【India】

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Site Visit to Mumbai-Ahmedabad High Speed Rail Construction Site

SAWADA Takaaki, Senior Research Fellow and Executive Director, JTTRI-AIRO
MINAMI Yusuke, Research Fellow, JTTRI-AIRO

1. Introduction

Mumbai-Ahmedabad High Speed Railway (MAHSR) is one of the high speed rail corridor projects in India, which will connect the 508km distance between Mumbai and Ahmedabad in approximately 2 hours at its fastest speed. The maximum operation speed is to be 320km/h. MAHSR is based on the Shinkansen, the Japanese bullet train, system according to the Joint Statement on India and Japan Vision 2025. Hence MAHSR project has been implemented with cooperation between India and Japan.

Under the support of National High Speed Rail Corporation Limited (NHSRCL), Chairman Mr. Shukuri of JTTRI, Mr. Sawada and, Mr. Minami of JTTRI-AIRO visited the construction sites of MAHSR in May 2022. The current progress and situation of the site are reported in this paper.

2. Overview of the Site Visit

The construction sites were located between the Bilimore station and Surat station in Gujarat state (Figure-1), as parts of the C-4 Package which is the largest civil work in the MAHSR project with a length of 237km. Out of 508km of the whole project, a 465km stretch is designed as viaduct, and the sites introduced were typical viaduct sections where bridge piers and beams were being constructed with reinforced concrete. The contractor is Larsen & Toubro Limited (L&T), a local company in India.

Figure-1 MAHSR overview and the location of the site visit[1)]

It took about 4 - 5 hours, one way, to travel from New Delhi to the sites by domestic flightand car.

3. Casting Yard Ch. 254 for Segmental Girder

The first site was a casting yard for precast segmental girders. Many girders, segmented into about 2m each, were manufactured there, and a casting process, in which fresh concrete was cast into a steel mould form through a concrete pump, was demonstrated during the visit (Picture-1 and Picture-2). Several lines for casting were aligned in the yard, and gantries were installed in each to hoist and move materials and segmental girders after curing so that manufacturing works of segmental girders could proceed simultaneously.

According to their working process, segmental girders cast in this yard would be transported across a highway to another erection yard and installed along a 9.1km scope to the Surat station.

Picture-1 Cross section of a segmental girder

Picture-2 Casting work

4. Erection Yard Ch.254-256 for Segmental Girder

The next site was an erection yard for precast segmental girders. An overhead launching gantry had already been installed on completed piers (Picture-3). Segmental girders would be transported to this site, lifted with the gantry, and unified by post-tensioning to form a 35m to 34m length of girder.

At the time of the visit, those segments had not yet been transported to this site. However, as far as the eye can reach, piers were already completed and the preparation for erection seemed to be going smoothly(Picture-4).

Picture-3 Overhead launching gantry

Picture-4 Completed piers

5. Casting Yard Ch. 243 for Full-Span Girder

Following that, we moved on to a casting yard for full-span girders. When completed, a 40m length full-span girder weighs approximately 970 tons. After curing, or being stored, those girders are transported from the casting yard to the nearby erection yard by a straddle carrier, a self-propelled cargo handling machine. Hoisting and conveying a full-span girder was demonstrated during the visit (Picture-5 and Picture-6). Full-span girders for about 12.7km section will be manufactured in this yard.

Similar to other yards visited, a variety of spaces and facilities are aggregated in one yard, such

as space for deforming and assembling reinforcement, casting fresh concrete into moulds, storing completed girders, a concrete batching plant, straddle carriers for carrying various materials, and accommodations for workers. The entire casting process is managed and operated like an on-site manufacturing facility.

Picture-5 Hoisting work by a straddle carrier

Picture-6 Whole figure of a straddle carrier

6. Casting and Erection Yard Ch.238 for Full-Span Girder

The last site was a casting and erection yard for full-span girders placed beside the railway line, where the construction had progressed furthest. Several completed girders were stacked and stored near the railway line, and several more girders had already been erected on the piers (Picture-7). The process of erecting girders can be devided into 4 steps as below:

1) Moving a girder to nearby piers by a straddle Carrier.
2) Hoisting a girder onto pre-erected girders by a set of bridge gantries.
3) Transporting a girder on a girder transporter to nearby a launching gantry.
4) Lifting and placing a girder onto designed piers by a launching gantry.

We were allowed entry onto the viaduct. The details of the mechanism and operation flow on the viaduct were introduced (Picture-8). After manufacturing and erecting full-span girders for about a 6km section, most of the facilities in this yard would be relocated to another yard and be re-utilized.

Picture-8 A launching gantry on the viaduct

Picture-7 Overview of the casting and erection yard

7. Other Initiatives for Supervision

Various initiatives had been developed for construction supervision. For instance, checklists were used for the quality control of each work process. Some processes were modified to secure schedule control.

There were other supervision controls situated off-site. One is a dedicated laboratory established for analyzing more than 10,000 geological samples centrally. The examined geological information were leveraged to quality control of underground foundation piles. A dedicated approach for surveying has also been implemented. In order to install trucks for high-speed rail with quite a high accuracy, civil structures are also to be built with a high degree of accuracy. In MAHSR, 16 reference points had been set all along the railway line and utilized for quality control with high accuracy.

8. Closing

Through the visit, it was seen that the work environment was well managed and safe. Not only the officers of NHSRCL, and L&T, but also general workers were equipped with safety gears, such as helmets, reflective vests, protective footwear, etc. When going up to the top of the viaduct, we did not come across any unsafe spots due to the sufficient facilities installed, such as banisters, balustrades, safety signs, etc. Safety control for both people and the facility seemed to be well organized.

In addition, it could be observed that the civil structures of the MAHSR had many of the same specifications as the Shinkansen. Through the Shinkansen system, it appears that the cooperation between India and Japan has been enhanced and and the railway technology of Japan has contributed to the railway development of India.

Picture-9 National flags on the viaduct

Reference

1) Ambassador of Japan to India visit to MAHSR construction sites in Gujarat on 12th April 2022、https://nhsrcl.in/sites/default/files/2022-05/Print-pdf.pdf、National High Speed Rail Corporation Limited、Access: 1st June 2022