



CRUDE PALM OIL FOR PAVING ROADS IN COLOMBIA

NEW SOURCES OF INCOME FOR THE OIL PALM AGRIBUSINESS



WARM MIX ASPHALT

It is a material for the construction of pavement, comprised by asphalt and mineral aggregates which, in general, are a mixture of coarse, fine and mineral filler aggregates. The asphalt acts as binder, forming a cohesive mass that is ideal for building wearing courses.

Currently, the mixing and compacting processes of the asphalt mixes are made at high temperatures. The mixing temperature at the plant ranges from 150 to 200 °C, and the compacting temperature in the application of the wearing courses ranges from 130 to 150 °C, thus the name hot-mix. Asphalt and aggregates are heated to ensure a proper viscosity that is capable of covering the aggregate particles, optimizing the performance of the pavement; these procedures emit polluting gases that cause serious environmental damages.

Since the 1990's, the pavement industry around the world has been developing techniques that allow reducing asphalt mixing-and-application temperatures, resulting in a reduction in the emission of polluting gases, better labor conditions for the operators, and reducing the use of energy in both asphalt manufacturing and pavement placement operations. These are known as

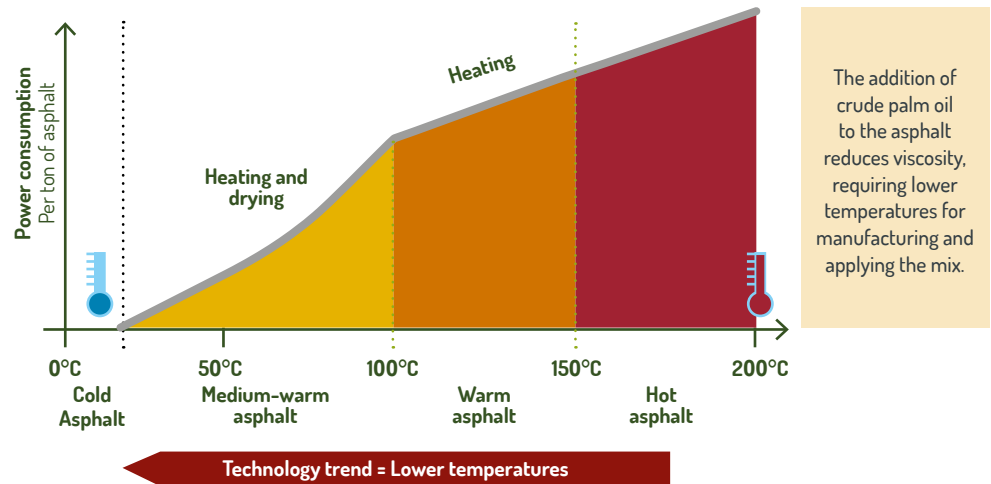


Figure 1. Classification of asphalt concrete by temperature range. Source: The use of warm mix asphalt. European asphalt pavement association. 2014.

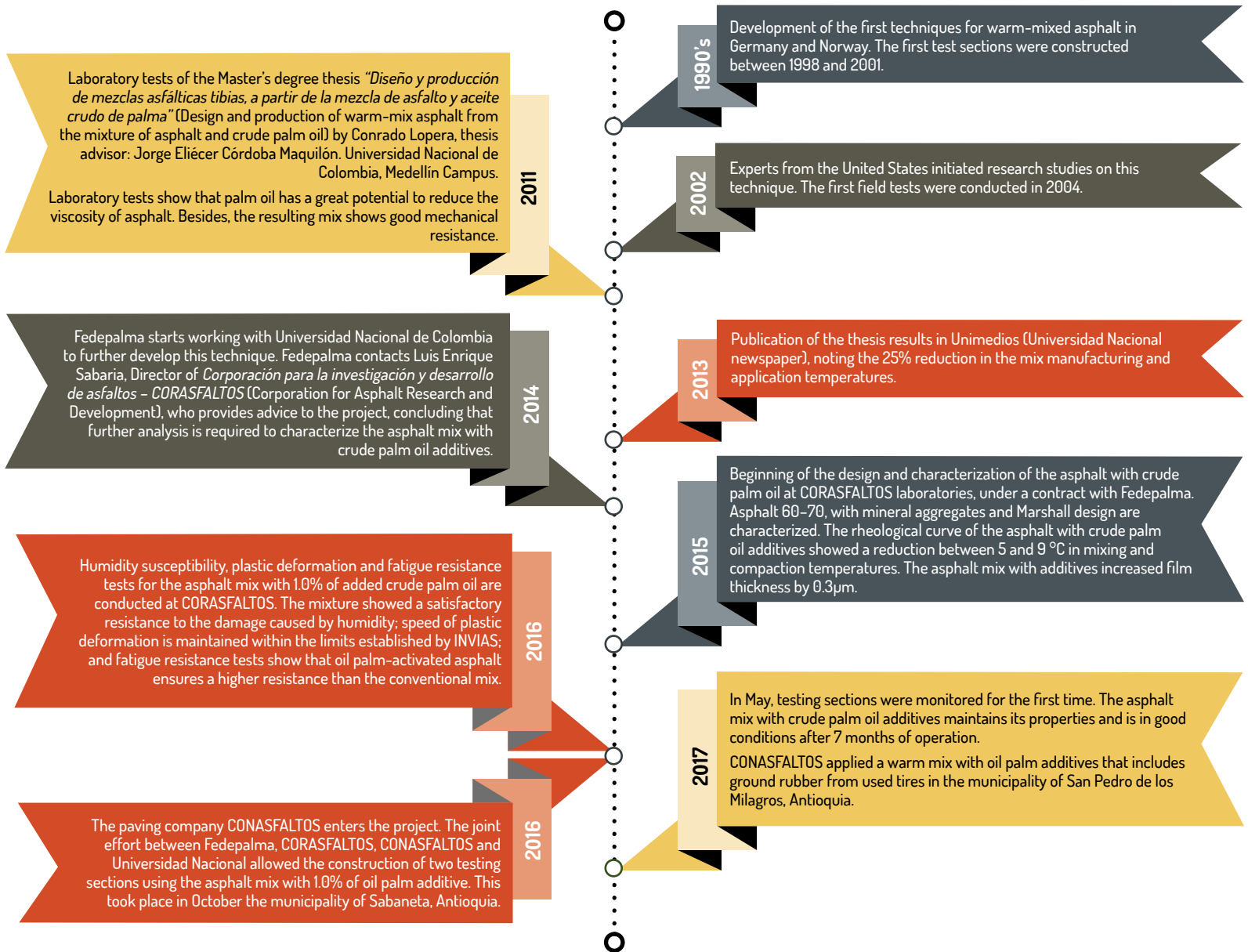
warm-mix asphalt technologies, which have the same performance as the hot mixes.

Different techniques have been used to reduce the viscosity of asphalt, allowing a complete cover of the aggregates and the subsequent compaction of the mix at low temperatures. The techniques to produce warm-mix asphalt may be classified according to the type of additive used to modify the viscosity of the asphalt. The most common additives include: organic additives, chemical additives, and foams. Figure 1 shows the

classification of the mixtures per temperature range.

The timeline below shows the development of warm-mix asphalt, indicating its international beginnings and the development conducted by Fedepalma based on the master's degree thesis "*Diseño y producción de mezclas asfálticas tibias, a partir de la mezcla de asfalto y aceite crudo de palma*" (Design and production of warm-mix asphalt from the mixture of asphalt and crude palm oil), conducted at the School of Mines of Universidad Nacional de Colombia, Medellín Campus.

PROJECT DEVELOPMENT TIMELINE



ASPHALT CONCRETE WITH CRUDE PALM OIL ADDITIVES TEST SECTION

- MATERIALS -



Mineral Aggregates

Aggregates were obtained from CONASFALTOS S.A. Bello quarry.

- Wear 500 rev: 23%.
- Wear 100 rev: 4%
- Fractured faces: 96%

Crude Palm Oil

- AGL % OR acidity %: 2.40%
- Humidity %: 0.06%
- Impurity %: 0.022%

Asphalt 60/70

- Viscosity: 60 °C: 3150 P
- Penetration: 54(1/10 mm)
- Softening point: 49 °C
- The asphalt was modified with: 1% crude palm oil and 2% gilsonite

The reduction in the manufacturing temperature of the warm-mix asphalt requires less fuel for heating the mix, resulting in lower emissions at the plant.



- MANUFACTURING OF THE ASPHALT MIX WITH 1.0% OF CRUDE PALM OIL ADDITIVE -



Addition of crude palm oil to the asphalt



Preparation of the asphalt mix at 137 ± 3 °C



Production of 194 tons of this mix



Reduction of 10% of fuel usage in the production of the mix



We observed a significant reduction of steam emissions that generate volatile organic compounds

◀ Reduction of 15 °C in the mixing temperature in comparison with conventional mixtures

◀ The mix obtained has a shinier appearance in comparison with hot mixes, which means a greater adherence between mineral aggregates and the asphalt

◀ The characteristics of the asphalt mix prepared with crude palm oil are equal to those of a conventional mix, both prepared with asphalt 60/70

TESTING SECTION OF THE ASPHALT MIX WITH CRUDE PALM OIL ADDITIVES

- APPLICATION OF THE ASPHALT MIX WITH ADDITIVES IN TWO TEST SECTIONS -



Application of the mix at a temperature between 110–120 °C

◀ The mix showed good coverage and shine



Significant reduction in the generation of organic steams compared with a conventional mix

◀ Low manufacturing and placement temperatures of the warm mix minimize steam and odors emissions, creating healthier working conditions for workers. This positive aspect was noted by the application squad



Mix compaction started at 115 °C and ended at 70 °C

◀ On-field densification was achieved by reducing normal compaction temperatures in 20–30 °C



The mix was applied in two sections of 100 and 90 meters long, 7 and 5 meters wide, and a thickness of 75 and 60 mm, respectively, in the municipality of Sabaneta, Antioquia. Medium traffic roads

- FIRST MONITORING TO THE PAVEMENT - (ASSESSMENT 7 MONTHS AFTER THE APPLICATION)



Visual inspection

◀ Good condition of the pavement, without fissures, cracks or permanent deformations



Density of the asphalt mix

◀ The density of the samples taken is consistent with the initial compaction interval, indicating there has been no subsequent densification caused by the traffic, as a result of the good performance of the mix



Flatness

◀ Planimetry assessment with a 3-meter platometer. There has been no rutting in the asphalt surface course



Surface evenness

◀ IRI values for surface evenness range between 2.87 m/km and 3.37 m/km. These are considered appropriate for the rehabilitation of pavement in urban roads



WITH THE SUPPORT OF THE OIL PALM DEVELOPMENT FUND

**Federación Nacional de Cultivadores
de Palma de Aceite, Fedepalma**

www.fedepalma.org