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Soil Characteristics Of Race 2A Between Streets 9 And 11 In The Area Araguaney, Department Of Arauca

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Abstract

Geotechnical engineers classify soils according to their characteristics and properties in relation to their use in foundations or building construction materials. Modern engineering classification systems are designed to allow an easy transition from field observations to basic predictions of soil engineering properties and behaviors. In this study a soil characterization of a sector in the Department of Arauca in race 2ª between streets 9-11 is carried out, with the purpose of making an improvement for the design of a pavement. This study was carried out by the AASHTO method and laboratory tests: Granulometric analysis by sieving, Material passing sieve No. 200, Moisture content and California Bearing Ratio (CBR). To calculate the design CBR, the method of the North American Asphalt Institute was used, resulting in a CBR of 3.66% and a material classified as SM (silty sands of medium to low plasticity) and sandy silts of low to no plasticity classified as ML, typifying them as soils of regular to poor performance as subgrade of a road.

Keywords*:* soil; classification; granulometry; characteristics; study; study

1. Introduction

The aspect related to geotechnics is associated with the stability of the area through which the road under study passes and of each of the geological (Oppenheim, V. 2022) and geomorphological (Forero-Ospino, O. E., & Duarte-Delgado, W. F. (2019) differentiated units, as well as of the existing and designed works of art.

Indeed, the geotechnical study is aimed at establishing the geotechnical (Bogado, G. O., Pintos, N. A., Reinert, H. O., & Bressan, D. A. 2017), (physical mechanical) properties of the materials in the area and the analysis of the destabilizing forces (Valiente Sanz, R., Sobrecases Martí, S., & Díaz Orrego, A.

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(2016) and those restoring structures of the equilibrium based on the properties of such materials. The depth of exploration was given in each case by the conditions found previously carried out. In this case it is observed in the studied area that there is a road in a critical state therefore geotechnical studies are carried out in order to initiate a process of construction and transformation of the road, since the constructive advantages offered by concrete make it the most implanted construction material in this sector (O Hurtado Figueroa, J A Cárdenas Gutiérrez and O Gallardo, 2018).

2. Method

It is intended to perform the soil study (Castillo-Valdez, X., Etchevers, J. D., Hidalgo-Moreno, C. M. I., & Aguirre-Gómez, A. (2021). to identify the type of soil to be worked, and thus be able to determine the surface management of rainwater (Juez Pirachican, P. A.)

The Geotechnical Design study was developed following the following methodology:

- Compilation and analysis of available information.
- Exploration of the road corridor with soundings taken every seventy meters or where there is evidence of soil stratification changes.
- Laboratory testing of samples taken in the field.
- Processing of the data obtained with direct penetration for CBR (Condori Huerta, P. Y. (2022).
- Determination of the typical structure section according to the results obtained from soil classification and bearing capacity by the AASHTO method (Maza Palomino, K. M., & Valentin Minaya, M. B. (2022) and the method of medium and high traffic volumes with references to the design charts.

2.1. Sample

For the soil study of Cra. 2A between streets 9 and 11 in the Araguaney sector, Department of Arauca.

Three picks are (Buitrago Perez, L. A., & Duarte Torrado, F. A. (2021) made in order to stratify the area to be intervened and take samples to be processed in the laboratory, also with the dynamic cone equipment CBR records are taken in situ and then correlated with the laboratory CBR, this information is processed to incorporate it into the design (Huaracca, T., & Antonio, J. (2021).

2.3. Instrument(s)

In the field, hand picks were made with pick and shovel and tools from the soil laboratory were used.

2.1. Parameters and Design Variables

Laboratory tests.

The following tests were carried out with the representative samples extracted (ASTM D4318. (2000), INV-148-13:

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- Granulometric Analysis by Sieving.
- Material passing sieve No. 200.
- Moisture Content.
- California Bearing Ratio - C.B.R.

2.2. Data analysis

In the review of the information found was the following:

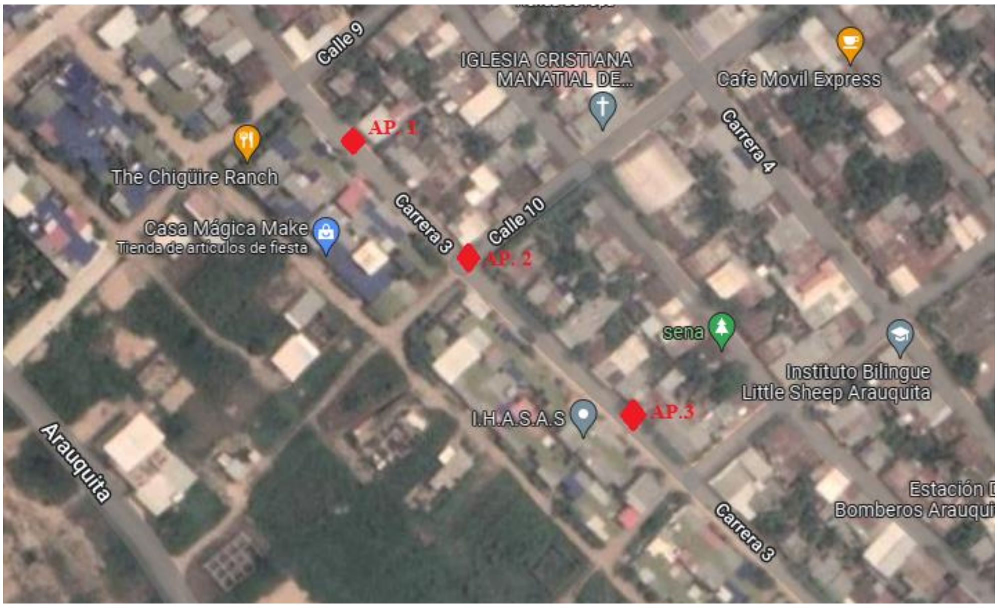
In general, it was determined that the analysis zones present very similar soil types in their great majority, the sector being characterized by embankments (Ledezma Aldunate, A. (2021) with fill material (Rivas, P., Villar, M. V., Campos, R., Pelayo, M., Martín, P. L., Gómez, P., ... & Mingarro, E. (2021) confined of very similar physical properties, being classified within the soils as light brown silty clay and light-colored fine clay with white betas. Dark colored fine clay was also found.

3. Results and discussion

3.1. Location of laboratory tests

The laboratory tests were carried out at the following locations:

Figure 1. Location of apiques



3.2. Soil classification

The tested samples were classified according to the American Association of State Highway Officials (AASHTO) and the Unified Soil Classification System (SUCS). Untested samples were classified by simple field tests, observations and comparisons with representative samples. According to the results obtained in laboratory tests.

3.3. Subsoil Conformation

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In order to perform the soil characterization of the sector, the following activities were carried out:

- Preliminary tour of the area, observing the critical points and selecting the places for the exploration works.
- The field and laboratory work was programmed.
- Field work: representative soil samples were taken for the corresponding laboratory tests. Among the tests carried out were C.B.R. tests to determine the resistance of the soil where the future construction will be projected, such C.B.R. tests were carried out by immersing the sample in water in order to represent the critical condition of saturation of the subgrade.

3.4. Characteristics of the foundation soil

The results obtained are summarized below:

Ap-1. Carrera 2ª between Streets 9 and 10

Table 1. AP1. Carrera 2a between 9th and 10th Streets

Description	Result
Moisture content	19.3%
Moist Unit Weight	0.077lb/pg^3
Unit Weight Dry Weight Compaction	0.065lb/pg3
Corrected CBR	3.16

Ap-2. Carrera 2ª Crossroads with Calle 10

Table 2.AP2. Carrera 2a intersection with 10th Street

Description	Result
Moisture content	19.3%
Moist Unit Weight	0.077lb/pg^3
Unit Weight Dry Weight Compaction	0.065lb/pg3
Corrected CBR	3.89

Ap-3. Carrera 2ª between 10th and 11th Streets

Table 3. AP3. Carrera 2a between 10th and 11th Streets

Description	Result
Moisture content	19.3%
Moist Unit Weight	0.078lb/pg^3
Unit Weight Dry Weight Compaction	0.066lb/pg3
Corrected CBR	4.41

3.5. Estimation of the design CBR

The classification of soils according to the CBR yielded is as follows:

Table 4. Classification of soils according to CBR.

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	CBR<3	Bad
	3<CBR<5	Fair
	5<CBR<10	Good
	10<CBR<20	Very Good
“S5	CBR>20”	Excellent

According to the results obtained in the piles, this is the soil classification of the sector:

Table 5. Soil classification according to CBR obtained.

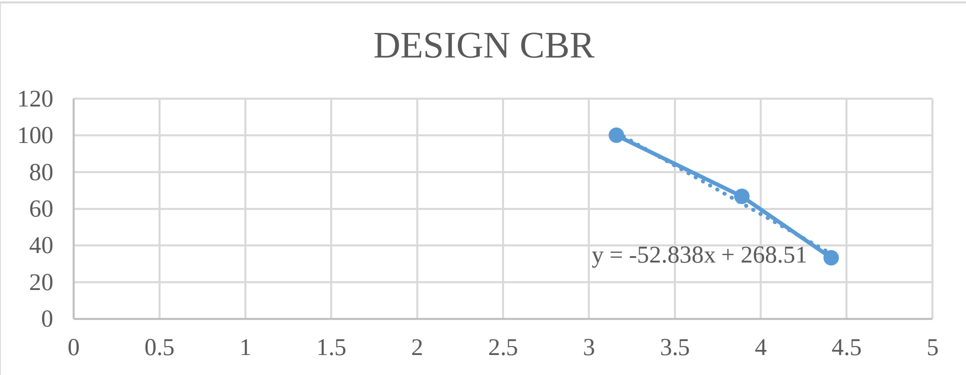
AP	CBR	Category	Behavior	AASHTO
AP-1	3.16	S2	Regular	A-4
AP-2	3.89	S2	Regular	A-4
AP-3	4.41	S2	Regular	A-4

To calculate the design CBR, the method of the North American Asphalt Institute was used, defined as that value that is equal to or exceeded by each resistance value of the tests, called percentile. The design strength value should be that which is equal to or exceeded by 75% of the test results.

Table 6. Estimation of the design CBR

Apique No.	Values in (%) of CBR found	Number of CBR values, equal or higher	% of CBR values, equal to or greater than
Ap. No.1	3.16	3	100
Ap. No.2	3.89	2	66.67
Ap. No.3	4.41	1	33.33

Figure 2. Estimation of design CBR



According to the graph shown in the figure, with a percentile of 75%, a CBR design of 3.66% is obtained.

5. Conclusions

The geomechanical parameters observed and involved in the analysis were: Soil types and classes, water table and bearing capacity.

The area under study, where the works to be executed will start, presents a superficial asphalt layer of variable thickness. Next, a filling material with the presence of (Zerna Morla, L. G. 2021) debris was observed in the stratification, and in other sectors a cement soil which has

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reached the end of its useful life. Next, a material classified as SM (silty sands of medium to low plasticity) (Scipion Falla, A. G. 2022) sandy silts of low to no plasticity (Cedeño Plaza, F. A. 2022) classified as ML could be seen, typified as soils of regular to bad behavior as subgrade of a road.

After obtaining the results of the characterization of the subgrade of the three piles made in the area, it is concluded that the properties and mechanical characteristics of the soil are similar and for this reason a single geological design unit is adopted.

According to the analysis of the stratigraphy of the subsoil and the laboratory tests carried out, it is concluded that the natural soil found in the area under study is type A-4 according to the AASHTO classification system, and is made up of a material with the following characteristics:

- Permeability: Low to medium.
- Capillarity: Low.
- Elasticity: Small to medium.
- Volume changes: Low.
- Value as Foundation Soil: Very poor to fair.
- Drainage Characteristics: Poor.

It should be noted that an improvement should be made to the subgrade with ball stone material or raw material with a maximum size of 4" (Quispe Torres, G. (2022).

Concrete pavements generally use a wide range of aggregates and sands, as long as they comply with certain minimum conditions that are especially related to the grain size (INVIAS E-123-12).

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