Comments by the autor of the introductory report

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Comments by the Author of the Introductory Report
Remarques de l'auteur du rapport introductif
Bemerkungen des Verfassers des Einführungsberichtes

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Three of the seven papers for the prepared discussion deal with the theme in general: submitted by Kupfer, Wittfoht, Lee/Chaplin. Baur's concentrates on one special construction method. The remaining papers, submitted by Kondo/Miyazaki, Machado de Andrade, Boué/Gepp, give descriptions of the design and construction of one special bridge or viaduct.

The paper of Boué and Gepp is a case in itself in that it provides a solution to a very special problem: the construction of a bridgedeck under an existing railway-yard. Their solution consists of transversal shifting. Although their solution is based on a steel deck, it can be applied with the same economical succes in the case of concrete decks. The paper shows that, in some cases, the majority of the criteria for the design are determined by the various stages of construction and not by the final conditions of usage.

The more advanced techniques for the construction of concrete bridges are dictated by various motives, e.g.

- speedy construction , necessitated by climatie conditions, such as described by Kondo and Miyazaki.

- reduction of man-hours by elimination of traditional methods of scaffolding and for formwork.

- more efficient organisation as afforded for instance, by one fixed covered casting-yard.

- independence of ground and traffic conditions.

The aforementioned advanced techniques have for the greater part originated from a combination of some of the above motives e.g.

- precast segmental cantilever-construction with glued joints.

- selflaunching piecemeal system (Taktschiebeverfahren) as described by Baur.

- spanwise construction with off-the-ground stepping formwork equipment as described by Wittfoht and Kupfer.

It is noteworthy, that different countries seem to give preference to different methods and for various reasons. The cast-in-situ boxgirders (according to either the cantilever method or the spanwise construction) has been developed in Germany, encouraged by the great tradition of carpentry in that country.

France and England favour the precast beams or box-segments.
A further determining factor with respect to the way in which the advanced techniques are used is the need to reduce either the load on the auxiliary structure or the cantilever bending moment in the concrete structure itself during critical stages of construction.
Wittfoht mentions that above the limit of 50 m the casting of one span in a single operation results in the load on the auxiliary construction being too heavy.
In the case of the Siegtal-bridge - maximum span 105 m - this problem was solved by casting 10 m segments cantilevering on both sides of the pier up to midspan. Machado de Andrade applies the same principe for the bridge across the Zamberi in Mozambique - span 70 m - with the exception, that the central part of the span is cast in one operation, resulting in the expansion joints being positioned at a distance of 20 m from the pier. His solution is comparable with that of Dyckerhoff and Widmann's approach to the Lennetal-bridge and Elztal-bridge. The latter, however, worked with less casting stages.
Menn points out, that the reduction of dead weight during constructior can also be achieved by casting the cantilevered portions of the box-section after completion of the box-section itself over one span, so that the weight of the cantilevered portions is carried by the concrete structure itself. A similar example, concerning a bridge in Australia is given by Lee.
At the Semorile-viaduct near Rapallo in Italy, constructed according the "Taktschiebeverfahren", only the U-shaped part of the box-girder was launched, the entire deck-slab being cast in-situ after the launching.
The construction of the Semorile-viaduct is also interesting for another reason. With the "Taktschiebeverfahren" the large cantilever moment during launching is normally reduced by means of auxiliary piers, as described by Baur and Kupfer. At the Semorile-viaduct this reduction was achieved by temporary stay-cables and a temporary pylon. This method, which has also been applied in France, can be compared with the application of temporary stay-cables, used in the cantilever construction: for instance, The Zoo-bridge in Cologne, mentioned by Kupfer. There is a difference, however: in the case of the "Taktschiebeverfahren" the pylon moves over the pier during launching, resulting in large shear forces at the pier during launching.

Quite often the application of advanced construction methods leads to new shapes either of the complete bridge or details there of, or to the use of new materials. This, in itself may lead to the necessity for new criteria both in architectural and structural aspects. Wittfoht states that proper application of the stepping formwork method creates special requirements for the shape of the piers. Kupfer mentions that advantages of tapered beams which, inter alia, facilitate the lowering of the formwork. For similar reasons he shows a slight preference for beams in stead of box-girders and suggests that diaphragms be left out, if possible even at the supports during construction. Wittfoht, on the other hand, favours box-sections, because they afford a greater possibility of replacing bearings.

This aspect of maintenance in combination with durability merits more attention than is has hitherto received in the evaluation of new construction techniques and new types of bridges. Menn, for instance, has stressed the importance of a watertight bridgedeck, which can resist thawing salt: This requirement is of special importance in the case of construction methods with either glued joints or touching joints.
On the other hand it may be that the criteria we use for the statical behaviour of bridges are too severe. If we could eliminate diaphragms by means of a more sophisticated design philosophy, taking into account the probability of frequent occurance of various loading cases, this could result in changes in the shape of bridges, facilitating applicability to advanced construction methods.
These changes may be either in the shape of the complete bridge or in details thereof. If, for instance, we could allow higher shear stresses near the supports, as suggested by Baur, the "Taktschiebe-verfahren" would be less hampered by this criterion of permissible shear stress.
An other aspect, worthy of mentioning due to its importance for the development of building techniques is the standardisation of cross-sections. Hitherto, most mediumsized bridges (up to 200 - 300 m) have been built either in the traditional way or as a combination of traditional and advanced methods. If the equipment could be designed for regular use for fixed cross-sections, it might encourage investment in advanced equipment.

Summarising, the following items may be subjects for further detailed study:

- maintenance and durability, in particular with respect of thawing salts.

- evaluation of design criteria and standards.

- standardisation of cross-sections.

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