



The construction of the girder just above the existing Shinkansen viaduct in urban area

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Summary

We are now carrying out a project to open new line “Ueno-Tokyo line”, which connects two radiate railway lines. This line is now under construction just above the in-service Shinkansen line, because we couldn't obtain the space for new line in urban area. We applied a viaduct structure with double-deck system, which consisted of a viaduct for the new line added on the existing viaduct for Shinkansen. We completed all of the girder constructions with high difficulty without any accidents by carrying out elegant design and construction. In this paper, we describe the construction of the girders between piers of new viaduct just above the Shinkansen line.

Keywords: railway viaduct; just above a railway; double-deck viaducts; movable erection girder

1. Layered structure using the existing viaduct

The Ueno-Tokyo line project is the construction of a new double track line from Tokyo Station to Ueno Station (Fig.1). The Ueno-Tokyo line project is building a new line for 3.8km between Tokyo station and Ueno station. Section of the new line construction space, side of Tokyo station and Ueno station, construct to the space are using as detention of the train current. For about 0.6km near Kanda station, we construct Double-deck viaduct. Because, this area is very narrow, does not have enough space to build a new line. Double-deck viaduct for the Ueno-Tokyo line consists of steel rigid-frame pier and abutment, pre-stressed concrete girder, and steel girder, added on viaduct for Shinkansen (Fig.2).

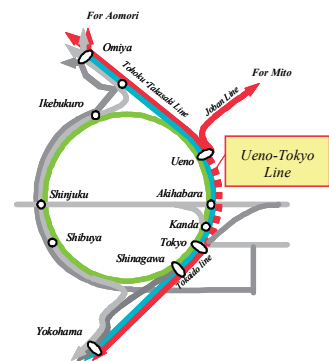


Fig. 1: Location of Ueno-Tokyo line

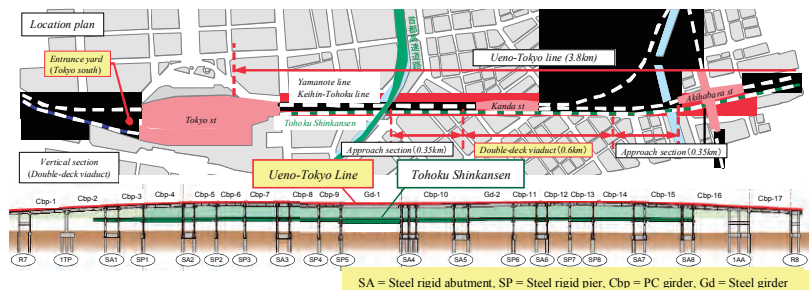


Fig. 2: Location plan and vertical section

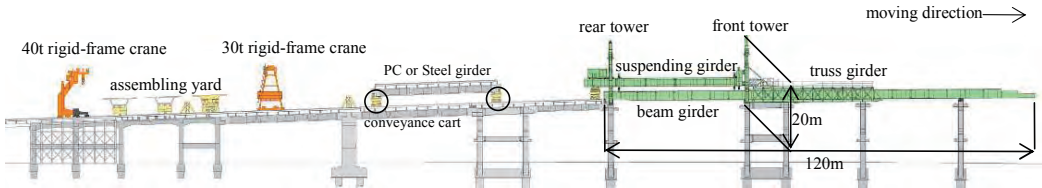


Fig.3: Schematic diagram of PC and Steel girder and movable erection girder

2. The construction method of pre-stressed concrete and steel girder

A push-out method has been applied to construct pre-stressed concrete and steel girders by using huge movable erection girder which has been manufactured specially, whose gross weight is about 1,800t (Fig.3).

Pre-stressed concrete and steel girder is constructed just above the Shinkansen. Pre-stressed concrete girder which is divided into 11-19 brocks set up at assembling yard by using the 40t and 30t rigid-frame crane. Steel girder set up in the same way. After, pre-stressed concrete and steel girder is conveyed to the construction site by using two conveyance carts. Movable erection girder is consisted of beam girder, truss girder, suspending girder, front tower and rear tower. Beam girder is pushed forward by the power of propulsive jack which is equipped on truss girder. Suspending girder is suspended by front and rear tower. Therefore, suspending girder can go up and down. Besides, we have to correct the direction of the movable erection girder according to the alignment of a track in construction because a track is not necessarily a straight line.

The steps of construction by using the movable erection girder can divide into two works.

1. The work by the previous day of construction

Pre-stressed concrete and steel girder which has set up at assembling yard is conveyed by using two conveyance carts. And, pre-stressed concrete and steel girder is set temporary on beam girder by using two conveyance carts which have been divided into two blocks of upper and lower sides until the day of construction.

2. The work on the day of construction

The day of construct a girder, in order to ensure the safety of the Shinkansen located in directly under, we have to complete a maximum of 63m girder sending work and a maximum of 6.9m girder descent work for 3 hours and a half after the last train (Fig.4).

It is required for about 40 days in order to construct one girder. After construct a girder, we move erection girder to the next site and construct following girder. In repeating this cycle one by one, we are performing the girder construction.

3. Conclusion

Construction of seventeen pre-stressed concrete girders and two steel girders was started in December, 2010 and completed in April, 2013 including approach section and vertical section (Fig.5). In the meantime, the construction has been performed safely without an accident, and operation of the Shinkansen was continue underneath the construction place, was not affected by construction. The East Japan earthquake in 2011 was occurred during the construction period, has been observed intensity upper-5 is also the place, it is no damage at constructing structure for the Ueno-Tokyo line. We started a trial run of Ueno-Tokyo line from August, 2014. At last, the Ueno-Tokyo line will be opened on March 14, 2015.

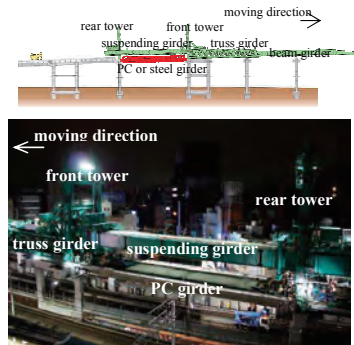


Fig.4: Descent work



Fig.5: Panoramic view of double-deck structures