

Closed Books and Notes Exam & Assume Reasonably Any Missing Data & Max. Mark = 100 Marks.

↪ First Question (22 Marks)

1. (4 Marks) What are the known methods for accepting road projects?  
( Explain the advantages and disadvantages)
2. (8 Marks) Explain in brief, the common plans for quality control on road projects?
3. (6 Marks) What are rules for inspecting each of the following:  
a) Trucks                      b) Asphalt Mix                      c) Coordination between paving forces
4. (4 Marks) What are the tests required to be performed on:  
a) Aggregate                      b) Mineral Filler                      c) Asphalt

↪ Second Question (22 Marks)

1. (2 Marks) State two important uses of the open graded friction course layer.
2. (2 Marks) As a highway engineer, state two precautions you would follow to reduce the chance of pumping for a new concrete pavement section.
3. (2 Marks) What is the design criteria for the asphalt Institute method?
4. (4 Marks) For a very cold climate, which binder grade should be used, Pen 60-70 or Pen 100-120 and why?
5. (3 Marks) "Asphalt is a linear visco-elastic material". Explain this statement. Show figures to support your answer.
6. (4 Marks) For asphalt concrete, define voids filled with asphalt (VFA) and what is the importance of it?
7. (5 Marks) An asphalt concrete specimen has a mass in air of 1249.3 gm, mass in water of 735.8 gm, and saturated surface dry mass of 1250.2 gm. Calculate the bulk specific gravity of the specimen.

↪ Third Question (24 Marks)

1. (6 Marks) Draw the 6 plots used to design the HMA using Marshall Method and explain how the optimum asphalt content is determined from these plots.
2. (3 Marks) An aggregate gradation, using a 19 mm maximum aggregate size, is being selected to achieve maximum density, determine the required percent passing a #8 sieve (2.36 mm) for this condition.
3. (6 Marks) What are the main reasons for the following:  
a) Asphalt aging                      b) AC rutting                      c) AC fatigue cracking                      d) Stripping



4. (9 Marks) Determine the AC, Base and Subbase layer thicknesses for the pavement system shown in the following figure for an ESAL of  $20 \times 10^6$ ,  $R = 95\%$ ,  $S_o = 0.35$ , initial PSI = 4.5 and terminal PSI = 2.5

Surface,  $E_1 = 400,000 \text{ psi}$ ,  $a_1 = 0.42$

Base,  $E_2 = 40,000 \text{ psi}$ ,  $a_2 = 0.17$ ,  $m_2 = 1.2$

Subbase,  $E_3 = 10,000 \text{ psi}$ ,  $a_3 = 0.07$ ,  $m_3 = 1.1$

Subgrade, CBR = 4%

↳ **Fourth Question**

(20 Marks)

The given contour map shows a horizontal alignment of a **4-lane divided highway** proposed to be constructed in a certain area. It is required to:

- (10 Marks) Draw the longitudinal profile of a section of the proposed highway starting from station (25+00) to station (30+00) showing the following:
  - Ground levels.
  - Longitudinal design levels if the design level of station (25+00) & (30+00) are 91.0 m & 103.0 m respectively.
  - The values of the chosen longitudinal gradients
  - Elements of vertical curves (if required) [ Use k-value = 8 for crest or sag curves]
- (4 Marks) Draw the cross-section of the proposed highway at station (28+50) [Use recommended widths for different cross-section elements.
- Sketch a plan for the intersection area between the proposed highway and the shown existing highway if it is also a **4-lane divided highway** for the following cases:
  - (3 Marks) If it is at-grade intersection
  - (3 Marks) If it is interchange ( show the directions of traffic with arrows).

↳ **Fifth Question**

(22 Marks)

- (8 Marks) Explain in details the factors and surveys required for airport site selection.
- (3 Marks) Draw an international airport layout, show all elements.
- (2 Marks) Explain the advantages and disadvantages of air transport in general and in particular during the Nature/Human disasters like earthquakes (Haiti-2010) and Tusnami (Asia) and bombing in Ghaza..
- (3 Marks) Mention the main points in the report you prepared. (Everybody is different)
- (4 Marks) Draw the imaginary surfaces?-At the beginning of 2010, Dubai has celebrated the opening of the highest tower in the world with 800 m height. Determine the location of the nearest international airport for safe landing, take off and turning zone of aircrafts.
- (2 Marks) What are the corrections required for basic runway length.

## AASHTO Chart for Design of Flexible Pavement

NOMOGRAPH SOLVES:

$$\log_{10} W_{18} = Z_R S_0 + 9.36 \log_{10} (SN+1) - 0.20 + \frac{\log_{10} \left[ \frac{\Delta PSI}{4.2 - 1.5} \right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 \log_{10} M_R - 8.07$$

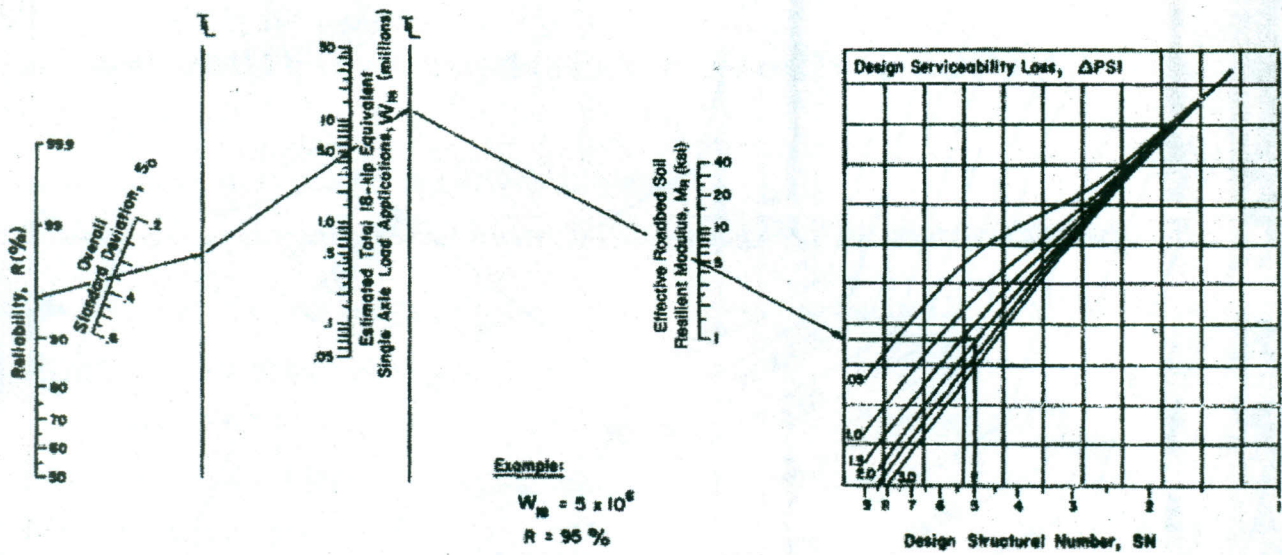


Figure 3.1. Design Chart for Flexible Pavements Based on Using Mean Values for Each Input.

Best Wishes

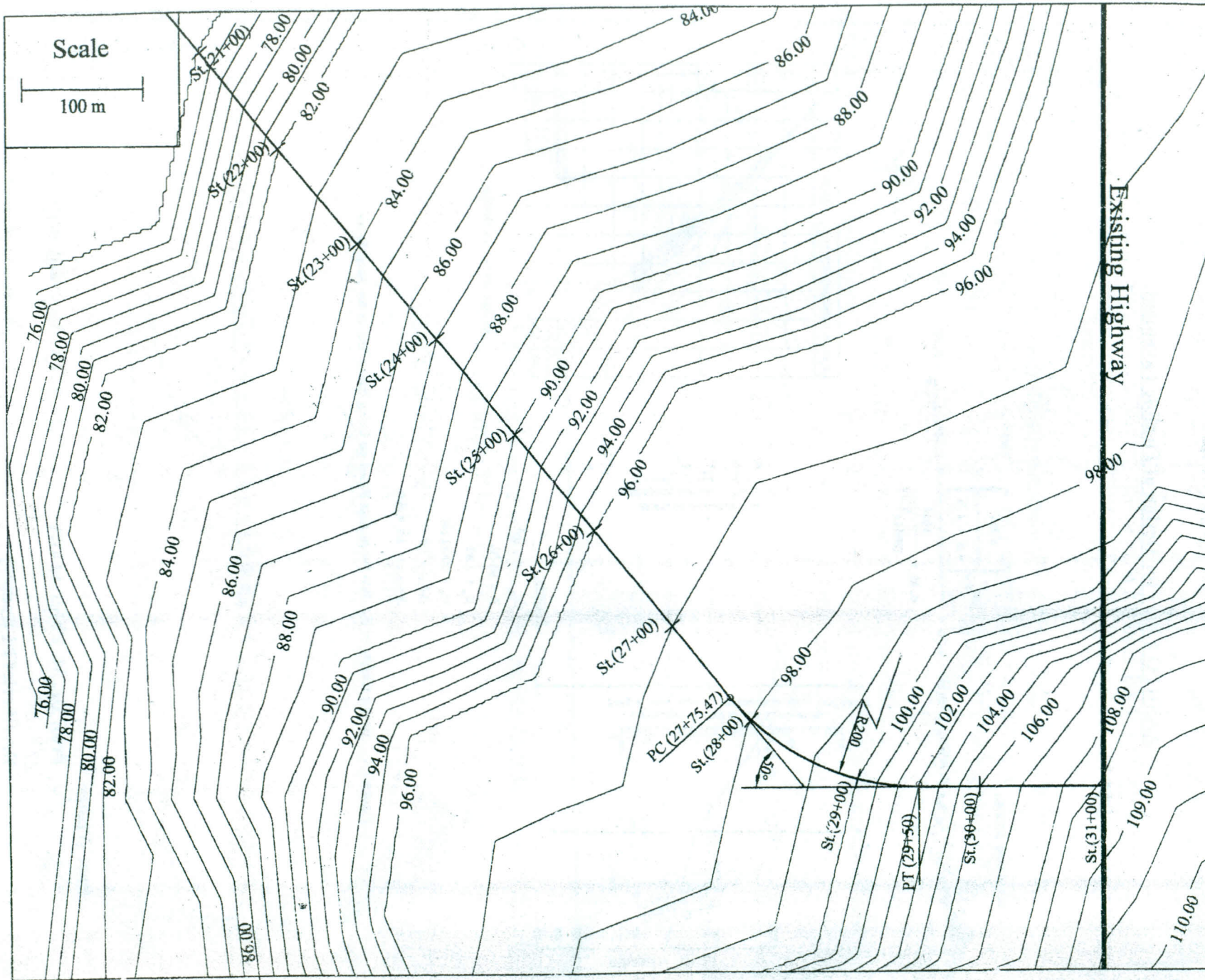
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Contour map / Horizontal alignment of proposed highway