The New Mumbai International Airport Terminal — GRC Perfects Innovative Peacock Feather Design

Project Overview
Very unique forms of white-colored glass-fiber-reinforced concrete (GRC) were selected for use in the new Terminal 2 Building of the Mumbai International Airport in India. The entire process took a total of two years, from the time CanBuild Management Ltd. entered the bid and provided the white GRC samples until the project was awarded to CanBuild. The client Mumbai International Airport Pvt. Ltd. (MIAL) and the construction firm Larsen & Toubro Ltd. did a comprehensive search to make sure that GRC was indeed the right material for the project. They also looked globally to find the right GRC supplier. The building design was based on the concept given by the architectural firm Skidmore, Owings & Merrill LLP (SOM). There were many challenges involved, not only in the design aspect but in the GRC manufacturing and installation processes as well. The bidding GRC suppliers were all asked to provide technical submissions such as samples, mock-ups, and prototypes when submitting their design proposals. When the project was finally awarded to CanBuild, an expedited schedule from design and manufacturing to delivery and installation was called for, and it was far tighter than what CanBuild had initially expected.

Product Selection
The terminal was designed by SOM. They are among the innovative global architectural firms that recognize the superior features of GRC, such as its strength, aesthetics, durability, and ability to conform easily to any shape, making GRC a material of choice. For this project they decided to use the white-colored GRC for ceiling coffers above the outside entrance of the Level 4 departure area, the column covers, the column capitals, and the bullnose (the rounded eave-like structure running around the entire exterior perimeter of the building). During the tender process, MIAL and Larsen & Toubro created a joint procurement team that explored a wide
variety of options for finishes that would give the building the required look. Therefore, GRC had to prove superior to other types of materials, which included aluminum to be used in the panels for the bullnose. In addressing such competition, CanBuild created a series of mock-ups, prototypes, and technical submissions to demonstrate that GRC was the right choice of material for the project. This approach, together with GRC’s excellent qualities, led MIAL and Larsen & Toubro to confirm that GRC was indeed the best material to meet SOM’s specifications.

**Design Motif**
The design of the columns and the ceiling all were based on a peacock feather motif. The peacock is the national bird of India and is considered an iconic symbol.

**Ceiling Coffer Panels**
There are a total of 2,524 ceiling panels, with a standard-sized panel measuring 2.88 m × 2.68 m. The panels all are designed so that the "eye" of the peacock feather is located at the center. In some panels, the "eye" is aligned so as to run diagonally from bottom left to right, while in other panels it is aligned in the opposite manner. Selected panels have a downlight positioned above an aperture. The "eye" and the lights are positioned so as to form a pattern.
Column Covers
The horizontal sectional views of the columns are also shaped to portray the “eye” of the peacock feather. There are a total of 9 columns which are covered with GRC panels. Of the 9 columns, 7 are composed of 12 panels which start from the floor of Level 4 up to the underside of the column capital. The remaining 2 columns are composed of 52 panels which start from the ground floor level all the way up to the underside of the column capital just beneath the ceiling. The total number of GRC panels used for all columns combined is 188.

Column Capitals
Column capitals are gently curving structures that connect the columns to the ceiling. A total of 2,376 GRC panels were used in the 9 columns. The design, manufacture, and installation of the column capitals was particularly complex, as they all had curves running in two directions. Each column capital panel had to be designed with multi-directional curves to result in the intricate shape required for the final design.

The columns, column capitals and ceiling coffers are all designed to mirror the GRC panels used in the terminal interior.

Bullnose
The bullnose circumnavigation the entire exterior perimeter of the building. The bullnose is composed of 298 sectors, with each sector consisting of 5 panels from top to bottom, making the total number of GRC panels used in the bullnose 1,490. Of such 5 panels, 3 were joined together on the ground on-site using a steel frame and a steel truss solution. This allowed the joined panels to span the roof members and be erected all at once. As a result, only three crane lifts were necessary per sector. Access constraints were met by deploying various types of cranes that catered to different needs, one of which was a 650 ton crane with a jib measuring 100 m.
Mumbai International Airport, Terminal 2 Building
(Chhatrapati Shivaji International Airport T2)

Location: Mumbai, India (2014)
Client: Mumbai International Airport Pvt. Ltd. (MIAL)
Design: Skidmore, Owings & Merrill LLP (SOM)
Construction: Larsen & Toubro Ltd.
GRC Manufacture and Installation: CanBuild Management Ltd.
Site Area: 105 ha
Building Area: 450,000 m²
Number of Floors: 4
Height: 45 m
Features Employing GRC: Ceiling coffers, column covers, column capitals, and bullnose

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