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Fabrication of welded steel girders

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Ausführung geschweisster Stahlträger

Diskussion

Execução de vigas de aço soldadas

Discussão

Exécution de poutres en acier soudées

Discussion

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Mr. Berridge observed that the authors had given a good account of modern workshop welding practice in the fabrication of girderwork, but so far as railway bridges were concerned they had not linked the requirements for erection and future maintenance with their ideas of designing for simplification of fabrication. His experience was that welded fabrication gave scope for improved site connections leading to simplified, and consequently quicker, erection, and facilities for future maintenance, better than had ever been possible with riveted construction. On the Western Region of British Railways where prefabrication had been adopted for spans up to 110 feet in length, there was a preference for that method of fabrication which by the completion of the flange-to--web fillets before the addition of the web stiffeners allowed those fillets to be deep peneration welds made with continuous coated rod fed by an automatic welding machine (Fig. 1). Using a 4 S. W. G. electrode, a 3/8-inch fillet could be laid down in a single run at a rate varying between 20 inches per minute with a current of 900 amperes and 12 inches with 600 amperes. With the girder tilted at an angle of about 45 degrees undercutting could be avoided altogether. Costly manipulators were not required. A girder distorted due to having a greater amount of welding

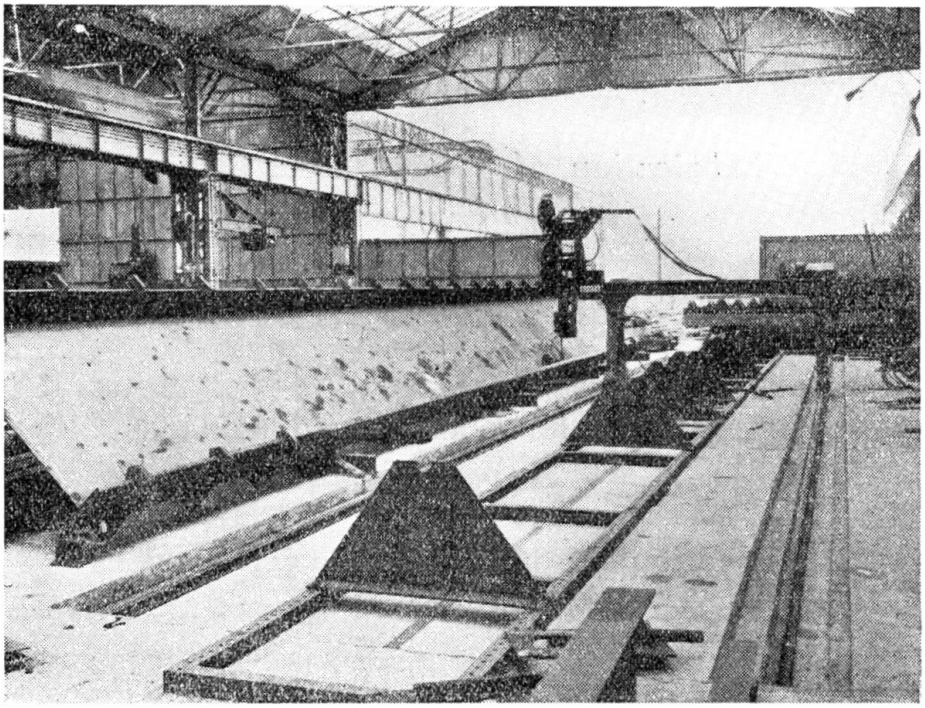

FIG. 1. Welding the web to a flange in a Fusarc automatic welding machine. Note long uninterrupted run attained by adding the stiffeners afterwards

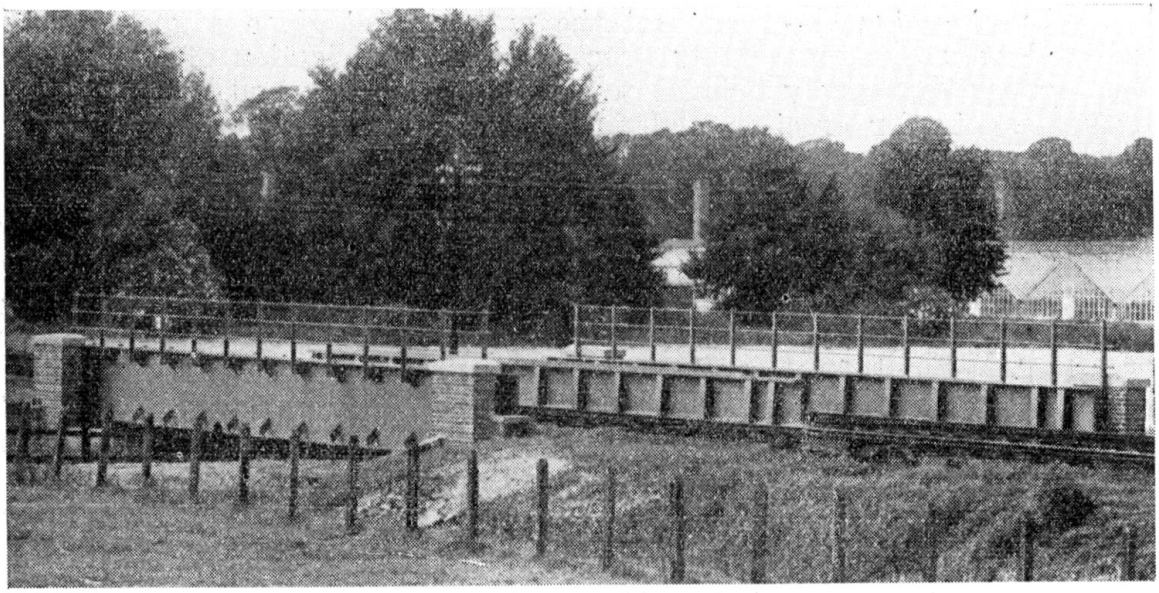

FIG. 2. In welded plate girder construction intermediate stiffeners are not always necessary on the outside of the outer girders

on one side than on the other, as might be the case with an outer girder where there were no intermediate stiffeners on the outside of the web (Fig. 2), was easily straightened by the application of heat from a propane gas burner. While problems of distortion were greater in welded fabrication, it should be remembered that riveted work was by no means immune from distortion. The act of riveting plates to one flange of an I-beam can result in considerable bowing if proper precautions are not taken against distortion.

A combination of welded fabrication in the workshop and the use of high strength bolts for all site connections was ideal.

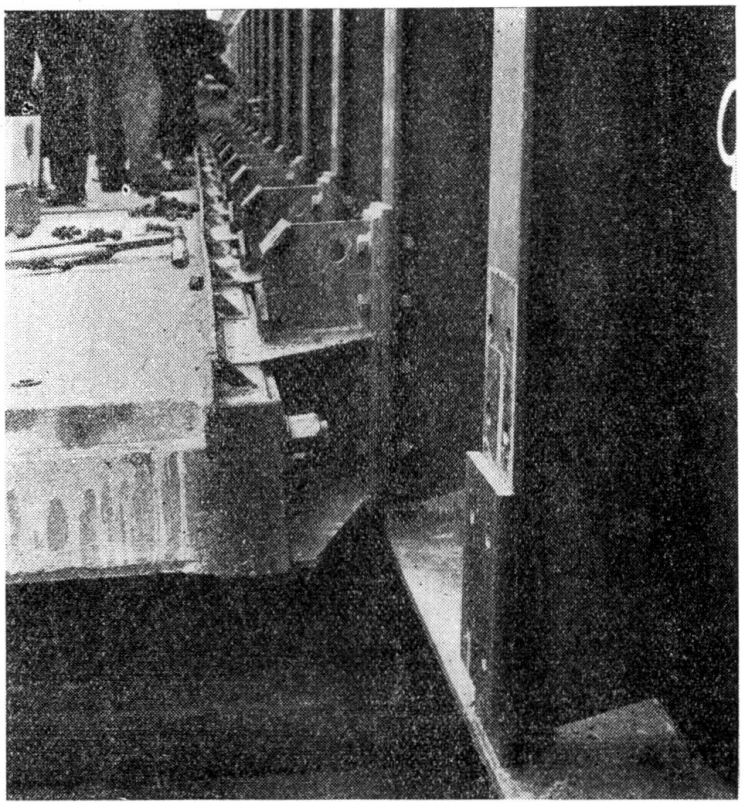

FIG. 3. The bolted connection between deck units (in this case they are of precast prestressed concrete) and the main girders of a half-through type span

Mr. Berridge had eliminated site welding during erection even in the half-through type plate-girder span. The design incorporated tee section stiffeners presenting a sloping flange against which the ends of cross girders, or steel brackets in the case of precast prestressed concrete deck units, were landed on shear plates (welded on the face of the stiffener flange); and the moment stresses, due to the fixity of the joint, were carried by high strength bolts, tightened to a predetermined torque, completing the connection between the cross girders or steel brackets on the deck unit and the main girders (Figs. 3 & 4).

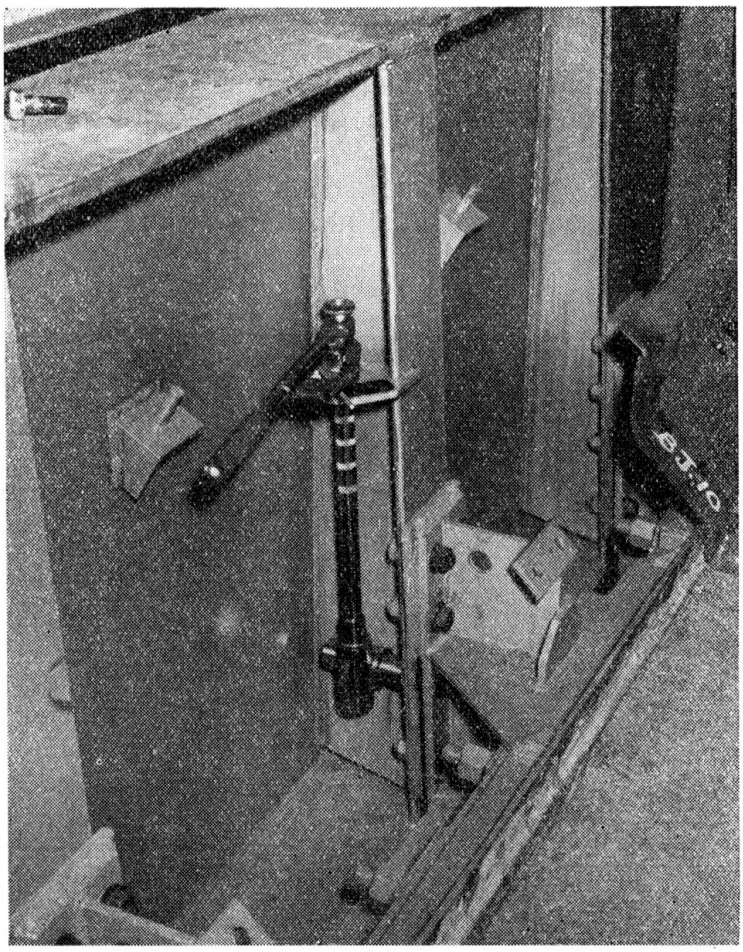

FIG. 4. The use of a torque-multiplying spanner in conjunction with a torque-limiting spanner for tightening high-strength bolts connecting deck units to a main girder

SUMMARY

The author thinks the ideas expressed in the various papers for simplifying fabrication do not pay sufficient attention to the all-important requirements for site erection and future maintenance. The best practice in welded girder fabrication is to make the web-to-flange fillets using deep-penetration electrodes fed by an automatic machine (Fig. 1). It is important to tilt the girder to avoid undercutting; the stiffeners should be fitted afterwards, any distortion being removed by heat. It is not essential to fit intermediate stiffeners on both sides of the web (Fig. 2). The author shows a form of construction eliminating site welding. Shear between deck girders and main girders is carried by shear

plates welded on the sloping flanges of tee-shaped stiffeners while the moment stresses due to end fixity are taken by high strength bolts (Figs. 3 & 4).

ZUSAMMENFASSUNG

Der Verfasser war der Ansicht, dass die Vorschläge des Autors für eine Vereinfachung der Fabrikation äusserst wichtigen Bedürfnissen der Montage und des Unterhalts nicht genügend Rechnung trugen. Die beste Art, geschweisste Träger herzustellen, ist die Verwendung von Schweissmaschinen mit tiefwirkenden Elektroden für die Nähte zwischen Flanschen und Steg. (Fig. 1) Zur Vermeidung von Ueberkopfschweissungen ist es wichtig, dass der Träger gekippt wird; die Aussteifungen sollten nachträglich eingeschweisst werden, eventuelle Verdrehungen werden durch Erwärmen ausgeschaltet. Es ist nicht nötig, Zwischen-Aussteifungen beidseitig des Steges anzubringen. (Fig. 2) Der Verfasser zeigt eine Bauweise, die die Bauplatzschweissung vermied. Die Schubbeanspruchung zwischen den Fahrbahnträgern und den Hauptträgern wird durch Schubplatten übertragen, die an abgeschrägten Flanschen der T-förmigen Aussteifungen angeschweisst werden, während die Biegebeanspruchung infolge Endeinspannung durch hochwertige Schrauben übertragen wird. (Fig. 3 und 4).

RESUMO

O autor pensa que as sugestões expressas nas diversas contribuições para simplificar a fabricação não dão suficiente importância às exigências da montagen e da conservação posterior das obras. Em vigas soldadas, é preferível executar os cordões de canto na ligação da alma aos banzos utilizando uma máquina de soldadura automática e electrodos de alta penetração (Fig. 1). Para evitar soldaduras ao alto torna-se importante inclinar a viga; os reforços da alma devem soldar-se posteriormente, sendo a viga desempenada a quente. Não é essencial colocar os reforços intermédios em ambos os lados da alma (Fig. 2). O autor indica uma forma de construção que permite eliminar a soldadura no local. O esforço cortante entre as vigas do tabuleiro e as vigas principais é absorvido por cutelos soldados nos banzos inclinados de reforços em T; as tensões devidas à flexão proveniente da rigidez das extremidades são absorvidas por parafusos de alta resistência (Figs. 3 e 4).

RÉSUMÉ

L'auteur, est d'avis que les suggestions exprimées dans les différentes contributions en vue de simplifier la fabrication n'attachent pas sufisament d'importance aux exigences du montage et de l'entretien postérieur des ouvrages. Dans le cas de poutres soudées, il est préférable d'éxécuter les cordons d'angle de liaison de l'âme aux semelles au moyen d'une machine automatique en utilisant des electrodes à haute pénétration (Fig. 1). Pour éviter des soudures au plafond il est important d'incliner la poutre;

les raidisseurs doivent être soudés par après, la poutre étant dégauchie à chaud. Il n'est pas essentiel de placer les renforts intermédiaires des deux côtés de l'âme (Fig. 2). L'auteur indique une méthode de construction permettant d'éliminer la soudure sur place. L'effort tranchant entre les poutres du tablier et les poutres principales est absorbé par des goussets soudés aux semelles inclinées de raidisseurs et T et les contraintes dûes à la flexion provenant de la rigidité des extremités sont absorbées par des boulons à haute résistance (Fig. 3 et 4).