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

Pinnacle Crafts Infrastructure Marvel with the Help of BIM

Pinnacle Implemented Building Information Modeling for Dubai International Airport, the 3rd busiest airport in the world.

"Our team benefitted in terms of accuracy, data integrity, revision management, quality of detailing and higher productivity. We could successfully generate coordinated models and allow our consultant to check possible interference between building systems, leading to better project planning and cut down delay. BIM solution played a vital role in design optimization, coordination and construction management. It was good to see that our BIM engineers worked in a coordinated manner, completing the project on time,"

—Bimal Patwari
CEO
Pinnacle Infotech

DUBAI INTERNATIONAL AIRPORT, CONCOURSE 4. 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. Started in 1998, the company is one of the most sought after names in the AEC industry. Having adopted BIM for 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, VA Hospitals, medical centers, high rise towers, industrial plants, dams and many more. Currently, Pinnacle is providing BIM services to the upcoming tallest building in the world – Kingdom Tower, Jeddah.

Project Summary – Dubai International Airport - Expansion of Concourse 4

One of the prestigious projects undertaken by Pinnacle - Dubai International Airport (DI) in UAE is the 3rd busiest airport in the world (based on passenger traffic) and the 6th busiest international cargo airport. Spread over an area of 3,31,84,222 sq. m, it has been awarded as the best Airport in the Middle East for four consecutive years. Moreover, it has received Business Traveler Award held in Dubai (2016) for being the best Airport in the Middle East.

Pinnacle executed the expansion of Concourse 4, a new concourse area of DI. The airline mission for Concourse 4 (C4) at DI is to serve all Airport Operations Other Airlines (OAL). Situated on the Westside of DI, C4 was conceptually envisioned as an airside satellite concourse in the Strategic Plan 2020 (SP 2020). The majority of primary terminal passenger processing functions (i.e. passenger check-in, emigration, immigration, baggage claim and customs) would occur at Terminal 1 (T1) and C4 and T1 to be linked by an Automated People Mover (APM) system. Concourse 4 (C4) is an extension and continued development of Concourse 1 (C1), 2 (C2) and 3 (C3). It would be a fully airside structure developed under a metal shell to accommodate 17 Aircraft Stands (12 Code E, 4 Code F and 1 Code C) with contact gates and boarding lounges with approximately 64,460 m^2 building footprint, 696 m building Length, 28 m building height (at highest point), 150,000 m2 floor space (combining 3 main floors including apron level, first floor, second floor and partial third floor) and around 149,600 m^2 gross built up area.

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PIS worked with various software applications like Autocad MEP fabrication, Navisworks and PDF viewer for quick and error free shop drawings and3D model.

BIM Scope of Work for DI– Expansion of Concourse 4

Pinnacle used Autodesk Revit to create the 3D BIM Model (LOD 400) for MEP and Fire Protection trades for DI– Concourse 4 to meet the project objectives like:

- 3D Model Creation of Concourse 4 for MEP and Fire Protection Trades & Coordination (Clash Detection & Mitigation, Visualization)
- Constructability Review (Model Updation to reflect changes resulting from Design changes, RFI Generation & Updation, As-Built Updation)
- Coordinated Service Drawings for complete coordination among all trades
- Builder's Work drawings for MEP penetrations through structural slab and walls
- Shop drawing Creation of Mechanical (CHW & Duct Work), Plumbing (Drainage & Water Supply), Electrical (Light, Power, Fire Alarm & Containment), Fire protection & Builder Work (Slab & Wall Penetration)
- Detailed Quantity Take-off (QTO), incorporating manufacturer's reference

BIM Work Process

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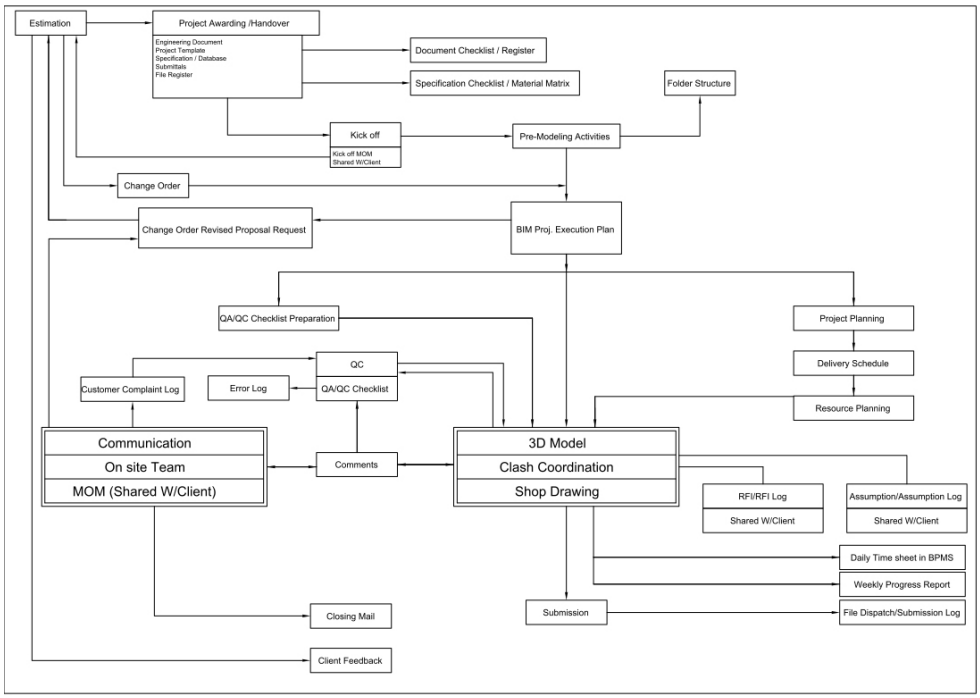

The Pinnacle Methodology

1: Large Volume of Work with Aggressive Deadline - The volume of the project was large with all MEPF services including Mechanical System, chilled water system, smoke control management system, cold water system, domestic hot water & sanitary drainage system, grey water & storm water system, fire protection system, MV & LV supply system, solid waste handling system, emergency power system, normal & emergency lighting system, lighting control system, earthing & lightning protection system, fire alarm & detection system and building management system.

Moreover, the overall project schedule was aggressive with the deadline for completion within 28 months.

PIS approach:

- PIS engaged a team of more than 70 engineers (including off-site and on-site) to work on this project. It was broadly divided into three groups - one for the apron level and the other two for the departure and arrival levels. Each group had its own sub group of 6-8 engineers with defined targets.
- In order to keep up 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 Autocad MEP fabrication, Navisworks and PDF viewer for quick and error free shop drawings and3D model.

2: Implementing Unique Module Support System - Instead of traditional support, unique module support system was used for MEP services. Pinnacle implemented module support system for the first time in this project. It was challenging for Pinnacle to consider all MEP services in the module support, which is a kind of rack system for installing, fabricating and coordinating services, as the team was not aware of its standards and specifications.

PIS approach:

- Module support expertise was deputed at PIS India office.
- PIS Engineers checked and reviewed the module standards and access clearance for inconsistencies (For example maximum length, width and height of module support was 6m, 2.4m and 2.4 m respectively depending on MEP service load. Distance between two hoops was 1200 mm and clearance between G-bracket to MEP services was 75 mm minimum.)
- Identified the areas, where maximum number of model support could be used. (For example corridor area & riser shaft area)
- As per site requirement, Pinnacle team produced a minimum of 25 module support drawings per day.

3: Inconsistencies in IFC design document - The IFC design documents had several inconsistencies that needed to be sorted out before the commencement of modeling.

PIS approach:

- The design validation engineers checked and compared the IFC design documents for inconsistencies (for example the capacity of an FCU given in the plan should match with the same mentioned in the equipment schedule, riser diagram and submittal) and recalculated the data (size of pipes and ducts, fluid flow rate, etc).
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- Over 100 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.

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BIM ensured ease of access for maintenance provisions and facility management.

4: Coordination among various services - Coordination among various services was difficult as the complex structure of the airport did not allow any service to pass through the beam/concrete wall, unless it was not conceived at the design stage and the space between false ceiling and the true ceiling was inadequate in many cases.

PIS approach:

- Pinnacle BIM modelers made all efforts to ensure that the pipes and ducts can pass through the designated cutouts in the concrete beam/walls. This was done by carefully shifting and altering the service routes, considering the access and clearance required and altering the sizes of ducts and pipes within allowable limits.

- At places where coordination was genuinely impossible, RFIs were sent to the consultant for lowering the false ceiling height.

5: Multiple standards of representation for various levels of structure, including 54 zones - The airport was constructed for three levels, which housed sections like apron, departure, arrival and plant room area.

PIS approach:

- One sample model was initially prepared for each MEP section. This was vetted by all MEP engineers, deputed at site. When the same was thought to be acceptable by the sub-contractor, contractor and the consultant, 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, avoiding rework.

- BIM coordinators from contractor were at the PIS India office throughout the project and trained the team in India about the consultant's latest requirements.

Fundamental Challenges and how BIM helped?

I. **Input Challenges-** Number of inconsistencies were found in the input drawings. BIM helped in identifying the mismatch in the risers, schedules, sections, architecture and structural drawings.
II. **Missing/Incomplete Information-** Duct sizes and grill dimensions were missing. BIM identified the need for providing revised diffuser & lighting layout on the ceiling. Besides, there were incomplete information related to material types and MEP design layout for all three levels. RFI's were raised to resolve these issues. Several workshops were conducted with stakeholders for speedy resolution.
III. **Dimensioning Errors in plan and section drawing-** BIM helped Pinnacle to make the root cause analysis for dimensioning errors, resulting in clashes.
IV. **Constructability Issues/ Reviews-** Several code related and constructability issues were raised through RFI's and the model and drawings were updated based on the responses.
V. **Maintenance Issues-** BIM ensured ease of access for maintenance provisions and facility management. There was not enough space for maintenance inside Shaft and corridors. Consequently, resizing of duct was made. Equipment and services were relocated to facilitate maintenance.
VI. **Accessibility Issues -** BIM also detected accessibility issues and saved time for rework.
VII. **Space Constraint-** BIM identified space constraint and saved time, rework and eliminated wastage.
VIII. **Cutout location correction-** BIM identified the need to correct cutout location for MEP services.
IX. **Design Issues Faced-** BIM coordination identified the clash and raised it to consultants which resulted in revision of design. Multiple issues were identified in single drawing and resolved through drawing validation such as civil design mismatch with MEP plan (clash between duct & FP to same downpoint) which saved diaster during erection, missing ceiling height information, MEP services clashing with each other and also with structure due to space constraint, pipe riser was not matching with PK2 drawings, continuation mismatch between Zone -12 & Zone-13, among others.

Pinnacle's Value Addition:

Pinnacle performed coordination work among all trades in a rigorous manner that reduced clashes and saved time and money for the project.

- Over 100 RFIs are raised pertaining to missing data, conflicting data, constructability/aesthetic issues, maintenance issues and accessibility issues.

- More than 1000 total clashes (including 750 critical clashes) were resolved for Structure Vs. Architecture, Structure Vs MEP, Architecture Vs MEP, MEP Vs MEP, space constraint, plan Mismatch, Design discrepancy, Access/Maintenance issues and Aesthetic issues.

"Autodesk Revit helped us progress through each phase of the project, starting from floor setup to structural and MEP clash detection. Pinnacle 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,"

—**Anirban Dhali & Pinaki Karmakar**
Deputy Manager
Pinnacle Infotech

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

—**Soumen Mukherjee**
Assistant General Manager
Pinnacle Infotech

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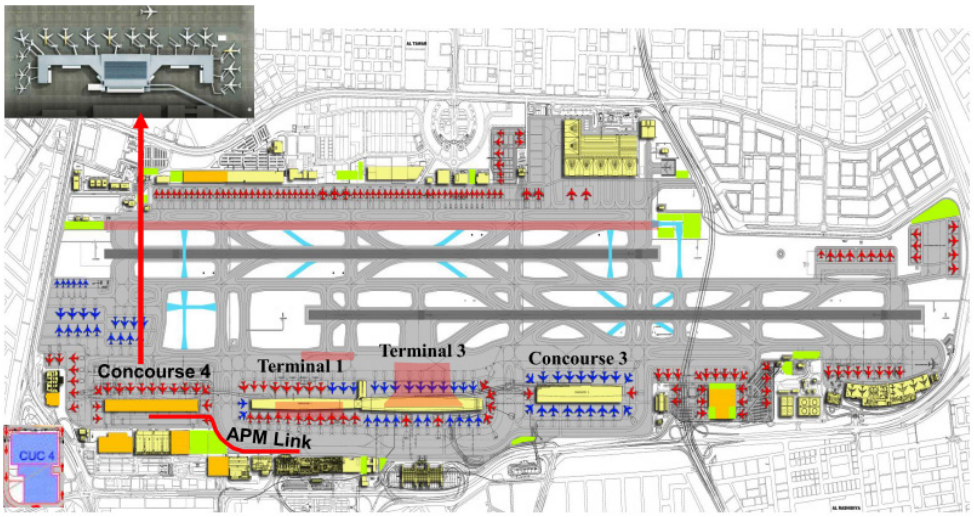
Summary:

"Our team benefitted in terms of accuracy, data integrity, revision management, quality of detailing and higher productivity. We could successfully generate coordinated models and allow our consultant to check possible interference between building systems, leading to better project planning and cut down delay. BIM solution played a vital role in design optimization, coordination and construction management. It was good to see that our BIM engineers worked in a coordinated manner, completing the project on time," said Bimal Patwari, CEO, Pinnacle Infotech.

BIM helped Pinnacle Infotech to plan using intelligent models and allowed the team to anticipate, plan and coordinate every aspect of the project design, detailing and construction. 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.

"Autodesk Revit helped us progress through each phase of the project, starting from floor setup to structural and MEP clash detection. Pinnacle 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," said Anirban Dhali & Pinaki Karmakar, Deputy Managers, Pinnacle Infotech.

Concluded Soumen Mukherjee, Assistant General Manager, Pinnacle Infotech, "Using BIM software for model design, we could easily produce drawings with various cutaways, elevations and sections, bringing the project to life. We used fabrication models in Navisworks for project coordination and thus could avoid the cost of rework from the existence of clashes."



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