



O N L I N E

LEARNING

HIGHWAY DRAINAGE AND MAINTENANCE - Part 2

SKAA 2832 HIGHWAY ENGINEERING

Mr Che Ros Ismail | Dr Norhidayah Abdul Hassan

Faculty of Civil Engineering



Content

- ✓ Highway Drainage System
- ✓ Highway Maintenance
- ✓ Pavement Rehabilitation
- ✓ Visual Assessment of Flexible Pavement Surface Conditions



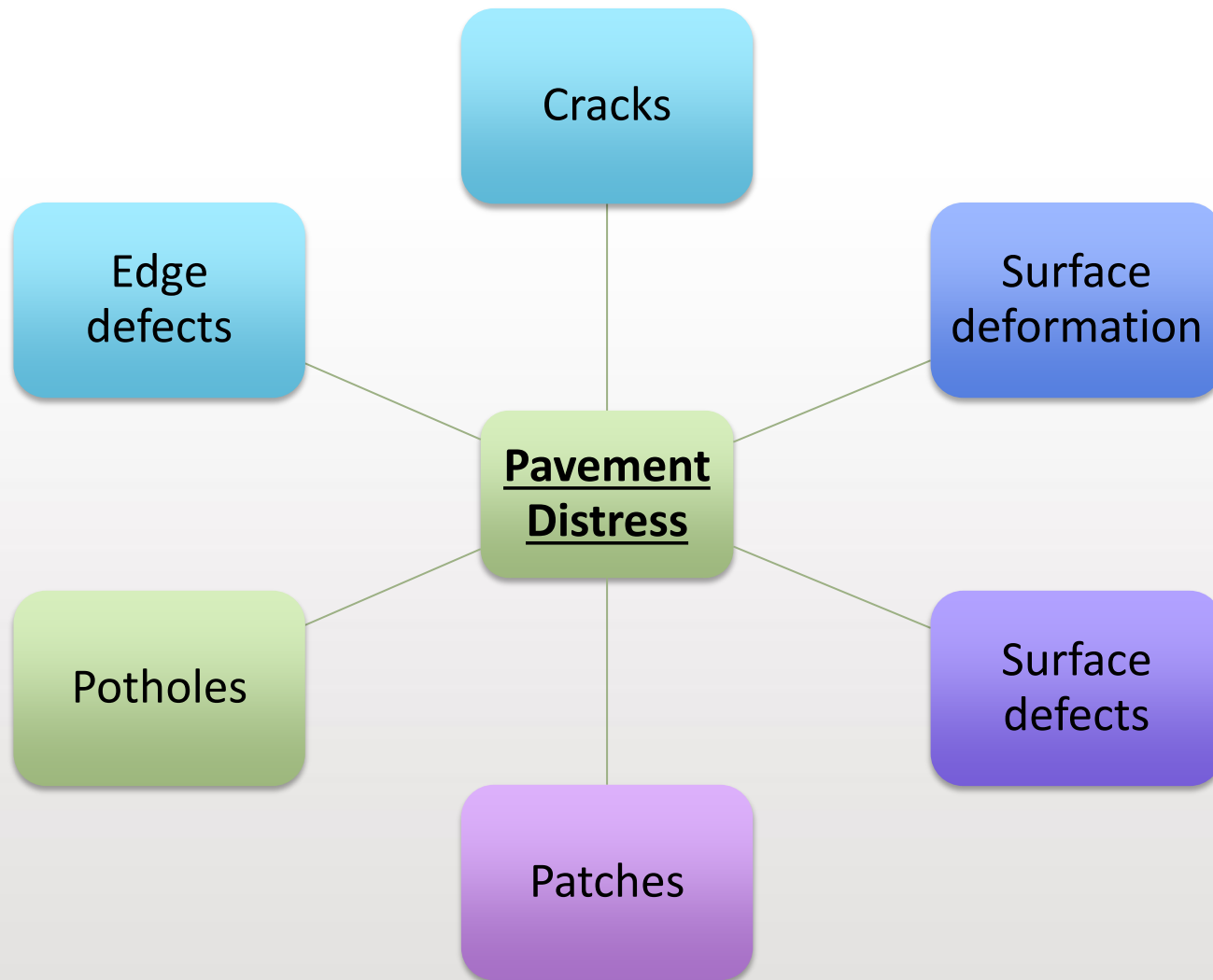
Pavement ability to
continue service

Determine deficiencies
and inadequacies

Importance?

Determine remedial
measures

Planning and
programming



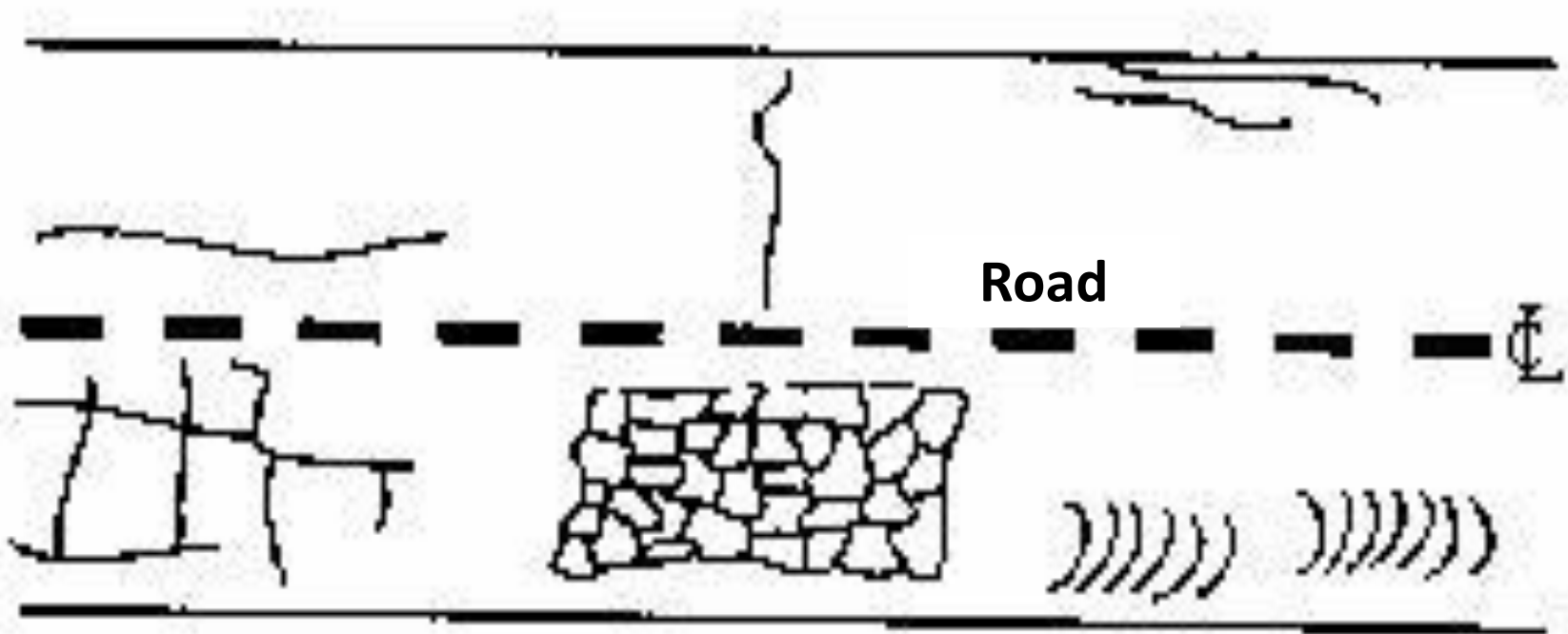


Cracks

Longitudinal

Transverse

Edge



Block

Crocodile

Crescent

Road





Possible causes of cracks

- ✓ Depression and Shrinkage
- ✓ Fatigue life of surfacing exceeded
- ✓ Age embrittlement of surfacing
- ✓ Reflective cracking from underlying layers
- ✓ Poor construction joint



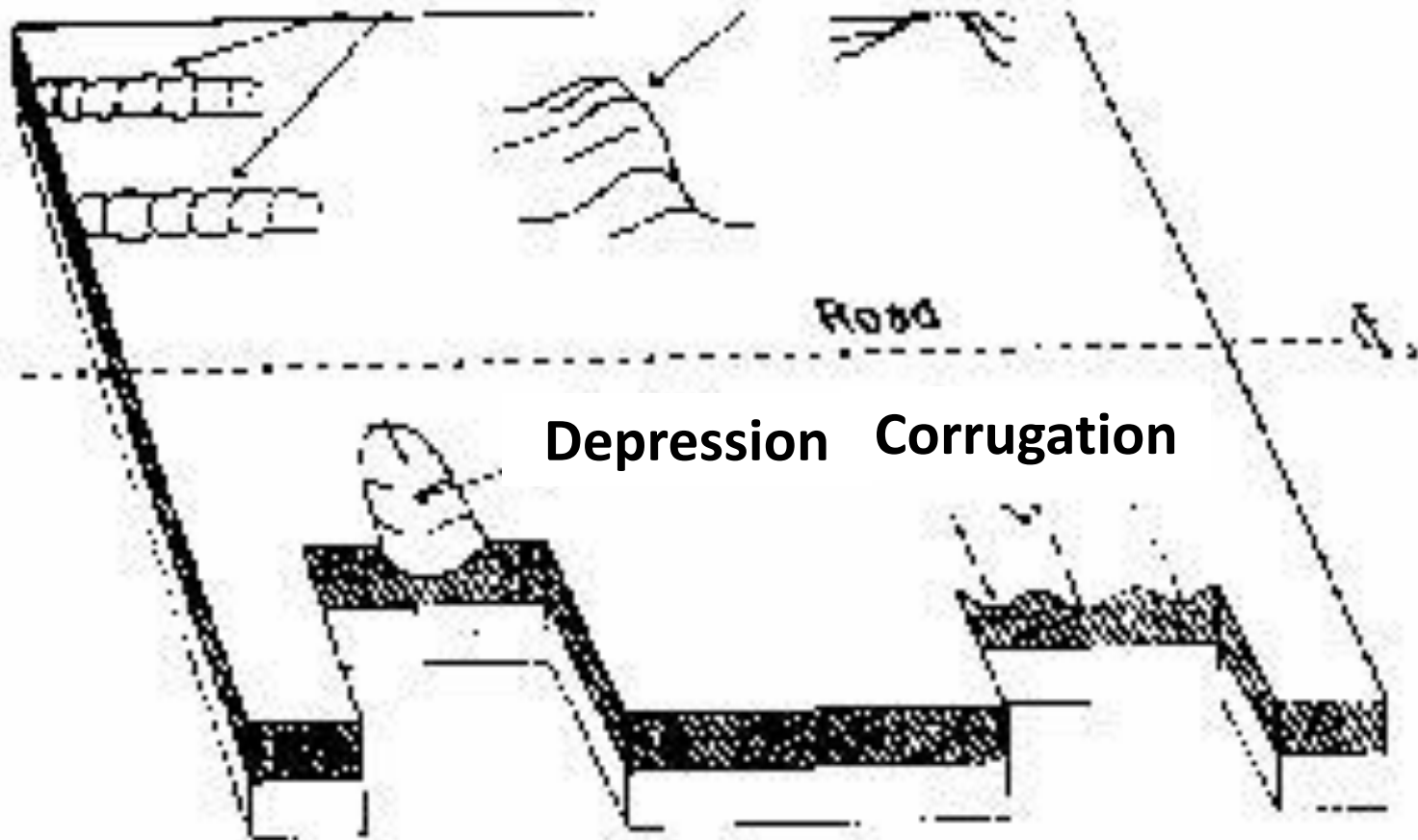
Treatments of Cracks

- ✓ Crack sealing
- ✓ Cut and patch
- ✓ Replace the surface material
- ✓ Thin overlay with stiffer mix
- ✓ Reconstruction

Surface Deformation

Rutting

Shoving



Depression Corrugation



Possible causes of Deformations

- ✓ Inadequate thickness
- ✓ Poor compaction
- ✓ Unstable premix, base or sub-base
- ✓ Lack of bond between bituminous layers

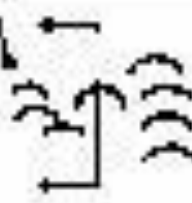
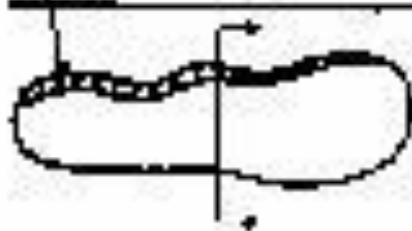
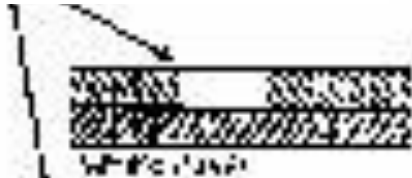


Treatments of Surface Deformations

- ✓ **Overlay or reconstruction**
- ✓ **Replace/recycle with stiffer mix**
- ✓ **Base/sub-base strengthening**
- ✓ **Improve subsoil drainage**
- ✓ **Shoulder improvement**

Delamination

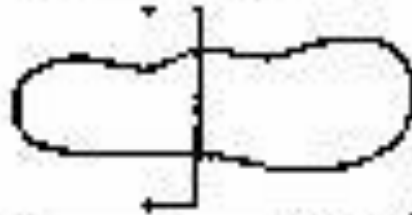
Polishing



Bleeding



**Stripping/
raveling**





Possible causes of Surface Defects

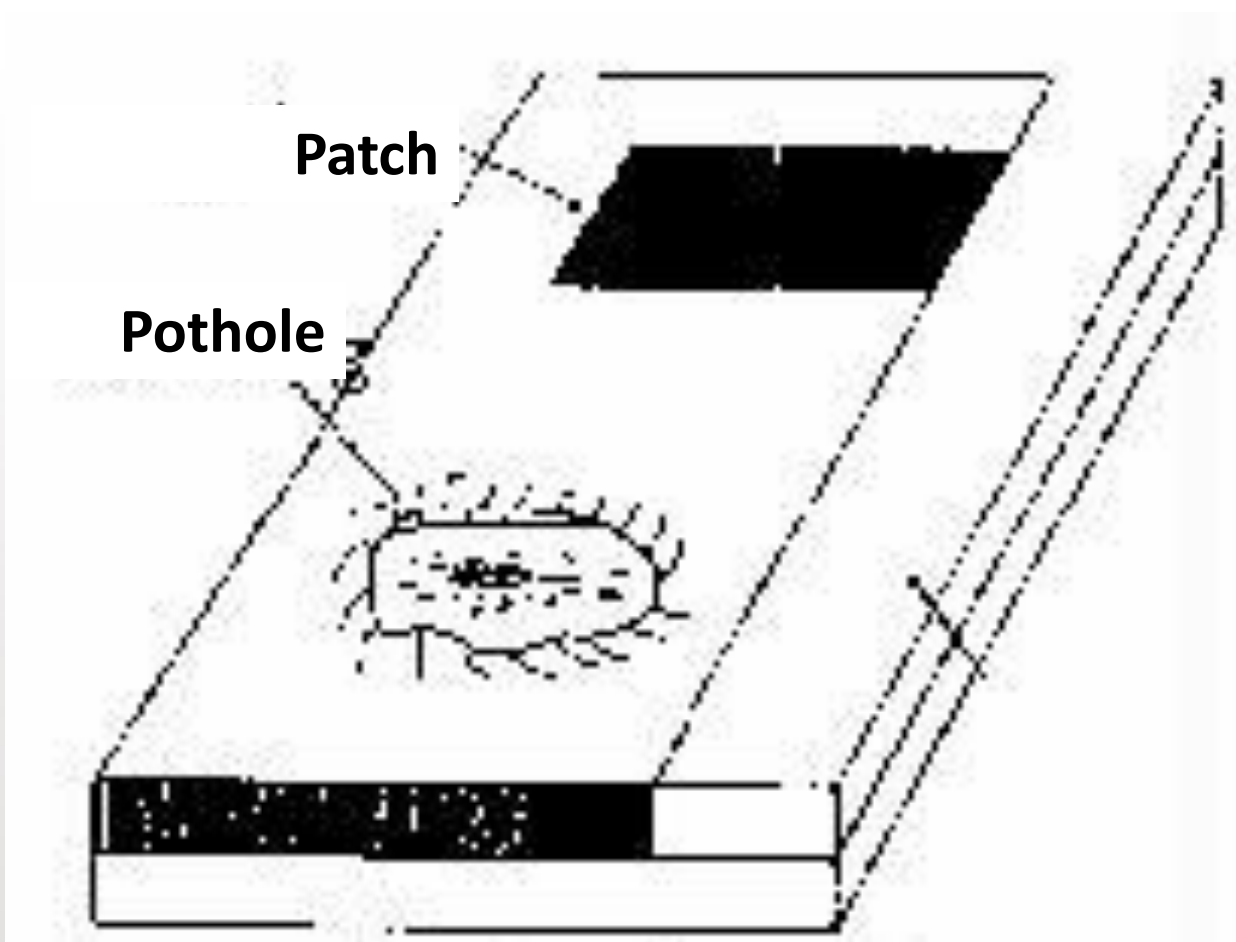
- ✓ Excessive/lack of binder content
- ✓ Poor adhesion between aggregate and binder
- ✓ Inadequate compaction
- ✓ Low PSV
- ✓ Seepage of water



Treatments of Surface Defects

- ✓ Apply hot sand
- ✓ Thin bituminous overlay
- ✓ Use stiffer mix
- ✓ Reconstruction of weak layers

Patch & Pothole





Patching





Pothole

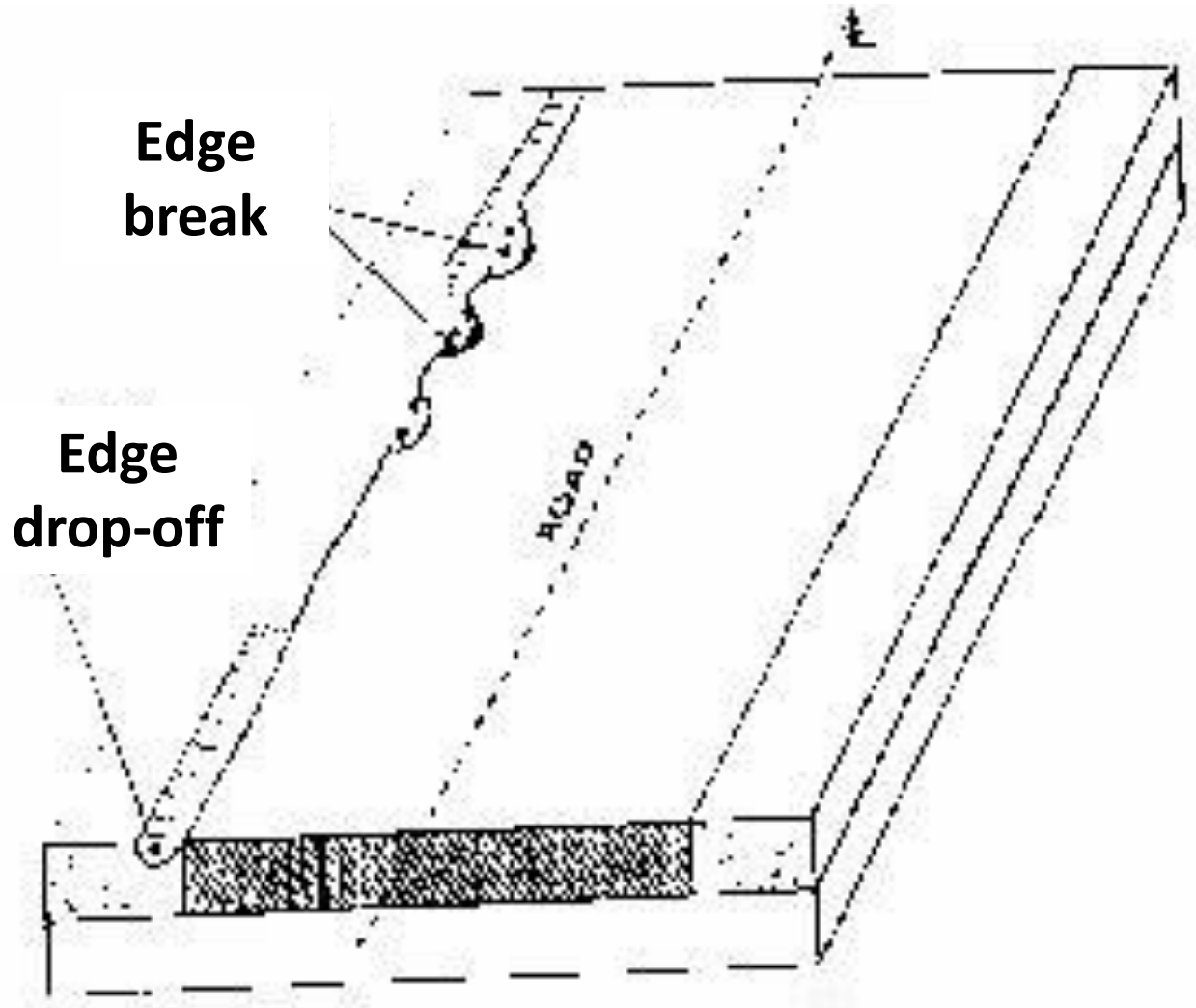
Possible causes:

- ✓ loss of surface
- ✓ moisture entry thru cracks
- ✓ load associated base disintegration

Probable treatments:

- ✓ cut and patch
- ✓ base reconstruction

Edge defects





Possible causes of Edge defects

- ✓ Inadequate width/edge support
- ✓ Loss of adhesion to base
- ✓ Shoulder material of low resistance to abrasion and erosion
- ✓ Resurface pavement w/o resurface shoulder



Treatments of Edge defects

- ✓ Widening
- ✓ Re-alignment
- ✓ Strengthen and leveled shoulder
- ✓ Cut and patch
- ✓ Replace shoulder material