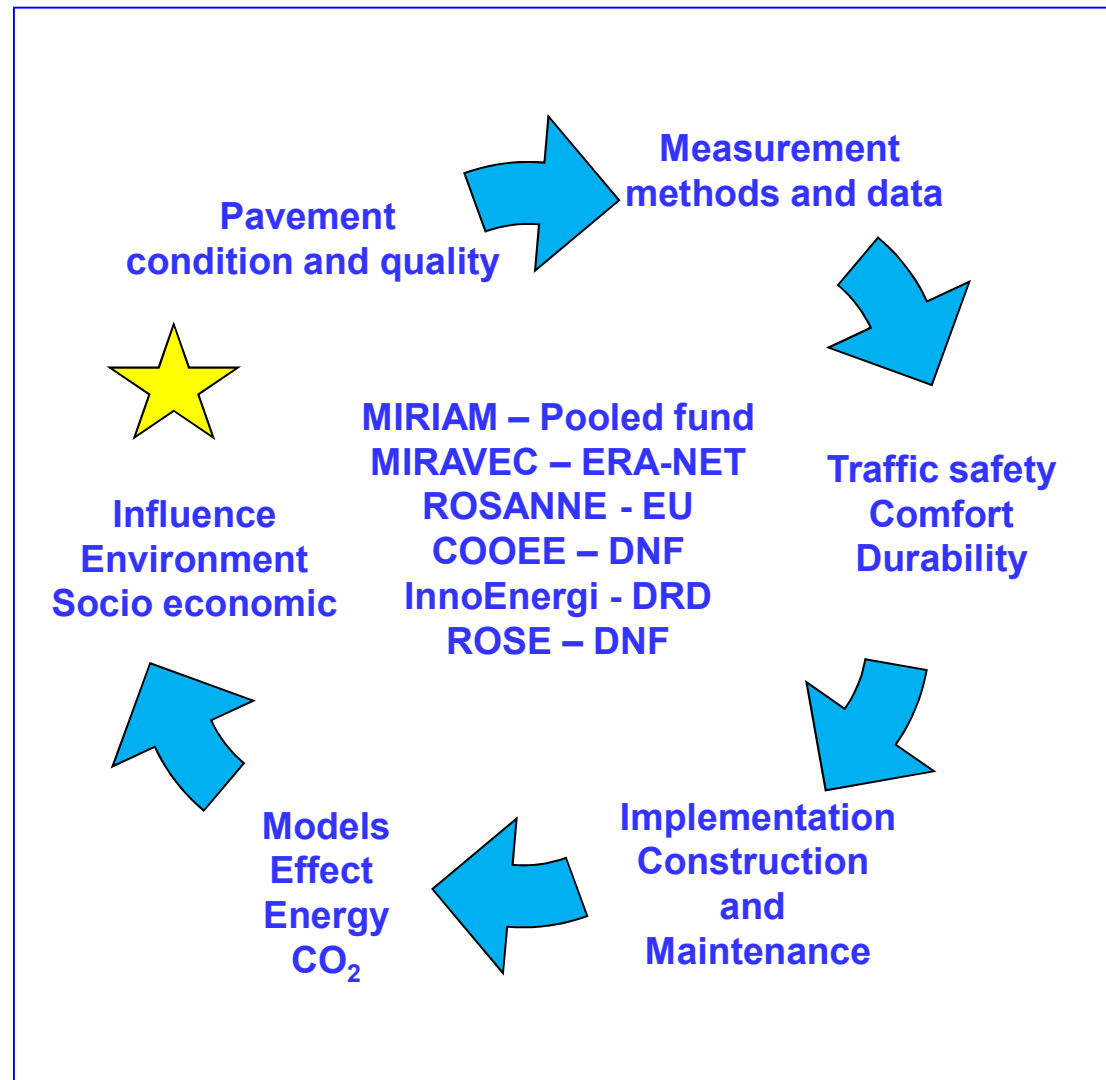


# Pavements to reduce rolling resistance and vehicle CO<sub>2</sub> emissions

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# International activities for low rolling resistance research



## Effect, Potential and Challenges

### CO<sub>2</sub> reduction for a competitive price

Socioeconomic calculations shows that the price for obtaining the CO<sub>2</sub> reduction is competitive in relation to other CO<sub>2</sub> reducing actions.

### Other focus point are safety and noise

We do not want to jeopardize safety and noise, so skid resistance and tyre/road noise has been measured. These measurements have shown that the low rolling resistance pavements has a good skid resistance and a noise reducing effect.

### Durability – 2017 will provide a well defined asphalt type to be commercially constructed in 2018.

In 2016 durability of 14 different asphalt mixes, based on SMA 6 and SMA 8 has been tested. The test results shows that the low rolling resistance SMA 8 has similar durability as a traditional SMA 11.

# Low rolling resistance pavements - potential savings



Traditional  
Asphalt (SMA 11)



Low rolling  
resistance  
asphalt (SMA 8)

## Savings by using low rolling resistance pavement on 50 km of motorways

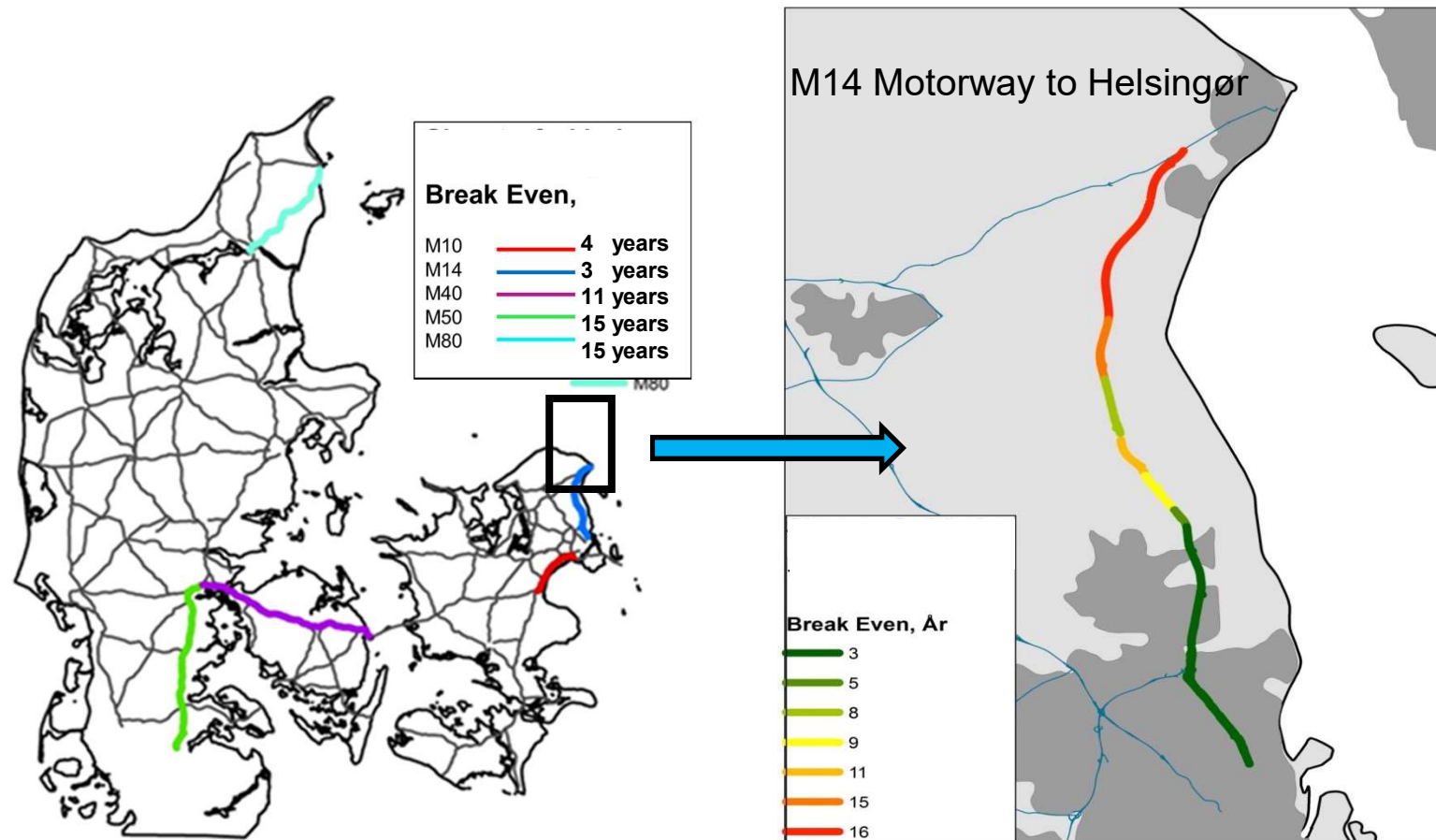
CO <sub>2</sub>	3 300 ton
Fuel	1,1 million litre

**Total savings of CO<sub>2</sub> when the  
complete state roads in Denmark  
has low rolling resistance  
pavements 160.000 ton per year**

## Low rolling resistance pavements also reduce noise

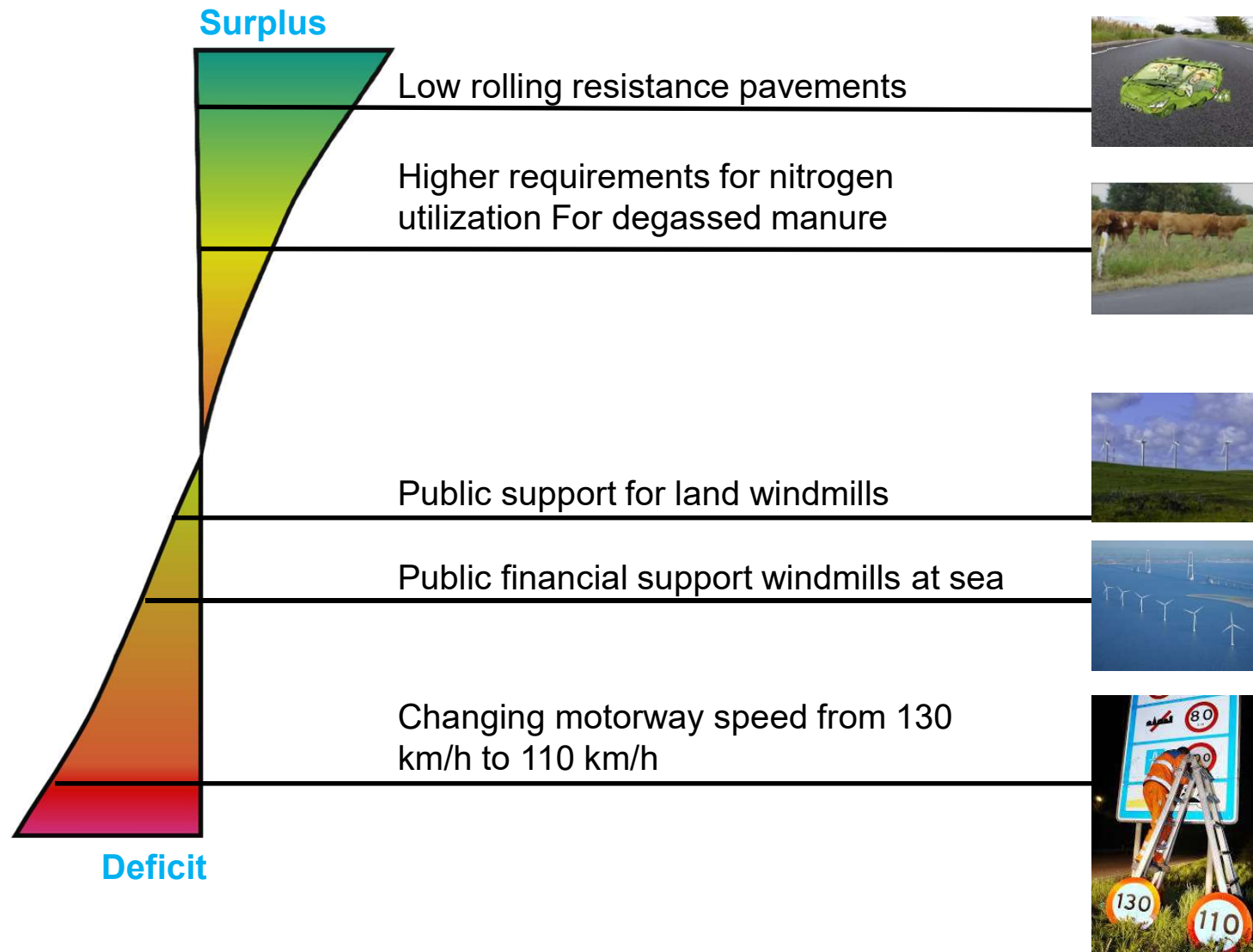
Reference value dB		SMA 6 L.R.R Pavement	SMA 8 L.R.R Pavement
50 km/t	89 dB	88 dB	89 dB
80 km/t	96,5 dB	95,4 dB	96 dB

## Low rolling resistance pavements – number of years in service before investment becomes a surplus for the society



# Low rolling resistance pavements

## - Socioeconomic potentials compared to other initiatives



# What is technical possible

Four test sections has been paved since 2012.

## The tests showed:

- That by using low rolling resistance SMA6 and 8 it is possible to obtain a reduction in rolling resistance of 6 and 3 % compared to a traditional SMA8
- Compared to the state roads in Denmark, it is possible to obtain a reduction of app. 20%, equivalent to a fuel saving of app. 6%.

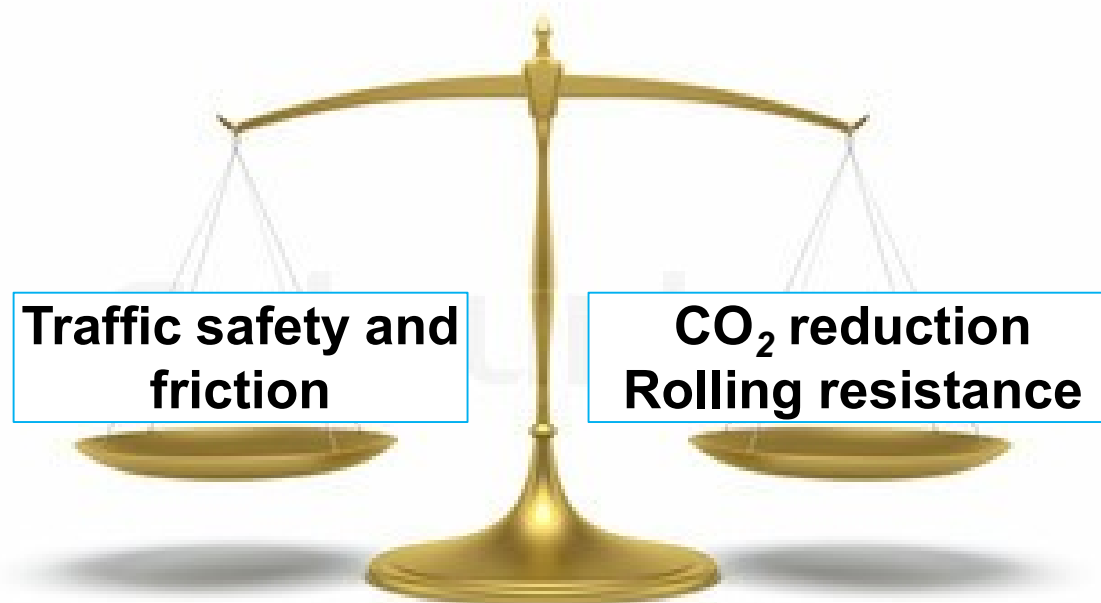
## ***But !***

*Within the first two years the tests sections started ravelling.*

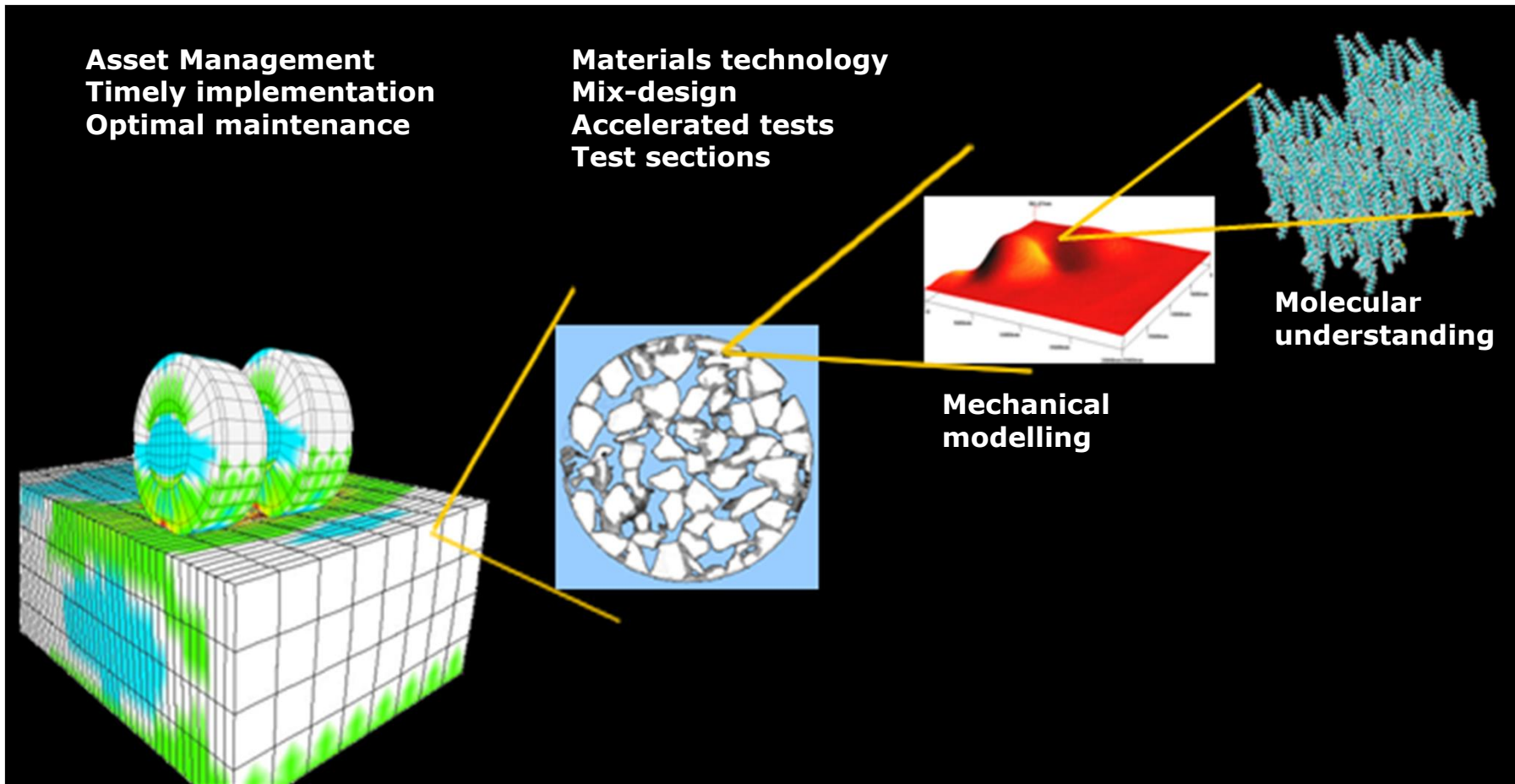




## Challenges – finding the right balance



# The complexity of obtaining equilibrium



# Durability is the key for socioeconomic benefit

- Provide low rolling resistance in entire lifetime
- Does not loose grip
- No ravelling or stone loss
- The pavements material characteristics are stable over time (rutting and climatic impact)



# Danish Road Directorate initiated an innovation project with focus on durability for low rolling resistance pavements

## New mix design developed in 2016

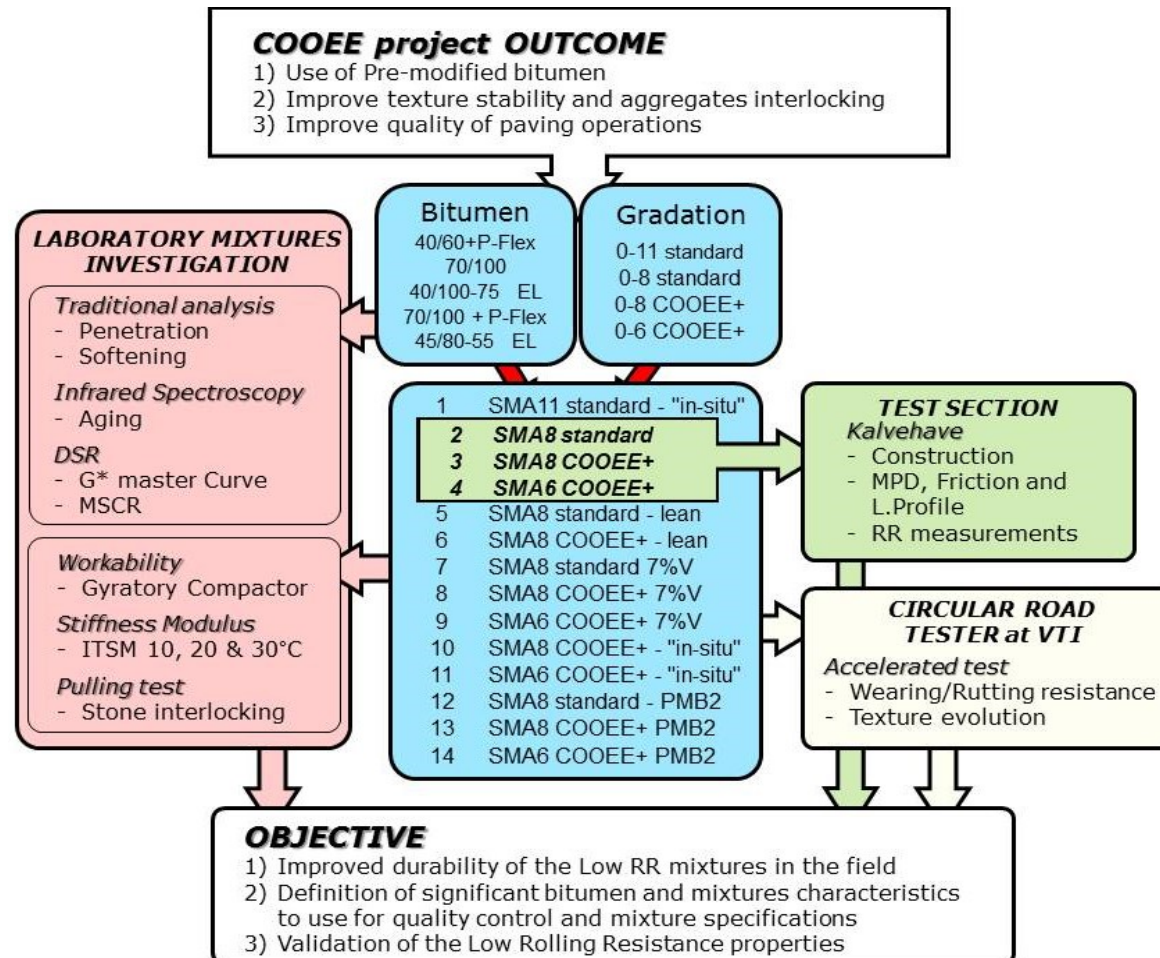
### Purpose:

- New mix design for better workability of the asphalt
- Better texture stability

### How to achieve this:

- Changes in the gradation curve
- Change in the active filler (cement, hydrated lime)
- Pre-modified bitumen

# The complexity in finding durability



## What was done to test durability

- **Laboratory tests**

  - Mix-design

  - Test of bitumen and asphalt (stiffness and adhesion)



- **Accelerated loading tests at VTI in Sweden**

  - Rutting and texture development



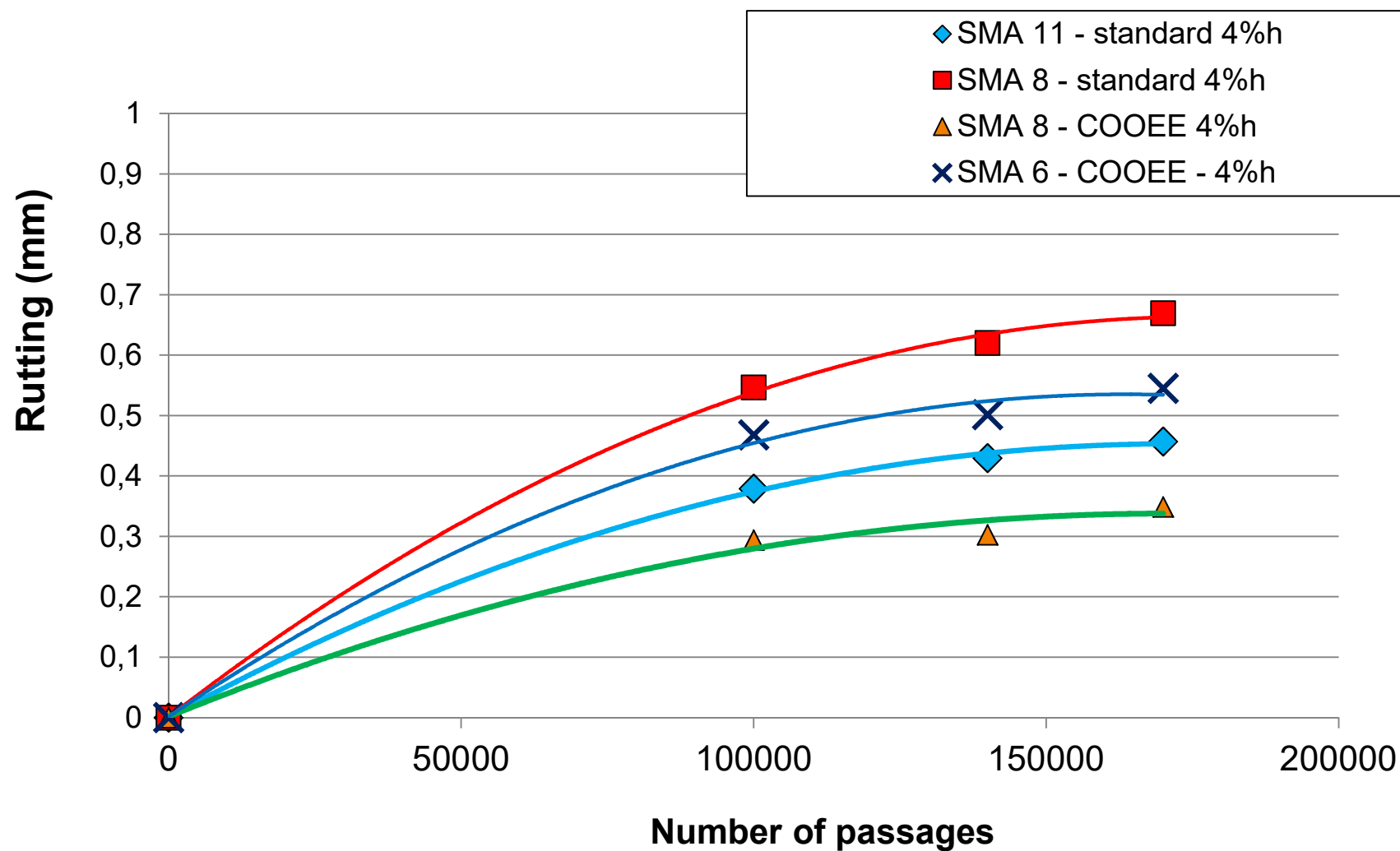
- **Test section in 2016**

  - Paving technology

  - Texture, friction and evenness

  - Rolling resistance

## Development of rutting from accelerated tests at VTI in 2016





## Further perspectives



2,5 km of motorways will be paved in June 2017

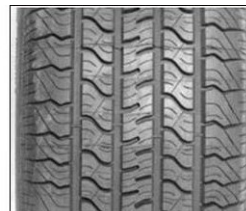
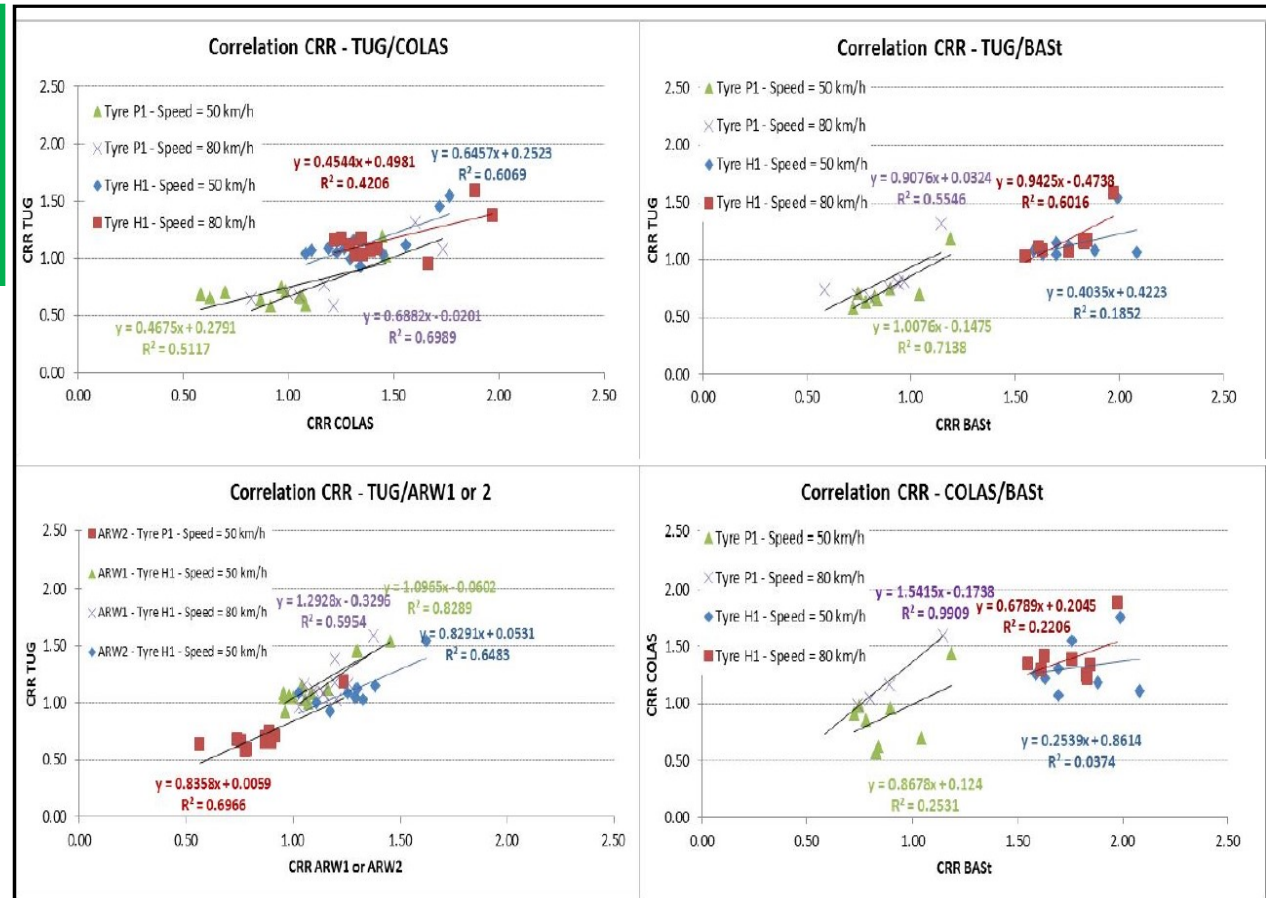
Depending of support from the government, 50 km of low rolling resistance pavements will be constructed in 2018 and 2019 on motorways in Denmark.

There is a high level of political interest in Denmark to include low rolling resistance pavements to become a supporting mean for reducing CO<sub>2</sub> emission



# Challenges concerning measurements of rolling resistance

## MIRIAM and ROSANNE projects



SRTT



AAV4



MCFN

## Further research initiatives

In 2016 the ROSE project "Road Saving Energy", was initiated, supported by the Danish Innovation

**Partners are:**

Universities RUC and DTU, Danish Road Directorate, IFSTTAR in France.

Private companies; AfterMath, Continental AG, Greenwood Engineering A/S, NCC Roads A/S, Total Denmark A/S).



**Aim of ROSE:**

Creating the scientific background for a 20% reduction in rolling resistance.

**This will contribute to:**

An additional reduction in fuel consumption.

**If successful the ROSE-project will:**

Lead to a reduction in the energy consumption in Denmark by 1,5%



Thank you for your  
attention

