CORRESPONDENCE

on Papers published in Proceedings, Part II, June 1953

Railway Paper No. 48

" The Design of Structures in Relation to Maintenance and Inspection " †

by

Frank Turton and Norman Stewart Cox, B.Sc.(Eng.), M.I.C.E.

Correspondence

Mr W. T. Wilks observed that the Authors appeared to have overlooked the fact that there was still, in Britain, a shortage of steel and building materials, and evidently disregarded the recommendations contained in memoranda issued by the Ministry of Works. Since the British Railways were such large users of steel and other building materials, there was every reason why they should strictly observe those recommendations so as to make their contribution in the economy drive. Furthermore, the saving in the use of those materials would automatically result in some economy in the present-day working of the railways—now a matter of urgency.

Mr Turton had stressed the confidence he placed in the reliability of the properties of steel, and appreciated the efforts made by the steel industry in providing such first-class material. Although the railways in Britain had been large users of steel for many years, it would be interesting to know what contributions they had made in the past towards any research in the manufacture and improvement of the quality of steel.

In the past 40 or 50 years, British railway engineers had had a poor record for research work ; in fact, it had been difficult even to induce them to accept new methods tested and tried by enterprising companies. It was hoped that in the field of research of prestressed concrete, they would make their fair contribution and, in fact, endeavour to become leaders, since their resources were greater than those of any other industry and certainly their use of prestressed concrete was far more extensive.

It was, however, encouraging to note that, in the past 5 or 6 years, some railway structural engineers responsible for policy-making were considering the use of prestressed concrete as a medium, for as recently as

† Proc. Instn Civ. Engrs, Part II, vol. 2, p. 365 (June 1953).

1946, one railway structural engineer's view of it had been, to quote, " We don't want anything to do with piano wire."

Mr Cox had pointed out difficulties in design and materials, but offered little help towards their solution. The experienced designers had been fully aware of those difficulties in what was the Great Western—and later the Western Region—for the past 25 years but had always been discouraged from putting forward suggestions to rectify them. The proposal contained in the Author's conclusion on p. 393 would not solve the many problems. It was true, however, that an exchange of views between the design and maintenance staffs would be helpful in some small measure, but the real solution would be for selected members of each section to spend several years in each of the other sections. So far as the Western Region was concerned, the latter suggestion had always been vetoed and, consequently, there had been little progress in overcoming the many maintenance problems presented by Mr Cox. During the existence of the old Great Western Railway, it had been the procedure for the design section to prepare designs, estimates, and contract documents and submit them to the District Engineer for comments but, invariably, any criticism offered usually made manifest the lack of interest in, and knowledge of, the designer's work.

Fig. 19 showed one expensive type of smoke chute which had been recently devised, using asbestos-cement sheets. Was it definitely known what would be the effects of smoke on that material, and could any indication be given of the life of the chute ? It should be apparent to any engineer that, considering the amount of smoke drifting about locomotive sheds, a smoke chute was totally inadequate to deal with the situation. It was suggested that the only effective way of dealing with the problem was to have mechanical extraction.

Referring to *Fig. 16*, the type of structure which was being used for a new locomotive shed on the Western Region was incompatible with the knowledge railway engineers had of the detrimental effects of smoke fumes on steel. Braced roof trusses and lattice roof-girders should have been the last choice for that particular job, and when the cost of maintenance was also taken into consideration, it was very uneconomical. If the roof lay-out had to be northlight construction (a point which was difficult to concede) then obviously the roof girders should have been of the Vierendeel welded type and the rafters of the trusses should have consisted of rolled steel channels or joists only so as to eliminate the use of light structural bracings and pockets in which corrosion was rapid. Capital expenditure might have been slightly higher but the maintenance cost would have been reduced.

The deterioration of the reinforced-concrete structure illustrated in *Fig. 8* was not surprising when it was realized that on the Western Region there was little appreciation of the value of quality control of concrete even so late as 1939, although from about 1910 onwards, British civil

engineers had been taking an interest in reinforced concrete and had carried out much research work on that important point by 1939. On the Western Region, the design of the first reinforced-concrete structure by the Railway's own civil engineering staff had not been undertaken until 1928–1929, and the first real attempt to formulate its own specification for concrete had not taken place until 1943 or 1944.

In *Figs 11*, attention was focused on a detail of construction for roof trusses, pointing out the weakness of having double-angle rafters and main ties. The defect had been well known for at least 25 years, but no solution had been found for large-span trusses that was satisfactory and economical. The experienced designer had, for many years, used single angles wherever possible in short-span trusses, but above 60 feet the idea of a single angle was invariably impractical and uneconomical. It was believed that the rigid frame construction might prove to be the answer.

A last point for comment was the size of the standard G.W.R. glazing bar. If a 3½-inch-deep bar was used for all spans of glazing, then for short spans it was an extravagant use of soft timber, a material which was very scarce.

The Authors, in reply, stated that, far from having overlooked the fact that there was still a shortage of steel and building materials, they were acutely aware of it, and indeed it was difficult to see how a responsible designer could be so ignorant of the situation as Mr Wilks seemed to suggest, because he had been forced to grapple with the many problems associated with shortage for the past 13 years.

Although some railways had been making extensive use of reinforced concrete before 1939, the subsequent shortage of steel and timber had led to more bridges being built in concrete on the late London, Midland and Scottish Railway and the present London and Midland Region than in steel—a complete reversal of policy, which had not only resulted in the saving of steel, but had also contributed in no small measure to the more economical working of the railways. It should also be pointed out that railway structural engineers had not only considered the use of prestressed concrete, but had been using it, particularly in bridge work, for the past 7 years. Their contributions towards the furtherance of the use of that medium had been recorded in several Papers and other publications.

Where it was necessary to use steel—and there were many cases of railway-bridge reconstruction work where there was no alternative—extensive use was made of welding with a consequent saving of up to 20 per cent in the weight of steel as compared with a riveted structure.

The right use of those two materials—concrete and steel—should be the railway engineer's constant endeavour, and that automatically resulted in true economy.

Mr Wilks had stated that the railways in Britain had been large users of steel for many years, and had asked what contributions they had made towards any research in the manufacture and improvement of the quality

of steel. There were several ways of contributing to research of that kind, and surely one of them was to be a large and discriminating buyer ; in that connexion it was interesting to recall that the former London and North-Western Railways had built its first steel bridge carrying the line in 1876, and from 1884 onwards that Company had almost ceased to use wrought iron for its structures. That was long before many other authorities and engineers had begun to use mild steel for similar purposes.

Mr Wilks had made several interesting comments on Part II of the Paper, but was not entirely up-to-date in his knowledge of Western Region practice.

His suggestion that selected designers should spend several years on works maintenance, and maintenance staff a similar period on design was counsel of perfection which could rarely be followed in practice.

The smoke chute shown in *Fig. 19* was a development of the old pattern timber chute and was proving less costly to maintain.

Mechanical extraction of smoke from engine sheds was more costly to install and maintain and was really effective only when engines were correctly placed in relation to the extractor fans.

Braced roof trusses and lattice roof girders in Western Region engine sheds had given satisfactory service without excessive corrosion because of their height above engine-stack level. An example of that could be seen in the Old Oak Common shed constructed before 1900.

Airport Paper No. 23

" Methods of Soil Stabilization and their Application to the Construction of Airfield Pavements " †

by

Donald John Maclean, B.Sc., and Peter John Mackenzie Robinson, B.Sc.(Eng.), A.M.I.C.E.

Correspondence

Mr R. S. Colquhoun referred to the Authors' suggestion, on p. 450, that for temporary military airfields it would be desirable to devise a surfacing which combined the rigidity of metal surfacing with the imperviousness of bituminized hessian surfacing. With that suggestion he completely agreed, but he was at variance with the Authors' opinion that such a development had yet to be made.

† Proc. Instn Civ. Engrs, Part II, vol. 2, p. 447 (June 1953).