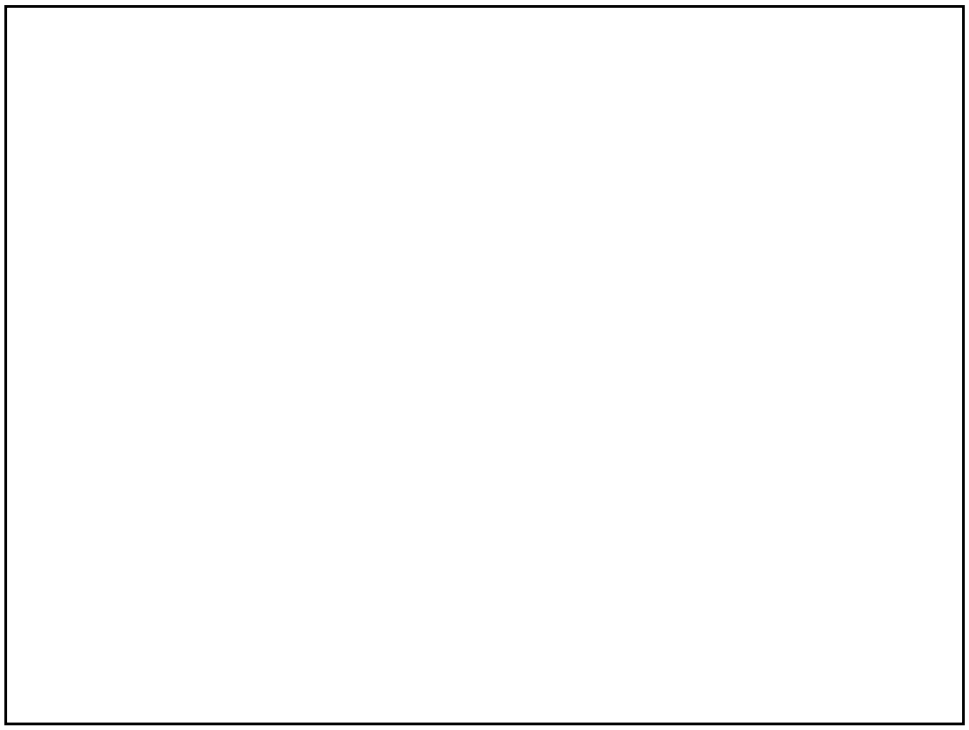
CE 442

Construction and Maintenance of Highways and Airports

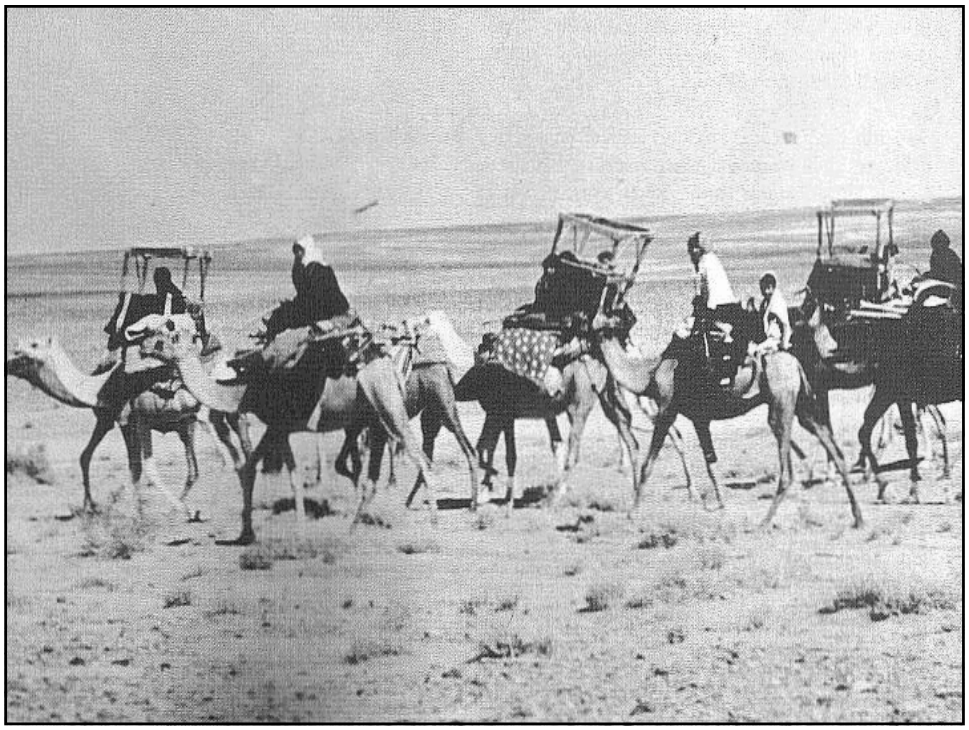
Professor Hamad I. Al-Abdul Wahhab

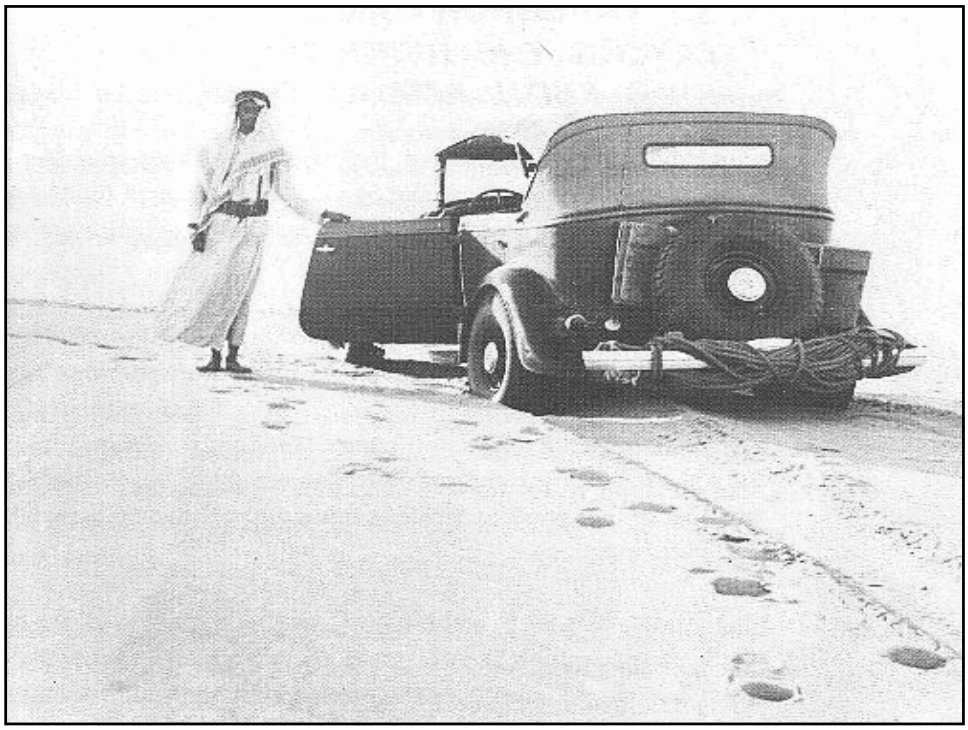
Phone 3828
Office: 16-111
Office hrs: S,T 9:00 – 11:00 AM

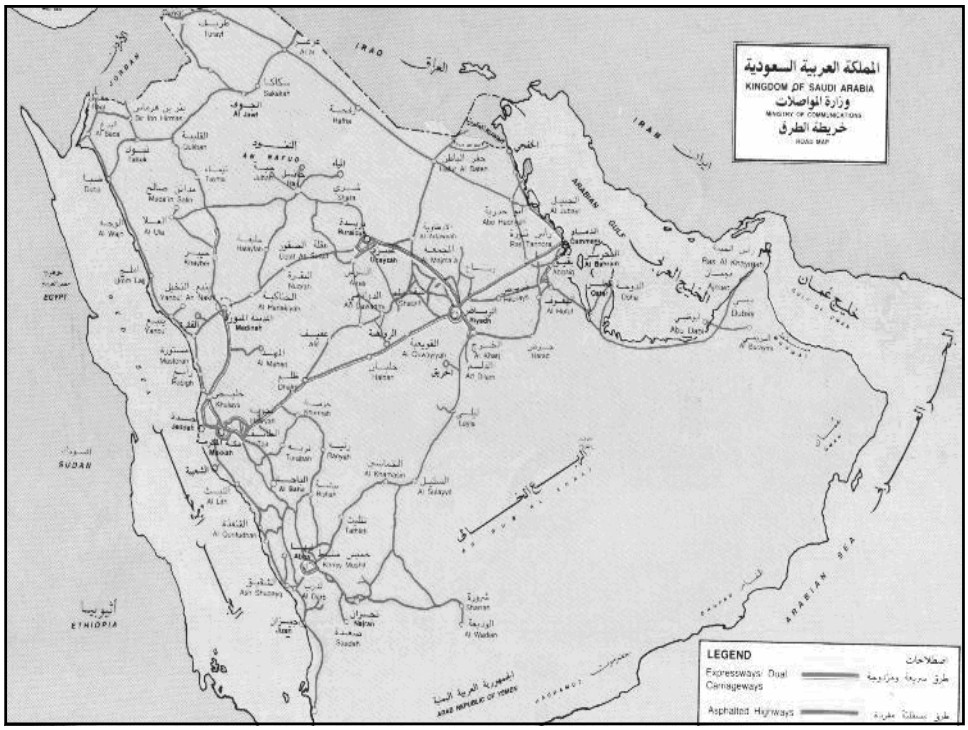


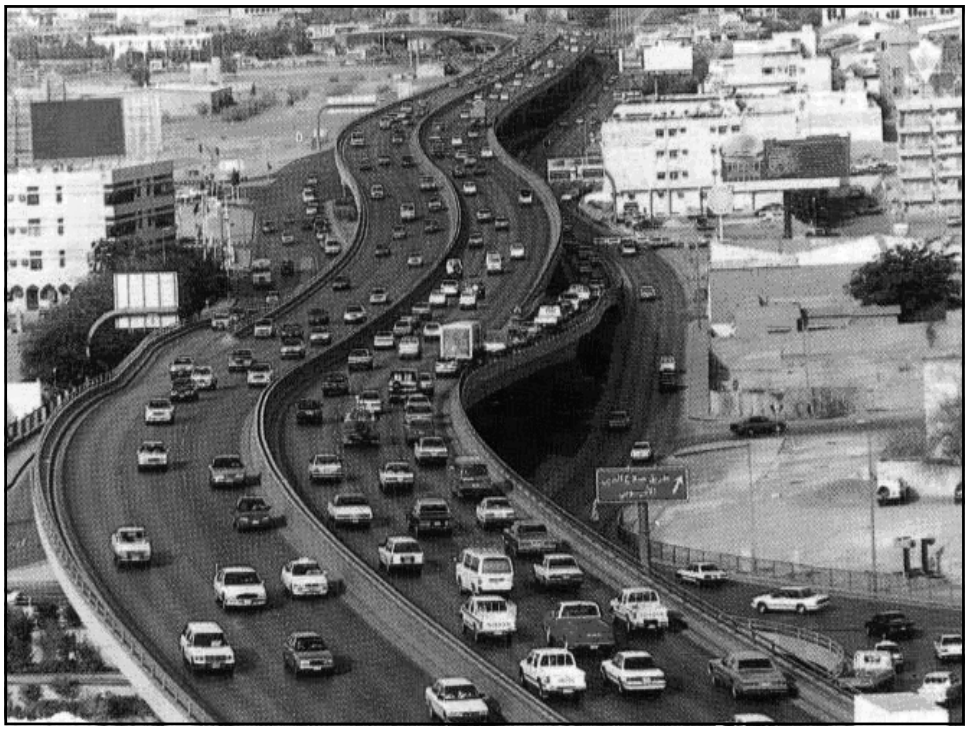
INTRODUCTION TO PAVEMENT STRUCTURES

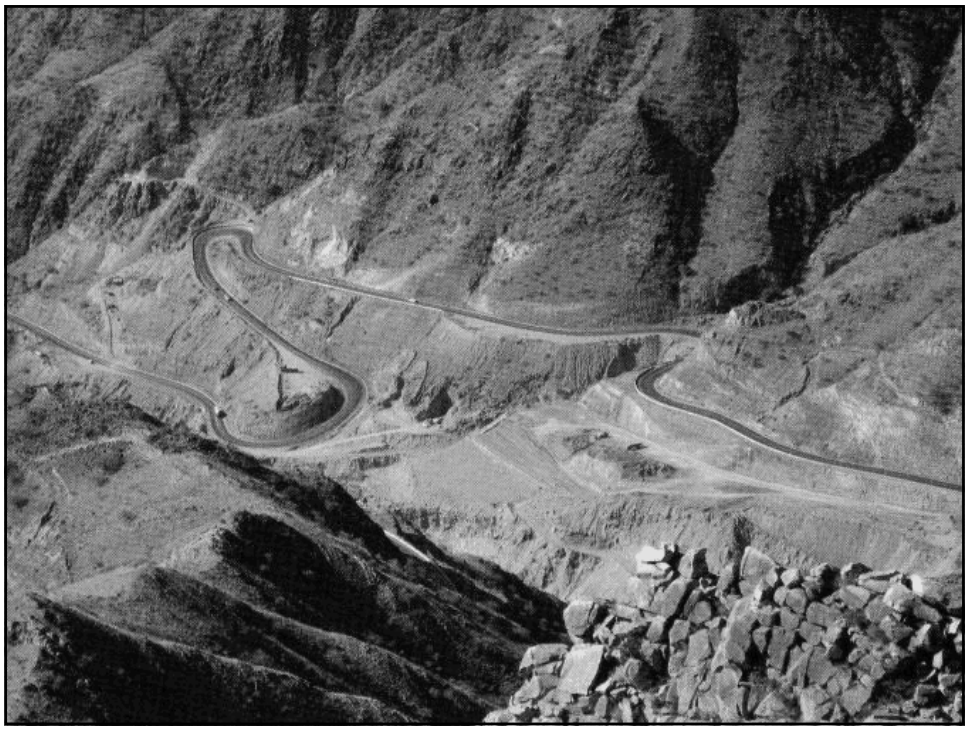
Why do we need pavements? Discussion

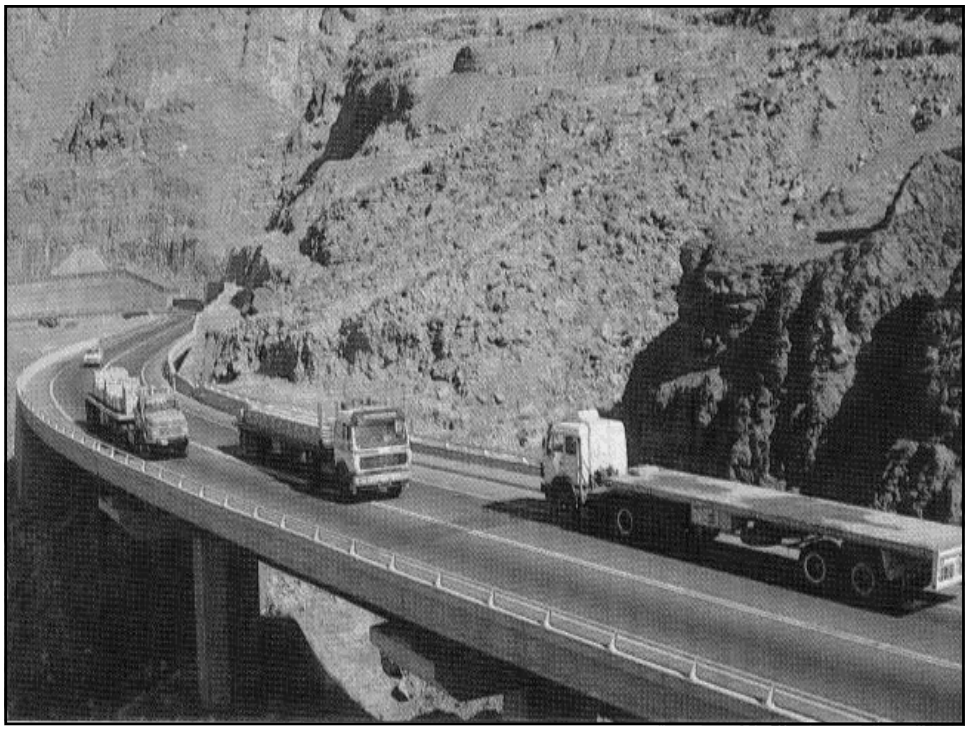


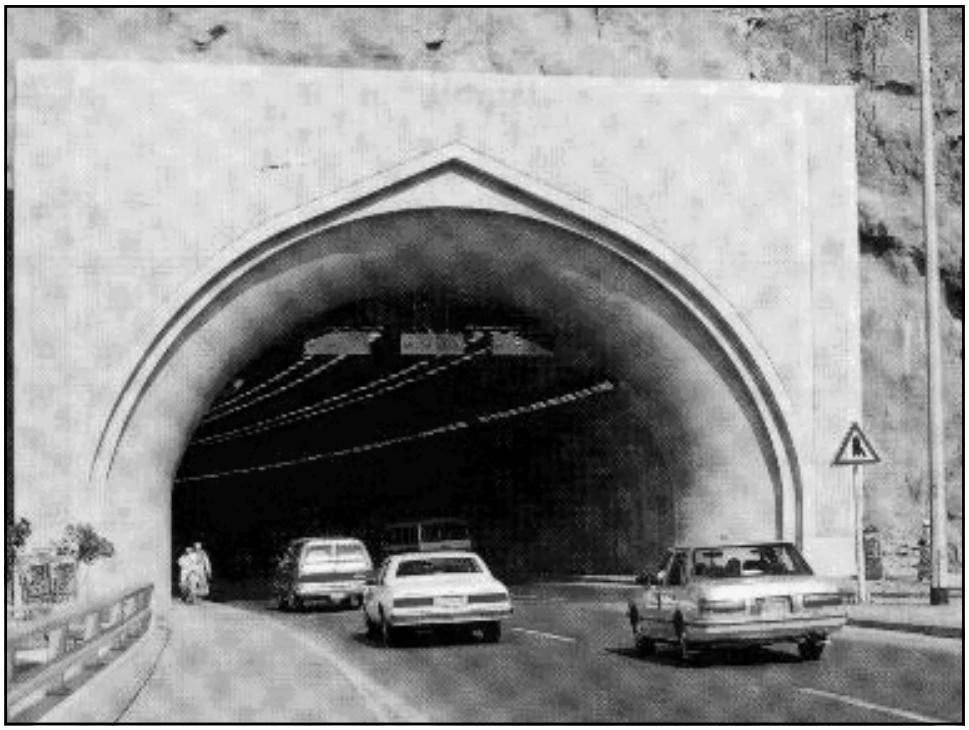


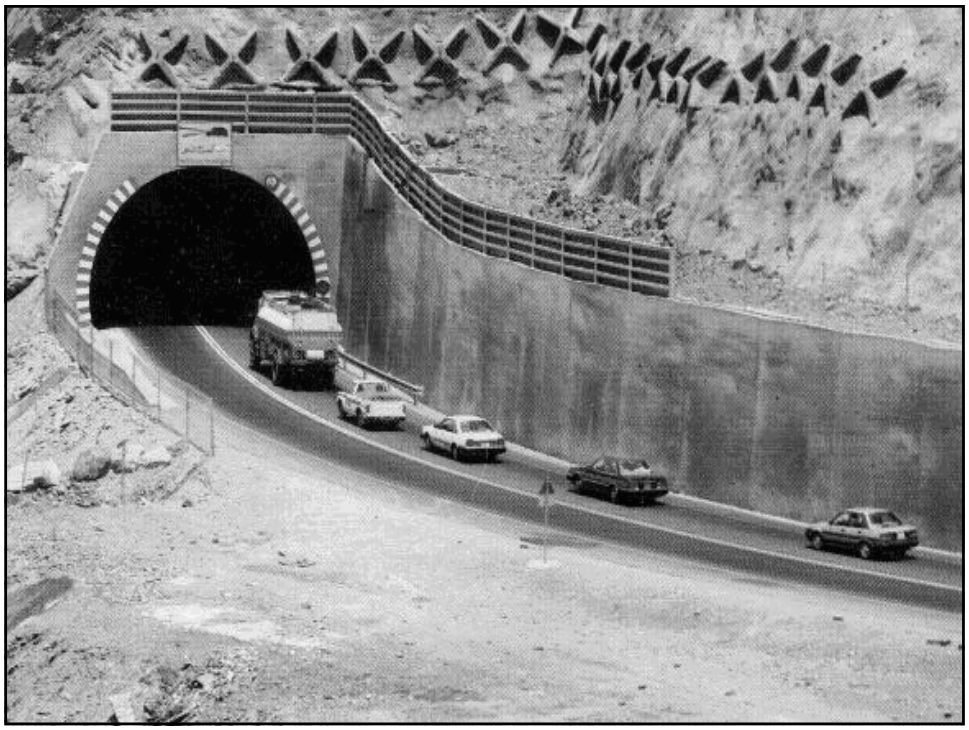

المملكة العربية السعودية
KINGDOM OF SAUDI ARABIA
وزارة المواصلات
MINISTRY OF COMMUNICATIONS
خريطة الطرق
ROAD MAP
IRAQ
العراق
IRAN
ايران
JORDAN
EGYPT
SUDAN
ETHIOPIA
ARABIAN GULF
ARABIAN SEA
AR RAFUD
LEGEND
Expressways: Dual Carriageways
Asphalted Highways

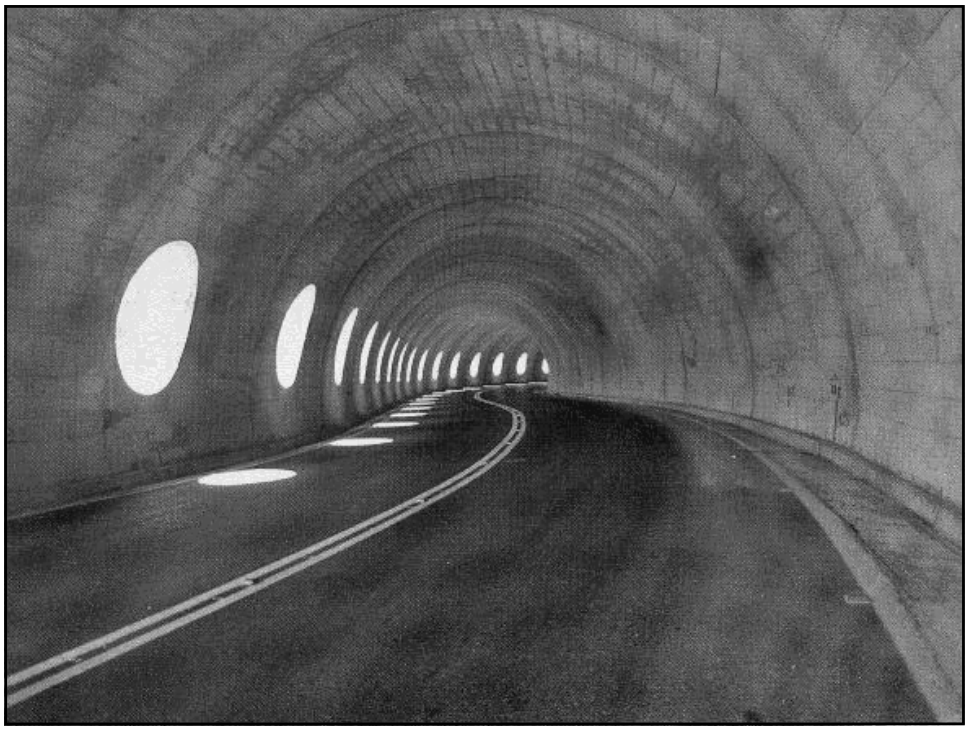


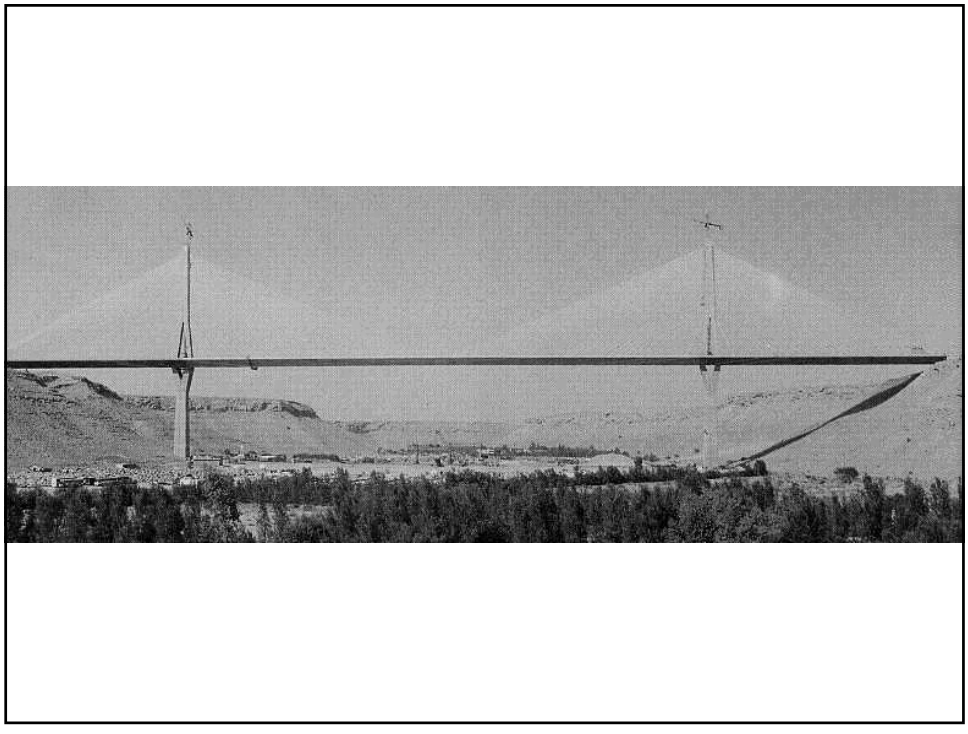


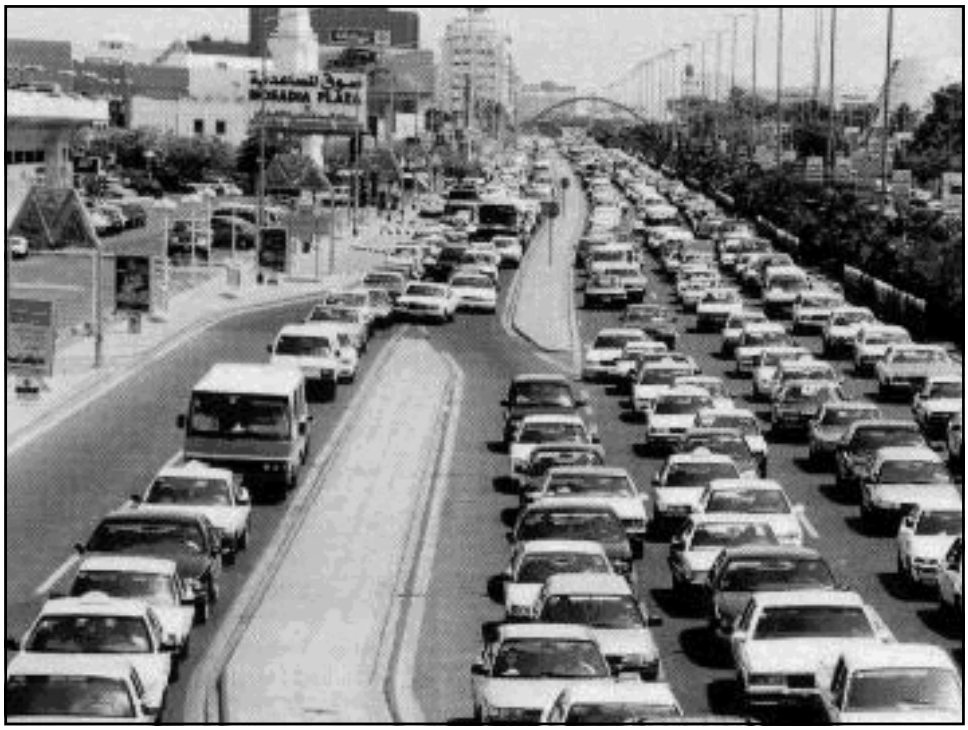


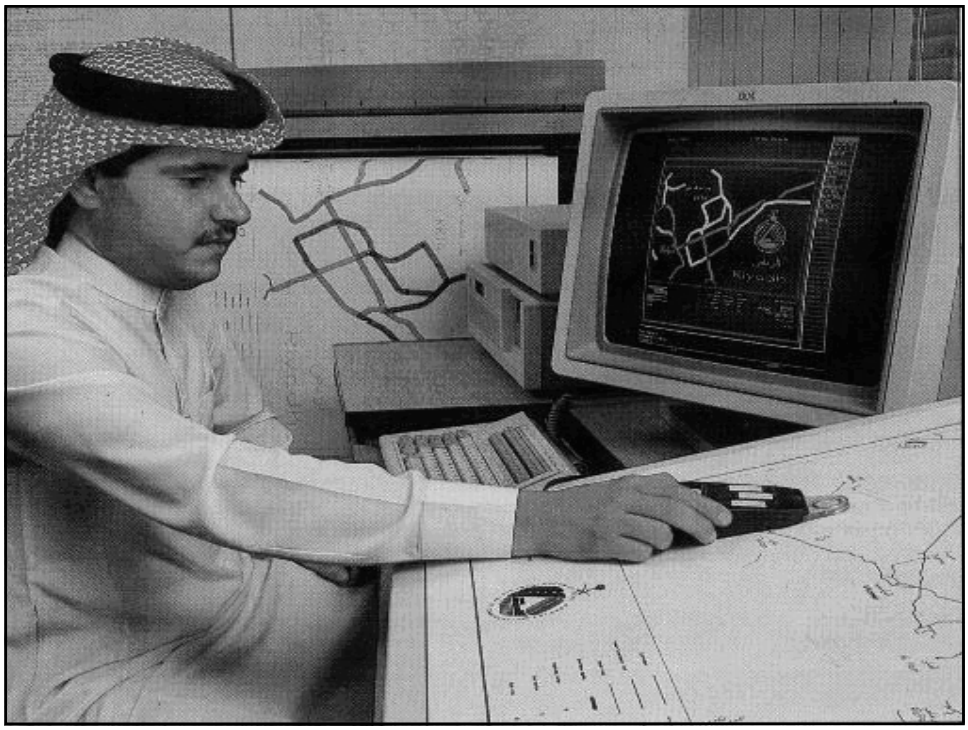




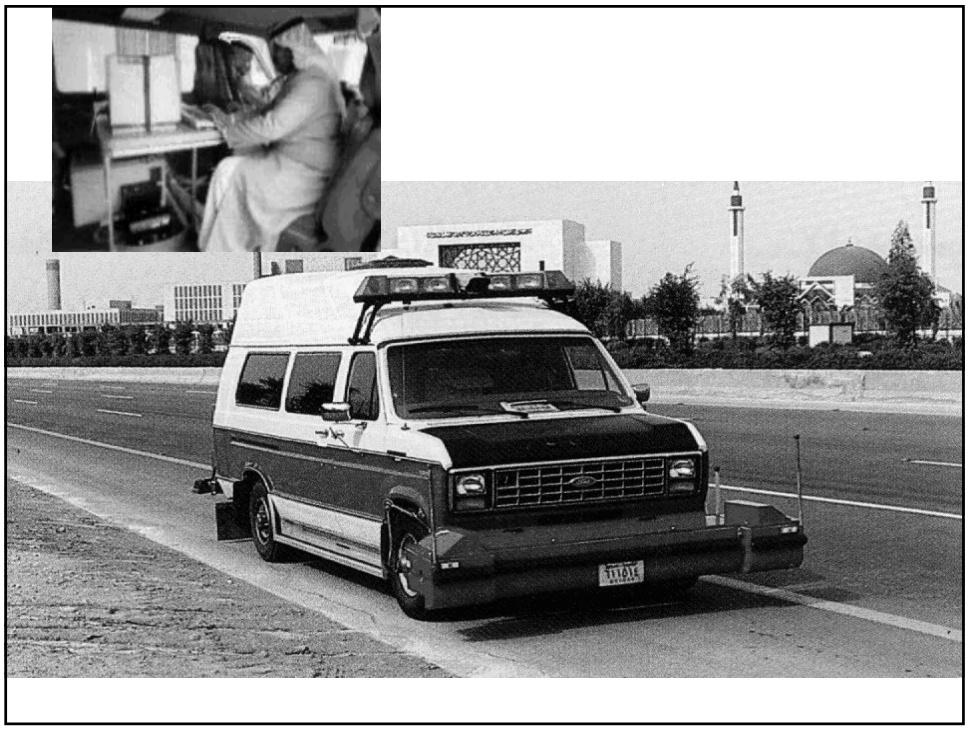




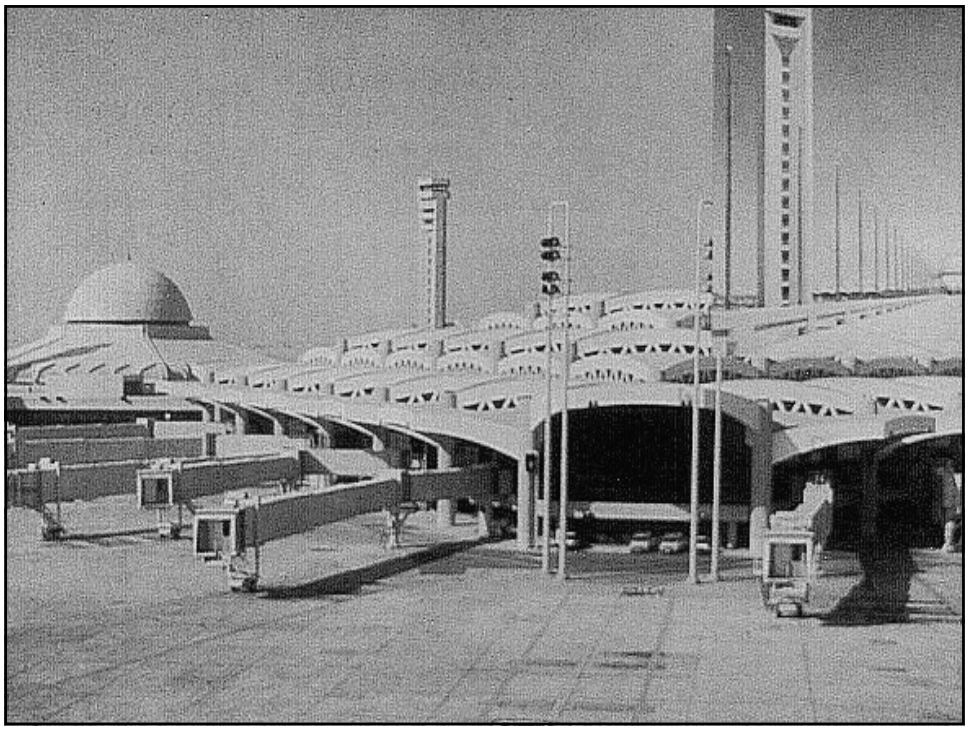





mm




السعودية
HZ-AHN



Functions of a Pavement

1. **Load Bearing Capacity: Distribute load from tires to Subgrade**

2. **Seal Roadbed from Moisture, Prevent Dust/Loss of Soil**

3. **Smooth Surface for Comfortable Ride**

4. **Safe Ride “Friction with Tire,” Skid Resistance**

Rigid Pavement

A pavement structure of which the surface course is made of Portland cement concrete

Flexible Pavement

A pavement structure of which the surface course is made of asphaltic concrete

The essential difference between Flexible pavement and Rigid pavement is the manner in which they distribute the load

Pavement Section

A layered system designed to distribute concentrated traffic loads to the subgrade.

Structural Model

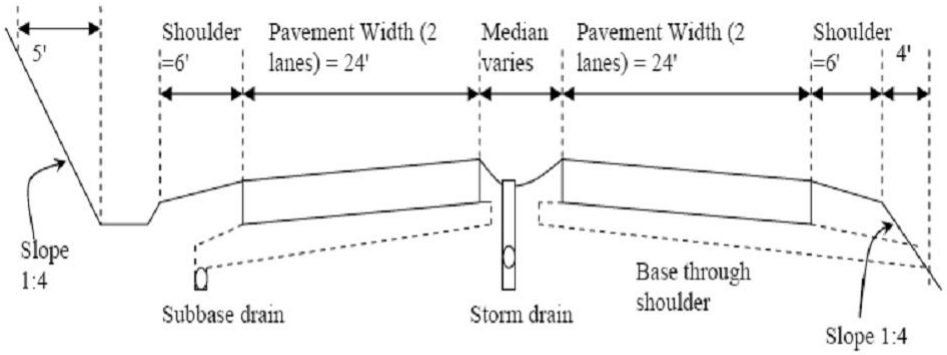
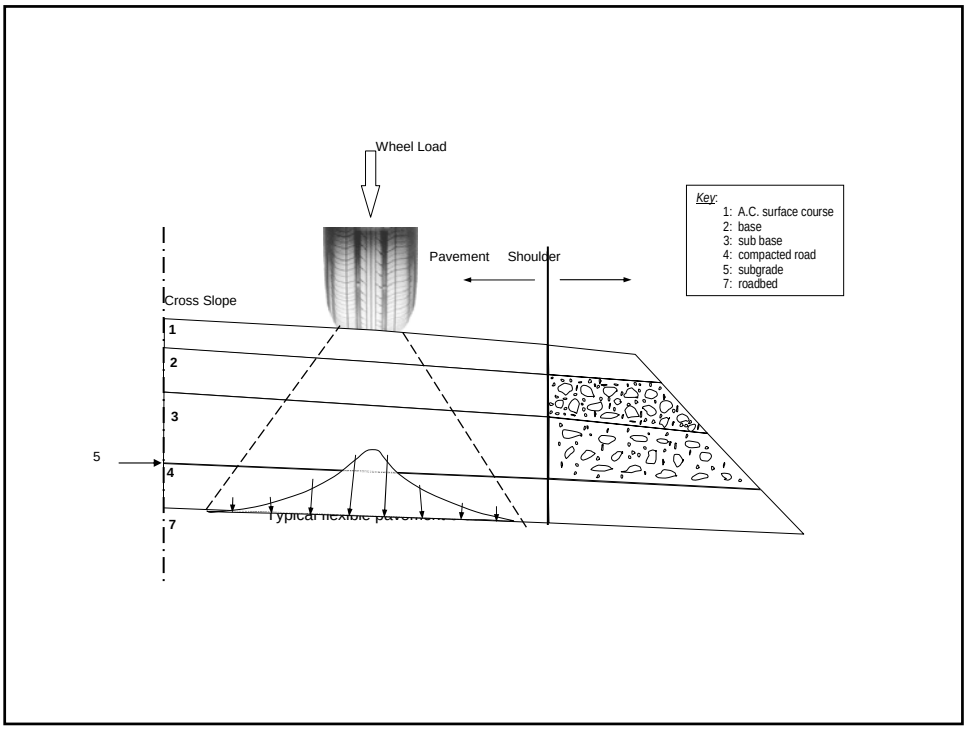
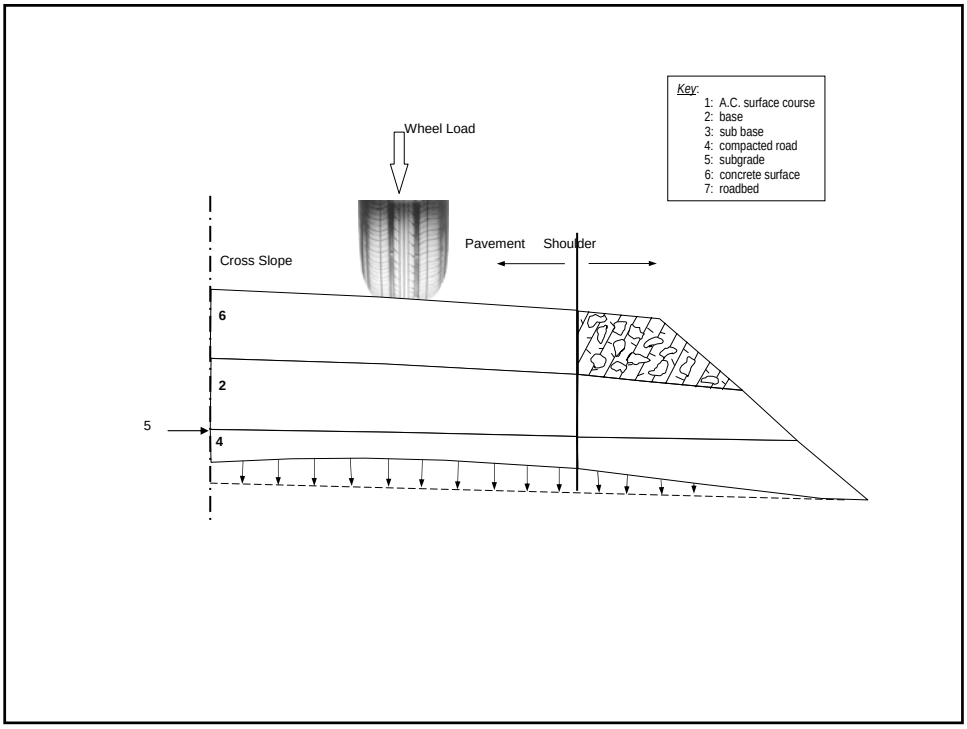
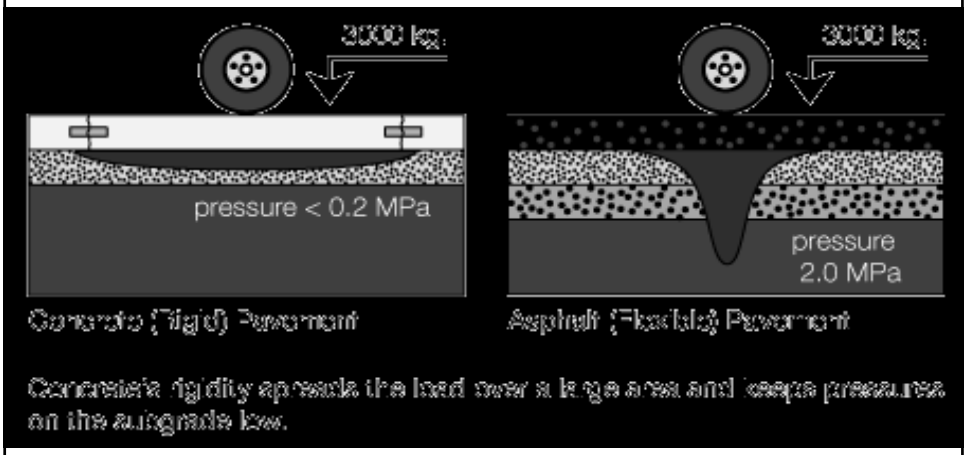
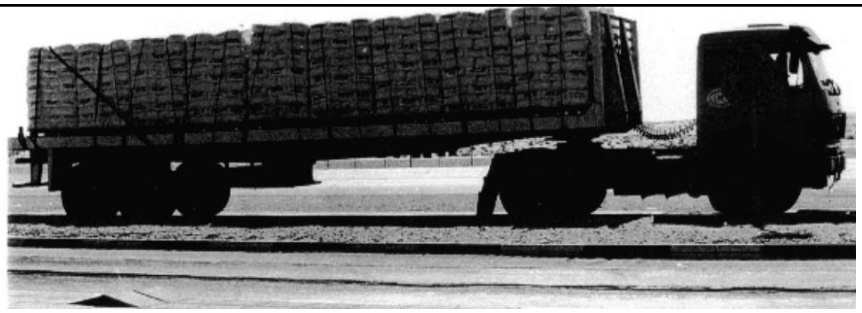


Figure: Cross section of the highway

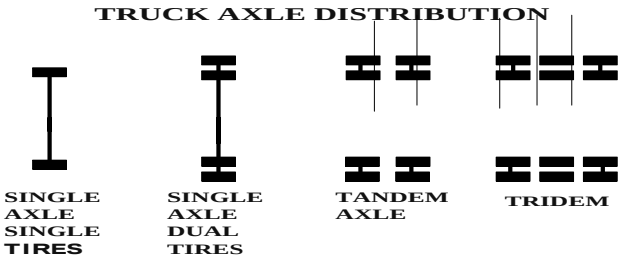

Wheel Load
Key:
1: A.C. surface course
2: base
3: sub base
4: compacted road
5: subgrade
7: roadbed
Pavement
Shoulder
Cross Slope
1
2
3
5
4
7


Key:
1: A.C. surface course
2: base
3: sub base
4: compacted road
5: subgrade
6: concrete surface
7: roadbed
Wheel Load
Pavement
Shoulder
Cross Slope
6
2
5
4

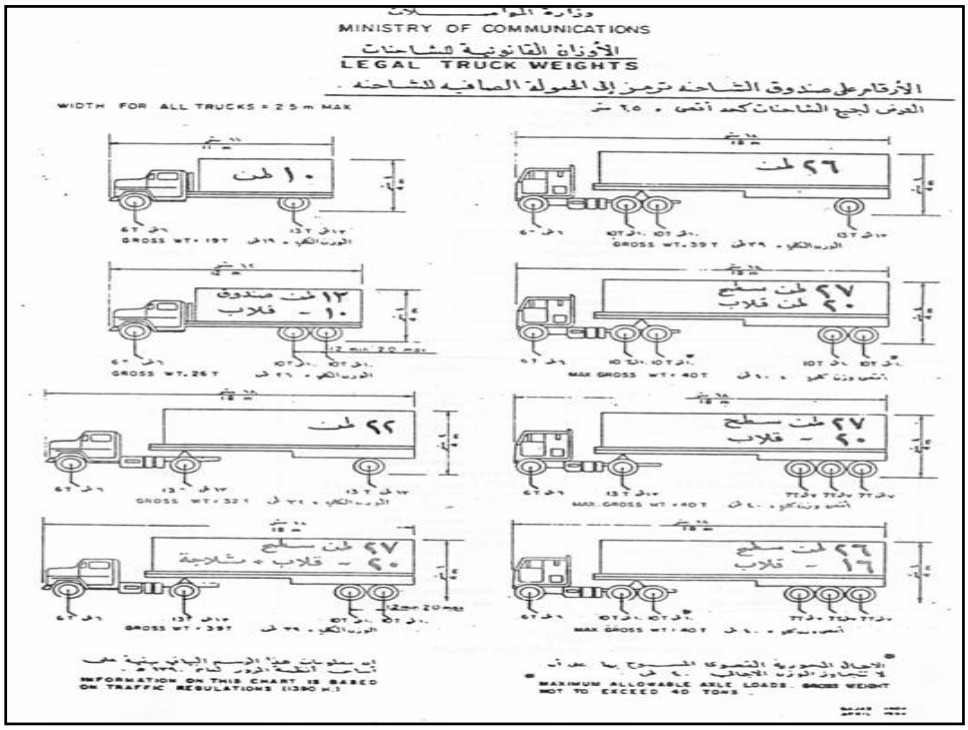

3000 kg
pressure < 0.2 MPa
3000 kg
pressure
2.0 MPa
Concrete (Rigid) Pavement
Asphalt (Flexible) Pavement
Concrete's rigidity spreads the load over a large area and keeps pressures on the subgrade low.

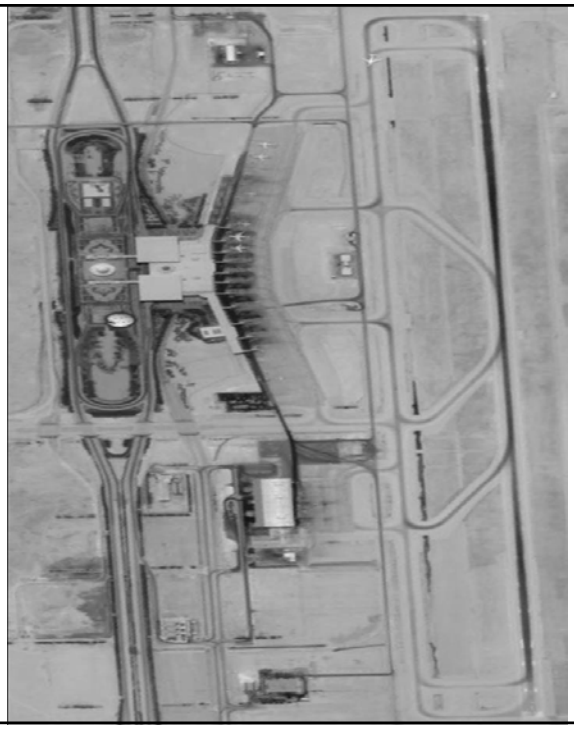


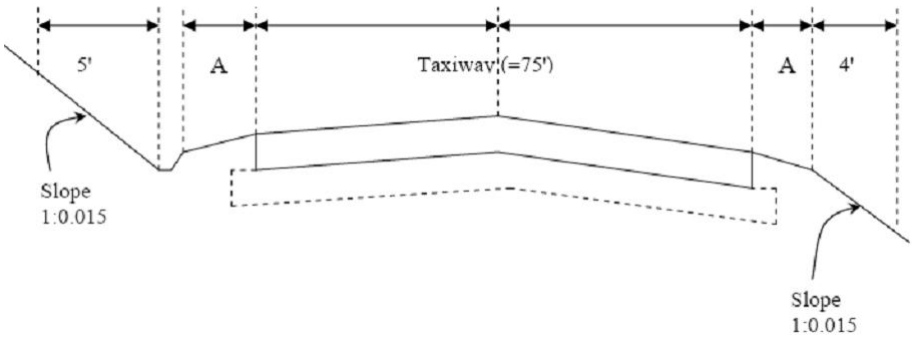
Wheel load:

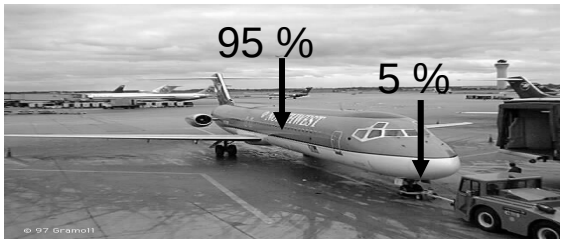


- Wheel can be single or dual
- Axle can be single, Tandem or Triple
- Legal axle load is (18 kip , 8 Ton) on Dual Axle. for more load add more axles
- For tandem-axles, the maximum allowable is 32 kip with spacing of 40"- 48".


وزارة المواصلات
MINISTRY OF COMMUNICATIONS
الأوزان القانونية للشاحنات
LEGAL TRUCK WEIGHTS
الأرقام على صندوق الشاحنة ترمز إلى الحمولة الصافية للشاحنة
WIDTH FOR ALL TRUCKS = 2.5 m MAX
العرض لجميع الشاحنات كحد أقصى = ٢,٥ متر
١٠ طن
GROSS WT. 19 T
٢٦ طن
GROSS WT. 39 T
١٣ طن صندوق
١٠ - قلاب
GROSS WT. 26 T
٢٧ طن سطح
٢٠ طن قلاب
MAX GROSS WT. 40 T
٢٢ طن
GROSS WT. 32 T
٢٧ طن سطح
٢٠ - قلاب
MAX. GROSS WT. 40 T
٢٧ طن سطح
٢٠ - قلاب + ثلاجة
GROSS WT. 39 T
٢٦ طن سطح
١٦ - قلاب
MAX GROSS WT. 40 T
INFORMATION ON THIS CHART IS BASED ON TRAFFIC REGULATIONS (1390 H.)
MAXIMUM ALLOWABLE AXLE LOADS. GROSS WEIGHT NOT TO EXCEED 40 TONS





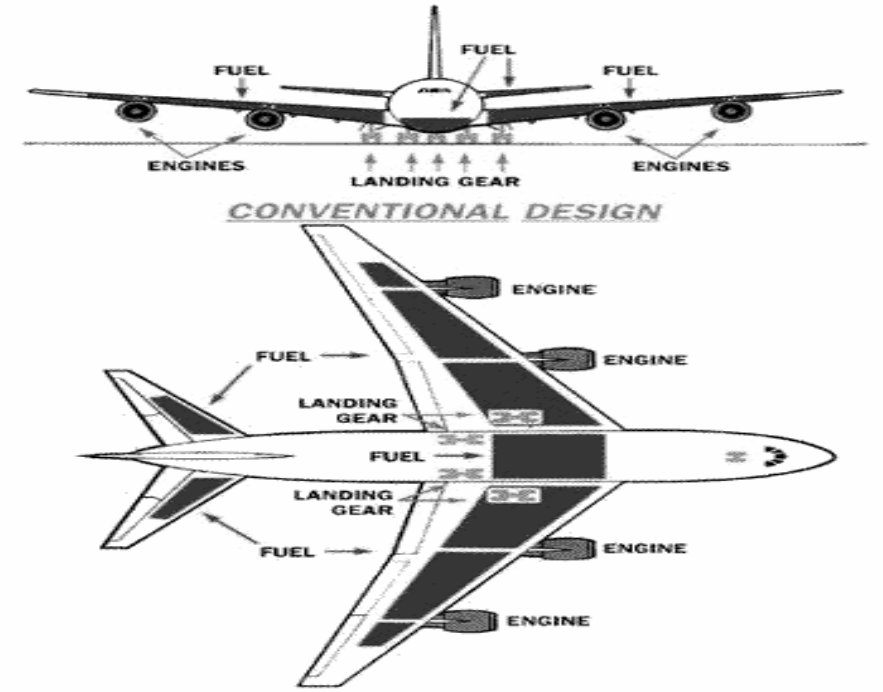


Airport:

0 Single	00 dual	Nose wheels	
0	0	(1) single gear	Main gear
00	00	(2) dual gear	
00 00	00 00	(3) twin-tandem gear	
00 00 00 00 00 00 00 00		(4) Double twin-tandem gear	


N700JJ


JAL



Serviceability:

Present Serviceability Index (PSI) was developed during the AASHTO road test. It is based on rating scale to designate the condition of the pavement at a certain time.

0 - very poor pavement

5 - excellent pavement

PSI is based on satisfaction, comfort, roughness, skid resistance etc. The index can be correlated with objective with objective measurements done on the surface of the pavement such as Roughness cracking, and Rut depth in the case of flexible pavement.

A Highway pavement is usually designed for a terminal PSI (TSI) of 2.5

Types of distress:

Distress are caused by:

(1) Traffic loading (overloading, tire pressure, and repetitions) (Rut, fat crack)

(2) Environmental conditions, Temp., Rainfall … (volume change due to wetting and drying)

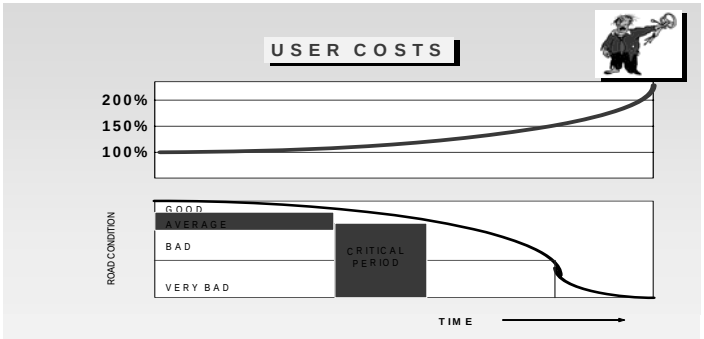
(3) Materials.

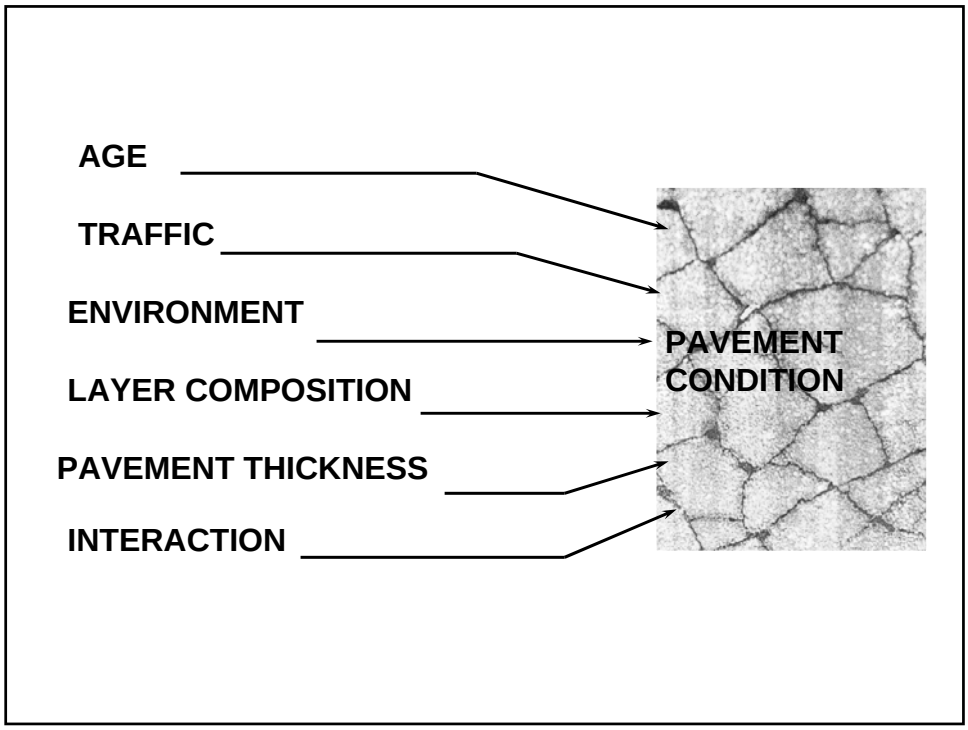
flexible

$$PSI = 5.03 - 1.9 \log (1 + S_V) - 0.01 \sqrt{c + p} - 1.38 R_D$$

S_V = roughness
c = cracking p, patching
R_D = Rut depth

for rigid pavement $R_D = 0$.



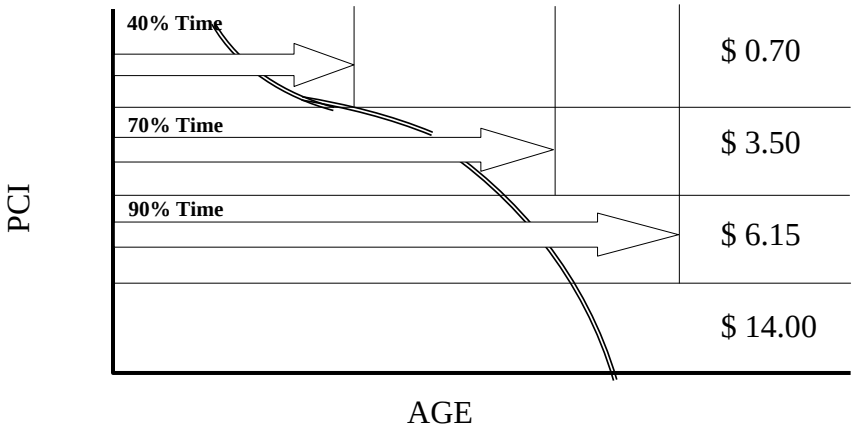


Utah study

Good roads cost less

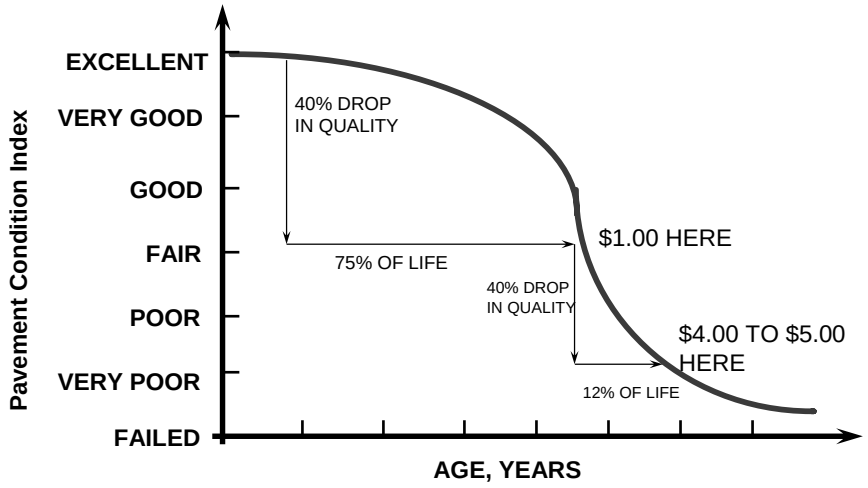
- If maintained at a reasonable level of service
- Preventive maintenance

Effect of Treatment Timing on Costs



(Part 1) APEP 8

Pavement Life Cycle



Timing of Maintenance