The Lateral Load Slip Performance of Fasteners used in Fibrous Plaster Linings

Introduction

In January 2019, a series of lateral load slip tests were undertaken on fasteners used to attach fibrous plaster linings to timber framing. This testing was carried out to determine whether fibrous plaster linings could be used as a replacement lining in the GIB EzyBrace® systems.

Previous testing undertaken at BRANZ (Herbert(1996)) had determined in-plane shear capacities of fibrous plaster sheets. These tests indicated that the in-plane shear capacity of fibrous plaster significantly exceeded the in-plane shear capacity of 10 mm thick GIB Braceline® and GIB® Standard.

Three series of tests were undertaken:-

(i) Load slip tests on nominally 10 mm thick fibrous plaster
(ii) Load slip tests on 10 mm GIB Braceline®
(iii) Load slip tests on 10 mm thick GIB® Standard.

Test Arrangement

All testing was undertaken using the Aerotron universal test machine located in the Development Centre of Winstone Wallboards Ltd, Penrose. Details of the test arrangement are shown in Figure 1.

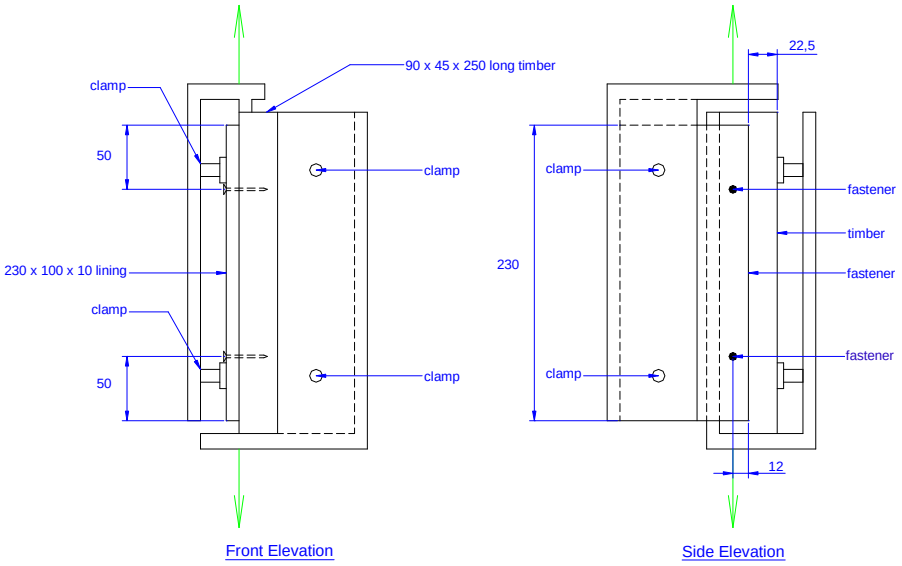


Figure 1
Details of Test Arrangement

In all tests, 32 mm long by 6 gauge GIB® Grabber high thread screws were investigated. An end distance of 50 mm and an edge distance of 12 mm were used in all testing. The fibrous plaster lining specimens were supplied by Designer Plaster Ltd in Morrin Road, St Johns.

The 10 mm GIB® Standard linings were cut from a number of sheets. Prior to testing, the lining side plates and the timber specimens were weighed, and the dimensions measured.

The loading of the specimen was displacement controlled. Three cycles to ±0.5 mm followed by three cycles to ±1, ±2, ±5, ±4, ±5 and ±6 mm were undertaken. A constant displacement rate of 1 mm per second was used in testing.

Results

Typical load displacement behaviour for fibrous plaster, GIB Braceline® and GIB® Standard joints are shown in Figures 2 to 4 respectively. Detailed load displacement performance graphs are given in Appendix A.

The strength of the 10 mm fibrous plaster joints and the GIB Braceline® are controlled by the strength of the screws. All the 10 mm thick GIB® specimens failed by the paper face tearing and the gypsum crushing and cracking. Peak loads for both the fibrous plaster and GIB Braceline® joints occurred at ±2 mm displacement. The GIB® Standard joints tended to be more ductile than the fibrous plaster and GIB Braceline® joints. The GIB® Standard maintained approximately 80 % of the maximum load up to a displacement of ±6 mm.

In Table 1, the maximum loads obtained from testing are given. Detail maximum loads are given in Appendix A.

Table 1
Maximum Loads

Lining	Average Maximum Total Load (kN)	Standard Deviation	Coefficient of Variation (%)
10 mm Fibrous Plaster	1.837	0.322	17.51
12.5 mm Fibrous Plaster	1.644	0.227	13.80
10 mm GIB® Standard	0.909	0.100	11.00

The strength of the fibrous plaster joints are approximately 13 % higher than the strength of the 10 mm GIB Braceline® joints and approximately double the strength of the GIB® Standard joints.

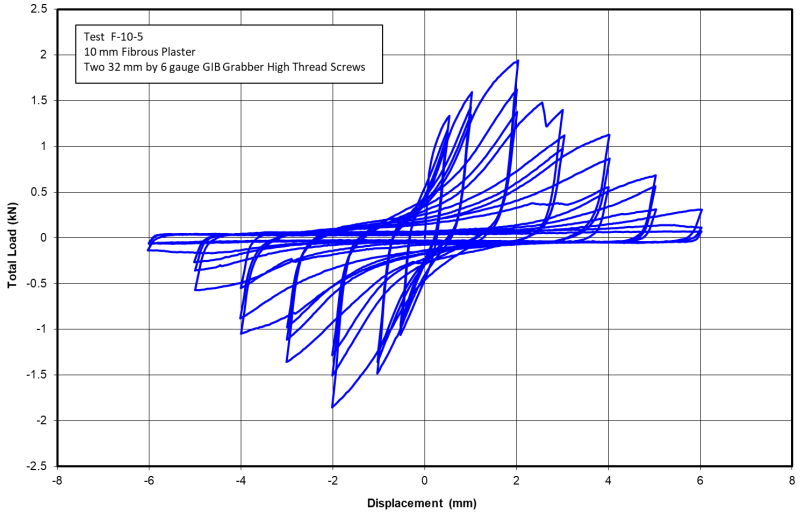


Figure 2
Typical Load Displacement Behaviour Fibrous Plaster Joint

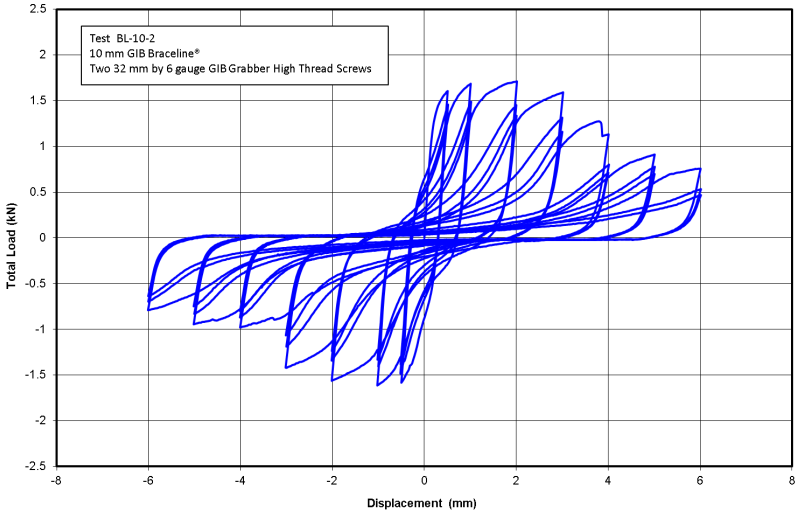


Figure 3
Typical Load Displacement Behaviour GIB Braceline® Joint

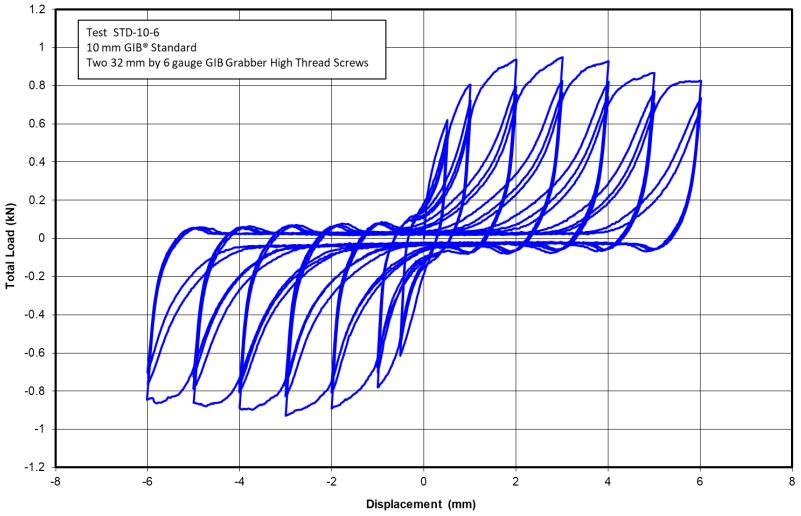


Figure 4
Typical Load Displacement Behaviour GIB® Standard Joint

Summary

The resistance of GIB EzyBrace® bracing elements are controlled by the strength and stiffness of the fasteners connecting the linings to the framing. The results of the load slip testing described above and the testing undertaken at BRANZ indicate that 10 mm fibrous plaster can be substituted for either 10 mm GIB Braceline® or GIB® Standard in GIB EzyBrace® bracing elements with the bracing resistance of the element being maintained.

References

Herbert, P.D., 1996, "Report on Testing of Fibrous Plaster Fixings", Building Technology Test Report STR316, March 1996.

, 2011, "GIB Ezybrace® Systems, Winstone Wallboard Product Literature, CBI 5113, June 2011.

NZS3604, 2011, "Timber Framed Buildings", New Zealand Standard NZS3604, 2011.

Appendix A

10 mm Fibrous Plaster

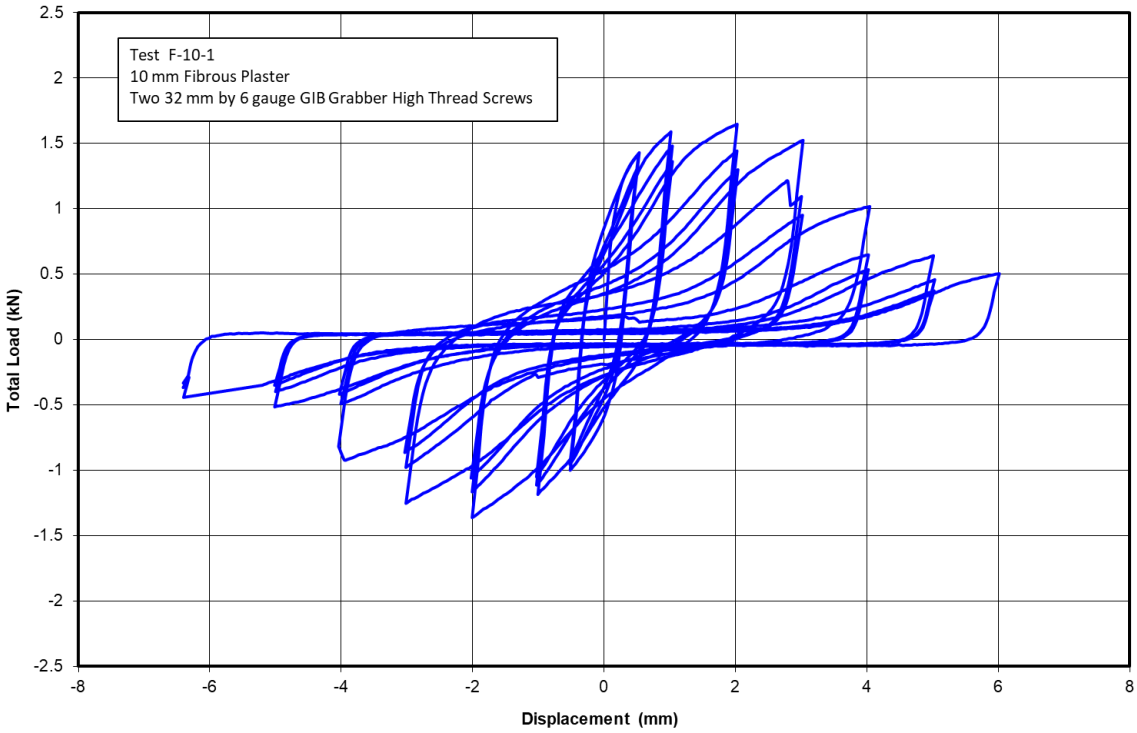
Test	Lining Mass/Area (kg/m^2)	Timber Density (kg/m^3)	Maximum Positive Total Load (kN)	Maximum Negative Total Load (kN)	Average Maximum Total Load (kN)
F-10-1	11.53	467	1.646	-1.361	1.504
F-10-2	11.71	532	2.132	-1.517	1.825
F-10-3	11.29	510	1.566	-1.808	1.687
F-10-4	11.71	478	2.580	-1.297	1.939
F-10-5	11.55	542	1.940	-1.855	1.898
F-10-6	11.26	496	1.918	-1.310	1.614
F-10-7	11.33	501	2.163	-2.001	2.082
F-10-8	11.25	530	1.752	-1.829	1.791
F-10-9	11.84	478	2.103	-1.910	2.007
F-10-10	11.74	517	2.103	-1.953	2.028

10 mm GIB Braceline®

Test	Lining Mass/Area (kg/m^2)	Timber Density (kg/m^3)	Maximum Positive Total Load (kN)	Maximum Negative Total Load (kN)	Average Maximum Total Load (kN)
BL-10-1	8.97	467	1.951	-1.366	1.659
BL-10-2	8.93	532	1.711	-1.613	1.662
BL-10-3	8.82	510	1.708	-1.474	1.591
BL-10-4	8.89	478	1.707	-1.435	1.571
BL-10-5	8.84	542	1.517	-1.409	1.463
BL-10-6	8.92	496	1.904	-1.265	1.585
BL-10-7	8.80	501	2.063	-1.497	1.780
BL-10-8	8.87	530	1.896	-1.458	1.677
BL-10-9	8.90	478	1.776	-1.440	1.608
BL-10-10	9.02	517	1.816	-1.877	1.847

10 mm GIB® Standard

Test	Lining Mass/Area (kg/m^2)	Timber Density (kg/m^3)	Maximum Positive Total Load (kN)	Maximum Negative Total Load (kN)	Average Maximum Total Load (kN)
STD-10-1	6.71	467	0.959	-0.763	0.861
STD-10-2	6.74	532	1.001	-0.870	0.936
STD-10-3	6.74	510	1.044	-0.876	0.960
STD-10-4	6.68	478	0.999	-0.844	0.922
STD-10-5	6.65	542	0.993	-0.902	0.948
STD-10-6	6.58	496	0.949	-0.929	0.939
STD-10-7	6.62	501	0.979	-0.861	0.920
STD-10-8	6.64	530	1.013	-0.862	0.938
STD-10-9	6.76	478	0.863	-0.642	0.753
STD-10-10	6.75	517	1.015	-0.807	0.911



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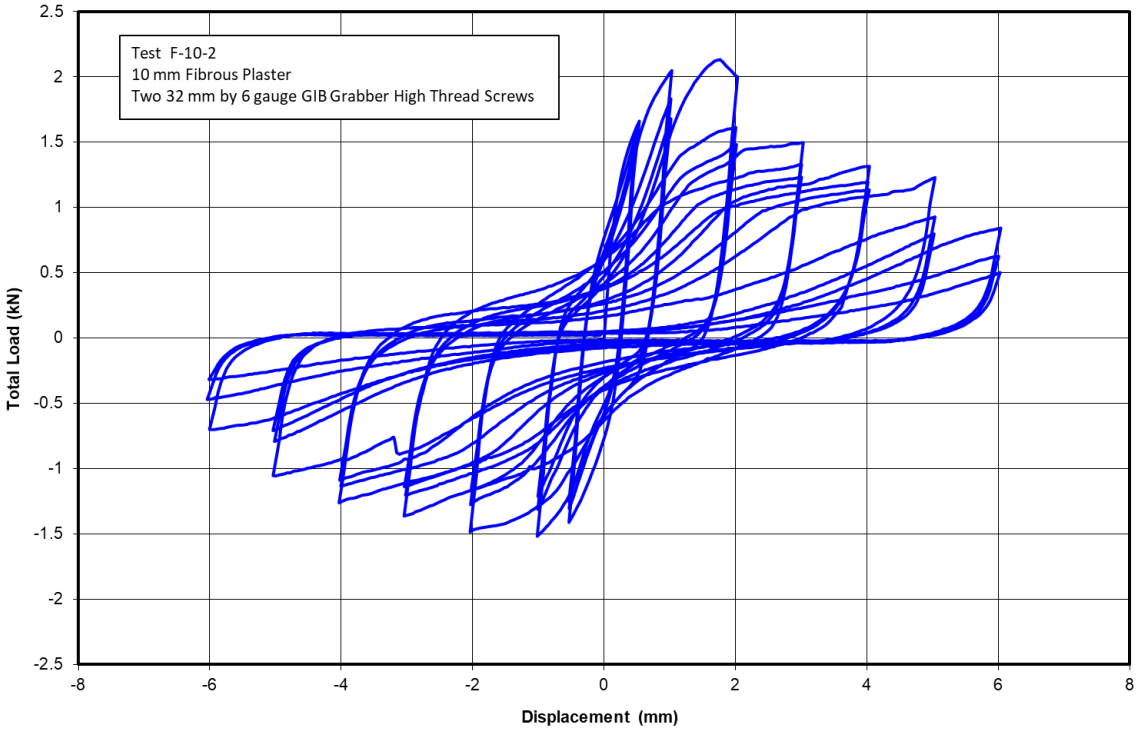

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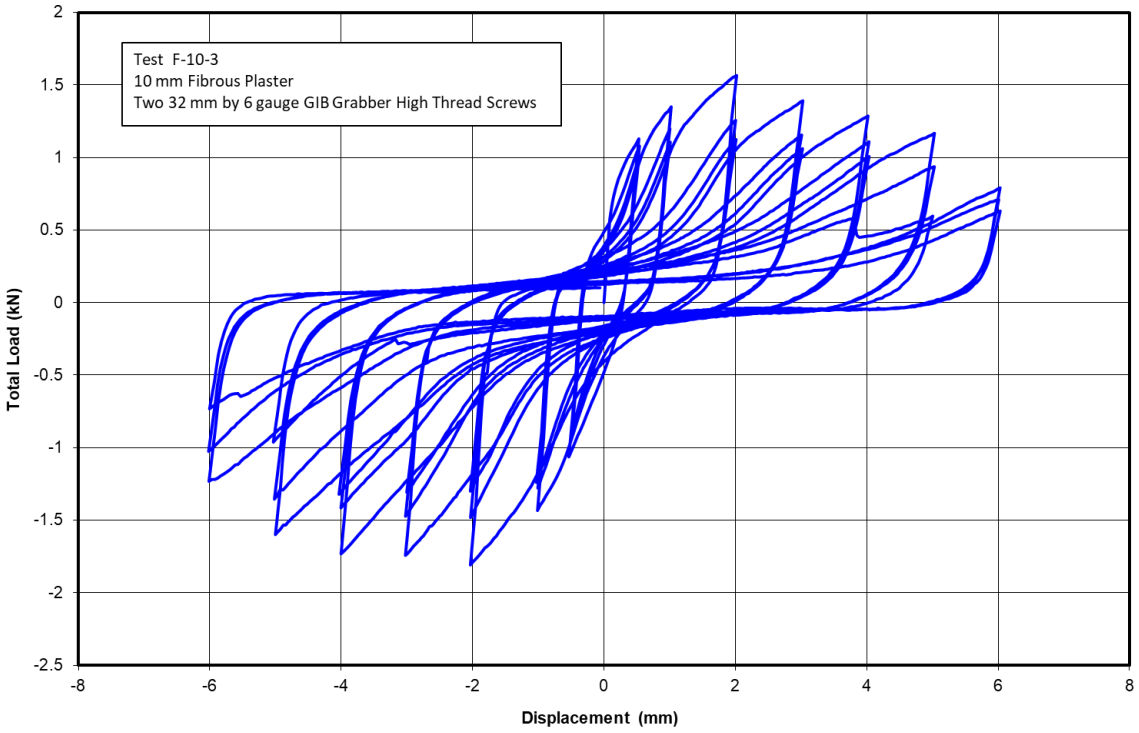

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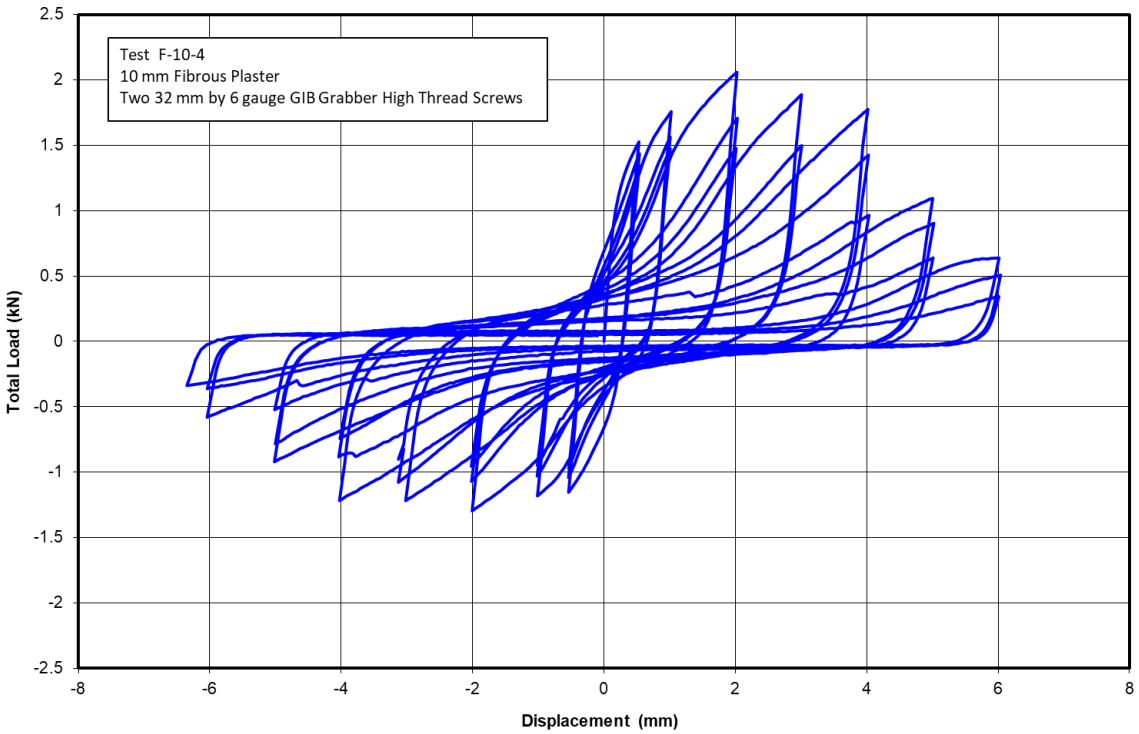

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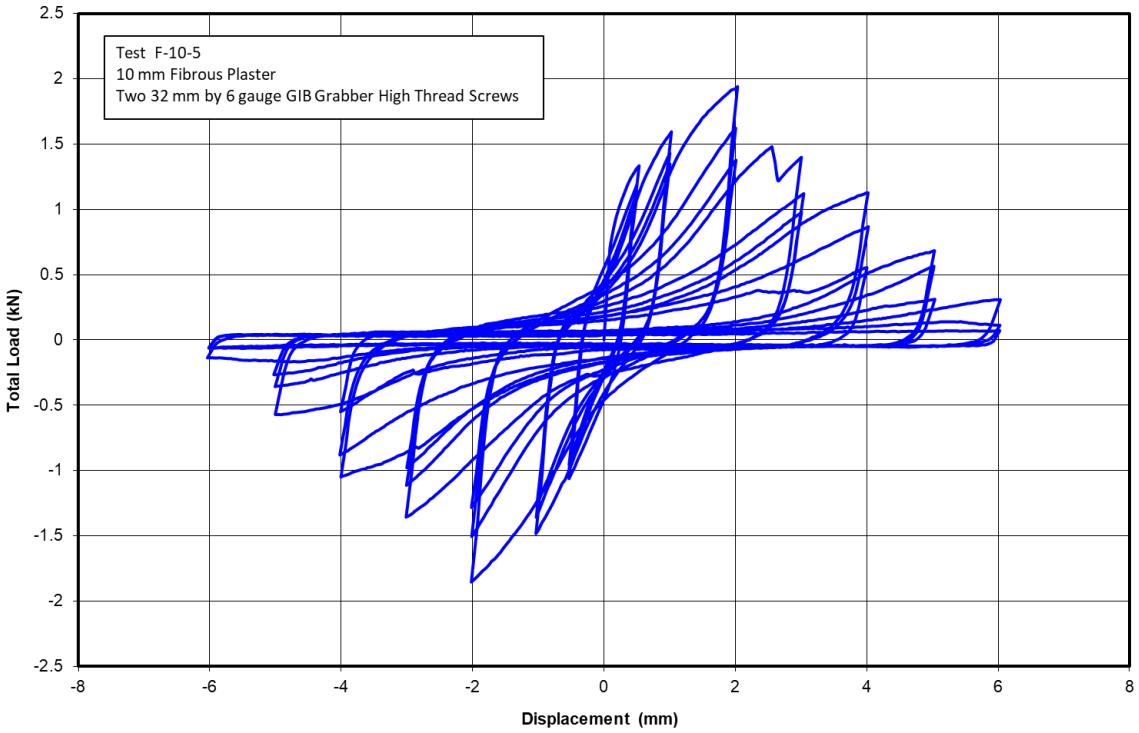

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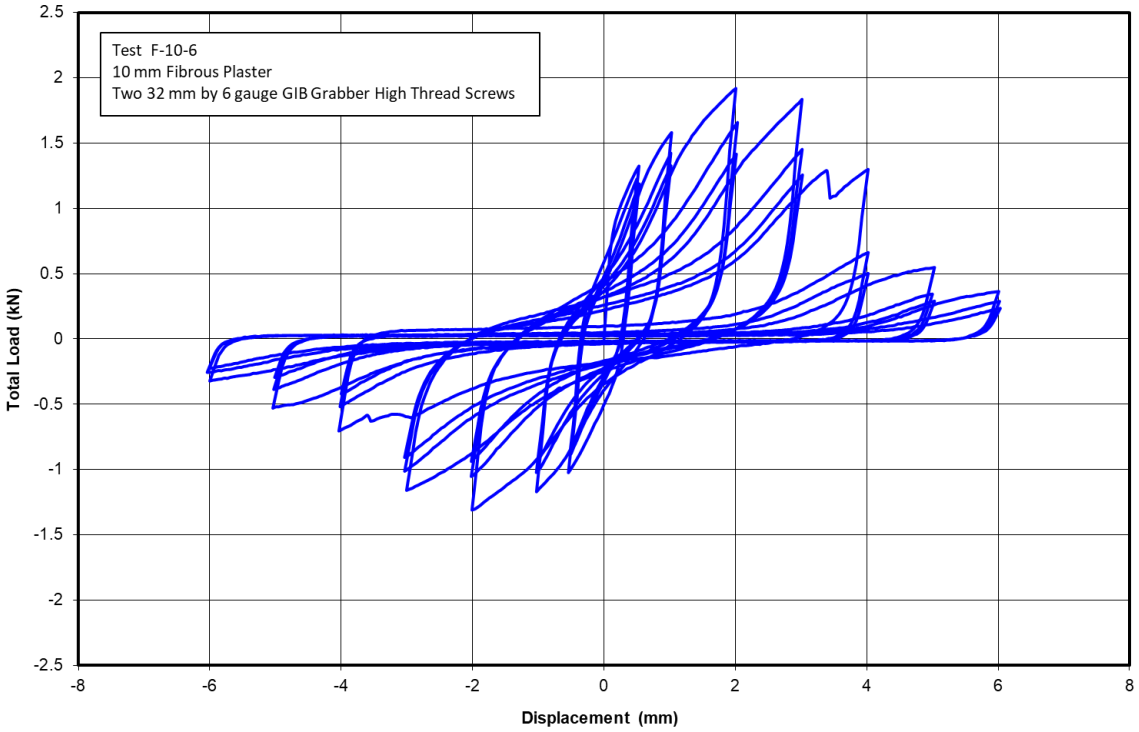

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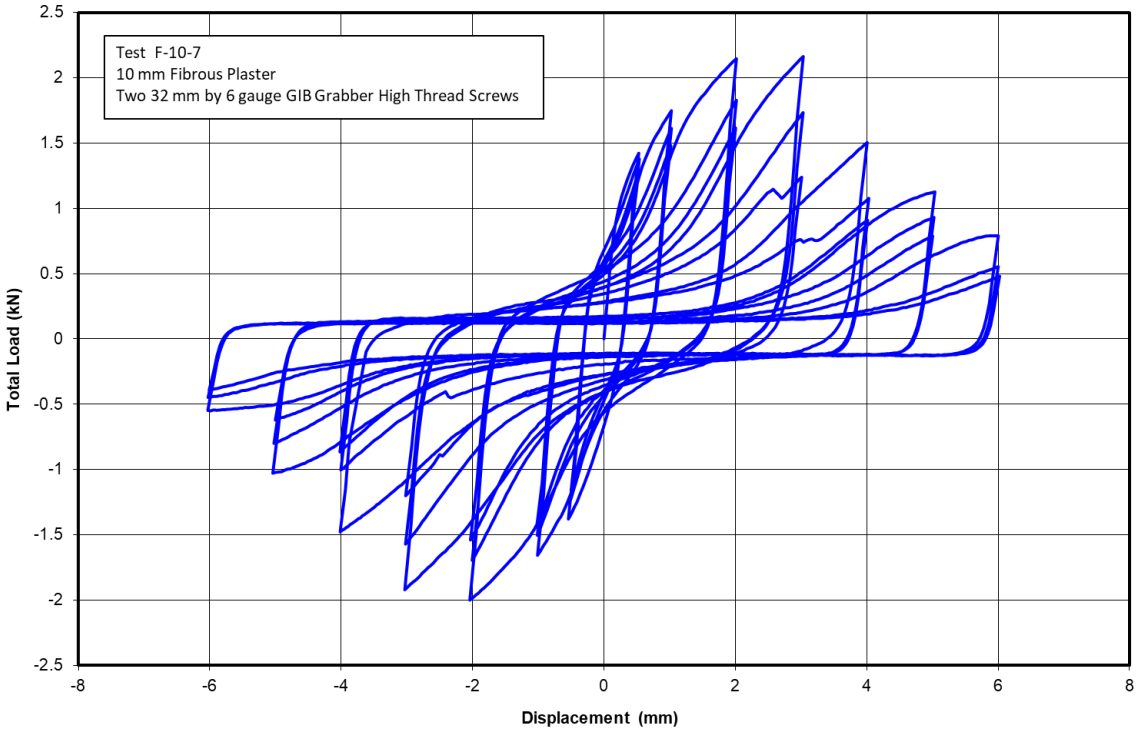

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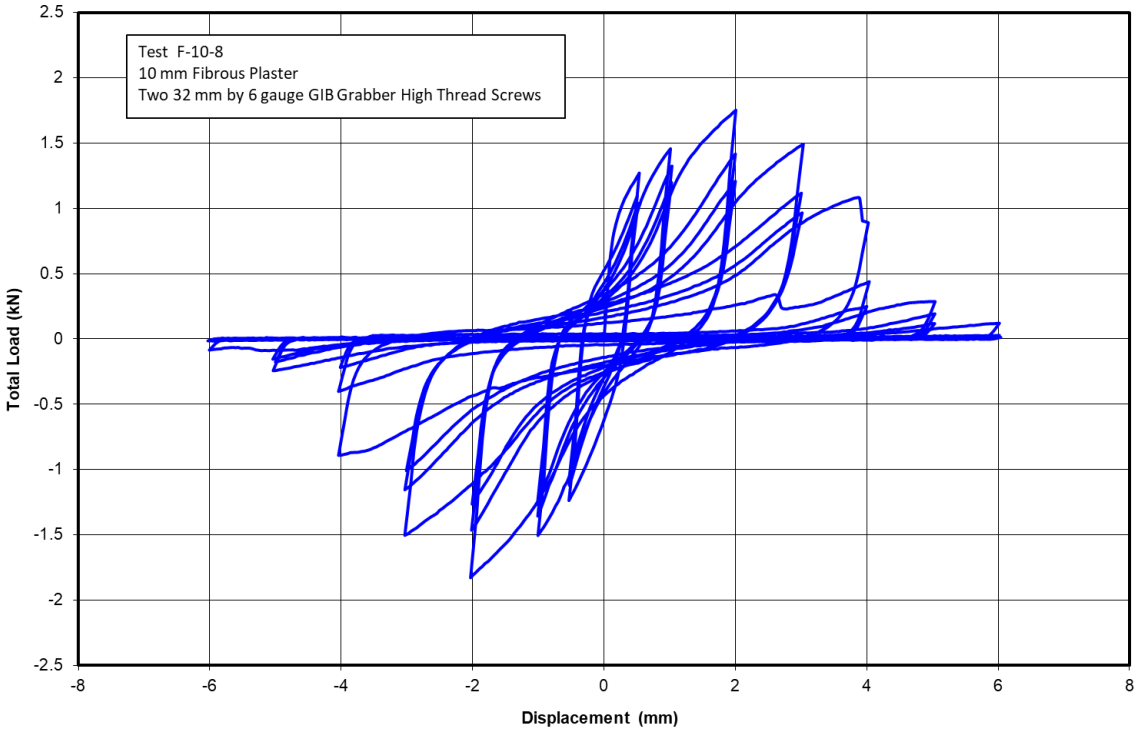

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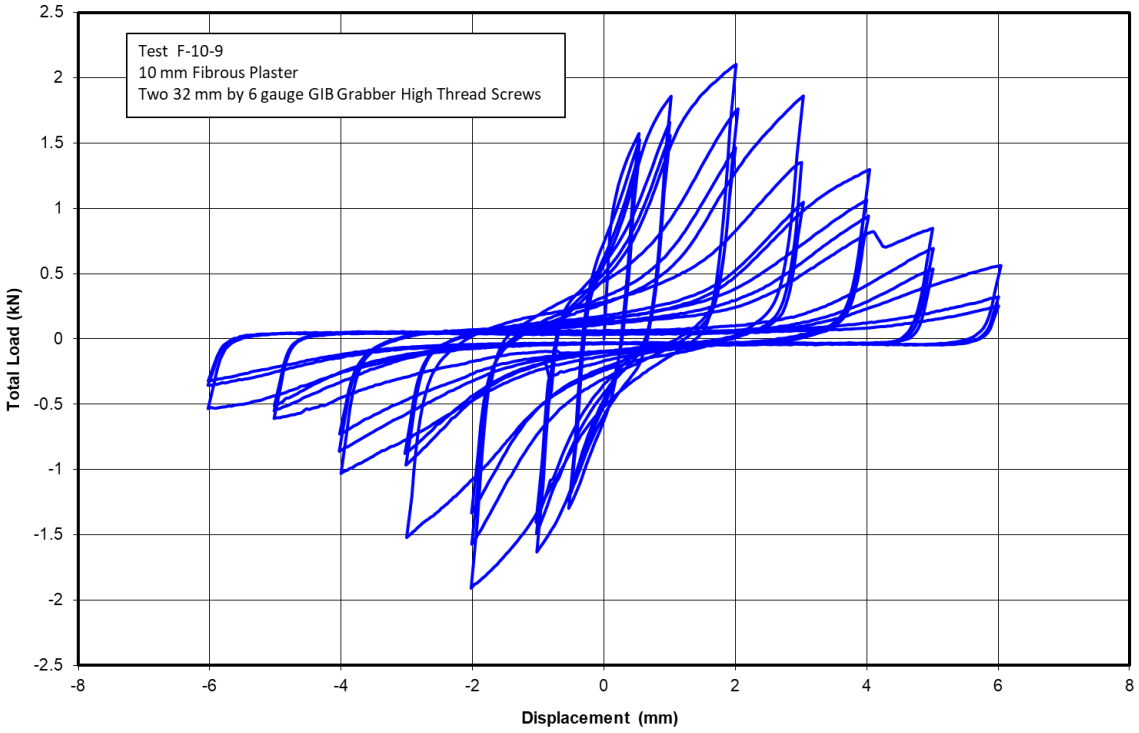

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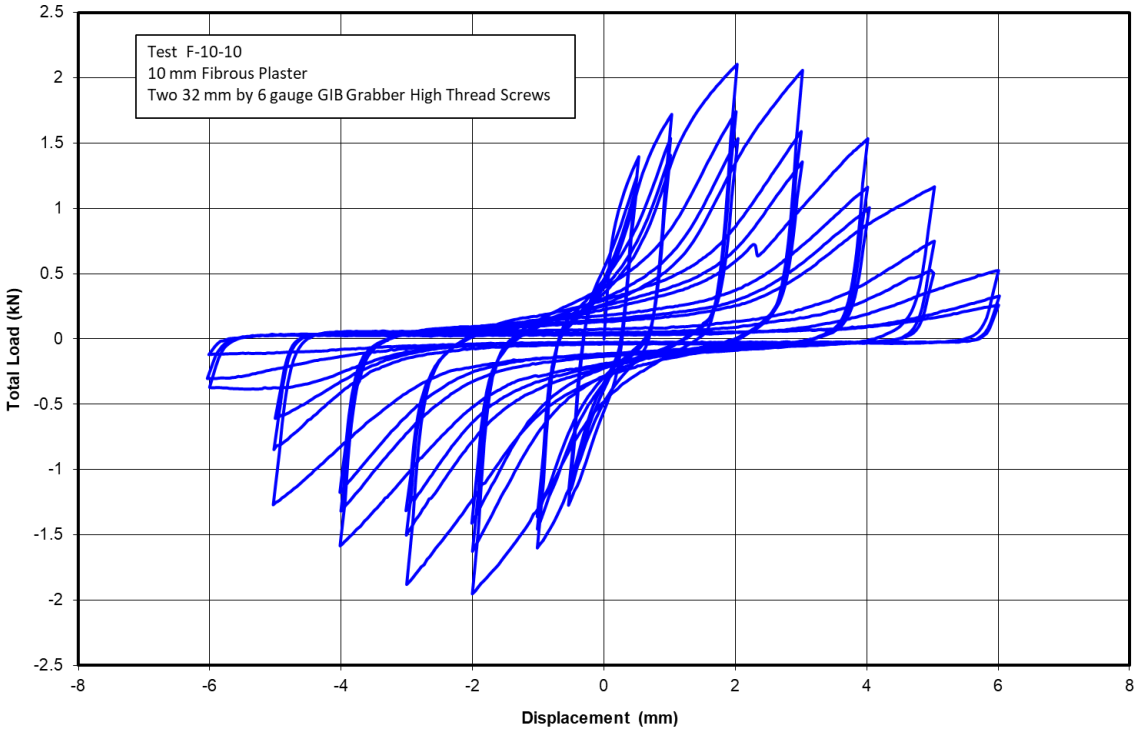

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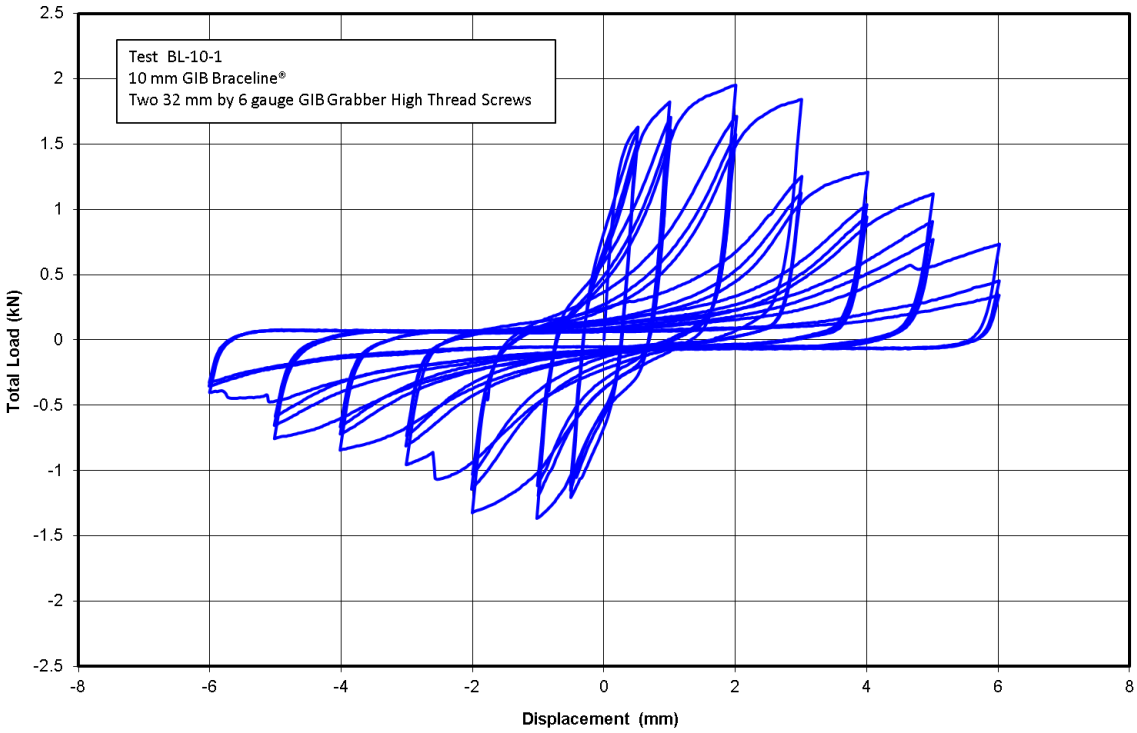

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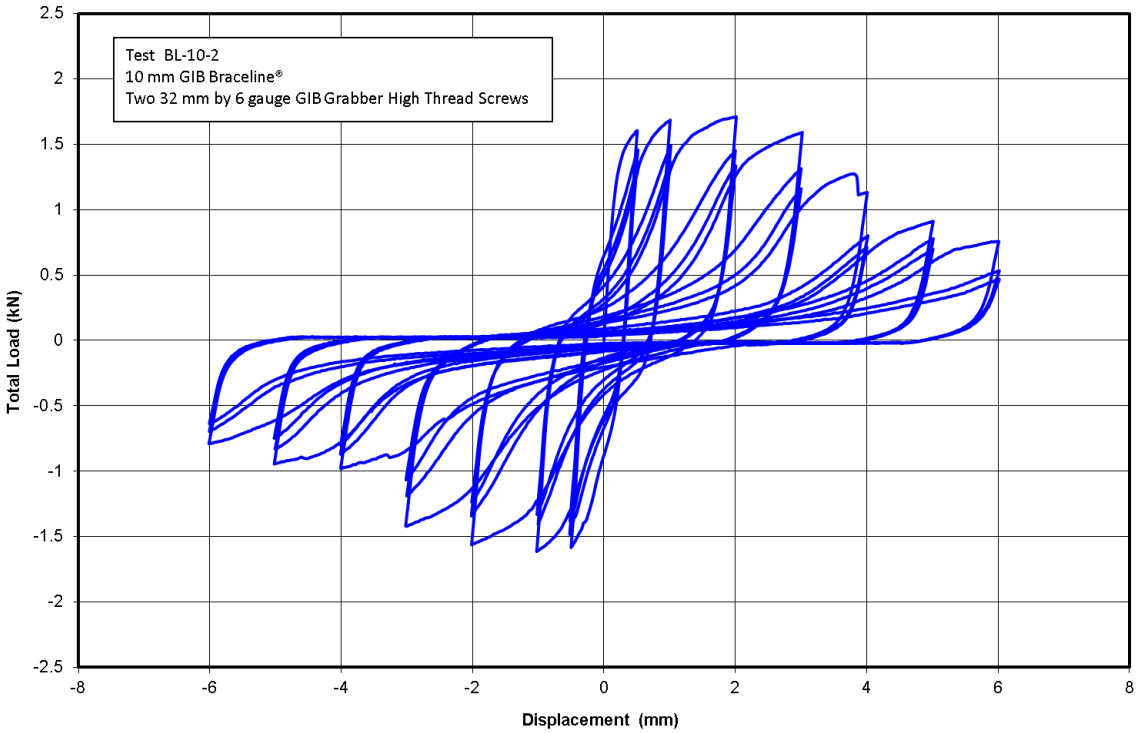

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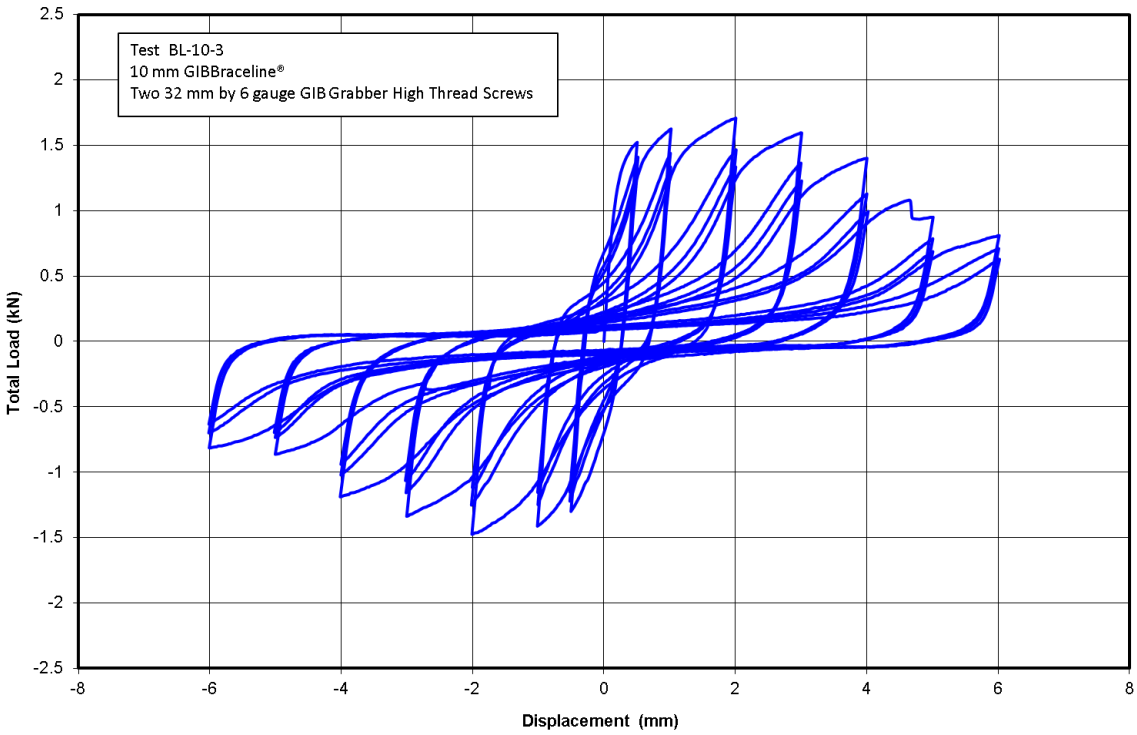

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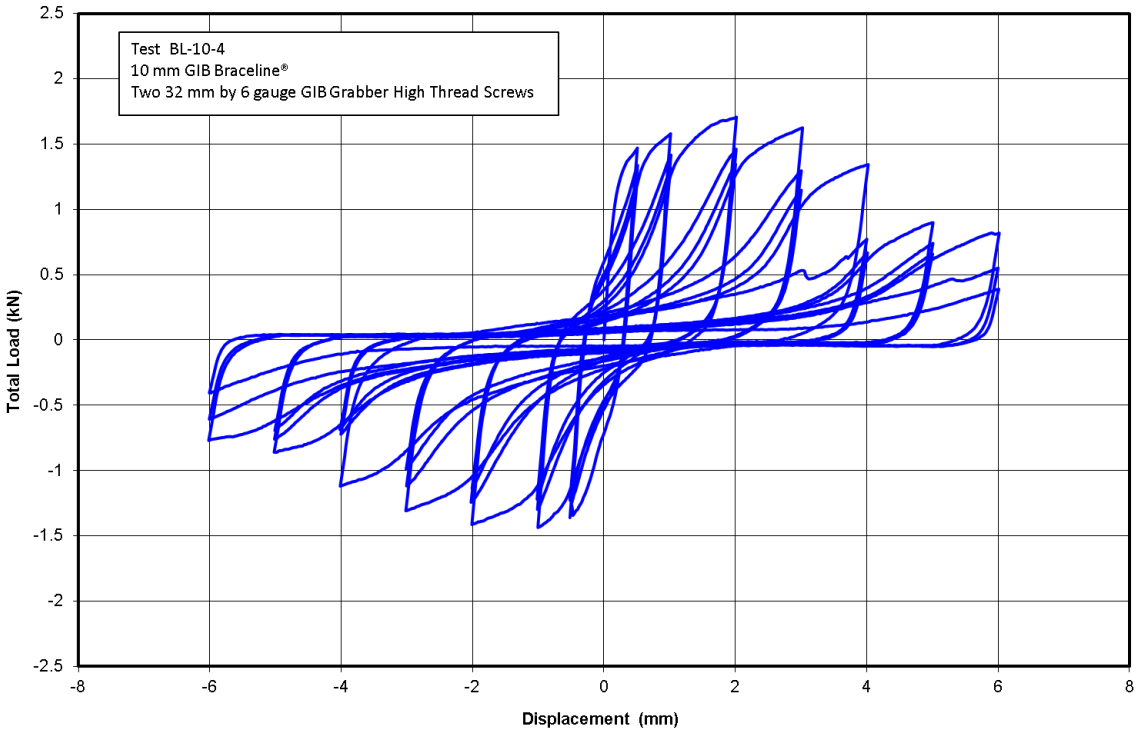

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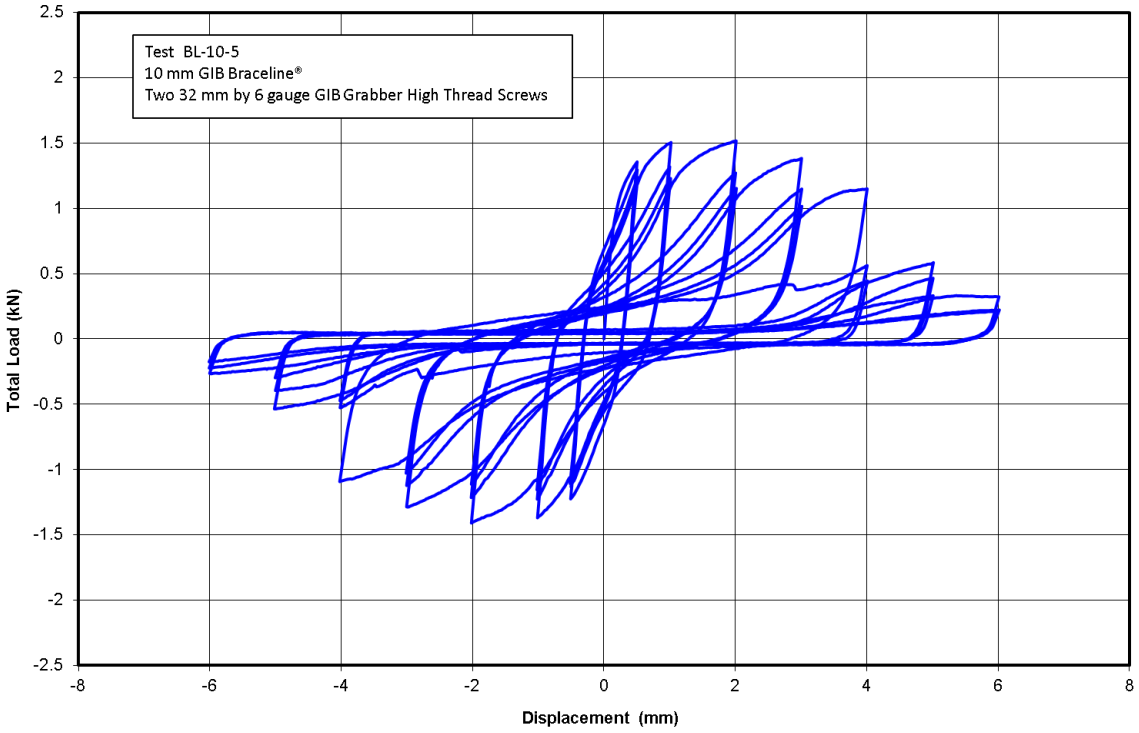

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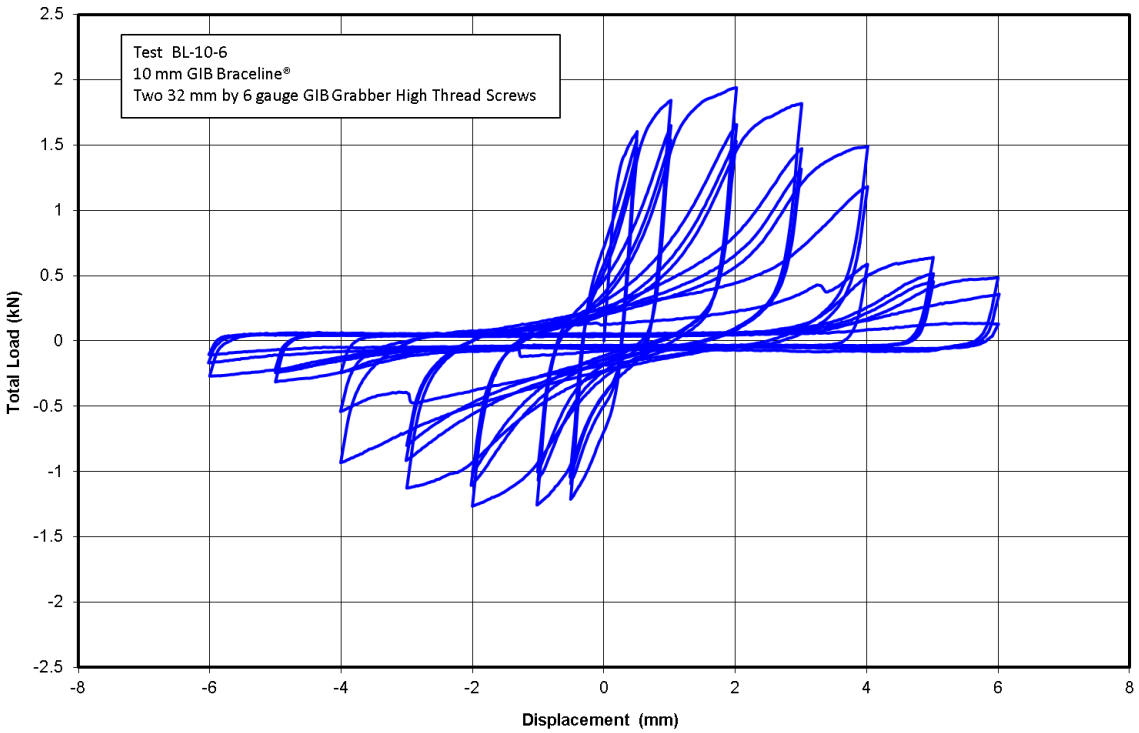

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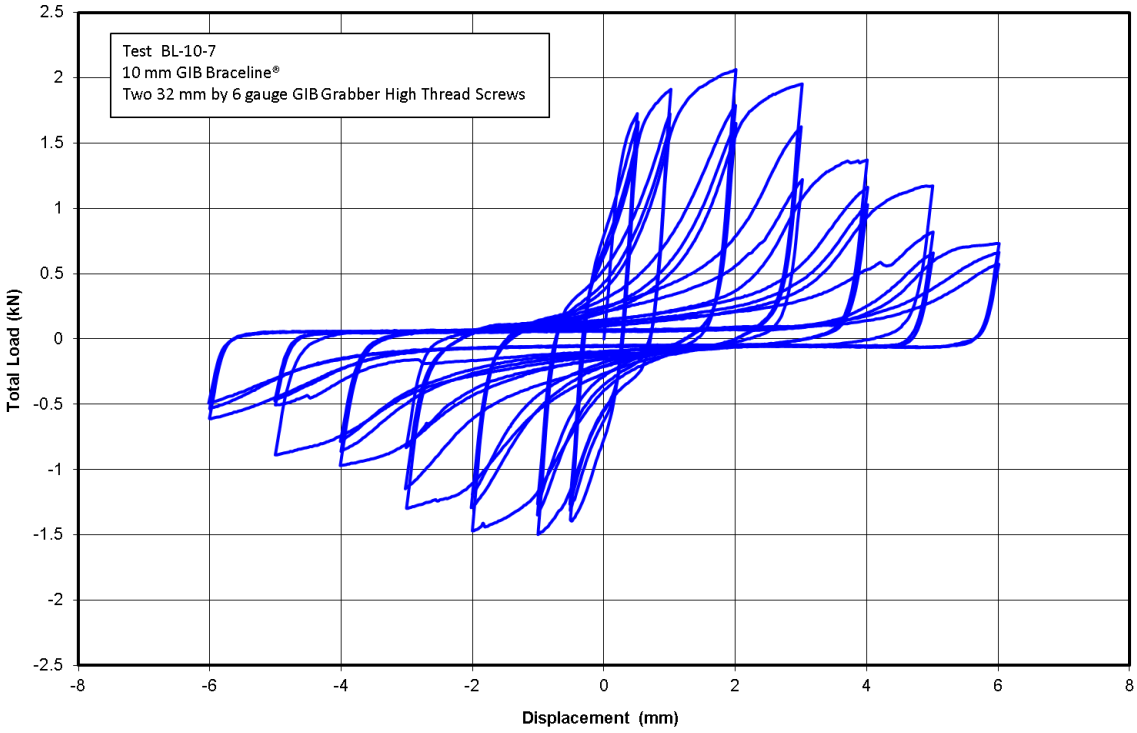

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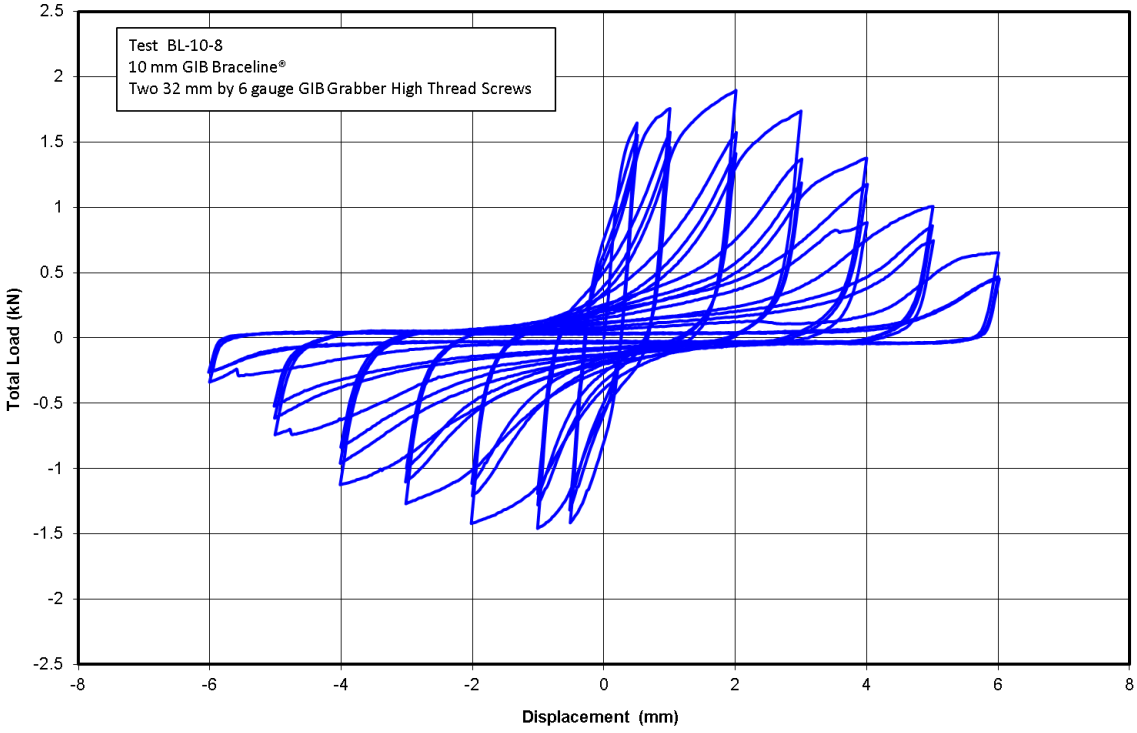

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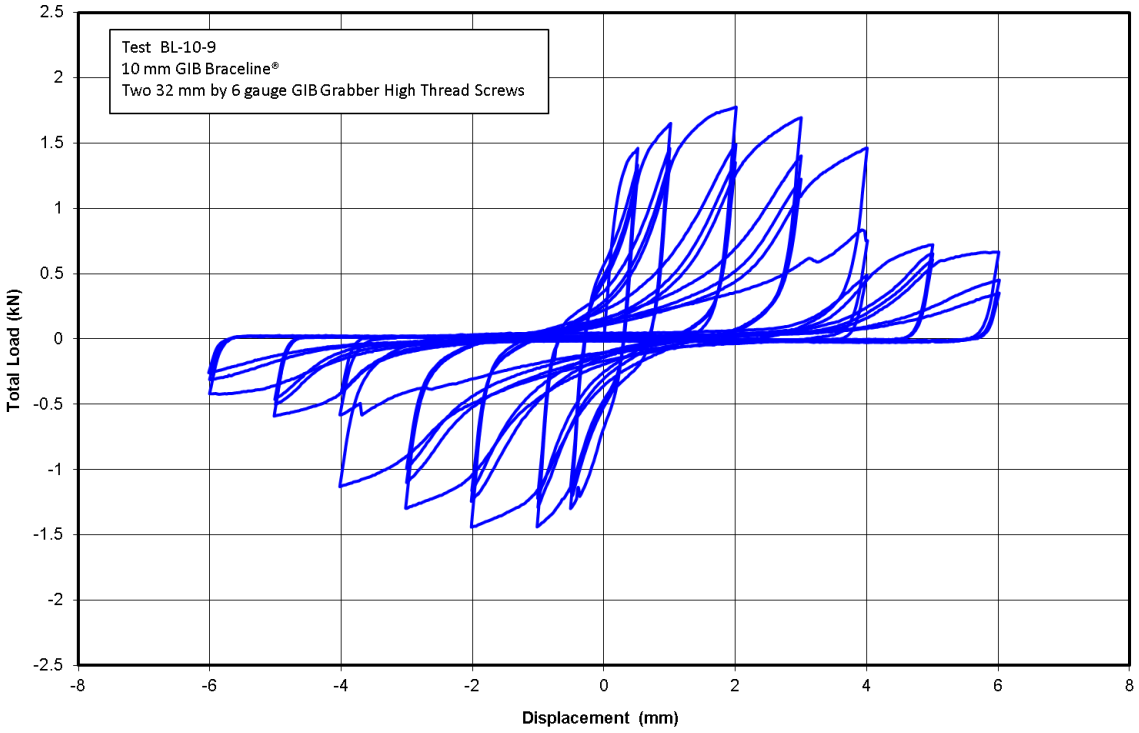

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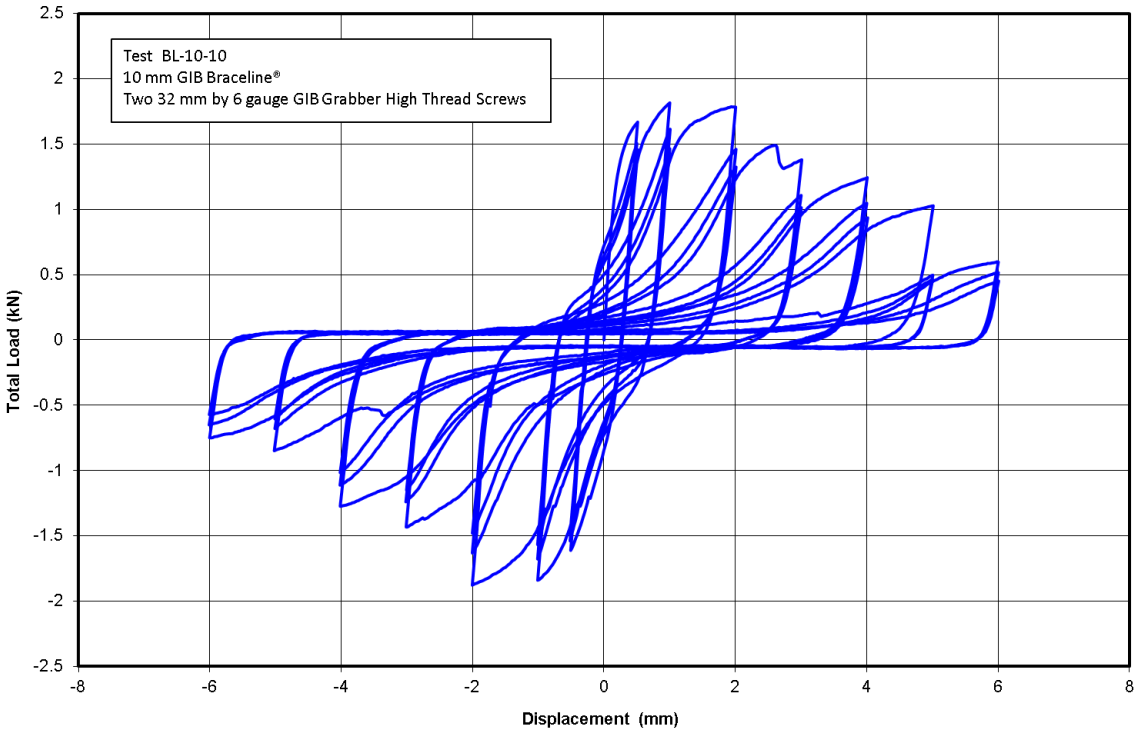

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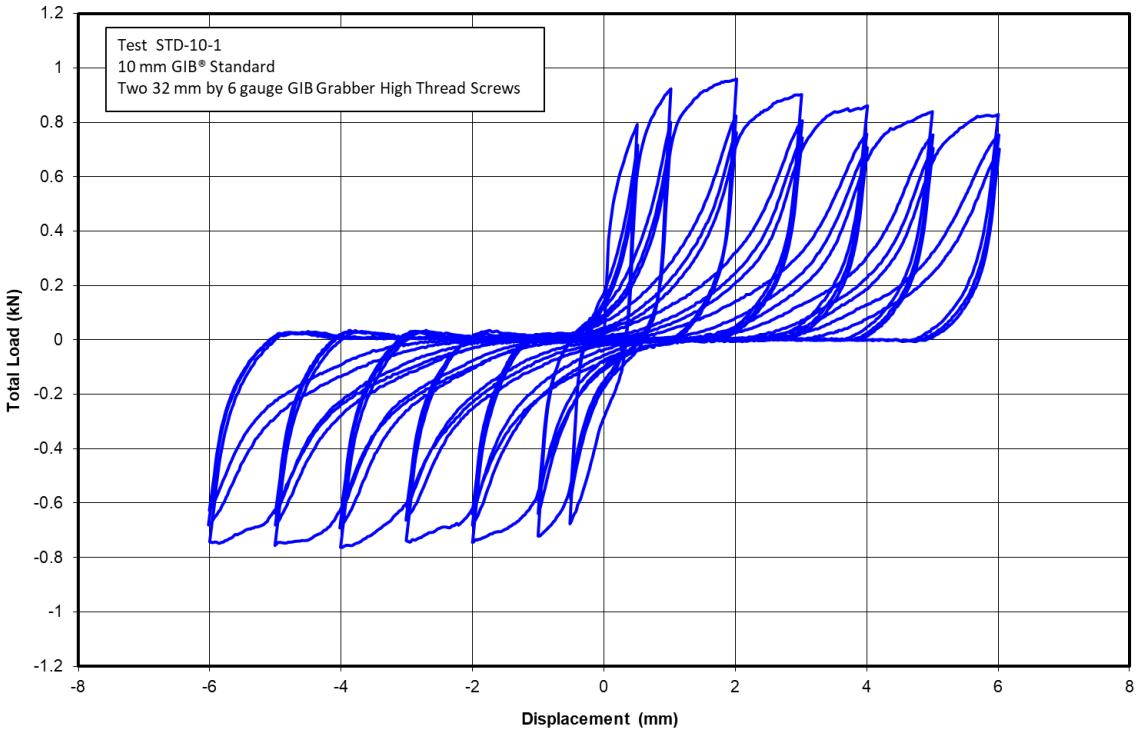

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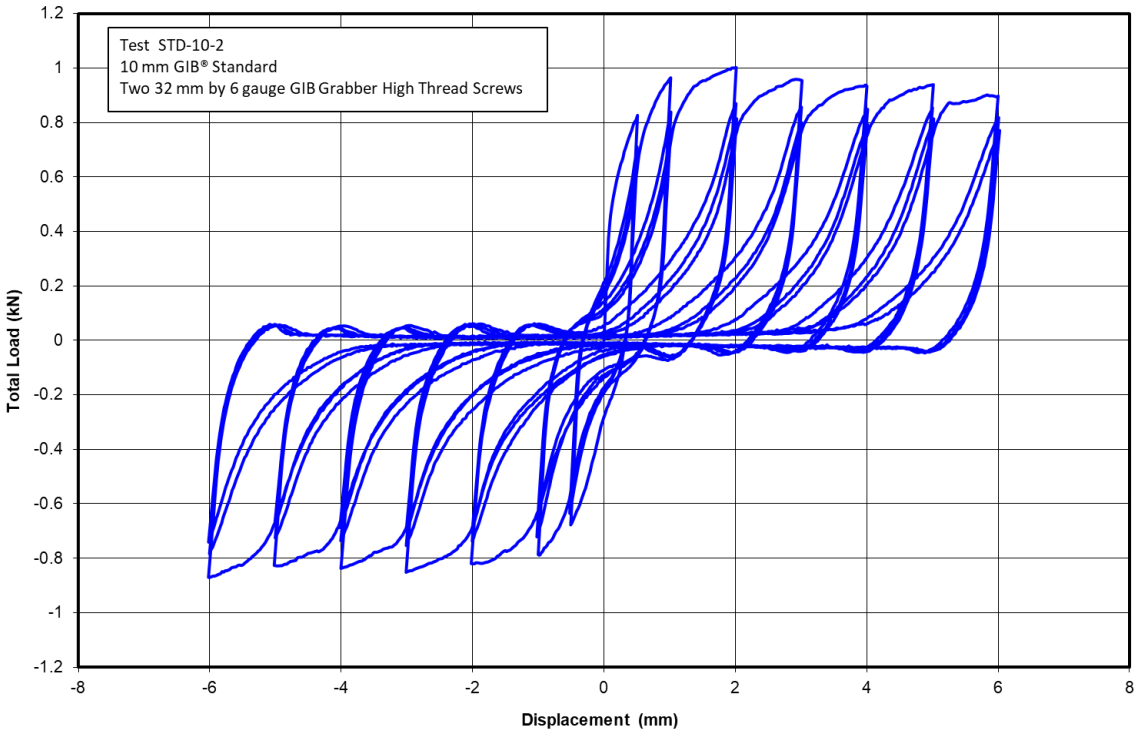

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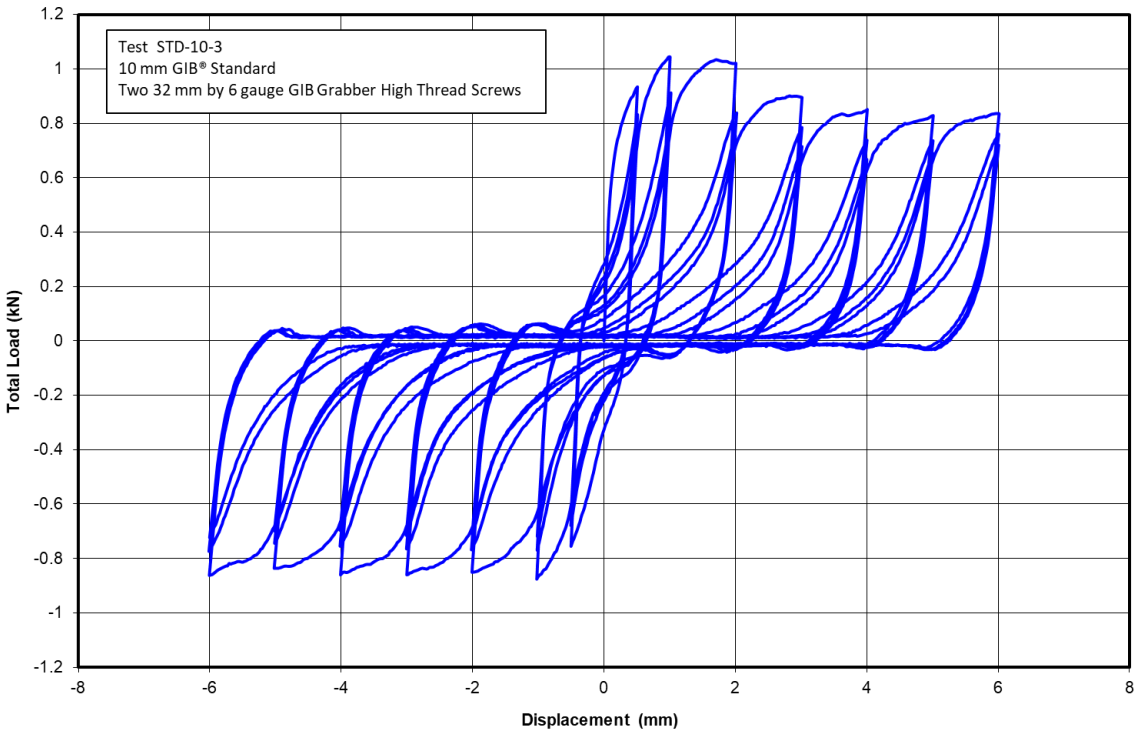

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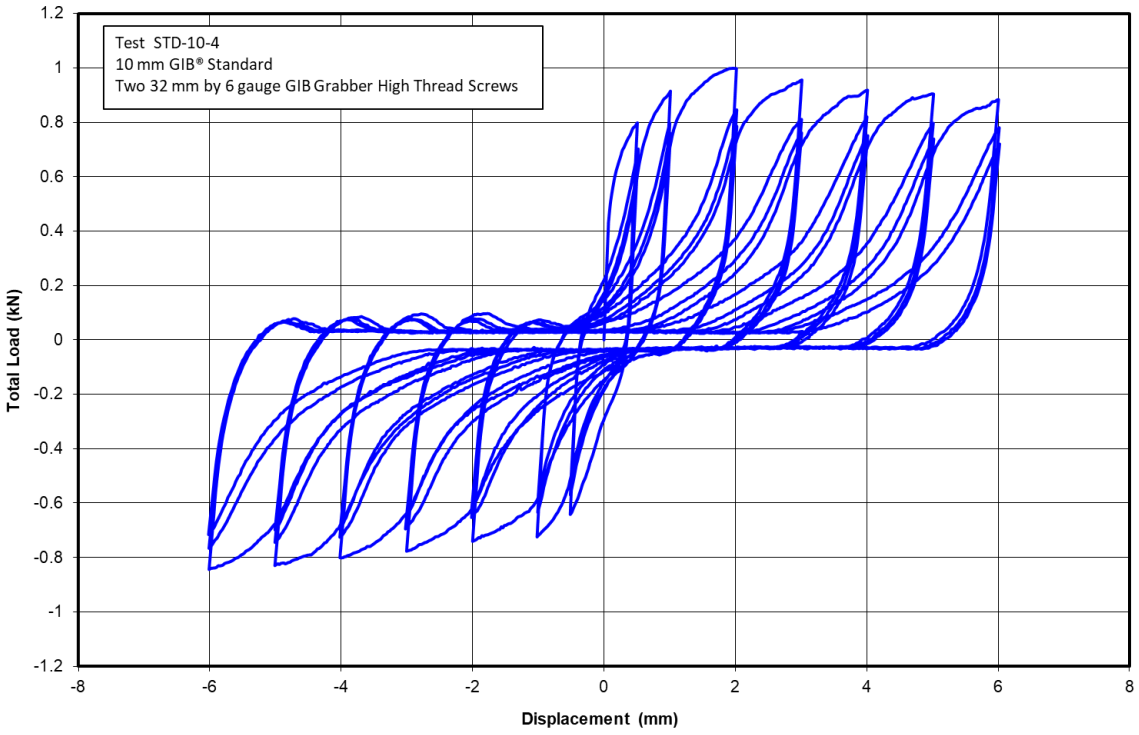

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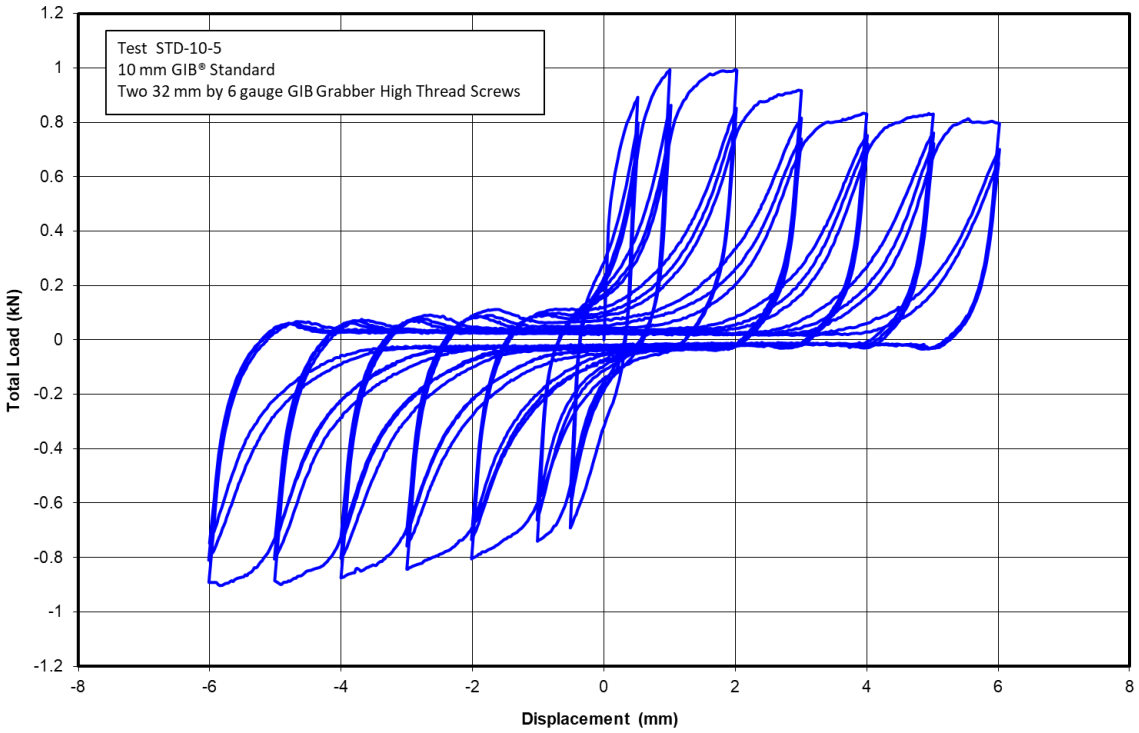

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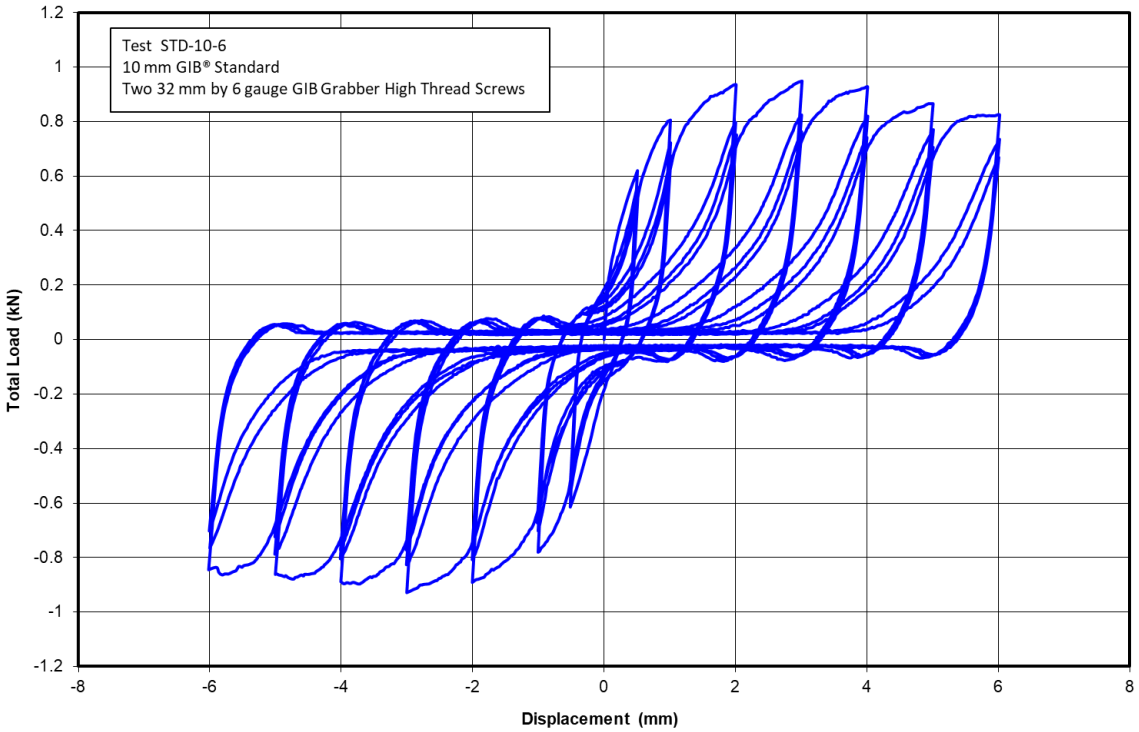

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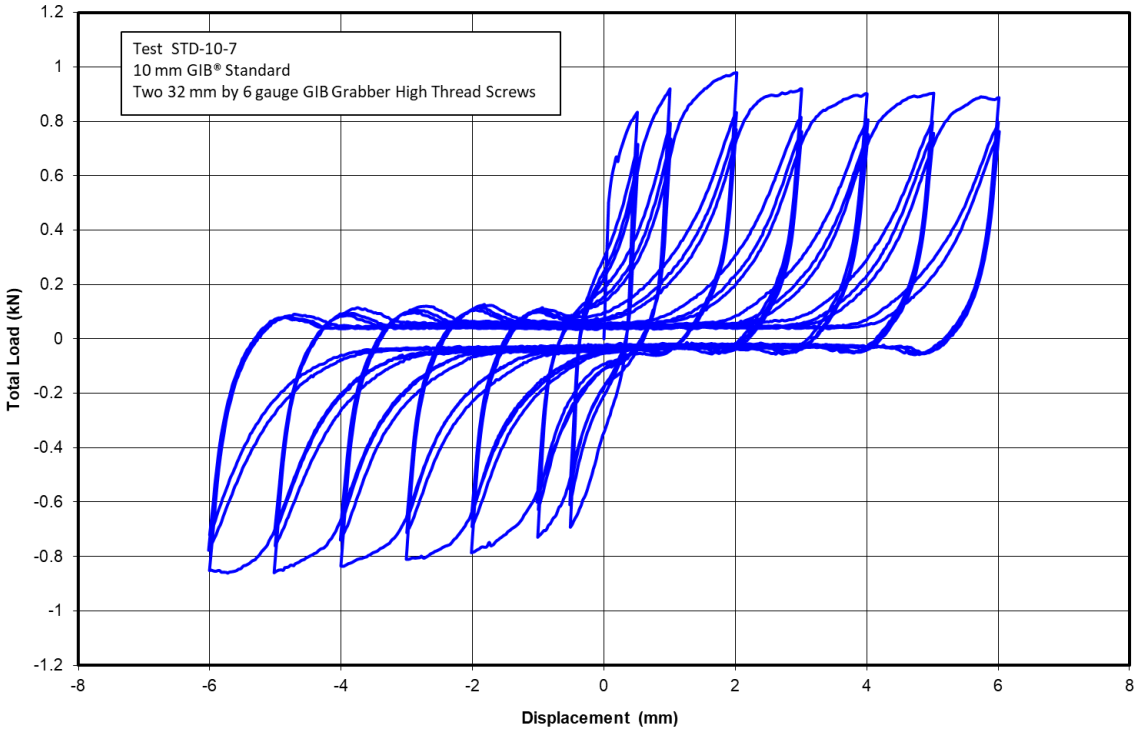

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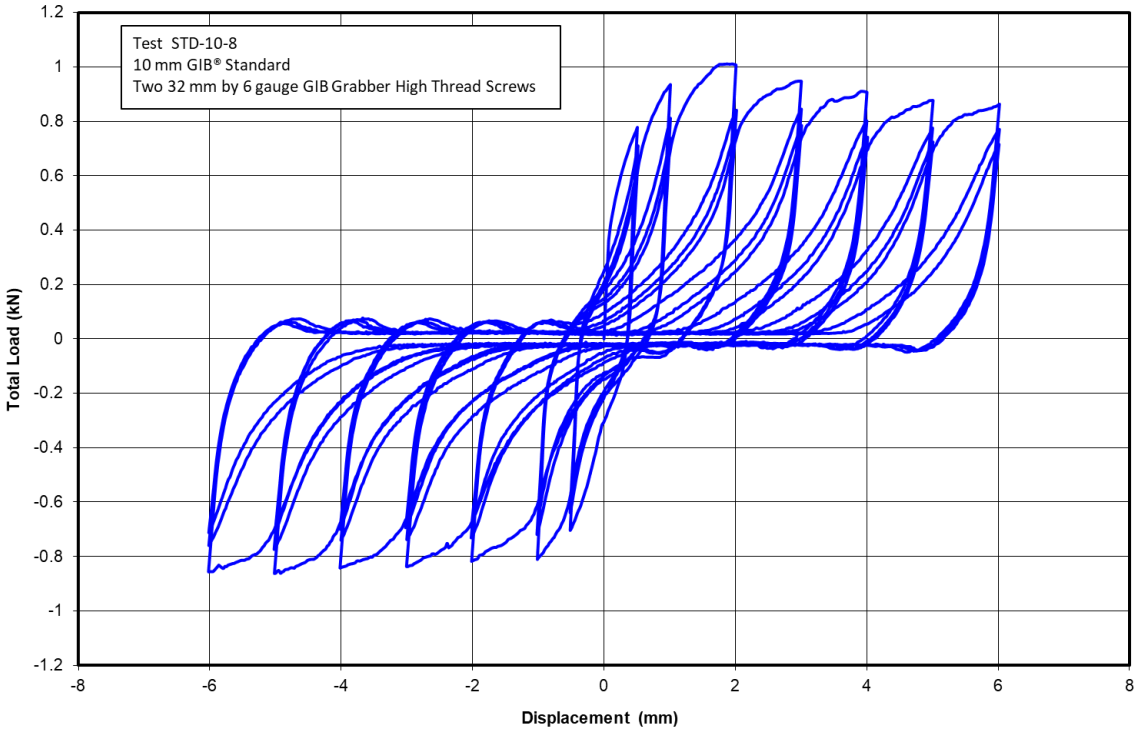

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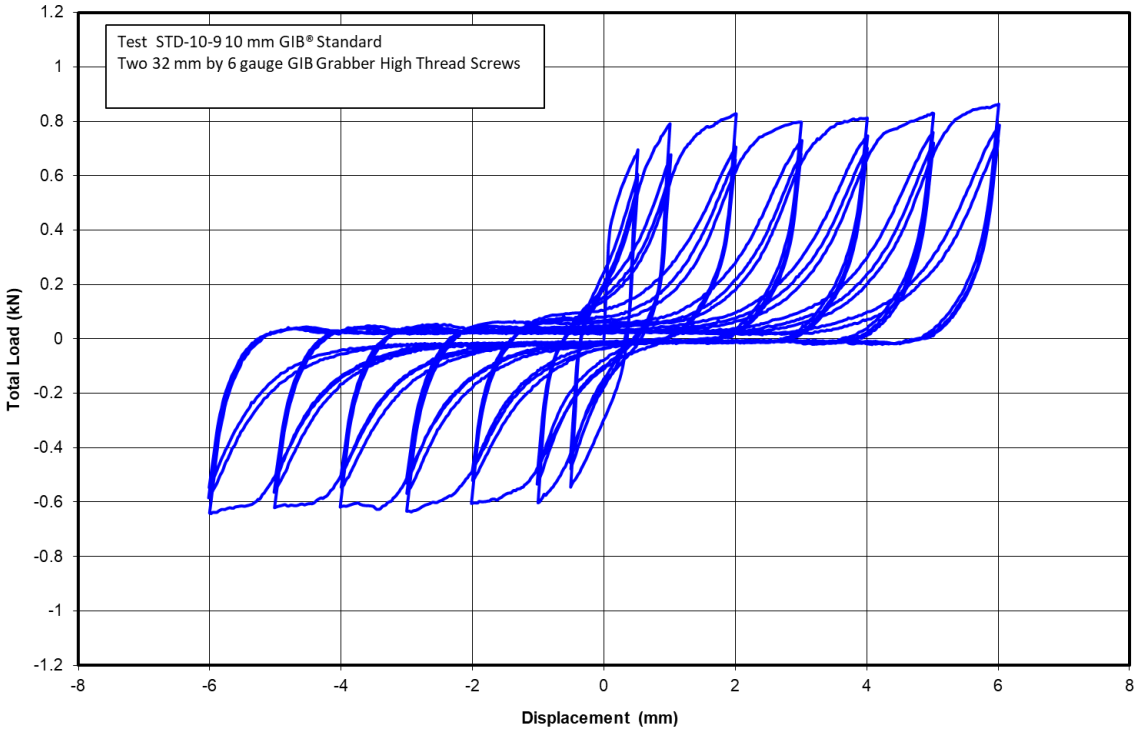

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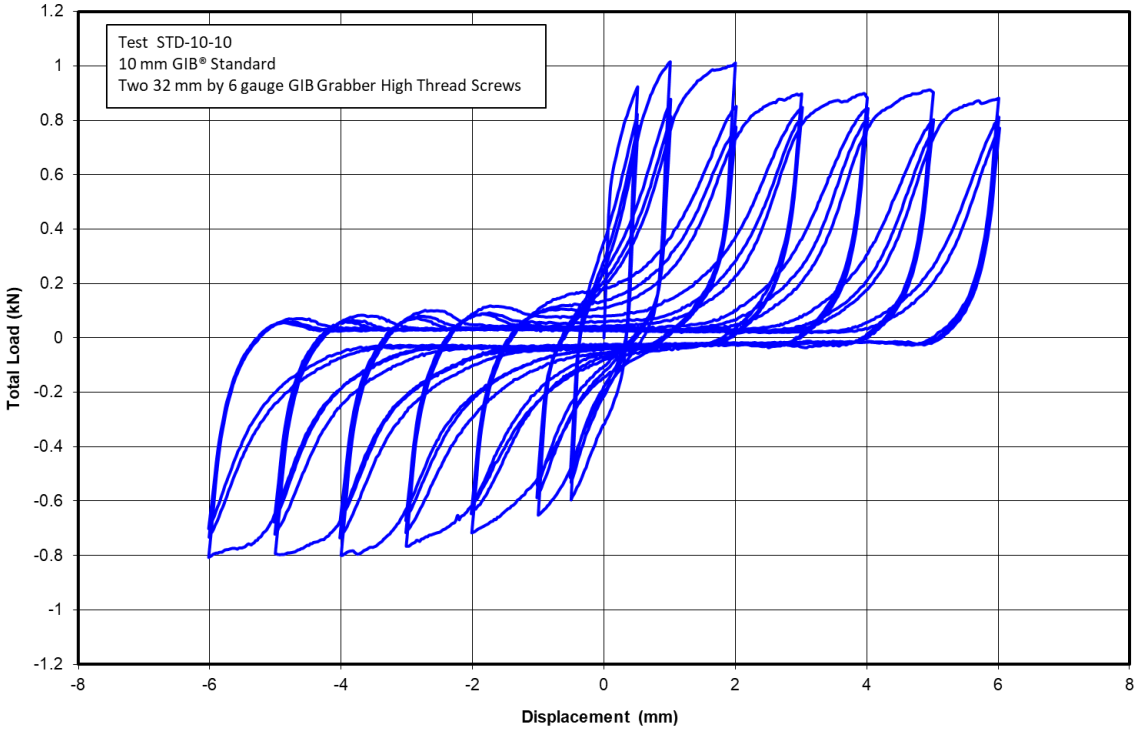

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