Swedish Practice in Bituminous Pavement Engineering

TRAFIKVERKET
SWEDISH TRANSPORT ADMINISTRATION

“Everybody arrives smoothly - the green and safe way”

Mats Wendel, EUR ING

Deputy Head of National Maintenance, Road and Railway

Outline

- About Sweden
- Challenges for the Transport Administration
- Economy…
- Swedish Road Maintenance Performance Standard
- Contracting systems
- Important projects (ongoing implementation)

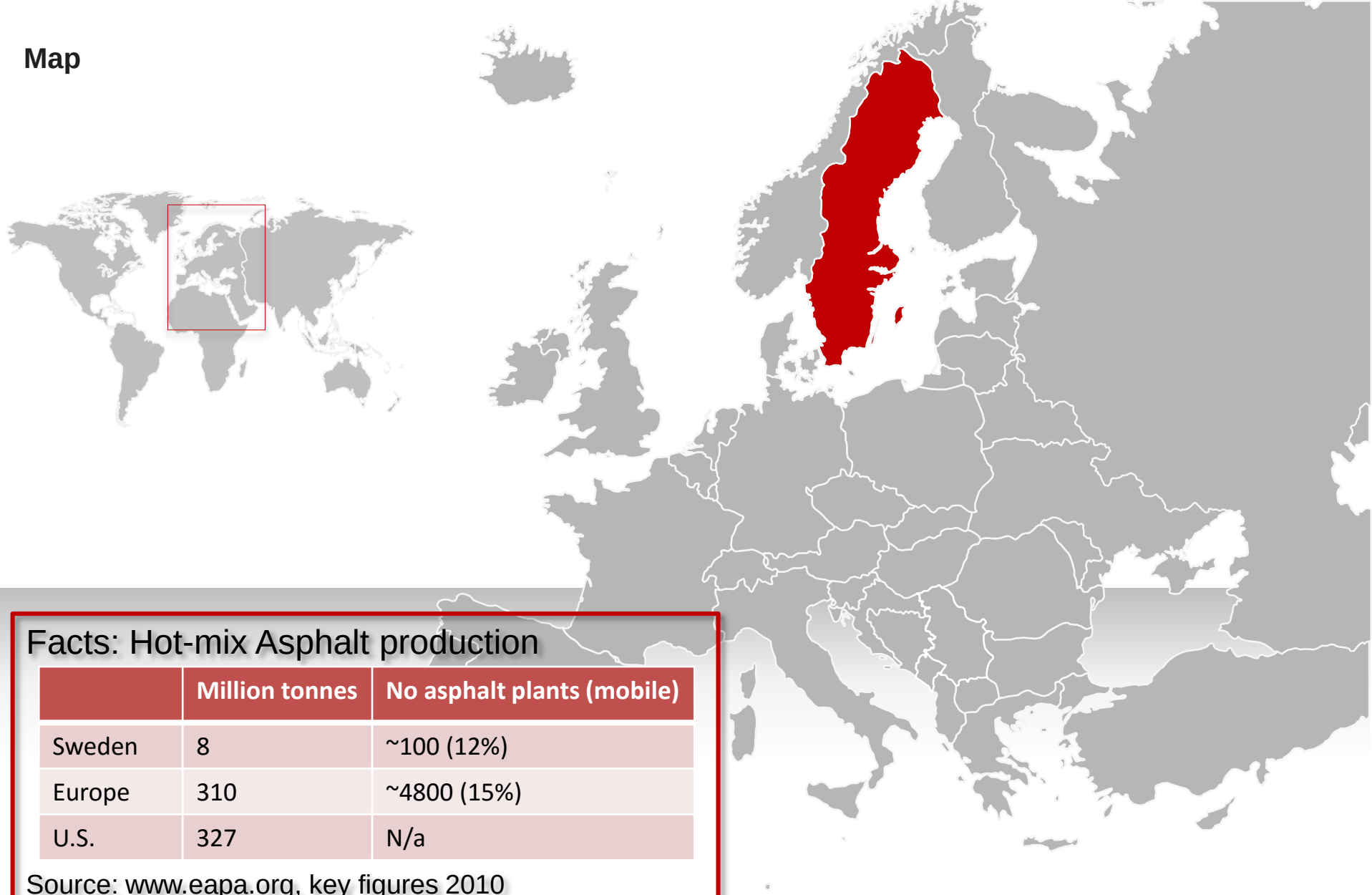
About Sweden

- Where is Sweden in the World? — Not Switzerland!
- Is Sweden larger than California, by size? — YES! (by 5%)
- How fast are you allowed to drive? (as maximum speed limit) — 120 km/h (75 mph)
- What is the maximum allowed gross weight of trucks? — 60 metric tonnes (132.000 pounds)
- Are they allowed the same speed limit? — No, 80 km/h (50 mph)

A few famous Swedish companys:

- Volvo,
  IKEA,
  Ericsson

Map



Facts: Hot-mix Asphalt production

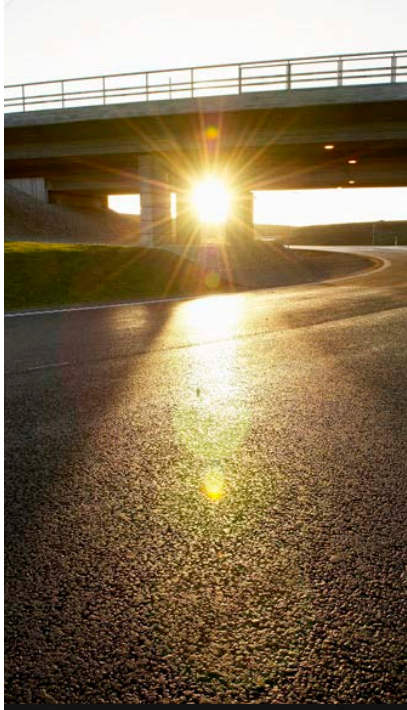
	Million tonnes	No asphalt plants (mobile)
Sweden	8	~100 (12%)
Europe	310	~4800 (15%)
U.S.	327	N/a

Source: www.eapa.org, key figures 2010

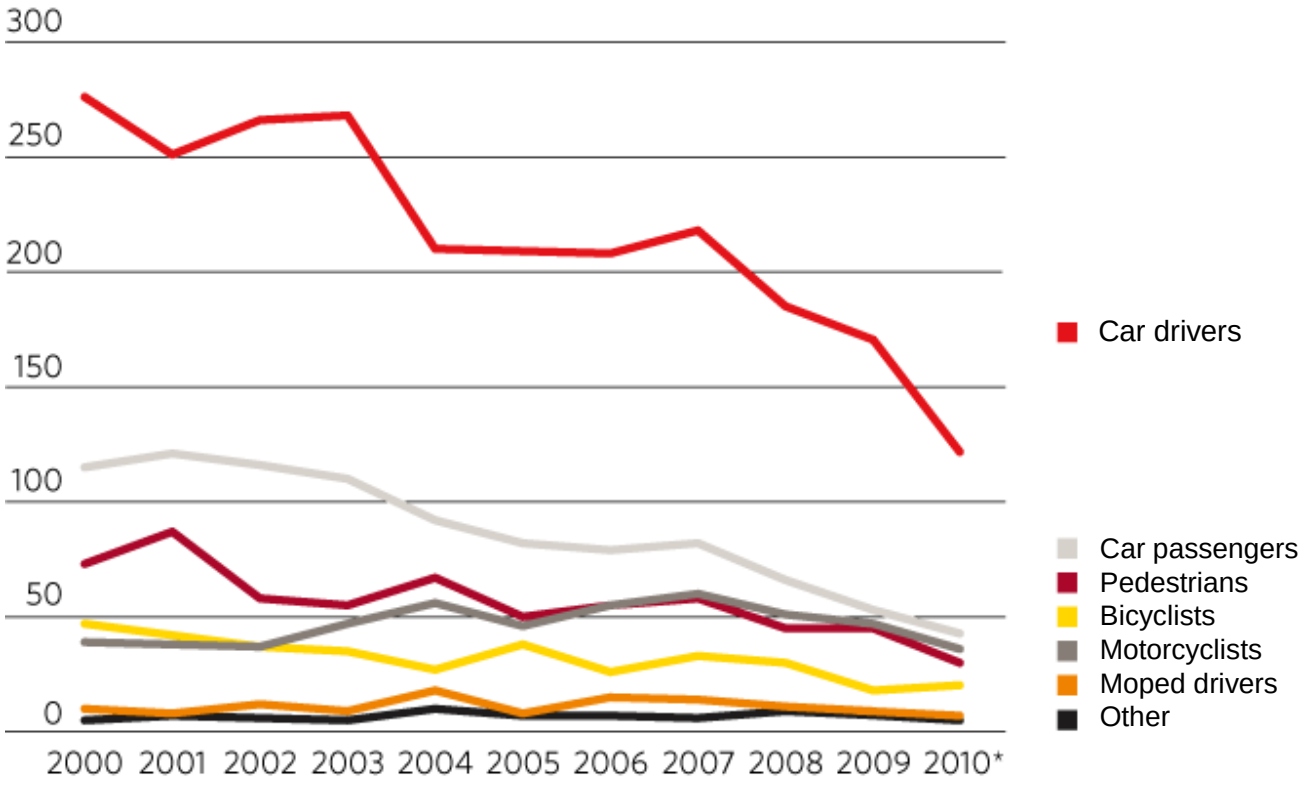
Sweden’s road and rail networks

- The road network
  - 98,400 km of state roads
  - 41,000 km of municipal streets and roads
  - 76,100 km of private roads with state grant

- The railway network
  - 11,900 km of railway line
  - 90% electrified
  - 11 400 switches
  - 560 stations for boarding and alighting



Road accident statistics



Number of road traffic fatalities by traffic type, excluding illness
*As of 2010, excluding suicides (15–20 cases per year)

Source: The Swedish Transport Administration Annual Report 2010

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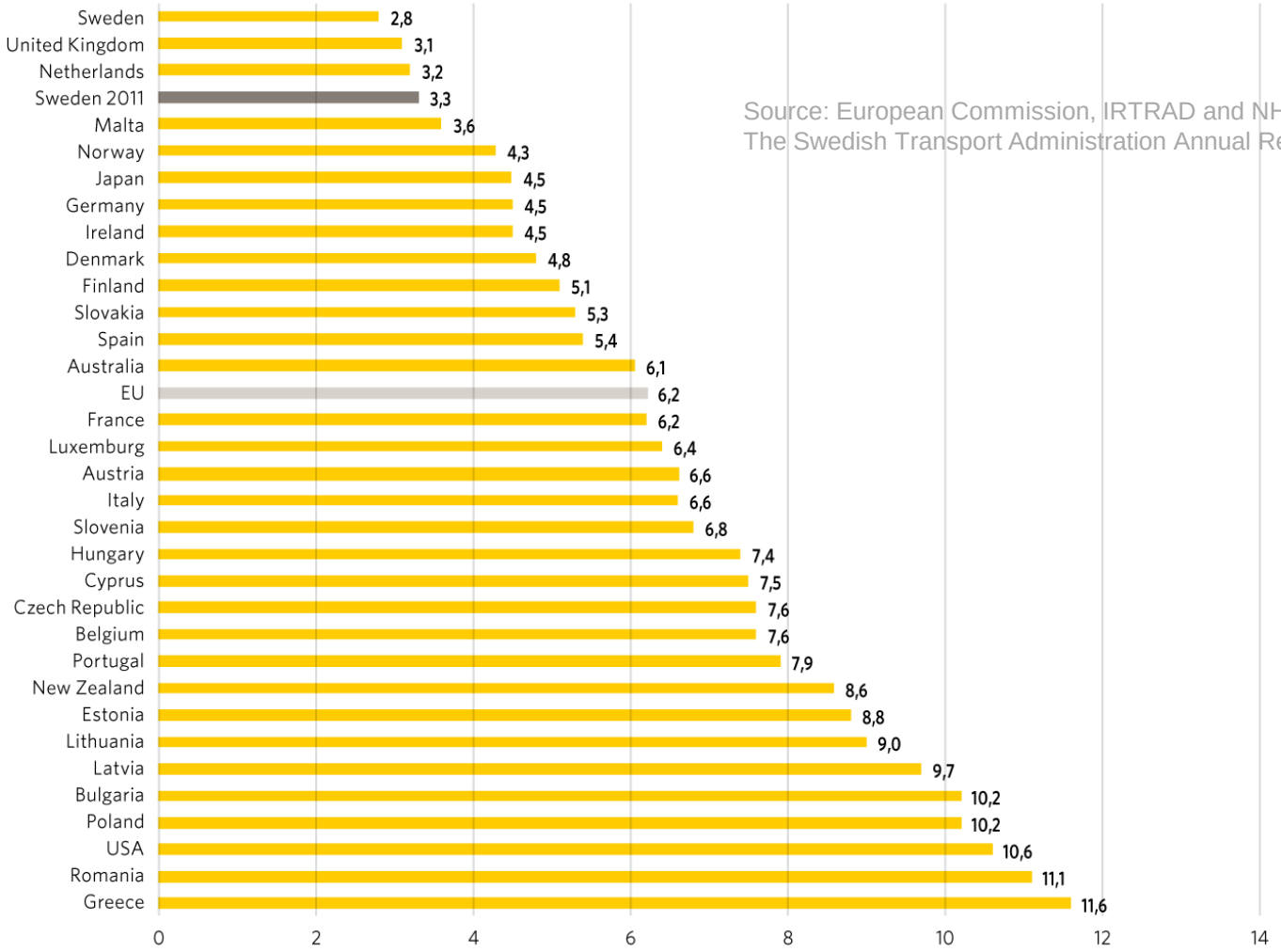
International comparison, fatalities in road trac per 100 000 inhabitants in 2010 and in 2011 (Sweden)



Source: European Commission, IRTRAD and NHTSA and The Swedish Transport Administration Annual Report 2011

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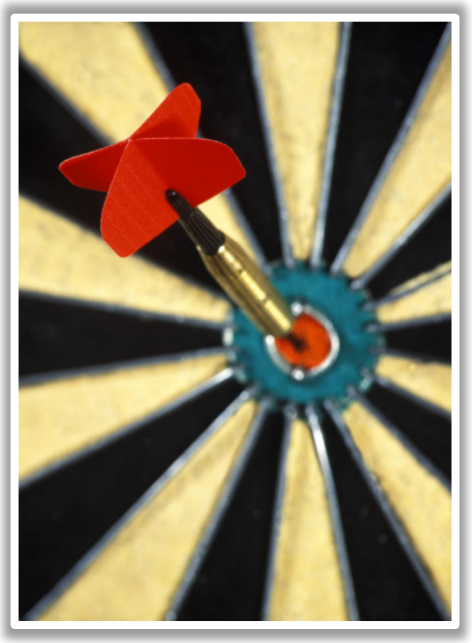
We’re committed to a safer transport system

- Adjustment of road traffic speed – adjustment to road traffic safety standards
- More than 1 000 traffic safety cameras are located on the most dangerous roads
- Work on influences: alcohol/drugs, seat belt use, keeping to the speed limit, safety on and near railway tracks and bicycle helmet use
- 4 200 km of multi-lane, bidirectional highways
- Suicide on roads and rail reduced through preventative measures

Objectives

- Road safety
- Trafficability
- Respect for the environment
- Long service life for installations
- Socio-economic gains



Specific Challenges for Sweden

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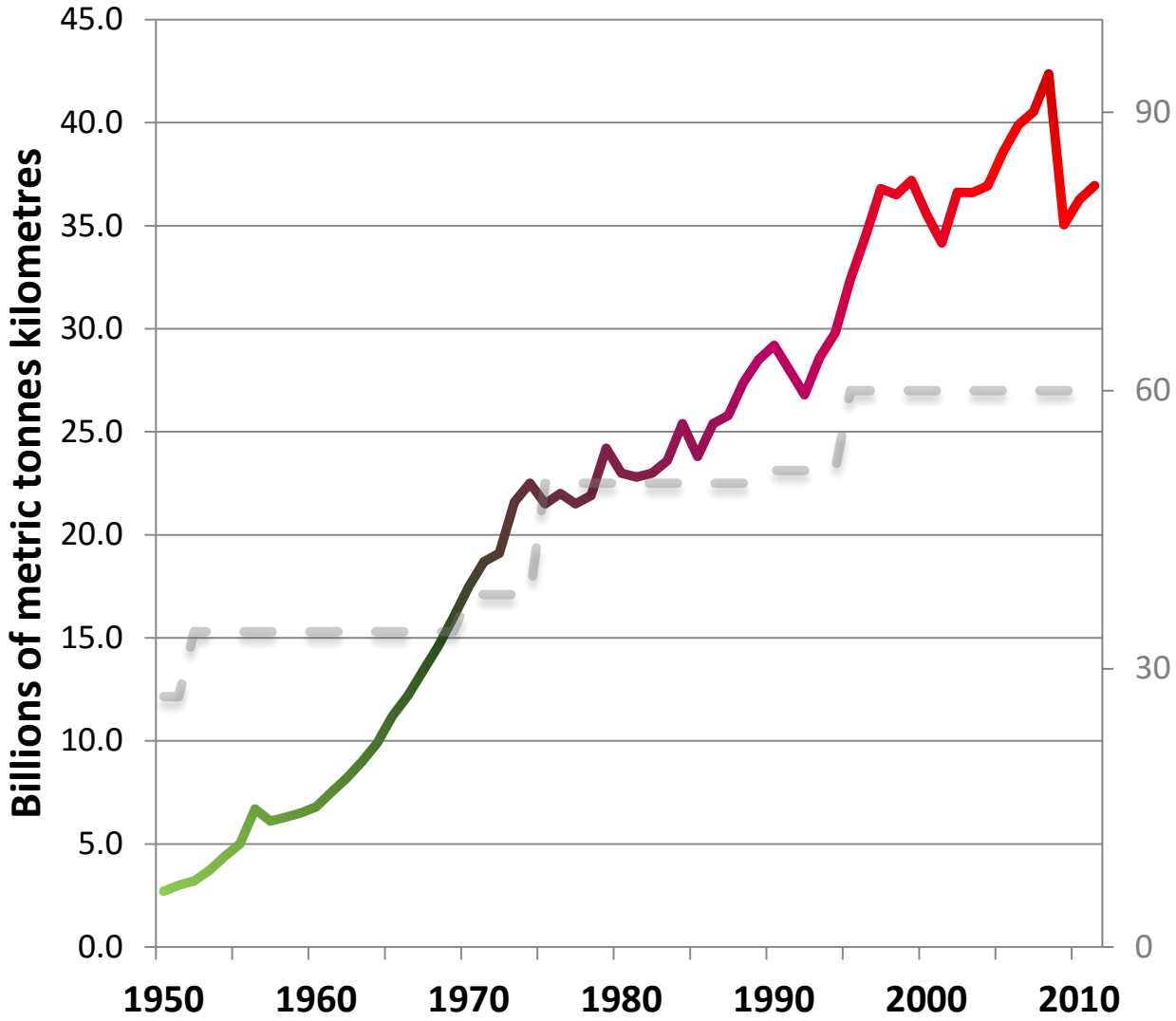
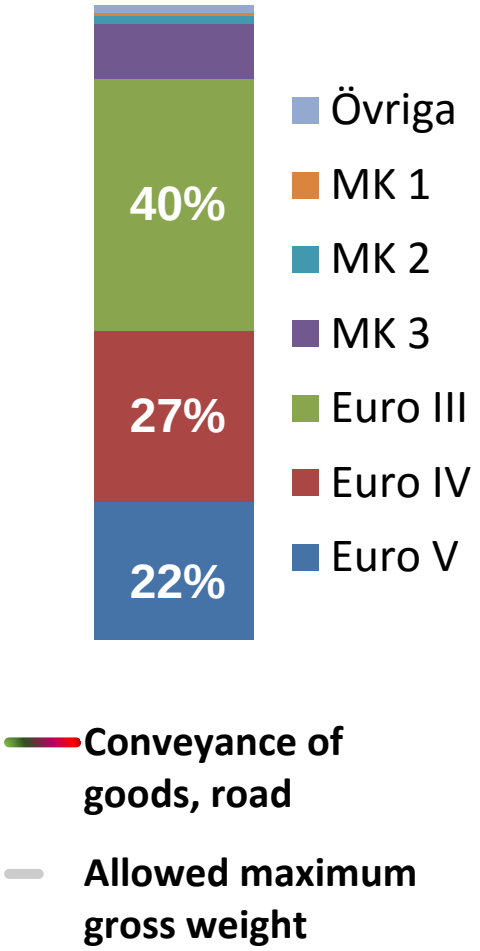
Yearly increase of heavy traffic



Distribution in environmental class 2010*



Source: trafikanalys mfl. www.trafa.se

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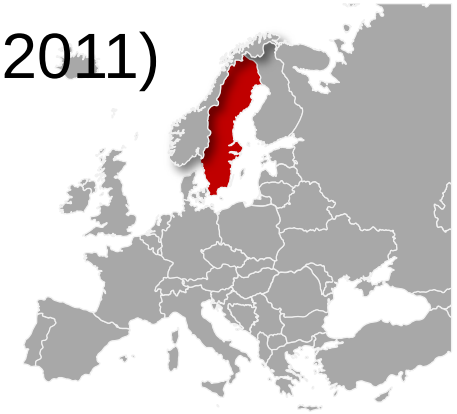
SWEDEN: Paving market, annually:

- Short paving season, between May-October
- STA end user of 40 - 60 % of the total market
- STA uses about 10 -15 million m2 of Chip Seal
- STA uses about I million tons of soft asphalt mixes low traffic roads (Pen > 800)
- High performing binders approx. 3-5 % of total HMA used (increasing)
- Performance based contracts (approx 15%, 2011)
- Contractor have full responsibility.
- Warranty: a minimum 5 years (all contracts).



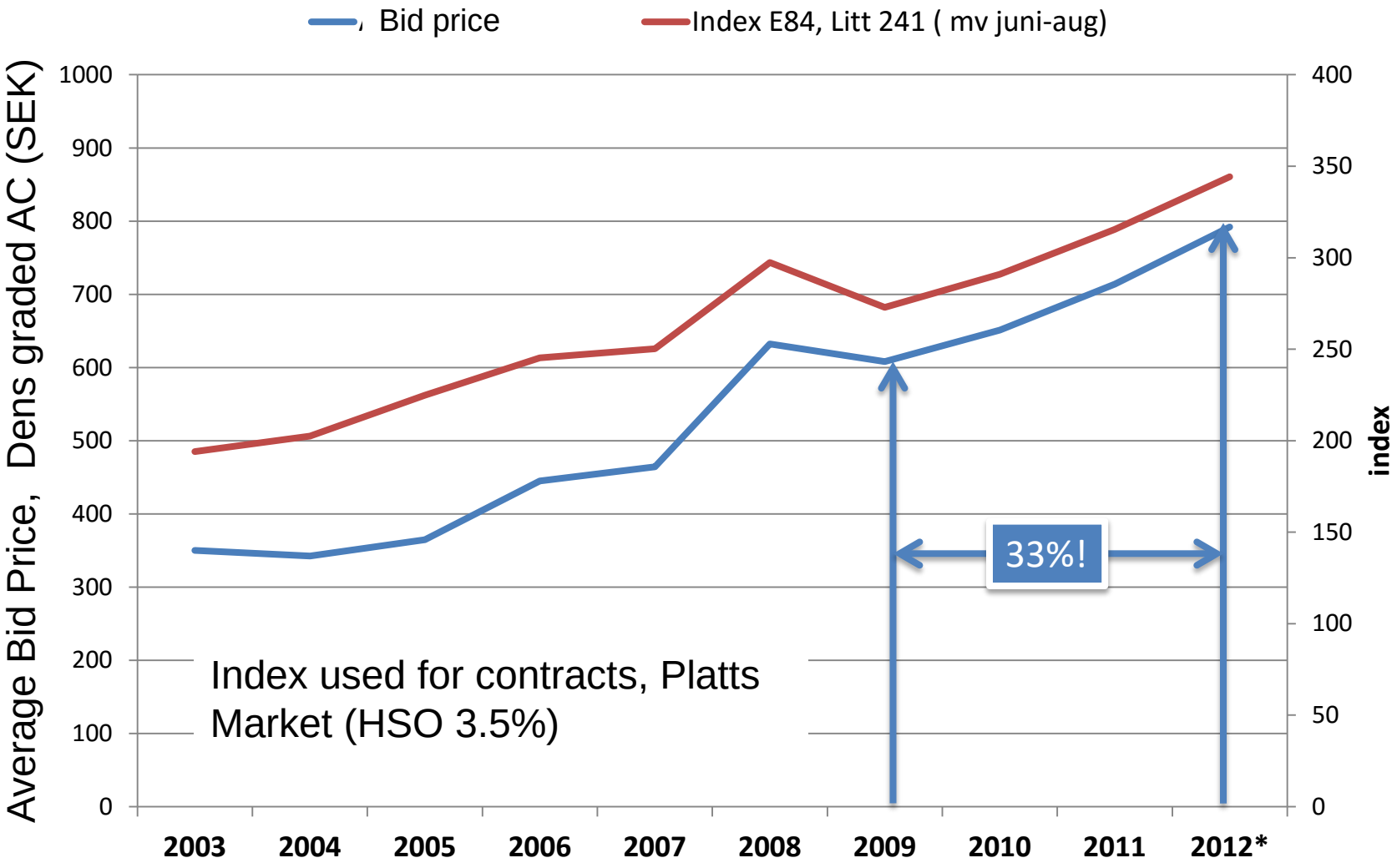
Road Management of $1.3 billion, annually

- The volume of the Swedish Transport Administration activity is approximately $6.7 billion per year, of which
  - Investments – approximately $3.7 billion
  - Operations and maintenance – approximately 2.1 billion

- Surfacing: $ 500 million
- Bridges and tunnels: $ 150 million
- Roadside equipment: $ 200 million
- Winter operations: $ 300 million

Figures refer to 2010 year of operations

Price- and index development 2003-2012



* Index prognosis

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Road Surface Measurements

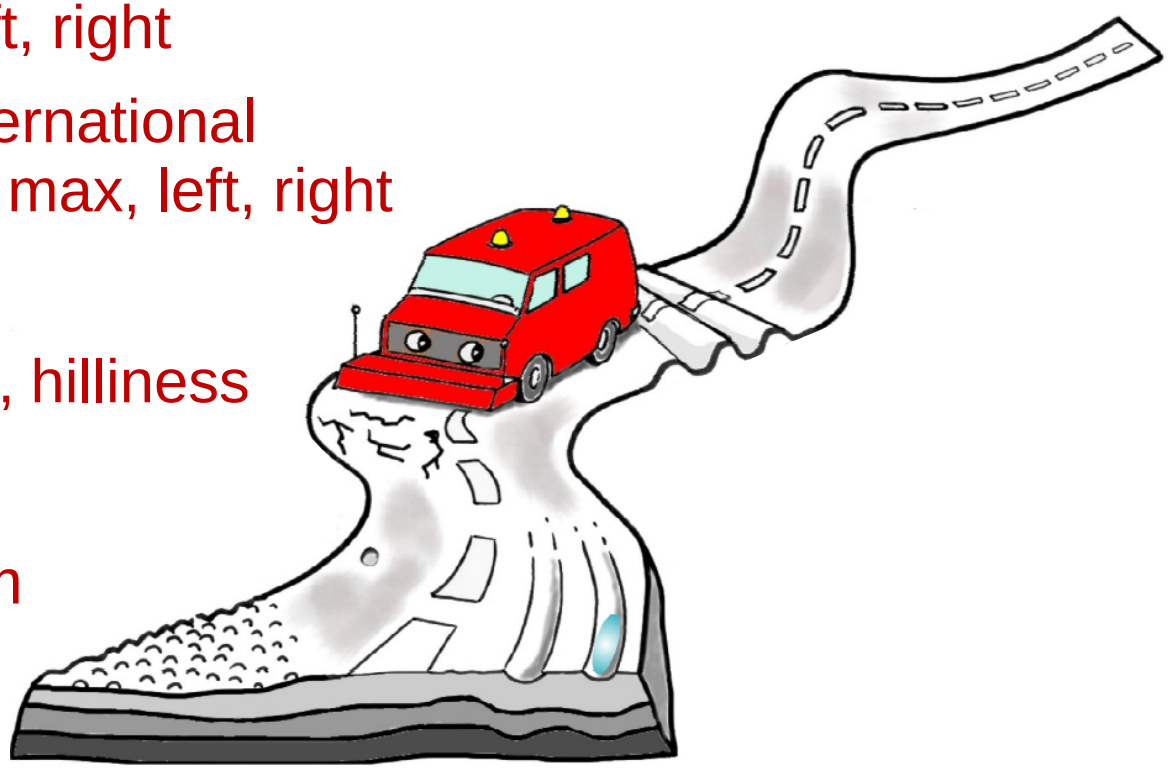
Started ~1980
1983 (Laser –RST)
Road surface measurements have been used in Sweden since 1985.
Since 1990 the entire national and primary road networks are measured each year, together with parts of the secondary road network

Use
Network level – Overview
Network to project level
PMS - Project Level
Quality Control
Drainage

The Laser-RST is used for network surveys

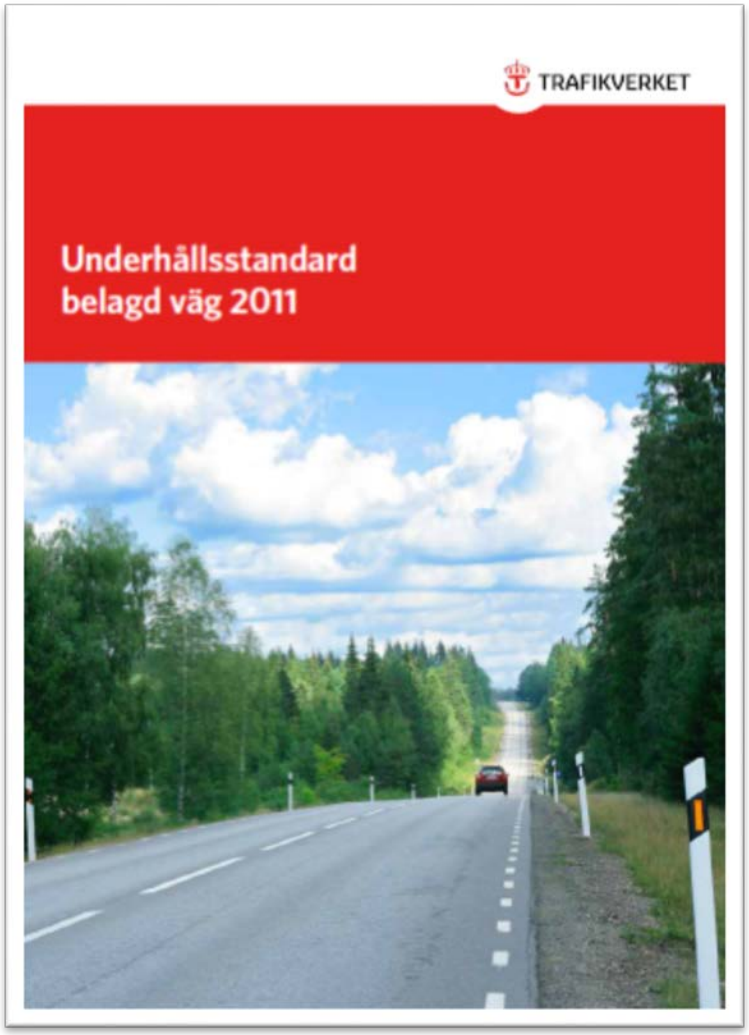
Parameters

- Rut Depth; max, left, right
- Roughness IRI (International Roughness Index); max, left, right
- Cracks
- Crossfall, curvature, hilliness
- Texture
- Pictures each 20 m

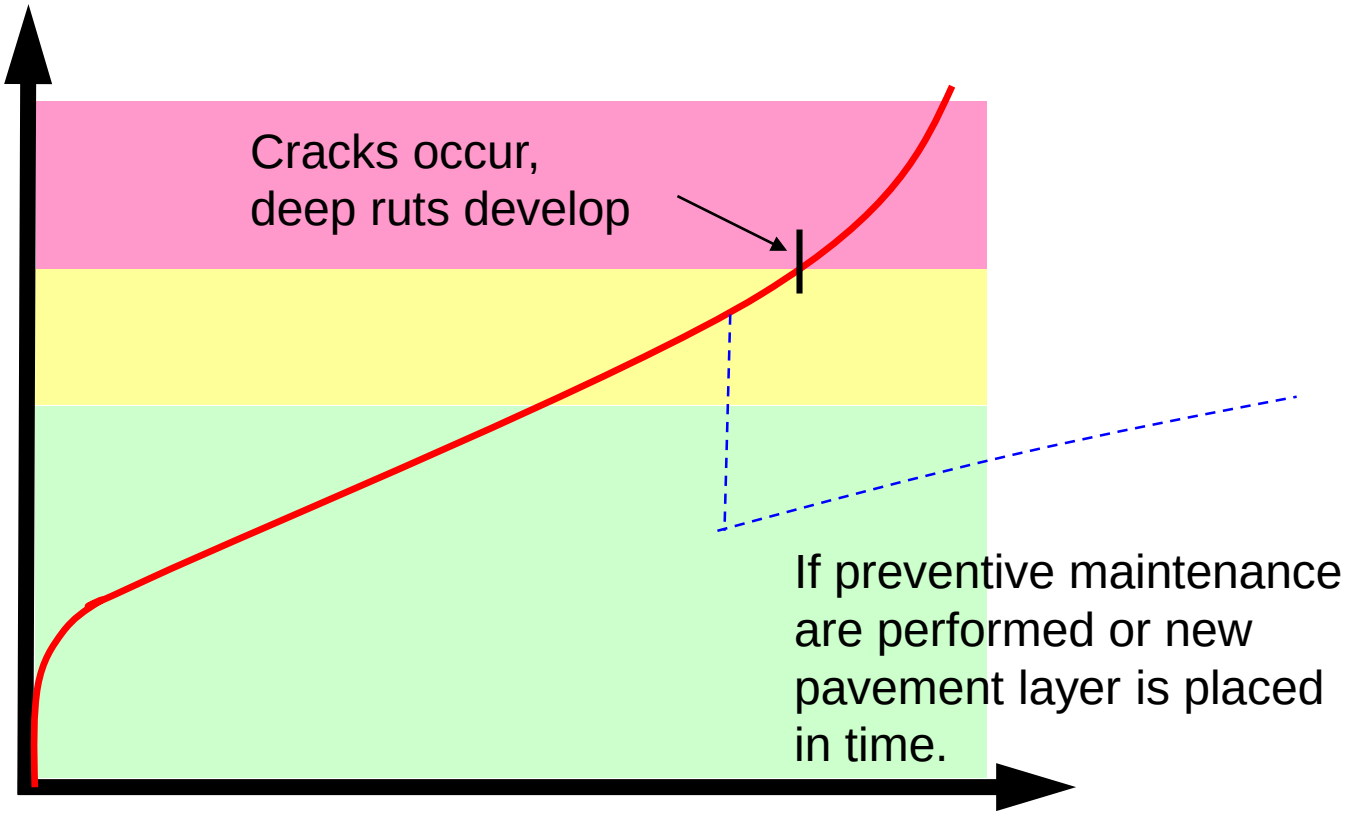


Swedish Road Maintenance Performance Standard 2011

- Describes performance by four parameters:
  - Rut depth, International Roughness Index (IRI), Edge Deformation and macro texture
- The standard uses traffic class by amount (AADT) and allowed speed.
- Roads where performance compliance are not met, reports as deficiencies.
- The deficiencies can be calculated and are defined by road class and geography.



Schematic degradation process, Roads

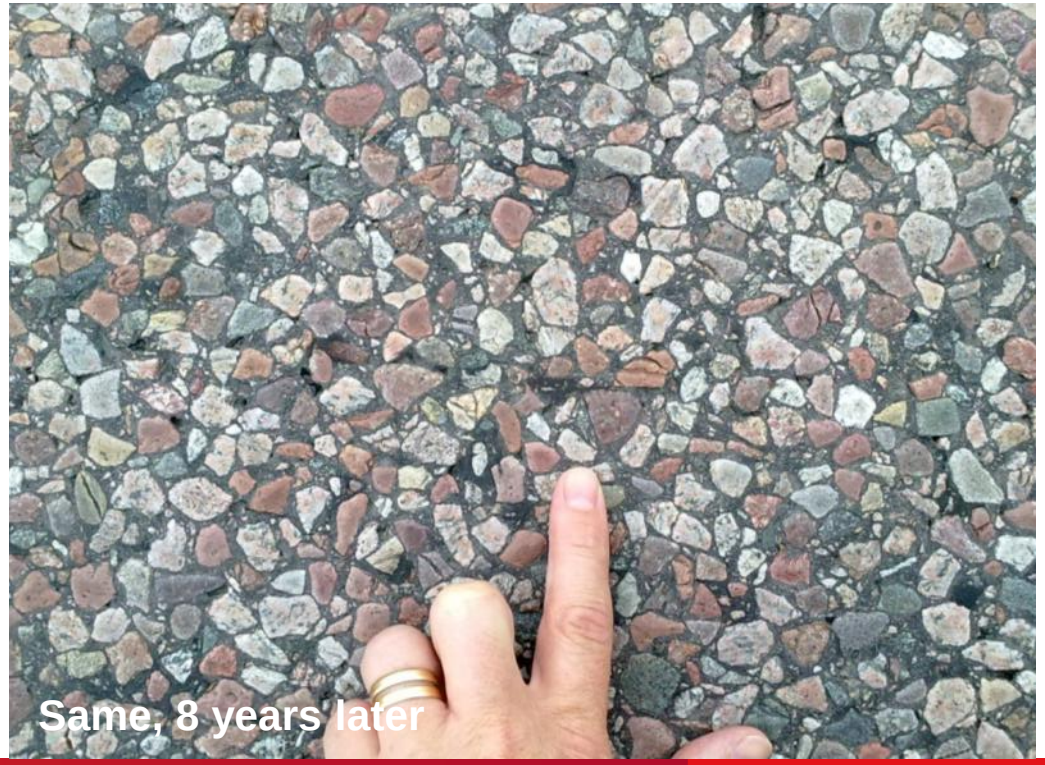


* Durability is mainly dependent of:
Type of road, traffic amount, % heavy trucks, % studded tires, pavement selection, design/thickness, quality and age

Traffic volume dependent:
High: 8-12 years
Mean: 10-15 years
Low: 12-20 years

Typical SMA 16 pavement

7000 AADT, 10% heavy trucks



Warranty vs DB-contracts

The volume of **Design-Build projects** for contracts has been targeted to increase. These contracts are also called Innovative or Performance contracts.

Standard contracts
80 % 2012
50 % 2018

DB-contracts
20 % 2012
50 % 2018

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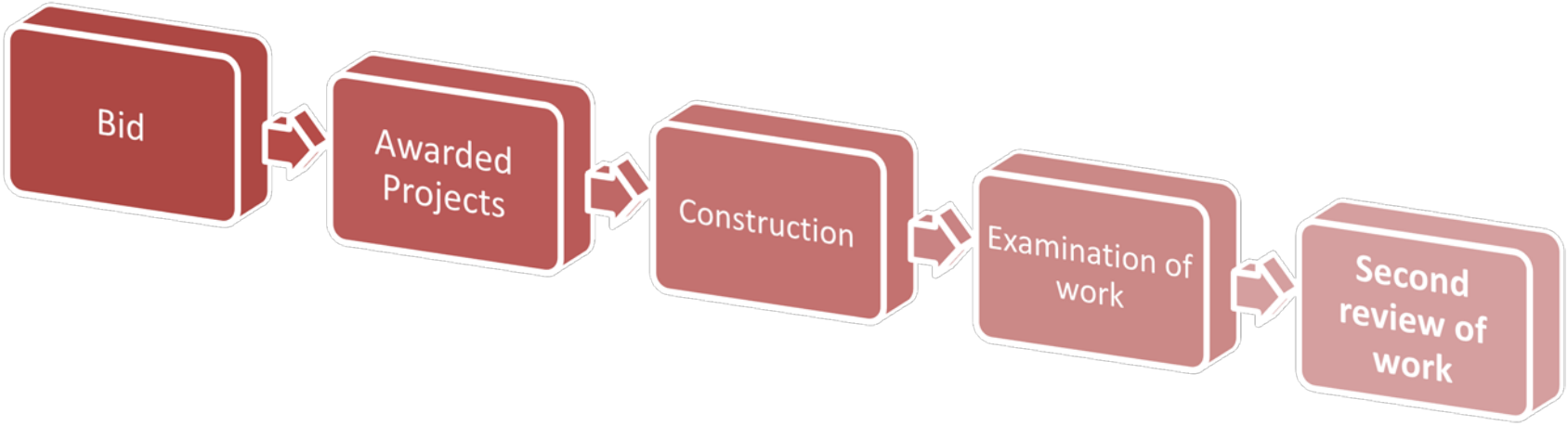
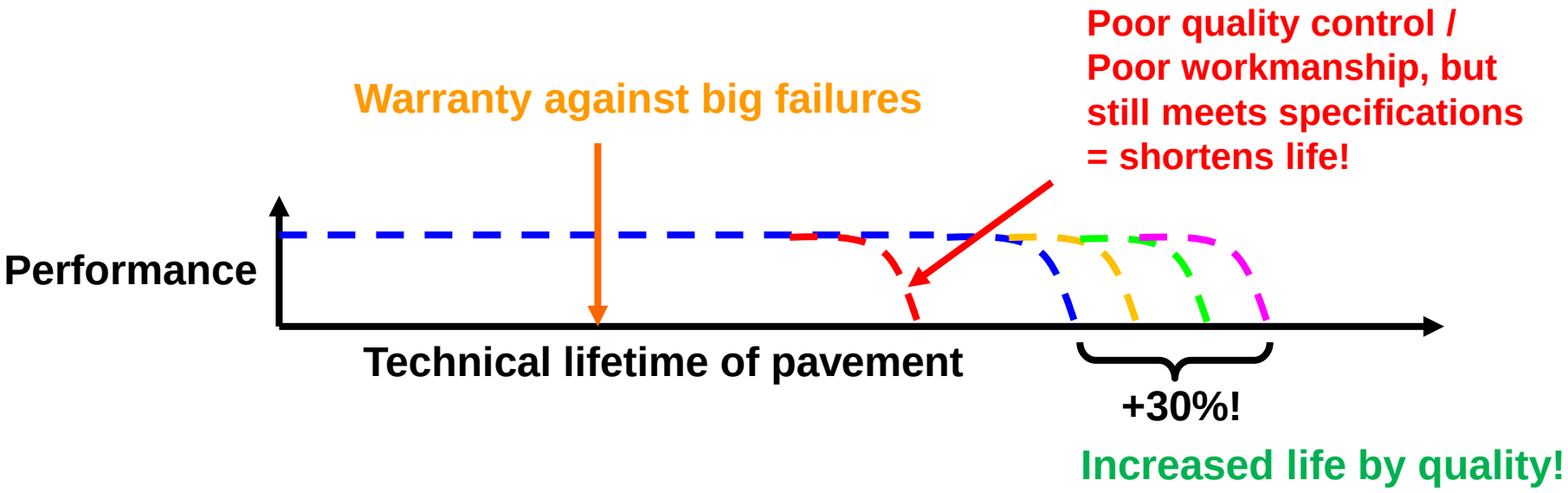
Guarantee / Warranty Practice (5 years)



+ Gives contractor an incentive to meet specification and to pay attention to workmanship
+ Reduces risk for road owner
- No incentive for improvements

Note that the contractor has the responsibility to find cause of premature failure and to recommend an action plan.

Innovative contracts (performance)



- Increased performance through good workmanship, modern equipment and techniques, improved recipes and use of additives, implemented research and development.

Asphalt Rubber – a new concept for road pavements in Sweden

- **"A three year (2007 – 2009) research and development project where the STA is the main responsible part "**
- **2010 – ongoing**
  - **continuous study of produced test sections**
  - **continued implementation**

Focus: Implementation of already existing technology

Tires with steel studs - an extra challenge for AR

TheGoodStuff...

Some locations for the AR test sections

Close to city:

1. Malmö area
2. Norrköping
3. Gothenburg
4. Jönköping
5. Stockholm
6. Storuman
7. Uppsala

Several test sections at most places.

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AR production in Sweden 2007-2012

- > 110 000 ton of Mix
- > 100 km of test sections
- > 25 Different Projects
- Used around 2 000 ton of Rubber granules (0-1 mm)

What have we achieved with our AR project, so far

1) We can produce Asphalt Rubber with, as expected, good quality!
2) We have shown that environmental issues (leakage, emissions) can be managed. In a broader view there is no negative impact to the surrondings – benefits exists!
3) The workers health can be managed; especially with sharing information and a maximum manufacturing temperature (not to be exceeded).
4) We have a technical specification for AR - GAP graded pavements.
5) Asphalt Rubber is definitely a pavement concept for Swedish roads.

KGO-III method

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What is the Flow Mixing Technology*?

- A technology to produce asphalt concrete mixes with same or better quality without use of extra additives.
- Through a controlled way of production, reduce valuable sources of raw material, save energy, and give long lasting products.

* The Flow Mixing Technology is also called the KGO-III method, which is patented technology by Karl Gunnar Ohlson, Sweden

KGO-III surface, paved in 2004,
picture from summer 2010.

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FogSeal
– no more flying chips!

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”It all comes down to maintenance, else is preparation”.

– Björn Östlund, former vice director at STA

“A satisfied customer”

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IKEA

Thank you!

Thanks! Questions?, contact me:

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