

Wind Tunnel Measurements of Transmission Cable Drag

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ABSTRACT:

Drag characteristics of transmission line cables were measured in the Fluid Dynamics and Diffusion Laboratory wind tunnels at Colorado State University. Comparative measurements of drag produced by sections of smooth cylinders, conventional and modified "compact" cable cross sections were examined. The wind induced forces on the transmission line segments were measured by a special drag balance consisting of a binocular beam supplied with strain gages and selected preloadings for stabilizing the force balance system. The drag forces were measured at five wind speeds ranging from 60 to 120 mph (Reynolds numbers = 4×10^4 - 1.1×10^5). Calibration deviations were maintained at $\pm 0.3\%$, no hysteresis or nonlinear behavior of the setup were realized, and an overall repeatability of better than 96% was realized. Measurements of drag over the smooth cylinder were in the sub-critical Reynolds number range and produced an average value of $C_d = 1.2$, super critical drag coefficients from 1.05 to 1.11 were measured on the conventional transmission line cable, and for the compact cable drag coefficients from 0.90 to 0.95 were measured.

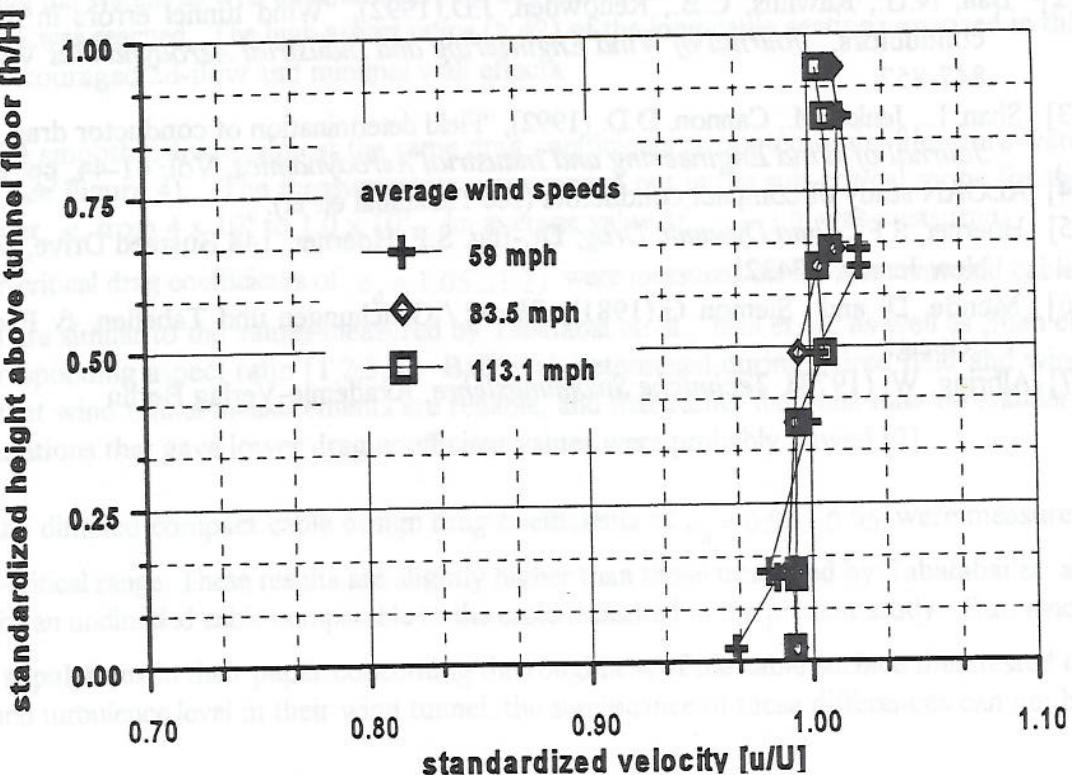


Figure 2 Standardized velocity profiles at different mean velocities.

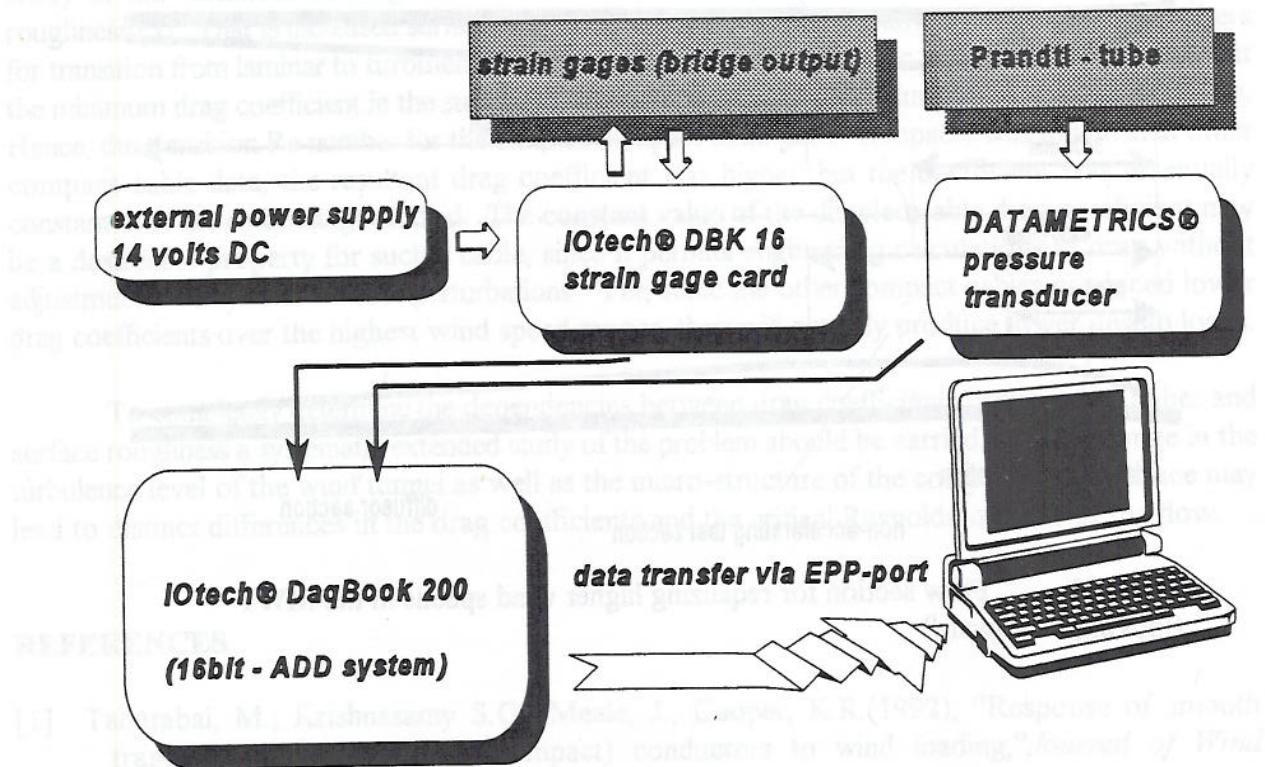


Figure 3 Data acquisition system.

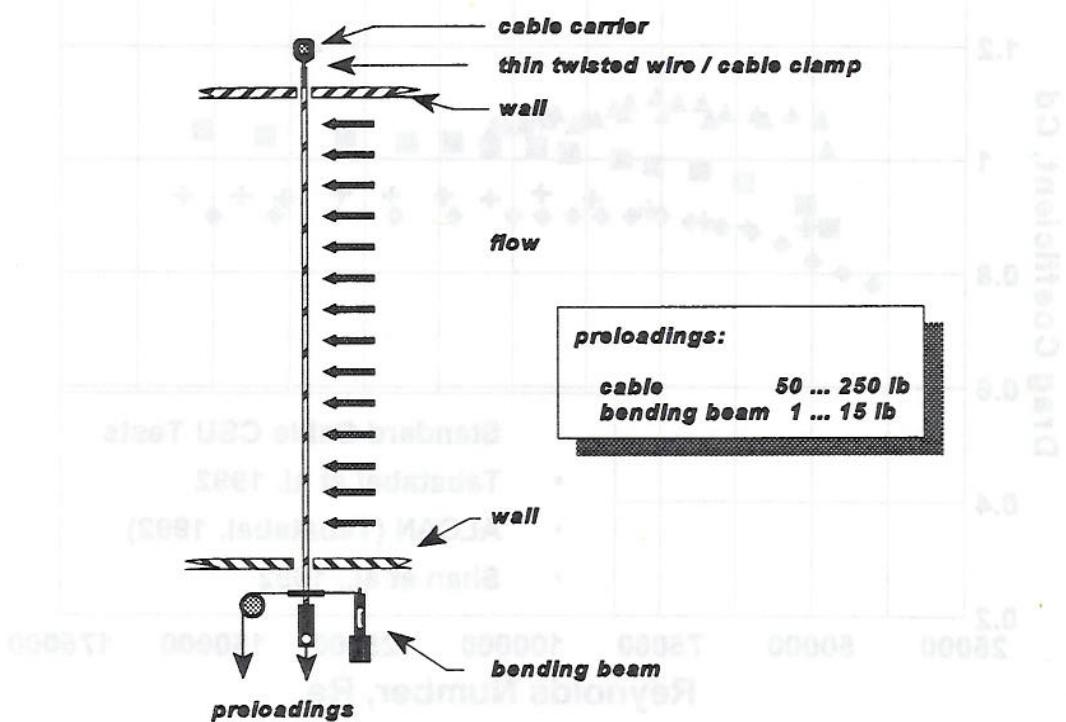


Figure 4 Experimental setup used for drag force measurements.

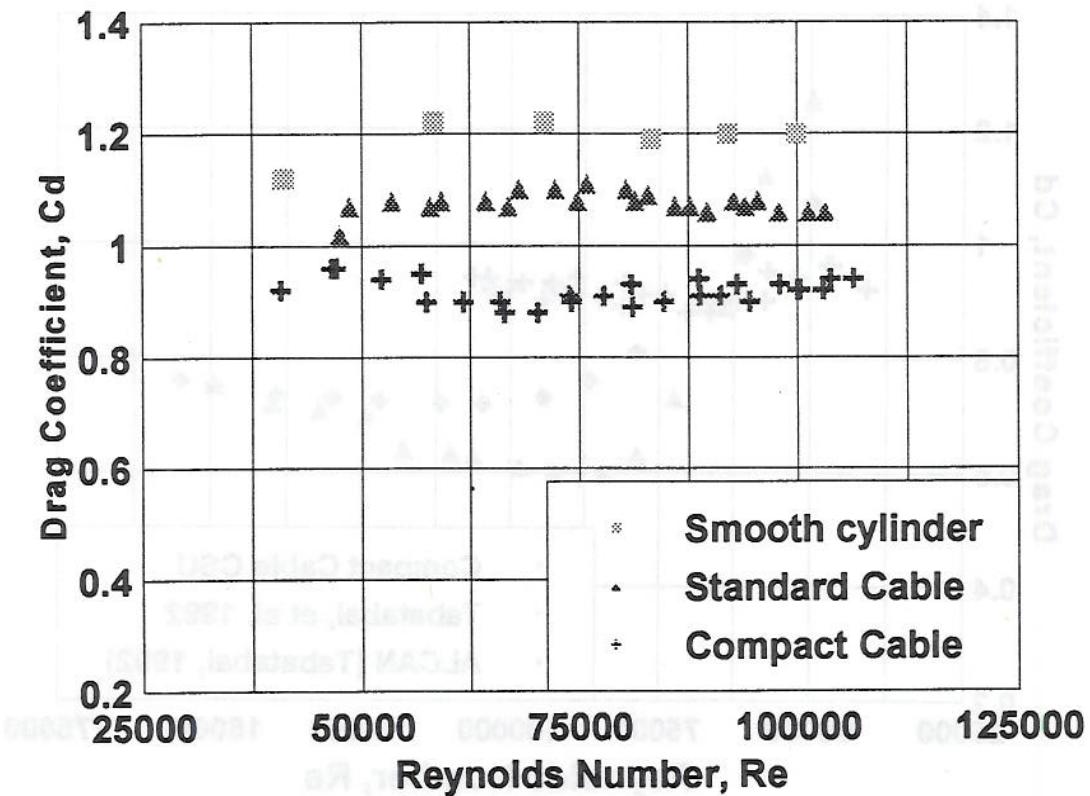


Figure 5 Comparison of drag coefficients - CSU Measurements

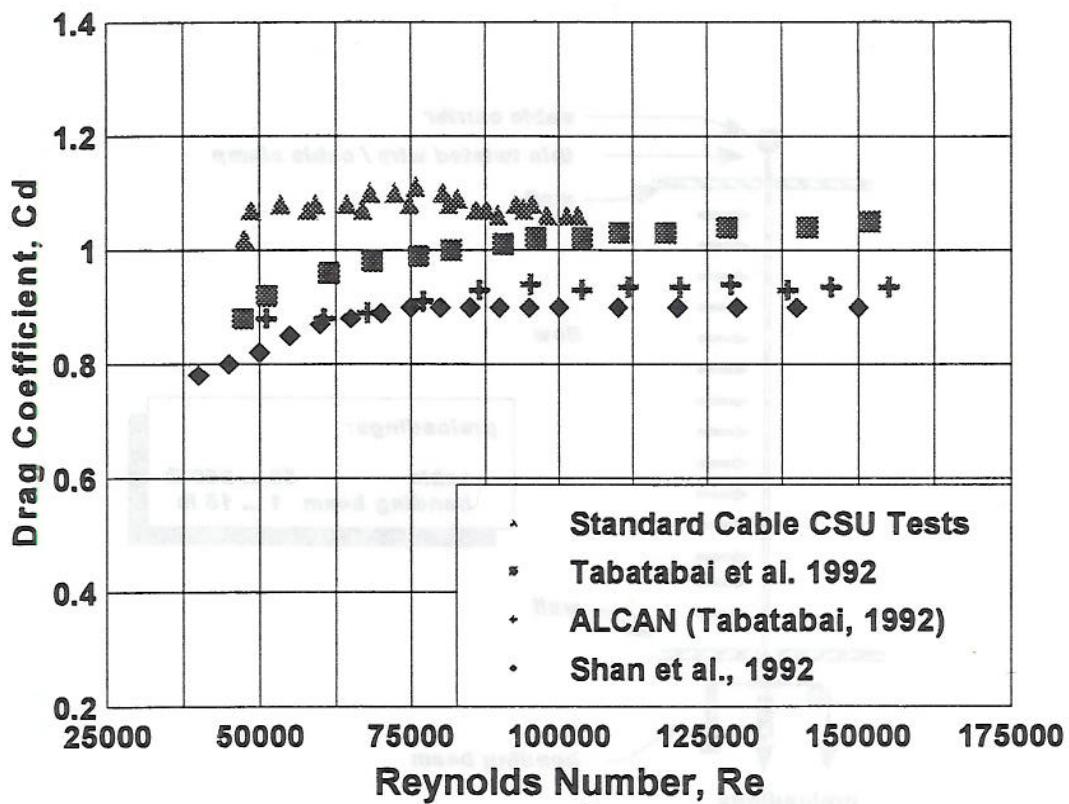


Figure 6: Comparison - results conventional cable with other authors.

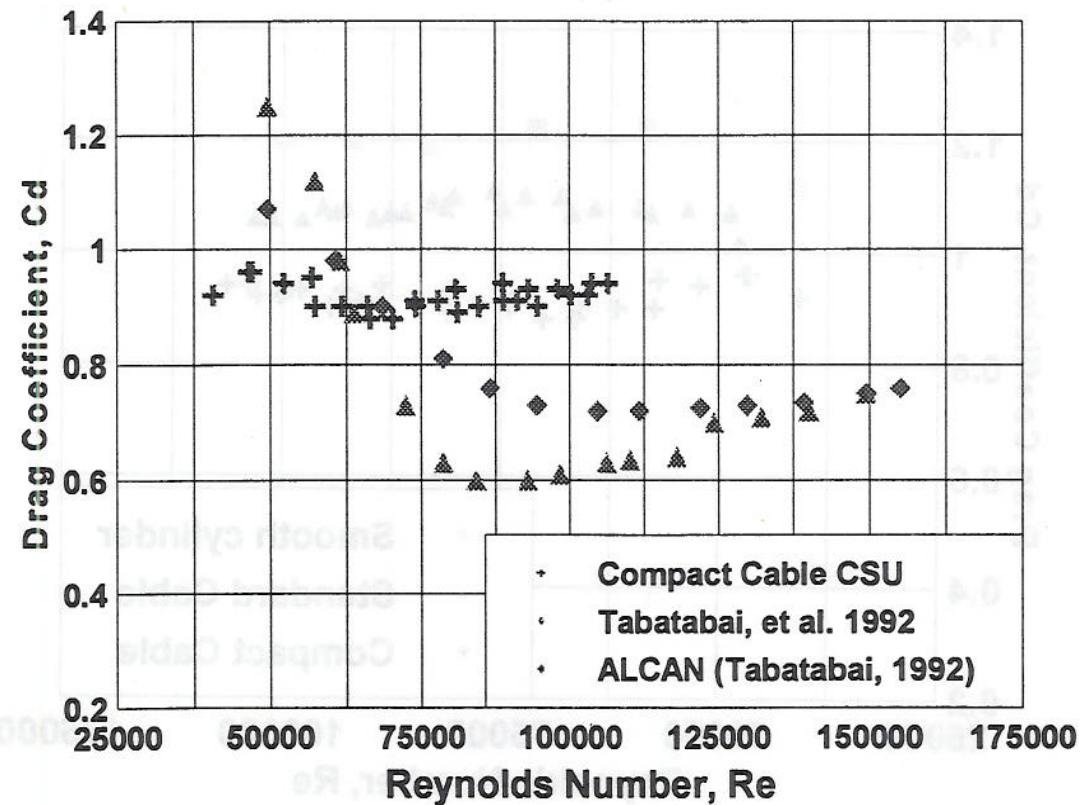


Figure 7: Comparison - compact cable results with other authors.