**Step 3 – Vertical Alignment Study**

**CE353 Principles Of Transportation And Traffic Engineering**

**Group 522**

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## Introduction

The road profile will be drawn taking datum at every 30m. With the obtained values a table will be drawn and if necessary a vertical curve will be fitted.

## Procedure

Start with A= 0+ 000.000

In addition to the stations which are taken at every 30 m, stations of PC, PT of horizontal curves drawn at previous stages of the project.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Angles Between Stations | | | | Arc Lengths Between Stations | | | |
| L1 | L2 | L3 | L4 | L1 | L2 | L3 | L4 |
| 4.12 | 8.59 | 0.5 | 2.91 | 21.5567 | 29.9987 | 1.7555 | 20.3162 |
| 5.79 | 8.59 | 8.59 | 4.3 | 30.3189 | 29.9987 | 29.9987 | 29.9987 |
| 5.79 | 8.59 | 8.59 | 4.3 | 30.3142 | 29.9987 | 29.9987 | 29.9987 |
| 2.12 | 8.59 | 8.59 | 4.3 | 11.1162 | 29.9987 | 29.9987 | 29.9987 |
|  | 8.59 | 8.59 | 4.3 |  | 29.9987 | 29.9987 | 29.9987 |
|  | 8.59 | 7.93 | 4.3 |  | 29.9987 | 27.6959 | 29.9987 |
|  | 8.59 |  | 4.3 |  | 29.9987 |  | 29.9987 |
|  | 8.59 |  | 4.3 |  | 29.9987 |  | 29.9987 |
|  | 7.86 |  | 1.97 |  | 27.4382 |  | 13.7465 |

* St. Km =325.65-47.04

St. Km = 0 + 278.61

St. Km +

=300m

=

=403m

St. Km

=371.92+403.69-47.04-157.99

=570.58

St. Km

Note: If we repeat all these processes by written in the guideline, we can get all the results respectively:

* St. Km = 0 + 570.58

St. Km = 0 + 836.95

* St. Km = 1 + 227.77

St. Km = 1 + 377.21

* St. Km = 1 + 629.10

St. Km = 1 + 873.17

* St. Km B = 1 + 947.20

Calculate elevations for each ST. Points.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| POINTS | A | ST1 | ST2 | ST3 | ST4 | ST5 | ST6 | ST7 | ST8 | ST9 |
| St. Km. | 0 | 0+030 | 0+060 | 0+090 | 0+120 | 0+150 | 0+180 | 0+210 | 0+240 | 0+270 |
| Ground El. | 465 | 467.152 | 470.829 | 473.646 | 478.013 | 480.975 | 482.750 | 485.930 | 489.111 | 491.136 |
| Grade El. | 5 | 5.0107 | 5.0291 | 5.0432 | 5.0651 | 5.0799 | 5.0888 | 5.1047 | 5.1206 | 5.1307 |

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| PC-I | ST10 | ST11 | ST12 | PT-I | ST13 | ST14 | ST15 | ST16 | ST17 | ST18 |
| 0+278.61 | 0+300 | 0+330 | 0+360 | 0+371.92 | 0+390 | 0+420 | 0+450 | 0+480 | 0+510 | 0+540 |
| 491.146 | 493.292 | 496.734 | 500.125 | 500.898 | 502.264 | 506.286 | 510.304 | 512.480 | 516.770 | 520.087 |
| 5.1307 | 5.1415 | 5.1587 | 5.1756 | 5.1789 | 5.1863 | 5.2064 | 5.2265 | 5.2374 | 5.2589 | 5.2754 |

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| ST19 | PC-II | ST20 | ST21 | ST22 | ST23 | ST24 | ST25 | ST26 | ST27 | PT-II |
| 0+570 | 0+570.58 | 0+600 | 0+630 | 0+660 | 0+690 | 0+720 | 0+750 | 0+780 | 0+810 | 0+836.95 |
| 521.626 | 521.626 | 524.456 | 529.456 | 533.103 | 540.125 | 545.736 | 550.158 | 550.979 | 551.954 | 553.698 |
| 5.2831 | 5.2831 | 5.2973 | 5.3223 | 5.3405 | 5.3756 | 5.4037 | 5.4258 | 5.4299 | 5.4348 | 5.4435 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ST28 | ST29 | ST30 | ST31 | ST32 | ST33 | ST34 | ST35 | ST36 | ST37 | ST38 |
| 0+840 | 0+870 | 0+900 | 0+930 | 0+960 | 0+990 | 1+020 | 1+050 | 1+080 | 1+110 | 1+140 |
| 553.957 | 556.893 | 557.107 | 556.055 | 554.959 | 553.884 | 553.261 | 554.275 | 555.515 | 556.756 | 557.995 |
| 5.4451 | 5.4595 | 5.4605 | 5.4345 | 5.4498 | 5.4444 | 5.4421 | 5.4464 | 5.4526 | 5.4588 | 5.4650 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ST39 | ST40 | PC-III | ST41 | ST42 | ST43 | ST44 | ST45 | PT-III | ST46 | ST47 |
| 1+170 | 1+200 | 1+227,77 | 1+230 | 1+260 | 1+290 | 1+320 | 1+350 | 1+377,21 | 1+380 | 1+410 |
| 559.087 | 561.792 | 565.654 | 565.936 | 570.029 | 570.818 | 570.217 | 569.415 | 567.850 | 567.636 | 564.952 |
| 5.4704 | 5.4840 | 5.5033 | 5.5047 | 5.5252 | 5.5291 | 5.5261 | 5.5221 | 5.5143 | 5.5132 | 5.4998 |

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| ST48 | ST49 | ST50 | ST51 | ST52 | ST53 | ST54 | PC-IV | ST55 | ST56 | ST57 |
| 1+440 | 1+470 | 1+500 | 1+530 | 1+560 | 1+590 | 1+620 | 1+629,1 | 1+650 | 1+680 | 1+710 |
| 562.233 | 560.275 | 555.847 | 552.301 | 550.560 | 547.245 | 543.384 | 542.318 | 540.943 | 536.953 | 531.890 |
| 5.4862 | 5.4764 | 5.4542 | 5.4365 | 5.4278 | 5.4112 | 5.3919 | 5.3866 | 5.3797 | 5.3598 | 5.3345 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ST58 | ST59 | ST60 | ST61 | ST62 | PT-IV | ST63 | ST64 | B |
| 1+740 | 1+770 | 1+800 | 1+830 | 1+860 | 1+873,17 | 1+890 | 1+920 | 1+947,20 |
| 530.268 | 533.093 | 537.959 | 541.230 | 544.084 | 545.822 | 547.848 | 550.779 | 552.500 |
| 5.3263 | 5.3405 | 5.3648 | 5.3812 | 5.3954 | 5.4041 | 5.4142 | 5.4289 | 5.4375 |

We modified the profile by drawing the grade lines.

Since we found |g2-g1|<0.5% we did not establish a curve, instead we solved the question.

## Question

|  |  |
| --- | --- |
| g1 | -0.03 |
| g2 | 0.02 |
| L | 62.03 |
| pc\_elevation | 400.93 |
| a | 0.000403 |
| b | -0.03 |
| c | 400.93 |

|  |  |
| --- | --- |
| x | y |
| 0 | 400.93 |
| 5 | 400.7901 |
| 10 | 400.6703 |
| 15 | 400.5707 |
| 20 | 400.4912 |
| 25 | 400.4319 |
| 30 | 400.3927 |
| 35 | 400.3737 |
| 40 | 400.3748 |
| 45 | 400.3961 |
| 50 | 400.4376 |
| 55 | 400.4992 |
| 60 | 400.5809 |
| 62.03 | 400.6199 |

Ss= 90m  
V= 70km/h  
L=(5\*70^2)/395 =62.03  
a= 5/200/L

## Discussion of Results

We started the third step of the project by stating the stations every 30m on our best line. We started at our point A as = + 000.000m and continued on every 30ö for other stations. On straight partians of our best line we simply measured 30m distances using circles with diameter of 30m. On horizontral curves we used angle deflection method and computed arc lengths according to the curve length’s propartion to the Δ and the thus angle which sees 30m is computed using the formula (angle deflection formula) For parts which covers both from straight and arc portions we first measured the straight portion and the new measured the remaining portion on arc according to the method described above. At the points 30m length barely exceeded out of straight portion and for sake of simplicity we passed these points by 29.xxxm first asking to our teaching assistant.

We calculated elevations of all station points using the methods described in project guide line. Then using the horizontal station points and their respective elevations we drew our ground profile. In our ground profile we have 1/10 scale in vertical to horizontal distance. Each square represents 3m in vertical and 30m in horizontal axis.

After setting the profile we decided on no setting a vertical curve since our|g2-g1|<0.5%.

## Conclusion

Our calculations may have errors caused by not using enough decimals or neglecting small portions of our best line for sake of simplicity, we completed third step of our project and learned how to create ground profile and how to set vertical curves .