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Introduction to HIGHWAY ENGINEERING

SKAA 2832 HIGHWAY ENGINEERING

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HIGHWAY MATERIALS

Part 1

Introduction, Types of Pavement, Pavement Layers

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Content

INTRODUCTION

ROAD CLASSIFICATION

PAVEMENT LAYERS

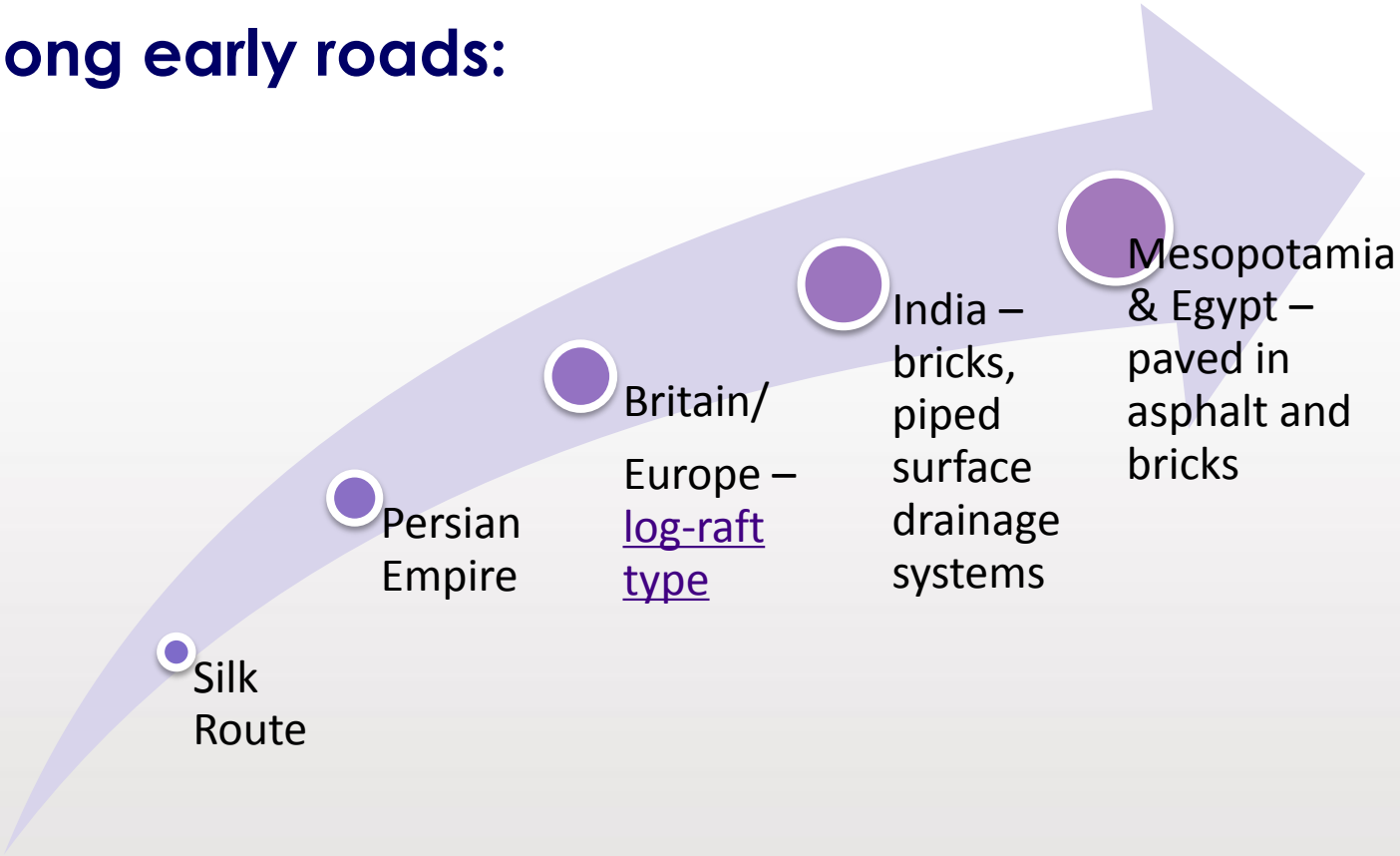
- Subgrade
- Subbase
- Road base
- Surfacing

PAVING MATERIALS

- Aggregate
- Bitumen

INTRODUCTION

Among early roads:



INTRODUCTION

Types of road surface:

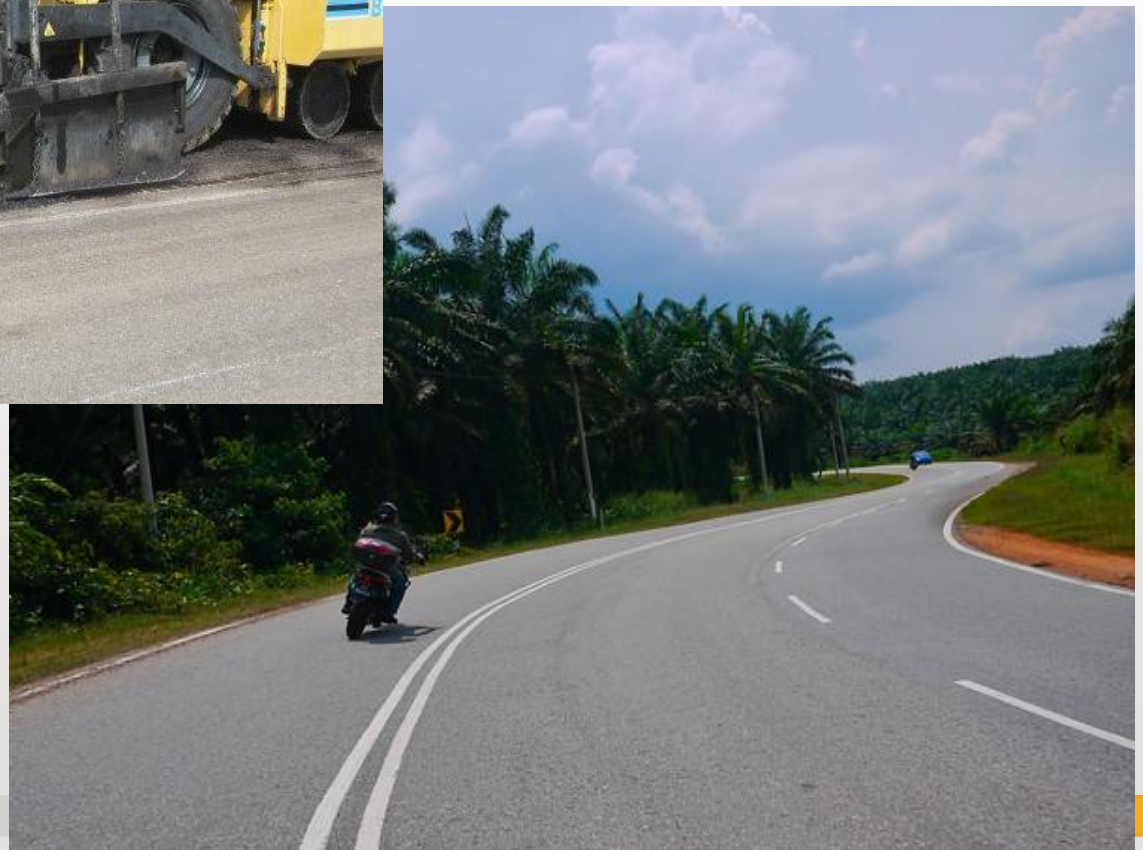
- Earth road
- Gravel road
- Concrete road (rigid)
- Interlocking concrete block pavement (semi-rigid)
- Bituminous road (flexible)
  - ✓ Surface dressing
  - ✓ Asphaltic concrete
  - ✓ Porous asphalt

Earth Road

Gravel Road

Surface Dressing (chip seal)

Asphaltic Concrete (dense)

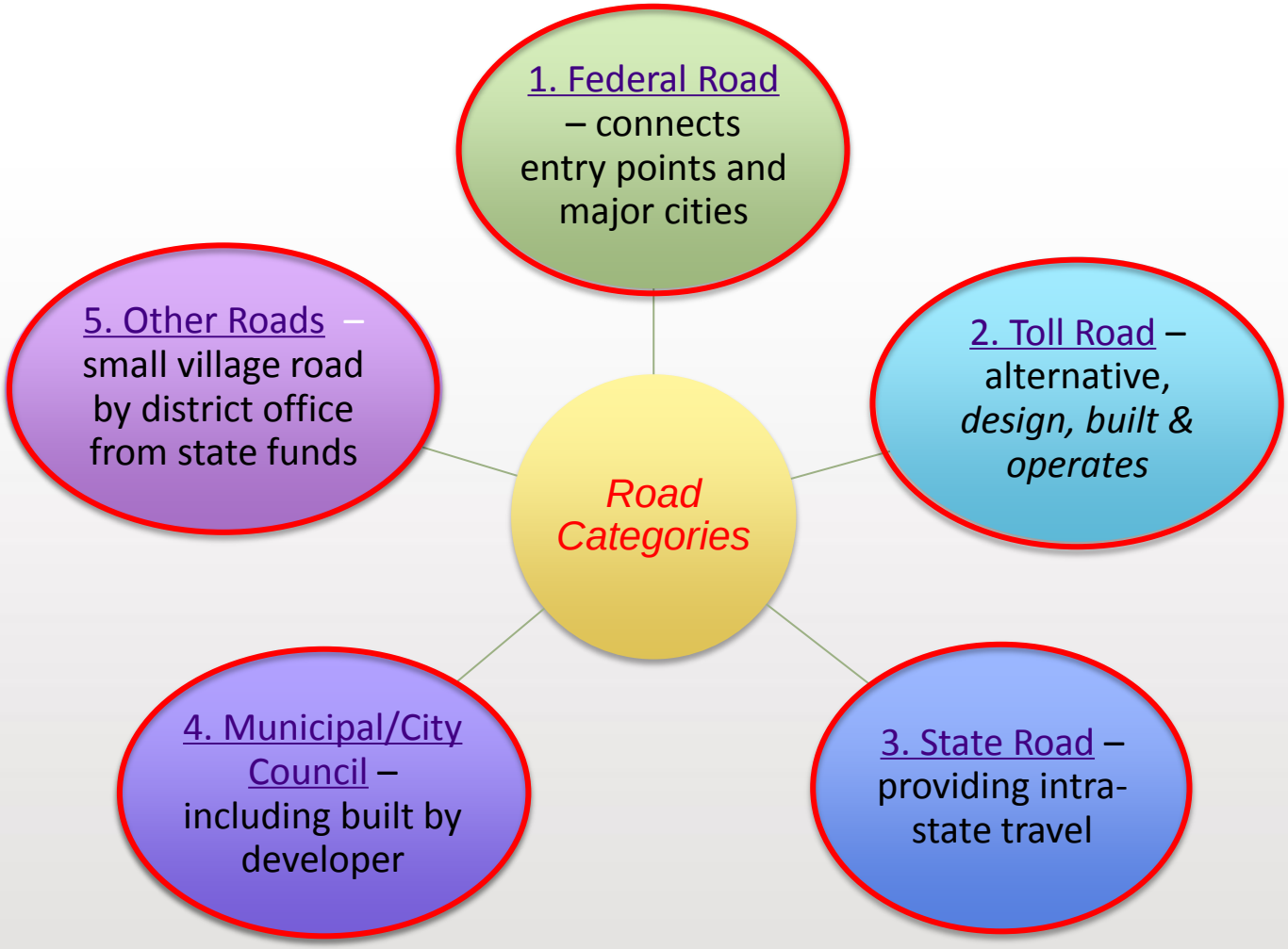


Porous Asphalt

Concrete Pavement

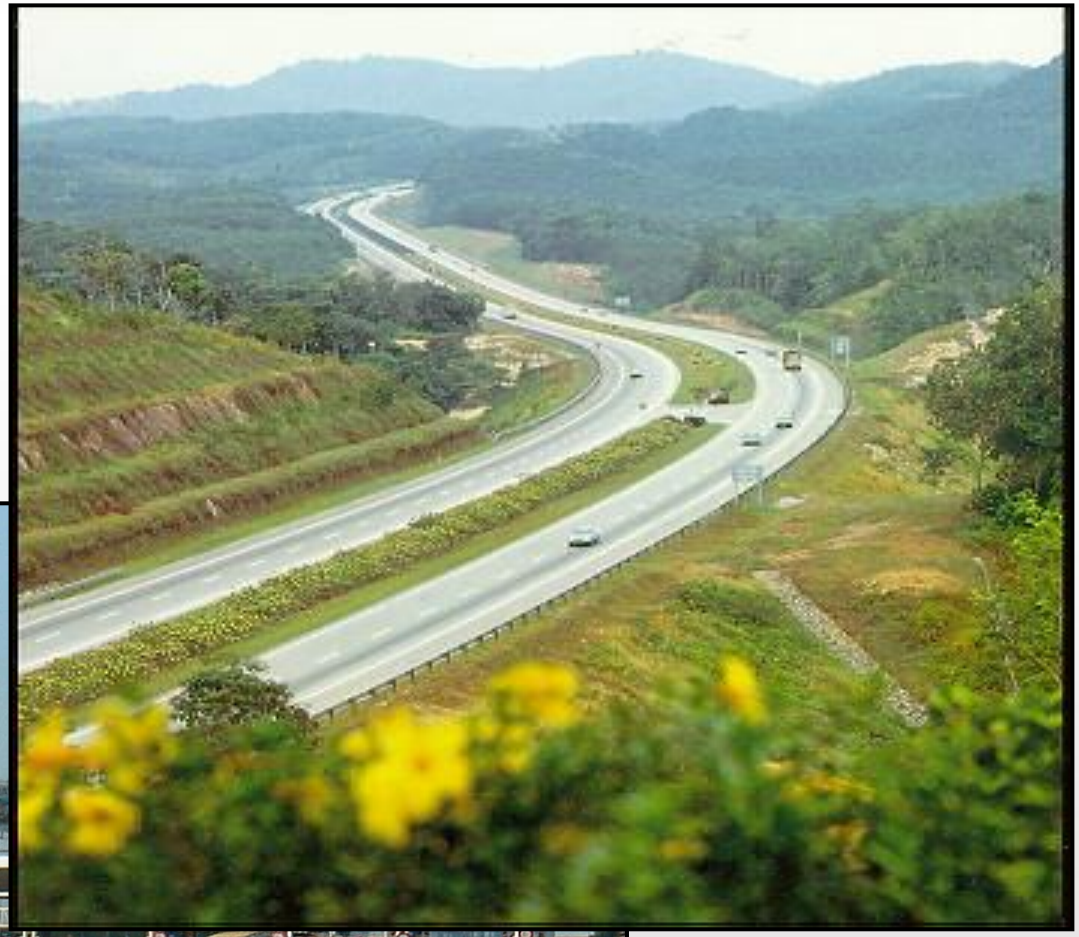
Interlocking Concrete Block Pavement

Road Categories



1 Federal Road

E2 Expressway (Toll Road)



J 8 State Road

Municipal Road

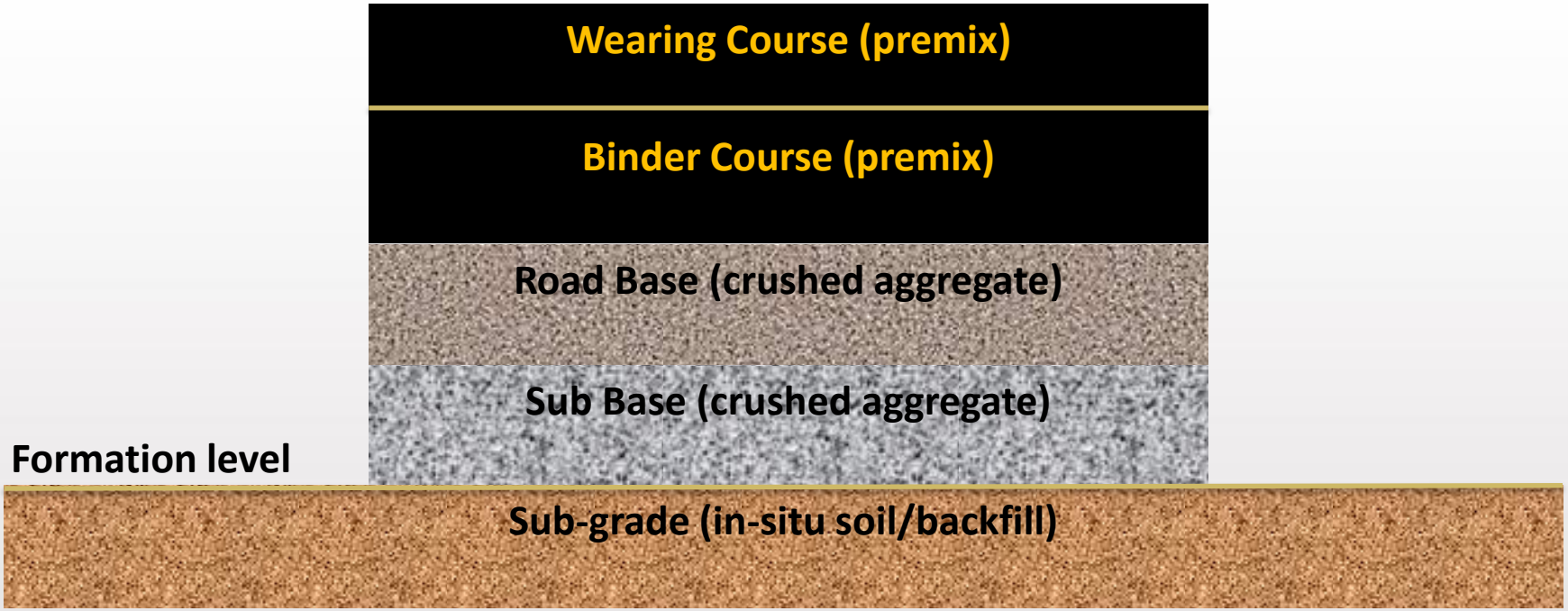
Other Road

Road Classification Standard

Rural – R **Urban – U**

R1/U1 – speed ≤40 km/h	Lowest geometric design
R2/U2 – low volume of local traffic; speed 50 km/h; no access control.	Low geometric design
R3/U3 – serve local traffic; partial or no access control; speed 60 km/h.	
R4/U4 – speed ≥70 km/h; partial access control.	Medium geometric design
R5/U5 – speed ≥80 km/h; partial access control.	High geometric design
R6/U6 –traveling speed ≥90 km/h; full access control.	

ROAD LAYERS


Wearing Course (premix)
Binder Course (premix)
Road Base (crushed aggregate)
Sub Base (crushed aggregate)
Formation level
Sub-grade (in-situ soil/backfill)

Sub-grade

Properties of good sub-grade:

- ✓ Stable
- ✓ Consistent strength
- ✓ Able to drain away water

Factors affecting soil strength:

- ✓ Soil type
- ✓ Moisture content
- ✓ Method and compaction effort

Tests on soil for sub-grade

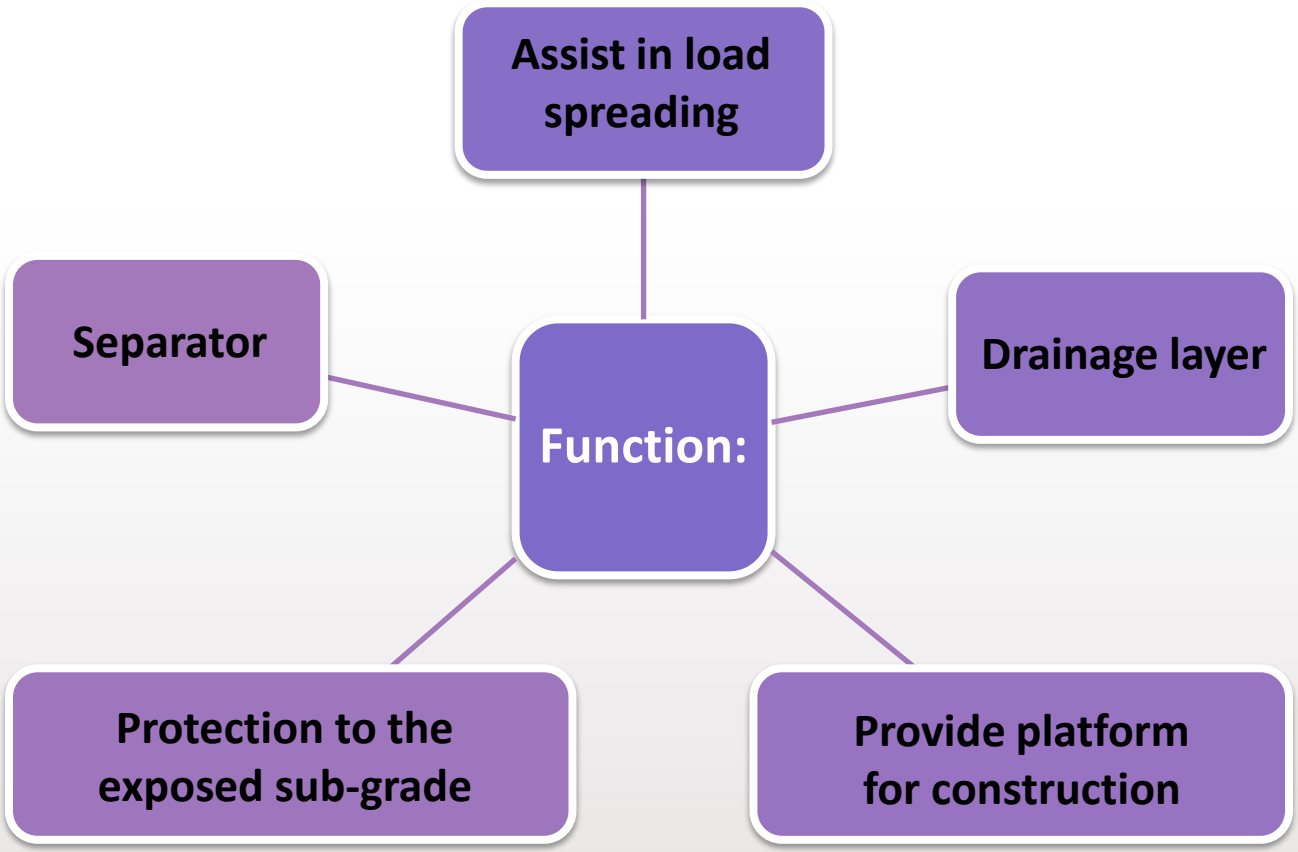
- ✓ Liquid Limit (LI)
- ✓ Plastic Limit (PI)
- ✓ Compaction
- ✓ California Bearing Ratio

Sub-grade

Unsuitable materials:

1. Silt, peat, logs, stumps, toxic material and mud
2. Any material
   - Consists of highly organic clay and silt;
   - Having LL > 80% and/or PI > 55%;
   - Susceptible to spontaneous combustion;
   - Containing large amounts of roots, grass and other vegetable matter.

Sub-base


Assist in load spreading
Separator
Function:
Drainage layer
Protection to the exposed sub-grade
Provide platform for construction

Sub-base

Materials used:

- ✓ Sandy laterite, CBR > 20
- ✓ Crushed aggregate, CBR > 30
- ✓ Cement stabilised, CBR > 60

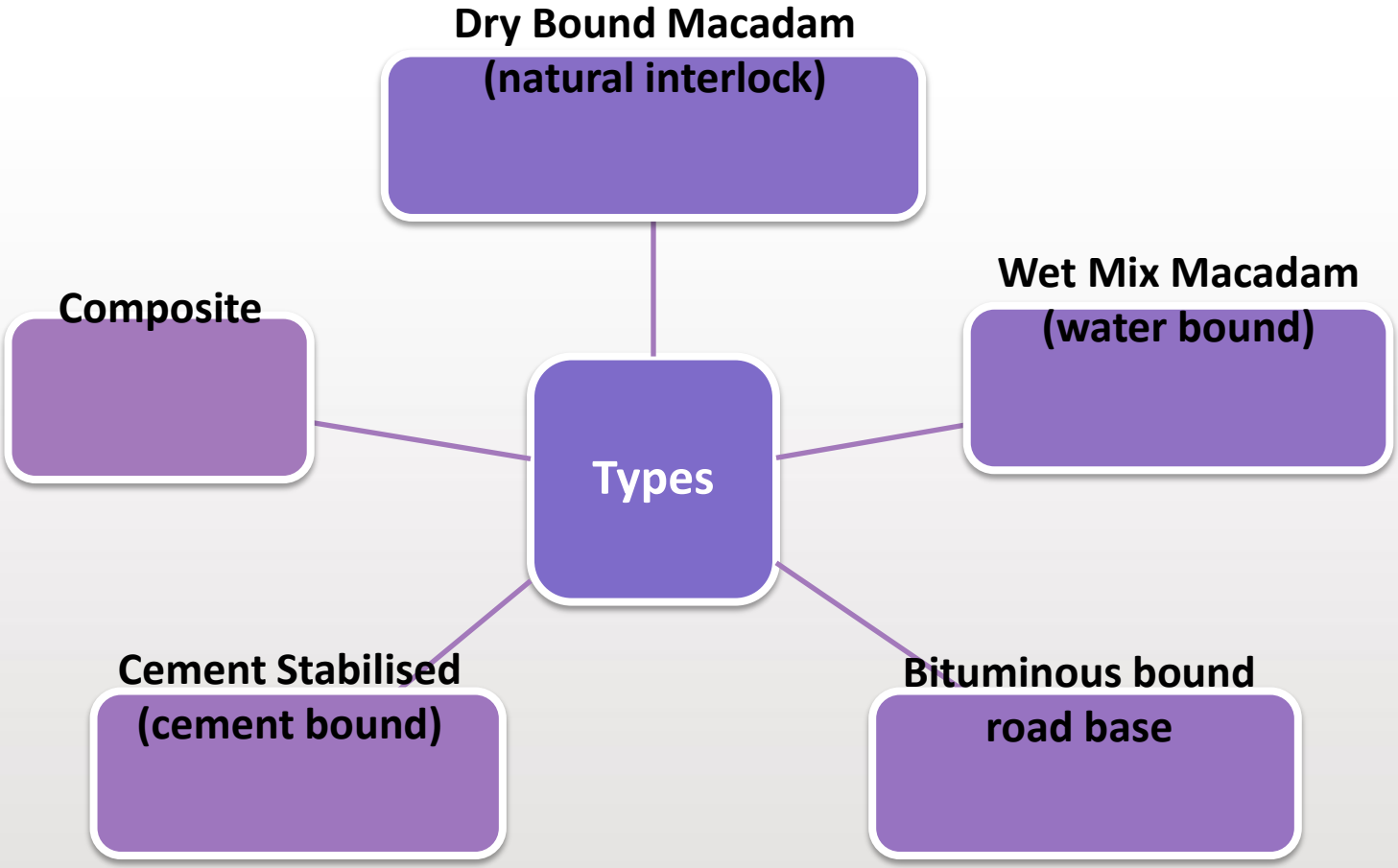
Quality tests:

- ✓ California Bearing Ratio (CBR)
- ✓ Liquid Limit (LI)
- ✓ Plastic Index (PI)
- ✓ Aggregate Crushing Value
- ✓ Los Angeles Abrasion Value
- ✓ Grading (sieve analysis)

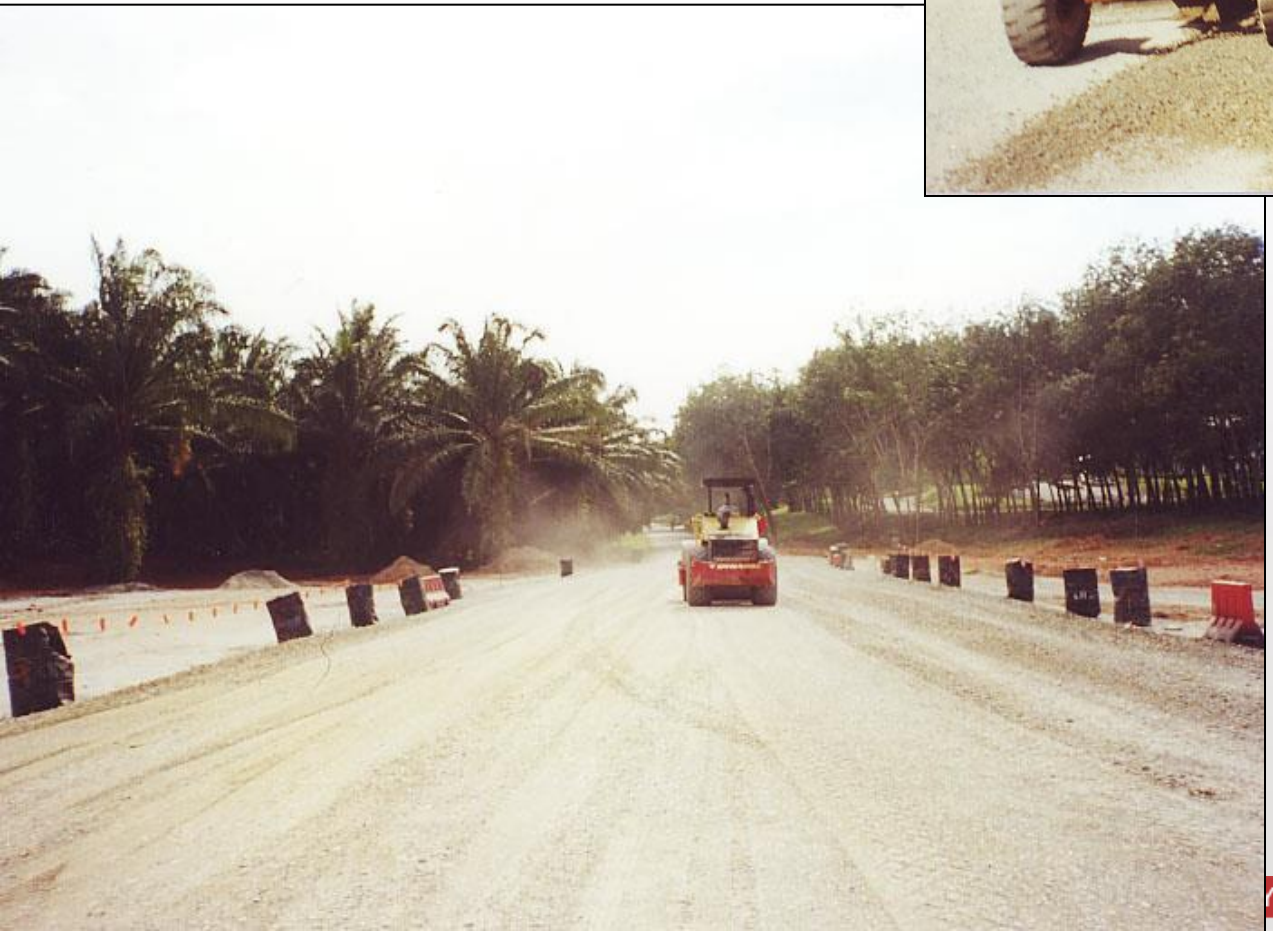
Subbase

Road Base

- Main load spreading layer



Road base



Surface layer

Two main layers

Binder Course

Function:

- Distribute load over road base
- Provide good shape and surfaces to lay wearing course

Example: ACB 28, BMB20, AC14

Wearing course

Function:

- Provide durable skid resistance surface
- Withstand abrasion and traffic stresses
- Cambered for drainage purpose

Example: ACW20, BMW14, AC10

Material used – asphaltic concrete (crushed aggregate + binder + filler)

Binder Course

Wearing Course

Thank You