

What is asphalt?

Asphalt is a sticky, black, brown substance in a semi-solid state.

Asphalt can occur naturally or can be produced out of petroleum.



Asphalt concrete is asphalt mixed with aggregates such as sand or gravel used in roads.

Also known as asphalt concrete, bituminous concrete, or blacktop.

Important Chemical Reactions

A small amount of polyaromatic hydrocarbons (PAHs) is found in asphalt. PAHs are known to be carcinogenic. PAHs are found in asphalt because of the high temperatures used to produce asphalt.

Bonds/IMFs

Asphalt is a complex mixture of hydrocarbons. The primary bonds in asphalt are covalent bonds between carbon and hydrogen atoms. There are also van der Waals forces between the molecules.

Asphaltenes



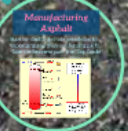
Chemical Structure of Asphaltene/Bitumen

Asphaltene is a complex mixture of hydrocarbons. It is a high molecular weight, high boiling point, and high viscosity component of bitumen. It is a solid at room temperature and is insoluble in light petroleum solvents.

Importance

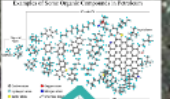
Now covers 94% roads in America.

- Means more smoother
- Only top layer of roads must be replaced during maintenance.



Manufacturing Asphalt

Mix that 300 tons with a more suitable aggregate to produce a workable material.



Threats from Asphalt: Slow Release Asphalt Oil, Medium, Kerogen, Rapid Release of Asphalt.

Consent

The National Oceanic and Atmospheric Administration (NOAA) has issued a consent decree with the American Petroleum Institute (API) regarding the release of asphalt into the environment.

Historical Usage

Asphalt has been used for thousands of years. It was used by the ancient Egyptians to make waterproofing materials for their ships and buildings.

National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) is responsible for monitoring and regulating the release of asphalt into the environment.

3 Options

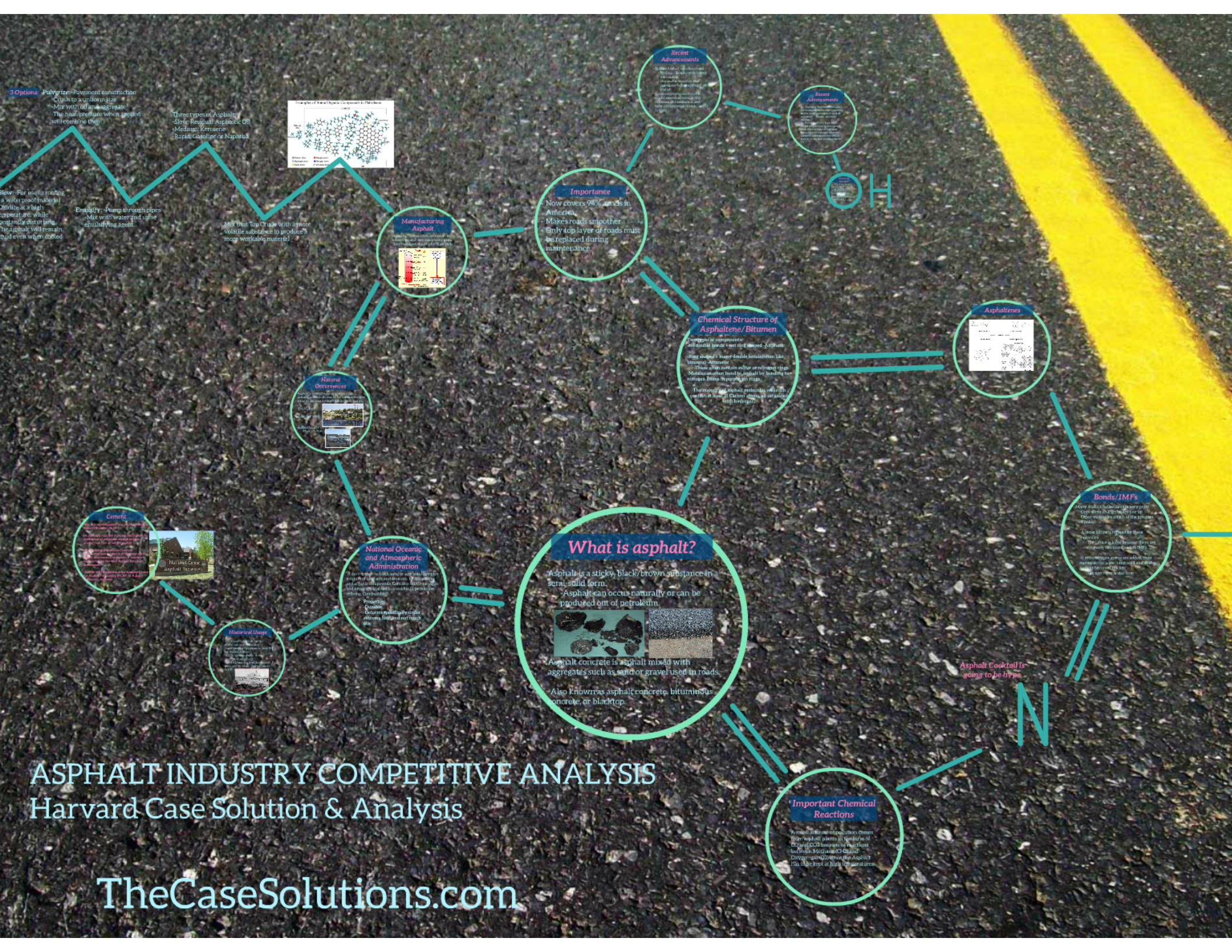
1. Pavement: "Inherent" asphalt mix. Cracks, less uniform size. Mix will fill and seal itself. This has an issue when applied will cure faster.

2. Sealant: "Inherent" asphalt mix. Cracks, less uniform size. Mix will fill and seal itself. This has an issue when applied will cure faster.

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ASPHALT INDUSTRY COMPETITIVE ANALYSIS

Harvard Case Solution & Analysis



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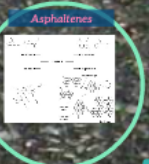
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Chemical Structure of Asphaltene/Bitumen

Asphaltene/bitumen is a complex mixture of high molecular weight hydrocarbons. It consists of many discrete benzene rings like benzene, naphthalene, etc. These often contain sulfur or nitrogen rings. Aromatic atoms tend to be linked by bonding the nitrogen atoms in porphyrin rings. These asphaltene molecules often contain a lot of carbon atoms, as saturated with hydrogen.



Bands/IMFs

Many bands (intermolecular forces) are present in asphalt. Other molecules (like) of the asphalt are present.

Asphalt is held together by these forces.
The forces that hold asphalt together are intermolecular forces (IMFs).
If intermolecular forces are about their strength for a given material and the ability to hold together, the material is also true.

Asphalt Cocktail is going to be hype

Important Chemical Reactions

Asphalt is a complex mixture of many different hydrocarbons. It is a semi-solid form of carbon and hydrogen. It is a complex mixture of many different hydrocarbons. It is a semi-solid form of carbon and hydrogen.

Manufacturing Asphalt

Asphalt is made by heating a mixture of bitumen and aggregates. The bitumen is heated to a temperature of about 150°C and the aggregates are heated to a temperature of about 180°C. The two are then mixed together to form asphalt.

Natural Occurrence

Asphalt is found in natural deposits around the world. It is a semi-solid form of carbon and hydrogen. It is a complex mixture of many different hydrocarbons. It is a semi-solid form of carbon and hydrogen.

National Oceanic and Atmospheric Administration

NOAA is responsible for monitoring and reporting on the health of the nation's oceans, coastal ecosystems, and the atmosphere. NOAA also provides information on the effects of climate change on the ocean and the atmosphere.

Private: Detects rapidly rising extreme heat and track size.

Historical Usage

Asphalt has been used for thousands of years. It was used to make roads, bridges, and other structures. It was also used as a waterproofing material.

Cement

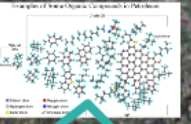
Cement is a binding material made from limestone and clay. It is used to make concrete, which is a mixture of cement, sand, and gravel. Concrete is used for building structures like roads, bridges, and buildings.

3 Options Polymerize - Pavement construction

Crush to a uniform size.
Mix with oil and aggregate.
The heat/pressure when applied will combine them.

Three types of Asphalt

Slow-Residual Asphaltic Oil
Medium-Kerosene
Rapid-Gasoline or Naphtha



Add their Top 2 mix with some volatile substance to produce a more workable material

Emulsify - Pump through pipes
Mix with water and some emulsifying agent.

Slow - For use in coating a water proof material
Cooling at a high temperature while constantly disturbing, the asphalt will remain fluid even when cooled.

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Chemical Structure of Asphaltene/Bitumen

Two types of components:

-No double bonds + not ring shaped -Aliphatic

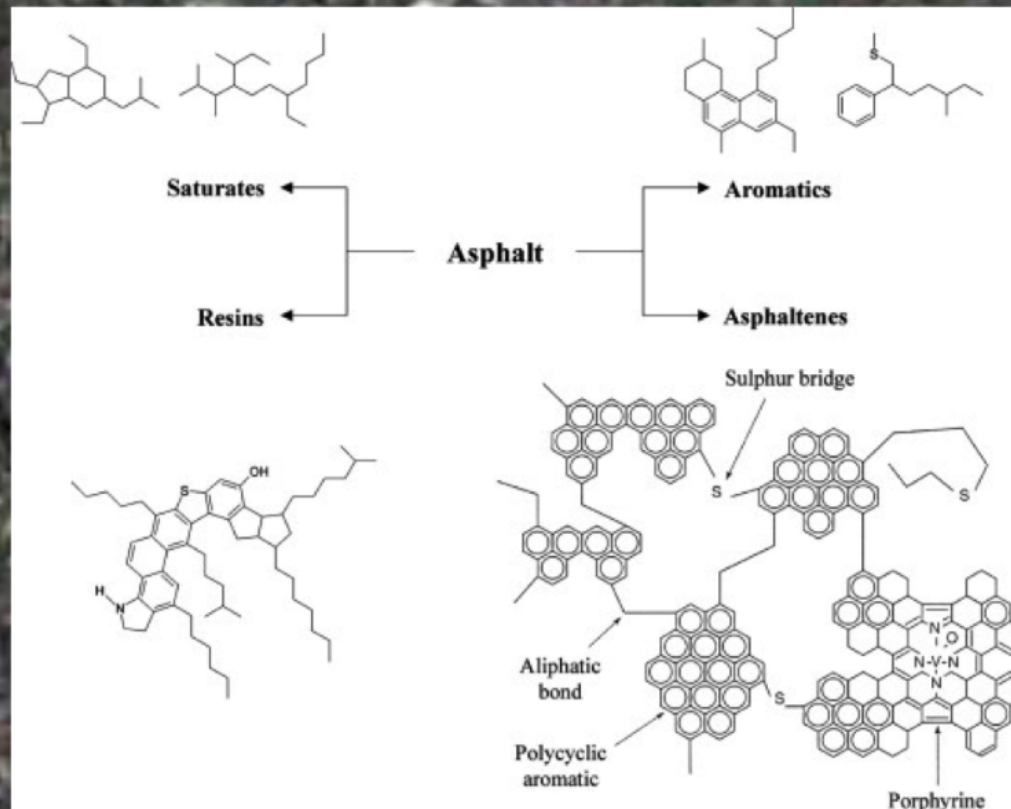
-Ring shaped + many double bonds (often like benzene) -Aromatic

-These often contain sulfur or nitrogen rings.

-Metals can often bond to asphalt by bonding to nitrogen atoms in porphyrin rings

-The majority of asphalt molecules will each contain at least 31 Carbon atoms, all saturated with hydrogen.

Asphaltenes



Bonds/IMFs

- Many asphalt molecules are very polar
 - Oppositely charged poles line up
 - Other molecules attach at the junction of poles
- A loose lattice is formed by these molecules
 - The lattice is loose because there are not many electrons, so less IMFs
- If more oxygen atoms are added, then more electrons are integrated and so the asphalt becomes thicker.
 - The converse is also true

Important Chemical Reactions

A small amount of pollution comes from asphalt plants in the form of CO and CO₂ because of reactions between Methane (CH₄) and Oxygen gas (O₂) since the Asphalt has to be kept at high temperatures.

National Oceanic and Atmospheric Administration

"A dark-brown to black solid or semisolid complex mixture of aliphatic and aromatic hydrocarbons and organic compounds. Contains sulfur, nitrogen and oxygen. Obtained as a residue in petroleum refining. Combustible."

Properties:

- Durable
- Deforms specifically under extreme heat and not much else