COMPANY
Pinnacle Infotech
LOCATION
Durgapur, India
SOFTWARE
Autodesk® Revit®

Saving Significant Time and Money with the Help of BIM

Pinnacle extensively uses Autodesk Revit for Ambuja Patna City Center, India.

"Autodesk BIM solution played a vital role in design optimization, coordination and construction management. It was a pleasure to see that our BIM engineers worked in a coordinated manner, completing the project on time,"

—**Biswaroop Todi**
Vice President
Pinnacle Infotech

Image courtesy: Pinnacle Infotech

Headquartered in Durgapur, India, Pinnacle Infotech is a global leader in Building Information Modeling (BIM) services. Pinnacle caters to clients in more than 30 countries, collaborating across time zones with global delivery centers in India, USA, UAE and Italy. Founded in 1998, the company is one of the most sought after names in the AEC industry. Having adopted BIMfor more than a decade, Pinnacle has successfully executed over 4000 landmark projects like Dubai International Airport, Muscat Airport, Delhi International Airport – T3, pharmaceutical plants, Msheireb Downtown Construction - Doha, hospitals, high rise towers, industrial plants, dams, bridges and many more. Currently, Pinnacle is providing BIM services to the upcoming tallest building in the world – Kingdom Tower, Jeddah.

Project Summary – Ambuja Patna City Center

'Ambuja Patna City Center' is one of the prestigious projects undertaken by Pinnacle - a mixed use residential and commercial construction situated at Patna in Bihar, India. Pinnacle has received NDTV Design & Architecture Award in 2014 for providing maximum BIM services for this project, which is spread over an area of 982,975 sq. ft. (Residential – 298,163 Sq.ft + Commercial - 684,812 Sq.ft) comprising of two residential towers with 19 Floors (G+17+Roof+Above Roof) and 1 commercial mall with 14 floors (B+G+12+Roof), divided into 5 Blocks including Clock Tower and Service Block. This project is set to exemplify Ambuja Realty's continuous pursuit of excellence in transforming the entire region. Ambuja Patna is set to be a shopper's paradise and entertainment center with a huge Cineplex, shopping amenities and various other attractions.

Laying the groundwork in BIM

Pinnacle created the 3D BIM Model in LOD 400 for the architectural, structural, site utility, site logistics, MEP and fire protection trades for City Centre Patna to meet the project objectives including:

- Constructability review
- 3D modeling creation for architectural, structural, site utility, MEP and fire protection trades and coordination (clash detection & mitigation, visualization)
- Quantity Take-Off (BOQ) &BBS (bar bending schedule)

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The volume of the project was large with architectural, structural, site utility, MEP and fire protection services.

- 4D construction phasing (scheduling, phasing, sequencing)
- Coordinated drawings (shop drawings, sleeve drawings, insert drawings, isometric views) for complete coordination among all trades
- Shop drawing validation and approval stamp on GFC
- Presentations (renderings, walkthroughs and mock-ups)
- As-built Updation of Models and Drawings as per site requirement

Work process involving Pinnacle's in-house team, on-site team, client and consultant:

a. BIM process involving Pinnacle's on site team, client and consultant

APCC-WIP Server for Internal Use of Stakeholders:

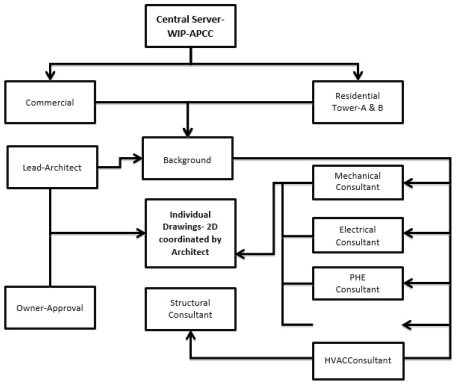

Image courtesy: Pinnacle Infotech

b. APCC-BIM Server for Pinnacle, Site & Consultant and Owner

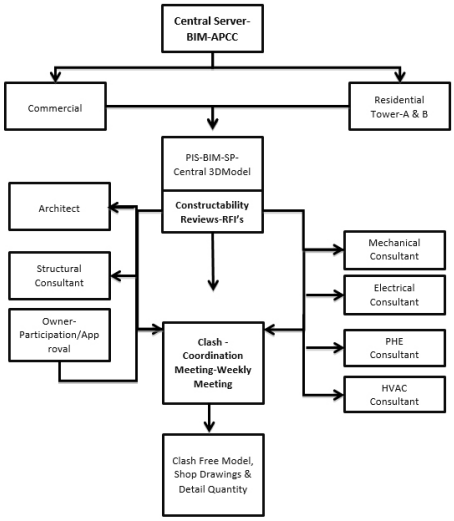

Image courtesy: Pinnacle Infotech

Note: APCC:Ambuja Patna City Center
WIP: Work-in-Progress

Challenges:

1: The volume of the project was large with architectural, structural, site utility, MEP and fire protection services. Besides, the overall project schedule was aggressive with the deadline for completion within a year.

PIS approach: (PIS stands for Pinnacle Infotech Solution)

- PIS engaged a team of over 14 engineers. It was broadly divided into two groups -for the residential tower and for the commercial. Each group had its own sub group of 2-3 engineers with defined targets.
- In order to keep pace with the casting schedule, client's casting program was sought and accommodated in the PIS schedule of delivery.
- PIS worked with various software applications like Autodesk Revit (architecture, structure, MEP), Navisworks Manage, 3ds Max® Design, AutoCAD and MS office for creating quick and error free 3D model, quantities, shop drawings and virtual simulation of the construction plan.

2: The working drawing documents had several inconsistencies that had to be sorted before the commencement of modeling.

PIS approach:

- The engineers checked and compared drawings for inconsistencies (for example mismatch between plan and sections as well as schedule and plan) and raised RFI's for correction (sizes of pipe and duct, fluid flow rate, breaker size, lux level, etc).
- PIS team maintained single server for all stakeholders to track record of all changes/ revisions. Individual drawing transmittal was approved by the consultant before the beginning of BIM work process.
- Over 500 RFIs were raised, where client's decision was considered necessary. The RFIs were vetted by the client, who in turn escalated the same to the consultant for probable solution.

3: The working drawing documents had several inconsistencies that had to be sorted before the commencement of modeling.

PIS approach:

- Pinnacle deputed a site team who had the experience of handling high rise building. The team coordinated closely with the client and other vendors and contractors located at the site. The vendors included supplier for lighting control system, fire alarm system, ELV system, fire fighting system.
- Fortnightly meetings were organized and attended by the senior management of Pinnacle to ensure better coordination.
- Pinnacle BIM modelers made all efforts to ensure that the coordination between all trades was properly done for clash free model and GFC drawing preparation.
- At places where coordination was genuinely impossible, RFIs were sent to the client/consultant for lowering the false ceiling height.

4: Pinnacle had to deal with multiple standards of representation from consultants for this mixed use building with sections like parking, offices, hotels, sky lobbies, residences and mechanical floors. Each section had its own design and standards.

PIS approach:

- One sample model was initially prepared for each section. This was vetted by all the stakeholders of the client. When the same was thought to be acceptable, the other areas of that section were prepared. This ensured adequate knowledge transfer to the members about the requirement of a section before the commencement of modeling and avoidance of rework.
- Pinnacle prepared a 4D model which helped construction managers to track the project timeline, allocate resources, save cost and rework. Work-sharing visualization feature of Revit allowed viewing in canvas the ownership status of elements, outdated elements as well as elements assigned to particular work sets. Revit also helped with DWG exports, where the team could update the export user interface and save the preset, configuring the output requirements.

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210 total man days saved from BIM implementation.

BIM Making Process Simple

I. **Input Challenges-** BIM helped to find several inconsistencies in the input drawings.

II. **Incomplete Information-** Column, beam, duct sizes and grill dimensions were incomplete, which was then done using BIM.

III. **Dimensioning Errors in plan and section drawing-** BIM helped Pinnacle to make the root cause analysis for dimensioning errors, resulting in clashes.
- In the Architectural Section of the basement plan drawings, dimensions for all cutouts were shown from the bottom of each cutout, whereas pipe dimensions were shown from center and top of the pipe. This resulted in clash between cutout and pipe as the representation of the two differed from each other.

IV. **Constructability Issues/ Reviews-**
- Beam was clashing with window and so the window size was revised
- Column, beam size mismatch between plan and schedule and so the schedule was revised
- P - Trap was clashing with ceiling and Soil Pipe and so S -Trap was used
- Floor & Beam cut-out was missing in drawing and hence Cut-out incorporated
- Manhole was clashing with structure and so manhole location was shifted

V. **Maintenance Issues-** BIM ensured ease of access for maintenance provisions and facility management. There was not enough space for maintenance inside shaft and so FD was located in shaft

VI. **Space Constraint-** BIM identified space constraint and saved time, rework and eliminated wastage

VII. **Cutout location correction-** BIM identified the need to correct cutout location

VIII. **Design Changes-** BBS/Reinforcement Validation & Design Changes were made using BIM. Sample changes were made in beam. Marked bar diameter was changed based on REBAR projection and analysis done by Pinnacle and bar size was optimized through revised RC detail

IX. **Coordinating/Design Issues Faced-** BIM coordination identified the clash and raised it to consultants which resulted in revision of design. Multiple issues were identified in drawings and resolved through drawing validation including:
- Civil Design mismatch with MEP plan (clash between Duct & FP to same Downpoint) which saved disaster during erection
- No space to place trap
- Multi-Sensor BFCs were coming inside the water tank in basement area
- Wrong ceiling height
- PHE down comer location was clashing with column capital in MEP drawings and so issues were identified and reported, resulting in design revision
- Mismatch between Architectural & MEP background as MEP designer used the old architectural background to design
- Mismatch between cut outs, stub posts & club
- A structural beam is missing in plan, resulting in Beam Depth mismatch between section & plan layout
- Parapet wall height mismatch between plan (1200) & section (2400) drawing
- Main pipe clashing with structure and courtyard hydrant dia was missing
- Cable tray clashing with Duct in Basement
- Structural Beam Missing in Plan - Beam Depth mismatch between section and plan layout

X. **Code related issues-** Resisted code violation - Soil pipe in electrical room

XI. **Architectural issues-** BIM enforced architectural changes by setting the views straight. Issues were raised for the following:
- Pipe exposed in car parking area and also in main entrance
- Balcony drain pipe exposed in balcony and FP pipe exposed in stair case

Pinnacle's Value Addition:

The project gets the value addition in terms of BBS (Bar Bending Scheduling) which helped to show the shapes and dimensions of every reinforcing bar and the number of bars required on a particular job for the construction of a reinforced concrete structure. Pinnacle also coordinated work among all the trades in a rigorous manner that reduced clashes and saved time and money for the project.

- 525 RFIsare raised pertaining to missing data, conflicting data, constructability/ aesthetic issues, maintenance issues and accessibility issues

- 2223 total clashes (including 350 critical clashes) were resolved, out of which 256 for Structure Vs. Architecture, 487 for Structure Vs MEP, 595 for Arch Vs MEP, 550 for MEP Vs MEP, 66 for space constraint, 55 for plan mismatch, 52 for design discrepancy, 112 for access/maintenance issues and 50 for aesthetic issues

- $298,5409 (Rs. 201,321,055.92) total cost saved for the construction project, out of which $31715 (Rs. 213,8701.02) for labour, $14,561 (Rs. 981,883.90) for MEP items, $78,081 (Rs. 526,5193.13) for dismantling, $122,093 (Rs. 823,2785.93) for rework, $94308 (Rs. 635,9230.88) through BBS/ Reinforcement validation &design changes (saving 90 metric ton quantity)

- 210 total man days saved from BIM implementation, out of which 90 Man Days for Civil Items including concrete, steel reinforcement, shuttering, finishing, interior items and facade, 30 man days for dismantling including Civil, MEP &Labour and 90 Man Days for rework including civil, MEP and labour.

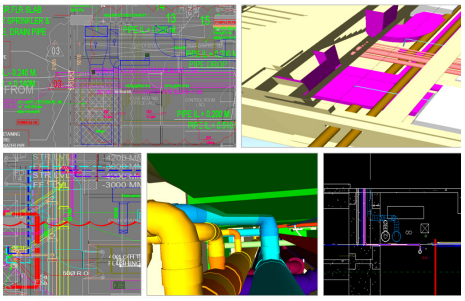

Image courtesy: Pinnacle Infotech

"Using BIM software for model design, we could easily produce drawings with various cutaways, elevations and sections through renderings and animations, bringing the project to life. We combined Revit design and fabrication models in Navisworks for project coordination and thus could avoid the cost of rework from the existence of clashes,"

—**Kankan Bhadra**
Deputy Manager
Pinnacle Infotech

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Autodesk Revit helped Pinnacle Infotech to plan and execute using intelligent models and allowed its team to anticipate, plan and coordinate every aspect of the project like design, detailing, construction and maintenance.

Summary:

Ambuja Patna was the first Indian project for which Pinnacle has provided the maximum BIM services and received NDTV Award. The company benefitted in terms of accuracy, data integrity, revision management, quality of detailing and higher productivity. The Pinnacle team could successfully generate coordinated models and allowed stakeholders to check possible interference between building systems, leading to better project planning and reduced delay in construction.

Autodesk Revit helped Pinnacle Infotech to plan and execute using intelligent models and allowed its team to anticipate, plan and coordinate every aspect of the project like design, detailing, construction and maintenance. It helped to identify constructability issues before the construction by detecting the number of clashes, thus avoiding work stoppages, rework and wastage of time, material and manpower.

Chandan Sutradhar, Senior Manager, Pinnacle Infotech said, "Revit software helped us progress through each phase of the project, starting from floor setup to structural and MEP clash detection. Pinnacle has reviewed critical areas in 3D for any changes made and evaluated space constraint successfully. BIM facilitated various design disciplines to collaborate in a flawless manner as a single information platform, enhancing work efficiency, reducing errors, verifying aesthetic looks and improving building performance."

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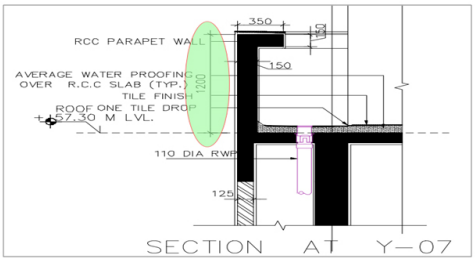
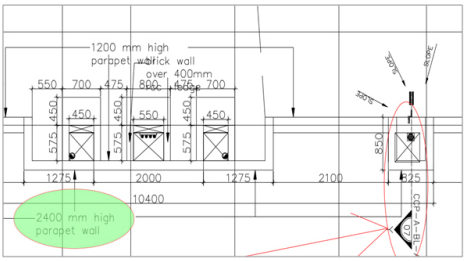
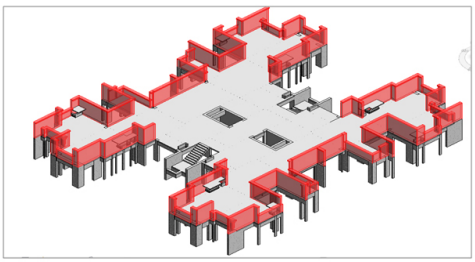
"Autodesk BIM solution played a vital role in design optimization, coordination and construction management. It was a pleasure to see that our BIM engineers worked in a coordinated manner, completing the project on time,"concludes Biswaroop Todi, Vice President of Pinnacle Infotech.







Parapet wall height mismatch in between plan (1200) & section (2400) drawing.

In case if first set of drawings were being followed for construction, the mentioned two beams with slab would have been done in constructution resulting in dismantling and rework later.

Image courtesy: Pinnacle Infotech

Conflict Category	Number of Clash	Saved Cost	Saved Time
Clashes			
Structure Vs. Architecture	256	$ 450000	7800
Structure Vs MEP	487	$ 420000	8200
Arch Vs MEP	595	$ 480000	7500
MEP Vs MEP	550	$ 440000	8360
Space Constraint	66	$ 410000	7200
Plan Mismatch	55	$ 200000	7500
Design discrepancy	52	$ 190000	6500
Access/Maintenance Related	112	$ 240000	7800
Aesthetic Related	50	$ 170000	4240

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