



IGOR RUTTMAR

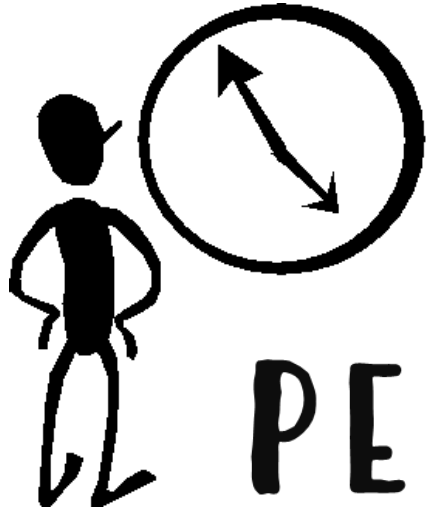


STRABAG

WORK ON PROGRESS

pkd Polish Road Congress





PERPETUAL PAVEMENTS

IAT Seminar: Achieving Sustainable Roads
28th March 2023, Athlone



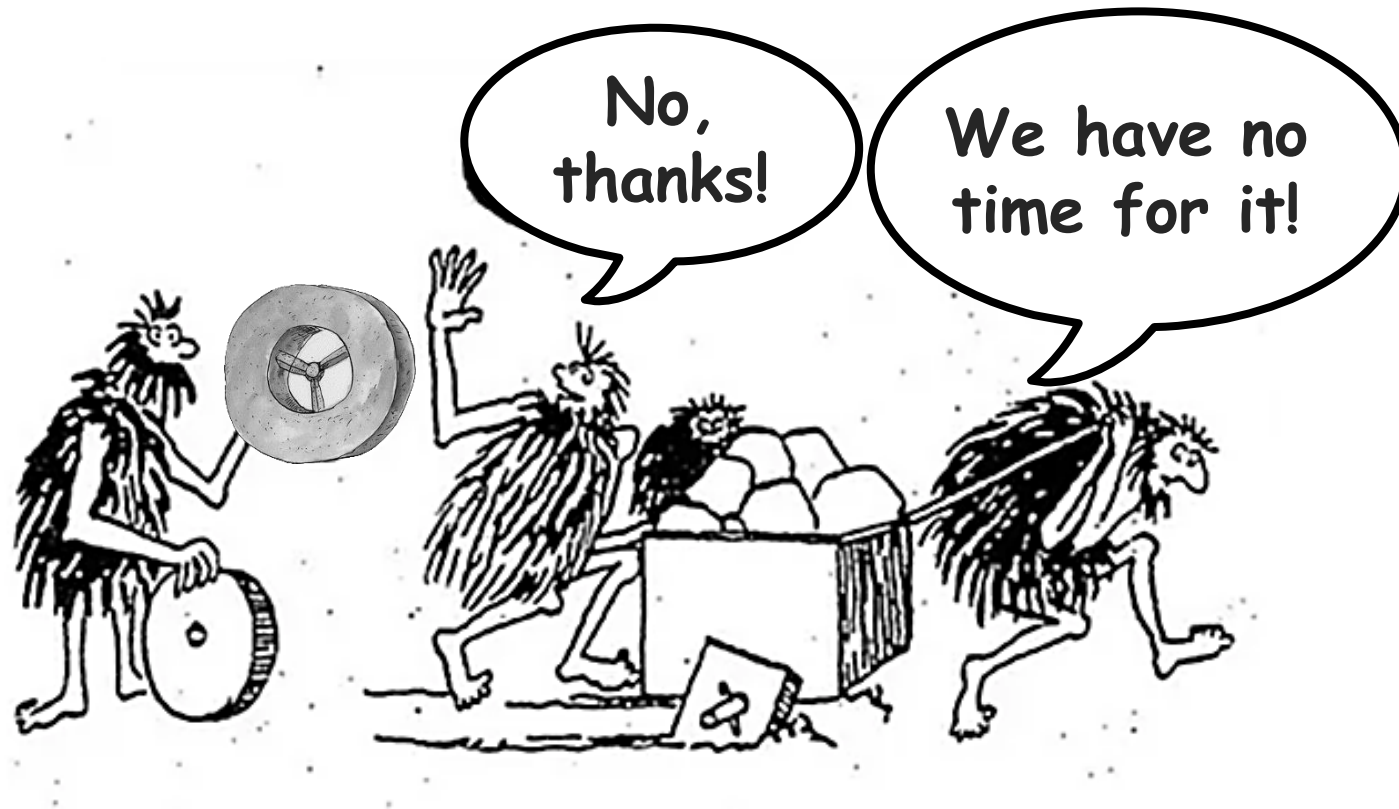


DISCLAIMER

We **do not** want
to re-invent the
wheel!



...we just want to put it **where it belongs!**

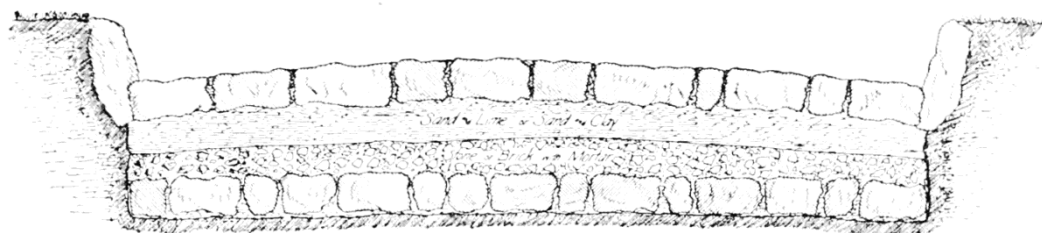
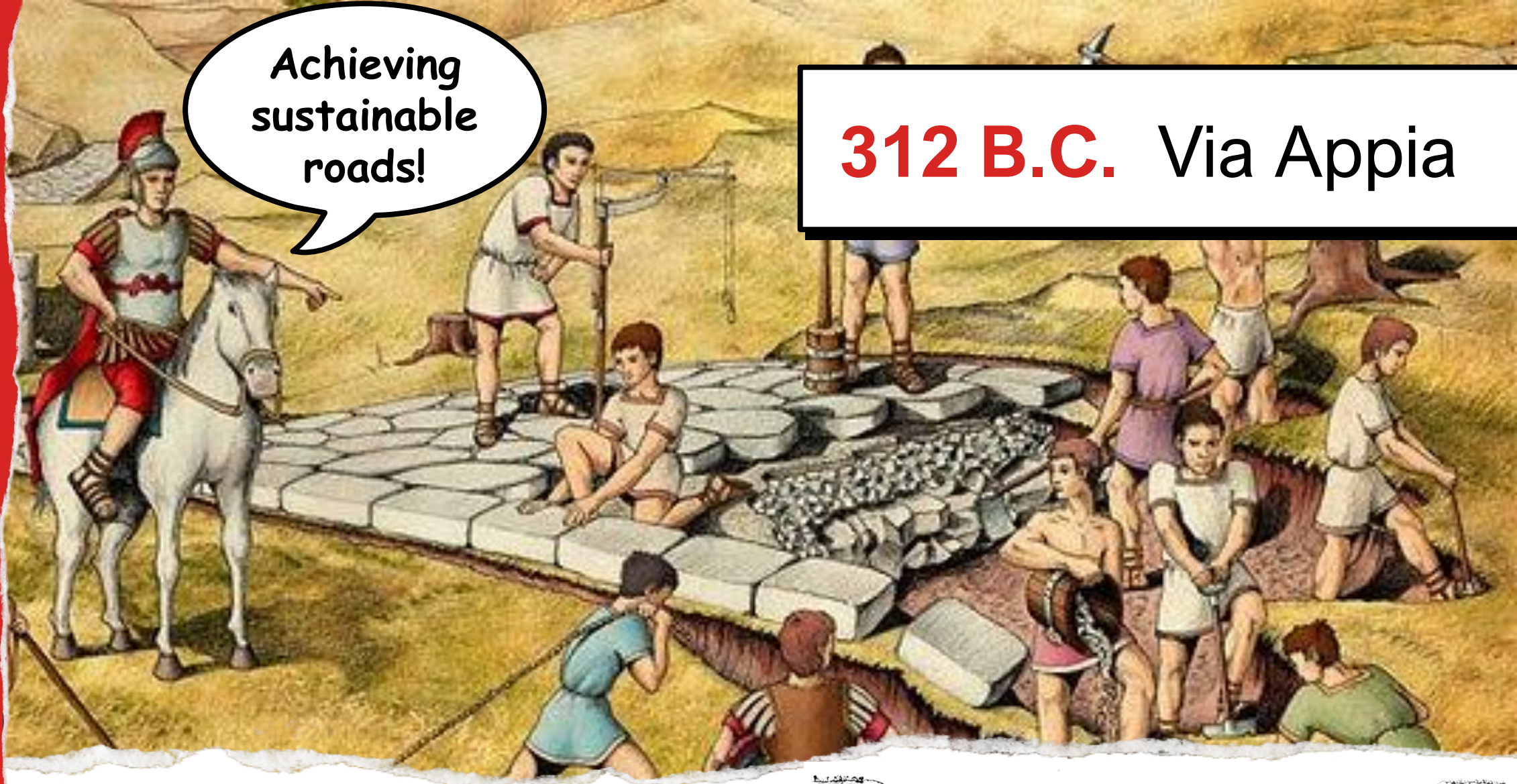


PAST AND PRESENT

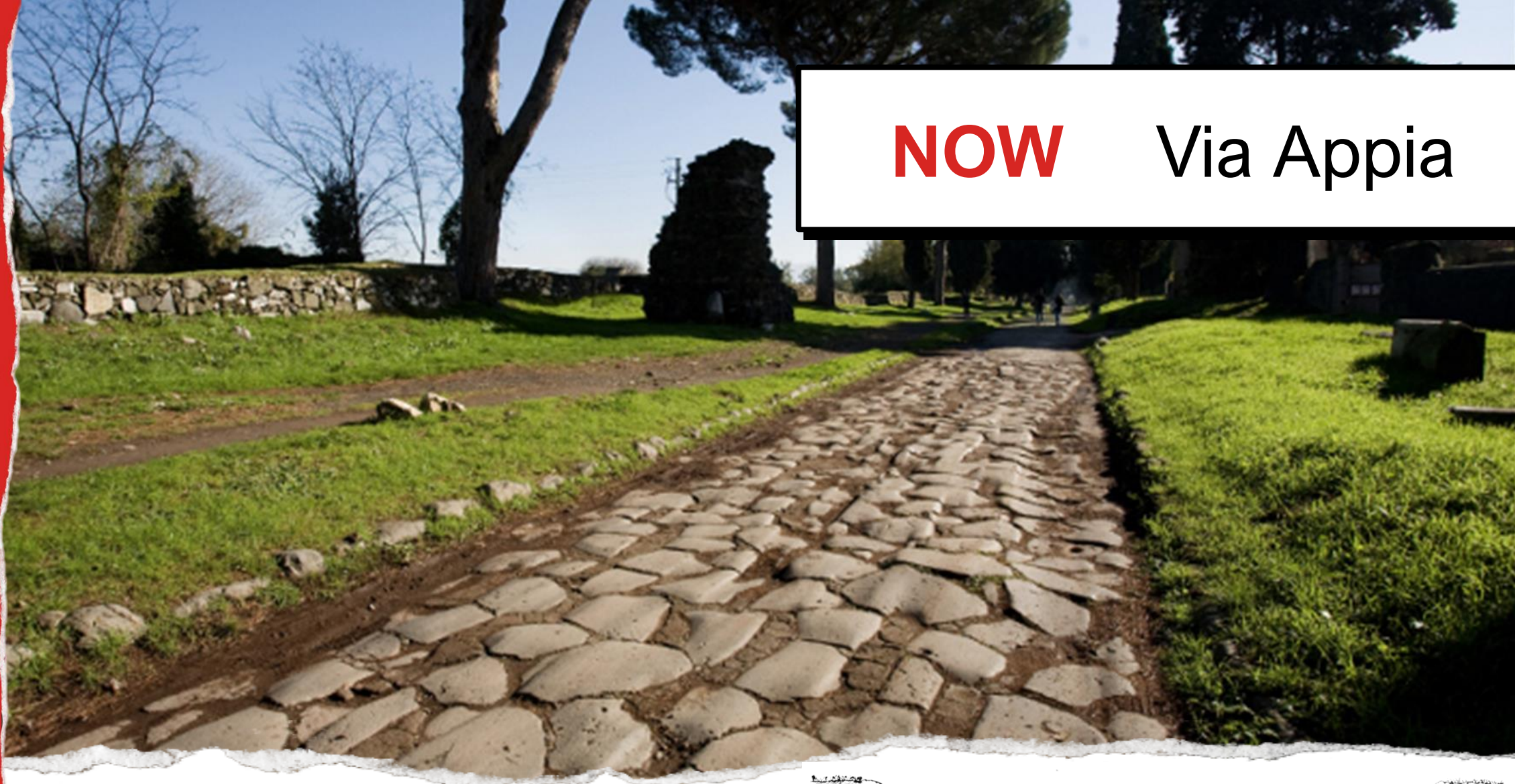
ROMAN ROADS

Achieving sustainable roads!

312 B.C. Via Appia



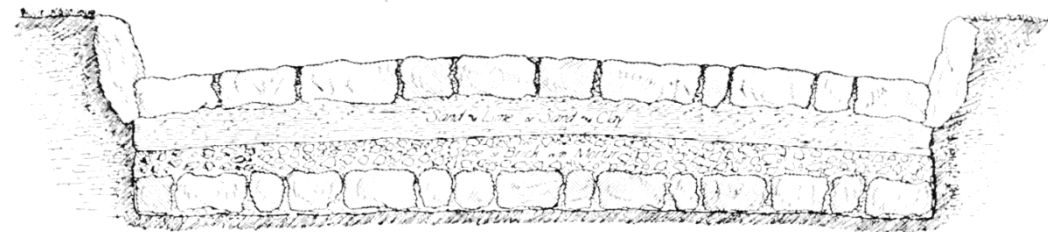
ROMAN ROADS



NOW

Via Appia

it's perpetual!





John Loudon McAdam
(1756 –1836)

Confidence
through Quality!

1823

Macadam road
construction

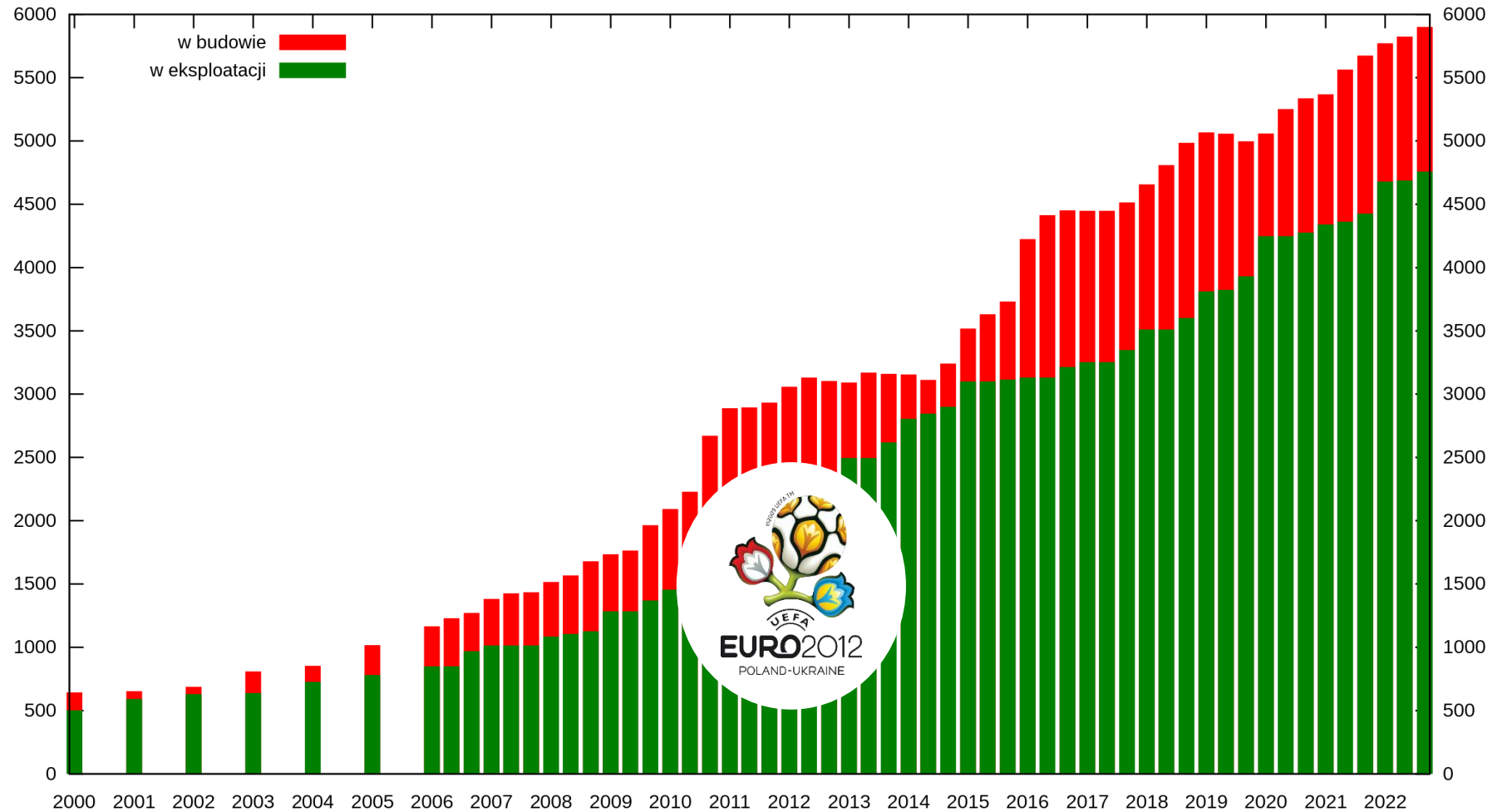




ON THE WAY TO SUSTAINABLE ROADS

HIGHWAYS AND EXPRESSWAYS CONSTRUCTION IN POLAND

Autostrady i Drogi Ekspresowe w Polsce





2000

**TRADITIONAL
ASPHALT
PAVEMENT**





2000

binder c. 8 cm
AC 0/20 B-50

wearing c. 4 cm
SMA 0/11 B-50

base c. 17 cm
AC 0/25 B-50

15 mln
115 kN
ESALs



2004

HIGH
STIFFNESS
MODULUS AC
"EME"





2004

9 cm
AC 20 PMB

4 cm
SMA 11 PMB

13 cm
**AC WMS 20
„EME” 20/30**

17 mln
115 kN
ESALs





HVS
(Heavy Vehicle Simulator)
PRUSZKOW



HVS

(Heavy Vehicle Simulator)

PRUSZKOW

2008

PROJECT PARTICIPANTS:

STRABAG
TEAMS WORK.

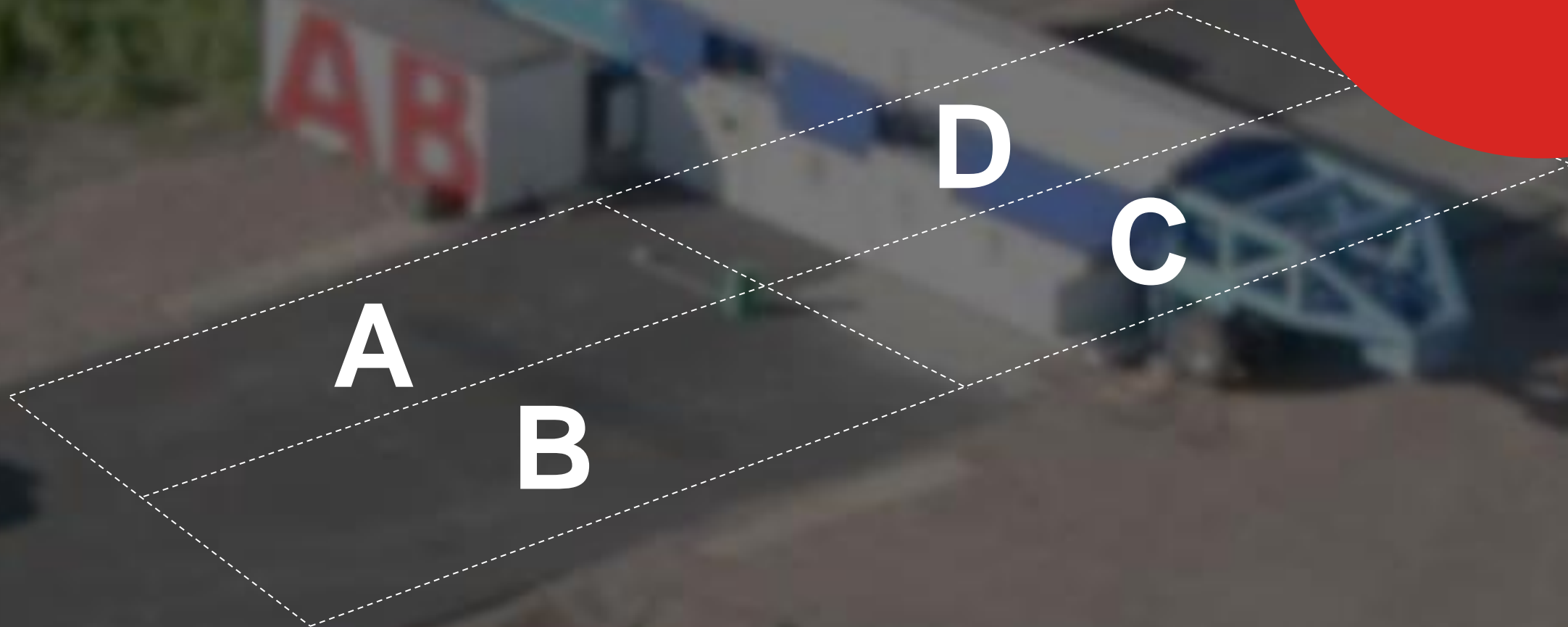
TPA

IBDiM

ORLEN Asphalt

LAFARGE

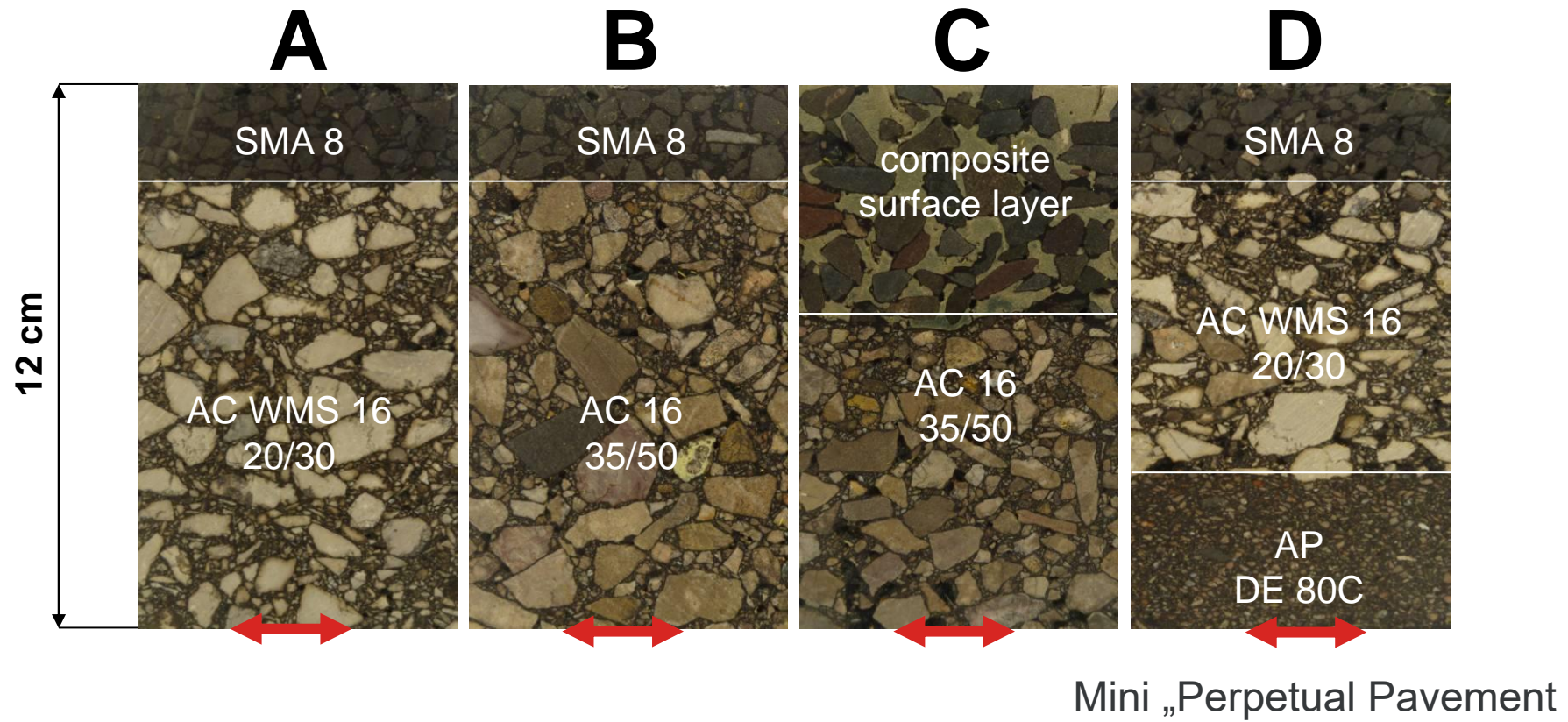
HVS
(Heavy Vehicle Simulator)
PRUSZKOW





**SPENS
RESEARCH
PROGRAM**

TESTED PAVEMENT TYPES:

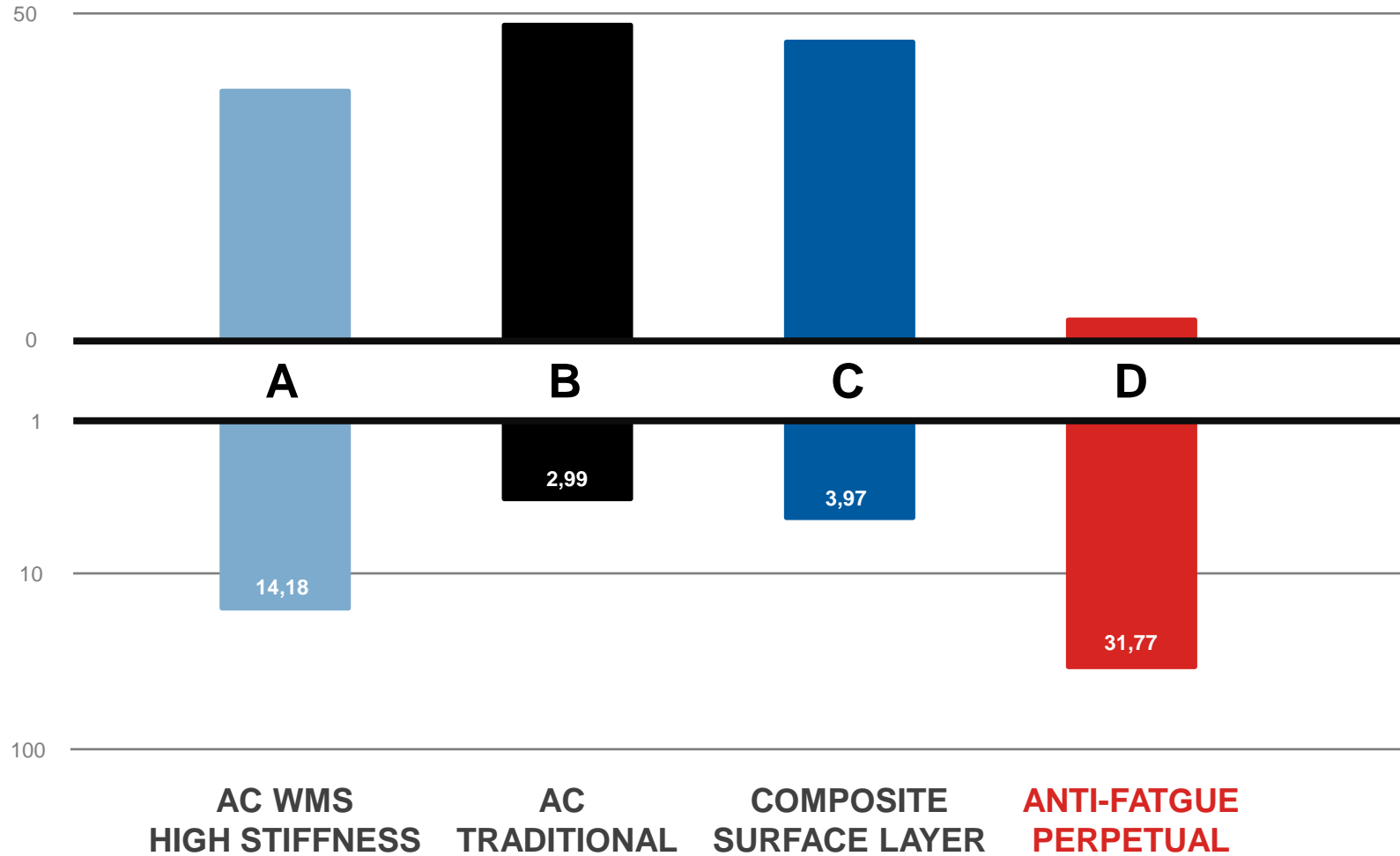




FATIGUE DAMAGE / LIFE

Fatigue
damage

Fatigue
life



UNIA EUROPEJSKA
EUROPEJSKI FUNDUSZ
ROZWOJU REGIONALNEGO



PARP



INNOWACYJNA
GOSPODARKA
NARODOWA STRATEGIA SPOJNOŚCI

2013

Perpetual Pavement

BBTM 8A ARB

AC WMS 16
PMB 25/55-60

AC 5 AF
ARB



PROJECT PARTICIPANTS:

STRABAG
TEAMS WORK.



2011

**HIGH
STIFFNESS
MODULUS AC**

Polish Abrev.: AC WMS





2011

8 cm

AC WMS 16

PMB 25/55-60

4 cm

SMA 11

PMB 45/80-55

17 cm

AC WMS 16

20/30

54 mln

115 kN
ESALs



... and the winter came!



**LOW
TEMPERATURE
CRACKING**

**TOO
STIFF!**



”

Much
to learn
you still
have.

Yoda, The Empire Strikes Back



„GET BACK TO THE LAB!”





TPA LAB, PRUSZKÓW 2012



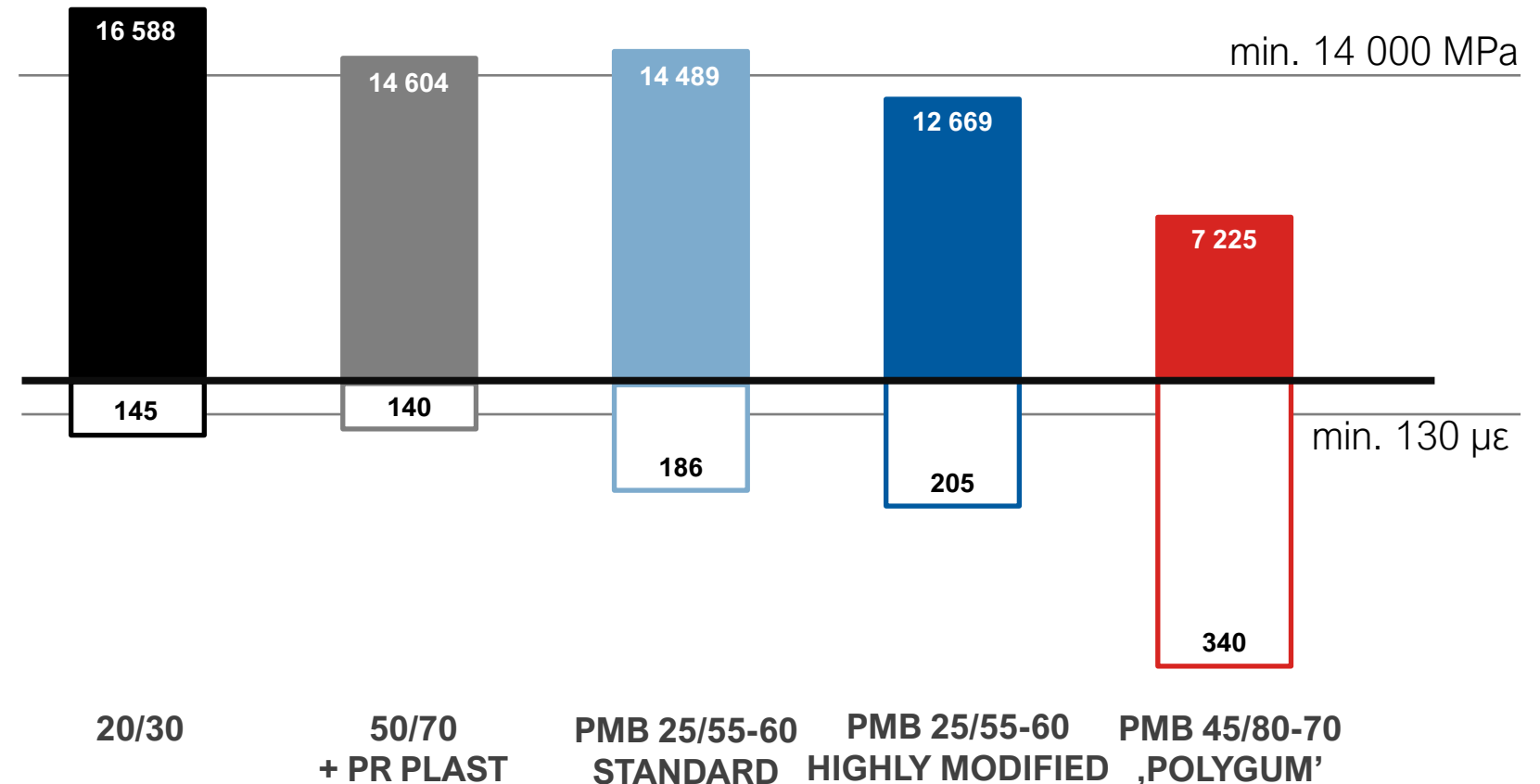
STIFFNESS VS FATIGUE

STIFFNESS vs FATIGUE for different binder types

AC „WMS” 16 HIGH STIFFNESS MIX DESIGN 4PB-PR (10°C, 10 Hz)

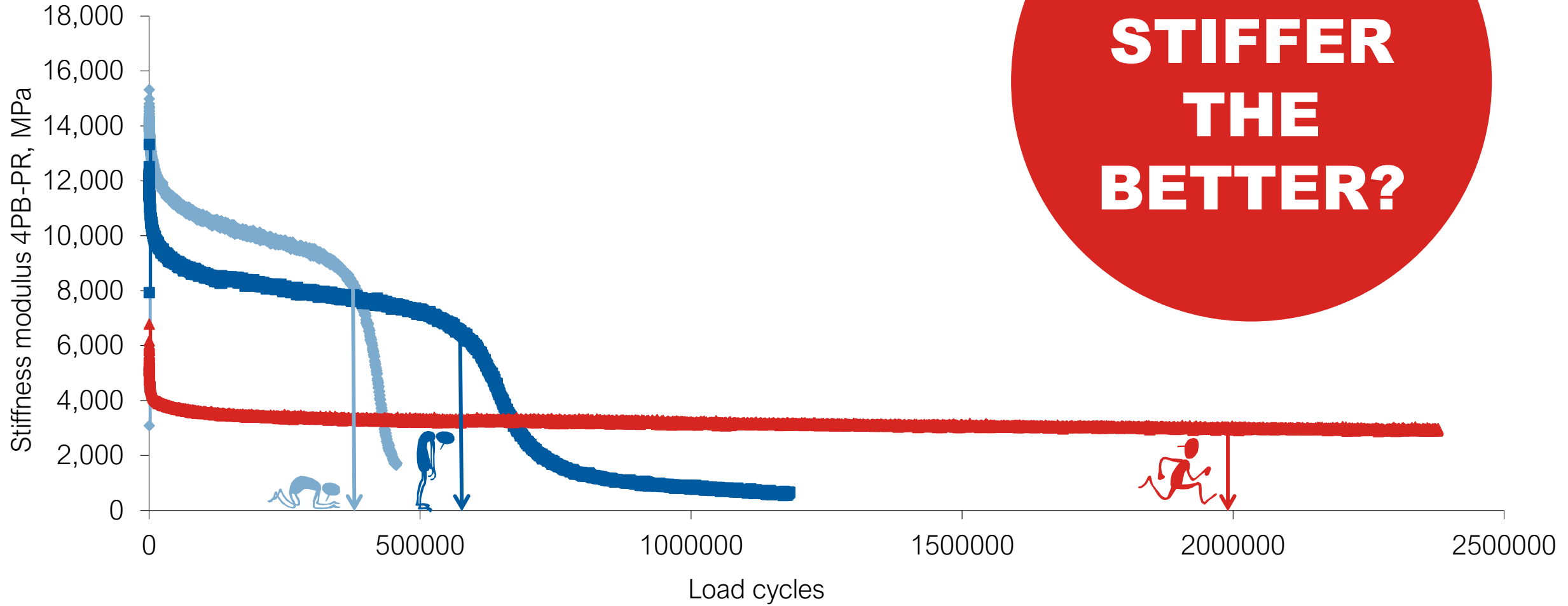
Stiffness
modulus S
[MPa]

Resistance to
fatigue ϵ_6
[$\mu\text{mm}/\text{mm}$]



DROP OF STIFFNESS @ FATIGUE TESTS

AC WMS 16 (EME) 4PB-PR (10°C, 10 HZ)



**THE
STIFFER
THE
BETTER?**

AC WMS PMB 25/55-60

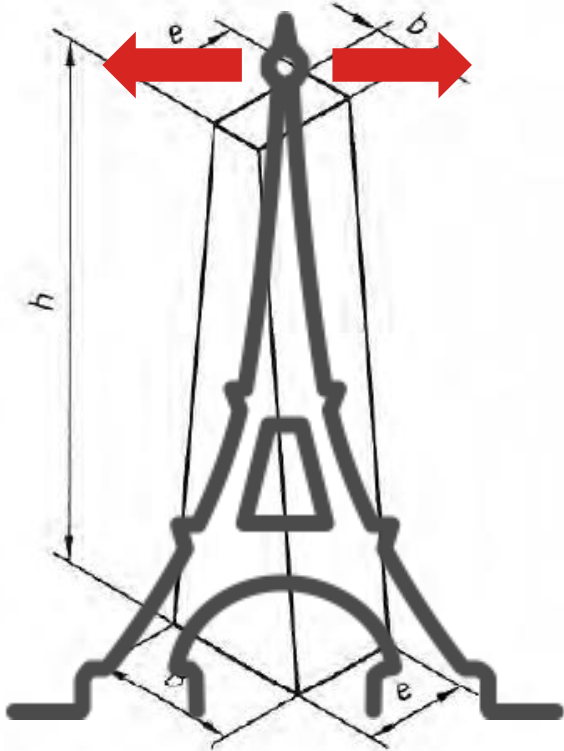
AC WMS PMB 25/55-60 WM

AC WMS PMB POLYGUM 45/80-70

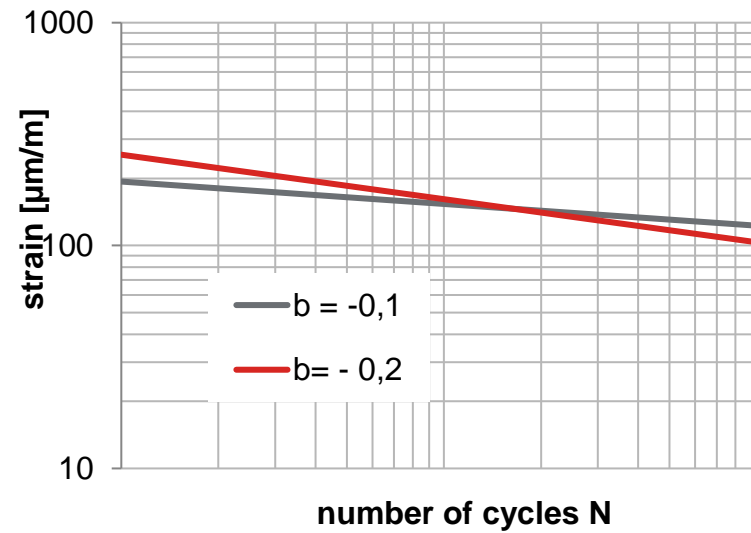
FRENCH DESIGN METHOD

FATIGUE CRITERION

2PB-TR (15°C, 10 Hz)



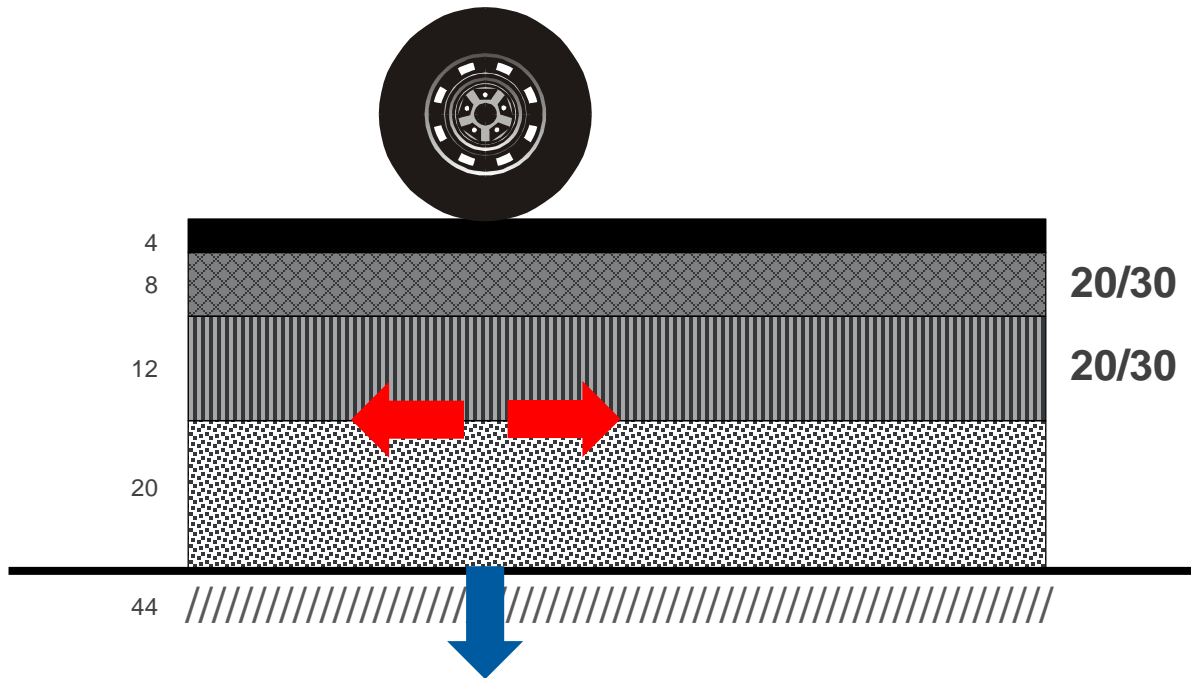
$$NE = \left(\frac{\varepsilon_{t,ad}}{\varepsilon_6(10^\circ\text{C}, 25\text{Hz}) \cdot \left[\frac{E(10^\circ\text{C})}{E(\theta_{eq})} \right]^{0,5} \cdot k_r \cdot k_c \cdot k_s} \right)^{\frac{1}{b}} \cdot 10^6$$



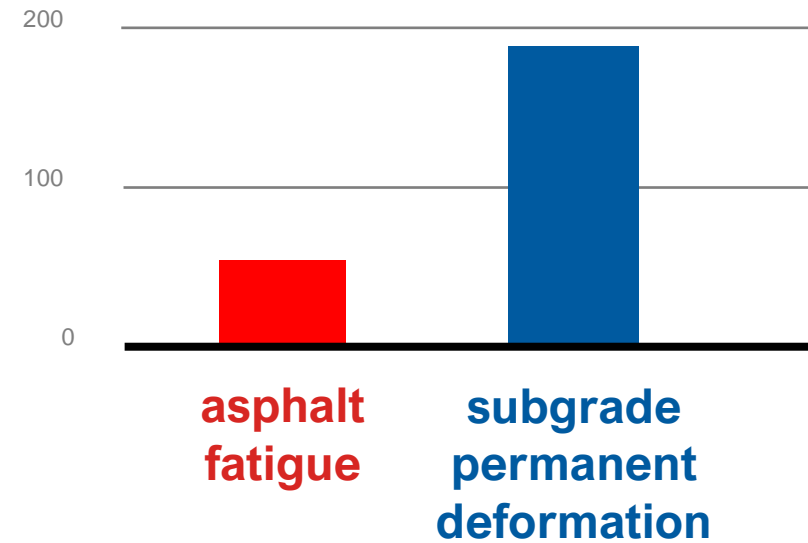
AC WMS (EME) PAVEMENT DESIGN

TRAFFIC LOAD CLASS KR5

AC WMS USING 20/30 AND/OR PMB 25/55-60



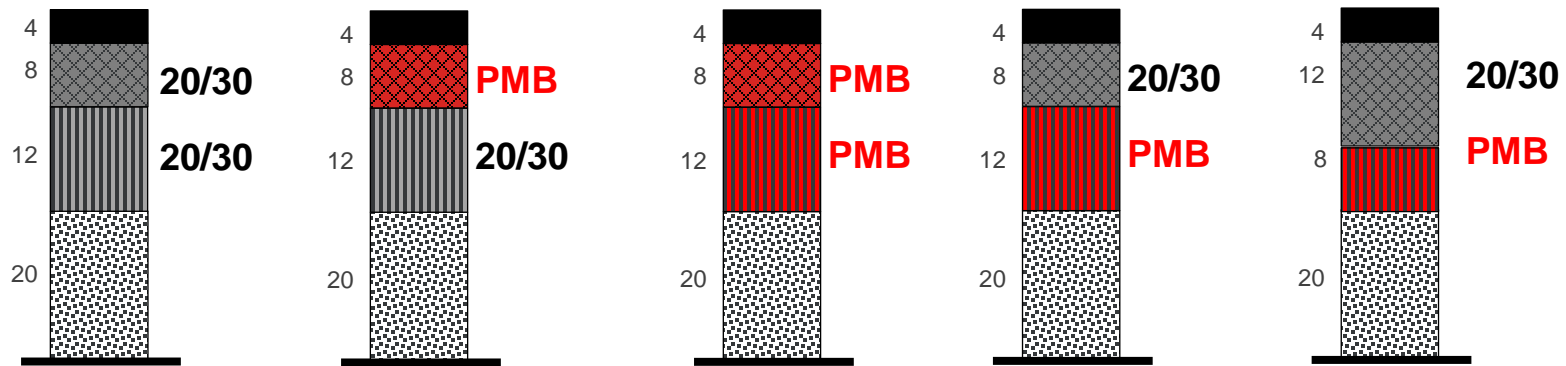
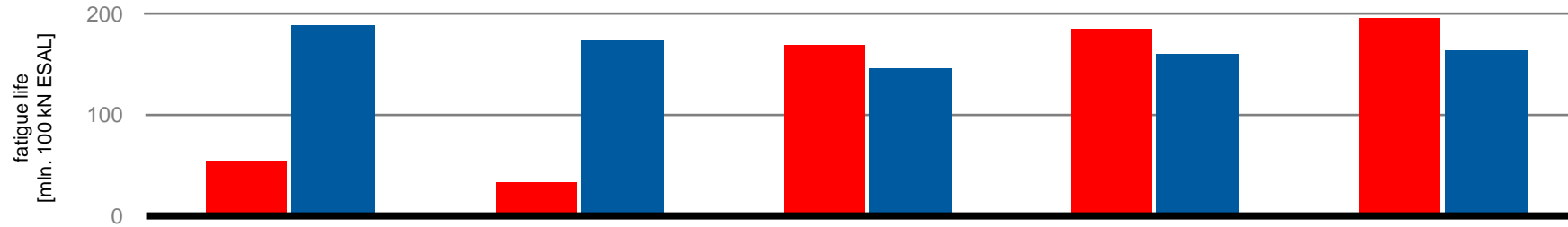
two criteria




AC WMS (EME) PAVEMENT DESIGN

TRAFFIC LOAD CLASS KR5

AC WMS USING 20/30 AND/OR PMB 25/55-60



 AC WMS 16 PMB 25/55-60
 AC WMS 16 20/30



”

Mind what you
have learned.
Save you it can.

Yoda, The Empire Strikes Back





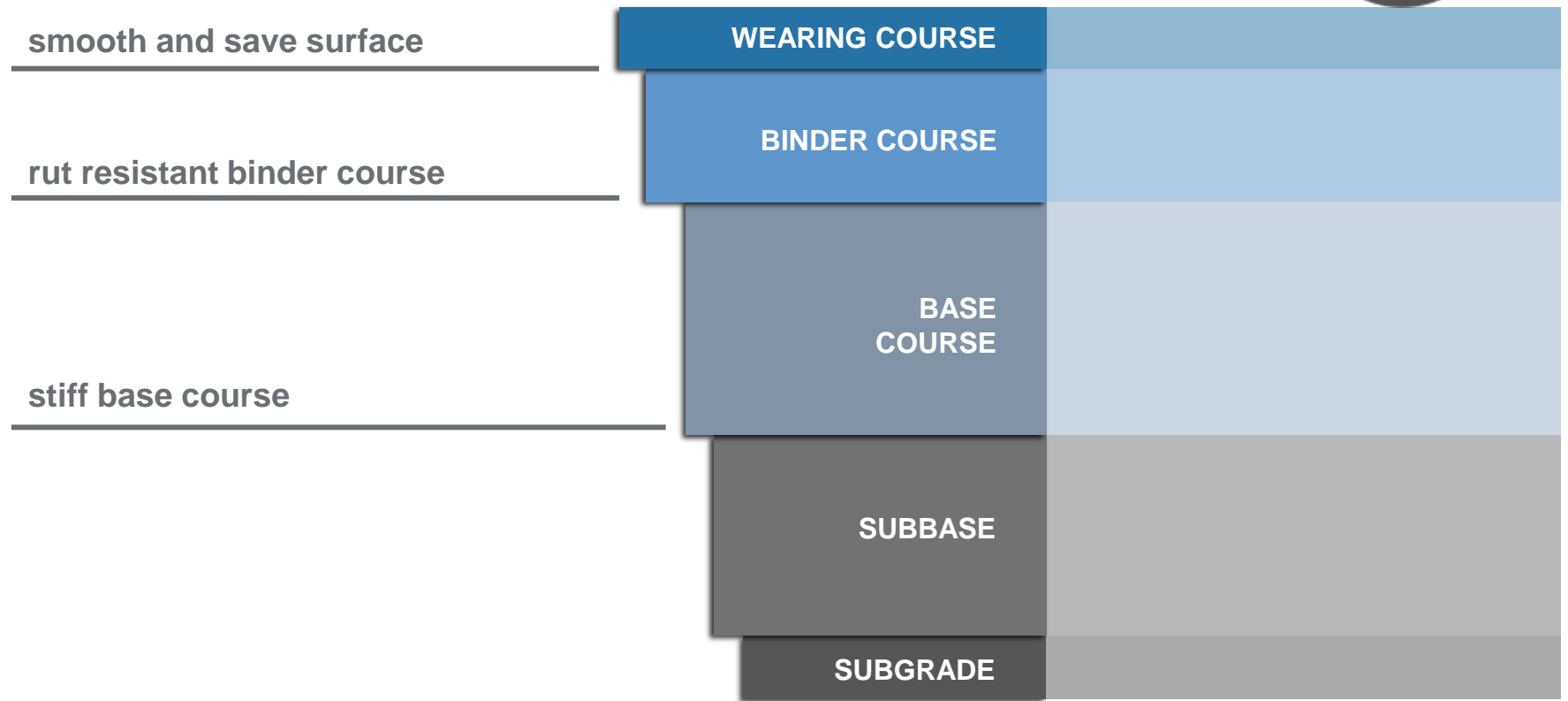
Perpetual pavement is „an asphalt pavement designed and built to last longer than 50 years without requiring major structural rehabilitation or reconstruction, and needing only periodic surface renewal (...).”

APA definitione (2001)

TRADITIONAL ASPHALT PAVEMENT

FATIGUE FAILURE

CRITICAL STRAIN AT BOTTOM



TRADITIONAL ASPHALT PAVEMENT

FATIGUE FAILURE CRITICAL STRAIN AT BOTTOM

smooth and
save surface

rut resistant
binder course

stiff base
course

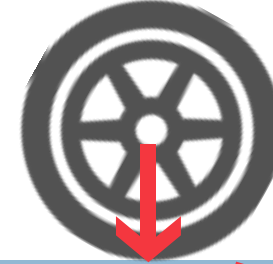
WEARING COURSE

BINDER COURSE

BASE
COURSE

SUBBASE

SUBGRADE



TRADITIONAL ASPHALT PAVEMENT

FATIGUE FAILURE

CRITICAL STRAIN AT BOTTOM

smooth and
save surface

rut resistant
binder course

stiff base
course

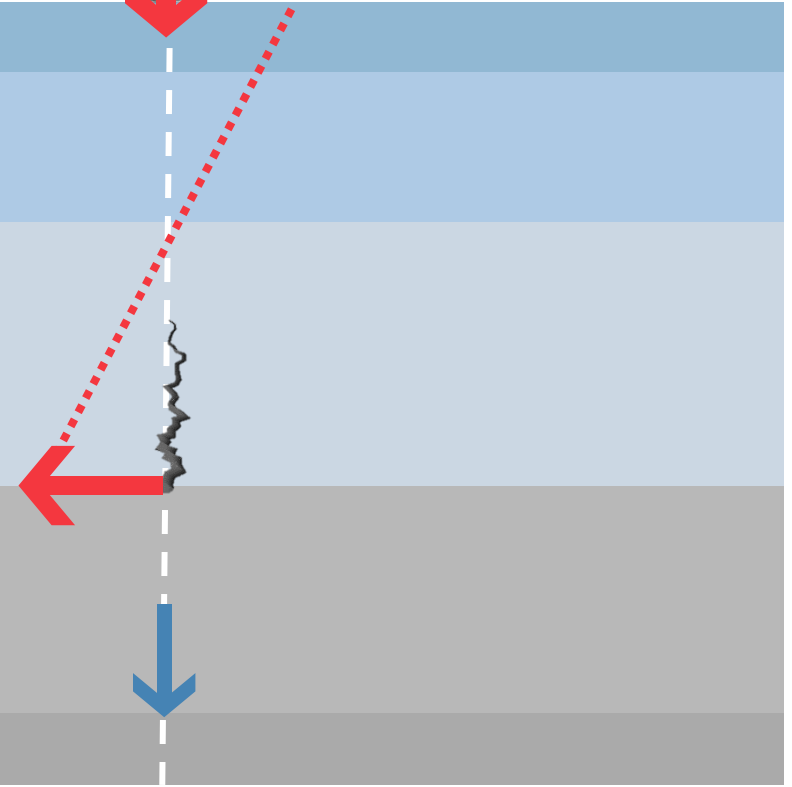
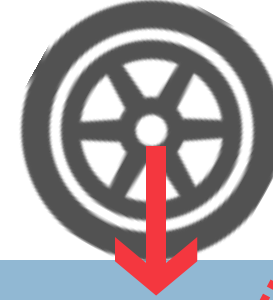
WEARING COURSE

BINDER COURSE

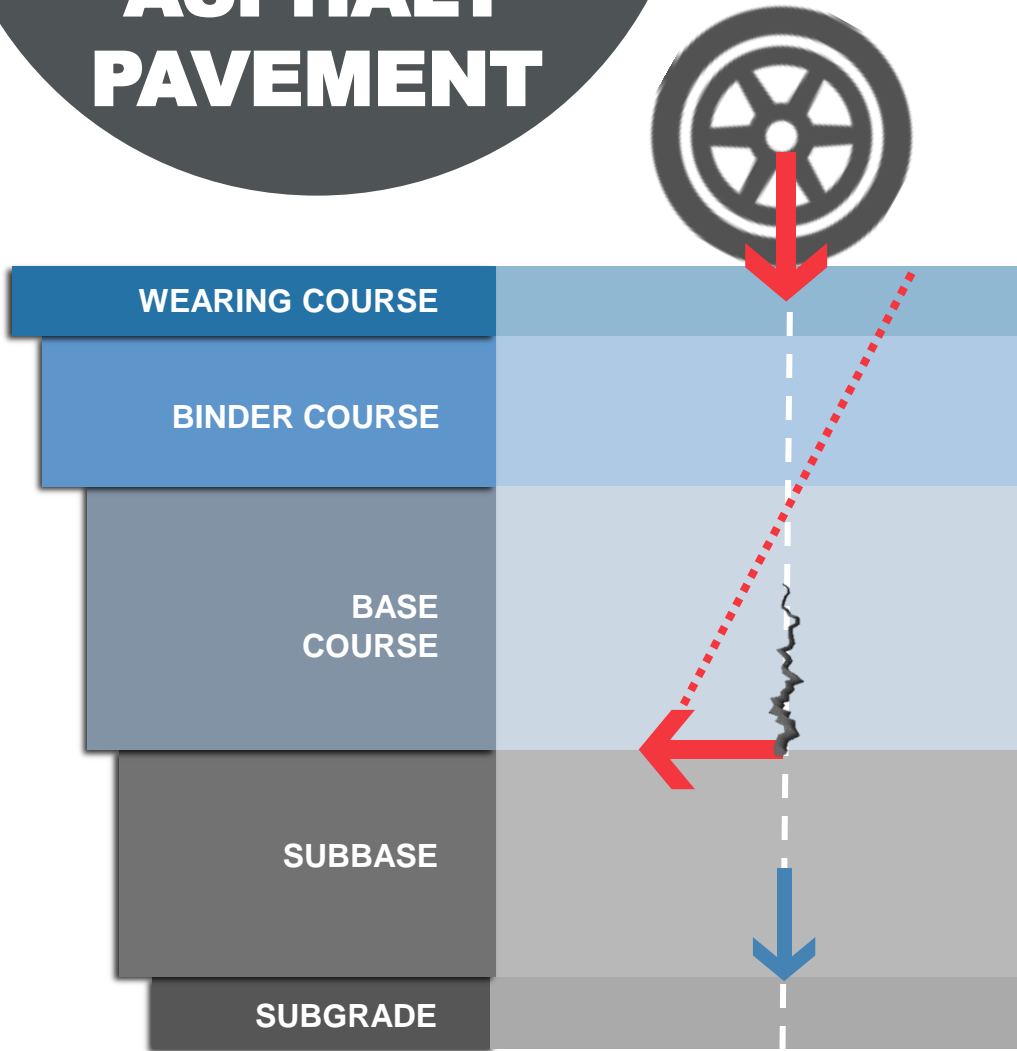
BASE
COURSE

SUBBASE

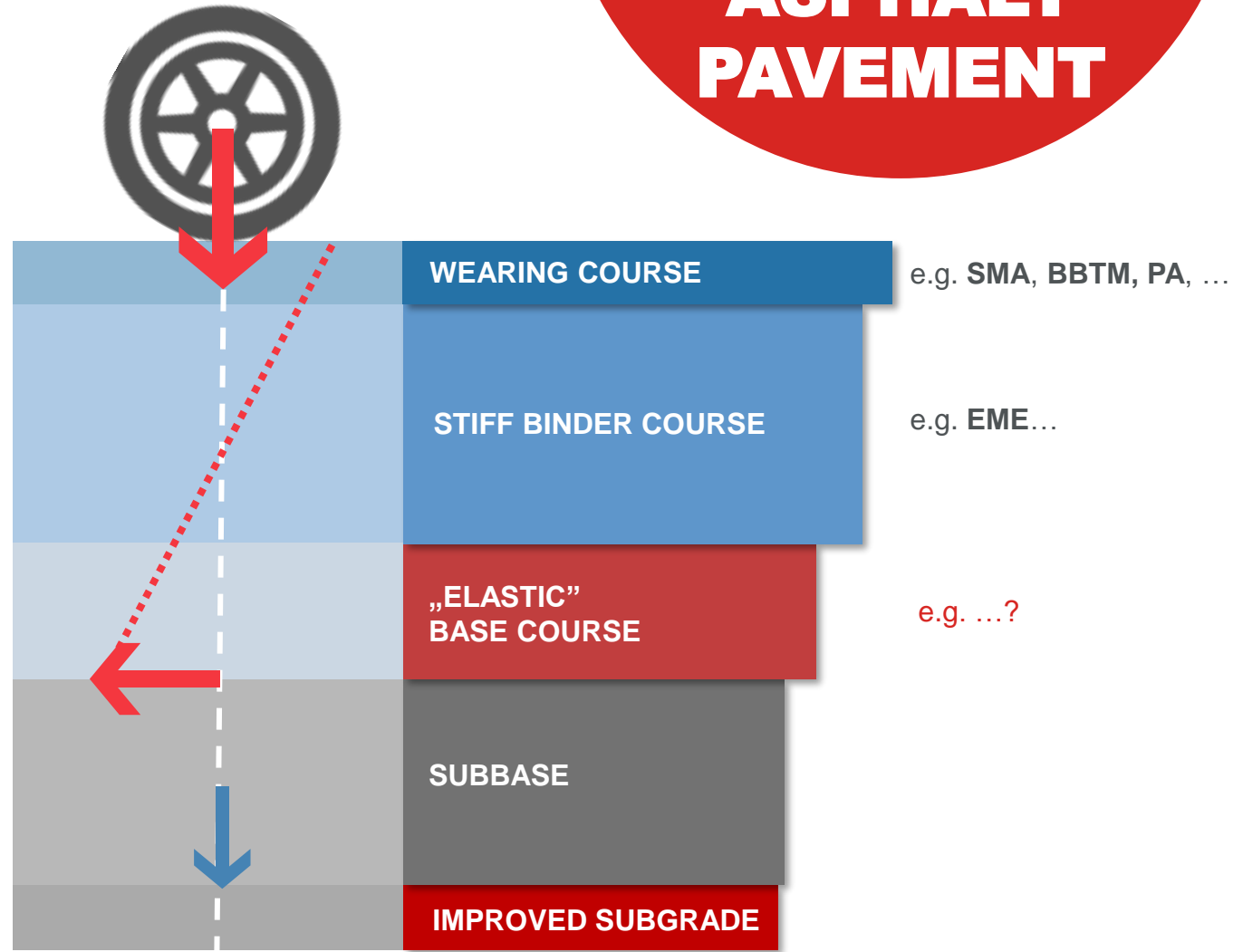
SUBGRADE



TRADITIONAL ASPHALT PAVEMENT

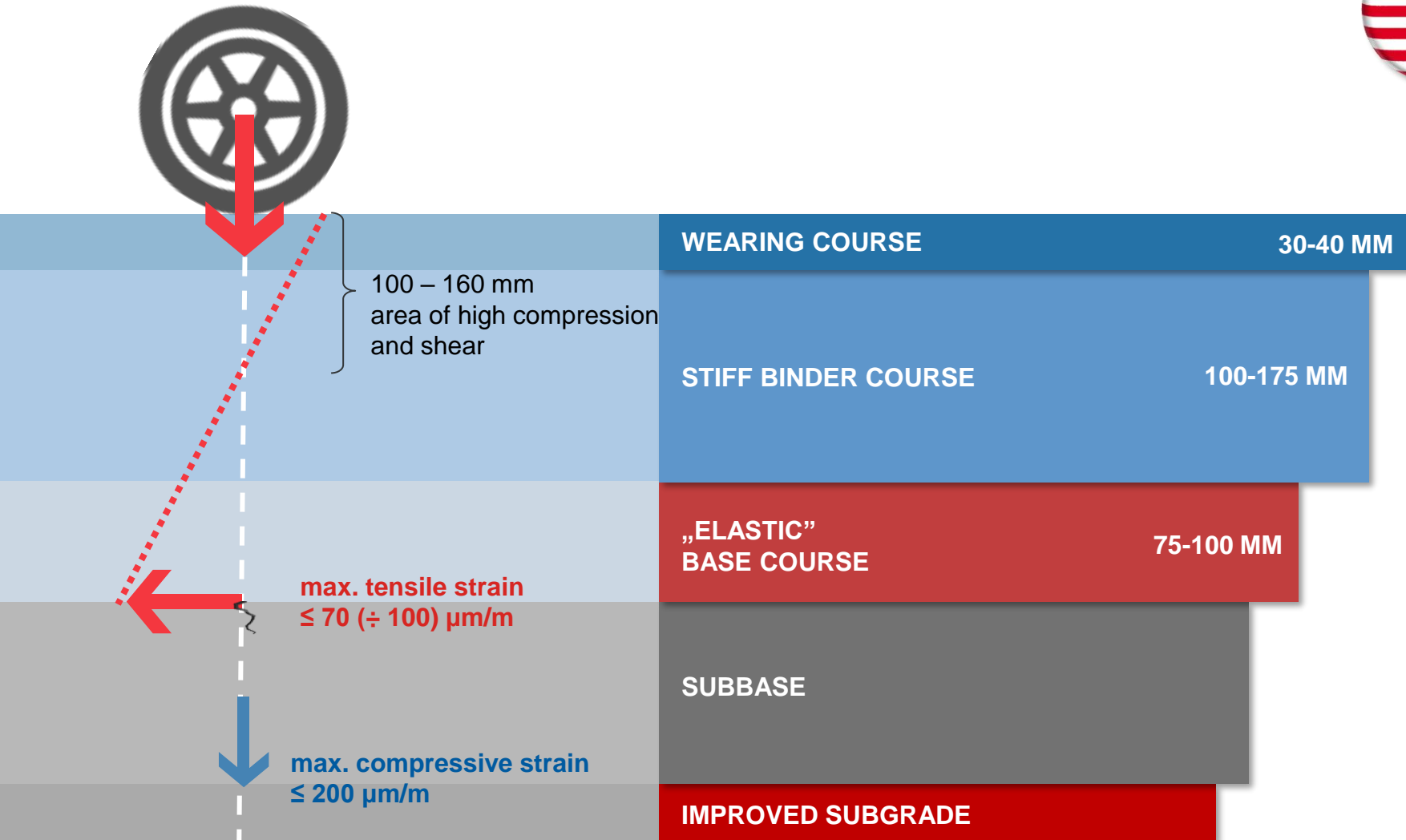


PERPETUAL ASPHALT PAVEMENT





PERPETUAL ASPHALT PAVEMENT



renewable
(e.g. SMA)



stiff, rut resistant
(e.g. EME)



„anti-fatigue“ layer

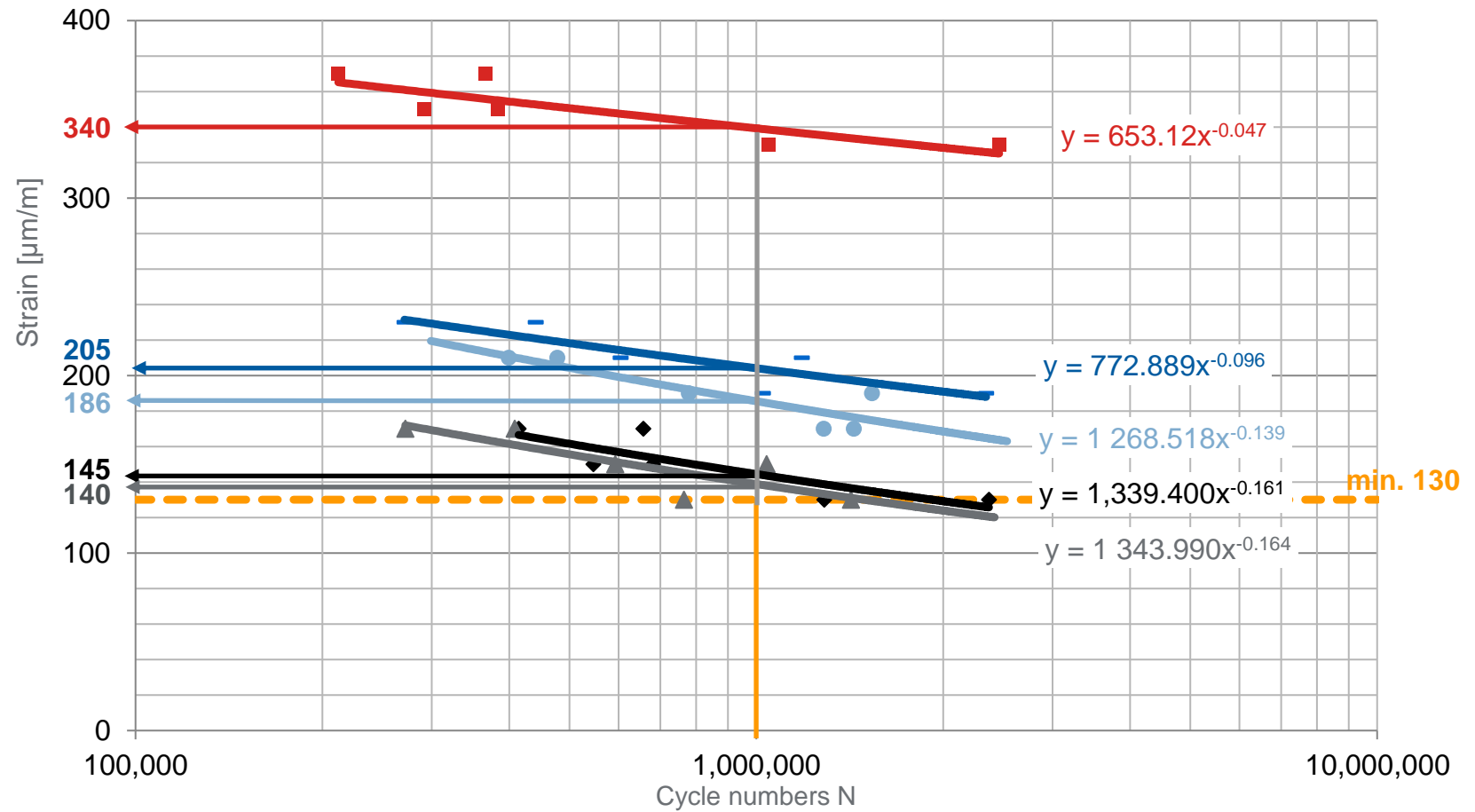


ANTI-FATIGUE ASPHALT MIX



PMB 45/80-80 POLYGUM

4PB-PR (10°C, 10 HZ) ACC. PN-EN 12697-24



● AC WMS 16 PMB 25/55-60

◆ AC WMS 16 20/30

— AC WMS 16 PMB 25/55-60 WM

■ AC MWS 16 PMB 45/80-80 SM

▲ AC WMS 16 50/70+DU



FIRST PERPETUAL PAVEMENT IN EUROPE

S8
DESIGN
&
BUILD

S8

KATOWICE

WARSAW

S7

CRACOW

S 8

perpetual pavement



2015



142 mln
115 kN
ESALs

32 mln
115 kN
ESALs

traditional pavement

S 8

TRIAL SECTION
**ANTI-FATIGUE
LAYER**

(150 m)

2014



S 8

TRIAL SECTION
**ANTI-FATIGUE
LAYER**

(150 m)

2014



S 8

Magazyny

Na żywo

NEWS OF THE DAY

2014



13.09.2014 | Superasfalt prosto z Polski – 18 lat gwarancji, 50 lat bez remontu

Drogowa rewolucja to nie żarty. Testowe 150 metrów superasfaltu leży już na S8. Żadnych dziur, kolein i nierówności – to będzie nowa polska specjalność. Drogowcy sprawdzają, czy asfalt się nie męczy, a zmęczeni kierowcy pewnie ... [rozwin](#)

Źródło: Fakty TVN

S8

WIEDZA

START

O NAS

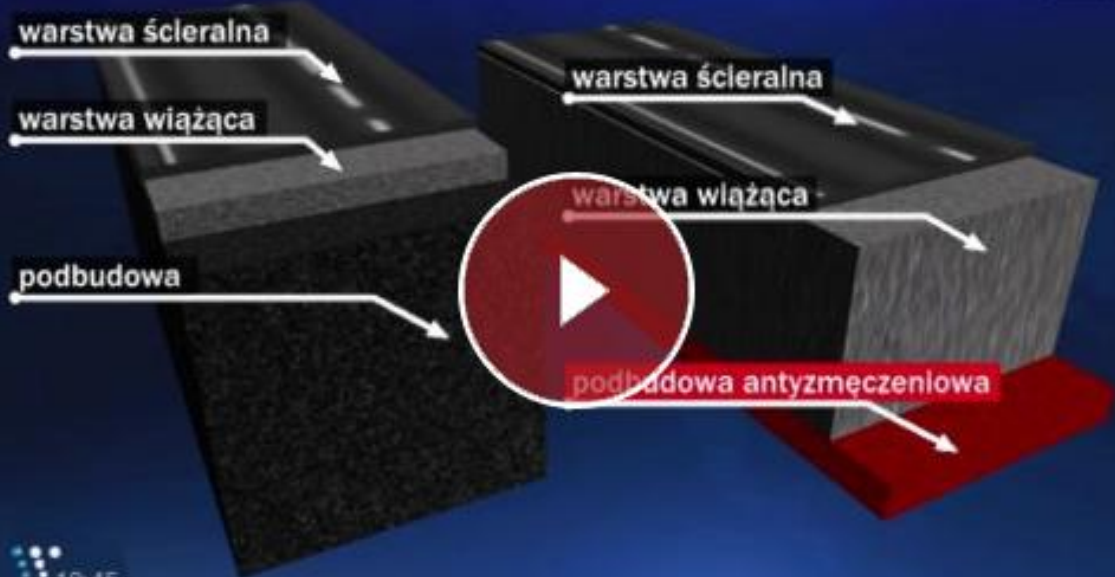
NEWS OF THE DAY

DRUGA

TWARZE

Publikacja: 13 września 2014, 19:53

TVP 1 HD



19:45

Lubię to! 0

Dobrych dróg w Polsce przybywa, ale dziury i koleiny, są wciąż zimą wielu z nas. Kierowcy płaczą i płacą. Drogowcy zazwyczaj tłumaczą się klimatem, że albo mamy upał albo siarczysty mróz. Ale uwaga, nadchodzi rewolucja - pod Warszawą jest właśnie testowany



TOP 10

1. — Anna Przybylska 1978-2014
2. — Pożegnanie
3. — (Nie)trzeźwy poranek
4. — Groźny zabójca
5. — Wojny stadionowe
6. — Putin jak Herkules
7. — System obrony
8. — W spirali długu
9. — Tragedia pod ziemią
10. — Wirus strachu

S 8

NEWS OF THE DAY

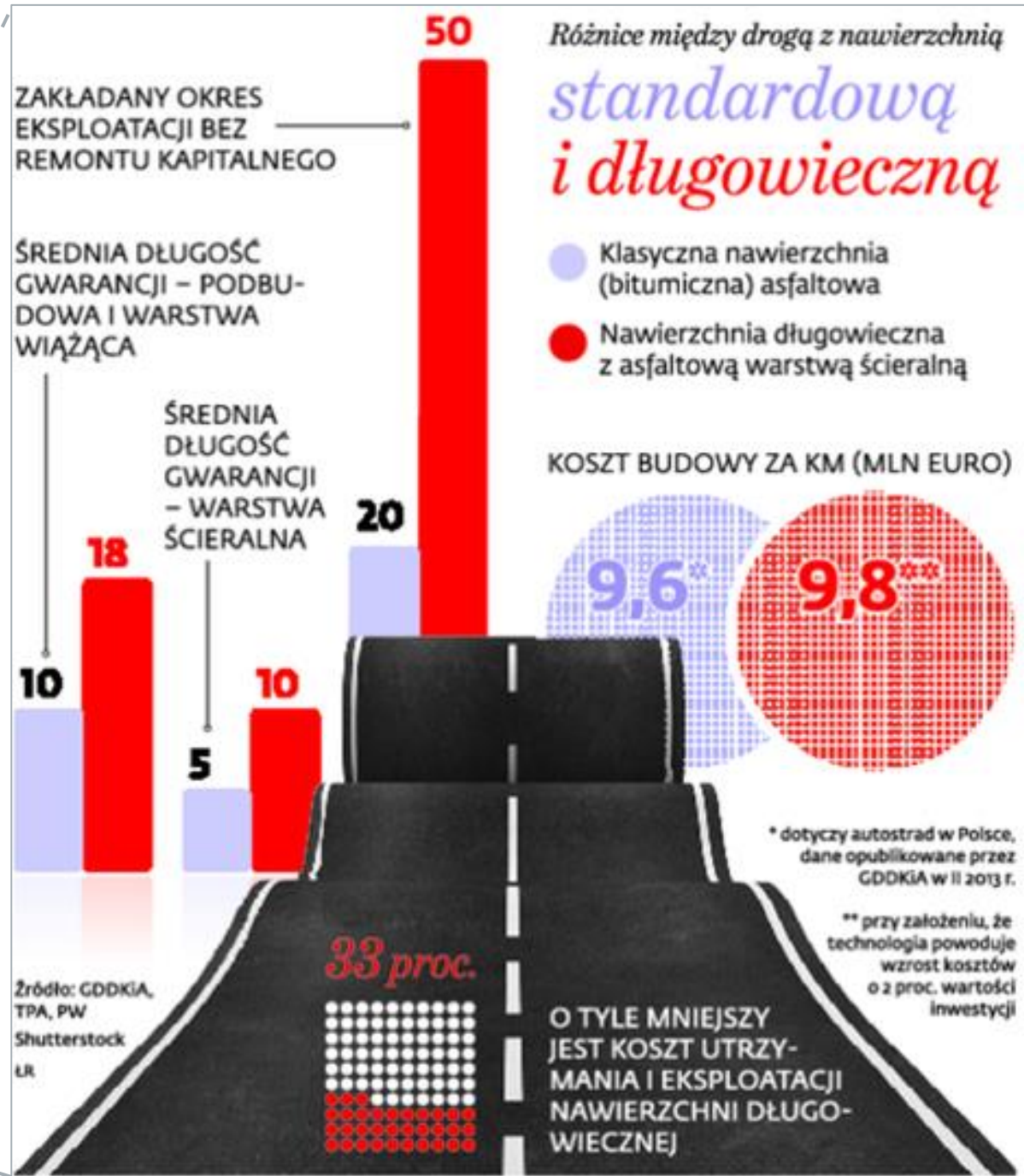
2014



9:05
WSTAJESZ I WIESZ
MEC. P. SCHRAMM,
KANCELARIA
GESSEL

tvn 24
21:47
ŚWIAT

Polska i Świat
PREMIER DONALD TUSK ZŁOŻYŁ DYMISJĘ NA RĘCE PREZYDENTA
PILNE
NDERSKIEJ KOMISJI: MALEZYJSKI BOEING 777 ZOSTAŁ STRĄCONY



S 8

„GESTRATA“
SITE-SEEING

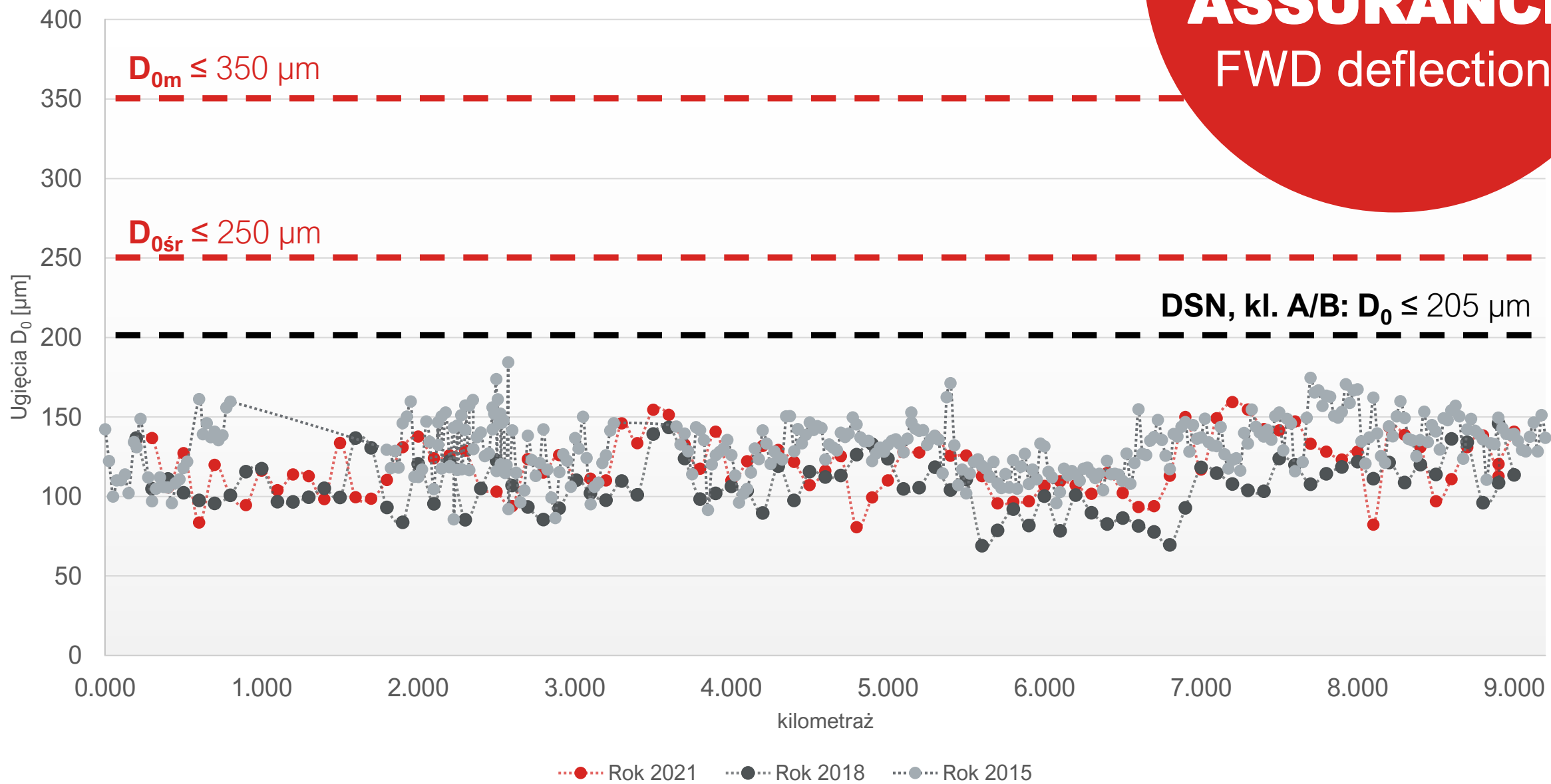
2014





OPACZ – PASZKÓW

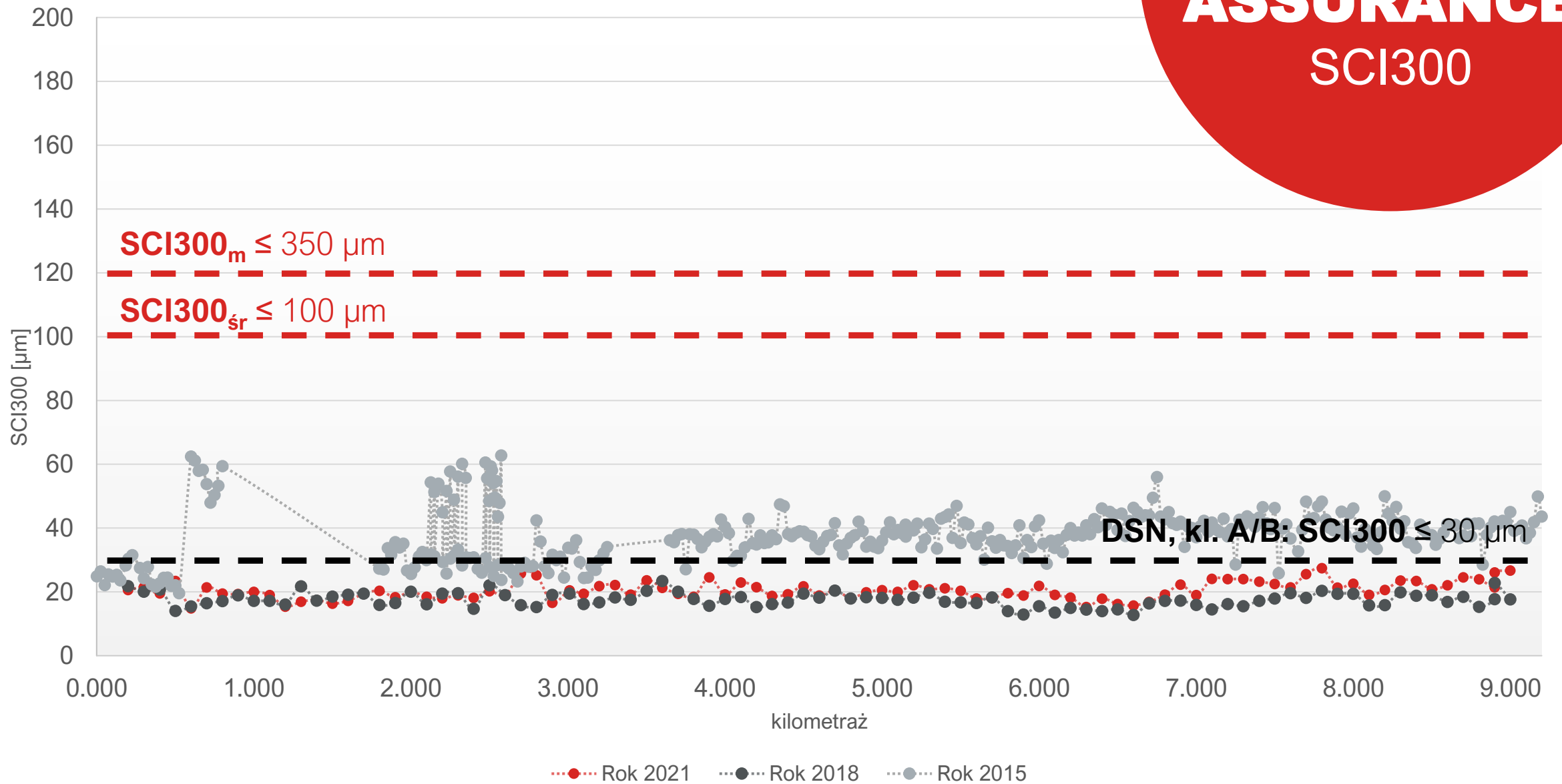
CENTRAL DEFLECTIONS, RIGHT SIDE, SLOW LANE





OPACZ – PASZKÓW

SCI300, RIGHT SIDE, SLOW LANE



**LONG LIVE
50 YEARS**

2015





AND THE STORY
GOES ON...



IMPLEMENTING **HiMA** 45/80-80



Asfalt

Asfalt
drogowy
zwykły



Polimer
SBS

Asfalt

Asfalt
modyfikowany

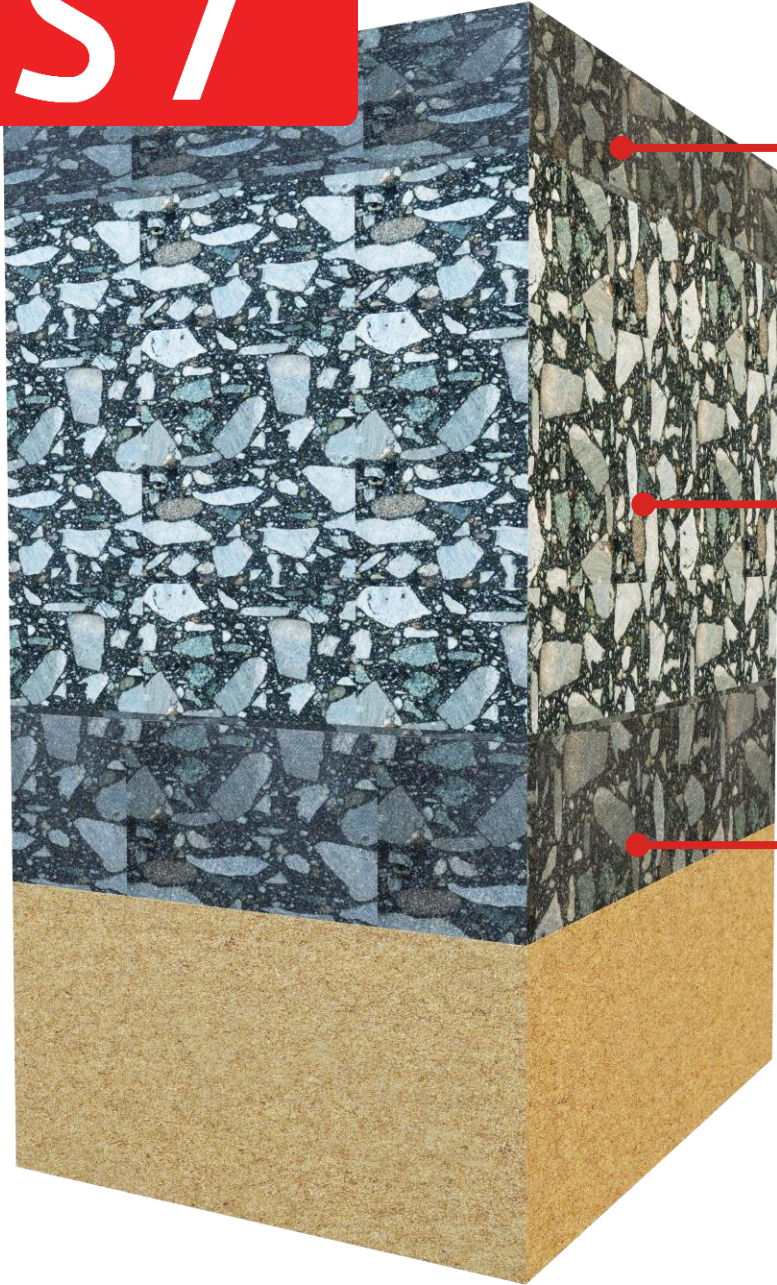


Polimer
SBS

Asfalt

Asfalt
wysokomodyfikowany
(długowieczny)

S7



3 cm

SMA 8 ARB

17 cm

AC WMS 16

PMB 25/55-60

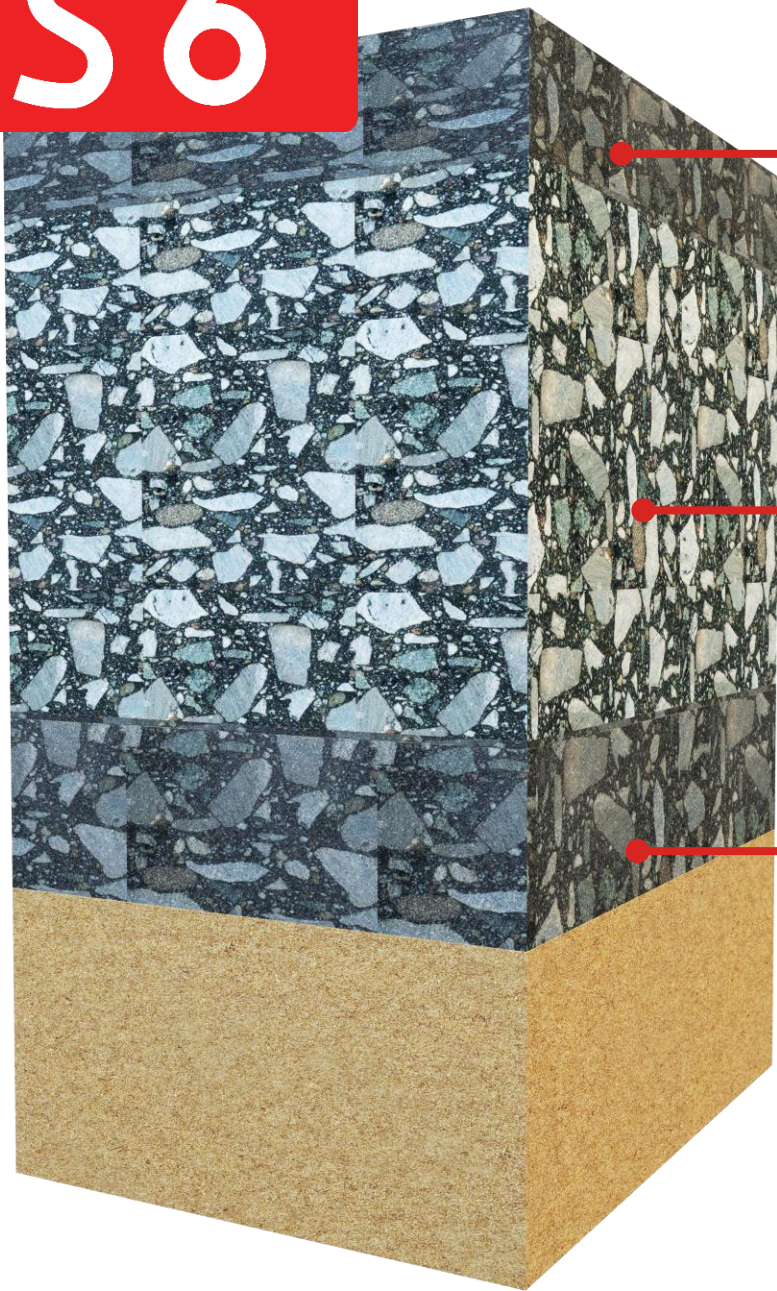
6 cm

AC AF (anti-fatigue) 16

PMB 45/55-80 HiMA



S 6



3 cm

SMA 8 ARB

12 cm

AC WMS 16

PMB 25/55-60

7 cm

AC AF (anti-fatigue) 16

PMB 45/55-80 HiMA





EFRA
EFEKTYWNA RAFINACJA

**GDAŃSK
REFINERY**

2018



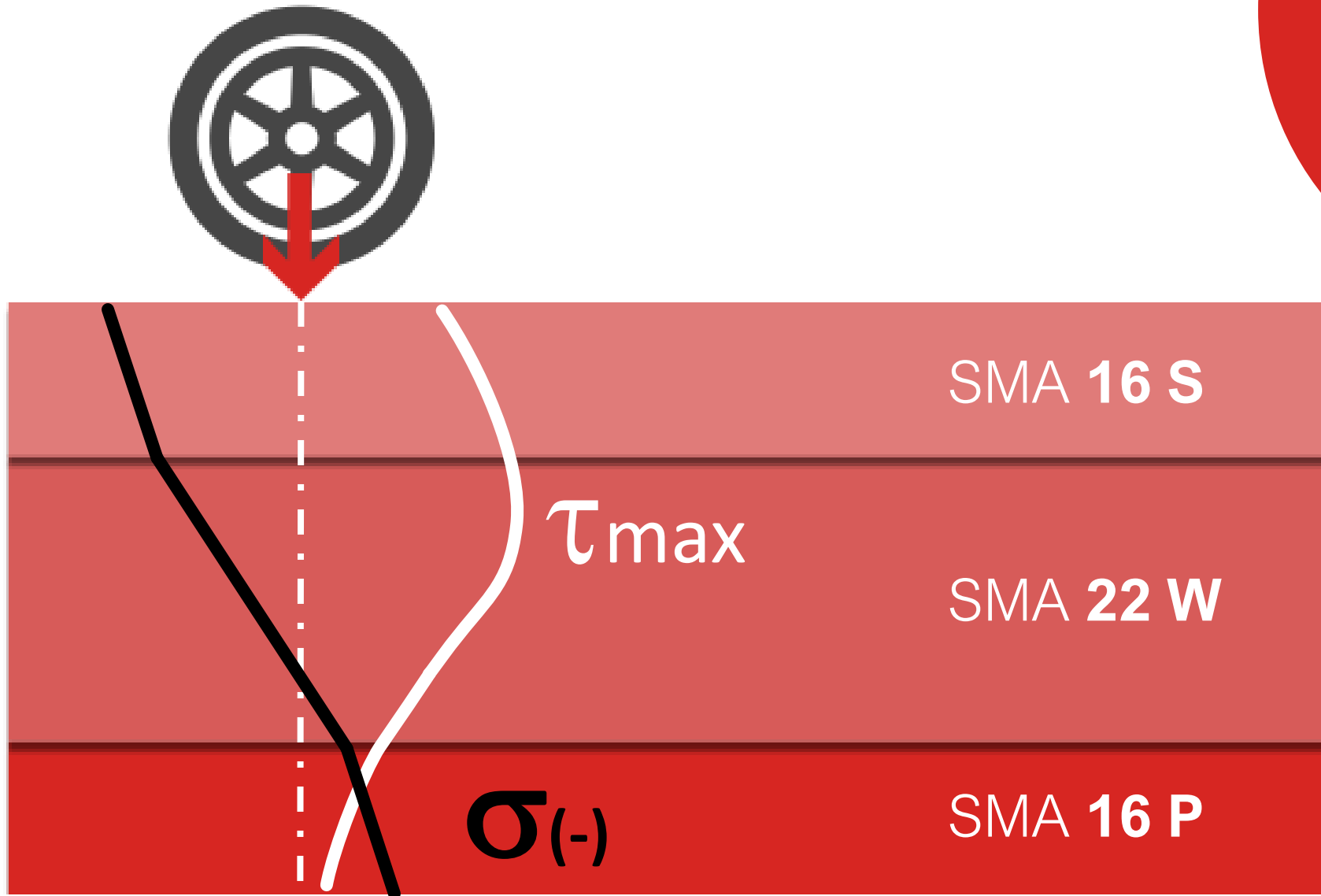
HEAVY DUTY

2018



$$E^* = ?$$

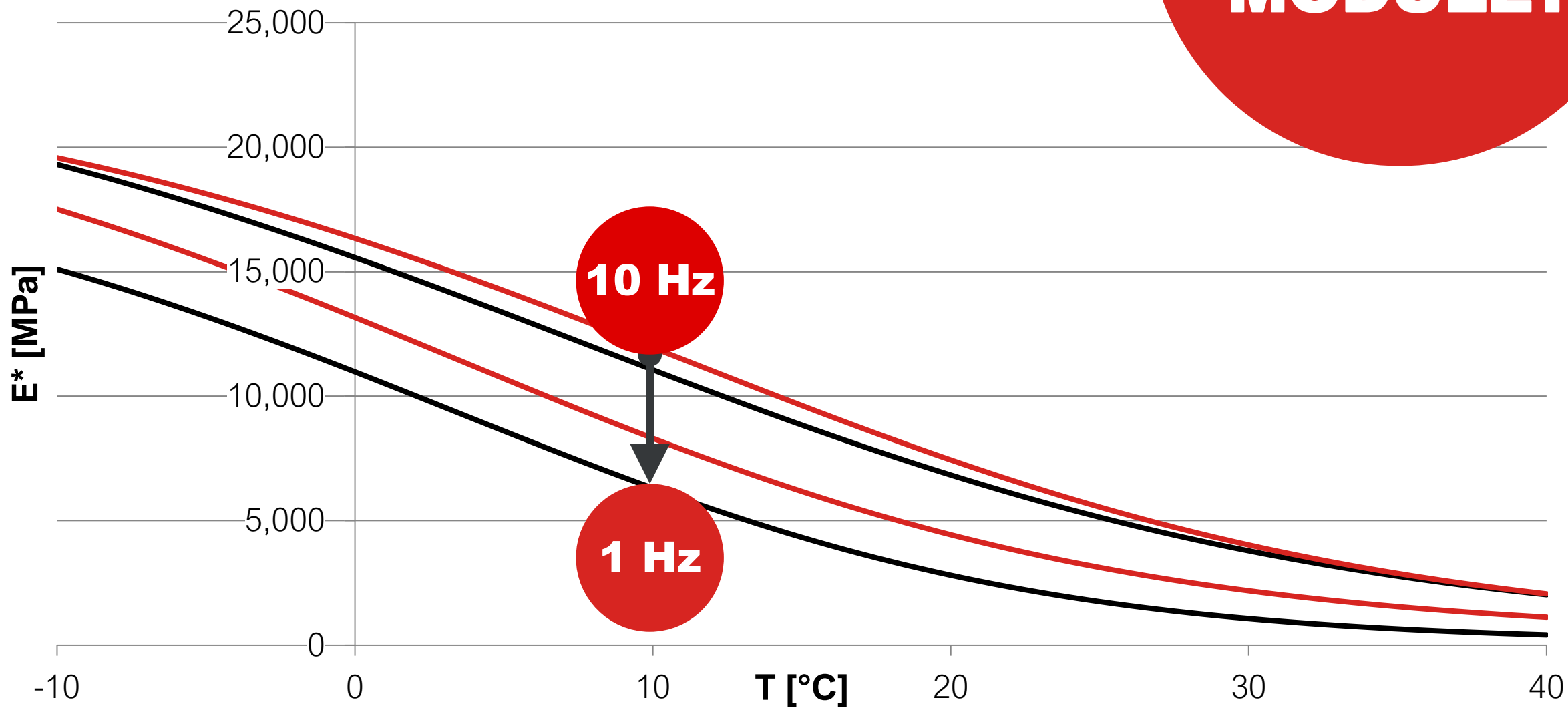
$$h = ?$$



DECREASE OF E* @ SHORTER LOAD TIME

SMA 16 P i SMA 22 W

**WHAT
MODULE?**



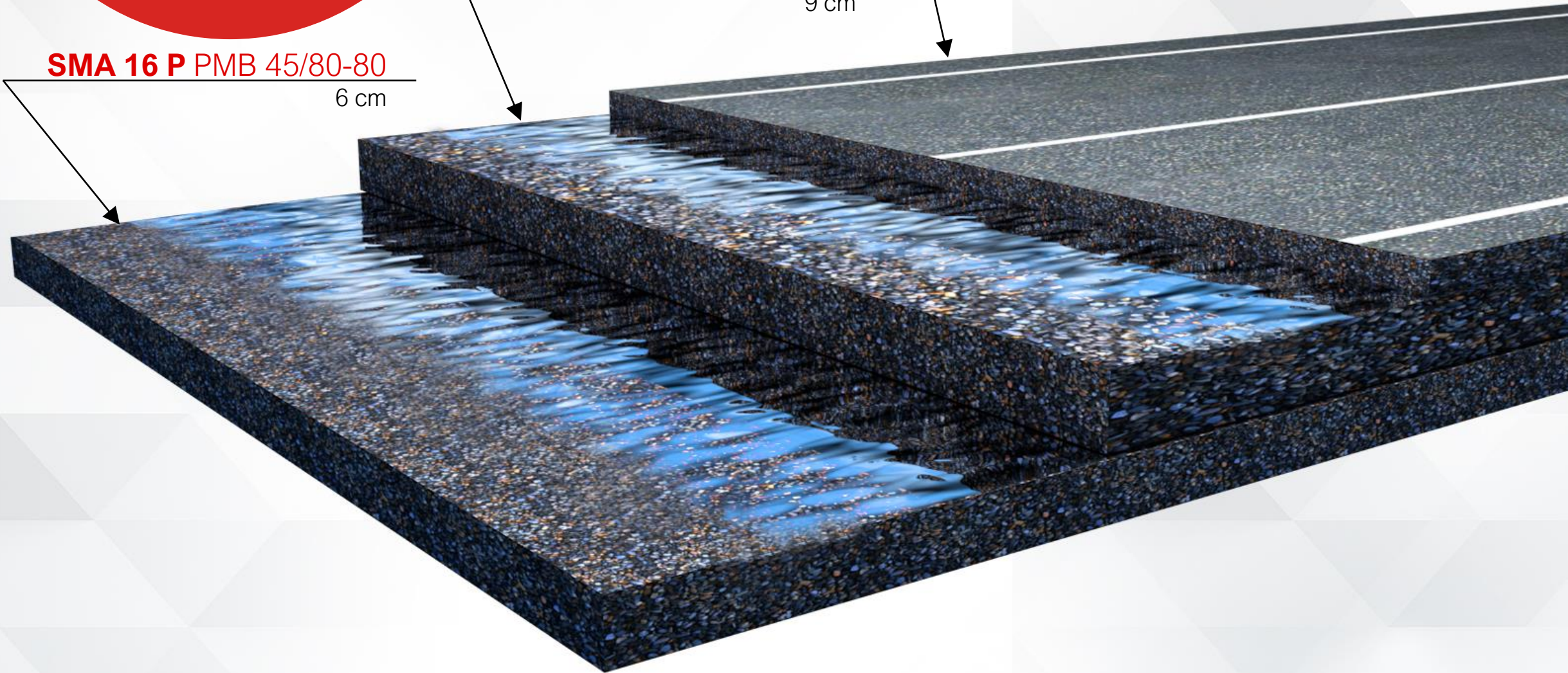
T P A

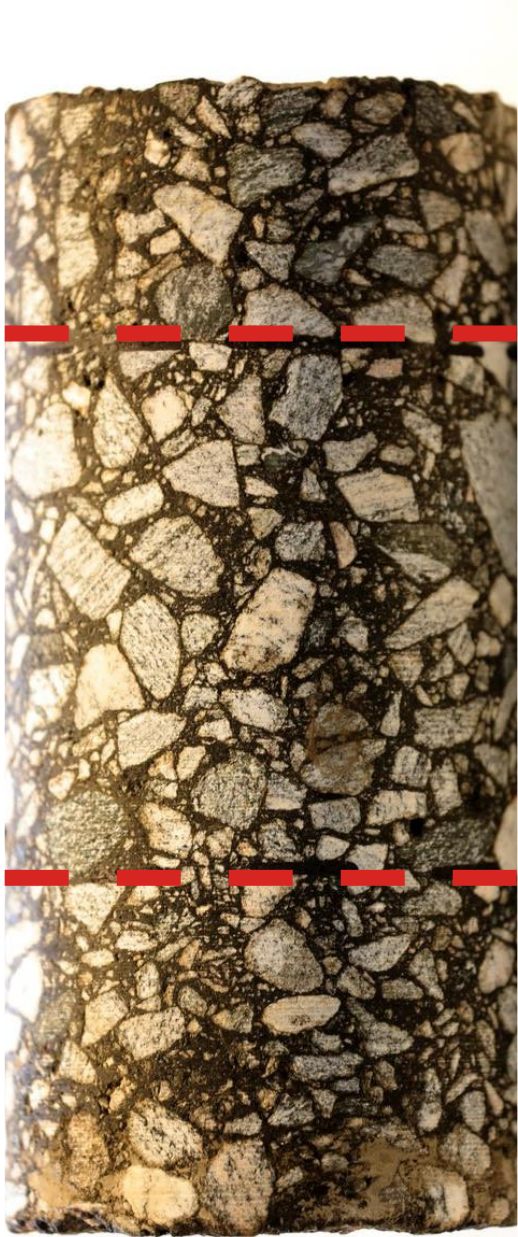
DESIGN

SMA 16 P PMB 45/80-80
6 cm

SMA 22 W PMB 25/55-80
9 cm

SMA 16 S PMB 45/80-80
5 cm





5 cm

SMA 16 PMB 45/80-80



9 cm

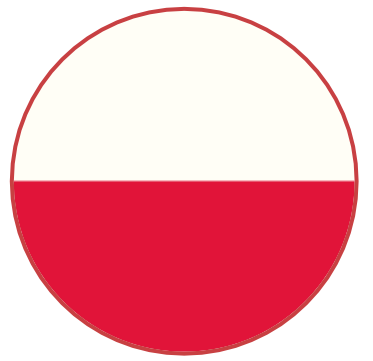
SMA 22 PMB 25/55-80



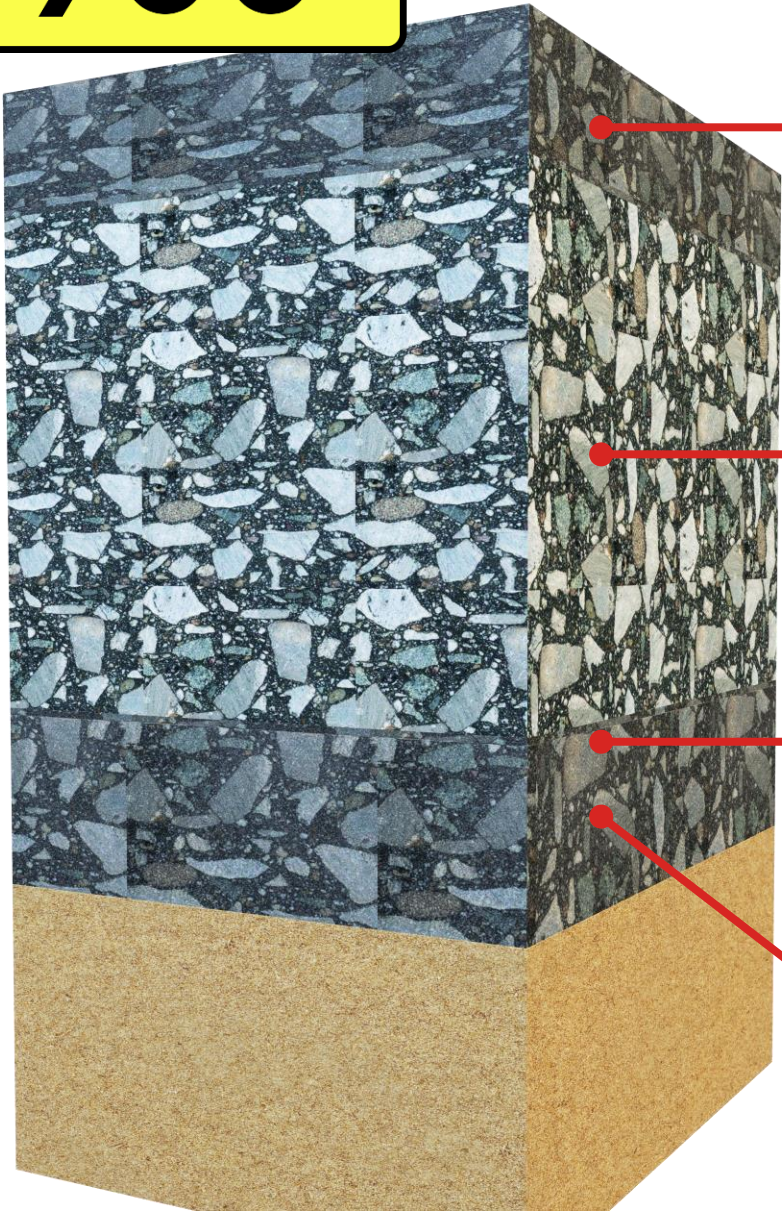
6 cm

SMA 16 PMB 45/80-80

FULL-DEPTH TRIPLE SMA



938



4 cm

SMA 11 45/80-80 HiMA

8 cm

AC 16 W

PMB 45/80-80 HiMA + hydrated lime

8 cm

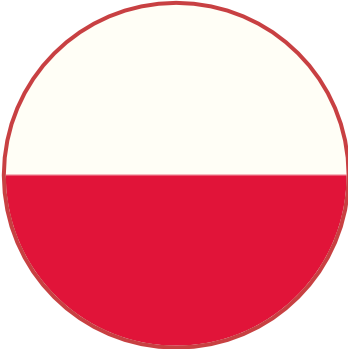
AC 22 P

PMB 45/80-80 HiMA + hydrated lime

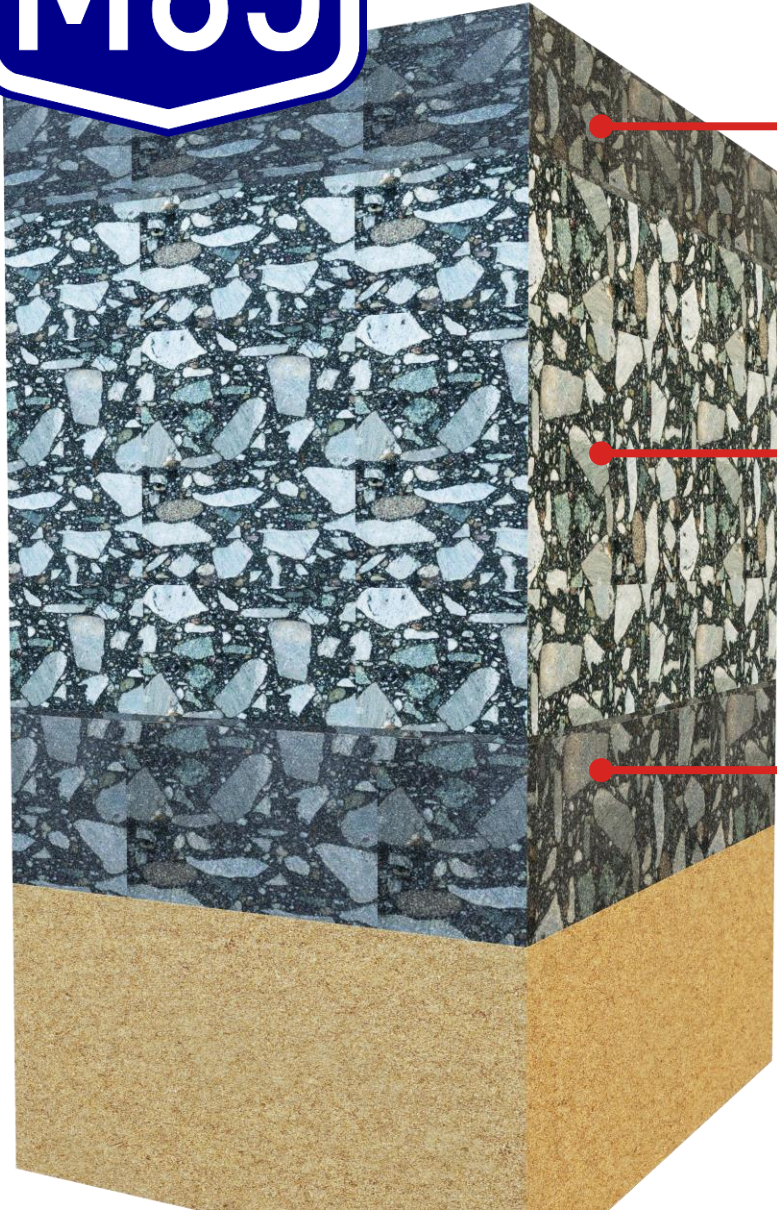
8 cm

AC 22 P

PMB 45/80-80 HiMA



M85



3 cm

SMA 8 ARB

12 cm

AC EME 16

PMB 25/55-60

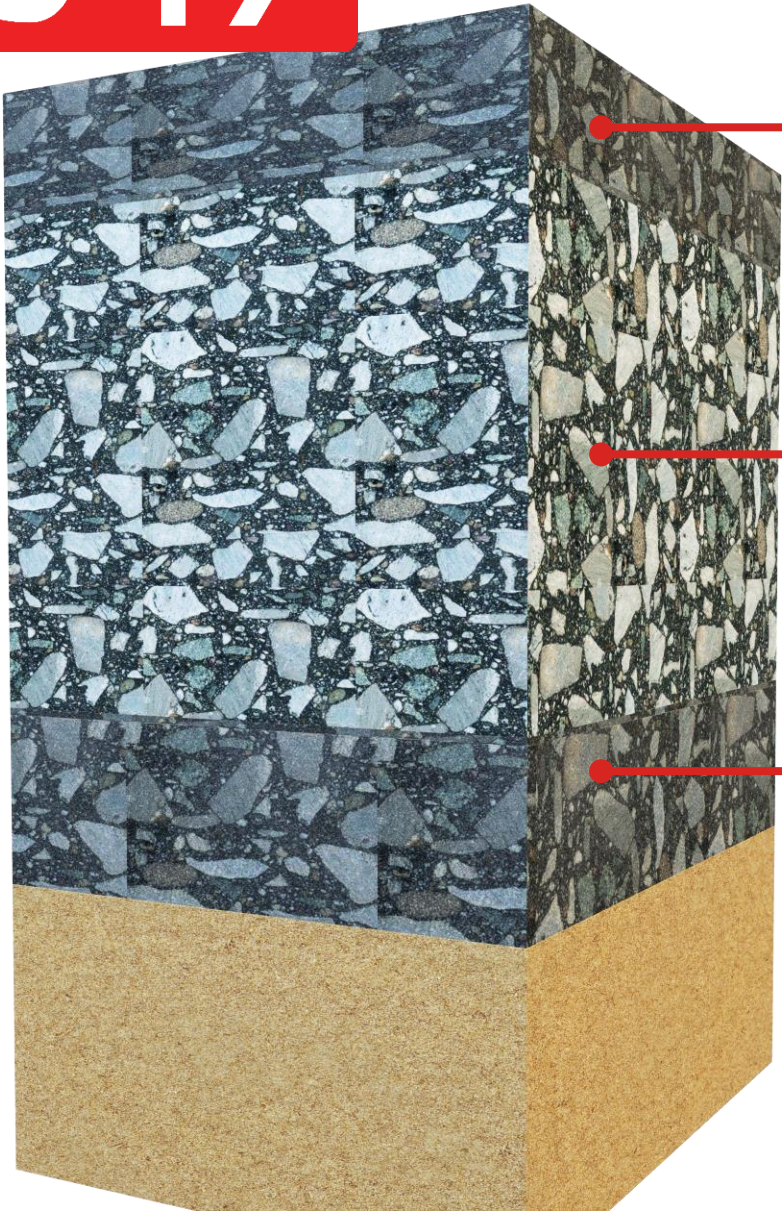
7 cm

AC AF 16

PMB 45/80-80 HiMA



S 19



4 cm
SMA 11 ARB

13 cm
AC 16 ARB

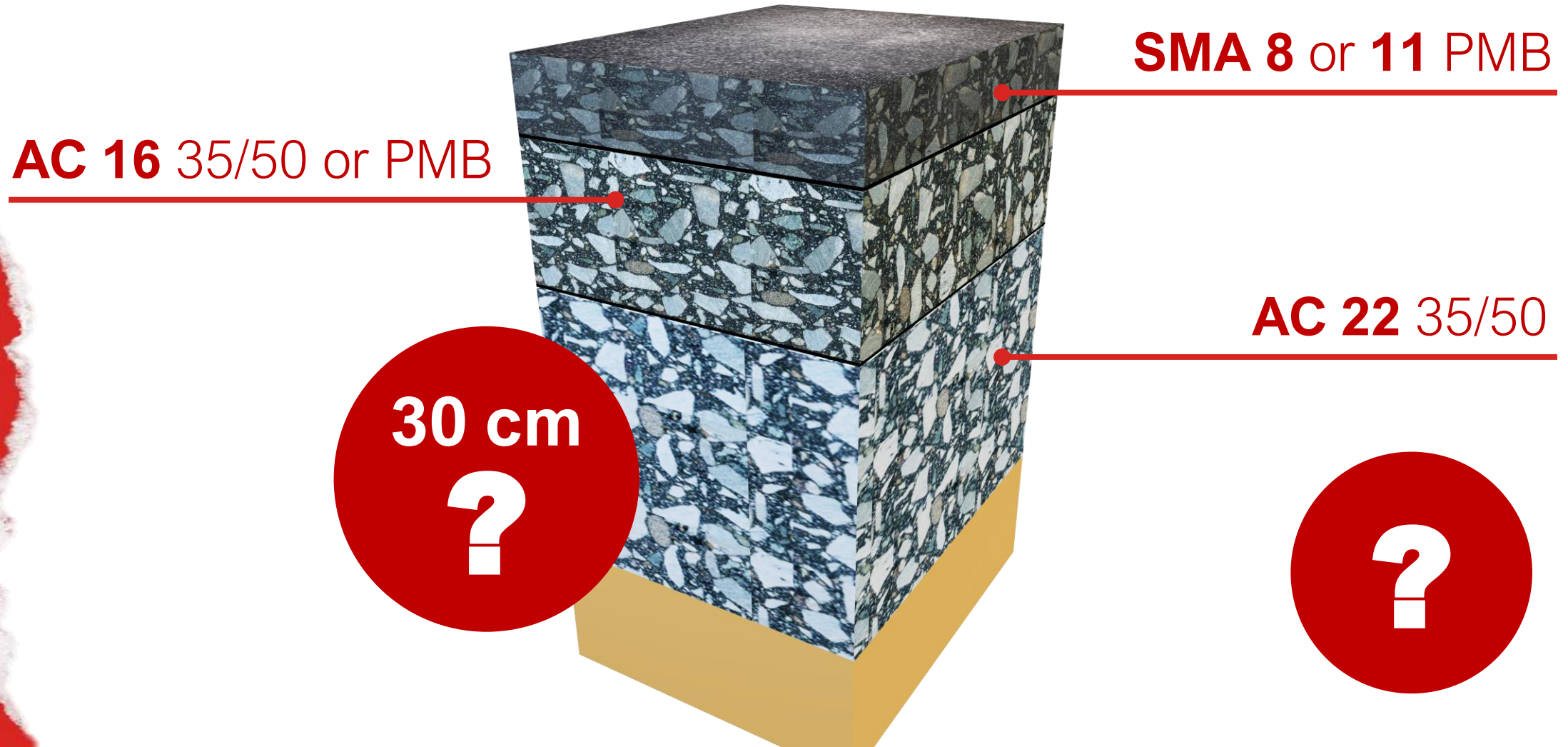
8 cm
AC AF 11 ARB



AND THE
QUESTION IS...?



FOR HOW LONG YET...?



”

You must
unlearn what
you have
learned.

Yoda, The Empire Strikes Back





Yoda, The Empire Strikes Back