11.15 – 11.45 COFFEE

11.45 – 12.15 Viable recovery options for construction and demolition waste.

Christian J. Engelsen, SINTEF, Norway

12.15 – 12.45 OSAMAT – oil shale ash use in road construction – monitoring intermediate results

Arina Koroljova, Eesti Energia AS

Andres Brakmann, Ramboll Estonia

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Euroopa Liit
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EJKL
ESTONIAN RECYCLING
COMPETENCE CENTER

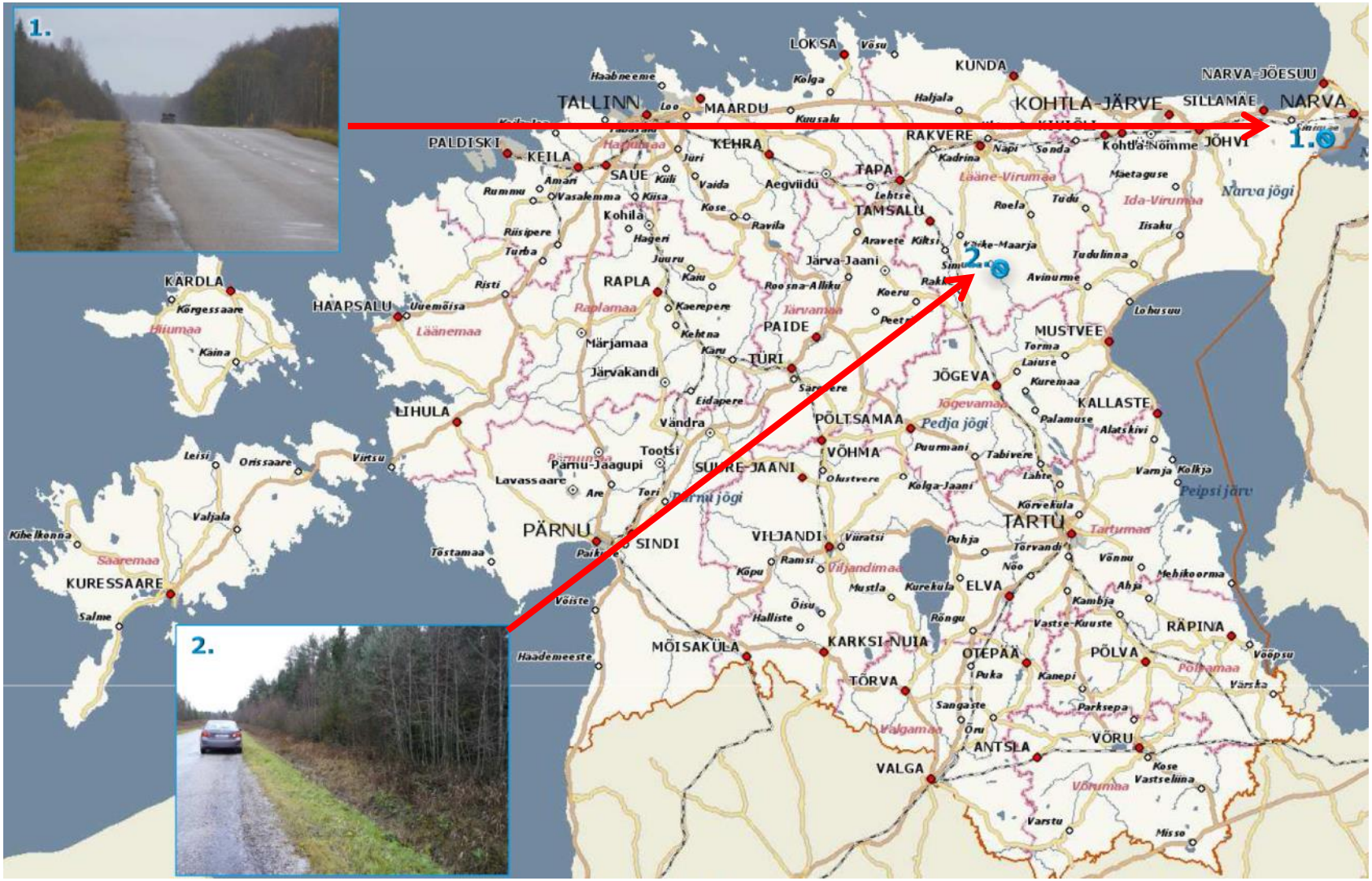
TEEDEKLASTER
ESTONIAN ROAD CLUSTER

OSAMAT PROJECT
ELECTRICITY PRODUCTION BY-PRODUCTS USE IN ROAD CONSTRUCTION

ANDRES BRAKMANN

TALLINN 09.10.2013

PROJECT LOCATION



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LABORATORY TESTING

- **Ash** and **mining waste aggregates** are produced as by-products during electricity production
- Laboratory tests were carried out to assess feasibility of different oil shale ash fractions as road base stabilization binding agents. The feasibility in stabilization was tested with compressive strength and freeze-thaw weathering tests on several stabilized mining waste based aggregates and gravel samples

Table 1. Properties of binding agents used in stabilization tests

Sample	Explanation	Water content w [%]	Loss of ignition LOI [%]	Soil type	pH
OSA EF BL3 OBT	Oil shale ash, electric filter, Block 3, Old burning technology	0,4	3,4	Si	13,0
OSA EF BL8 NBT	Oil shale ash, electric filter, Block 8, New burning technology	0,2	3,4	Si	13,0
OSA BOTT BL8	Oil shale ash, bottom ash, Block 8	0,0	11,8	grSa	12,9
OSA CYCL	Oil shale ash, cyclone ash	0	1,0	saSi	13,0
Comp. CEM	Composite cement (CEM II /B-M(T-L) 42,5 R)	-	-	-	-
SR	Sulphate resistant cement (CEM I 42,5 N)	-	-	-	-

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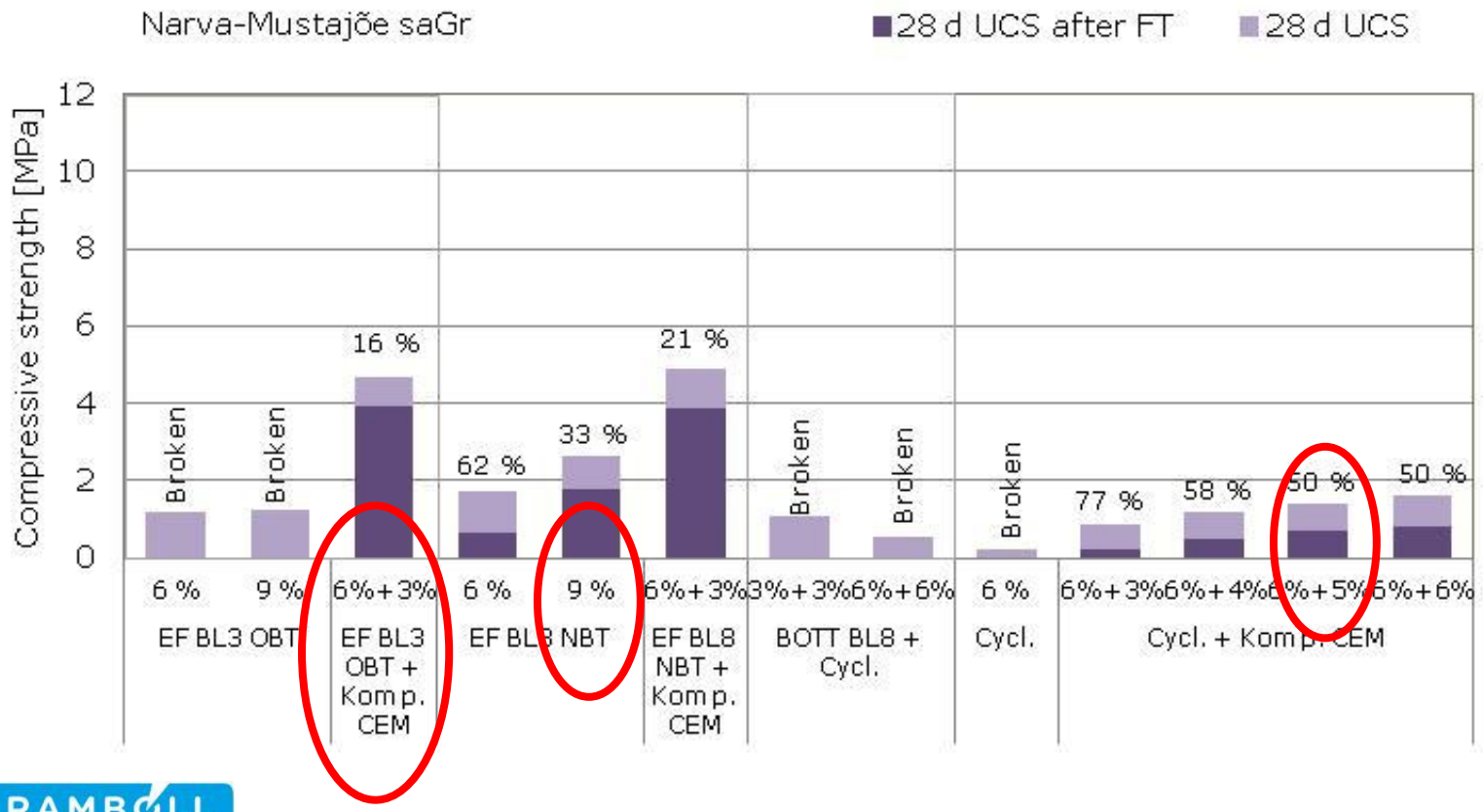
LABORATORY TESTING

- OSA laboratory test results with Narva-Mustjõe road material



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DESIGN

MWA grain size

MAC grain size

Chainage	Length	Structure	Struct type
0+50-5+00	450 m	Layers stabilisation MWA+MAC 25 cm EF BL3 OBT 6% + KS 3% Old ash stabilised layer not removed	A
5+00-9+50	450 m	Layers stabilisation MWA+MAC 25 cm CYCL 5% + KS 5% Old ash stabilised layer not removed	B
9+50-10+50	100 m	Layers stabilisation MWA+MAC 35 cm EF BL3 OBT 6% + KS 3% Old ash stabilised layer removed	A*
10+50-11+50	100 m	Layers stabilisation MWA+MAC 35 cm EF BL11 NBT 9% Old ash stabilised layer removed	D*
11+50-12+50	100 m	Layers stabilisation MWA+MAC 35 cm CYCL 5% + KS 5% Old ash stabilised layer removed	B*
12+50-15+80	330 m	Layers stabilisation MWA+MAC 25 cm EF BL3 OBT 6% + KS 3% Old ash stabilised layer not removed	A
15+80-16+80	100 m	Layers stabilisation MWA+MAC 25 cm EF BL11 NBT 9% Old ash stabilised layer not removed	D

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CONSTRUCTION

- Planned spreading of binding agent

- Actual spreading of binding agent

FOLLOW-UP

- Since October 2012 three follow-up studies have been carried out on the Narva-Mustjõe road section. The following inquiries have been made:
  - Drilled samples were taken from the road structure to check the stabilisation depth and make UCS tests in the laboratory
  - Inspection of rut depth and defects (cracks)
  - Measurements of bearing capacity with falling weight deflectometer (FWD)

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FOLLOW-UP

Structure type*	28d UCS [MPa]	28d UCS FT [MPa]	1 year UCS on site [MPa]
A	3,9	3,3	8,0
B	1,6	1,2	4,2
D	3,3	2,3	3,4

Structure type*	Length [m]	Cracks per 100 m	AV rut depth [mm]
A	880	1,6	2,9
B	550	1,3	2,7
D	200	0,5	2,5

*A = layer stabilisation 25/35 cm: MWA + MAC, EF BL3 OBT 6 % + KS 3 %
*B = layer stabilisation 25/35 cm: MWA + MAC, CYCL 5 % + KS 5 %
*D = layer stabilisation 25/35 cm: MWA + MAC, EF BL 8 NBT 9 %

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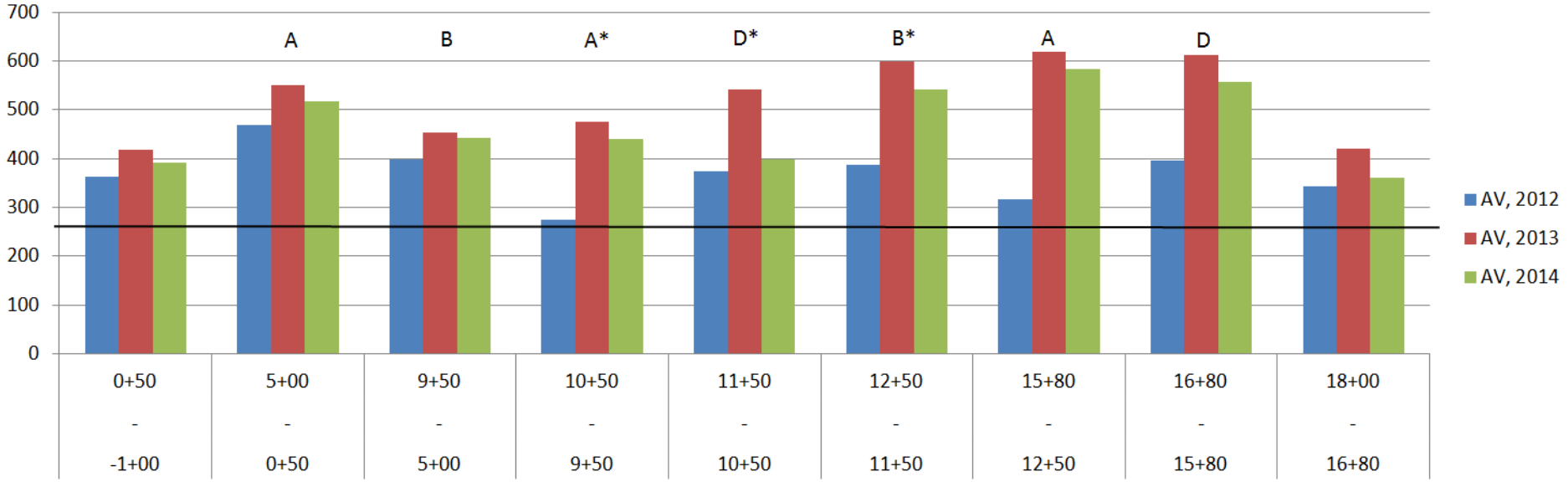
FWD MEASUREMENT RESULTS



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CONCLUSION

The execution of the OSAMAT project will continue, but some conclusions can be made:

1) MWA and MAC can make good body material for construction of stabilized layers.
2) It is possible to utilize OSA binders to improve road bearing capacity.
3) The construction technology or equipment needs to be improved to enable mixing of binders off site and wet mixing. This would save time and result in more homogeneous stabilization.
4) Water content and compaction control are important in the test sections construction it was problematic.
5) The follow-up study results show continuous hardening of the stabilized layer, high bearing capacity and transverse cracks. Tests shall be made with only ash stabilization to achieve adequate bearing capacity and no or less transverse cracks.
6) Follow-up studies need to be continued to register the development of cracks and their effect to the road structure.

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THANK YOU

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http://www.osamat.ee/