

## London Underground

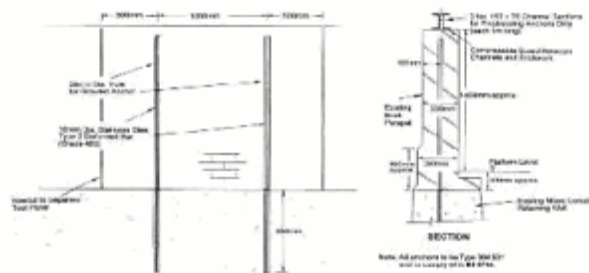
London Underground has a great many brick walls and parapets supported on elevated structures. As it is the world's oldest underground system, many of the walls are between 100 and 150 years old and are consequently suffering from a degradation of the mortar which is invariably lime based.

An insitu load test was carried out in order to demonstrate the applicability of Cintec anchors for both stabilising these structures and for strengthening them against dynamic air pressure loading. The test was also used to confirm that the performance of the strengthened wall had been correctly calculated and thus provide assurance of the methodology.



Post-tensioning Cintec anchor in test panel.

Two 16mm diameter 2 stage anchors were installed vertically, the anchorage length within the supporting structure was then inflated and left to fully harden. The anchor was then tensioned and the second sock occupying the remaining space in the masonry wall was inflated.



Details of test panel strengthening scheme.

Once the anchors were cured, an applied wind loading was simulated by the application of a lateral point load on a horizontal spreader beam positioned at the walls centre. An incremental lateral load up to 3.5kN/m was applied by a hydraulic jack which demonstrated a linear elastic response.



The predicted response, calculated beforehand and based on assumed values for the material properties, was within 30% of the measured values. Bearing in mind the wide range of uncertainties in relation to the wall stiffness and strength, this demonstrated an adequately high level of accuracy. On completion of the test, no cracking or spalling was observed. It was concluded that the strengthening scheme presented both "an economic and aesthetic solution to the refurbishment of understrength and unstable masonry parapets".