

Magdalen Bridge, Oxford

On May 1st of each year Magdalen Bridge becomes the focal point for Oxford's May-day celebrations. Choristers traditionally sing from the Tower of Magdalen College located at the Oxford end of the bridge, attracting both students and tourists to listen and enjoy the atmosphere. For some, these festivities can even include jumping from the parapets into the river Cherwell below.

A test on the strength of the parapets had been originally undertaken in 1998. There were concerns about the pressures being imposed upon the parapets by the people standing on top of them and also by the large crowds that may push against them.

This test revealed that the 6m length of parapet was unable to withstand a load of 2.0kN/m. This result revealed considerably less strength than had been anticipated and therefore some form of remedial work was considered necessary. In February 2002 another section of parapet was tested on the South West side over the first span heading towards Oxford.

The section had been reinforced with Cintec anchors over a 5.66m length. It was conducted in compliance with the requirements of 'The Home Office Guide to Safety at Sports Grounds' Fourth Edition and used specially designed barrier load testing rigs (see figure 1). Deflections were monitored with dial gauges having a resolution of 10 microns.

A load level of 5kN/m was requested by the client. The parapet was initially loaded up to a bedding load of 4kN/m to remove any slack from the components of the parapet. It was then loaded to 5.0kN/m to observe the level of deflection. The parapet was found capable of accepting the load and the maximum deflection measured was 0.57mm at approximately midway between two die blocks located either side of the test length (see Test Certificate below). Because of the successful trials, the parapet walls for the entire lengths of Magdalen bridge will be strengthened with Cintec Anchors. Vertical M20 anchors of 2m are located within the die blocks and M25 anchors of 4.5m are installed through the pillasters. The horizontal anchors are M16 and between 7m and 10m in length.



Fig 1



Fig 2



Fig 3

Figure 2 shows the holes drilled horizontally through the parapet.
Figure 3 shows a horizontal Cintec anchor prior to installation.

LOAD TESTING OF MAGDALEN ROAD BRIDGE PARAPET OXFORD ISIS ACCORD					JOB REFERENCE No: IA/503/03			
BEDDING CYCLE					BARRIER DETAILS			
Pressure/psi	Load/Ram/kN	Deflections/mm			Length	5.68 m	Factor(1.1/Height)	0.88
0	0.00	G1	G2	G3	Height	1.25 m	No of rams	5
280	0.60	44.48	41.86	48.54	Spacing	n/a m	Total des. service load	18.92 kN
535	1.59	44.14	41.13	47.93	Gradient	n/a °	Max load/ram (bedding)	3.98 kN
790	2.39	43.71	40.42	47.30	Bedding load	4.00 kN/m	Total proof test load	24.90 kN
1045	3.19	43.19	39.67	46.56	Design load	5.00 kN/m	Max load/ram (proof)	4.98 kN
1300	3.98	42.42	38.38	45.50	TEST ARRANGEMENT			
0	0.00	44.13	41.37	48.17				
Maximum deflection/mm		2.06	3.48	3.04				
Maximum Permanent Deflection/mm (Max=2mm)		0.36	0.49	0.37				
Recovery% (Min=75%)		83.0	85.9	87.8				
PROOF CYCLE					Date Tested: 22/02/02			
Pressure/psi	Load/kN	G1	G2	G3	OBSERVATIONS PRIOR TO TESTS			
344	1.00	43.85	40.79	47.61	Test conducted on section strengthened with Cintec 'anchors', on South West side of bridge, on span nearest Headington end. Locations 1 - 3 tested in 1998.			
663	1.99	43.40	40.01	46.93	Missing coping stone and horizontal reinforcement bar, to right of test.			
981	2.99	42.83	39.17	46.19	Test length shortened to 5.66m, away from missing coping stone.			
1300	3.98	42.22	38.22	45.33	OBSERVATIONS DURING & AFTER TESTS			
1619	4.98	40.88	36.47	43.84	Cracks appeared in mortar joints under tension during loading, i.e. at rear face of coping mid-span, at front face of coping near end of span, and joint between ballusters and balustrade plinth.			
LOAD MAINTAINED FOR FIVE MINUTES					Cracks visible under load closed on release of load.			
					One cycle of bedding load and one cycle of full load applied as instructed by engineers on site.			
1699	4.98	40.49	36.18	43.61				
0	0.00	43.83	40.80	47.67				
Maximum deflection/mm		3.64	5.19	4.56				
Maximum Permanent Deflection/mm		0.50	0.57	0.50				
Recovery% (Min95%)		86.3	89.0	89.0				