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Statement of Certification

Laboratory Tests on "Oval Shape Bracer" Hillside Washers for X-Bracing

This is to certify that we have conducted a comprehensive schedule and a program of laboratory testing and review on your "Oval Shape Bracers" with x-bracing rods at 45 degree angle. "Stress-Lok" washers matching the curvature of the hillside or hardened flat washers were also evaluated in these tests. The objective of the testing program was to establish the load carrying capacity of these washers and the failure modes.

This work was conducted at the Structural Laboratories of the Civil Engineering Department of Mississippi State University under my direction and supervision.

The test results confirmed previous findings made on the Triangle Fasteners Corporation "Bracer" hillside washers with rectangular base. Tested "Oval Shape Bracers" with rods at the most critical 45° exceeded the load carrying capacity of the x-bracing rods while the structural member remained viable by confining the pressures on the web. The "Oval Shape Bracers" were found to be superior to the rectangular shape by minimizing the stress concentration on the corners caused by structural deformations of the thin webs under loading.

In addition, the "Stress-Lok" washers prevented rod slippage over the curvature of the hillside washers. Triangular Fasteners hardened flat washers performed well and as expected but allowed slippage and premature bending and deformation of the rods before ultimate failures. Standard soft and off the shelf flat washers should not be used.

Procedures and calculations established in the literature for the design of x-bracing anchorage can be used with confidence when specifying and selecting ductile iron "Oval Shape Bracer" hillside washers by utilizing the same base dimensions of the rectangular "Bracers" (3"x 4") for determining the load capacity of the x-bracing assembly.

Respectfully submitted by,



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