Steel Arm Bracket Assessment

NEETRAC Project Number: 11-120

July, 2011

Requested by: Buddy Phillips
Georgia Power

Principal Investigator: Dylan Summer

Reviewed by: Joseph Goldenburg, P.E.

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1.0 SUMMARY

Three steel arm brackets were supplied to NEETRAC for an ultimate tensile test (UTS) along with two bushing and two Y-bolts. Two steel arm brackets were tested with a bushing and a Y-bolt in the eye of the samples. The third steel arm bracket was tested with only a Y-bolt in the eye of the sample. Samples using the bushing failed above 22,900 lbs, while the sample using the Y-bolt only failed above 20,800 lbs.

2.0 SAMPLES

Three steel arm brackets were provided to NEETRAC by Georgia Power. The as-received condition of the three samples is shown in Figures 1 through 3.

Figure 1: The as-received condition of Sample 1-1. The bushing was removed to show the condition of the eye.

Figure 2: The as-received condition of Sample 1-2. The bushing was removed to show the condition of the eye.

Figure 3: The as-received condition of Sample 1-3. The Y-bolt was removed to show the condition of the eye.

3.0 PROCEDURE

Visual and dimensional examinations were performed on the samples. The sample with the least material distance between the wear of the eye and the edge of the front plate, Sample 1-3, was tested with only a Y-bolt through the eye. The remaining two samples were tested with bushings and a Y-bolt through the eye of the samples. The three samples were cut to fit into the Tinius

Olsen machine and were bolted in place. The test setup for each sample can be seen in Figures 4 through 6.

The samples were preloaded to an initial tension of 100 lbs and then pulled to destruction at a rate of 6,000 lb/min.

Figure 4: Test setup of Sample 1-1 and a close-up of the bushing and Y-bolt in the eye.

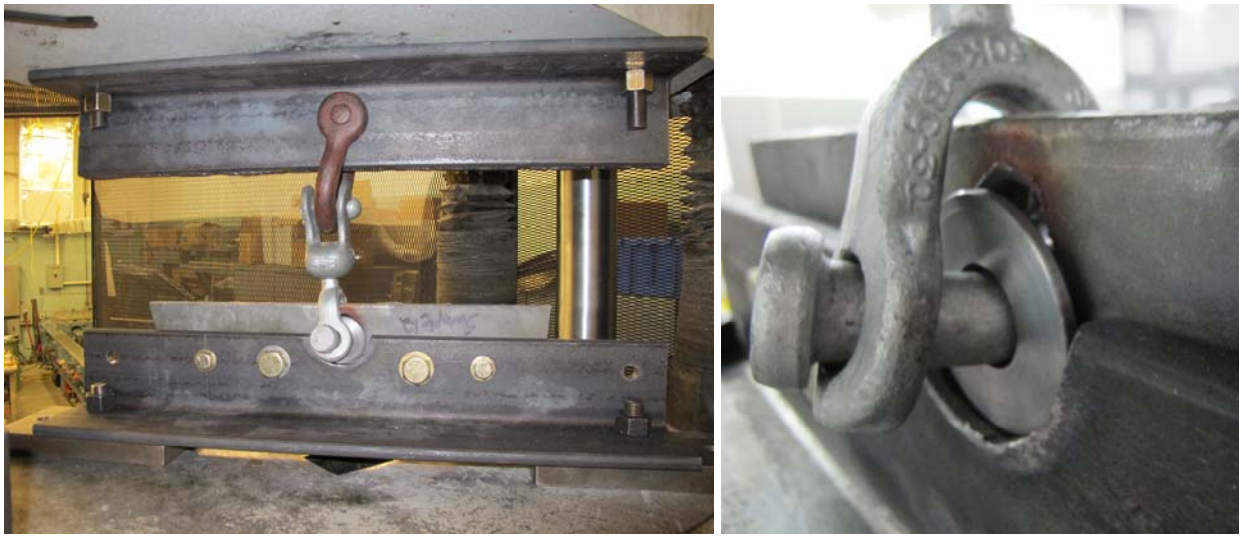

Figure 5: Test setup of Sample 1-2 and a close-up of the bushing and Y-bolt in the eye.

Figure 6: Test setup of Sample 1-3 and a close-up of the Y-bolt in the eye.

4.0 RESULTS

4.1 Visual Inspection

All three samples showed signs of corrosion and wear in the eye. A close-up view of the condition of the eye of each sample can be seen in Figures 7 through 9.

Figure 7: The as-received condition of the eye of Sample 1-1. The material appears to have yielded though the excess material seems to have been chipped off of the front of the eye. The wide area of wear suggests that the Y-bolt may have been rocking and swaying over an extended period of time in the field.

Figure 8: The as-received condition of the eye of Sample 1-2. The material appears to have yielded as there is an excess of material displaced at the edge of the wear of the eye. The wide area of the wear suggests that the Y-bolt may have been rocking and swaying over an extended period of time in the field.

Figure 9: The as-received condition of the eye of Sample 1-3. The material appears to have yielded as there is an excess of material displaced at the edge of the wear of the eye. The wide area of the wear suggests that the Y-bolt may have been rocking and swaying over an extended period of time in the field.

4.2 Ultimate Tensile Test

All three samples deformed during the test. Sample 1-3 resulted in a shear tear out of the eye from the Y-bolt. The results from the ultimate tensile strength test of each sample can be seen in Table 1. The deformation for each sample can be seen in Figures 10 through 11.

Table 1: Ultimate Tensile Strength Test Results

Sample #	**Material Distance Between Eye Wear and Plate Edge**	**Breaking Load**	**Failure Mode**
	[in]	[lbs]	
1-1 Bushing 1	0.6230	22,996	Fixture bolts shear failure. Eye deformed but did not shear.
1-2 Bushing 2	0.5535	25,211	Y-bolt clevis tensile failure. Eye deformed but did not shear.
1-3 Y-bolt	0.5230	20,895	Shear tear out of eye from Y-bolt.

Figure 10: Sample 1-1 deformation after shear of inside bolts of fixture. The eye deformed but did not shear.

Figure 11: Sample 1-2 deformation after failure of socket of Y-bolt and a close-up of socket failure. The eye of the sample deformed but did not shear.

Figure 12: Sample 1-3 failure and shear tear out from Y-bolt.

5.0 CONCLUSION

Sample 1-1 was pulled to 22,996 lbs during the ultimate tensile strength test and deformed but did not result in a shear tear out of the eye. Sample 1-2 was pulled to 25,211 lbs during the ultimate tensile strength test and deformed but did not result in a shear tear out of the eye. Sample 1-3 was pulled to 20,895 lbs during the ultimate tensile strength test and resulted in a shear tear out of the eye.

6.0 EQUIPMENT

Tinius Olsen Universal Testing Machine, calibration control # CQ 0013.
Starrett 6-in Digital Caliper, calibration control # CQ 3044.