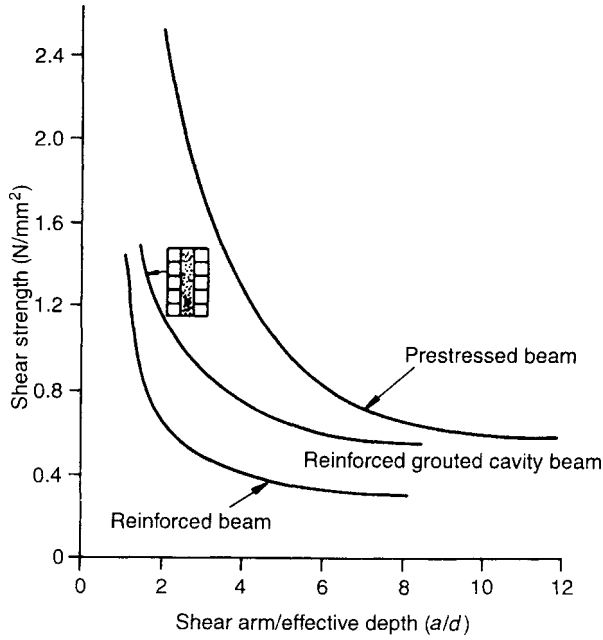


**Fig. 11.2** Shear strengths of different types of brickwork beams of similar cross-sections.

than one of reinforced brickwork or reinforced grouted brickwork cavity construction. Although the experimental results are for brickwork beams, the findings are applicable also for other type of masonry flexural elements.

3. *Improved service and overload behaviour.* By choosing an appropriate degree of prestressing, cracking and deflection can be controlled. It may, however, be possible to eliminate both cracking and deflection entirely, under service loading in the case of a fully prestressed section. In addition, the cracks which may develop due to overload will close on its removal.
4. *High fatigue resistance.* In prestressed masonry, the amplitude of the change in steel strain is very low under alternating loads; hence it has high fatigue strength.

## 11.2 METHODS OF PRESTRESSING

The techniques and the methods of prestressing of masonry are similar to those for concrete.

### 11.2.1 Pretensioning

In this method, the tendons are tensioned to a desired limit between external anchorages and released slowly when both the masonry and its concrete infill have attained sufficient strength. During this operation, the forces in the tendons are transferred to the infill then to the masonry by the bond.

### 11.2.2 Post-tensioning

In this method, the tendons are tensioned by jacking against the masonry element after it has attained adequate strength. The tendon forces are then transmitted into the masonry through anchorages provided by external bearing plates or set in concrete anchorage blocks. The stresses in anchorage blocks are very high; hence any standard textbook on prestressed concrete should be consulted for their design. In some systems the tendon force is transmitted to the brickwork by means of threaded nuts bearing against steel washers on to a solid steel distributing plate.

The tendons can be left unbonded or bonded. From the point of view of durability, it is highly desirable to protect the tendon by grouting or by other means as mentioned in clause 32.2.6 of BS 5628: Part 2. For brick masonry, post-tensioning will be easier and most likely to be used in practice. It is advantageous to vary the eccentricity of the prestressing force along the length of a flexural member. For example, in a simply supported beam the eccentricity will be largest at the centre where the bending moment is maximum and zero at the support. Unless special clay units are made to suit the cable profile to cater for the applied bending moment at various sections, the use of clay bricks may be limited to:

- Low-level prestressing to increase the shear resistance or to counter the tensile stress developed in a wall due to lateral loading.
- Members with a high level of prestress which carry load primarily due to bending such as beams or retaining walls of small to medium span.

*Example 1*
A cavity wall brickwork cladding panel of a steel-framed laboratory building (Fig. 11.3) is subjected to the characteristic wind loading of 1.0kN/m$^2$. Calculate the area of steel and the prestressing force required to stabilize the wall.

*Solution*
In the serviceability limit state the loads are as follows:

$$\text{design wind load} = \gamma_f w_k = 1 \times 1.0\text{kN/m}^2$$