Memorandum Denver, Colorado

Chief, Canals Branch January 18, 1956

Chief, Hydraulic Laboratory Branch

Results of tests to determine the merits of constructing baffle piers with the upstream face vertical and normal to the sloping floor of a baffled chute

At the request of Messrs. Terrell and Curtis, a series of tests were conducted in the Hydraulic Laboratory to determine the relative hydraulic merits of constructing piers on baffled chute with the upstream pier face (1) vertical and (2) normal to the slope.

The tests were conducted in the 1:16 model of the check intake structure of Potholes East Canal. The model represented a 200-foot length of approach channel, chute on a 2:1 slope, and an outlet channel filled with sand for erosion studies. A vertical step 2 feet 4 inches high was placed at the upstream end of the 2:1 slope. For the purpose of these tests piers 3 feet high and spaced 4 feet 6 inches apart were placed on the 2:1 chute. Details of the piers are shown in Figure 1. The model was operated at a discharge equivalent to 35 second-feet per foot of channel width. The control gates were removed from the structure to provide ideal entrance conditions to the sloping apron.

Two criteria were used to determine the effectiveness of each set of baffle piers: (1) Height of splash. One side wall was painted with water-soluble paint which appeared darker when wetted by the splash from the piers. (2) Amount of erosion. Scour patterns in the outlet channel were obtained for each set of piers after the model had operated for one-half hour.

Figure 2 shows the results using the two sets of baffle piers. The photographs on the right side of Figure 2 indicate the test set-up and the results with the upstream face of the baffles placed normal to the 2:1 slope while the photographs on the left were obtained with the pier face vertical, Figure 1. By noting the height of the water marks along the painted wall in Figure 2C, it can be seen that the splash extended to approximately elevation 740 feet with the pier faces placed normal to the slope. When the vertical-faced piers were installed, the splash extended to elevation 735 feet. Thus, the height of splash was about 5 feet lower with the vertical-faced piers. No attempt was
made to determine the quantity of water which would pass over the top of a training wall of normal height. However, it can be assumed that the amount of water passing over a given training wall would be proportional to the height of splash.

Figure 2D shows the scour pattern obtained with the two pier shapes. With the normal-faced piers installed the eroded bed was slightly higher in the vicinity of the right training wall than when vertical-faced piers were used, as indicated by the position of the 909-foot contour. However, for practical purposes, there is no difference in the two scour patterns. It should be noted that the scour pocket (elevation 906) along the left training wall was a result of the wall of symmetry and would not occur if the entire width of structure had been constructed.

The above tests indicate no conclusive superiority of one shape of block over the other as far as depth of scour is concerned. Although the depth of scour using the normal-faced piers was slightly less in the vicinity of the right training wall, the difference in the two scour patterns was too small to be conclusive. However, similar tests were made during the studies on the check intake structure, Potholes East Canal, using baffle piers 4 feet 6 inches high and a unit discharge of 61 second-feet. Results of these tests are shown in Figure 3. Although the outlet channel scoured to elevation 904 feet with each set of piers, more material was moved when the vertical-faced piers were installed. With the normal-faced piers, the low area in the resulting scour pattern was confined to a small pocket near the end of the right training wall as indicated by the 906-foot contour. The low area in the vicinity of the right wall was considerably larger when the vertical-faced piers were installed. This same tendency, although to a smaller extent, is indicated in the scour patterns of Figure 2 for the 3-foot piers.

From these tests, it is concluded that a baffled chute with the upstream face of the piers placed normal to the chute slope will give slightly less scour in the outlet channel than chute equipped with vertical-faced piers. Therefore, the normal-faced piers are recommended for locations where the scour must be kept to a minimum and splash over the training walls will create no unusual problems. However, in those locations where splash will cause washing and drainage problems, the vertical-faced piers are recommended to keep the amount of splash to a minimum.
A PIER WITH FACE NORMAL TO SLOPE

B. PIER WITH VERTICAL FACE

BAFFLED CHUTE STUDIES
A. Upstream pier faces normal to slope.

B. Upstream pier faces vertical.

C. Discharge 35 cfs per foot of channel width.

D. Erosion after 1/2 hour of operation

BAFFLED CHUTE STUDIES
A. Upstream pier faces normal to slope.

B. Upstream pier faces vertical.

BAFFLED CHUTE STUDIES
Check Intake Structure - Potholes East Canal
Discharge 61 cfs Per Foot of Channel Width