INTRODUCTION

The development of structural adhesives has been led by the aircraft industry and the reason is simple. No other connection technique is capable of meeting the demanding requirements. The same is not true in the construction industry, but bonding nevertheless offers significant advantages. The slow take-up is largely a result of the perception of risk in a conservative industry.

One potential advantage of adhesives in civil engineering is that the resulting connections are distributed rather than localised. This is notionally possible with welding too, but the necessary procedures are extremely expensive. Usually, welds are highly localised and they represent points of weakness where stresses are concentrated. The same is true of bolted or riveted connections where stress is transferred from one part to another in a localised way. The use of friction grip fasteners only partially overcomes this problem.

A second advantage of adhesives is that they do not damage the materials which are being connected. The adhesion is basically a consequence of the adsorption of adhesive macromolecules onto the adherend surfaces through atomic forces (Van der Waals forces). Their effect does not penetrate like the heat-affected zone of a weld or like a bolt hole. The significance of this is primarily that the fatigue strength of the...
adherend is not impaired. In comparison with welding, a further factor is that adhesive bonding causes no distortion of the parent material.

A third advantage is that adhesives may readily be used to connect dissimilar materials. For example, steel strengthening plates may be bonded to concrete, to cast iron or to wrought iron, materials which are singularly difficult to repair. Being electrically insulating, adhesives might allow the use of dissimilar metals in combination without the accelerated corrosion which would normally ensue. This may be important in repairing older bridges.

APPLICATIONS

To date, the role of adhesives in construction has been restricted largely to strengthening and repair. Steel plates have been bonded externally to concrete beams to provide temporarily increased strength [Refs 1 - 5] and epoxy mortars have been used to repair spalled concrete [Refs 6,7]. The purpose of the present paper is to promote an application of adhesives in new construction. In the particular example chosen, the bonding of transverse stiffeners to steel plates, two of the advantages discussed above are utilised.

Transverse stiffeners for plate girders

Steel plate girders and boxes are very popular for bridge work. Modern techniques of automatic fabrication have reduced the cost of steel dramatically in recent years and it commonly wins in competitive tender against concrete even for quite moderate spans of bridge. Modern designs tend to use very thin webs with transverse and sometimes longitudinal stiffeners to hold the web flat (Figure 1). Transverse stiffeners remote from load positions are normally attached to the compression flange (where fatigue is not a problem) and stop short about four web thicknesses from the tension flange (where fatigue resistance is important). The lower