1. You have been tasked to do the structural design for a new interstate highway in an exurban area. The road will have 3 lanes in each direction. Based on current traffic estimates, the one-way traffic volume during the first year of operation will be as follows:

   - Single unit trucks = 1872/day
   - Double unit trucks = 1762/day
   - Truck trains = 247/day

Based on historical averages, the traffic is expected to grow by 2% per year for the foreseeable future. Assume a design life of 30 years and design for a terminal serviceability level of 3.0.

   The basic pavement materials available to you are as follows:

   - Surface course: 12.5-mm NMAS dense-graded HMA mix with E = 440,000 psi (1" minimum)
   - Binder course: 25-mm NMAS dense-graded HMA mix with E = 440,000 psi (3" minimum)
   - Base course: Crushed stone aggregate with $E_{SB} = 28,000$ psi (6" minimum)

For simplicity, you can design the surface and binder course together as a single asphalt layer (because their moduli are the same). The relative thicknesses of the surface and binder courses are determined by variables other than the structural design of the pavement such as minimum and maximum layer thicknesses and the cost of the different mixes.

The existing subgrade soil is fairly competent. The average CBR is 16 in the dry months of May through August and 13 the rest of the year. Assume the pavement has excellent drainage and stays saturated for less than 1% of the time.

Design the pavement for reliability levels of 90% and 99% and compare the results.

2. How would the results change if this same pavement had to be built in West Tennessee where you can assume CBR = 5 all year long? Repeat your calculations for 90% reliability.

3. In the previous problem we used a crushed stone base course, which is fairly expensive material. To save money, let’s assume we’ve opted to add a sandy gravel subbase to the pavement structure. This material can be assumed to have a structural layer coefficient of $a_3 = 0.11$. How would that change your design from the previous problem?