People's Democratic Republic of Algeria

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

HIGHER NATIONAL SCHOOL FOR HYDRAULICS

Post graduation and Scientific Research Department

Scientific Summary Report

Drawn up

by

Mr.Bachir Benlaoukli

This report is issued with the aim of being a part of the Academic Accreditation documents. The aforesaid report is meant to be a summary of the main pedagogic and scientific research activities achieved since my recruitment at E.N.S.H in 1998 so far.

Supervisions

- Supervision of approximately 100 students at undergraduate level.
- Supervision of a student at master level 2014.

Jury

- Member and chairman of boards of examiners within the scope of Master's Thesis.
- Member of juries for senior professional diploma

ENSH colloquies

- Member of organizing committee, International Colloquy 2000, on water and environment, organized by the ENSH.

- Member of the scientific member, International Colloquy 2008 CIGRE, « water and environment », organized by ENSH.

- Member of the scientific committee, International Colloquy 2012 CIGRE, « water and environment », organized by the ENSH.

- Member of the scientific committee, international Colloquy 2015 CIGRE, « water and environment », organized by the ENSH.

Review of studies programs and plans

- Member of the committee chaired by Mr.Salah B., professor at ENSH, responsible for reorganizing and making substantial alterations to the contents of the ENSH's educational programs of 3rd,4th and 5th academic years.

- Member of the committee chaired by Ms.Touaibia.B; professor at ENSH, responsible for substantially improving and enhancing the ENSH's post graduation education programs.

ENSH's science journal

Member of the reading committee for the international science journal "Eau et Environnement" of the Higher National School for Hydraulics-ENSH

Teaching manuals:

- Edition of a lecture handout on the sizing of small-size structures-2006.
- Another lecture handout with the heading « site works planning » -2007.
- A calculation code for students for the calculation of floods routing.
- A calculation code for students for the calculation of training walls stability.

Teaching edition*:*

Publication of a booklet on the sizing of hill dams and small-size dams. The authors: B.Touaibia, B.Benlaoukli ENSH. ISBN: 9947-0-0508-9.

Lectures:

- Oral communication with the heading: « Algerian experience in the field of hill dams. International Seminar on « small-size dams in the Mediterranean world » Tunis, 28th-31st May, 2001. Authors: B.Benlaoukli, B.Touaibia.

- Presentation of a poster at the international conference « hydrology of the Mediterranean and semi-arid regions » Montpellier, 1st-4th April, 2003, with the heading: « quantitative approach of silting up at 15 operating dams in the north Algeria ». By par B.Touaibia, B.Benlaoukli, S.Bouhaniche.

- Oral communication with the heading: « Impact of El Moustakbal dams releases on the silting up of an irrigation diversion dam ». VIIe of the Scientific Assembly of IAHS. Brazil, 02nd-09th, April, 2005, given by .Touaibia, M.Touaibia, B.Benlaoukli, A.Bessalem and MF.Sidi Moussa.

- Oral communication with the heading: « Contribution at optimizing the top width of small-size dams – Case of small-size dams in northern Algeria ». 1st international Colloquy – Water and Climate- Comparative views North-South, Rouen France dated 25th-26th, September, 2012 , given by B.Benlaoukli and B.Touaibia

- Communication with the heading: « Problematic of groundwater dams in the south of Algeria. Case of Ouled Djellal underflow dam ». 24th Meeting of Earth Science. RST PAU France dated 27th-31st October, 2014. , given by B.Benlaoukli, and M.Meddi.

Publications:

- Publishing a scientific article with the heading : " Algerian experience in the field of the studies for hill dams", in the French and Canadian journal "Revue des sciences de l'eau" " Journal of Water Science', Publication : « L'expérience algérienne dans le domaine des études de retenues collinaires», Journal of Water Science Québec-Vol 17/2 Editions lavoisier. Paris 2004. Authors: B.Benlaoukli, B.Touaibia. P 153-162.
- Publication: « Impact of El Moustakbel dam releases on the silting up of an irrigation diversion dam, Blida, algeria », International Association of Hydrological Sciences IAHS Publication 292-2005. Authors: Benina Touaibia, Mohamed Touaibia, Bachir.Benlaoukli, Abdelaziz Bessalem, Mohamed Fawzi Sidi Moussa. P 333-339

- Methodological article on «floods routing- Step by Step Method », prepared at the request of Direction for Mini and Medium hydraulics-Hydraulics Ministry for use within the scope of a seminar on small-size dams of Sétif in 1985.

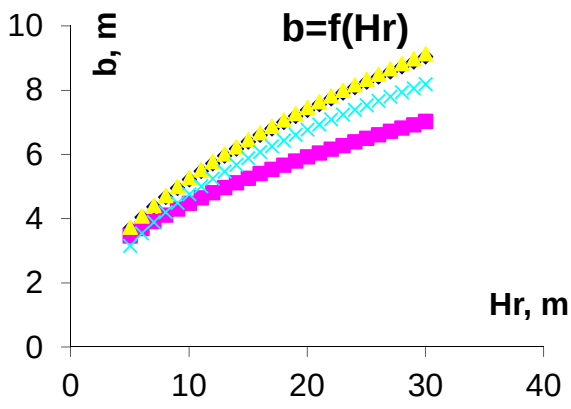
Scientific works the most significant are undoubtedly those falling within the scope of CNEPRU's researches projects with the respective headings:

First project:

Research project CNEPRU 0901/04/2004, with the heading: «**Integrated Water Resources Management in a Hydrographical Basin** ", the project of which Ms. Touaibia, Professor at ENSH is the manager. As a searcher, I focused my work on the searching for a relation that optimizes the dimension of top width depending on the structure height.
The searching for the **optimum thickness** of the crest of a dam with local materials, involves the structures with a height ranging from 15.0 3 and 30 3, i.e.; hill dams, small-size dams and medium-size dams.

In actual fact, the existing empirical formulas such as those of Preece, Knappen anonymous or simplified have always given results with great disparities between them.

The program, model prepared using the spreadsheet Excel, allowed making calculations for about fifteen structures with different heights. These values were transformed in a form of graphics, thereby allowing the spindles (ranges) to be highlighted, and within which are the admissible values (fig1).



This sample of about fifteen Algerian dams was used as work base knowing that the top width is closely linked to the embankment height, as shown by the sample. The four (04) formulas have allowed, based on approaches more or less logic, searching for the consensus between them. This consensual approach allowed determining six (06) mathematical relations.

Once the bounds of ranges defined, we have carried out a dimensional analysis in order to determine the law to which belongs the intermediary curve to stress the relation of optimal top thickness of the embankment. Several relations were established.
Work progress is characterized by the definition of the most simple and most representative expressions for the sample.
The aforementioned relations are:

(I) $y = 0,15x + 3,5$;
(II) $y = 2,730\ln(x) - 1,287$,
(III) $y = 1,867x^{0,427}$;
(IV) $y = 3,952e^{0,023x}$;

In addition to these expressions, two other relations were highlighted; they are relatively a bit more complex than those mentioned above. They are written as follows:

(V) $y = -0,003x^2 + 0,286x + 2,261$
(VI) $y = -7E\text{-}08x^6 + 8E\text{-}06x^5 - 0,000x^4 + 0,009x^3 - 0,137x^2 + 1,215x - 0,22$

The six aforementioned as regards tests relations gave satisfactory results.

Since the objective of our work is to propose a unanimous formula for the determination of top thickness of a dam, we have, after an in-depth analysis of the results, determined a relation that wins the backing for the four formulas on which our work was based.

In the six relations, (x) represents the embankment height H_r, and (y) is the top width of the structure b. The most simple and most practical expression we propose is the following:

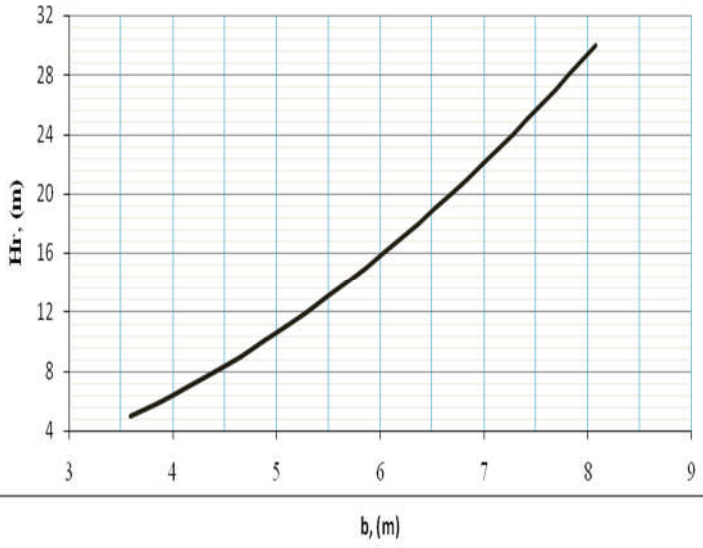
$$y = 1,867x^{0,427}$$

This formula was translated into practical language. By converting this relation in order to render it workable, we obtain as follows:

$$b = 1,867\ H_r{}^{0,427}$$

Given the fact that this formula allows determining not the maximum or the minimum value of the top width, but the optimum value, it can henceforth be written as follows:

$$\boldsymbol{b_{opt} = 1,867\ H_r{}^{0,427}}$$



The result obtained that we consider very encouraging requires the institution of a debate to comparing the results with the aim of extending this relation that could bear the ENSH's formula name.
The graph, figure No.2, allows reaching the optimum top width without going through any formula. Starting from the embankment height (ordered), towards the intersection with the curve, and by

protruding the abscissa we obtain the width useful for the embankment. (Project completed).

Second project:

Research project CNEPRU F05320070001, with the heading: " **Drought and torrential floods: Study, forecast and protection: Case of hydrographic basins floodings".** Directed **by** Ms.Touaibia, Professor at ENSH.
My contribution was based on the definition of the optimum freeboard of embankments depending on their height. In other words, the work was devoted to the searching for the most influent parameters on the freeboard dimension in the earth dams whatever the structure height.

The existing empirical relations such as those of Stevenson, Molitor and Mallet Pacquant have all shown that the freeboard directly depends on the length of water table, wind speed, and to a lesser extent, the maximum water depth in the lake.
The program, model prepared using the spreadsheet Excel, allowed making calculations for about fifteen dams with different heights.

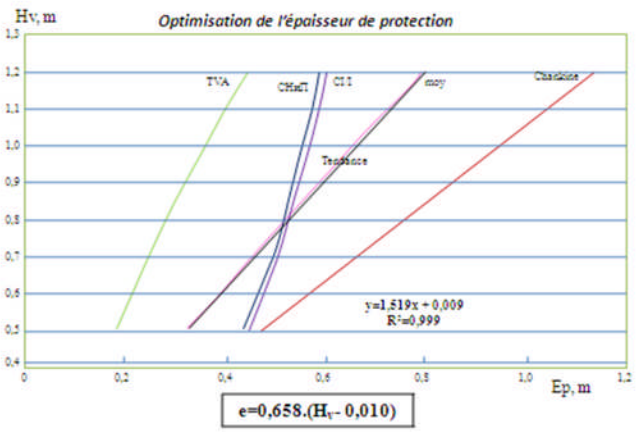
From the results obtained, we were able to notice Molitor relation cannot be taken into consideration when the wind speed is below 80 km/h. As the maximum winds speed in Algeria are generally speaking below those considered to be as critic , and for the projects located on northern Algeria's territories, the relations the most indicated for determining the wave height are those of Stevenson and Mallet-Pacquant. (Project completed).

Third project:

Research project CNEPRU F05320100001, with the heading: "**Contribution at water resources management in view of climate change.**"

The interest of my work is contributing at the searching for the optimum width of the upstream slope protection of a dam with local materials.

The existing empirical relations such as those of Chankine, СНиП II-И.4-62, Gaillard, TVA, Corps of engineers/Irribarren have all shown that the freeboard directly depends on the specific gravity of non-structural material and on the face inclination with respect to the horizontal.
The program, mode prepared using the spreadsheet Excel, allowed making calculations for about fifteen dams with different heights. (Project completed).



Once the lower and higher bounds of ranges are defined, we have carried out a dimensional analysis in order to determine the law to which belongs the intermediary curve to stress the optimum relation of embankment protection.

Work progress is characterized by the definition of the most simple and most representative expressions for the sample. This consensual approach allowed having six mathematical relations defined.

$$e=0,658.(H_v- 0,010)$$

Based on the fact that the value 0, 01 is noticeably negligible for the crest dimension at the embankment level, we will have finally the following expression:

$$e=0,658.H_v$$