CE 353 PRINCIPLES OF TRANSPORTATION AND TRAFFIC ENGINEERING

PROJECT WORK

These handouts were prepared to guide you through the project work of CE 353 Principles of Transportation and Traffic Engineering course. Without attending the lecture and recitation hours these will not help you much since they are not prepared as recipe but as guide only.

INTRODUCTION

You are given topographic maps of scale 1/1000. The origin and destination of the required highway to be designed are indicated as A and B points respectively. Your task is to carry out a highway design to connect the points A and B considering economy, safety and rider's comfort.

The topographic maps are composed of contour lines. Contour lines are imaginary lines that connect the points of equal height. The contour interval is the difference in height between two consecutive contour lines.

The classification, design speed and the terrain type of the highway are mentioned on the maps as 'Class / Terrain Type / Design Speed'. The standards of the highway will be determined according to these.

The project work will be carried out in five steps. At the end of each step, written reports will be submitted as stated below.

HOW TO WRITE THE PROJECT REPORT

The reports that you are going to prepare should consist of the following parts :

1) Aim
2) Procedure
3) Calculations: Every calculation you carried out and every formula you used should be shown in this part. If you are using a spreadsheet, you do not need to show the details of your calculations but you should certainly state the formulas you used.
4) Discussion of Results: This is the most important part of your report. Please specify all the things you considered during your work. State the things that are particular to your project.
5) Conclusion

Every part of the report has special importance and you will lose credits for the missing parts. The table handed-out should be filled in and submitted as the first page of your report.

PROJECT WORK STEPS

STEP 1 - ZERO LINE STUDY

INTRODUCTION

Zero line study is a rough study to determine an initial possible route for horizontal alignment which does not violate the gradient limitations.

PROCEDURE

- The standards of your highway is specified on top of your map as:
  'Class / Terrain Type / Design Speed'.

  With these standards, refer to your 'Geometric Standards of Highways Table' and determine your maximum gradient (G_{max}).

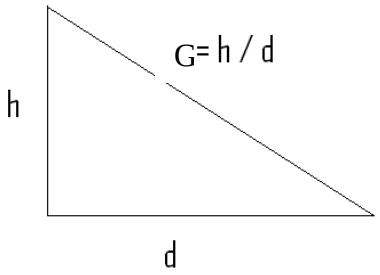
- The gradients you use should satisfy;

  $G \leq G_{max}$

- Calculate the divider opening by;

  $d = h / G$

  $do = d * S * 100$



where; do = divider opening (cm)
h = contour interval (m)
d = horizontal distance (m) (real distance)
G = selected gradient (%)
S = scale of topographic map

- Paying attention to the restrictions stated below, start at point A and by passing to the next contour with the divider, end with point B.

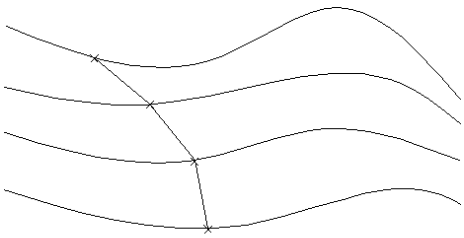
- Locate the zero line by connecting the divider markings with **broken lines.**

RESTRICTIONS

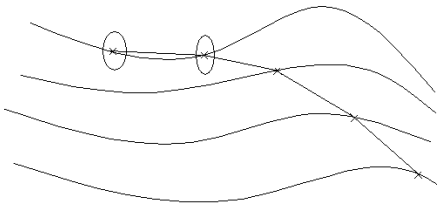
- You are allowed to change the gradient at 2 different points on your map at most. Therefore a maximum of 3 different gradients (which are lower than or equal to G_{max}) can be applied to the map.

- Cross the rivers and roads perpendicularly as shown. (You may violate the divider opening restriction in this case)

- Avoid zig–zags when drawing zero lines.
- Keep in mind that transforming from +a% to –a% gradient is a change of gradient.

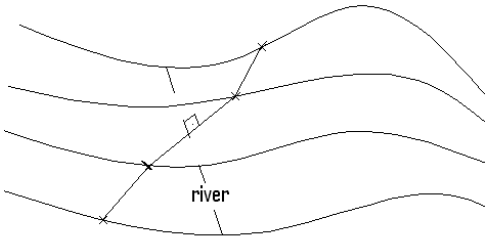


RIGHT

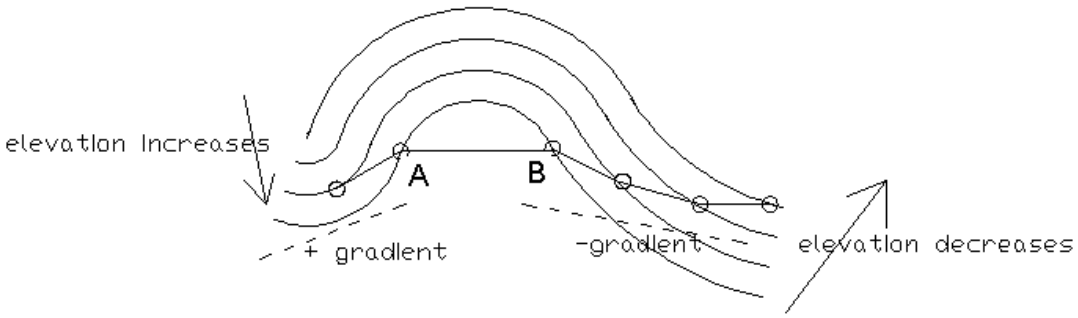


WRONG

(same contour)



RIVER PASSING



(or vice versa)

Note that between points A and B there is no elevation difference therefore there is no slope!!! But there are gradient changes at points A and B.

CAD RESTRICTIONS

Through your project DO NOT forget to work with layers. In first step, create layers as DIVIDERS & ZERO-LINE. Don't erase any of your work. Keep them in proper layers. Your drawing including the map should be named as

ce353_group##(step##).dwg

Learn the group number from your project advisor. At every submission stage, give the proper step number, eg. ce353_group53(step01).dwg

DON'T use any capital letter in the file name.

Your file name should be exactly in the same format as given. Be careful about the name. Find below the names which are not accepted:

Ce353_group07(step01).dwg
ce353_group07(step01).dwg.dwg
ce353_group07(step01).dwg
ce353_group07(step1).dwg
ce353_group7(step01).dwg
ce353_gr07(step1).dwg
ce353_group07(step1)son.dwg

• You have to submit your CAD file and report on METU-ONLINE. You do not need to print out.

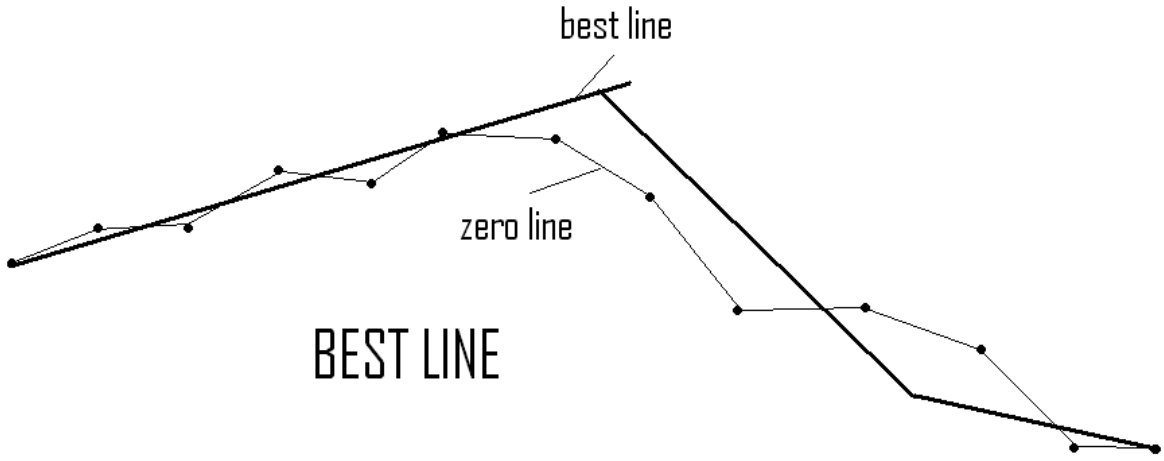
STEP 2 - ESTABLISHING BEST LINES AND HORIZONTAL CURVES INTRODUCTION

INTRODUCTION

In this study, the horizontal alignment will be finalized by establishing polygons (best lines to the zero lines) and horizontal curves.

PROCEDURE

- Draw best lines according to your zero line. Do not let these lines deviate too much from the zero line. (Less deviation --- better fit to the topography --- less cost) An example is shown below:

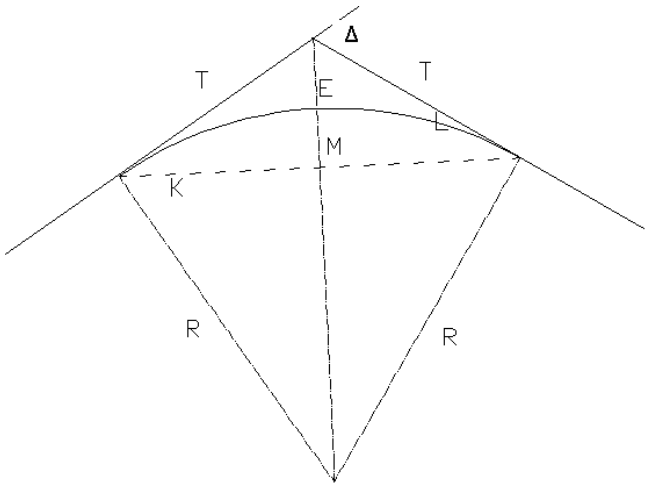


- Refer to your 'Geometric Standards of Highways Table' to determine your minimum radius of curvature Rmin.
- Introduce your horizontal curves regarding your standards and restrictions listed below.
    - The radii you choose should be greater than or equal Rmin. Ri > Rmin
    - Calculate superelevation for each horizontal curve. It must be less than 8%.
    - Minimum distance between two successive curves(dmin) should be;

      dmin =2*(Ls1 + Ls2) / 3
      Lsi = 0,0354 Vd ^3 / Ri
      where ; Lsi = Transition distance for curve i. (m)
      Vd = Design speed (km/hr)
      Ri = Radius of curve i (m)

- You should introduce **<u>enough</u>** horizontal curves.

- Measure your deflection angles. (Δi)
- To indicate your PC, PI and PT points on the map.
- Calculate your curve elements (T, L, M, E, K) in real distances using Δ_i and R_i. Show the curve elements for each curve on a sketch (<u>not on your maps</u>) as below:



- Measure your K on your map and compare it with the calculated value.
- Do not erase zero line.