

**“Cumberland” ACSS/TW HS 285 Conductor
Tensile/Elongation Tests**

Southwire Company

NEETRAC Project Number: 06-011

April, 2006



Requested by:

Mr. Uday Sinha

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SUMMARY

Mr. Uday Sinha of Southwire Company requested that NEETRAC perform tensile tests on five (5) extra high strength steel core samples and three (3) composite conductor samples of 1926.9 “Cumberland” ACSS/TW HS 285 conductor. All samples exceeded their strength rating demonstrating that the published values are appropriate for use in line designs in accordance with standard practices. Elongation measurements are provided for the composite conductor samples for engineering information.

SAMPLES

One 500 ft. reel of 1926.9 kcmil “Cumberland” ACSS/TW HS 285 conductor with extra high strength steel core; Properties: 19 x 0.1133” EHSS; OD: 1.55”; RBS: 65,000 lb; Core rating: 52,679 lb

PROCEDURE

Core:

Samples were cut from the reel using a procedure that preserves the “as-manufactured” stress in each conductor strand. Each sample was cut to 19 feet. Cast-resin laboratory fittings were used to terminate the test samples (composite conductor). Each steel strand was stripped of the galvanize coating using diluted hydrochloric acid to aid in securing the wires in the resin sockets. After the resin was cured, the aluminum strands were removed from each sample leaving only the core.

After installing the end fittings, the test gage section measured 17’4” for each sample. Samples were pre-loaded to 1000 lb, and then pulled to destruction at a loading rate of 25,000 lb/min. A data acquisition system records time, tension, and actuator position 6 times per second for the duration of the test.

Composite Conductor:

Samples were cut in the same manner as the core samples. Sample length was 20’7”. They were subsequently terminated with resin fittings, and mounted in the MTS hydraulic tensile machine. The tests were conducted in two runs, the first run measuring elongation and the second run determining the ultimate tensile strength. For the elongation measurement, a cable extensometer was installed on each sample. The free-span conductor length is 19 feet. The active gage section between knife-edges on the cable extensometer is 18 feet, +/- 1/16”. Load, crosshead position, elongation, and temperature data were saved to a computer file. For both tests, each sample was pre-loaded to 1000 lb and pulled at a

rate of 30,000 lb/min. The elongation samples were pulled to 75% RBS, relaxed to 1000 lb, and the cable extensometer removed to protect it from the ultimate tensile test. Then, each sample was pulled to destruction. Both data files were processed to produce the load versus strain charts.

RESULTS

Table 1 shows results for the five core samples and Table 2 shows results for the three composite conductor samples.

Table 1, Loads, % Nominal Rating, and Failure Modes for Cumberland ACSS/TW HS 285 Core Samples			
Sample #	Max. Load, lb	% Nominal Rating	Failure Mode/Comments
06011TC1	54,290	103	Gage section break, multiple locations
06011TC2	54,310	103	Gage section break; multiple locations
06011TC3	54,310	103	Gage section break; 18" from end fitting
06011TC4	54,340	103	Gage section break; 5' from end fitting
06011TC5	54,370	103	Gage section break; 4' from end fitting

Table 2, Loads, % RBS, % Strain, and Failure Modes for Cumberland ACSS/TW HS 285 Composite Conductor Samples				
Sample #	Max. Load, lb	% RBS	% Strain	Failure Mode/Comments
06011ET1	66,960	103	5.07	Steel strands failed; aluminum intact
06011ET2	66,670	103	4.67	Steel strands failed; aluminum intact
06011ET3	66,840	103	4.76	Steel strands failed; aluminum intact

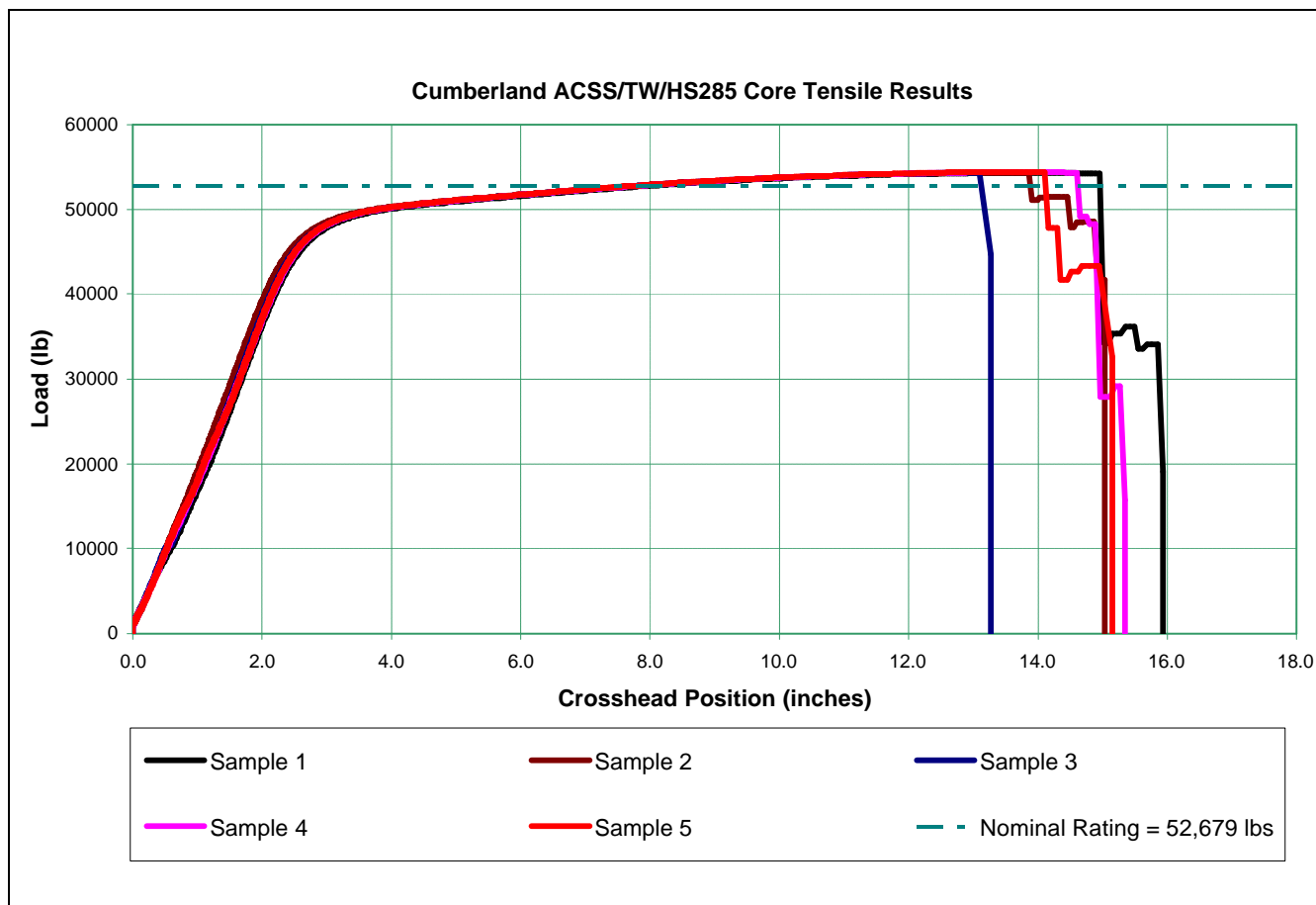


Figure 1, Load versus Crosshead Position, Cumberland ACSS/TW HS 285 Core Samples

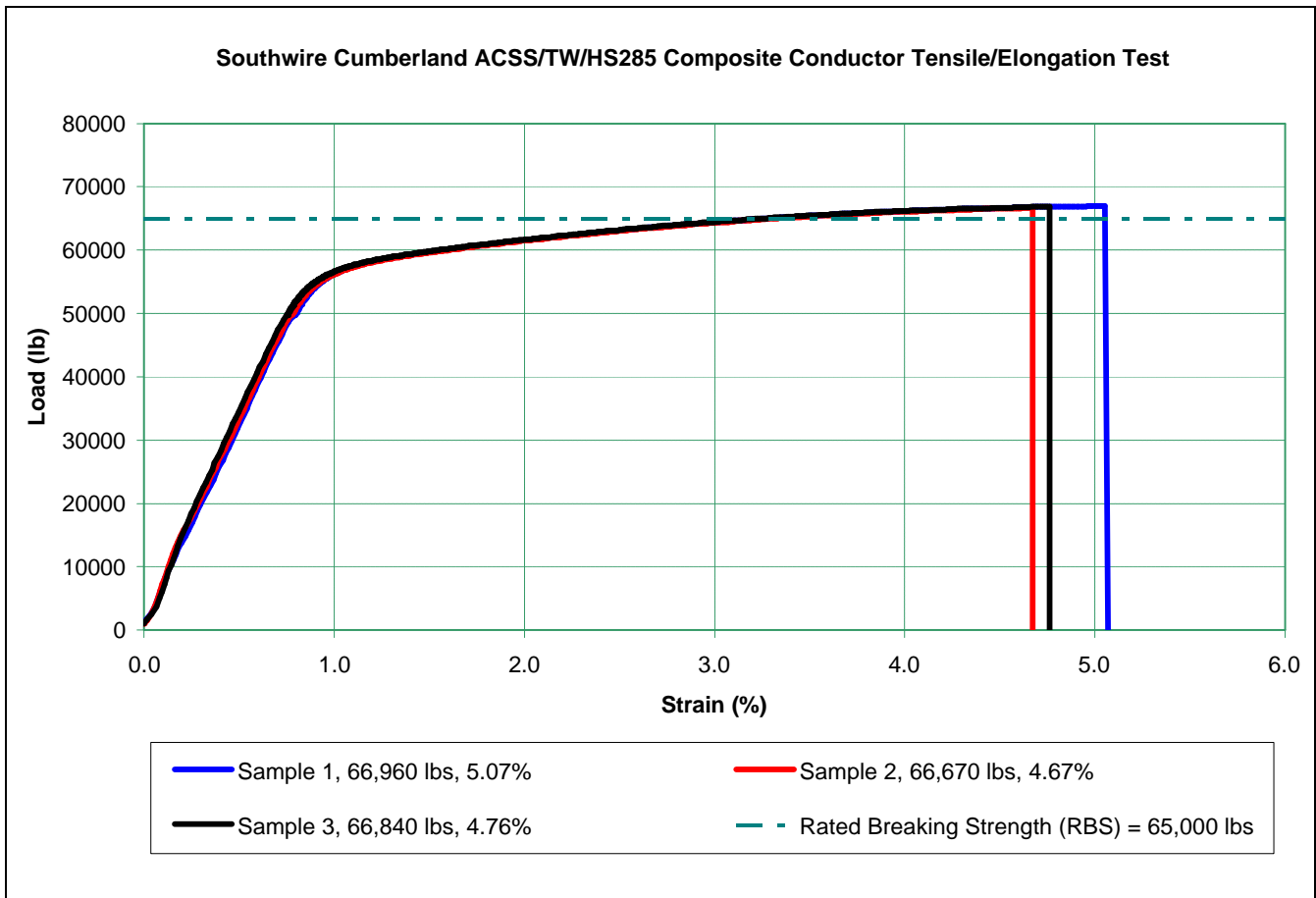


Figure 2, Load versus Strain, Cumberland ACSS/TW HS 285 Composite Samples

Note: Strain past 75% RBS (0.8% strain) is derived from crosshead position data, scaled based on calibrated strain data recorded with the extensometer.

CONCLUSIONS

Test results support use of a rated breaking strength of 65,000 lb for the Cumberland ACSS/TW HS 285 conductor with extra high strength steel core. Test results support use of a nominal rating of 52,679 lb for the extra high strength steel core of Cumberland ACSS/TW HS 285 conductor.

EQUIPMENT LISTING

- 1) MTS Servo-hydraulic tensile machine, Control # CQ 0195 (load and crosshead data)
- 2) Dynamics Research Corporation (DRC)/NEETRAC cable extensometer, Control # CQ 3002 (strain data)
- 3) Yokogawa DC100 data acquisition system, Control # CN 3022 (temperature data)

REFERENCES AND STANDARDS LISTING

- 1) ASTM E4, (Calibration of Load Testing Machines)
- 2) ASTM B857, Standard Specification for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Supported (ACSS/TW)