

WHITE PAPER



# Leveraging **BIM** for Design & Construction



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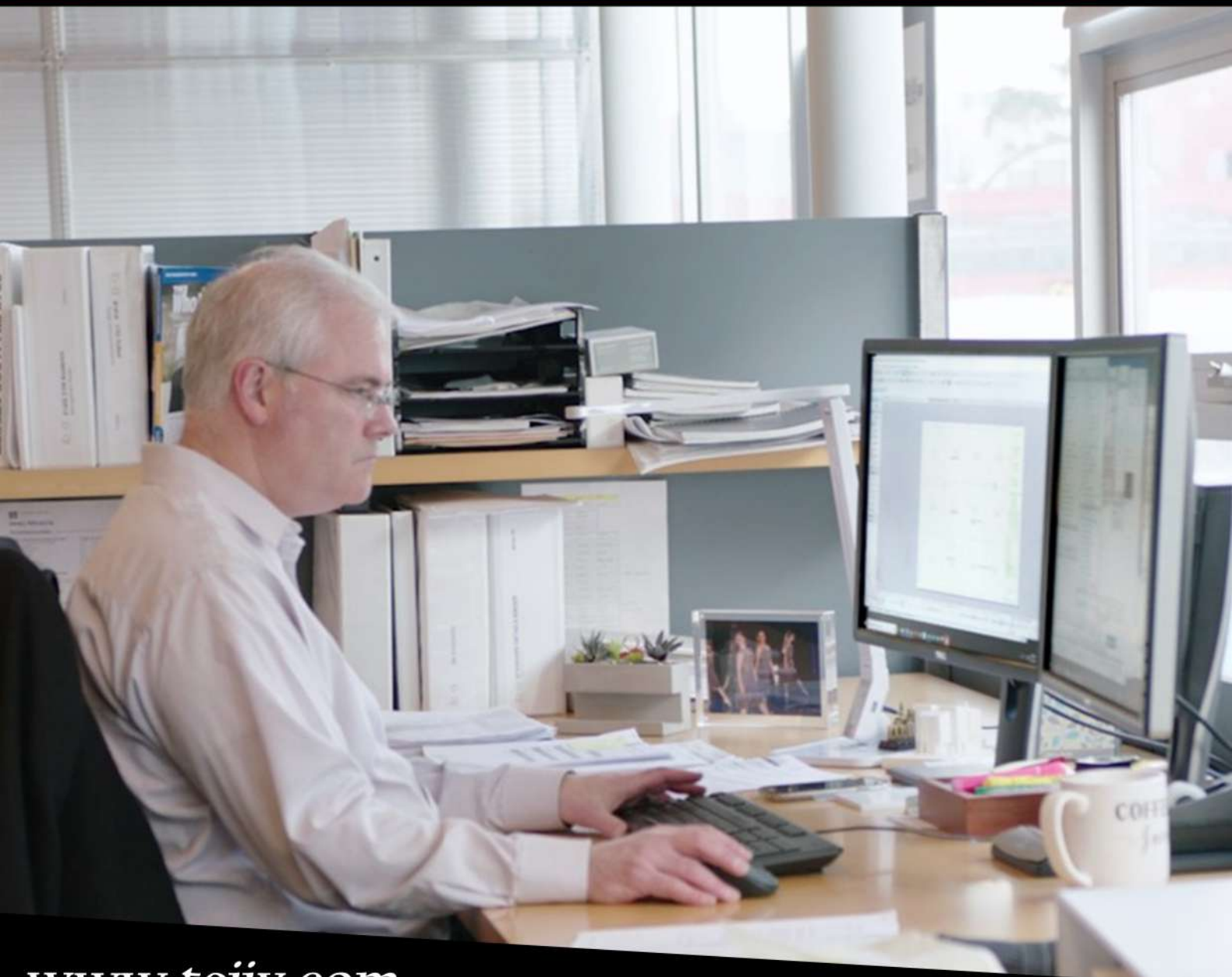
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# Executive Summary

The White Paper explores how AEC professionals can leverage BIM for building design and construction.

## Introduction

AEC Professionals are laying the groundwork in BIM to enhance revenue, productivity, efficiency & cost. Construction professionals in the USA are extensively using Autodesk Revit for saving significant time and money.





# BIM Alignment for Construction Facility

## - Challenges -

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### **i. Schedule Constraint:**

The construction professionals often have to deal with volume of work for large projects involving architectural, structural, site utility, MEPFP (Mechanical, Electrical, Plumbing, and Fire Protection) services. The overall project schedule management with a deadline for completion within a few months is the biggest factor.

### **ii. Resource Management & Time Constraint:**

Coherently maintaining a balance among several people simultaneously at the same construction site is challenging for construction professionals.

### **iii. Environmental Factors:**

AEC professionals face complexity to bring sustainable design (Green Building) to construction so that the workforce can get a healthy work environment.

### **iv. Collaboration with Multiple Project Stakeholders:**

Project Stakeholders across the world in various countries include Architects, Designers, Consultants, Engineers, Owners, Contractors, Vendors, and several others and so coordination with all project team members is often challenging for construction project managers.

### **v. Risk of Delay:**

AEC professionals also face the risk of delay in their projects, owing to the involvement of huge material resources for construction.



## BIM Software Applications Used for Resolving Project Challenges

- Revit
- AutoCAD
- Navisworks
- Civil 3D
- 3DS MAX
- BIM 360

## BIM Technology Resolving Construction Project Challenges

**i. An error-free 3D model:** Revit, Navisworks, 3DS Max, AutoCAD & BIM 360 create an error-free 3D model with exact quantities, shop drawings, and virtual simulation of the construction plan.

Implementation of technologies helps to make a strict schedule for several labors to work at a time on--site, facilitating smooth project construction & completion, saving work hours.

**ii. Streamlined process:** Revit BIM helps the Engineers involved in the construction process work with clearly defined targets to keep pace with the casting schedule. They seek the casting program & accommodate in the delivery schedule.

**iii. Sustainable green building designs:** Revit facilitates construction professionals to bring sustainable green building design to construction by planning through façade design during the pre-construction stage. The engineers produce the Shop drawings from the Revit Model and share with multiple stakeholders to assure a flawless construction.

**iv. Better Collaboration:** Revit BIM enables the on-site team members to collaborate with Contractors, Consultants & other Project Stakeholders for improved coordination, navigating clashes in the 3D model to get instant solutions, saving construction time. Revit software ensures proper coordination among trades for Clash Free Modeling & Shop Drawing Creation, resulting in the flawless site installation.

**V. Accurate BOQ:** 4D BIM Model & accurate Bill of Quantity produced from Revit help construction project managers to track timeline, allocate resources, save cost & rework. Revit work-sharing visualization allows viewing in canvas the tenure of outdated elements & components assigned to specific work sets. Revit also helps DWG exports, where the team members can update export user interface & save preset, configuring output requirement.





# Details of BIM Services for Design & Construction

## – Scope of Work

BIM Model creation in Revit for architectural, structural, site utility, site logistics, and MEPFP Services help to meet the following objectives:

- **Constructability Review**
- **3D Modeling & Clash Coordination & Mitigation**
- **Quantity Take-Off (BOQ)**
- **Bar Bending Schedule**
- **Construction Phasing**
- **Coordinated drawings**
- **Shop Drawing Validation**
- **Marketing Presentation**
- **As-built Update**

# BIM Scope of Work

## How 3D to 8D BIM Supports AEC Industry In Analysis?

- **3D BIM Model communicates design intent with parametric data**
  - ✓ Improved Project Visualization
  - ✓ Enhanced Collaboration
  - ✓ Reduced Rework
  - ✓ Visualizing Present Model Conditions
  - ✓ Safety & Logistics Model Creation
  - ✓ Prefabrication
  - ✓ Accurate Field Layout
- **4D BIM Influences Schedule for Construction Project Changes**
  - ✓ 4D BIM Simulation Model facilitates project participants
  - ✓ Construction Project Phasing Simulation
  - ✓ Lean Scheduling for Planner & Equipment Deliverables
  - ✓ Detailed Simulation & Installation
  - ✓ Visual Validation for Payment Approval
- **5D BIM Estimates Cost of Construction Project**
  - ✓ Cost-effective Construction Solution
  - ✓ Real-time Conceptual Modeling & Cost Planning
  - ✓ Quantity Extraction Supporting Comprehensive Cost Estimate
  - ✓ Trade Verification of Fabrication Model, Steel, Rebar, MEP
  - ✓ Prefabrication for Equipment Room & MEP Systems
  - ✓ Value Engineering
- **6D BIM Optimizes Energy Consumption & Sustainability**
  - ✓ Overall reduction in energy consumption
  - ✓ Conceptual & Detailed Energy Analysis
  - ✓ Sustainable Element Tracking
  - ✓ LEED Tracking
- **7D BIM Manages Asset Life Cycle & Facilities**
  - ✓ Optimized Asset Management from Design to Demolition
  - ✓ Lifecycle BIM Strategies & As-Built
  - ✓ BIM Embedded Operations & Maintenance Manuals
  - ✓ COBie Data Extraction
  - ✓ BIM Maintenance Plan & Technical Support
  - ✓ File Hosting on Digital Exchange System
- **8D BIM Modeling Prevents Accident through Design**
  - ✓ Outlining Hazard for BIM Model Elements
  - ✓ Safe Design Suggestion
  - ✓ On-site Risk Control for Hazards through Design Revision



# Key Takeaways

## Improving Communication throughout Project

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### **-Collaborative Tools for Improved Team Communication –**

Autodesk Revit BIM software helps to progress through each phase of the project, starting from floor setup to Architectural, Structural, and MEPFP (Mechanical, Electrical, Plumbing, Fire Protection) clash detection. Using Revit, BIM Engineers can review critical areas in 3D for any change and evaluate space constraint successfully. Revit BIM facilitates various design disciplines to collaborate flawlessly as a single information platform, improving work efficiency, mitigating errors, validating aesthetic looks and enhancing building performance

### **-Construction Project Visualization -**

Using Revit BIM software for 3D model design, BIM Engineers easily produce drawings with various cutaways, elevations, and sections through renderings and animations, bringing the project to life. The engineers combine Revit design and fabrication models in Navisworks for effective project coordination, thus avoiding the cost of rework from the existence of clashes. They can create a virtual tour of the proposed building with a 360-degree view of the Construction through detailed 3D renderings & walkthroughs on 3DS Max and Revit software platforms facilitating project visualization before Construction.

### **-Facilitating Construction Project Analysis -**

Revit BIM Modeling solution plays a crucial role in design optimization, coordination, and construction management. BIM engineers work in a coordinated manner, completing their projects on time.



# Details of the Methodology – Strategy Planning with Revit BIM

## Analysis with Revit

### Testing Effects

- Structural Load Analysis
- Wind Load Simulation
- Live Load Calculation
- Comprehensive Analysis of Structural Elements (columns, beams, floors, etc.) for risk-free delivery

### Design Validation

- Constructability & Maintenance of Structures with Openings, Beam and Clashes
- Revit BIM is used efficiently for Structural & MEP Design, Detailing & Prefabrication

### Material Quantity Extraction

- Quantity Takeoff & Estimation for Enhanced Productivity & Constructability Analysis

### Schedule Update

- Enhancing Building Design & Life-Cycle Performance
- Project Stakeholders benefit from integrating Autodesk Revit BIM with Procurement, Contract, Document Management, Cost Control, Project Management, Energy Performance, Budget Evaluation & Risk

# Communication Protocol

## How Cloud Technology Facilitates Project Delivery

Point cloud data management provides easy collaboration, revit work-sharing data management.

BIM 360 Software helps AEC professionals to work from different places at one central model, and record changes in the cloud environment, managing RFIs, shop drawings, contract documents, and information exchange efficiently.

Cloud collaboration of Autodesk BIM 360 brings all stakeholders at the same platform, enabling Live model visualization, and error mitigation from central database.

## Value Addition

### Value Added Benefits with BIM

#### Risk Mitigation

Resolving critical clashes arising out of conflicts amongst various services, including structure, architecture, MEP along with space Constraint, plan mismatch, design incompatibility, accessibility & aesthetic issues

#### Cost Reduction

Implementing Revit BIM process for green building design through the Revit BIM process, cost-saving is possible for the entire project like, for instance, making the Building Baseline system efficient with auto-sized fans through the simulation software.

#### Saving Money

Autodesk Revit BIM adoption helps to save money for the construction project, arising out of Labour, MEP Items, Dismantling, Rework, through Bar Bending Schedule/Reinforcement Validation & Design Changes

#### Saving Time

Revit BIM saves time for the project from Civil Items, including Steel Reinforcement, Concrete, Shuttering, Finishing, Interior Items, Dismantling, and more.



# Summary

## Summarizing Key Thoughts

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- BIM Software Technology facilitates AEC professionals to progress through each phase of the project, from floor setup to Structural & MEP clash detection.
- AEC professionals can review critical areas in 3D Revit BIM for any changes made and evaluate space constraints successfully.
- Revit BIM facilitates design disciplines to collaborate flawlessly, improving work efficiency, decreasing errors, validating aesthetic looks, and enhancing building performance.
- BIM-360 Cloud Collaboration enables seamless access from anywhere to visualize the complex model in the cloud without any stand-alone software.
- Autodesk BIM-360 Collaboration also facilitates global sharing, site, Construction, fabrication, and design manifestation amongst stakeholders, paving the workforce to live in the cloud.

## About the Company

### About Tejy Inc

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Tejy Inc is a multidisciplinary engineering, BIM, architectural services, permit expediting, estimating, quantity take-off, staffing and construction management Firm in Washington, DC, serving AEC Industry for the last 14 Years. Tejy Inc. is trusted to deliver projects to federal, States, and Fortune 500 Companies. The Company has completed projects up to \$240 Million and encompasses 1200 satisfied clients throughout North America.



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