PAVEMENT SPECIALISTS

Pavement Preservation 2012

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What is a Road?

A road is a load bearing structure for the purpose of allowing the conveyance of people, animals and vehicles

Once it is built it starts to deteriorate and needs to be maintained.

The overall structure of the road is very slow to deteriorate

Why Asphalt?


W

Heavy Loadings

Materials for Road Construction

- Aggregates
- Asphalt Cement
- Air
- Water
- Clay
- Portland Concrete Cement
- Lime
- Polymers
- Tires
- Steel
- Brick
- Wood
- Glass
- Plastic
- Fibers
- Used Carpets
- Tennis Balls
- Oils
- Lignonsulphonates
- Magnesium chloride
- Calcium chloride

Alaska State Library - Historical Collections

Three Forms of Energy

Mechanical

Thermal

Chemical


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Why Asphalt?

Why Asphalt?

What is its purpose?

- **Waterproofing**
- **Dust Abatement**
- **Aggregate Durability**
- **Widely available**
- **Non-hazardous, benign**
- **Strength – it is part of a structural system**

Asphalt Composition

A semi-solid, refined material

Mostly carbon and hydrogen (hydrocarbons), minor amounts of O, N & S and metals.

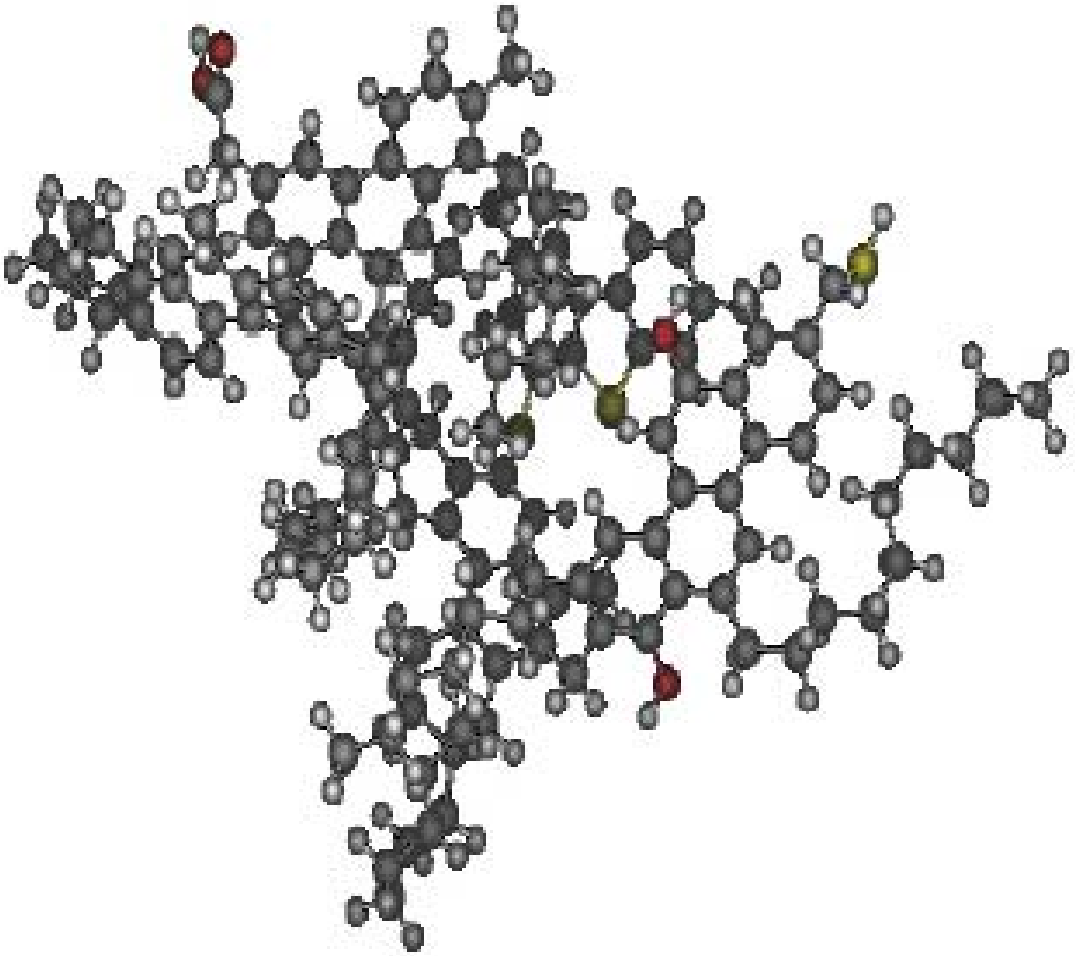
Minor constituents → ***heteroatoms***.

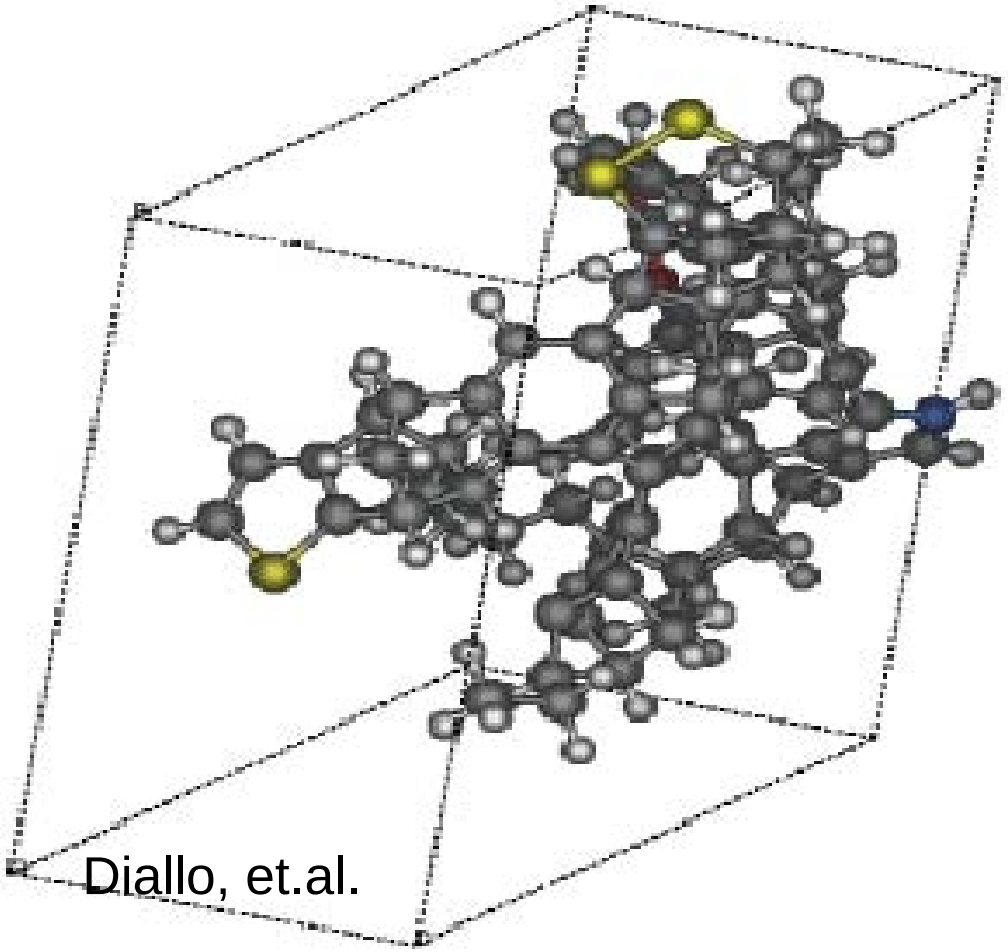
Heteroatoms → 'functional groups.'

Asphalt is a mixture of complex molecules.

Oils → Resins → Asphaltenes

Asphaltene Structure





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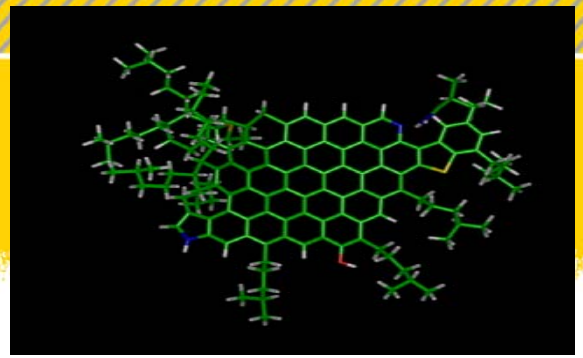

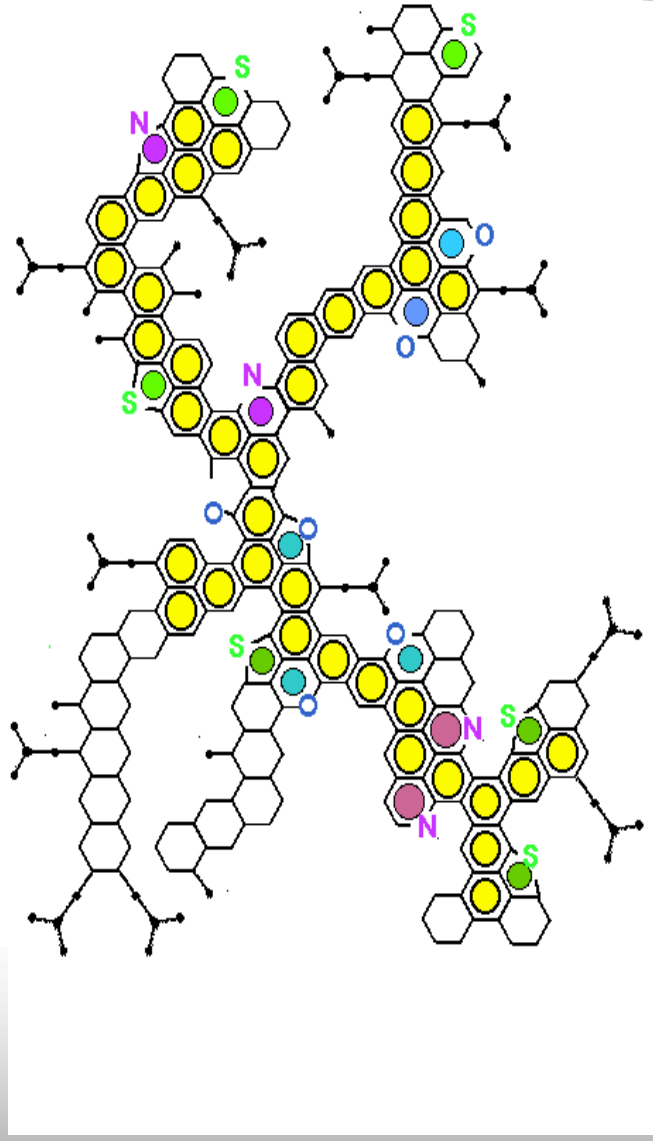
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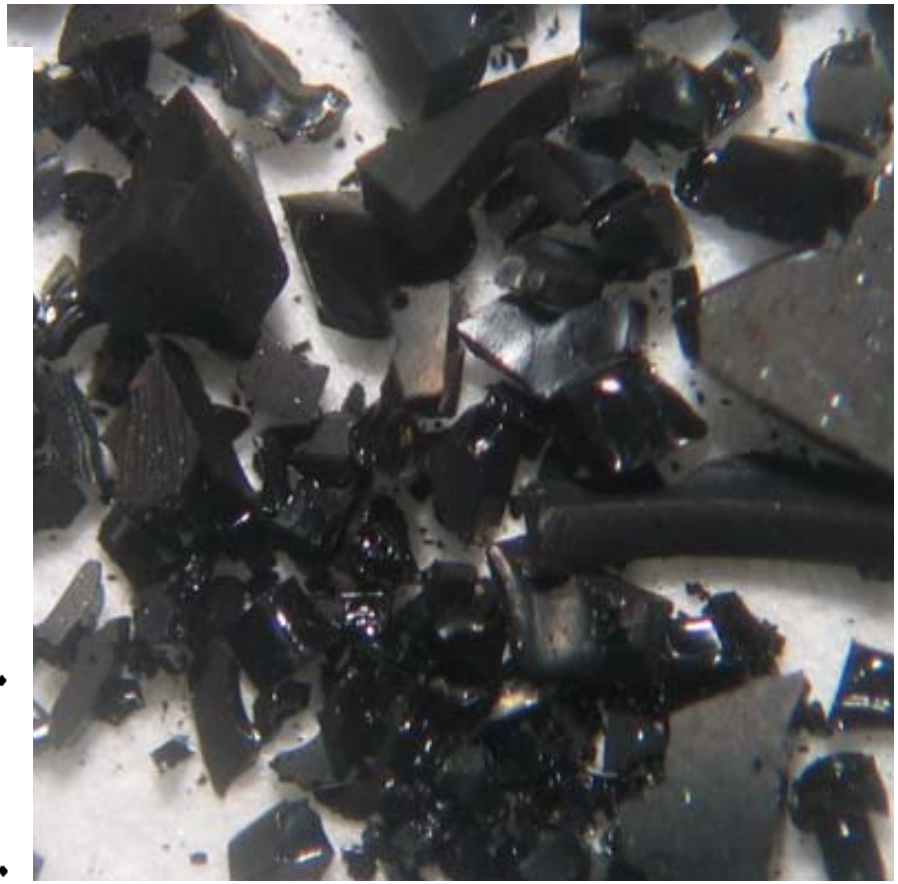


Asphalt Manufacture

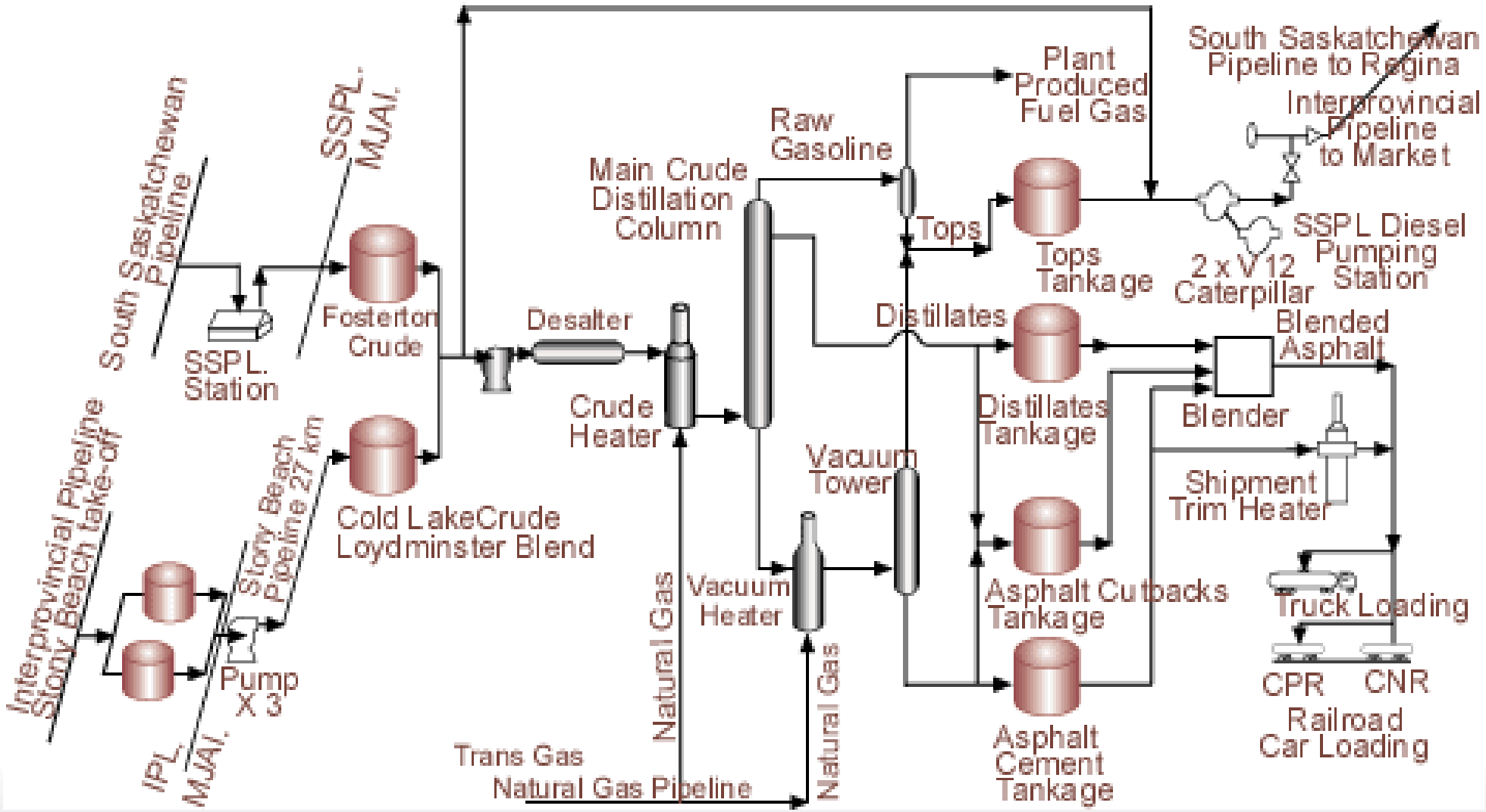
Asphalt manufactured (refined) via thermal separation process.

Crude Oil distilled at atmospheric pressure & ~ 600C.

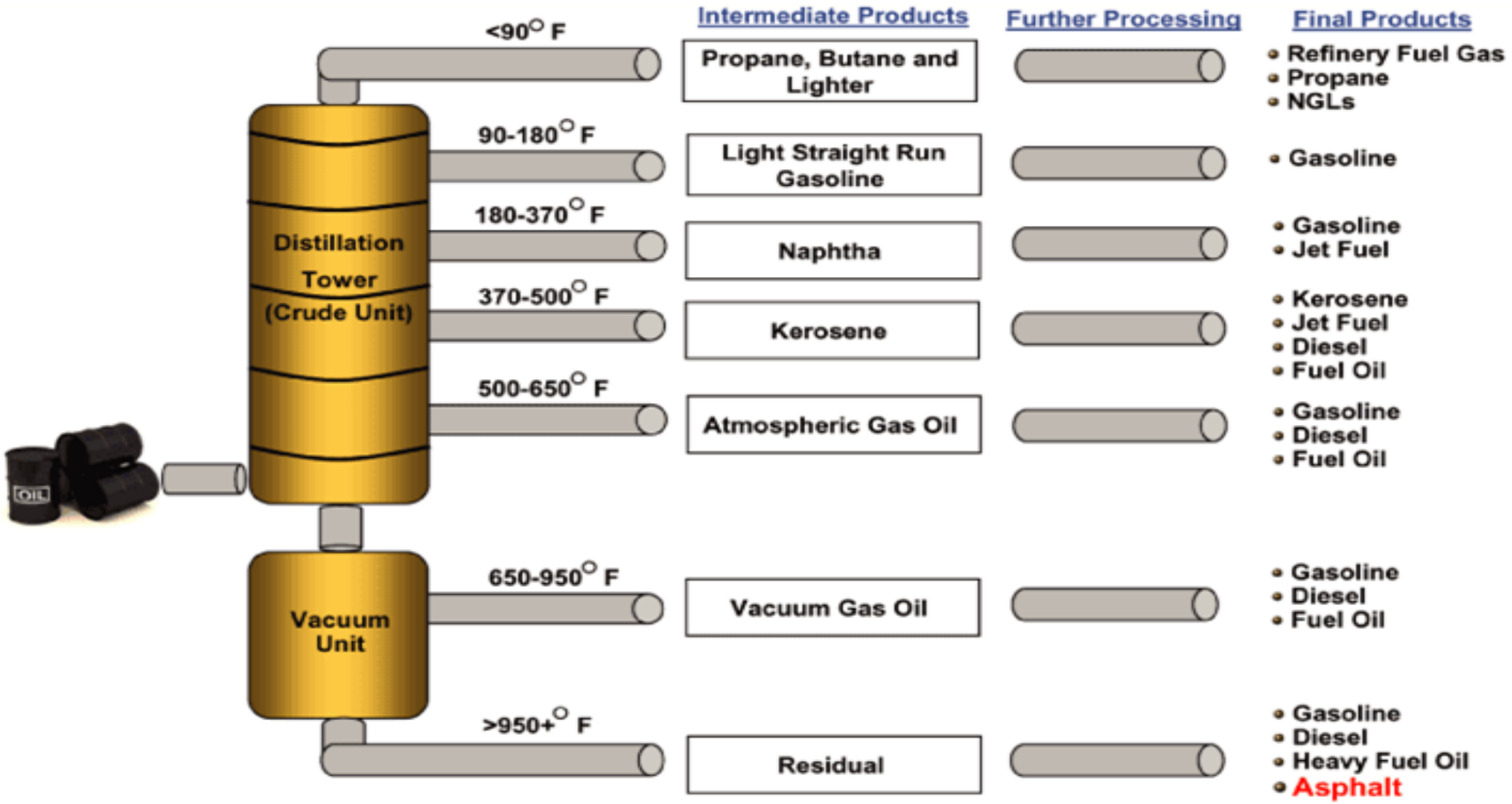
Bottoms of the distillation (residuum) distilled at reduced pressure (under vacuum).

Vacuum residuum is asphalt, or asphalt cement.

Asphalt Manufacture



Refining Schematic

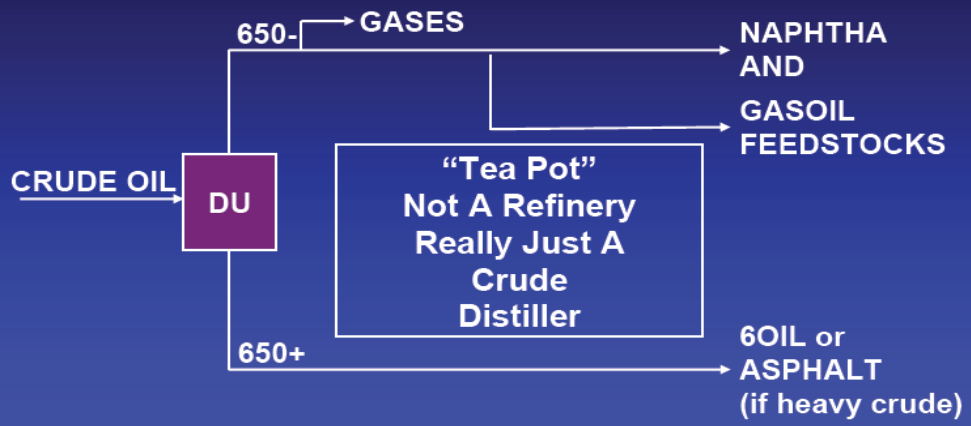


Factors Affecting New Asphalt Properties

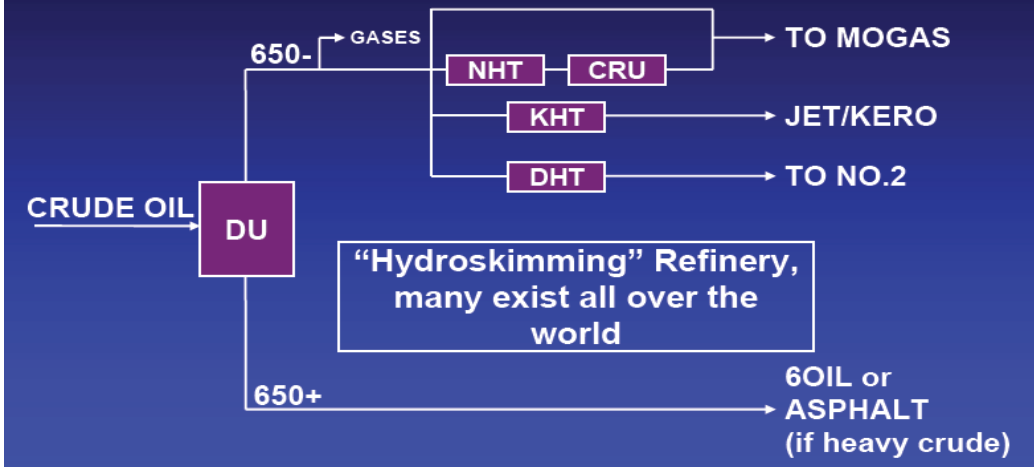
- **Crude Oil**
  - **Light, medium, or heavy**
  - **Sweet or Sour**
  - **Heteratoms**
- **How it is refined**
  - **Temperature**
  - **Pressure**
  - **Time**

Why Asphalt Will Never be Cheap Again...

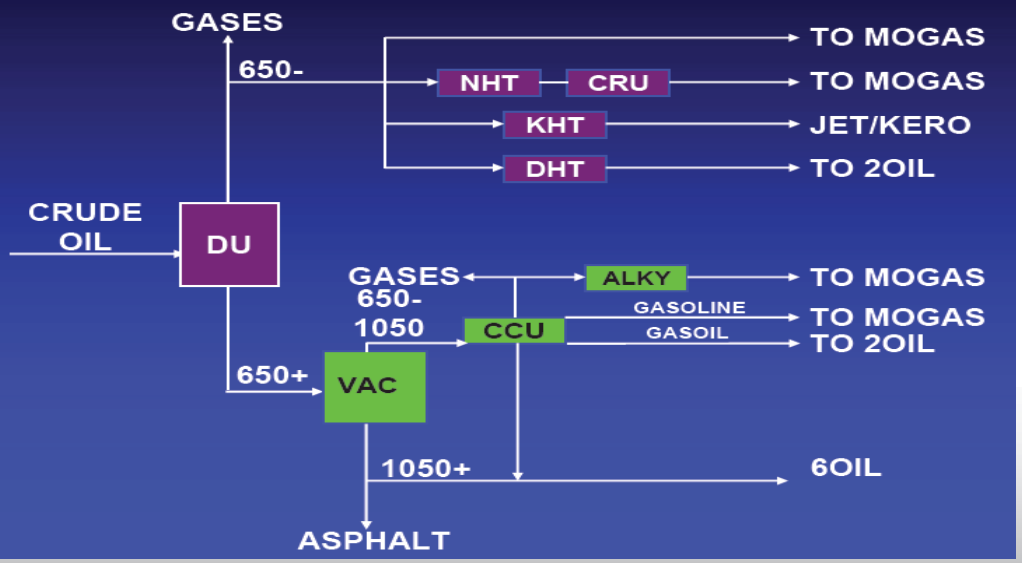
Topping Refinery



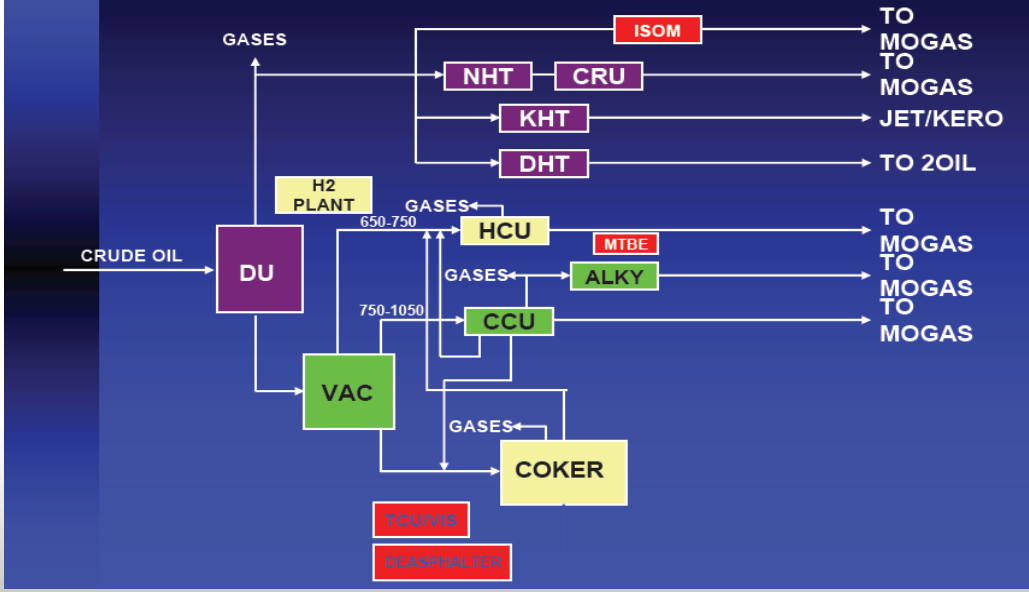
Simple Refinery



CCU - "Complex" Refinery

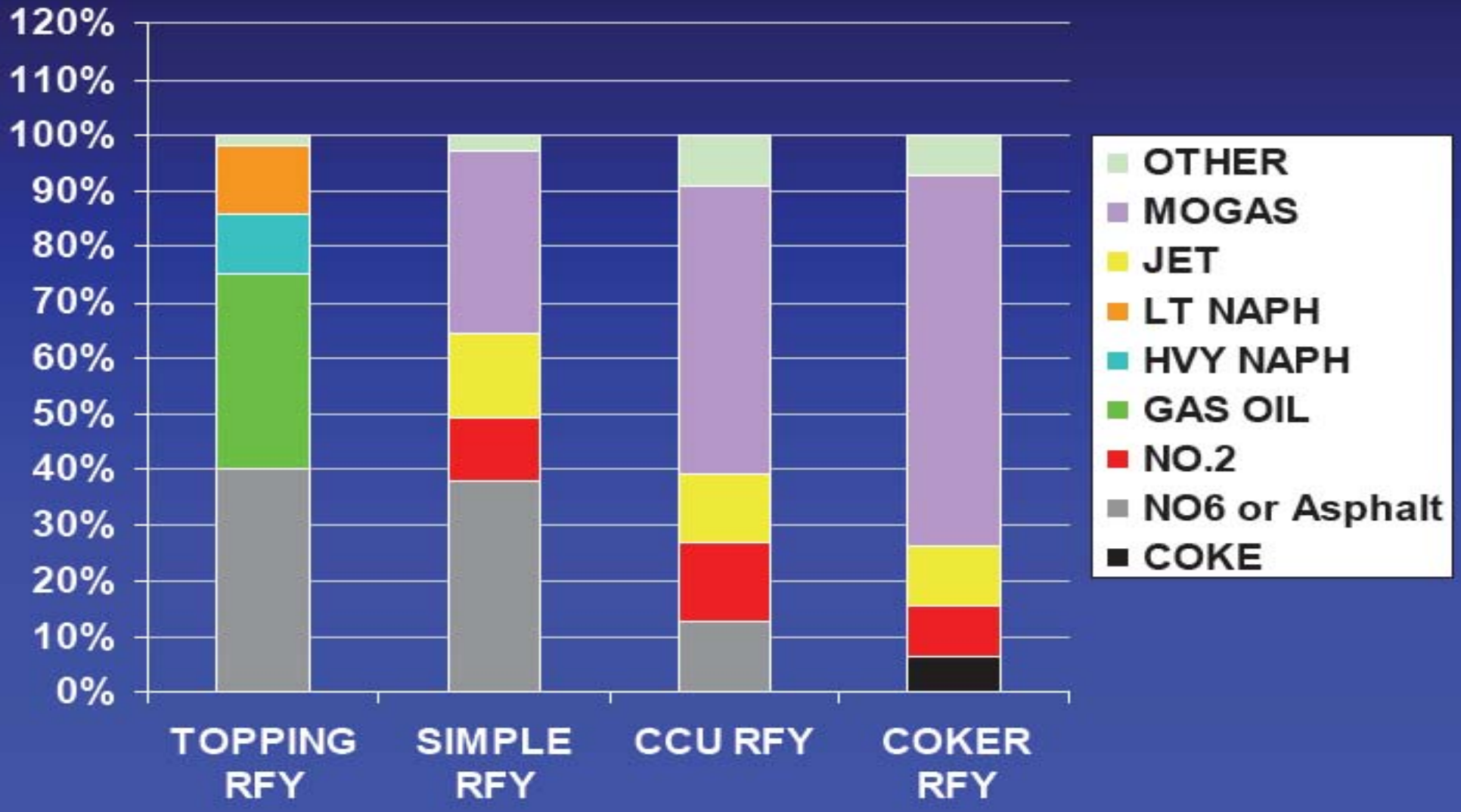


CCU/HCU/Coker - "Very Complex" Refinery



http://construction.transportation.org/sites/construction/docs/Haveland,%20Conoco,%20Asphalt%20and%20Fuel.pdf

Refinery Yield (% of Crude Intake)



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Asphalt Refining Capacity & Demand 2010

U.S. Total	535,000 B/D
	34.3 million tons
	Does not include Canadian asphalt capacity
U.S. Demand	25.3 million tons

Source: Oil and Gas Journal US Refining Report
Asphalt Institute Annual Usage Survey

Asphalt Economics

Barrel of Oil/Asphalt => 160 Liters

$ 90 per bbl	$ 515 per T
$ 100 per bbl	$ 570 per T
$ 120 per bbl	$ 685 per T

- This reflects only raw material costs for the refiner.
- It does not consider refining costs, transportation, or profit
- Does not consider market forces

Diesel Economics

Barrel of Oil/Diesel => 160 Liters

$ 2.50 per gallon	$ 0.66 per L	$ 105 per barrel
$ 3.00 per gallon	$ 0.79 per L	$ 126 per barrel
$ 4.00 per gallon	$ 1.05 per L	$ 168 per barrel

- This reflects only raw material costs for the refiner.
- If $ 100 crude, and $ 4 diesel, would you make diesel or asphalt?

Aspalt Pricing – Going Forward in 2012

According to Poten & Partners (1/6/12)

Rocky Mountain								
WY/MT					490	—	555	
CO/NM	+525	—	550		+500	—	550+	
AZ/UT	525	—	600		520	—	575	
Wholesale – Rail FOB					+450	—	460+	
West Coast/Northwest								
WA/OR	+550	—	575		+545	—	565+	
N. CA	+585	—	620–		+585	—	595+	
S. CA	+580	—	640–		+550	—	590+	

Asphalt

Three ways to move (pump) asphalt cement

1. **Heat (standard asphalt from refinery).**
2. **Thin with diluent. (cutbacks)**
3. **Emulsify (disperse AC in water).**

Each method has different costs and environmental effects associated with it.

Asphalt Cement - Grading

Based on performance parameters at high and low service temperatures

PG 64-22

“64” refers to 64 C (147F)

viscosity at mixing/laying temperatures

rutting potential

“-22” refers to -22 C

cold weather performance

Cutback Asphalt Cement

Types of cutback asphalt cement:

- RC: Rapid Cure (gasoline, naphtha):
  - High volatility of solvent
  - Tack coats, surface treatments
- MC: Medium Cure (kerosene):
  - Moderate volatility
  - Stockpile patching mix
- SC: Slow Cure (heavy oils, diesel):
  - Low volatility
  - Prime coat, dust control, cold mix

Asphalt Rubber

Thermal energy and mechanical energy used to combine:

- **asphalt cement,**
- **crumb rubber tires,**
- **and other additives**

Enhanced engineering properties of the asphalt-rubber composite.

Asphalt Emulsion or Emulsified Asphalt

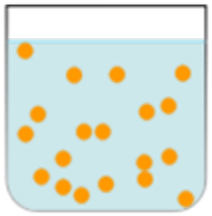
Combine two liquids that don’t mix

Homogeneous

Droplets within a continuous phase

Ⓐ 

Two Immiscible Liquids

Ⓑ 

Unstable Emulsion

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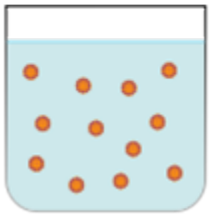
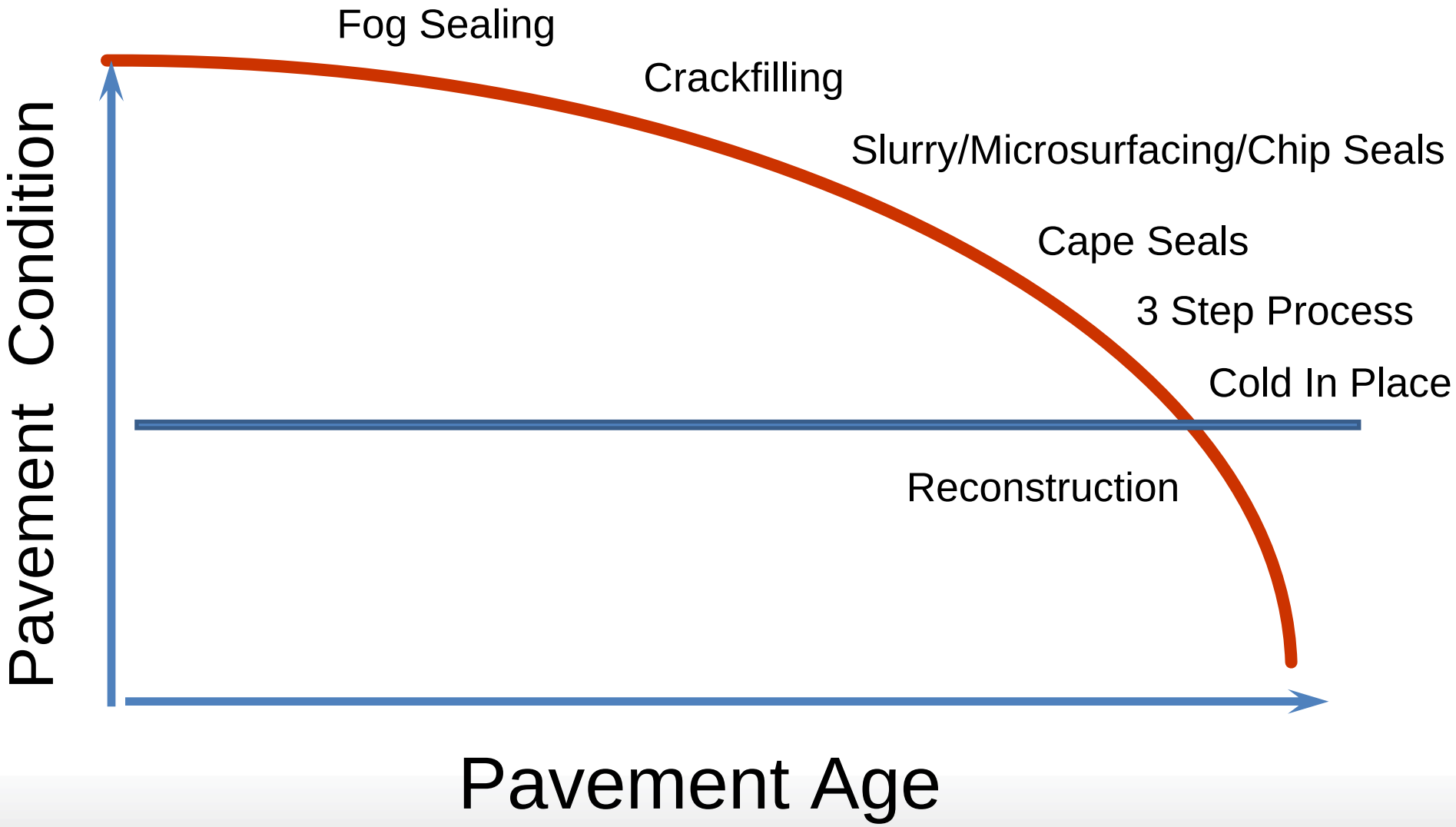
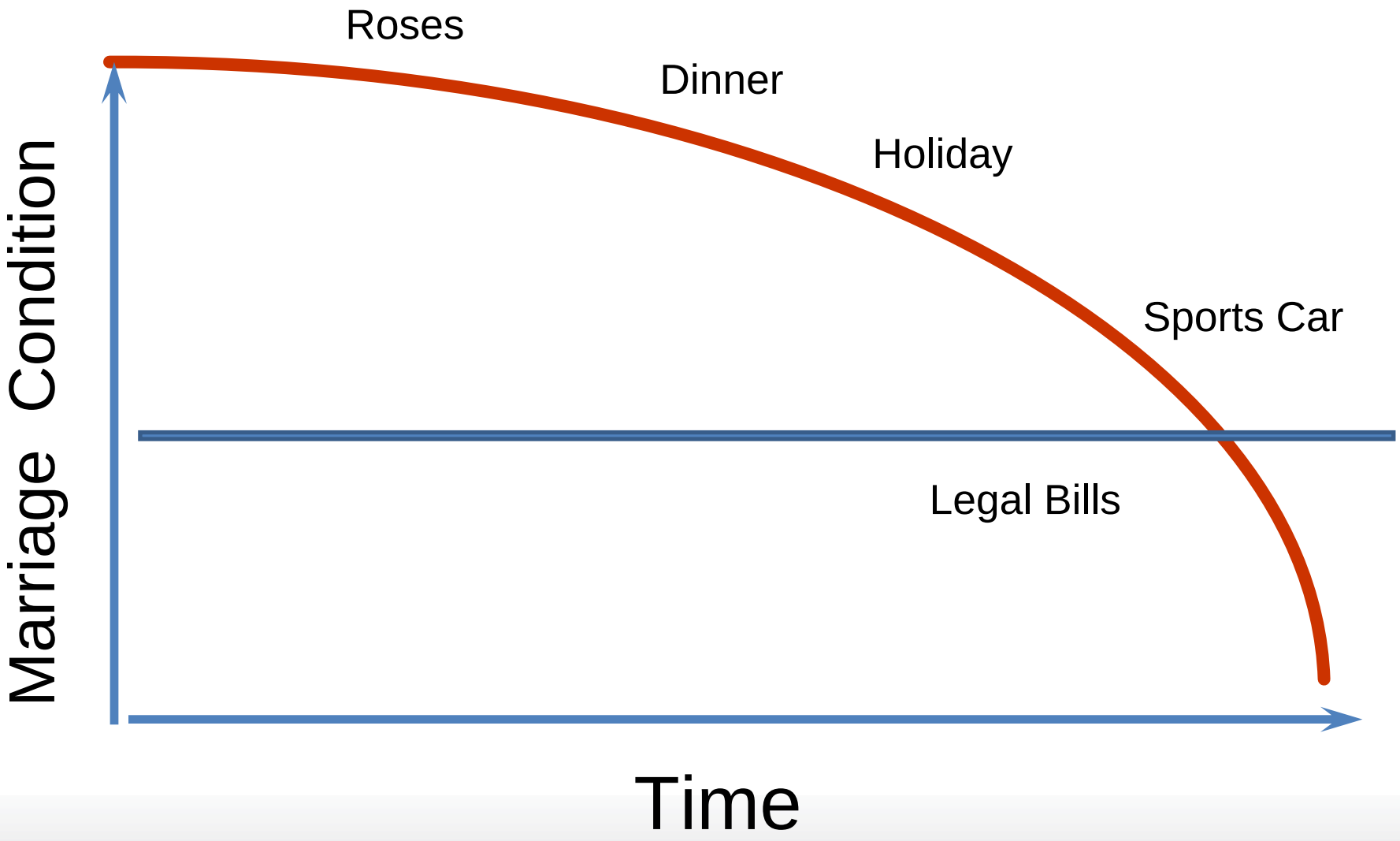
Separation begins

Ⓓ 

Stabilized with an emulsifier

Surface Treatments Moving Along the Curve




Roses
Dinner
Holiday
Sports Car
Legal Bills
Marriage Condition
Time

Thank you

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