Figure 709 can also be used to determine the wave angle, $, or may be used with the equations to determine the required downstream depth or width parameter if a certain transition length is designed or required.

To minimize the length of the transition section, Y_3 / Y_1 should generally be between 2 and 3. However, F_3 shall not be less than 1.7 for all transition designs. For further discussion on oblique jumps and super-critical contractions, refer to CHOW, 1959.

706.2.1.2 Expanding Transitions

The goal of a properly designed expansion transition is to expand the flow boundaries at the same rate as the natural flow expansion. Based on experimental and analytical data results, the minimum length of a super-critical expansion shall be as follows:

$$L_t \geq 1.5\,(T_w)\,F_{r1} \qquad (745)$$

Where L_t = Minimum Transition Length (ft)

T_w = Difference in the Top Width of the Normal Water Surface Upstream and Downstream of the Transition

F_{r1} = Upstream Froude Number

706.2.2 Bends

Bends in super-critical channels create crosswaves and super-elevated flow in the bend section as well as further downstream from the bend. In order to minimize these disturbances, the minimum radius of curvature in the bend shall be based on the super-elevation of the water surface not exceeding 2 feet. **Equation 740** in Section 706.1.2 shall be utilized to determine allowable radius. In no case shall the radius of curvature be less than 50 feet.

A value of C = 1.0 shall be used for all trapezoidal channels and for rectangular channels without transition curves. For rectangular channels with transition curves, a value of C = 0.5 value may be used.

706.2.3 Spiral Transition Curves

When a designer desires to reduce the required amount of freeboard and radius of curvature in a rectangular channel, spiral transition curves may be used. The