Asphalt and Asphalt Pavements - A Technical Overview

Asphalt, asphalt pavements and roads have been indispensable components of modern infrastructure and industrial developments, making it essential for a pavement professional to know the basics. Since the installation of the first asphalt pavement in 1870 by Edmund J. DeSmedt, in front of the City Hall in Newark, NJ, the use of asphalt has skyrocketed. Today over 750 million tons of asphalt mix is used in U.S. alone. There are 4 million miles of roads, with just over 45,000 miles of highways in the US, 94% of which are paved with asphalt. The total miles of highways could circle the earth 160 times and the highways two times. Seventy percent of all construction materials worldwide are based on asphalt. Asphalt is used in more than 250 products, and the majority is related to road and pavement construction.

What is asphalt?

Beyond the American Society for Testing and Materials' definition as “a dark brown to black cementitious material in which the predominating constituents are bitumens which occur in nature or are obtained in petroleum processing,” asphalt is a very complex material comprising of thousands of compounds, ranging from simple to complex molecules; paraffin, naphthalene (cycloparaffin), aromatic hydrocarbons, and polycyclic aromatic hydrocarbons (PAHs). It also contains relatively small amounts of sulfur, nitrogen and oxygen.

Asphalt is a thermoplastic material, which liquefies to water-thin consistencies at high temperatures and solidifies when cooled to ambient conditions. This property, combined with its outstanding adhesive (sticky) properties, makes it an ideal material for keeping aggregate “glued” together in pavement. In addition, asphalt is flexible, durable and has excellent waterproofing properties. Asphalt, however, has poor resistance to ultraviolet (UV) degradation (graying of asphalt), which necessitates the preservation of the pavements through well-established practices, namely sealcoating.

The composition of asphalt varies – no two sources yield the same asphalt composition, and furthermore the composition changes with aging and storage. This is why the Strategic Highway Research Program was established in 1987, as a 5-year, $150 million project to improve the durability and performance of the roads in the U.S. Of that budget, $50 million of the funding was used to develop “performance driven” specifications for asphalt binders.