

PAP 79

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NOTE SUR L'UTILISATION DE LA BENTONITE
POUR L'ETANCHEITE DU RADIER DU CANAL
D'AMENEE DE LA CHUTE D'OTTMARSHEIM
(NOTE ON THE UTILIZATION OF BENTONITE
FOR WATERTIGHTNESS OF THE INVERT OF
THE FEEDER CANAL OF THE
D'OTTMARSHEIM POWER DROP)

Electricite de France
North Hydraulic Equipment Region

June 6, 1955

Translation by C. W. Thomas

Denver, Colorado
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TRANSLATOR'S PREFACE

This is a working translation only
but all the ideas expressed by the
original author can be obtained
from it in its present form.

The headrace canal of the Ottmarschein power drop has a length of about 14 km (9.7 miles) with an average slope of 7 cm per kilometer (0.00007).

The ground water table, of which the slope is much greater (about 1 meter per kilometer)(0.001), cuts at its minimum level the surface of the bed of the canal at a point from which the linings are of concrete with the object of realizing a complete watertightness of the works.

Upstream from this point only the banks are concrete lined, the horizontal permeability being considerably greater than the vertical permeability. The invert is treated with alluvial deposits and soil of a thickness that decreases gradually and in proportion as the blanket approaches the upstress, the head of water in the canal above the underground water table diminishes from 8.5 meters (28 feet) to zero. The soil was chosen, by laboratory study, from the deposits of cleanings pushed aside at the beginning of the work. The best material is that in which the granulation gives, after sprinkling and compacting, a minimum of voids and the greatest percentage of clay.

In a zone of 2.5 km (1.55 miles) upstream from the origin of the concrete invert, about 200,000 square meters (240,000 square yards) the bed of the canal has been formed by compacting of two layers of earth of 0.15 meter (6 inches) thickness (after compaction) with an interposition between these two layers of a film of bentonite (Bentonite of St. Francis des glycerines).

The processes for the operations were as follows:

Place and level the first layer of earth

Wet down so that each grain takes its place and compaction by movement of a compacting vehicle having only four wheels, loaded with gravel, the load under each wheel being about 9 tons and giving a unit pressure on the soil in the order of 6 kg/cm^2 (90 lb/sq in)

Spreading of the film of bentonite by means of a manure spreader at a rate of about 2 kg/sq m (3.7 lb/sq yd)

Place and level the second layer of earth. This operation being effected with a great deal of precaution and in such a manner as to avoid disturbing the film of bentonite. (The trucks made their approach by backing, never passing over the layer of bentonite)

Compacting the second layer in the same fashion as the first

Protection of the overall by a layer of 0.5 meter (1.64 feet) of sand and gravel alluvium





In a second zone extending 2.5 km (1.55 miles) upstream from the first--two layers of compacted earth but without the interposition of bentonite--the second layer here was distinctly less carefully finished than the first and only on a part of this was there scattered the protective layer of 30 cm (11.8 inches) of gravel

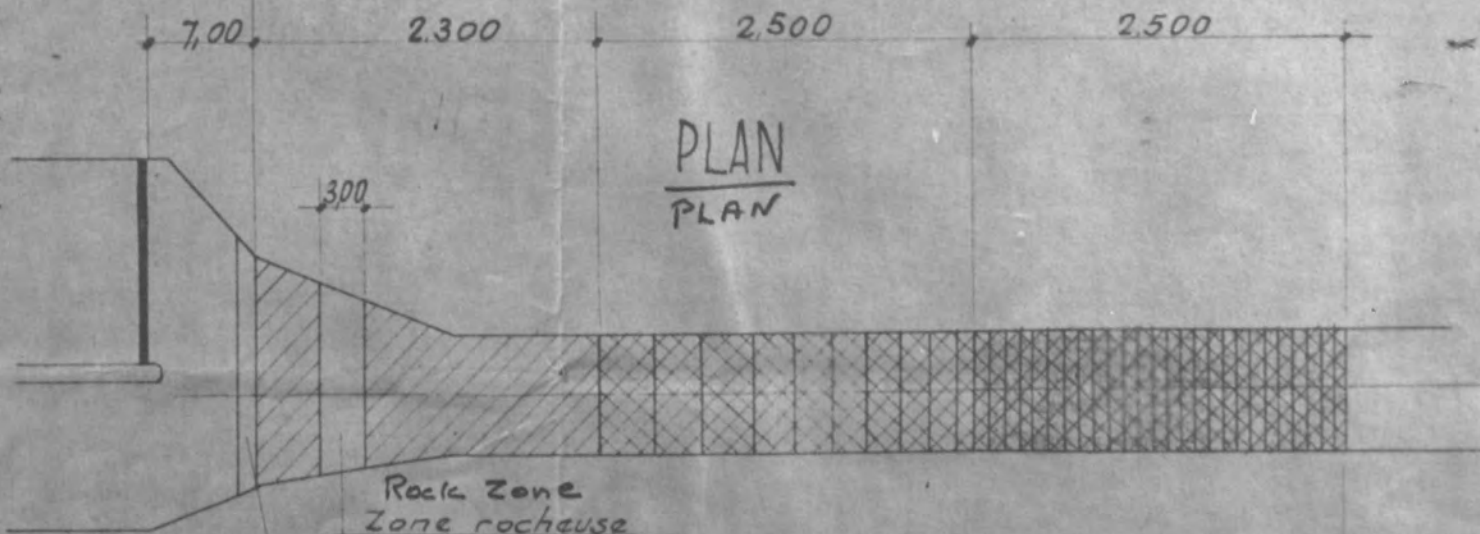
In a third zone that extended 2 km (1.24 miles) upstream from the second was a single compacted layer without protection

Finally in the last zone, which constituted the transition with the foot of Kembs Powerplant, about 1 km (0.62 mile), nothing was done. This zone is in effect the old tailrace canal from the Kembs Powerplant and cutoff behind which has been constructed the Ottmarschein Canal. It was impossible to compact it. Moreover, in this zone the level of the water surface in the canal is the same as that of the mean subsurface nappe and leakage is not anticipated.

CHUTE D'OTTMARSHHEIM D'OTTMARSHHEIM POWER DROP
 CANAL D'AMENÉE FEEDER CANAL

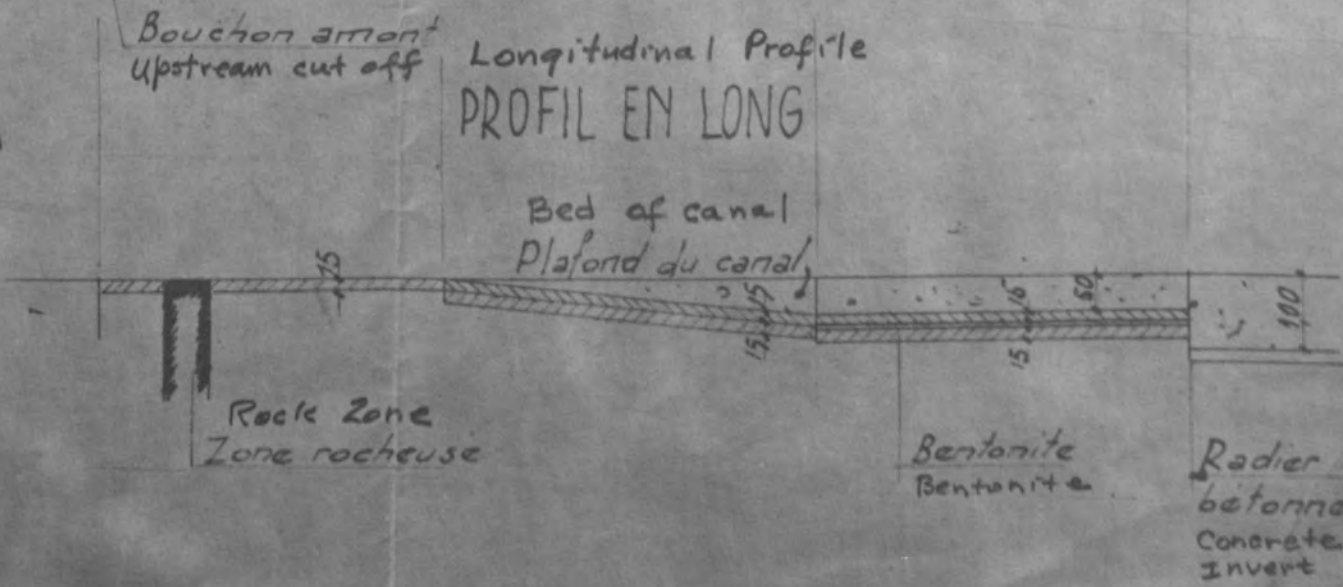
SCHEMA DE PRINCIPE DES ZONES DE COMPACTAGE
 Sketch of the principle of the zones of compaction

- 1st Layer 1^{ère} Couche 
- 2^d Layer 2^{ème} Couche 
- Gravel Cover Garnissage gravier 
- Bentonite 



- Scales
Echelles
- Length Longueurs 1/50.000
 - Width Largeurs 1/5.000
 - Thickness Epaisseurs 1/100

KEMBS POWER PLANT
USINE DE KEMBS



Bouclon amont
Upstream cut off