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Building of a subgrade road layer based on marine sediment with experimental monitoring

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- 10th International SedNet Conference -
- 14-17 June 2017 , Genoa, Italy -

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Introduction



- European project : Sustainable Environmental Treatment and Reuse of Marine Sediment



European Regional Development Fund
The European Union, investing in your future

Fonds européen de développement régional
L'Union Européenne investit dans votre avenir



- Partners :



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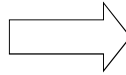
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Introduction



- In France, 50 Mm³ of sediments are dredged every year

➔ Feasibility of using sediment as a material for subgrade road layer ?



- 12 sediment from Channel sea

➔ 4 sediment chosen



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Materials



- Sediments

Sediment	A	C	F	G
Organic Matter (%)	5.9	12.5	1.3	4.7
Fine fraction – 0-80 µm (%)	94.7	78.7	14.2	78.9
Optimal Moisture Content OMC (%)	27	37	9	20
Optimal Dry Density ODD (t.m ⁻³)	1.39	1.09	1.89	1.54
Immediate Bearing Index (IBI) at OMC	21	10	31	17

- Dredged Sand
- Quicklime (Lhoist)
- Hydraulic Road Binder ROLAC (Lafarge Le Havre-St Vigor)

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- Mix design :

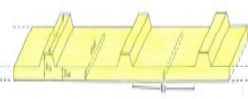
- Sediments A, C, G : 59.3 % Sediment, 25.4% Dredged Sand, 2.6% Quicklime, 12.7% HRB ROLAC
- Sediment F : 94.3% Sediment, 5.7% HRB ROLAC

Mix	A	C	F	G
Optimal Moisture Content OMC (%)	20.0	27.0	7.8	16.0
Optimal Dry Density ODD (t.m ⁻³)	1.58	1.33	2.15	1.7
Immediate Bearing Index (IBI) at OMC	20	15	90	23
Swelling (%) ($\leq 5\%$)	3.66	3.44	/	0.39
R_{it} (MPa) (≥ 0.2 MPa)	0.22	0.09	/	0.30

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- 5 experimental boards (sediment C twice)



Preparation drawing of the test plots.



Creation of the backfill area



Geomembrane, recovery drains and neutral sand



Spreading sediments



Addition of lime using a spreading truck



Addition of binder using a spreading truck



Mixing



Impermeabilisation using a layer of stone-based asphalt after compaction

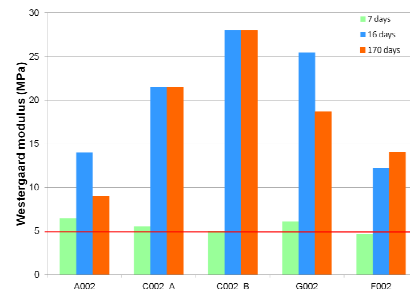
Monitoring results



• Plate load test :



Westergaard bearing tests



Results of the Westergaard bearing test



All sediments usable in subgrade road layer

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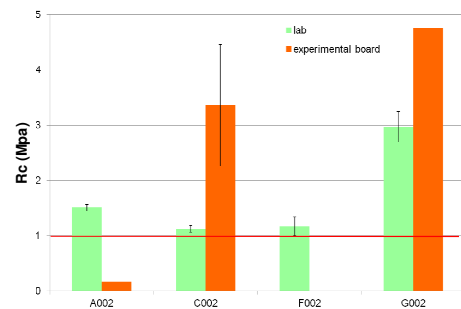
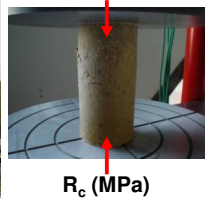
Monitoring results



• Mechanical strength :



Core driller for soils.

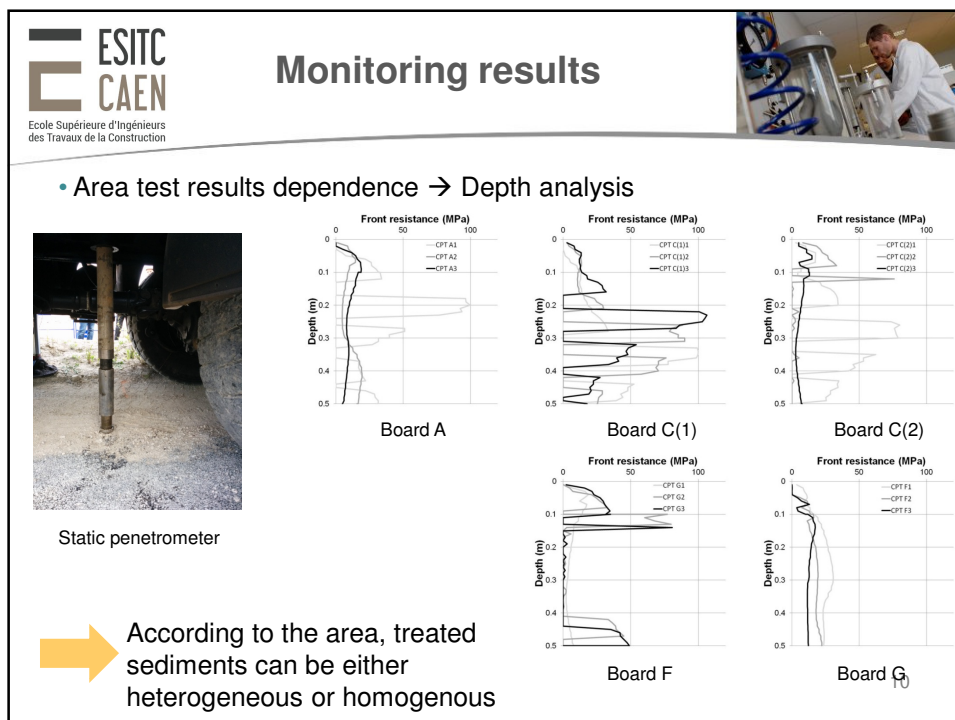
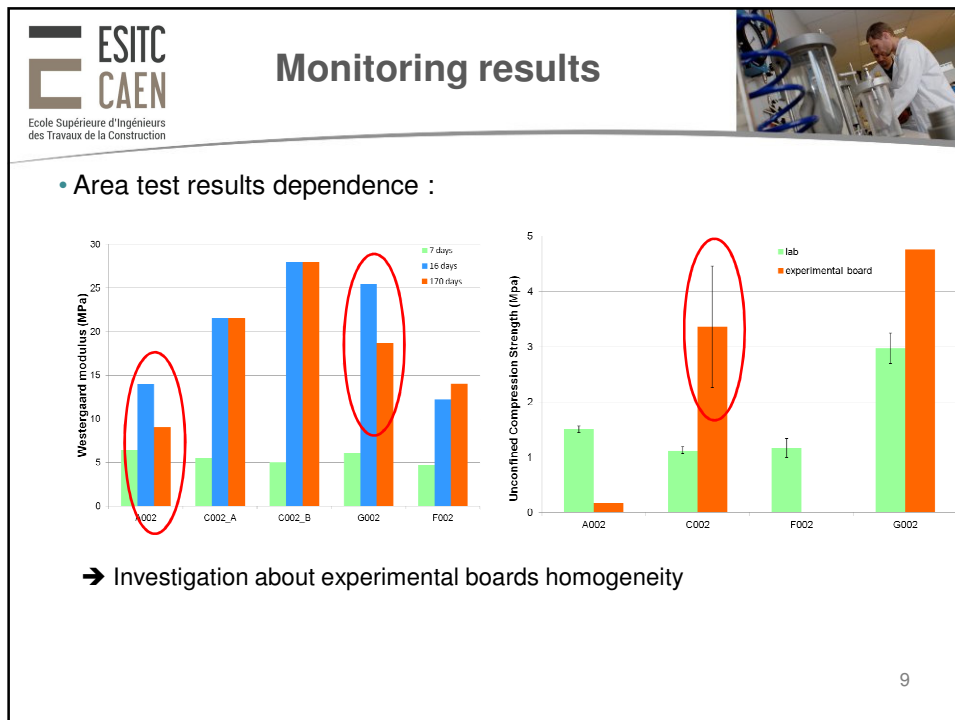


Rc of laboratory and core samples taken at 180 days



Sediment C and G usable in subgrade road layer

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Monitoring results



- Why these results ? → Working method
 - Sediments A and C far from the optimum water content
 - Heterogenous water content in the sediment/sand mix
 - Spreading technique used
 - Worksite machines during mixing operations



Spreading truck



Crawler



Ruts



Mixing between plots



Working method need to be adapted to the construction site

Conclusion



- Sediments can be reuse in subgrade road layer
- Lab studies allow to fit the good mix
- A main issue is homogeneity of the final material
- Storage conditions and working method need to be adapted to the construction timing and site



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Sustainable, Environmental Treatment And Reuse of
Marine Sediments

GUIDE

Land-based management of dredged port
sediments: reuse for road engineering

Co-ordinated by:
Dr. BOUTIER, Dr. BOUTIER & BOUTIER, 2015, Caen
Dr. LE GUERN, Dr. LECHE & BOUTIER, 2015, Caen







Thank you for your attention

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