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Staad pro steel design examples pdf

Transcript:ENGI 7704 Design of Steel StructuresComputer Analysis of Steel Structures by STAADPrepared by Shah Alam1STAAD PRO 2004 SOFTWARESTAAD is a comprehensive structural engineering software that addresses all aspects of structural engineering analysis, design, verification, and visualization. STAAD performs the analysis and design of the structure for different types of structures, such as trusses, plane, space (3D), floors (2 D plane and but loads are vertical or out of that plane).2STAAD TutorialsGiving demonstration for how to use the software by showing only the basic steps for static analysis. As STAAD has two main methods of modeling (input editor (script language) and/or through graphical environment). Tutorials will show only graphical methods. Further readings and more information about the program can be found through the internet. For example www.reiworld.com3STAAD Tutorial No.1ANALYSIS & DESIGN OF STEEL TRUSS4TUTORIAL NO.1: STEEL TRUSSThe figure above shows a steel truss from several trusses supposed to cover a certain area. As shown, the truss has a cantilever part its span equals 4.0m. The proposed truss depth is 3.0m.The loads as shown, are concentrated at the truss joints. The values of its load case are shown. Use all the data you take in the Steel Course for analysis and design.5Main Steps of ModelingEntering job information. Building model geometry. Defining member properties, sections. Assigning loads (load cases, combinations..) Defining pre-analysis print out, analysis type, and post-analysis printout. Defining design requirements.6How to Start the Program?From Start Menu - Select the STAAD.Pro icon from the STAAD.Pro 2004 program group.789The STAAD Graphical Environment will be invoked and the following screen will appear:101. ENTERING JOB INFORMATION.112. Building Model (Structure) GeometryHow to Define the Truss Geometry? One of the methods that you can create construction lines and then draw on these lines the truss members.Noting that the number of construction lines is excluding first line.121314How to see the Diagram Labels (ex. Node numbers, beam numbers, etc.?15Node and beam labels are a way of identifying the entities we have drawn on the screen, and very useful when dealing with the output results.163. Defining member properties, sectionsProperty: In which we can define or choose sections properties of the members of the truss. Spec.: In which we can define or choose members specifications. Support: In which we can define the supports properties (restraints). Load: In which we can define the applied loads, load cases, load combinations. Material In which we can define the material properties. (ex. E, density, etc.)17Property:1819Assigning the sections created to the model20SupportsBy clicking on the support icon the shown window will appear. We have to create new kinds of supports.212223244. Defining LoadsThe creation and assignment of load cases involves the following two steps: 1. First, we will be creating all 3-load cases. 2. Then, we will be assigning them to the respective members/nodes.252627Also, we can define load combinations according to required. For example, we can create a load combination 1.25 D.L. + 1.5 L.L + 0.8 W.L.282930313233343536373839404142434445647484950 After one analysis, member selection is requested. Since member sizes change during the member selection, another analysis is done followed by final code checking to verify that the final sizes meet the requirements of the code based on the latest analysis results. This problem is installed with the program by default to C:\Users\Public\Documents\STAAD.Pro CONNECT Edition\Samples\Sample Models\US\US-1 Plane Frame with Steel Design.STD when you install the program. where: L = 15 ft, H1 = 20 ft, H2 = 15 ft, and H3 = 9 ft WLx = 0.6 k/ft, WLy = 1.0 k/ft, RL = 0.9 k/ft, LL = 1.2 k/ft, P1 = 35 kips, P2 = 15 kips Members 1, 3, & 4 are a W14x90, Members 5, 6, & 7 are a W21x50, Member 2 is a W10x49, Members 8 through 13 are a W18x35. All other members comprising the truss are a L4x4x1/4 Actual input is shown in bold lettering followed by explanation. STAAD PLANE EXAMPLE PROBLEM NO. 1 Every input has to start with the term STAAD. The term PLANE signifies that the structure is a plane frame structure and the geometry is defined through X and Y axes. UNIT FT KIP Defines the input units for the data that follows. JOINT COORDINATES 1 0. 0. ; 2 30 0 ; 3 0 20 0 6 30 20 0 7 0 35 ; 8 30 35 ; 9 7.5 35 ; 10 22.5 35. 11 15 35 ; 12 5. 38. ; 13 25 38 14 10 41 ; 15 20 41 ; 16 15 44 Joint number followed by X and Y coordinates are provided above. Since this is a plane structure, the Z coordinates need not be provided. Note: Semicolons (;) are used as line separators to allow for input of multiple sets of data on one line. MEMBER INCIDENCE 1 1 3 ; 2 3 7 ; 3 2 6 ; 4 6 8 ; 5 3 4 6 4 5 ; 7 5 6 ; 8 7 12 ; 9 12 14 10 14 16 ; 11 15 16 ; 12 13 15 ; 13 8 13 14 9 12 ; 15 9 14 ; 16 11 14 ; 17 11 15 18 10 15 ; 19 10 13 ; 20 7 9 21 9 11 ; 22 10 11 ; 23 8 10 Defines the members by the joints to which they are connected. MEMBER PROPERTY AMERICAN 1 3 4 TABLE ST W14X90 ; 2 TA ST W10X49 5 6 7 TA ST W21X50 ; 8 TO 13 TA ST W18X35 14 TO 23 TA ST L40404 Member properties are from the British steel table. The term ST stands for standard single section. MEMB TRUSS 14 TO 23 The above command defines that members 14 through 23 are of type truss. This means that these members can carry only axial tension/compression and no moments. MEMB RELEASE 5 START MZ Member 5 has local moment-z (MZ) released at the start joint. This means that the member cannot carry any moment-z (i.e., strong axis moment) at node 3. UNIT INCH DEFINE MATERIAL START ISOTROPIC STEEL E 29000 POISSON 0.3 DENSITY 0.000283 ALPHA 6e-006 DAMP 0.03 TYPE STEEL STRENGTH FY 36 FU 58 RY 1.5 RT 1.2 END DEFINE MATERIAL The DEFINE MATERAL START initiates input for a material definition, which can later be assigned to all members. STAAD.Pro has several built-in material definitions, including the ISOTROPIC STEEL material used here. The length unit is changed from FEET to INCH to facilitate the input in familiar units. CONSTANTS BETA 90.0 MEMB 3 4 MATERIAL STEEL ALL UNIT FT The CONSTANT command initiates input for material constants or material definition references. The BETA command specifies that members 3 and 4 are rotated by 90 degrees around their own longitudinal axis. See G.4.3 Relationship Between Global and Local Coordinates for the definition of the beta angle. SUPPORT 1 FIXED ; 2 PINNED A fixed support is located at joint 1 and a pinned support at joint 2. PRINT MEMBER INFORMATION LIST 1 5 14 PRINT MEMBER PROPERTY LIST 1 2 5 8 14 The above PRINT commands are self-explanatory. The LIST option restricts the print output to the members listed. LOADING 1 DEAD AND LIVE LOAD Load case 1 is initiated followed by a title. SELFWEIGHT Y -1.0 One of the components of load case 1 is the selfweight of the structure acting in the global Y direction with a factor of -1.0. Since global Y is vertically upward, the factor of -1.0 indicates that this load will act downwards. JOINT LOAD 4 5 FY -15. ; 11 FY -35. Load 1 contains joint loads also. FY indicates that the load is a force in the global Y direction. MEMB LOAD 8 TO 13 UNI Y -0.9 ; 6 UNI GY -1.2 Load 1 contains member loads also. GY indicates that the load is in the global Y direction while Y indicates local Y direction. The term UNI stands for uniformly distributed load. Loads are applied on members 6, and 8 to 13. CALCULATE RAYLEIGH FREQUENCY The above command at the end of load case 1, is an instruction to perform a natural frequency calculation based on the Rayleigh method using the data in the above load case. LOADING 2 WIND FROM LEFT MEMBER LOAD 1 2 UNI GX 0.6 ; 8 TO 10 UNI Y -1. Load case 2 is initiated and contains several member loads. * 1/3 RD INCREASE IS ACCOMPLISHED BY 75% LOAD LOAD COMB 3 75 PERCENT DL LL WL 1 0.75 2 0.75 The above command identifies a combination load (case no. 3) with a title. The second line provides the load cases and their respective factors used for the load combination. Note: Any line beginning with an asterisk (* character) is treated as a comment line. PERFORM ANALYSIS This command instructs the program to proceed with the analysis. LOAD LIST 1 3 The above command activates load cases 1 and 3 only for the commands to follow. This also means that load case 2 will be made inactive. PRINT MEMBER FORCES PRINT SUPPORT REACTION The above PRINT commands are self-explanatory. Also note that all the forces and reactions will be printed for load cases 1 and 3 only. PARAMETER CODE AISC UNIFIED NSF 0.85 ALL BEAM 1.0 ALL KY 1.2 MEMB 3 4 RATIO 0.9 ALL PROFILE W14 MEMB 1 3 4 The PARAMETER command is used to specify steel design parameters such as net section factor (NSF), effective length factor for bending about the minor axis (KY), etc. Information on these parameters can be obtained from the manual where the implementation of the code is explained. The BEAM parameter is specified to perform design at every 1/12th point along the member length, which is also the default. The RATIO parameter specifies that the ratio of actual loading over section capacity should not exceed 0.9. SELECT ALL The above command instructs the program to select the most economic section for all the members based on the results of the analysis. GROUP MEMB 1 3 4 GROUP MEMB 5 6 7 GROUP MEMB 8 TO 13 GROUP MEMB 14 TO 23 Although the program selects the most economical section for all members, it is not always practical to use many different sizes in one structure. Grouping is a procedure by which the cross section which has the largest value for the specified attribute, which in this case is the default and hence the AREA, from among the associated member list, is assigned to all members in the list. Hence, the cross sections for members 1, 3 and 4 are replaced with the one with the largest area from among the three. PERFORM ANALYSIS As a result of the selection and grouping, the member sizes are no longer the same as the ones used in the original analysis. Hence, it is necessary to reanalyze the structure using the new properties to get new values of forces in the members. PARAMETER BEAM 1.0 ALL RATIO 1.0 ALL TRACK 1.0 ALL A new set of values are now provided for the above parameters. The actual load to member capacity RATIO has been redefined as 1.0. The TRACK parameter tells the program to print out the design results to the intermediate level of descriptively. CHECK CODE ALL With the above command, the latest member sizes with the latest analysis results are checked to verify that they satisfy the CODE specifications. STEEL TAKE OFF This command instructs the program to list the length and weight of all the different member sizes. FINISH This command terminates the STAAD run. STAAD PLANE EXAMPLE PROBLEM NO. 1 UNIT FT KIP JOINT COORDINATES 1 0. 0. ; 2 30 0 ; 3 0 20 0 6 30 20 0 7 0 35 ; 8 30 35 ; 9 7.5 35 ; 10 22.5 35. 11 15 35 ; 12 5. 38. ; 13 25 38 14 10 41 ; 15 20 41 ; 16 15 44 MEMBER INCIDENCE 1 1 3 ; 2 3 7 ; 3 2 6 ; 4 6 8 ; 5 3 4 6 4 5 ; 7 5 6 ; 8 7 12 ; 9 12 14 10 14 16 ; 11 15 16 ; 12 13 15 ; 13 8 13 14 9 12 ; 15 9 14 ; 16 11 14 ; 17 11 15 18 10 15 ; 19 10 13 ; 20 7 9 21 9 11 ; 22 10 11 ; 23 8 10 MEMBER PROPERTY AMERICAN 1 3 4 TA ST W14X90 ; 2 TA ST W10X49 5 6 7 TA ST W21X50 ; 8 TO 13 TA ST W18X35 14 TO 23 TA ST L40404 *MEMB TRUSS *14 TO 23 MEMB RELEASE 5 START MZ 14 to 23 start MPY 0.99 MPZ 0.99 14 to 23 end MPY 0.99 MPZ 0.99 UNIT INCH DEFINE MATERIAL START ISOTROPIC STEEL E 29000 POISSON 0.3 DENSITY 283e-006 ALPHA 6e-006 DAMP 0.03 TYPE STEEL STRENGTH FY 36 FU 58 RY 1.5 RT 1.2 END DEFINE MATERIAL CONSTANTS MATERIAL STEEL ALL BETA 90.0 MEMB 3 4 UNIT FT SUPPORT 1 FIXED ; 2 PINNED PRINT MEMBER INFORMATION LIST 1 5 14 PRINT MEMBER PROPERTY LIST 1 2 5 8 14 LOADING 1 DEAD AND LIVE LOAD SELFWEIGHT Y -1.0 JOINT LOAD 4 5 FY -15. ; 11 FY -35. MEMB LOAD 8 TO 13 UNI Y -0.9 ; 6 UNI GY -1.2 CALCULATE RAYLEIGH FREQUENCY LOADING 2 WIND FROM LEFT MEMBER LOAD 1 2 UNI GX 0.6 ; 8 TO 10 UNI Y -1. * 1/3 RD INCREASE IS ACCOMPLISHED BY 75% LOAD LOAD COMB 3 75 PERCENT DL LL WL 1 0.75 2 0.75 PERFORM ANALYSIS LOAD LIST 1 3 PRINT MEMBER FORCES PRINT SUPPORT REACTION PARAMETER CODE AISC UNIFIED NSF 0.85 ALL BEAM 1.0 ALL KY 1.2 MEMB 3 4 RATIO 0.9 ALL PROFILE W14 MEMB 1 3 4 SELECT ALL GROUP MEMB 1 3 4 GROUP MEMB 5 6 7 GROUP MEMB 8 TO 13 GROUP MEMB 14 TO 23 PERFORM ANALYSIS PARAMETER BEAM 1.0 ALL RATIO 1.0 ALL TRACK 1.0 ALL CHECK CODE ALL STEEL TAKE OFF FINISH PAGE NO. 1 ********** * * * STAAD.Pro CONNECT Edition * * Version 22.00.00.** * * Proprietary Program of * * Bentley Systems, Inc. * * Date= DEC 13, 2018 * * Time= 9:57:20 * * * * Licensed to: Bentley Systems Inc * ********** 1. STAAD PLANE EXAMPLE PROBLEM NO. 1 INPUT FILE: US-1 Plane Frame with Steel Design.STD 2. UNIT FT KIP 3. JOINT COORDINATES 4. 1 0. 0. ; 2 30 0 ; 3 0 20 0 6 30 20 0 5. 7 0 35 ; 8 30 35 ; 9 7.5 35 ; 10 22.5 35. 6. 11 15 35 ; 12 5. 38. ; 13 25 38 7. 14 10 41 ; 15 20 41 ; 16 15 44 8. MEMBER INCIDENCE 9. 1 1 3 ; 2 3 7 ; 3 2 6 ; 4 6 8 ; 5 3 4 10. 6 4 5 ; 7 5 6 ; 8 7 12 ; 9 12 14 11. 10 14 16 ; 11 15 16 ; 12 13 15 ; 13 8 13 12. 14 9 12 ; 15 9 14 ; 16 11 14 ; 17 11 15 13. 18 10 15 ; 19 10 13 ; 20 7 9 14. 21 9 11 ; 22 10 11 ; 23 8 10 15. MEMBER PROPERTY AMERICAN 16. 1 3 4 TA ST W14X90 ; 2 TA ST W10X49 17. 5 6 7 TA ST W21X50 ; 8 TO 13 TA ST W18X35 18. 14 TO 23 TA ST L40404 19. *MEMB TRUSS 20. *14 TO 23 21. MEMB RELEASE 22. 5 START MZ 23. 14 TO 23 START MPY 0.99 MPZ 0.99 24. 14 TO 23 END MPY 0.99 MPZ 0.99 25. UNIT INCH 26. DEFINE MATERIAL START 27. ISOTROPIC STEEL 28. E 29000 29. POISSON 0.3 30. DENSITY 283E-006 31. ALPHA 6E-006 32. DAMP 0.03 33. TYPE STEEL 34. STRENGTH FY 36 FU 58 RY 1.5 RT 1.2 35. END DEFINE MATERIAL 36. CONSTANTS 37. MATERIAL STEEL ALL 38. BETA 90.0 MEMB 3 4 EXAMPLE PROBLEM NO. 1 -- PAGE NO. 2 39. UNIT FT 40. SUPPORT 41. 1 FIXED ; 2 PINNED 42. PRINT MEMBER INFORMATION LIST 1 5 14 MEMBER INFORMAT LIST 1 EXAMPLE PROBLEM NO. 1 -- PAGE NO. 3 MEMBER INFORMATION ---------- MEMBER START END LENGTH BETA JOINT JOINT (FEET) (DEG) RELEASES 1 1 3 20.000 0.00 5 3 4 10.000 0.00 000001000000 14 9 12 3.905 0.00 000011000011 ********** END OF DATA FROM INTERNAL STORAGE ********** 43. PRINT MEMBER PROPERTY LIST 1 2 5 8 14 MEMBER PROPERTY LIST 1 EXAMPLE PROBLEM NO. 1 -- PAGE NO. 4 MEMBER PROPERTIES. UNIT - INCH ---------- MEMB PROFILE AX/ IZ/ IY/ IX/ AY AZ SZ SY 1 ST W14X90 26.50 999.00 362.00 4.06 6.16 13.73 142.71 49.93 2 ST W10X49 14.40 272.00 93.40 1.39 3.40 7.47 54.40 18.68 5 ST W21X50 14.70 984.00 24.90 1.14 7.90 4.66 94.62 7.63 8 ST W18X35 10.30 510.00 15.30 0.51 5.31 3.40 57.63 5.10 14 ST L40404 1.93 1.18 4.90 0.04 0.67 0.67 0.76 1.73 ********** END OF DATA FROM INTERNAL STORAGE ********** 44. LOADING 1 DEAD AND LIVE LOAD 45. SELFWEIGHT Y -1.0 46. JOINT LOAD 47. 4 5 FY -15. ; 11 FY -35. 48. MEMB LOAD 49. 8 TO 13 UNI Y -0.9 ; 6 UNI GY -1.2 50. CALCULATE RAYLEIGH FREQUENCY 51. LOADING 2 WIND FROM LEFT 52. MEMBER LOAD 53. 1 2 UNI GX 0.6 ; 8 TO 10 UNI Y -1. 54. * 1/3 RD INCREASE IS ACCOMPLISHED BY 75% LOAD 55. LOAD COMB 3 75 PERCENT DL LL WL 56. 1 0.75 2 0.75 57. PERFORM ANALYSIS P R O B L E M S T A T I S T I C S ---------- NUMBER OF JOINTS 16 NUMBER OF MEMBERS 23 NUMBER OF PLATES 0 NUMBER OF SOLIDS 0 NUMBER OF SURFACES 0 NUMBER OF SUPPORTS 2 Using 64-bit analysis engine. EXAMPLE PROBLEM NO. 1 -- PAGE NO. 5 SOLVER USED IS THE IN-CORE ADVANCED MATH SOLVER TOTAL PRIMARY LOAD CASES = 2, TOTAL DEGREES OF FREEDOM = 43 TOTAL LOAD COMBINATION CASES = 1 SO FAR. ********** * * * RAYLEIGH FREQUENCY FOR LOADING 1 = 3.13858 CPS * * MAX DEFLECTION = 1.21777 INCH GLO X, AT JOINT 7 * * * ********** 58. LOAD LIST 1 3 59. PRINT MEMBER FORCES MEMBER FORCES EXAMPLE PROBLEM NO. 1 -- PAGE NO. 6 MEMBER END FORCES STRUCTURE TYPE = PLANE ---------- ALL UNITS ARE -- KIP FEET (LOCAL) MEMBER LOAD JT AXIAL SHEAR-Y SHEAR-Z TORSION MOM-Y MOM-Z 1 1 1 54.05 -2.00 0.00 0.00 0.00 -61.74 3 -52.25 2.00 0.00 0.00 0.00 21.74 3 1 40.71 18.99 0.00 0.00 0.00 247.88 3 -39.36 -9.99 0.00 0.00 0.00 41.97 2 1 3 33.81 -5.48 0.00 0.00 0.00 -21.74 7 -33.07 5.48 0.00 0.00 0.00 -60.47 3 3 28.90 -0.16 0.00 0.00 0.00 -41.97 7 -28.35 6.91 0.00 0.00 0.00 -11.09 3 1 2 58.79 0.00 -2.00 0.00 -0.00 0.00 6 -56.99 0.00 2.00 0.00 40.00 0.00 3 2 55.17 0.00 -3.51 0.00 0.00 0.00 6 -53.82 0.00 3.51 0.00 70.15 0.00 4 1 6 31.94 0.00 -5.48 0.00 59.02 0.00 8 -30.59 0.00 5.48 0.00 23.19 0.00 3 6 31.66 0.00 -13.66 0.00 105.29 0.00 8 -30.65 0.00 13.66 0.00 99.65 0.00 5 1 3 -3.48 18.45 0.00 0.00 0.00 0.00 4 3.48 -17.95 0.00 0.00 0.00 0.00 181.98 3 3 -10.16 10.46 0.00 0.00 0.00 0.00 4 10.16 -10.09 0.00 0.00 0.00 102.77 6 1 4 -3.48 2.95 0.00 0.00 0.00 -181.98 5 3.48 9.55 0.00 0.00 0.00 148.97 3 4 -10.16 -1.16 0.00 0.00 0.00 -102.77 5 10.16 10.53 0.00 0.00 0.00 44.29 7 1 5 -3.48 -24.55 0.00 0.00 0.00 -148.97 6 3.48 25.05 0.00 0.00 0.00 -99.03 3 5 -10.16 -21.78 0.00 0.00 0.00 -44.29 6 10.16 22.16 0.00 0.00 0.00 -175.43 8 1 7 36.53 16.62 0.00 0.00 0.00 60.47 12 -36.43 -11.20 0.00 0.00 0.00 20.64 3 7 37.60 10.47 0.00 0.00 0.00 11.09 12 -37.52 -2.03 0.00 0.00 0.00 25.36 9 1 12 36.77 8.94 0.00 0.00 0.00 -20.63 14 -36.66 -3.52 0.00 0.00 0.00 56.94 EXAMPLE PROBLEM NO. 1 -- PAGE NO. 7 MEMBER END FORCES STRUCTURE TYPE = PLANE ---------- ALL UNITS ARE -- KIP FEET (LOCAL) MEMBER LOAD JT AXIAL SHEAR-Y SHEAR-Z TORSION MOM-Y MOM-Z 3 12 36.66 7.58 0.00 0.00 0.00 -25.36 14 -36.58 0.87 0.00 0.00 0.00 44.93 10 1 14 41.85 -19.60 0.00 0.00 0.00 -56.95 16 -41.74 25.02 0.00 0.00 0.00 -73.14 3 14 34.32 -13.87 0.00 0.00 0.00 -44.93 16 -34.24 22.31 0.00 0.00 0.00 -60.54 11 1 15 41.83 -19.63 0.00 0.00 0.00 -57.16 16 -41.72 25.06 0.00 0.00 0.00 -73.14 3 15 35.88 -15.65 0.00 0.00 0.00 -42.57 16 -35.80 19.72 0.00 0.00 0.00 -60.54 12 1 13 40.08 7.85 0.00 0.00 0.00 -27.16 15 -39.97 -2.43 0.00 0.00 0.00 57.15 3 13 27.72 8.78 0.00 0.00 0.00 -3.23 15 -27.64 -4.71 0.00 0.00 0.00 42.56 13 1 8 40.49 11.35 0.00 0.00 0.00 23.19 13 -40.39 -5.92 0.00 0.00 0.00 27.16 3 8 26.74 19.68 0.00 0.00 0.00 99.65 13 -26.66 -15.61 0.00 0.00 0.00 3.23 14 1 9 -2.27 0.01 0.00 0.00 0.00 0.00 12 2.29 0.01 0.00 0.00 0.00 0.00 3 9 5.63 0.01 0.00 0.00 0.00 0.00 12 -5.61 0.01 0.00 0.00 0.00 0.00 15 1 9 1.82 0.01 0.00 0.00 0.00 -0.00 14 -1.78 0.01 0.00 0.00 0.00 0.00 3 9 -4.73 0.01 0.00 0.00 0.00 -0.00 14 4.76 0.01 0.00 0.00 0.00 -0.00 14 24.45 0.02 0.00 0.00 0.00 -0.00 3 11 -10.26 0.01 0.00 0.00 0.00 -0.00 17 1 11 -21.23 0.02 0.00 0.00 0.00 -0.00 15 21.27 0.02 0.00 0.00 0.00 -0.00 3 11 -23.97 0.01 0.00 0.00 0.00 -0.00 15 24.00 0.01 0.00 0.00 0.00 -0.00 18 1 10 -1.71 0.01 0.00 0.00 0.00 -0.00 15 1.75 0.01 0.00 0.00 0.00 0.00 EXAMPLE PROBLEM NO. 1 -- PAGE NO. 8 MEMBER END FORCES STRUCTURE TYPE = PLANE ---------- ALL UNITS ARE -- KIP FEET (LOCAL) MEMBER LOAD JT AXIAL SHEAR-Y SHEAR-Z TORSION MOM-Y MOM-Z 3 10 5.69 0.01 0.00 0.00 0.00 -0.00 15 -5.66 0.01 0.00 0.00 0.00 0.00 19 1 10 1.97 0.01 0.00 0.00 0.00 0.00 13 -1.95 0.01 0.00 0.00 0.00 0.00 3 10 -6.90 0.01 0.00 0.00 0.00 0.00 13 6.91 0.01 0.00 0.00 0.00 0.00 20 1 7 -17.29 0.02 0.00 0.00 0.00 0.00 9 17.29 0.02 0.00 0.00 0.00 0.00 3 7 -19.94 0.02 0.00 0.00 0.00 -0.00 9 19.94 0.02 0.00 0.00 0.00 0.00 21 1 9 -19.44 0.02 0.00 0.00 0.00 0.00 11 19.44 0.02 0.00 0.00 0.00 0.00 3 9 -14.52 0.02 0.00 0.00 0.00 0.00 11 14.52 0.02 0.00 0.00 0.00 0.00 22 1 10 -21.48 0.02 0.00 0.00 0.00 0.00 11 21.48 0.02 0.00 0.00 0.00 0.00 3 10 -5.75 0.02 0.00 0.00 0.00 0.00 11 5.75 0.02 0.00 0.00 0.00 0.00 23 1 8 -23.40 0.02 0.00 0.00 0.00 0.00 10 23.40 0.02 0.00 0.00 0.00 0.00 3 8 0.86 0.02 0.00 0.00 0.00 0.00 10 -0.86 0.02 0.00 0.00 0.00 -0.00 ********** END OF LATEST ANALYSIS RESULT ********** 60. PRINT SUPPORT REACTION SUPPORT REACTION EXAMPLE PROBLEM NO. 1 -- PAGE NO. 9 SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE ---------- JOINT LOAD FORCE-X FORCE-Y FORCE-Z MOM-X MOM-Y MOM Z 1 1 2.00 54.05 0.00 0.00 0.00 -61.74 3 -18.99 40.71 0.00 0.00 0.00 247.88 2 1 -2.00 58.79 0.00 0.00 0.00 0.00 3 -3.51 55.17 0.00 0.00 0.00 0.00 ********** END OF LATEST ANALYSIS RESULT ********** 61. PARAMETER 62. CODE AISC UNIFIED 63. NSF 0.85 ALL 64. BEAM 1.0 ALL 65. KY 1.2 MEMB 3 4 66. RATIO 0.9 ALL 67. PROFILE W14 MEMB 1 3 4 68. SELECT ALL STEEL DESIGN EXAMPLE PROBLEM NO. 1 -- PAGE NO. 10 STAAD.PRO MEMBER SELECTION - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). ***NOTE : AISC 360-16 Design Statement for STAAD.Pro. *** AXIS CONVENTION ***: ========== The capacity results and intermediate results in the report follow the notations and axes labels as defined in the AISC 360-16 code. The analysis results are reported in STAAD.Pro axis convention and the AISC 360:16 design results are reported in AISC 360-16 code axis convention. AISC Spec. STAAD.Pro Description ---------- ---------- ---------- X Z Axis typically parallel to the sections principal major axis. Y Y Axis typically parallel to the sections principal minor axis. Z X Longitudinal axis perpendicular to the cross section. SECTION FORCES AXIS MAPPING: - AISC Spec. STAAD.Pro Description ---------- ---------- ---------- Pz FX Axial force. Vy FY Shear force along minor axis. Vx FZ Shear force along major axis. Tz MX Torsional moment. My MY Bending moment about minor axis. Mx MZ Bending moment about major axis. *** DESIGN MESSAGES ***: ========== 1. Section classification reported is for the cross section and loadcase that produced the worst case design ratio for flexure/compression Capacity results. 2. Results for any Capacity/Check that is not relevant for a section/loadcase based on the code clause in AISC 360-16 will not be shown in the report. 3. Bending results are reported as being ◆about◆ the relevant axis (X/Y), while the results for shear are reported as being for shear forces ◆along◆ the axis. E.g : Mx indicates bending about the X axis, while Vx indicates shear along the X axis. *** ABBREVIATIONS ***: ========== F-T-B = Flexural-Torsional Buckling L-T-B = Lateral-Torsional Buckling F-L-B = Flange Local Buckling W-L-B = Web Local Buckling L-L-B = Leg Local Buckling C-F-Y = Compression Flange Yielding T-F-Y = Tension Flange Yielding EXAMPLE PROBLEM NO. 1 -- PAGE NO. 11 STAAD.PRO MEMBER SELECTION - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 1 |----------| Member No: 1 Profile: ST W14X68 (AISC SECTIONS)| | Status: PASS Ratio: 0.833 Loadcase: 3 | | Location: 0.00 Ref: Eq.H1-3a(H1-1b) | | Pz: 40.71 C Vy: 18.99 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: 247.9 | |----------| - Member : 2 |----------| | Member No: 2 Profile: ST W12X26 (AISC SECTIONS)| | Status: PASS Ratio: 0.675 Loadcase: 1 | | Location: 15.00 Ref: Eq.H1-3a(H1-1b) | | Pz: 33.07 C Vy: -5.481 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: 60.47 | |----------| - Member : 3 |----------| | Member No: 3 Profile: ST W14X61 (AISC SECTIONS)| | Status: PASS Ratio: 0.888 Loadcase: 3 | | Location: 20.00 Ref: Eq.H1-1b | | Pz: 53.82 C Vy: 0.000 Vx: -3.507 | | Tz: 0.000 My: -70.15 Mx: 0.000 | |----------| - Member : 4 |----------| | Member No: 4 Profile: ST W14X90 (AISC SECTIONS)| | Status: PASS Ratio: 0.538 Loadcase: 3 | | Location: 0.00 Ref: Eq.H1-1b | | Pz: 31.66 C Vy: 0.000 Vx: -13.66 | | Tz: 0.000 My: 105.3 Mx: 0.000 | |----------| - Member : 5 |----------| | Member No: 5 Profile: ST W18X40 (AISC SECTIONS)| | Status: PASS Ratio: 0.864 Loadcase: 1 | | Location: 10.00 Ref: Eq.H1-1b | | Pz: 3.481 T Vy: 17.95 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: -182.0 | |----------| - Member : 6 |----------| | Member No: 6 Profile: ST W21X44 (AISC SECTIONS)| | Status: PASS Ratio: 0.842 Loadcase: 1 | | Location: 2.50 Ref: Eq.H1-1b | | Pz: 3.481 T Vy: -.1761 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: -185.4 | |----------| - Member : 7 |----------| | Member No: 7 Profile: ST W18X40 (AISC SECTIONS)| | Status: PASS Ratio: 0.842 Loadcase: 3 | | Location: 10.00 Ref: Eq.H1-1b | | Pz: 10.16 T Vy: -22.16 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: 175.4 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 12 STAAD.PRO MEMBER SELECTION - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 8 |----------| Member No: 8 Profile: ST W14X22 (AISC SECTIONS)| | Status: PASS Ratio: 0.771 Loadcase: 1 | | Location: 0.00 Ref: Eq.H1-3a(H1-1b) | | Pz: 36.53 C Vy: 16.62 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: 60.47 | |----------| - Member : 9 |----------| | Member No: 9 Profile: ST W12X22 (AISC SECTIONS)| | Status: PASS Ratio: 0.809 Loadcase: 1 | | Location: 5.83 Ref: Eq.H1-3a(H1-1b) | | Pz: 36.66 C Vy: 3.515 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: -56.94 | |----------| - Member : 10 |----------| | Member No: 10 Profile: ST W12X26 (AISC SECTIONS)| | Status: PASS Ratio: 0.816 Loadcase: 1 | | Location: 5.83 Ref: Eq.H1-3a(H1-1b) | | Pz: 41.74 C Vy: -25.02 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: 73.14 | |----------| - Member : 11 |----------| | Member No: 11 Profile: ST W12X26 (AISC SECTIONS)| | Status: PASS Ratio: 0.816 Loadcase: 1 | | Location: 5.83 Ref: Eq.H1-3a(H1-1b) | | Pz: 41.72 C Vy: -25.06 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: 73.14 | |----------| - Member : 12 |----------| | Member No: 12 Profile: ST W14X22 (AISC SECTIONS)| | Status: PASS Ratio: 0.777 Loadcase: 1 | | Location: 5.83 Ref: Eq.H1-3a(H1-1a) | | Pz: 39.97 C Vy: 2.432 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: -57.15 | |----------| - Member : 13 |----------| | Member No: 13 Profile: ST W14X30 (AISC SECTIONS)| | Status: PASS Ratio: 0.829 Loadcase: 3 | | Location: 0.00 Ref: Eq.H1-3a(H1-1b) | | Pz: 26.74 C Vy: 19.68 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: 99.65 | |----------| - Member : 14 |----------| | Member No: 14 Profile: ST L20202 (AISC SECTIONS)| | Status: PASS Ratio: 0.754 Loadcase: 3 | | Location: 0.00 Ref: Eq.H2-1 | | Pz: 5.625 C Vy: -.4554E-02 Vx: -.4554E-02 | | Tz: 0.000 My: -.1012E-03 Mx: 0.1012E-03 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 13 STAAD.PRO MEMBER SELECTION - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 15 |----------| Member No: 15 Profile: ST L25253 (AISC SECTIONS)| | Status: PASS Ratio: 0.235 Loadcase: 1 | | Location: 0.00 Ref: Cl.E3 | | Pz: 1.824 C Vy: -.5918E-02 Vx: -.5918E-02 | | Tz: 0.000 My: 0.1733E-03 Mx: -.1733E-03 | |----------| - Member : 16 |----------| | Member No: 16 Profile: ST L30253 (AISC SECTIONS)| | Status: PASS Ratio: 0.821 Loadcase: 1 | | Location: 3.91 Ref: Eq.H2-1 | | Pz: 24.43 T Vy: 0.2114E-03 Vx: 0.2114E-03 | | Tz: 0.000 My: 0.2237E-01 Mx: -.2237E-01 | |----------| - Member : 17 |----------| | Member No: 17 Profile: ST L20204 (AISC SECTIONS)| | Status: PASS Ratio: 0.877 Loadcase: 3 | | Location: 3.91 Ref: Eq.H2-1 | | Pz: 23.99 T Vy: 0.1653E-03 Vx: 0.1653E-03 | | Tz: 0.000 My: 0.1677E-01 Mx: -.1677E-01 | |----------| - Member : 18 |----------| | Member No: 18 Profile: ST L25253 (AISC SECTIONS)| | Status: PASS Ratio: 0.733 Loadcase: 3 | | Location: 0.00 Ref: Cl.E3 | | Pz: 5.694 C Vy: -.4424E-02 Vx: -.4424E-02 | | Tz: 0.000 My: 0.7830E-04 Mx: -.7830E-04 | |----------| - Member : 19 |----------| | Member No: 19 Profile: ST L20202 (AISC SECTIONS)| | Status: PASS Ratio: 0.804 Loadcase: 3 | | Location: 2.28 Ref: Eq.H2-1 | | Pz: 6.907 T Vy: 0.4779E-03 Vx: 0.4779E-03 | | Tz: 0.000 My: 0.4374E-02 Mx: -.4374E-02 | |----------| - Member : 20 |----------| | Member No: 20 Profile: ST L25253 (AISC SECTIONS)| | Status: PASS Ratio: 0.790 Loadcase: 3 | | Location: 3.75 Ref: Eq.H2-1 | | Pz: 19.94 T Vy: -.2987E-04 Vx: -.2987E-04 | | Tz: 0.000 My: 0.2461E-01 Mx: -.2461E-01 | |----------| - Member : 21 |----------| | Member No: 21 Profile: ST L25253 (AISC SECTIONS)| | Status: PASS Ratio: 0.785 Loadcase: 1 | | Location: 3.75 Ref: Eq.H2-1 | | Pz: 19.44 T Vy: -.1450E-03 Vx: -.1450E-03 | | Tz: 0.000 My: 0.3268E-01 Mx: -.3268E-01 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 14 STAAD.PRO MEMBER SELECTION - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 22 |----------| Member No: 22 Profile: ST L25253 (AISC SECTIONS)| | Status: PASS Ratio: 0.861 Loadcase: 1 | | Location: 3.75 Ref: Eq.H2-

PROPERTIES (LOC: 5.83, PROPERTIES UNIT: IN) | | Ag : 8.850E+00 Axx : 5.182E+00 Ayy : 3.726E+00 | | Ixx : 2.910E+02 Iyy : 1.960E+01 J : 3.800E-01 | | Sxx+: 4.217E+01 Sxx-: 4.217E+01 Zxx : 4.730E+01 | | Syy+: 5.825E+00 Syy-: 5.825E+00 Zyy : 8.990E+00 | | Cw : 1.141E+03 x0 : 0.000E+00 y0 : 0.000E+00 | |----------| | MATERIAL PROPERTIES | | Fyld: 5184.000 Fu: 8351.999 | |----------| | Actual Member Length: 5.831 | | Design Parameters | | Kx: 1.00 Ky: 1.00 NSF: 0.85 SLF: 1.00 CSP: 1.00 | |----------| | COMPRESSION CLASSIFICATION (L/C: 1 LOC: 0.00) | | l l p l r CASE | | Flange: NonSlender 8.74 N/A 15.89 Table.4.1a.Case1 | | Web : Slender 48.26 N/A 42.29 Table.4.1a.Case5 | | | | FLEXURE CLASSIFICATION (L/C: 1 LOC: 0.00) | | l l p l r CASE | | Flange: Compact 8.74 10.79 28.38 Table.4.1b.Case10 | | Web : Compact 48.26 106.72 161.78 Table.4.1b.Case15 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 37 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 11 Contd. |----------| | CHECKS FOR AXIAL TENSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Ten. Yld. 0.000 286.7 0.000 Cl.D2 1 0.00 | | Ten. Rupt. 0.000 286.7 0.000 Cl.D2 1 0.00 | |----------| | CHECKS FOR AXIAL COMPRESSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Buck. X 40.99 274.6 0.149 Cl.E3 1 0.00 | | Flex. Buck. Y 40.99 250.1 0.164 Cl.E3 1 0.00 | | Flex. Tor. Buck 40.99 261.2 0.157 Cl.E4 1 0.00 | |----------| | CHECKS FOR SHEAR | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Shear X 0.000 100.7 0.000 Cl.G1 1 0.00 | | Shear Y 24.57 80.48 0.305 Cl.G1 1 5.83 | |----------| | CHECKS FOR BENDING | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Yld. Y 71.84 127.7 0.562 Cl.F2.1 1 5.83 | | Flex. Yld. Y 0.000 24.27 0.000 Cl.F6.1 1 0.00 | |----------| | CHECKS FOR AXIAL BEND INTERACTION | |----------| | | | RATIO CRITERIA L/C LOC | | Clause H1 0.644 Eq.H1-1b 1 5.83 | | Cl.H13-IP 0.637 Eq.H1-3a(H1-1b) 1 5.83 | | Cl.H13-OP 0.291 Eq.H1-3b 1 5.83 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 38 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 12 |----------| | Member No: 12 Profile: ST W14X30 (AISC SECTIONS)| | Status: PASS Ratio: 0.506 Loadcase: 1 | | Location: 5.83 Ref: Eq.H1-3a(H1-1b) | | Pz: 38.62 C Vy: 2.651 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: -55.68 | |----------| | SLENDERNESS | | Actual Slenderness Ratio : 47.018 | | Allowable Slenderness Ratio : 200.000 LOC : 0.00 | |----------| | STRENGTH CHECKS | | Critical L/C : 1 Ratio : 0.506(PASS) | | Loc : 5.83 Condition : Eq.H1-3a(H1-1b) | |----------| | SECTION PROPERTIES (LOC: 5.83, PROPERTIES UNIT: IN) | | Ag : 8.850E+00 Axx : 5.182E+00 Ayy : 3.726E+00 | | Ixx : 2.910E+02 Iyy : 1.960E+01 J : 3.800E-01 | | Sxx+: 4.217E+01 Sxx-: 4.217E+01 Zxx : 4.730E+01 | | Syy+: 5.825E+00 Syy-: 5.825E+00 Zyy : 8.990E+00 | | Cw : 1.141E+03 x0 : 0.000E+00 y0 : 0.000E+00 | |----------| | MATERIAL PROPERTIES | | Fyld: 5184.000 Fu: 8351.999 | |----------| | Actual Member Length: 5.831 | | Design Parameters | | Kx: 1.00 Ky: 1.00 NSF: 0.85 SLF: 1.00 CSP: 1.00 | |----------| | COMPRESSION CLASSIFICATION (L/C: 1 LOC: 0.00) | | l l p l r CASE | | Flange: NonSlender 8.74 N/A 15.89 Table.4.1a.Case1 | | Web : Slender 48.26 N/A 42.29 Table.4.1a.Case5 | | | | FLEXURE CLASSIFICATION (L/C: 1 LOC: 0.00) | | l l p l r CASE | | Flange: Compact 8.74 10.79 28.38 Table.4.1b.Case10 | | Web : Compact 48.26 106.72 161.78 Table.4.1b.Case15 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 39 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 12 Contd. |----------| | CHECKS FOR AXIAL TENSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Ten. Yld. 0.000 286.7 0.000 Cl.D2 1 0.00 | | Ten. Rupt. 0.000 286.7 0.000 Cl.D2 1 0.00 | |----------| | CHECKS FOR AXIAL COMPRESSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Buck. X 38.71 274.6 0.141 Cl.E3 1 0.00 | | Flex. Buck. Y 38.71 250.1 0.155 Cl.E3 1 0.00 | | Flex. Tor. Buck 38.71 261.2 0.148 Cl.E4 1 0.00 | |----------| | CHECKS FOR SHEAR | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Shear X 0.000 100.7 0.000 Cl.G1 1 0.00 | | Shear Y 8.800 80.48 0.109 Cl.G1 3 0.00 | |----------| | CHECKS FOR BENDING | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Yld. X -55.68 127.7 0.436 Cl.F2.1 1 5.83 | | Flex. Yld. Y 0.000 24.27 0.000 Cl.F6.1 1 0.00 | |----------| | CHECKS FOR AXIAL BEND INTERACTION | |----------| | | | RATIO CRITERIA L/C LOC | | Clause H1 0.513 Eq.H1-1b 1 5.83 | | Cl.H13-IP 0.506 Eq.H1-3a(H1-1b) 1 5.83 | | Cl.H13-OP 0.349 Eq.H1-3b 1 5.83 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 40 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 13 |----------| | Member No: 13 Profile: ST W14X30 (AISC SECTIONS)| | Status: PASS Ratio: 0.811 Loadcase: 3 | | Location: 0.00 Ref: Eq.H1-3a(H1-1b) | | Pz: 26.86 C Vy: 19.06 Vx: 0.000 | | Tz: 0.000 My: 0.000 Mx: 97.37 | |----------| | SLENDERNESS | | Actual Slenderness Ratio : 47.018 | | Allowable Slenderness Ratio : 200.000 LOC : 0.00 | |----------| | STRENGTH CHECKS | | Critical L/C : 3 Ratio : 0.811(PASS) | | Loc : 0.00 Condition : Eq.H1-3a(H1-1b) | |----------| | SECTION PROPERTIES (LOC: 0.00, PROPERTIES UNIT: IN) | | Ag : 8.850E+00 Axx : 5.182E+00 Ayy : 3.726E+00 | | Ixx : 2.910E+02 Iyy : 1.960E+01 J : 3.800E-01 | | Sxx+: 4.217E+01 Sxx-: 4.217E+01 Zxx : 4.730E+01 | | Syy+: 5.825E+00 Syy-: 5.825E+00 Zyy : 8.990E+00 | | Cw : 1.141E+03 x0 : 0.000E+00 y0 : 0.000E+00 | |----------| | MATERIAL PROPERTIES | | Fyld: 5184.000 Fu: 8351.999 | |----------| | Actual Member Length: 5.831 | | Design Parameters | | Kx: 1.00 Ky: 1.00 NSF: 0.85 SLF: 1.00 CSP: 1.00 | |----------| | COMPRESSION CLASSIFICATION (L/C: 1 LOC: 0.00) | | l l p l r CASE | | Flange: NonSlender 8.74 N/A 15.89 Table.4.1a.Case1 | | Web : Slender 48.26 N/A 42.29 Table.4.1a.Case5 | | | | FLEXURE CLASSIFICATION (L/C: 1 LOC: 0.00) | | l l p l r CASE | | Flange: Compact 8.74 10.79 28.38 Table.4.1b.Case10 | | Web : Compact 48.26 106.72 161.78 Table.4.1b.Case15 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 41 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 13 Contd. |----------| | CHECKS FOR AXIAL TENSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Ten. Yld. 0.000 286.7 0.000 Cl.D2 1 0.00 | | Ten. Rupt. 0.000 286.7 0.000 Cl.D2 1 0.00 | |----------| | CHECKS FOR AXIAL COMPRESSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Buck. X 39.00 274.6 0.142 Cl.E3 1 0.00 | | Flex. Buck. Y 39.00 250.1 0.156 Cl.E3 1 0.00 | | Flex. Tor. Buck 39.00 261.2 0.149 Cl.E4 1 0.00 | |----------| | CHECKS FOR SHEAR | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Shear X 0.000 100.7 0.000 Cl.G1 1 0.00 | | Shear Y 19.06 80.48 0.237 Cl.G1 3 0.00 | |----------| | CHECKS FOR BENDING | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Yld. X 97.37 127.7 0.762 Cl.F2.1 3 0.00 | | Flex. Yld. Y 0.000 24.27 0.000 Cl.F6.1 1 0.00 | |----------| | CHECKS FOR AXIAL BEND INTERACTION | |----------| | | | RATIO CRITERIA L/C LOC | | Clause H1 0.816 Eq.H1-1b 3 0.00 | | Cl.H13-IP 0.811 Eq.H1-3a(H1-1b) 3 0.00 | | Cl.H13-OP 0.345 Eq.H1-3b 3 0.00 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 42 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 14 |----------| | Member No: 14 Profile: ST L30253 (AISC SECTIONS)| | Status: PASS Ratio: 0.187 Loadcase: 3 | | Location: 0.00 Ref: Eq.H2-1 | | Pz: 4.778 C Vy: -.2456E-02 Vx: -.2652E-02 | | Tz: 0.000 My: -.1246E-03 Mx: 0.1155E-03 | |----------| | SLENDERNESS | | Actual Slenderness Ratio : 61.594 | | Allowable Slenderness Ratio : 200.000 LOC : 0.00 | |----------| | STRENGTH CHECKS | | Critical L/C : 3 Ratio : 0.187(PASS) | | Loc : 0.00 Condition : Eq.H2-1 | |----------| | SECTION PROPERTIES (LOC: 0.00, PROPERTIES UNIT: IN) | | Ag : 1.000E+00 Axx : 4.700E-01 Ayy : 5.640E-01 | | Ixx : 9.095E-01 Iyy : 5.788E-01 J : 1.178E-02 | | Sxx+: 5.634E-01 Sxx-: 5.604E-01 Zxx : 4.733E-01 | | Syy+: 4.326E-01 Syy-: 5.093E-01 Zyy : 1.042E+00 | | Cw : 1.141E+03 x0 : -5.432E-01 y0 : -7.929E-01 | |----------| | MATERIAL PROPERTIES | | Fyld: 5184.000 Fu: 8351.999 | |----------| | Actual Member Length: 3.905 | | Design Parameters | | Kx: 1.00 Ky: 1.00 NSF: 0.85 SLF: 1.00 CSP: 1.00 | |----------| | COMPRESSION CLASSIFICATION (L/C: 3 LOC: 0.00) | | l l p l r CASE | | Flange: Slender 13.30 N/A 12.77 Table.4.1a.Case3 | | Web : Slender 15.96 N/A 12.77 Table.4.1a.Case3 | | | | FLEXURE CLASSIFICATION (L/C: 3 LOC: 0.00) | | l l p l r CASE | | Flange: Compact 13.30 15.33 25.83 Table.4.1b.Case12 | | Web : NonCompact 15.96 15.33 25.83 Table.4.1b.Case12 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 43 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 14 Contd. |----------| | CHECKS FOR AXIAL TENSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Ten. Yld. 2.432 32.40 0.075 Cl.D2 1 3.91 | | Ten. Rupt. 2.432 32.40 0.075 Cl.D2 1 3.91 | |----------| | CHECKS FOR AXIAL COMPRESSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Buck. X 4.778 27.15 0.176 Cl.E3 3 0.00 | | Flex. Buck. Y 4.778 25.55 0.187 Cl.E3 3 0.00 | | Flex. Buck. U 4.778 27.15 0.176 Cl.E3 3 0.00 | | Flex. Buck. V 4.778 25.55 0.187 Cl.E3 3 0.00 | |----------| | CHECKS FOR SHEAR | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Shear X 0.3608E-02 9.137 0.000 Cl.G1 1 0.00 | | Shear Y 0.3342E-02 10.96 0.000 Cl.G1 1 0.00 | |----------| | CHECKS FOR BENDING | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Yld. U 0.5782E-18 1.752 0.000 Cl.F10.1 1 3.25 | | Flex. Yld. V -.4985E-02 2.270 0.002 Cl.F10.1 1 2.28 | | L-T-B Abt U 0.5782E-18 1.752 0.000 Cl.F10.2 1 3.25 | | F-L-B Abt U -.2891E-18 1.709 0.000 Cl.F10.3 1 0.98 | | F-L-B Abt V -.4985E-02 2.213 0.002 Cl.F10.3 1 2.28 | |----------| | CHECKS FOR AXIAL BEND INTERACTION | |----------| | | | RATIO CRITERIA L/C LOC | | Clause H2 0.187 Eq.H2-1 3 0.00 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 44 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 15 |----------| | Member No: 15 Profile: ST L30253 (AISC SECTIONS)| | Status: PASS Ratio: 0.127 Loadcase: 3 | | Location: 3.79 Ref: Eq.H2-1 | | Pz: 4.010 T Vy: 0.2043E-03 Vx: 0.2206E-03 | | Tz: 0.000 My: 0.4628E-02 Mx: -.4286E-02 | |----------| | SLENDERNESS | | Actual Slenderness Ratio : 102.522 | | Allowable Slenderness Ratio : 300.000 LOC : 0.00 | |----------| | STRENGTH CHECKS | | Critical L/C : 3 Ratio : 0.127(PASS) | | Loc : 3.79 Condition : Eq.H2-1 | |----------| | SECTION PROPERTIES (LOC: 3.79, PROPERTIES UNIT: IN) | | Ag : 1.000E+00 Axx : 4.700E-01 Ayy : 5.640E-01 | | Ixx : 9.095E-01 Iyy : 5.788E-01 J : 1.178E-02 | | Sxx+: 5.634E-01 Sxx-: 5.604E-01 Zxx : 4.733E-01 | | Syy+: 4.326E-01 Syy-: 5.093E-01 Zyy : 1.042E+00 | | Cw : 1.141E+03 x0 : -5.432E-01 y0 : -7.929E-01 | |----------| | MATERIAL PROPERTIES | | Fyld: 5184.000 Fu: 8351.999 | |----------| | Actual Member Length: 6.500 | | Design Parameters | | Kx: 1.00 Ky: 1.00 NSF: 0.85 SLF: 1.00 CSP: 1.00 | |----------| | COMPRESSION CLASSIFICATION (L/C: 1 LOC: 0.00) | | l l p l r CASE | | Flange: Slender 13.30 N/A 12.77 Table.4.1a.Case3 | | Web : Slender 15.96 N/A 12.77 Table.4.1a.Case3 | | | | FLEXURE CLASSIFICATION (L/C: 1 LOC: 0.00) | | l l p l r CASE | | Flange: Compact 13.30 15.33 25.83 Table.4.1b.Case12 | | Web : NonCompact 15.96 15.33 25.83 Table.4.1b.Case12 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 45 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 15 Contd. |----------| | CHECKS FOR AXIAL TENSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Ten. Yld. 4.017 32.40 0.124 Cl.D2 3 6.50 | | Ten. Rupt. 4.017 32.40 0.124 Cl.D2 3 6.50 | |----------| | CHECKS FOR AXIAL COMPRESSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Buck. X 1.983 22.47 0.088 Cl.E3 1 0.00 | | Flex. Buck. Y 1.983 18.63 0.106 Cl.E3 1 0.00 | | Flex. Buck. U 1.983 22.47 0.088 Cl.E3 1 0.00 | | Flex. Buck. V 1.983 18.63 0.106 Cl.E3 1 0.00 | |----------| | CHECKS FOR SHEAR | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Shear X 0.3287E-02 9.137 0.000 Cl.G1 1 0.00 | | Shear Y 0.3045E-02 10.96 0.000 Cl.G1 1 0.00 | |----------| | CHECKS FOR BENDING | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Yld. U -.5782E-18 1.752 0.000 Cl.F10.1 1 2.71 | | Flex. Yld. V -.8018E-02 2.270 0.004 Cl.F10.1 1 3.25 | | L-T-B Abt U -.5782E-18 1.509 0.000 Cl.F10.2 1 2.71 | | F-L-B Abt U -.5782E-18 1.709 0.000 Cl.F10.3 1 2.71 | | F-L-B Abt V -.8018E-02 2.213 0.004 Cl.F10.3 1 3.25 | |----------| | CHECKS FOR AXIAL BEND INTERACTION | |----------| | | | RATIO CRITERIA L/C LOC | | Clause H2 0.127 Eq.H2-1 3 3.79 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 46 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 16 |----------| | Member No: 16 Profile: ST L30253 (AISC SECTIONS)| | Status: PASS Ratio: 0.755 Loadcase: 1 | | Location: 3.91 Ref: Eq.H2-1 | | Pz: 24.23 T Vy: 0.2693E-03 Vx: 0.2907E-03 | | Tz: 0.000 My: 0.1203E-01 Mx: -.1114E-01 | |----------| | SLENDERNESS | | Actual Slenderness Ratio : 123.188 | | Allowable Slenderness Ratio : 300.000 LOC : 0.00 | |----------| | STRENGTH CHECKS | | Critical L/C : 1 Ratio : 0.755(PASS) | | Loc : 3.91 Condition : Eq.H2-1 | |----------| | SECTION PROPERTIES (LOC: 3.91, PROPERTIES UNIT: IN) | | Ag : 1.000E+00 Axx : 4.700E-01 Ayy : 5.640E-01 | | Ixx : 9.095E-01 Iyy : 5.788E-01 J : 1.178E-02 | | Sxx+: 5.634E-01 Sxx-: 5.604E-01 Zxx : 4.733E-01 | | Syy+: 4.326E-01 Syy-: 5.093E-01 Zyy : 1.042E+00 | | Cw : 1.141E+03 x0 : -5.432E-01 y0 : -7.929E-01 | |----------| | MATERIAL PROPERTIES | | Fyld: 5184.000 Fu: 8351.999 | |----------| | Actual Member Length: 7.810 | | Design Parameters | | Kx: 1.00 Ky: 1.00 NSF: 0.85 SLF: 1.00 CSP: 1.00 | |----------| | COMPRESSION CLASSIFICATION (L/C: 1 LOC: 93.72) | | l l p l r CASE | | Flange: Slender 13.30 N/A 12.77 Table.4.1a.Case3 | | Web : Slender 15.96 N/A 12.77 Table.4.1a.Case3 | | | | FLEXURE CLASSIFICATION (L/C: 1 LOC: 93.72) | | l l p l r CASE | | Flange: Compact 13.30 15.33 25.83 Table.4.1b.Case12 | | Web : NonCompact 15.96 15.33 25.83 Table.4.1b.Case12 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 47 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 16 Contd. |----------| | CHECKS FOR AXIAL TENSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Ten. Yld. 24.24 32.40 0.748 Cl.D2 1 7.81 | | Ten. Rupt. 24.24 32.40 0.748 Cl.D2 1 7.81 | |----------| | CHECKS FOR AXIAL COMPRESSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Buck. X 0.000 19.49 0.000 Cl.E3 1 0.00 | | Flex. Buck. Y 0.000 14.57 0.000 Cl.E3 1 0.00 | | Flex. Buck. U 0.000 19.49 0.000 Cl.E3 1 0.00 | | Flex. Buck. V 0.000 14.57 0.000 Cl.E3 1 0.00 | |----------| | CHECKS FOR SHEAR | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Shear X 0.6519E-02 9.137 0.001 Cl.G1 1 7.81 | | Shear Y 0.6039E-02 10.96 0.001 Cl.G1 1 7.81 | |----------| | CHECKS FOR BENDING | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Yld. U -.1156E-17 1.752 0.000 Cl.F10.1 1 5.21 | | Flex. Yld. V -.1639E-01 2.270 0.007 Cl.F10.1 1 3.91 | | L-T-B Abt U -.1156E-17 1.445 0.000 Cl.F10.2 1 5.21 | | F-L-B Abt U -.1156E-17 1.709 0.000 Cl.F10.3 1 5.21 | | F-L-B Abt V -.1639E-01 2.213 0.007 Cl.F10.3 1 3.91 | |----------| | CHECKS FOR AXIAL BEND INTERACTION | |----------| | | | RATIO CRITERIA L/C LOC | | Clause H2 0.755 Eq.H2-1 1 3.91 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 48 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 17 |----------| | Member No: 17 Profile: ST L30253 (AISC SECTIONS)| | Status: PASS Ratio: 0.730 Loadcase: 3 | | Location: 3.91 Ref: Eq.H2-1 | | Pz: 23.47 T Vy: 0.2110E-03 Vx: 0.2278E-03 | | Tz: 0.000 My: 0.8998E-02 Mx: -.8334E-02 | |----------| | SLENDERNESS | | Actual Slenderness Ratio : 123.188 | | Allowable Slenderness Ratio : 300.000 LOC : 0.00 | |----------| | STRENGTH CHECKS | | Critical L/C : 3 Ratio : 0.730(PASS) | | Loc : 3.91 Condition : Eq.H2-1 | |----------| | SECTION PROPERTIES (LOC: 3.91, PROPERTIES UNIT: IN) | | Ag : 1.000E+00 Axx : 4.700E-01 Ayy : 5.640E-01 | | Ixx : 9.095E-01 Iyy : 5.788E-01 J : 1.178E-02 | | Sxx+: 5.634E-01 Sxx-: 5.604E-01 Zxx : 4.733E-01 | | Syy+: 4.326E-01 Syy-: 5.093E-01 Zyy : 1.042E+00 | | Cw : 1.141E+03 x0 : -5.432E-01 y0 : -7.929E-01 | |----------| | MATERIAL PROPERTIES | | Fyld: 5184.000 Fu: 8351.999 | |----------| | Actual Member Length: 7.810 | | Design Parameters | | Kx: 1.00 Ky: 1.00 NSF: 0.85 SLF: 1.00 CSP: 1.00 | |----------| | COMPRESSION CLASSIFICATION (L/C: 1 LOC: 93.72) | | l l p l r CASE | | Flange: Slender 13.30 N/A 12.77 Table.4.1a.Case3 | | Web : Slender 15.96 N/A 12.77 Table.4.1a.Case3 | | | | FLEXURE CLASSIFICATION (L/C: 1 LOC: 93.72) | | l l p l r CASE | | Flange: Compact 13.30 15.33 25.83 Table.4.1b.Case12 | | Web : NonCompact 15.96 15.33 25.83 Table.4.1b.Case12 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 49 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 17 Contd. |----------| | CHECKS FOR AXIAL TENSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Ten. Yld. 23.48 32.40 0.725 Cl.D2 3 7.81 | | Ten. Rupt. 23.48 32.40 0.725 Cl.D2 3 7.81 | |----------| | CHECKS FOR AXIAL COMPRESSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Buck. X 0.000 19.49 0.000 Cl.E3 1 0.00 | | Flex. Buck. Y 0.000 14.57 0.000 Cl.E3 1 0.00 | | Flex. Buck. U 0.000 19.49 0.000 Cl.E3 1 0.00 | | Flex. Buck. V 0.000 14.57 0.000 Cl.E3 1 0.00 | |----------| | CHECKS FOR SHEAR | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Shear X 0.6532E-02 9.137 0.001 Cl.G1 1 7.81 | | Shear Y 0.6050E-02 10.96 0.001 Cl.G1 1 7.81 | |----------| | CHECKS FOR BENDING | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Yld. U -.1156E-17 1.752 0.000 Cl.F10.1 1 4.56 | | Flex. Yld. V -.1638E-01 2.270 0.007 Cl.F10.1 1 3.91 | | L-T-B Abt U -.1156E-17 1.445 0.000 Cl.F10.2 1 4.56 | | F-L-B Abt U -.1156E-17 1.709 0.000 Cl.F10.3 1 4.56 | | F-L-B Abt V -.1638E-01 2.213 0.007 Cl.F10.3 1 3.91 | |----------| | CHECKS FOR AXIAL BEND INTERACTION | |----------| | | | RATIO CRITERIA L/C LOC | | Clause H2 0.730 Eq.H2-1 3 3.91 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 50 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 18 |----------| | Member No: 18 Profile: ST L30253 (AISC SECTIONS)| | Status: PASS Ratio: 0.279 Loadcase: 3 | | Location: 0.00 Ref: Cl.E3 | | Pz: 5.199 C Vy: -.2264E-02 Vx: -.2444E-02 | | Tz: 0.000 My: 0.1314E-03 Mx: -.1217E-03 | |----------| | SLENDERNESS | | Actual Slenderness Ratio : 102.522 | | Allowable Slenderness Ratio : 200.000 LOC : 0.00 | |----------| | STRENGTH CHECKS | | Critical L/C : 3 Ratio : 0.279(PASS) | | Loc : 0.00 Condition : Cl.E3 | |----------| | SECTION PROPERTIES (LOC: 0.00, PROPERTIES UNIT: IN) | | Ag : 1.000E+00 Axx : 4.700E-01 Ayy : 5.640E-01 | | Ixx : 9.095E-01 Iyy : 5.788E-01 J : 1.178E-02 | | Sxx+: 5.634E-01 Sxx-: 5.604E-01 Zxx : 4.733E-01 | | Syy+: 4.326E-01 Syy-: 5.093E-01 Zyy : 1.042E+00 | | Cw : 1.141E+03 x0 : -5.432E-01 y0 : -7.929E-01 | |----------| | MATERIAL PROPERTIES | | Fyld: 5184.000 Fu: 8351.999 | |----------| | Actual Member Length: 6.500 | | Design Parameters | | Kx: 1.00 Ky: 1.00 NSF: 0.85 SLF: 1.00 CSP: 1.00 | |----------| | COMPRESSION CLASSIFICATION (L/C: 3 LOC: 0.00) | | l l p l r CASE | | Flange: Slender 13.30 N/A 12.77 Table.4.1a.Case3 | | Web : Slender 15.96 N/A 12.77 Table.4.1a.Case3 | | | | FLEXURE CLASSIFICATION (L/C: 3 LOC: 0.00) | | l l p l r CASE | | Flange: Compact 13.30 15.33 25.83 Table.4.1b.Case12 | | Web : NonCompact 15.96 15.33 25.83 Table.4.1b.Case12 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 51 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 18 Contd. |----------| | CHECKS FOR AXIAL TENSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Ten. Yld. 1.124 32.40 0.035 Cl.D2 1 6.50 | | Ten. Rupt. 1.124 32.40 0.035 Cl.D2 1 6.50 | |----------| | CHECKS FOR AXIAL COMPRESSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Buck. X 5.199 22.47 0.231 Cl.E3 3 0.00 | | Flex. Buck. Y 5.199 18.63 0.279 Cl.E3 3 0.00 | | Flex. Buck. U 5.199 22.47 0.231 Cl.E3 3 0.00 | | Flex. Buck. V 5.199 18.63 0.279 Cl.E3 3 0.00 | |----------| | CHECKS FOR SHEAR | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Shear X 0.3299E-02 9.137 0.000 Cl.G1 1 0.00 | | Shear Y 0.3055E-02 10.96 0.000 Cl.G1 1 0.00 | |----------| | CHECKS FOR BENDING | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Yld. U 0.5782E-18 1.752 0.000 Cl.F10.1 1 1.63 | | Flex. Yld. V -.8158E-02 2.270 0.004 Cl.F10.1 1 3.25 | | L-T-B Abt U -.5782E-18 1.509 0.000 Cl.F10.2 1 2.17 | | F-L-B Abt U -.5782E-18 1.709 0.000 Cl.F10.3 1 2.17 | | F-L-B Abt V -.8158E-02 2.213 0.004 Cl.F10.3 1 3.25 | |----------| | CHECKS FOR AXIAL BEND INTERACTION | |----------| | | | RATIO CRITERIA L/C LOC | | Clause H2 0.279 Eq.H2-1 3 0.00 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 52 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 19 |----------| | Member No: 19 Profile: ST L30253 (AISC SECTIONS)| | Status: PASS Ratio: 0.195 Loadcase: 3 | | Location: 2.28 Ref: Eq.H2-1 | | Pz: 6.280 T Vy: 0.2741E-04 Vx: 0.2959E-04 | | Tz: 0.000 My: 0.2630E-02 Mx: -.2436E-02 | |----------| | SLENDERNESS | | Actual Slenderness Ratio : 61.594 | | Allowable Slenderness Ratio : 300.000 LOC : 0.00 | |----------| | STRENGTH CHECKS | | Critical L/C : 3 Ratio : 0.195(PASS) | | Loc : 2.28 Condition : Eq.H2-1 | |----------| | SECTION PROPERTIES (LOC: 2.28, PROPERTIES UNIT: IN) | | Ag : 1.000E+00 Axx : 4.700E-01 Ayy : 5.640E-01 | | Ixx : 9.095E-01 Iyy : 5.788E-01 J : 1.178E-02 | | Sxx+: 5.634E-01 Sxx-: 5.604E-01 Zxx : 4.733E-01 | | Syy+: 4.326E-01 Syy-: 5.093E-01 Zyy : 1.042E+00 | | Cw : 1.141E+03 x0 : -5.432E-01 y0 : -7.929E-01 | |----------| | MATERIAL PROPERTIES | | Fyld: 5184.000 Fu: 8351.999 | |----------| | Actual Member Length: 3.905 | | Design Parameters | | Kx: 1.00 Ky: 1.00 NSF: 0.85 SLF: 1.00 CSP: 1.00 | |----------| | COMPRESSION CLASSIFICATION (L/C: 3 LOC: 0.00) | | l l p l r CASE | | Flange: Slender 13.30 N/A 12.77 Table.4.1a.Case3 | | Web : Slender 15.96 N/A 12.77 Table.4.1a.Case3 | | | | FLEXURE CLASSIFICATION (L/C: 3 LOC: 0.00) | | l l p l r CASE | | Flange: Compact 13.30 15.33 25.83 Table.4.1b.Case12 | | Web : NonCompact 15.96 15.33 25.83 Table.4.1b.Case12 | |----------| EXAMPLE PROBLEM NO. 1 -- PAGE NO. 53 STAAD.PRO CODE CHECKING - AISC 360-16 LRFD (V1.1) ********** ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE Noted). - Member : 19 Contd. |----------| | CHECKS FOR AXIAL TENSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Ten. Yld. 6.284 32.40 0.194 Cl.D2 3 3.91 | | Ten. Rupt. 6.284 32.40 0.194 Cl.D2 3 3.91 | |----------| | CHECKS FOR AXIAL COMPRESSION | |----------| | DEMAND CAPACITY RATIO REFERENCE L/C LOC | | | | Flex. Buck. X 1.287 27.15 0.047 Cl.E3 1 0.00 | | Flex. Buck. Y 1.287 25.55 0.050 Cl.E3 1 0.00 | |