CROSS SECTION DESIGN

With reference to the ROAD DESIGN FORM, the grade elevations will be used to plot the typical roadway section on the groundline cross section.

In a fashion similar to the horizontal alignment, the Vertical Points of Intersection (VPI's) can and should be determined at the end of the tangent sections. The designer may select both the station and elevation for the VPI's. For example, the station can either be read graphically off of the profile or rounded up or down to the nearest full, half, or quarter station or any other desired station. The elevation can be read from the profile or rounded to a figure that may ease computations. The station and elevation of each VPI should be recorded on the ROAD DESIGN FORM. Once the VPI's have been established, the tangent elevations can be quickly computed via the following equation:

$$\text{Elevation}_{\text{station X}} = \text{Elevation}_{\text{VPI}} + (\text{Station X} - \text{Station}_{\text{VPI}})\ \text{Grade}(\%)$$

Record the computed elevations on the ROAD DESIGN FORM. See item G.

Refer to the appendix discussion of vertical curve computations for guidance in the computation of the grade elevations along the vertical curves. Record this information on the ROAD DESIGN FORMS, items H and I.

II. With the grade elevations established, the designer can begin drafting the roadway template onto the cross sections. The template is drawn at the elevation of the subgrade. That is the grade at which the primary earthwork is completed. Any surfacing must go on top of this grade. Allow for this feature in drawing the typical section. If the design

roadway is to be ten feet wide, the subgrade may be on the order of twelve to fifteen feet in width depending on the surfacing. Since this must be constructed and paid for, it is important that it is included in the design.

The typical section must be drawn to include curve and slough widening, turnouts, and the widening required for drainage inlet of various types.

Drainage pipes or trench drains must also be considered when preparing the cross sections. The typical section (in concert with vertical alignment) must provide for adequate cover.

III. Where sliver fills, full bench sections or other difficult construction conditions show up on the cross sections, the designer is well advised to stop at the end of that particular design zone and revise the horizontal and/or the vertical alignments to eliminate or at least minimize the problems.

IV. As each cross section is drawn, refer to the plan to determine the angle of skew with respect to the "L" line centerline. Cross sections were taken for the "P" line perpendicular or at an angle of ninety degrees to the centerline. The alignment of the "L" line that results from the design process may not intersect the cross section at ninety degrees. If the cross section is skewed on the order of thirty degrees from the perpendicular note the skew angle in the remarks column on the ROAD DESIGN FORM.

V. On some occasions, the centerline of the "L" line may be moved in such a fashion that the skew is excessive, that cross sections cross one another or that the centerline runs off of one or more cross sections. The designer must exercise judgment in handling these situations. To fail to

consider these situations or to ignore their effects will result in serious errors in the earthwork computations and the ensuing mass diagram.

It is not possible to outline the solution to all of the possible skewed cross section situations that the designer will encounter. Each situation will require that the designer carefully sketch and consider the situation. The goal is to make the most accurate estimate of the volume of earth material that will have to be excavated or placed.