CE481: Design Project (Last date for submission: 5.00 pm Monday 11th November, 2024)

Question:
Given below are details of required layers in a flexible pavement under different conditions. Each group (A to H) should be using the layer configuration mentioned along with the group name. Details of members in each group is uploaded in a separate file.

Q1. Design layer thicknesses of the flexible pavement using IRC 37-2012 for the given traffic conditions and layer configuration

Table 1: Flexible pavement layer composition for each group

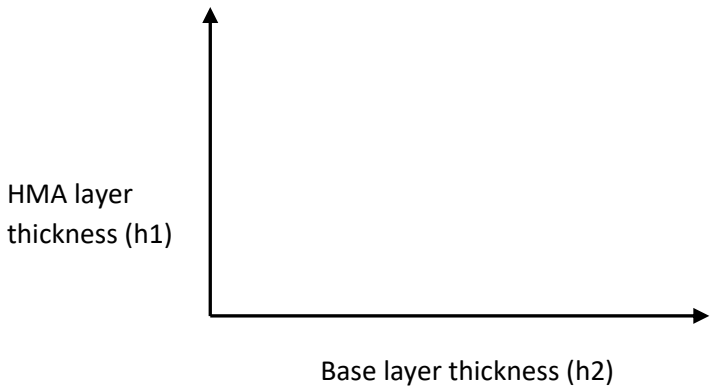
Group no.	Traffic load	50 cm Subgrade	Sub-base	Base	HMA
A	120msa, 90% reliability	Subgrade CBR=8% μ=0.31	unbound base layer	unbound base layer	bituminous layer M_R=2600Mpa μ=0.35
B	135msa, 80% reliability	Subgrade CBR=15% μ=0.27	unbound sub-base layer	unbound base layer	bituminous layer M_R=3500Mpa μ=0.35
C	80msa, 90% reliability	Subgrade CBR=16% μ=0.25	unbound sub-base layer	unbound base layer	bituminous layer M_R=3900Mpa μ=0.35
D	75msa, 80% reliability	Subgrade CBR=5% μ=0.30	cemented sub-base layer	unbound base layer	bituminous layer M_R=2500Mpa μ=0.35
E	145msa, 90% reliability	Subgrade CBR=8% μ=0.35	cemented sub-base layer	unbound base layer	bituminous layer M_R=3500Mpa μ=0.35
F	125msa, 90% reliability	Fly Stabilized Subgrade CBR=15% μ=0.30	cemented sub-base layer	unbound base layer	bituminous layer M_R=3000Mpa μ=0.35

G	100msa, 80% reliability	Subgrade CBR=10% μ=0.25	cemented sub-base layer	unbound base layer	bituminous layer M_R=2500Mpa μ=0.35
H	140msa, 90% reliability	Subgrade CBR=13% μ=0.30	unbound sub-base layer	unbound base layer	bituminous layer M_R=3000Mpa μ=0.35

* Properties of unbound, cemented base and subbase (as per IRC 37-2012)

Q2. Use IITPAVE software to arrive at a more economical section (Design should be safe and must be using the exact same materials identified for each group)

1) Assumptions used in the design approach
2) Sectional drawing of IRC design
3) Screen shots of IIT Pave runs supporting the design modifications
4) Sectional drawing of modifications with IIT Pave design
5) Compare and evaluate the designs with reasons and parameters contributing to the observed difference between IRC design and IIT Pave design approaches
6) Sectional drawing of modified design using IIT pave
7) Based on IIT Pave data, prepare a typical bituminous pavement design chart as shown in figure below.
   a) Starting with a full depth bituminous pavement prepare fatigue and rutting where the pavement is safe in both rutting and fatigue by changing the thickness of base layer (changes in h1 with respect to increase in h2). Assume subgrade and subbase properties to be the same as given in table 1.. Minimum of 5 data points each for fatigue and rutting curves
   b) Identify the optimum design in the graph
   c) Provide the supporting data (strain values, calculated N_F and N_R values etc.) for each iteration/layer thicknesses used in a separate table.



   d) Compare your observations with thickness obtained in Q1 and Q2
   e) Perform a cost analysis to identify the most economical design for all data points obtained in 7a as per the following details
      i) Assume 1000 meters of pavement length for cost comparison

ii) Use layer thicknesses as obtained from Q7a.
iii) Show in a single table the details of for all designs in Q7a: Col. 1-3 thickness details of each layers; Col: 4-7 rates used for each layer; Col 8: Total Cost for 1000 m of pavement section)
iv) Assume rate of HMA = Rs. 10,000/m^3.
v) Assume rate of Unbound base = Rs. 4,250/m^3.
vi) Assume rate of unbound sub-base = Rs. 3,750/m^3.
vii) Ignore cost of subgrade preparation

8) Provide final design recommendations and comments

9) **<u>Submission:</u> Prepare and submit a professional design report (maximum 5 pages) with the following details**