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MODEL STUDIES OF STILLING POOLS BELOW DAMS

A Translation of

Tvary podjezd vysetrene pokusy

ve zmenszenem meritku

by

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in

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Model Studies of the Stilling Pools
Below Dams

Model studies were used to determine the shape of stilling pools below four dams during the first quarter of the present year.

These studies were requested by the Waterways Commission in Prague for dams on the Elbe River at Svnojedech and at Smiricich and on the Vltava River at Vranem and at Hluboke.

Therefore this technical memorandum was prepared to explain how the model tests were conducted and what design was recommended for construction.

Since the models of the structures at Svnojedech and at Hluboke were for a central portion of a bay, they did not include the study of any particular dam piers. The models of the dams at Vranem and at Smiricich included the middle pier and parts of the adjacent bays of the dam.

The models were made principally of wood and the accompanying sluice gates were either of wood or of brass sheet metal. The model scale for all models was 1:52 except the model of the dam at Vranem which was 1:40. These models were placed in glass-sided testing flumes." (Described in the official article on the purpose, origin and arrangement of the State Hydraulic Exposition of 1930 by Dr. Eng. Jan Smetana of the State Hydrotechnical Institute of J. G. Masaryk.)

The object of the stilling pool is to reduce the high velocity of the water, which is gained either from the fall over the dam or from the drop to the outflow under the sluice gates, in such a manner that the erosive power of the water which discharges from the pool will not cause deep scour.

So a layer of fine sand was placed in the testing flume at the toe of the stilling pool to determine the amount of scour. In certain cases the sand grains used were those that were retained on a 1 mm. sieve and that were passed through a 1-1/2 mm. sieve.

The photographs, figures 2-5, were taken through the vertical, glass, side-walls of the testing flume. They illustrate the cross-section of the stilling pool, the type of flow, and the amount of scour after a test of a fixed time.

The direction of the flow of the water was traced by white cotton strings threaded on fine suspended iron wires. So it is noted that the water partly flows away from the dam, stream lines, and partly curls or circles in the water, rollers, in proportion to the original discharge of the water.

Notes on individual pictures.

The dam in Svnojedech, figure 2, was built with two openings of 20 meter width. Each opening is controlled with a Stoney gate which is equipped with a regulating apparatus. The difference between the upper and lower water levels is 3.80 meters at low water. This Stoney gate dam is of the proportions necessary to handle flows such as occur at the center of the Elbe River.

Figure 2 shows the profile of the stilling pool recommended from model studies of the dam at Svnojedech. The photograph records the most dangerous hydraulic condition in the model when the flow over and under gate was 6.75 m^3/sec for 1 meter length of the crest of the dam (1 lm), and after a period of running of four hours and fifteen minutes. The length of the stilling pool from the crest of the opening is 16.50 meters.

The model of the dam at Uranea on the Ultava for a future time has four openings of 20 meters width. Each opening is controlled by two stoney gates. The difference between the upper and lower water levels is 11.90 meters at low tide.

Figure 3 illustrates the shape of pool recommended by the model tests. This photograph shows: the hydraulicly quieted flow of $1m^3$/sec/lm over the lowered upper gate, and how a bottom roller at the end of the stilling pool gathers and deposits eroded material at the end of the pool. It may be added that the height of the sill at the end of the pool is 1.2 meters above the bottom of the river bed. The length of the pool from the crest of the opening is 25.60 meters.

The model studies for the stilling pool for the dam at Hluboke on the Ultava River were interesting because the pool must satisfy the flow conditions for the first step of construction when the three 20 meter-wide openings are controlled by one Stoney gate for a height of 2.57 meters, and for the second stage of construction when the openings in the dam are controlled by two Stoney gates for a height of 4.19 meters. The regulation is maintained in the first step by inflow and outflow under the gates, and in the second stage by the overflow and outflow under the gates.

Figure 4 gives the shape of the pool for the dam at Hluboke on the Vltava River for a maximum flow under the gates of $5m^3/s/m$. The short length of the pool 10.90 meters with no paving beyond the pool effectively absorbed the erosive power of the water.

For the dam at Simirich a model was constructed with two dam openings of over 11 meters wide and with a fall at low water of 9 meters. The openings are controlled by two-high Stoney gates in each bay.

Figure 5 shows the shape of the stilling pool for the model of the dam at Simirich and the action for a maximum flood of $16.3\ m^3/sec/m$. The length of the pool measured from the crest of the opening is 23.60 meters.

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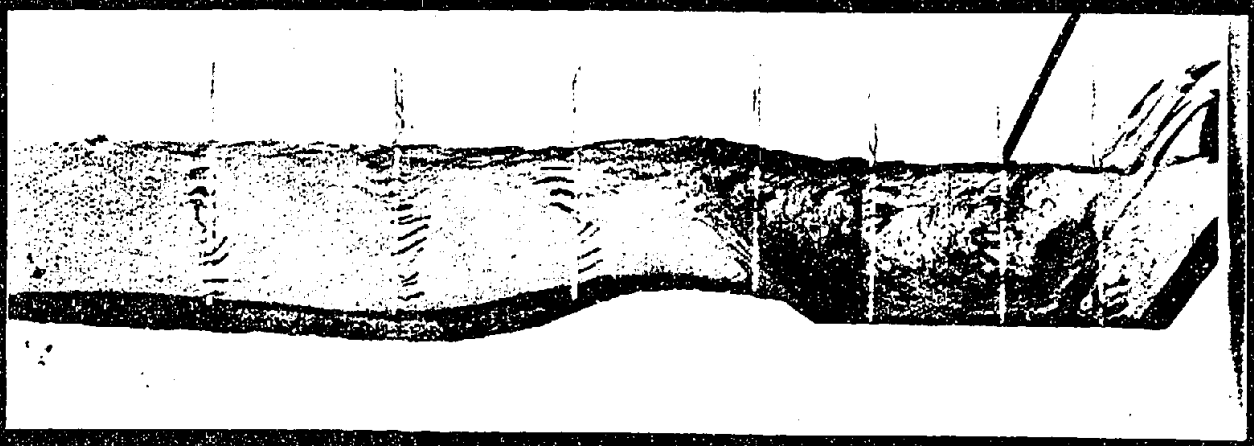
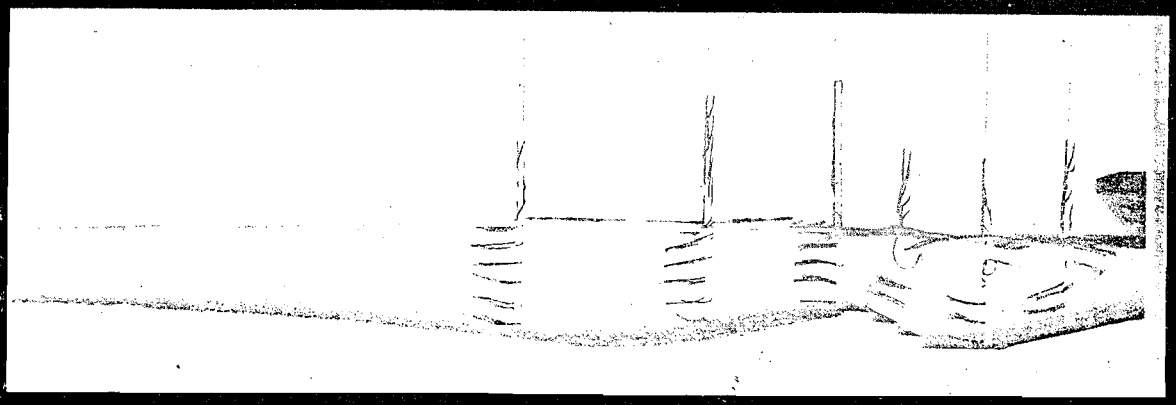
Obr. 2. Tvar podjezi pro zdymadlo na Labi v Srnojedech

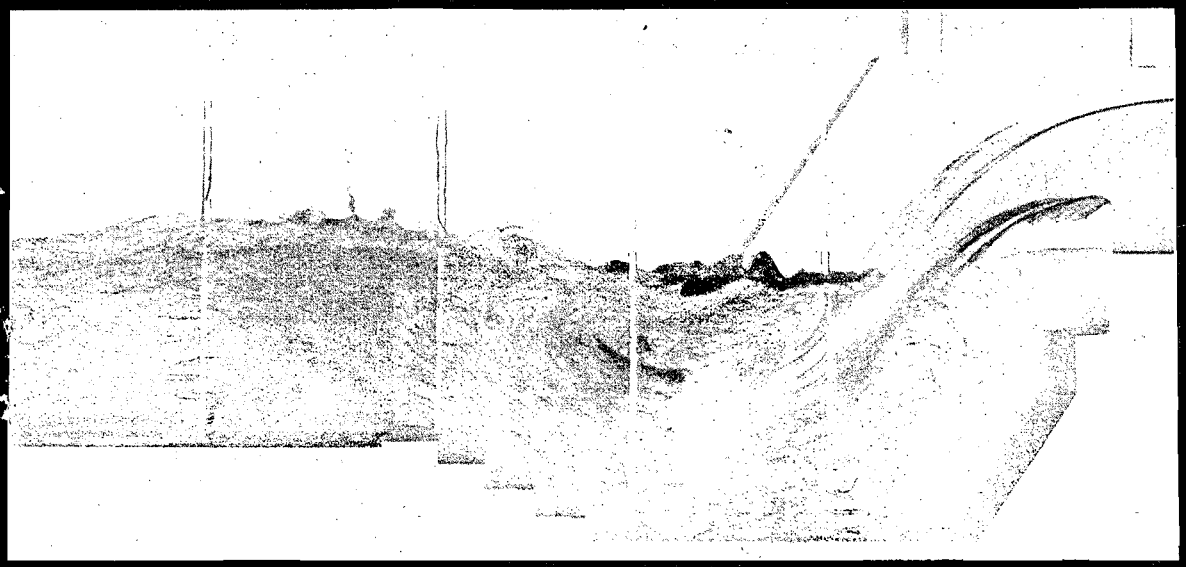
FIG 2 STILLING POOL FOR MODEL ON ELBE KR N S





Obr. 4. Tvar podjezí pro stupeň na Vltavě v Hluboké.

FIG. 4. STILLING POOL FOR CHUTE ON ULTAVA IN HLUBOKE



Obr. 5. Tvar podjezí pro zdymadlo na Labi ve Smiřicích.

FIG. 5 STILLING POOL FOR MODEL OF DAM ON ELBE RR. IN SMIRICICH