

# BELT CONVEYOR BENTS

## 6A-CBENT.EXE

PARAMETRIC BELT CONVEYOR BENT DESIGN OPTIMIZATION PROGRAM ENABLES RAPID FEASIBILITY STUDIES AND ESTIMATES.

## ITEM M

Program computes from parametric input data an estimated weight of belt conveyor support bents.

NOTE 1: This Program should be worked following CTRUSS in order to pre-determine input data.

1) Enter parametric descriptive data into FrmBent as seen at left. Follow unit requirements.

The screenshot shows the 'FrmBent' program window with the title 'BELT CONVEYOR BENT WEIGHT ESTIMATING PROGRAM'. The interface includes a menu bar (FILE), a status bar (PROGRAM VERSION = 6A1\_CBENT 20110225 - License Version CBENT Program), and a main input data table. The table contains various parameters such as ISZ (Seismic Cs Factor), CDL (AVGAL DEAD FORCE AT TOP OF BENT), CDL (AVGAL LIVE FORCE AT TOP OF BENT), FF (LATERAL FORCE AT TOP OF BENT), FAW (LATERAL WIND FORCE ON BENT PER UNIT OF HEIGHT), FAA (TRANSVERSE MID-HEIGHT FORCE), JDS (OVERALL HEIGHT), JDSX (MAX TRANSVERSE UNBRAISED HEIGHT), L (TOP WIDTH), LDA (BOTTOM WIDTH), C (NUMBER OF PANEL SECTIONS), EW (SPACING OF TOP CORREL SUPPORTS), H (NUMBER OF HORIZONTAL MEMBERS EACH PANEL), DE (NUMBER OF DIAGONAL MEMBERS EACH PANEL), FV (STEEL YIELD STRENGTH), M (LIMITING FL/W SLENDERNESS RATIO), AN (ANGLE FROM HORIZONTAL), and BL (BRIDGE LOAD). To the right of the table are 'UNITS' (ENGLISH/METRIC), 'COMMANDS' (APPLY, COMPUTE-4, GRAPHIC-3, CLEAR-5), and a disclaimer: 'FOR ESTIMATING AND OPTIMIZATION ONLY! FINAL DESIGN MUST BE PERFORMED BY A QUALIFIED PROFESSIONAL ENGINEER!'.

2) Click 1 -APPLY to ensure data is properly entered.

3) Licensees Click "FILE" in upper left corner to initiate Microsoft style file saving.

4) Click COMPUTE-4 to display Form1 seen at left.

The screenshot shows the 'Form1 BENT DESIGN OPTIMIZATION and WEIGHT ESTIMATOR' window. It displays four sections: 1. MAIN LEGS, 2. HORIZONTAL MEMBERS, 3. DIAGONALS, and 4. TOP BEAM. Each section has input fields for MIN LBS/FT, DATA BASE, INTACT, FORCE KIPS, and FT. A 'CURRENT DATA' table is visible at the bottom left, showing values for FABRICATED STEEL KIPS, MAX FOUNDATION LOAD KIPS, and MIN FOUNDATION LOAD KIPS. On the right side, there are various output fields and a list of data bases (e.g., ALL\_W\_M\_SHAPES, HSS\_SQUARE\_ALL, HSS\_SQUARE\_ALL) with a slider bar to navigate through them. The interface also includes buttons for APPLY, COMPUTE, and CLEAR, and a disclaimer at the bottom: 'DEVELOPER' and '5 BLANK'.

NOTE 2: Program methodology auto selects shape meeting AISC ASD criteria from within the data base you select. Multiple iterations "smoothes" output.

5) Data bases are listed in the green text box at the far right. With your mouse move the slider bar at the right up and down to view the entire list. These correspond closely to AISC shape availability. Excluded are rectangular tubing shapes and unequal leg angles.

6) For a first approximation CLICK onto ALL\_W\_M\_SHAPES at the very top of the list. (This data base has the widest range of properties.)

7) Click onto green command box entitled APPLY ALL-16 near upper right. This applies the same data base to all members.

8) In each of the 4 multi-colored boxes to the right of label "DATA BASE" will appear "ALL\_W\_M\_SHAPES". This becomes the data base for a first computation.

In red area at bottom left:

9) Click "SIMPLE SPAN COMPUTE -8" or "COMPUTE - 8"

10) View in text box to right of "FABRICATED STEEL KIPS" a computed weight of steel in kips (1 kip = 1,000 lbs). In text box to immediate right will appear OK, WEAK ?, NO or SELECT ? Only OK is permissible. If other than OK appears visually search "SHAPE = "in each colored box to determine which member(s) do not qualify.

If ALL\_W\_M\_SHAPES has been selected and OK does not appear it is unlikely a solution will be found based on the entered INPUT parameters. Option is to adjust input data.

## REAL TIME OPTIMIZATION

Reducing weight of bents is essential for cost reasons.

11) For each member to the right of "INT<sup>ACT</sup>" appears a number representing the INTERACTION or COMBINED STRESS RESULT. Multiplying this by 100 think of it in terms of "efficiency of use." 1 (or 100% efficiency) is ideal. This will seldom appear but numbers such as .9 are quite frequent. If the number is less you have the option of trying different data bases to raise the "INT<sup>ACT</sup>" result. In doing this use the separate "APPLY" command in each colored box for each member.

12) Data bases preceded by ALL, HSS\_SQUARE (TUBING) or W14 cover a range of sizes. Using one of these first will provide guidance or first approximation to a more size specific data base. Size designated data bases (W24 etc) include all shapes of that size (depth) that are also metric. Clicking a size designated data base enables a "fine tuning" of results. Near size data bases should also be clicked. Concurrent use of "MIN WT" command enables specifying shapes that are actually available or preferred for purchase reasons .

13) Standardizing member sizes is customary fabrication practice. In the upper right corner of Form1 is a text box for entering MIN WT ALL LBS/FT. A minimum weight entered here and clicked at APPLY ALL-16 or applied to an individual MEMBER sets a minimum weight in conjunction with the entered shape data base. For example: The writer sometimes likes to check the weight summary. I enter W16 as the data base and 99 as the minimum weight. This forces display of W16X100.

14) PRICE: Multiply SIMPLE SPAN STEEL KIPS BY your price per 1000 lbs. Program is for estimating only. Weights do not include connections:

## PURPOSE

For both vendors and planners proposals and feasibility studies are both time consuming and costly. The time taken is the worst of these concerns because taking time prevents the real-

time optimization needed to achieve the best result.

**POTENTIAL USERS MAY INCLUDE”**

Consulting Engineers, Contractors, Steel Fabricators, Mining Companies, State Highway Departments, Belt Conveyor Vendors.

**PROOF OF METHOD –**

In grey area immediately to left of data base listing enter data for individual beams and columns taken from AISC Manuals and compare.

End of Subject