Cavity Lock Systems Limited - Test Data Reports

KENNET BRIDGE, READING Project Ref. 16435/04 Kennet Bridge, Reading. BRITISH RAILWAY BOARD, BRITISH RAIL WESTERN REGION, WESTERN HOUSE, 1 HOLBROOK WAY, SWINDON, WILTS, SW1 1BY	OVE ARUP & PARTNERS, CAMBRIAN BUILDINGS, MOUNTSTUART SQUARE, CARDIFF CF1 6QP.

PRELIMINARY LOAD TEST REPORT

KENNET BRIDGE, READING

FEBRUARY 1988

1.0 INTRODUCTION

Drawing SK 03 shows the elevation and section of the trial holes and test holes for the Kennet Bridge, Reading. The trial holes, nos. 1 and 4 were used to determine the thickness of the wall construction together with the nature of the fill material for 2 metres beyond the front wall. The test holes, nos. 2, 3, and 21 were 76mm diameter holes to contain 25mm diameter FITS ban with a grout feed pipe (10mm diameter) surrounded by grout, filling the drilled hole.

The results of the trial holes and test holes were as follows:

Hole#	Bwk	Clay	Rubble	Clay	Bwk	Total
			Length			
1 3m	1.0m	2m	-		-	-
2 9.5m	1.5m	6.8m	-	-	1.2m	
3 10m	1.0m	4.0m	0.9m	3.1m	1.0m	

4	1.0m	2.0m				3m
5	1.0m	3.0m	-	-	-	
6	1.0m	3.0 with chalk				
These holes were drilled by D.S. Wilcox using rotory coring under compression air.						
Hole#	Bwk	Clay	Bwk	Clay		
21	1.1m	7.5m	0.95m	0.25m		
Hole#	Pre-drilled	Clay	Chalk	Bwk	Clay	
1	3m	4.15m	-	0.05m	-	
4	4m	1.8m	1.2m	1.30m	0.75m	
5	5m	3.05m	-	1.30m	0.35m	
6	4m	4.2m	-	0.6m	0.10m	
These holes were drilled by Temple Hazell Associated using rotory percussive drilling in the hard masonry ands rotory drag bit in the fill materials.						

2.0 ANCHOR INSTALLATION

The two 25mm diameter anchors in a sleeve of 9.5m and 10.0m lengths were installed in the drill holes in one continuous length, but with a separation between the rear 5 metre length and the front length so that each could be grouted separately. For the test anchors, nos. 2 and 3, only the rear 5 metre length was to be grouted so that the anchorage provided by the buried wall could be ascertained. Unfortunately due to problems with the sock tearing in drill hole number 2, this anchor was grouted over its full length. However, the length embedded in the front wall will be drilled out or over-drilled so that the required test load can be applied. The over-drilling damaged anchor #2 and a replacement anchor #21 was installed.

3.0 TESTING

The test procedure is included in Appendix A. The basic procedure was applied only to anchor 3#, anchor 21# was test loaded under maximum load only.

Dial gauges were mounted against the end of the threaded anchor and of the end of the travelling rod of the test rig. The nett deflection is the difference between the two dial gauge readings.

Anchor Nos. 2 and 3 were to be tested loaded. However, because anchor 2 was inadvertently routed to the front wall brickwork, test loading started with anchor 3. Although intended as a 5 tonne capacity anchor in the final solution, it was decided to test load anchor 2 to 9 tonne. Since it was the first anchor test loaded it was considered prudent initially to remove the deflection gauges at 30kN test load.

After the initial pre-loading, the loading was applied in 5kN increments to 30kN. Problems with the gauge slipping on the jack led to abandonment of this series of readings at 30kN and the load was removed from the anchor. For completeness, the deflection readings obtained are given in Table 1.0. After adjustment of the dial gauges and the test rig, a pre-load was again applied as previously. Deflection readings were taken up to 30kN and as the load was decremented back to zero. Incremental loading was then applied in 5kN increments and deflection readings recorded up to 55kN, when the gauges were removed. Loading then continued up to 70kN, when the travelling arm reached the limit of its extension, see Table 1.0 at the end of the text and 5K03.

The load was removed from the anchor and steel wedges inserted against the face of the brickwork so as to provide increased travel for the jack. Pre-load was applied and removed as previously and load was then applied to the anchor in

increments of 10kN up to 90kN.The load was applied up to 98kN and held at 95kN for some minutes before being left at 90kN for the twenty four test.

As a rough check on the dial gauge readings, the extension of the threaded anchor from the face of the wall was measured by metal tape in the zero load position and after 90kN of load had been applied. The nett elongation based on these measurements was 7mm. However, the scope for error in the readings is large because of the uneven surface of the brickwork and the difficulty in reading the tape accurately for small readings. The check value compares with a pro-rats reading from the dial gauges of 3.9mm. If the elongation was based on the 2.5mm steel bar alone (ignoring the grout and any friction with the clay), the free length would give an elongation of 4.9mm.

On return to site on Wednesday 30th December, the test load had dropped to approximately 75kN. No oil leakage was immediately apparent in the vicinity of the jack but heavy rain may have washed it away. The load was returned to 90kN and held for 15 minutes without loss of load. The load was then released from the anchor.

Anchor #21 was test loaded to 105kn and the load held for 30 minutes. The test was then concluded.

4.0 CONCLUSIONS

To test and trial holes have shown that it is feasible to drill 80mm diameter holes through the clay fill material and through the far brickwork wall. At the lower level of the test holes, the stiff clay is more easily drilled than the clay in the higher holes I and 4.The latter clay proved exceedingly difficult to progress through and alternative techniques (e.g. rotary percussive drilling in the clay) should be considered for the actual anchor installations.

The test loading for anchor No. 3 satisfactorily established the elastic performance of the anchor under load up to 30kN.The load/deflection curve is essentially linear up to 50kN. A test load of at least 76kN was satisfactorily applied to this test anchor for a twenty four hour period; the load dropped from 90kN to 76kN over this period.

Problems with the grout injection occurred on the test anchor 2 and 3 could be attributed in part to the small diameter of grout feed pipe. It is recommended that the overall diameter of the drill hole be increased to at least 105mm to accommodate a larger diameter grout feed pipe. This diameter is the minimum now recommended by Cintec NV if sufficient cover is to be provided by the injected grout to protect the steel anchor.

Test anchor #21 was satisfactorily tested under a load of 105kn, the load being held for thirty minutes. It was not considered necessary to record the anchor elongation.

ANCHOR No. 3

APPLY PRE-LOAD TO 10kN in 5kN INCREMENTS
DECREMENT LOADING TO ZERO IN 5k N INCREMENTS

LOAD kN	1st INCREMENTAL LOADING DIAL GAUGE mm.			1st DECREMENTAL LOADING DIAL GAUGE mm.			INCREMENTAL LOADING TO TEST LOAD DIAL GAUGE mm		
	GI	G2	NETT	GI	G2	NETT	GI	G2	NETT
0	0	0	0	0	0	0	0	0	0
5	0	0	0	-	-	-	0	0	0
10	0	0.17	0.17	0	0.58	0.58	0	0.18	0.18
15	0	0.53	0.53	-	-	-	0	0.50	0.50
20	0	0.80	0.80	0.12	1.17	1.05	0	0.81	0.81
25	0.08	1.07	0.99	-	-	-	0.08	1.08	1.00
30	0.20	1.35	1.15	0.20	1.35	1.15	0.20	1.39	1.19
35							0.30	1.69	1.39
40							0.42	2.08	1.66
45							0.55	2.55	2.00
50							0.71	3.10	2.39
55							0:84	3.25	2.41
60				GAUGES REMOVED					
65									
70				MAXIMUM TRAVEL REACHED					
75									
80									
85									
90									
95									
100									

GI - Gauge on anchor
G2 - Gauge on travelling arm

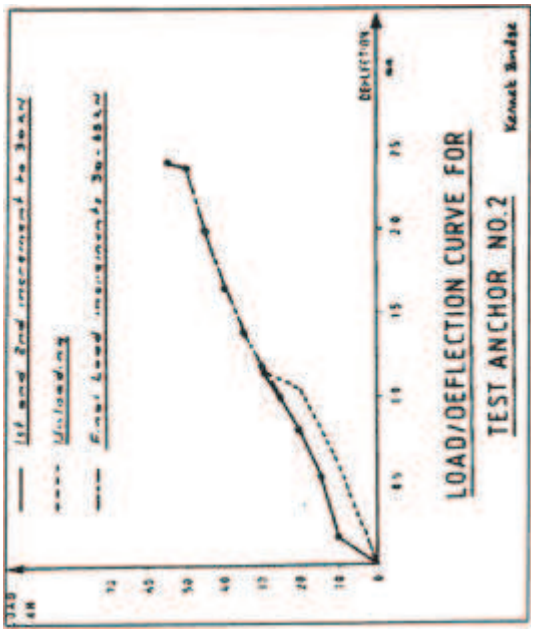
TABLE 1.0 LOAD-DEFLECTION READINGS

APPENDIX A

TEST PROCEDURES FOR ANCHORS AT KENNET BRIDGE, READING FOR BRITISH RAIL VVESTERN REGION

Anchor I - test load to 9 tonnes as per dwg C3S248
Anchor 2 - test load to 5 tonnes as per dwg C3$2411

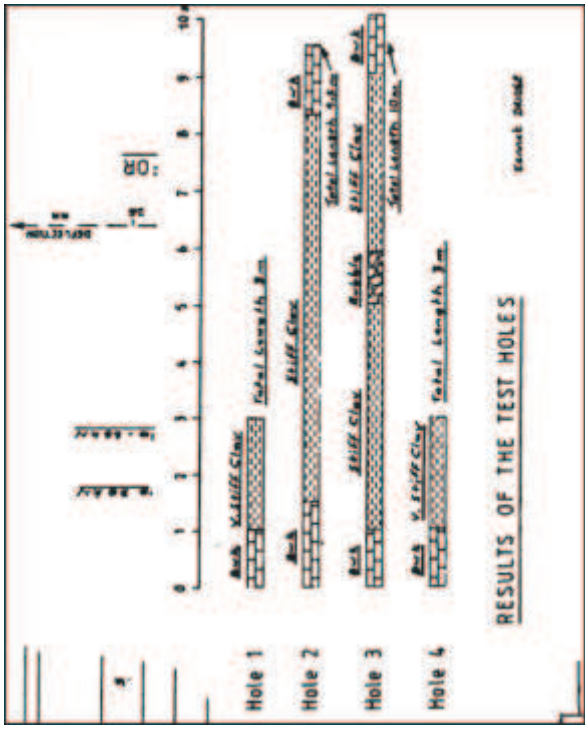
1. Attach jack to the test anchor
2. Apply pre-load of 10kN in 5kN increments to the test anchor, allowing I minute between increments.
3. After I minute at 10kN, decrement the load in 5kN decrements with I minute between decrements.
4. Set dial gauge to be used to measure elongation of test anchor to zero;accuracy of gauge to be 0.01mm or bergen
5. Apply load in increments of nor more than 5kN and hold for I minute.
6. Read the died gauge at each load increment.



7. Repeat steps 5 and 6 up to: 60 kN for anchor I :30 kN for anchor 2
8. Hold load for I minute.
9. Decrement load in 5kN decrements, holding the load for I minute at each decrement.
10. Record the dial gauge reading at each decrement.
11. Repeat steps 5 and 6 up to: 90 kN Ear anchor I, 50 kN Ear anchor 2 but removing the dial gauge at: 60 kN for anchor I, 30 kN for anchor 2

12. Record any change in the adjacent brickwork during the loading with particular note made of maximum failure load.

Care should be adam by means of visual observation and monitoring of the dial gauge readings to ensure that the wall does not fail prematurely and damage the instrumentation.



If in doubt, the dial gauge may be removed after 50% of the test load is reached.

If anchor failure should occur, a full description *with sketches* of the failure mode should be made.

APPENDIX B

ANCHOR No. 3

APPLY PRE-LOAD TO 10kN in 5kN INCREMENTS
DECREMENT LOADING TO ZERO IN 5k N INCREMENTS

LOAD kN	1st INCREMENTAL LOADING DIAL GAUGE mm.			1st DECREMENTAL LOADING DIAL GAUGE mm.			INCREMENTAL LOADING TO TEST LOAD DIAL GAUGE mm		
	G1	G2	NETT	G1	G2	NETT	G1	G2	NETT
0	0	0	0	0	0	0	0	0	0
5	0.12	0	0.12	-	-	-	0.10	0	-0.10
10	-	-	-	0.46	0.31	-0.15	0.25	0.14	-0.09
15	0.27	0.25	-0.02	0.60	0.73	0.13	0.39	0.45	0.06
20	0.38	0.60	0.22	0.70	1.14	0.44	0.51	0.78	0.27
25	0.50	0.98	0.48	0.76	1.29	0.53	???	1.08	0.50
30	0.62	1.29	0.67				0.70	1.35	0.65
35							0.82	1.20	0.38
40							Dial slipped off during this test		
45									

G1 - Gauge on anchor
G2 - Gauge on travelling arm

TABLE B.1 INITIAL LOAD-DEFLECTION READINGS