ANALYTICAL PAVEMENT DESIGN - ASPHALT

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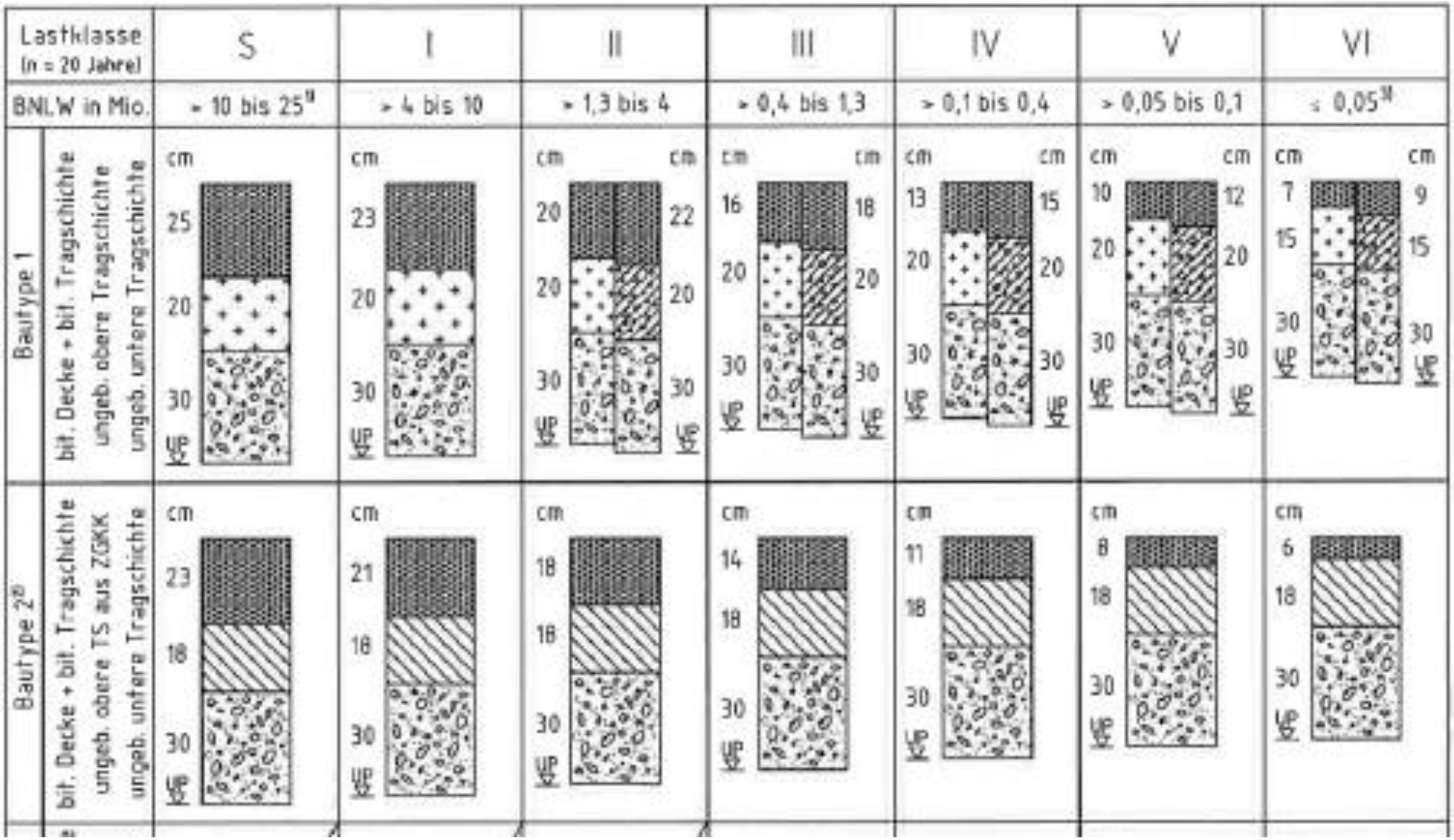
ASFiNAG BMG

Conference Asphalt Pavements 2015 in České Budějovice

Current Pavement Design



Research Project

- IVWS TU-Wien
- ISBS TU-Braunschweig
- OMV Refining & Marketing GmbH
- Teerag Asdag AG
- Swietelsky Bauges.m.b.H.

Input Quantities

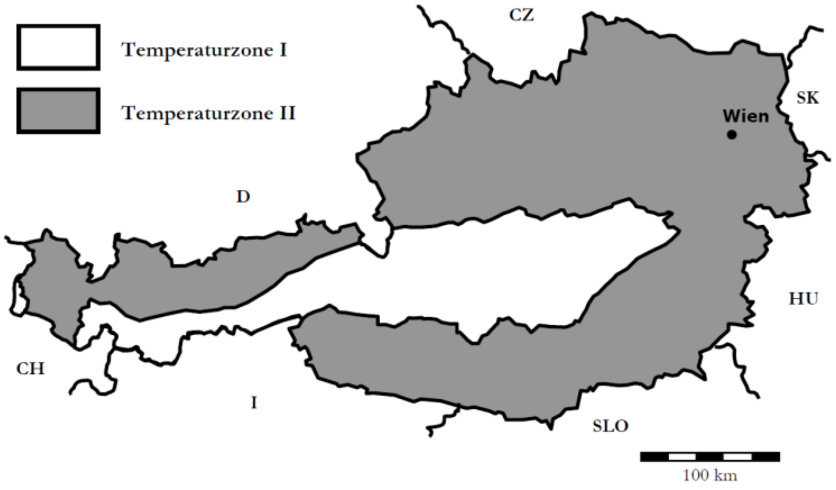
- significant traffic loads
- climate
- material properties
  - subgrade bearing capacity
  - unbound and bound layers
  - asphalt
    - performance based requirements
    - stiffness behavior
    - Fatigue behavior

Traffic Loads

HGV traffic volume	distribution of HGVs	distribution of HGV gross vehicle weights	Distribution of HGV axle loads	
avaliable	not avaliable	not avaliable	not avaliable	level 1
avaliable	avaliable	not avaliable	not avaliable	level 2
avaliable	avaliable	avaliable	avaliable	level 3

Climate

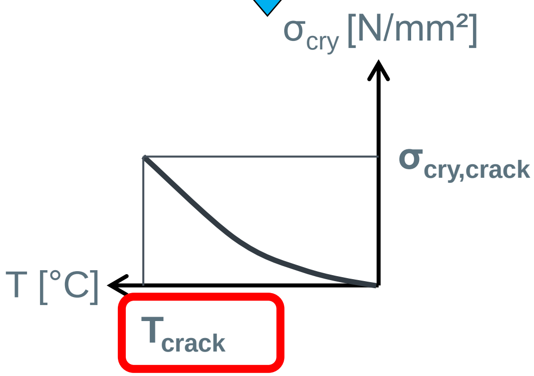
- two significant climate zones
  - bearing capacity of subgrade
  - stiffness of asphalt

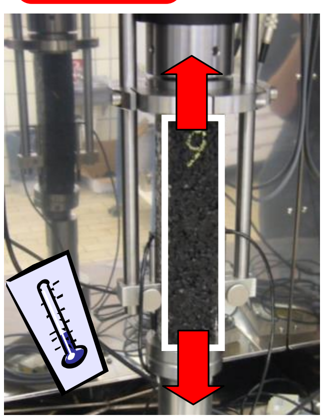


- 2 climate zones and 12 representative asphalt temperature profiles
- day- and night temperatures
- realistic profiles of temperature for each period

Performance Based Requirements

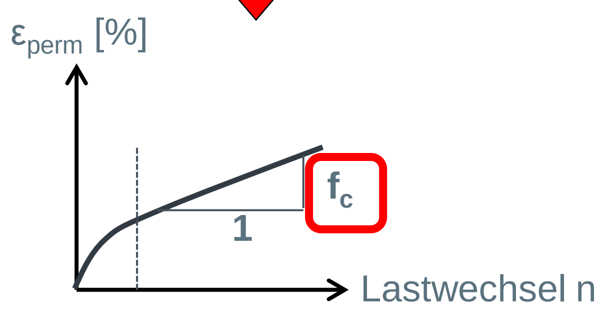
Low Temperature

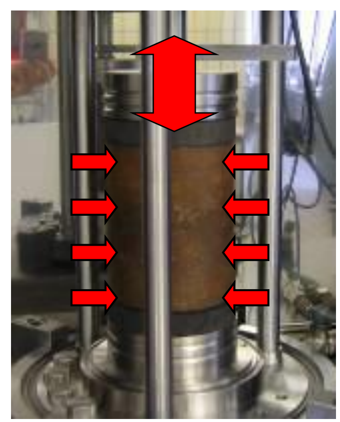




cool down test
EN 12697-46 (2012)

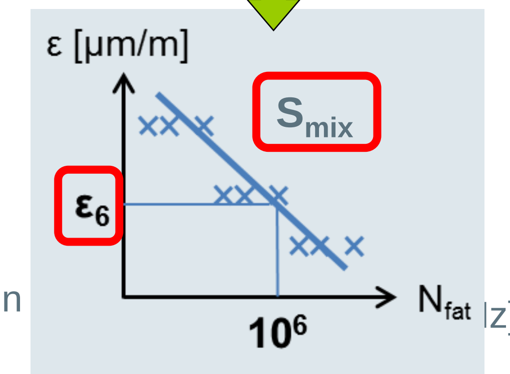
Deformation

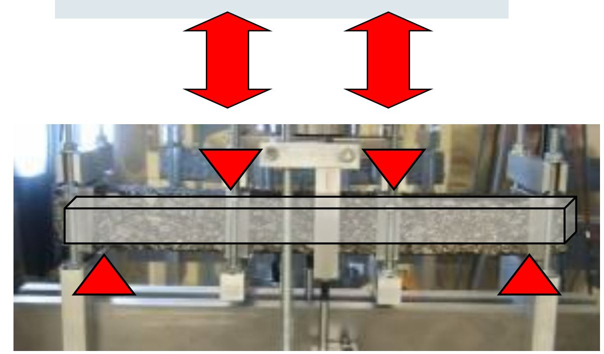




triaxial test
EN 12697-25 (2005)

Stiffness and Fatigue





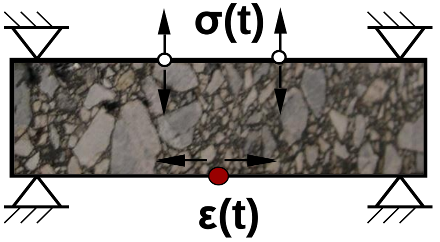
4 point bending test
EN 12697-24 (2012)
EN 12697-26 (2012

Stiffness Behavior

HMA volumetric data	G* from DSR test (EN 14770)	HMA stiffness Smin declared at 20°C (EN 13108)	
avaliable	not avaliable	not avaliable	level 1
avaliable	avaliable	not avaliable	level 2
avaliable	not avaliable	avaliable	level 3

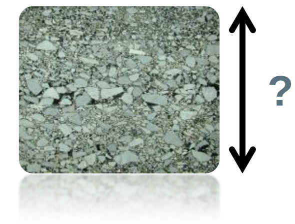
Fatigue Behavior

- determination of ε_6 with the four point bending test EN12697-24
- producer assures with inital test



ε_6 [µm/m]
90
130
190
250

Verification – Analytical Design



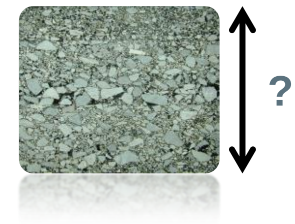
- design process:

$$\frac{N_{erw}}{N_{zul}} \leq 1$$

N_{erw} … expected number of passages (impact)

N_{zul} … number of load cycles pavement resits (resistance)

Example for Design

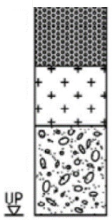


Boundary conditions:

- climate zone II
- representative heavy traffic collective
- distribution of vehicle groups from toll data
- stiffness behavior of model bitumen (bitumen and polymer modified bitumen)
- declared fatigue behavior

B	$\varepsilon_{6\text{-}130}$
pmB	$\varepsilon_{6\text{-}190}$ $\varepsilon_{6\text{-}250}$ $\varepsilon_{6\text{-}300}$

Evaluation of the results

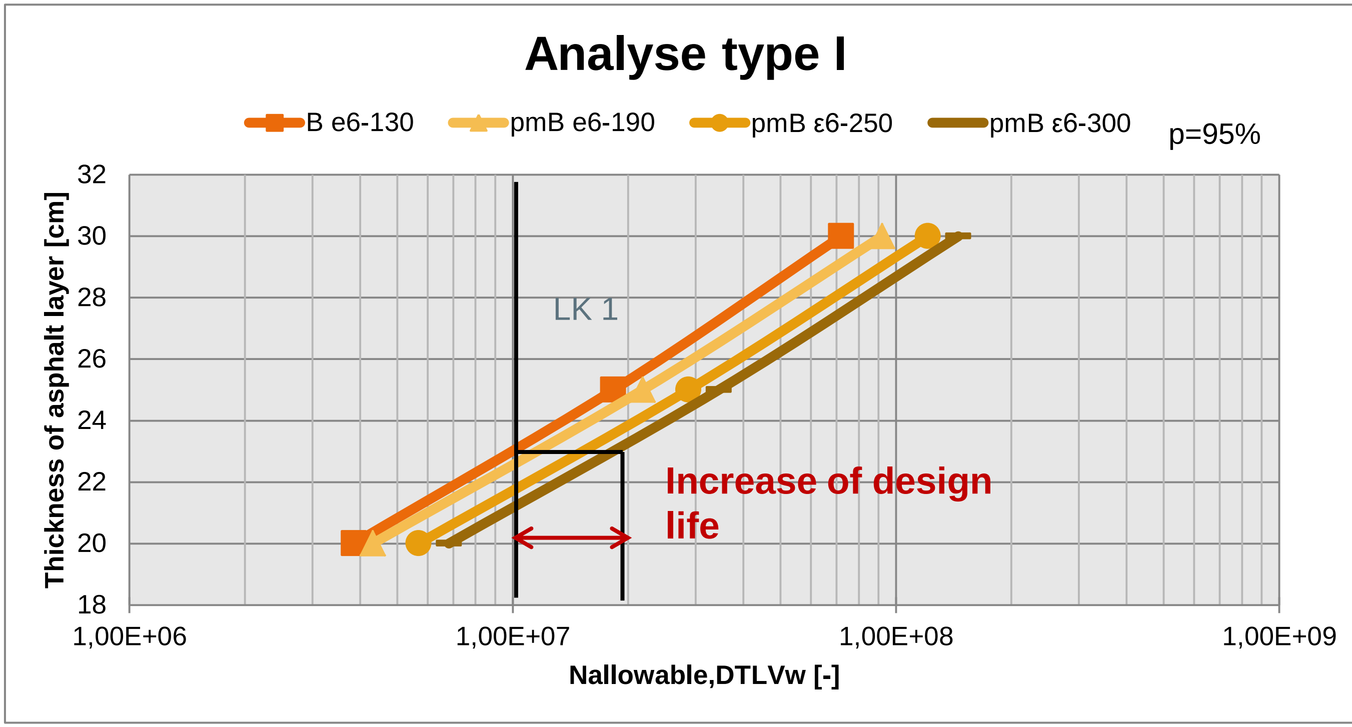


cm

20-30 bitumious layer

20 unbound upper layer

30 unbound lower layer



Conclusion

- The current pavement design is limited to standardized input quantities for material properties and traffic loads

- Analytical pavement design enables:
  - Free design
  - Consideration of real vehicle weights and axle loads of the heavy traffic
  - Consideration of real material properties of the asphalt (stiffness & fatigue behavior)
  - Implementation of performance based requirement
  - Cost effectiveness

- New Austrian standard (RVS) for analytical pavement design – Asphalt roads (RVS 03.08.68) asfinag.at