1. Calculate the maximum allowable joint spacing for a doweled concrete pavement 12 feet wide and 10 inches thick resting on an unstabilized gravel base course with a modulus of subgrade reaction of 200 psi/in. Assume the lowest mean monthly temperature is 60°F less than the temperature at placement and the concrete has a specified tensile strength of 500 psi. Clearly state any other assumptions.

2. Repeat the previous problem assuming you will rely on aggregate interlock alone to transfer loads across the joints. Clearly state any other assumptions.

3. We’ve decided to use a slab length of 35 ft. Calculate the maximum daytime curling stresses in the interior of the slab and along the longitudinal edge of the slab based on a typical temperature gradient of 3°F per inch of slab thickness. Assume the elastic modulus of the concrete is 4,250,000 psi. Clearly state any other assumptions and remember that there are both longitudinal and transverse curling stresses in the slab interior.

4. Determine the length, diameter, and spacing of tie bars needed between the two adjacent pavement lanes. Assume you will use standard rebar with a yield stress of 40,000 psi. Clearly state all other assumptions.

5. Because we are using a 35-ft slab length, we will have to use dowels to transfer load from one slab to the next in the direction of travel. Assume the dowels will be placed at 1-ft intervals with the outermost dowels 6" from the edge of the slab. The design axle load is 18,000 lb with the outside wheel centered over the dowel closest to the edge of the slab and the inside wheel centered over the dowel 7' to the left. Assume the concrete has a compressive strength ($f'_{c}$) of 5500 psi. Based on recent research, assume that zero shear stress occurs at a distance of $1.0 \ell$ from the point of application of the wheel load. Determine an appropriate dowel bar diameter.