

## Nynas

**Cold mixed recycling is the future for more than half of Sweden's road planings – a fact that has impacted heavily on emulsion binder performance.**

# Recycling raises the standard in Sweden

Swedish roads have been repaired by cold mixed recycling techniques for over 15 years but until recently binder technology had limited its use to minor roads. Nynas Nordic has now developed a high performance emulsion binder – Nyrec – which is enabling cold recycling to be used on more heavily trafficked roads.

Use of recycled road planings in Sweden has grown in recent years due to a combination of new government recycling policies and increased planing prior to road reconstruction. The legislation means that all asphalt road planings have to be reused within pavement construction, while the increase in planing has raised the volume of material available to recycling operations.

"In the past Swedish roads were reconstructed by overlaying a 50mm thick layer of new asphalt directly over the old surface," says Nynas Nordic Technical Engineer Ulf Lillbroända. "Now the old surface course is planed off before a new one is

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Ulf Lillbroända.

applied which improves the surface regularity and prolongs the service life of the new pavement."

Only half of the 1Mt of planings produced annually in Sweden can be reused in hot mix plants due to specification requirements which limit the recycled content in hot mixes to between 10 and 15%. Cold mixed asphalts can be formed entirely from recycled planings and the pressure came on to increase the use of cold recycling in order to meet the new recycling targets.

"The biggest barrier to wider use of cold mix recycling was performance," says Lillbroända. "Traditional cold mix uses soft bitumen emulsions which produces a pavement which is adequate for low traffic roads which carry less than 1500 vehicles a day.

"Soft bitumen was historically favoured for cold mix recycling on minor roads because it allowed frost heave to take place in winter and self healing in summer. Movement of this kind can only be tolerated on low use roads and the pavements produced through this technique are simply not strong enough to withstand heavier trafficking. Significant performance improvements were necessary before cold mix could be used elsewhere on the highway network."

Nynas Nordic responded to the problem by developing a high performance emulsion binder which enables cold mix to be used on higher grade roads. Nynas' development of the new emulsion technology – which eventually became the Nyrec family of binders – began in 1995 and involved close liaison with Skanska.

The actual formulation of Nyrec is a closely guarded secret but according to Lillbroända it uses a stiffer binder to give better bonding and increased functional performance.

Nyrec is a cationic emulsion which is designed to remain in an unbroken state during the mixing process and breaks under compaction. Breaking describes the setting process during which the liquid emulsion binder – usually formed from up to 70% bitumen and 30% water – becomes a cohesive bituminous binder film.



Ulf Lillbroända works in Sweden as a Technical Engineer with Nynas Nordic.

2: Half of all asphalt road plannings in Sweden are reused in cold mix recycling.

3: Controlled breaking makes Nyrec bound cold mix materials easier to handle and able to be trafficked immediately after compaction.

4: Nyrec's properties can be varied depending on the required end performance and service life



## Nyrec in the UK

Development work is currently under way at Nynas Bitumen which could soon enable Nyrec to make its UK debut. British Government targets to increase the use of secondary or recycled aggregates mean that this new binder may form an important tool for highway engineers working to meet the recycling aims.

Emulsion mixing plants used in Sweden use slightly different processes to those in the UK and there was some initial concern that the differences could alter the properties of the binder.

"Mixing is critical to the final characteristics of an emulsion binder so we have carried out a number of in depth trials of Nyrec with some of our customers," says Nynas Bitumen Development Chemist Dennis Day. "As a result of the trials we have revised the Swedish mixing process for use in UK plant."

With UK binder production perfected, the next stage is a laying trial and Nynas is currently working with Aggregate Industries UK to secure a suitable site. "Finding the first site for trial of a new material is always tricky," says Day. "But we hope to find one soon which will open the way for wider use of Nyrec on our roads."

"Traditional soft bitumen emulsions that were used in cold mix tended to break during mixing and the increased cohesion which resulted made them difficult to handle and lay," says Lillbroända.

"The controlled breaking of Nyrec allows the unbroken emulsion binder to act as a lubricant, making it easier to handle, and breaking is initiated by mechanical compaction. Once started, the breaking process is quick which means the newly compacted surface can be trafficked immediately."

Mix design, handling and laying must be carefully controlled to ensure the cold mix material remains in an optimum condition but Lillbroända is confident of its performance

capabilities. He says: "Cold recycling can produce a pavement which is as good as any hot mixed material but only if the design is right."

Nyrec's properties can be varied depending on the required end performance and service life. The binder has now been successfully used on roads which carry up to 5000 vehicles per day – a traffic volume which represents almost 85% of the Swedish highway network.

Lillbroända says: "In time we hope to develop some computer software to aid mix design and we are hoping to adapt the binder for use with other secondary aggregates."

**email hotline:** [info@modernasphalts.com](mailto:info@modernasphalts.com)