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EFFECTS OF SPANWISE BLOWING ON THE SURFACE PRESSURE DISTRIBUTIONS AND VORTEX-LIFT CHARACTERISTICS OF A TRAPEZOIDAL WING-STRAKE CONFIGURATION	February 1979
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15. Supplementary Notes

James F. Campbell: Langley Research Center
Gary E. Erickson: Northrop Corporation, Hawthorne, California

16. Abstract

The present investigation was conducted to measure the effects of spanwise blowing on the surface pressures of a 44° swept trapezoidal wing-strake configuration. Wind-tunnel data were obtained at a free-stream Mach number of 0.26 for a range of model angle of attack, jet thrust coefficient, and nozzle chordwise location. Results of this study showed that spanwise blowing delayed the leading-edge vortex breakdown to larger span distances and increased the lifting pressures. Vortex lift was achieved at span stations immediately outboard of the strake-wing junction with no blowing, but spanwise blowing was necessary to achieve vortex lift at increased span distances. Blowing on the wing in the presence of the strake was not as effective as blowing on the wing alone. Spanwise blowing increased lift throughout the angle-of-attack range, improved the drag polars, and extended the linear pitching moment to higher values of lift. The leading-edge suction analogy can be used to estimate the effects of spanwise blowing on the aerodynamic characteristics.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Spanwise blowing Vortex lift Wing-strake configuration Pressure distributions	Unclassified - Unlimited Subject Category 02

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	69	$5.25

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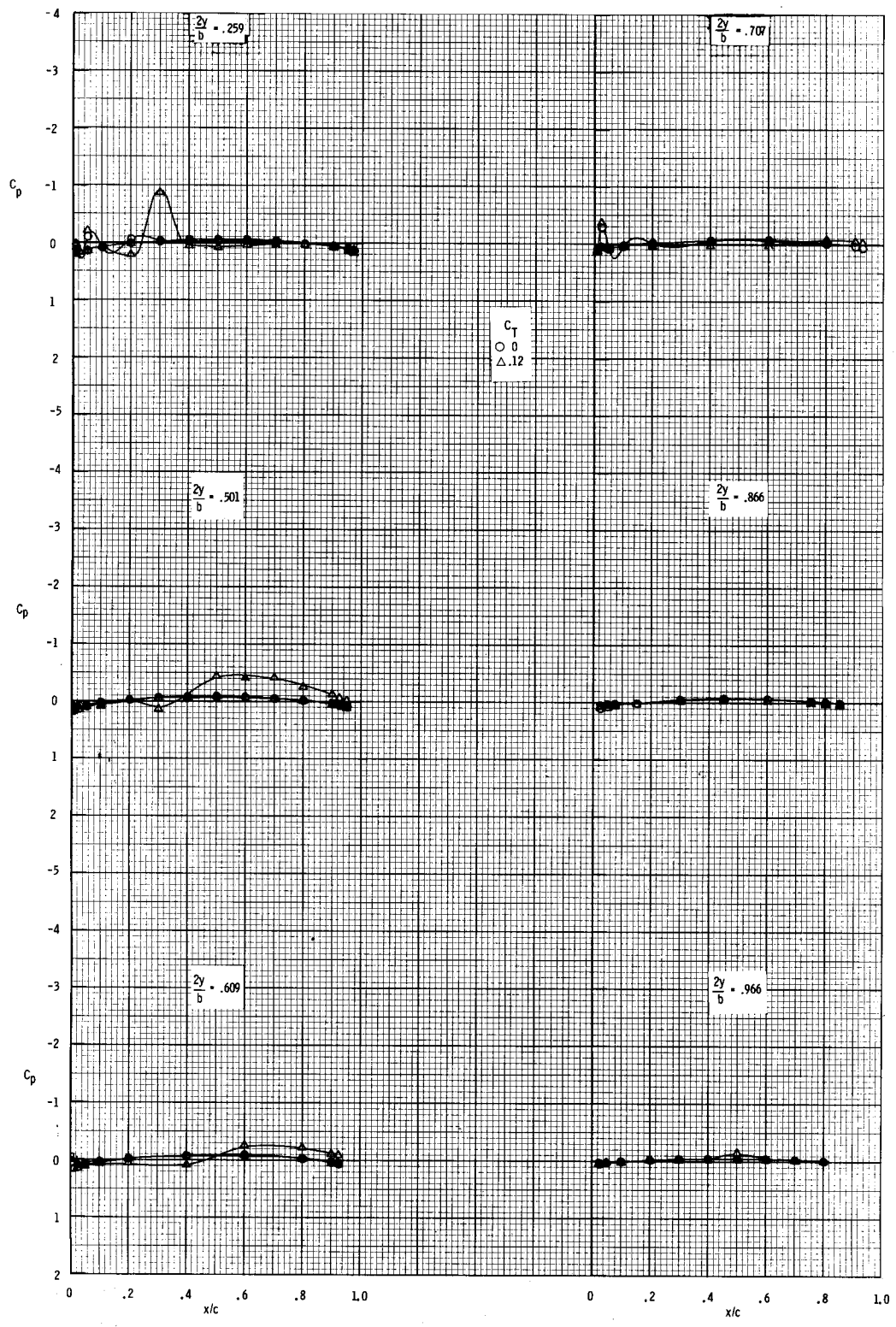
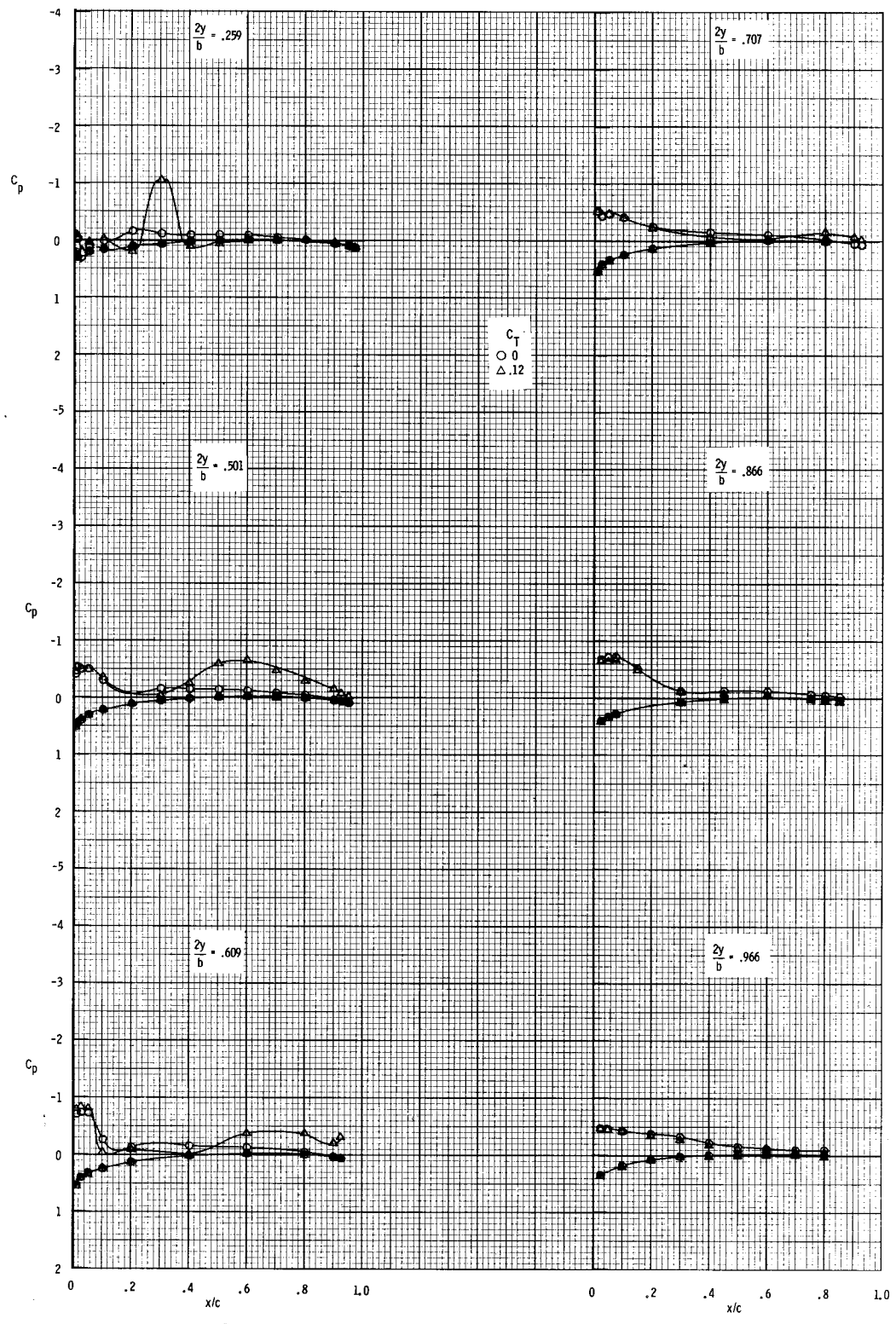


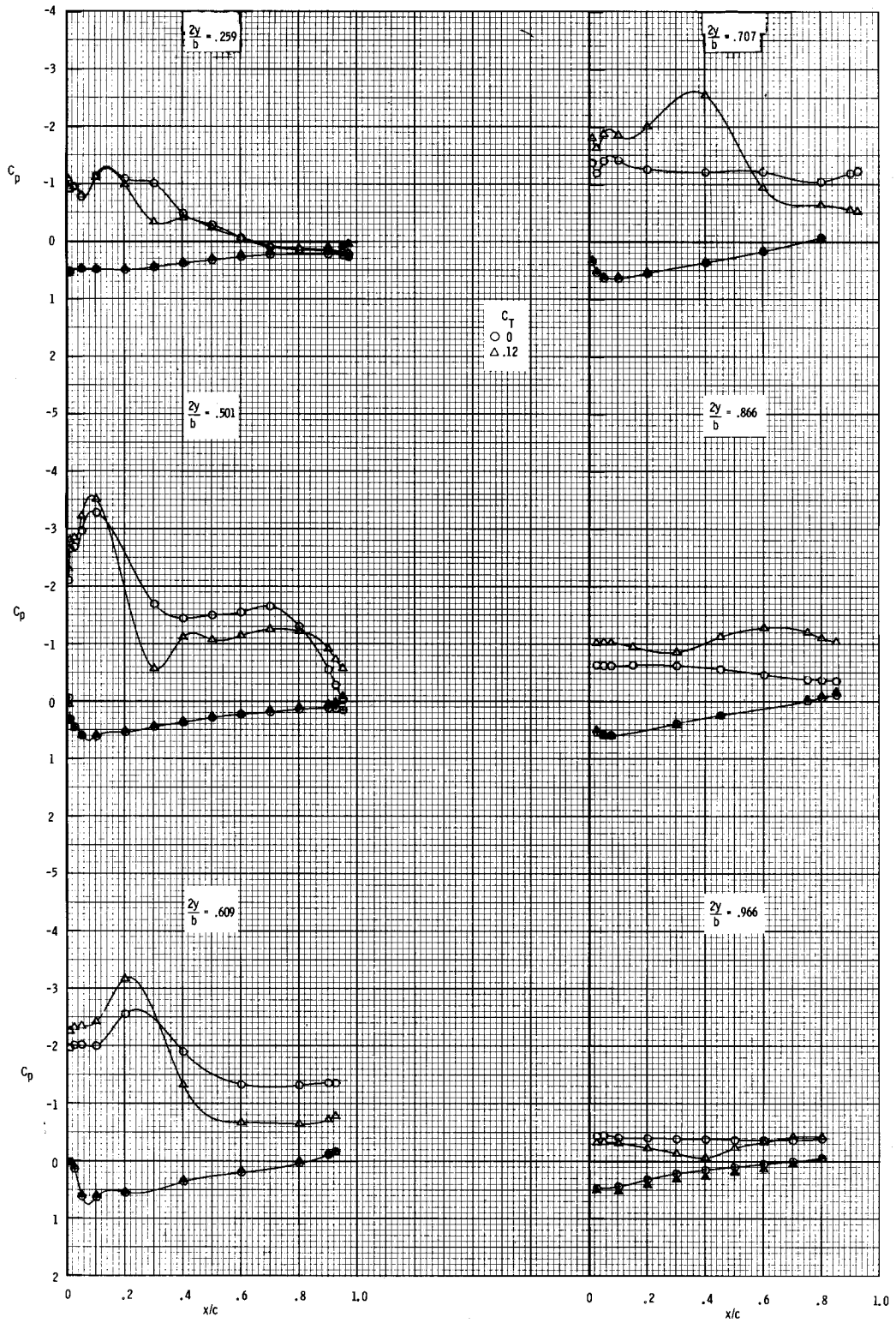
(a) $\alpha = 0^{\circ}$.

Figure 7.- Effect of spanwise blowing on chordwise distributions of C_p for a range of α with strake on. $x_n/c_r = 0.23$.



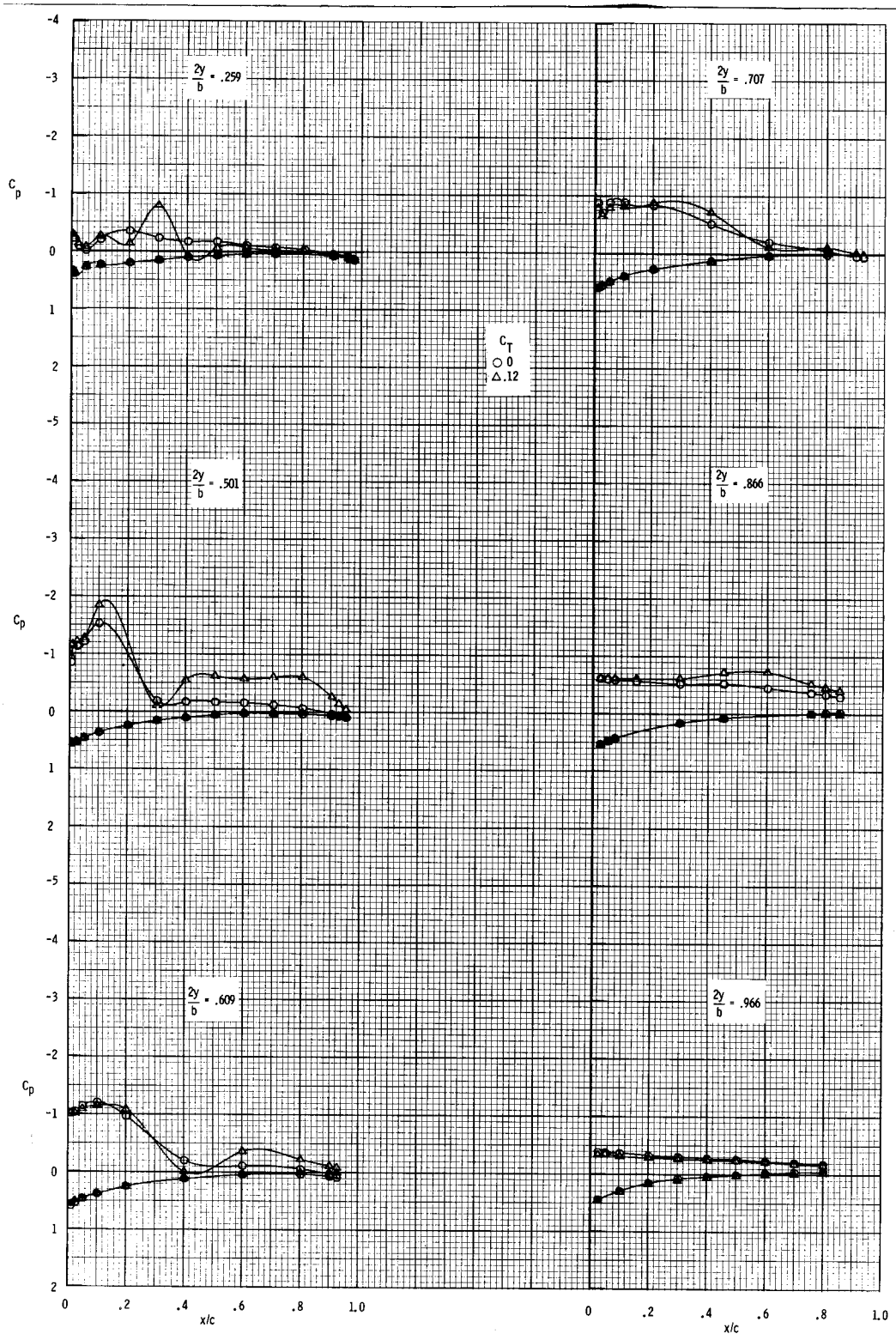
(b) $\alpha = 4.0^{\circ}$.

Figure 7.- Continued.



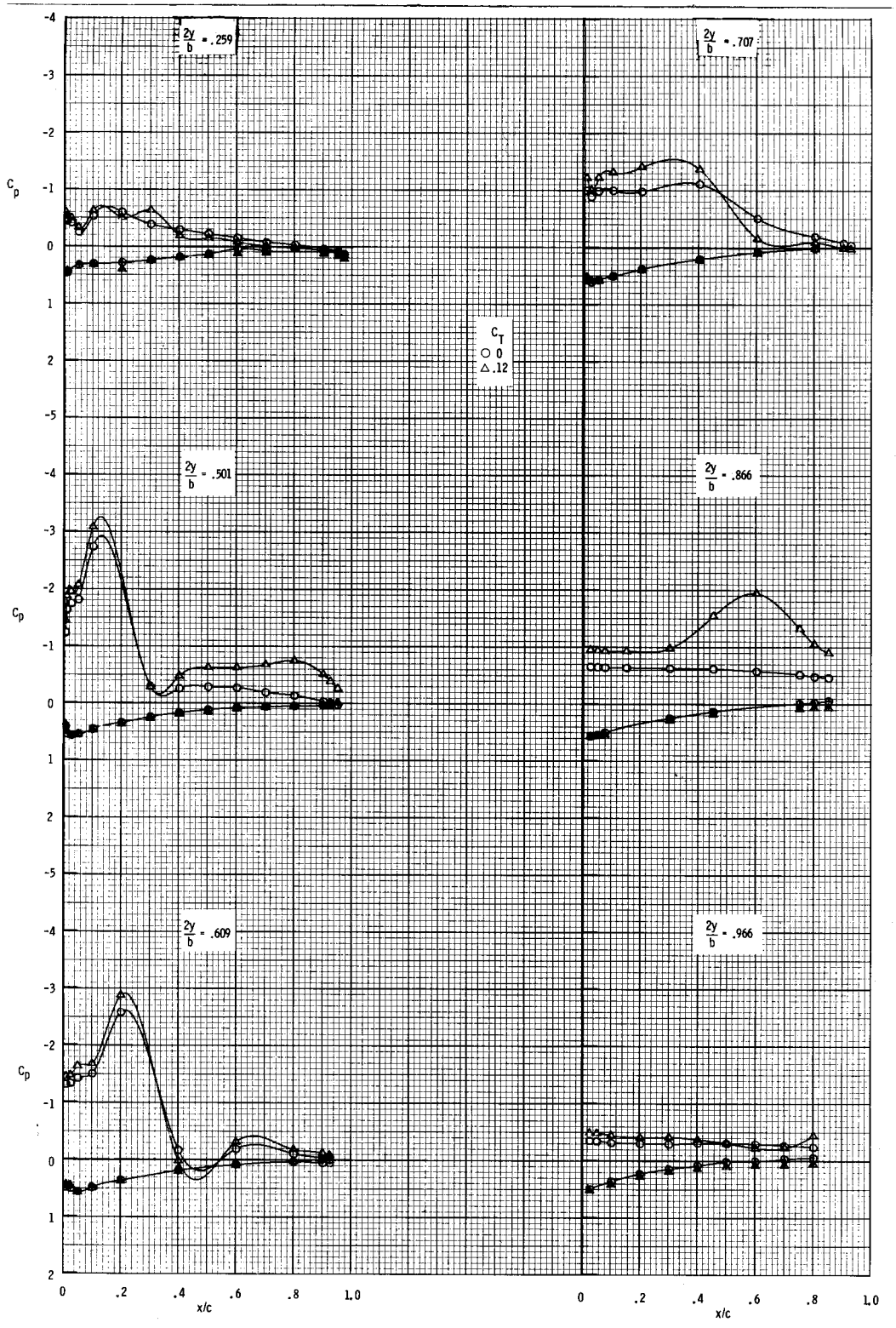
(f) $\alpha = 20.8^{\circ}$.

Figure 7.- Continued.



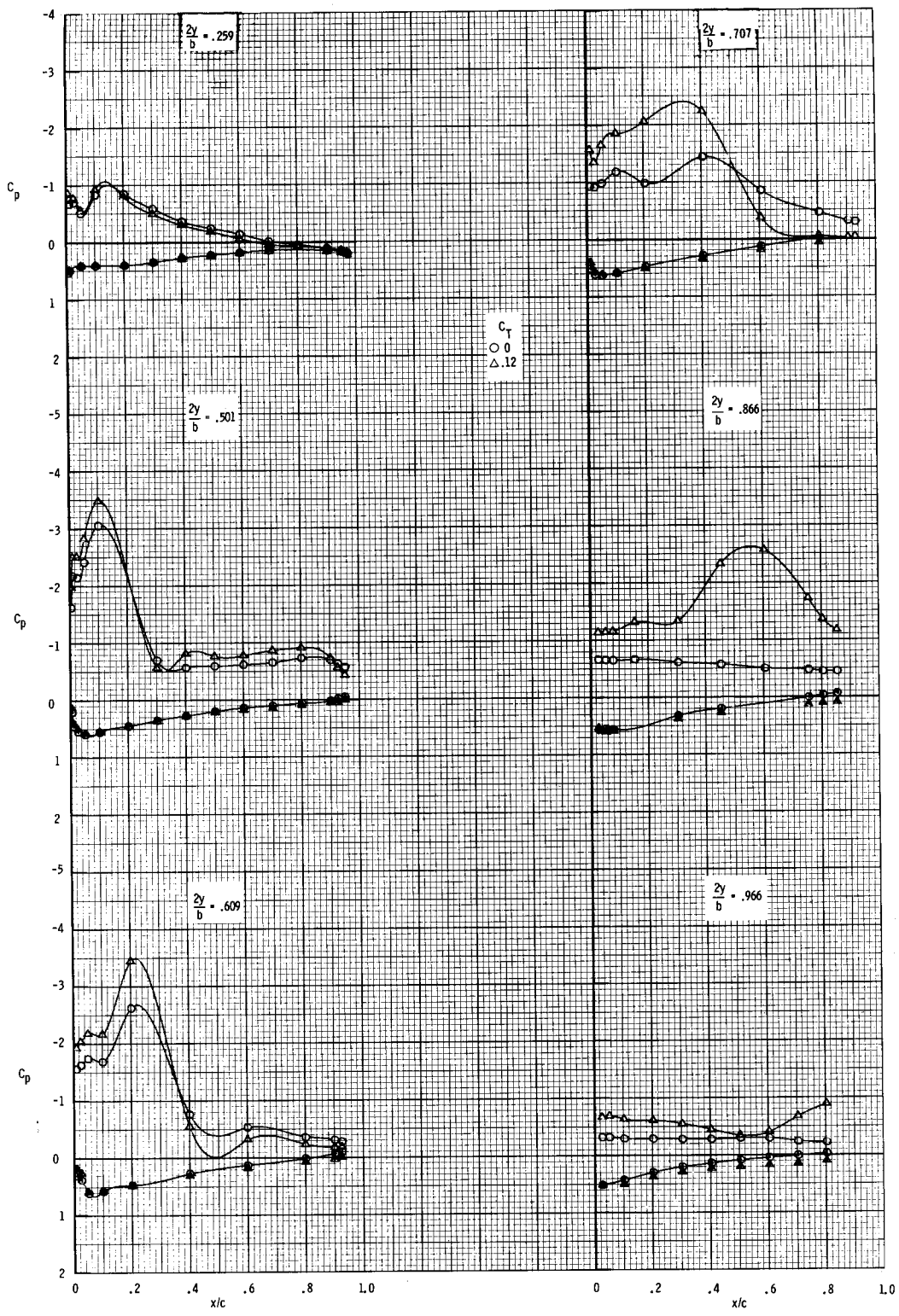
(c) $\alpha = 8.1^{\circ}$.

Figure 7.- Continued.



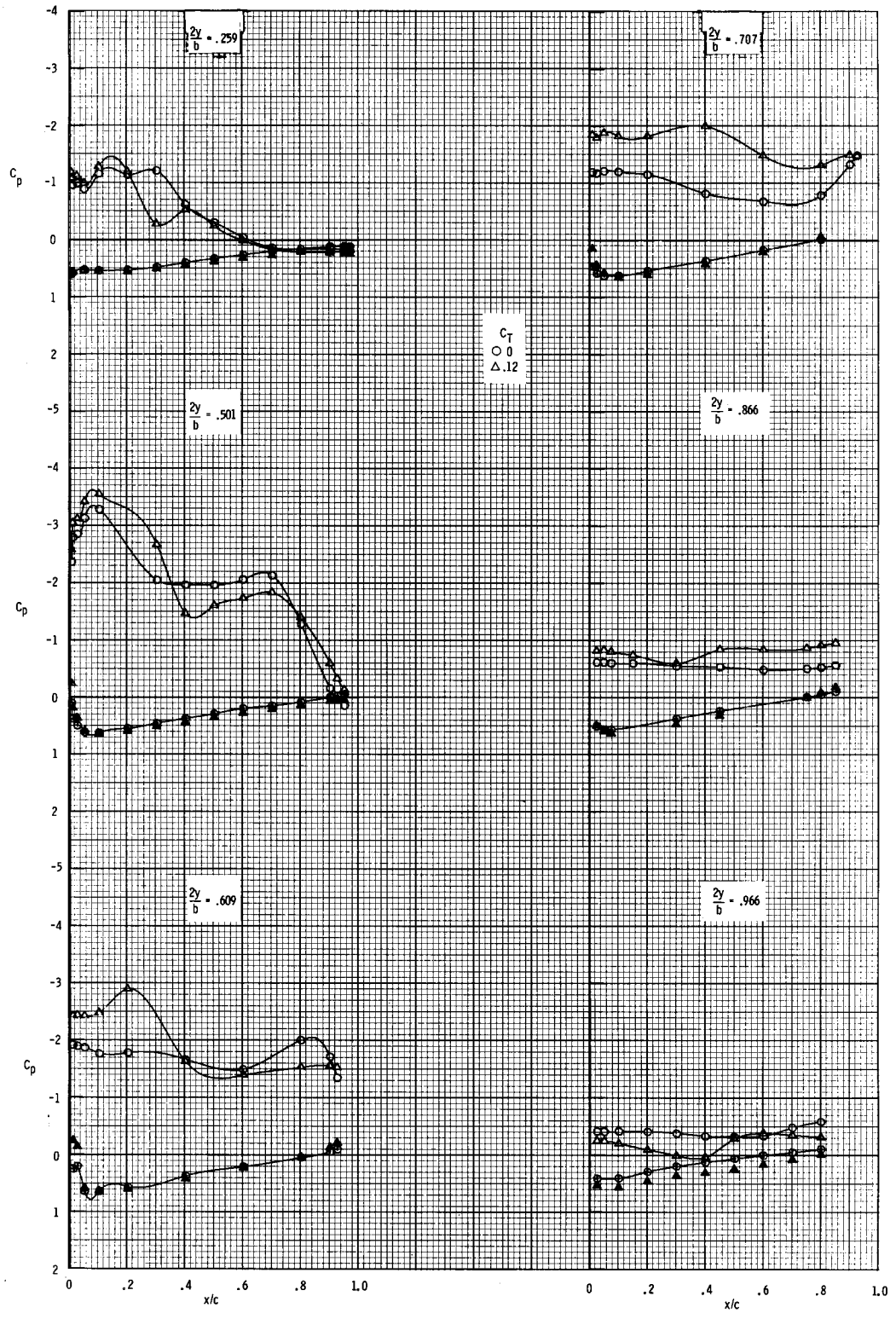
(d) $\alpha = 12.4^{\circ}$.

Figure 7.- Continued.



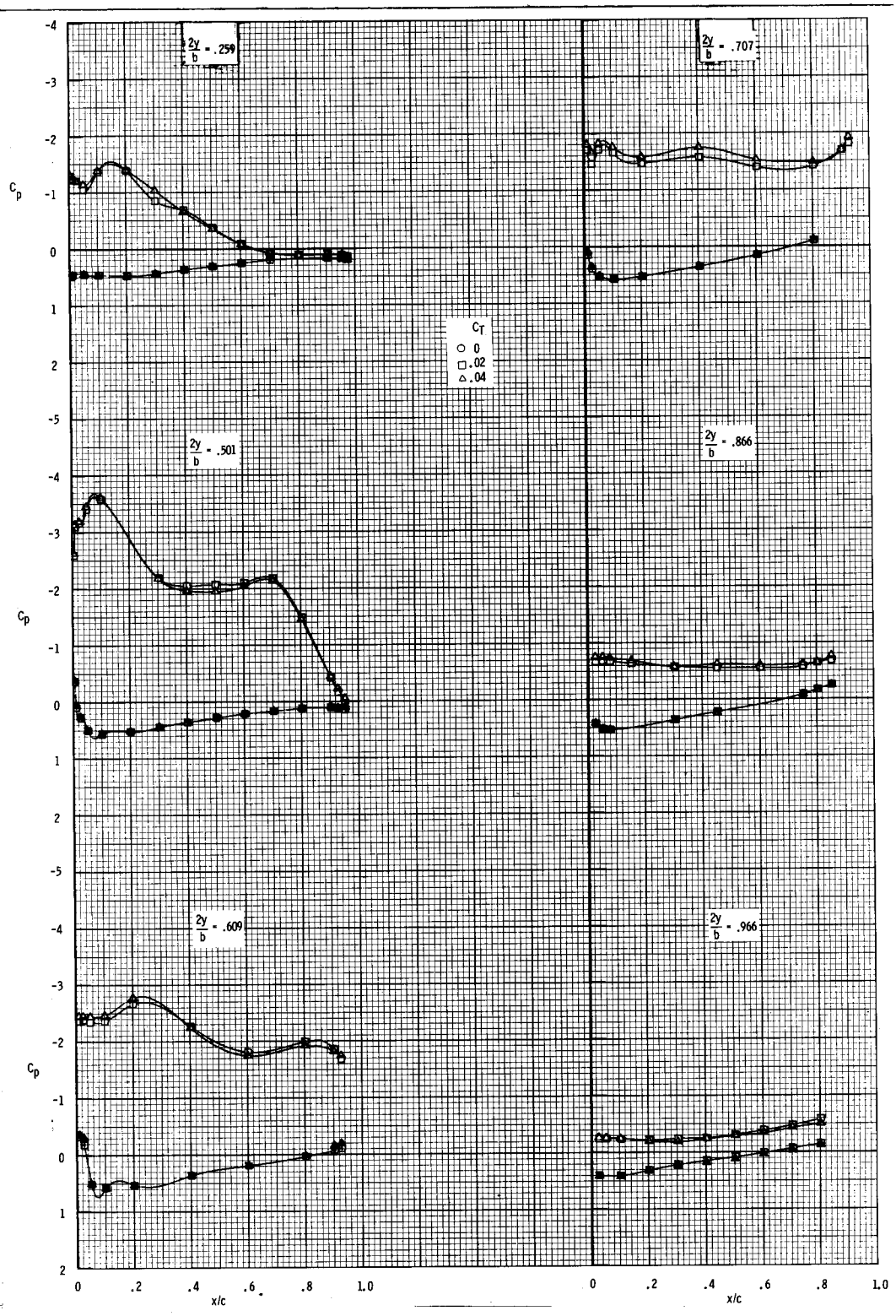
(e) $\alpha = 16.3^{\circ}$.

Figure 7.- Continued.



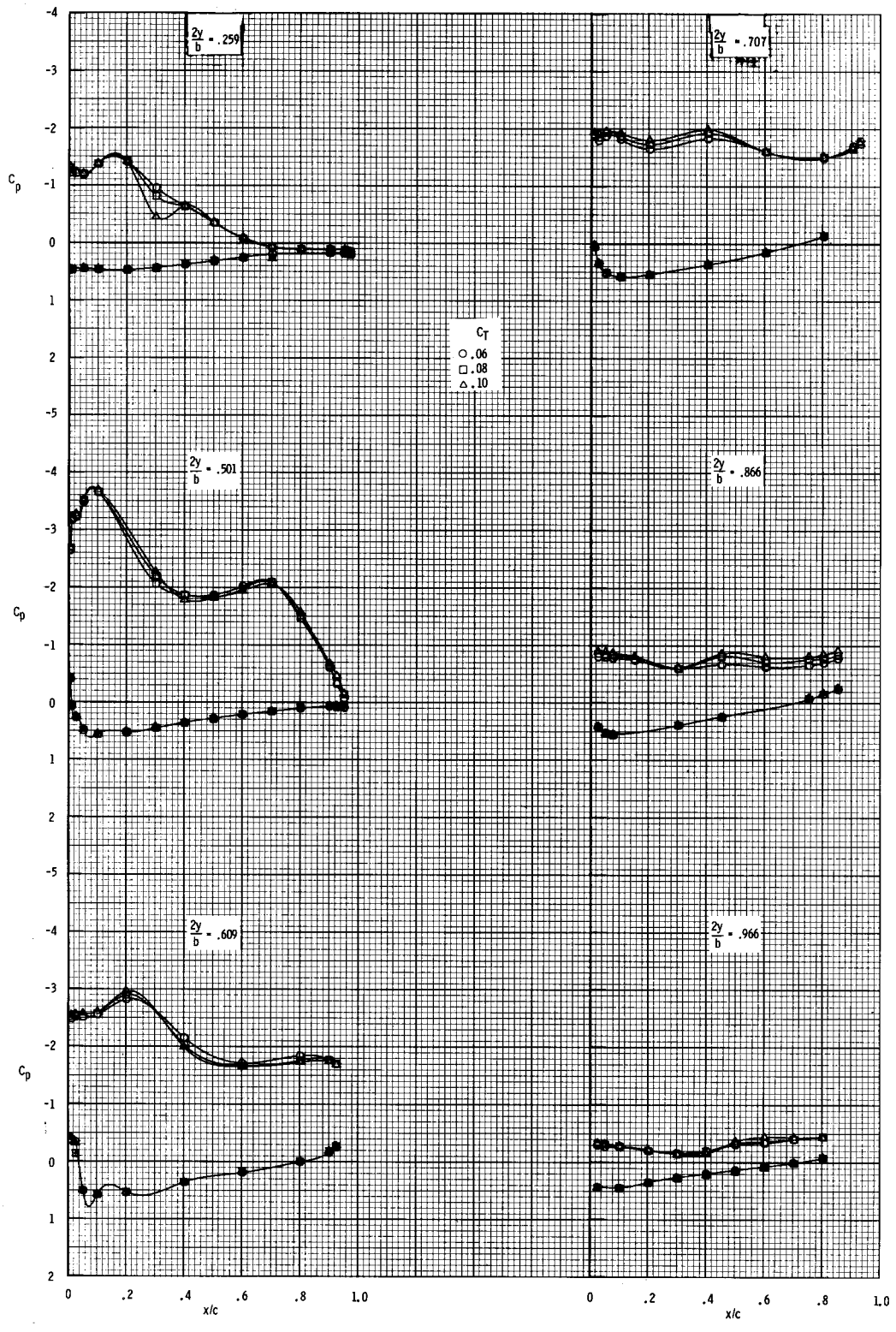
(g) $\alpha = 23.9^{\circ}$.

Figure 7.- Concluded.



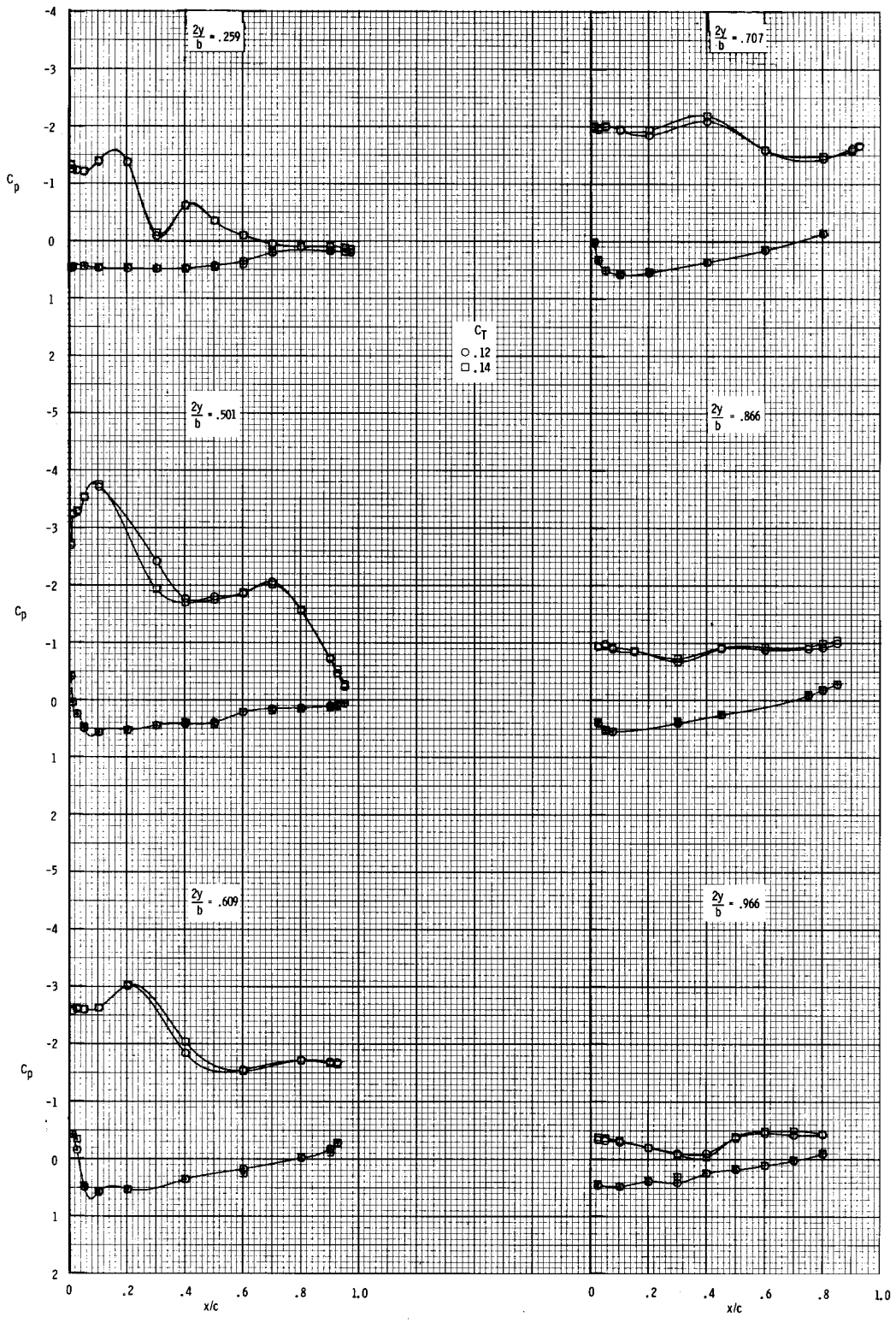
(a) C_T = 0, 0.02, and 0.04.

Figure 8.- Effect of C_T on chordwise distributions of C_p for $\alpha \approx 24^o$ with strake on. x_n/c_r = 0.23.



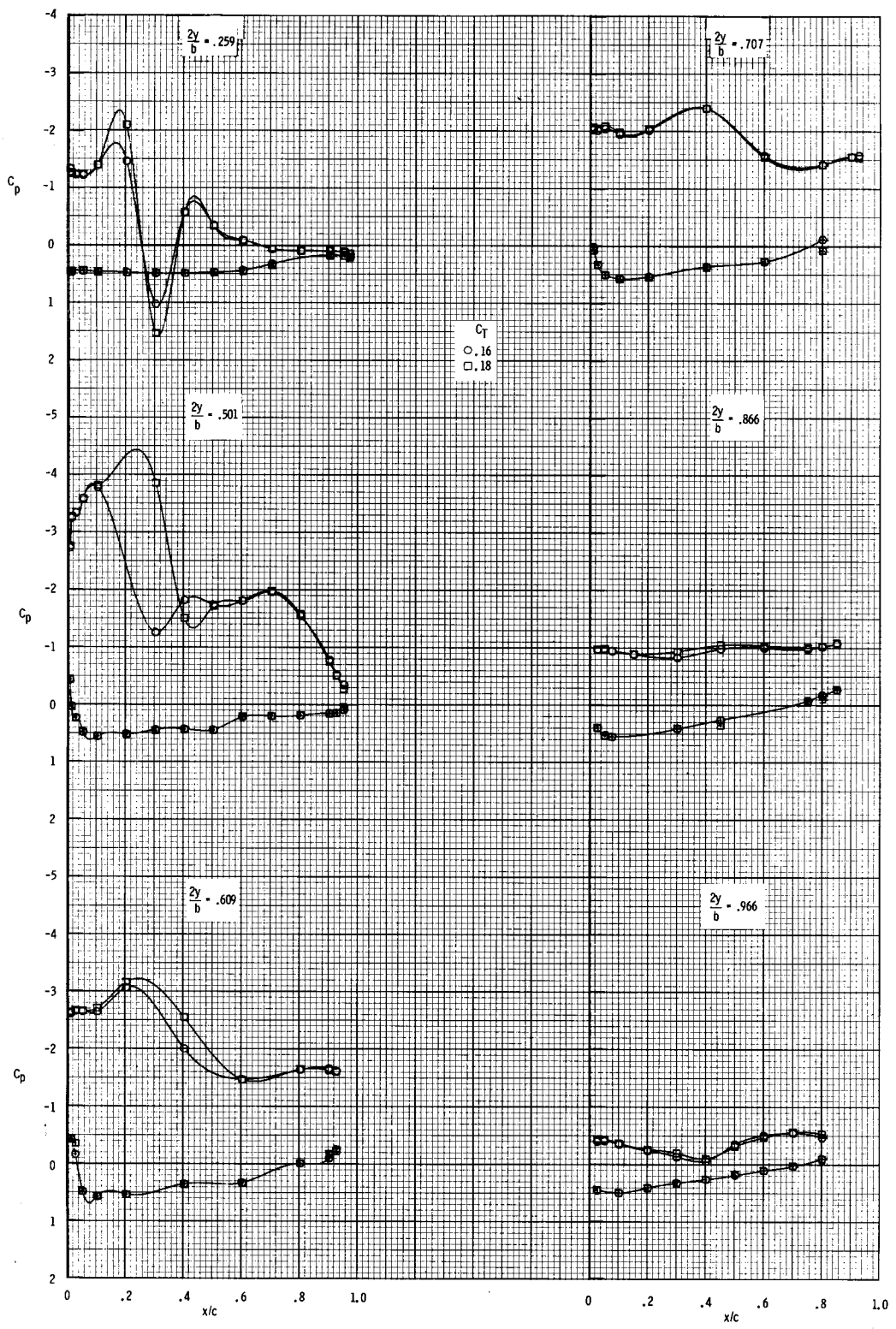
(b) C_T = 0.06, 0.08, and 0.10.

Figure 8.- Continued.



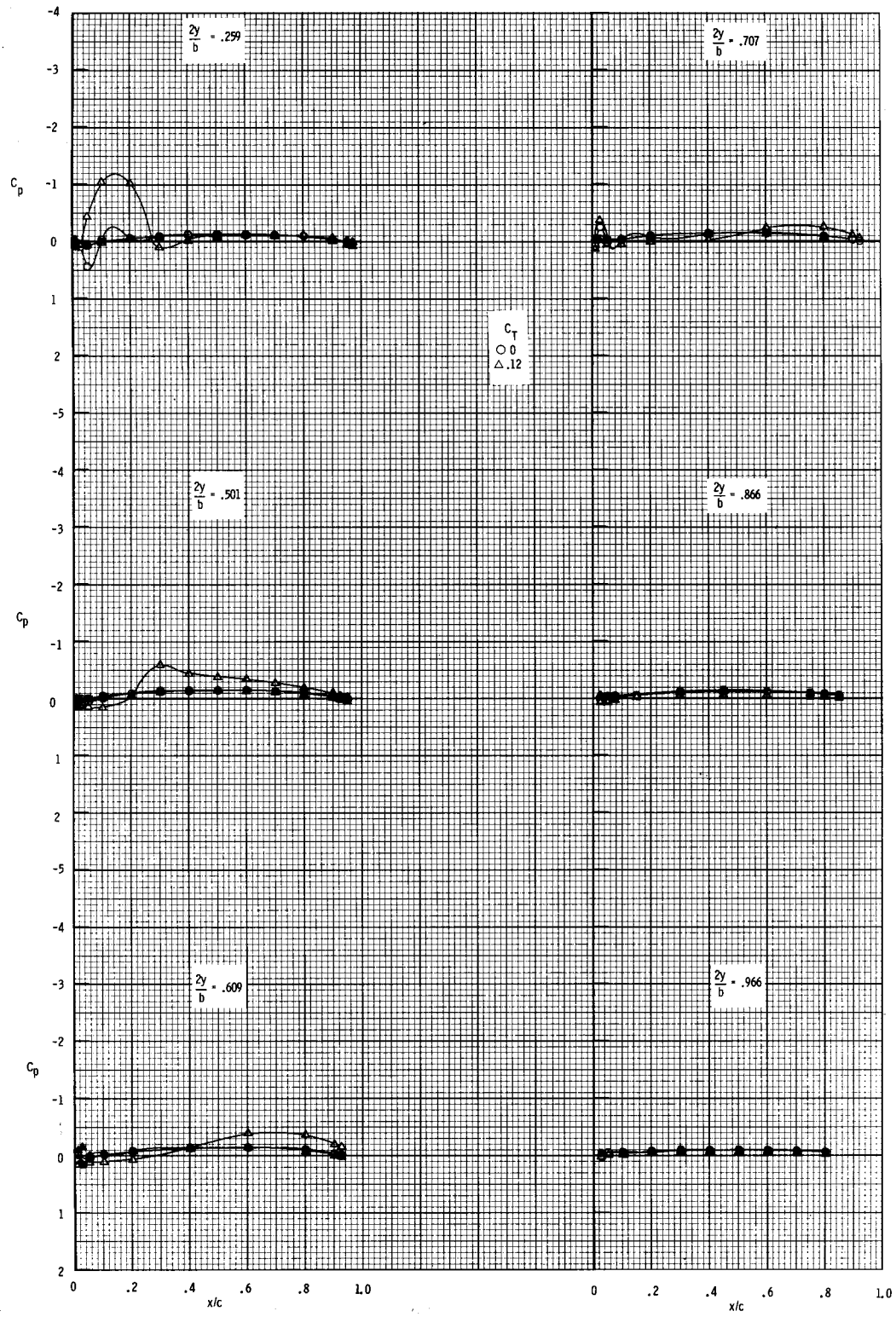
(c) C_T = 0.12 and 0.14.

Figure 8.- Continued.



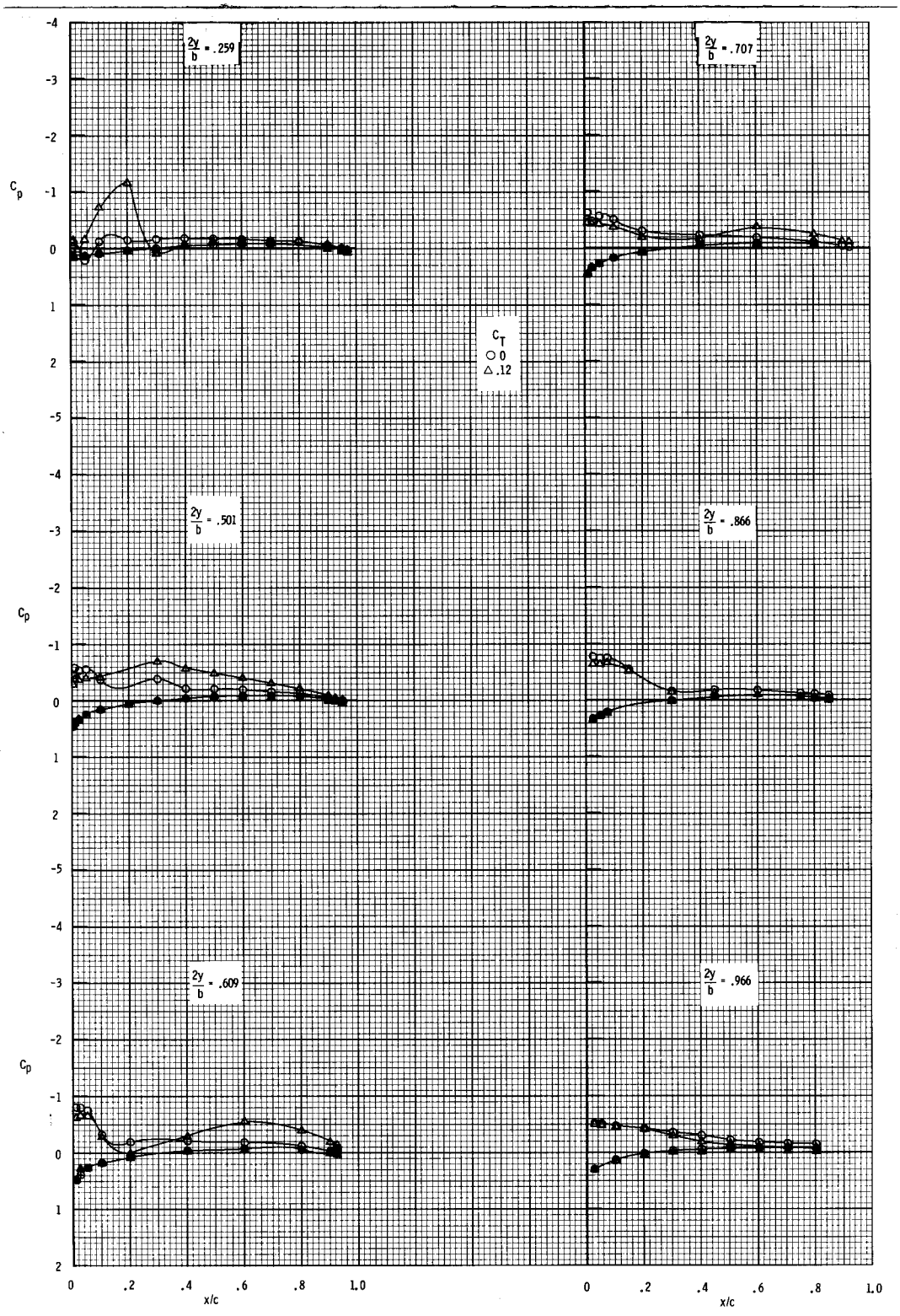
(d) C_T = 0.16 and 0.18.

Figure 8.- Concluded.



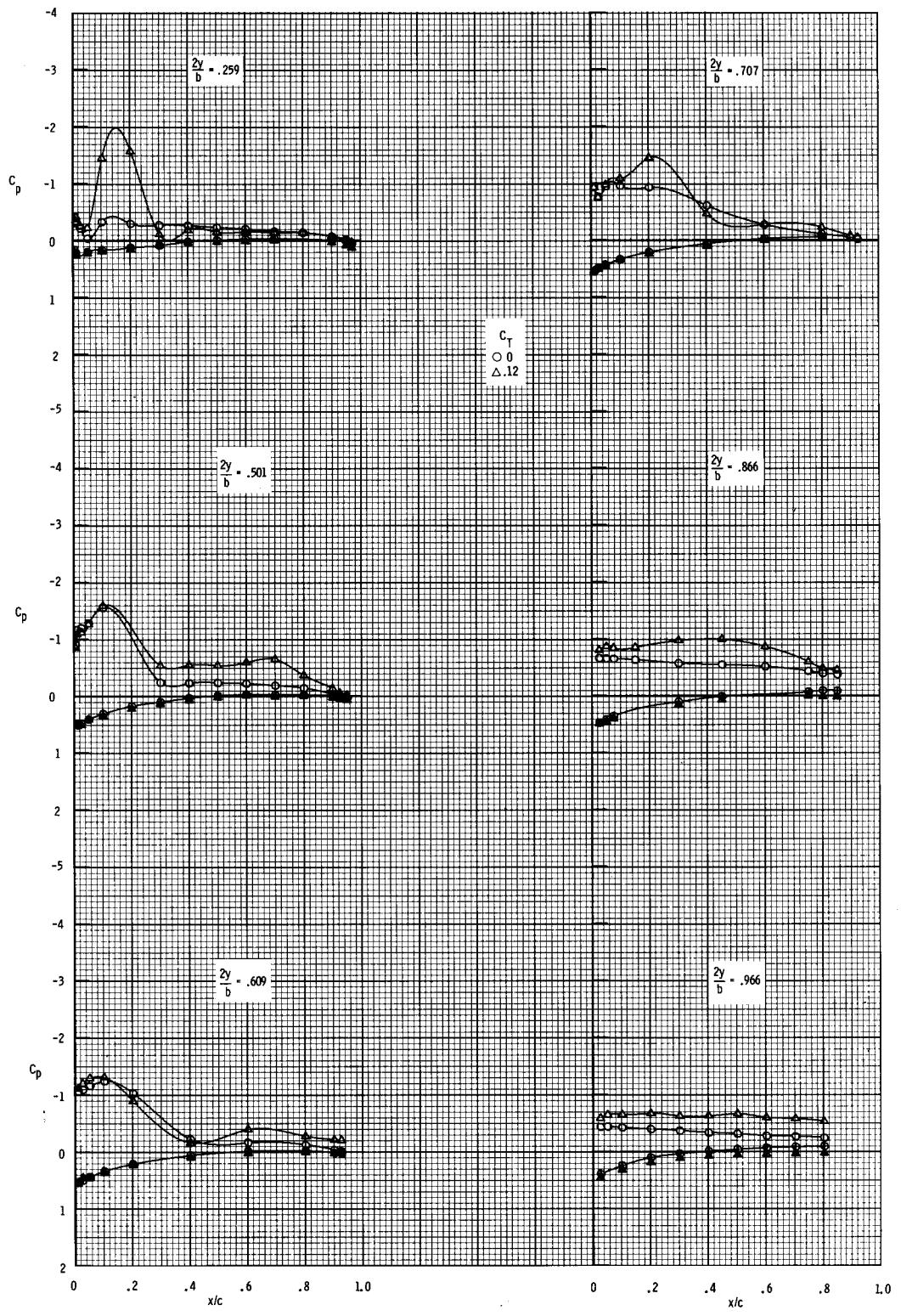
(a) $\alpha = 0^{o}$.

Figure 9.- Effect of spanwise blowing on chordwise distributions of C_p for a range of α with strake on. $x_n/c_r = 0.15$.



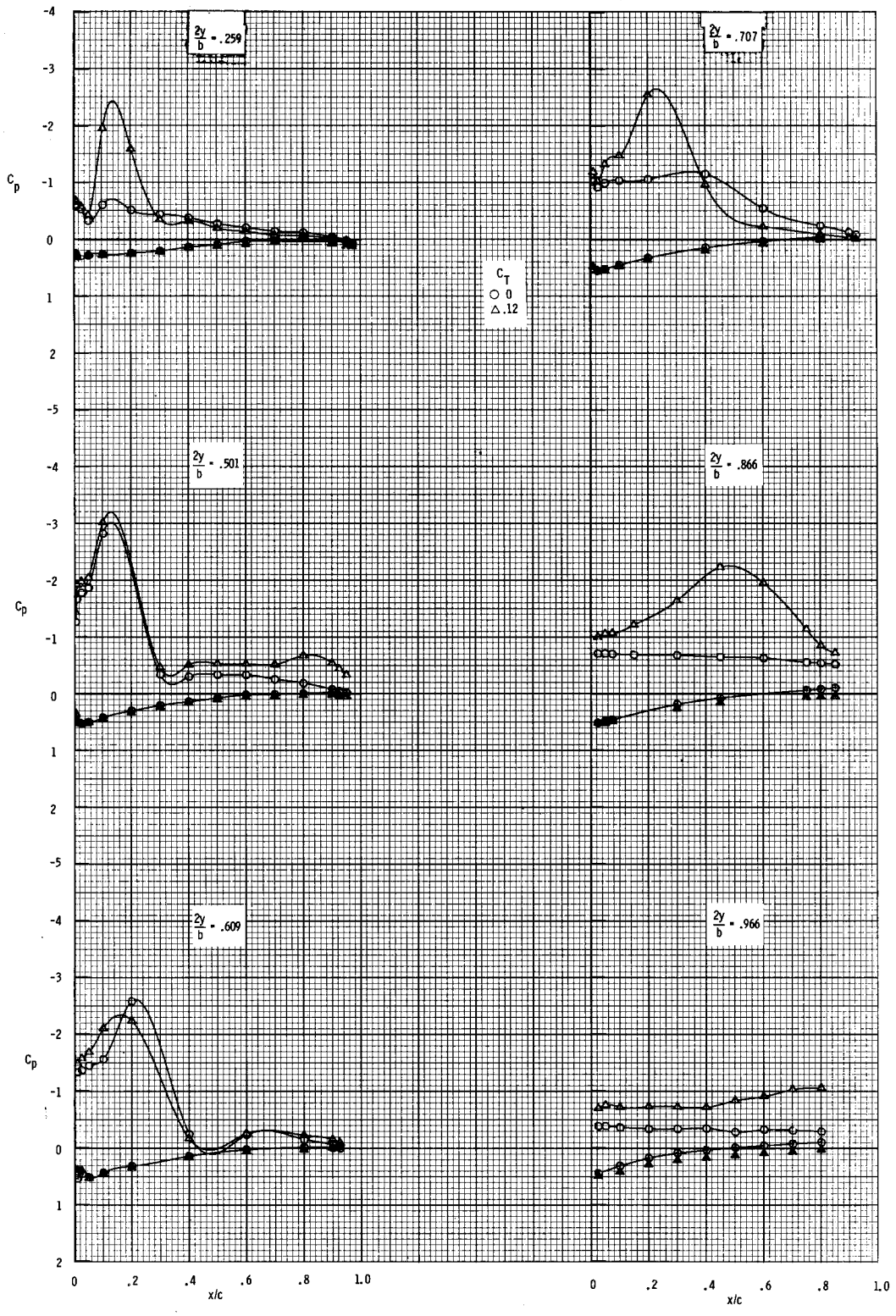
(b) $\alpha = 4.0^{\circ}$.

Figure 9.- Continued.



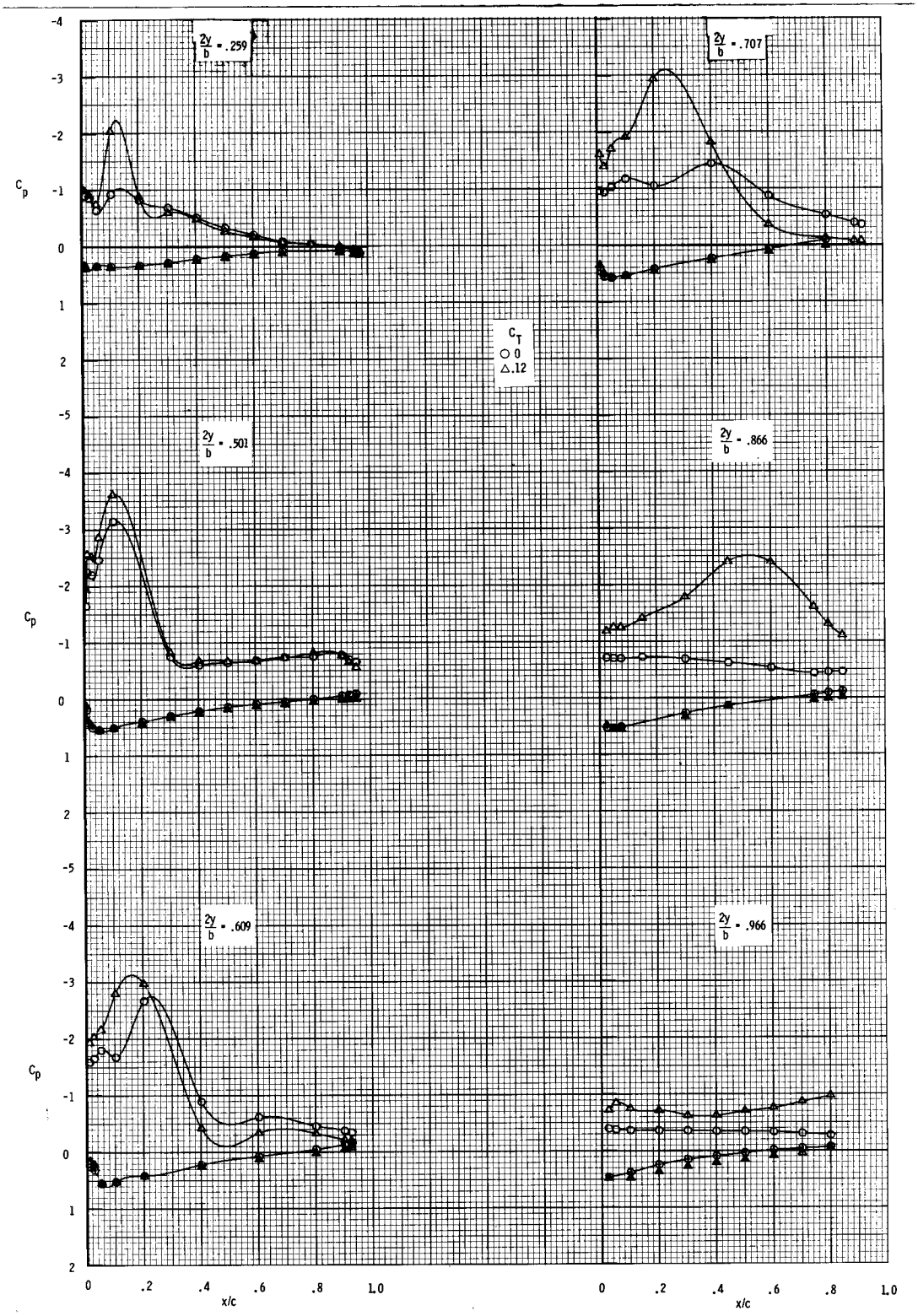
(c) $\alpha = 8.1^{\circ}$.

Figure 9.- Continued.



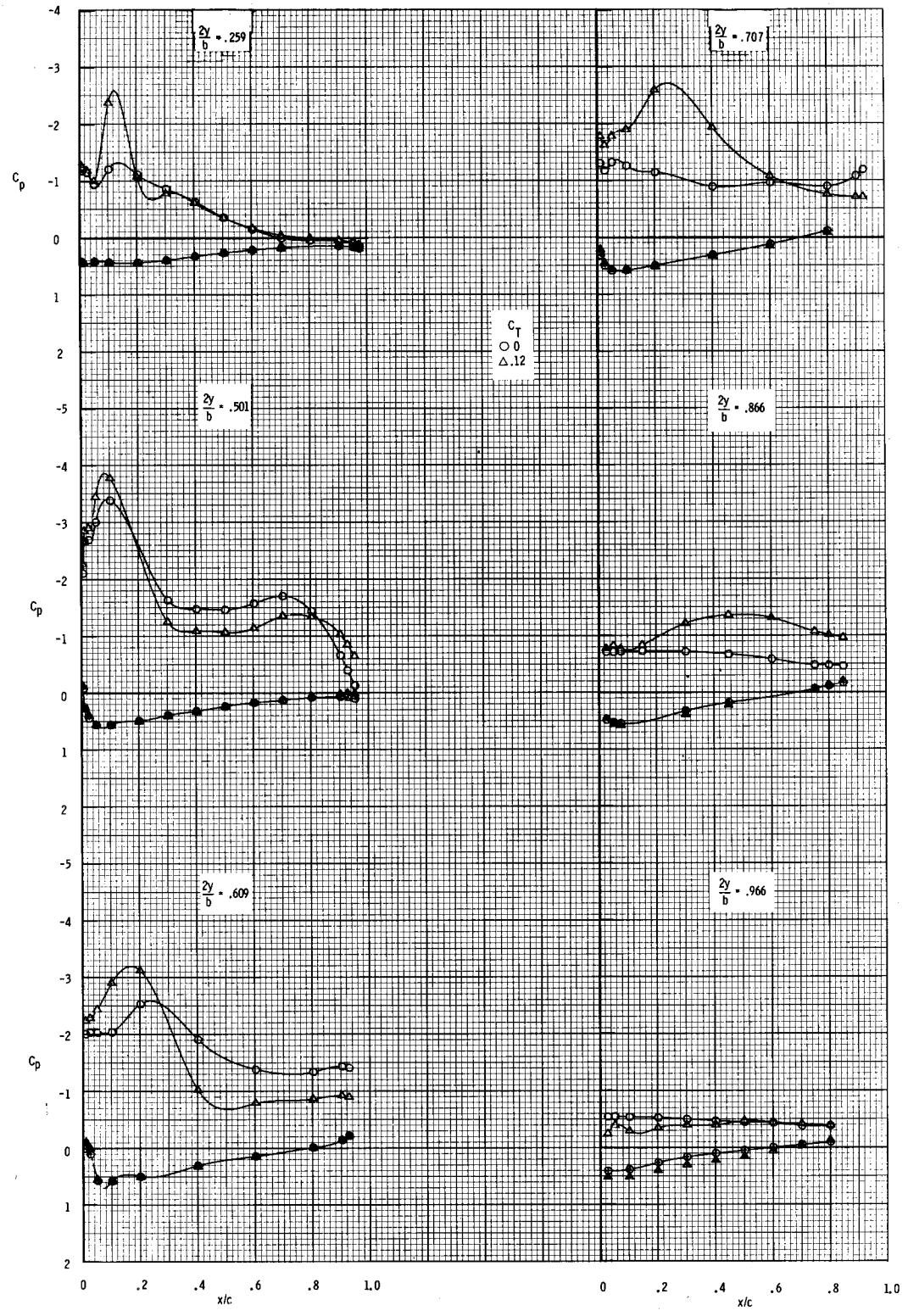
(d) $\alpha = 12.4^{\circ}$.

Figure 9.- Continued.



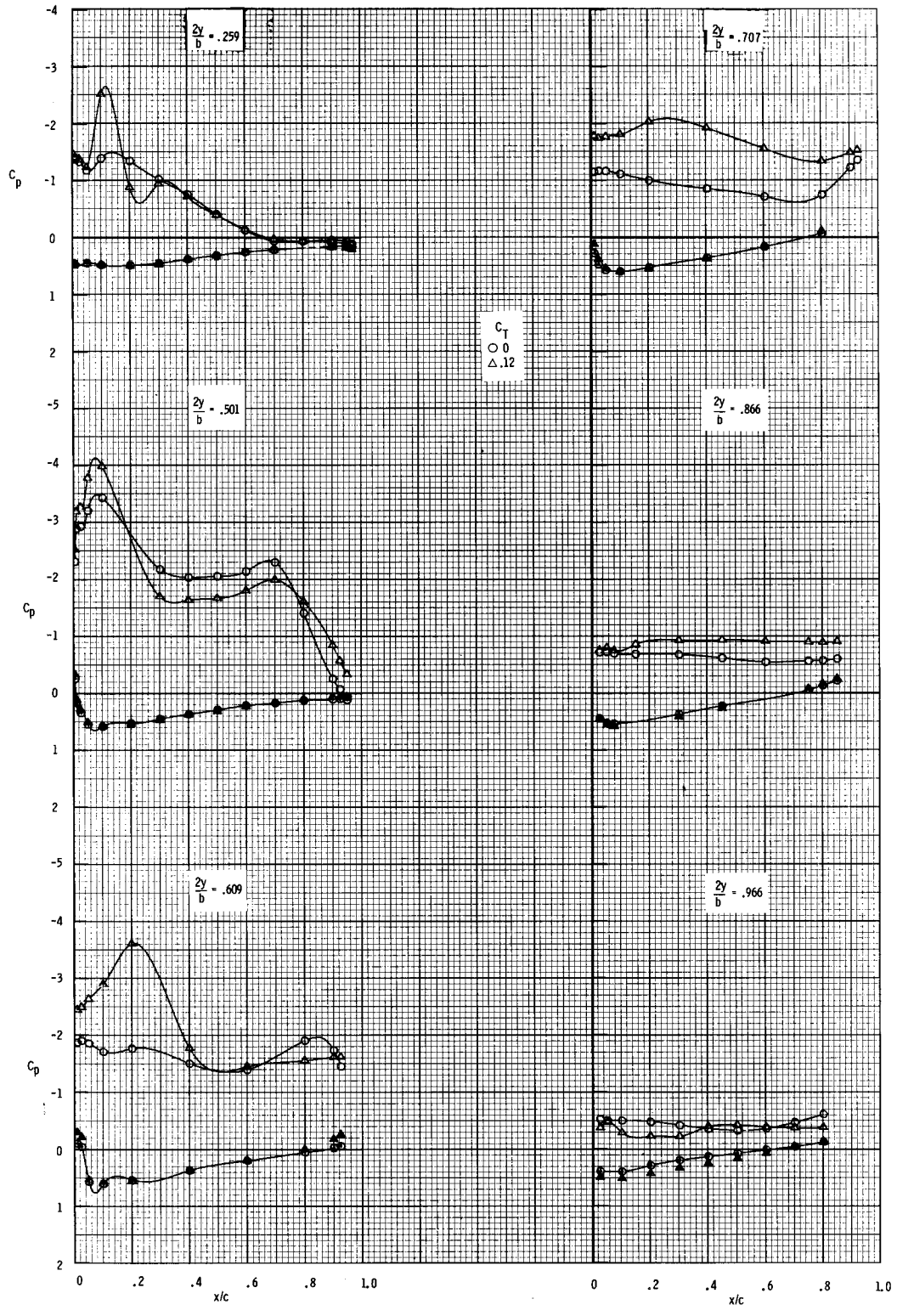
(e) $\alpha = 16.6^{\circ}$.

Figure 9.- Continued.



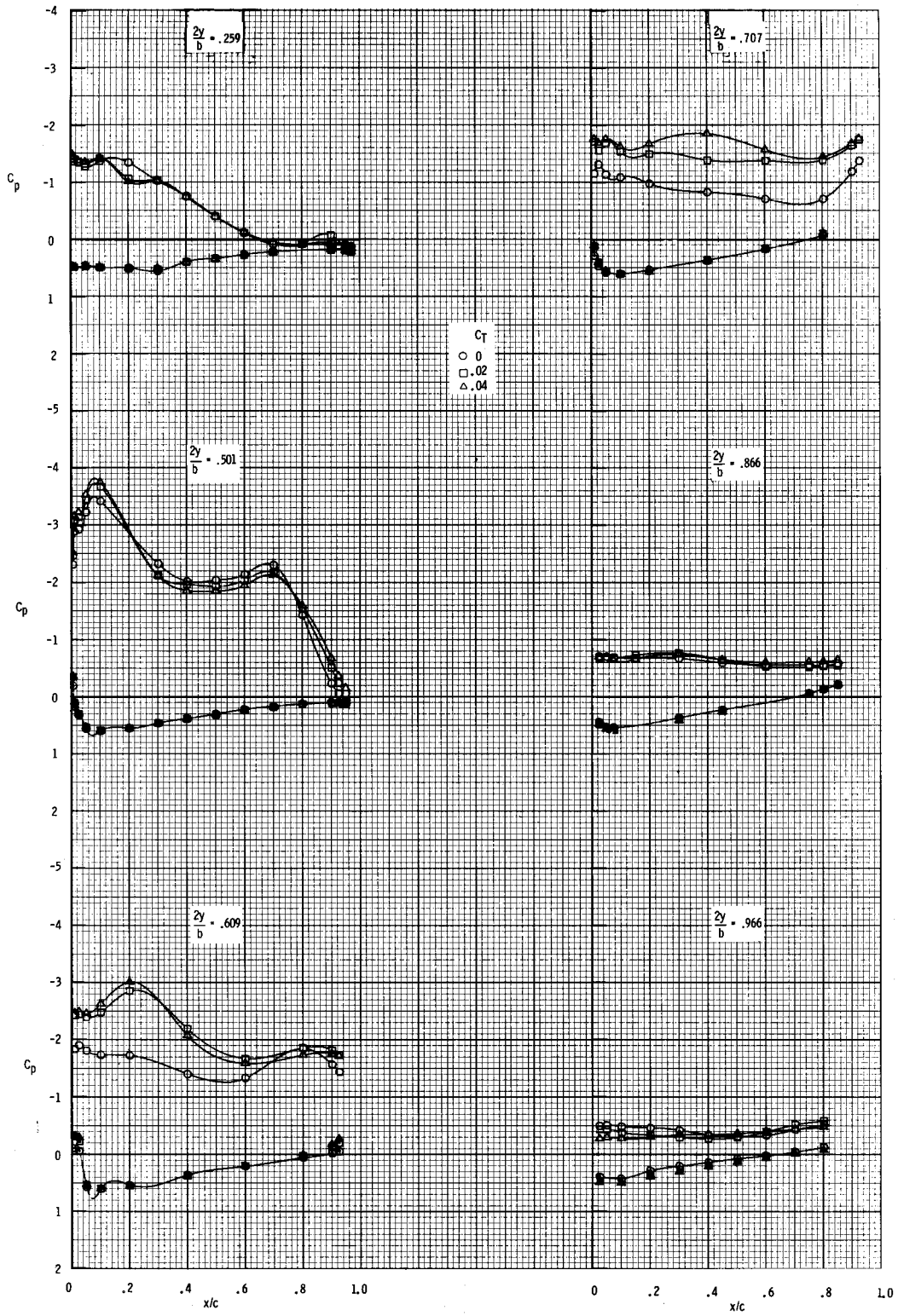
(f) $\alpha = 20.7^{\circ}$.

Figure 9.- Continued.



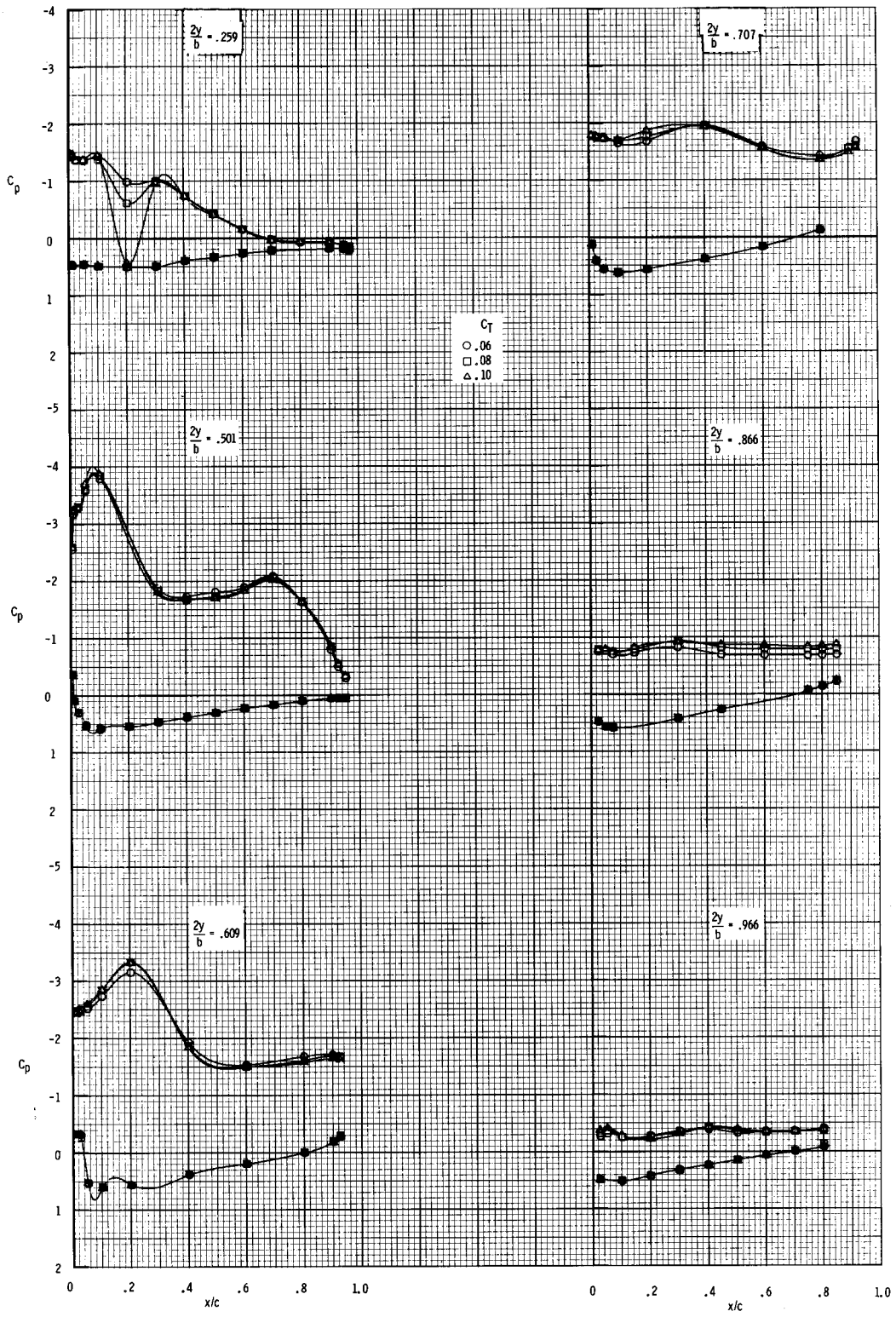
(g) $\alpha = 23.9^{\circ}$.

Figure 9.- Concluded.



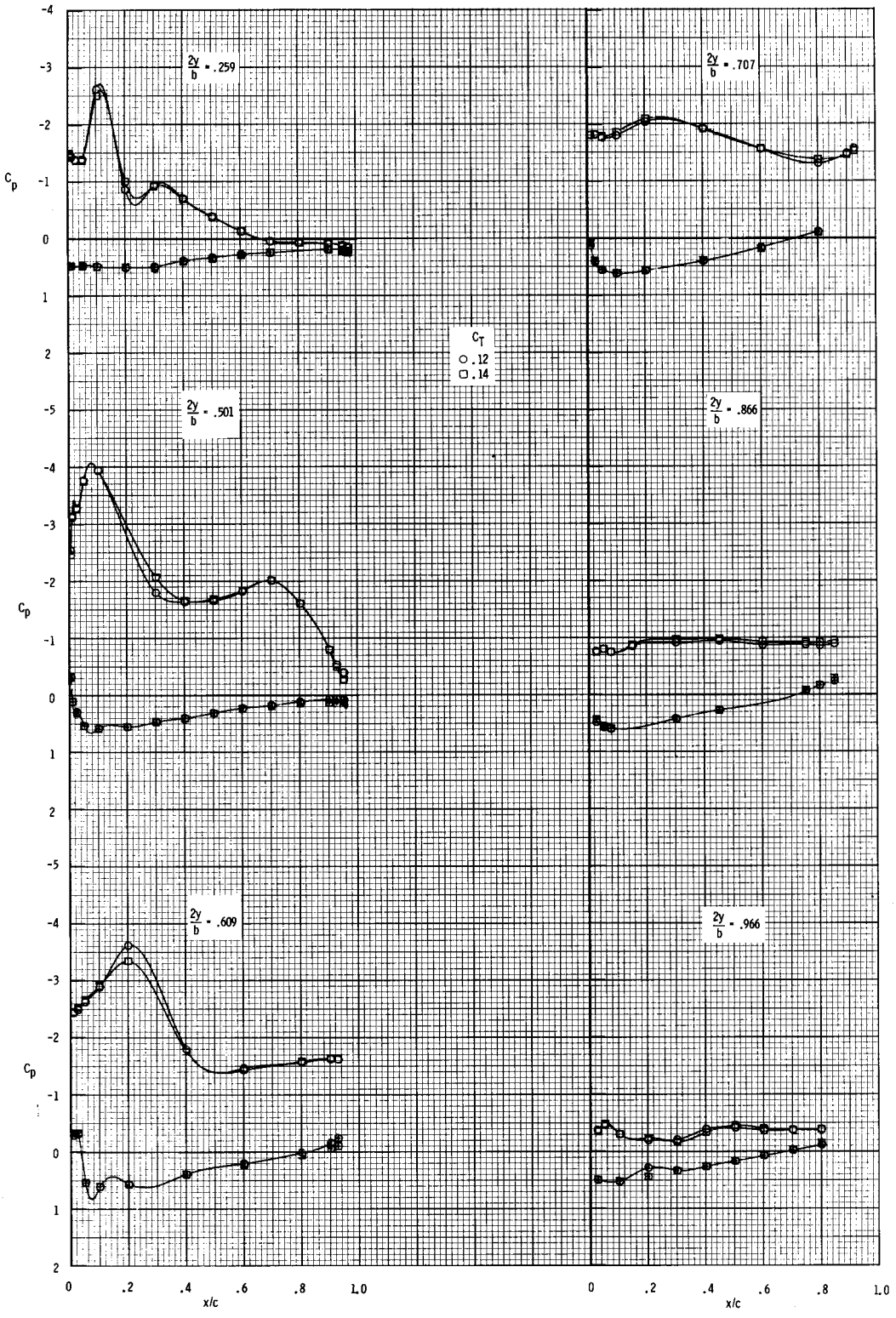
(a) C_T = 0, 0.02, and 0.04.

Figure 10.- Effect of C_T on chordwise distributions of C_p for $\alpha \approx 24^o$ with strake on. x_n/c_r = 0.15.



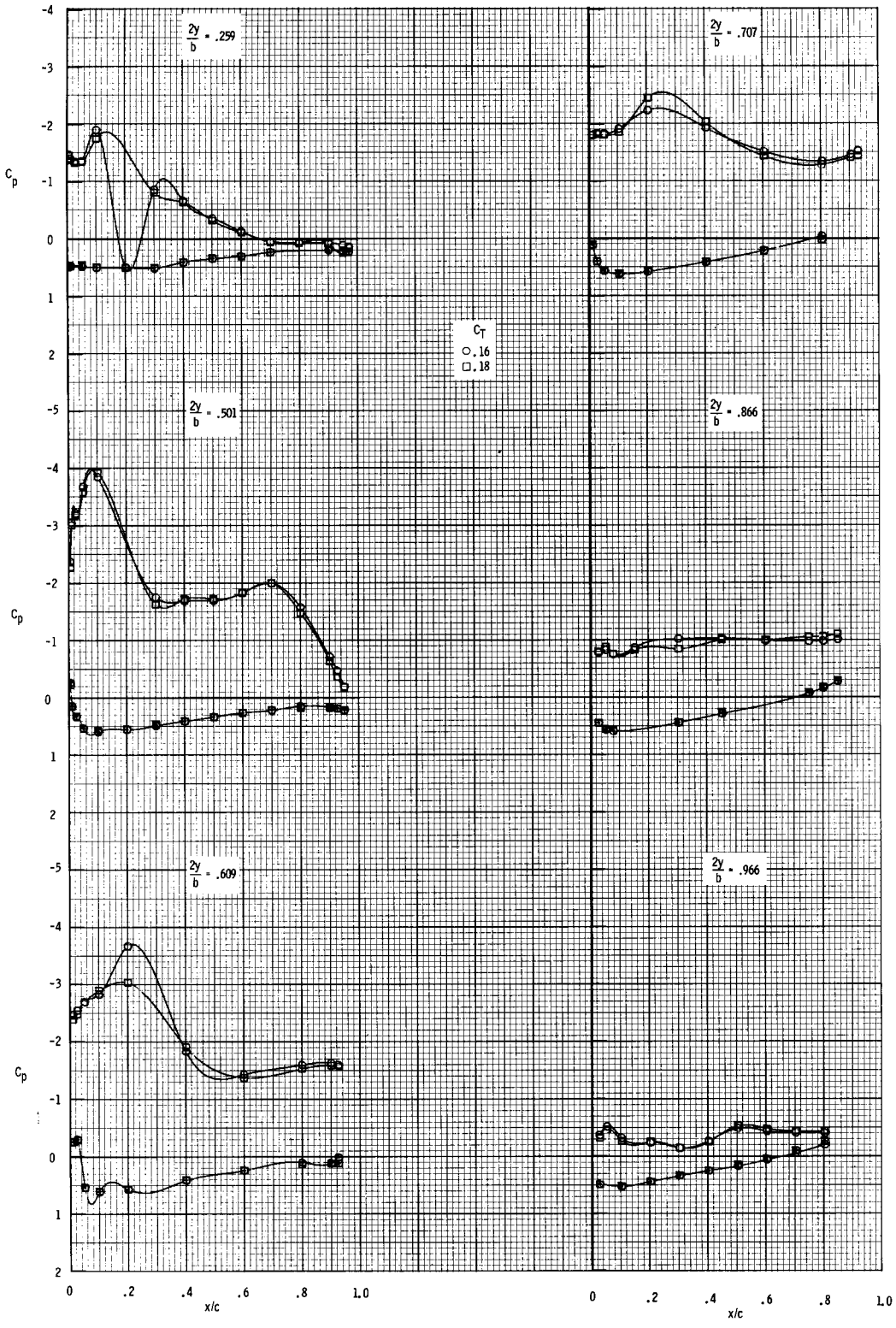
(b) C_T = 0.06, 0.08, and 0.10.

Figure 10.- Continued.



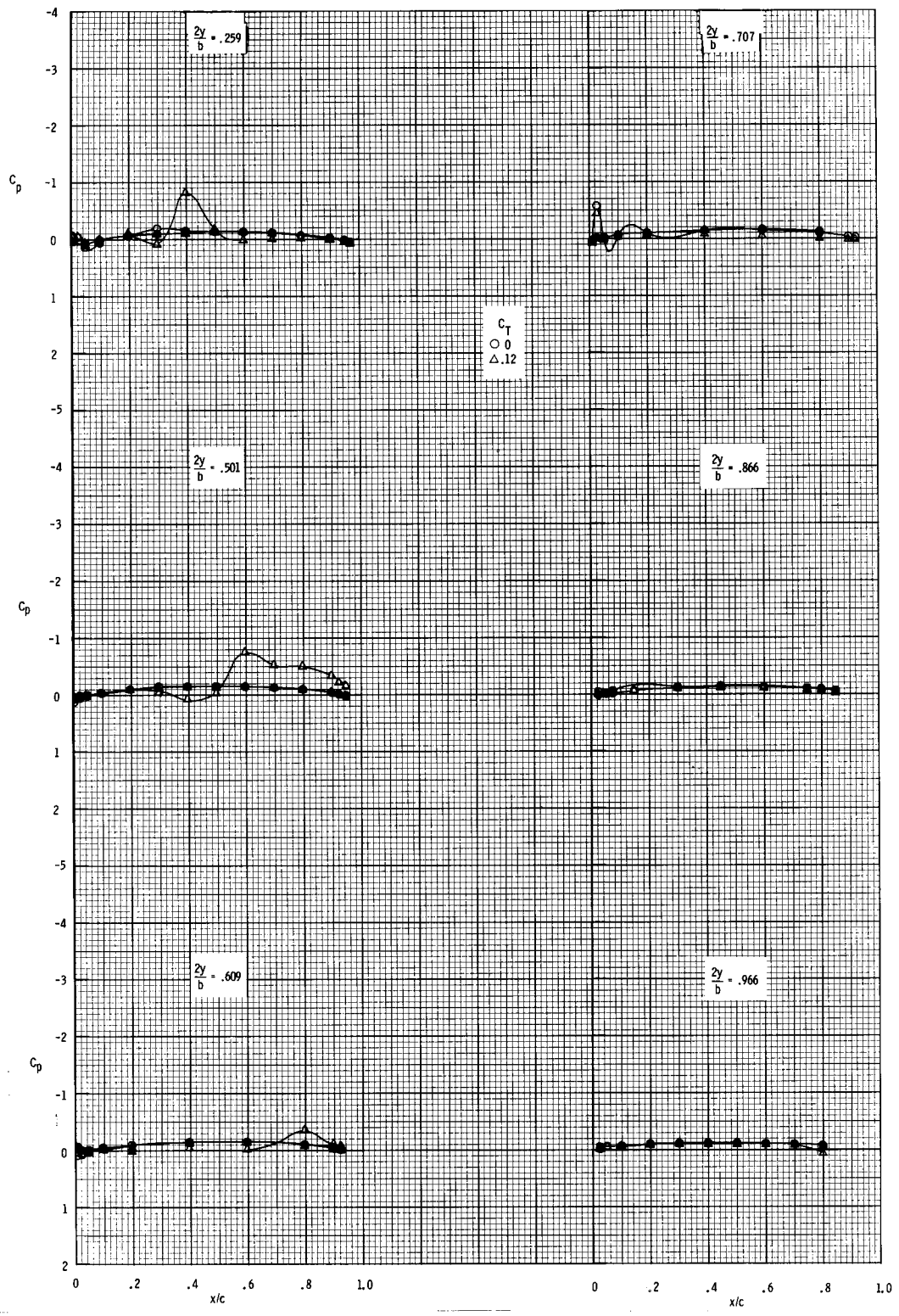
(c) C_T = 0.12 and 0.14.

Figure 10.- Continued.



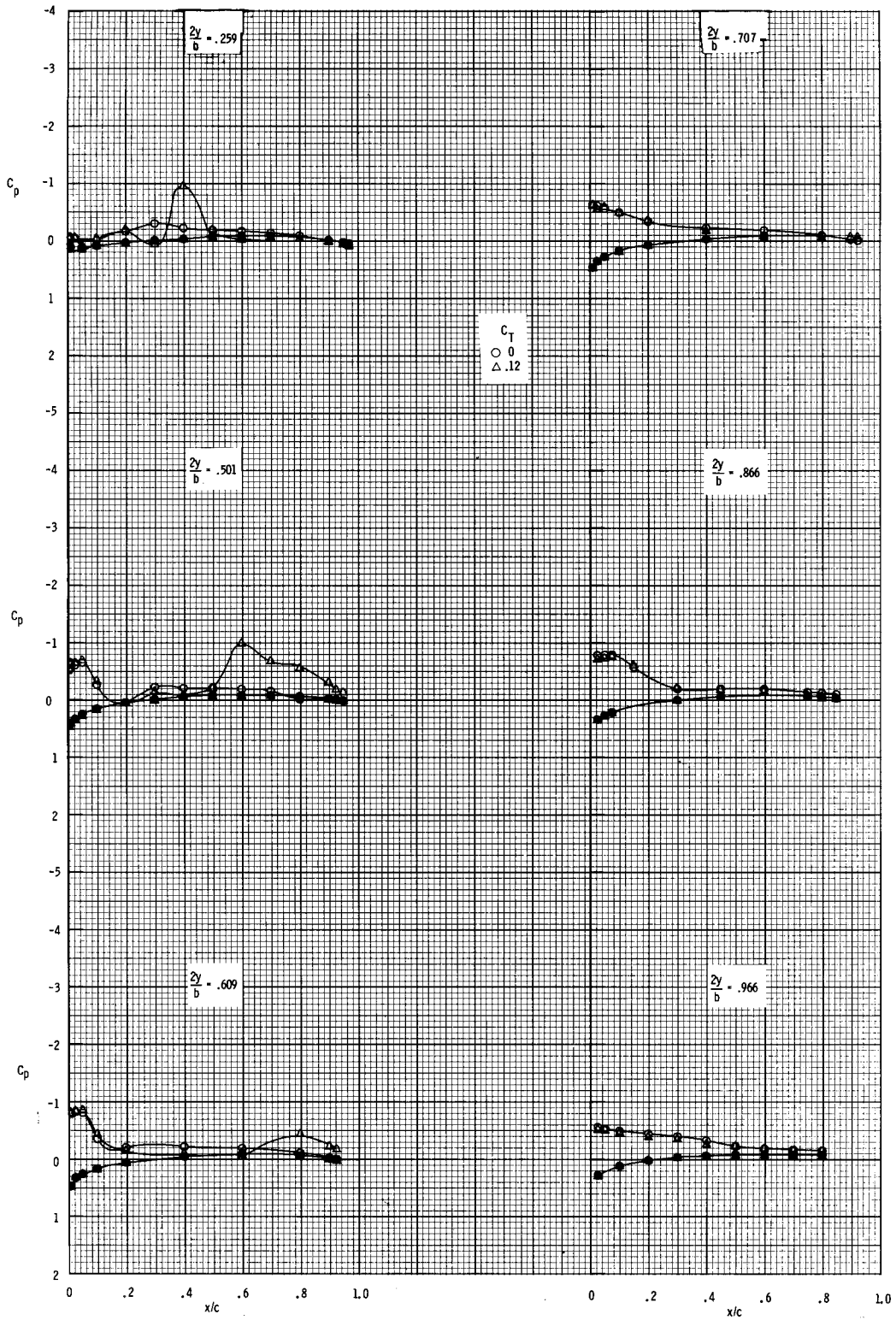
(d) C_T = 0.16 and 0.18.

Figure 10.- Concluded.



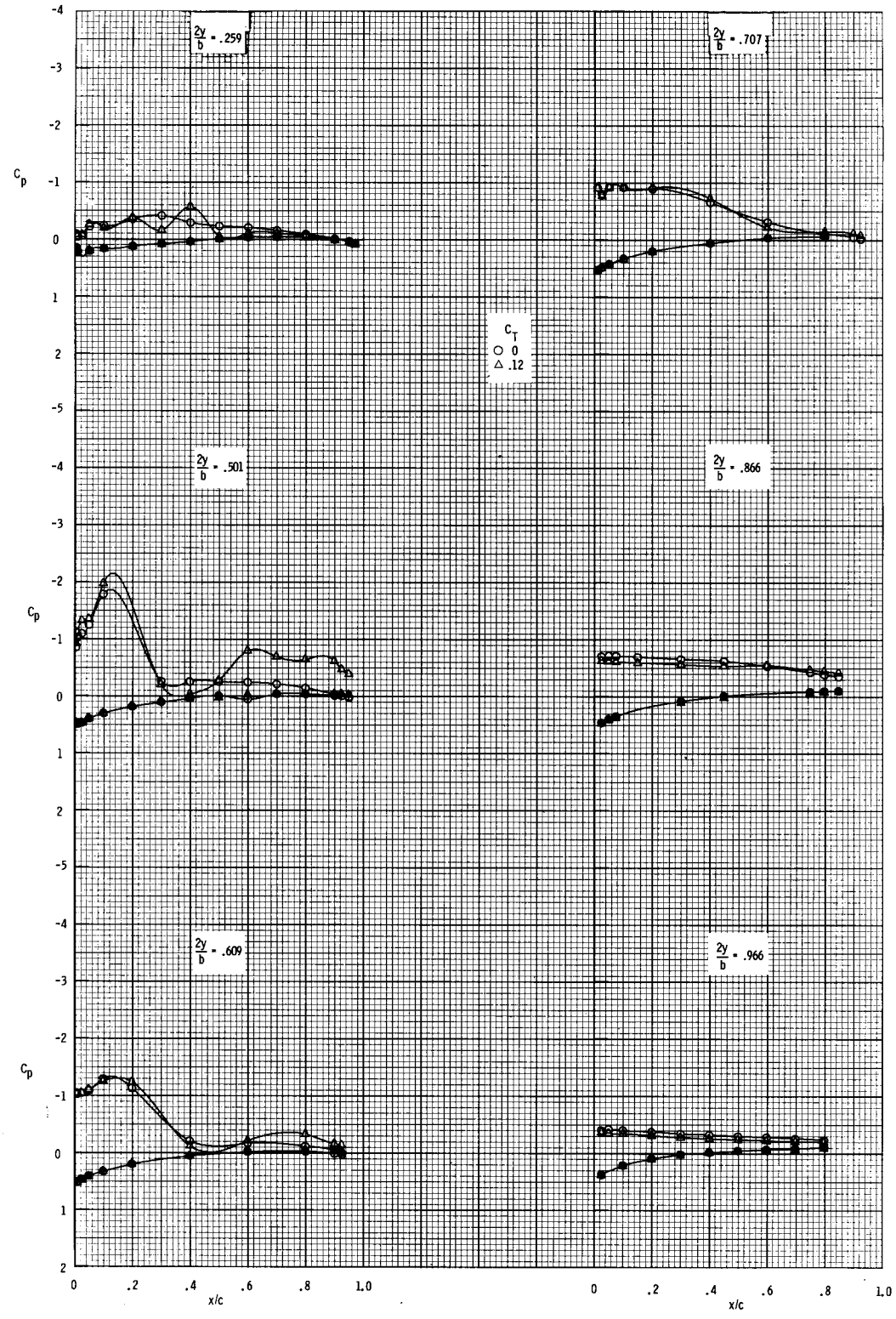
(a) $\alpha = 0^{o}$.

Figure 11.- Effect of spanwise blowing on chordwise distributions of C_p for a range of α with strake on. $x_n/c_r = 0.32$.



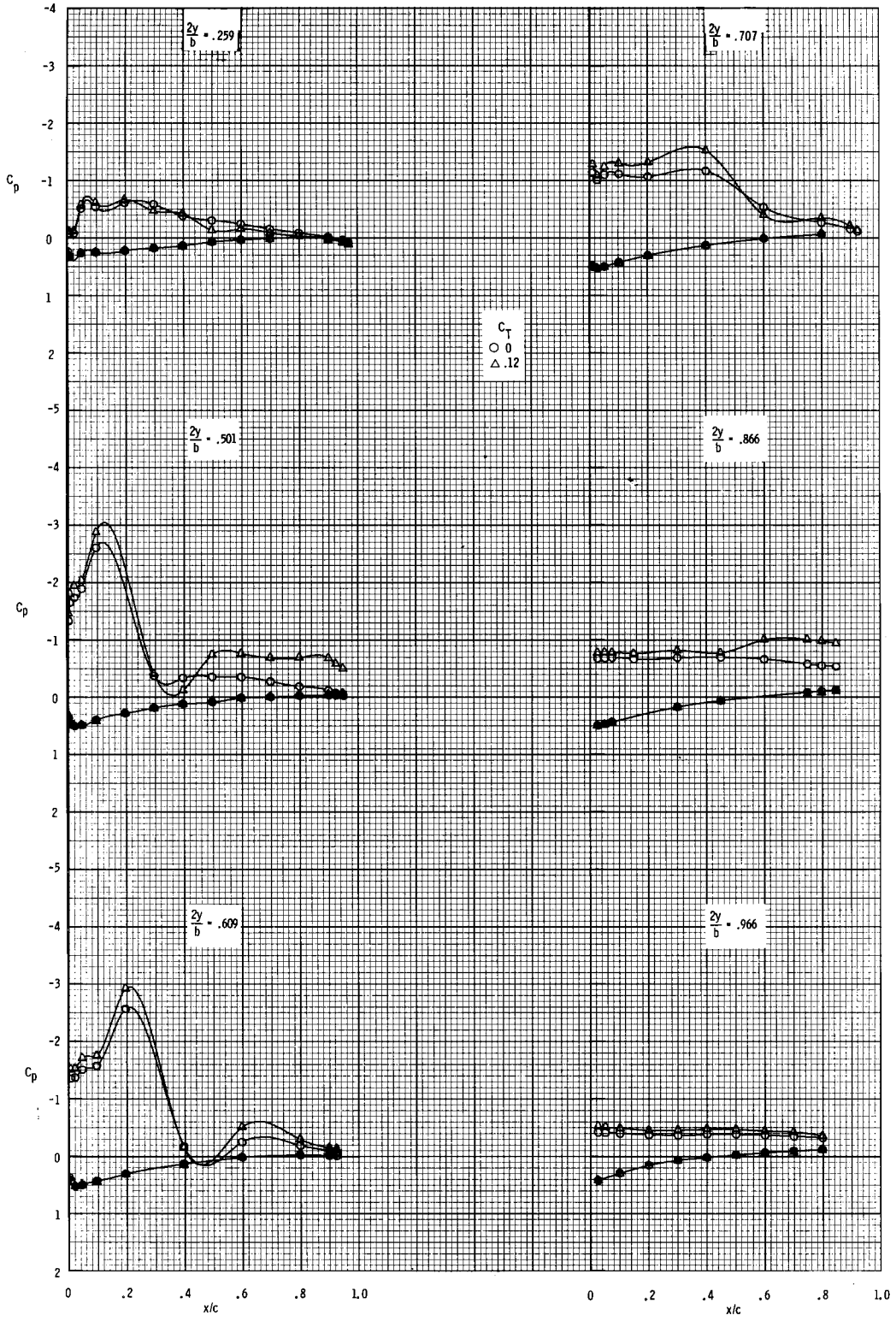
(b) $\alpha = 4.0^{\circ}$.

Figure 11.- Continued.



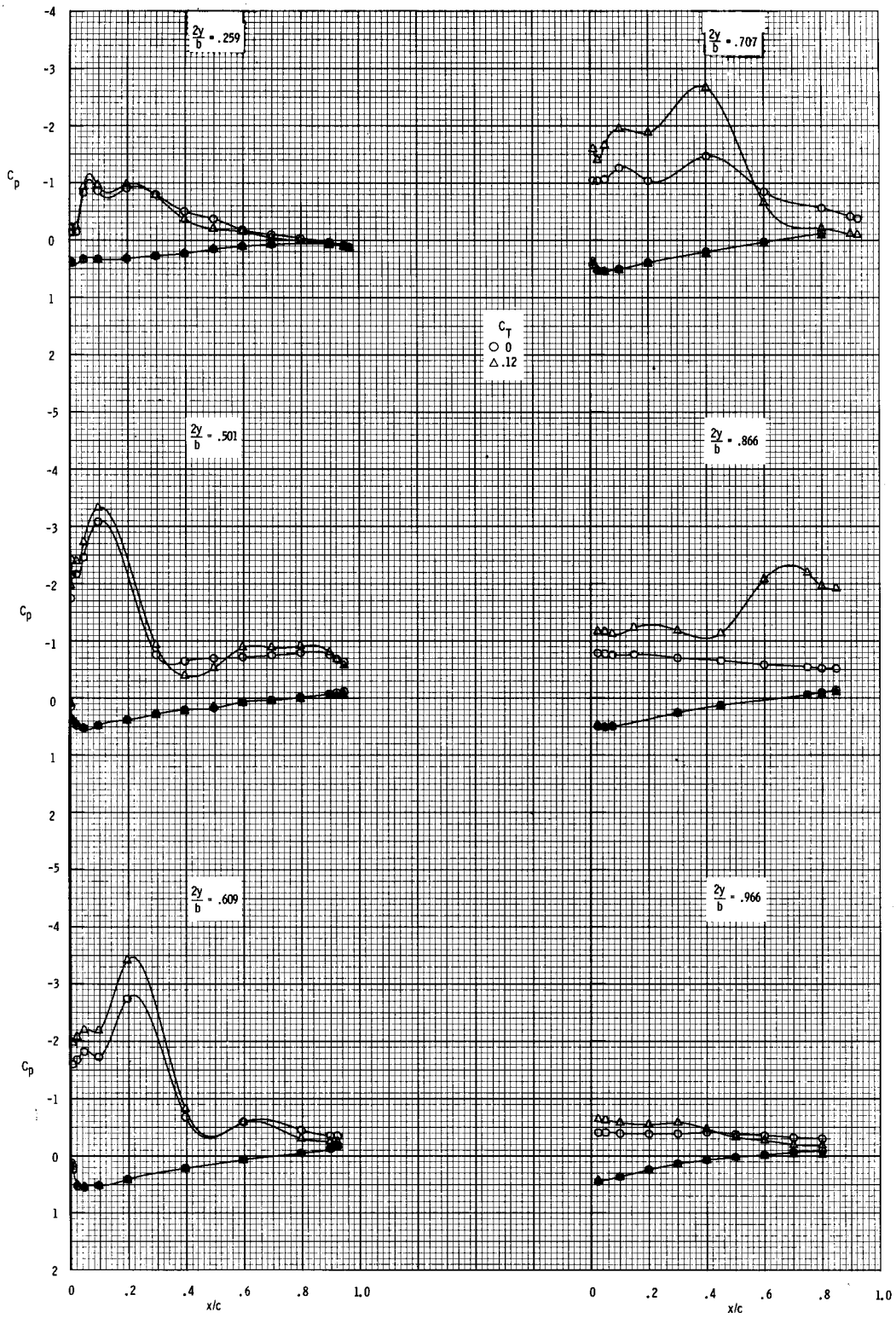
(c) $\alpha = 8.1^{\circ}$.

Figure 11.- Continued.



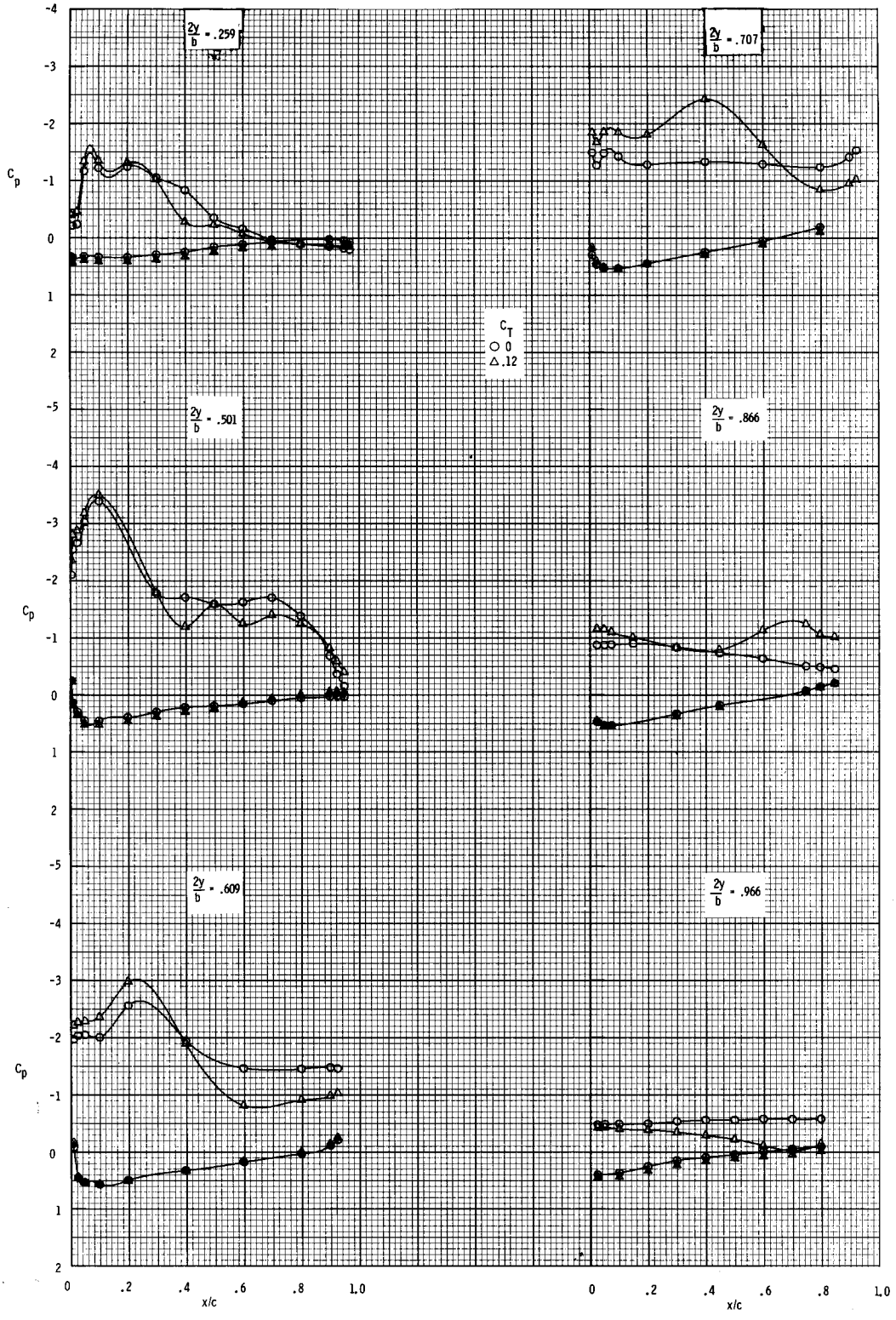
(d) $\alpha = 12.4^{o}$.

Figure 11.- Continued.



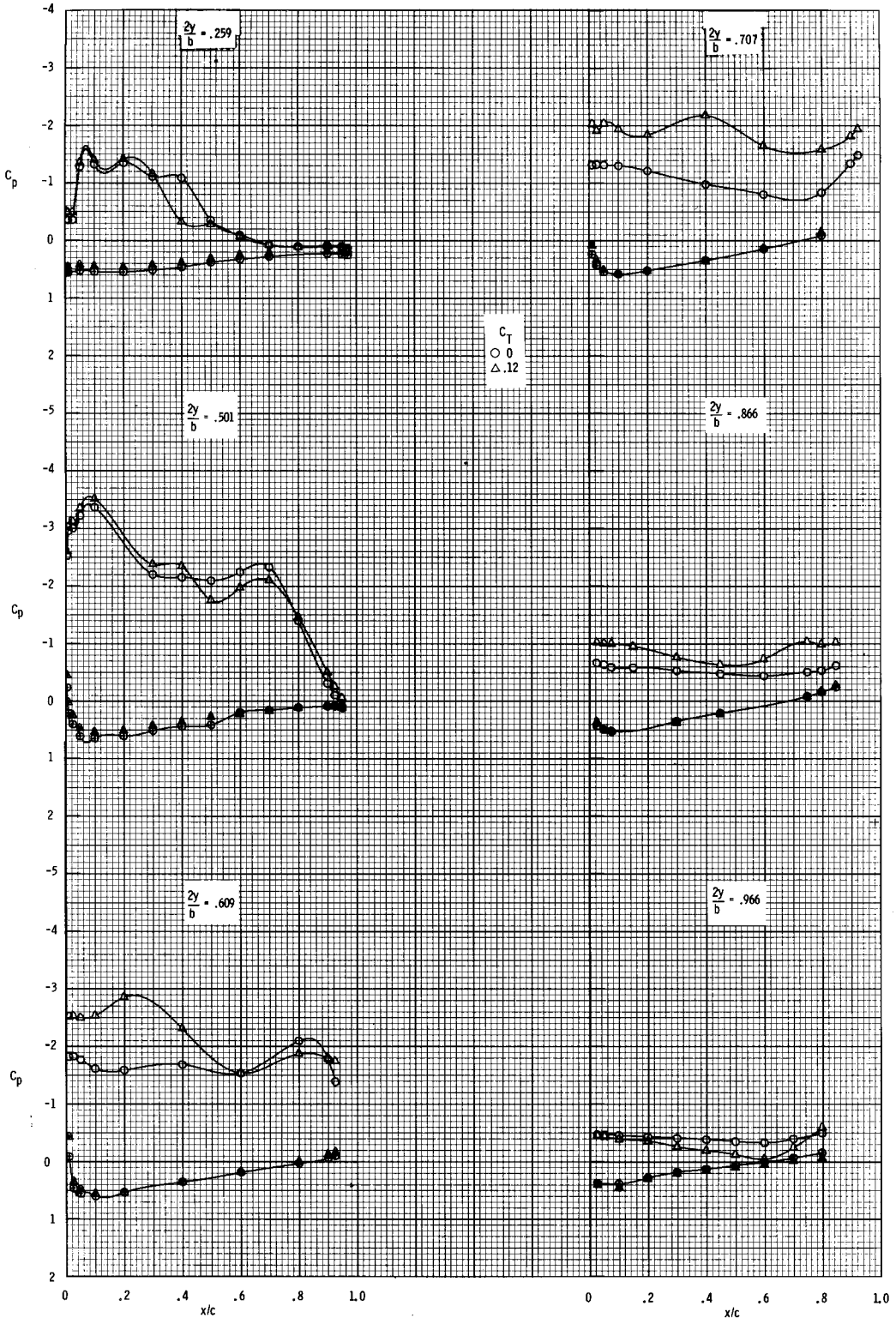
(e) $\alpha = 16.7^{\circ}$.

Figure 11.- Continued.



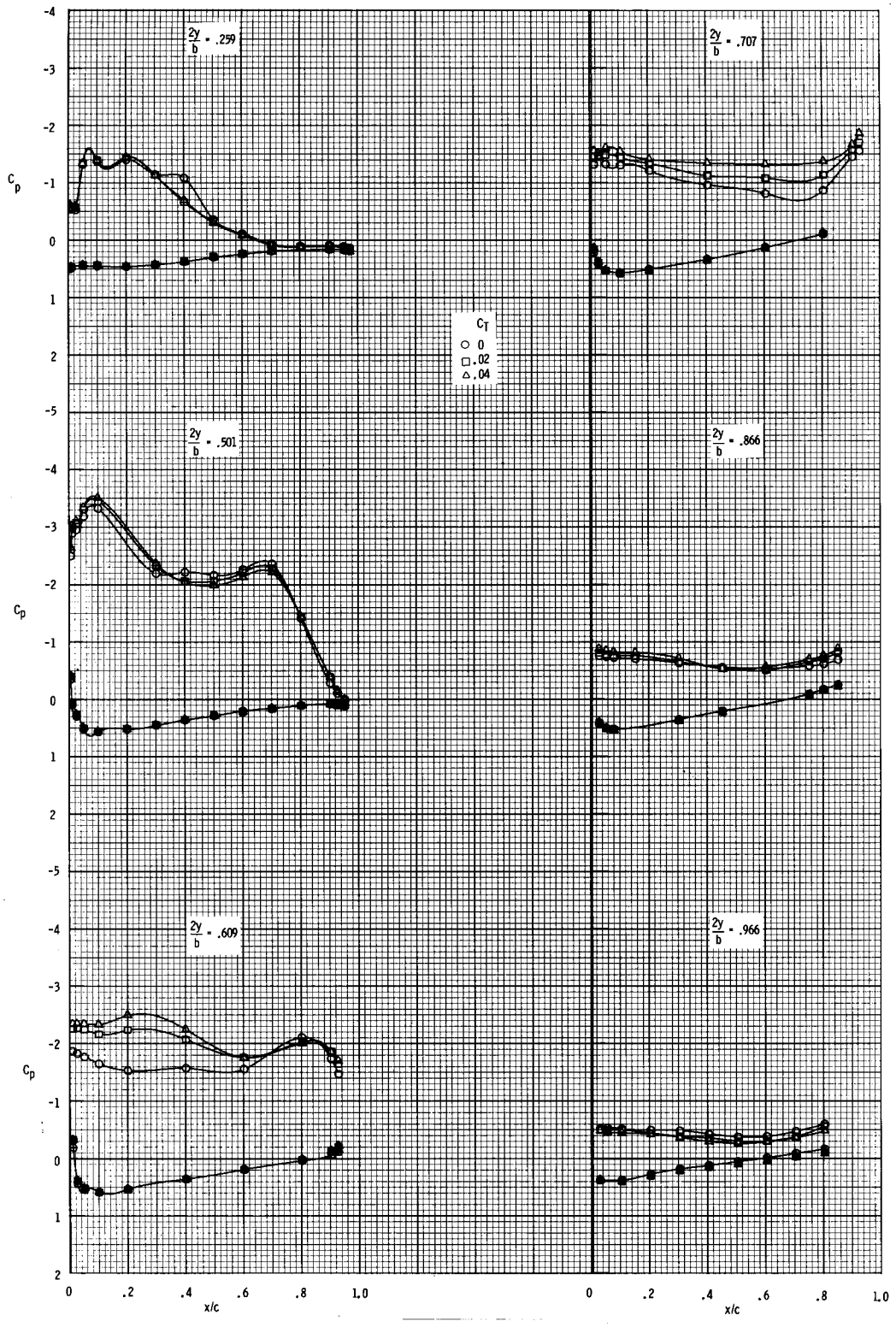
(f) $\alpha = 20.8^{\circ}$.

Figure 11.- Continued.



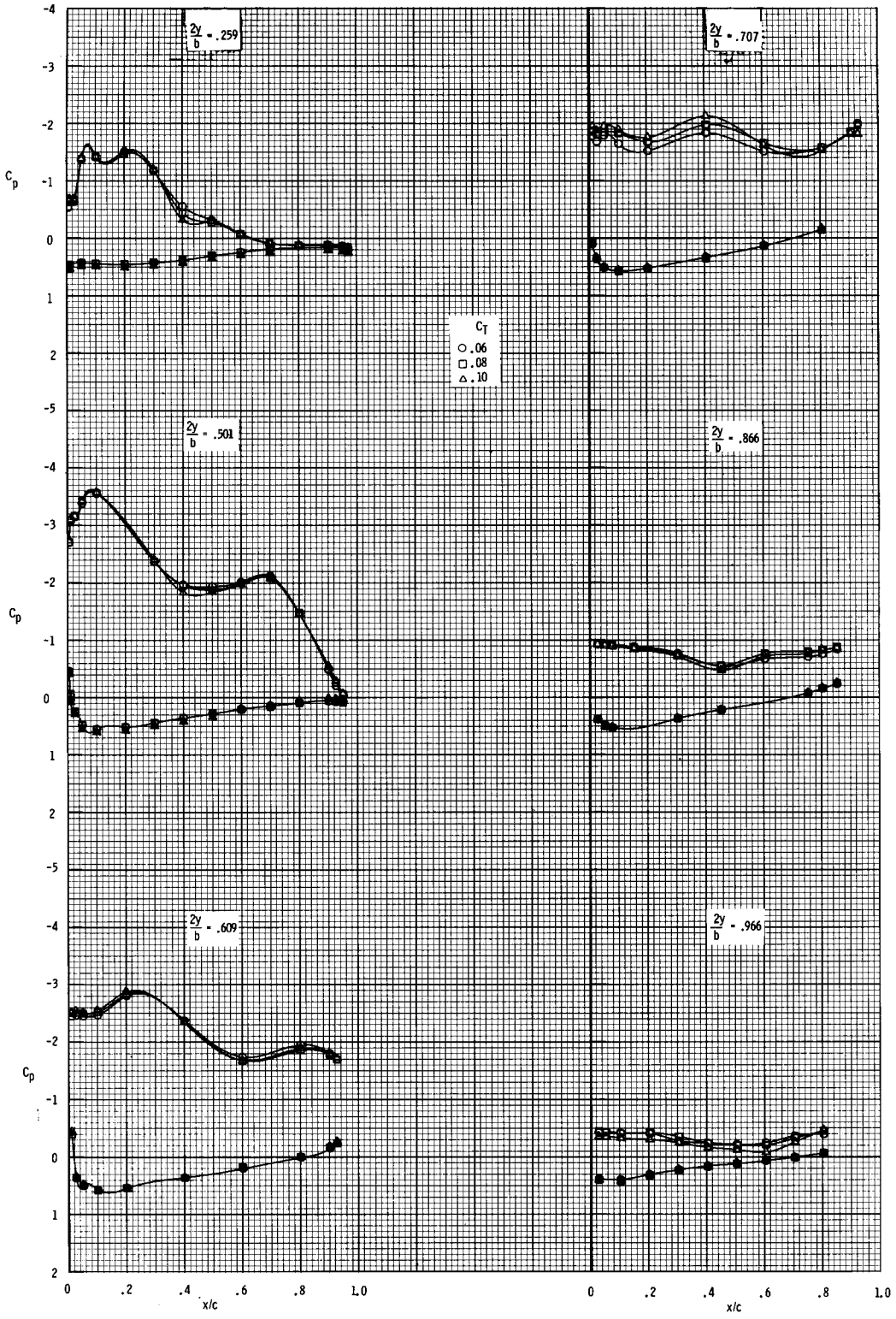
(g) $\alpha = 24.1^{\circ}$.

Figure 11.- Concluded.



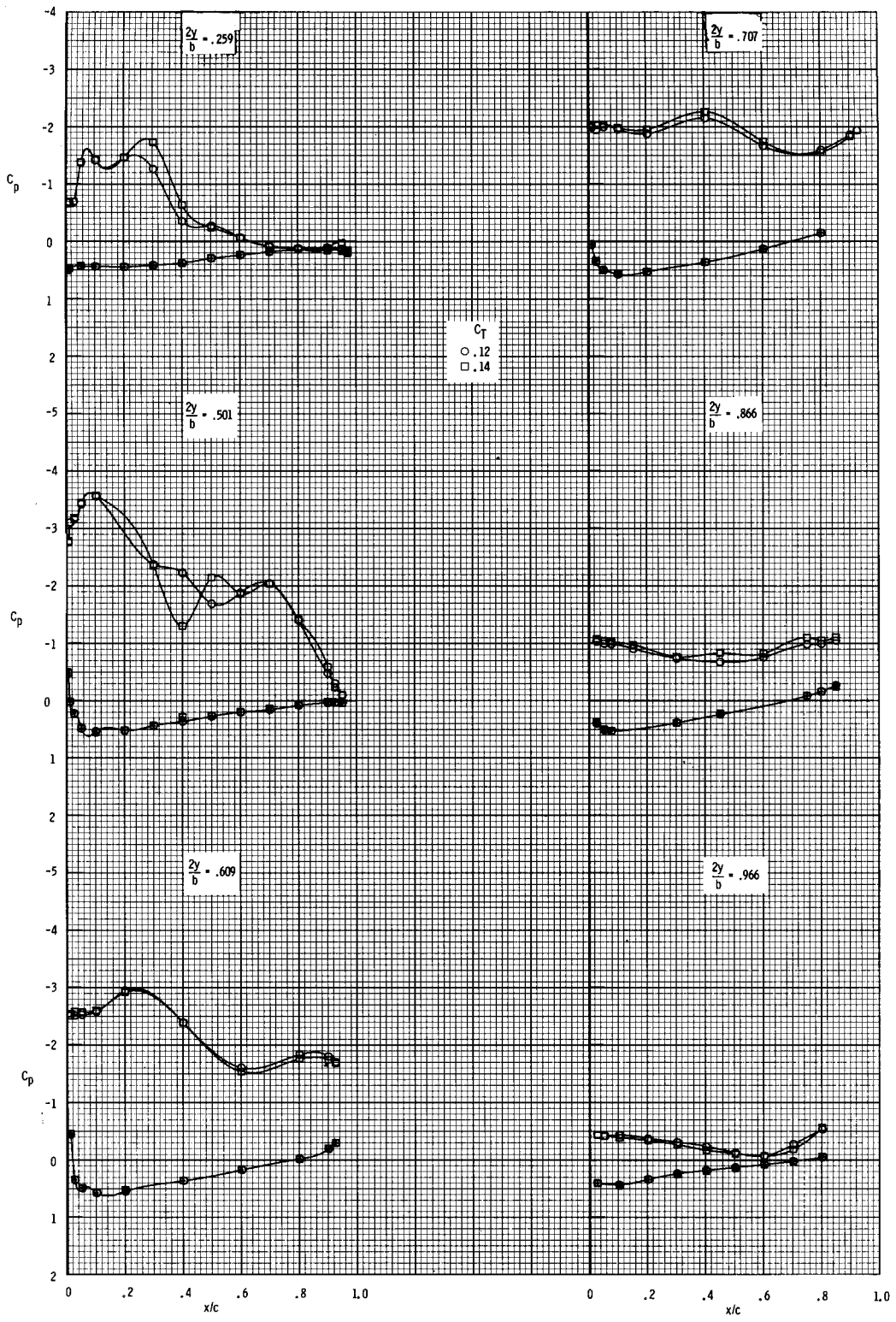
(a) C_T = 0, 0.02, and 0.04.

Figure 12.- Effect of C_T on chordwise distributions of C_p for $\alpha \approx 24^o$ with strake on. x_n/c_r = 0.32.



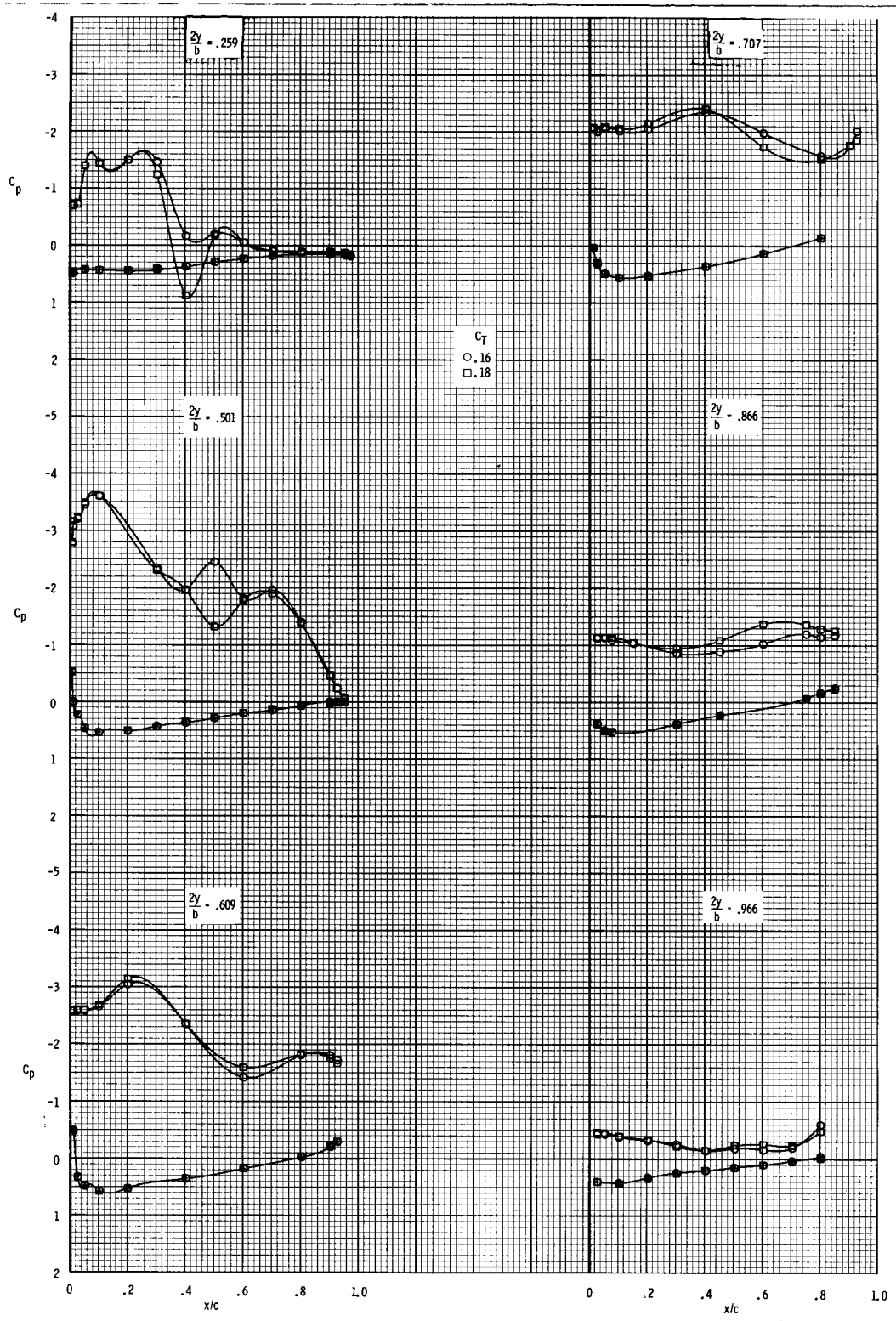
(b) C_T = 0.06, 0.08, and 0.10.

Figure 12.- Continued.



(c) C_T = 0.12 and 0.14.

Figure 12.- Continued.



(d) C_T = 0.16 and 0.18.

Figure 12.- Concluded.

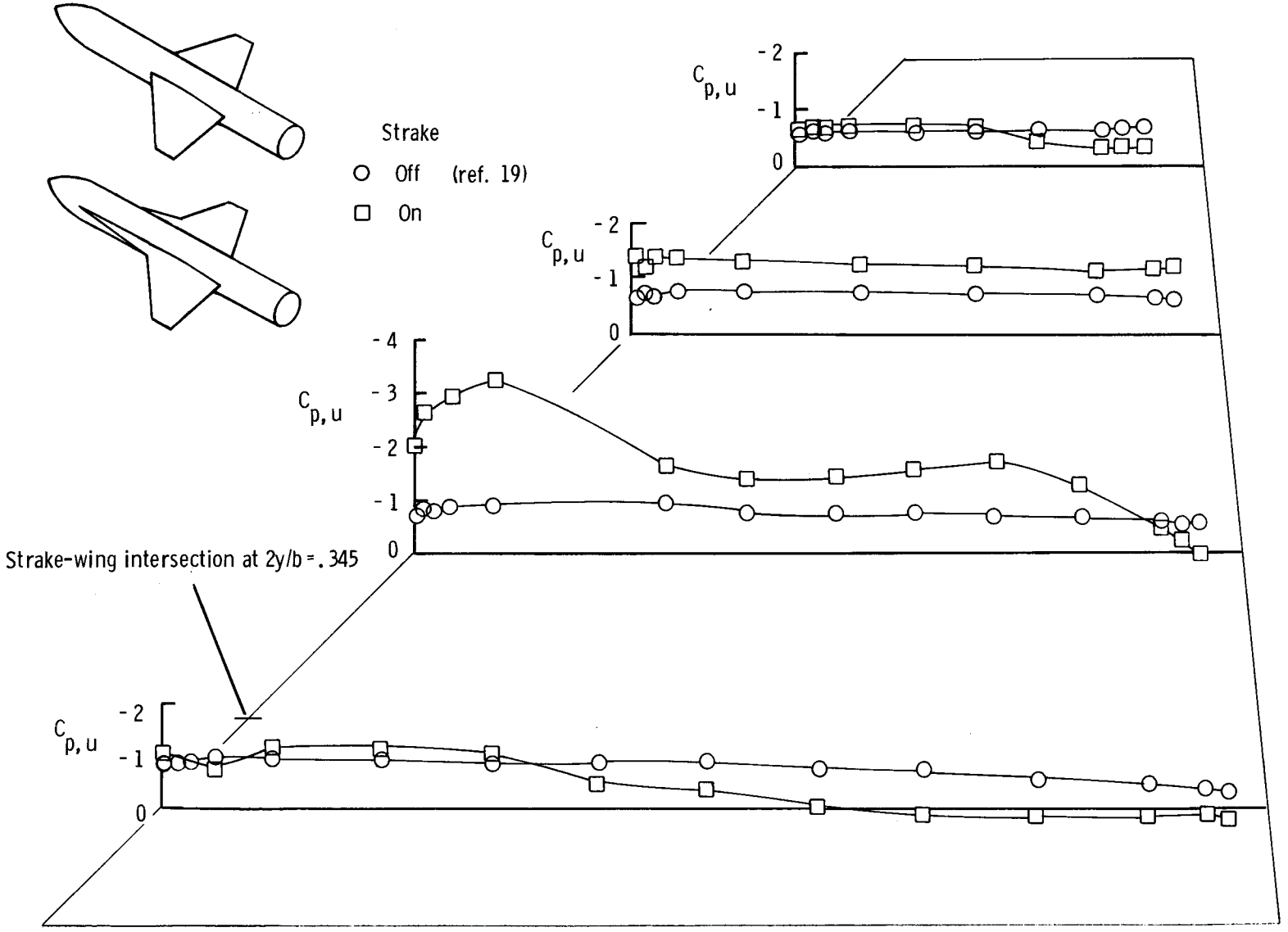
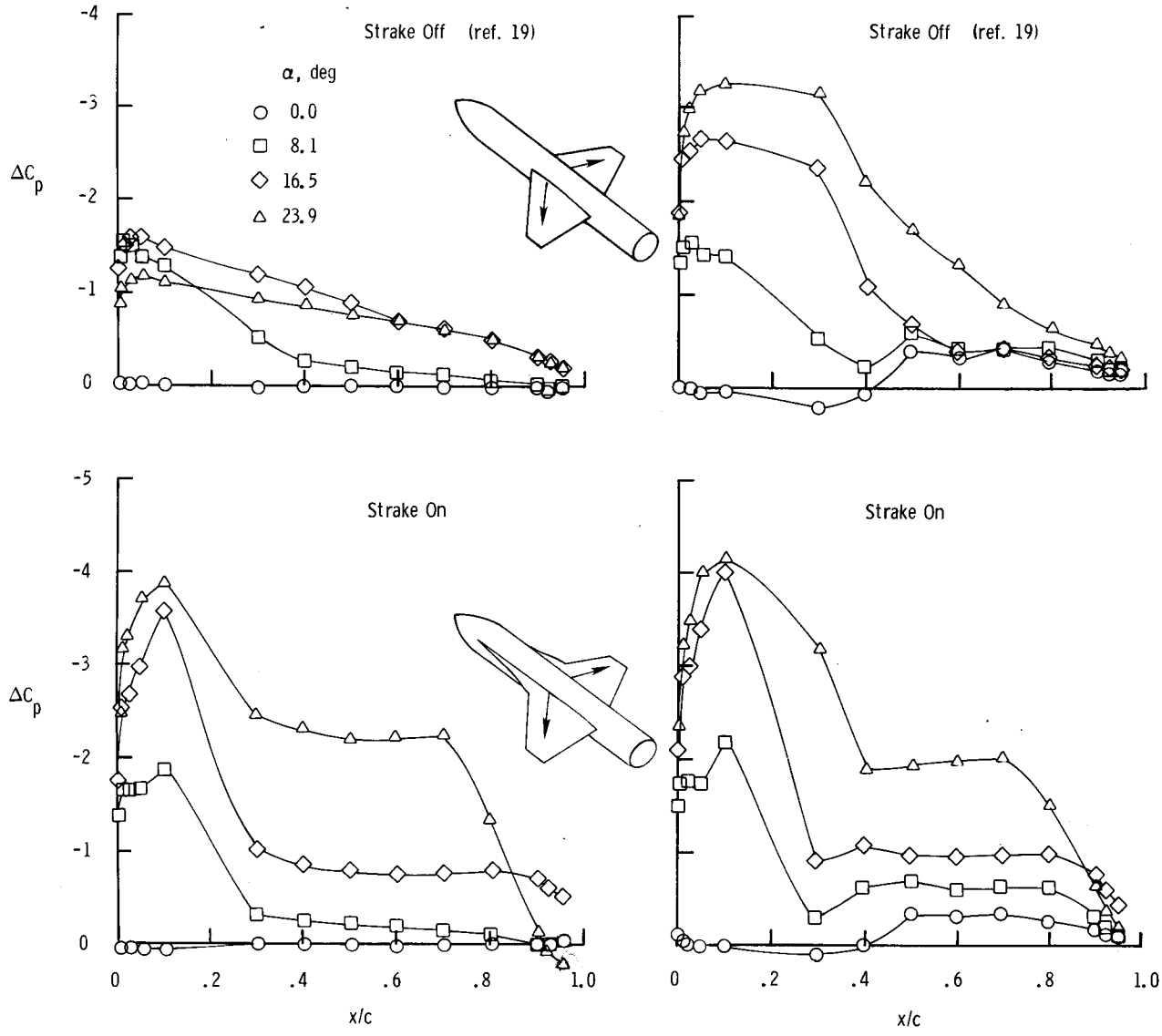
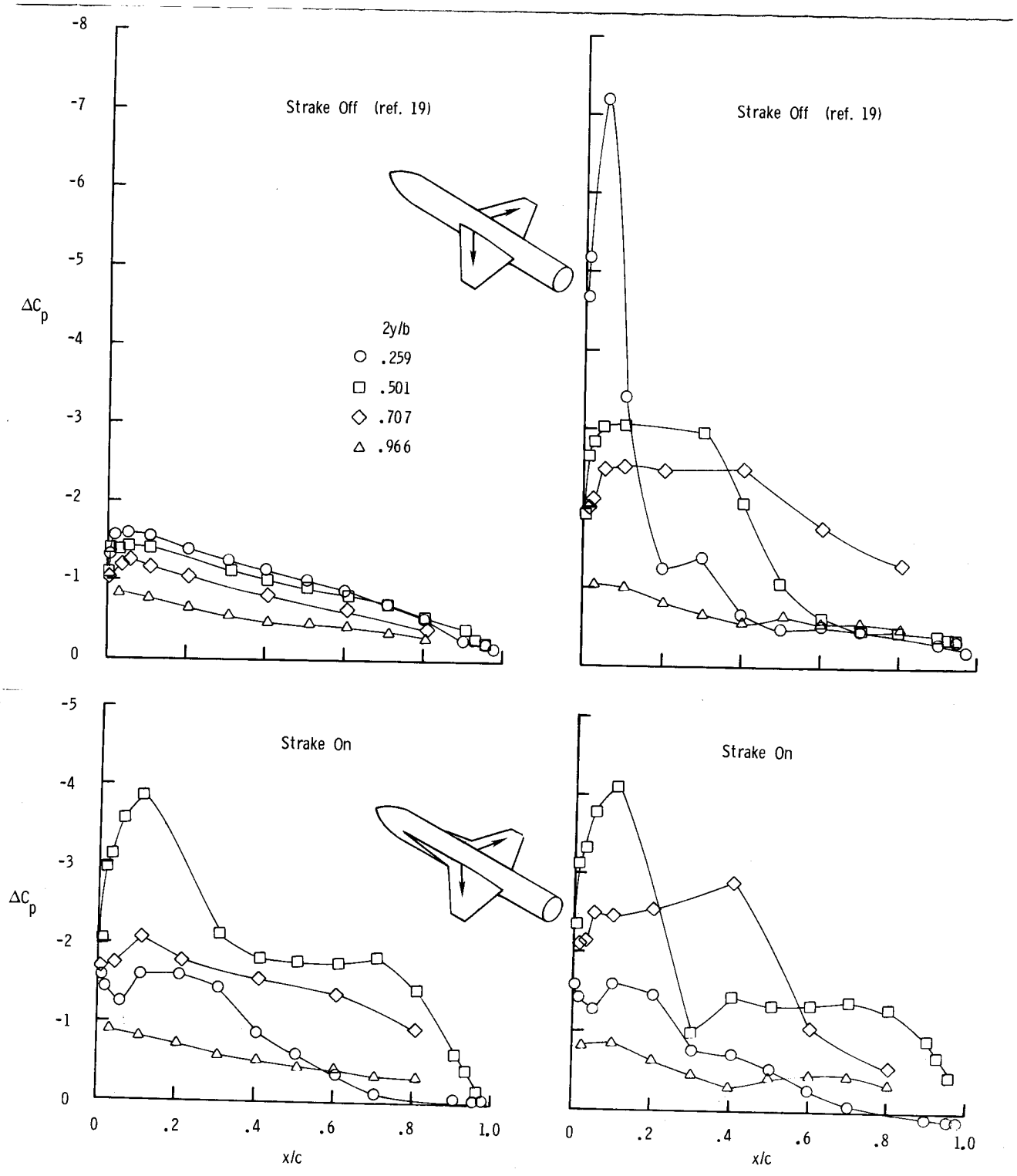


Figure 13.- Schematic diagram of wing surface pressures for strake-off and strake-on configurations with blowing off. $\alpha \approx 20.6^{o}$.



(a) $C_T = 0.$ (b) $C_T = 0.12.$

Figure 14.- Effect of α on chordwise pressure distributions of ΔC_p at $2y/b = 0.501$ for the strake-off and strake-on configurations for two values of C_T. $x_n/c_r = 0.23$.



(a) $C_T = 0.$ (b) $C_T = 0.12.$

Figure 15.- Effect of span location on chordwise pressure distributions of ΔC_p for the strake-off and strake-on configurations for two values of C_T. $\alpha \approx 20.6^o$; $x_n/c_r = 0.23$.

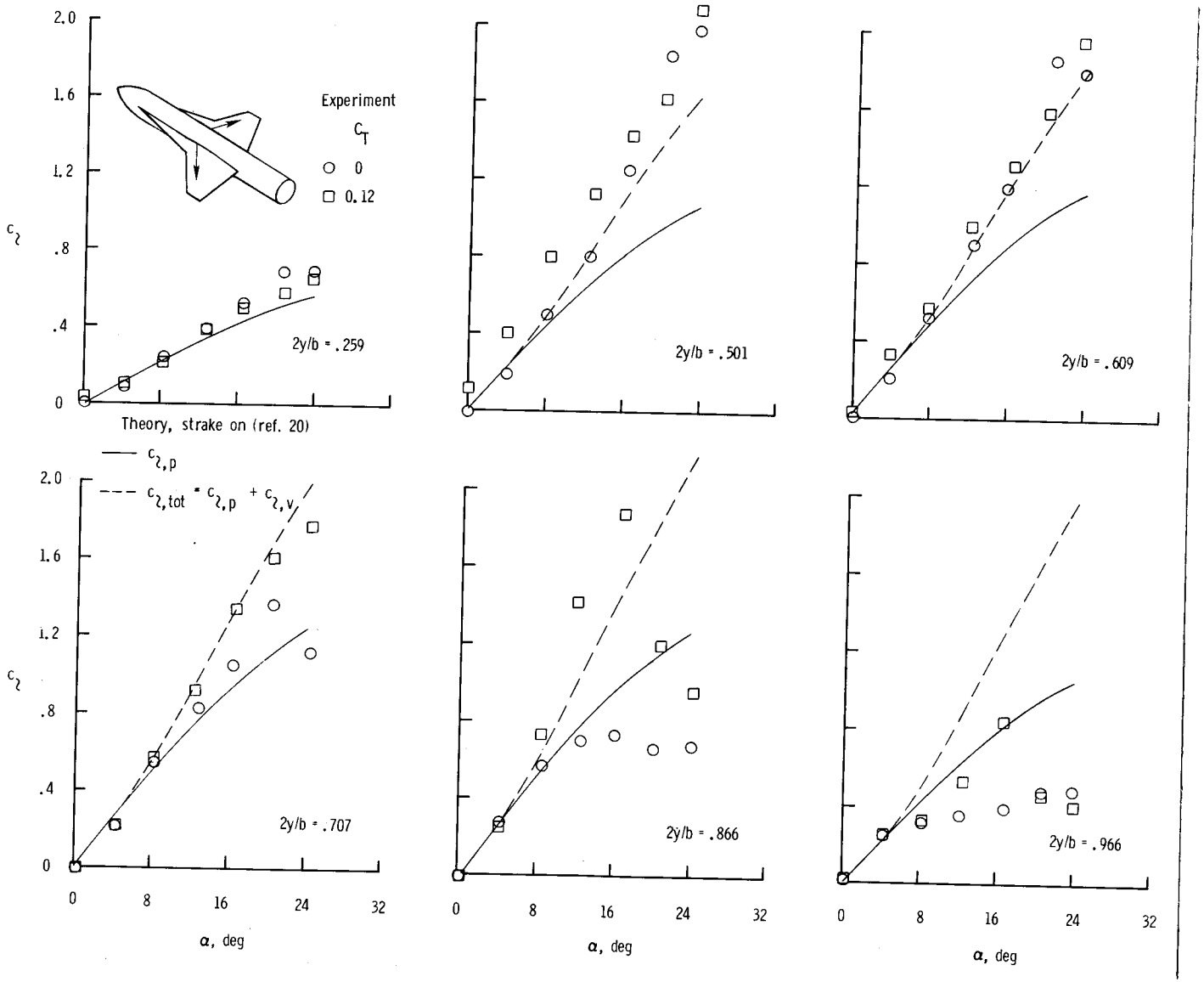
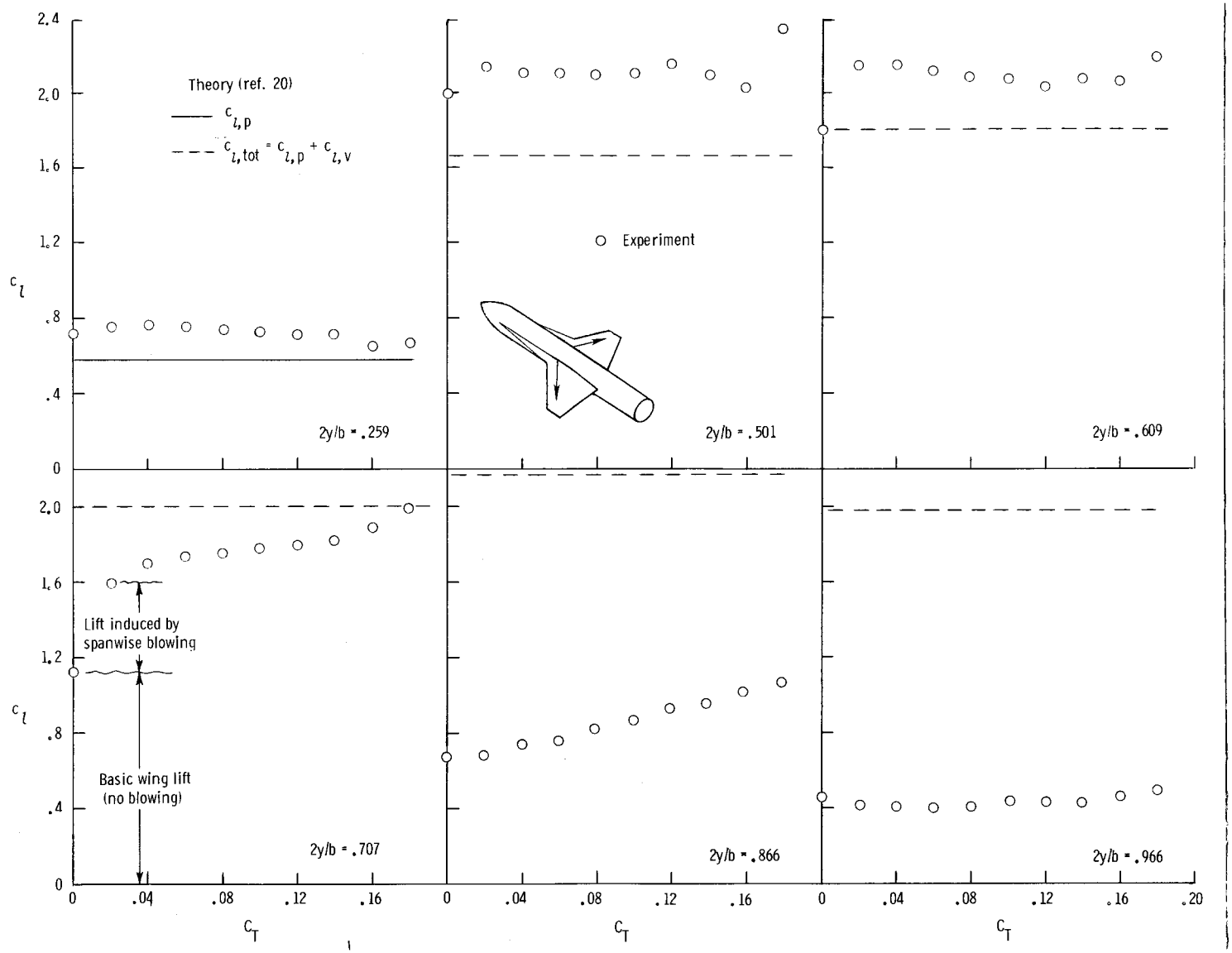
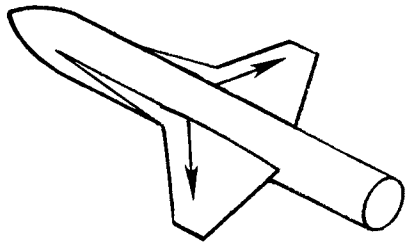


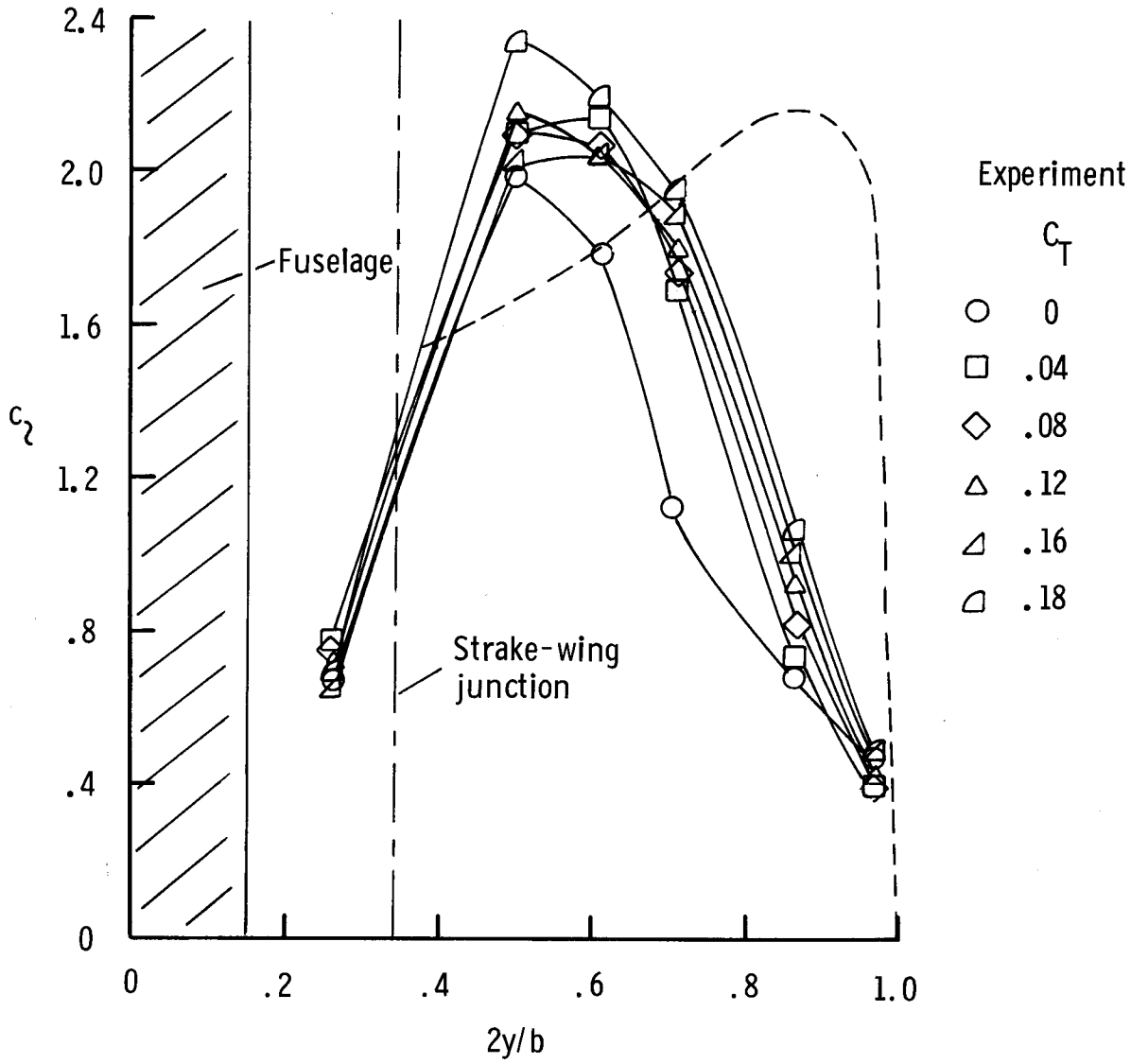
Figure 16.- Effect of spanwise blowing on wing section lift characteristics with strake on. $x_n/c_r = 0.23$.



(a) Variation of c_l with C_T.

Figure 17.- Effect of C_T on section lift characteristics with strake on. $\alpha = 23.9^o$; $x_n/c_r = 0.23$.





(b) Variation of c_l with 2y/b.

Figure 17.- Concluded.

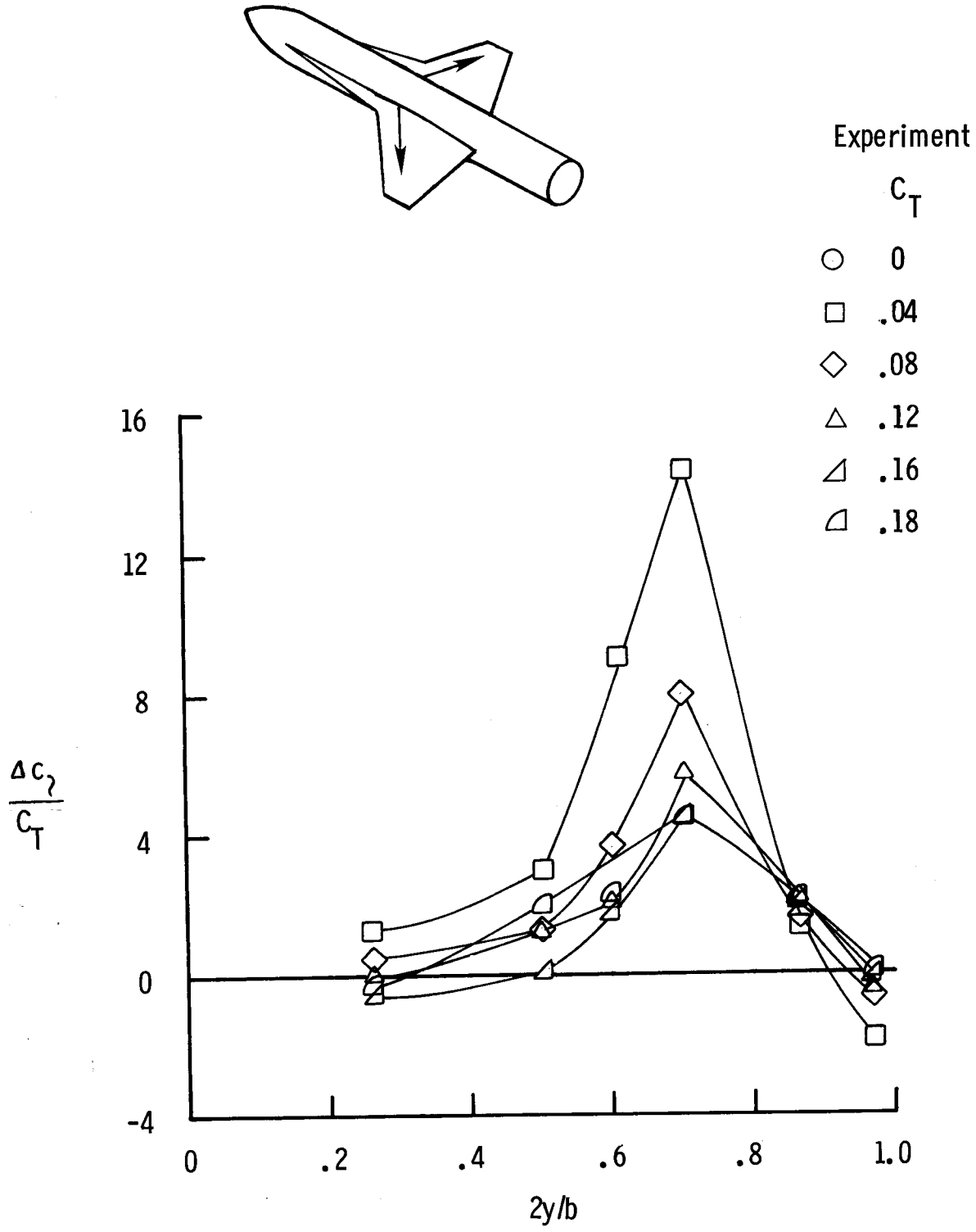


Figure 18.- Variation of section lift coefficient and lift augmentation ratio along the span for a range of C_T with strake on. $\alpha = 23.9^o$; $x_n/c_r = 0.23$.

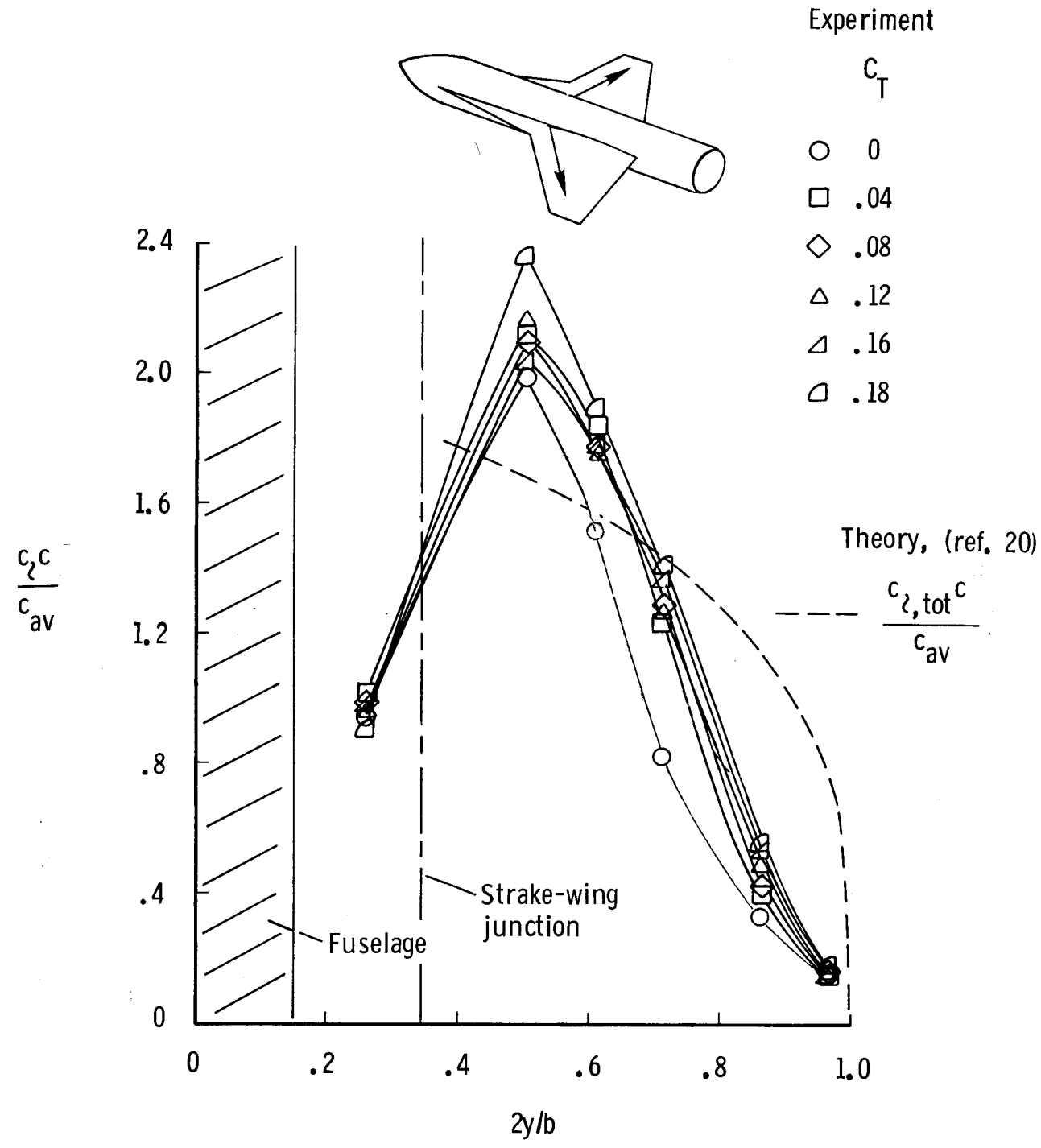


Figure 19.- Effect of spanwise blowing on span loading for the wing with strake on at $\alpha \approx 24^\circ$. $x_n/c_r = 0.23$.

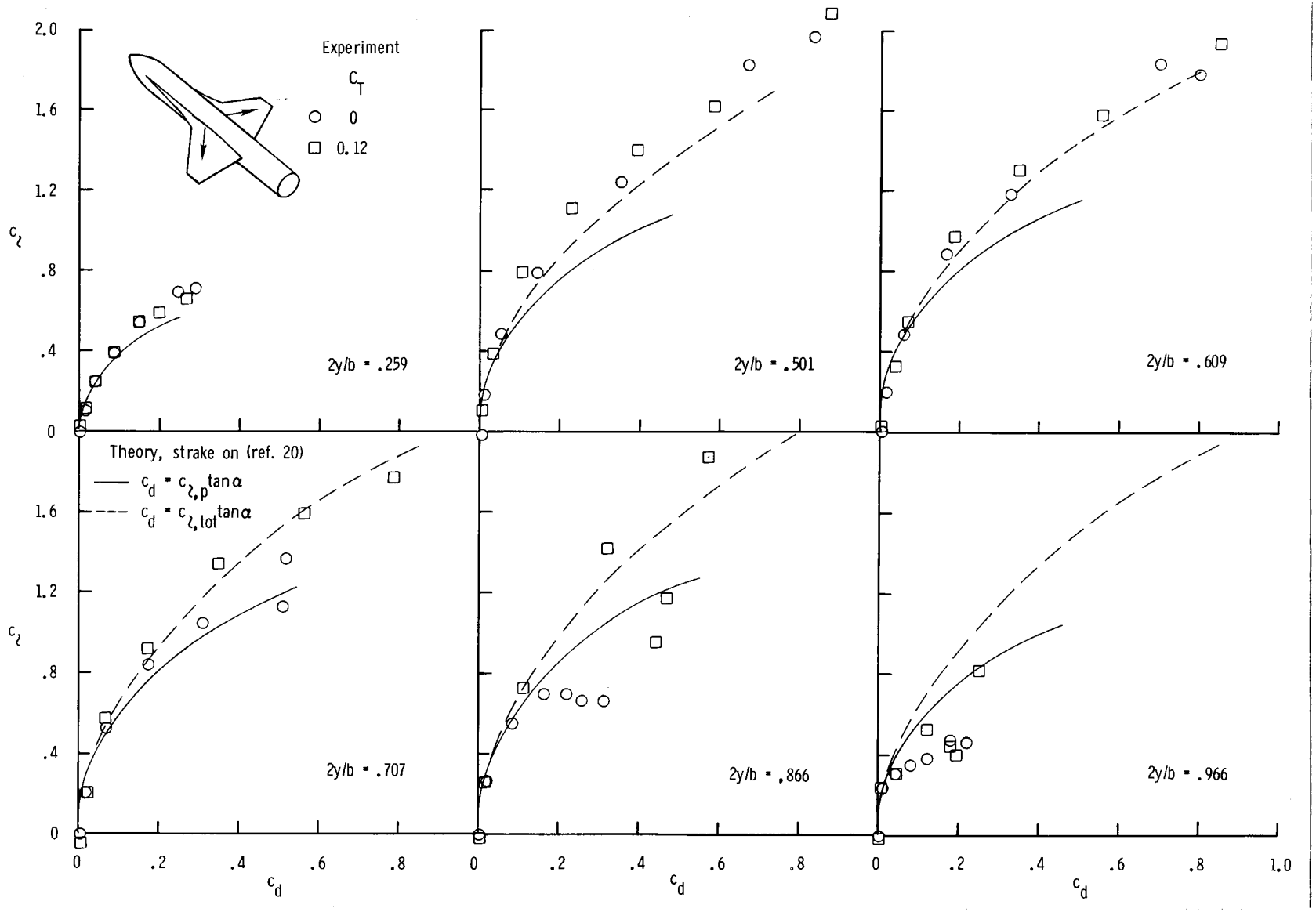


Figure 20.- Effect of spanwise blowing on wing section drag characteristics with strake on. $x_n/c_r = 0.23$.

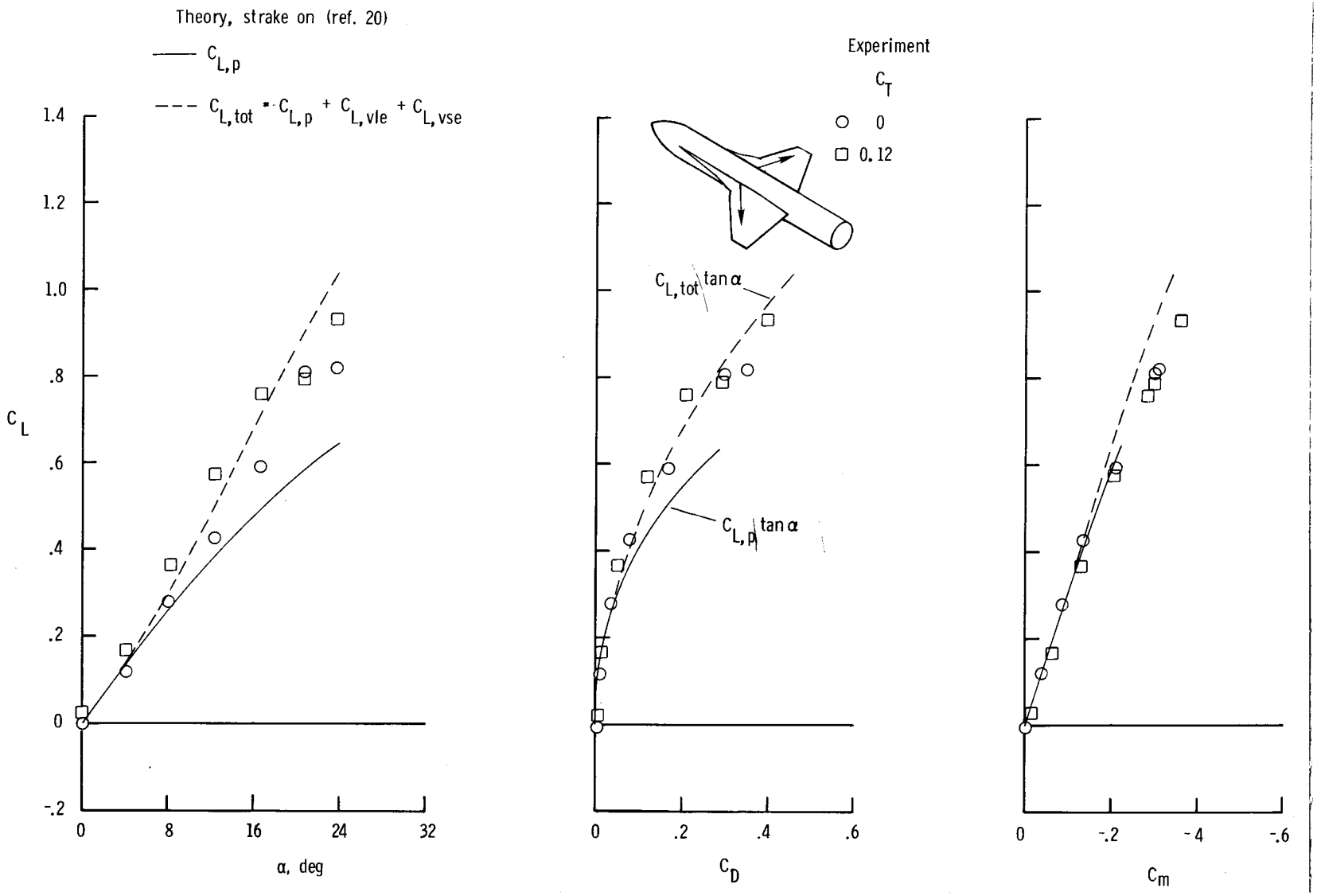


Figure 21.- Effect of spanwise blowing on longitudinal aerodynamic characteristics with strake on. x_n/c_r = 0.23.

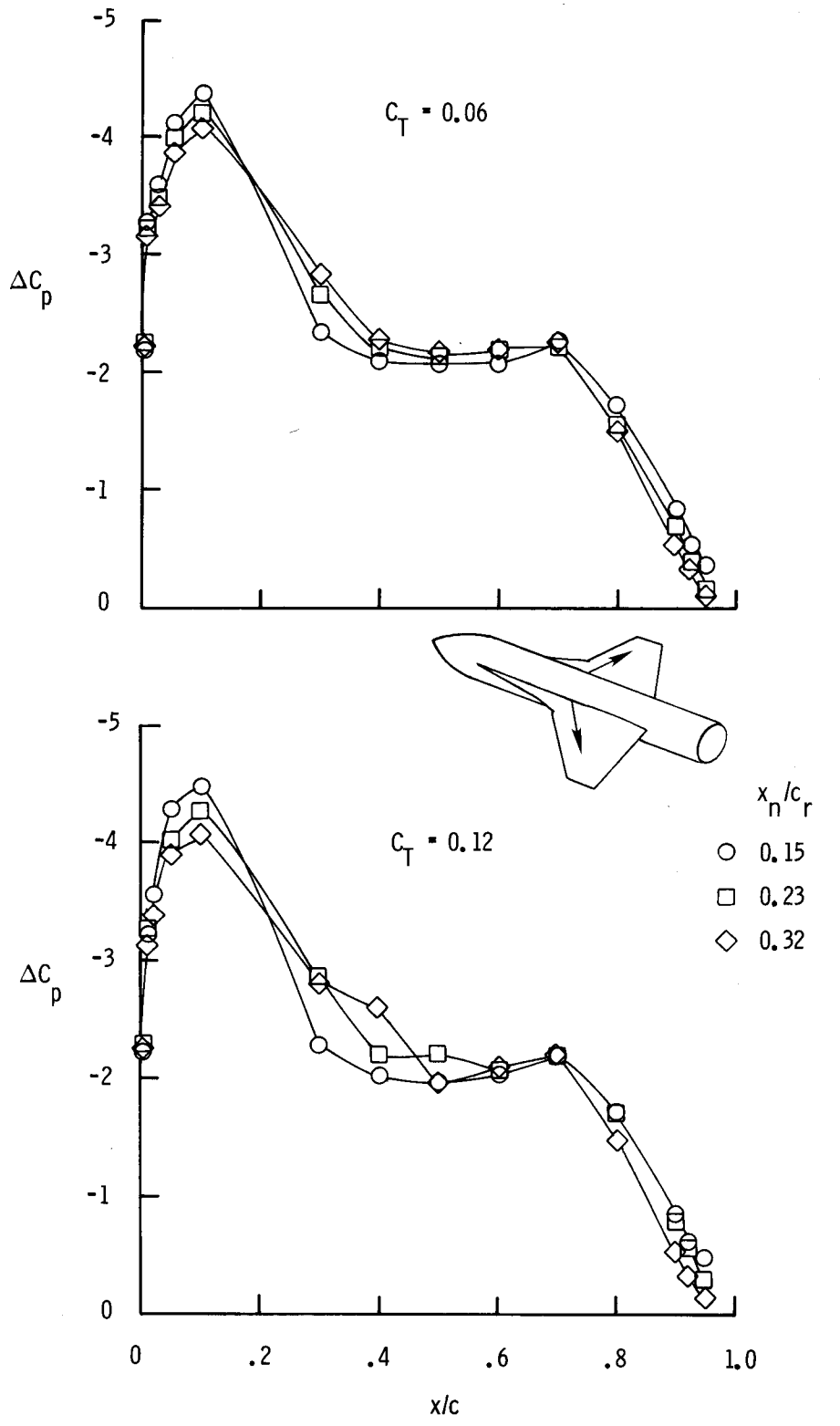


Figure 22.- Effect of x_n/c_r on chordwise pressure distributions of ΔC_p at $2y/b = 0.501$ for two values of C_T with $\alpha \approx 24^o$.

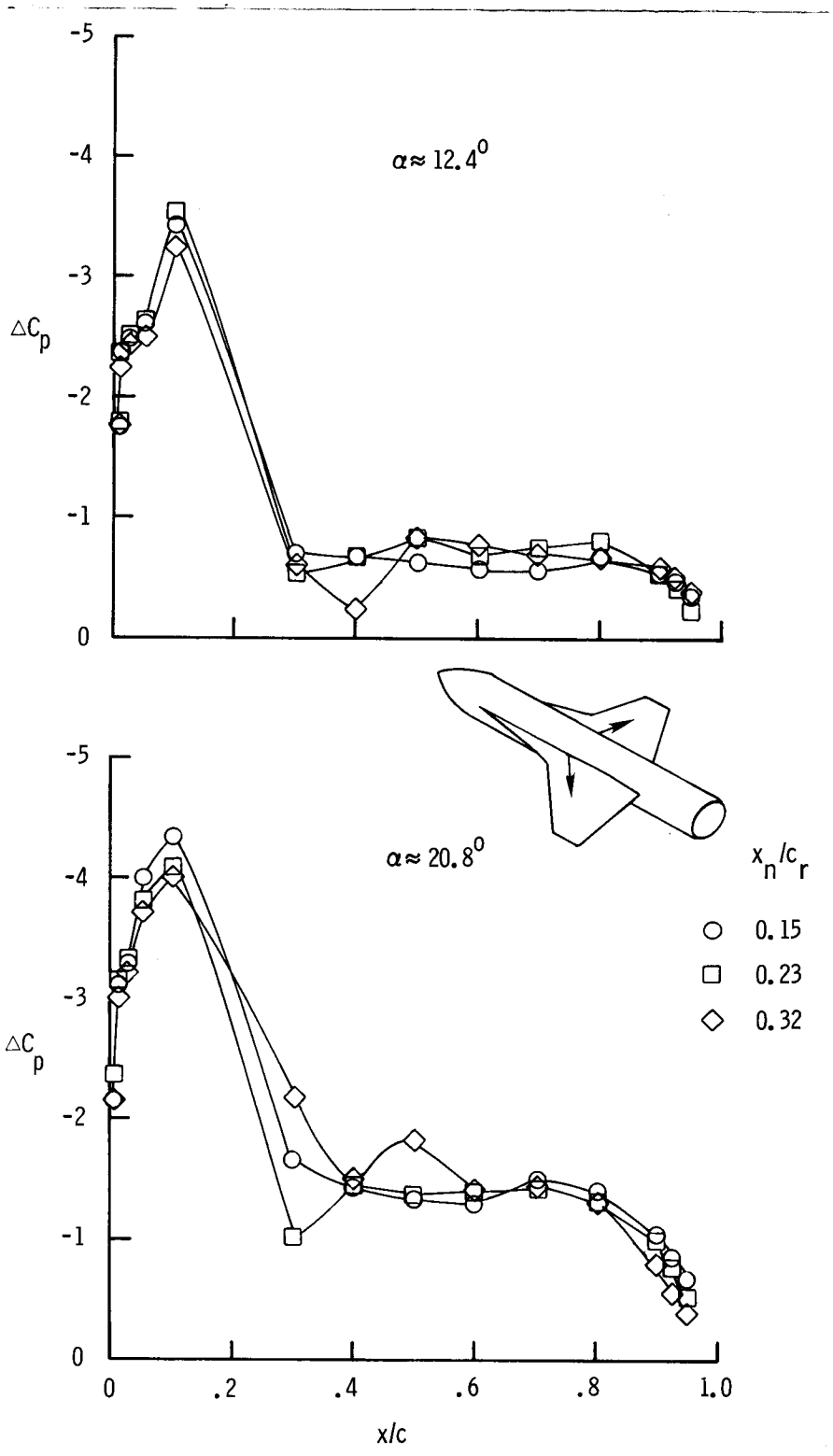


Figure 23.- Effect of x_n/c_r on chordwise pressure distributions of Δc_p at $2y/b = 0.501$ for two values of α. $C_T = 0.12$.

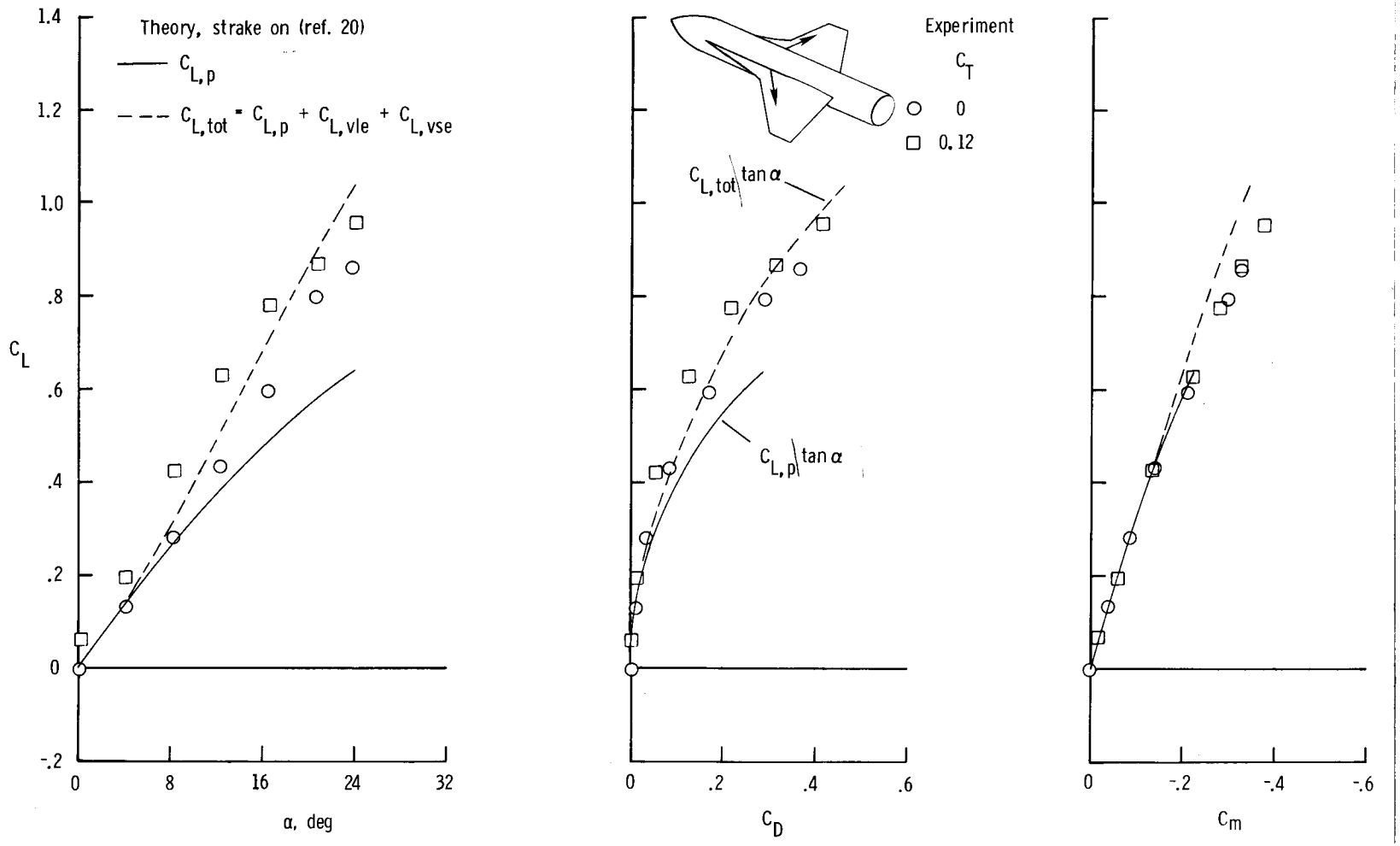


Figure 24.- Effect of spanwise blowing on longitudinal aerodynamic characteristics with strake on. x_n/c_r = 0.15.

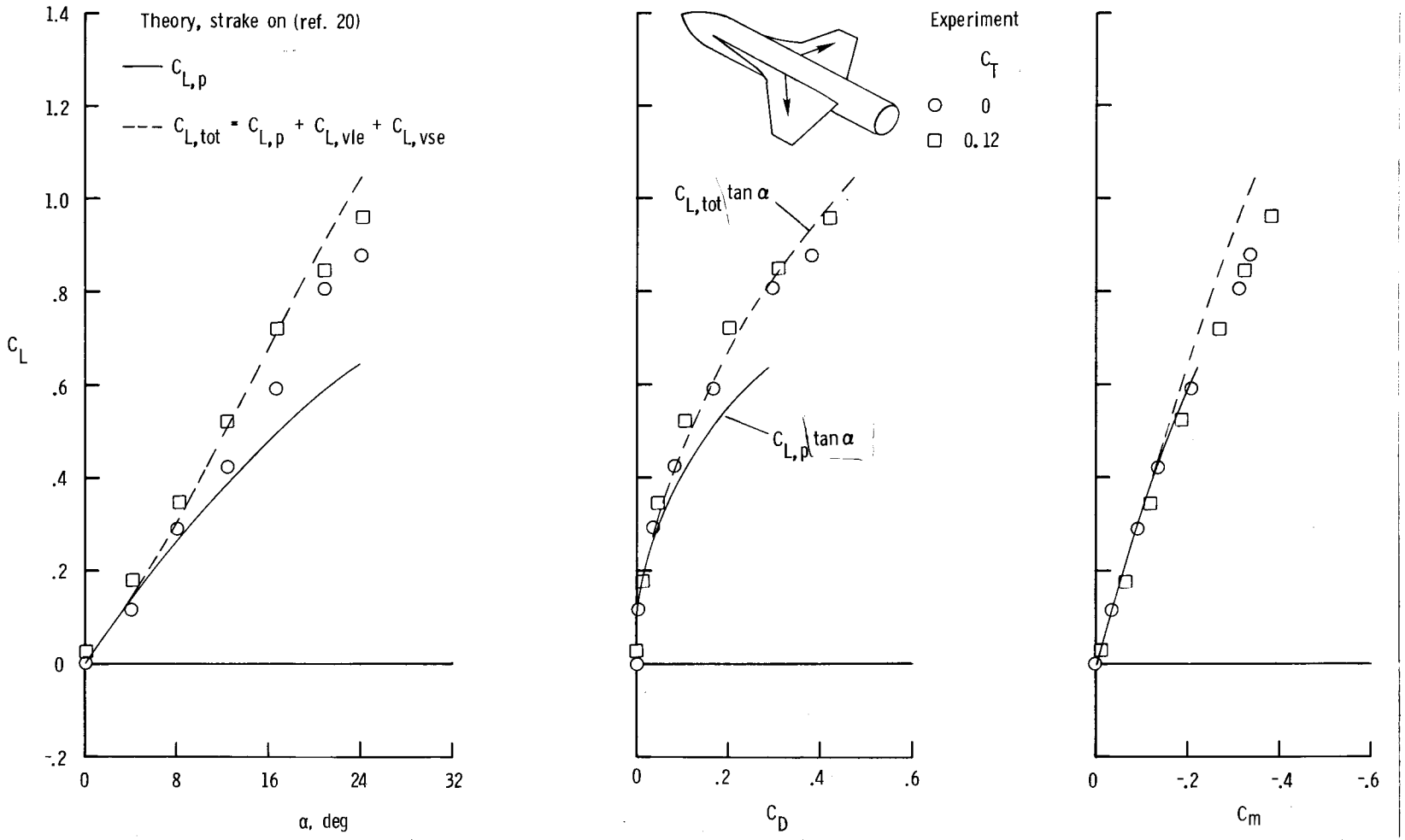


Figure 25.- Effect of spanwise blowing on longitudinal aerodynamic characteristics with strake on. x_n/c_r = 0.32.

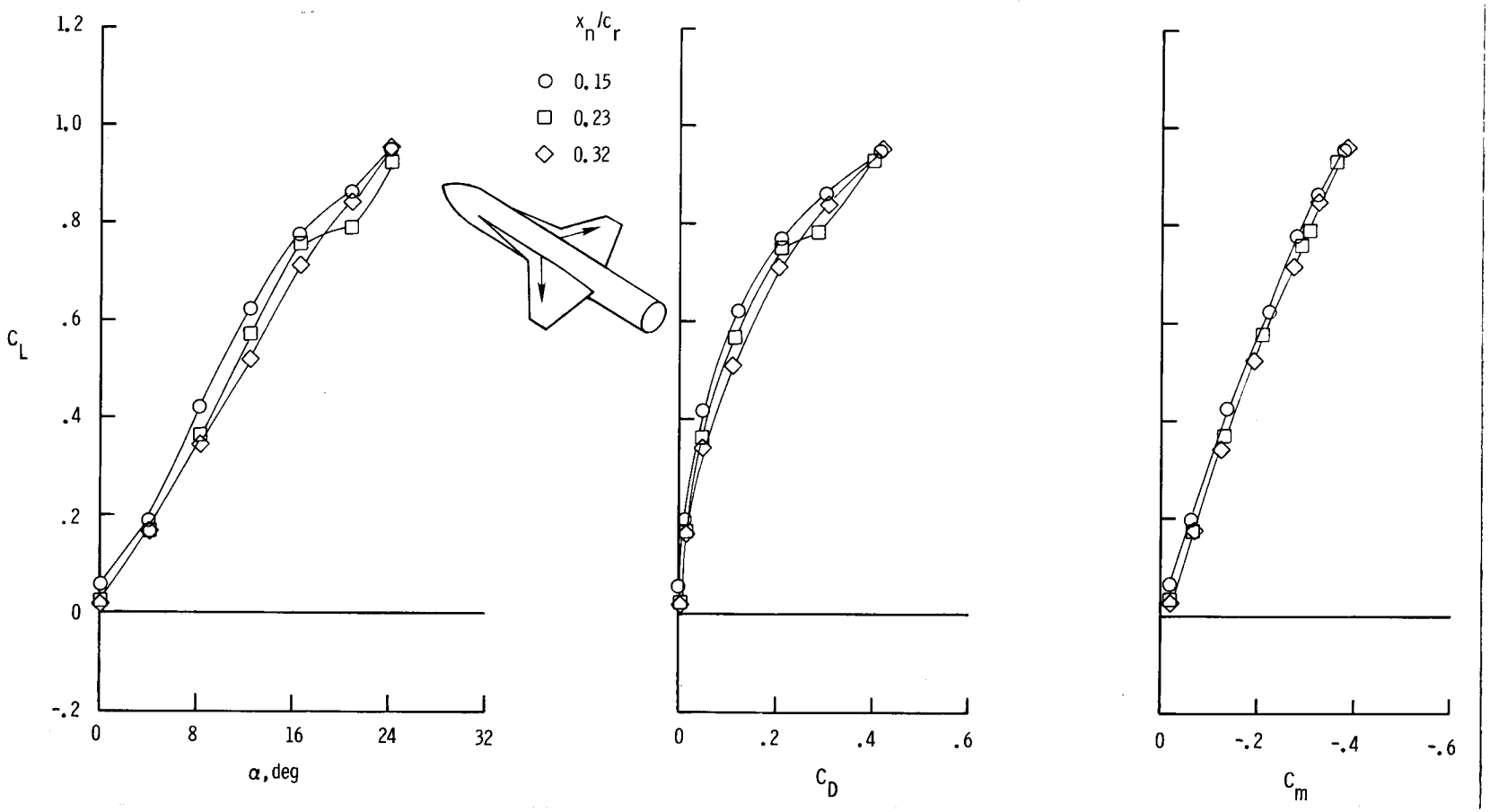


Figure 26.- Effect of x_n/c_r on longitudinal aerodynamic characteristics with strake on. C_T = 0.12.