

**Introduction to Asphalt  
Technology**

John Zaniewski  
LTAP Consultant  
PO Box 6103  
WVU  
Morgantown, WV 26506

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**Objectives**

- Understand the materials used for construction of flexible pavements
- Bituminous materials
- Aggregates
- Mix Design process
  - Marshall
  - Superpave
- Construction and inspection of asphalt concrete pavements

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**Fundamentals of Bituminous  
Materials and Mixes**

- Asphalt
  - hydrogen and carbon + minor elements
  - Bitumen
- Mineral Aggregate
  - coarse
  - fine
  - mineral filler
- Air
- Hot mix asphalt -
  - mixture of aggregate and asphalt
  - high quality road construction
- Cold mix
  - mixture of aggregate and emulsion
  - patching
- Spray applications

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## Uses of Asphalt

- Hot mix pavement -
  - central mix in batch, continuous or drum plant
  - transported hot
  - placed with paver
  - compacted
- Cold mix
  - central plant
  - use emulsion or cutback
  - used for patching
- Surface treatment
  - application of asphalt
  - single sized aggregate
  - rolled to orient aggregate
- Tack coat
  - spray application of emulsion
  - bond surface with new paving mix

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## Fundamentals of Asphalt

- Types of bituminous materials
- Types of aggregates
- Mix design
- Construction
- Performance

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## Bituminous Materials

- Asphalt - distillation of petroleum products
  - natural
  - manufactured
- Tar
  - destructive distillation process
    - from production of coke for coal
    - resistant to gasoline

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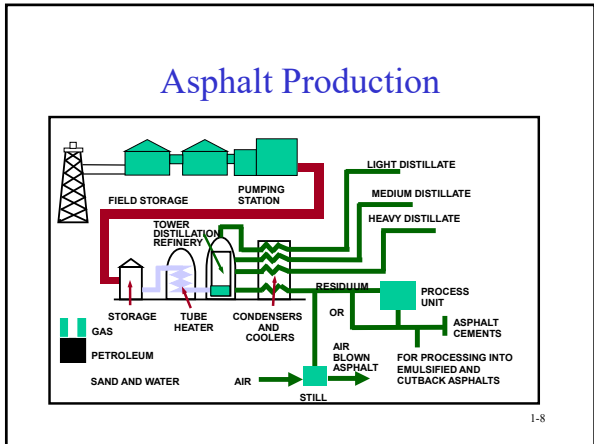
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- ### Asphalt Properties
- Consistency or hardness
    - ability to flow
    - viscosity
  - Effect of Heat
    - flows at high temperatures
    - stiff at low temperatures
    - ages when exposed to high temperature and air
  - Adhesion
  - Durability
  - Handling

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- ### Types of asphalt binders
- Binders
    - neat
    - modified
  - Emulsions
    - suspension of asphalt in water
  - Cutback
    - asphalt reduced in solvent
      - gasoline
      - naphtha
      - diesel

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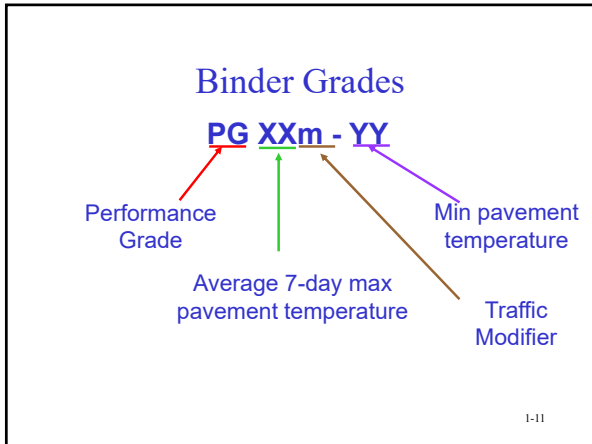
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- ### Grade Selection
- Primary selection based on temperature of the pavement about 1 inch below the surface
  - Selection modified based on traffic
    - loads
    - speeds
- WV grades**
- **Standard grade**
    - PG 64S-22
  - High volume roads
    - PG 64H-22
  - Optional
    - PG 58S-28
    - PG 64E-22
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- ### Aggregates Used in Asphalt
- 93 to 97 percent of weight of hot mix
  - Types
    - Limestone
    - Gravel
    - Blast furnace slag
    - Sand
      - manufactured
      - natural
    - Mineral filler
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## Properties of Aggregates

- Resistance to weathering
- Abrasion resistance
- Deleterious materials
- Unit weight - density
- Fractured faces
- Surface texture

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## Asphalt Mix Design

- Determine the combination of aggregates and asphalt that provides mixes with required characteristics
- Mix design methods
  - Marshall
  - Superpave
- Technicians are required to obtain certification by completing an approved mix design class.

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## Desired Characteristics

- Stability - ability to resist loads without excessive deformation
- Workability - ability to place and compact the mix
- Durability - ability to resist changes caused by traffic and environment

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## Construction

- Surface preparation
- Mix production
- Transportation
- Placement
- Compaction

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## Site preparation

### New Construction

- Planning and communication
- Traffic control
- Grade preparation
  - Grade
  - Compaction

### Rehabilitation

- Overlay
- Planning and communication
- Traffic control
- Surface preparation
  - Patching
  - Clean/sweep
  - Tack coat

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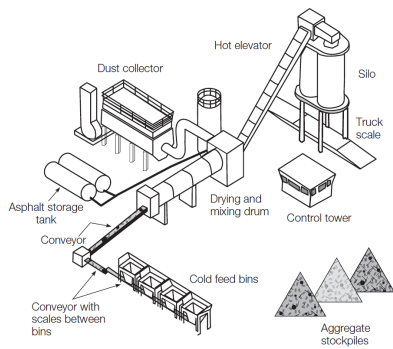
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## Hot Mix Production Drum Plant



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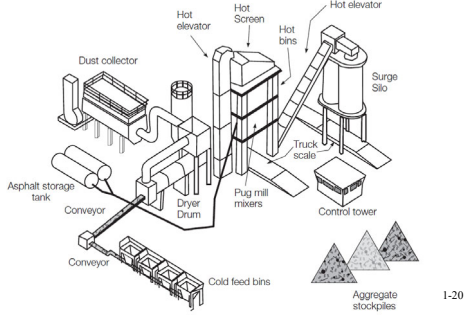
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## Hot Mix Production Batch Plant



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## Asphalt Concrete Placement

- Continuous operation
  - Delivery
  - Loading paver
  - Constant head of material
  - No thickness adjustment



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## Compaction

- Arrange aggregates into dense configuration
- Eliminate compaction by traffic
- Eliminate permeability



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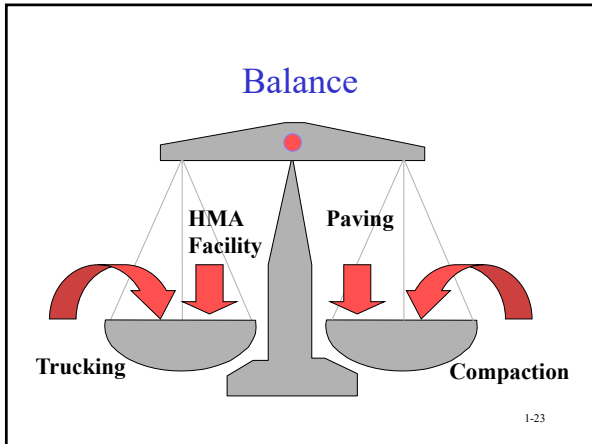
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- ### HMA Performance
- Highways serve the user!!!!!!!!!!
  - Performance parameters
    - Skid resistance
    - Smoothness
    - Distress?????
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- ### Summary
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| <ul style="list-style-type: none"> <li>• Asphalt – refined material           <ul style="list-style-type: none"> <li>– Neat</li> <li>– Modified</li> </ul> </li> <li>• Aggregates           <ul style="list-style-type: none"> <li>– Natural</li> <li>– Crushed</li> <li>– Slags</li> </ul> </li> <li>• Air</li> </ul> | <ul style="list-style-type: none"> <li>• Mix design           <ul style="list-style-type: none"> <li>– Marshall</li> <li>– Superpave</li> </ul> </li> <li>• Production           <ul style="list-style-type: none"> <li>– Hot mix</li> <li>– Cold mix</li> </ul> </li> <li>• Construction</li> <li>• Performance</li> <li>• Maintenance</li> </ul> |
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