INDIAN RAILWAYS

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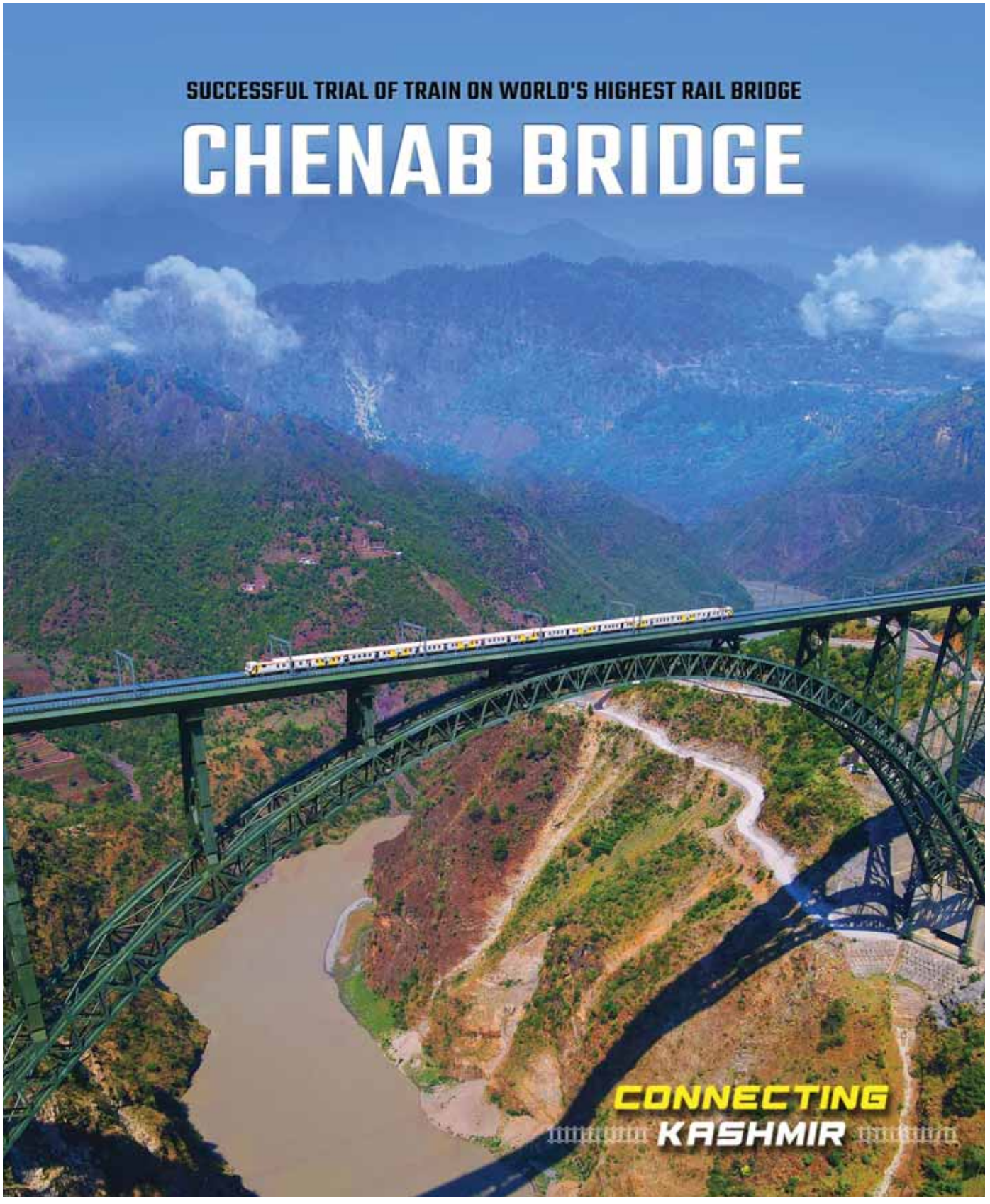

National High Speed Rail Corporation Limited has successfully launched another steel bridge of 130 m length on 23rd June 2024. The steel bridge was launched over Delhi-Mumbai National Expressway near Vadodara in Gujarat for Mumbai-Ahmedabad Bullet Train Project.

The bridge launching was completed within 24 hours with intermittent breaks to allow road traffic to pass.

This 3000 MT of steel bridge of 18 m in height and 14.9 m in width has been fabricated at the workshop in Wardha, Maharashtra and was transported on trailers to the site for installation. It requires tremendous efforts to pull such a heavy girder which is likely to be the longest over any national highway in the country.

The bridge fabrication utilized approximately 124,246 Tor-Shear Type High Strength (TTHS) bolts with C5 system painting and metallic spherical bearings, all designed for a 100-year lifespan. The steel bridge was assembled at the site at a height of 15 m from the ground on temporary trestles and was pulled with automatic mechanism of two semi-automatic jacks, each of capacity of 250 ton using mac-alloy bars.

The project is being executed meticulously, maintaining the utmost standards of safety and engineering excellence. Leveraging Japanese expertise, India is increasingly utilizing its own technical and material resources to build infrastructure under the "Make in India" initiative. The steel bridge for the Bullet Train Project is a major example of this effort.

This is the third out of the 28 steel bridges completed for the corridor. The first and second steel bridge was launched across National Highway 53, in Surat and over Vadodara-Ahmedabad main line of Indian Railways, near Nadiad in Gujarat, respectively.

Steel bridges are most suitable to cross Highways, Expressways and Railways lines, unlike pre-stressed concrete bridges, spanning 40 to 45 meters, which are suitable for most sections, including river bridges.

India has the expertise of fabricating steel bridges for heavy haul and semi high-speed trains which run between 100 and 160 kmph. Now, the same expertise in fabrication of steel girders is implemented on Bullet Train corridor too which will have a staggering operational speed of 320 kmph.

100 m long 'Make in India' Steel Bridge Launched Over Indian Railways Tracks for Bullet Train Project

The first steel bridge of 100 m length, launched over Vadodara-Ahmedabad main line of Indian Railways, near Nadiad in Gujarat for Bullet Train Project- Mumbai- Ahmedabad Bullet Train Corridor.

Along with Japanese knowhow, India is increasingly utilizing its indigenous technical and material capabilities to build the infrastructure under 'Make-in-India' vision. And, this steel bridge for Bullet Train Project is one of such examples.

This 1486 MT of steel bridge has been fabricated at the workshop in Bhuj district of Gujarat, which is almost 310 km away from location of bridge launching site and was transported on trailers to the site for installation.

At the site, the steel bridge was assembled at a height of 15.5 mt from the ground on temporary trestles. Thereafter, the launching nose of 63 m in length and approx. 430 MT weight was assembled with the main bridge assembly. The steel bridge was pulled with automatic mechanism of two jacks, each of capacity of 180 MT using High Tension strands. The bridge was pulled in complete traffic and power blocks of Indian Railway lines with meticulous planning and precision.

Technical Points

- Length of the main bridge: 100 m
- Weight of the main bridge: 1486 MT
- Launching nose length: 63 m
- Launching nose weight: 430 MT

Each production batch of steel was tested by Ultrasonic Testing (UT) at the manufacturer's premises. The making of steel bridges undergoes high-tech and precise operations of cutting, drilling, welding and painting as per the design drawings prepared by Japanese engineer. The welders and supervisors were certified by International Welding Experts. The welding process is monitored by Japanese International Welding Experts (IWE) stationed at each workshop. Fabricated structure undergoes Check Assembly process and then follows the sophisticated 5- layered painting of the steel structure.

The painting technique adopted for the steel girders is first-of-its-kind in India. It conforms to C-5 Painting system of Japan Road Association's "HANDBOOK FOR CORROSION PROTECTION OF STEEL ROAD BRIDGES". The jointing of steel members is done using Tor Shear Type High Strength Bolts (TTHSB), which are being used first time for any railway projects in India.

This is the second out of the 28 steel bridges completed for the corridor. The first steel bridge was launched across National Highway 53, Surat in Gujarat. Approximately 70,000 MT of specified steel is used in making of these steel bridges. The length of these steel bridges span varies from 60 m 'simply supported' to 130 + 100 m 'continuous span'.

Steel bridges are most suitable to cross Highways, Expressways and Railways lines, unlike pre-stressed concrete bridges, spanning 40 to 45 meters, which are suitable for most sections, including river bridges. India has the expertise of fabricating steel bridges for heavy haul and semi high-speed trains which run between 100 and 160 kmph. Now, the same expertise in fabrication of steel girders will be implemented on MAHSR corridor too which will have a staggering operational speed of 320 kmph.■

Sabarmati Rolling Stock Depot for Bullet Train Project-An Example of Sustainability and Efficiency

The Mumbai Ahmedabad Bullet Train Project, a symbol of modern infrastructure, is set to usher in a new era of sustainability and efficiency with the development of the Sabarmati Rolling Stock Depot.

Designed to seamlessly integrate with the operational needs of the Bullet Train Project, the Sabarmati Rolling Stock Depot encompasses state-of-the-art facilities aimed at both light and heavy maintenance of trainsets. Spread across an impressive 83 hectares, it is the largest of the three depots and is equipped with cutting-edge equipment including inspection bays, washing plants, workshops, sheds, and stabling lines. The Sabarmati Depot stands as a beacon of innovation, drawing inspiration from depots in Japan.

The depot features 4 (four) inspection lines and 10 stabling lines, with plans for expansion to 8 (eight) inspection lines and 29 stabling lines in the future. Additionally, specialized facilities such as bogie exchange lines and general inspection lines have been incorporated to ensure comprehensive maintenance capabilities.

Key highlights of the Sabarmati Rolling Stock Depot include:

- A dedicated test track for post-overhaul testing of trainsets, ensuring optimal performance before deployment on the mainline.
- Industrial sheds of unprecedented scale, providing ample space for maintenance and overhaul activities.
- Centralized control facilities for efficient train shunting operations and overall depot management.
- From dining rooms and canteens to auditoriums and training facilities, the depot offers a holistic environment for staff and personnel.

In line with sustainable practices, the Sabarmati Depot incorporates eco-friendly initiatives such as rainwater harvesting and wastewater recycling. Rooftop rainwater harvesting and bore well water will fulfil depot's water requirements, while modern sewage and effluent treatment plants ensure responsible management of waste.

Furthermore, the depot is equipped for the segregation, compaction, and proper handling of garbage generated both onboard trains and within the depot premises, underscoring its commitment to save environment.

The depot sheds and buildings are being designed so that solar panels can be installed in future. The Sabarmati Depot alone will have the potential of solar power generation of around 14 MW.

With a forward-looking approach, the Sabarmati Rolling Stock Depot is not just an example of technological prowess but also a blueprint for sustainable infrastructure development. As construction progresses, the depot to play a pivotal role in the success of the Mumbai Ahmedabad Bullet Train Project, setting new standards for efficiency, reliability, and environmental responsibility.

Construction update on Sabarmati Rolling Stock Depot

- Earthwork has been completed for the depot.
- The foundation works and RCC works for the administrative building are in progress.

Over 76,000 Segments to be Cast for the 16 km Tunnel for Bullet Train Project

Under construction is 21 km tunnel between the Bandra Kurla Complex and Shilphata for the Mumbai-Ahmedabad Bullet Train Project. Of the total length, 16 km will be excavated using three Tunnel Boring Machines (TBMs), while the remaining 5 km will be constructed using the New Austrian Tunnelling Method (NATM). To construct the 16 km section with TBMs, 76,940 segments will be cast to form 7,441 rings. Special ring segments are being cast for the tunnel lining, each ring comprising nine curved segments and one key segment, with each segment being 2 meters wide and 0.5 meters thick.

High-strength M70 grade concrete is being used to ensure superior structural integrity and long-term durability. The casting and stacking yard, covering an area of 98,898 sqm (9.9 hectares) in Mahape, Thane district, Maharashtra, is currently being commissioned. The yard will feature nine sets of moulds, each containing ten pieces. Four sets of these moulds are already being installed on-site.

The yard is equipped with various cranes, gantries, and machines to automate and mechanize the casting operations, ensuring high-quality assurance during the casting and stacking of the segments. Additionally, the facility will include casting sheds, a stacking area, a batching plant, and a steam curing area.■

24x7 Geotechnical Monitoring for Bullet Train Project

Various types of Geotechnical Instruments like Inclinometers, Vibration monitors, Ground settlement markers, Tilt meter etc. have been installed at and around construction sites for monitoring tilt, settlement, vibration, cracks and deformation. These instruments play a crucial role in making sure that neither there is any risk to ongoing underground works like excavation and tunnelling nor to the structures surrounding the site.

The Geotechnical Instruments are connected to their respective modules to record and monitor the activities. This allows on-time identification of potential risks and enabling timely interventions to mitigate them.

The dust and noise monitors are also being installed at construction sites, to ensure that the noise and air pollution remains in the permissible limit at and around construction sites.

The construction activities are in progress for 21 km long underground portion of Bullet Train corridor in Mumbai and Thane districts in Maharashtra. The works include excavation for about 1 km long and

32-meter-deep (around 10 store inverted building) underground Bullet Train station at Bandra Kurla Complex, construction of shafts and portals for tunnelling works.

Three mega Tunnel Boring Machines (TBMs), will be deployed for 16 km tunnelling work, which includes 7 km under sea tunnel and remaining 5 km of the tunnel will be made by using New Austrian Tunnelling Method. The depth of the tunnel will vary from 25 meters to 57 meters. Three Shafts, one ADIT and a portal are being constructed for lowering Tunnel Boring Machines.■

394-meter-long Additionally Driven Intermediate Tunnel Completed for Bullet Train Project

The Additionally Driven Intermediate Tunnel (ADIT) of 394 meter at Ghansoli for Mumbai-Ahmedabad Bullet Train Project, has been excavated. This will expedite the construction of 21 km long tunnel between BKC and Shilphata in Maharashtra.

The 26-meter-deep inclined ADIT will facilitate construction of the 3.3 km (approx.) tunnel through New Austrian Tunnelling Method (NATM), by allowing simultaneous access for tunnelling 1.6 meter (approx.) on each sides. Out of 21 km of tunnelling works, 16 km is through Tunnel Boring Machines (TMBs) and remaining 5 km is through NATM.

The excavation work for ADIT was started on 6th December, 2023, and the entire length of 394 meter is excavated in a short duration of six months. Total 214 controlled blasts were done using 27,515 kg explosives under supervision of experts and high level of instrumentation was used to ensure safe excavation.

The ADIT of internal dimension: 11 meter X 6.4 meter will give direct vehicular access to the main tunnel during construction and operations and may also be used for the purpose of evacuation process in emergency situation.

A number of monitoring instruments are being used to ensure safe excavation of the tunnel and all the structures in the nearby area. Some of the instruments being used for the work are SSP (Surface settlement Points), ODS (Optical displacement Sensor) or tilt meter for displacement in both axis, BRT (By reflect target/3D targets), Strain Gauge for micro strains in tunnel surface, Seismograph for Peak Particle Velocity (PPV) or vibration and seismic wave monitor.

The construction activities related to 21 km (approx.) long tunnel from Mumbai Bullet Train station to Shilphata in the state of Maharashtra is progressing at a fast pace. The 7 km (approx.) stretch of this tunnel will be under the sea at Thane Creek (Intertidal zone). This is the first of its kind tunnel to come up in the country.

The 21 km long tunnel will be a single tube tunnel to accommodate two track meant for up and down tracks. To construct this tunnel, TBMs with cutter heads of 13.6 meter diameter will be used. Usually 6-8 meter diameter cutter heads are used for urban tunnels used in MRTS-Metro system, as these tunnels accommodate one track only.

The under construction three shafts at BKC, Vikhroli, and Sawli will facilitate the construction of 16 km long tunnel through TBMs.