



NTNU – Trondheim
Norwegian University of
Science and Technology

Measuring the effect of de-icing solutions on the adhesion of asphalt mixtures

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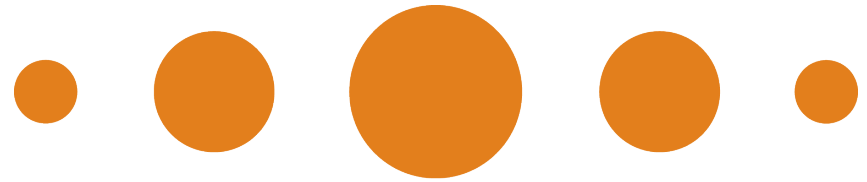


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Statens vegvesen



AVINOR





Deicing fluids

- Avoid/remove thin ice layers
- Lower the freezing point
- Anticompaction



Deicing fluids

- Avoid/remove thin ice layers
- Provide pavements with higher friction values
- Lower the freezing point

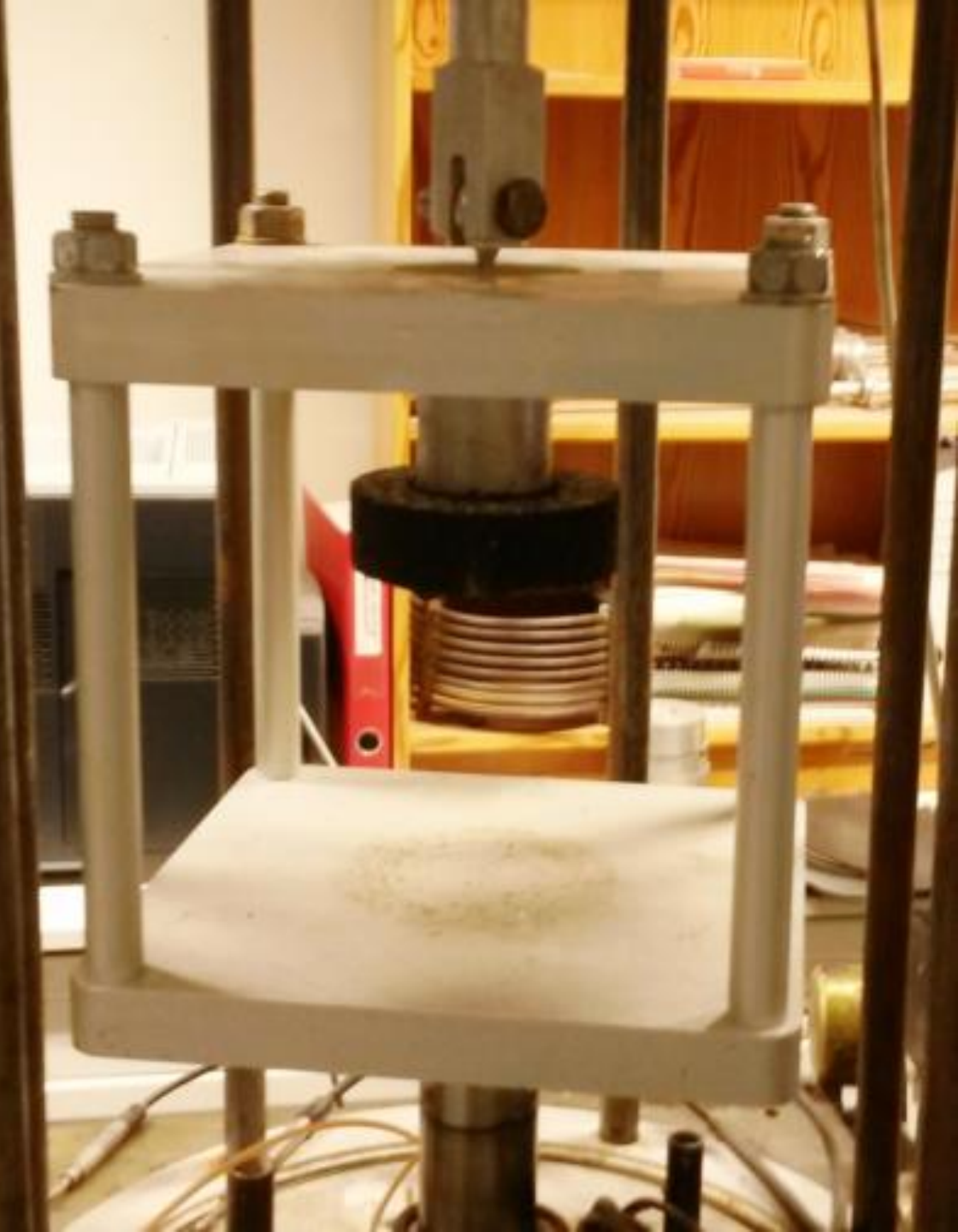
- Degradation and softening of bitumen
- Increase of ice pressure within the pores
- Loss of aggregate material

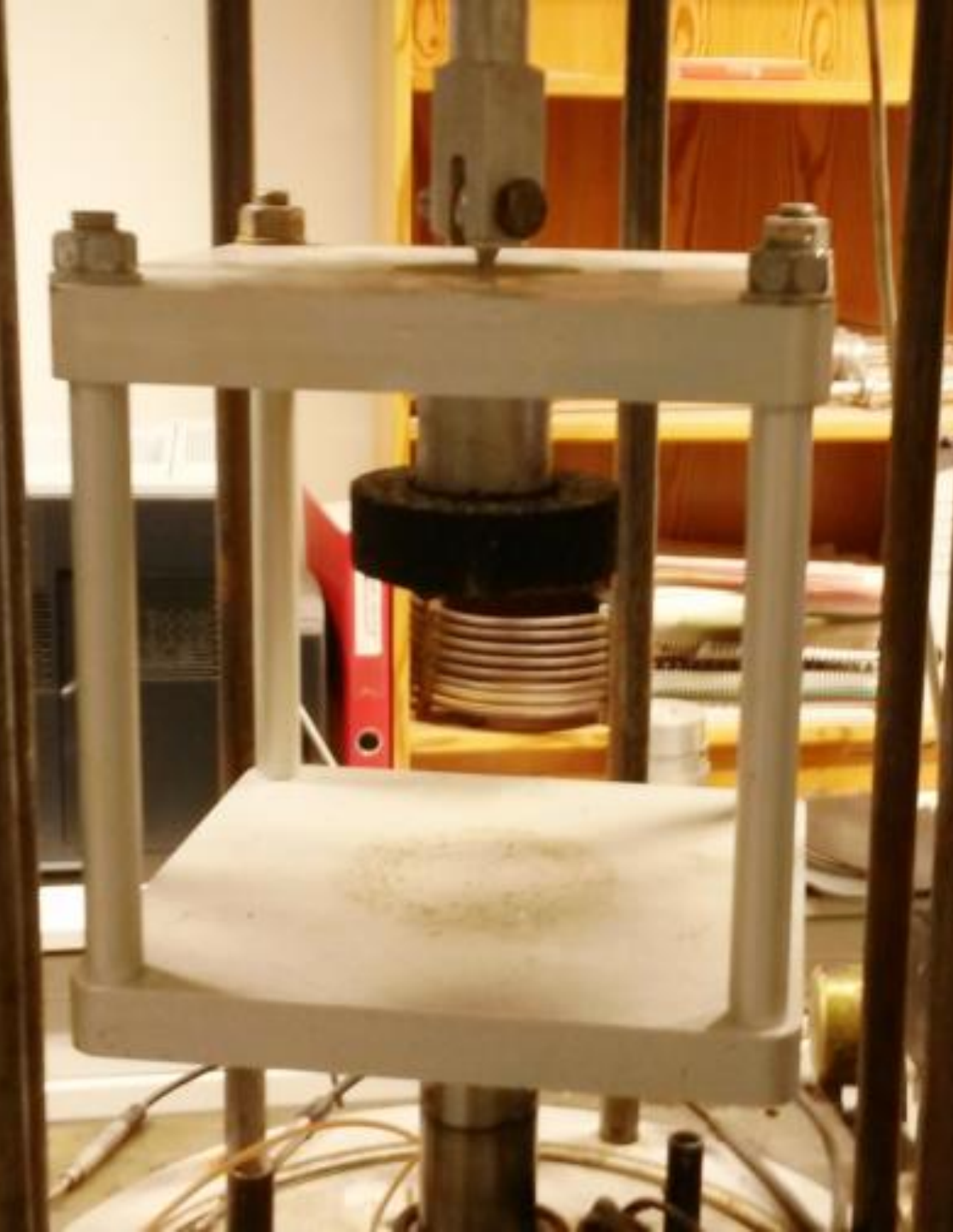
Deicing fluids

- Sodium Chloride (NaCl)
 - Most used deicer on roads and highways
 - Low cost
- Potassium formate (KCHO₂)
 - Used on airport runways

De-icing test







$$\sigma = \frac{F_{max}}{A}$$

$$\beta = \frac{\sigma_{wet}}{\sigma_{dry}} \times 100$$



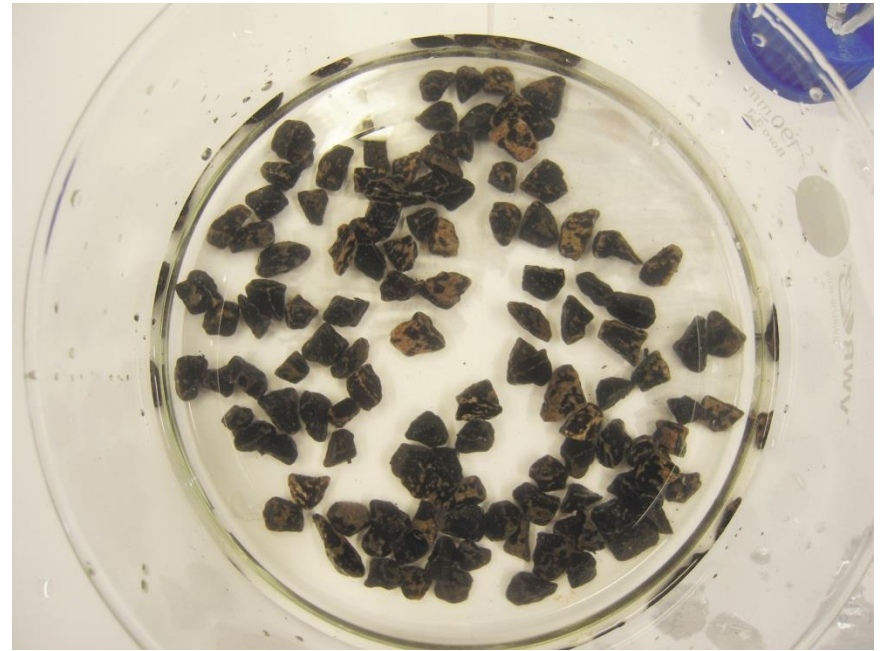
- A. superficial
- B. deep within the asphalt specimen
- C. de-bonding from the glue

- 76 days long test (manufacturing, storage, testing)
- need of experienced technicians
- glue failure
- *“ [...] repeat [...] until the mean of both the dry and wet groups are the average of not less than four determinations.”*
- *the test compares the results to dry samples*

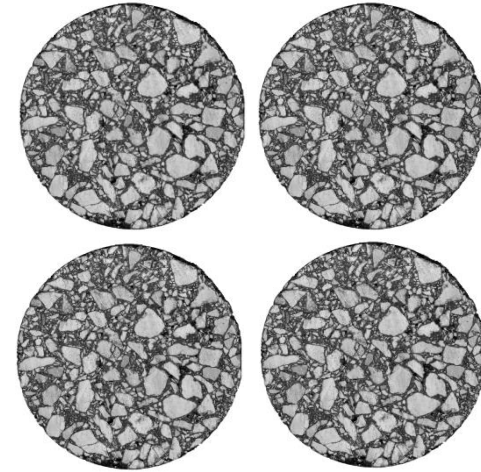
Can we use any other test?



ITS



Rolling bottle

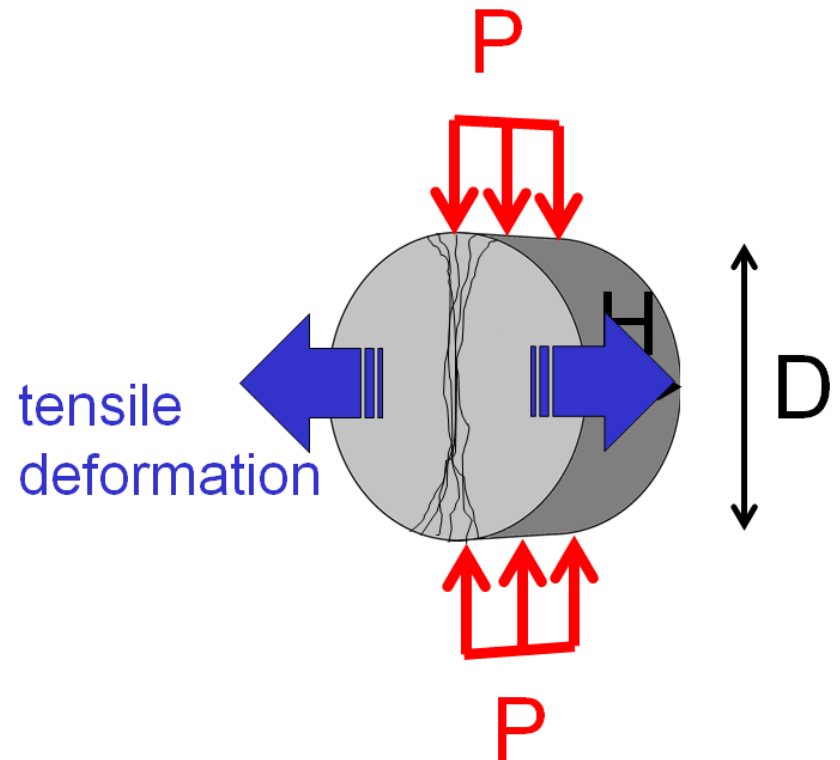


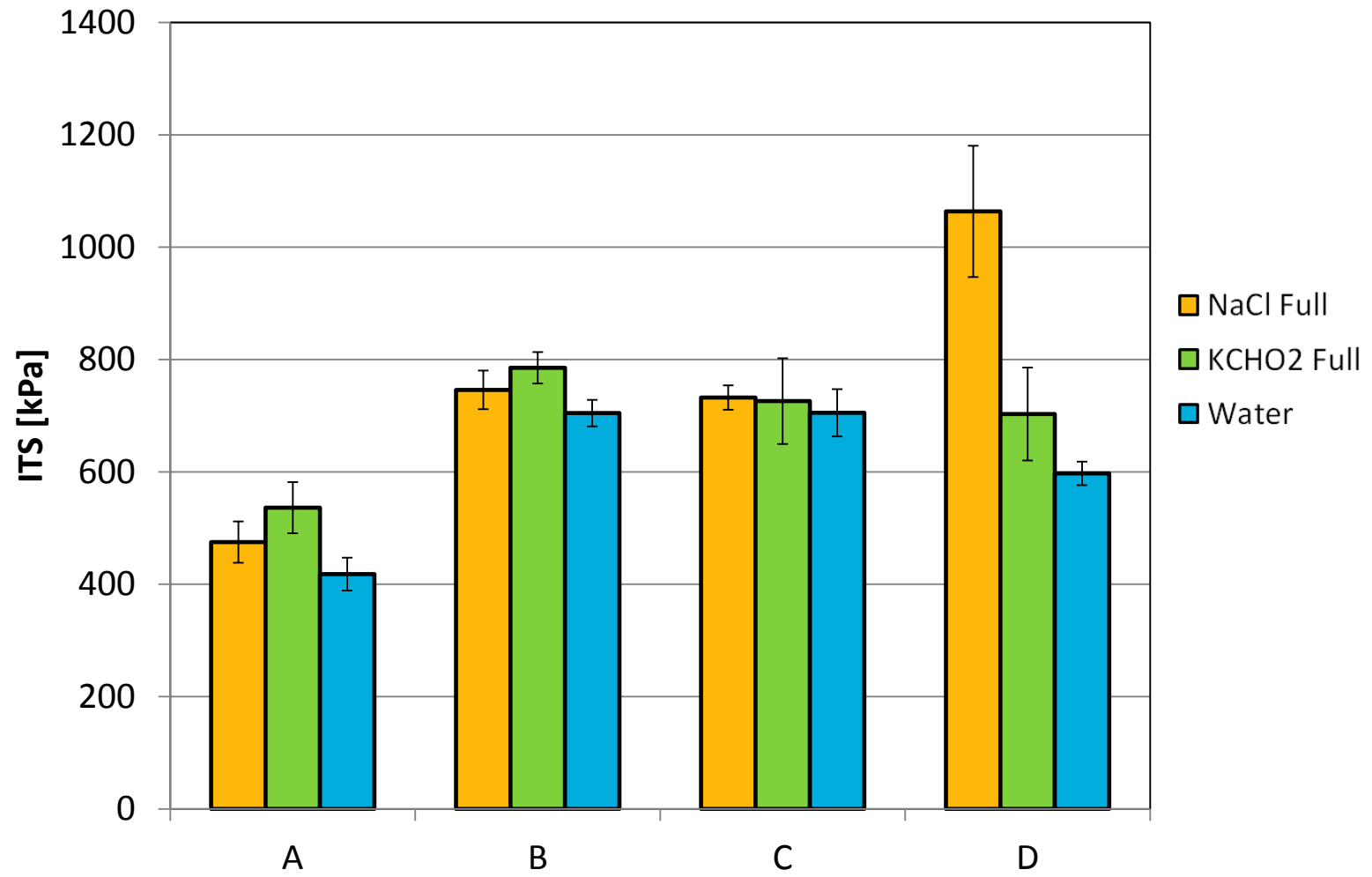
		A	B	C	D
Actinolite	[%]	-	40.6	-	-
Albite	[%]	18.3	18.1	35	30.35
Biotite	[%]	-	-	-	1.33
Calcite	[%]	-	4.4	0.4	16.23
Chlorite	[%]	-	-	-	16.07
Clinochlore	[%]	-	18.1	2.2	-
Epidote	[%]	-	11.8	-	-
Microcline	[%]	15.2	5.8	10.1	2.45
Muscovite	[%]	18.3	0	15.1	12.32
Quartz	[%]	48.2	1.2	37.2	21.25

Indirect Tensile Strength test (ITS)

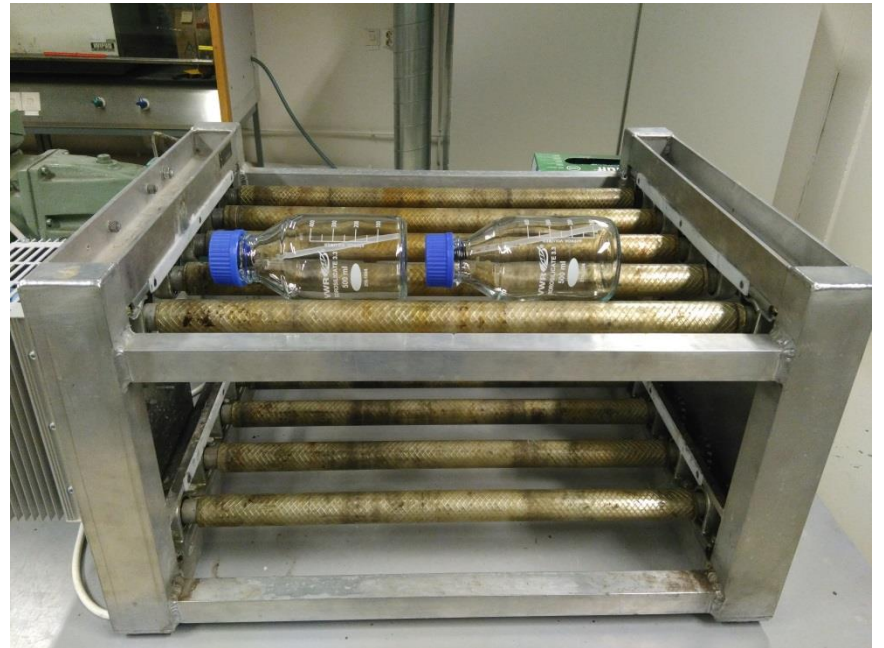
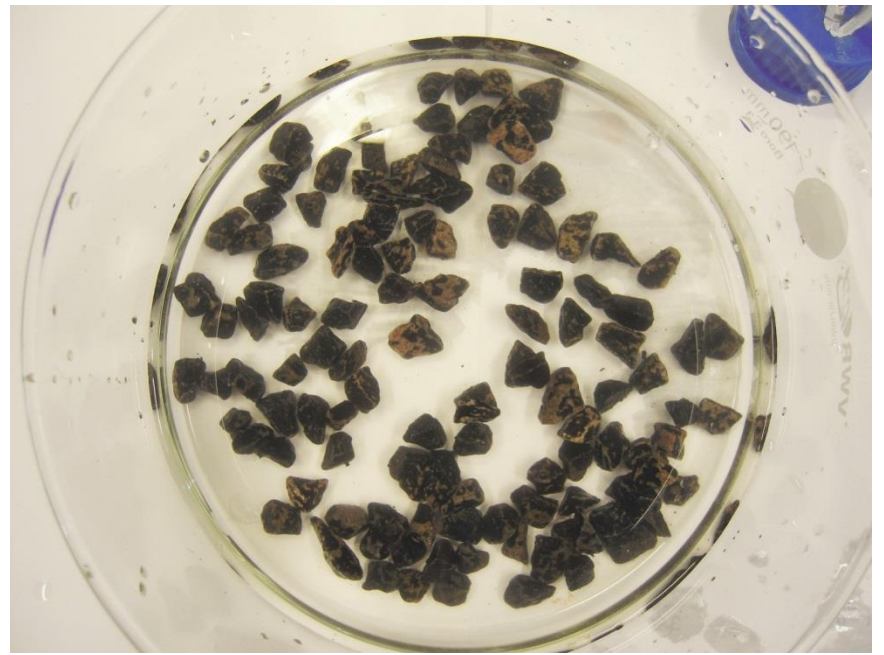


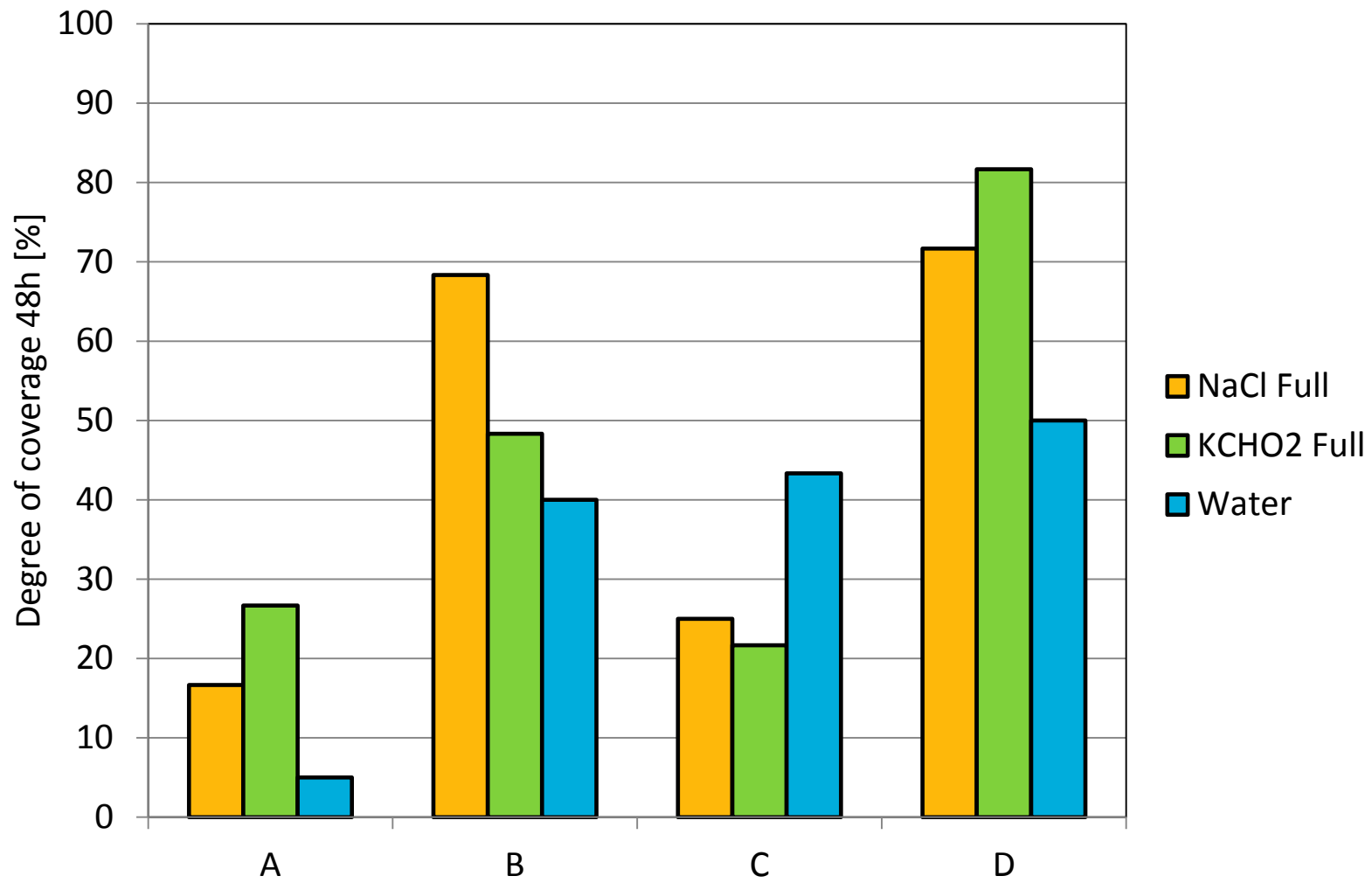
$$ITS = \frac{2P}{\pi D H}$$

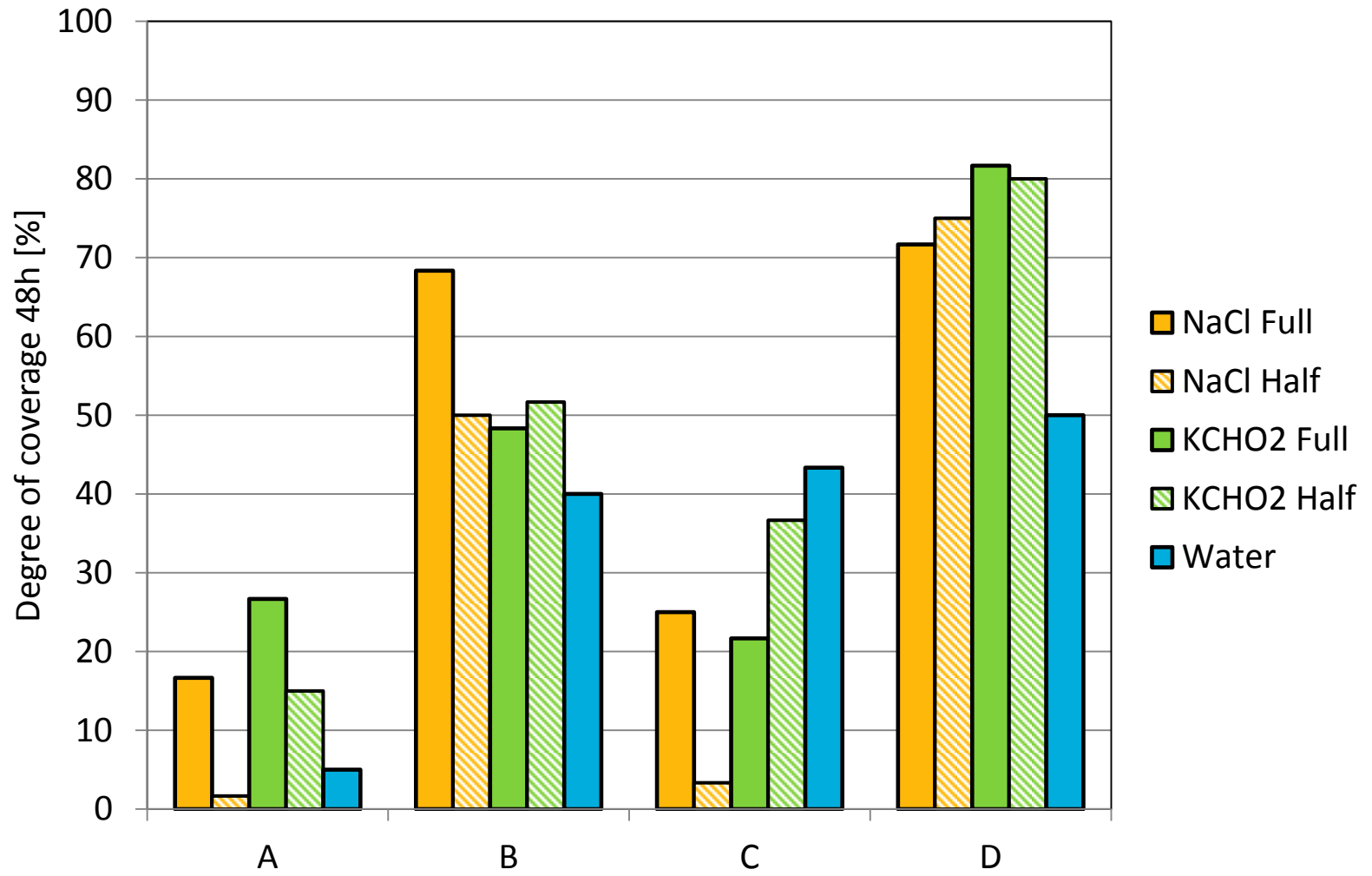


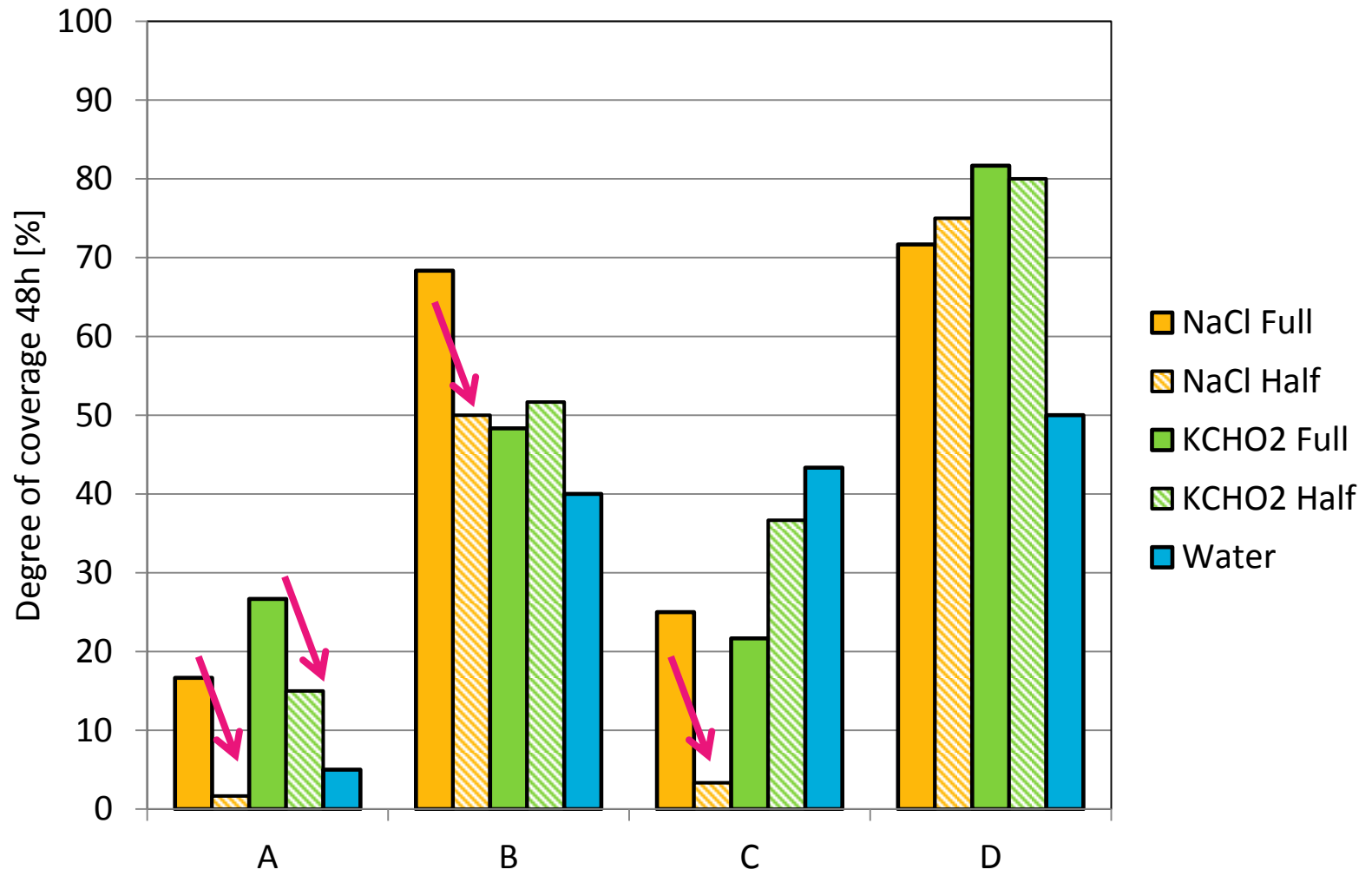


Rolling Bottle test (RB)









Can we use any other test?

- no difference where observed when considering the cohesion of the mixture
- significantly lower adhesion damage was observed compared to water in all but one mixture
- large differences between the different mixtures are still observed

Conclusions

- Water is bad, deicers not so much
- Deicers seem to affect the bond between aggregate and binder and not the binder itself
- An adhesive test could be considered as alternative to the EN 12697-41



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Thank you!

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