Field Test Program of Stabilization on a Principal Forest Road

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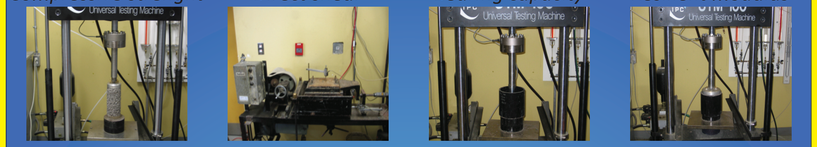
1- Laboratory tests and results

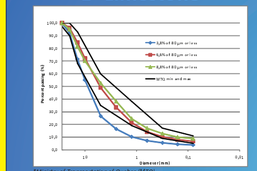
Test

Compressive strenght — *Direct shear* — *Bearing capacity* — *Resilient modulus*

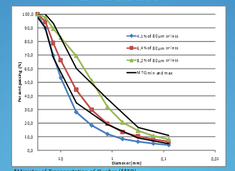


Mineralogy and grading

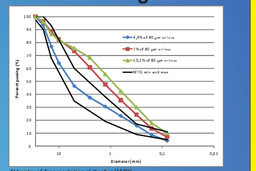
1- Limestone



2- Basalt



3- Granitic gneiss



*Ministry of Transportation of Quebec (MTQ)

Products tested

Stabilization agents

Polymer emulsion

1,4 | 2,4 | 3,4 (l/m²)

Cement

1,5 | 3,5 | 4,5 | 6 (%)

Dust supressants

Calcium chloride

1,2 | 1,8 | 2,3 (l/m²)

Natural brine

1,3 | 1,5 | 1,8 (l/m²)

Example for granitic gneiss (7% of 80 µm or less)

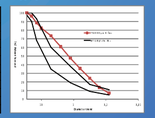
Aggregate geotechnical properties

Caracterisation tests	Results		MQ 206 MTQ requirements
Grading	$P_{0.080}$ = 6.4%		-
Modified proctor	Optimal (%) humidity: 5.3% Maximum dry density: 2312 kg/m³	Dry density: 2312 kg/m³	-
Bearing capacity	Initial at 2.5 mm: 18.4 kN	Initial at 5 mm: 20.7 kN	-
Los Angeles test	$P_{1.60}$ = 59.9%		≤ 50 %
Microdeval test	Micro-Deval (abs): 12.7%		≤ 25 %
Absorption (aggregates 5 mm)	Relative density : 2.67	$P_{0.080}$ = 0.82%	-
Absorption (aggregates 5 mm)	Relative density : 2.68	$P_{0.080}$ = 0.22%	-
Methylene blue sand test	Absorption in soil : 0.046 cm³/g		≤ 0.25

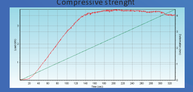
*Ministry of Transportation of Quebec (MTQ)

Grading of the aggragate

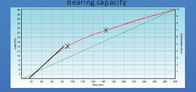
Sieve (mm)	Weight (g)	Percent passing (%)
28	0	100
20	809.8	93.5
14	2212.9	76.9
10	1713.8	64.0
5	2322.7	46.5
2.5	70.3	37.6
1.25	54	30.7
0.630	57.4	23.4
0.315	58.4	16.0
0.16	56.6	8.8
0.08	34.9	4.4



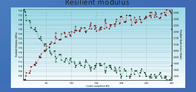
Compressive strenght



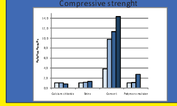
Bearing capacity



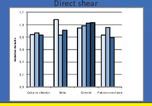
Resilient modulus



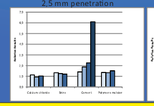
Compressive strenght



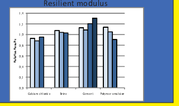
Direct shear



Bearing capacity



Resilient modulus



2- Tests in controlled conditions

Mechanical and climate laboratory road simulator

- To-and-fro movement (6 km/h)

The system is in function 24 hours/7 days and make about 200 000 cycles per week.

- Tire pressure controlled

A maximun pressure of 830 kPa (120 psi) can be applied.

- Load controlled

A pneumatic wheel with a standard truck-size tread travels back on forth on tha sample.

- Frost and thaw cycles

The sample is isolated on all its surface except the top to create real conditions of frost and spring thaw.

- Breaking and accelaration simulation

The moving wheel produces similar surface shear stresses as an accelerating or breaking vehicle.

- Programmable side movement

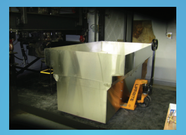
The whole surface of the sample is used during the test to create real conditions environment.

- Rain cycle

The rain drops have a mean diameter of 3 mm, the mean space between them is 2,5 mm and they reach the sample surface with an average speed of 6 m/s.

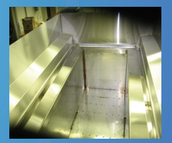
- Characteristic of the sample

There are sensors at different levels in the road sample to make sure that the load and the humidity of the sample are always known.



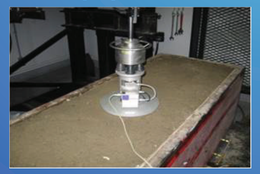
- Independant catch of run-off and percolation waters

This allows to study the permeability of the ground and the amount of stabilization agents catch in the run-off and percolation waters. The washability of the product can thus be studied.



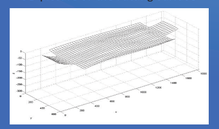
Example of the results

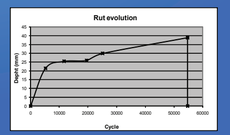
- Falling weight deflectometer



- Rut measurement

-3D picture or the rutting surface





3- Field performance

Sections realization

Traffic

Layer 1

Replacing surface aggregate

Compaction

Results

Falling weight deflectometer

Precipitation Occurence Sensor System

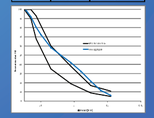
Aggregate geotechnical properties

Caracterisation tests	Results		MQ 206 MTQ requirements
Grading	$P_{0.080}$ = 6.4%		-
Modified proctor	Optimal (%) humidity: 4.9%	Dry density: 2130 kg/m³	-
Penetration capacity	Initial at 2.5 mm: 10.3 kN	Initial at 5 mm: 9.45 kN	-
Los Angeles test	$P_{1.60}$ = 49.99%		≤ 50 %
Micro-Deval test	Micro-Deval (abs): 17.3%		≤ 25 %
Sensitive size (aggregates 5 mm)	Relative density : 2.67	$P_{0.080}$ = 1.17%	-
Sensitive size (aggregates 5 mm)	Relative density : 2.65	$P_{0.080}$ = 0.42%	-
Methylene blue	Absorption (soil) : 0.49 cm³/g		≤ 0.25

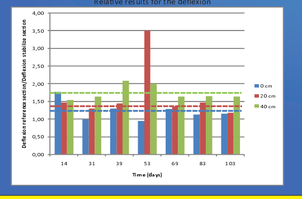
*The aggregate had a water content of 6.8% when the field was stabilized
*Ministry of Transportation of Quebec (MTQ)

Grading of the aggragate

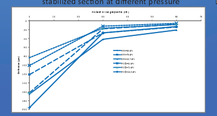
Sieve (mm)	Weight (g)	Percent passing (%)
28	108.6	99.0
20	784.6	92.0
14	1250.5	80.9
10	1129.7	72.0
5	1581.0	58.5
2.5	58.9	49.8
1.25	54.0	41.0
0.630	64.7	32.4
0.315	73.2	23.6
0.16	67.2	13.8
0.08	36.7	6.4

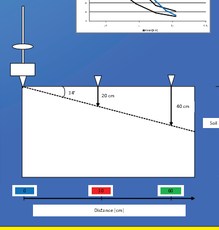


Relative results for the deflexion



Deflection of the field for the reference and the stabilized section at different pressure





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