CE 490 Highway Design

1) A two-foot thick bridge will be built to carry Elm Street over the state highway with a clearance of 16 feet. The two roads will intersect at station 19+05 on Elm Street and station 35+92 on the state highway. The state highway is on a 1200 foot vertical curve that starts at station 31+50 at elevation 625.11 between a -3% grade and a +4% grade. Elm Street will have a +4% grade followed by a -1% grade. These two grade lines on Elm Street intersect at station 19+25 at elevation 642.00.

a) What is the length of the curve on Elm Street?

b) Give the elevations on the curve on Elm Street at the PVC, PVT and at every 100 foot station.

2) What is the minimum length of vertical curves on Elm and the state highway for problem #1 assuming a 50 mph design speed for Elm and a 70 mph design speed for the state highway? (Use charts in the book.)

3) Determine the maximum degree of curvature and minimum radius that should be used for design speeds of 80, 100, 120 and 140 km/hr. assuming e+f = .25.

4) The mid-ordinate of a 100 ft. chord on a horizontal curve was measured and found to be a maximum of 6.77 ft. At this same point the curve had a super elevation of .063 ft./ft. Provide a graph of the maximum speed on the curve with an f of .10, .20, .30, .40 and .45.

5) Develop the centerline location of a highway between points A and B as shown on the attached drawing. (use a 1.0% downgrade ahead from point A not 1.0 as shown) Assume that the road is classified as a local town road and is expected to have an average daily traffic of 700 vehicles per day. Determine the appropriate design class from the WDOT facilities manual and draw a typical cross section of the road (showing pavement width, shoulders, and side slopes, etc. in both cut and fill). Locate the highway horizontally and vertically. Show both the horizontal and vertical alignment in plan and profile views on a separate drawing on plan and profile paper or C size drawing paper. Use the attached standards for your drawing. The highway must match horizontally and vertically at points A and B (i.e., there can be no changes horizontally or vertically beyond these points). Also calculate the maximum safe speed on the highway assuming e_{max} = .08 and f = .16.

Due April 15, 2004
Standards for Drawings

Follow WDOT practice for drawings. (There are sample highway plans in the CUTS reading room.) Use the English units system with stations every 100 feet; use plan and profile paper (available from the Bookstore), and label the following:

- Show Vertical Alignment with a vertical scale of 1" = 5 ft., horizontal 1" = 100 ft.
  Show existing ground profile and stationing as a light weight line
  Show proposed grade as a heavy line including:
    - Gradients, PVC, PVI, PVT and L for vertical curves
    - Elevations at every 100 ft. station and at the PVC, PVI and PVT (show at bottom of page)

- Horizontal Alignment
  For each curve, label the PC, PT, PI, and give the station equations. Indicate bearings and lengths of tangents. Also provide curve data (I, R, D, L, T, LC, E and M) for each curve as a table. Show stationing and a north arrow, use a scale of 1" - 100 ft..

Your drawing will be checked to see whether it meets these standards.

**Points will be taken off if the drawing is messy, incomplete or poorly labeled**
Start project
sta 0 + 00
1.0% downgrade from back
elev = 820.00
due north

scale 1" = 100 ft.

Slush Turtle Marsh
elev. 798.00

Match line

Match line
End project
elev = 826.00
2.5% upgrade ahead,
due north

Slush Turtle Marsh
elev. 798.00

Match line