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EUROPEAN CONCRETE PAVING ASSOCIATION

Soil stabilisation and in-situ pavement recycling: two sustainable road construction techniques

Turning the existing soil into a high performing construction layer, or recycling worn out asphalt pavements by recycling the existing road, are two perfect examples of the circular economy concept. Raw materials are no longer simply consumed but recycled in place, reducing waste to a minimum and preventing the extraction of natural resources. Less waste, less materials and less transportation mean that not only environmental but also economic benefits can be achieved. Applications include all types of roads, port and airport pavements, and railway tracks.

Photo: E. Scheldraete

Photo: FEBELCEM

Deteriorated road surface.

Photo: IECA

Worksite of in-situ pavement recycling.

■ IN-SITU PAVEMENT RECYCLING WITH CEMENT

The road network deteriorates under the influence of age, the traffic of heavy vehicles and climatic conditions. The damage - permanent deformations, potholes, cracks, rutting - may concern only the surface or may affect the complete structure. In the case of surface damage, this is very often an indicator of more structural deficiencies.

Preservative maintenance measures are the best way to prevent or delay road deterioration. Tackling the structural damage can only be done by structural maintenance, for which different techniques are available:

- Complete reconstruction of the road structure
- Renewal of the surface layer (wearing course)
- Strengthening by overlay
- In-situ cold recycling with cement or hydraulic road binders

In order to choose the right maintenance or rehabilitation technique, decision-makers need to take into account a whole set of criteria: duration of the works, global cost, health and safety, nuisance, durability, and social and environmental impacts. In-situ pavement recycling offers many advantages with regard to these criteria. It combines performance, competitiveness and environmental friendliness.

What is in-situ pavement recycling?

The principle is simple: the old pavement, consisting of one or more asphalt layers upon a granular base, is considered as the quarry of natural resources which are to be treated on site. First, a preliminary study determines the type and distribution of the different materials. The existing pavement is milled off over the full depth and cement or a hydraulic road binder is added, and also extra aggregates and/or water if necessary. These materials are mixed to become a new homogeneous and quality material. After levelling and compaction of the new layer, it becomes a highly performing road base, ready to be covered with a new surface course of asphalt or concrete.

The benefits

There are plenty of reasons to opt for in-situ pavement recycling. By the use of the materials that are already on site, natural resources are saved and there is less transportation of construction materials. This also means less emission of pollutants, less nuisance and less degradation of the adjacent road network.

Photos: CIMbéton

From left to right: spreading of a hydraulic binder – View of a recycling machine with cement slurry distribution – Compaction of the layer with a vibratory roller.

■ SOIL STABILISATION

What is soil stabilisation?

Stabilising soil with binders is an environmentally-friendly and cost effective method of converting poor quality soil into structural layers with high bearing capacity. This enables the production of pavements, embankments, earth structures, railways, etc.

Weak soils with a high plasticity can be treated in-situ in order to improve the geotechnical characteristics: a better compaction is possible and the site is accessible for construction traffic. A step further is the stabilisation of the layer, which means that a durable water- and frost-resistant (sub)base layer is achieved.

Photo: Wirtgen

Soil stabilisation worksite.

The benefits

Since soil treatment makes use of the existing on-site materials, it reduces the use of natural aggregates. Other environmental benefits consist of minimising landfills and local construction traffic, emissions and nuisance. Economic benefits are derived from these advantages, as well as the reduction of the time of project completion compared to a "dig and dump" design. The result is a high-performance capping layer or base layer.

■ BINDERS

Different binders or a combination of them are used for soil treatment and in-situ pavement recycling.
The main types are cement, lime and hydraulic road binder. Other types are granulated slag, fly ash or chemical binders. Of these, hydraulic road binders (HRB) have properties specifically suited for treatment of soils. They consist of a powder made from a blend of different constituents, with a high degree of uniformity in all properties. They exist in two categories: normal hardening and rapid hardening HRBs.
Important to note is that all three – cement, lime and HRB – are standardised construction products which are CE-marked according to the Construction Products Regulation.

Lime: EN 459-1
Cement: EN 197-1
Hydraulic Road Binders (HRB): EN 13282-1 and -2

The combination of different types of binders or the use of HRB allow for tailored solutions for different soil characteristics.

Photos: Wirtgen

Cement spreader.

Integrated stabiliser and spreader.

■ EQUIPMENT

Specialised equipment is available for the different techniques:

- Recyclers/Stabilisers
- Cement spreaders
- Water tanks
- Integrated machines

■ APPLICATIONS

Most of the applications of in-situ pavement recycling concern rural roads - mainly smaller local roads - but in some cases also trunk roads and highways, especially the rehabilitation of the heavy-vehicle lane. Soil stabilisation for subbases and bases can be used in many applications, not only all types of road construction, but also for industrial pavements, port and airport pavements and beneath rail tracks.

In-situ pavement recycling and soil stabilisation are widely used techniques which fit perfectly in the concept of a circular construction industry.

Photos: Firmes Ecológicos SOLTEC

Soil stabilisation is used in a wide range of applications such as port and airport pavements and beneath railway tracks.

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