Platform overbridges for the channel tunnel Folkestone terminal

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Ponts sur les quais de la gare terminus du Tunnel sous la Manche, Folkestone

Gleisüberführungen an der Endstation des Ärmelkanaltunnels, Folkestone

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1. INTRODUCTION

The Platform Overbridges will link the shuttle train platforms with the rest of the terminal area. There are four overbridges, each about 300m long and up to 5 lanes wide, with a total of 29 ramps, each 80m long, connecting them to the platforms. The layout of Overbridge 1 is shown in Fig. 1. The scale and geometrical complexity of the four bridges is notable; they involve over 50 highly skewed spans over rail tracks, with a total deck area of 48000m^2, The structures were conceived, designed and constructed over a 42 month period under a design-and-construct contract, so the interaction between the construction requirements and the design process was a particular feature of the project.

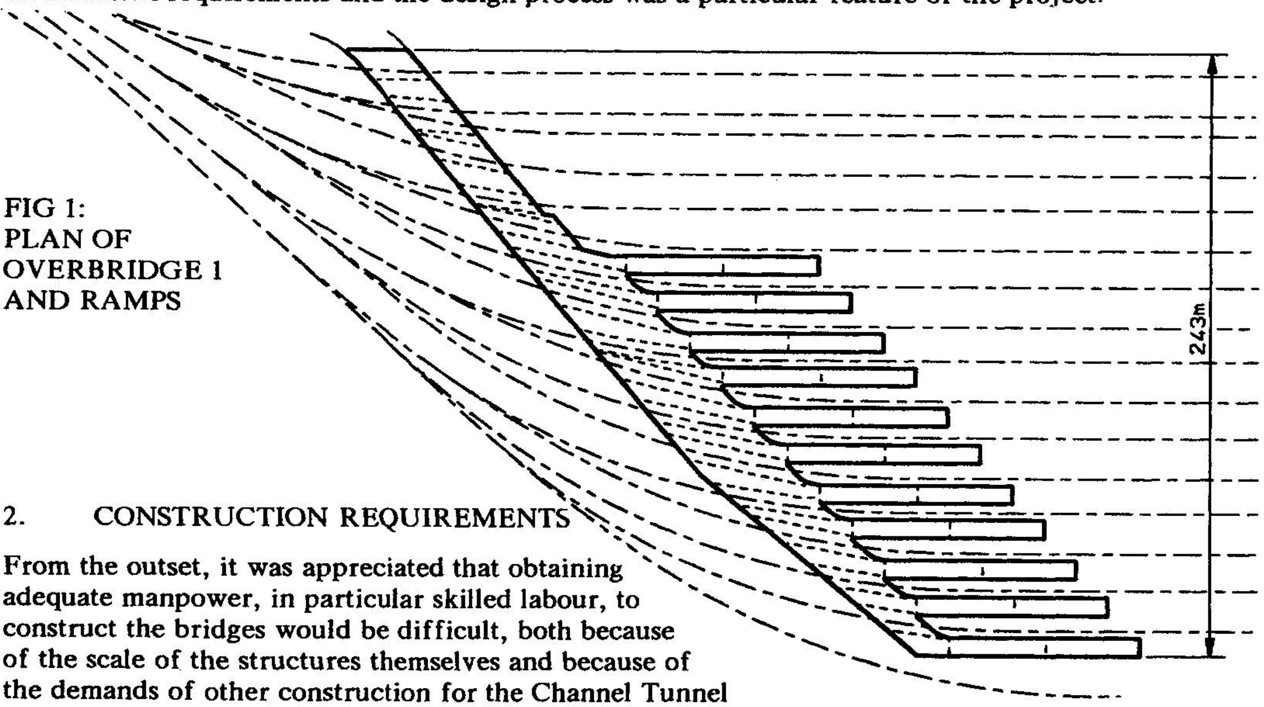

FIG 1: PLAN OF OVERBRIDGE 1 AND RAMPS

2. CONSTRUCTION REQUIREMENTS

From the outset, it was appreciated that obtaining adequate manpower, in particular skilled labour, to construct the bridges would be difficult, both because of the scale of the structures themselves and because of the demands of other construction for the Channel Tunnel project. In addition, the construction programme was extremely short. Simpie and rapid construction methods were therefore essential, aiming to gain maximum benefits from the repetitive nature of the work. These constraints meant that insitu concrete work should be kept to a minimum in the design and steel or precast concrete used wherever possible. The extent to which these aims could be met was limited by two factors: one was the complex geometry of the overbridges and the other was the need to maintain flexibility in the developing design because of the fast-track nature of the project.

3. OTHER CONSTRAINTS

The layout of the bridges was subject to severe spatial constraints, in particular the high skew and complex converging railway alignments, leaving varying and restricted space for supports. Fig. 1 illustrates the problem. In addition the structural depth available for the decks over the rail tracks was limited by the lengths of the ramps, which could not be increased. The structures were required to be robust against possible impact from derailed trains, so wall supports were preferred.

The bridges were to be founded on imported granular fill, placed over weathered to stiff clays. Piled foundations were avoided for reasons of construction programme and available resources.

In developing the design, considerable thought was given to the appearance of the structures and their integration in the overall concept of the Terminal. Because of the scale of the site, a low, solid appearance was preferred, rather than a series of conflicting, elevated structures. This approach had the secondary advantage that space under the bridges could be used for equipment rooms, etc. without detracting from the appearance.

4. DESIGN AND CONSTRUCTION OF OVERBRIDGES

The design of the overbridges was developed from the constraints described above. The structural system consists of reinforced concrete boxes located between the rail tracks, with simply-supported decks connecting them and spanning over the tracks. The simply-supported spans consist of precast, pretensioned concrete beams with insitu concrete decks. A partial cross-section is shown in Fig. 2.

The boxes are founded directly on the imported fill, thereby eliminating the need for piling. They are proportioned to keep bearing pressures, and hence settlements, to acceptable limits. Settlements have been monitored against theoretical predictions, and to date good correlation has been observed.

Geometric variations precluded the use of precast concrete for the boxes, but a high rate of insitu concrete placing was achieved with large, re-usable formwork panels.

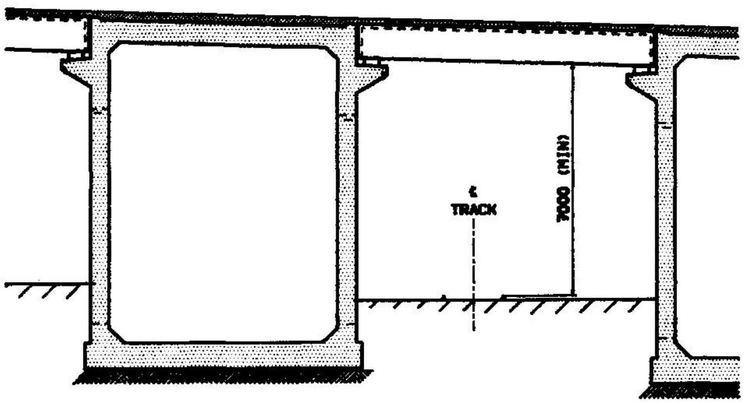

FIG 2: OVERBRIDGE CROSS SECTION

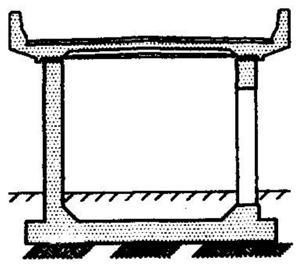

FIG 3: RAMP CROSS SECTION

5. DESIGN AND CONSTRUCTION OF RAMPS

The design of the ramps connecting the overbridges to the platforms employs the same principles. However, as all 29 ramps are similar, there is more scope for repetitive construction methods. The lower sections of the ramps consist of earth fill between concrete retaining walls. The decks for the upper ramp sections are formed from precast concrete units, which span transversely across two insitu concrete walls, as shown in Fig. 3. At the junction with the bridge the ramp structure connects with the corresponding box.

The precast concrete ramp deck units with their integral parapets are 7.4m long, 3.25m wide and weigh 25t each. They bear on thin rubber pads on the supporting walls and are connected to each other structurally using insitu concrete. They have allowed simple, repetitive and rapid construction methods with minimum on-site labour; normally a team of 6 men placed the units for one ramp in 8 hours.

6. CONCLUSIONS

The construction requirements were met by a simple and robust structural solution providing the maximum opportunity for precasting of units. This allowed large areas of bridge deck and complex shapes to be constructed by rapid and repetitive methods using the minimum amount of skilled labour.