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WP2 Unbound Materials
Best Recycling Practices

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FEHRL

WP2 Unbound materials

Dismantling and handling of unbound road layers

Common aspects of recycling into new unbound layers

Recycling of:

- Unbound materials
- Hydraulically bound materials
- Asphalt materials
- Mixed materials

For new unbound road applications

Best Practice Guide

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Mainly based on input from:

- Belgium
- Czech Republic
- Denmark
- France
- Germany
- Netherlands
- Slovenia
- Sweden

Literature, national standards and practices, case studies

Recycling of road materials

Recycling rates close to 100% in many countries, but also countries with large potential for further recycling

Densely populated regions with limited natural resources: Recycling systems/plants

Elsewhere more project specific

Taxes on deposited materials 0 – 50 €/ton

(Netherlands and Belgium landfilling not allowed)

Taxes on extracted virgin materials 0 – 1,8 €/ton

Best Practice Guide

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Project focuses on best technical solutions!

Not necessarily the most sustainable solution,
will be project specific

LCA and LCC tools recommended

Preparation

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Investigation of existing road:

- Layer thicknesses
- Material quality – harmful substances ?

Separate excavation of unbound layers to be recycled

Hydraulically bound layers – typically breaking, excavation and crushing

Asphalt layers – either breaking, excavation and crushing or milling of layers

Common aspects

- Deformation on loading
- Strength development
- Content of degradable organic matter
- Resistance to mechanical action
- Resistance to climatic action
- Permeability
- Susceptibility to frost heave
- Environmental impact (leaching)

Unbound materials to new unbound layers

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Usually not problematic

Little information found

Overall same requirements as for virgin materials

Main issue to consider: Possible contamination

- Fines (handling or from adjacent layers)
- Harmful substances (tar, pollution)

Hydraulically bound to new unbound layers

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From cement bound bases and concrete pavements

- Lower specific mass and higher optimum water content
- Can be used for subbase or (preferably) base layers
- Design modulus 300 – 450 MPa (conservative) – Strength development
- "Careful" compaction effort recommended, to avoid production of fines

Asphalt materials to new unbound layers

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Most common (preferred) application: To new hot mix asphalt

Possible unbound applications of crushed asphalt:

- Surface course (mixed with gravel)
- Base layer, will with time bond to form a layer with properties similar to normal asphalt base layers
- Subbase layer

Recommendations: Compaction preferably in warm weather and after sprinkling water, number of passes depends on temperature

Mixed materials to new unbound layers

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Some regions: Road materials mixed with building rubble

Only selectively dismantled materials applicable

Different mixes (examples):

- 90 % concrete
- 50 % concrete, 50 % bricks
- 50 % concrete, 50 % asphalt

Requirements for contaminants (mostly from buildings)

Can be used for surface, base and subbase courses

Design E-modulus from 150 to 800 MPa

Research issues

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- Development of performance based test methods (deformation, resistance to climatic and mechanical action)
- Strength development and other long-term properties
- Limit values for environmental impact (leaching)
- "Solidification" of crushed asphalt in unbound layers
- Composition of mixed materials, limit values for good performance