STRUCTURE FOR PAVEMENT UNDER HEAVY TRAFFIC

TRICOUCHE

Outstanding strength
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Contracting authorities often call for pavement structures that will withstand traffic without damage for long periods of time. When traffic is heavy, this requirement is generally met by providing thick structures with a variety of layers of well-defined types and characteristics. The conventional rule that the lowest-quality materials should be placed in the lower levels and the higher-performance materials at the surface is disproved by a new structure designed and developed by Eurovia. It reflects better knowledge of pavement dynamics and the ongoing effort to rationalize the use of available materials. These structures are thinner but ensure long service life in pavements with heavy traffic.

Tricouche is the result of Eurovia studies that analysed the mechanics of pavement structures with a view to using the highest-performance materials only in those areas of the structure that are subjected to the highest loadings. The process replaces the usual upper base course / lower base course tandem with a structure made up of two thin outside layers of high-performance bituminous materials separated by a less expensive intermediate material with lower performance.

**KEY BENEFITS**

- A **cost-effective** material
- **Excellent** mechanical properties
- **Unrivalled** service life
- Can be produced with the **Tempera® processes**

**KEY FIGURES**

- Thickness reduced by up to **factor of 2** while maintaining technical characteristics
- **Setra certificate** issued in **2005**
- **Modulus ratio** of the materials used between **2** and **10**
HIGH TRAFFIC...
SAVINGS ASSURED

At equal service life, a 200 mm thick (60 + 80 + 60 mm) Tricouche structure is equivalent to 250 mm of high-modulus asphalt or 380 mm of Class 2 road base asphalt. The materials balance (aggregate, hydrocarbon products) obviously confirms the advantages of the Tricouche solution.

Reducing thicknesses generates immediate savings in projects using the process and contributes to environmental protection, both directly by limiting the aggregate needed and indirectly by reducing the energy required to manufacture and lay these materials.

The performance of Tricouche recommends it for the construction of pavements subject to heavy traffic, over substrates of low to medium bearing capacity and for long service lives.

WHAT IT TAKES FOR SUCCESS

The upper and lower layers of Tricouche consist of a thin application of high-modulus asphalt or Renfovia. This asphalt mix has excellent mechanical properties, and in particular high stiffness modulus and high elongation capacity under repeated loadings. Formulated with 0/10 aggregate, it is laid in a single thickness that is independent of the traffic and set at the minimum technically feasible level of 60 to 70 mm.

The middle layer is often made up of Grave Mousse, a material made by adding foamed hot bitumen to unheated aggregate, typically of 0/14 grading. It is applied in a thickness determined by a structural pavement design, generally between 80 and 150 mm. A specific road base asphalt with low binder content can also be used.

A surface course of very thin asphaltic overlay, for example Microvia TM® or Rugovia TM®, lends the pavement the desired surface characteristics. In certain cases, the upper layer of Tricouche can be made of high-modulus asphaltic concrete to serve as the surface course.
An analysis of the dynamic behaviour of pavement structures and their failure modes shows the indisputable advantages of Tricouche in terms of service live.

In a conventional structure with bonded layers of similar stiffness characteristics, any fatigue crack that appears at the base of the structure propagates very quickly to the surface.

In a Tricouche structure, in which the intermediate layer is much less rigid than the other two, the failure mode is sequential and the propagation of the crack is blocked at each interface, where a new crack initiation process is needed for the failure to continue.

This favourable configuration is made possible by an elastic modulus ratio of the materials used of between 2 and 10.

At higher ratios, as for instance in the case of an intermediate layer of untreated aggregate, major tensile stresses appear at the base of the upper and lower layers, which cannot be reduced by increasing the thickness of the intermediate layer. The high fatigue resistance of the material at the base of the Tricouche structure, together with sequential failure, lend the process its outstanding performance.

Tricouche was tested on the fatigue bench at the Laboratoire Central des Ponts et Chaussées in Nantes. The experiments demonstrated the structure's specific dynamic behaviour as well as the benefits of the new concept in terms of durability.

Following passage of 4.3 million 13 tonne axle equivalents corresponding to 15 years of T1 traffic (500 trucks/day). Tricouche showed no signs of fatigue or deterioration.

Tricouche received a Setra certificate in November 2005 as part of the Road Innovation Charter. The process is patented.