

Pavement Materials & Design

Introduction to Pavement Systems

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Objectives

- Introduce students to the basic concepts of pavement systems.
- Understand the components and functions of pavement structures.
- Differentiate between types of pavements and their applications.

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Reading Assignment:

- Principles of Pavement Design by E. J. Yoder and M. W. Witczak, 2nd Edition,
 - Chapter 1: "Introduction to Pavement Systems", pp. 1-25.
- Pavement Engineering: Principles and Practice by Rajib Mallick and Tahar El-Korchi,
 - Chapter 2: "Pavement Types and Components", pp. 20-40.

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What is a Pavement System?

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What is a Pavement System?

- **Pavement** system is that part of the road or highway which supports the wheel loads imposed on it from traffic moving over it.
- What is a Pavement System?

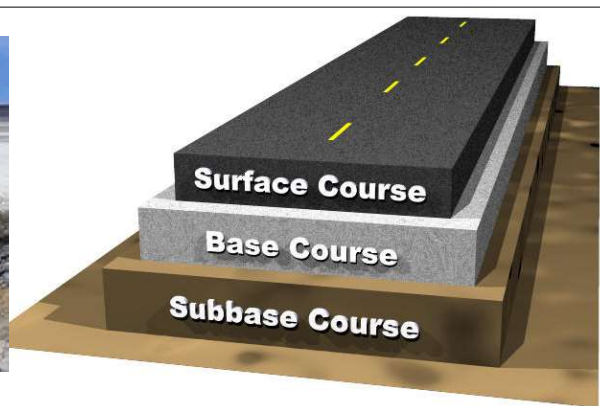
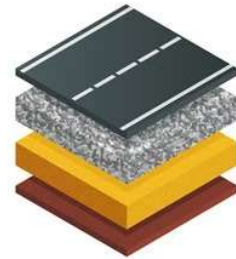


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What is a Pavement

- Pavement is a multi-layered structure put as horizontal layers one above the other, which distributes the vehicular loads over a larger area



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<https://www.dreamstime.com/stock-image-asphalt-layer-road-construction-image35766921>

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Purpose of Pavement Systems

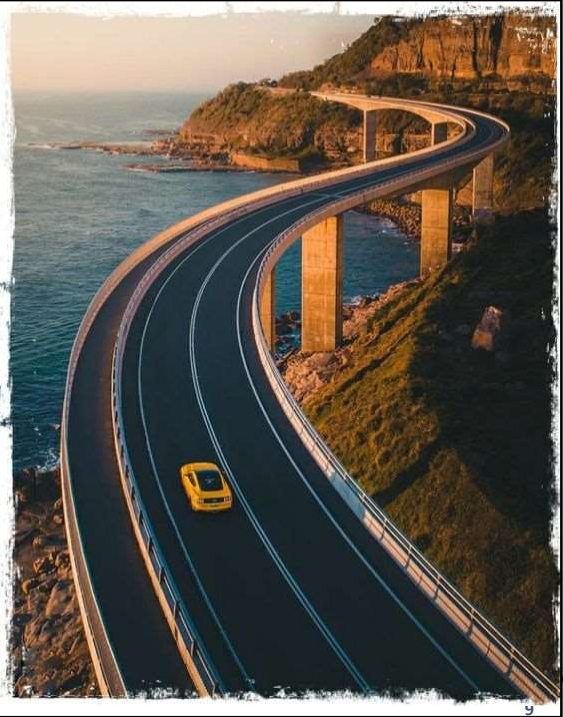
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Purpose of Pavement Systems

Functionality:

- Provides a smooth and even surface for vehicles, reducing wear and tear on vehicles and improving ride quality.

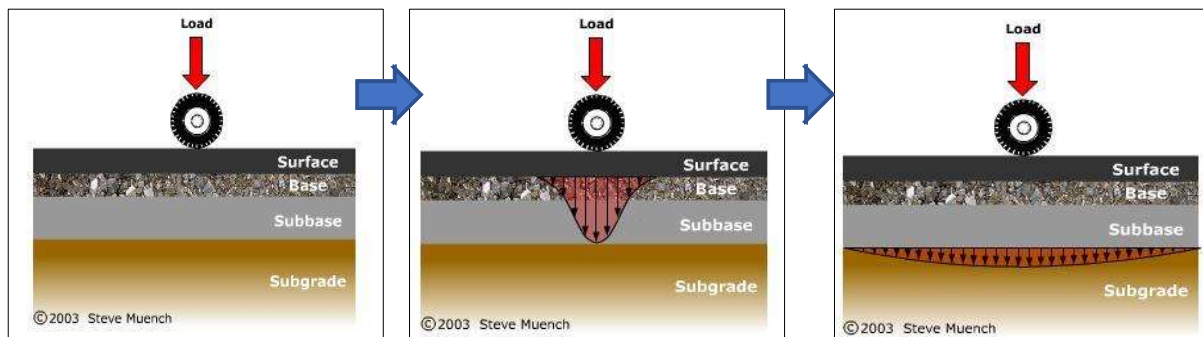


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Purpose of Pavement Systems

Load Support

- Distributes traffic loads to prevent damage to underlying soils and maintain structural integrity.



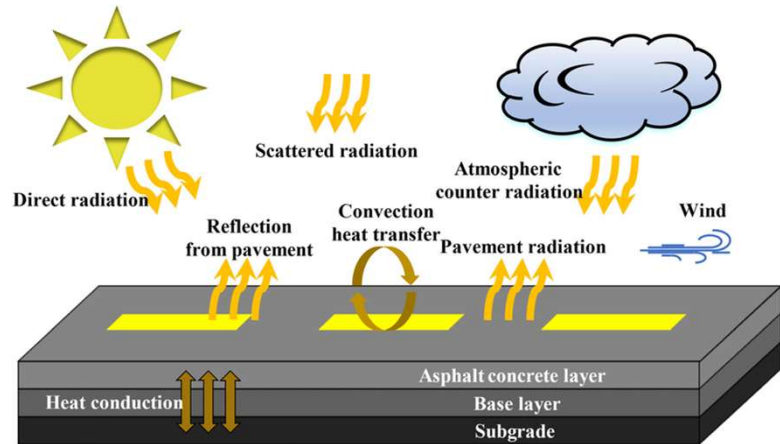
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Purpose of Pavement Systems

Durability

- Designed to withstand traffic loads, environmental factors, and aging to ensure a long service life.



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Purpose of Pavement Systems

Drainage:

- Facilitates proper water runoff to prevent erosion and damage to the pavement and subgrade.



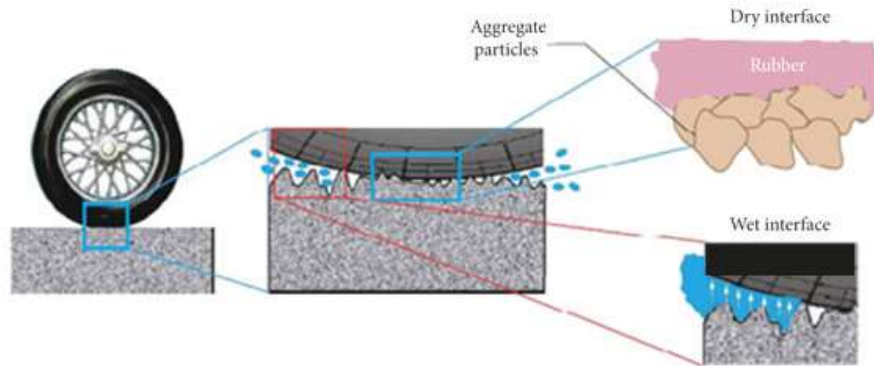
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Purpose of Pavement Systems

Safety:

- Enhances vehicle traction and reduces the risk of accidents by maintaining a stable driving surface.



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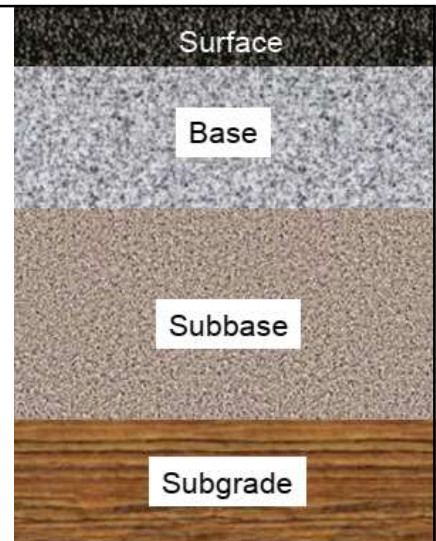
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Pavement Structure and Components

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- Pavement is a **multi-layered** structure put as **horizontal layers** one above the other, which **distributes the vehicular loads over a larger area**



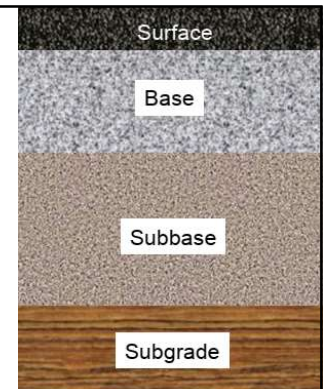
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Pavement Structure and Components

Subgrade

- **Function:**
 - supports the entire pavement structure.
- **Materials:**
 - Natural soil or fill material that



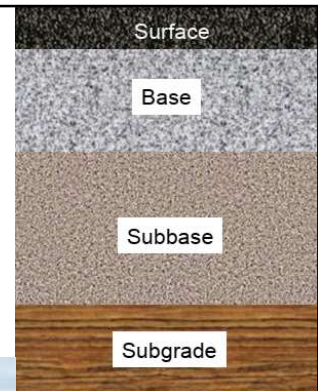
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Pavement Structure and Components

Subbase Course:

- **Function:**
 - Provides additional support and assists in drainage.
- **Materials:**
 - Coarse aggregates or treated soils.



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Pavement Structure and Components

Base Course:

- **Function:**
 - Supports the surface course and distributes loads to the subbase and subgrade.
- **Materials:**
 - Granular materials or stabilized materials.



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Pavement Structure and Components

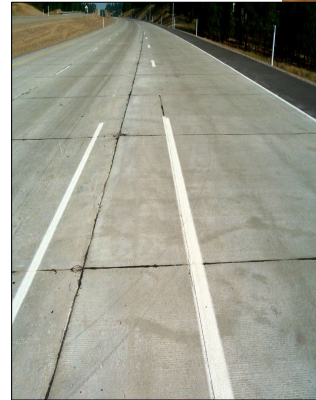
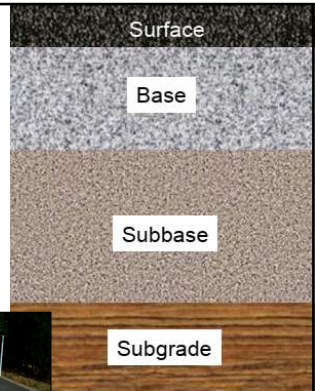
Surface Course:

■ Function:

- Provides a smooth driving surface, wear resistance, and skid resistance.

■ Materials:

- Asphalt or concrete.

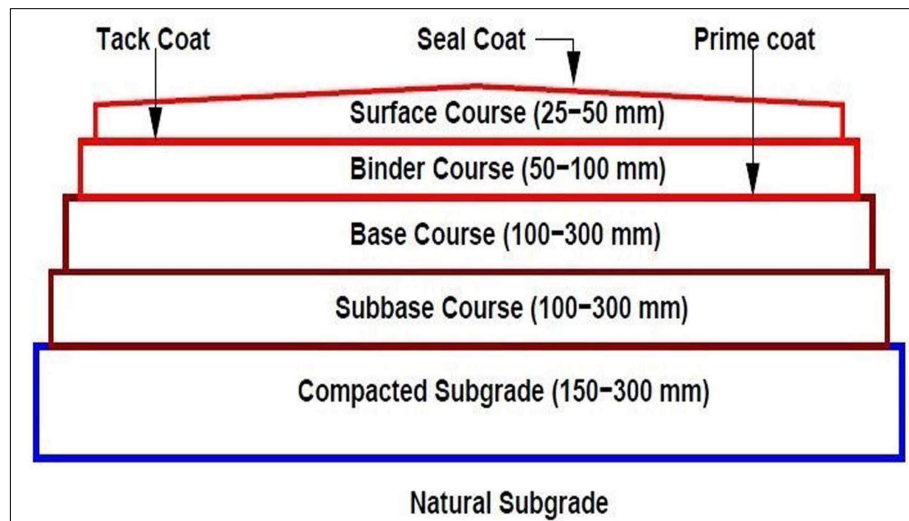


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Cross section consist of (from top):

1. Seal coat
2. Surface course
3. Tack coat
4. Binder course
5. Prime coat
6. Base course
7. Subbase course
8. Compacted subgrade
9. Natural subgrade



*The use of various courses is based on either necessity or economy, and some of the courses may be omitted

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Classification of pavements

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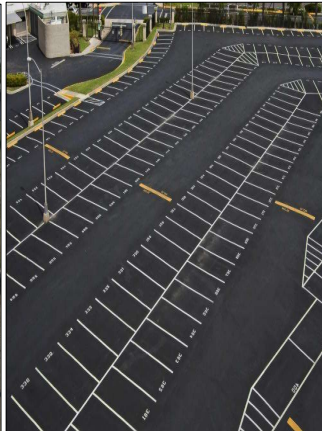
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Classification of pavements

Classification by function



Highway pavement



Parking lots pavements



Airport pavements



Ports and Heavy industrial pavements

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Classification of pavements

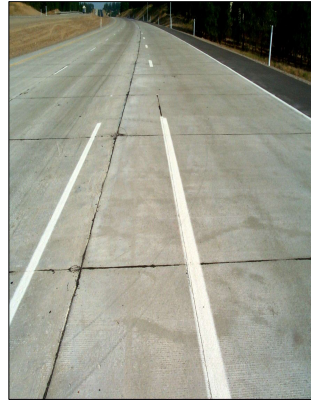
Classification by structure



Gravel (unpaved) pavements



Flexible pavements (asphalt concrete)



Rigid (concrete) pavement



Composite pavements

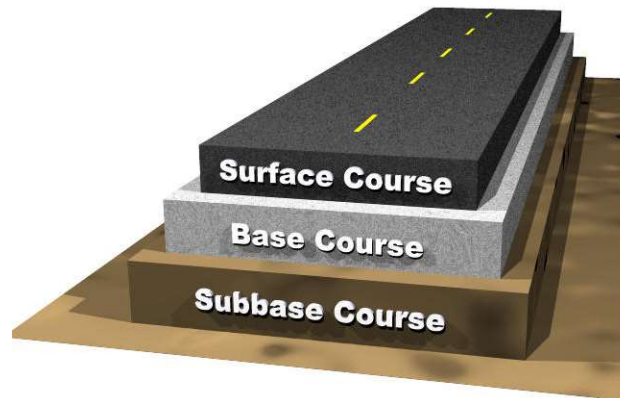
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Flexible pavements

- Pavements typically consist of asphalt concrete placed over granular base/subbase layers supported by the compacted soil

➤ Materials: Asphalt binder, aggregate, and additives.

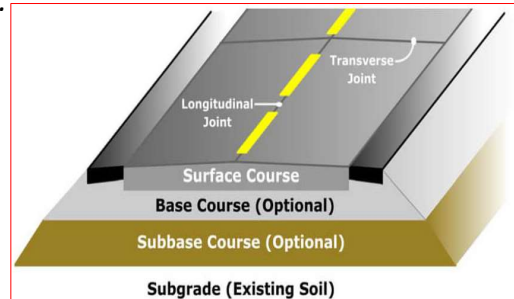


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Rigid pavements

- Pavement constructed of **Portland cement concrete Pavements** (150 -300 mm) placed over granular base/subbase layers (100-300 mm) supported by the subgrade.
- *Materials: Portland cement concrete, reinforcement.*



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Composite pavements

- Consists of **multiple structurally significant** layers of different heterogeneous compositions
- Composed of both **HMA & PCC**.
- **Very expensive and rarely used.**
- **Most of the available are the rehabilitation of PCC using asphalt overlays.**



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Factors Affecting Pavement Performance

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Factors Affecting Pavement Performance

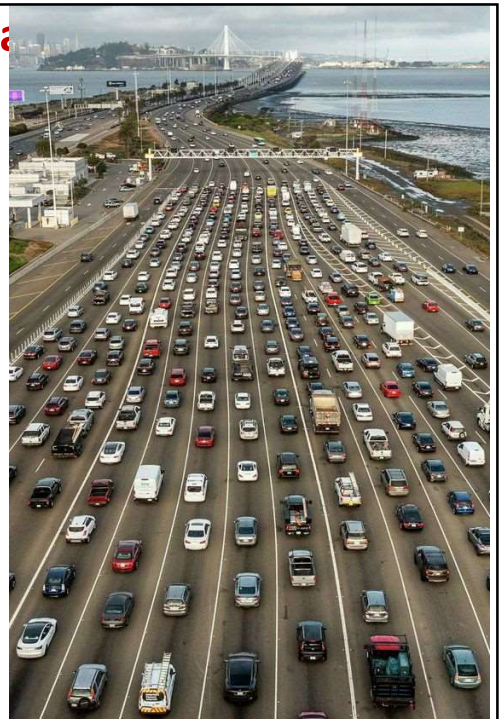
Traffic Loads and Volume:

■ Impact:

- Higher loads and traffic volumes lead to increased wear and potential damage.

■ Considerations:

- Design must account for expected traffic conditions.



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Factors Affecting Pavement Performance

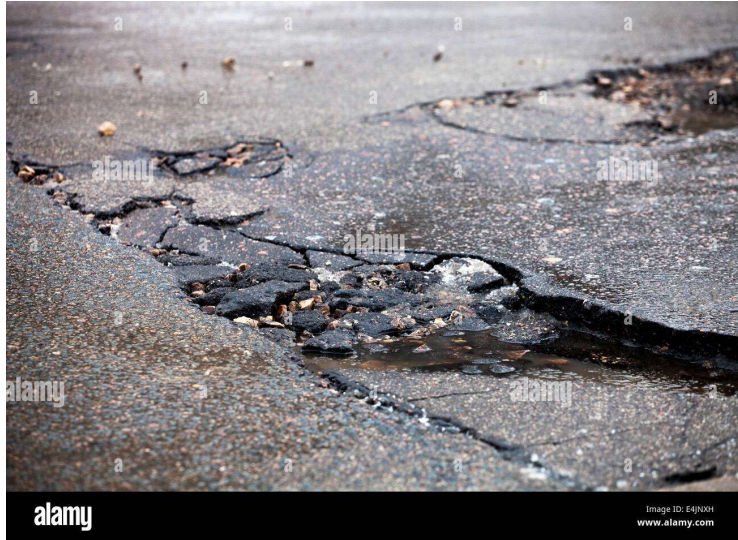
Environmental Factors:

■ Effects:

- Temperature fluctuations, moisture, and freeze-thaw cycles impact pavement performance.

■ Mitigation:

- Use of appropriate materials and design to withstand environmental stresses.



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Factors Affecting Pavement Performance

Material Properties:

■ Impact:

- High-quality materials enhance performance and longevity..

■ Considerations:

- Regular testing and quality control during construction.



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Factors Affecting Pavement Perform

Design and Construction Practices:

■ Design:

- *Proper design according to traffic loads and environmental conditions.*

■ Construction:

- *Adherence to standards and best practices to ensure pavement performance*

