Bulletin of the *Transilvania* University of Braşov • Vol. 9 (58) - 2016
Series I: Railways, Roads and Bridges Section

ASPECTS REGARDING THE SOILS TREATMENT AND THE FOUNDATION LAYERS FROM LOCAL MATERIALS WITH HYDRAULIC ROAD BINDERS FOR AIRPORT ROAD STRUCTURES

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Abstract: *We are going to present the physical-mechanical characteristics and the bearing capacity of the capping layer made from an dusty clay, and also of the ballast foundation layer, both treated with hydraulic road binders for an airport road structure.*

Key words: *soil treatment, hydraulic road binders, dosage, bearing capacity, compaction degree, CBR, compression resistance.*

1. Introduction

Iasi international airport is one of the oldest attested airports from Romania.

In the context of modern technologies required by the airplanes constructors we are going to use more and more aircrafts with weight over 100 tons, and the old runway of PCN 22 (Pavement Classification Number) it's not corresponding anymore to the requests of actual and future traffic challenges [1].

The new runway was design as a flexible structure for a PCN 70 and it has in its road structure a capping layer from soil stabilized with hydraulic road binders and a foundation ballast layer stabilized with hydraulic road binders and it has on top 3 asphaltic layers.

2. Laboratory Tests for the Capping Layer Stabilized with Special Hydraulic Road Binder [2]

The soil which is going to be treated with hydraulic road binder [2] is a hard, plastic, dusty clay, which has a free swelling of U_L = 46.67 %, and it is a 4b soil according to STAS 2914/84, and the hydraulic road binder has the physical-mechanical characteristics from table 1.

The capping layer was stabilized on a width of 25cm with special hydraulic binders [2] in percentage of 2.5%.

In table 2 and figure 1 are showed the results obtained on the Modified Proctor test for the stabilized soil with 2.5% special hydraulic binder [2], [7].

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Physical-mechanical characteristics of soil Table 1

No	Characteristics	Obtained values	Admission conditions	Norms
1	Free water %	0.33	max. 2	SR EN 459 – 2 / 2003 pct.5.11
2	Finesse as remains on 90 μm (%)	8.27	max. 15	SR EN 196 – 6 / 2010
3	CaO+MgO (%)	57.22	min.40	SR EN 196 – 2 / 2006
4	SO3 (%)	1.97	max.4	SR EN 196 – 2 / 2006

Table 2

Compaction characteristics	Sign	Value
Optimum humidity	W_{opt} %	15.3
Maximum dry density	P_d max g/cm^3	1.834

In table 3 are presented the compression resistance at 7 days on cylinders made of stabilized soil with special hydraulic binder [2].

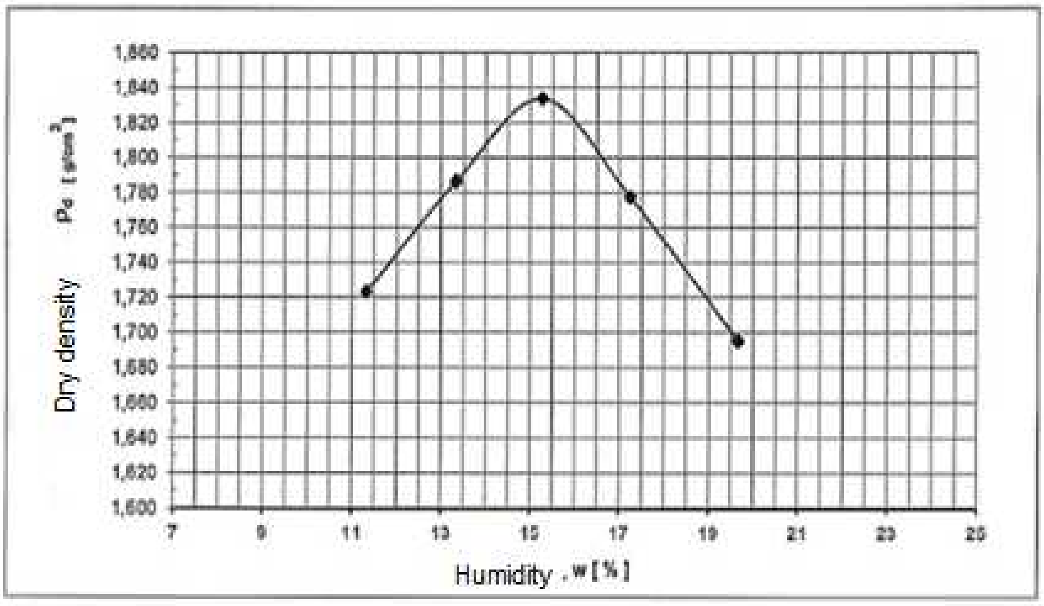

Fig. 1. *Modified Proctor diagram for the stabilized dusty clay with special hydraulic binder [2]*

The compression resistance at 7 days on cylinders made of stabilized soil with special hydraulic binder Table 3

No	Test age. days	Binder percentage %	Weight of cylinder	Volume	Compaction characteristics Modified Proctor		R_{c7} N/mm^2	Average N/mm^2
					γ_d(g/cm^3)	w_{opt} (%)		
1	7	2.5	296.7	148.2	1.834	15.3	1.446	1.43
2	7	2.5	297	148.8	1.834	15.3	1.443	
3	7	2.5	296.9	148.6	1.834	15.3	1.408	

For the bearing capacity test was made the CBR test obtaining a medium value of 45.84 % and it was determined the bearing capacity with Benkelman test on layers of 4.00 m wide and it was obtained a medium deflection of d_{BM} = 133.68 (0.01 mm).

Also, the compaction degree was of D = 98.16 %.

3. Laboratory Tests for the Ballast Stabilized with Hydraulic Road Binder [3]

The ballast used is crushed ballast sort 0/25mm which has the characteristics from table 4 and figure 2.

Table 4

Characteristics	Obtained results	Technical conditions [8]
Granularity	Continuous, conf. Fig.2	Continuous
Fractions content 0...8 mm	60.8	50 – 80
Un-uniformity content (U_N)	40	min.8
Sand equivalent (EN)	71.7	min.30
Los Angeles (LA)	16.57	max. 35 %

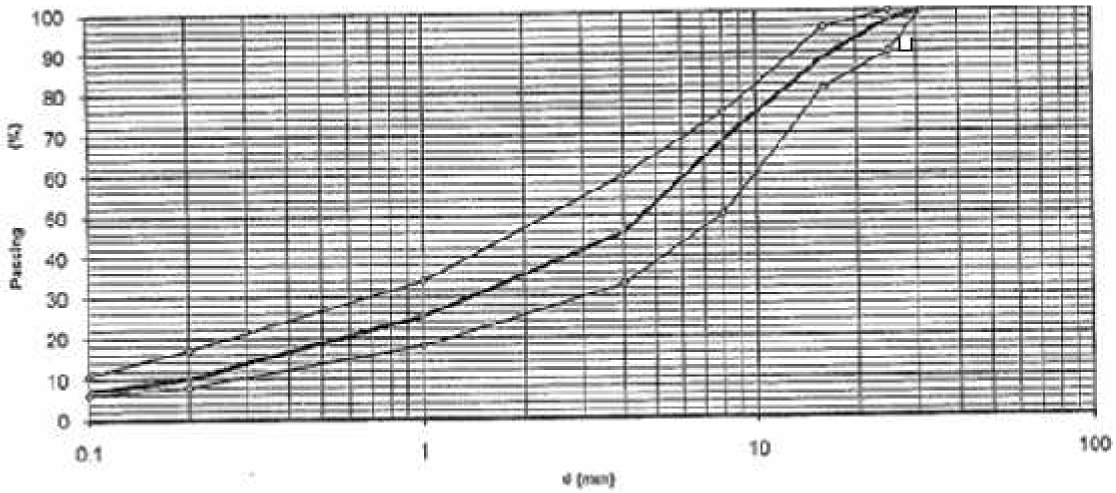

Fig.2. *Granularity curve for ballast*

• Hydraulic road binder characteristics [3], [4]

For ballast stabilization was used a hydraulic road binder HRB E3 in percentage of 3.5% with the characteristics from table 5.

In table 6 and figure 3 are shown the results obtained through Modified Proctor test for the ballast stabilized with 3.5% of hydraulic road binder HRB E3 [3].

The characteristics of ballast stabilization Table 5

No	Characteristics	Performance	Norms
1	Initial time of setting	>90 minutes	SR EN 13282-1:2013 [6]
2	Stability (mm)	<10	
3	Compression resistance at 7 days	>10MPa	
4	Compression resistance at 28 days	22.5 – 42.5 MPa	
5	SO3 %	<4	

The results obtained through Modified Proctor test for the ballast stabilized with 3.5% of hydraulic road binder HRB E3 Table 6

Compaction characteristics	Signe	Value
Optimum humidity	W_{opt} (%)	6.56
Maximum dry density	ρ_{dmax} (g/cmc)	2.22

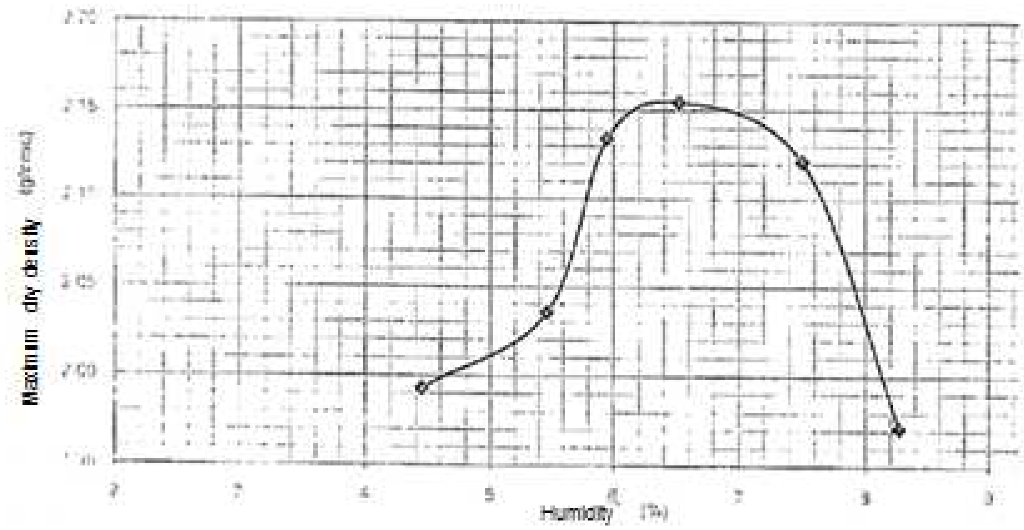

Fig. 3. *Modified Proctor diagram for the stabilized ballast with hydraulic road binder HRB E3 [3]*

The compression resistances at 7 days and 28 days Table 7

			7 days			28 days		
Surface of trial	S	mm^2	4069	4069	4069	4069	4069	4069
Breaking force	F	KN	7.9	7.6	7.7	11.7	11.5	11.8
Compression resistance	Rc	N/mm^2	1.94	1.87	1.89	2.88	2.83	2.90
Medium value	N/mm^2		1.90			2.87		

The compression resistance at 3 days on cylinders made with the material from the site Table 8

	Doroport TB25 – hydraulic road binder HRB E3		
Weight of cylinder	913.8	914	914.5
Height of cylinder, mm	105	105.2	105.3
Diameter of cylinder, mm	71.5	71.5	71.5
Surface mm^2	4015.2	4015.2	4015.2
Force, N	4420	4450	4440
Rc 3 days N/mm^2	1.10	1.11	1.10
Rc medium N/mm^2	**1.10**		

In table 7 are presented the compression resistances at 7 days and 28 days, obtained in the laboratory and in table 8 are presented the compression resistance at 3 days on cylinders made with the material from the site.

4. Conclusions

The usage of layers stabilized with hydraulic road binders are going to make durable road structures, with very good results from bearing capacity and compression resistance point of view, resistance to freeze thaw, structures that are leading to low maintenance costs.

The combination of stabilized layers with the in site making are leading to significant reduction of technological costs, its facilitating the use of local materials, in site, its decreasing the costs with boring holes.

The solutions and technologies existing in the Romanian market are allowing the construction of optimum structures from technical and economical point of view such was the case of the execution of the capping layer and the foundation layer for the runway of the Iasi international airport [5].

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