



Hrvatsko asfaltno društvo



Croatian asphalt association

The influence of asphalt workmanship on pavement service life

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**Međunarodni seminar ASFALJNI KOLNICE 2017
International seminar ASPHALT PAVEMENTS 2017**

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Durable roads



2011-2014

vegvesen.no/varigeveger

The goal of the R & D program Durable Roads is to achieve increased pavement service life and reduced annual cost for the pavement structure on Norwegian road network.



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Organisation of NPRA (Norwegian Public Roads Administration)

- The Directorate of Public Roads
- Five regions
- 72 Driver and vehicle licensing offices
- 7 500 employees

Norwegian public road network: 93 800 km

- 10 500 km national roads, highways
- 44 300 km county roads
- 39 000 km municipal roads





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Norway; a country of tunnels

1100 tunnels in NPRRA service

Total tunnel length **1200 km**

Including the world's longest
road tunnel [Lærdal tunnel](#)





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Norway; a country of bridges



[Hardanger bridge; 1380 m](#)

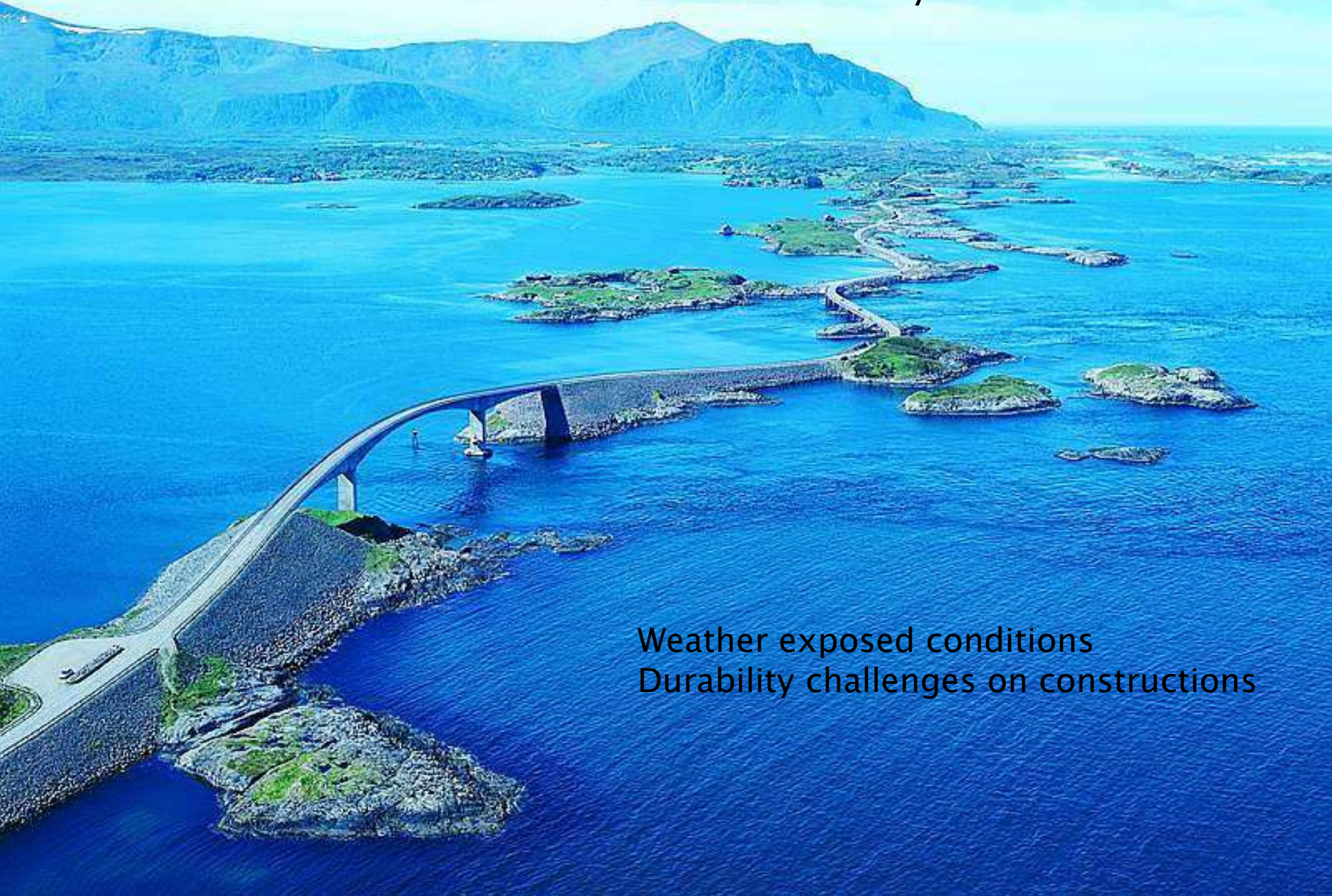
20700 bridges in
NPRA service

Total bridge length
850 km

140–160 new bridges
every year

The Atlantic Ocean Road in Norway

“Construction of the Century”



Weather exposed conditions
Durability challenges on constructions



Norway; a country of tunnels and bridges

1 100 tunnels



20 700 bridges



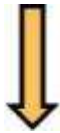
“a premise for freedom of movement and accessibility”

But; maintenance and operation costs are high!

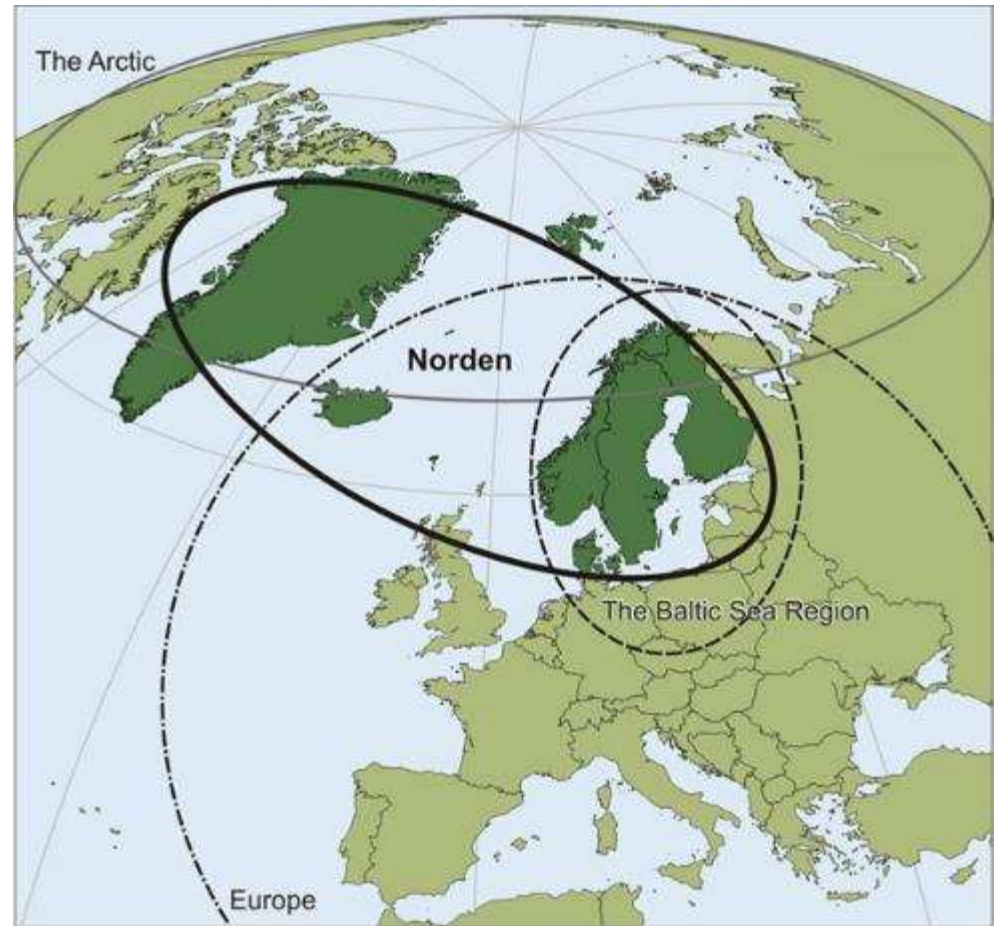


The Nordic countries have climate challenges

- up-west corner of Europe
- facing the Atlantic ocean
- Mexico Gulf-stream waters (warm)
- Arctic winds and waters (cold)



- southern vs. northern conditions
- coastal vs. inland conditions
- precipitation; rain and snow
- rapidly changing temperatures
- high and low temperatures





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Nordic countries use **studded winter tires**





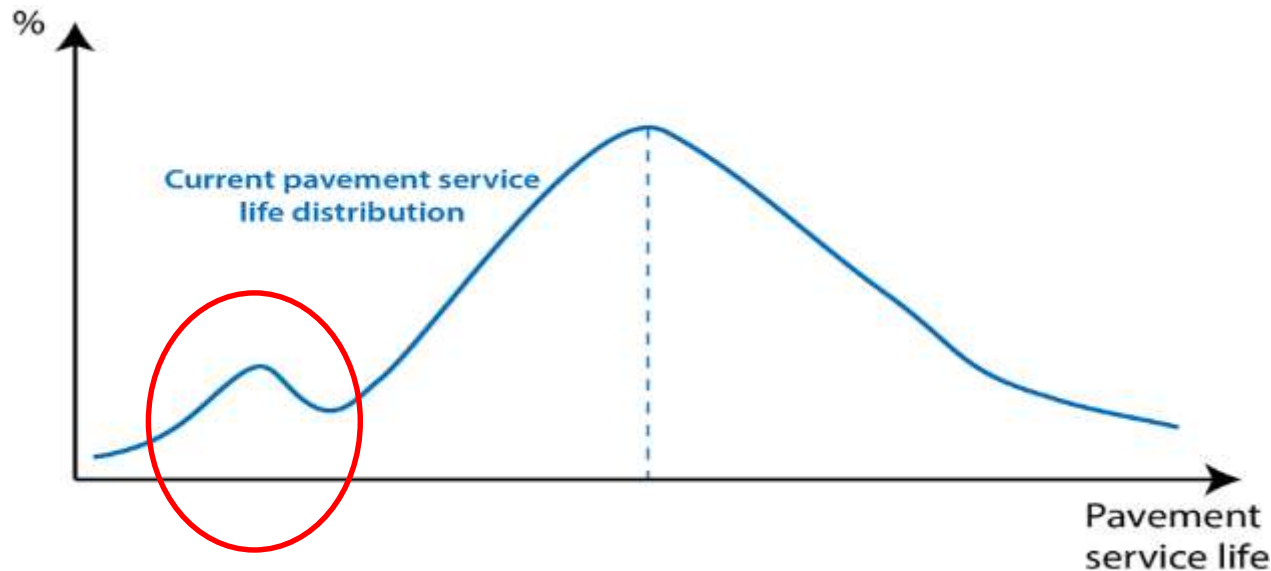
Studded tires → asphalt surface wear



- increased maintenance costs
- reduced traffic safety
- dust and health problems in cities



Present situation – many premature failures



- Premature pavement failures/distresses occur too often
- Focus on cost and completion time
- Less focus on quality of work and proper use of materials/techniques
- Inadequate control procedures



Present situation – many premature failures

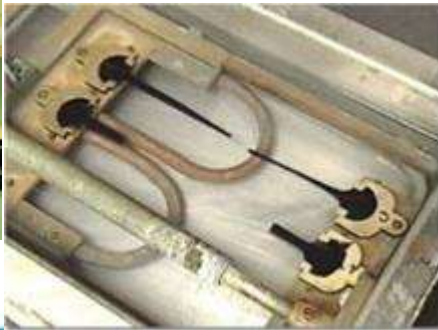


- ▶ Interlayer bonding, joints, bleeding etc. are typical problems
- ▶ Often related to asphalt works, not mix design



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The asphalt mix itself is most often OK



- ▶ Material testing, mix design ✓
- ▶ Asphalt production ✓
- ▶ Quality assurance, FPC ✓



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But something happens from plant to final pavement

Pictures from “Best practice guide”:





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Then, who decides the final outcome of the job?



Key words:

- Competence
- Motivation

Skilled workers are more motivated workers



NPRA actions to prolong pavement service life

- ▶ **Technical improvements**,
including clearer and more precise requirements
- ▶ **Competence improvements**,
involving both road owners and contractors





Many distresses because of lack of bonding

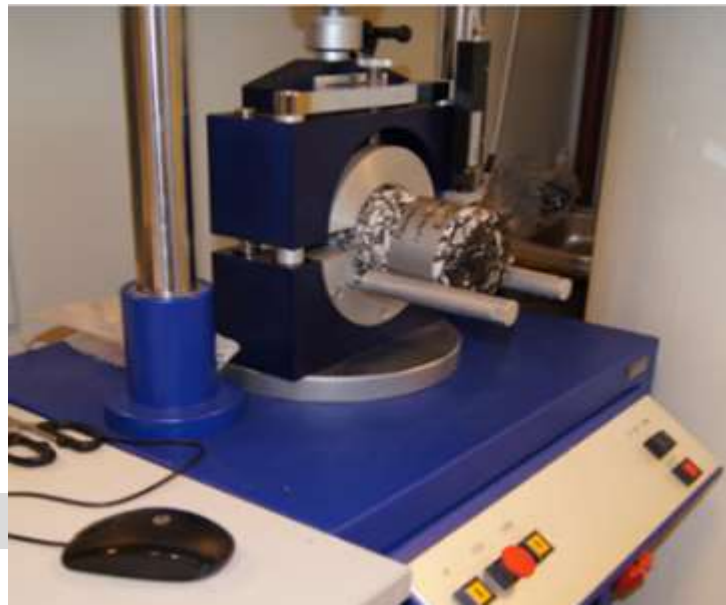


Actions regarding bonding:

- Improved contract descriptions
 - Area to be covered by tack coat, minimum amount of bitumen pr m²
- Improved control procedures
- Introduced new laboratory methods/procedures



«shear bond test»





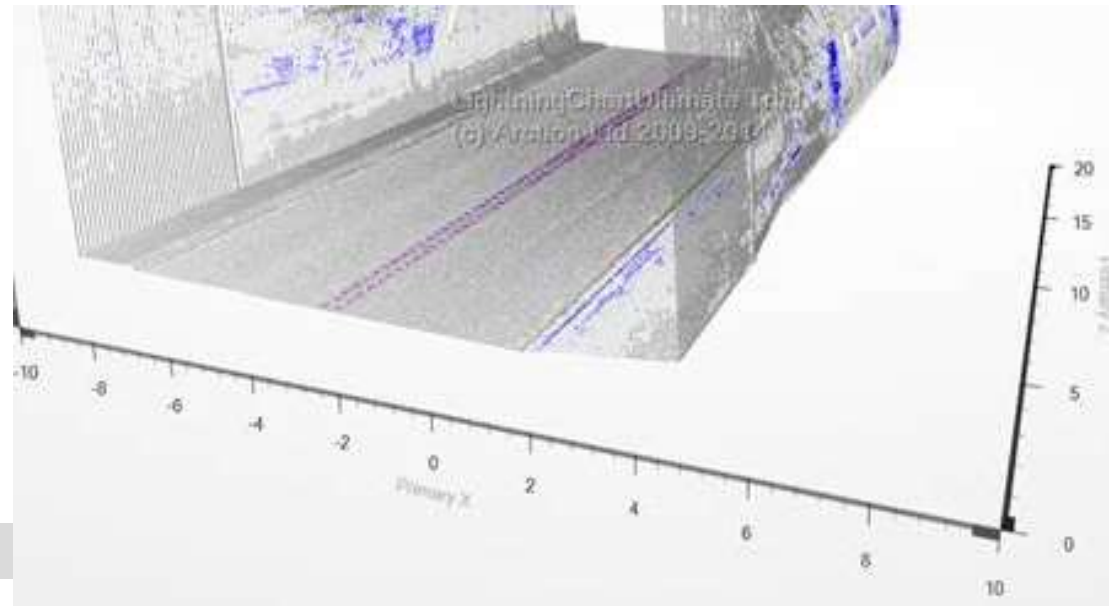
Many distresses because of non-homogeneous asphalt





ViaPPS - NPRA's laser based road monitoring system

- 360 degree rotating laser scanning
- Resolution;
 - 1300 measuring points in each cross profile
 - Cross profile gap 8 cm (at 60 km/h)
- Detailed surface detection (rutting, texture, cracking etc.)
- New application; tunnel profiles





New module in ViaPPS: Homogeneity

Statistical texture analysis from laser data



Image of asphalt surface homogeneity



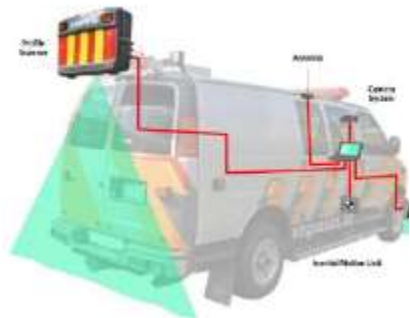
Extreme slippery and/or open textured areas can be detected instantly



Start new paved section

Bleeding areas

End new paved section





Many distresses because of open joints





Execution of longitudinal and transverse joints



Tried out special measures in some contracts, e.g. **edge restraining devices.**

And; intensified control and **increased focus** on these problems in all regions





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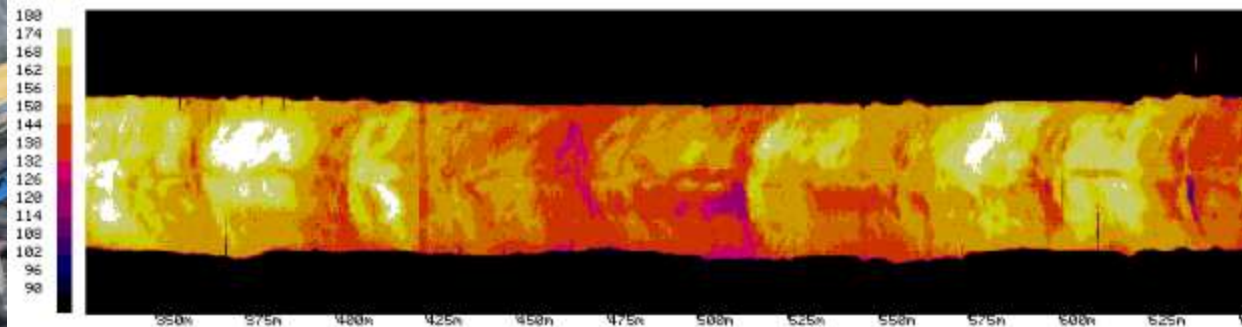
30 % of Norwegian asphalt is boat transported;
create problems due to long distances, reloadings etc.



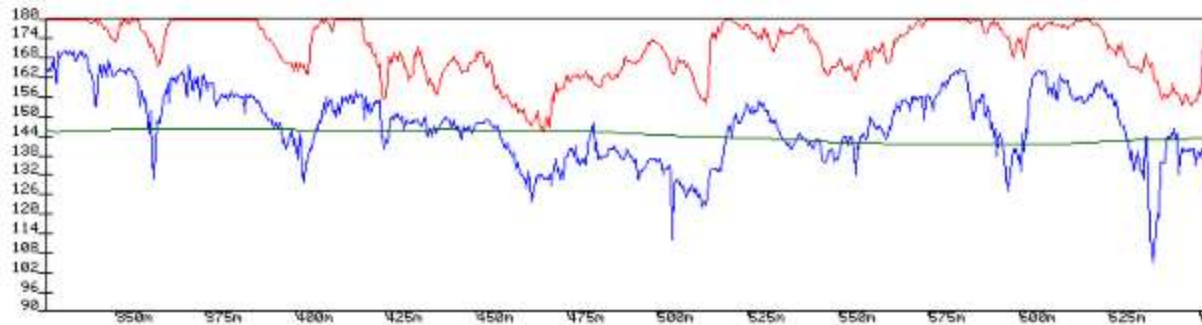


Promising experiences from IR scanning

IR cameras have shown to be a very useful tool to detect inhomogeneities, especially in connection to **boat transport contracts**.



LOGNAMN: 2016-05-20-02.log
SIDA: 2/3



----- maks temp ----- min temp ----- risk temp

Typical temperature profile on the road after reloading from boat to truck and further on to paver. Cold materials in almost every truck load can be seen.





Boat contracts in 2016: Introduced extra loading/mixing equipment on the road (feeder or Shuttle Buggy)



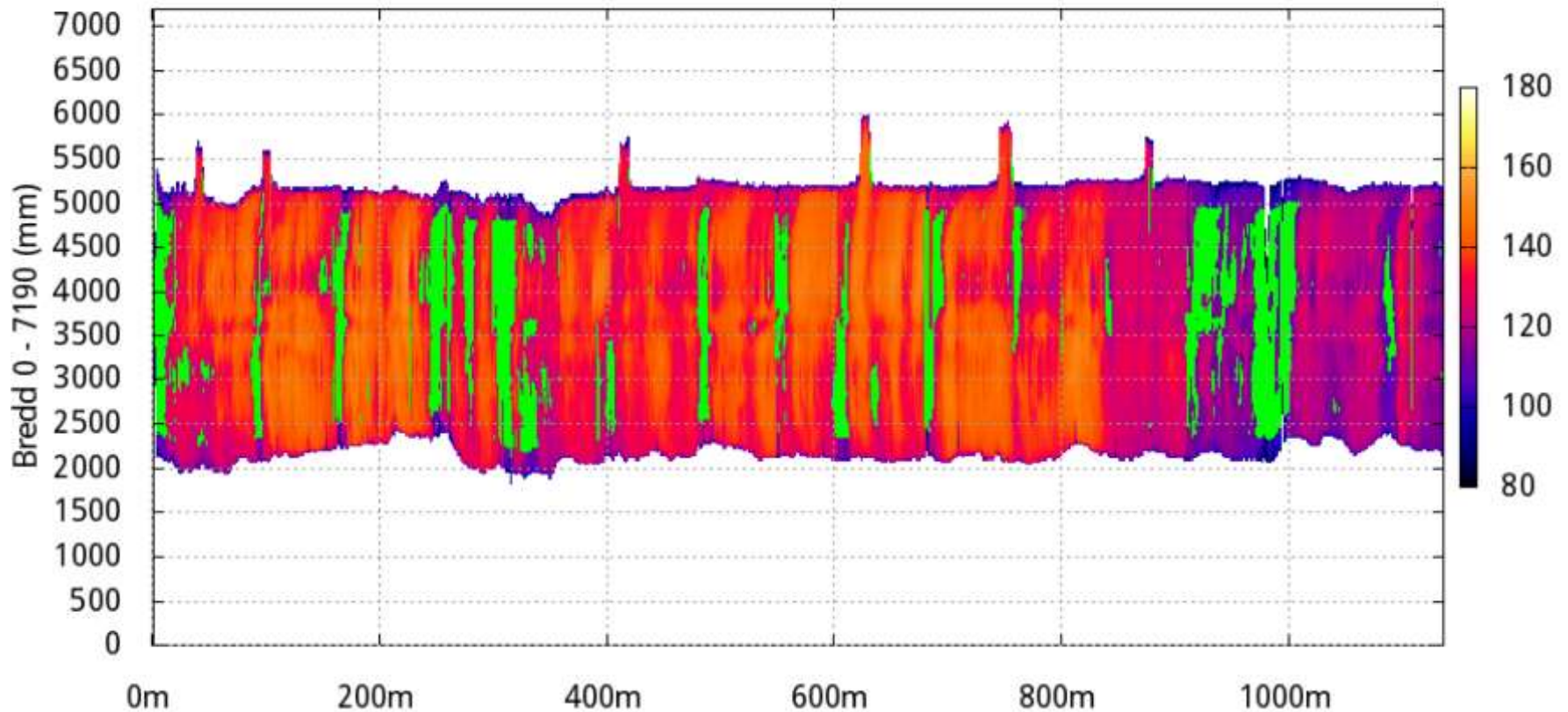
Positive results; the effects can be read directly from the IR pictures (see next slides)





Boat transport **without** feeder/Shuttle Buggy

2016-08-17-02 - Temperaturkarta

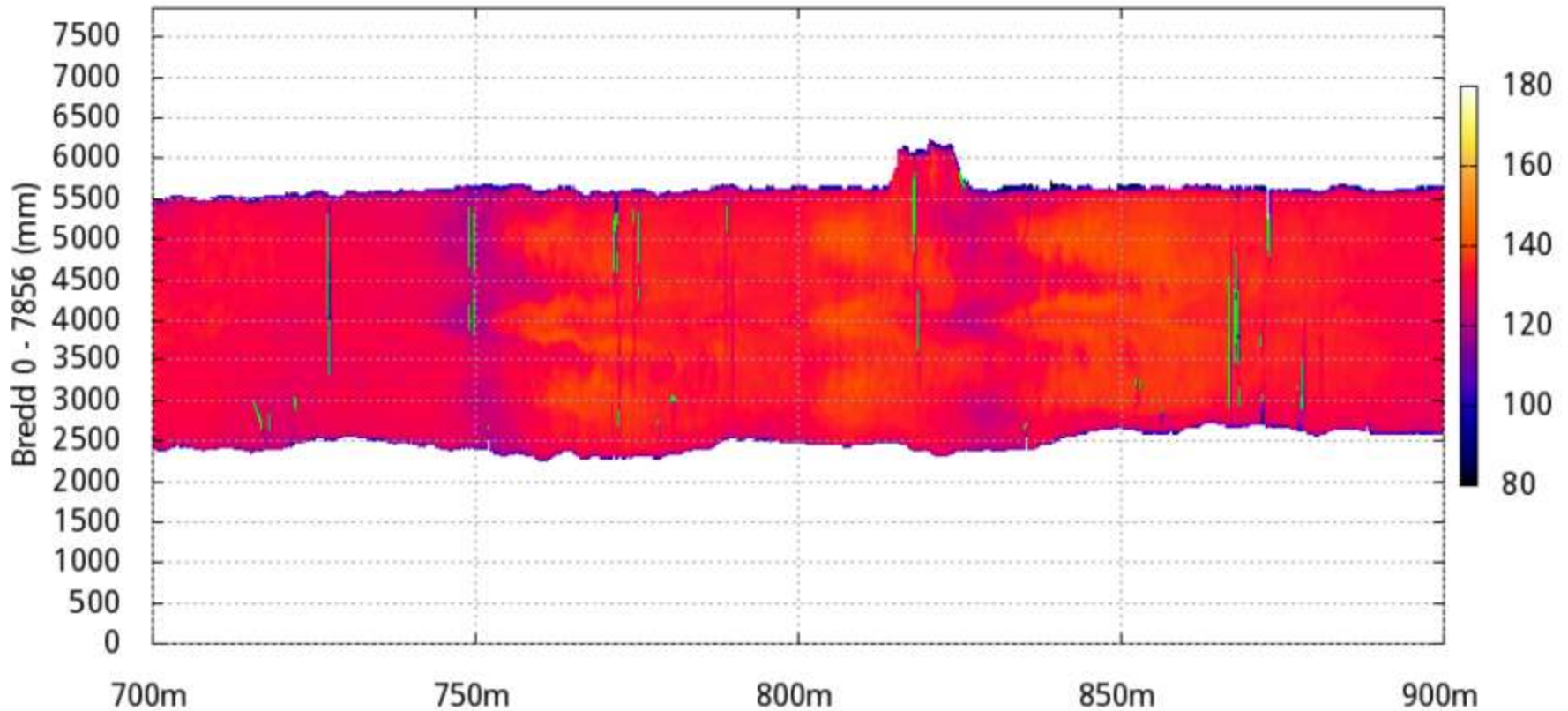


 Risk area 10,6 %



Boat transport with feeder/Shuttle Buggy

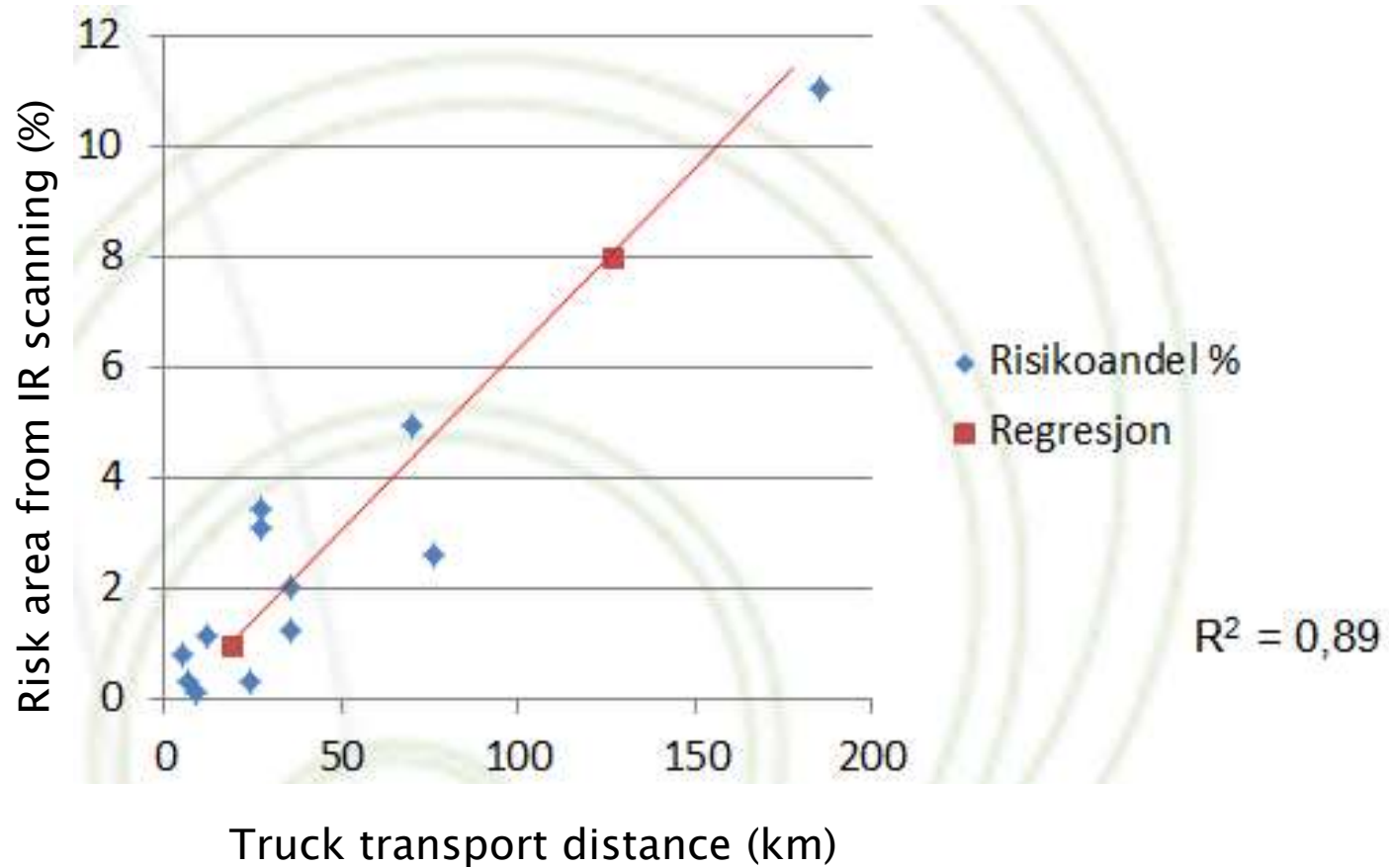
2016-06-24-01 - Temperaturkarta



 Risk area 1,4 %



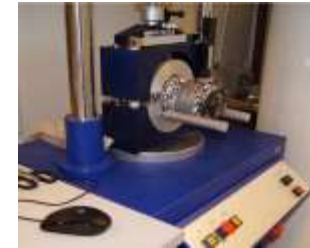
Risk area vs. transport distance (on truck)





Actions for pavement improvement (summary)

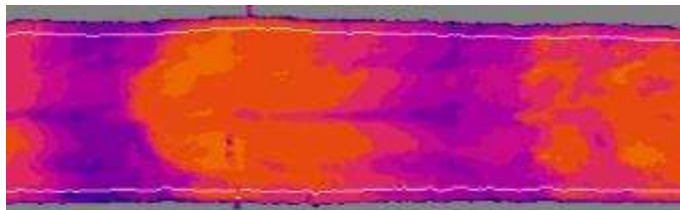
- Improved bonding/tack coat requirements
- Improved execution of joints
- Improved surface control



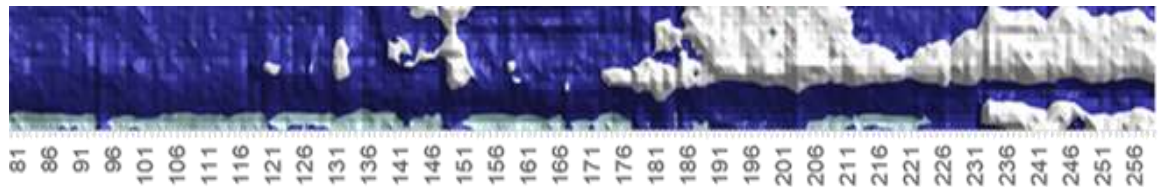
shear bond
test



- extra tack coating
- edge compaction
- revised void requirements



IR scanning



«homogeneity mapping» from laser scanning data
(detecting bleeding and open textured areas)



Actions for pavement improvement (summary)

➤ Best practice guide



example;
truck loading

➤ Boat transport guidelines



– loading/unloading
procedures
– temperature control/
considerations

➤ Asphalt control instructions

- IR scanning
- priority list of parameters to check



Actions for pavement improvement (summary)

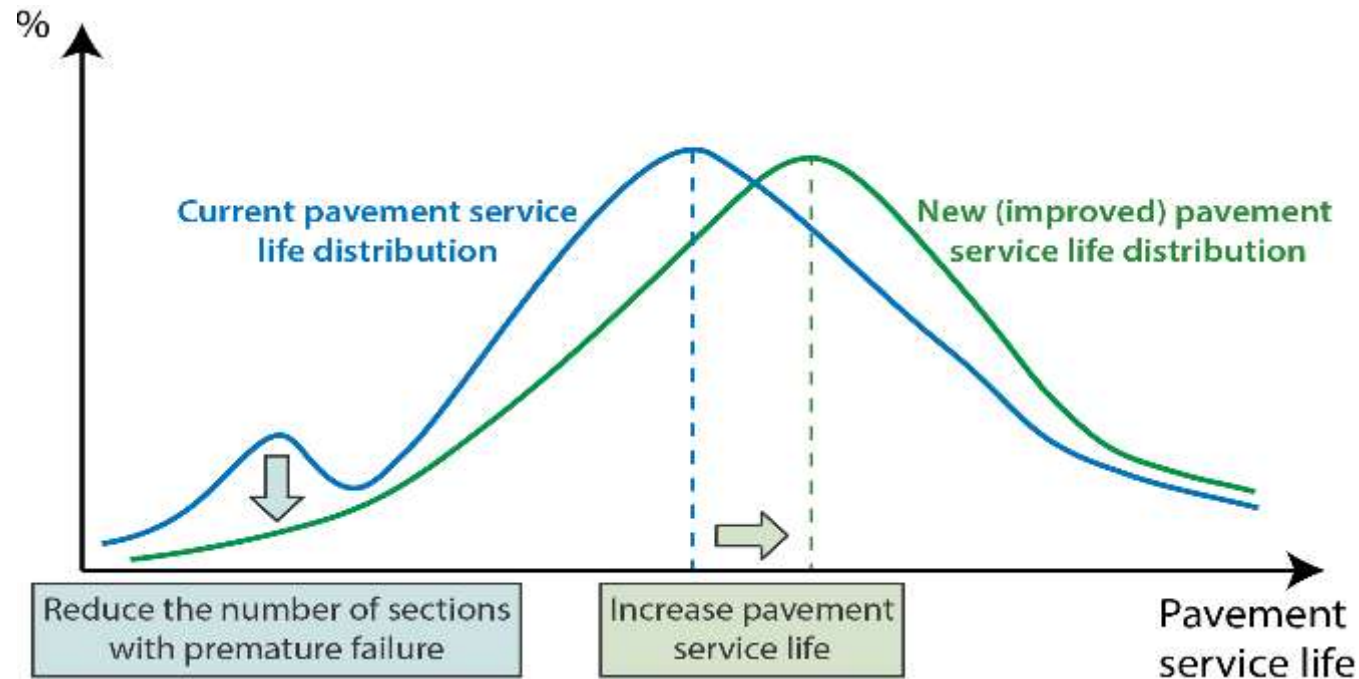
► Training courses and competence building



- Know-how transfer from experienced to young professionals
- Review/update of control procedures
- Training on use of instruments and measurement procedures
- Calibration
- Etc.



Main objective – increase pavement service life

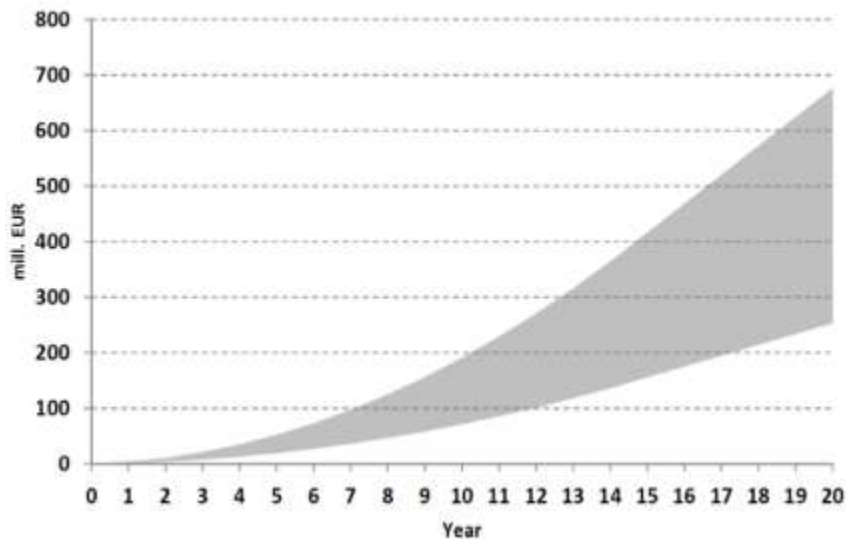


- Avoiding early distresses and failures will give substantial savings

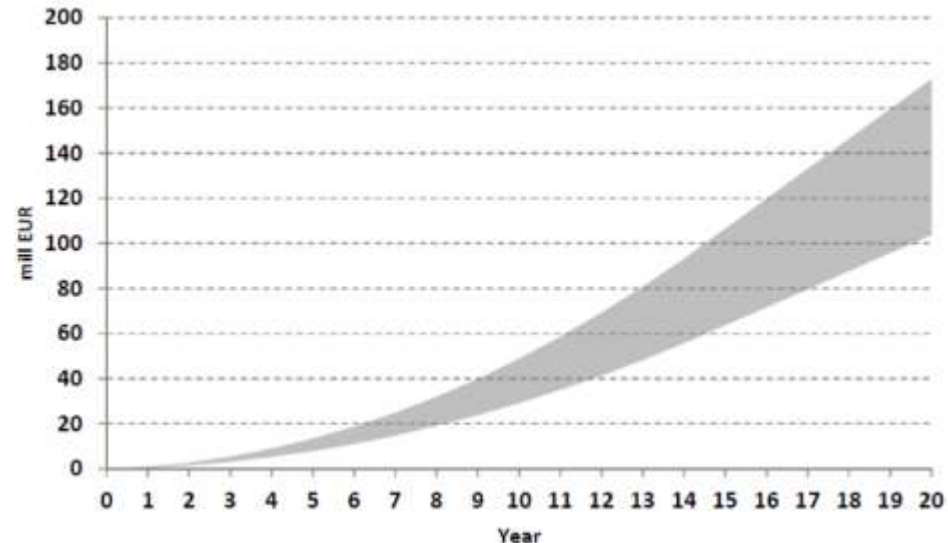


What if we succeed?

- Considerable savings over time, in both maintenance and repair costs



reduced pavement maintenance costs



reduced patching/repair costs



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Conclusion

- ▶ We are convinced that we can obtain a very good payback when investing in good workmanship and improved competence/ expertise





Thank you!

The North Cape in midnight sun