Sustainable asphalt Reuse
Awakened environmental awareness

Today’s society is thriving strongly towards environmental protection and conservation of natural resources. New legislation, education and upbringing are pushing forward sustainability and creating an environmentally conscious generation. Manufacturing and consumer habits aim at conserving the environment and saving energy.

The asphalt industry has been investing in sustainable development and recycling for several years now. In many cases the industry has already reached the international environmental requirement to decrease their CO$_2$ emissions by 20% during 1990–2020.
Asphalt is largely crushed stone, or aggregate (approx. 95%), glued together with bitumen, an adhesive (approx. 5%). Bitumen is distilled from crude oil at oil refineries. Bitumen also occurs naturally as natural asphalt. The aggregate used in asphalt is mostly crushed rock, but gravel or sand are also used on occasion.

Asphalt is mainly a natural material; very rarely are additives or chemicals added. In some asphalt products limestone, stone ash, polymers, fibres or other materials are added to aid adhesion.

Asphalt is manufactured at asphalt plants by mixing heated up aggregate with warm bitumen. In room temperature bitumen is a solid or semi-solid material, which, when heated, becomes fluid. At 100 – 180 °C, the asphalt's usual manufacturing temperature, the bitumen will mix evenly with the aggregate. The mixed asphalt will then be
transported from the plant to the site, spread with a paver into a 35–100 mm thick layer, and compacted with rollers. Once cooled the asphalt is ready for use.

Asphalt is widely used. In Nordic countries all main roads and a majority of the rest of the road networks are paved with asphalt. An asphalt paving is a dust-free, durable, environmentally friendly and economic solution for varied surfaces such as streets and roads. An paved surface is smooth with good friction. Compared to alternative road surfaces, asphalt produces low rolling resistance and very low noise levels. In addition, it is commonly used for bicycle and pedestrian traffic, playgrounds, and other recreational grounds.
Under urban streets and roads is a vast network of technical infrastructure, such as electrical and communication cables, district heating and water pipes, and sewage. Their building and maintenance requires the opening up of the paving. The excavated asphalt is collected and transported to the nearest asphalt plant or other appropriate location. At the plant the asphalt is crushed and the crushed asphalt granules are used for new asphalt. This asphalt granule as well as the collected old asphalt is generally called reclaimed asphalt pavement, RAP.

It is also common to resurface worn out asphalt by milling the top layer, so that new asphalt can be laid on an even surface. The milled old asphalt is taken to the asphalt plant to be reused. The majority of asphalt plants have the appropriate equipment to reuse reclaimed asphalt pavement, RAP.

Reclaiming asphalt pavements, RAP
Up to 100% reusable

The asphalt industry is one of the forerunners of recycling and reuse. Asphalt is 100% recyclable, meaning practically that all of the RAP is either reused or recycled.

Reusing old asphalt has increased in popularity since the seventies. Today’s large scale recycling has been made possible with heavy investing into new machinery. Thanks to these new techniques large quantities of old asphalt can be reused. In certain cases over 50% of the raw materials of new asphalt are RAP.

The Nordic countries produce approximately 23 million tonnes of asphalt and reclaim approximately 4–5 million tonnes of old asphalt. The majority of old asphalt will be used as a raw material for new asphalt. Part of the old reclaimed asphalt will be recycled as either an unbound or half-bound material for base courses. From an economic and environmental point of view it would be beneficial to reuse most of the recycled asphalt as raw material for new asphalt, making the most use of the bitumen contained within the RAP.
Reclaimed asphalt is a valuable raw material

Bitumen is the most expensive component of asphalt. Reclaimed asphalt contains a lot of bitumen, and reheating and reusing it is simple. For these reasons recycling asphalt produces considerable savings, especially if the transportation distances of the old asphalt are reasonably short.
Recycling techniques

In *hot recycling* the RAP is heated up and used as raw material for new asphalt. When using large quantities of old asphalt, the asphalt granules must be heated up before being mixed with other raw materials.

The asphalt industry has developed techniques enabling reuse of asphalt on the road. In *in-situ recycling* large machinery is used to heat up and hot mill the road surface. The milled asphalt is then evenly mixed with new asphalt and spread back on to the surface. This is usually referred to as *Remixing* and *Repaving*.

This technique is most efficient on large continuous paving works. Large quantities of reused asphalt are produced quickly, efficiently and on location. Large savings are made in logistics, making it very economical. It has been shown that the annual and lifecycle costs of asphalt paving produced in this manner are low.

In some cases so called *cold recycling* is used. With the aid of bitumen emulsions cold recycled asphalt is mixed with cold aggregate, and used to improve road structures.
Recycled asphalt is just as good as new

The standards and regulations of the asphalt industry favour the use of reclaimed asphalt as a raw material in asphalt production. Same quality requirements are posed on both asphalt made from new materials and asphalt containing reclaimed asphalt, making reused asphalt just as high quality, clean and durable as new asphalt.
Financial benefits of recycling

Recycling asphalt yields notable savings in the costs of materials and logistics. These savings alone, especially due to saving on new bitumen, make recycling economical. Reusing the aggregate also offers savings, especially in countries that have to import it. Recycled asphalt reduces the need and cost of transportation, significantly reducing emissions at the same time.

Research clearly shows that recycling asphalt lowers energy costs and CO$_2$ emissions significantly. This combined with low annual costs makes recycling an environmentally, economically and industrially important goal.

Producing reused asphalt is a clean and safe process. The industry has in use machinery that does not harm the environment and the immediate surroundings. Safety in the workplace and emissions are the same as in the production of new asphalt.
Clean recycling safely

Reusing asphalt is possible with certain requisites. Old asphalt is classified as waste. Old asphalt can be stored for 3 years, and must be used within that time. Taking old asphalt to a landfill is not recommended. Even environmental authorities recommend reusing asphalt, despite its waste classification.

The asphalt industry and most of its plants have all the facilities to store and handle old asphalt. Almost all asphalt is 100 % recyclable. Some exceptions are old tar asphalts and certain polluted asphalts. These will need to be taken to appropriate waste disposal sites or treated with special methods.

The road is not a landfill. The asphalt industry has rigorously refused to accept any old asphalt suspected to harm the workers, the environment or the recycling process. With its regulations, requirements for purity, and knowledge of materials, the asphalt industry ensures that the asphalt products used in the future by the industry and the larger society are clean and safe.
The Nordic Road Forum, NVF, and its pavement committees promote development within the field of road and traffic, through collaboration between representatives of the road sector in Denmark, Finland, The Faroe Islands, Iceland, Norway and Sweden.

NVF’s pavement committees in various Nordic countries have in recent years discussed several themes around sustainability and the environment. In 2011 the pavement committee’s main subject was recycling and reusing asphalt. It came to the conclusion that the asphalt industry largely recycles and reuses old asphalt and its experiences of the process are positive. The committee also believes that, as the knowledge of the process and its benefits increase, the reuse can be increased significantly in the future.

With this brochure, NVF hopes to inform its partners and stakeholders about the recycling and reuse of asphalt and its benefits.

This brochure is a joint venture by all of NVF’s national pavement committees, lead by Lars Forstén, Finland. This brochure is published in the six Nordic languages and English.

This brochure can be ordered from the national NVF-contacts within the six Nordic countries.