction of the Terminal 2 of the Kempegowda International Airport by March 2021. BIAL authorities approached their vision of an innovative and futuristic airport with a design philosophy of four key pillars – garden terminal concept, sustainability, technology, and showcasing the art and culture of the state of Karnataka.

Solution

In its attempt to digitally transform the design and construction processes and address the potential challenges associated with the mega project, BIAL mandated BIM for the entire project lifecycle of Terminal 2 of KIA. In an industry and country first, the project team used the Autodesk® BIM Collaborate Pro (earlier known as BIM 360 Design) for end-to-end project delivery, that is, design, fabrication, construction, operations, and maintenance of the new terminal. The company also leveraged the full extent of the Autodesk Suite to fulfil its vision of new and intelligent infrastructure, while connecting people, data, and workflow in the construction project. The end BIM goal of the project included integrating COBie (Construction Operations Building Information Exchange) data with the BIM models for facility management and operations.

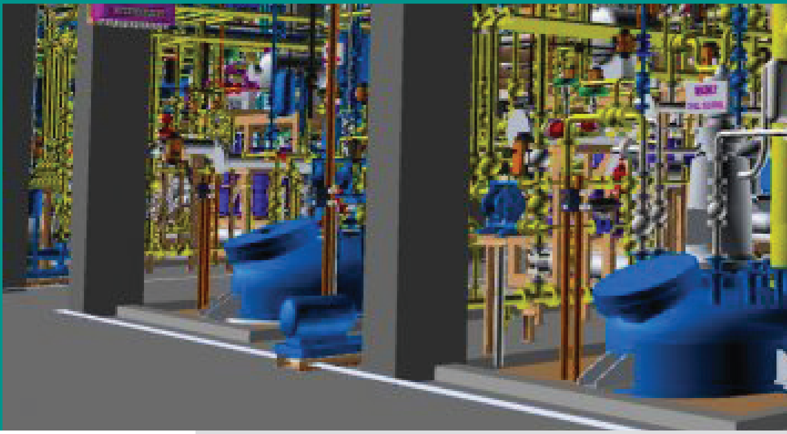
Challenges

- Expansive project scope
- Compact project timeline of two-and-a-half years
- Difficulty in multi-stakeholder collaboration
- Lack of a common unified platform
- Legacy dependence on paper-based models
- Negative environmental impact

Value Proposition

- Expedite design and construction processes, including delivery of 5000 drawings in six months
- Seamless multistakeholder collaboration
- Intelligent real-time digital models as single source of truth
- Sustainability-led design and construction
- 75% reduction in RFI time and zero working hours lost
- Improved productivity and construction efficiency

Industrial Buildings



Qualitative Return on Investment

Plan and Design

- Parametric designing capabilities of BIM help design complex structures and long span structures in factory and industrial set-ups
- Faster collaboration among multiple stakeholders associated with the project
- Error reduction and decrease in construction time by early clash detection

Building

- Helps in real-time clash detection in case of constructing complex MEP designs
- Use of design model as basis for prefabricated components
- Quick and efficient reaction to design changes

Operations and Maintenance

- Easy integration with facility operations and management systems
- Serves as a shared knowledge resource for information about the as-built infrastructure asset

Quantitative Return on Investment

40%
Average Design Time Saved

50 Days
Average Construction Time Saved

22%
Average Project Cost Saved

130 Hours
Resource Hours Saved

23%
Material Saved

Source: GW Consulting Analysis
N=10

CASESTUDY

Project Name: DCS controlled plant, C2C Engineering

C2C Engineering was tasked with building a multi-product, multipurpose, state-of-the-art, batch-type, DCS controlled plant for Deccan Fine Chemicals. Deccan approached C2C Engineering to work on ‘Launch Plant’, a project spread over a total area of 3120 sq. m. All in all, the project contains a Main Block of 52m x 66m spread over 6 levels, an Auxiliary Block of 30m x 8m spread over 3 levels, a Scrubber Block of 14m x 14m, a Tank Farm of 14m x 66m, interconnected with a Pipe Rack totaling 171m.

Solution

C2C maked use of a number of top-of-the-line engineering solutions for successful delivery. It used AutoCAD’s Plant 3D Toolset to generate intelligent P&IDs, for equipment modelling, piping and structural steel detailing, as well as AutoCAD Revit for building modelling, and AutoCAD MEP toolset for electrical and instrumentation detailing.

They chose AutoCAD Plant 3D as an exclusive platform to execute this project to:

- Create piping specifications based on client requirements
- Create piping and instrumentation inline components
- Model all equipment and piping
- For visualization and to create walk-throughs

Challenges

This was a challenging ask, with C2C being tasked with delivering a plant designed to accommodate 905 pieces of equipment, 11250 pipelines totalling 52 Kms of CS & SS pipes of sizes varying from ½” to 16”, 26 Kms of MSPTFE pipes consisting of 26,000 spool pieces of sizes 0.1 to 3 m, 362 electrical motors, 67.5 Km of electrical power cables, 35 Kms of electric control cables, 196 Km long instrumentation cables, control panels, on/off valves and more.

Value Proposition

Time and cost efficient project delivery

C2C was able to significantly reduce manual effort in visualization, eliminate errors and accommodate ongoing changes, all within budget and time constraints.

Business benifit- The customer was pleased with C2C’s performance that they contracted them to work on another project and have begun talks to send more work our way.

Residential, Commercial, and Mixed-use Buildings

Qualitative Return on Investment

Plan and Design

- Design optimization through early visualization
- Faster collaboration among multiple stakeholders associated with the project
- Timely clash detection during design development stage

Building

- Use of design model as basis for prefabricated components of large structures
- Quick and efficient reaction to design changes
- Efficient estimation of required resources and materials help in saving cost and time

Operations and Maintenance

- Serves as a shared knowledge resource for information about the as-built infrastructure asset
- Improved commissioning and handover of facility and asset information

Quantitative Return on Investment

43%
Average Design Time Saved

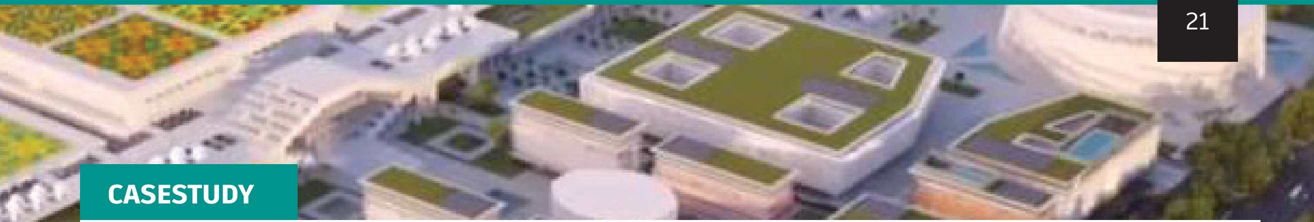
73 Days
Average Construction Time Saved

23%
Average Project Cost Saved

360 Hours
Resource Hours Saved

25%
Material Saved

Source: GW Consulting Analysis
N=16



CASESTUDY

Project Name: India International Convention and Expo Centre (IICC), New Delhi

The India International Convention and Expo Centre (IICC) in New Delhi is a unique, multipurpose convention center developed under the smart city initiative of the Government of India with a vision to be an icon of India and to obtain a platinum certification from the Indian Green Building Council (IGBC). With a total area of 1,000,000 sq m, IICC is India's largest convention and exhibition complex with large exhibition halls, an auditorium, and multi-arena facilities.

Solution

The BIM Engineers, one of the design consultants on the project, deployed the latest technological know-how in BIM to build the dynamic facilities of IICC. The consultants challenged the conventional method of designing the structure, by transitioning from in-silos data in AutoCAD to collaborative Revit models to efficiently control and develop the design and coordination process. By transitioning from CAD to BIM, the plan-to-design, design-to-construction, and construction-to-handover processes became more accessible and robust. The focus of the structural design was on sustainability – through developing the building envelope, general installations, energy efficiency, and control systems, among other things.

Challenges

- Expansive scale and complex nature of the project
- Difficulty in coordination between the ASMEP services
- Continuously evolving design expectations from the client
- Spatial coordination issues leading to delay in construction processes
- Software compatibility issues resulting in reworks

Value Proposition

- Improved collaboration for design coordination, and document management
- Early clash detection using Autodesk Navisworks
- Seamless spatial and built environment data exchange lead to minimal data losses
- Better time, cost, and quantity estimates
- Better control over site inventory and project plans
- Improved construction quality using value engineered decisions using Autodesk Revit

Water Infrastructure

Qualitative Return on Investment

Plan and Design

- Facilitates simplification of processes and promotes work linkage during planning stage
- Faster collaboration among multiple stakeholders associated with the project
- Various conflicts and problems in the design process can be identified by using BIM model simulation and testing, and the program can be made timely changes and adjustments

Building

- Use of design model as basis for prefabricated components of large structures
- Efficient estimation of required resources and materials help in saving cost and time

Operations and Maintenance

- Serves as a shared knowledge resource for information about the as-built infrastructure asset
- Virtual simulation function of BIM technology helps to check the performance and effectiveness of water supply and drainage system after construction

Quantitative Return on Investment

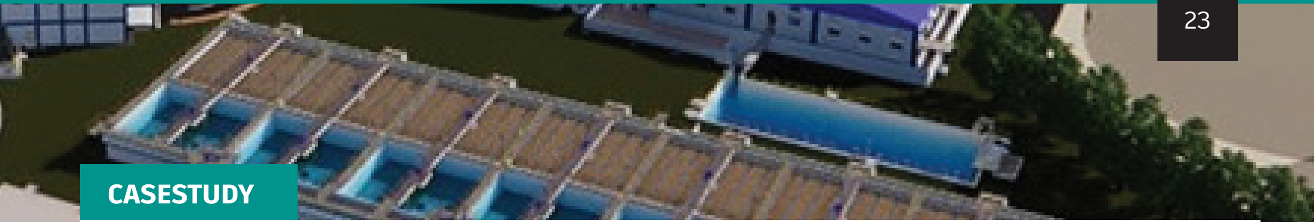
45%
Average Design Time Saved

44 Days
Average Construction Time Saved

24%
Average Project Cost Saved

275 Hours
Resource Hours Saved

Source: GW Consulting Analysis
N=12



CASESTUDY

Project Name: Chandrawal Water Supply Project - 477 MLD Advanced Water Treatment Plant

The Chandrawal Water Supply Project - 477 MLD Advanced Water Treatment Plant—an engineering, procurement, and construction (EPC) project awarded by the Delhi Jal Board—is a first of its kind for ozonized disinfection in India at an output scale of 477 MLD (million liters per day). The Chandrawal area, often experiences intermittent water supply and is considered a “water stressed zone” of New Delhi.

Solution

According to the team, they could only achieve the new additions and increasing the capacity of the plant within the current site by having the ability to view and see the 3D models with BIM. But they aren’t stopping there with 3D BIM. 4D BIM is being implemented for planning and scheduling, 5D BIM for cost monitoring during capital expenditures, 6D BIM for sustainability in the solar power energy management, and 7D BIM for operations and management. To reach important sustainability goals set by the owner, the plant will be built with solar power generation. To create this energy efficient system, solar path analysis has been verified with the help of Revit for optimum location of panels. The use of the AEC Collection—including Civil 3D, Revit, Navisworks, AutoCAD, and Dynamo—is boosting quality construction and scheduling. Virtual construction, clash detection, and AR/ VR reviews are completed before the release of any engineering deliverables.

Challenges

Providing clean and safe drinking water and finding the space for the actual water treatment plant.

The Engineering Design & Research Center (EDRC) of L&T Construction faced site constraints as it was extremely difficult to finalize the hydraulic design and installations for the project, since it is an integration with an existing 182 MLD water treatment plant and 36 MLD recycling plant.

The current plant serves 1.3 million people with a conventional treatment system that could not handle the toxic pollutants present in the raw water.

Result

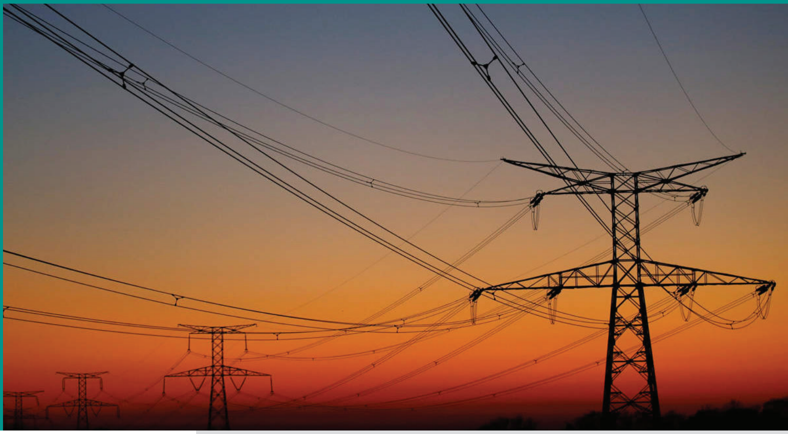
With a tight timeline and budget, the team realized 20% time savings (approximately 4500 hours) and $300,000 with 3D BIM and concurrent design and engineering.

3D visualizations aided in seamless and easy approval from clients by transparent communication.

With Dynamo, the team can control the parametric models in Revit, resulting in a larger number of iterations and options within a shorter period.

The new treatment plant will serve 2.3 million people with continuous, uninterrupted water supply Also built within the limited space

Power and Electricity Infrastructure



Qualitative Return on Investment

Plan and Design

- Visualize the entire electrical system in 3D and help in pinpointing the clashes or conflicts in-between the systems
- Faster collaboration among multiple stakeholders associated with the project
- Various conflicts and problems in the design process can be identified by using BIM model simulation and testing, and the program can be made timely changes and adjustments

Building

- Use of design model as basis for prefabricated components of large structures
- Efficient estimation of required resources and materials help in saving cost and time

Operations and Maintenance

- Serves as a shared knowledge resource for information about the as-built infrastructure asset
- Virtual simulation function of BIM technology helps to check the performance and effectiveness of supply lines
- Helps data centre managers to identify capacity limits before they are reached to avoid costly downtime

Quantitative Return on Investment

33%
Average Design Time Saved

38 Days
Average Construction Time Saved

15%
Average Project Cost Saved

200 Hours
Resource Hours Saved

Source: GW Consulting Analysis
N=8

Oil and Gas Infrastructure

Qualitative Return on Investment

Plan and Design

- Helps in creating detailed design generation and the digital representation of structure alongside the functional aspect, saving time and cost
- Earlier collaboration among multiple stakeholders associated with the project
- Helps understand the structural designs as intended and impart appropriate strength to the structure by reinforcement

Building

- Use of design model as basis for prefabricated components for large structures
- Efficient estimation of required resources and materials help in saving cost and time
- Quick and efficient reaction to design changes

Operations and Maintenance

- Provides value-added insights by getting a virtual walkthrough of the rig model before the maintenance engineer is actually on to the tasks
- Serve as a shared knowledge resource for information about the as-built infrastructure asset
- Virtual simulation function of BIM technology helps to check the performance and effectiveness of supply lines

Quantitative Return on Investment

15%
Average Design Time Saved

70 Days
Average Construction Time Saved

18%
Average Project Cost Saved

110 Hours
Resource Hours Saved

Source: GW Consulting Analysis
N=8

Conclusion and Key Takeaways

What have we learned?

The examination of BIM ROI assessment for Indian construction and infrastructure projects suggests that Indian firms are actively looking at deploying BIM across varied infrastructure projects. Architects, engineers and contractors of the Indian AEC ecosystem are quantitatively and qualitatively assessing the impact of BIM. Indian infrastructure stakeholders are looking at implementing BIM, echoing the observation that technology becomes invisible once it becomes ubiquitous. An assessment and evaluation of BIM's Return on Investment (RoI) across Indian Infrastructure Projects highlights –

- → Need for BIM Policy and Mandate for Infrastructure projects
- → Increase awareness of BIM's value proposition across engineers and contractors
- → Enhance adoption and understanding of BIM across highway and bridge project stakeholders
- → Actively create and strengthen opportunities for BIM implementation
- → Develop a strategic RoI discipline to support the prioritization and internal socialization of BIM implementation
- → Periodically conduct internal regime to monitor BIM ROI and BIM Maturity evolution across projects

Study Outline

Purpose

The purpose of the report is to identify and analyse the key measurable factors, value drivers and strategic benefits – both qualitative and quantitative, associated with BIM implementation in Indian infrastructure projects. The findings of this study will provide the Indian decision-makers, consultants, architects, engineers and contractors with the return on investment from use of BIM across infrastructure projects in India.

Design/Methodology/Approach

To identify BIM's strategic RoI, the study develops a comprehensive systemic review of mainstream case studies of BIM implementation in Indian infrastructure projects. A total of 84 projects have been taken into consideration from different sources including conference proceedings, company websites, journals, etc., and validated through one-on-one interview to evaluate the true value-proposition of BIM in infrastructure projects.

Practical Implications

The outcomes of this study would assist the Indian government authorities inclusive of key Infrastructure Ministries, stakeholders within the AEC ecosystem to understand BIM's strategic RoI in infrastructure projects whilst providing a deeper and wider perspective of the need for BIM mandate/policy to improve productivity challenges in the construction industry of India.

Originality

This study identifies and analyses the measurable factors associated with BIM on an industry scale rather than a particular organization or a project.

Acknowledgement

The report has been prepared by Geospatial World – a global think tank actively involved in raising awareness around the value of using geospatial, BIM and Digital Twin among governments, policy makers, businesses and public at large for the past 25 years. Autodesk India's team, led by Mr. Nikhil Bagalkotkar, Head Technical Sales - AEC, APAC and Mr. MK Sunil, Country Manager – AEC, worked with Geospatial World's Consulting Team, led by Ms. Ananya Narain and Titas Roy, and undergraduate students Saurabh Kumar and Saral Verma from IIT Kanpur, to deliver the report on **BIM's Strategic Return on Investment (RoI) in Indian Infrastructure Projects** in order to raise awareness of the value-proposition of using BIM among the key decision makers in the country.

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List of Abbreviations

2D – Two dimensional

3D – Three dimensional

4D – Four dimensional

5D – Five dimensional

6D – Six dimensional

7D – Seven dimensional

RoI – Return on Investment

BIM – Building Information Modelling

AEC – Architecture, Engineering and Construction

GIS – Geographic Information Systems

NIP – National Infrastructure Pipeline

FDI – Foreign Direct Investment

USD – United States Dollar

GDP – Gross Domestic Product

CAD – Computer-aided Design

AR – Augmented Reality

VR – Virtual Reality

ROB – Railway Overbridge

ROW – Right of Way

TPFEPL – TPF Engineering Private Limited

IRC – Indian Railways Corporation

NCR – National Capital Region

DMRC – Delhi Metro Rail Corporation

CDE – Common Data Environment

GHG – Greenhouse Gas

LOD – Level of Detail

BIAL – Bangalore International Airport Limited

COBie – Construction Operations Building Information Exchange

RFI – Request for Information

MEP – Mechanical, Electrical and Plumbing

C2C – Customer to Customer

DCS – Distributed Control System

CS – Carbon Steel

SS – Stainless Steel

P&IDs – Process & Instrumentation Diagrams

IICC – India International Convention and Expo Centre

IGBC – Indian Green Building Council

ASMEP – Architecture, Structural Design, Mechanical Engineering, Electrical Design and Plumbing & Sanitation

MLD – Million Litres Per Day

EPC – Engineering, Procurement, and Construction

EDRC – Engineering Design & Research Center

CWMC – Centre Water Management Centre

IIT – Indian Institute of Technology

KIA – Kempegowda International Airport

MSPTFE – Mild Steel Polytetrafluoroethylene Lined Pipe

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