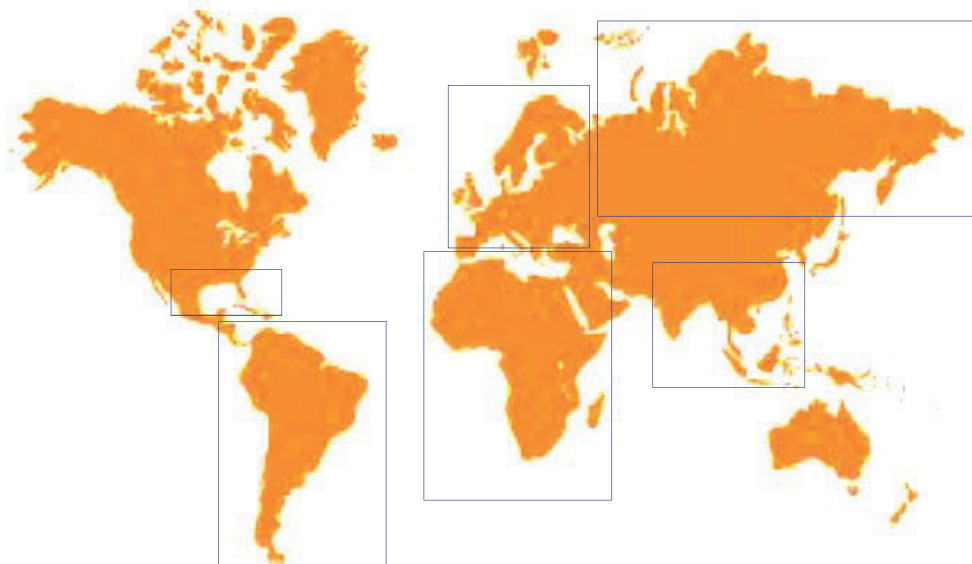




**Stabilization and Waterproofing**  
**any type soil in the World**

## **TEST FREEZING**





With the UNIVERSITY



**CUJAE**

Facultad de Ingeniería Civil

CECAT

Departamento de Ingeniería Civil

*Instituto Superior Politécnico  
"José Antonio Echeverría"*

**CUJAE**

*Centro de Estudios de Construcción  
y Arquitectura Tropical*

**CECAT**

**Ciudad La Habana CUBA**

#### INFORMATION ON RESULTS

Freezing and thawing tests  
of soil treated with the System Rocamix

#### Classification of soil

AASHTO = A-7-6 clay (Capdeville)

#### Sample Dimensions

Sample R1

Sample R2

Height = 7.6 cm

Height = 7.7 cm

Diameter = 3.8 cm

Diameter = 3.8 cm

Volume = 86.2 cm<sup>3</sup>

Volume = 87.3 cm<sup>3</sup>

Initial density = 1703 kg / m<sup>3</sup>

initial density = 1793 kg / m<sup>3</sup>

#### Test conditions

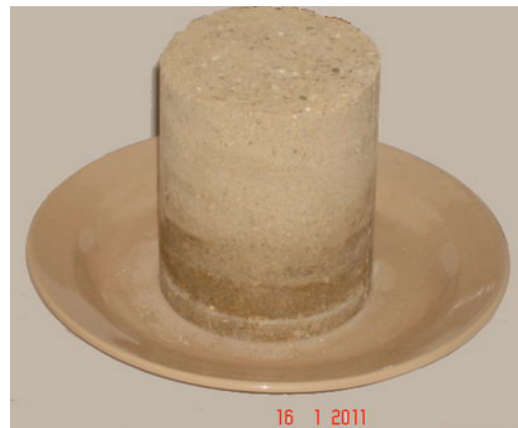
Samples placed in a freezer

Temperature = - 18 ° C (0 ° F)

**Sample R1**



**Sample R2**



**TEST RESULT**

<b>Sample R1</b>	<b>Sample R2</b>
<i>Parameters to be measured</i>	<i>Parameters to be measured</i>
Wh before drying: 146.82 gr.	Wh before drying: 156.52 gr.
Wh after drying at room temperature : 143.73 gr.	Wh after drying at room temperature: 144.41 gr.
<b>FREEZING</b>	<b>FREEZING</b>
<b>24 hrs. Freezing</b> Wh: 143.26 gr. <b>Note:</b> on this sample (Frozen) we note only a few grains of the free wall and the entire sample as a whole without any visible changes.	<b>24 hrs. Freezing</b> Wh: 144.00 gr <b>Note:</b> you do not notice any change in the frozen sample
<b>48 hrs. Freezing</b> Wh: 143.02 gr. Freezing	<b>48 hrs. Freezing</b> Wh: 143.70 gr. Freezing
<b>120 hrs. Freezing</b> Wh: 143.14 gr. Freezing <b>Note:</b> Ok	<b>120 hrs. Freezing</b> Wh: 143.72 gr. Freezing <b>Note:</b> Ok
<b>144 hrs. Freezing</b> Wh: 143.33 gr. Freezing <b>Note:</b> Ok	<b>144 hrs. Freezing</b> Wh: 143.9 gr. Freezing <b>Note:</b> Ok
<b>168 hrs. Freezing</b> Wh: 143.65 gr. Freezing <b>Note:</b> Ok	<b>168 hrs. Freezing</b> Wh: 143.93 gr. Freezing <b>Note:</b> Ok
<b>192 hrs. Freezing</b> Wh: 143.63 gr. Freezing <b>Note:</b> Ok	<b>192 hrs. Freezing</b> Wh: 143.91 gr. Freezing <b>Note:</b> Ok
<b>216 hrs. Freezing</b> Wh: 143.63 gr. Freezing <b>Note:</b> Ok	<b>216 hrs. Freezing</b> Wh: 143.66 gr. Freezing <b>Note:</b> Ok
<b>264 hrs. Freezing</b> Wh: 142.67 gr. Freezing <b>Note:</b> Ok	<b>264 hrs. Freezing</b> Wh: 143.80 gr. Freezing <b>Note:</b> Ok
<b>Exposition with room temperature</b>	<b>Exposition with room temperature</b>
<b>(Defrost)</b> W Inc. Frozen: 142.67 gr.	<b>(Defrost)</b> W Inc. Frozen: 143.80 gr.
<b>24 Hrs. after</b> Wh: 135.46 gr. <b>Note:</b> the Structure is Normal	<b>24 Hrs. after</b> Wh: 136.75 gr. <b>Note:</b> the Structure is Normal

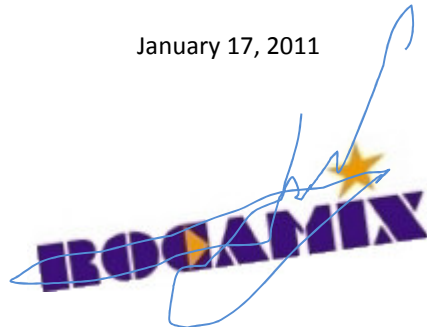
168 Hrs. after Wh : 121.04 gr.	168 Hrs. after Wh : 122.21 gr.
<b>Las samples are again put in the freezer</b> 120 Hrs. after: Wh : 121.79 gr.	<b>Las samples are again put in the freezer</b> 120 Hrs. after: Wh : 122.83 gr.
168 hrs. In the Freezer: Wh: 121.62 gr.	168 hrs. In the Freezer: Wh: 123.06 gr.
After the samples were placed in the natural ambience 96 hrs to be immediately immersed in water for 104 hrs. <b>NO SIGNIFICANT ALTERATION.</b>	After the samples were placed in the natural ambience 96 hrs to be immediately immersed in water for 104 hrs. <b>NO SIGNIFICANT ALTERATION.</b>

### Conclusions

- Note that the samples were stabilized with the Rocamix system in an amount of 0.40 per m<sup>3</sup> and an addition of Portland cement in an amount of 15 kg. per m<sup>3</sup>. The application of Rocamix system was performed 21 days prior to drying so as to reinforce the cement.
- Throughout the process samples no change was observed. The behavior was absolutely normal.**
- Do not forget during application field meet AASHTO soil stabilization rules and in particular the water disposal rules.

Prof. MSc. Ing. Pedro Morales Quevedo      Prof. Msc. Ing. Juan M. Junco del Pino  
Members of the Technical Assistance College Rocamix

January 17, 2011



# FREEZING

PATH land IN A VINEYARD  
Near BORDEAUX (FRANCE)



Before



Work done with ROCAMIX



After



Under the snow in February 2009 (-9°C)



after the snow

**NO ASSIGNMENT TO ROAD AFTER CROSSING THE SNOW**