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RECYCLING MATERIALS FROM ROAD PAVEMENTS

The Austrian Approach to Recycling of Concrete Pavements

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Overview

- The need for recycling
- General requirements
- The Austrian situation
- Recycling concrete pavements in Austria
  (> 20 years experience)
- EU-project DIRECT_MAT
- Conclusion

The need for recycling

Advantages

- Conservation of natural resources
- Limitation of landfills
- Reduction of transportation distance
- Homogeneous material with proved behaviour over years

The need for recycling

Example

A1 Vienna - Salzburg

~ 290 km → ~ 3.200.000 m² pavement → ~ 700.000 m³ aggregate

The need for recycling

Choice 1

~ 700.000 m³

> 200% concrete for Burj Khalifa

The need for recycling

Choice 2

~ 700.000 m³

Landfilling ¾ volume of Teotihuacan pyramid

General requirements for recycling technique

- Wide spectrum of application
- Maximum recycling quote of old concrete
- Avoidance of « downcycling »
- No reduction of quality compared to natural resources
- Conformity with national rules and standards

General requirements

RVS 08.17.02 (also available in English: www.fsv.at)

Required aggregate sizes	GK22 or GK32, 3 fractions, of which one has a maximum aggregate size of 4 mm, the others with a minimum aggregate size of 4 mm 1)
Aggregate maximum density	given value ± 30 kg/m³
Grading D > 4 mm	GC90/15 or GC85/20
Grading D ≤ 4 mm	GF85, category in accordance with table 2 in ÖNORM EN 12620
Aggregate form	SI40
Shell content	SC10
Fine aggregate content, coarse	f1.5
Fine aggregate content, fine	f10
Freeze-thaw resistance D > 4 mm	F1
Freeze-thaw resistance D ≤ 4 mm	F1 in accordance with ONR 23303, section 11.2
Acid-soluble sulphate	AS0.8
Alkali silica reaction in accordance with ÖNORM B 3100	Load class 3
Grading D = 22, D = 32	Range AC22, AC 32

1) The use of **recycled concrete material larger than 4 mm is permissible**. To this end, the recycled concrete:

- must be resistant to frost and de-icing chemicals,

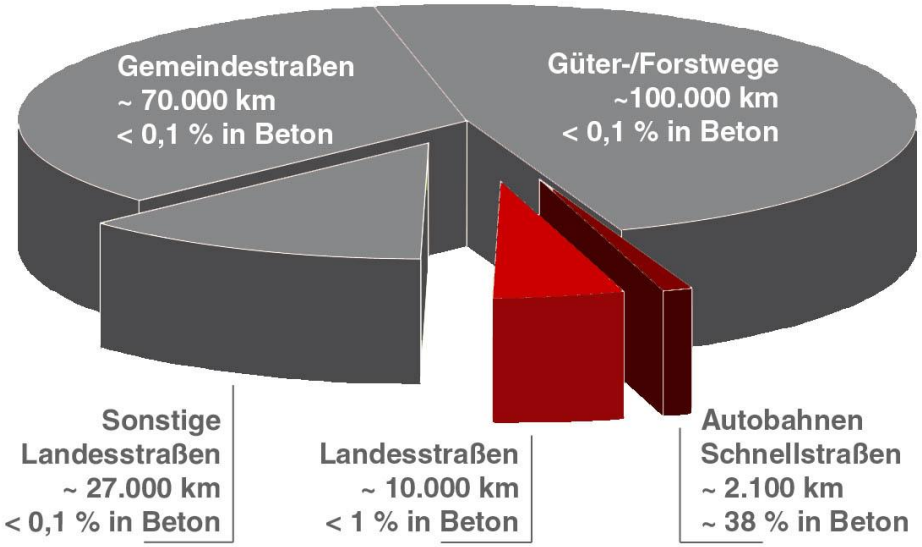
- content of bituminous material (according to ÖNORM EN 933-11) **< 20 %,**

- be **tested for alkali silica reaction** in due time on material larger than 4 mm using the accelerated test 0/4 or accelerated test 0/4 and a long-time test,

- the material shall be **sieved, cleaned from dust, and any sealants and steel removed**, so the requirements of the above table are met.

The Austrian situation

Road network Austria



The Austrian situation

Exposed aggregate surface

- Strength
- Load distribution
- Wear resistance
- Stability against deformation
- Brightness
- Noise reduction
- Skid resistance

Recycling Concrete Pavements in Austria

Demolition and Preparation

- Demolition

→ Analysing/testing

→ Relaxation

→ Breaking

→ Temporary storage

- Preparation

→ Crushing

→ Sorting

→ Washing

→ Temporary storage

→ Mono-material storage

(up to 20 % bituminous content permissible,
R&D: up to 50% possible)

Recycling Concrete Pavements in Austria

Two-lift concrete paving

- Top concrete layer = surface layer

Highest quality concrete with exposed aggregate concrete

→ Skid-/wear resistance

→ Brightness

→ Noise reduction

→ Evenness

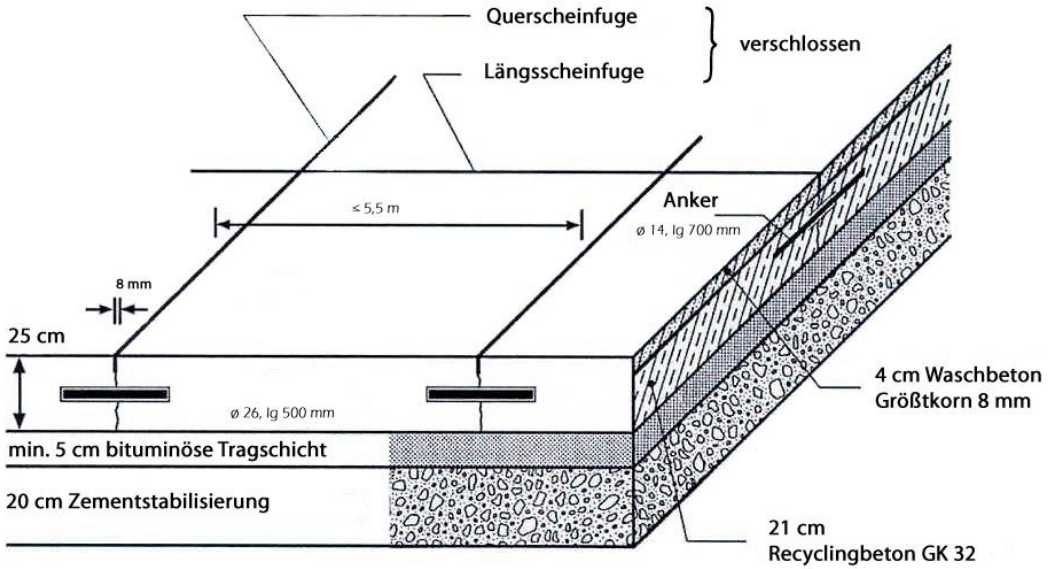
→ Stability against deformation

- Bottom concrete layer

Low-cost quality concrete with recycled aggregates ≥ 4 mm

- Casting fresh in fresh

Two-lift construction



Recycling Concrete Pavements in Austria

What about the fine aggregates?

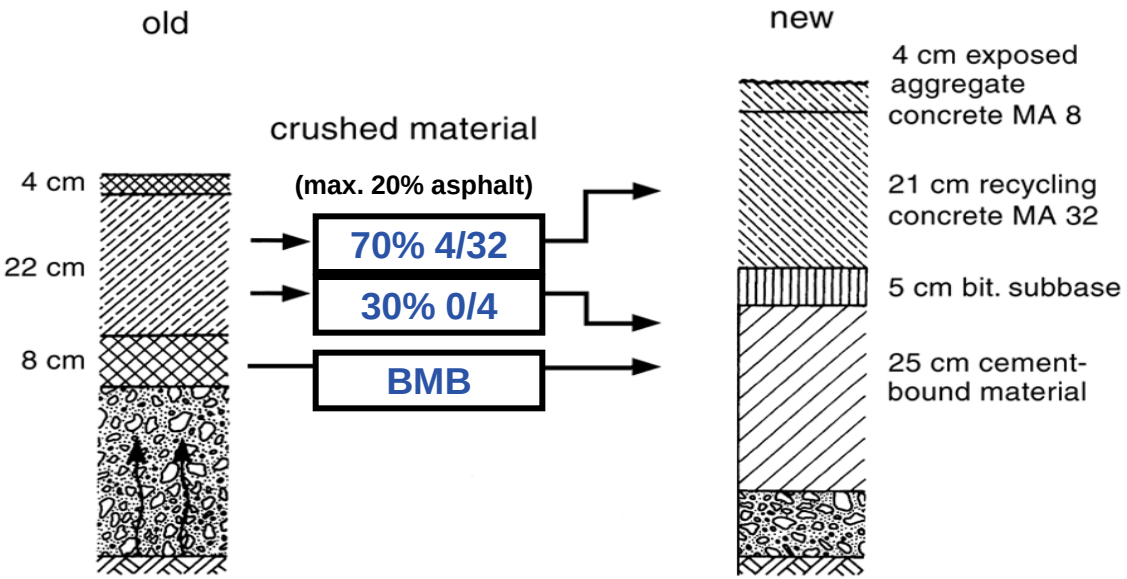
- **Difficulties with recycled aggregates ≤ 4 mm**

High water absorption, edged shape

→ Difficult workability

- **Solution**

Use for improvement of cement stabilisation



Recycling Concrete Pavements in Austria

Benefits

- Technical

Optimal use of resources

→ All the recycling aggregates can be recycled in new pavement

→ Bond between cement matrix and recycled aggregate

- Environment

→ Saving of natural resources

→ Reduction of emissions due to decrease of transport

- Costs

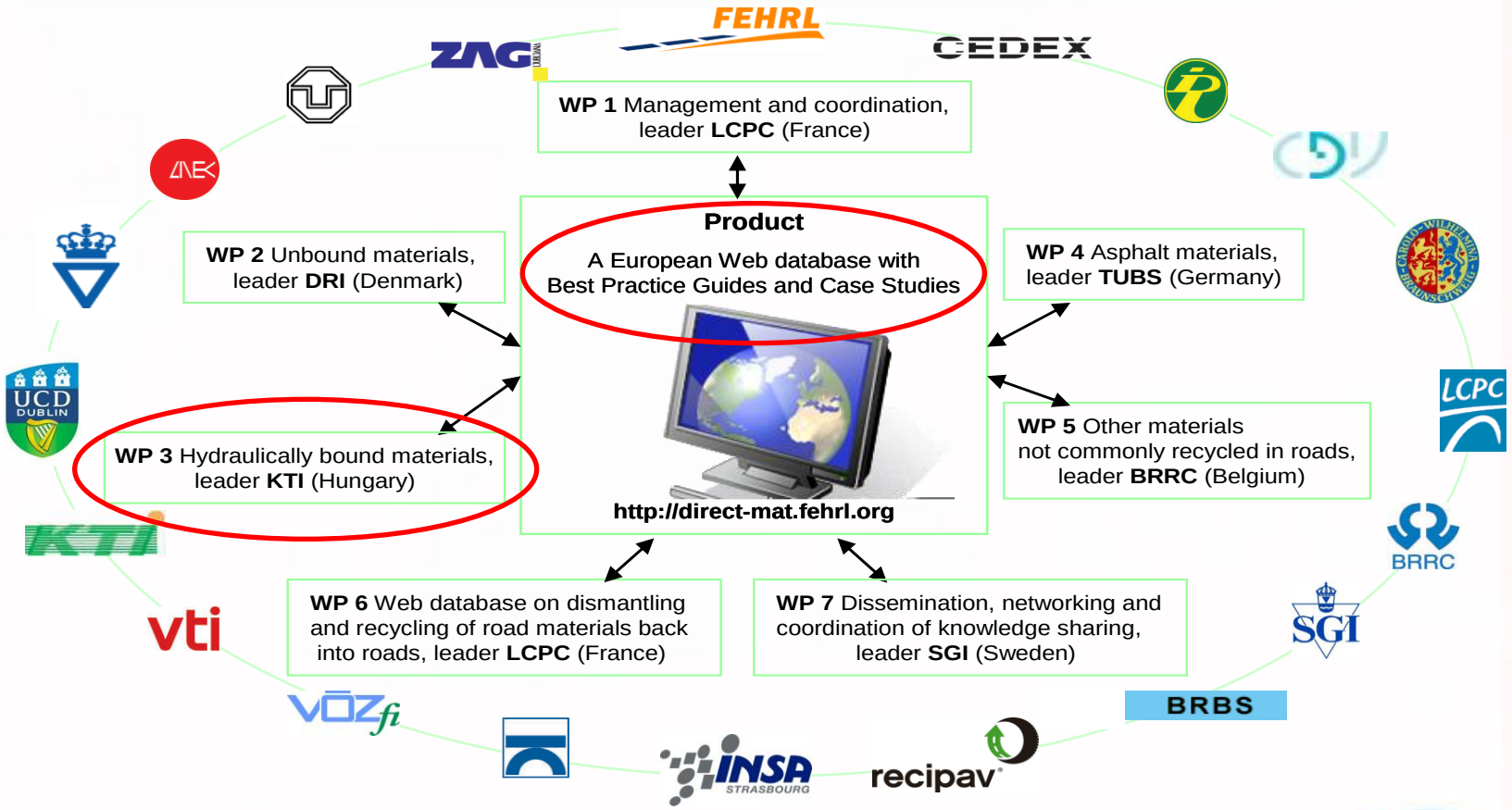
→ Optimisation of material use

→ Reduction of costs for transportation

→ Avoidance of landfilling costs

EU-project DIRECT_MAT

Overview



Outcome (WP3)

- Big differences in knowledge and use
- Some countries have good techniques
- Techniques experiences over years

Two-lift paving with recycled aggregates is a sustainable and promising technique in the next future

→ Need for dissemination of knowledge

European seminar Brussels, 2011 October 18th

Further information on http://direct-mat.fehrl.org/

Two-lift paving - a sustainable technique

- Environment

Saving natural resources

Avoidance of landfills

Reduction of emissions

- Economic

Optimised material use

Reduction of transportation costs

- Social

Surface properties

Reduction of emissions

[Wathne, 2010]

Thank you for your kind attention!

Muchas Gracias por su atenciòn!

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