SOME FEATURES OF THE DONZERE-MONDRAGON CANAL--FRANCE

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The following is a brief summary of some of the more interesting features of the work on the Donzere-Mondragon Canal, France. There are many interesting engineering features of the canal, but it appears that the works in connection with the exclusion of transported materials are more interesting to us at the moment.

A general idea of the project may be obtained from Figure 1. There is a dam across the Rhone River near Donzere, France. Just upstream from the dam and on the left bank is a double intake to the Navigable Power Station Canal, Figure 2. The entire ensemble is located just downstream from where the river emerges from the Donzere Gorge.

The main dam across the Rhone is situated about 1 kilometer downstream from the canal headworks. It has been placed at a point of inflection in the curvature of the river, the flow being approximately normal to it. The length of reservoir formed between it and the canal entrance will provide turning space for vessels should the canal entrance be passed.

Design has been largely based on model tests and consists of five sluices, each of 31.5 meters clear width, and one navigable sluice of 45 meters adjacent to the left bank. A typical cross section of the dam may be seen in Figure 3. The radial gates are provided with hinged shutters 1.57 meters high at the top for small regulations of flow. The top level of the shutter is at 58.65 meters, the .065-meter clearance between the reservoir level and the top of the gate being to allow for waves formed by the wind action on the reservoir. The edge of the shutter is provided with several projecting heads to divide the sheet of water overflowing and, hence, to avoid undesirable vibration.

Canal Headworks

The extensive use of models in the design of hydraulic projects is characteristic of contemporary French civil engineering practice which is well exemplified by the works at Donzere (Figure 2). The Rhone River transports a great deal of solid matter in this region, estimated at 12 million cubic meters of suspended solids and 400,000 cubic meters of sand and gravel per year. One of the

main problems of the design of the canal headworks was to prevent the ingress of the sand and gravel into the canal in times of flood. The solution adopted after exhaustive model tests was to provide two separate canal intakes, as shown in Figure 2, one for navigation and one for the additional water required for the power station.

The line of the navigation canal forms, in effect, a continuation of the line formed by the river upstream in its passage through the Donzere Gorge. This canal is relatively wide, 100 meters, and shallow, with a sill level of 54.5 (reservoir level 58.0) compared with a level of about 49.0 meters of the river bed in the center of the stream, and takes about one-third of the flow into the canal. The entrance to the Power Canal is deeper and narrower, with a sill level of 52.5 meters, and is situated on the concavity of the curve of the riverbank. This canal takes two-thirds of the flow.

It is well known that on a curve the flow of a river carrying materials in transport tends to segregate, the liquid flow tending to pass to the outside of the curve and the solids to the inside, on the side of convexity of the bank. The power intake is, therefore, favorably situated to avoid the ingress of solids, but as a further precaution, it has been built with a sill, saw toothed in plan and projecting in section (Figure 4), to encourage solid materials to be directed downstream along the natural curve of the river where they will be evacuated from time to time through the main dam. This sill behaved very satisfactorily during the model tests, forming an eddy in the stream with a horizontal axis along its length which caused the solid materials to be carried downstream and toward the center of the stream away from the sill. If the space immediately under the sill was filled with alluvial materials, a flood would scour it out again.

The sill of the navigation canal consists simply of a line of steel sheet piles, since the velocities in this canal do not exceed 1.5 meters per second.

Control of Canal Flow

The headworks also include a dam across each of the two entrance canals. Control of the flow is necessary at these points since the level of the reservoir is 2 or 3 meters below that of the highest flood and also since, from time to time, the gates of the main dam will be opened to scour out sand and gravel in the reservoir. During this operation, the 15 million cubic meters of water in the headrace canal can thus be impounded. A further important reason for this control ~~are~~ is to mitigate any damage that would be caused to the surrounding countryside in the case of a breach of a canal

dike and to provide for a very gradual rise in the water level and the surrounding water table when the canal is filled.

Design studies indicated that two separate dams gave a more economical solution than a single structure downstream at the confluence of two canals. The navigation canal has a dam consisting of two sector gates of 45 meters span and 7 meters high. When raised, the gates give a clearance of 7 meters above average water surface for navigation. The power canal dam consists of three sluices, each controlled by a single vertical lift wheel sluice gate of 24 meters span and 6.5 meters high.

Much additional information on other features of the canal is available in my files.

PLAN DE SITUATION

Echelle: 1/1.500.000e

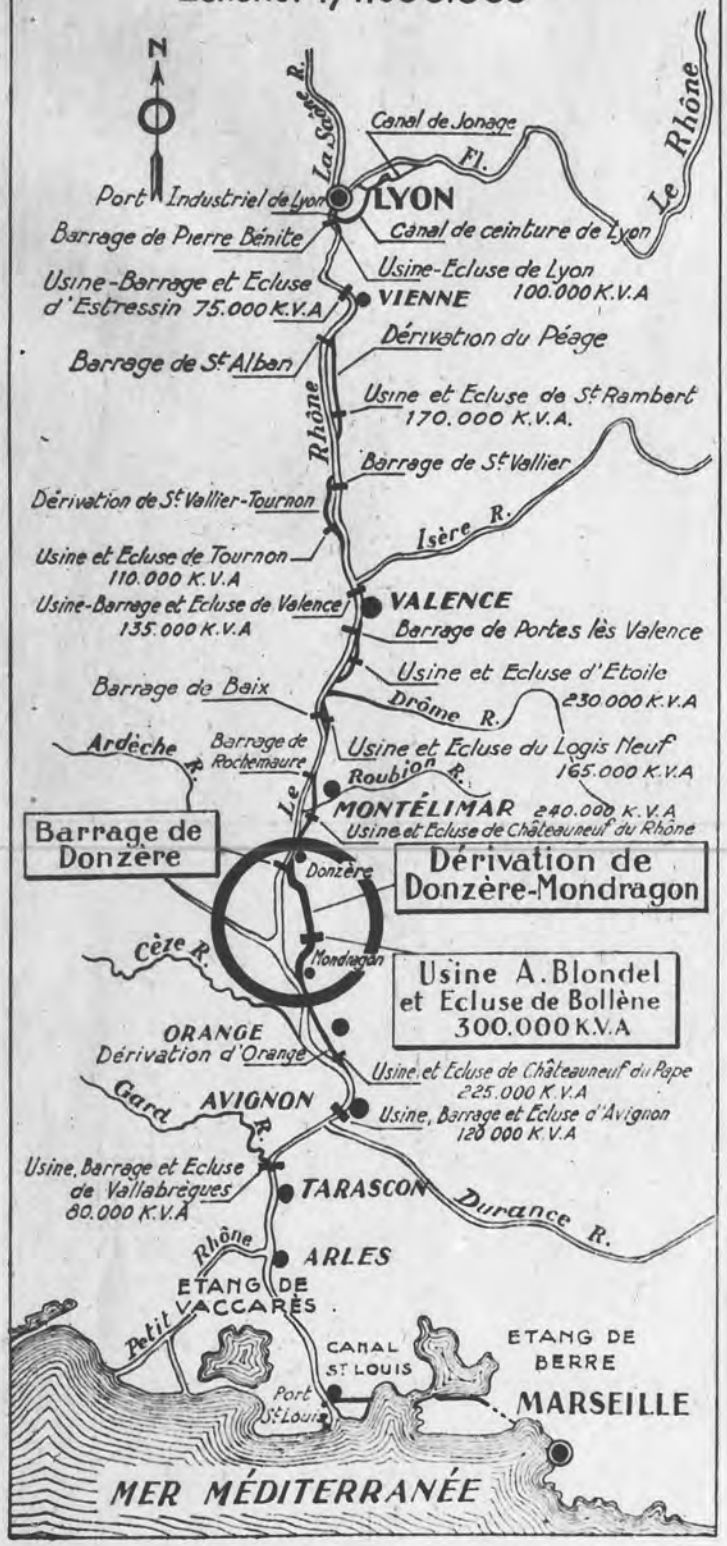


Figure 1

PLAN D'ENSEMBLE DES OUVRAGES

Echelle: 1/200.000e

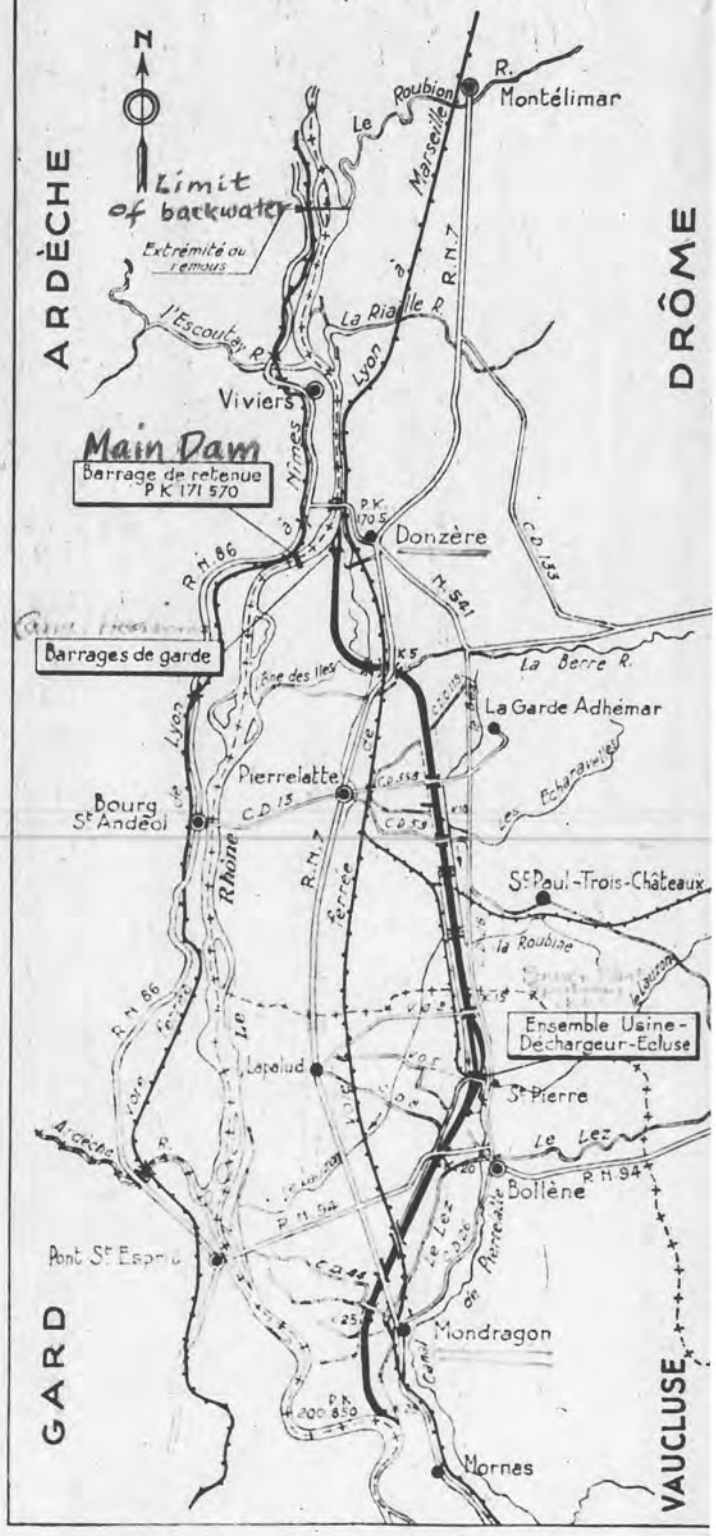


Figure 2

PLAN DE L'ORIGINE DE LA DÉRIVATION

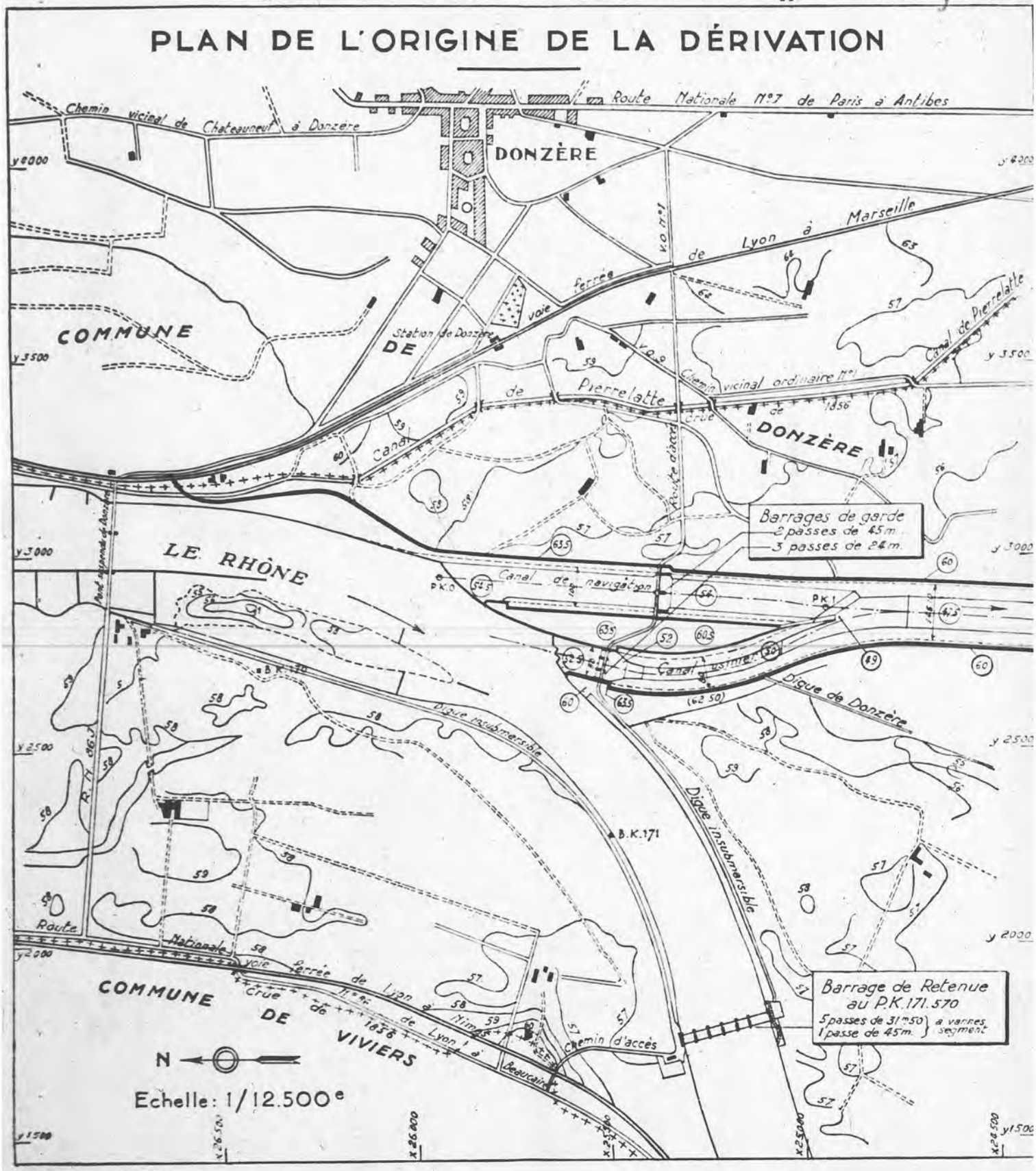


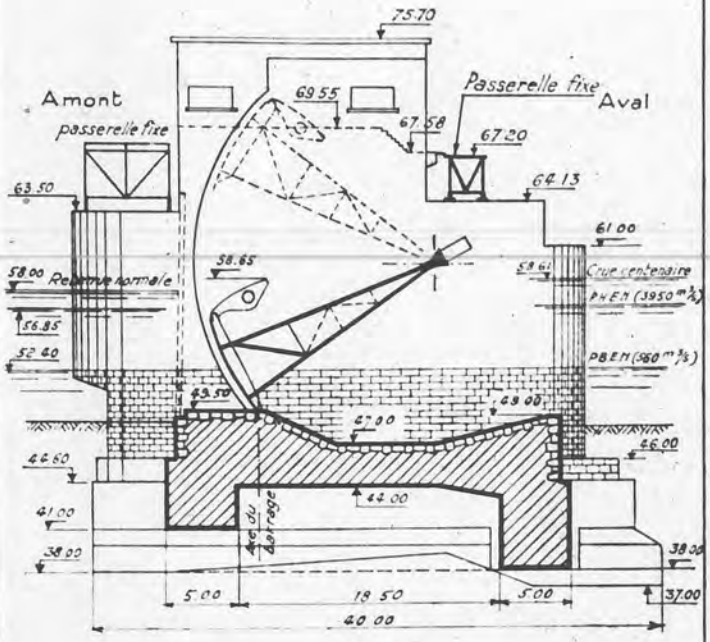
Figure 3

BARRAGE DE RETENUE

5 passes de 31 m 50 _ 1 passe de 45 m
5 passes à vannes segment à volet
1 passe à vanne segment (passe I)

Coupe transversale d'une passe

Echelle : 1/500e



_ Culée de R.D. et deux piles fondées sur le calcaire; trois piles et culée de R.G. fondées sur la mollasse tendre.

_ Radiers des passes I (R.D) et II fondés sur calcaire, autres radiers fondés sur la mollasse tendre.

Génie civil : Société des Grands Travaux de Marseille et Entreprise Joya - Chabert

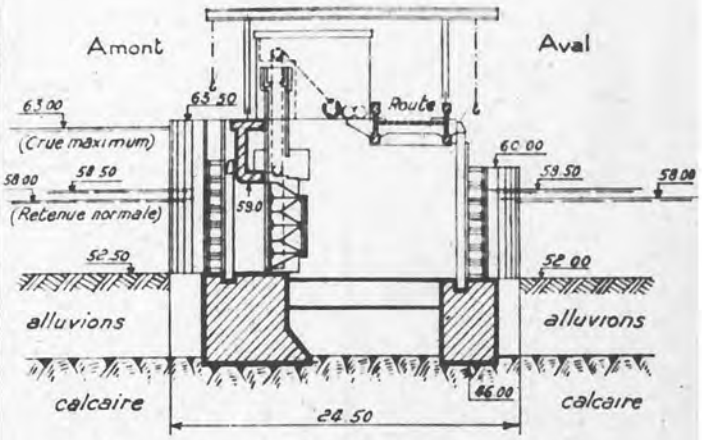
Vannes : Schneider & Cie et Cie de Fives-Lille

BARRAGES DE GARDE

Branche usinière

(3 passes de 24 m à vannes wagon)

Coupe transversale d'une passe
Echelle : 1/500e

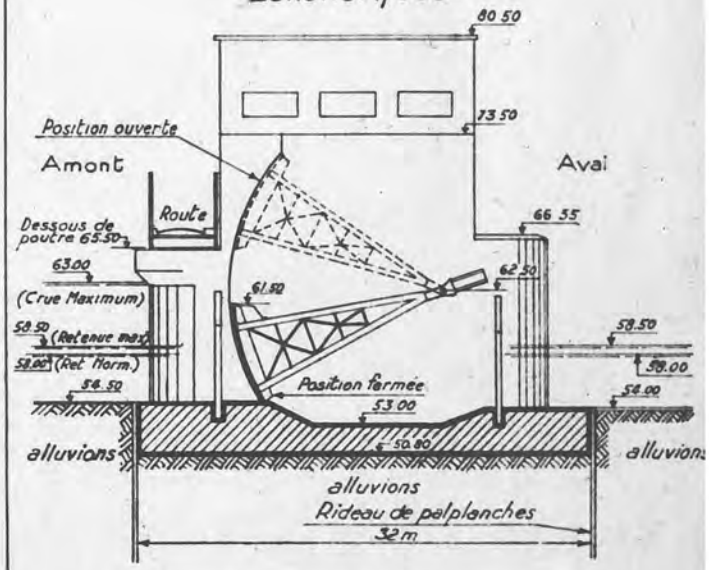


Vannes : Etablissements Dingler

Branche navigable

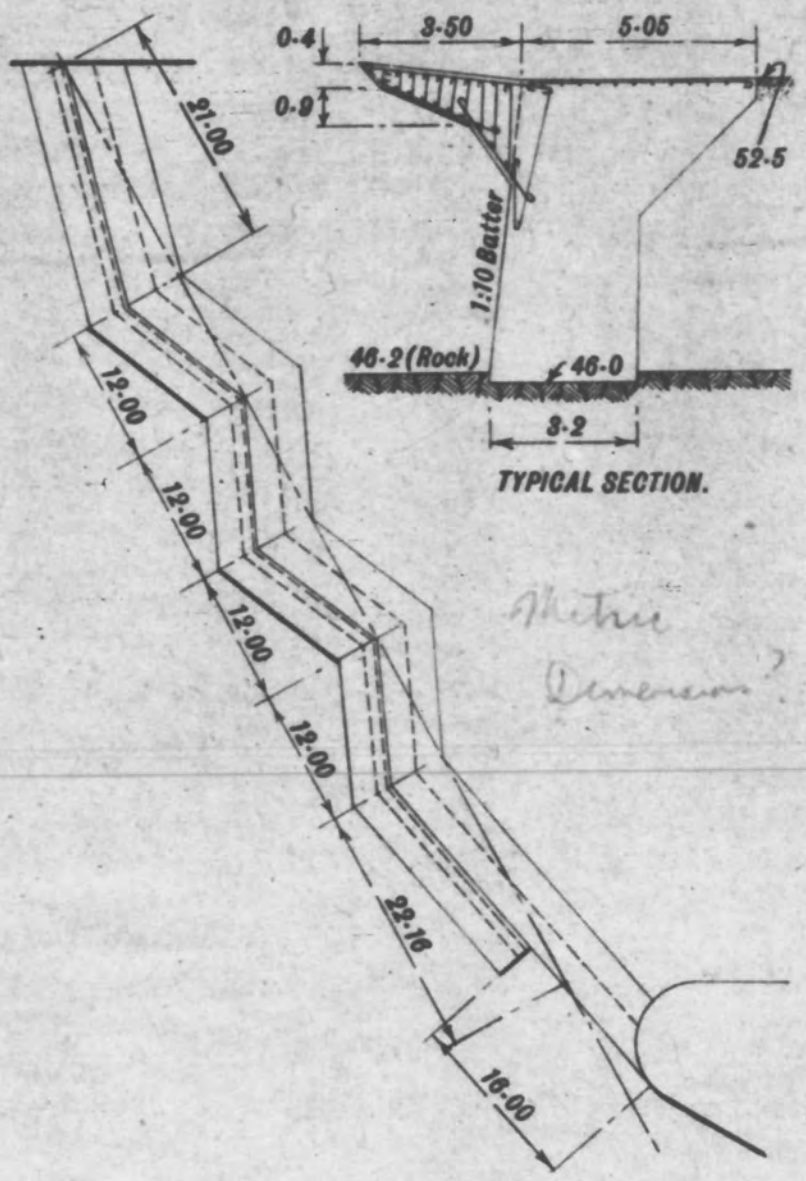
(2 passes de 45 m à vannes segment)

Coupe transversale d'une passe
Echelle : 1/500e



Vannes : Etablissements Daydé

Figure 9



Metric Dimensions?

FIG. 24—SILL OF POWER CANAL