# APPENDIX F

## *CONFIGURATION REQUIREMENTS*

(This Appendix to be incorporated into the Contract)

# Table of Contents

## *A. Introduction*

The roadway design software must be configured to meet Caltrans' drafting, design, and surveying standards and methods, per the Caltrans Highway Design Manual (e.g. "Index. 201.3", "Topic 504"), CADD Manual, and Plans Preparation Manual.. Links to those manuals are shown below:

Caltrans Highway Design Manual:
http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm

CADD Manual:
http://www.dot.ca.gov/hq/oppd/cadd/usta/caddman/english/toc.htm

Plans Preparation Manual:
http://www.dot.ca.gov/hq/oppd/cadd/usta/ppman/toc.htm

Surveys Manual:
http://www.dot.ca.gov/hq/row/landsurveys/SurveysManual/Manual_TOC.html

All software configurations must be complete within six months following contract execution.

As design and drafting standards may change, the software must be configurable by Caltrans. Contractor must provide a System Administration Manual that includes software configuration procedures when acceptance testing begins.

## *B. General Configuration*

General configuration requirements are as follows:

1. The default preferences (drafting, display, save, and security preferences, etc.) and options must be set up for each functional unit (roadway, hydraulics, landscape, structures, and right of way.)

2. Custom definable toolbars and/or menus must be created to run the typical commands for each of the following processes:

    a. Survey Processing;

    b. Horizontal Alignment;

    c. Vertical Alignment;

    d. SuperElevation;

    e. Drainage;

f. COGO;

g. DTM/Contours; and

h. Plans Preparation.

3. Styles (fonts, weights, levels, colors, and line styles), if applicable, for roadway data must be developed to match the Caltrans Plans Preparation and CADD manuals for:

   a. Text;

   b. Points;

   c. Line work (e.g. alignments, Existing ETW, Design EP, HP, contours, etc.); and

   d. DTM's.

   NOTE: If the software is unable to assign different styles to a feature based on existing vs. design, the survey features can add the prefix “su-“ to those survey features.

4. Filters (selection criteria) must be developed based on styles for the following:

   a. Photogrammetric data;

   b. Survey data;

   c. R/W data; and

   d. Roadway data.

5. Data Transfer:

   a. Methods of transferring the following types of data among users within the same software must be developed for:

      - Photogrammetric data, points and line work;
      - Survey data, points and line work;
      - Geometry; and
      - DTM's.

   b. Methods of exporting the following data for use with Trimble Survey Controller must be developed for:

- Points;
- Roadway definitions (alignments, profiles, and cross sections); and
- Design DTM.

c. Methods of exporting the following data for use with Machine Guidance must be developed for:

- Roadway definitions (alignments, profiles, and cross sections); and
- Design & Existing DTM's.

6. Legacy Data Import:

a. Methods of importing legacy data files must be developed for:

- TSS file format; and
- SRV file format.

Refer to the Bidder's library for additional information about these formats.

- The file 'TSS-File-Format.PDF 'describes the TSS file format.
- Translation tables: table.rpt & table.sym
- An example TSS file containing data, 'TSS-Example.tss'
- A DGN file of the resulting data, 'TSS-Result.dgn'
- The file 'SRV Format.doc' describes the SRV file format.

## *C. Survey Configuration*

1. Photogrammetric Data:

   a. A method must be developed to:

   - Import data from a V7 & V8 format 3D DGN file, and
   - Assign codes to the data based on graphical attributes, using the following table:

| Code | Linestyle | Weight | Color | Level Slot |
|---|---|---|---|---|
| PCNTGNV | 3 | 2 | 7 | 7 |
| PCNTGNV | 3 | 0 | 7 | 7 |
| PCNT | 0 | 2 | 7 | 7 |
| PCNT | 0 | 0 | 7 | 7 |
| PASPH | 0 | 0 | 9 | 2 |
| PASPH | 0 | 0 | 9 | 3 |
| PBRK | 0 | 0 | 3 | 11 |
| PBRK | 0 | 0 | 27 | 15 |
| PBRKGNV | 2 | 0 | 27 | 15 |
| PBRKGNV | 3 | 0 | 27 | 15 |
| PCONC | 3 | 0 | 4 | 2 |
| PCONC | 3 | 0 | 4 | 3 |
| PCURB | 0 | 3 | 4 | 2 |
| PCURB | 0 | 2 | 4 | 3 |
| PCURB | 0 | 3 | 4 | 3 |
| PDIKE | 0 | 2 | 2 | 2 |
| PDIKE | 0 | 2 | 2 | 3 |
| PDIRT | 2 | 0 | 4 | 2 |
| PDTRD | 0 | 0 | 6 | 2 |
| PETW | 0 | 0 | 2 | 3 |
| PEW | 0 | 0 | 1 | 6 |
| PFL | 0 | 0 | 17 | 6 |
| PHDWL | 0 | 2 | 5 | 5 |
| PRWL | 0 | 2 | 5 | 2 |
| PSPOT | 0 | 0 | 0 | 11 |
| PSPOT | 0 | 0 | 7 | 11 |
| PSTRP | 7 | 0 | 2 | 3 |

b. The software shall categorize photogrammetric data with a feature name or code. The graphics attributes of the data shall follow the table contained in the bidder's library within PhotoFeatures.doc

2. Survey Data:

   a. The workflow to import and process raw data from a Trimble Survey Controller must be developed.

   b. The software shall categorize survey data with a feature name or code. The graphics attributes of the data shall follow the table contained in the bidder's library within SurveyFeatures.doc

3. R/W Data:

   The software shall categorize R/W elements with a feature name or code. The graphics attributes of the elements shall follow the table contained in the bidder's library under RWFeatures.doc

4. Customized metes and bounds report:

   The metes and bounds deed description shall be similar to the following format:

   *THENCE (1) South 67°56'53" West, 119.03 feet to the beginning of a curve concave southeasterly, said curve has a radius of 414.00 feet;*

   *THENCE (2) southwesterly along said curve a distance of 272.77 feet through a central angle of 37°45'00" to a point of tangency;*

   *THENCE (3) South 30°11'53" West, 100.00 feet to the beginning of a curve concave northwesterly, said curve has a radius of 386.00 feet;*

   *THENCE (4) southwesterly along said curve a distance of 204.35 feet through a central angle of 30°20'00" to a point of compound curvature, said curve has a radius of 100.00 feet and is concave northerly;*

   *THENCE (5) westerly along said curve a distance of 144.86 feet through a central angle of 83°00'00" to a point of compound curvature, said curve has a radius of 200.00 feet and is concave easterly;*

   *THENCE (6) northerly along said curve a distance of 313.62 feet through a central angle of 89°50'42" to [INSERT END OF DESCRIPTION];*

## *D. Roadway Design Configuration*

The software shall categorize design data with a feature name or code. The graphics attributes of the data shall follow the table contained in the bidder's library within RoadwayFeatures.doc.

1. Horizontal Alignment:

   The software will check alignment design speeds based on the following table.

**Relation of Conditions to Design Speed**

| **Conditions** | **Design Speed (mph)** |
|---|---|
| **LIMITED ACCESS TYPES** | |
| Freeways and expressways in mountainous terrain | 50-80 |
| Freeways in urban areas | 55-80 |
| Freeways and expressways in rural areas | 70-80 |
| Expressways in urban areas | 50-70 |
| **CONVENTIONAL HIGHWAYS** | |
| Rural | |
| Flat terrain | 55-70 |
| Rolling terrain | 50-60 |
| Mountainous terrain | 40-50 |
| Urban | |
| Arterial streets | 40-60 |
| Arterial streets with extensive development | 30-40 |
| **LOCAL FACILITIES** (Within State right of way) | |
| Facilities crossing a freeway or expressway, connecting to a conventional highway or traversing a State facility | AASHTO (1) |
| Facilities connecting to a freeway or expressway | 35M/45A |
| M=Mandatory A=Advisory | |
| (1) If outside of State right of way and no specific local standards apply, the minimum design speed shall be 30 mph. | |

a. Curve Radius Standards

The software shall check alignments to make sure they have the minimum curve radius for a given design speed based on the following table.

Standards for Curve Radius

| Design Speed mph | Minimum Radius of Curve (ft) |
|---|---|
| 20 | 130 |
| 30 | 300 |
| 40 | 550 |
| 50 | 850 |
| 60 | 1,150 |
| 70 | 2,100 |
| 80 | 3,900 |

The software will check to make sure that for central angles less than 10 degrees, the minimum curve length will be 800 feet and checks that for central angles smaller than 30 minutes, no curve is required.

b. Alignment Graphics Attributes

The software shall categorize alignments with a feature name or code. The graphics attributes of the alignments shall follow the table below for those features listed:

**Linear Feature Attributes Table**

| Feature | Linestyle | Weight | Color | Level |
|---|---|---|---|---|
| Mainline | 0 | 3 | 0 | 15 Main Align |
| Frontage | 0 | 2 | 0 | 17 Front Align |
| Ramp | 0 | 2 | 0 | 13 Ramp Align |
| Stage 1 | 0 | 2 | 3 | 51 Stage 1 |
| Stage 2 | 0 | 2 | 3 | 53 Stage 2 |
| Stage 3 | 0 | 2 | 3 | 55 Stage 3 |
| Temporary | 0 | 2 | 0 | 25 Temp Rdwys |

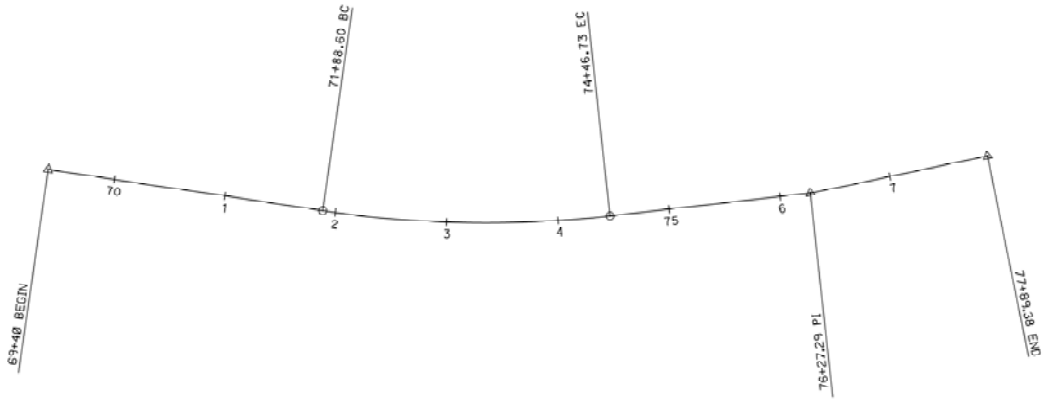
c. Stationing and Annotation Attributes

The text and tic sizes for alignments are based on a plotting scale of 1” = 50’ (Caltrans Base Scale). It is important to place text at the appropriate CADD size within the drawing based on the intended scale of the plotted

plan sheet. For any plot scale, the text and tic marks will appear 0.14 inches when plotted on a 22" x 34" plan sheet. Leader lines at the beginning and ending of alignment and horizontal curves will appear 2.4 inches long. Leader lines at the beginning and ending of curves will extend radially toward the center of the curve with the station value and the letters BC and EC following the station values respectively.

The tic intervals for stationing will be every 100'. The whole number value of the station will be annotated without the "+00" portion of the station every 500'. The annotated value of the other 100' intervals will be the single hundred values for that station.

Example:




The annotation attributes for the alignments with the listed feature name or code shall follow the table below:

**Stationing and Annotation Attributes Table**

| Feature | Weight | Color | Level |
|---|---|---|---|
| Mainline | 1 | 0 | 16 Main Anno |
| Frontage | 1 | 0 | 18 Front Anno |
| Ramp | 1 | 0 | 14 Ramp Anno |
| Stage 1 | 1 | 3 | 52 Stage 1 Anno |
| Stage 2 | 1 | 3 | 54 Stage 2 Anno |
| Stage 3 | 1 | 3 | 56 Stage 3 Anno |
| Temporary | 1 | 0 | 25 Temp Rdwys |

2. Vertical Alignment:

   a. The software will check vertical alignment design grades based on the following:

      **Maximum Grades for Type of Highway and Terrain Conditions**

| Type of Terrain | Freeways and Expressways | Rural Highways | Urban Highways |
|---|---|---|---|
| Level | 3% | 4% | 6% |
| Rolling | 4% | 5% | 7% |
| Mountainous | 6% | 7% | 9% |

   b. The software shall check vertical alignments for the following criteria:

      i. Minimum grades should be 0.5 percent in snow country and 0.3 percent at other locations.

      ii. Minimum Curve Length:

      - For algebraic grade differences of 2 percent and greater, and design speeds equal to or greater than 40 miles per hour, the minimum length of vertical curve in feet should be equal to 10V, where V = design speed in miles per hour.

      - For algebraic grade differences of less than 2 percent, or design speeds less than 40 miles per hour, the vertical curve length should be a minimum of 200 feet.

      - Vertical curves are not required where the algebraic difference in grades is 0.5 percent or less.

c. Graphics Attributes

The graphics attributes of the alignments shall follow the table below:

**Roadway Profile and Vertical Alignment Attributes Table**

| Type | Linestyle | Weight | Color | Level |
|---|---|---|---|---|
| Roadway Vertical Alignment | 0 | 1 | 0 | 60 Nongeo Data |
| Original Ground Profile | 3 | 1 | 0 | 60 Nongeo Data |

d. Stationing and Annotation Attributes

Profile lines shall be shown with the designation and grade percent. The beginning and ending of vertical curves will be annotated with the station, elevation and letters BVC or EVC for begin and end of curve respectively. The length of curve will be displayed between the BVC and EVC. The vertical point of intersection (VPI) shall be annotated with the station and elevation value. The vertical scales for alignment shall be 1"= 10', 1" = 5' or 1" = 2' depending on the type of terrain and roadway.

The text is based on a plotting scale (horizontal) of 1" = 50' (Caltrans Base Scale). It is important to place text at the appropriate CADD size within the drawing based on the intended scale of the plotted plan sheet. For any plot scale, the text will appear 0.14 inches when plotted on a 22" x 34" plan sheet. All text annotation for vertical alignments will use the font CTFont1.

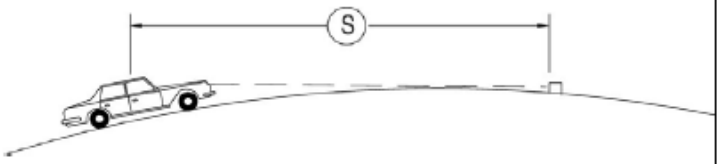
e. Stopping Sight Distance:

The software shall check vertical alignments to make sure they have the minimum stopping sight distance required for a given design speed based on the following table. To calculate the stopping distance for crest or sag vertical curves, see the diagrams and equations below the table. If any curve in the alignment fails the minimum stopping sight distance requirement, the software shall report both the stopping sight distance calculated and the stopping distance required.

**Minimum Stopping Sight Distances**

| Design Speed[1] (mph) | Stopping[2] (ft) |
|---|---|
| 20 | 125 |
| 25 | 150 |
| 30 | 200 |
| 35 | 250 |
| 40 | 300 |
| 45 | 360 |
| 50 | 430 |
| 55 | 500 |
| 60 | 580 |
| 65 | 660 |
| 70 | 750 |
| 75 | 840 |
| 80 | 930 |
| [1]See Topic 101 for selection of design speed. | |
| [2] For sustained downgrades, refer to advisory standard in Index 201.3 | |

## Stopping Sight Distance on Crest Vertical Curves




Drivers eye height is 3 feet ½ inch.
Object height is ½-foot.

L = Curve Length (feet)

A = Algebraic Grade Difference (%)

S = Sight Distance (feet)

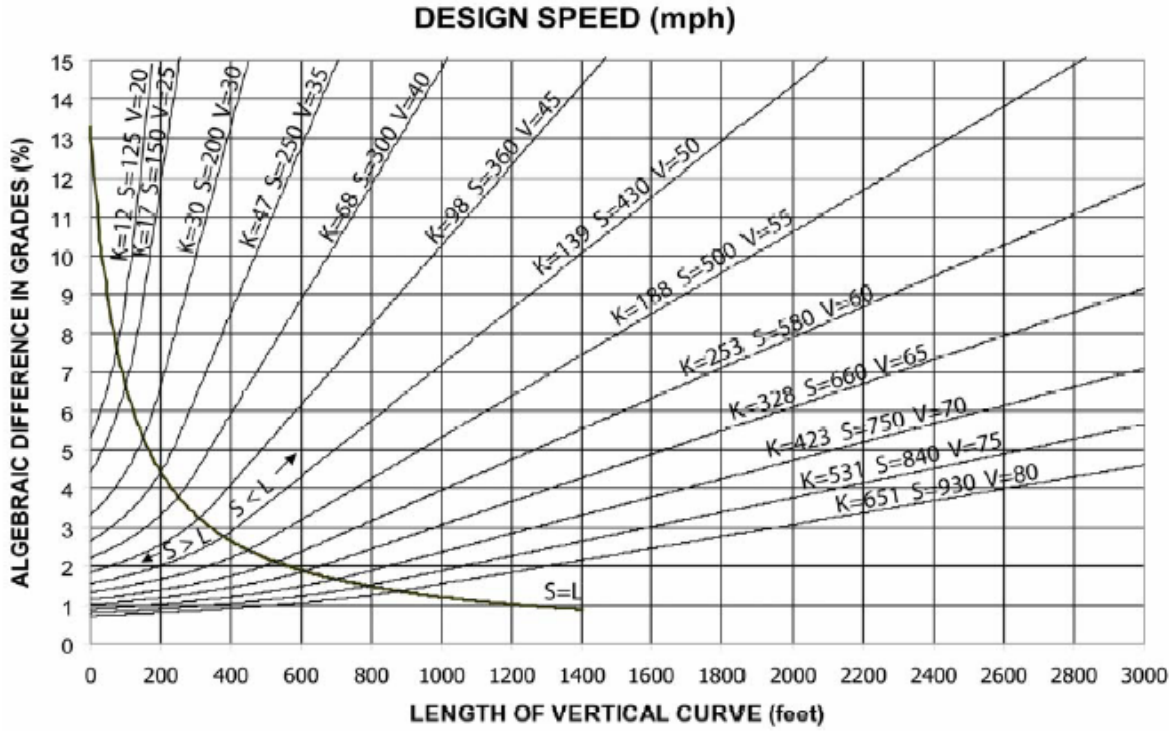
V = Design Speed for "S" in mph

K = Distance in feet required to achieve a 1% change in grade. K value as shown on graph is valid when S < L.

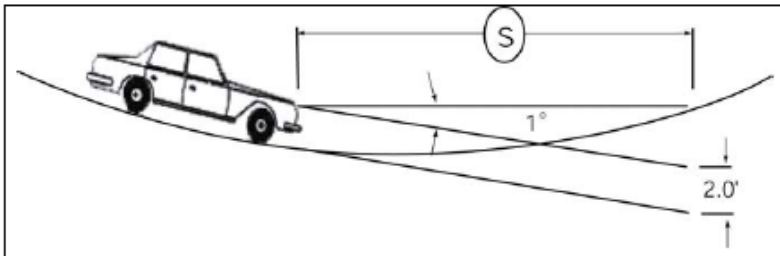
**Notes:**

- Before using this figure for intersections, branch connections and exits, see Indexes 201.7 and 405.1, and Topic 504.
- See Figure 204.4 for vertical curve formulas.
- See Index 204.4 for minimum length of vertical curve

| When S > L | When S < L |
|---|---|
| $L = 2S - 1329/A$ | $L = AS^2/1329$ |



## Stopping Sight Distance on Sag Vertical Curves

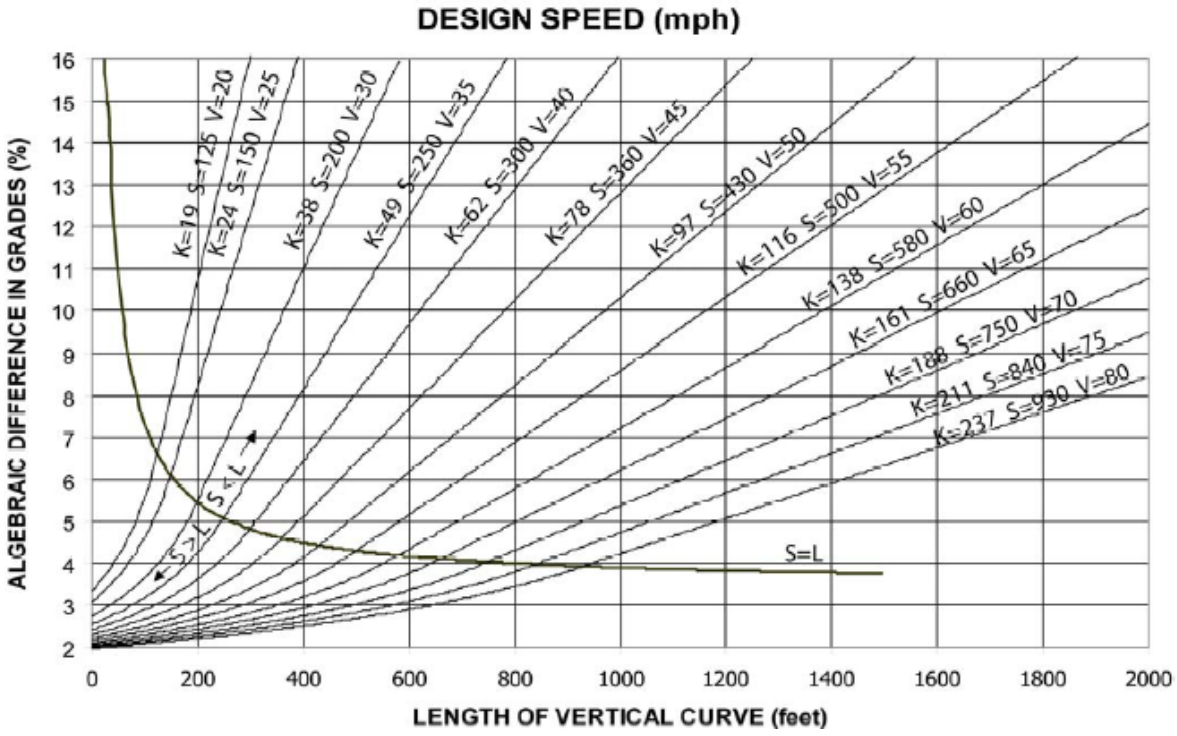



L = Curve Length (feet)
A = Algebraic Grade Difference (%)
S = Sight Distance (feet)
V = Design Speed for "S" in mph
K = Distance in feet required to achieve a 1% change in grade. K value as shown on graph is valid when S < L.

**Notes:**

- For sustained downgrades, see Index 201.3.
- Before using this figure for intersections, branch connections and exits, see Indexes 201.7 and 405.1, and Topic 504.
- See Figure 204.4 for vertical curve formulas.
- See Index 204.4 for minimum length of vertical curve.

| When S > L | When S < L |
|---|---|
| $L = 2S - (400 + 3.5S)/A$ | $L = AS^2/(400 + 3.5S)$ |



3. Superelevation:

   a. The software will check and specify alignment standard Superelevation rates based on the following table.

**Standard Superelevation Rates**
**(Superelevation in Feet per Foot for Curve Radius in Feet)**

| Ramps, 2-Lane Conventional Highways, Frontage Roads[1] | | Freeways, Expressways, Multilane Conventional Highways | | When Snow & Ice Conditions Prevail (Usually over 3,000 ft elevation) | | Urban Roads (35 – 45 mph) | | Urban Roads (less than 35 mph) | |
|---|---|---|---|---|---|---|---|---|---|
| For emax = 0.12 | | For emax = 0.10 | | For emax = 0.08 | | For emax = 0.06 | | For emax = 0.04 | |
| Range of Curve Radii | e Rate | Range of Curve Radii | e Rate | Range of Curve Radii | e Rate | Range of Curve Radii | e Rate | Range of Curve Radii | e Rate |
| Under 625 | 0.12 | | | | | | | | |
| 625 – 849 | 0.11 | | | | | | | | |
| 850 – 1,099 | 0.10 | Under 1,100 | 0.10 | | | | | | |
| 1,100 – 1,349 | 0.09 | 1,100 – 1,349 | 0.09 | | | | | | |
| 1,350 – 1,599 | 0.08 | 1,350 – 1,599 | 0.08 | Under 1,600 | 0.08 | | | | |
| 1,600 – 1,899 | 0.07 | 1,600 – 1,899 | 0.07 | 1,600 – 1,899 | 0.07 | | | | |
| 1,900 – 2,199 | 0.06 | 1,900 – 2,199 | 0.06 | 1,900 – 2,199 | 0.06 | Under 600 | 0.06 | | |
| 2,200 – 2,699 | 0.05 | 2,200 – 2,699 | 0.05 | 2,200 – 2,699 | 0.05 | 600 – 999 | 0.05 | | |
| 2,700 – 3,499 | 0.04 | 2,700 – 3,499 | 0.04 | 2,700 – 3,499 | 0.04 | 1,000 – 1,499 | 0.04 | Under 500 | 0.04 |
| 3,500 – 4,499 | 0.03 | 3,500 – 4,499 | 0.03 | 3,500 – 4,499 | 0.03 | 1,500 – 1,999 | 0.03 | 500 – 999 | 0.03 |
| 4,500 – 19,999 | 0.02 | 4,500 – 19,999 | 0.02 | 4,500 – 19,999 | 0.02 | 2,000 – 6,999 | 0.02 | 1,000 – 4,999 | 0.02 |
| 20,000 & over | (2) | 20,000 & over | (2) | 20,000 & over | (2) | 7,000 & over | (2) | 5,000 & over | (2) |

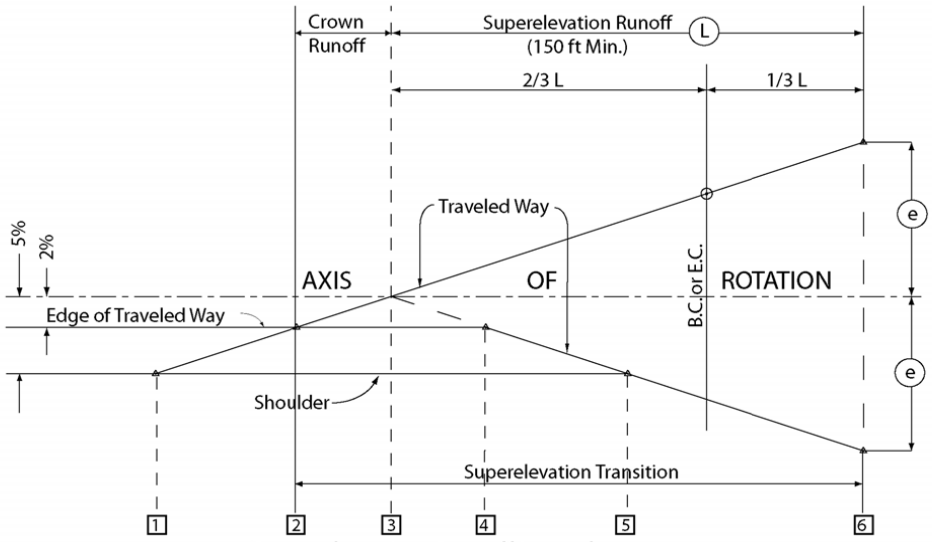
Notes:
(1) For frontage roads under other jurisdictions see Index 202.7.
(2) Use standard crown section.

b. The software shall specify a Superelevation transition. The length of Superelevation transition should be based upon the combination of Superelevation rate and distance from axis of rotation to outside edge of lanes in accordance with the tabulated Superelevation runoff lengths in the following table and diagram.

**Superelevation Transition**

| Formulas | | Explanation of Terms |
|---|---|---|
| 2-Lane Roads | L = 2500 e | (L) = Length of Superelevation Runoff - ft |
| Multilane Roads & Branch Connections | L = 150 De | (e) = Superelevation rate - ft/ft |
| Ramps | | (D) = Distance from axis of rotation to outside edge of lanes - ft |
| Multilane | L = 2500 e if possible | |
| Single Lane | L = 2000 e | |
| MINIMUM L = 150 FT | | MAXIMUM L = 510 FT |

Adjust computed length to nearest 10 ft. length divisible by 3




Superelevation Runoff Lengths

| Superelevation Rate "e" ft/ft | Length, L (feet) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2-Lane Highways & Multilane Ramps | Single Lane Ramps | Multilane Highways and Branch Connections With Various "D" Widths | | | | | | |
| | | | 24 ft | 36 ft | 48 ft | 51 ft | 60 ft | 63 ft | 75 ft |
| 0.02 | 150 | 150 | 150 | 150 | 150 | 150 | 180 | 180 | 240 |
| 0.03 | 150 | 150 | 150 | 180 | 210 | 240 | 270 | 270 | 330 |
| 0.04 | 150 | 150 | 150 | 210 | 300 | 300 | 360 | 390 | 450 |
| 0.05 | 150 | 150 | 180 | 270 | 360 | 390 | 450 | 480 | 510 |
| 0.06 | 150 | 150 | 210 | 330 | 450 | 450 | 510 | 510 | |
| 0.07 | 180 | 150 | 270 | 390 | 510 | 510 | | | |
| 0.08 | 210 | 150 | 300 | 450 | | | | | |
| 0.09 | 240 | 180 | 330 | 180 | | | | | |
| 0.10 | 240 | 210 | 360 | 510 | | | | | |
| 0.11 | 270 | 210 | 390 | | | | | | |
| 0.12 | 300 | 240 | 420 | | | | | | |
| For widths of "D" not included in table, use formula above. | | | | | | | | | |

c. The software shall check Superelevations for the following criteria:

- Flat spots (i.e. where the Superelevation and profile are flat) must be revealed. Flat spots are undesirable from a drainage standpoint and should be avoided.

- Where curve radius and length, and tangents between curves are short and standard SuperElevation rates and/or transitions may not be attainable. In such situations, the highest possible SuperElevation rate(s) and transition length should be used, but the rate of change of cross slope should not exceed 6 percent per 100 feet.

d. Superelevation Graphics Attributes

The graphics attributes of the Superelevation diagrams shall follow the table below:

**Linear Feature Attributes Table**

| Feature | Linestyle | Weight | Color | Level |
|---|---|---|---|---|
| Left ES | 0 | 1 | 0 | 60 Nongeo Data |
| Right ES | 0 | 1 | 0 | 60 Nongeo Data |
| Left ETW | 0 | 1 | 0 | 60 Nongeo Data |
| Right ETW | 0 | 1 | 0 | 60 Nongeo Data |
| Axis/Rotation | pp-axis | 3 | 0 | 60 Nongeo Data |

e. Stationing and Annotation Attributes

- The text is based on a plotting scale of 1” = 50’ (Caltrans Base Scale). It is important to place text at the appropriate CADD size within the drawing based on the intended scale of the plotted plan sheet. For any plot scale, the text will appear 0.14 inches when plotted on a 22” x 34” plan sheet.
- All text annotation for SuperElevation diagrams will use the font CTFont1.

4. Templates:

Software shall provide the following design template objects:

a. Lane 1

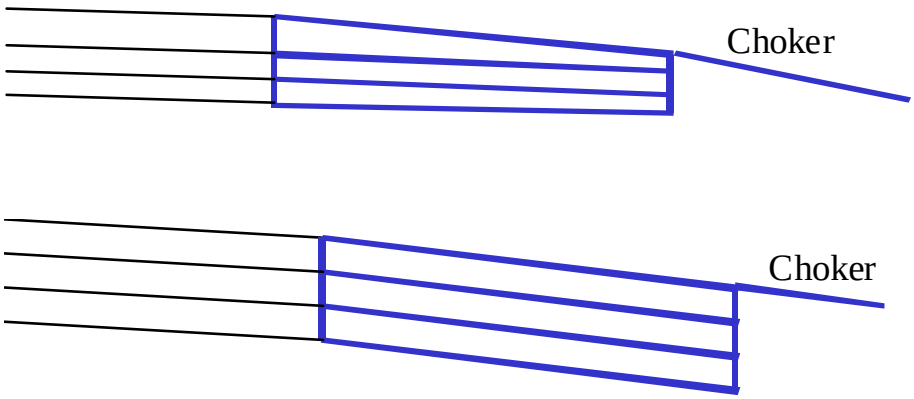
- A design lane template piece that shall accommodate up to 5 different pavement layers.
- The cross slopes of this lane template can be defined by both a value typed in by the user or from a predefined SuperElevation definition.
- The width of the lane template can be defined by both a value typed in by the user or by the intersection along the cross section line with a pre-defined geometry element.

b. Lane 2

- The design lane template piece shall accommodate up to 5 different pavement layers.
- The cross slopes and the width of this lane template shall be determined by the intersection along the cross section line with a pre-defined, 3-dimensional string.

c. Shoulder 1

- A design shoulder template piece that shall accommodate up to 5 different pavement layers.
- The cross slopes of this top surface (finished grade) of the shoulder template can be defined by both a value typed in by the user or from a predefined superelevation definition.
- The width of the shoulder template can be defined by both a value typed in by the user or by the intersection along the cross section line with pre-defined geometry element.
- The outside edge of the shoulder template shall have an option to add a “choker” when the edge is in a fill section. See diagram below.
- The cross slope of the bottom of the shoulder template shall have the option to either follow the cross slope of the top surface or follow the cross slope of the Lane template at the same cross section. See diagram below.



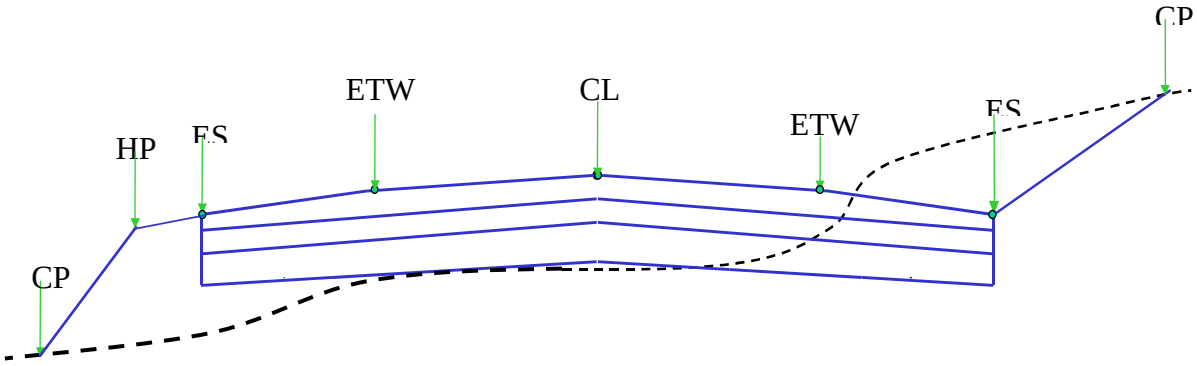
d. Side Slope 1

- A Side Slope template piece that shall intersect to a named existing surface at a user-defined slope with a default value of 4:1.

e. Side Slope 2

- A Side Slope template piece that shall intersect to a named existing surface at a user-defined distance with a default distance value of 18’ from the edge of shoulder.

Below is a sample of a design template with the names of the points specified.




The names of labels on the templates shall follow the naming convention listed below.

5. Cross Section Plotting:

a. The cross-sections shall plot to at least a 1”=10’ scale and a 1” = 5’ scale.

b. The linear attributes of the cross section lines shall match the following table.

**Linear Feature Attributes Table**

| Feature | Linestyle | Weight | Color | Level |
|---|---|---|---|---|
| New Cross Sections elements | 0 | 2 | * | 60 Nongeo Data |
| Major Grid | 0 | 2 | 2 | 11 Undefined |
| Minor Grid | 0 | 0 | 3 | 9 Profile Grid |
| Frame | 0 | 0 | 0 | 10 Sheet Format |
| Border | 0 | 3 | 0 | 10 Sheet Format |
| Leaders | 0 | 1 | 0 | 60 Nongeo Data |

*Refer to Roadwayfeatures.doc in the Bidder's Library.

c. The annotation attributes of the cross section lines shall match the following table.

**Annotation Attributes Table**

| Feature | Wt. | Color | Level | Font | Plotted Text Size (inches) * |
|---|---|---|---|---|---|
| Dist-Co-Rte | 1 | 0 | 10 Sheet Format | CTFONT1 | 0.175 |
| EA | 1 | 0 | 10 Sheet Format | CTFONT1 | 0.175 |
| Sheet No. | 1 | 0 | 10 Sheet Format | CTFONT1 | 0.175 |
| Scale | 1 | 0 | 10 Sheet Format | CTFONT1 | 0.175 |
| Sheet Title | 0 | 0 | 10 Sheet Format | CTFONT43 | 0.60 |
| Date | 1 | 0 | 10 Sheet Format | CTFONT1 | 0.175 |
| Labels | 1 | 0 | 60 Nongeo Data | CTFONT1 | 0.14 |
| Station | 1 | 0 | 60 Nongeo Data | CTFONT1 | 0.20 |
| Grid Labels | 1 | 0 | 60 Nongeo Data | CTFONT1 | 0.175 |
| Alignment | 1 | 0 | 10 Sheet Format | CTFONT1 | 0.24 |

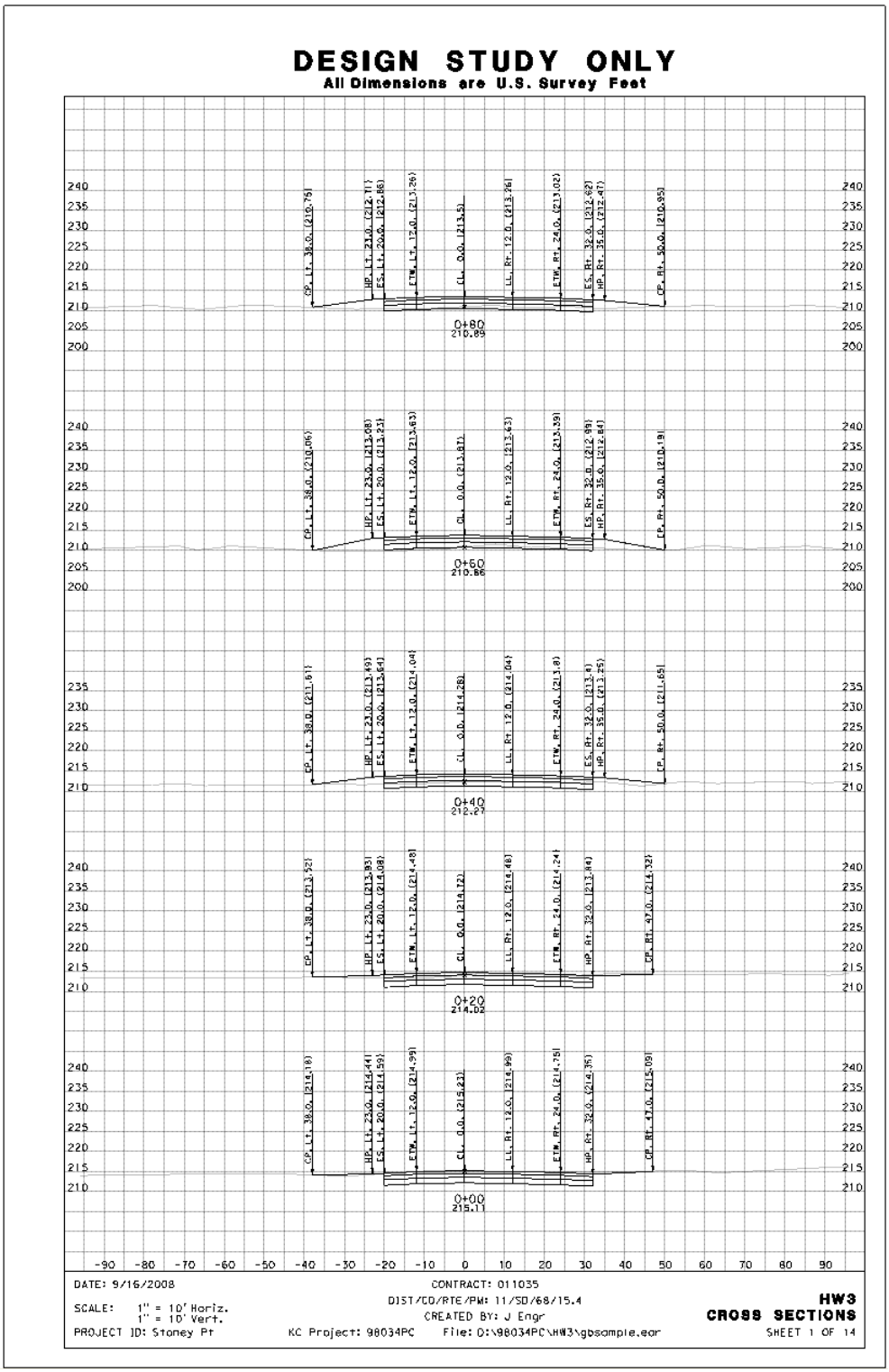
* For any plot scale, the plotted text will appear as noted above on a 22" x 34" cross-section sheet.

d. The grade break labels on the design cross-sections shall have the naming convention listed in the following table.

**Grade Break Labels Table**

| Label | Description |
|---|---|
| BAR | Barrier – used for both faces. If point is coincidental with ES then use BAR. |
| BEN | Bench – used for both edges |
| BKWALL | Back of wall |
| BKCURB | Back of curb – typically not staked by Surveys but this provides clarifying information for Construction |
| BKSW | Back of sidewalk |
| CL | Centerline |
| CONFM | Conform |
| CONT | Contour grading lines |
| CP | Catch point – intersection of design surface with existing surface |
| EP | Edge of pavement – only for use with miscellaneous roadway sections including bike paths, rest stops, dike pads, etc. |
| ES | Edge of shoulder |
| ETW | Edge of traveled way |
| FL | Paved or unpaved flow line |
| FSW | Front of sidewalk |
| FWALL | Face of wall |
| HP | Hinge point – top of slopes within the design surface |
| LL | Lane line – also used for Pavement Structure change |
| LOL | Layout line for retaining, sound, or wing walls |
| ML | Match line |
| PG | Profile grade |
| R/W | Right of way |
| RSP | Rock Slope Protection |
| S/C | Saw cut line |
| SL | String line – the plane of the traveled way |
| TBERM | Top of berm |
| TCURB | Top of curb – typically not staked by Surveys but this provides clarifying information for Construction |
| TDIKE | Top of dike – typically not staked by Surveys but this provides clarifying information for Construction |
| TDITCH | Top of ditch |
| TOE | Toe – bottom of slopes within the design surface, not the catch point |
| TWALL | Top of wall |

Below is an example of an acceptable cross section sheet originally on 22” x 34” reduced to fit on the page



6. Custom Reports:

   a. Project Report

      Summary of project data must include options for:

      - Alignments with associated profiles and cross sections,
      - DTM's, and
      - Geometry layout lines.

   b. Slope Stake Listings;

      The software shall create slope stake listings on an 8 ½" by 11" sheet which contains all the information depicted in the examples listed below, as applicable. The software must also have the following options when generating the listings:

      - With a display of the cross section at each station;
      - Without a display of the cross section at each station;
      - With the cuts/fills between every offset calculated from catch point to centerline;
      - Without the cuts/fills between every offset calculated from catch point to centerline;
      - Includes R/W located by the entered offset or by the selection of an element;
      - Saves one, two, three, or more stations per page;
      - Landscape layout; and
      - Portrait layout.

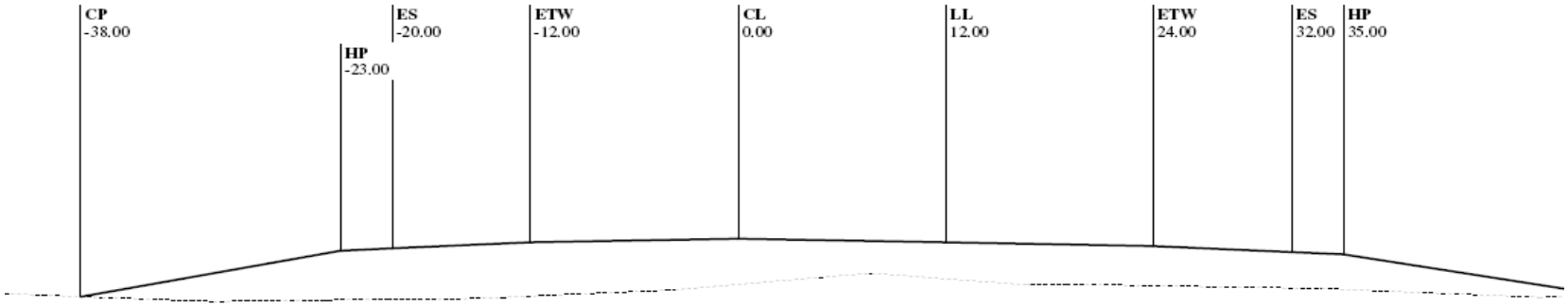
**Annotation Attributes Table**

| Feature | Font | Font Style | Text Size (pt.) |
|---|---|---|---|
| Header & Footer | Times New Roman | Regular | 10 |
| Alignment Name | Times New Roman | Bold | 10 |
| Station | Times New Roman | Bold | 10 |
| Key Point Feature | Times New Roman | Bold | 8 |
| Key Point Data | Times New Roman | Regular | 8 |

SLOPE STAKE LISTING EXAMPLE #1

SLOPE STAKE LISTING & DIAGRAM
February 9, 2009 9:06:21 AM

Station Range: 0+00.00 to 1+20.00
Project Units: US Survey Feet
Contract No.: 11-011034
Co./Rte./PM: SD/168/15.4-17.3




**Alignment Chain HW3**
**Station: 0+60.00**

| CP | HP | ES | ETW | CL | LL | ETW | ES | HP | CP |
|---|---|---|---|---|---|---|---|---|---|
| -38.00 | -23.00 | -20.00 | -12.00 | 0.00 | 12.00 | 24.00 | 32.00 | 35.00 | 50.00 |
| 210.06 | 213.08 | 213.23 | 213.63 | 213.87 | 213.63 | 213.39 | 212.99 | 212.84 | 210.19 |
| -4.97:1 | -5.00% | -5.00% | -2.00% | | -2.00% | -2.00% | -5.00% | -5.00% | -5.65:1 |
| F 3.02 | F 0.15 | F 0.40 | F 0.24 | | F 0.24 | F 0.24 | F 0.40 | F 0.15 | F 2.65 |
| @ 15.00 | @ 3.00 | @ 8.00 | @ 12.00 | | @ 12.00 | @ 12.00 | @ 8.00 | @ 3.00 | @ 15.00 |

Route: 168
EAR Filename: D:\98034PC\HW3\gbsample.ear
C/F information is calculated from CP to CL for each grade break

SLOPE STAKE LISTING EXAMPLE #2

## SLOPE STAKE LISTING

Station Range: 0+00.00 To 1+20.00
Project Units: US Survey Feet
Contract No.: 11-011034
Co./Rte./PM: SD/168/15.4-17.

February 09, 2009 9:14:29 AM

**Alignment Chain: HW3**
**Station: 0+00.00**

| CP | HP | ES | ETW | CL | LL | ETW | HP | CP |
|---|---|---|---|---|---|---|---|---|
| -38.00 | -23.00 | -20.00 | -12.00 | 0.00 | 12.00 | 24.00 | 32.00 | 47.00 |
| 214.18 | 214.44 | 214.59 | 214.99 | 215.23 | 214.99 | 214.75 | 214.35 | 215.09 |
| -1.72% | -5.00% | -5.00% | -2.00% | | -2.00% | -2.00% | -5.00% | 4.96% |
| F 0.26 | F 0.15 | F 0.40 | F 0.24 | | F 0.24 | F 0.24 | F 0.40 | C 0.74 |
| @ 15.00 | @ 3.00 | @ 8.00 | @ 12.00 | | @ 12.00 | @ 12.00 | @ 8.00 | @ 15.00 |

**Alignment Chain: HW3**
**Station: 0+20.00**

| CP | HP | ES | ETW | CL | LL | ETW | HP | CP |
|---|---|---|---|---|---|---|---|---|
| -38.00 | -23.00 | -20.00 | -12.00 | 0.00 | 12.00 | 24.00 | 32.00 | 47.00 |
| 213.52 | 213.93 | 214.08 | 214.48 | 214.72 | 214.48 | 214.24 | 213.84 | 214.32 |
| -2.74% | -5.00% | -5.00% | -2.00% | | -2.00% | -2.00% | -5.00% | 3.23% |
| F 0.41 | F 0.15 | F 0.40 | F 0.24 | | F 0.24 | F 0.24 | F 0.40 | C 0.48 |
| @ 15.00 | @ 3.00 | @ 8.00 | @ 12.00 | | @ 12.00 | @ 12.00 | @ 8.00 | @ 15.00 |

**Alignment Chain: HW3**
**Station: 0+40.00**

| CP | HP | ES | ETW | CL | LL | ETW | ES | HP | CP |
|---|---|---|---|---|---|---|---|---|---|
| -38.00 | -23.00 | -20.00 | -12.00 | 0.00 | 12.00 | 24.00 | 32.00 | 35.00 | 50.00 |
| 211.61 | 213.49 | 213.64 | 214.04 | 214.28 | 214.04 | 213.80 | 213.40 | 213.25 | 211.85 |
| -12.52% | -5.00% | -5.00% | -2.00% | | -2.00% | -2.00% | -5.00% | -5.00% | -9.35% |
| F 1.88 | F 0.15 | F 0.40 | F 0.24 | | F 0.24 | F 0.24 | F 0.40 | F 0.15 | F 1.40 |
| @ 15.00 | @ 3.00 | @ 8.00 | @ 12.00 | | @ 12.00 | @ 12.00 | @ 8.00 | @ 3.00 | @ 15.00 |

Route: 168
EAR File Name: D:\98034PC\HW3\gbsample.ear
C/F information is calculated from CP to CL for each grade break

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