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RESEARCH ARTICLE

APPLICATION OF THE ROAD EARTHMOVING GUIDE TO PLATFORM SOILS IN THE THIES REGION: AXISES THIES-MONTROLLAND AND THIES-KHOMBOLE

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ABSTRACT

Having noted the lack of adequate documentation on road earthworks, linked to the lack of national standards in Senegal that define the conditions of realization, the object of this document is to propose a method for the proper execution of earthworks and the layers form. To this end, a study was conducted on the soils of one of the 14 regions of Senegal, namely the region of Thiès, one of the second cities of the country which is 87 km from the Senegalese capital Dakar. Two roads of 2.5 km long were selected to make manuals sampling of these platform soils in Thiès, the first axis in the municipality of Montrolland located 12 km north of the study area and the second in the rural municipality of Khombole which is 8 km east of the study area.

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INTRODUCTION

The development of our cities is linked to infrastructure. The transport sector in Senegal is dominated by the road sector, which has seen many investments in recent years. The road infrastructure was developed following the implementation of the sectoral transport plans. In 1991, the Transportation Sector Adjustment Program (PAST) reformed the planning and management of road projects [1]. The Second Transport Sectoral Plan (PST2) came into effect in 2000 and is primarily aimed at improving the efficiency of services and infrastructure. The plan is consistent with the objectives of the poverty reduction strategy and focuses on protecting the environment. It is in this context that, to improve the overall efficiency of road management, it is necessary:

- On the one hand, to update geotechnical studies on existing platform soils in Senegal.
- On the other hand, to establish a parameter for the choice and implementation of materials encountered in earthworks.

Indeed, in the absence of a technical reference base, the sizing of pavements in Senegal is most often based on specialized works capitalizing on the experiences experienced in countries in the tropical zone. Beyond the synthesis of geotechnical conditions and the implementation of the materials represented by these experiences, it remains that they take only very partially into account the specificities of the Senegalese road context. The pavement structures to which they result do not always reflect the local conditions of execution of the works, much less the optimal use of locally available materials. However, this document reflects the research conducted on platform soils in the region of Thiès, but cannot answer all the questions raised by the construction of the road. Indeed, in any road construction project, it is imperative to understand the behaviour of the soil during and after the construction of the road, hence the importance of earthworks.

We call earthworks the various movements of earth whose purpose is to dig or modify the structure of the soil. This change in ground level is carried out by cutting and filling.

Objectif: The objective of applying the Reference Guide to Road Earthworks to the platform floors of the Thiès region will be achieved by implementing processes that give our roads geometric characteristics (long profile, cross profile, alignment, etc.) Considering the materials used for earthworks, make the most appropriate choice based on the type of project, geography and environmental site encountered.

MATERIALS AND METHODS

This study is concentrated in the Thiès region. It consists in the execution, on two road routes, namely the Thiès-Montrolland and the Thiès-Khombole axis, of manual boreholes. Sampling will be based on the following assumptions:

- a depth of 100 cm for each manual survey;
- a 500 m linear spacing between boreholes on either side of the road axes;
- a journey of 2.5 km on each axis;
- at least 25 m separate each borehole from the road layout.

This operation allows a visual description of the soil present and the samples taken in the laboratory for a physical and mechanical characterization. No groundwater was encountered at any sampling point [4-5].

Figure 1 and Figure 2 show the five holes on the Thiès-Khombole axis and the six holes on the Thiès-Montrolland axis respectively. Surveys revealed the presence of sand on the first road route, and lateritic sand on the second. The samples collected were composed of loose soils and were analyzed using the following laboratory test procedures:

Natural water content, Atterberg limits or sand equivalent depending on the nature of the soil, sieve size, blue value, Proctor compaction test and CBR punching test [6-13].

RESULTS AND DISCUSSION

Mechanical Characterization

Results Water Content: The sand collected on the Thies-Khombole axis has low water levels due to the absence of fines. On the other hand, the Thiès-Montroland axis has much higher water content because it contains a fine content, this was observed in the particle size test in Table 1.

Atterbergresults : The results of the plasticity index of the sands of the Montrolland zone are shown in Table 2 below. According to the GTR, the results obtained for the lateritic sands of the Thiès-Montrolland axis are weakly clayey soils since their plasticity index varies around 12.

Sand Equivalent Results: According to the GTR the results obtained for the sands of the Thiès-Khombole axis are represented in Table 3. We have soils of average plasticity since their ES values are between 20 and 40.

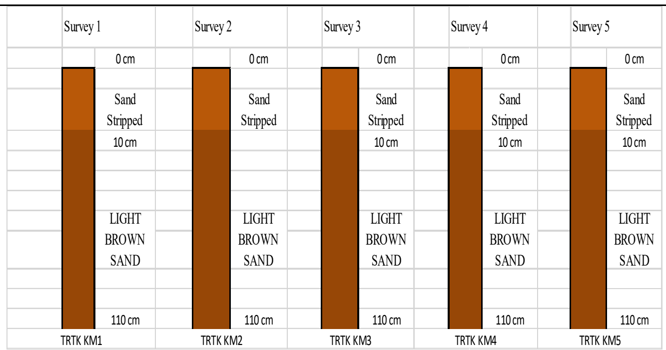

Figure 1. Section of the polls on theThiès-Khombole axis

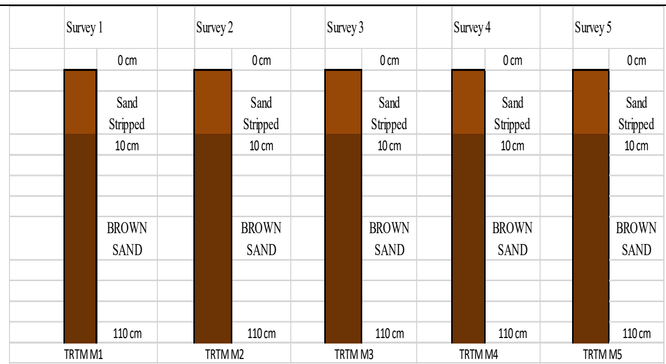

Figure 2. Section of the polls on the Thiès-Montrolland axis

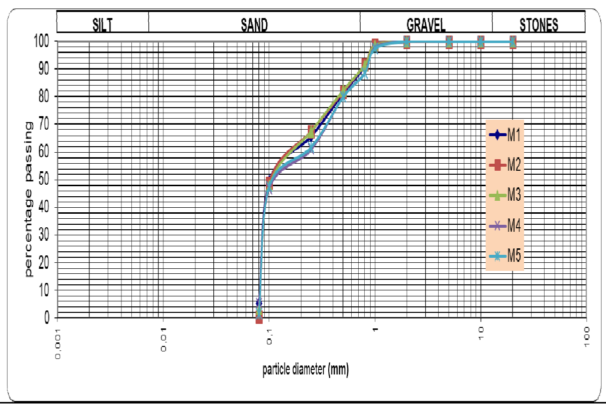

Figure 3: Curve of the particle size analysis after sieving the samples of the Thiès-Montrolland axis

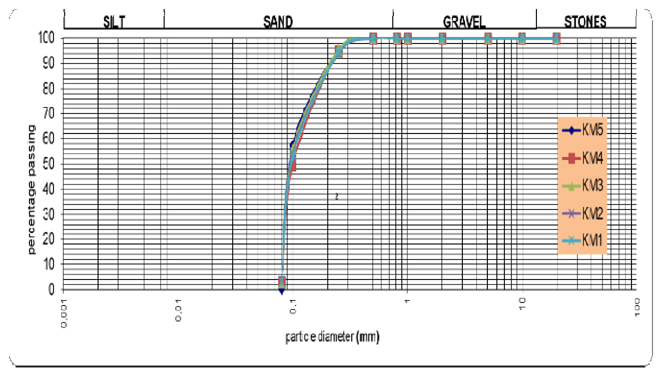

Figure 41: Particle size analysis curve after sieving samples from the Thiès-Khombole axis

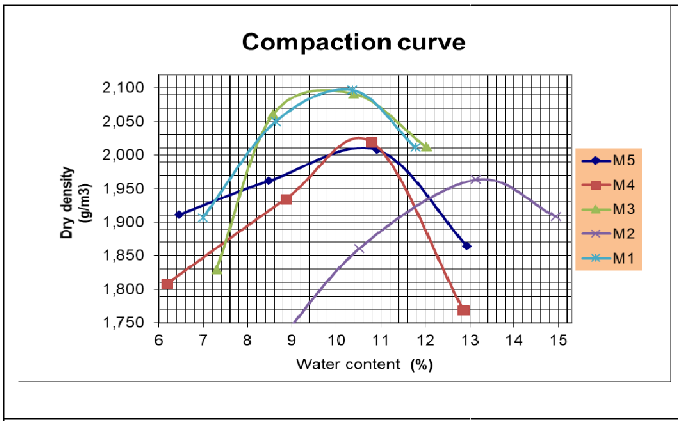

Figure 52: Sand Proctor (Thiès-Montrolland) compaction

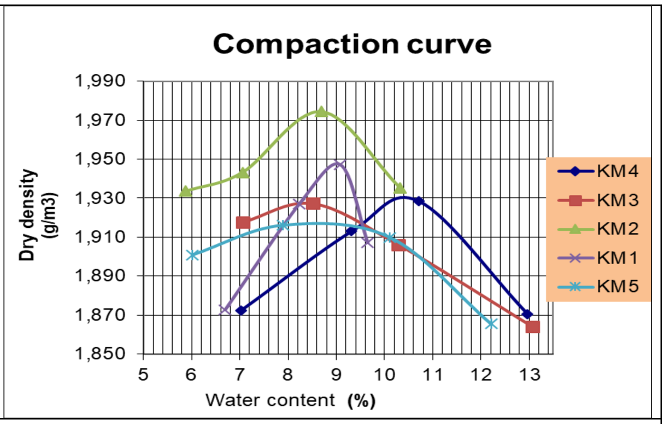

Figure 6: Sand Proctor compaction curve (Thiès-Khombole)

Granulometricanalysis : Figures 3 and 4 show, respectively, all the curves obtained during the granulometric tests of the sands of the Thies-Montroland axis and the sands of the Thiès-Khombole axis.

Table 1. Water Content Results

KHOMBOLE					
Samples	KM1	KM2	KM3	KM4	KM5
Wn(%)	1,10	1,13	0,99	1,07	0,96

MONTROLLAND					
Samples	M1	M2	M3	M4	M5
Wn (%)	6,51	8,09	4,68	5,93	6,51

Table1: AtterbergLimit Test Results

MONTROLLAND					
Samples	M1	M2	M3	M4	M5
IP	13,25	12,96	12,53	13,77	12,99

Table 3: Sand equivalent test results

KHOMBOLE					
Samples	KM1	KM2	KM3	KM4	KM5
ES	26,6	28,9	28,1	27,05	28,58

Resultats Value in Blu: The results obtained for the test vbs are presented in Table 4.

Table 4. VBS test results

MONTROLLAND					
Samples	M1	M2	M3	M4	M5
VBS	1,33	1,49	1,50	1,50	1,42

KHOMBOLE					
Samples	KM1	KM2	KM3	KM4	KM5
VBS	0,34	0,46	0,32	0,46	0,62

According to the GTR the results obtained for the sands of the Thiès-Montroland axis we have low silt soils (soil little plastic and sensitive to water) since their VBS values are between 0.2 and 1.5. For the sands of the axis Thiès-Khombole their VBS values revolve around 0.4 hence the presence of sandy soils see insensitive to water.

Proctor Results: Figure 5 shows the different proctor curves obtained after testing on soils of Montroland.

The figure 6 shows the different proctor curves obtained after testing on soils of Khombole. The results obtained at the Proctor optimum are given in the following table 5:

Table 5. Proctor test results

MONTROLLAND					
Samples	M1	M2	M3	M4	M5
wopt (%)	8,17	8,63	8,01	7,97	8,17
γdmax	21,00	19,61	21,00	20,50	20,10

KHOMBOLE					
Samples	KM1	KM2	KM3	KM4	KM5
wopt (%)	8,80	9,10	8,80	7,680	8,17
γdmax	19,49	19,75	19,29	19,31	19,65

CBR results : The results obtained for the test CBR are presented in Table 6.

Table 6: CBR test results

MONTROLLAND					
Samples	M1	M2	M3	M4	M5
I.CBR	5,2	3,1	3,2	4,7	5,0

KHOMBOLE					
Samples	KM1	KM2	KM3	KM4	KM5
I.CBR	2,4	3,1	2,1	3,7	2,6

The average values of the CBR index in this table are less than 5 mpA (except M1 and M5) for each of the axes studied, justifying that it is require to provides for a new replacement soil with an ICBR value greater than 5 MPa [13]. The various results obtained have made it possible to characterize the sands of Montroland as well as the sands of the Khombole area. They also show that they do not have the required qualities in terms of lift and plasticity to be used in road pavement form layer.

CONCLUSION

The results of the geotechnical studies carried out along the route of each axis are presented and discussed in this document. Thus the Platform floors of our axes have 95% CBR indices of the OPM between 2% and 5%, and their lift classes is S1. These results allowed us to classify these soils according to the French 1992 GTR Road Moving Guide and then to give their conditions of use in fill and layer of form as illustrated in this document.

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