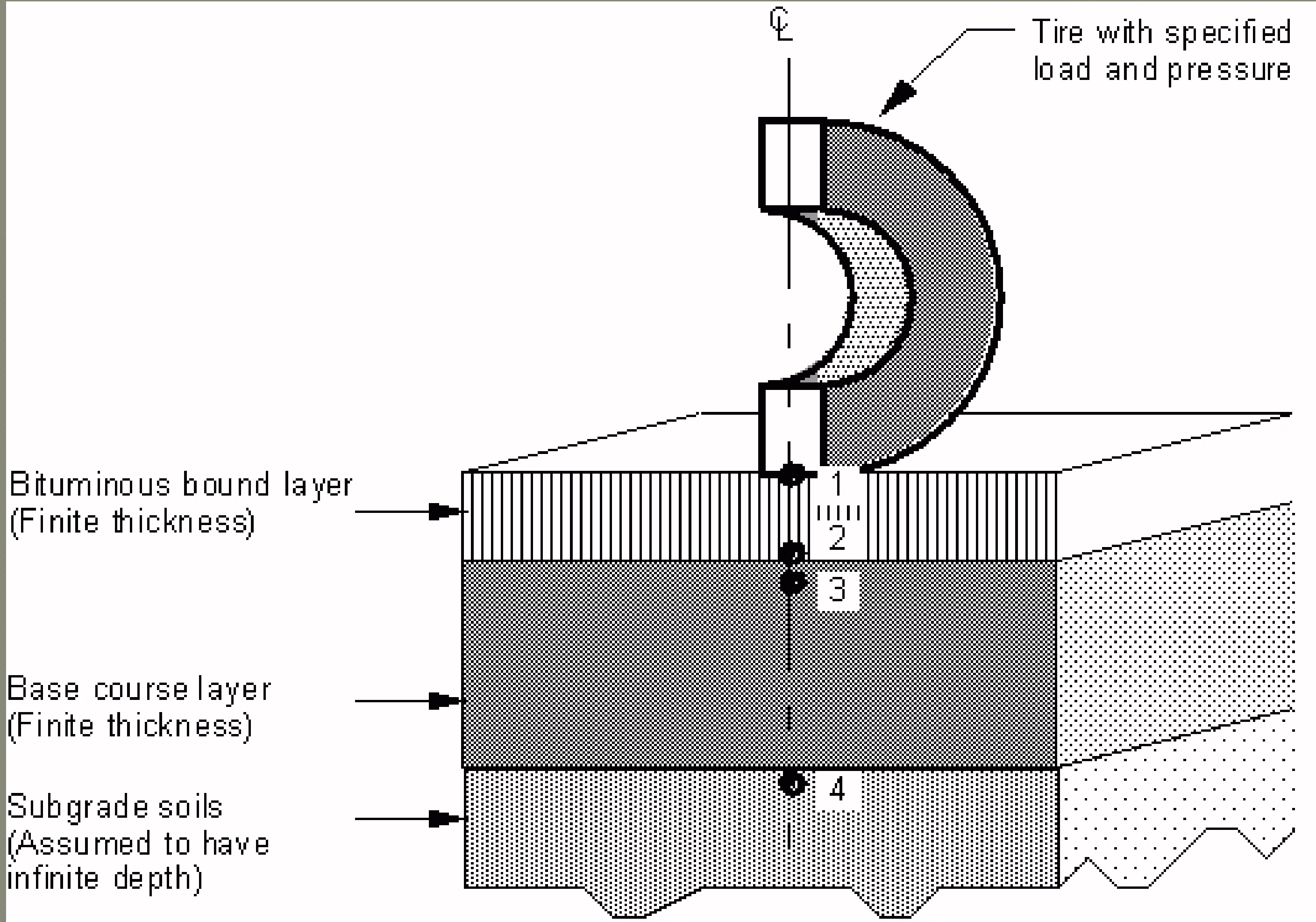
Diskusi: Penilaian Perkerasan Jalan

24 September 2014



1. Pavement surface deflection
2. Horizontal tensile strain at bottom of bituminous layer
3. Vertical compressive strain at top of base
4. Vertical compressive strain at top of subgrade

1. Bagaimana konsep pembebanan pada struktur perkerasan ?

- **Pavement Types**

  Much of this country relies on paved roads to move themselves and their products rapidly and reliably throughout the transportation system.

  Pavements can be generally classified into two broad categories:

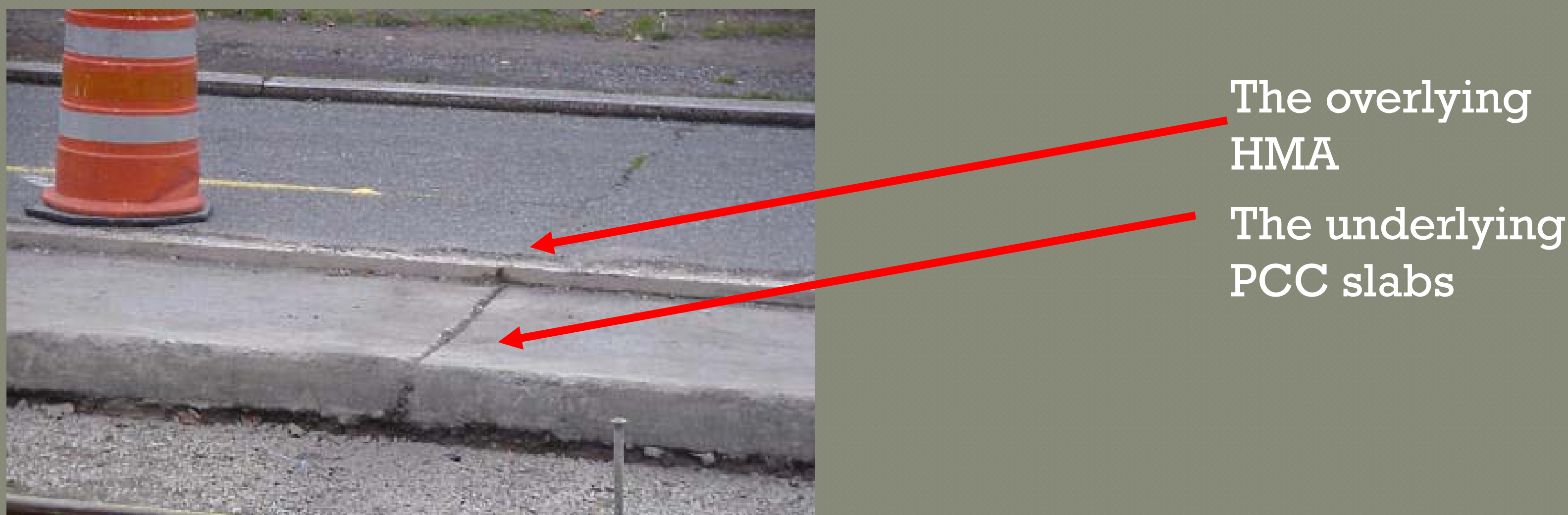
1. *Flexible pavements* These are asphalt pavements (sometimes called bituminous pavements), which may or may not incorporate underlying layers of stabilized or unstabilized granular materials on a prepared subgrade. These types of pavements are called "flexible" since the total pavement structure bends (or flexes) to accommodate traffic loads.
2. *Rigid pavements* These are portland cement concrete (PCC) pavements, which may or may not incorporate underlying layers of stabilized or unstabilized granular materials. Since PCC has a high modulus of elasticity, rigid pavements do not flex appreciably to accommodate traffic loads.

Figures of Pavement

In United State of America

In Republic of Indonesia

The FHWA also identifies a third type of pavement, called **a composite pavement**. Composite pavements are combination HMA and PCC pavements. Occasionally, they are initially constructed as composite pavements, but more frequently they are the result of pavement rehabilitation (e.g., HMA overlay of PCC pavement). Modeling these pavements depends on the composite action. For instance, an HMA overlay of rubblized PCC is typically classified as a flexible pavement, while an HMA overlay of a PCC pavement with no fracture preparation typically responds with rigid pavement characteristics (see Figure). Officially, the FHWA "composite pavement" category is defined as a "mixed bituminous or bituminous penetration roadway" of more than 25 mm (1 inch) of compacted material on a rigid base (FHWA, 2001)



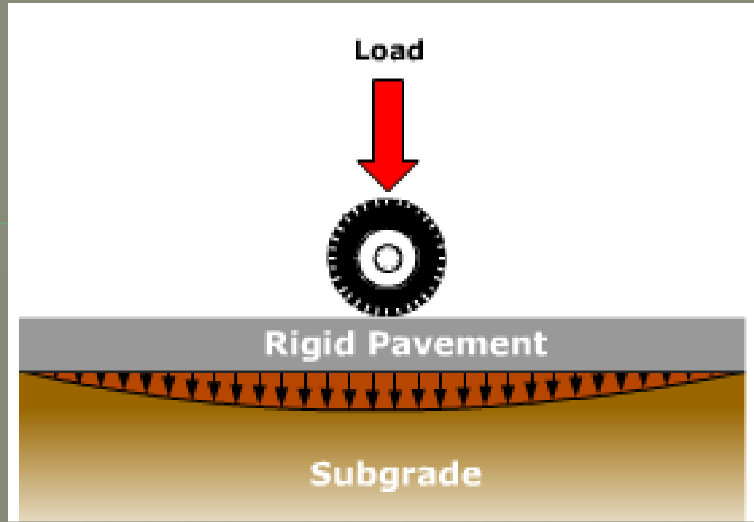
Load Distribution on Pavement

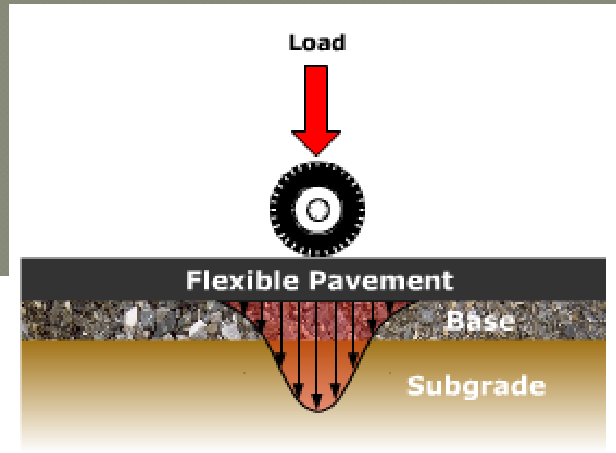
Flexible pavements are those which are surfaced with bituminous (or asphalt) materials. These can be either in the form of pavement surface treatments (such as a bituminous surface treatment (BST) generally found on lower volume roads) or, HMA surface courses (generally used on higher volume roads such as the Interstate highway network). These types of pavements are called "flexible" since the total pavement structure "bends" or "deflects" due to traffic loads. A flexible pavement structure is generally composed of several layers of materials which can accommodate this "flexing". On the other hand, rigid pavements are composed of a PCC surface course. Such pavements are substantially "stiffer" than flexible pavements due to the high modulus of elasticity of the PCC material. Further, these pavements can have reinforcing steel, which is generally used to reduce or eliminate joints.

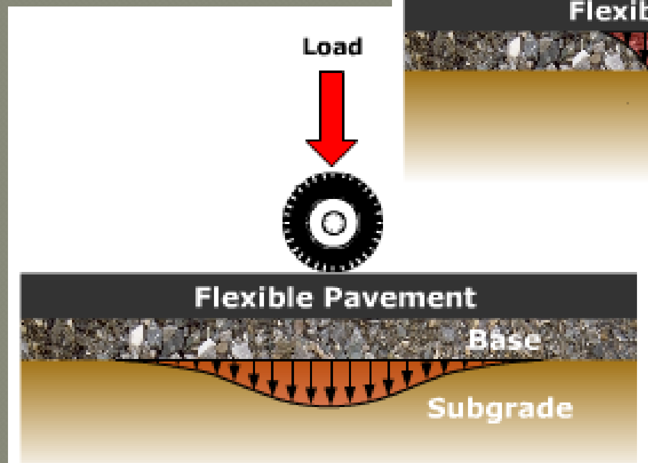
Flexible Pavement

Each of these pavement types distributes load over the subgrade in a different fashion.

- Rigid pavement, because of PCC's high elastic modulus (stiffness), tends to distribute the load over a relatively wide area of subgrade (see Figure). The concrete slab itself supplies most of a rigid pavement's structural capacity.
- Flexible pavement uses more flexible surface course and distributes loads over a smaller area. It relies on a combination of layers for transmitting load to the subgrade (see Figure).







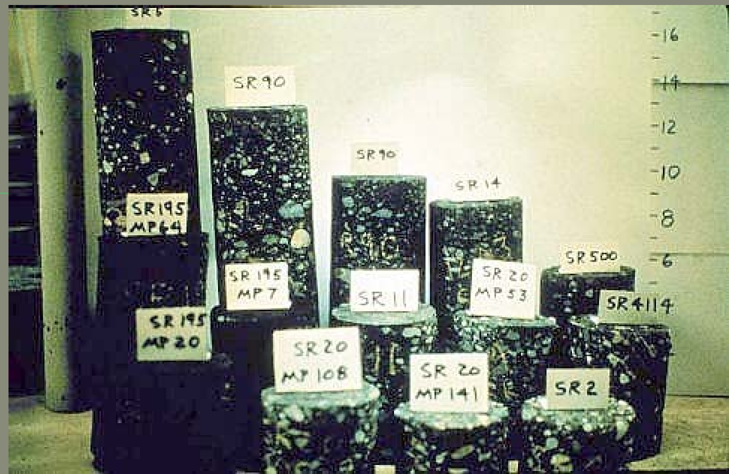
2. Apa yang Anda ketahui mengenai stress (tegangan) dan strain (regangan) pada perkerasan ?

Basic Structural Elements

A typical flexible pavement structure (see Figure) consists of the surface course and the underlying base and subbase courses. Each of these layers contributes to structural support and drainage. The surface course (typically an HMA layer) is the stiffest (as measured by resilient modulus) and contributes the most to pavement strength. The underlying layers are less stiff but are still important to pavement strength as well as drainage and frost protection. A typical structural design results in a series of layers that gradually decrease in material quality with depth.

ace Course

surface course is the layer in contact
traffic loads and normally contains the
hest quality materials. It provides
racteristics such as friction, smoothness,
e control, rut and shoving resistance and
nage. In addition, it serves to prevent
entrance of excessive quantities of
ace water into the underlying base,
base and subgrade (NAPA, 2001). This
structural layer of material is sometimes
divided into two layers (NAPA, 2001):



1. ***Wearing Course***. This is the layer in direct contact with traffic loads. It is meant to take the brunt of traffic wear and can be removed and replaced as it becomes worn. A properly designed (and funded) preservation program should be able to identify pavement surface distress while it is still confined to the wearing course. This way, the wearing course can be rehabilitated before distress propagates into the underlying intermediate/binder course.
2. ***Intermediate/Binder Course***. This layer provides the bulk of the

Base Course

The base course is immediately beneath the surface course. It provides additional load distribution and contributes to drainage and frost resistance. Base courses are usually constructed out of:

1. *Aggregate*. Base courses are most typically constructed from durable aggregates (see Figure 2.5) that will not be damaged by moisture or frost action. Aggregates can be either stabilized or unstabilized.
2. *HMA*. In certain situations where high base stiffness is desired, base courses can be constructed using a variety of HMA mixes. In relation to surface course HMA mixes, base course mixes usually contain larger maximum aggregate sizes, are more open graded and are subject to more lenient specifications.

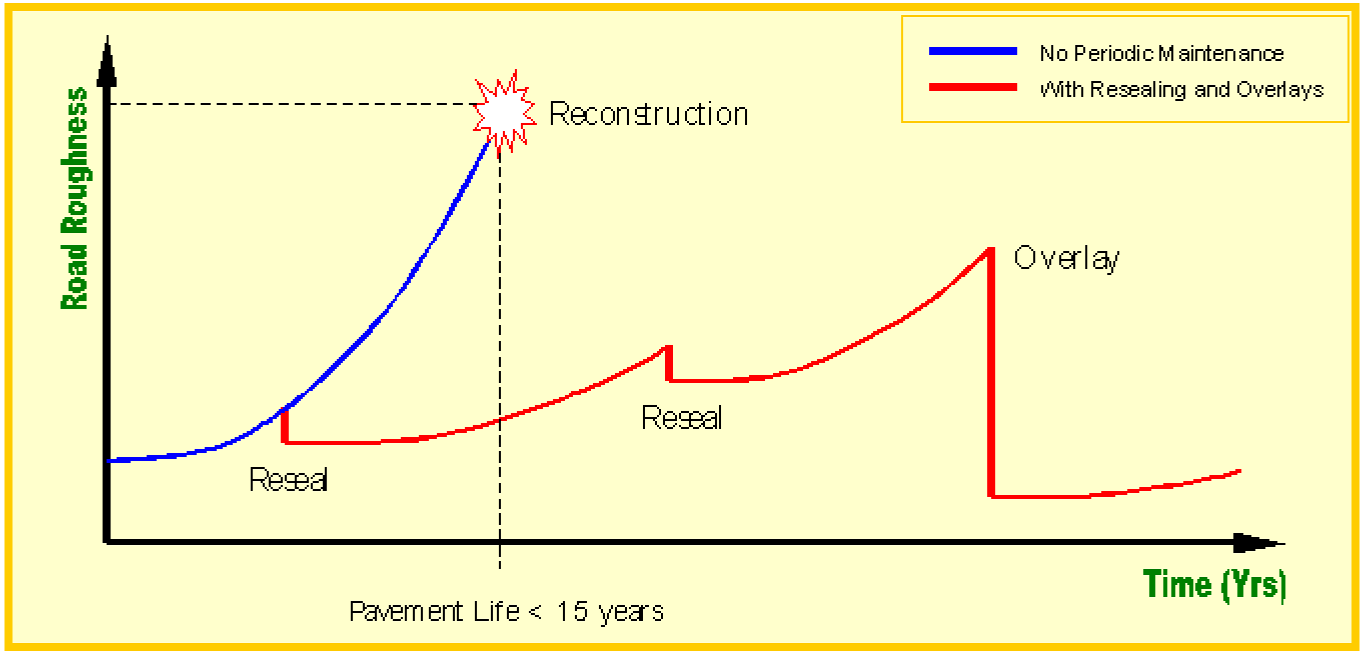
- ***Subbase Course***
  The subbase course is between the base course and the subgrade. It functions primarily as structural support but it can also:

1. Minimize the intrusion of fines from the subgrade into the pavement structure.
2. Improve drainage.
3. Minimize frost action damage.
4. Provide a working platform for construction.

The subbase generally consists of lower quality materials than the base course but better than the subgrade soils. A subbase course is not always needed or used.
For example, a pavement constructed over a high quality, stiff subgrade may not need the additional features offered by a subbase course so it may be omitted from design. However, a pavement constructed over a low quality soil such as a swelling clay may require the additional load distribution characteristic that a subbase course can offer. In this scenario the subbase course may consist of high quality fill used to replace poor quality subgrade (over excavation).

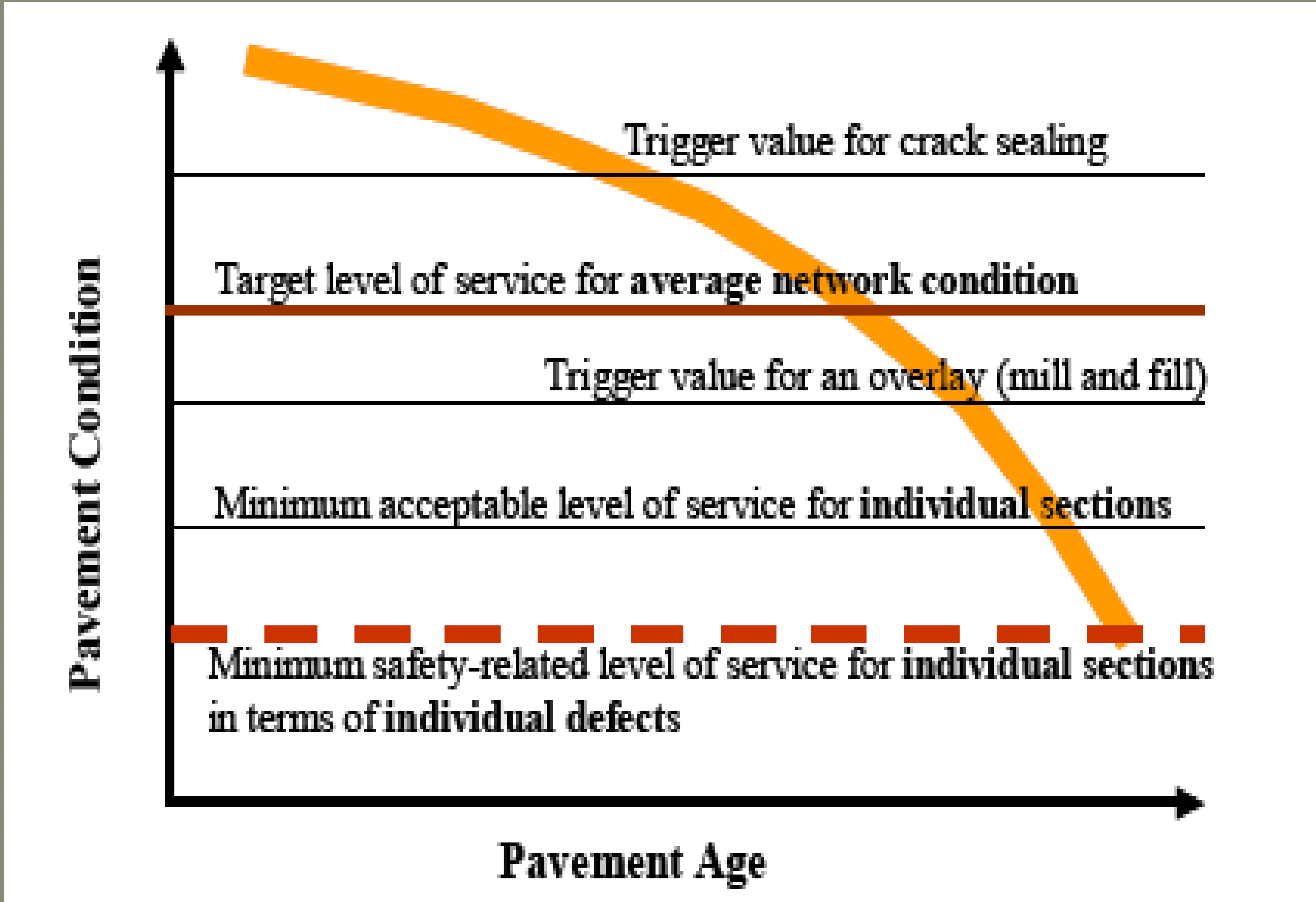
3. Bagaimana pengaruh pembebanan terhadap life-time struktur perkerasan jalan ?

Life Cycle of Pavement

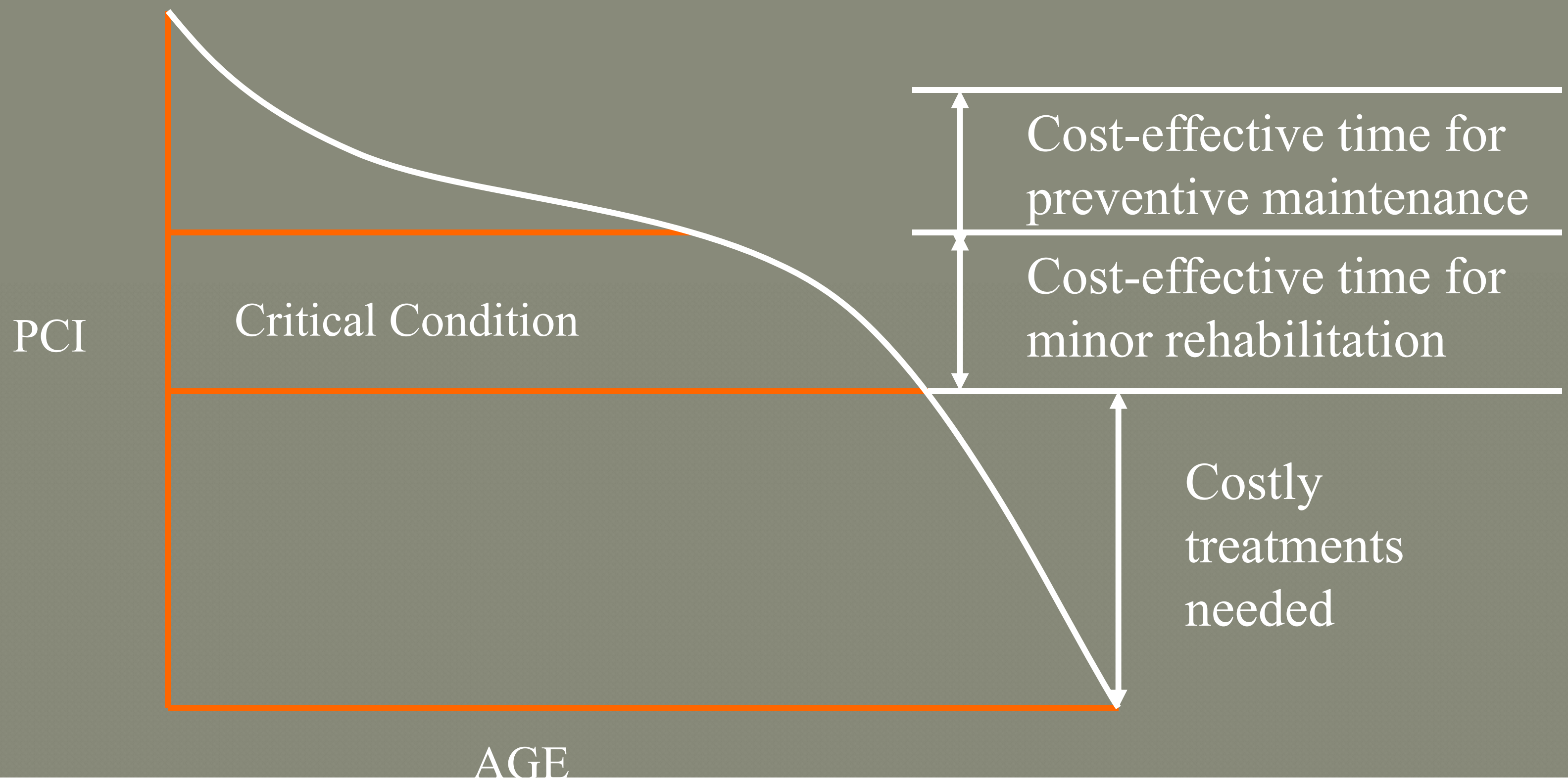


New Road (0 years)	Needing Reseal (4-8 years)	Without Maintenance (10-15 yrs)

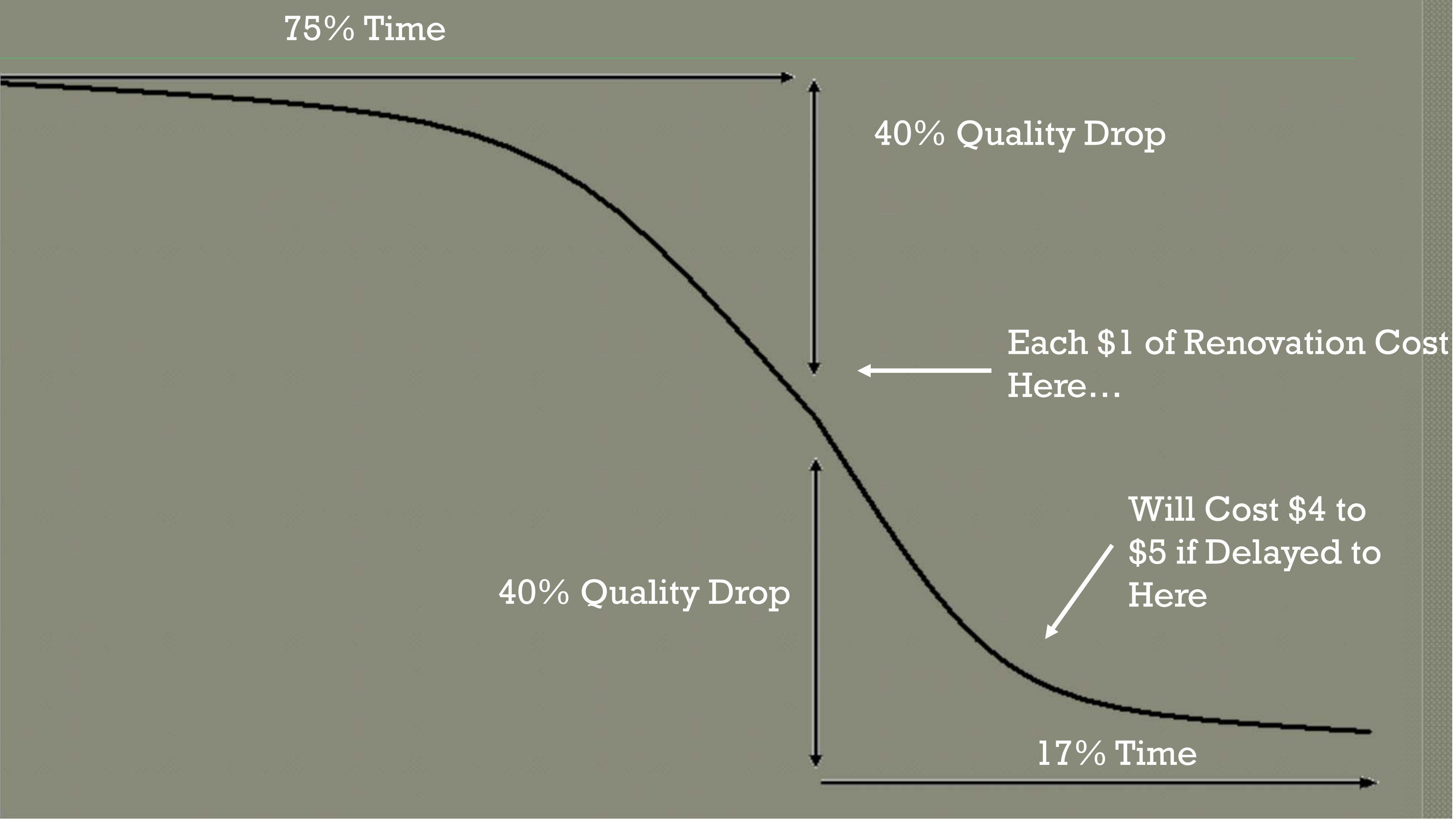
Criteria for Pavement Management



Managing Pavement Deterioration

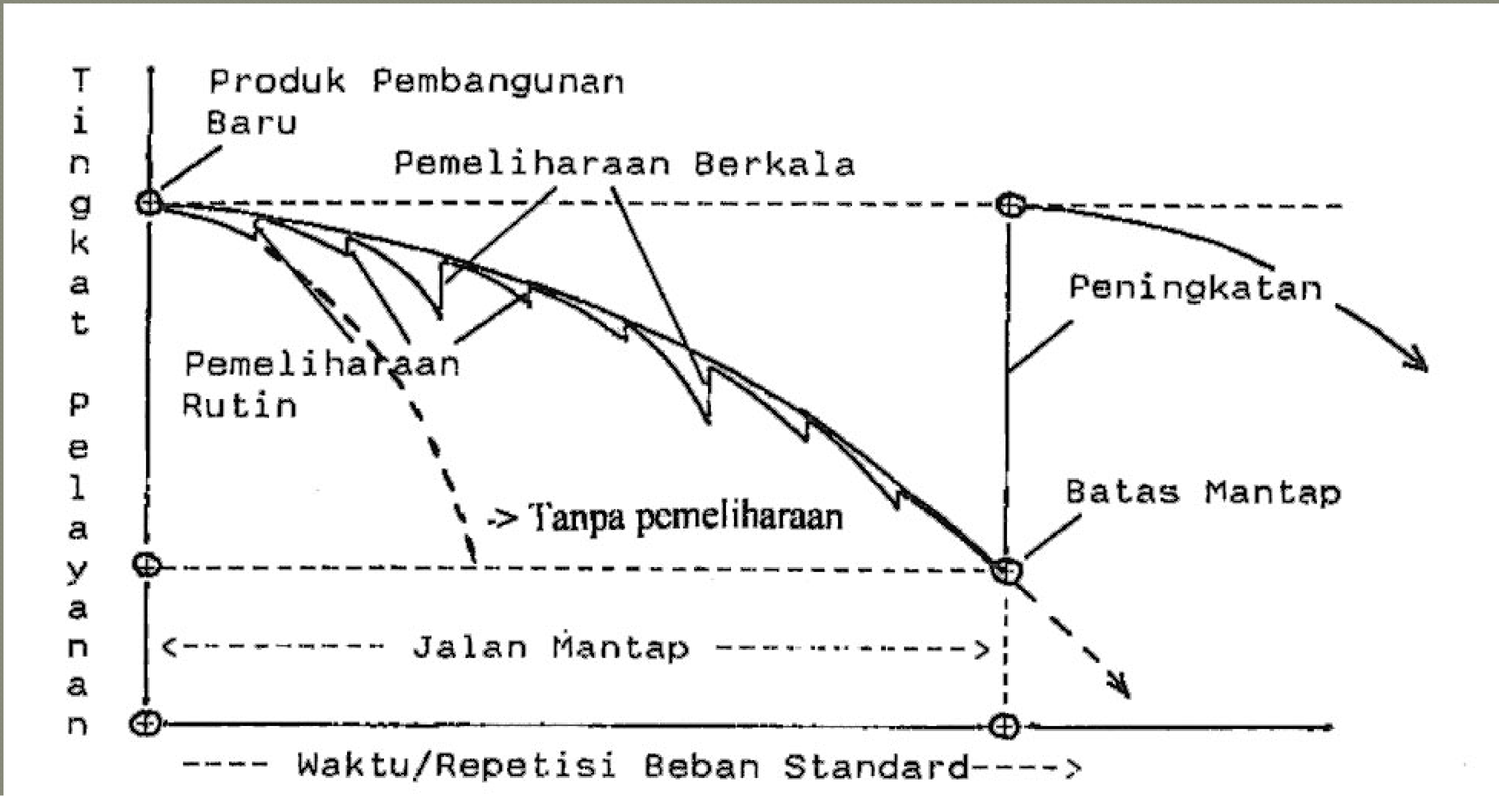


Normal Pavement Deterioration



4. Menurut Anda, seberapa signifikankah pembebanan mempengaruhi kerusakan alan ? Berikan contoh dan keterkaitannya dengan kerusakan retak jalan pada perkerasan lentur.

Kinerja Perkerasan Jalan



Kinerja Perkerasan Jalan

Persyaratan :

- Kondisi Fungsional
  - Kerataan dan kekesatan permukaan
  - *Present Serviceability Index* (PSI)
- Kondisi Struktural
  - Kekuatan dan daya dukung perkerasan
  - *Structural Number* (SN)

Kinerja Perkerasan Jalan

Present Serviceability Index (PSI) :

$$PSI = 5{,}03 - 1{,}91 \log\left(1 + SV\right) - 1{,}38 RD^2 - 0{,}01\sqrt{C + P}$$

SV = *slope variance* = $\dfrac{\Sigma Y^2 - (1/n)(\Sigma Y)^2}{n-1}$

Y = perbedaan elevasi antara dua titik yang berjarak 1 ft

n = jumlah pembacaan

RD = kedalaman alur kedua jejak roda (in.), diukur dengan mistar 4 m

C = panjang retak per 1.000 ft2

P = tambalan, ft^2 per 1.000 ft^2

Kinerja Perkerasan Jalan

Structural Number (SN) :

$$Log\ w_t = Z_n S_o + 9.36\log(SN+1) - 0.20 + \frac{\log\left(\frac{P_o - P_t}{P_o - P_{ff}}\right)}{0.4 + \frac{1094}{(SN+1)^{5.19}}} + 2.32\log Mr - 8.07$$

w_t = standard axle komulatif

Z_n = normal deviate

S_o = standar deviate

SN = structural number

P_o = initial serviceability

P_t = terminal serviceability

P_f = failure serviceability

Mr = modulus resilient

Kerusakan Jalan

Pengelompokan :

- Kerusakan Fungsional

  Kerusakan pada permukaan jalan yang dapat berhubungan atau tidak dengan kerusakan struktural.

  Kerusakan yang terjadi mengakibatkan fungsi jalan terganggu dan tidak memberikan tingkat kenyamanan dan keamanan.

  Untuk itu lapisan permukaan perkerasan harus dirawat agar permukaan kembali tidak kasar.

Pengelompokan :

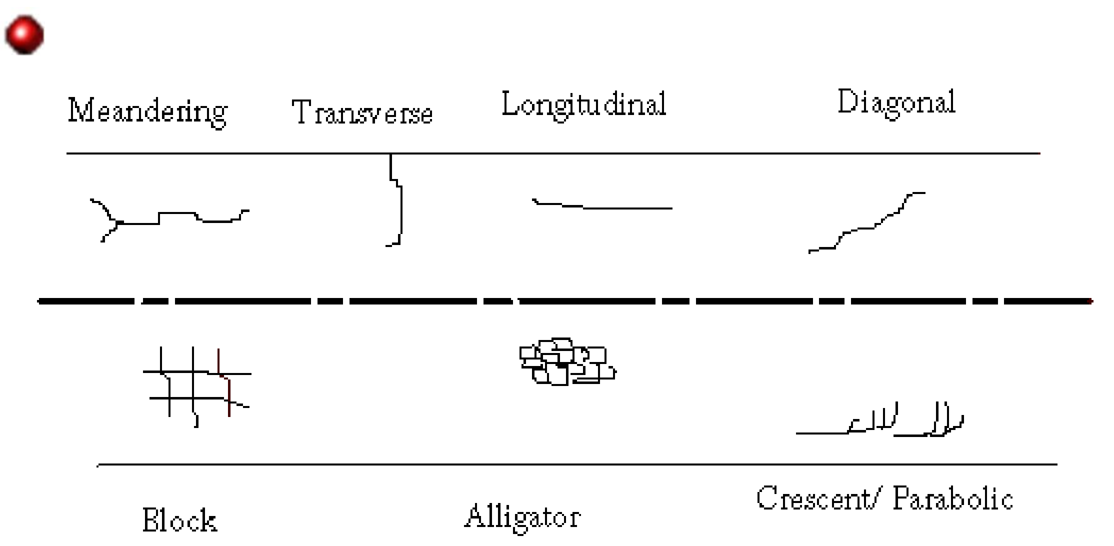
- Kerusakan Struktural

Kerusakan yg terjadi pd struktur jalan, sebagian atau seluruhnya, yang menyebabkan perkerasan jalan tidak lagi mampu menahan beban yg bekerja diatasnya.

Untuk itu perlu adanya perkuatan struktur dari perkerasan dengan cara pemberian pelapisan ulang (*overlay*).

Kerusakan Jalan

Jenis kerusakan pada perkerasan lentur :

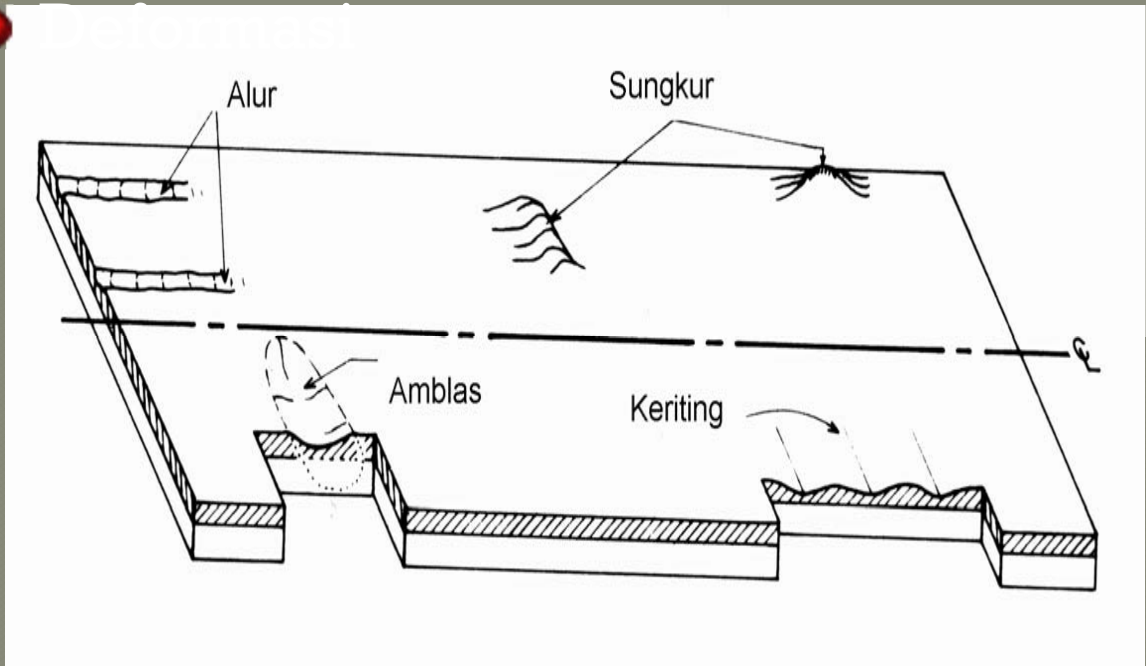


▪ Retak memanjang	▪ Memanjang searah sumbu jalan
▪ Retak melintang	▪ Melintang tegak lurus sumbu jalan

Kerusakan Jalan

Jenis kerusakan pada perkerasan lentur :

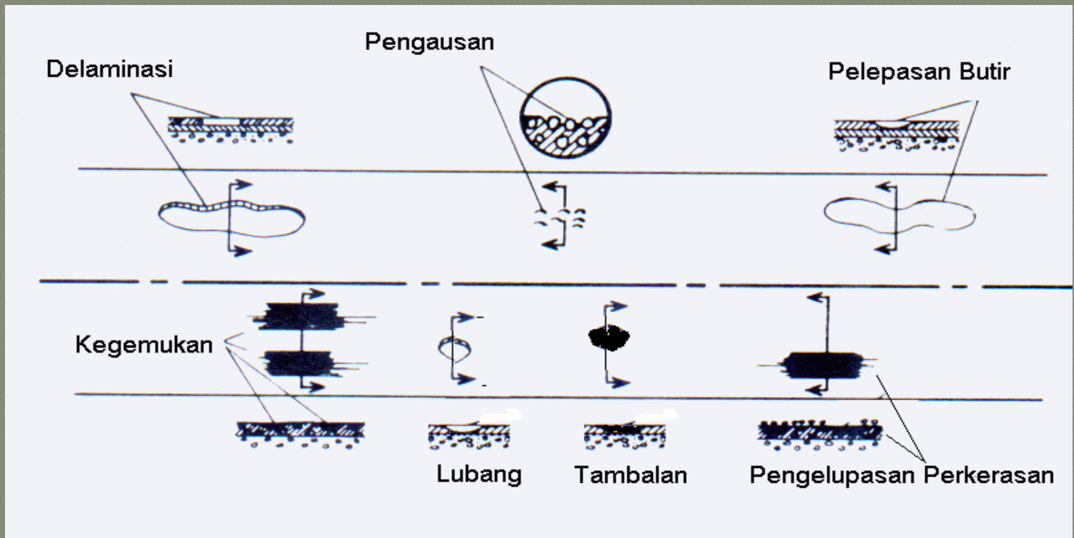
- Deformasi



Kerusakan Jalan

Jenis kerusakan pada perkerasan lentur :

- Cacat Permukaan

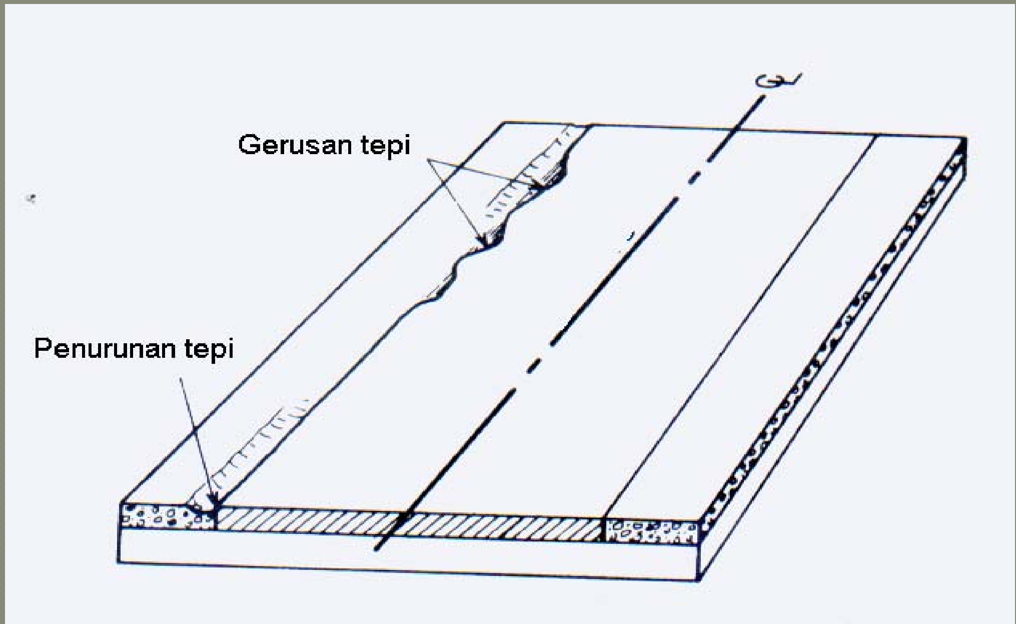


▪ Lubang	▪ Tergerusnya lapisan aus di permukaan perkerasan yang berbentuk seperti mangkok.
▪ Delaminasi	▪ Terkelupasnya lapisan tambah pd perkerasan

Kerusakan Jalan

Jenis kerusakan pada perkerasan lentur :

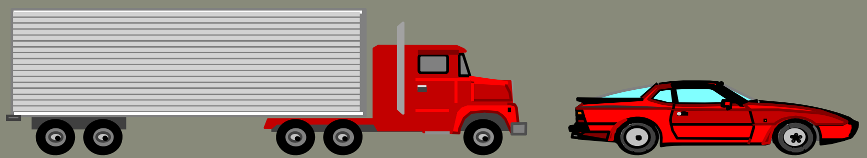
- Cacat Tepi Perkerasan



Penyebab Kerusakan Jalan

Faktor-faktornya :

- Lalu Lintas



- Non Lalu Lintas

Penyebab Kerusakan Jalan

Faktor Lalu Lintas :

- Beban kendaraan
- Distribusi beban kendaraan
- Pengulangan beban kendaraan
- Faktor perusak (*equivalency factor*)

Sumbu tunggal $$DF = \left[\frac{P}{8{,}16}\right]^4$$

Sumbu tandem $$DF = 0.086\left[\frac{P}{8{,}16}\right]^4$$

apabila sutu beban tunggal as dinaikkan dari 8.160 kg menjadi 16.320 kg (kurang lebih 2 x),
maka kerusakkan pada jalan yang akan terjadi adalah menjadi 16 x (enam belas kali).

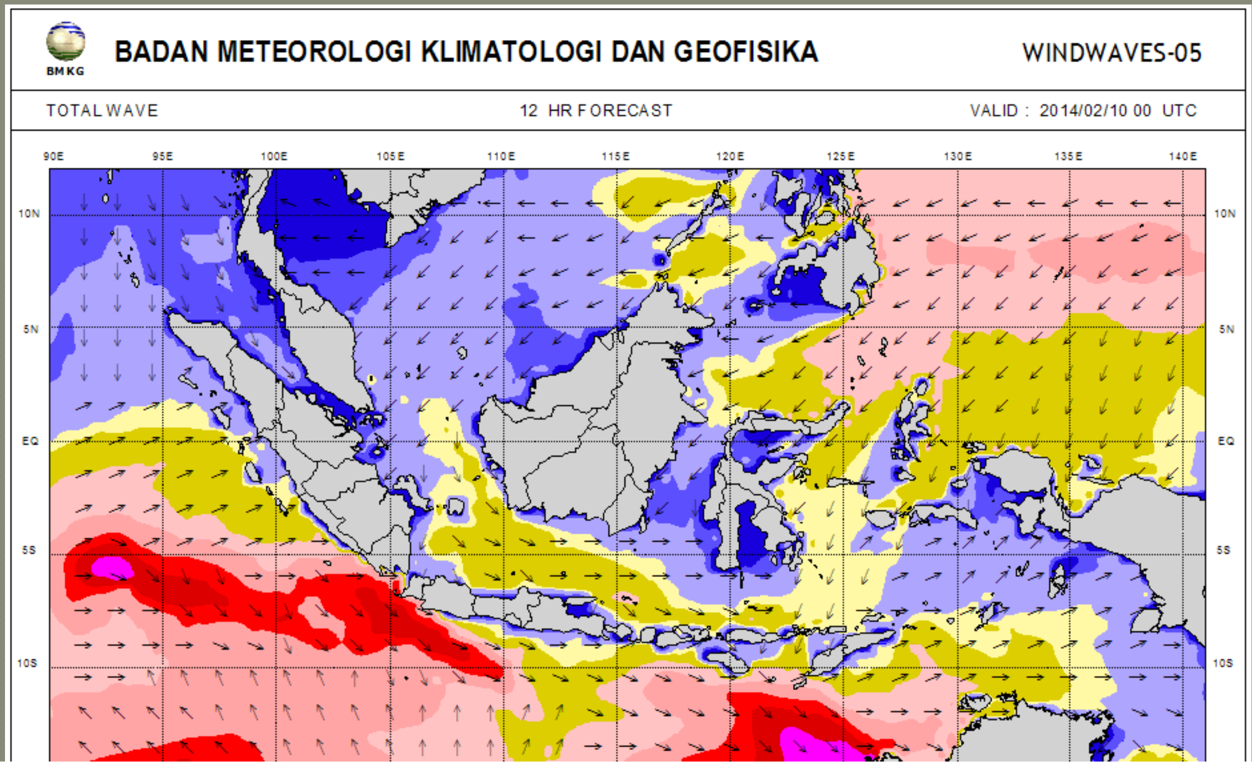
Penyebab Kerusakan Jalan

Faktor Non Lalu Lintas :

- Kekuatan tanah dasar dan material perkerasan
- Pemadatan tanah dasar dan lapisan perkerasan
- Pengembangan dan penyusutan tanah dasar
- Kedalaman muka air tanah
- Curah hujan
- Variasi temperatur sepanjang tahun

Current Situation

- Climate Change, Rainfall Intensity and Duration, Flood



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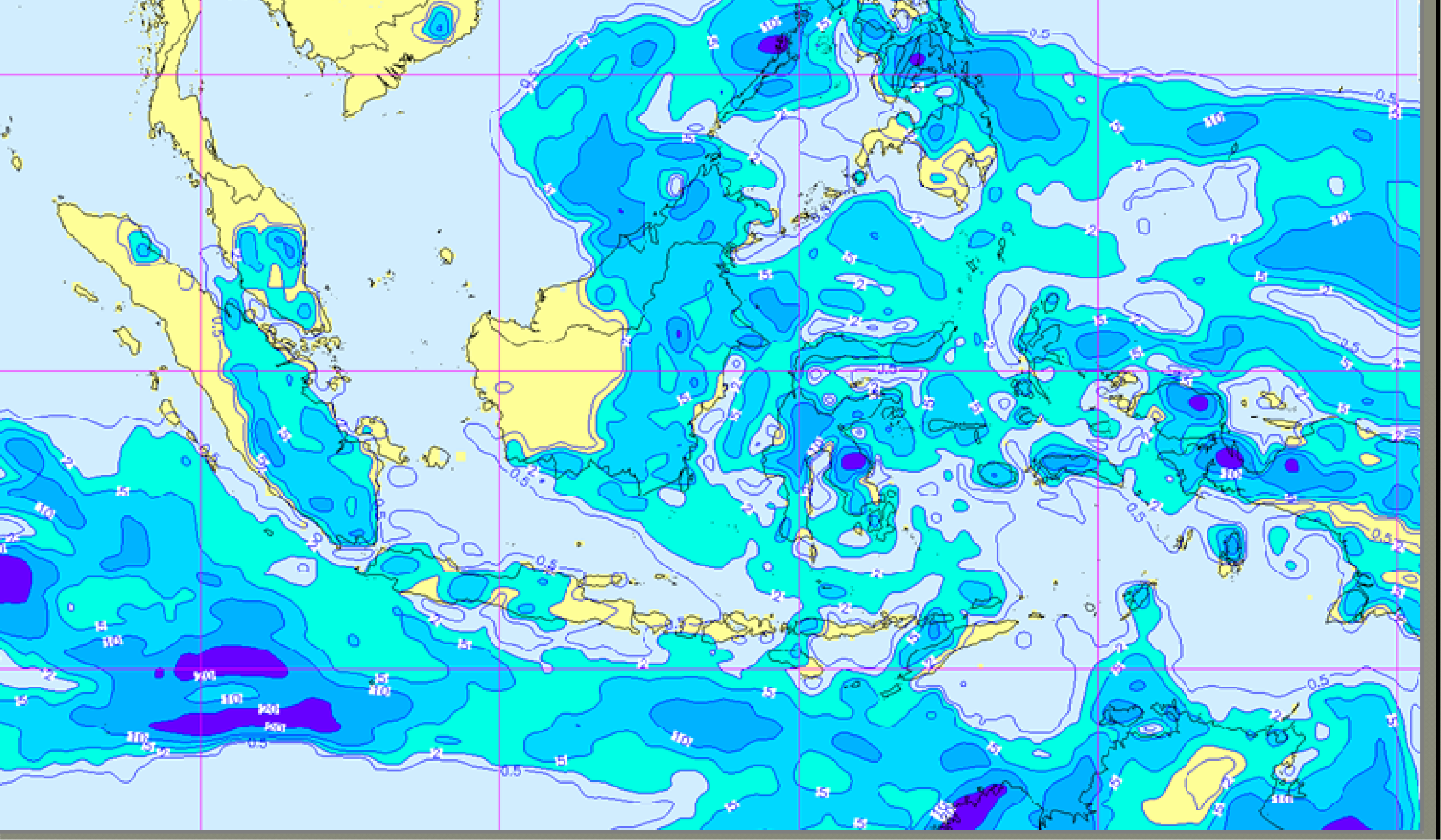


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JENIS KERUSAKAN:
BERLUBANG DI 28 TITIK SEJAUH 33 KM
JALAN LINTAS PAMULANG - PEKALONGAN
JENIS KERUSAKAN:

lekanisme Kerusakan Jalan