PLANNING THE "NEW HONJO STATION" OF JOETSU SHINKANSEN LINE

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Abstract: "New Honjo Station" will be the first station to newly be constructed on the operating line of the Joetsu Shinkansen. Shinkansen is the most general means of inter-city transportation. However, recently many people who live within 100 kilometers of metropolitan areas use Shinkansen as a commuter train.
Honjo City and many cities around Honjo petitioned that a new station was constructed. The area counts as one of future base points of Saitama prefecture. Now we are considering their petition and their development plan and are making our plan of the new station.
In this paper, we report the subjects of planning and constructing of new station. Especially in construction works, inserting four turnouts into the "concrete slab track" of the operating line of Shinkansen is the first case. We were studying how to make insertion time short in order to restrain the influence to train operating as possible, and also about the safe and economical method.

Key Words: Shinkansen, new station, development plan, plan of station installation

1. INTRODUCTION

Shinkansen is one of high-speed railways representative of Japan. And it is the most general means of inter-city transportation. Joetsu Shinkansen Line links Niigata City, one of main cities of Japan Sea area, with the Tokyo metropolitan area (Fig.1). However, in recent years, Shinkansen commuters from the outside edge of metropolitan area to the center area increased gradually (Fig.2).

"New Honjo Station" is planned to be at about 90 kilometers distance from Tokyo. Honjo City and many cities around Honjo organized a union for constructing new station in 1989. And the area counts as one of future base points of Saitama prefecture. We promised to cooperate with Honjo City and Saitama Prefecture. Now we have a target of starting the projects from the year 2001 and operation of the new station in the year 2004.

Fig.1 Shinkansen Railway Network

2. PLANNING SURROUNDING AREA OF THE NEW STATION

There is about 54 thousand population in Honjo city, and there is more than 350 thousands population in neighboring cities or towns. We predicte that 4250 people will use the new station a day. When passengers travel from Honjo to Tokyo by Shinkansen, it will take about 52 minutes. It is less than half the time of using conventional lines about 108 minutes. And in addition, passengers will be able to go directly to Tokyo Station without changing train.

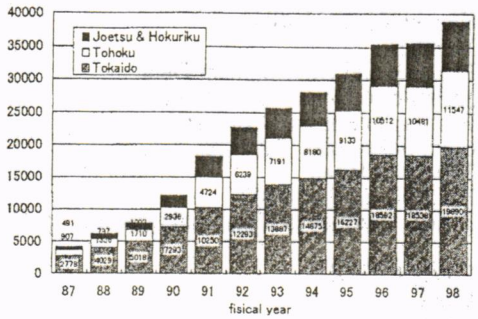

Fig.2 Change of the Number of Shinkansen Season Ticket

The new station will be 2 kilometers distance from existing Honjo station of conventional line or from the center of the city, but some principal road will be constructed aiming the time of starting operation of the new station. Using these roads, more people will be able to come to the station. Two new Shinkansen lines started operating in 1998 and 1999. All stations of each line have "Park & Ride" and a number of passengers coming to station by car increase now. So "Park & Ride" is planned to accept 1000 cars at "New Honjo Station" too.

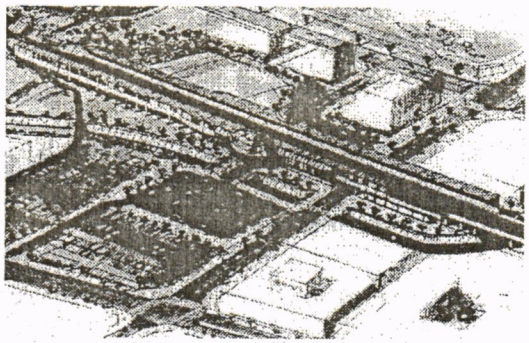

Fig.3 Sketch of The New Station

At the north side of the station, public cooperation will readjust the town lots (155ha) and build up square in front of the station, parking area, housing area and so on. At the south side, Waseda University has campus and the project plan of the university is the special area "Research Park" which includes institutes of education, information and communication technology.

3. RAILWAY STATION INSTALLATION

3.1 Location

Alignment of neighborhood of the new station is straight and gradient is 2‰ or 7‰. There are cutting section and viaduct section.

The location of the station was decided by the basic rules of the shinkansen structure. According to the rule, the station yard must be within the section of less than 3‰ gradient and turnout must not be in the vertical curve section.

Considering the land use plan around the station, it is better that the center of the station is in the viaduct section.

3.2 Track layout

Stations of Shinkansen lines almost have sidetracks. Joetsu Shinkansen line and

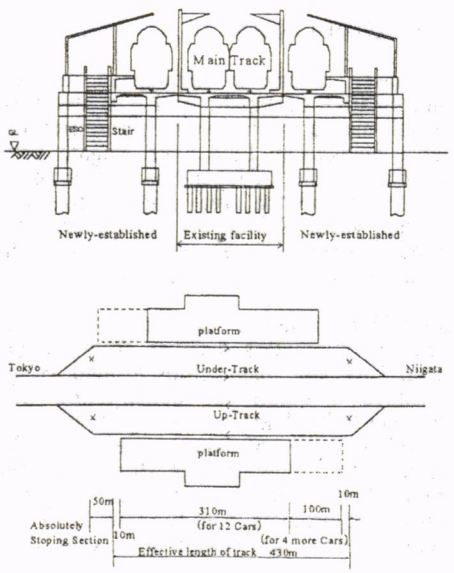

Fig.4 Cross section and Tack Layout of the station

Hokuriku Shinkansen line use the same tracks from Omiya St. to Takasaki St. In future when Hokuriku Shinkansen line is constructed to Kanazawa City, the passengers will increase more and more. Shinkansen provides various patterns of stopping at stations, for example, non-stop pattern, stopping at some principal stations, stopping all stations and so on. These various pattern make different speed of trains. Because of high-speed, it takes more 5 minutes for the train to stop at a station. In order to run more trains and more various pattern trains, the new station is required to equip sidetracks.

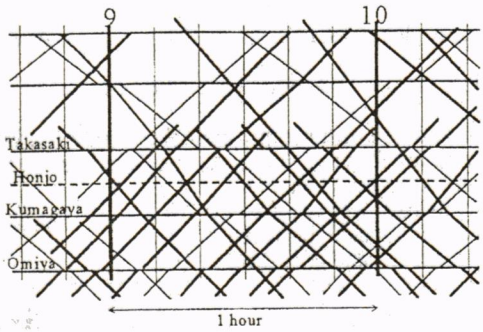

Fig.5 Operating Diagram of Joetsu Shinkansen line

Stations of Shinkansen lines have connecting track between up and down track in order to provide shuttle services in partial section of the line and against emergency. At first, we thought the new station is required to have connecting tracks too. But constructing the connecting track will be difficult and high-cost work and the new station is not planned to be a junction station. So stations neighboring to the new station, Takasaki or Kumagaya, will role junction station, and the new station was decided to not have connecting tracks (Fig.5). As a result of this decision, we could make the length of sidetrack shorter than that of original plan. Station track of Shinkansen must have 50 meters length safety section (Fig.2), but, in this case, trains go into sidetrack fixed direction. So this idea made the construction cost lower.

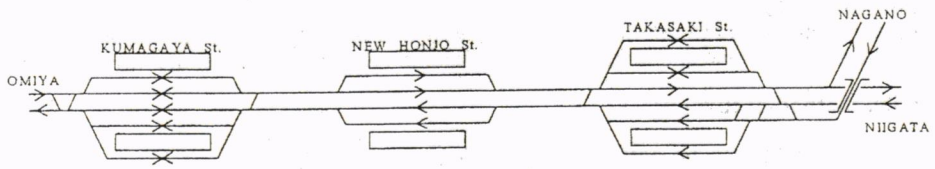

Fig.6 Track Layout around the New Station

3.3 Plan of inserting turnouts

Subject of conventional method

The new station is planned to have the sidetracks, and then four turnouts must be inserted to main tracks. The structure of the track is "concrete slab track", which is one of permanent track without ballast. It consists of roadbed concrete, fastening device, and rail. Rail is fastened to roadbed concrete directly.

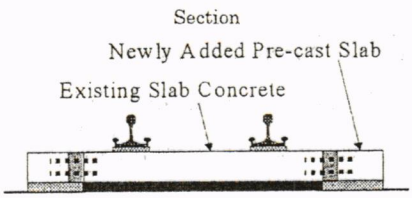

Fig.7 Slab Track

If time for inserting turnouts is enough, usually we remove the slab track and newly reconstruct roadbed concrete in the form of turnout. But, it is not suitable on operating track. So we studied about plans how to insert turnouts. One of methods is changing the track into ballast and inserting turnout.

When we inserted 38# turnout into slab track in 1996, we removed the slab track and inserted the turnout divided into 3 parts. For 3 days, we stopped Shinkansen operation about half the day. It took 9.5 hours to insert each part.

In the case of the new station, because there is 30 thousands traffic volume in this section, it is required that we must insert turnouts without big reduction of train services. To seek the most suitable method to fulfill the requirement is the key of implementation of the project.

Development of rail change method

Our new idea is using existing slab concrete. And we found several subjects as follows.

1 It is needed to widen the roadbed concrete.

Because width of turnout roadbed concrete is a little lager, it is necessary to widen the roadbed concrete for forming the turnout roadbed concrete. But, width of additional concrete parts will be very narrow, it is most better to use pre-cast parts and cast in place between new concrete and exsisting slab concrete (Fig.6).

2 There is height gap between turnout roadbed concrete and ordinary one.

The height from the top of the roadbed concrete level to the rail level is 212 millimeters in ordinary structure section. If fastening devise is ordinary parts of turnout, it is 253 millimeters in turnout section. So rail level must be raised 41 millimeters there. So we designed new bed plate "caved-in bed plate" which was thinner than ordinary one and it will be able to make the R.L. level even in the turnout section.

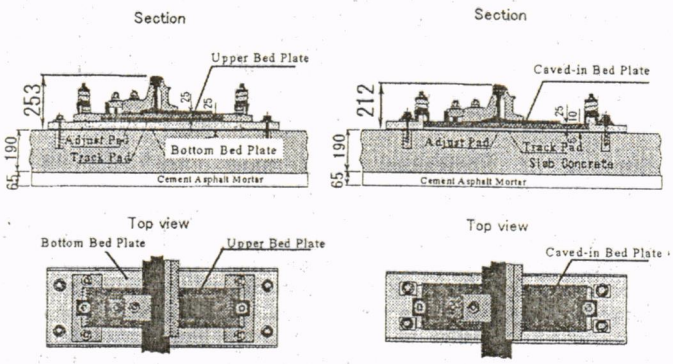

Fig.8 structure of bed plate of fastening device

Insertion method of turnouts

We studied the "changing partial rails" method to install a turnout. This method will make each work time short and restrain influence to train service. The process of this method is as follows.

1 Widening roadbed concrete
2 Inserting bed plates of turnout
3 Inserting rails which do not touch main rails like lead rail
4 Changing main rails
5 Inserting tongue rails and crossing

In order not to reduce train service, we can make sure of only 5.5 hours work time a day. It will take less than 5.5 hours for each step of 3,4,5.

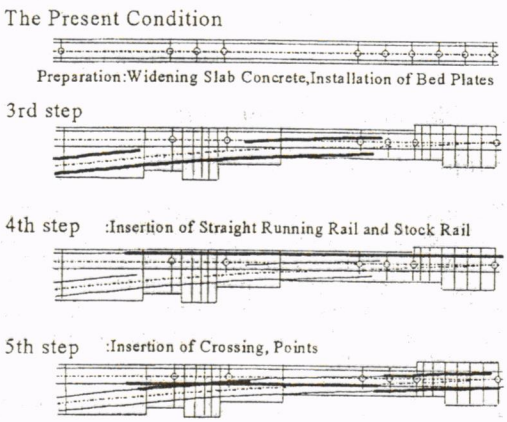

Fig.9 Process of Inserting Turnout

4. SUMMARY

We report the decision process, criteria and subject on constructing Sinkansen station. We regarded the plan around the station as important, and we were studying with planners of Honjo City and Saitama Prefecture about access means, square in front of the station, land use and so on. We were studying how to make insertion time short in order to restrain the influence to train operating as possible, and also about the safe and economical method.