International Journal of Civil Engineering, Construction and Estate Management

Vol.6, No.2, pp.59-68, September 2018

Published by European Centre for Research Training and Development UK (www.eajournals.org)

CONTRIBUTION IN THE MECHANICAL CHARACTERIZATION OF TWO RIVERS SAND FROM THE SOUTH-MIFI RIVER OF THE MIFI BASIN IN CAMEROON

Kamdjo Grégoire (Ph.D)[1], Nie Noumsi Thierry Constant[2], Ngapgue François[3], Gouafo Casimir (Ph.D)[1] and *Zoyem Gouafo Mathurin*[1]

[1]Fotso Victor University Institute of Technology, Civil Engineering Department, Laboratory of Industrial and Systems Engineering Environment (LISIE), University of Dschang Cameroon,

[2]Fotso Victor University Institute of Technology, Civil Engineering Department, Laboratory of Méchanical and the Modelisation of Physical Systemes (L2 MSP**)** Laboratory of Industrial and Systems Engineering Environment (LISIE), University of Dschang Cameroon,

[3]Associate Professor, Fotso Victor University Institute of Technology, Civil Engineering Department, Laboratory of Industrial and Systems Engineering Environment (LISIE), University of Dschang Cameroon,

ABSTRACT: *The valorization and the use of natural resources as building materials require a meticulous study of its geotechnical properties. Thus a study of river sands and crushed stones of the Area of the West Cameroon in the Department of MIFI was carried out with an aim of promoting its rational use in Civil Engineering constructions. After the fieldwork, laboratory studies have been focused on the mechanical characterization of the Sands samples of various careers taken; such as (Proctor test, test CBR and the formulation of the Concrete) and geotechnical references. These data made Object of traditional statistical treatments of the Mechanical Characterization; variability of each mechanical parameter, the search of correlations between some parameters and a factorial analysis of the whole data. The study concludes that the representative samples of the analyzed aggregates have mechanical properties which differed from the upper side of the South-Mifi River to the lower side of the river. The CBR from the upper side of the river is 15.05 and to the lower side 5.61 either a variation of 62.72 %.The normal Proctor from the upper side river gives a dry density of 1.33g/cm^3 for an optimal water content of 17.41 % and to the lower side river the dry density is 1.23 g/cm^3 for an optimal water content of 25.8 %.From the upper side, the modified Proctor test , the dry density is 1.53 g/cm^3 for an optimal water content of 16.9 % and to the lower side river the dry density is 1.39 g/cm^3 for a water content of 21.5 %.For the concrete compression resistance at 28 days, from the upper side river , the resistance strength is 26.70 MPa and to the lower side the resistance strength is 24 MPa.*

KEYWORDS: Characterization, Mechanical, Geotechnical, Crushed Stones, Sand Grain Size, Civil Engineering.

INTRODUCTION

We call aggregate a whole of grains of mineral origin with size ranging between 0.08 mm and 80 mm, coming from movable rocks, massive, ores or from the thermal transformation of industrial sub products. Sands are natural aggregates coming from the rivers (sea-bed, Reads River) and consist of one or more minerals thus quartz (SiO2), with an alluvial texture. There are also artificial aggregates which results from the thermal transformation of the rocks, sub

ISSN 2055-6578(Print), ISSN 2055-6586(online)

products, and waste or from the recycling process of old damaged structures. Sands have intrinsic characteristics which are related in general to the quality of the rocks exploited and just as of the extrinsic characteristics resulting from the conditions of formation such as the granularity, flatness, angularity…

They must answer some criteria or specifications to be able to be used in a concrete, a mortar or in other Civil Engineering works. Moreover, sands are classified in several categories with particular specifications for each one of them. The standard distinguishes the aggregates according to the use, the medium and the nature of the work such as:

Aggregate for layer of fitted (sub-base, base course and wearing course)

Aggregate for different qualities of concrete and mortar

LITERATURE/THEORETICAL UNDERPINNING

Various studies have been done (various analysis on the sand usage) for the formulation of concrete and mortar. Granite are stones having a good reputation for their durability, strength and exceptional resistance in the construction buildings. However, no research(analysis) has been realize on South-Mifi river sand where this aggregate abundantly exist and is mostly use in Civil engineering constructions. Moreover, crushed stones as Granite have already done an object of meticulous studies such as:

Who has studied the alteration of stones calco-alcaline and of granodiorite in the wild area of the Ivory Coast Republic. Many publications have been done on the longevity character, physical and mechanical of constructions materials (Leneu, 1959). In the restriction of his third cycle thesis worked on the alteration of volcanics rocks (Yongue-Fouateu, 1986). Has proced to the geotechnical characterization of the products of the alteration of rhyolitics in Bafou area limiting himself on intrinsic parameters of the material (Fetgo B, 2002). during the study of earth distortion in the Bana massive, has contribute in the geotechnical characterization of Granite stones (Kouayep Lawou, 2003). has sommary studied the physical properties of sand resulting the alteration of stones and rock of Batie (west Cameroon) and has done suggestion in other to improve the quality in the formulation of concrete (Keyangue, 2007). Made studies on the sands of some carreers of Bameda (in particular sands of Ndop, Woum, Mbattu) particularly saking on sand equivalent; and the analyse of theire consequences in concretes formulation (Goodwill, 2011).

MATERIALS AND METHODS

For better characterization of West Cameroon aggregates for a suitable use in civil engineering, an adapted methodology must be applied in other to efficiently conduct fieldwork, laboratory analysis and the calculation of different parameters of a structure we expect to build.

ISSN 2055-6578(Print), ISSN 2055-6586(online)

Fieldwork

Materials

The principal materials are represented here by the rocks, the grounds and the aggregates on which we take our various sand samples. For that we used the following equipment and tools:

- A pickaxe, a shovel and a hoe to trench in order to take the samples and to load them into bags;

- Polystyrene bags being used to take the samples;

- one decameter being used for the catches of measurements of various alternatives;

- Ear (individual protection equipment) for personal safety;

- Pens and memo pads for the catch of the data on site;

Localization of the site of study

In West Cameroon locality, several sand pits are open. An inventory of these last during many descents on the ground made it possible to operate a choice related with the geotechnical studies of the aggregates resulting from these various sites located between the parallels 5°25' and 5°28'00'' of Northern Latitude and the meridians 10° 20' and 10°25'00''.

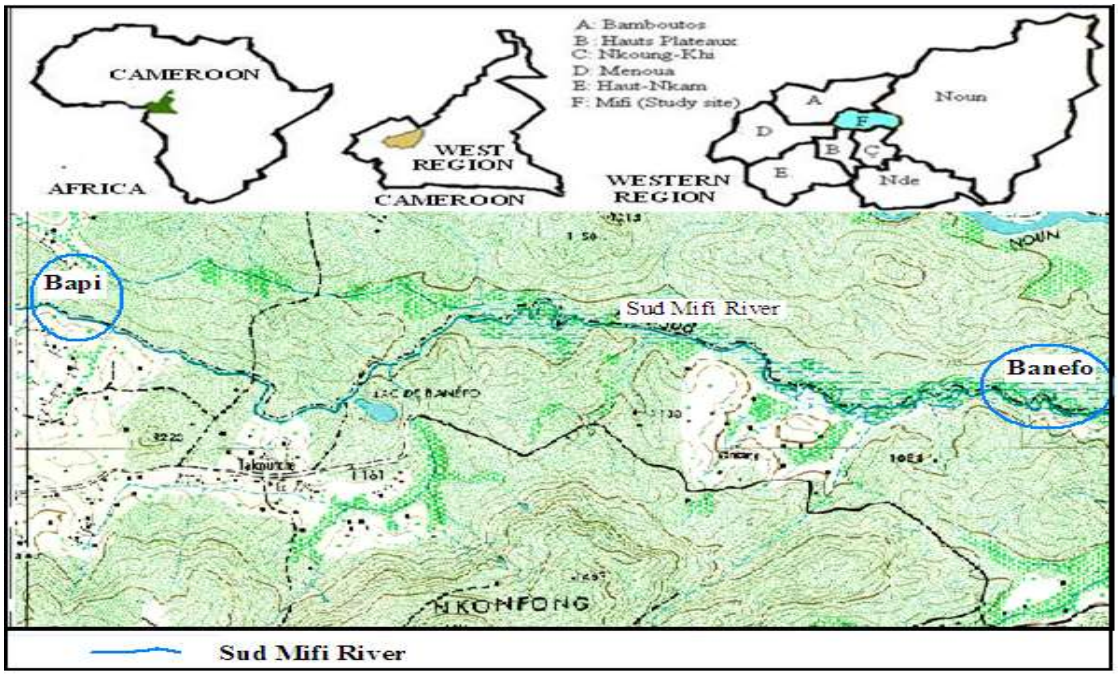

Figure 1: Localization of the study site

Sampling

With the aim of having the most representative samples, the approach of < shovel in hillock > was necessary, it should have been mixed materials that one made fall from a bleeding on all

ISSN 2055-6578(Print), ISSN 2055-6586(online)

the height of the coal face. Then the method of taking away by quartering made it possible to determine our operation by retaining the quantities necessary for work in laboratory. The resulted samples, taken on each alternative were packed in polystyrene bags and labeled for an identification of each one of these sands (CBR, water formulation of concrete, content optimal…).

Work in Laboratory

Work in laboratory was carried out on the various sand samples at the Laboratory of Engineering and the Industrial Systems and Environmental (LISIE) of the University Institute of Technology FOTSO Victor of Bandjoun associated with the Laboratory of Mechanics and Modeling Physical Systems (L2MSP).

Methods of Experimentation

In this part, the methods of experimentation for the determination of different characteristics from the materials will be presented:

- Mechanical characteristics: the CBR, formulation of concrete, water content optimal, optimal density.

Proctor Test

The test Proctor Normal or Modified makes it possible to find the water content optimal which leads to the best compaction of the material Le compaction of a material sample is made in a standardized mould, using a standardized lady, according to a process defined by the NFP 94-093.

Test CBR

Test CBR (Californian Bearing Ratio) is a test of bearing pressure (aptitude of materials to support the loads) embankments and subgrades compacted of the road works it acts to determine in experiments the bearing indices (IPI; CBR) in accordance with standard NF P94-078.

Formulation of the concretes

The formulation of the concretes aims to determine according to the criteria of handiness and of resistance defined by the schedule of conditions, the nature and the quantities of materials necessary to the formulation of one cubic meter of concrete in addition to, it is a question of defining, according to the type of work to be realized, the parameters necessary to the placement of the concrete and the stability in the short and long term of the work

RESULTS

It comes out of this study that the values of mechanical parameters of the river sands from South-Mifi River of the Mifi basin in the west region have specifically reached for each tested sand to the following results:

ISSN 2055-6578(Print), ISSN 2055-6586(online)

Table 1: Mechanical characteristics of different aggregates

Characteristics		Sand 1	Sand 2	Ecarts (%)
compactage Characteristic	$\rho_{dmax}(g/cm^3)$	**1.23**	**1.33**	**7.5**
	$W_{OPN}(\%)$	**25.8**	**17.41**	**32.51**
Compactage characteristic	$\rho_{dmax}(g/cm^3)$	**1.39**	**1.59**	**12.57**
	$W_{OPM}(\%)$	**21.5**	**16.9**	**21.40**
The carrier indice CBR		**5.61**	**15.05**	**62.72**
Resistance to Compression at 28 jours (f_c28) MPa		**24**	**26.70**	**10.11**

Optimal Water content and optimum Modified Proctor

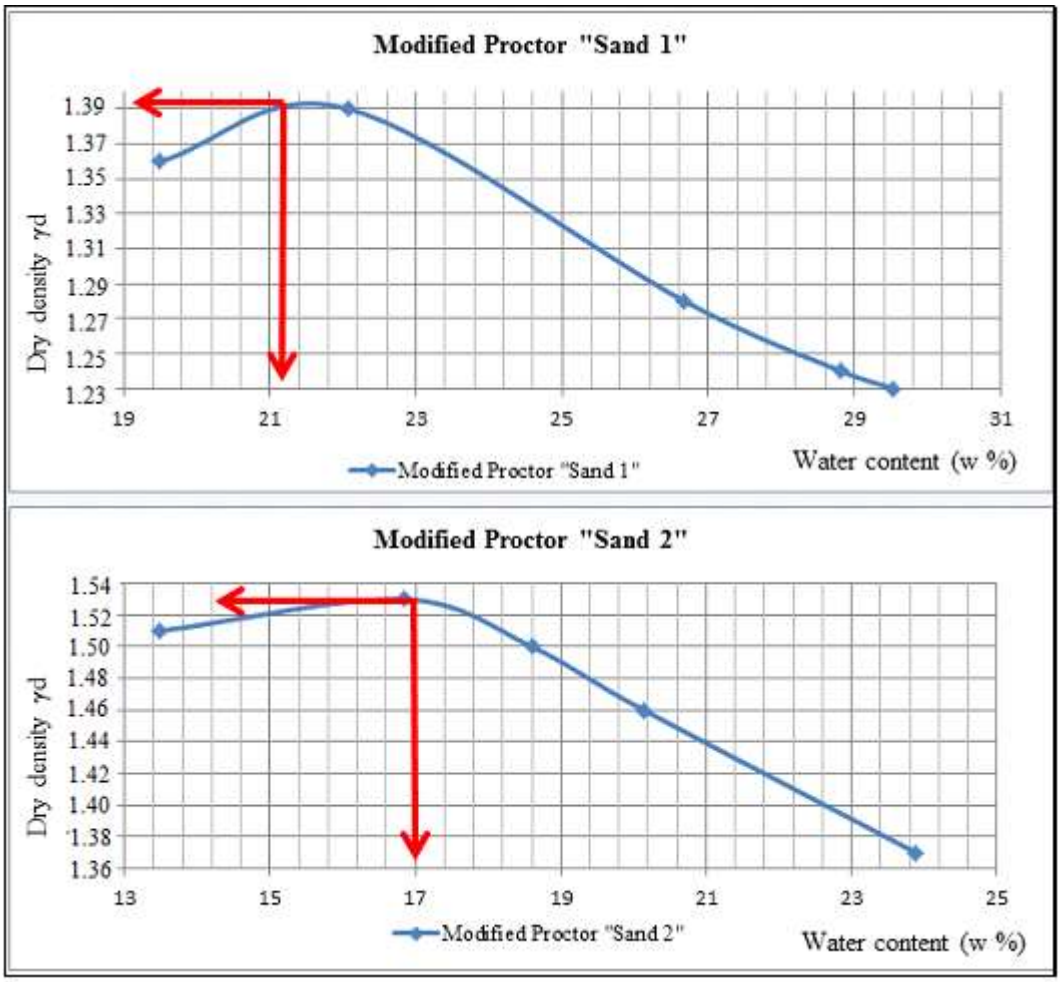

Figure 2: Modified Proctor curves of the various sand samples

ISSN 2055-6578(Print), ISSN 2055-6586(online)

Optimal Water content and optimum Normal Proctor

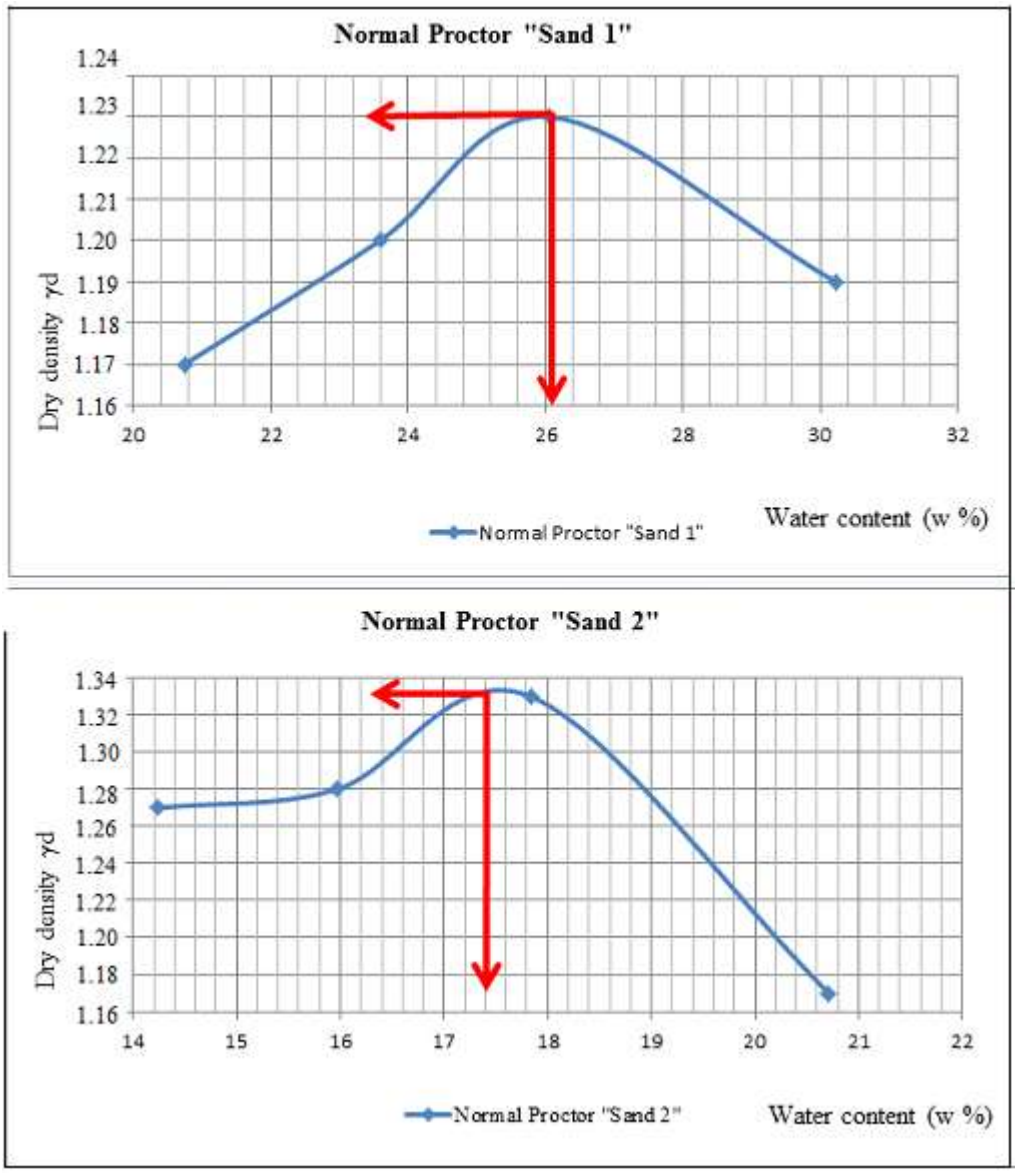

Figure 3: Normal Proctor curves of various sands

ISSN 2055-6578(Print), ISSN 2055-6586(online)

CBR (Californian Bearing Ratio)

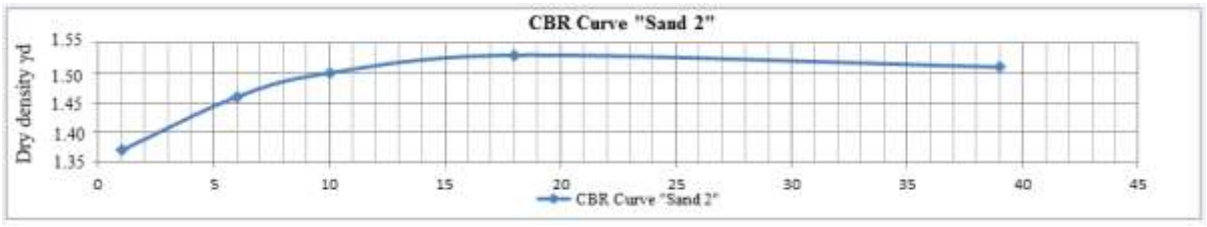

Figure 4: Immediate CBR curves of the various sand samples

Composition of concretes

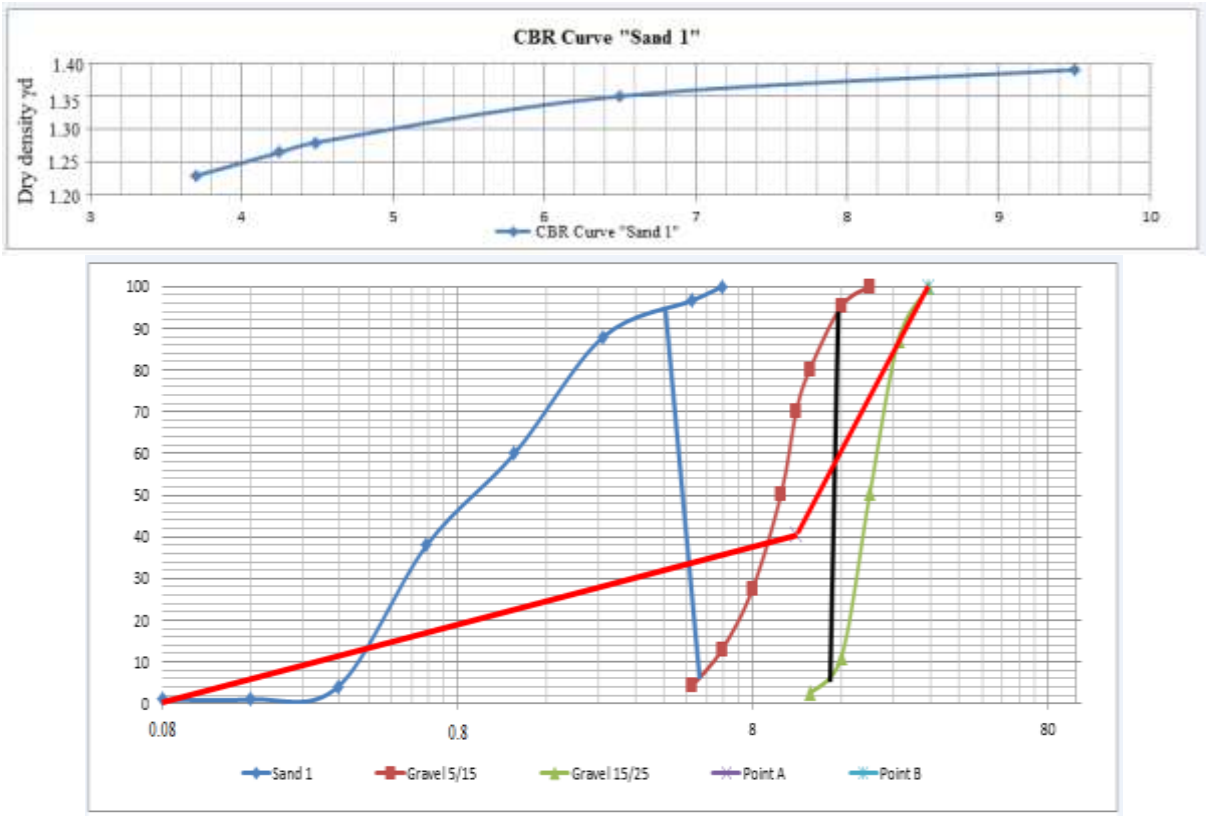

Figure 5: Grading curves of "Sand 1" and the various Gravels

ISSN 2055-6578(Print), ISSN 2055-6586(online)

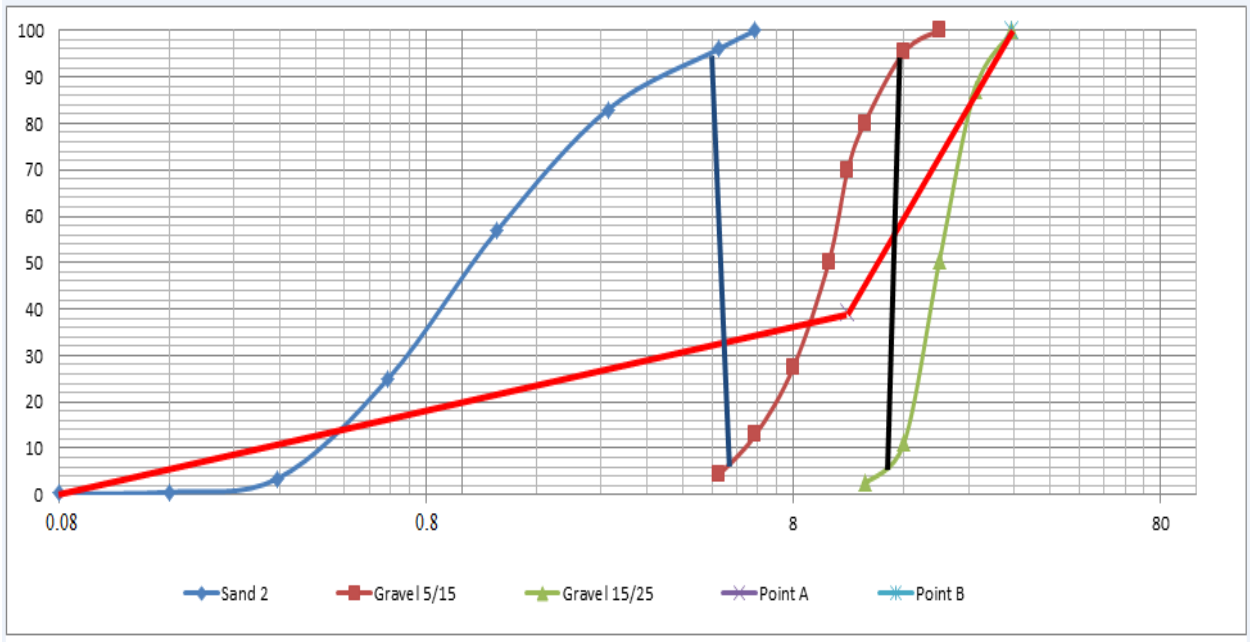

Figure 6: Grading curves of "Sand 2" and various Gravels

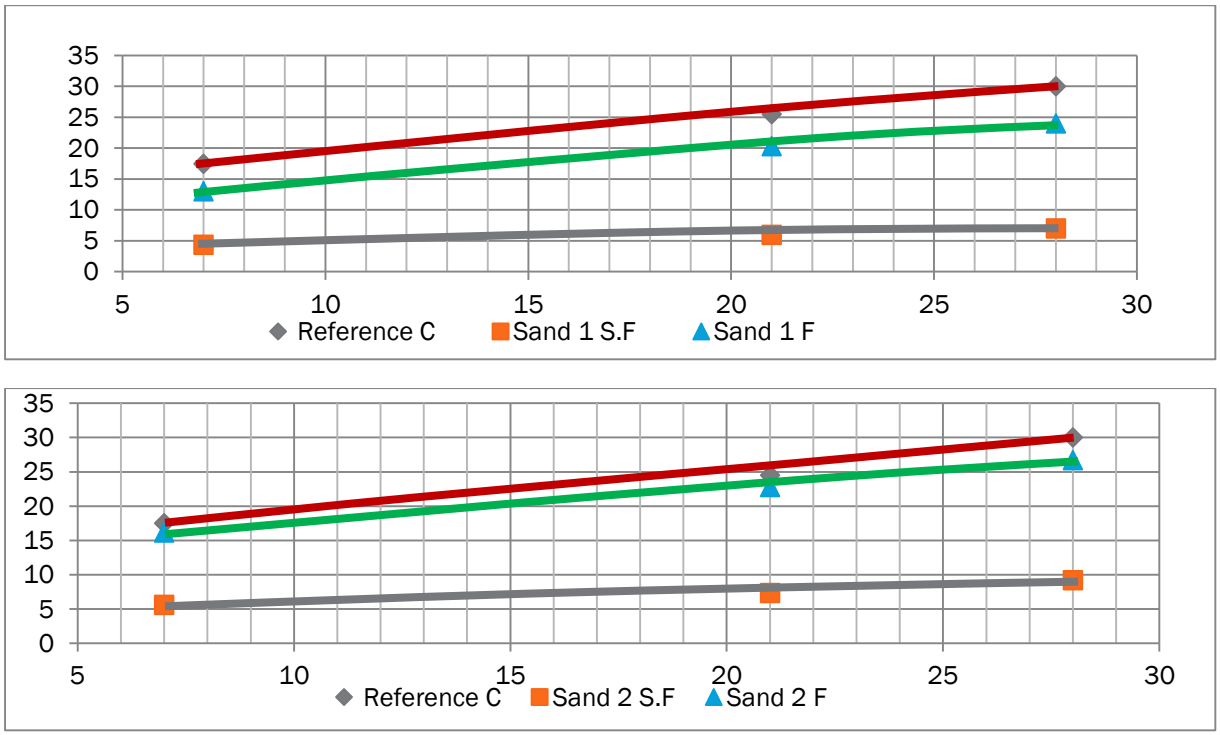

Figure 7: Curves of resistance of the test-tubes (various compositions) to different days

ISSN 2055-6578(Print), ISSN 2055-6586(online)

DISCUSSION

After having carried out the various laboratory tests, it comes out that:

Optimal dry densities with the OPN of various sands of 1.23g/cm^3 with 1.68 g/cm^3.In the same way their water contents with the OPN vary from 12.18% to 25.8%, which attests that these materials are advisable for the clothes industry:

- "Sand 1" and "Sands 2" are used for mortars and concretes

- The Index of bearing pressure CBR of "Sand 1" lies between 5 and 8 what gives us a ground of S1 class. «Sand 2" with an Index CBR ranging between 12 and 20 which leads to a ground of S3 class.

- To 7. 21. 28 days the concrete formulated with "Sand 2" with a better resistance characteristic to compression than those of "Sand 1" .We can thus conclude that the concrete formulated with "Sand 2" is a concrete of quality, resistance obtained is higher than desired resistance. On the other hand those obtained by "Sand 1" gives current concretes and thus resistance is lower than desired resistance.

Implication of the Model to Research and Practice

- “Sand1” is used for mortars formulation and current concretes.

- “Sand2” is used as base couch work material in roadway structure and also in good quality concretes.

CONCLUSION

At the end of our study, it was question for us to carry out a physical characterization of the aggregates of the careers of Mifi for their use in the Civil Engineering.We for that became heavy this characterization on the mechanical parameters which were presented and interpreted.From that it results the mechanical properties from various materials taken on the site. With the aim of develop these materials resulting from the sedimentary rocks, we also carried out, a comparison of the results obtained of the career of "Sand 1" with those obtained on the aggregates of the career of "Sand 2".

In end, the results obtained during this study pose the stakes constitutive of a data base mechanical of the aggregates of the career of “Sand 1” and “Sand2”;

Perspectives

- For the cementing field, it proves to be necessary to make a mineralogical study quantitative and qualitative, bus, resistances depend on it.

- For the field of the mechanical tests on hardened concretes, the tests (of compression and traction by splitting) must be carried out.The non-destructive tests must be also made with the sclerometriques ones.

- The effects of dimensional variations were not taken into account for modeling of swelling and the withdrawal. It would be of capital importance to study them bus of

ISSN 2055-6578(Print), ISSN 2055-6586(online)

them depend the complex phenomena on catch and the hardening of the mortars and the concretes.

REFERENCES

BRACE W.F., 1964. < < brittle in voice of stress in the Earth' S crust > >, international proceeding of the conference, Santa Monica, New York, AMERICAN ELSEVIER publishing Co, p.110-178

CEREPTP., 1984. (experimental centre of research of building studies and public works), pratique Guide on structures calculation of tropical countries. Edit. French documentation, Paris,155p.

Fetgo B., 2002. Geotechnical characterization of the products of the alteration of rhyolitics in Bafou area limiting himself on intrinsic parameters of the material.

French revue on geotechnic, 1983. Geotechnical studies and soil mechanics and materials. Project of DTU, RFG, Nº22, February 1983, Edit. Presses concassées, 27 pages.

Goodwill, 2011. Studies on the sands of some carreers of Bameda (in particular sands of Ndop, Woum, Mbattu) particularly saking on sand equivalent; and the analyse of their consequences in concretes formulation.

Jean FESTA, Georges DREUX, 2006. New concrete guide and its different elements, 8eme edition. Edit. Groupe Eyrolle, paris, 403p.

KEYANGUE T . J., 2007. Physical characterization of sands, resulting from alteration materials, from built-up granites and improvement of quality for the manufacture of concrete. Memory Master, Fac. SCI. Univ. DSCHANG, 68P.

Kouayep Lawou S., 2003. Study of earth distortion in the Bana massive, has contribute in the geotechnical characterization of Granite stones.

LABOGENIE, 1983.Recommendation for the use of sat crushed low register roadways, 27 pages.

Leneu F., 1959. Studied of the alteration of stones calco-alcaline and of granodiorites in the wild area of the Ivory Coast Republic. Many publications have been done on the longevity character, physical and mechanical of constructions materials.

MOKHFITAKARLI and WILLIAM P. Agbodjan, 2002. Experimental study of the thermal damage of the granite, destructive and nondestructive measurements.Laboratory of civil engineering and mechanical engineering, INSA of Rennes, 1-11

Yongue-Fouateu R (1986). Restriction of his third cycle thesis worked, on the alteration of volcanics rocks.

ISSN 2055-6578(Print), ISSN 2055-6586(online)