Aslan FRP
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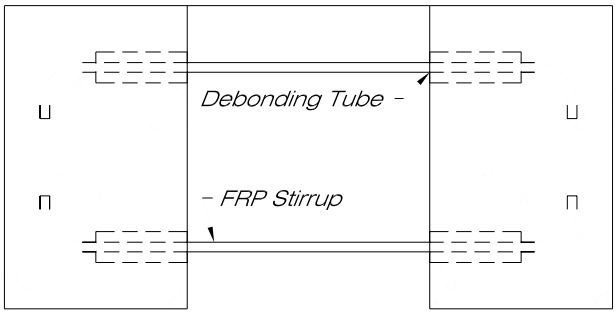
Test Report Date: 24-Jun-08

ACI 440.3R-04 Test Method B.5

Purpose: To test the strength capacity of the bent portion of various sizes of GFRP rebar as produced by Hughes Brothers, Inc. The capacities are based on ACI test method B5 as described in ACI 440.3-04.

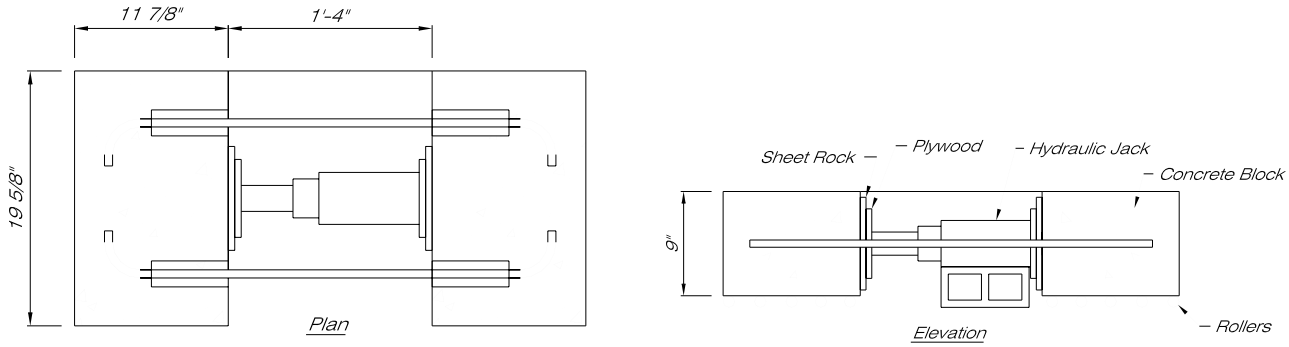
Test Run: Bent rebar produced by Hughes Brothers, Inc. are manufactured in a variation from the straight rebar. The bent line was configured to produce three sizes of U-shaped bars with exterior legs of 14" and an interior leg length of 36". The three sizes produced were #4, #5 and #6 (.5", .625" and .75" diameters respectively). Six specimens of each bar size were produced for testing.

Specimen Preparation: The U-shaped bars were cast into two 19.63" x 11.88" concrete blocks separated by 16" as shown in figures below. Each bar had a bond breaker tube applied from the end of the radius to the front of the concrete block to ensure that all of the force was carried by bent portion of the bar. Four 3/8" diameter steel stirrups were placed around the bars to confine the concrete and make sure that the specimen did not fail by concrete splitting.



Elevation

Procedure: The blocks were placed on five 1" smooth round GFRP bars, which served as rollers providing a "frictionless" surface. A hydraulic jack was placed between the two concrete blocks and aligned with the middle of the blocks both vertically and horizontally. The hydraulic jack was outfitted with a pressure gage so the maximum pressure could be recorded. The jack was loaded until a failure in the concrete or the rebar was observed. Upon failure the maximum pressure was observed and recorded. In the majority of the specimens the failure mode was bar break at the edge of the radius, however in 2 specimens (4-6 and 6-1) the concrete failed prior to the rebar failure. ACI requires that only 5 specimens be tested so it is acceptable to ignore the results from the specimens in which the concrete failed.



Results: The effective area of the jack was 11.05 in2 so to obtain the force on the bars the pressure was multiplied by the effective area. The load carried by each bar was assumed to be ½ the total load. The resulting strength of the bar was calculated by dividing the load on the bar by the area of the bar (.44in^2, .31in^2 and .20in^2 for #6,#5, and #4 respectively) The average strength of the bars was 72,785 psi, 81,790 psi and 76,818psi for the #6,#5 and #4 bars respectively. The bars retained 81%, 86% and 77% of the guaranteed tensile strength of a straight bar for the #6, #5 and #4 respectively. The individual results can be seen in the tables below.

#6 Test Data

Test #	Gauge (psi)	Force (lbs)	Stress (psi)	Stress (MPa)
6-1*	4800	53,040	60,029	413.89
6-2**	5300	58,565	66,282	457.00
6-3	5950	65,748	74,411	513.05
6-4	6050	66,853	75,662	521.67
6-5	5800	64,090	72,535	500.11
6-6	6000	66,300	75,036	517.36
Mean	5650	62433	70659	487.18
Mean (w/o 6-1)	5820.00	64311	72785	501.84
		% of Guaranteed	80.9%	

* Concrete failure, bar did not break

** Load was held near ultimate for several minutes

#5 Test Data

Test #	Gauge (psi)	Force (lbs)	Stress (psi)	Stress (MPa)
5-1	4200	46,410	75,637	521.50
5-2	4550	50,278	81,940	564.95
5-3	4500	49,725	81,039	558.75
5-4	4550	50,278	81,940	564.95
5-5	4000	44,200	72,035	496.66
5-6	5450	60,223	98,147	676.70
Mean	4542	50185	81790	563.92
		% of Guaranteed	90.9%	

#4 Test Data

Test #	Gauge (psi)	Force (lbs)	Stress (psi)	Stress (MPa)
4-1	2500	27,625	70,346	485.02
4-2	2600	28,730	73,160	504.42
4-3	3200	35,360	90,044	620.83
4-4	2550	28,178	71,753	494.72
4-5	2800	30,940	78,788	543.22
4-6*	2000	22,100	56,277	388.02
Mean	2608	28822	73395	506.04
Mean (w/o 4-6)	2730	30167	76818	529.64
		% of Guaranteed	76.8%	