

Walking on Razor's Edge



Churchgate Railway Terminus cover-over shed extension project, built despite all odds:

- Permitted working time: Two & a half hours every night
- Connection with a heritage building
- Space constraints at platforms
- Mobilisation & de-mobilisation of equipments at and between platforms
- Working below and above 'Over-Head High Voltage Electric Lines'

Location:	Mumbai
Country:	India
Client:	Western Railway
Products Used:	ECOBUILD™ BUILDING SYSTEMS
Project Details:	Clear Span: 44.10 m Length: 67.50 m Ridge Height: 13.75 m Total Area: 2915 m ²
Year:	2011

Mumbai's Churchgate Railway Terminus is one of the busiest railway stations in India. Being a business district, millions of commuters crowd on the Churchgate Terminus platforms daily. The roof cover at Churchgate terminus platforms was initially of 9-car length. However, ever since 12-car services were introduced in Mumbai Suburban section of Western Railway, there had been strong public demand from commuters to extend the cover to 12-car length. Tata BlueScope Building Solutions Business has made the life of millions of railway commuters a bit comfortable by supplying & erecting a cover over shed for the station's roof extension project, which aims at accommodating upto 15 car train coaches.

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Scope and Project Requirements

With 18 lakh commuters, 900 trains per day and maximum train frequency of 180 seconds, Churchgate terminus is one of the busiest stations in the country. The earliest train at Churchgate terminus departs at 4:15 am and the last train at 1:00 am. The allowed working time at site was just two and a half hour every night and hence to build an extended platform cover at Churchgate terminus was unthinkable, something never attempted before!

Due to space constraints, the temporary bracings and on-site fabrication were not allowed. The safety, structural stability and project completion timelines were the prime aspects throughout the project.

Attitude made all the Difference

The Building Solutions team decided to see the glass as half full and found solutions to work around all challenges.

Challenges	Solutions
To connect a new structure to the old heritage building	Building designed to match the profile and retain the form of the building by matching the existing building ridge & heritage
Heavy traffic at the busy terminus, max. train frequency of 180 seconds	<ul style="list-style-type: none">• Erection of building during 1.00 am to 3.30 am during block working only.• Multi crane system and boom lifts used for fast erection
Space constraints at platform for <ul style="list-style-type: none">• Movement of cranes & boom lifts; parking of cranes, boom lifts & equipment during day time• Storage of materials	<ul style="list-style-type: none">• Methodology devised on mobilisation and demobilisation of cranes at and between platforms• Grid wise complete material was sent as per erection sequence
Time and space constraints for transportation and storage	"Just in Time" material arrival at site
Working below and above 'Over Head High Voltage Electric Lines' safely	Methodology devised to lift the pieces of rafters between the OHE lines, then rotate above the electric lines to 90 degrees and then join above the electric lines.
Safety concerns during roof installation at day-time	Reduced risk by using SKY-WEB™ II, a passive fall protection system, during roof installation

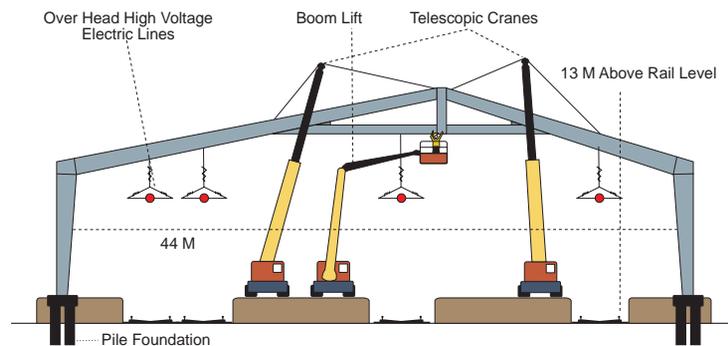
Innovative Solutions at Every Stage

Innovative Design

The structure was designed using 3D Analysis on STAAD PRO Software with AISC Design and load combinations as per IS 875. The few design related challenges were:

- At many locations there was no place for the column foundations and hence 'jack beams' were designed and provided with a whopping 23.50 m length

- Temporary bracings and guy ropes were not allowed and hence the steel columns were designed for the fixed base connection
- On the eastern side a structure is resting on RCC columns and on the western side the last 3 frames of the structure are resting on existing RCC Building
- The width of building was skewed along the length and every frame was unique
- Western Railway had restricted the column depth and base plate sizes
- The maximum length of individual components was limited to 6 meters from the point of view of transportation and handling at site



Just-In-time Manufacturing and Supply

The materials were required to be shipped on ‘Just-In-Time’ basis as storing the materials at platform was a major constraint. This forced the production planning and operations team to do the micro level scheduling for the manufacturing of critical components which were required on priority on the full kit basis. The logistics team arranged on-time vehicles to meet the critical erection deadlines. The 40’ long fleets carrying critical PEB erection materials reached on-time at the Churchgate terminus site and left the site early enough to avoid the traffic congestion at busy streets of South Mumbai.

Innovative Erection Scheme

The team did extensive planning in line with the requirements and norms of Western Railway. The team faced multiple challenges: working time constraints, overhead high voltage electric lines and space constraints which affected movement of cranes and storage of materials. The conventional erection equipments like derrick, chain pulley block, scaffolding, etc. were not suitable for this project due to safety issues.

Our erection team devised a unique methodology to mobilise high capacity telescopic cranes & boom lifts to start the erection and demobilise them from the site instantly. Methodology was also devised to maneuver pieces of rafters between overhead electric lines without causing damage to the lines. Erection of all components

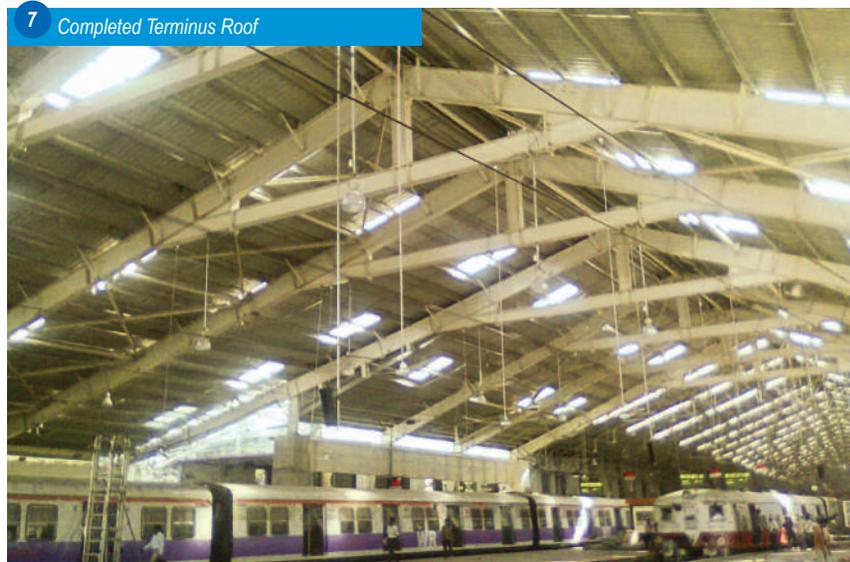
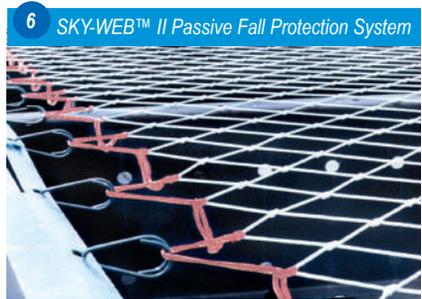
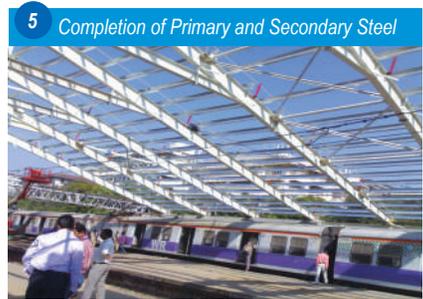
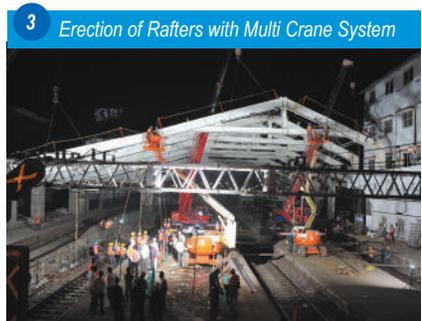
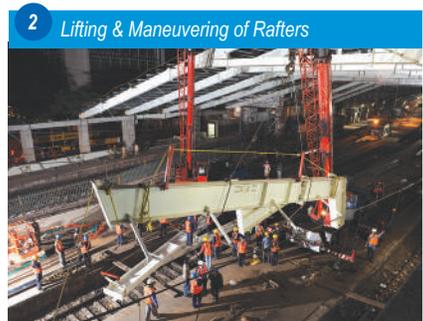
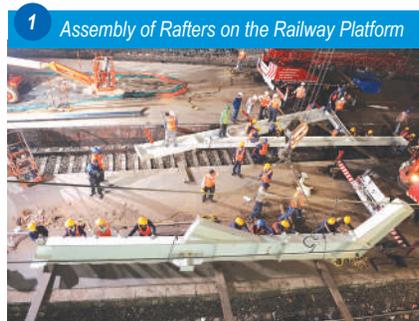


including rafters, bracings, strut tubes was done by handling them in the air with multi-crane system. The fixing was done with the help of boom lifters, which carried men and material to bolt the joints. Work for fixing of Z-section pre-punched and pre-galvanised purlins over erected rafters was also done in parallel, to save the time in the same blocks. The entire work was done in power-blocks without any slewing or lowering of overhead electric lines.

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Strong Commitment towards Safety

The erection was done by our certified builder under stringent supervision of construction safety team. All personnel working at site were inducted with safety motivation program. The trainings for working at height and safe erection practices were conducted as well. The roof sheeting work was completed safely using SKY-WEB™ II, a passive fall protection system.



Results

An economical, technically superior and highly durable structure was delivered within a very short span of time and without affecting the safety of passengers during the erection process. The site was completed in 21,288 safe man-hours and was LTI-free till building completion. The majesty of the grand old structure has not been compromised; it has rather been enhanced using modern

day, state-of-the-art materials and techniques. We are proud that we were part of the major landmark project.