Verulam

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Topics of importance openly discussed

Modelling stability

There have been several responses to Bill Addis' James Sutherland History Lecture paper (April 2013). Here, Bill Harvey supplies the following additional note that may be of interest to our members.

Bill Addis (in his Sutherland Lecture) follows others, notably Heyman, in commenting that one can use physical scale models to test the stability of masonry (read no tension) compression structures including arches, vaults and domes.

This is true provided the structures don't get too big or the forces too eccentric. In real scales, the latter is the serious issue. If there is a differential stress across the section and at one edge the stress is sufficient to cause creep, the outcome will be progressive bending of the structure or rotation of the foundation, or possibly both.

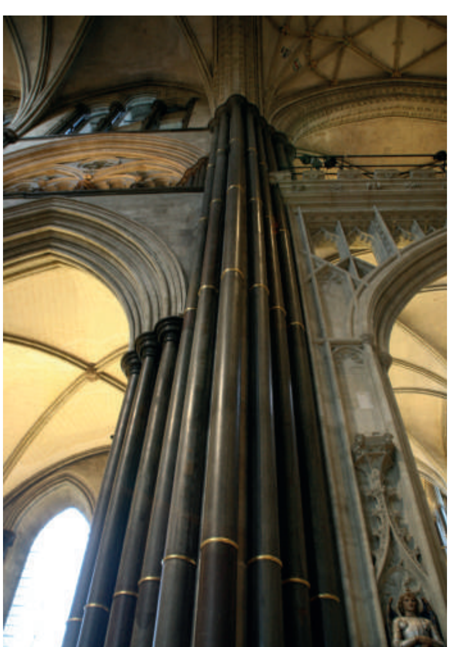

Figure 1

Stability in any large masonry structure is time dependent. Even if the structure is built with tight joints and so negligible creep, the foundations will creep if the stress gets a bit high and this will induce rotations that reduce (however slowly) stability. The bent columns in Salisbury Cathedral (Figure 1) show this action in progress.

The so-called 10 year rule may be good for 100 year structures but if movement manifests itself within those 100 years, 1000 year life becomes less certain. One cannot extrapolate over two orders of magnitude in time.

Gaudi may not have understood entirely, but by paring away his structure and following the force exactly, he could minimise the effects of creep.

I thank Bill for this information.

Precast concrete planks

In response to the publication of Technical Guidance Note 24 (Level 1) entitled 'Precast concrete planks' our regular correspondent from Malta, Denis Camilleri, has sent us the following cautionary note explaining how the form and condition of the support bearing can impact on the performance of this type of plank.

As outlined in the March 2013 issue, a good overview is given of this structural element as fitting in the overall building frame. These elements are noted as being supported on steel or concrete beams also known as non-rigid supports. For bearing on load bearing walling this is also classified as a rigid support. The minimum bearing width is given at 75mm for bearing on steel (Figure 3 in the guidance note) and concrete elements (Figure 4), whilst for bearing on masonry a minimum bearing of 100mm is given (Figure 5). However, no specification is given for the bedding mortar to accommodate the rotation at the support. Am I right in saying that when supported on a steel flange no bedding material is required?

Load tables giving safe allowable loads are produced for the various plank thicknesses and spans, for both the bare unit and a composite section with 75mm topping.

However, beside the safe load imposed on this floor element, the shear value of each plank is an important design consideration. This gains in importance when utilised in bridge decks or as transfer slabs in partitioned load bearing buildings. Figure 1 in the guidance notes shows the cross sectional shapes of panels available. The panel with circular cores normally has a lower shear capacity than the panel with elongated cores.

In a future technical note, additional guidance could possibly be provided on the following:

- Similar load tables, however this time outlining the shear values. prEN 1992-1 outlines the calculation for the shear capacity of a prestressed plank unit. Infilling of the holes towards the end of the plank achieves an increase in shear value for the plank. prEN 1168 outlines a calculation for the increase in shear value due to infilling of cores
- When precast prestressed hollow slabs are supported on non-rigid supports, tests have shown a reduction of shear resistance to these precast planks in the region of 40-77%. This has been noted due to the transverse deformation of the slab ends resulting from the deflection of the supporting beam. These beam deflections were noted to vary typically from L/1000 – L/300. This is reported in Pajari & Yang VTT research notes.

I thank Denis for this contribution. With regard to the general advice given in the March 2013 issue, to which Denis refers, it is also worth noting that care should be taken to ensure that the cores