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Technical
Series

Construction Materials: *Asphalt*

Types of Asphalt

Asphalt has a variety of applications in construction including:

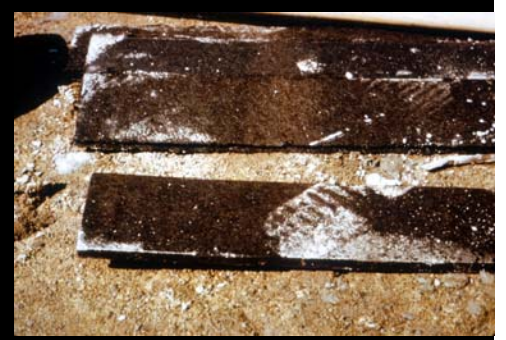
waterproofing & undercoatings

roofing materials

expansion joint filler

monolithic paving

unit pavers



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Asphalt Pavement



Asphalt paving mixtures consist of:

asphalt (or bituminous) cement

coarse aggregates

fine aggregates

mineral fillers

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Asphalt Pavement: Materials

Asphalt (or bituminous) **cement** is refined from crude petroleum and blended with other petroleum distillates:

RC: gas - rapid curing

MC: kerosene - medium curing

SC: low volatile oil - slow curing



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Asphalt Pavement: Materials

Aggregates consist of clean, dry:

Crushed stone

Gravel

Sand



Aggregates may be used singly or in combination.

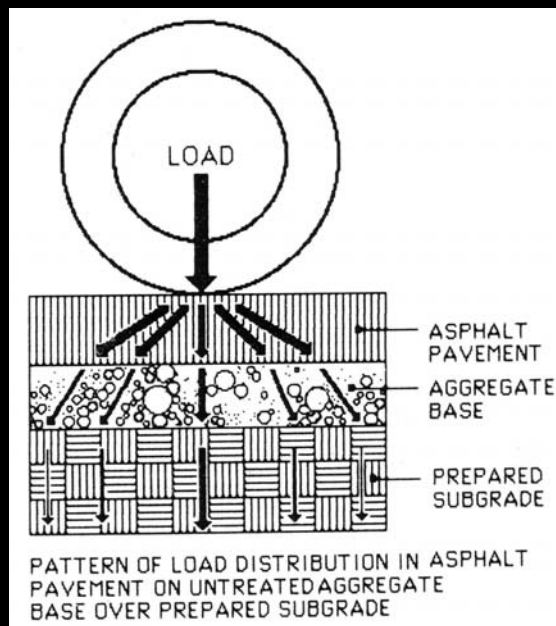
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Asphalt Pavement: Characteristics

Asphalt is a flexible pavement.

- Strength is derived from **layered construction** that distributes load over the subgrade (highest quality layer at the surface)



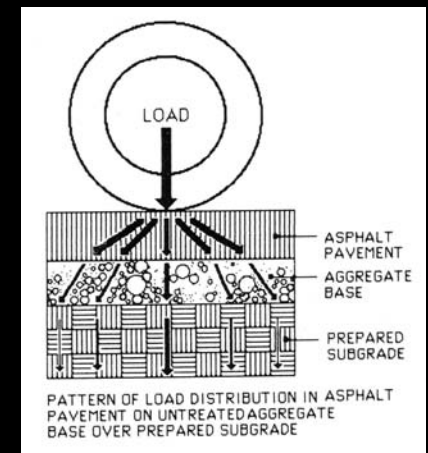
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Asphalt Pavement: Characteristics

Surface material does not assume structural strength as in rigid pavement (e.g. concrete)

- Asphalt provides an all-weather surface and prevents underlying layers from being destroyed by traffic and weather (asphalt should be viewed as a “protective skin”)
- Load is transmitted through the asphalt pavement. Load dissipates as it travels through the layers, since the load geometrically diminishes as it is transmitted down from the surface.



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Asphalt Pavement: Advantages

- Low initial cost
 - Leads to indiscriminant use.
 - Changes with economic climate
- Frost heave and settlement easily repaired.
- Easily opened and patched.
 - Results in rough roads
 - Visually chaotic
- No joints and more resilient riding quality.
- Heat absorption reduces icy conditions.



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Asphalt Pavement: Disadvantages

- More susceptible to heaving action and cracking
 - Weakness of material
 - Weakened subgrade particularly in spring
- Poor subgrades require more construction material

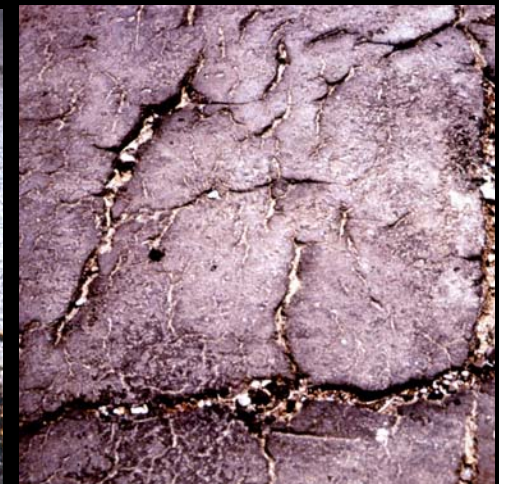


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Asphalt Pavement: Disadvantages

- Edges (particularly not contained) crack and break easily
- Requires greater maintenance - increased long term cost
- May soften in heat.



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Asphalt Pavement Classification

CLASS 1: Plant Mixes

Aggregates coated with asphalt by mechanical mixing.

- Hot-mix Asphaltic Concrete
- Cold-mix Asphaltic Concrete
- Road & Travel Plant Mixes

CLASS 2: Penetration Systems

Aggregates and asphalt placed separately in layered courses.

- Single Asphalt Surface Treatments
- Multiple Course Asphalt Treatments
- Penetration Macadam

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Asphalt Pavement Plant Mixes

Hot-Mix Asphaltic (Bituminous) Concrete

- Aggregates:
 - heated and dried
 - combined according to specific design
 - well (or dense) graded
- Mixed with asphaltic cement by mechanical methods.
- Hauled by truck, mechanically spread and rolled while hot.

Hot-mix asphalt is the highest quality asphalt pavement.



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Asphalt Pavement Plant Mixes

Cold-Mix Asphaltic (Bituminous) Concrete

- Aggregates and liquid asphalt mixed and placed at air temperature.
- Pavement normally placed in warm weather.
- Mechanical mixed by stationary or travel plant.



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Asphalt Pavement: Penetration Systems

Prime Coat: asphalt applied to untreated base and/or sub-base.

- Bonds base course and asphalt pavement binder (or base) course
- Consolidates surface
- Reduces rise of capillary moisture



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Construction Materials: *Asphalt*

Asphalt Pavement: Penetration Systems

Tack Coat: single application of asphalt

- Provides adhesion between previously prepared foundation layer and new wearing surface
- Bonds asphalt to structures such as curbs, catch basins, and manholes.



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Asphalt Pavement: Penetration Systems

Seal Coat: single application of asphalt and aggregate

- Seals raveling or cracked surfaces.
- Provides nonskid surface for old pavements.
- Provides color coat.



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Asphalt Pavement: Penetration Systems

Multiple Course Asphalt Treatment

- Placement of layer of asphalt and layer of aggregate - repeated one or more times.
- Aggregate + asphalt = 1 course
- Succeeding courses employ smaller aggregates.

Asphalt Macadam

- Crushed stone placed and rolled on prepared subgrade.
- Heavily sprayed with liquid asphalt to fill voids and bond stone.
- Thin layer of smaller aggregate to further fill voids.
- Seal coat applied.

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Porous Asphalt Pavement

Non-porous Pavements

High runoff rates may:

- increase flooding
- increase pollution
- decrease water supply

Porous Pavements

Reduced runoff rates may:

- reduce size and extent of storm drainage system
- enhance water supply
- relieve flash flooding
- preserve vegetation

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Porous Asphalt Pavement

Factors Influencing Porous Pavement Design

- Subgrade bearing capacity under wet soil conditions
- Subgrade permeability and water storage capacity
- Frost penetration
- Surface permeability

Construction of porous pavements requires an understanding of and sensitivity to their function.

- Use of open (or gap) graded mix design
- Avoid over compaction of subgrade
- Appropriate installation of geotextile fabric filters

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Porous Asphalt Pavement



Porous asphalt pavement



Normal asphalt pavement

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Designing and Specifying Asphalt Pavement

Design of Asphalt Pavements

- Subgrade and soil conditions are critical to the design. Consult a *soils and/or foundation engineer*.
- Consult with Asphalt Institute or other asphalt trade association regarding mix design.
- Reference standard charts based upon traffic design criteria (loading, traffic volumes, etc.), soil conditions and climate.

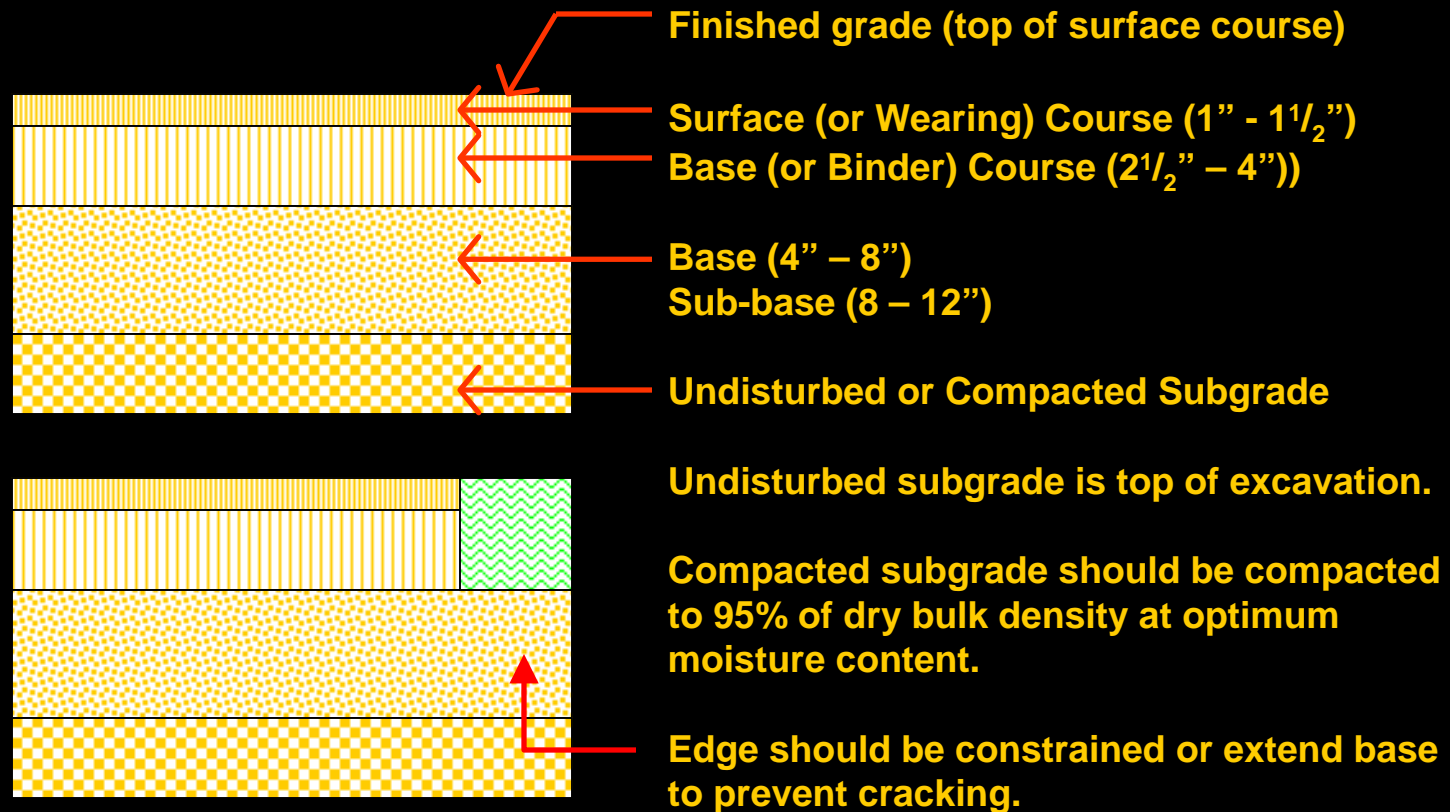
Asphalt Pavement Specifications

- Best reference for mix design is State DOT Highway Specifications. Batch plants are familiar with and are set up for these standards.

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Asphalt Pavement Details



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Asphalt Pavement Details

Surface (Wearing)
Course



Longitudinal
Joint



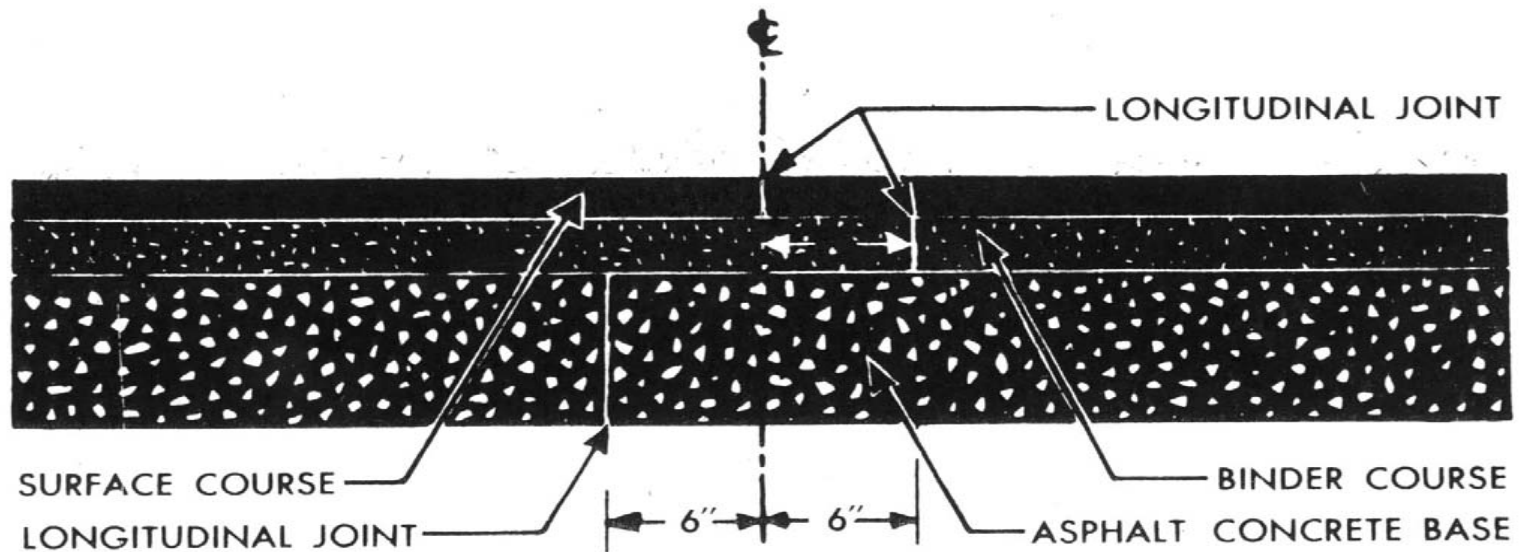
Base (Binder)
Course



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Asphalt Pavement Details



Avoid aligning longitudinal joints to reduce moisture penetration and weak vertical plane.

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Asphalt Pavement: Subgrade and Base



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Construction Materials: *Asphalt*

Asphalt Pavement: Subgrade and Base



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Construction Materials: *Asphalt*

Asphalt Pavement: Subgrade and Base



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Asphalt Pavement: Placement



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Construction Materials: *Asphalt*

Asphalt Pavement: Placement



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Asphalt Pavement: Placement



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Construction Materials: *Asphalt*

Asphalt Pavement: Placement



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Construction Materials: *Asphalt*

Asphalt Pavement: Color Coating

