

# BUILDING ROADS WITH HYDRATED LIME IN EUROPE... FEEDBACK FROM EXPERIENCE



**EuLA** - The European Lime Association



1. WHAT IS HYDRATED LIME?
2. BUILDING SITES – EXAMPLES
3. RESEARCH RESULTS



# 1. WHAT IS HYDRATED LIME?

## PRODUCTION

Burning

- $\text{CaCO}_3$  (Limestone)



Deglaze

- $\text{CaO} + \text{CO}_2$  (Burnt Lime)



- $\text{Ca(OH)}_2$  (Hydrated Lime)



# 1. WHAT IS HYDRATED LIME?

## DESCRIPTION



A natural product of limestone

- Particle size:  $< 0,063 \text{ mm}$  → it is a filler
- Spec. surface:  $\sim 18 \text{ m}^2/\text{g}$
- Bulk density:  $\sim 350 \text{ kg}/\text{m}^3$
- Strongly alkaline:  $\text{ph} > 12$



# 1. WHAT IS HYDRATED LIME?

## USE



Flue gas cleaning → **Eliminates undesirable substances**



Soil stabilization → **Improves mechanical performance**



Binder in mortar & plaster → **Coupling agent and increases the elasticity**



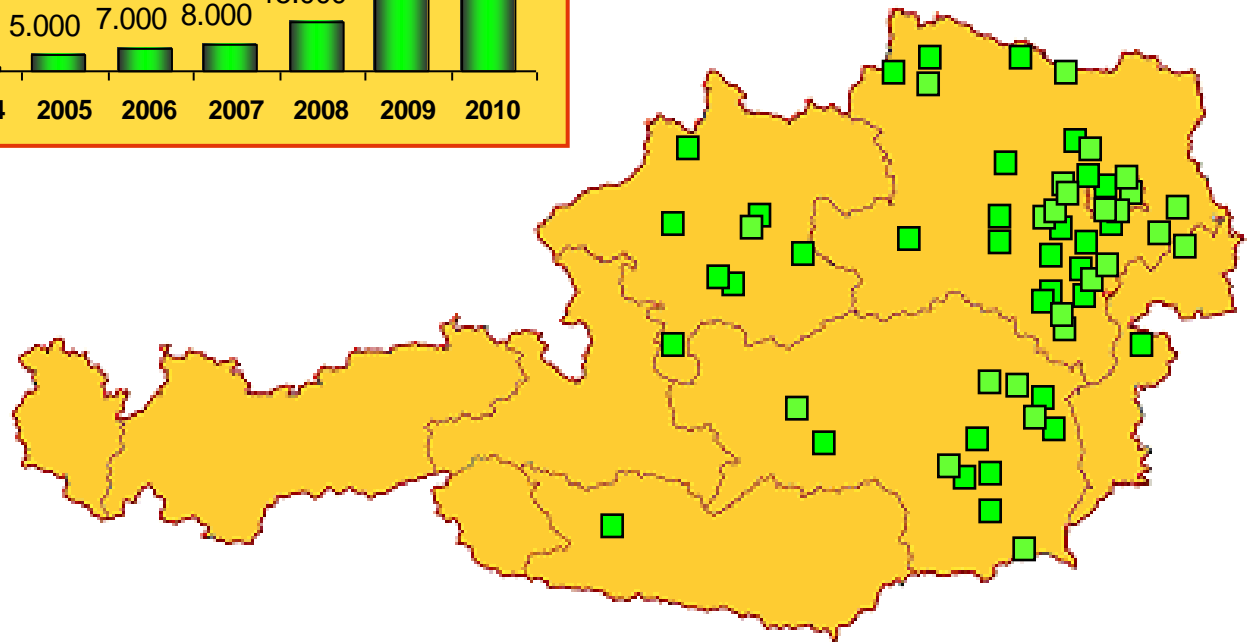
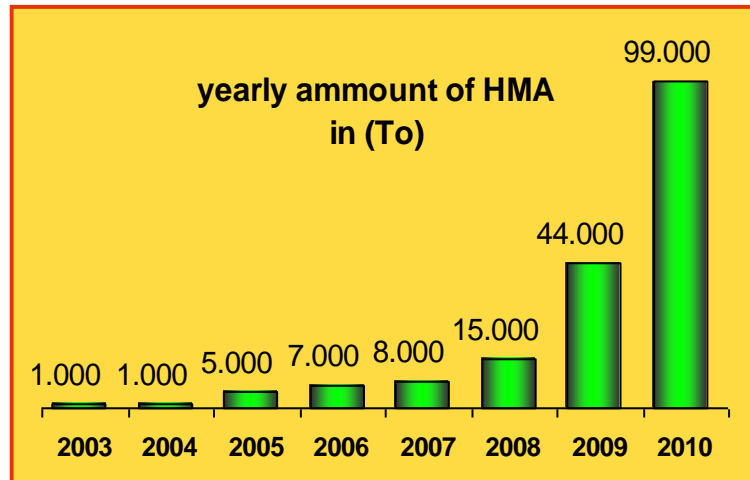
**Hot mix asphalt**



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# 2. BUILDING SITES - EXAMPLES

## AUSTRIA



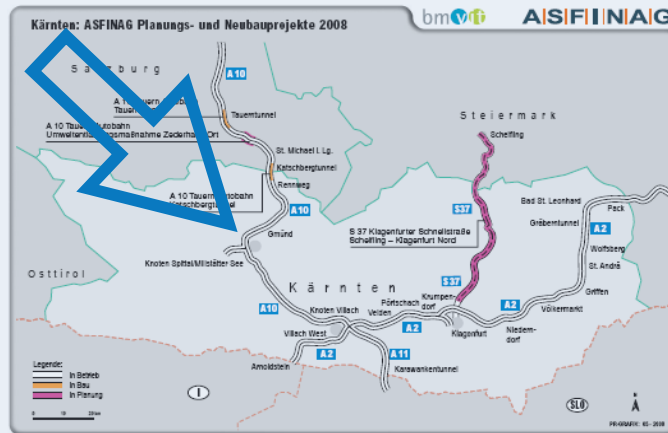


# 2. BUILDING SITES - EXAMPLES

## AUSTRIA – A 10 Lieserhofen



- ~ 18.000 vehicles / day
- 2,5cm LDDH on concrete
- PmB 50/90S & hydrated lime





# 2. BUILDING SITES - EXAMPLES

## AUSTRIA – L381-Abfahrt A9



**Without hydrated lime**  
**Rutting: 10,1 %**



**With hydrated lime**  
**Rutting: 5,1 %**



# 2. BUILDING SITES - EXAMPLES

## AUSTRIA – Vienna A 22

- 3,5 cm SMA 11 PmB
  - 8,5 cm AC 22 binder PmB
  - 12 cm AC 32 binder PmB
- **30% hydrated lime in the filler**



*Km 4,5 – 12,1 RFB Stockerau*

- 100.000t Hot mix asphalt
- from 4 Mixing plants



*Km 11,8 – 10,5/7,5 – 4,5 RFB  
Wien*

# 2. BUILDING SITES - EXAMPLES

## FRANCE – Vosges, RD 486

- 400t of HMA (AC 10 surf 50/70 BBSG)
- 1,5% Hydrated Lime



*Conseil Général des Vosges  
(French Public Road Manager)  
09/2011*





# 2. BUILDING SITES - EXAMPLES

## FRANCE – A132 & A29



- BBTM 10 35/50
- 1,5% of Hydrated Lime



*North and East French Highway network*



*A 132, 04/2011  
40 kT HMA*



*A 29, 04/2010  
46 kT HMA*



# 2. BUILDING SITES - EXAMPLES

## ITALY – High Speed Track



- Balocco high speed test track (2008)
- 8 km track for car testing. HL mandatory for wearing course.



# 2. BUILDING SITES - EXAMPLES

## ITALY – Tollways



- Tollway Brennero-Modena
- 313 km total length
- HL for wearing course (mandatory from June 2012)



- Tollway Piacenza Cremona Brescia
- HL mandatory for 17 km of brand new highway
- Application: pourous asphalt (2011)



- Tollway Brescia Verona Vicenza Padova
- HL recommended in guideline



- Passante di Mestre (34 km of A4 tollway)
- HL mandatory for pourous asphalt

# 2. BUILDING SITES - EXAMPLES

## NORWAY – E6 Lillehammer



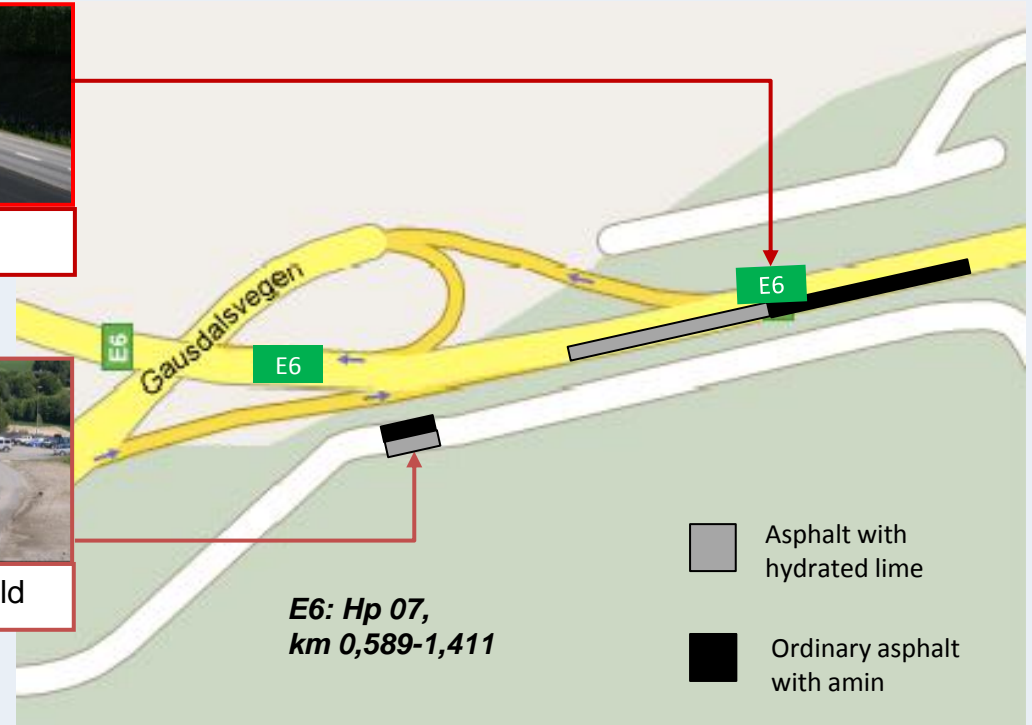
Asphalt performance  
(Field trial, 2009)



Field trial



Sampling test field

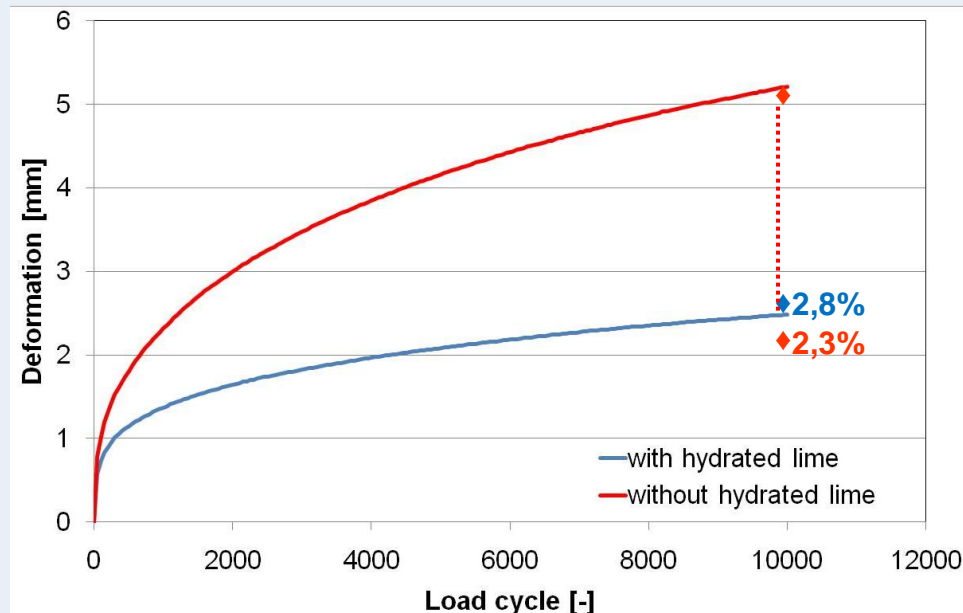


# 2. BUILDING SITES - EXAMPLES

## NORWAY – Field Trial, 2009



### Asphalt performance : Deformation & Ageing - Wheel track\*



200 mm  $\varnothing$  drill core from field trial (E6):

- 3 years old\*
- 2% air voids
- n = 10

**Half deformation after 10.000 load cycles\* with hydrated lime**





# 2. BUILDING SITES - EXAMPLES

## POLAND - Kielce, Żelazna street



Wearing course – SMA 0/12,8 - 4 cm Designed for 20 years of operation

- Section I – hydrated lime
- Section II - amine



Component	Fraction [mm]	Content [%]
Quartzite sandstone	2/6,3	10
	6,3/12,8	53
Dolomite	2/6	15
Limestone	0/4	12
Limestone flour		7
Slaked lime $\text{Ca}(\text{OH})_2$		3
Bitumen 50/70 + SBS 4%		6,1

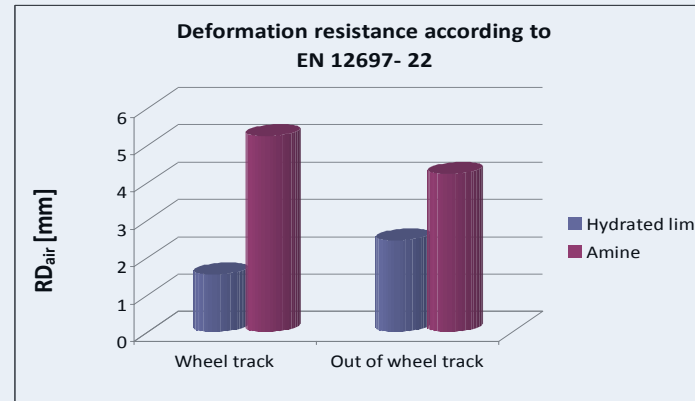
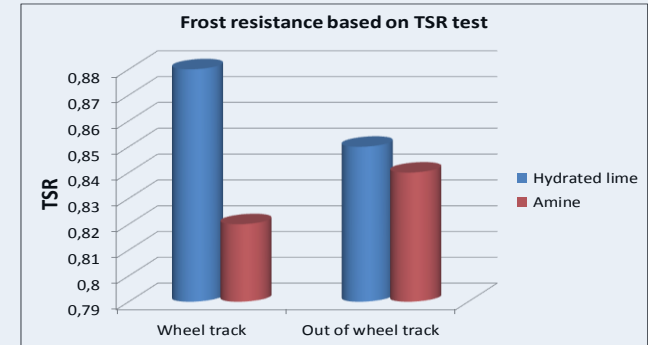
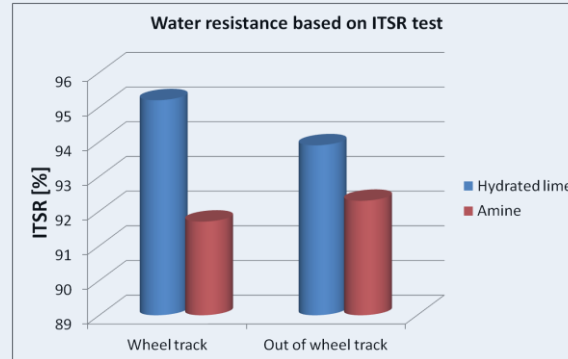


# 2. BUILDING SITES - EXAMPLES

## POLAND - Kielce, Źelazna street



### Results after 12 years





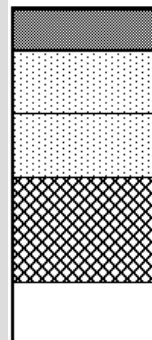
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# 3. RESEARCH RESULTS



S35 Murtal Schnellstraße - km 27,5 - km 23,8, RFB Bruck/Mur, built in 2008



## Without lime

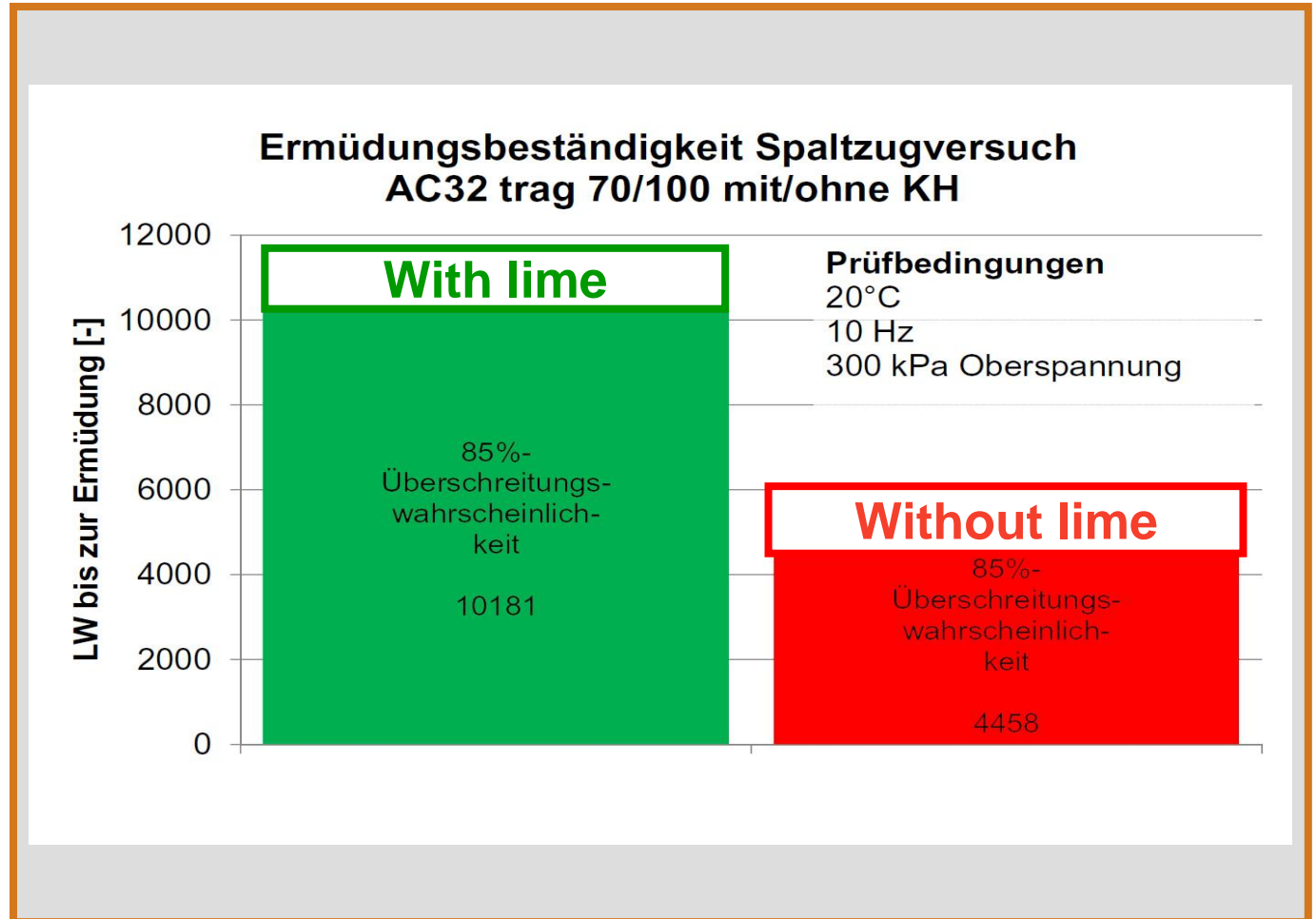
3,5	SMA 11 PmB 45/80-65, S3, G1
6,0	AC 22 binder PmB 45/80-65, H1, G4
6,0	AC 22 binder PmB 45/80-65, H1, G4
9,5	AC 32 trag 70/100, T1, G4
k.A.	bestehende ungebundene Tragschicht

## With lime

	SMA 11 PmB 45/80-65, S3, G1, Ka30
	AC 22 binder PmB 45/80-65, H1, G4, Ka30
	AC 22 binder PmB 45/80-65, H1, G4, Ka30
	AC 32 trag 70/100, T1, G4, Ka30
	bestehende ungebundene Tragschicht



# 3. RESEARCH RESULTS



# 3. RESEARCH RESULTS

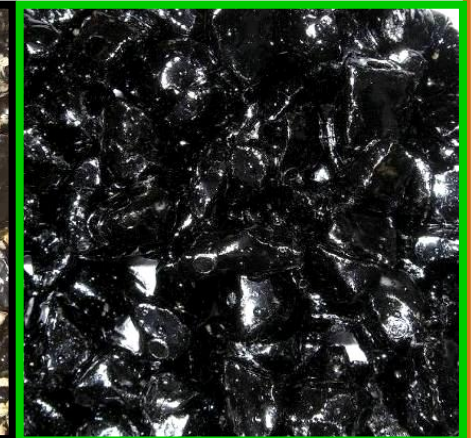
**Hydrated lime increases the adhesion behavior of acid aggregates**

- *Quartzite from Styria (Austria), with bitumen 70/100 after immersion in water.*

Bitumen **without**  
**additive**

with 3% milled  
limestone

with 3% **hydrated lime**



# 3. RESEARCH RESULTS

Hydrated lime increases the adhesion behavior of acid aggregates

- Quarzite from Slovakia with Bitumen 50/70 and PmB 45/80-75, after 24 h waterstorage

Bitumen 50/70 with limestone



Bitumen 50/70 with hydrated lime



PmB 45/80-75 with limestone



PmB 45/80-75 with hydrated lime





# State of the Art: at the mixing plant

- **Amount of delivery:** 12 t (30m<sup>3</sup>) or 24 t (60m<sup>3</sup>)
- **Dosing:** over filler weigh or plastic bags
- **Storage:** dry 6 months minimum





# SUMMARY



without



with lime

## adhesion



## fatigue



## rutting



Abbildung 1: rechter Probekörper, Bohrkern 1 und 2 nach 30.000 Zyklen



Abbildung 1: rechter Probekörper, Bohrkern 5 und 6 nach 30.000 Zyklen