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Joint Nordic/Baltic Symposium on Pavement designand Performance Indicators

- How should pavement service life be increased?

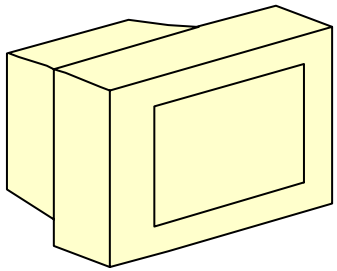
Oslo, 14. February 2008

Pavement service life and other lives

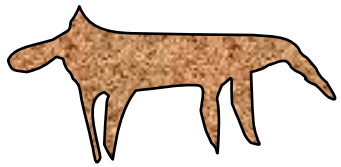
Geir Refsdal / Rolf Johansen

NPRA, Eastern Region

Life spans vary …….

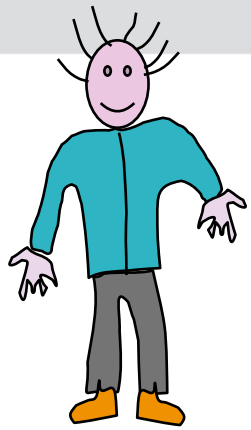


5 - 10 years



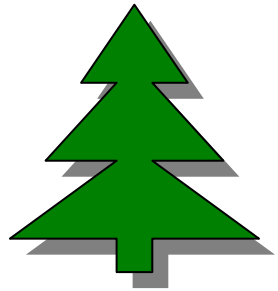
10 - 20 years

.. or 1 bill. heartbeats

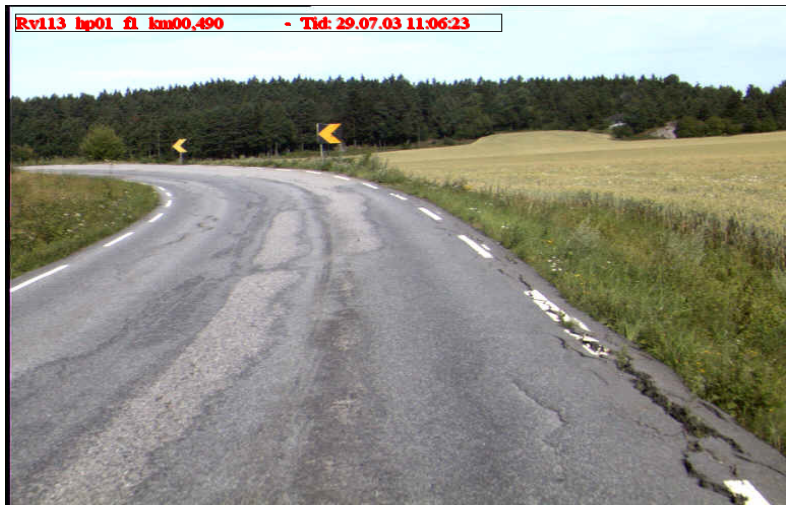


50 - 100 years

.. or 2,5 bill. heartbeats



50 - 500 years



40 – 60+ years

(~ 2 generations)

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The terminology varies …….

Design life

Design traffic

Design lifetime

Pavement service life

Residual life

Structural service life

Service life for the structure

Design period

Analysis period

Survival

Pavement life

Structural design life

Pavement lifetime

Structural design period

Design life / Design period:

Commonly meant: ***The length of time from opening a road to traffic until a "terminal condition" of the pavement is reached, that requires "major intervention".***

In Norway: 20 years

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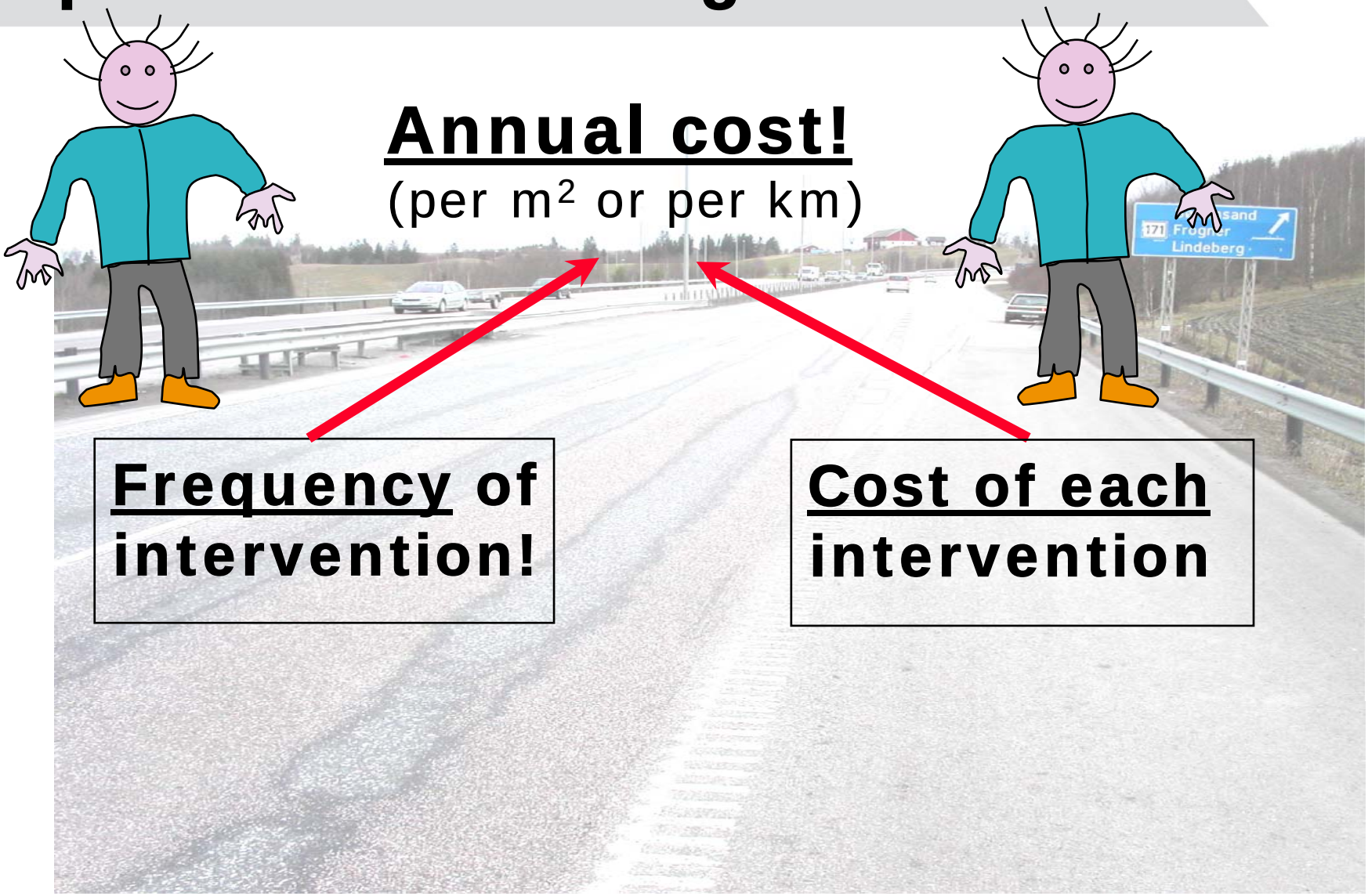
The life of a pavement ”owner” or pavement ”manager”:



Annual cost!
(per m² or per km)

Frequency of intervention!

Cost of each intervention

Intervention in practice:

Trigger: Poor surface condition, e.g. rutting, roughness, others ……..

Cause:	**Remedy:**
1. Wearing course	**= Resurfacing**
2. Poor binder course	**= Resurfacing**
3. Poor base course	**= Resurfacing**
4. Thin pavement	**= Resurfacing**
5. ”Reached its design life”	**= Resurfacing**

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The pavement service life ..

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Focus: **Surfacing service life !**

"The period of time from placing a wearing course until the surface condition is such that a new wearing course is required in order to meet established maintenance standards."

Eastern Region (National roads, 2005):

Average: 13,5 years

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Recent history

<u>Norway:</u> A ”quantum leap” in surfacing service life on national roads:

+ 50% during the past 15 years. But an alarming negative trend seen in 2005-2007.

An increased surfacing service life by 1 year saves NOK100 mill. per year (€12.5 mill.) in resurfacing cost.

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Surfacing service life (Norway)

The Norwegian Pavement and Materials Design Guide:

$$\frac{\text{Surfacing Service Life (”functional”) (”}\textbf{Actual}\text{”):}}{\text{Surfacing Service Life (nominal) (”What it }\textbf{should be}\text{”):}} =$$

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Pavement strengthening (Norway)

Strengthening is required:

...if the actual **surfacing service life** is less than **50%** of what it ”should be”.

Strengthening NOT required:

...if the actual **surfacing service life** is more than **70%** of what it ”should be”.

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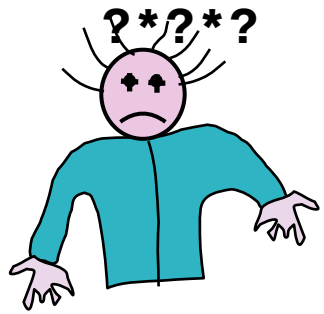
To what extent does the structural design influence the surfacing service life....?

Example, scenario:



- Design of a main road in Norway (”Level 1”). Frost blanket layer is required according to standards.
- The pavement designer has a **bad day at work:** Decimal error, the AADT was supposed to be 18.000, not 1.800!

The error:

The pavement misses out on 40 mm of asphalt.

....having consequences for the surfacing service life...? probably not....?

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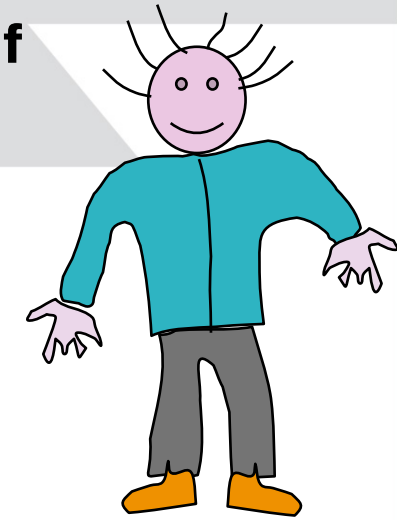
...

Pavement design – the viewpoint of the road ”owner”/”manager”



The concern:

- **What will the frequency of resurfacing be?**

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We think the pavement designer should focus on ……..

Attention to optimal (-meaning ”better”-) material types & material qualities, especially in the upper pavement layers, e.g. binder course!

Avoiding LARGE errors in:
- **the decision process concerning frost design!**
- **the assessment of subgrade strength. Climate!**

Making the <u>constructor</u> keep focus on:
- **quality control**
- **the risk of selecting ”wrong” materials**
- **the need for good workmanship!**

Surfacing service life

- why this is ”a more important life” than the other ”lives”?

The surfacing service life is a deciding factor for the maintenance expenditure.

All other ”lives” are forgotten history from the day the road is opened for traffic.

No ”conditions” or “assumptions” that were set out in the pavement design will ever be remembered.

(…and no designer can be found to receive the ovations at the end of the design period!)

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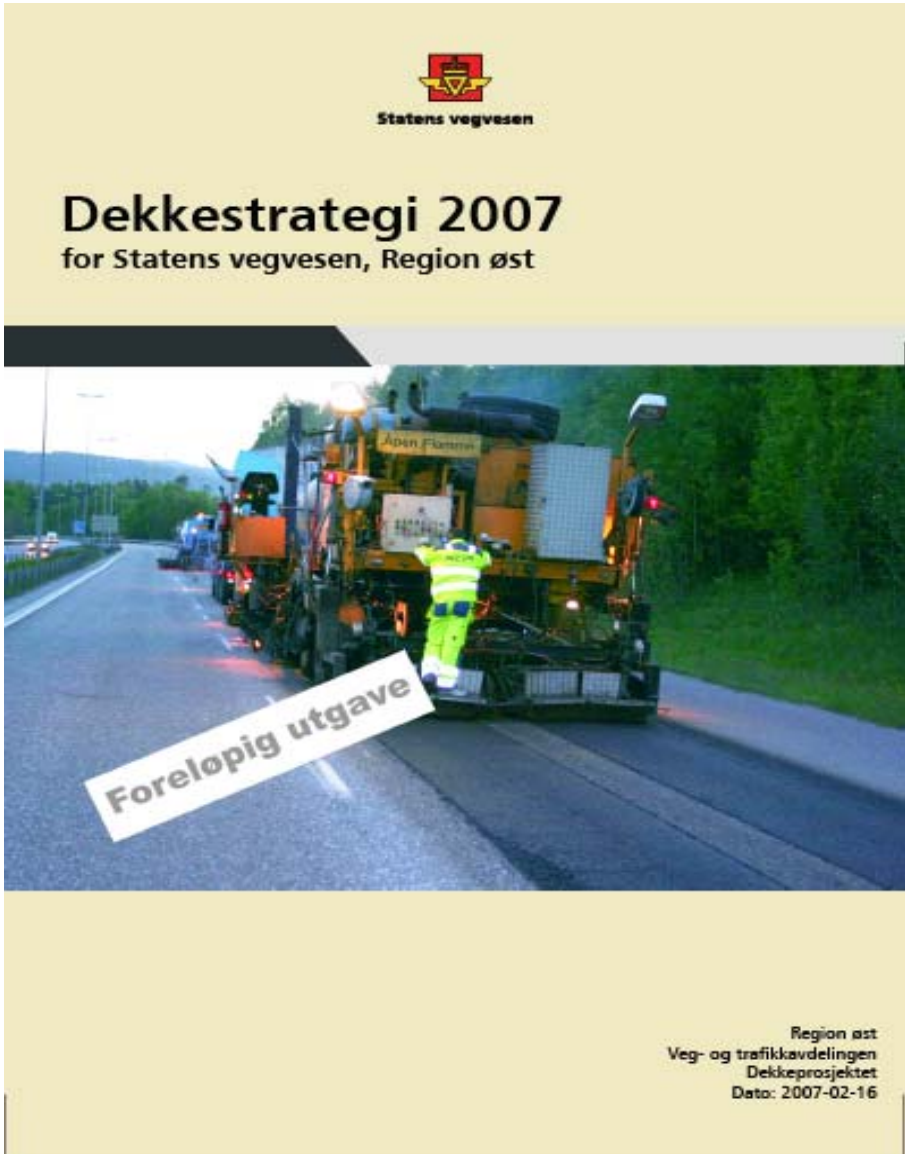
A parameter to reckon with!

Surfacing service life is a parameter that....:

- **Guides the selection of maintenance measures in a rational manner.**
- **Determines the need for pavement strengthening, with attention to economic realities.**

Surfacing Service Life in Eastern Region as part of

The resurfacing strategy



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Resurfacing strategy - catalogue

Example for ADT 1500 - 3000

Alternatives

r	**Type of surfacing**	forut-satt levetid (år)	d	**Annual cost, NOK per m²**							**Sum**	
				A	B	C	D	E	F	G		
1	Agb11 75 kg/m2	13,8	**3,06**	**1,82**	3,06	1,15	2,11	1,34	1,63	2,58	**4,88**	
2	Agb16 100 kg/m2	17,0	**3,39**	**1,57**	2,64	0,99	1,81	1,15	1,40	2,22	**4,95**	
3	Ma16 100 kg/m2	15,5	**3,31**	**1,67**	2,82	1,06	1,94	1,23	1,50	2,38	**4,98**	
4	Ab11 75 kg/m2	15,0	**3,32**	**1,71**	2,88	1,08	1,98	1,26	1,53	2,43	**5,03**	
5	Agb11 90 kg/m2	15,4	**3,36**	**1,68**	2,82	1,06	1,94	1,24	1,50	2,38	**5,03**	
6	Ma11 75 kg/m2	12,3	**3,06**	**1,99**	3,34	1,25	2,30	1,46	1,78	2,82	**5,05**	
7	Ma11 90 kg/m2	13,9	**3,32**	**1,81**	3,05	1,14	2,09	1,33	1,62	2,57	**5,13**	
8	Ab11 90 kg/m2	16,6	**3,68**	**1,59**	2,67	1,00	1,84	1,17	1,42	2,26	**5,26**	
9	Ab16 110 kg/m2	18,2	**4,10**	**1,49**	2,51	0,94	1,73	1,10	1,34	2,12	**5,59**	
10	Ab11 tynnd. 45 kg/m2	13,3	***3,33***	1,87	3,15	1,18	2,17	1,38	1,67	**2,66**	***5,99***	
11	Ab11 60 kg/m2	13,3	**2,93**	1,87	**3,15**	1,18	2,17	1,38	1,67	2,66	**6,08**	
12	Agb11 60 kg/m2	12,1	**2,74**	2,01	**3,39**	1,27	2,33	1,48	1,80	2,86	**6,13**	
13	Ma11 60 kg/m2	10,6	**2,79**	2,23	**3,76**	1,41	2,59	1,65	2,00	3,18	**6,56**	

Preparatory work, alternatives

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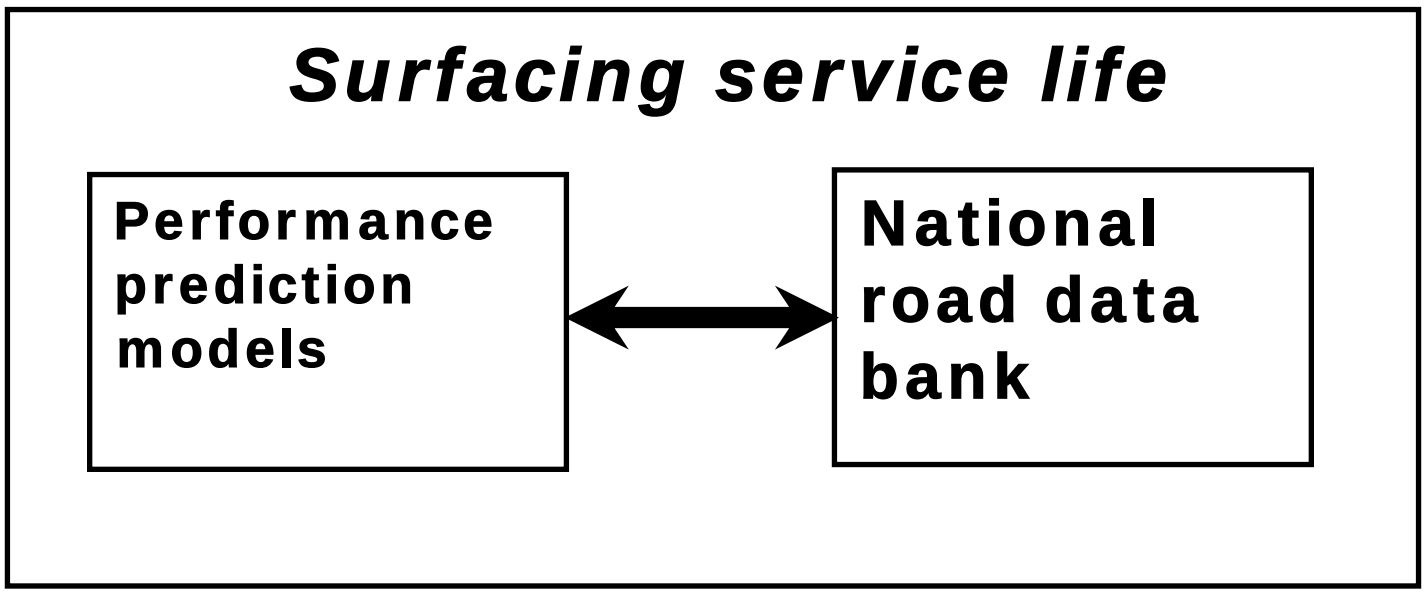
A parameter to reckon with! (2)

We expect the surfacing service life to also become a guiding factor in a future system for pavement design.

Our dream:



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The message ….

1. **Focus on all parameters that can contribute towards a longer surfacing service life.**
   (…and maintain this viewpoint also when making refinements to the pavement design system…..)

2. **Thereby we keep the focus on the <u>annual cost</u>!**

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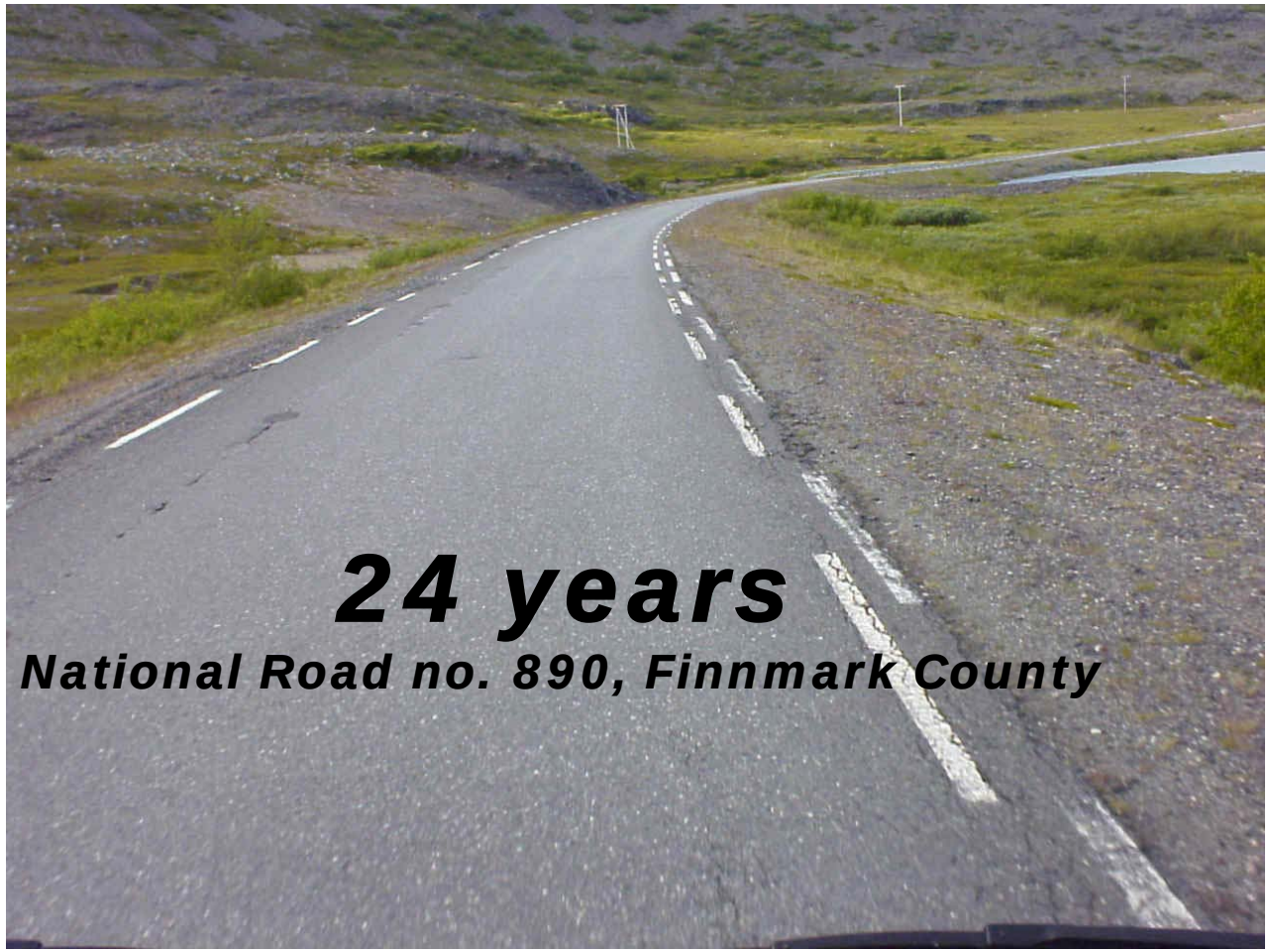
Thanks for your attention!



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geir.refsdal@vegvesen.no rolf_johansen@vegvesen.no