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A Method of "Erection Truss" for Replacement of Existing Plate Girders

Remplacement de poutres pleines par la manière de la poutre d'élévation

Beschreibung einer Methode, einen Blechbalkenträger mit Hilfe eines Hängewerkes auszuwechseln.

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Nowadays Japanese National Railways makes wide use of an "erection truss" as a means to replace, as quickly as possible, old deck plate girders. By this method deck plate girders up to 22.3 meter span and weighing about 35 t have been replaced, and this method is especially economical when used in cases where scaffolding would be very difficult or prohibitive to install, or where there are many bridges of equal span in the same locality.

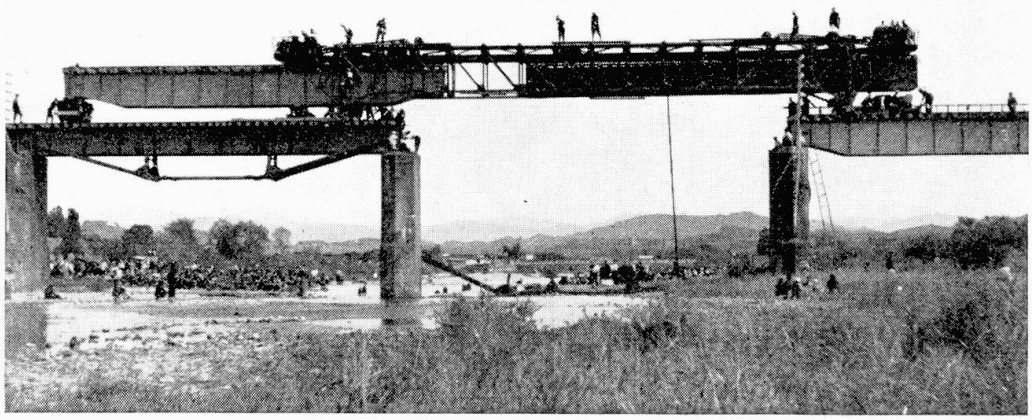


Fig. 1. The "erection truss" at the actual site

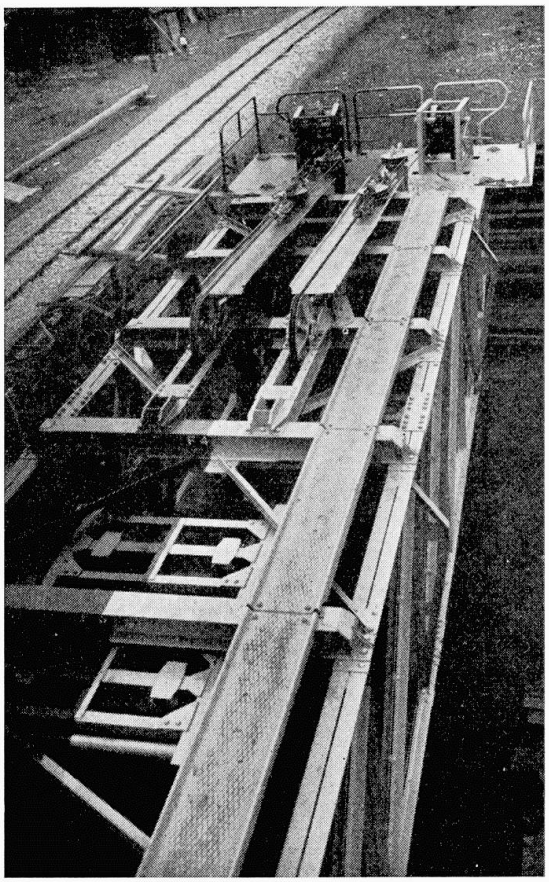


Fig. 2. Upper view of the "erection truss"

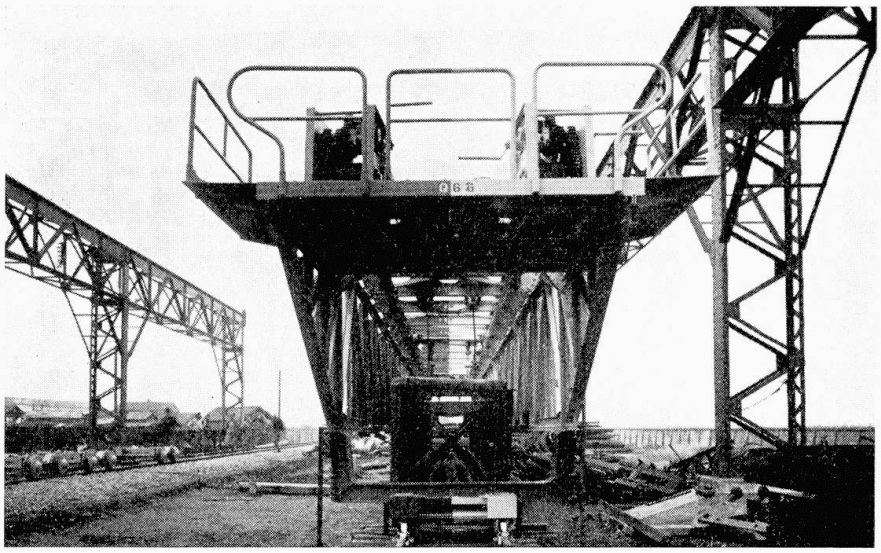


Fig. 3. Front view of the "erection truss"

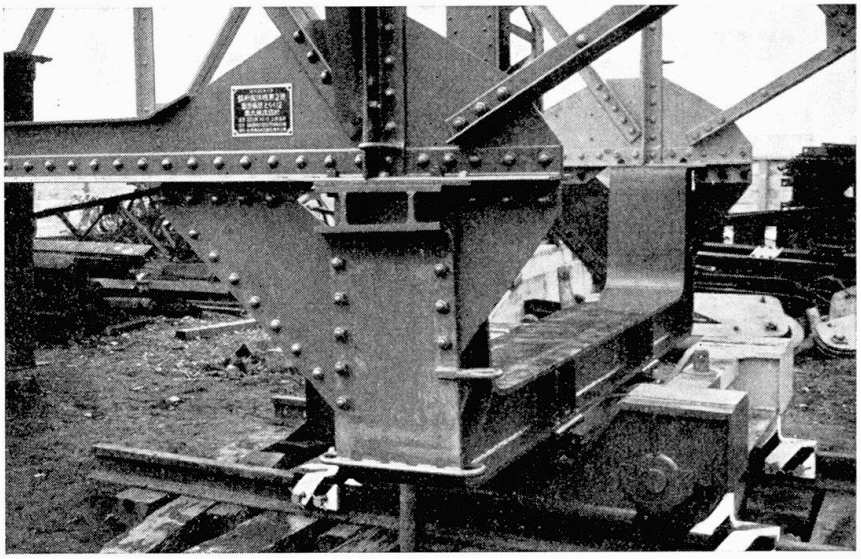


Fig. 4. Close-up of the part near the supporting trolley

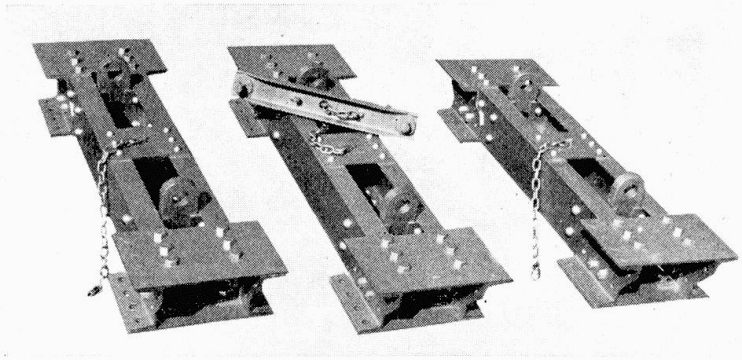


Fig. 5. Hanging beams made of aluminium alloy

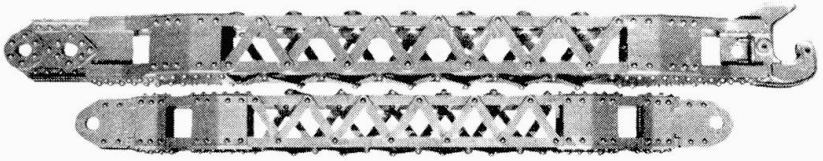
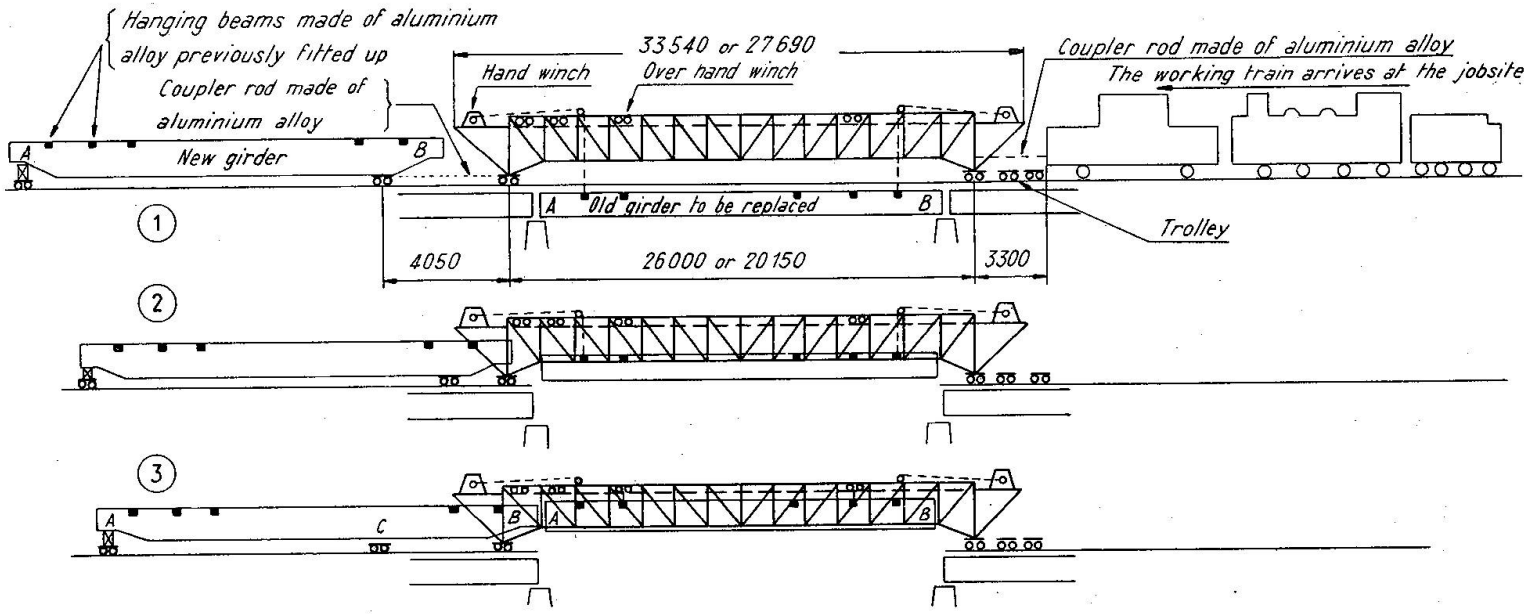
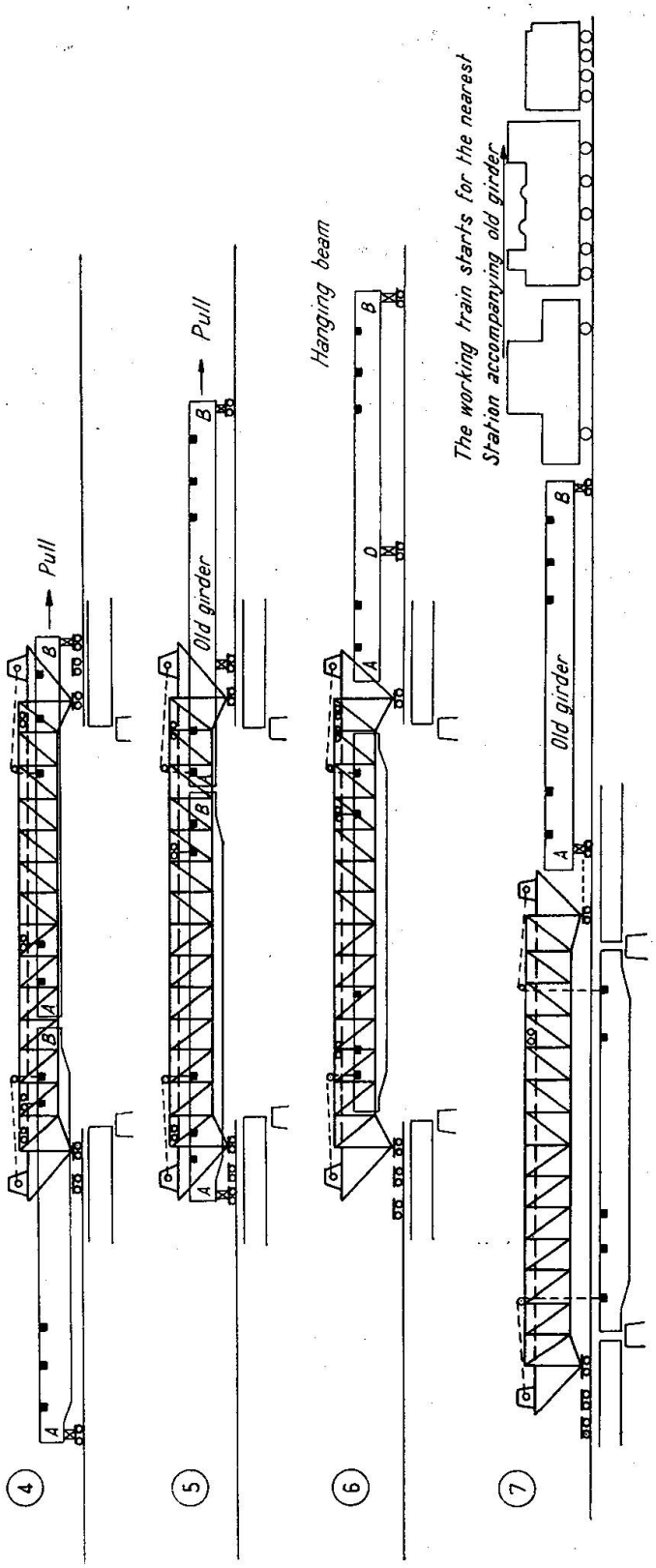


Fig. 6. Coupling rod made of aluminium alloy

Fig. 7. General procedure of renewing a plate girder with the erection truss



1. The erection truss sits astride of the span, wires from winch are fastened to the old girder.
2. The old girder is hoisted up.
3. The old girder is hanged to the overhead trolleys. Ends of the old and new girders are connected together and both girders are transferred.



4. The end of the old girder is set on the trolley and the end of the new girder is hanged to a overhead trolley, both girders are transferred.
5. Another end of the old girder is set on the trolley and another end of the new girder is hanged to a overhead trolley, both girders are transferred.
6. The connection of the two girders are removed, both ends of new girder are hanged to the wires from the winches.
7. The new girder is lowered.

The "erection truss" and its accessories are shown in Figs. 1 to 6. It consists of two main trusses spaced 2.9 metres between centres and is of inverted poney-truss type. Each main truss consists of five centre-span sections and two end-cantilever sections. These sections and other parts are designed so as to be readily transported by rail and assembled on site with a minimum of labour (say 120 mandays).

The "erection truss" spans 26 metres, but it can be made shorter (20.15 metres) for replacing girders of short span by temporarily removing the mid-span section of the centre-span truss. The operation of the "erection truss" is shown schematically in Fig. 7.

In designing the "erection truss" and its parts, every effort was made so that it may *not interfere with the construction gauge* and may minimize time and labour on site.

The time and persons needed on site are as follows:

for arrangements for hoisting up the old girder 6 min.;
for hoisting up the old girder 12 min.;
for arrangement for the transferring the girders 2 min.

1st step: for transferring the old and new girders 2 min.;
for setting the end of the old girder on a trolley 3 min.

2nd step: for transferring two girders 2 min.;
for setting the other end of the old girder on a trolley 5 min.

3rd step: for transferring two girders 2 min.;
for lowering down and setting the new girder on the piers 12 min.;
for arrangements for return to the station 6 min., total 53 min.

One boss, 2 assistants, 16 winchmen on the truss, 3 winchmen on the ground, 4 at overhead trolleys, 12 at trolleys on the tracks on the ground, 4 on the piers, totaling 42 persons.

J.N.R. has two sets of these trusses, they were made by the Matsuo Bridge Co., Ltd., in May 1949 and in Nov. 1950, respectively. Till the present time, 398 plate girders have been handled by these "erection trusses" and the results were all quite satisfactory.

As the result of applying this method, the cost of replacing the above-mentioned existing bridges has been reduced by nearly Y. 200,000 ($ 570), on an average, per span, as compared with the cost when scaffolding is used.

The weight of the truss itself is 22.827 tons and the weight of accessories, namely winches, trolleys, sheaves, blocks, hanging beams, coupling rods, etc. is 17.584 tons, totaling 40.411 tons. The cost of one set of the trusses is approximately Y. 5,000,000 ($ 14,000).

These trusses and accessories were designed by the Special Design Office of J.N.R.

Bibliography

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Summary

At present at various places on the Japanese National Railways, an erection truss is used to replace the old deck plate girders with upper track by new deck plate girders, the spans being up to 22.3 m and the weights about 35 tons.

The time needed amounts to approximately 60 minutes, a total of 42 persons being engaged on the work.

The J. N. R. has two sets of these erection trusses, one constructed in May 1949 and the other in November 1950.

Up to now, 400 old deck plate girders have been replaced by new ones.

The use of this erection truss system makes it possible to save an average of $ 570.— per span, as compared with the cost when using scaffolding.

These erection trusses and their accessories were developed by the special planning office of the J. N. R.

The cost of a set of erection trusses amounts to about $ 14000.—.

The construction and method of working can be understood from the accompanying illustrations.

Résumé

De nos jours, on utilise généralement sur les réseaux des Chemins de fer Nationaux Japonais le procédé de la „poutre d'élévation" pour le remplacement de l'ancienne poutre pleine par la nouvelle (jusqu'à la limite de la longueur de 22,3 mètres et de son poids d'environ 35 tonnes).

Le remplacement s'effectue en une heure et à l'aide de 42 personnes.

Les Chemins de fer Nationaux Japonais ont maintenant deux séries de poutres d'élévation datant des mois de mai 1949 et de novembre 1950.

Jusqu'à présent, 400 poutres pleines ont été remplacées par la nouvelle méthode.

Grâce à cette méthode, les frais d'un remplacement ont été diminués de 570 dollars américains par rapport aux frais de la méthode des échafaudages.

La poutre d'élévation en question et ses accessoires ont été développés par la section spéciale de projets des Chemins de fer Nationaux Japonais.

Le prix d'une poutre d'élévation est d'environ 14000 dollars américains.

La construction et les manœuvres sont indiquées dans les figures.

Zusammenfassung

Gegenwärtig wird auf verschiedenen Baustellen der Japanischen Staatsbahn ein Hängewerk (erection truss) verwendet, um die alten Blechbalkenträger mit obenliegender Fahrbahn (deck plate girder) bis zu 22,3 m Spannweite und etwa 35 t Gewicht durch neue Blechbalkenträger zu ersetzen.

Die für die Auswechslung benötigte Zeit beträgt rund 60 Minuten, wobei 42 Arbeitskräfte eingesetzt werden.

Die Japanische Staatsbahn ist im Besitz von zwei Sätzen dieser Hängewerke, die im Mai 1949 und im November 1950 hergestellt wurden.

Bis heute sind 400 alte Blechbalkenträger durch neue ersetzt worden.

Die Anwendung dieses Hängewerksystems ermöglicht gegenüber dem Gerüstverfahren eine Ersparnis von durchschnittlich $ 570.— pro Baustelle.

Diese Hängewerke und ihr Zubehör sind vom Spezial-Projektierungs-Bureau der J. N. R. entwickelt worden.

Die Kosten für einen Hängewerk-Satz betragen annähernd $ 14000.—.

Die Konstruktion und Arbeitsweise des Hängewerks sind den beiliegenden Bildern zu entnehmen.