Skagit River near Concreto, Wash.

Verification Study

The peak discharge of the flood of Nov. 27, 1949 was 153,000 second-feet from rating curve extended above 135,000 second-feet. The rating is defined at high stages by a series of measurements made in 1932. A slope-area survey was made on Aug. 29-31, 1950, in a reach whose downstream section was at the cableway and extended about 3,200 feet upstream to a point _____ feet downstream from the gaging station. Using the discharge from the rating curve of 153,000 second-feet, the value of n for the various sub-reaches was determined.

The profiles are fairly well-defined except for the right bank of sect. A and the results should be reliable. The writer would use the circled elevations shown on sheet No. 3 except for the right bank of section A where the value of 25.77 which roughly averages all the marks would be used. However, it does not matter very much because reach A-B is expanding and should not be used anyway even if the profile was well-defined at section A. The n for sub-reach B-C computes as .0276 and for C-D, .0325. However, from the stereo-realist slides, there does not appear to be any reason why A-B should be much different than B-C, or C-D. Therefore, using the 3-section formula, 3b, p.37 "Computation of Peak Discharge" the writers have computed (unchecked) an n of 0.0305 for the reach B-C-D, only. It is believed that this value is more reliable than any of the sub-reach values.

Flood of Dec. 13, 1921

The peak discharge for the flood of Dec. 13, 1921, was originally computed by Mr. J. E. Stewart, hydraulic engineer, U. S. Geological Survey, by the slope-area method and contracted opening methods as 240,000 second-feet. The slope-area reach was practically the same as that used for the verification study for the Nov. 27, 1949, flood. Stewart's section 1 was about 300 feet upstream from sect. A of the 1949 flood; his section 2 was between sections B and C; and his section 3 was about 700 ft downstream from sect. D. In the original computations an n of .033 was assumed for all sections on the basis of computed n's at Sedro Woolley. Highwater mark's were determined at all three sections on the right bank and at sections 1 and 3, only, on the left bank. Computation of discharge was made by the Chezy and Kutter formulas without adjusting surface slope for variations in velocity head.

Using Stewart's values of fall and area and wetted perimeter of the sections the peak discharge of the flood of Dec. 13, 1921, was recomputed as 209,000 cfs ~~second~~ with values of n assigned on the basis of those determined for the flood of Nov. 27, 1949. An n of 0.040 was used for the reach 1-2 and an n of .033 for reach 2-3. There appears from the stereo-realist slides to be very little likelihood of much change in conditions in the reach since 1921. The original notes and computations for the flood of 1921 are not available to the writer but a summary of them in Mr. Stewart's unpublished report "Floods in Skagit River Basin, Washington," 1923, gives a summary of the computations. After adjusting the areas for the difference in stage between the two floods, there appears to be practically no change between 1921 and 1949. The overall surface slope determined for the 1921 flood is almost exactly the same as that found for the 1949 flood. However, the flood of 1921 was 6.7 feet higher than that of 1949, but the effect of the trees on the banks probably is negligible.

The writers believe that there is little basis for using a higher n in the upper part of the reach than in the lower part. They feel that an n computed for the reach B-C-D is more logical. They also feel that only the reach 2-3 of Stewart's 1921 determination should be used in computing the discharge because reach 1-2 is expanding and the n for that reach may be questionable. Using Stewart's values of Fall, A, and V and the 2-section formula, the writers have computed (unchecked) a discharge of 225,000 second-feet using an n of 0.030 (as determined by the 3-section formula for verification study).

Revision of Historic Floods

In memorandum by Riggs and Robinson dated 11-14-50, there is listed proposed revisions for historic floods. These revisions are based on a straight line extension of the rating curve on log-log paper. However, some of the proposed revised figures actually fall to the left of the straight line extension (those for 1856 and 1897). The writers does not have any data upon which to judge the reasonableness of the straight line extension. However, it should be realized that a wide overflow section many miles downstream from the gage could cause the rating to bend to the right. Furthermore, if the discharge for the 1921 flood is plotted at gage height 47.6 feet and 225,000 second-feet it indicates a break to the right. On the basis that the peak for the 1921 flood as computed by Stewart (240,000 second-feet) is too high and that the rating now in effect and also in 1921 was the same all the way back to 1815, then the published values for all the historic floods are also a little too high but the highest flood (1815) may be correct. It is felt that the proposed revised figures as listed in the memorandum are too low. After the computation of the 1921 flood is checked, we would favor extending the rating exactly through that point.

F. J. Flynn
1-25-51

Revised- M. A. Benson
F. J. Flynn
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