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Technical Report No.26

Fatigue test on high strength bolts and 'Coronet' Load Indicators

Introduction

It was desired to investigate the effect of vibration and axial load reversals on High Strength Bolts tightened to proof load using 'Coronet' Load Indicators to register axial tension. ASTM A325 $\frac{3}{4}$ " diameter Bolts were used, together with the appropriate Load Indicators. The "Specification for Structural Joints using ASTM A325 or A490 bolts" limits the applied tension in A325 bolts to 36,000 p.s.i. and 40,000 p.s.i. for bridges and buildings respectively. The maximum applied load of 17 kips used in this test gives a stress of 39,000 p.s.i. which is in excess of the 36,000 p.s.i. limit for bridges where fatigue conditions are involved.

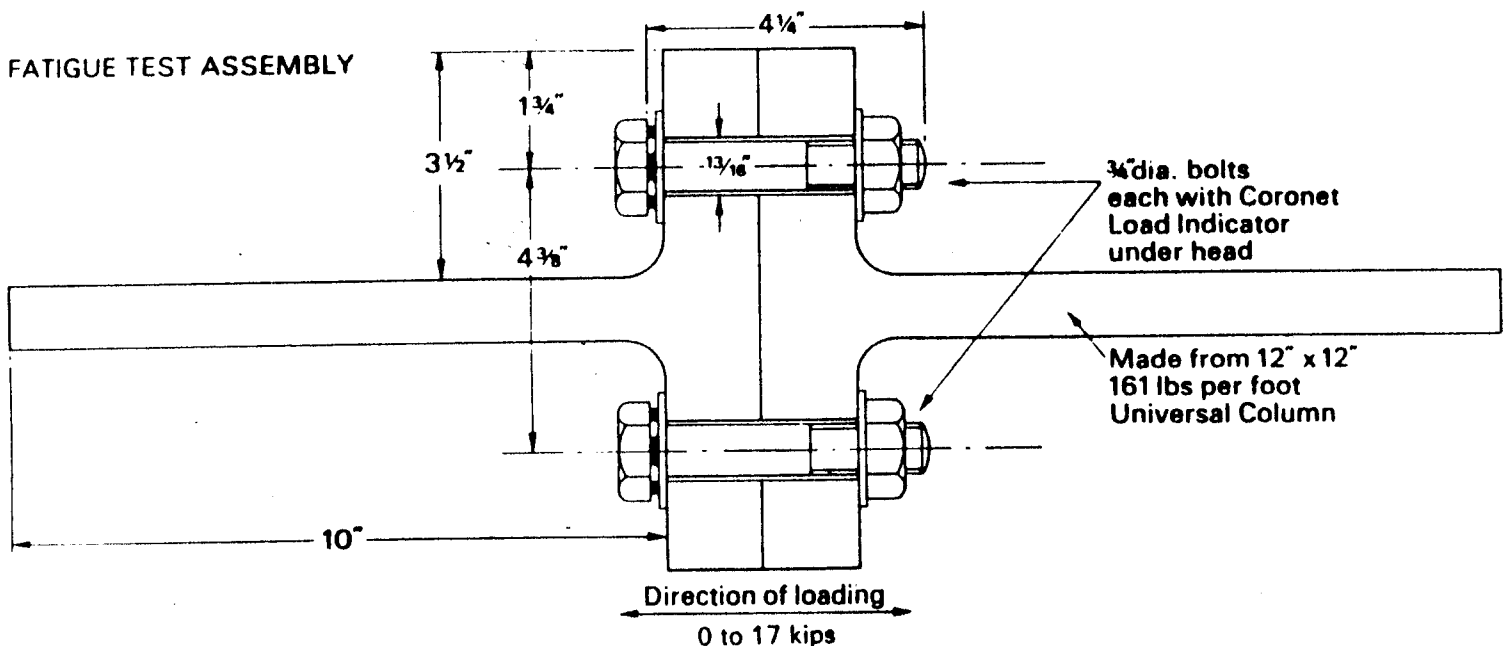
Summary

The assembly was subjected to 2,718,600 stress cycles between 0 and 0.6 x proof load without fracture. No change of bolt length was recorded.

Procedure

The test specimen comprised of two tee sections as shown in the diagram which were assembled with two $\frac{3}{4}$ " diameter High Strength Bolts and 'Coronet' Load Indicators. The bolts were tightened until the average Indicator gap was 0.015" which corresponds to the proof load of 28.4 kips.

The assembly was set up in a Losenhauser-U.H.S. 60 fatigue testing machine at the Laboratories of the British Welding Research Association at Abington Hall, Cambridge, England. Measurements of Indicator gaps and bolt lengths were taken at intervals during the test.



Results

Test load 0 to 17 kips.

Cycles	Bolt No. 1						Bolt No. 2														
						Bolt Length Inches						Bolt Length Inches									
						Before Tightening: 4.733						Before Tightening: 4.728									
						After Tightening: 4.741						After Tightening: 4.735									
Load Indicator Gaps — Inches											Load Indicator Gaps — Inches										
	1	2	3	4	Avge.		1	2	3	4	Avge.										
0	.009	.017	.020	.012	.0145	4.741	.022	.010	.006	.019	.0142	4.735									
55500	.009	.017	.020	.012	.0145	4.741	.022	.010	.006	.019	.0142	4.735									
698200	.009	.017	.020	.012	.0145	4.741	.022	.010	.006	.019	.0142	4.735									
1253600	.009	.017	.020	.012	.0145	4.741	.022	.010	.006	.019	.0142	4.735									
1887500	.009	.017	.020	.012	.0145	4.741	.022	.010	.006	.019	.0142	4.735									
2381900	.009	.017	.020	.012	.0145	4.741	.022	.010	.006	.019	.0142	4.735									
2718600	.010	.018	.020	.012	.015	4.741	.022	.010	.007	.020	.0147	4.735									
Bolt Extension Inches							Bolt Extension Inches														
Before Test: .008							Before Test: .007														
After Test: .008							After Test: .007														

Cycles endured — 2,718,600

No fractures observed.

Discussion of results

There is a small increase of 0.0005" in the average Indicator gap on both bolts at 2,718,600 cycles. However it is too small to effect any measurable change in the bolt lengths and is likely to be due to some very slight seating.

The test shows that High Strength Bolts with 'Coronet' Load Indicators will safely withstand the maximum designed fatigue loading permitted by "The Specification for Structural Joints using ASTM A325 or A490 Bolts".