Flexible Pavement Example

We are going to design a limited-access highway in an exurban area. The predominate terrain is rolling hills. In order to accommodate expected commuter traffic of 20,000 to 30,000 vehicles/day, we will need 3 traffic lanes in each direction. The two-way ADTT is expected to be 6000 trucks/day in the first year of operation. The average LEF is 1.14 based on statewide averages. It is assumed that truck traffic will grow at 3% per year over the 20-year design life.

Laboratory soils tests on the roadbed soil show a resilient modulus of 6000 psi for most of the year. During the months of March, April, and May, the modulus drops to 5000 psi due to increased rainfall.

Based on past experience with flexible pavements in the state, we will assume that the initial serviceability index of the pavement will be 4.3, which is higher than is traditionally assumed for flexible pavements.

Based on the high traffic volume and the fact that this is a 6-lane highway, we will select a terminal serviceability level of 2.5, so the loss of serviceability due to traffic over the 15-year performance period will be $\Delta \text{PSI} = 4.3 - 2.5 = 1.8$. Because the initial serviceability is not the traditional 4.2, we have to rewrite the design equation as

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

Note that the 4.2 in the denominator does not change because that represents the initial serviceability recorded in the AASHO Road Test.

The materials available to construct the pavement consist of hot-mix asphalt with an elastic modulus of 400,000 psi at room temperature, a crushed stone base material with a CBR of 100, and a gravel subbase material with a CBR of 10.