Asphalt modified with rubber powder

A winning test for general public and environmental protection

Rubber powder is one of the main ELT-derived products. In Italy about 25% of recovered ELTs are subject to a treatment and recovery process which reduces the ELT to increasingly small fragments, culminating in the production of fine rubber powder with a grain size of less than one millimetre. Ecopneus, one of the leading companies responsible for the management and treatment of end-of-life tyres in Italy, is also engaged in the promotion of new applications and end uses of these derived products, such as the use of rubber powder as an additional component of asphalt, in order to get a bituminous conglomerate with high performances and numerous advantages.

Modified asphalts contain binders that ensure:

- Higher resistance to permanent deformation due to the high viscosity of the binder;
- Greater elasticity and high performance of the road surface both at high and low temperatures;
- Excellent resistance of the mix to the action of water without any need for specific additives;
- SAM/SAMI (Stress Absorbing Membrane-Interlayer) treatments that prolong the life of the surface: the characteristics of rubberized bitumen may be used to produce superficial or intermediate membranes that are extremely effective against cracking.

The most interesting properties include:

- Longer life and lower maintenance costs;
- Greater resistance of surface to permanent deformation;
- Reduced sensitivity to temperature;
- Greater aging and oxidation resistance due mainly to the higher content of binder and the presence of anti-oxidants in the tyre rubber.

Road surfaces with rubber binders ensure:

- Saving of energy and natural resources, using elastomers recovered as a new material;
- Reduction in noise generated by the rolling of tyres and vehicle traffic in general. The structure of the rubber mix ensures less noisy surfaces even on infrastructure on which other types of noise-proofing mixes could not be used.

The advantages of modified asphalts

Modified asphalts obtained with the addition of rubber powder are more expensive than traditional asphalts; this is due to the cost of manufacturing process of the bituminous binder and to the higher percentage of bitumen required. Nevertheless, the analyses performed all over the world on their life cycle have demonstrated how higher starting costs have been largely re-absorbed over time, thanks to the longer durability of this kind of surfaces and to their lower maintenance costs. Furthermore, additional indirect economic advantages can result from the addition of rubber powder in asphalts, of which the entire community can benefit:

Contribution to ELTs use

The main indirect advantage is the identification of a secondary use of ELTs instead of their storage or illegal dumping. Suffice to say that the quantity of ELTs used to pave a road surface 1 km long, 4 cm thick, 10 metres
wide, and made with a binder containing 20% rubber powder dosed at 8% of the mix weight, is well over 10 tons.

**Added value of ELT is completely exploited**
Asphalts containing rubber powder enhance the intrinsic features of the material obtained from ELTs: the rubber enhances the physical features of the common materials used for road surfaces, hence bringing a long-term benefit for the tax payers and car drivers.

**Testing in Italy and worldwide**
Since their appearance on the world scene, modified asphalts, although through ups and downs, have experienced a non-stop diffusion. During the '60s, Charles McDonald developed a mix made of bitumen and rubber powder, whose main target was to repair Arizona’s road surfaces cracks.

This testing started in the United States in the early '70s, in Arizona; the product resulted to be so well-done and with perfect performances, that it was decided to use it directly in building new roads.

**Endurance and costs/performances ratio**
The endurance tests and the favourable costs/performances ratio have once more demonstrated the added value of this kind of modified asphalts, so that they are now widely used worldwide. It is now possible to find their application in the roads of: United States (Arizona, California, Texas, Florida), Portugal, Spain, Austria, Germany, Australia, South Africa, Canada, and China, just to mention the countries with the most significant uses.

**Noise reduction**
Traffic noise reduction (especially that produced by rolling tyres) represents another important benefit deriving from the addition of rubber materials into asphalts, and it has been documented in various areas around the world. In Europe, similar studies have been carried out in Belgium, France, Germany, Austria, the Netherlands, to reach Canada, Arizona, and California, just to quote a few.

Most widely used types of road surfaces are open-graded and gap-graded, that differ according to the components of the mixtures; for both of them important traffic noise reduction, from 40% up to over 80%, have been measured. In the United States, the monitoring performed on road surfaces has highlighted how those road surfaces made with the addition of rubber powder have maintained their initial sound-absorbing levels, or anyhow within fixed limits; on the contrary, road surfaces made with traditional asphalts have negatively evolved over time because of traffic wear.

The use of "rubberized" asphalts has become a consolidated practise over time also in Italy. As of today, road surfaces paved with the addition of rubber powder are mainly concentrated in Tuscany, Emilia Romagna, and the Province of Bolzano, besides an experiment started in Piedmont, that involves Ecopneus together with the Province and the Polytechnic of Turin.
**Experimentation in the Province of Turin**

In November 2010, in the Province of Turin, a section of 1,200 metres was asphalted with **bituminous mix containing rubber powder coming from End-of-Life Tyres**. Ecopneus was one of the sponsors of the experiment conducted within the scope of the works for the construction of the Venaria-Borgaro ring road. A surface area of about **16,000 square metres** was covered with modified asphalt whose mix contained the powder produced from **21,000 kg of ELTs**. The asphalted surface acts as a **pilot section for testing the performance in situ of the road surface** made of gap-graded bituminous mix containing rubber powder produced from End-Of-Life tyres. In this way, the performance of the asphalt may be monitored and tested with a view to obtaining further confirmation of the **main advantages** already observed in other countries. It is an important result for Italy, which creates extremely interesting prospects for the future in terms of both environmental protection and the safety of road users.

For this reason, in 2009, already confident of the result that would be obtained, Ecopneus signed a Letter of Intent with the **Provincial Authority of Turin, FISE-UNIRE** (Waste recovery and recycling operators’ association), **SITEB** (Road and asphalt industry operators’ association) and **ANFIA** (National automotive industry operators’ association) to conduct an innovative experiment in Italy, unique for its completeness and scientific value, with the technical and scientific support of the **Polytechnic of Turin**, with a view to determining the **best use for powder produced from End-of-Life Tyres in road asphalt**. The experiment also saw the participation of the companies Tritogom from Cherasco (CN) and **Rubber Affair** from Settimo Torinese, who provided the powder free of charge while **COGEFA** produced and laid the modified asphalt.