An Alternative to Conventional Windposts. Aggregate Concrete Blockwork Walls Containing WI Beams

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In 2006 CERAM began an experimental programme to investigate the performance of large blockwork walls, reinforced at intervals up their height by WI Beams. The concept was developed by Wembley Innovation Ltd as a simple alternative to the use of wind posts. The performance of the initial walls was very encouraging and lateral loads in the region of 6kN/m^2 were satisfactorily resisted. Since the initial tests various configurations of the walls, for example wall height to length ratios have been varied, the introduction of service penetrations, windows and door openings have been investigated and the connections to the framing elements of the building have been refined. In order to introduce the system to the mainstream of structural engineering consultants in the UK and elsewhere CERAM produced a design procedure which has been developed in conjunction with consultants Jenkins and Potter and Buro Happold.

The initial test walls were 8m wide and 5m high and WI Beams were included at approximately one third and two thirds of the wall height. The WI Beam is formed from trough shaped block units and this enables two 16mm diameter reinforcing bars to be fixed one above another in the void. The bars are fixed into cleats at either end and anchored to the columns at the sides of the walls. The void is then filled with concrete. Shear transfer rods connect the bond beam to the courses above and below the beam and hence the three courses act together as a stiffening beam layer. Figure 1 indicates a WI beam prior to concreting. In this case the key elements in the design are the sub panels above, between and below the WI Beams and these act as vertically spanning panels between the WI Beam elements which themselves span horizontally between the columns.

Figure 1 Exposed WI Beam components ready for concrete installation. The vertical transfer rods support the T16 reinforcing bar inside the trough block

From a construction point of view the details are as for standard masonry, although it is important that they are executed correctly as the wind loads being taken back into the structure are high. The walls should be built from 140mm solid aggregate concrete masonry units and an M4 or 1:1:6 cement:lime:sand mortar. In the test work a ready to use retarded 1:1:6 mix was satisfactorily used (Figure 2). At ground level the wall is built off a damp proof course layer, this should be bedded in accordance with BS 5628 Part 3. In the design, if there is sufficient compression due to load or a damp proof course is used which has been demonstrated by test to resist flexural tension, the base can be considered as supplying some bending moment restraint. As with most masonry the lift height is limited to 1.5m in a day and the masonry should be protected overnight. Standard 19mm x 2mm stainless steel frame cramps which project 175mm from the columns are placed at 450mm centres vertically. The cramps pass through 12mm thick, 140mm wide movement joint filler at each side of the wall. In the test walls Corofil was used. At the head of the wall, standard head restraints are used at 900mm centres. These pass through the cross joints in the top course and are mortared into the bed joint beneath the top course. A movement joint is left at the wall head to allow a maximum of 25mm movement. Corofil was used to fill this joint.

At the block work course below that of the WI Beam trough block, 40mm x 4mm x 610mm long shear transfer rods each with a 70mm foot at the base are placed. The trough blocks have centrally moulded holes which the transfer rods pass through at 900mm centres. They then fix into the vertical joints in the course above these units. Clearly the positioning of these bars is critical to the success of the system. The two T16 rebars are slotted into the column cleat at one end, placed along the full 9m span of the wall and cut to length at the end cleat. An 800mm overlap at joints is required to ensure continuity. The trough units are then concreted using C40 pre-mixed 10mm aggregate bagged or wet ready mixed concrete.

This fairly simple system has been used on a number of projects where it has enabled large horizontally spanning walls to be used. Case studies have shown possible material cost savings and reductions in procurement and installation durations. The system is simple and is patented, many of the components are standard off the shelf items and providing the installation follows the guidance given, the performance in resisting wind load is impressive.

Figure 2 Construction of an internal WI Beam wall between structural steel columns. The blockwork panel was 9 metres in length and 6 metres in height, and spanned between structural steel columns