Permeable pavements
- optimization of drainage asphalt

AAU – 3rd semester M.Sc.
Semester project (1. sep. – 1.jan2018)

(and further work done on my master thesis from 1. jan – 27. june 2018

Agenda

- Introduction and background
- Methods and expectations
- Marshall results
- Durability tests
- Clogging tests on new mix design
- Conclusion and further projects

AAU – 3rd semester M.Sc.
Semester project (1. sep. – 1.jan2018)

(and further work done on my master thesis from 1. jan – 27. june 2018

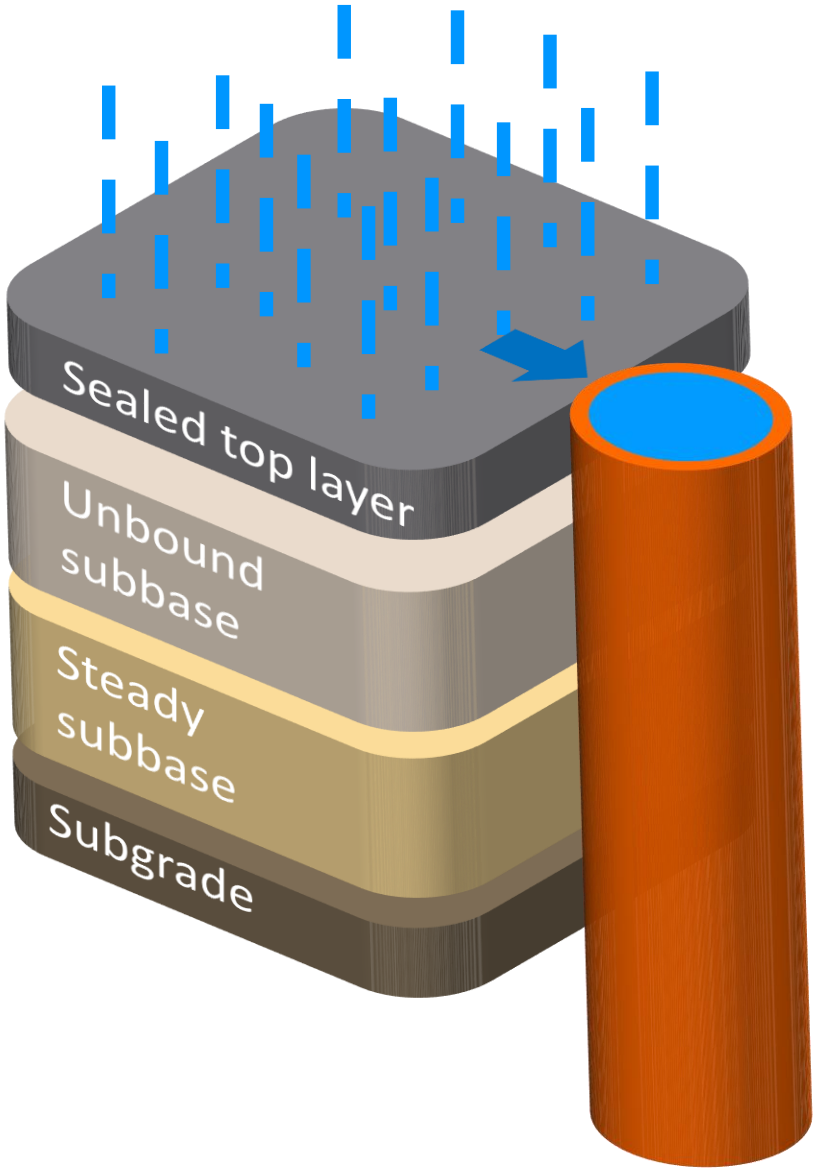
NCC

Fredericia, Asfaltlaboratorium

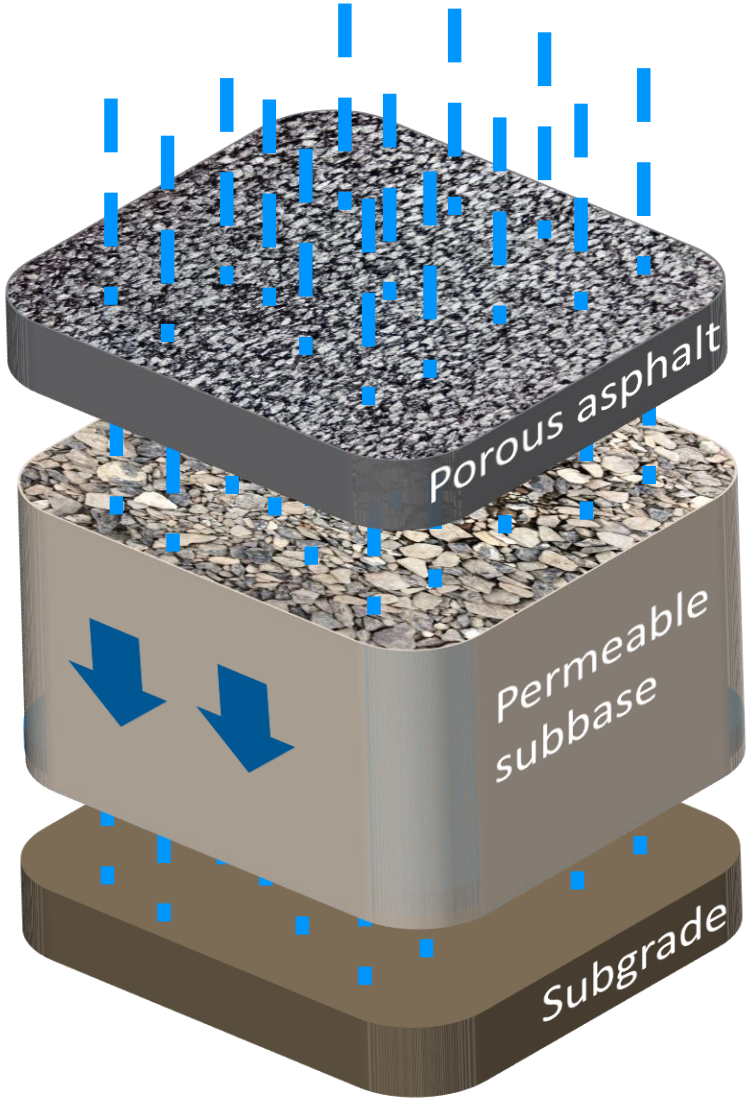
AALBORG UNIVERSITET

High intensity rainfall courses major damage…

Traditional pavement



Permeable pavement



.. Water can’t infiltrate through surface..

Porous asphalt, **2011**

Max. Aggregate size 8 mm

Max. Aggregate size 11 mm

Clogging in the air void→ Reduced permeability

Porous asphalt, optimized **2017**

Type 11

Max. Aggregate size 11 mm

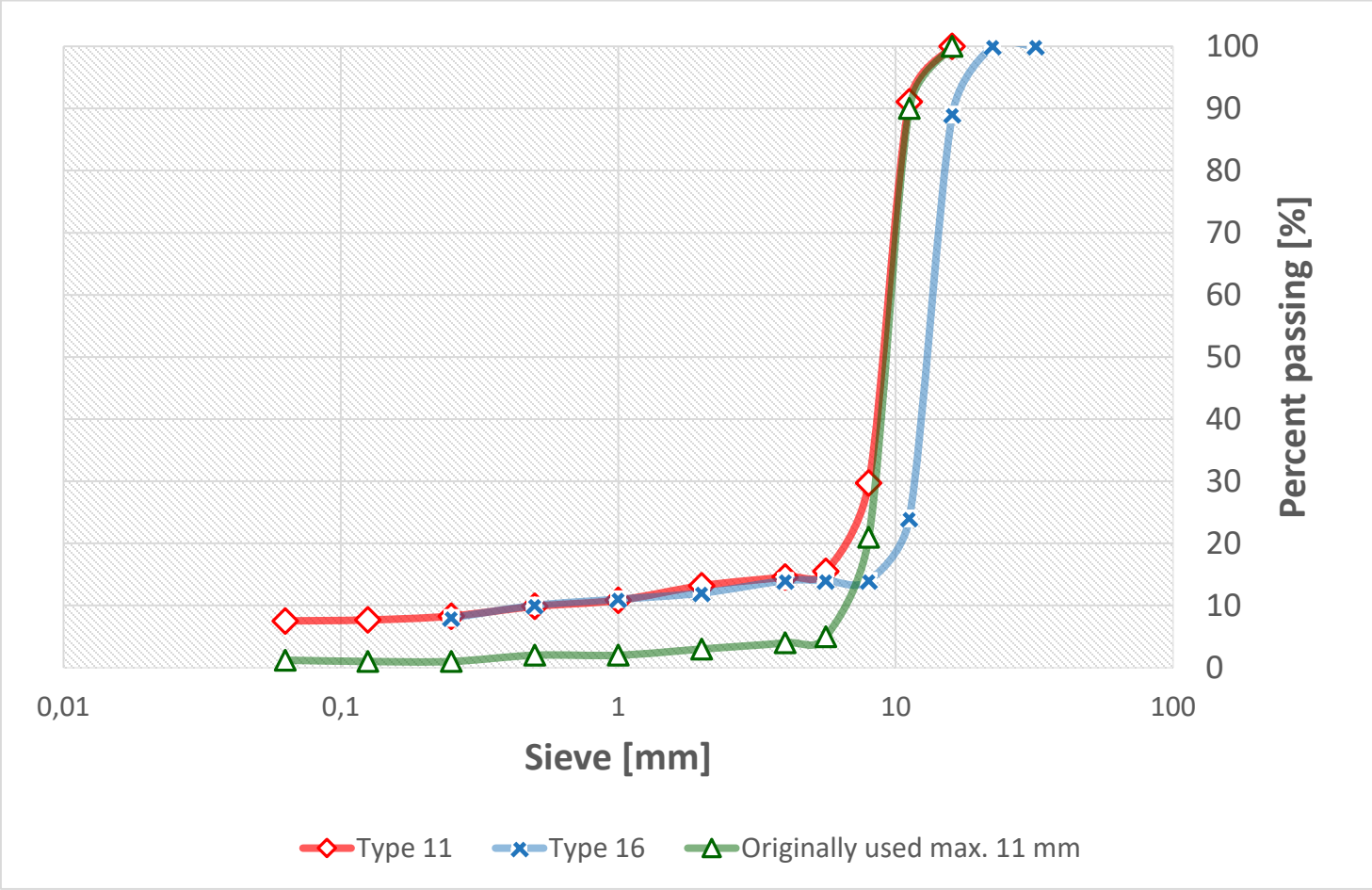
Type 16

Max. Aggregate size 16 mm

Optimization of the original mix design → Increase the air void

Optimization of the mix design

Mix design before optimization: 90 % maximum aggregate size 11 mm and 10 % stone dust of 0/2 mm, 3 % calcium and approx. 2% of cement and filler



How did I work with it?

Mix design

Asphalt

Air void

Less clogging – higher permeability

- 20% and 24 % for respectively type 11 and 16

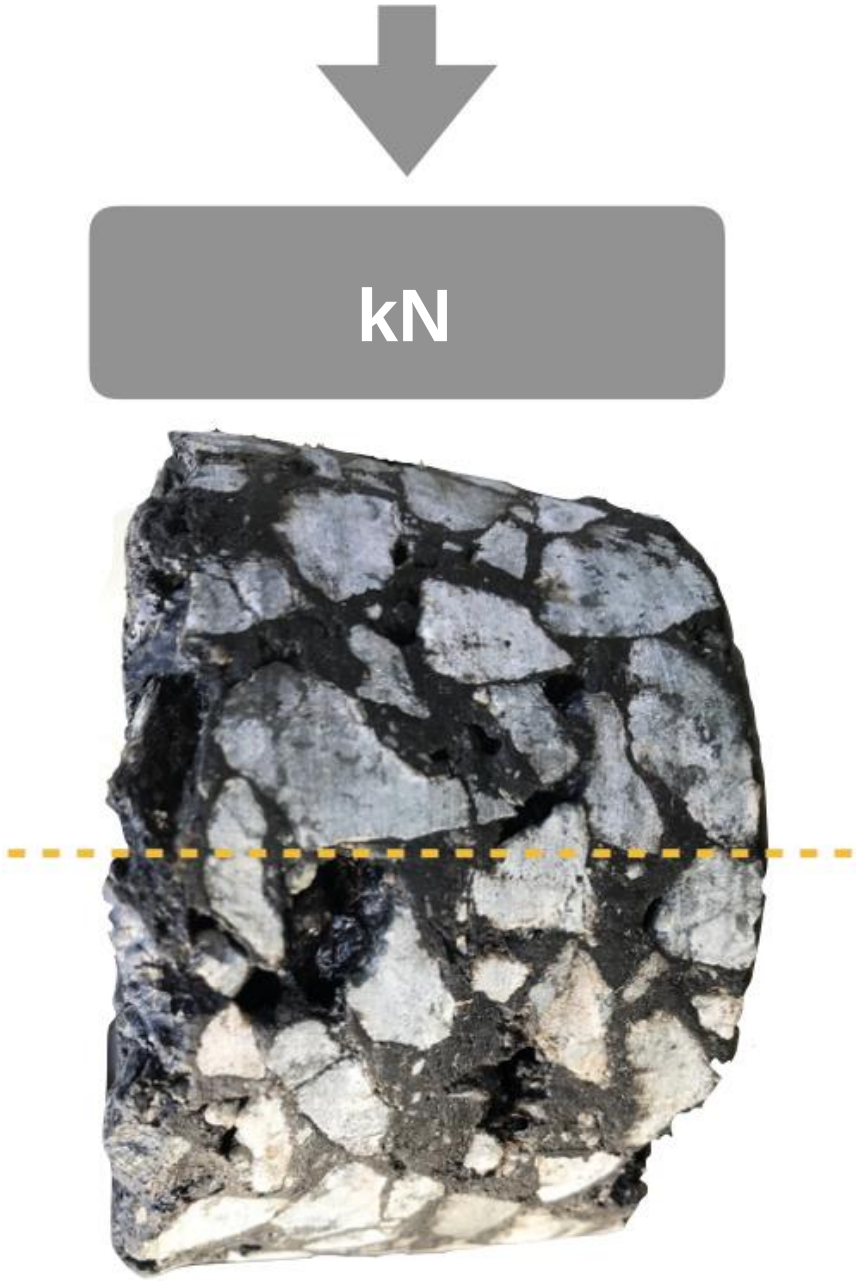
Stiffness

SBS highly modified binder:

- Higher stiffness than usual on porous asphalt is expected
- Minimum stiffness at 1500 Mpa

Binder: 70/100-75 Styrene- butadiene-styrene

Elastic recovery [%]	Penetration [1/10 mm]	Softening point [degrees]
80	70	75

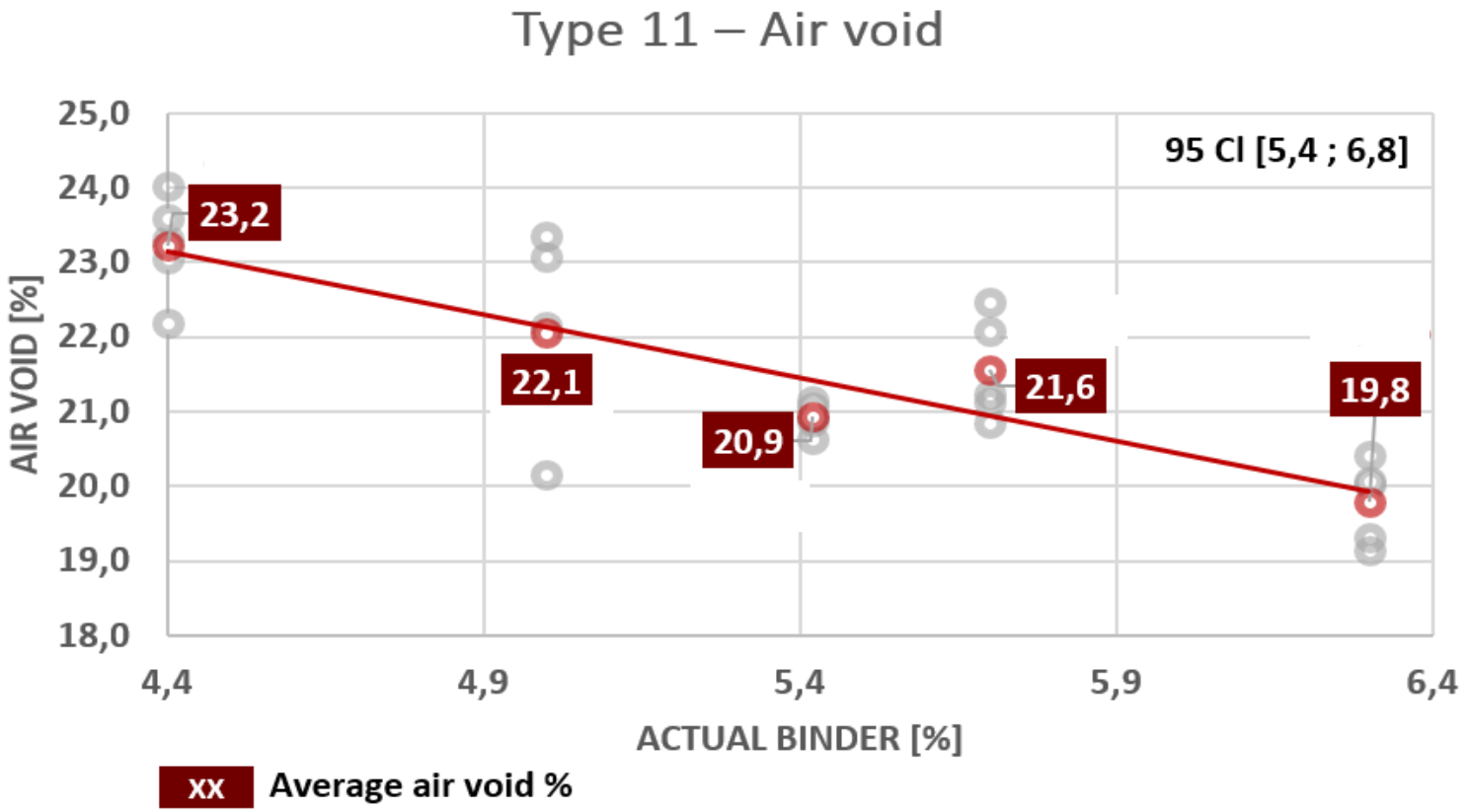


Stability

LA drum

After LA drum

Regression analysis and 95 CI

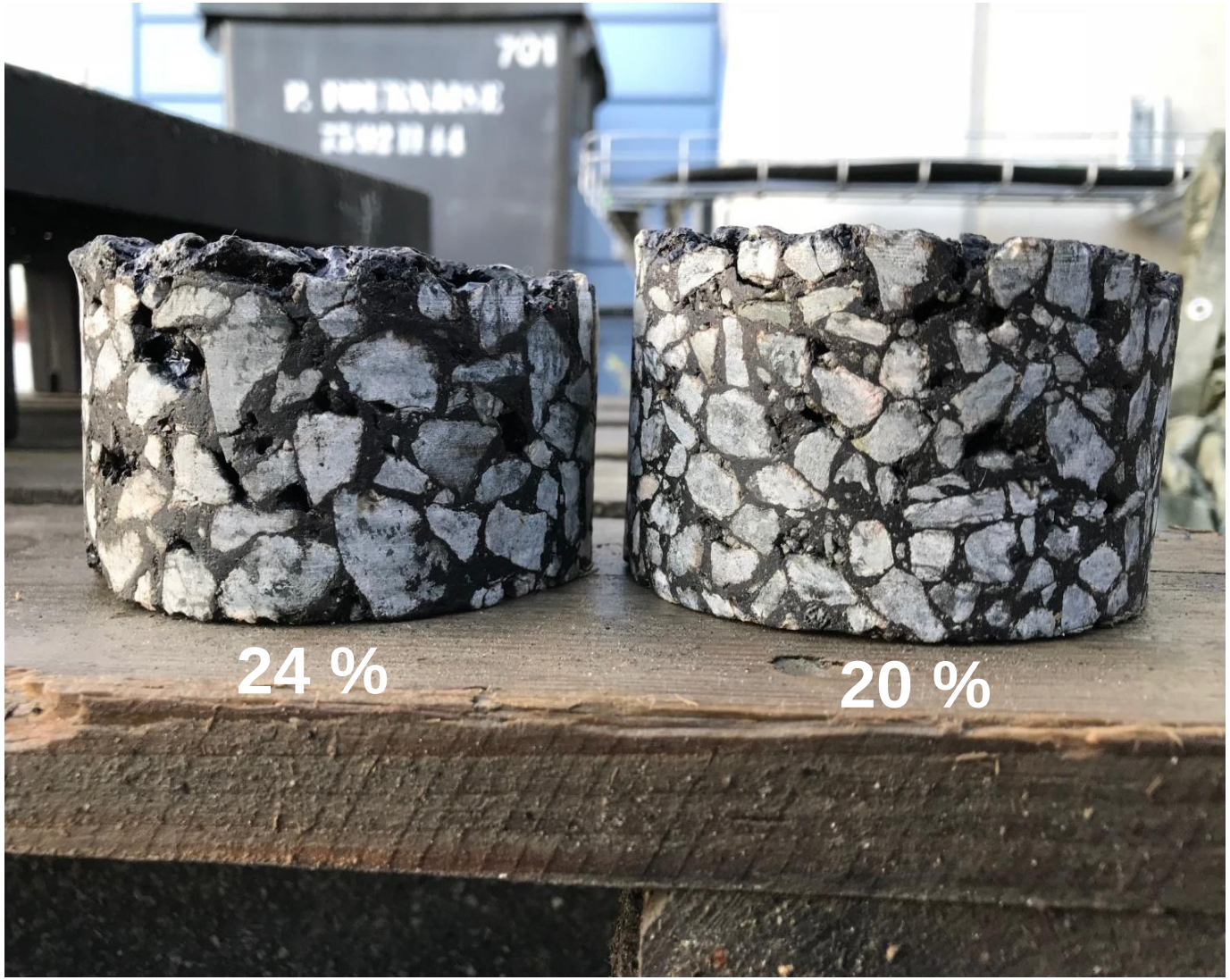


Chosen binder content:

6,3 % (theoretical) binder type 11
6,0 % (theoretical) binder type 16

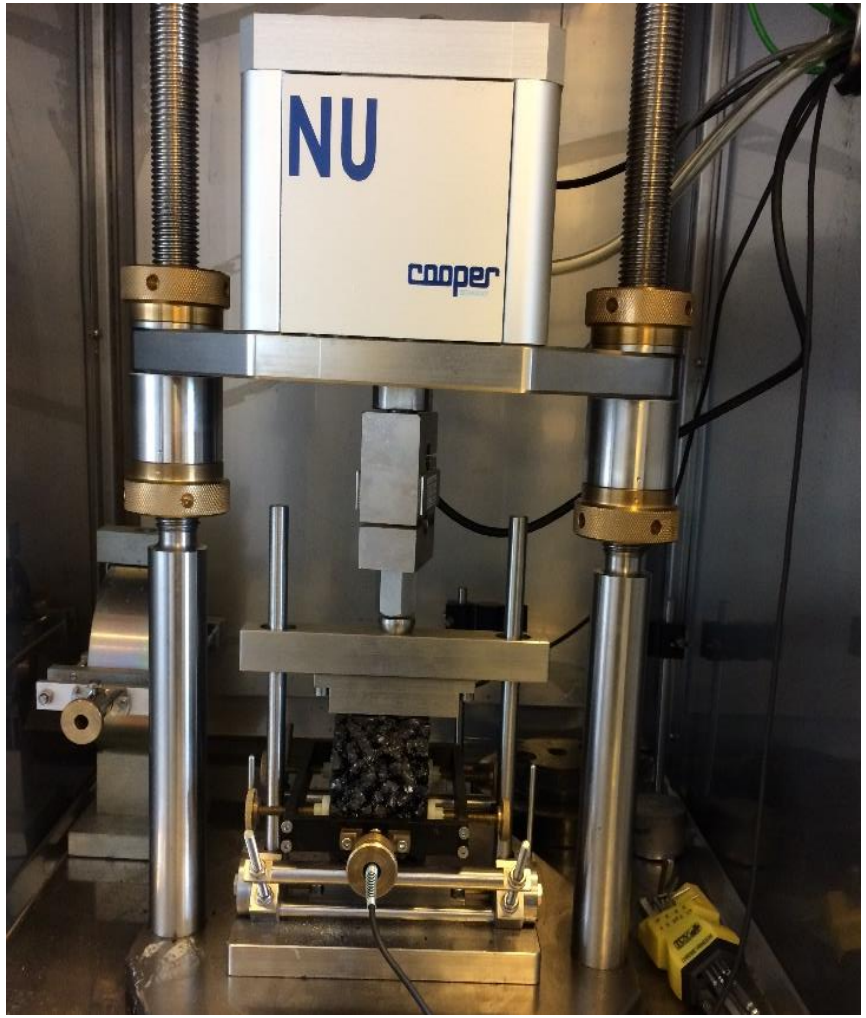
Air void and stability

- Fulfills the criterias:
  - Porous structure
  - Particle loss at 7 % type 11, and 12 % type 16.



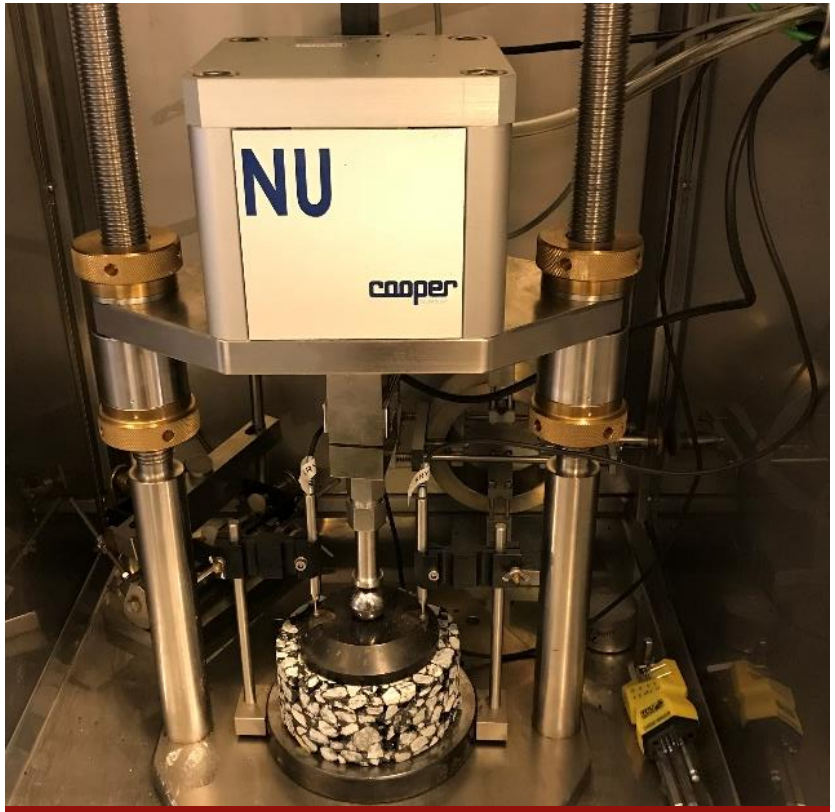
Stiffness

- Type 11 – 1500 MPa
- Type 16 – 1000 MPa



Durability tests

Wheel tracking



Dynamic creep test

Wheel tracking test

After the first 10000 runovers

GAB I (Airvoid 2,1 %)	4 mm
Tidligere type 11 (Airvoid 18 %)	11 mm
Optimized type 11 (Airvoid 20 %)	8 mm
Type 16 (Airvoid 24 %)	11 mm

Dynamic creep test

Good resistant to permanent deformation:
Creep < 2 µε/puls

SMA 11 (Airvoid 2,8 %)	0,5 µε/puls
Tidligere type 11 (Airvoid 18 %)	0,4 µε/puls
Type 11	0,4 µε/puls
Type 16	0,7 µε/puls

Clogging test – Inspiration from Technical Institute

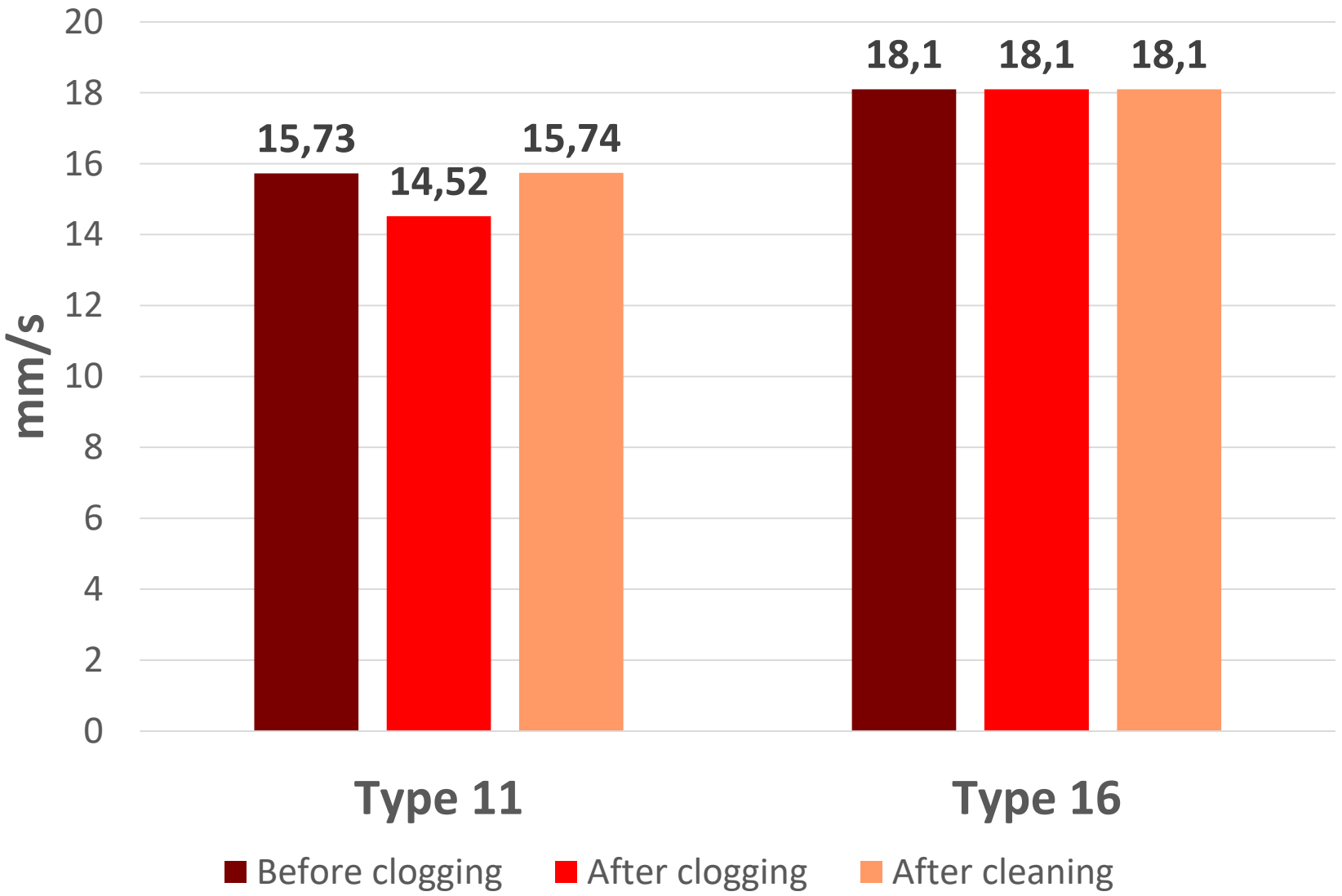
Permeability before

Clogging material

Clogged cores

High pressure

Type 16 has best abilities to delay clogging



Conclusion

- Good resistant to permanent deformation (when using creep test) – type 11/16
- Stiffness properties – type 11
- Infiltrationrate after cleaning – type 11/16
- Fastest infiltrationrate – type 16


JARL RUNGE
MADSEN
VENSTRE
NCC

Further projects done (master thesis)




Research on the permeable subbase material and in comparison to traditional subbase:

- Stiffness and field study
- Permeability

Could there be a chance to evolve this research into a Ph.D.?☺