



# ACE Structural Engineering Applications LLC

## ACE FrameWorks FPL Utilities

### Automated Gusset Plates for Fixed End Beams Documentation

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#### Automated Gusset Plates for Fixed End Beams (ACE\_GBA.MA)

(Versions - FWP 3.1.x.x/3.2.x.x rel 2.0.5 & FWP 7.0.x.x rel 7.0.5 & FWP 7.1/7.2/7.3 rel 6.0.5 & FWP 8.0.x.x rel 8.0.5 & FWP 9.0.x.x rel 9.0.5 & FWP 10.0.x.x rel 10.0.5 & FWP 11.0.x.x rel 11.0.5 & FWP 12.0.x.x rel 12.0.5)

The *Automated Gusset Plates for Fixed End Beams* application places top and/or bottom plates at each beam fixed end for the entire model (includes FWP attached models) or subset of the model defined by a selection set. A configurable set of top and bottom gusset plate variables are utilized to size the plate. A constant set of variables may be utilized for all connections or optionally the configuration may be based upon beam characteristics for the beam involved in the connection. This utility allows the option using a single set of connection variables (defined in definition file) or also defining a set of connection variable files with the BCS/BCV capability (see pages 4 & 16). The resulting gusset plate(s) is either triangular, rectangular, four sided or 5 sided and is represented by FrameWorks steel solid shape (type solid, slab or wall elements). Gusset plates are sized & placed for the purpose of interference detection - **NOT FOR THE PURPOSES OF CONNECTION DESIGN**. The connection end of a beam endpoint (beam endpoint must have rotation about local Z axis restrained) must either intersect a column cardinal point (CP) line or intersect a column endpoint. The ACE\_GBA application is designed to place large numbers of gusset plates in one fell swoop. This application also provides the option to create a steel detailing neutral (SDNF) file which can be transmitted to fabricator to define allowable gusset plate limits.



**Automated Gusset Plates for Fixed End Beams - Primary Dialog Box**

The utility has internal defaults for all the items shown on the dialog box above. The defaults may be overridden with user defined defaults by using a definition file which is discussed in detail later in this document.

# Automated Gusset Plates for Fixed End Beams Documentation

## Connection Types

This gusset plate utility is limited to a single connection type. This utility will place top and/or bottom gusset (stiffener) plates on the fixed end of flat beams framing into column ends or interior. Each beam is studied (random order) to determine potential for connections. A beam may have only one connection per end. The maximum number of gusset plates that can be placed is equal to four times the number of beams.

## Automated Gusset Plates for Fixed End Beams Primary Dialog Box Features

This Gusset Plate application, ACE\_GBA, has been designed to automatically size and place fixed end beam gusset plates for the entire structure or optionally a subset of the structure. This FrameWorks Plus FPL application is limited to beam end (vertical) gusset plates on fixed ends of beams, which rigidly intersect columns (i.e. beam end has not been released for rotation about  $M_z$ ). This application features the following controls on the Automated Gusset Plates for Fixed End Beams - Primary Dialog Box:

- Option button define processing scope
  - All Members
  - Selection Set
- Option button further define processing scope WRT beam to column intersection
  - All Interior & Exterior Intersections
  - Only Interior Intersections
  - Only Exterior Intersections
- Toggle option to allow only strong axis beams
- Toggle to deactivate BCS Sets
- Toggle option for SDNF file
- File button to select SDNF file
- Name keyin field for SDNF file (optional)
- Toggle option for overwrite
- Naming option Parameters
  - Option button to select naming technique
  - Name keyin field (if autaname not selected)
- Button to view connection variables & GP parameters
- Button to edit connection variables & GP parameters
- Button to investigate & report
- Button to process gusset plates

## Limitations

There are no fixed limits on the number of gusset plates which can be placed. The application dynamically allocates structures and provided there is enough memory and time a structure will be processed. If there is a memory limitation for primary processing, a CRITICAL message will be displayed stating the same. Dynamic structures are also utilized to create SDNF and UNDO data (considered NON-CRITICAL). Failure to allocate structures for SDNF & UNDO, will simply deactivate these features. Solution time is very dependent upon size of the structure and number of braces. If a structure is so large that processing is either not possible or too time consuming – try using a selection set subset of the structure. Solution speed can be significantly increased by keeping FrameWorks views inactive during process and windowing in to a blank view area.

# Automated Gusset Plates for Fixed End Beams Documentation

## Automated Gusset Plates for Fixed End Beams- Basic Operation

This Automated Gusset Plate application features simple but powerful operation. Ideally this (and all gusset plate applications) application should be operated on a “gusset plate only model” which has the structure attached as a model partition(s). Placing gusset plates directly into the model will work, but solid elements tend to be quite slow and the gusset plate solids will pose an enormous performance penalty for large structures. Gusset plates produced by this application can be considered throw-away files which can be easily recreated using the latest model(s). Thus immediately prior to interference detection investigation, existing gusset plates be deleted and a new set of gusset plates can be placed with this application.

The following are the recommended steps for utilizing this application:

- Step 1: Verify that the connection variables & parameters are as desired
- Step 2: If not, Edit that the gusset plate variables & parameters
- Step 3a: Define the processing scope (all members all models or a selection set)
- Step 3b: Define the column intersection option (all, interior only or exterior only)
- Step 3c: Define the strong axis option (strong axis only or both strong & weak(default))
- Step 4: Select gusset plate naming options
- Step 5: Select SDFN file options (creation status and name if applicable)
- Step 6: Execute the “Investigate & Report” option

If all looks well, proceed to step 7 else revise structure and/or variables as required.

- Step 7: Execute the “Process Gusset Plates” option

If all looks well, accept the results. If not, request an “UNDO” and revise structure and/or variables as required. If the results are accepted and a SDFN file was requested, a SDFN file is written. If all members were selected, the model is completely processed and the application should be exited. If the selection set option was utilized, either select another selection set for processing and repeat steps 6 & 7 or exit the application.

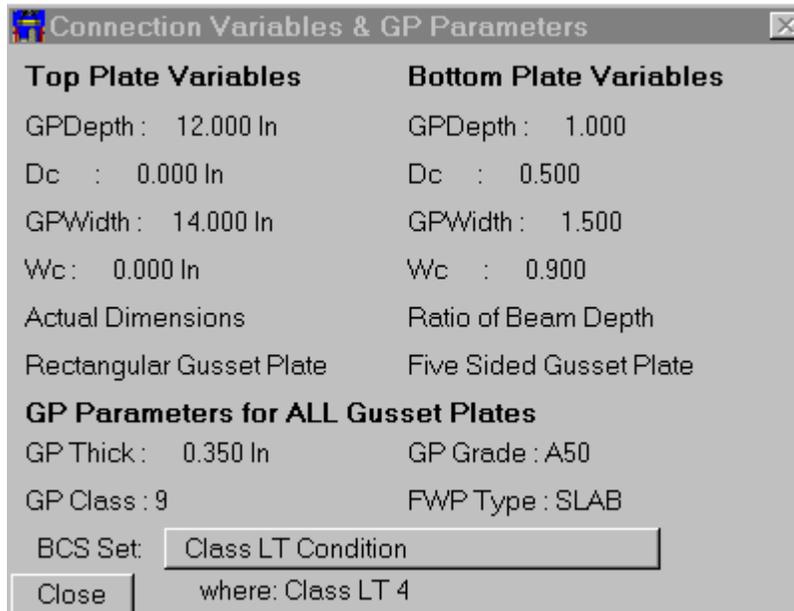
Each of the above steps is discussed in greater detail in the ensuing pages.

# Automated Gusset Plates for Fixed End Beams Documentation

## Automated Gusset Plates for Fixed End Beams - Basic Operation (continued)

### View Connection Variables & GP Parameters (step 1)

Pressing the view connection variables button will produce the following dialog box. This dialog box only allows viewing the connection variables and GP parameters.



**View Connection Variables & GP Parameters - Dialog Box**

There are several ways to define the connection variables & GP parameters for this application. Obviously one technique is via the definitions file. Unlike the two other automated applications, this application allows editing of the connection variables & parameters (see **Edit Connection Variables**). The connection variables & GP parameters control the size and properties for gusset plates. A BCS (beam connection specification file) may be specified in the definitions file if so desired. If a BCS file is specified, the dialog box will look like above in that it references BCS set. A BCS set is a set of connection variables (also parameters), which will be utilized if the beam in question meets the condition. The conditions may involve beam class, beam area, beam profile and beam name. Each BCS set may be seen via the option button shown in the dialog box. Above, the “Class LT Condition” definition variables are shown. The BCS sets are shown in the order in which they will be investigated. For a given beam, the sets are investigated from top to bottom and the first one that meets specified criteria is utilized. If none meet the criteria, the default definition set is utilized.

The definitions file, BCS and BCV files are discussed toward the end of this document. These files are critical for successful utilization of this application. The “Edit Connection Variables” option, can be utilized to create, import, export and/or edit BCV files, which are the connection variable files for a BCS set.

### NOTE ON GUSSET PLATE THICKNESS

If a value of 0.0 is specified for the gusset plate thickness, the beam web thickness will be utilized for the gusset plate thickness.

# Automated Gusset Plates for Fixed End Beams Documentation

## Automated Gusset Plates for Fixed End Beams - Basic Operation (continued)

### Edit Connection Variables & GP Parameters (Optional step 2)

Pressing the edit connection variables button will produce the following dialog box.

**Connection Variable & Parameter Editing Units : In**

Connection Variables & Parameters

Top Variables	Bottom Variables
GPDepth: 12.000	GPDepth: 1.000
Dc: 0.000	Dc: 1.000
GPWidth: 16.000	GPWidth: 1.500
Wc: 0.000	Wc: 1.500

Values: True Dimensions | Ratio BM Depth

Roundoff: 1/16 IN | 1/8 IN

**GP Parameters for ALL Gusset Plates**

Thickness: 0.375 | Class: 8 | Grade: A42 | Solid Type: Slab

Close - Retain Values | Cancel - Restore Orig Values & Exit

**Edit Connection Variables & GP Parameters - Dialog Box**

This dialog box features a pulldown menu with four important options (shown in Pulldown Menu Options below). The variables & parameters in this dialog box are initially displayed as untied (but can be tied) to the values read in the definition file. This dialog box allows defining, importing, editing, and saving of BCV files (first two pulldown command options). BCV files contain a complete definition of the connection variables & GP parameters. NOTE: a BCV file can be easily pasted into a definition file w/ notepad or virtually any editor.

In addition to the above operations, the second two pulldown menu commands provide two additional capabilities. First the values displayed can become the default definition values by issuing the Save Display Values as Default pulldown menu command. Thus a complete set of connection variables and parameters can be created “on the fly” (similar to the interactive gusset plate utilities). Finally, the original definition file values can be restored to display with the Display Original Default command (and then subsequently edited and/or Saved as Default).

### Pulldown Menu Options

**Connection Variable & Parameter Editing Units : In**

Connection Variables & Parameters

- Import BCV File
- Save BCV File
- Save Display Values as Default
- Display Original Default

GPWidth: 14.000

**Bottom Variables**

GPDepth: 1.000

Dc: 0.500

GPWidth: 1.500

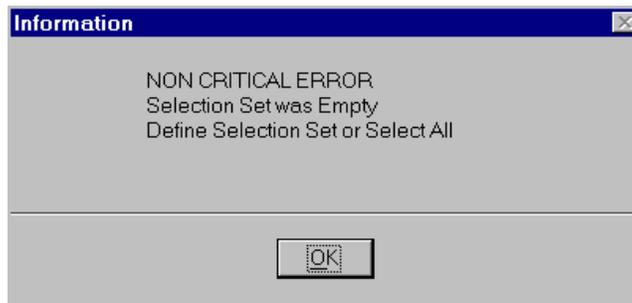
**Pulldown Menu - Partial Dialog Box Displayed**

# Automated Gusset Plates for Fixed End Beams Documentation

## Automated Gusset Plates for Fixed End Beams - Basic Operation (continued)

### Determine Processing Scope (step 3)

More often than not the processing scope will be all members – allowing the model(s) to be fully processed in one operation. The selection set option is provided to allow partial processing of model(s). It is anticipated that this option may be useful for very large structures or in cases where many bogus BEAMS & COLUMNS exist. The ACE FrameWorks Filter Selector can be utilized to create selection sets in such cases (warning: the FrameWorks filter information is not available to FPL applications and thus is not honored). The selection set can also be a valuable tool to simply see how the application would treat a given set of BEAMS & COLUMNS. If selection set is selected and a selection set does not exist at the time “investigate & report” or “process Gusset plates” is pressed, the following non-critical error will appear.



**Empty Selection Set Warning**

This utility also features two additional filter options. First, the type of beam to column intersection may be specified as: 1) All beam to interior or exterior columns, 2) Only beam to interior columns or 3) Only beam to exterior columns. Second, the beams may be restricted to those that have a rotation or 0 with a OV of (0,0,1) termed “Include Strong Axis Beams Only”. Additional filters have been provided to help eliminate placing gusset plates in undesired locations. There is a very real possibility of placing gusset plates that will overlap gusset plates placed by the automated vertical bracing gusset plate application. See the section “Avoiding Duplicate Gusset Plates”.

Note that the startup defaults for the processing options may be specified in the definitions file.

### Gusset Plate Naming (step 4)

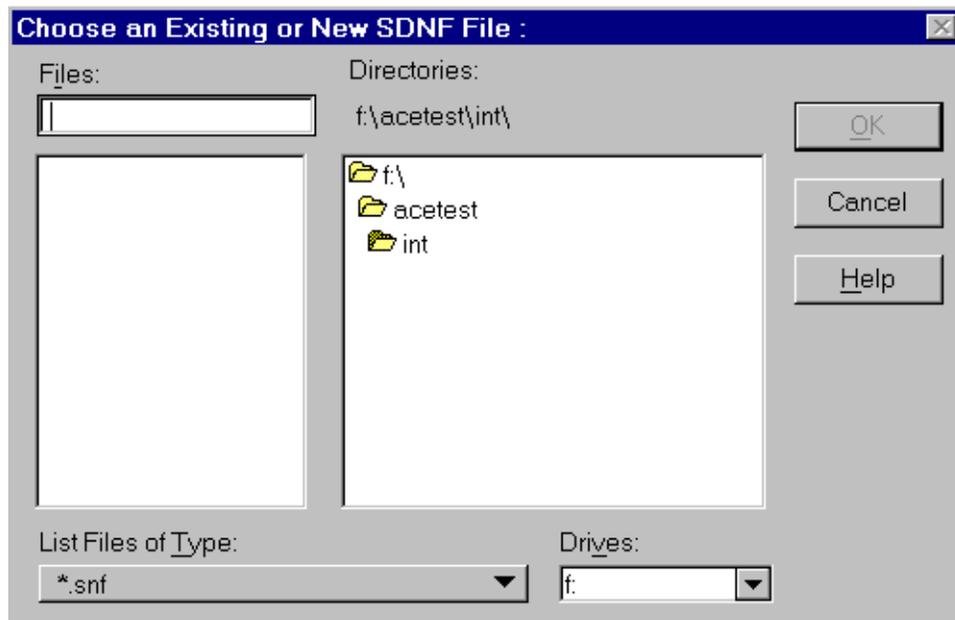
The gusset plate placed consists of one FrameWorks solid element (type: solid, slab or wall - specified in definition file) and may be named depending upon the naming option selected. The name may be a constant name or it may be a prefix with the FrameWorks gusset plate solid member ID (FWP ID) appended as a suffix. The default prefix is GBA, however a different prefix may be specified in the definition file or supplied at runtime. Other naming options include: a constant specified name; or FrameWorks normal naming for individual components (autoname).

# Automated Gusset Plates for Fixed End Beams Documentation

## Automated Gusset Plates for Fixed End Beams - Basic Operation (continued)

### Select SDNF file options (step 5)

A steel detailing neutral file (SDNF) may be written if desired. To request a SDNF file, toggle on the “Create SDNF file” toggle box. The startup defaults for the SDNF option may be specified in the definitions file. If the displayed SDNF file is not the desired file, the file may be specified via the keyin field or the FILE button. Pressing the FILE button will activate the following dialog box.



**SDNF File Dialog Box**

By default the SDNF file will be pointed to the project INT directory. The directory can be changed if desired. Key in a valid file name (extension not required – SNF will be used) and press enter, the file name will appear in the SDNF name keyin field. Note that an existing file may be selected. If an existing file is selected, the Overwrite toggle will become visible. By default, the application will append to existing files. If the Overwrite file toggle is on the existing file will be overwritten with the new SDNF data.

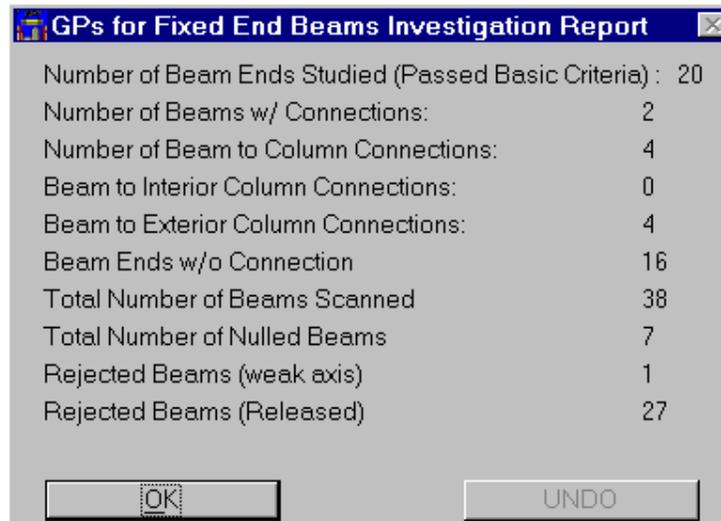
The SDNF file may also be specified with the SDNF name keyin field. If this option is utilized, both the name & path should be supplied.

# Automated Gusset Plates for Fixed End Beams Documentation

## Automated Gusset Plates for Fixed End Beams - Basic Operation (continued)

### Execute the “Investigate & Report” option (step 6)

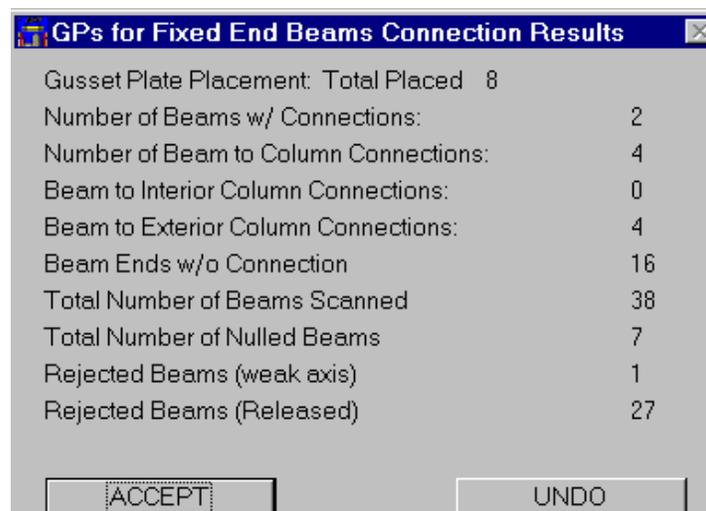
Investigate and Report is an optional step. Very large structures may require significant processing time. The investigate and report is always faster than the actual placement process (large numbers of solid placement is slow). When the investigate and report button is pressed, the following dialog box appears.



**Investigate & Report Dialog Box**

### Execute the “Process Gusset Plates” option (step 7)

The final step is the actual placement of gusset plates. If the “investigate & report” option was utilized, the results of the placement process are already known (barring actual placement errors). For extremely large structures, this may be a lengthy process. The placement status is shown in a message field during this operation. A running count on connections placed versus maximum possible number of connections is shown. After the last gusset plate is placed, the following dialog box appears.



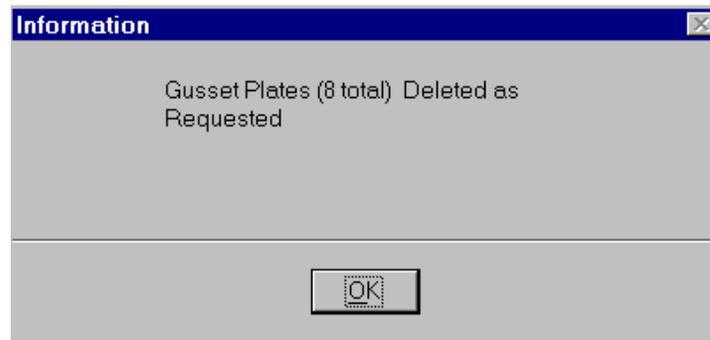
**Process Gusset Plate Results Dialog Box**

At this point the gusset plates may be accepted or rejected (immediately undone). Pressing the “UNDO” button will cause all of the previously placed gusset plates to be deleted and the following message dialog box will appear.

# Automated Gusset Plates for Fixed End Beams Documentation

## Automated Gusset Plates for Fixed End Beams - Basic Operation (continued)

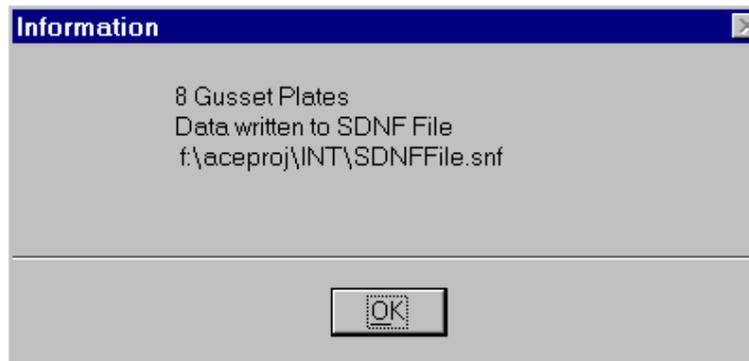
Execute the “Process Gusset Plates” option (step 7) continued



### UNDO Results Message

UNDO is accomplished by deleting the FWP solids that were placed. Neither FWP nor uStn compression is performed. FWP and/or uStn compression is the responsibility of the user. Neither ASCII nor binary SDNF data is written when UNDO is invoked.

If ACCEPT is pressed, the gusset plates will remain and if a SDNF file was requested, the following message dialog box appears.



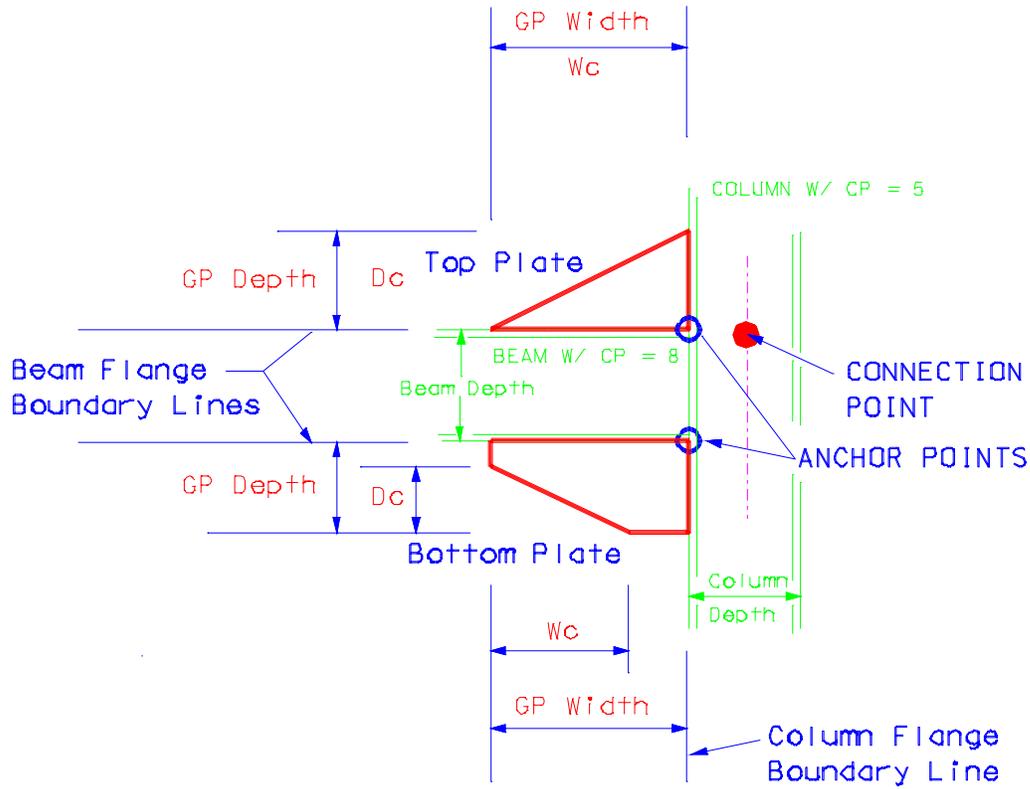
### SDNF ASCII File Message

After placement and subsequent messages, the primary dialog box will appear. If the all members option was in effect, all gusset plates have been placed for the model(s) and the application may be exited.

If the selection set option was in effect, more processing may be in order. Generate new selection set and process or exit the application.

# Automated Gusset Plates for Fixed End Beams Documentation

## Connection Diagram



As seen above the connection can contain a top and/or a bottom gusset plate. The gusset plate can have 3, 4 or 5 sides. The variables are specified separately for the top and bottom plates.

# Automated Gusset Plates for Fixed End Beams Documentation

## Important Notes

### Avoiding Duplicate Gusset Plates

As previously mentioned there is a very strong possibility that overlapping gusset plates can be placed if both the automated gusset plates for vertical bracing and this application are utilized on the same model. There are several ways to minimize or eliminate duplicate gusset plates. First, this application will only place gusset plates on fixed end beams. Thus using beam releases for simple framing beams is VERY IMPORTANT. Second, two new filters are provided. The column intersection and strong axis options can be useful. Finally the use of BCS & BCV files can be extremely valuable. Unlike the other gusset plate applications, this application allows specification of cases where gusset plates will not be placed (setting fGPWidth or fGPDepth to zero). Thus the default can be to not place gusset plates and BCS cases can point to specific situations where gusset plates are placed on beams. Alternately, BCS cases can be set to specifically exclude a filter set of beams.

If gusset plates overlap, it is not a serious situation. In all likelihood, reasonable interference real estate is occupied. The negative will be 1) more solid elements – speed decrease & file size increase and 2) more interferences are reported (some obviously duplicates).

### ASCII SDNF File

The ASCII SDNF file (has .snf extension) is optional. This file can be read by any SDNF import application which follows standard SDNF format. When writing to an existing SDNF file, a new Packet 20 is added to the file. Some SDNF import applications may not honor multiple Packet 20's. In such a case, the ASCII file may be combined with a standard editor. This file is written only if requested and if gusset plates are accepted (an UNDO was not requested).

### Binary SDNF File

In contrast to the ASCII SDNF file, a binary history file is written (if it exists – appended) for each model unless memory constraints are encountered. The binary SDNF file is placed in the project INT directory and is named ModelName.ACE. This file is provided for both history and future processing potential with fabricators. This file is written if gusset plates are accepted (i.e. an UNDO was not requested).

### Framing & Connectivity Requirements

The framing and connectivity requirements are also outlined below:

1. The connection plane must form a vertical plane (parallel to z axis)
2. Beams must be flat (lie in xy plane) and may not have end offsets
3. Columns must be vertical (parallel to z-axis) and may not have end offsets
4. Beam and Column members must intersect at 90 degrees
5. Beam end must be restrained for rotation about Z axis (local)
6. Beam must have CP 8 and must have either the strong or weak axis at beam intersection.
7. Beam endpoint must lie on a column CP line or intersect a column endpoint. The intersection option can be utilized to change this to be only endpoint intersect or only column CP line interior intersect.
8. Beam endpoint MUST be restrained against rotation (Mz if strong axis vertical or My if weak axis vertical). If Strong Axis only is toggled on, all rotated beams are ignored (i.e. only beams restrained Mz and having Strong Axis vertical are considered)
9. Column must have CP 5 and must have either the strong or weak axis at beam intersection.

# Automated Gusset Plates for Fixed End Beams Documentation

## Definitions File

Due to the dissimilar nature of the variables in the steel utilities, each steel utility has a separate definition (DEF) file. While each file is distinctly different, each file is similar in the basic method of definition. Each definition file may optionally be controlled with either of two environment variables. Thus a project specific definition file for each project may be easily specified. The environment variables may be specified in numerous ways (similar to any MicroStation variable), however the utilization of a project.pcf is highly recommended. Environment variable definition is discussed in detail in the installation notes provided with the ACE FrameWorks utilities. The default name and location for the definition file for this utility are: C:\ACE\_GBA.DEF. A directory for the definition file may be specified with the environment variable ACE\_DEF\_PATH (will look in specified path for file ACE\_GBA.DEF). A complete name and location of a definition file may be also specified with the environment variable ACE\_GBA\_DEF. The first valid definition file found is utilized. The search for a definition file happens in the following order or priority:

1. If the variable ACE\_GBA\_DEF is specified, the named file at this location will be used if found.
2. If the variable ACE\_DEF\_PATH is specified and ACE\_GBA.DEF is found in this directory, it is used.
3. If there is a c:\ace\_gba.def file it is utilized.
4. If none of the above, internal program defaults are utilized – a warning message will be displayed.

(if environment variables in 1 and/or 2 above are specified and corresponding DEF file is not found, a warning is displayed).

Due to the complex nature of the variables, the steel definition files allow the specification of units (either Metric (mm) or English (inch)). Thus a given default file may be utilized in either a Metric or English project. The FrameWorks model may be in any valid FrameWorks units. The units may be changed throughout the definition file. If units are not specified, it is assumed that the definition file units match the units of the model (if model units are feet or inch – definition file is in inches (English) & if model units are meters or mm – definition file is assumed mm (Metric)). If units are defined and they do not match the model, the variables after the units command are converted to match model units (i.e. inches for English models & mm for Metric models). A sample definition file is shown on this page. Toward the end of this document, the commands for the definition file are outlined in detail

## Sample Definitions File

### Typical Definition File:

```
UNI  ENG
GEN   0      1      0      0      SDNFFile
GRA   3      A36     A42     A50
PAR   .375  8      A42     SLA
CON  TOP VAL 10.0 10.0  14.0  14.0  8
NAM  SPE  GBA-
BCS  c:\BCSdata\sample.bcs
```

# Automated Gusset Plates for Fixed End Beams Documentation

## Definitions File - Command Definition

- **Valid Primary Keyword Commands:** (UNI, GEN, GRA, CON, PAR, NAME, BCS)
- Each record must begin with a valid primary keyword or it is ignored
- All records that start with a blank are considered comments
- The commands/keywords (records) may be placed in any order however the order is significant
- All values for a given command must be defined in order shown above. If default values are acceptable, only the changed values must be given. However all values up to that point must be defined whether changed or not.
- The components of a given command (record) must all be present and in the order shown
- The units command is special and may be repeated and located as required. While commands may be in any order, it should be obvious that the location of the units command is extremely important.
- All input values are either in INCHES (ENGLISH) or MM (METRIC)
- By default application looks for C:\ACE\_GBA.DEF definition file
- Definition file path may be defined with environment variable ACE\_\_DEF\_PATH
- ACE\_DEF\_PATH=d:\mydir\  
(the DEF file ACE\_GBA.DEF will be looked for in the directory d:\mydir)
- Definition file may be defined with environment variable ACE\_GBA\_DEF
- ACE\_GBA\_DEF = d:\mydir\mydef\_file (*highest priority definition*)  
(the DEF file mydef\_file will be looked for in the directory d:\mydir)
- **NOTE:** Components shown in bold may only be specified in the definitions file (uno)

## UNIT Command - Units Command (optional command)

**UNIT** {UNITTYPE}

where :

{UNITTYPE} May be ENGLISH or METRIC

All input for the application is in inches for English units and mm for metric units.

If units is not specified it is assumed that the units match the current model units.

Units may be changed at any time but be aware that the properties (in attached library) for the member specified must match the current model units.

## GEN Command - General Command defines general parameters

**GEN**        *iScope*    *iSDNFcreate*    *iStrongAxis*    *iIntersect*    *sSDNFfile*

where :

<i>iScope</i>	: 0-All Members 1-Selection Set - Initial Value
<i>iSDNFcreate</i>	: Toggle for ASCII SDNF file creation ( 1-On, 0-Off) - Initial Value
<i>iStrongAxis</i>	: Toggle for Strong Axis Only Beams ( 1-On, 0-Off) - Initial Value
<i>iIntersect</i>	: Option button for Column Intersection Behavior - Initial Value ( 0-Both, 1-Interior Only, 2-Endpoint Only)
<i>sSDNFfile</i>	: Name & path or name only for new or existing ASCII SDNF file – Initial Value If Name only - path is project INT directory If no extension is supplied, .snf is appended

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## Definitions File - Command Definition (con'd)

### CON Command - Connection Command defines default connection parameters

**CON**     *sTopBot*   *sValRat*   *fGPDepth*   *fDc*   *fGPWidth*   *fWc*   *iRound*

where :

<b>sTopBot</b>	:	Specifies top (TOP) or bottom (BOT) connection values (For both top & bottom plates, provide two CON commands – one for each)
<b>sValRat</b>	:	Specifies whether values specified are actual values (VAL) or a ratio (RAT) of beam depth (limits : <i>fDc</i> <= <i>fGPDepth</i> >0 <i>fWc</i> <= <i>fGPWidth</i> >0) (for RAT CON values   3.0 >= ALLVALUES >= 0)
<b>fGPDepth</b>	:	Depth at beam flange (inch or mm units) - distance normal to beam CP line
<b>fDc</b>	:	Depth cutout of beam away from connection (inch or mm units)
<b>fGPWidth</b>	:	Width at beam flange (inch or mm units) - distance along the beam CP line
<b>fWc</b>	:	Width cutout of beam away from connection (inch or mm units) (NOTE that above values are unitless for RAT)
<b>iRound</b>	:	Rounding coefficient for connection (0,1,2,4,8,16,32) 0 - Do not round 1 - Round to nearest inch or mm 2 - Round to nearest 1/2 inch or mm 4 - Round to nearest 1/4 inch or mm 8 - Round to nearest 1/8 inch or mm 16 - Round to nearest 1/16 inch or mm 32 - Round to nearest 1/32 inch or mm

#### Notes:

- 1) Specifying *fGPDepth* or *fGPWidth* as 0 will void the command and set all values to zero.
- 2) To only place plates on the top, provide a CON TOP command w/o a CON BOT command.  
(or alternately specify *fGPDepth* or *fGPWidth* as 0)
- 3) To place a triangular plate, set *fDc* equal to *fGPDepth* and *fWc* equal to *fGPWidth*.
- 4) To place a rectangular plate, set *fDc* equal to 0 and *fWc* equal to 0.

### PAR Command - Parameters Command defines default connection parameters

**PAR**     *fThick*   *iClass*   *sGrade*   *sSolidType*

<b>fThick</b>	:	Thickness value (inch or mm units)
<b>iClass</b>	:	Class for GP 9 >= class >= 0 (default 2)
<b>sGrade</b>	:	Grade value for Gusset Plate (default A36)
<b>sSolidType</b>	:	SOL for solid, SLA for slab or WAL for wall (default solid)

#### NOTE ON GUSSET PLATE THICKNESS (*tThick*)

If a value of 0.0 is specified for the gusset plate thickness, the beam web thickness will be utilized for the gusset plate thickness.

# Automated Gusset Plates for Fixed End Beams Documentation

## Definitions File - Command Definition (con'd)

### GRA Command - Grade Command defines grades options

(Note: Grade is used for edit option only)

**GRA** *iGrades sGrade1 ... sGraden*

where

**iGrades** : The number of grades (default value - 3,2,2 depending upon surface)  
**sGrades1** : Grade definition (24 character max - should also be defined in FrameWorks)  
**sGraden** : Last grade definition (10 maximum)

### NAME Command - Name Command defines method of naming components

(defines the initial value display & values - changeable in primary dialog box)

**NAME** {*NAME\_OPTION*} *name\_prefix*

where

{*NAME\_OPTION*} : Keyword - must be AUT or SPE or CON  
    *SPE*cified : Use the supplied name and append the member ID for gusset plate placed  
                  Thus each gusset plate will have a different name  
                  (This is the default option with the name "GPA")  
  
    *AUT*o : FrameWorks assigns names by type and sequence number  
           (name\_prefix not required or utilized)  
  
    *CON*stant : Use this name for all gusset plates

### BCS Command - Beam Connection Specification Command defines BCS file

(Optional command to define a Beam Connection specification file)

**BCS** *sBCSfile*

where

*sBCSfile* : Name of BCS (beam connection specification) file  
           Name includes file path, name and extension  
           Optional command:  
           if command not present, definition file is used for  
           all connections  
           if command is present, BCS file which fulfills BCS  
           specification is used for specific connection  
           else definition file is utilized

### NGP Command - Named Group Command defines namedgroups

(Optional command to define named groups)

**NGP** *iNGP\_solid iNGP\_slab iNGP\_wall*

where

**iNGP\_solid** : Named group for GP's placed as type SOLID ( default -1 which is none)  
**iNGP\_slab** : Named group for GP's placed as type SLAB ( default -1 which is none)  
**iNGP\_wall** : Named group for GP's placed as type WALL ( default -1 which is none)

NOTE: Namedgroups are defined globally for a project. The *iNGP\_xxx* value is an integer value that corresponds to the index of the global namedgroups. The first namedgroup is 0, the next is 1 and so on up to a maximum integer value of the number of namedgroups minus one. If a name group does not exist for the integer value specified, the member type in question will simply not be placed in a named group. A value of -1 specifies that the member type in question is not to be put in a namedgroup. In FWP namedgroups are specified by an alpha name so be careful when selecting integers. **SOLID NAMEDGROUPS ARE FUNCTIONAL with FWP version 7.00.00.17 and later.**

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## BCS & BCV Files

The BCS file, beam connection specification file, defines BCS sets. Each BCS set is a case, which is essentially a beam condition, with a corresponding BCV file. When a connection is being processed, the cases are studied starting with the first case and proceeding downward through the file. The first case that applies will dictate the BCV file used for the connection variables. If none of the cases are valid, the connection variables specified in the ACE\_GBA definition file are utilized. The case structure can be mixed as desired and can include either beam class or beam area or beam section (profile) or beam name. The entire case specification depends on the item specified (class, area, section, name) and can be best understood by looking at the file format on the ensuing pages. There can be from 1 to 25 case statements in a BCS file.

### BCS File

#### Sample BCS File

Typical BCS File w/ name *anything*.BCS (no spaces/blanks):

CAS	“Class 2 Cond”	class_spec	EQ	2	
CAS	“Very Large Area”	hugh_area	GT	18.0	
CAS	“WT”s”	wt_secs	LI	“WT”	
CAS	“W8x31 Prov”	w8_prov	MA	“W8X31”	
CAS	“SPL Named Beams”	spl_name	LI	“SPL”	
CAS	“Class Range 3-6”	class_range	BE	3	6

For each connection placed, the ACE\_GBA application starts with the first BCS case looking for a fulfilled condition. If a case condition matches, the specified BCV file is utilized. If the case condition fails, the next case condition is investigated. If all case conditions fails, the default condition specified in the ACE\_GHA definition file is utilized.

### BCV File

The BCV (beam connection variables) file carries basic gusset plate sizing & type information. A BCV file defines a set of connection variables for the four connection types and optionally parameter and location specifications. The BCV file may be created using a text edit and adhering to the format shown on the following pages.

When the BCV file is processed (read), connection variable & parameter values are placed in a BCS set. If a BCV file specifies only a subset of the information (i.e. for instance CON 1), the remainder of the BCS set for this case is the made up of the connection variables & parameters values which were read from the definition file.

#### Sample BCV File

```
UNITS ENGLISH
PAR 0.3750 2 A36 SLAB
CON BOT RAT 1.0 0.0 1.5 0.0 16
CON TOP RAT 0.0 0.0 0.0 0.0 16
```

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## Beam Connection Specification File Format

### BCS File - Command Definition

- **Has Only Two Valid Primary Keyword Commands: (CAS & UNI)**
- **Each record must begin with a the primary keyword or it is ignored**
- **A minimum of 1 CAS command is required, a maximum of 25 CAS commands are permitted**
- **All records that start with a blank (or incomplete) are considered comments**
- **The components of a given command (record) must all be present and in the order shown**
- **The full path & name location of the BCS file is specified in the ACE\_GBA definition file**
- **The Beam Connection Specification file must have a .BCS extension**
- **UNI command is identical to definition file and is not presented below**

### CAS Command - Case Command Structure

**CAS**    "*sCaseName*" *sFileName* {*Condition Statement*}

where :

**sCaseName:**                    Reference name for case up to 32 characters in quotes (spaces/ blanks are allowed)  
**sFileName:**                    Prefix Name of BCV file (32 char limit – no path – no extension – no spaces/blanks)  
**{Condition Statement}**        The condition may be CLA (class), ARE (area), SEC (profile or section) or NAM (name)

**{Condition Statement}** explanation

where:

#### CLASS Conditions

CLA	EQ	iValue		(note EQ stands for equal)
CLA	LE	iValue		(note LE stands for less than or equal)
CLA	LT	iValue		(note LT stands for less than)
CLA	GT	iValue		(note GT stands for greater than)
CLA	GE	iValue		(note GE stands for greater than or equal)
CLA	BE	iValueLow	iValueHigh	(note BE stands for between - inclusive)

#### AREA Conditions

ARE	EQ	fValue	
ARE	LE	fValue	
ARE	LT	fValue	
ARE	GT	fValue	
ARE	GE	fValue	
ARE	BE	fValueLow	fValueHigh

#### SECTION (Profile) Conditions

SEC	MA	"sValue"		(note MA stands for exact matches)
SEC	LI	"sValue"		(note LI stands "like" – similar first chars) LI matches len(sValue) chars

#### NAME Conditions

NAM	MA	"sValue"
NAM	LI	"sValue"

Where:

iValue	Integer value
iValueLow	Starting (lower) integer value
iValueHigh	Ending (higher) integer value
fValue	Floating point value
fValueLow	Starting (lower) floating point value
fValueHigh	Ending (higher) floating point value
sValue	Character data enclosed in quotes (spaces/blanks are permitted)

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## Beam Connection Variables File Format

### BCV File - Command Definition

- Valid Primary Keyword Commands : (UNI, CON & PAR)
- Each record must begin with a valid primary keyword or it is ignored
- All records that start with a blank are considered comments
- The commands/keywords (records) may be placed in any order however the order is significant
- All values for a given command must be defined in order shown above. If default values are acceptable, only the changed values must be given. However all values up to that point must be defined whether changed or not.
- The components of a given command (record) must all be present and in the order shown
- The units command is special and may be repeated and located as required. While commands may be in any order, it should be obvious that the location of the units command is extremely important.
- All input values are either in INCHES (ENGLISH) or MM (METRIC)
- By default application looks in the project BCS directory for BCV files

The **UNI**, **CON** & **PAR** commands are identical to the definition file and are not presented in detail here (see definition file section (presented previously) for complete command details).

*UNIT {UNITTYPE}*

*CON sTopBot sValRat fGPDepth fDc fGPWidth fWc iRound*

*PAR fThick iClass sGrade sSolidType*

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## LOG FILES

All applications can write log files if the environment variable `ACE_DUMP` is set to 1. There have been reports that some sites lock the C root drive and under certain conditions a locked C drive can cause a system fault 5.

All applications have been modified to warn of a locked drive/file and then gracefully exit. All applications now look for the environment variable `ACE_LOG_PATH`. If it is found, that is the directory where the log files will be placed. If the directory is locked or non-existent or if file is locked a warning will be given and the C drive will be tried. If it is locked or the file is locked a warning will be given and application will gracefully exit.

Usage of the variable `ACE_LOG_PATH` to control log file locations is similar to `ACE_DEF_PATH` to control DEF files. However there is one very important difference: `ACE_LOG_PATH` should NEVER point to a network drive (this is highly recommended for `ACE_DEF_PATH`). Everyone writes to the same named log file and if they are on a network drive there will be bad consequences. ALWAYS point `ACE_LOG_PATH` to a local drive (perhaps a temp off C root).