



# ACE Structural Engineering Applications LLC

## ACE FrameWorks FPL Utilities

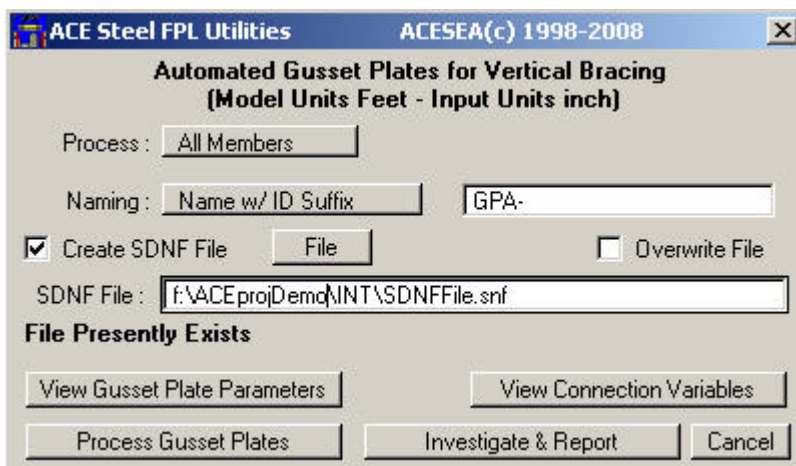
### Automated Gusset Plates for Vertical Bracing Documentation

Mar 15, 2013

#### Automated Gusset Plates for Vertical Bracing (ACE\_GPA.MA)

(Versions - FWP 3.1.x.x/3.2.x.x rel 2.0.9 & FWP 7.0.x.x rel 7.0.9 & FWP 7.1/7.2/7.3 rel 6.0.9 & FWP 8.0.x.x rel 8.0.9 & FWP 9.0.x.x rel 9.0.9 & FWP 10.0.x.x rel 10.0.9 & FWP 11.0.x.x rel 11.0.9 & FWP 12.0.x.x rel 12.0.9)

The *Automated Gusset Plates for Vertical Bracing* application both sizes and places gusset plates at each vertical brace (VBACE) end for the entire model (includes FWP attached models) or subset of the model defined by a selection set. The resulting gusset plate is always rectangular 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 rules and gusset plate sizing techniques are outlined in detail in the companion reference document “Modeling Vertical Bracing Gusset Plates for Interference Detection”. The reference document outlines the detailed rules for the various connection types and precisely defines gusset plate size and location for a given connection type with a specific set of user defined connection variables. Configurable connection variables provide a means to “tune gusset plate sizing”. As mentioned in the reference document, beams must be FrameWorks beams, columns must be FrameWorks columns and braces must be FrameWorks vertical braces. The connection end of a non-offset brace endpoint must either intersect a beam or column cardinal point (CP) line or intersect a beam or column endpoint. These and many other very important rules are discussed in the reference document - PLEASE READ THE REFERENCE DOCUMENT. This application and Gusset Plates for Vertical Bracing (ACE\_GPV) utilize the same connection types and sizing techniques. This utility allows defining a set of connection variable files with the VCS/VCV capability (pages 4 & 17). The ACE\_GPV is an excellent tool to determine values for the configurable connection variables, to create VCV files and to study connection behavior in general. The ACE\_GPA 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 - 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.

# **ACE Automated Gusset Plates for Vertical Bracing Documentation**

## **Connection Types**

This utility supports the following six vertical bracing connection types

- Type 1 - Two Brace to Beam (priority 9)
- Type 2 - Brace to Beam (priority 6)
- Type 3 - Brace to Beam-Column (priority 10)
- Type 4 - Brace to Column (priority 5)
- Type 5 - Brace to Column Base (priority 7)
- Type 6 - Two Brace to Column (priority 8)

Each vertical brace is studied (random order) to determine potential connections. Highest priority connections are attempted first and then lower priority connections are attempted until a connection is created or all options are exhausted. A vertical brace may have only one connection per end. The maximum number of gusset plates that can be placed is equal to twice the number of vertical braces. The number actually placed is generally much less due to the two brace to beam or column connections.

## **Automated Gusset Plates Primary Dialog Box Features**

This Gusset Plate application, ACE\_GPA, has been designed to automatically size and place vertical bracing gusset plates for the entire structure or optionally a subset of the structure. This FrameWorks Plus FPL application is limited to vertical bracing gusset plates only and features the following controls on the Automated Gusset Plates - Primary Dialog Box:

- Option button define processing scope
  - All Members
  - Selection Set
- 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 gusset plate parameters
- Button to view connection variables
- 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 memory for SDNF & UNDO capabilities 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 improved by keeping FrameWorks views inactive during process and windowing in to a blank view area.

# **ACE Automated Gusset Plates for Vertical Bracing Documentation**

## **Automated Gusset Plates - Basic Operation**

The Automated Gusset Plate application features simple but powerful operation. As previously mentioned this application is a companion of the Gusset Plates for Vertical Bracing application, ACE\_GPV. The ACE\_GPV application is valuable for studying vertical bracing connections and determining appropriate gusset plate sizing variables for an organizations connection standards and practices. ACE\_GPV is also valuable for special connection situations where a custom gusset plate might be desired. ACE\_GPA is the workhorse application which is intended for 95% plus of the vertical bracing gusset plates.

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 are as desired
- Step 2: Verify that the gusset plate parameters are as desired
- Step 3: Define the processing scope (all members all models or a selection set)
- Step 4: Select gusset plate naming options
- Step 5: Select SDNF 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 SDNF 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.

# ACE Automated Gusset Plates for Vertical Bracing Documentation

## Automated Gusset Plates - Basic Operation (continued)

### View Connection Variables (step 1)

This application only allows viewing the variables (unlike ACE\_GPV, editing is not allowed). Pressing the view connection variables button will produce the following dialog box.

Variable	Value
Connection Type	Two Braces to Beam
Wminimum	24.000
Dminimum	18.000
Wext	2.500
Dext	2.000
BoltDisMin	19.000
BoltDisArea	19.000
EdgeDis1	3.750
BraceRefArea	11.000
EdgeDis2	1.750
Roundoff	1/8 IN
VCS Set	Profile L Condition

Close      where: Profile like L\*

**View Connection Variables Dialog Box**

The only way to define the connection variables for this application is via the definitions file. The connection variables control the size and location for gusset plates. A VCS (vertical connection specification file) may be specified in the definitions file if so desired. If a VCS file is specified, the dialog box will look like above in that it references VCS set. A VCS set is a set of connection variables (also parameters), which will be utilized if the brace in question meets the condition. The conditions may involve brace class, brace area, brace profile and brace name. In connections involving more than one brace, the first brace placed in the file is utilized for the criteria. Each VCS set may be seen via the option button shown in the dialog box. Above, the default definition variables are shown. The VCS sets are shown in the order in which they will be investigated. For a given brace, 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.

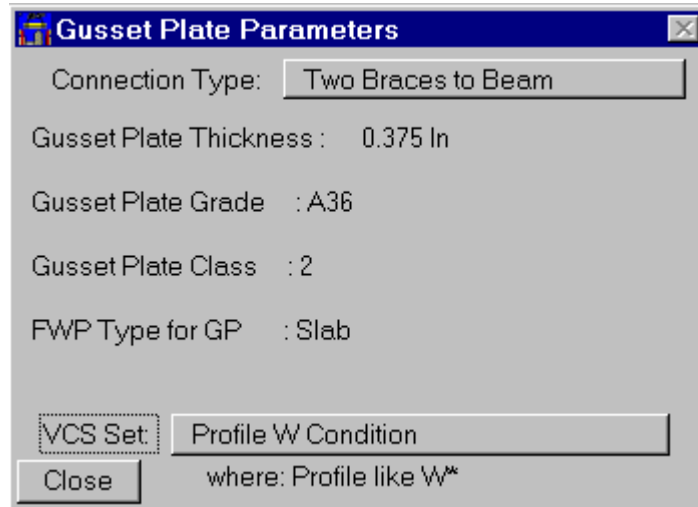
The definitions file, VCS and VCV files are discussed toward the end of this document. These files are critical for successful utilization of this application. The companion application, ACE\_GPV, is a tremendous tool for studying connections and determining connection variables for a project or organization. ACE\_GPV can also be utilized to create VCV files, which are the connection variable files for a VCS sets. **The reference document, “Modeling Vertical Bracing Gusset Plates for Interference Detection”, outlines the detailed rules for the various connection types and precisely defines gusset plate size and location for a given connection type with a specific set of user defined connection variables. The connection variables are discussed in detail in the reference document.**

# ACE Automated Gusset Plates for Vertical Bracing Documentation

## Automated Gusset Plates - Basic Operation (continued)

### View Gusset Plate Parameters (step 2)

This application only allows viewing the gusset plate parameters. Pressing the view gusset plate parameters button will produce the following dialog box.



**View Gusset Plate Parameters Dialog Box**

The only way to define the gusset plate parameters for this application is via the definitions file. The parameters are simple when compared to the connection variables. The parameters control thickness, class, grade and solid type. A VCS (vertical connection specification file) may be specified in the definitions file if so desired. If a VCS file is specified, the dialog box will look like above in that it references VCS set. A VCS set is a set of parameters (also connection variables), which will be utilized if the brace in question meets the condition. The conditions may involve brace class, brace area, brace profile and brace name. In connections involving more than one brace, the first brace placed in the file is utilized for the criteria. Each VCS set may be seen via the option button shown in the dialog box. Above, the default definition variables are shown. The VCS sets are shown in the order in which they will be investigated. For a given brace, 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.

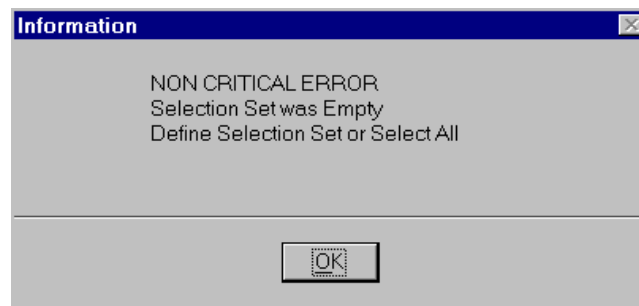
The definitions file, VCS and VCV files are discussed toward the end of this document. These files are critical for successful utilization of this application

# ACE Automated Gusset Plates for Vertical Bracing Documentation

## Automated Gusset Plates - 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 VBRACES (or 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 VBRACES, 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**

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

### Gusset Plate Naming (step 4)

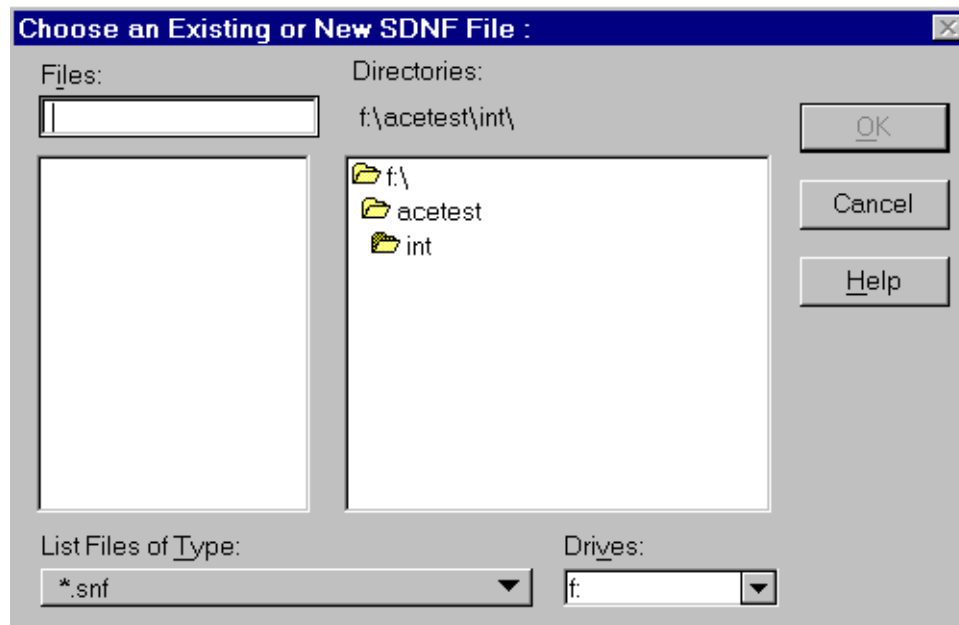
The gusset plate placed consists of one FrameWorks solid element (type: solid, slab or wall - specified in definition file) and may be named depending upon the naming option selected. The name may be a constant name or it may be a prefix with the FrameWorks gusset plate solid member ID (FWP ID) appended as a suffix. The default prefix is GPA, 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).

# ACE Automated Gusset Plates for Vertical Bracing Documentation

## Automated Gusset Plates - 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.

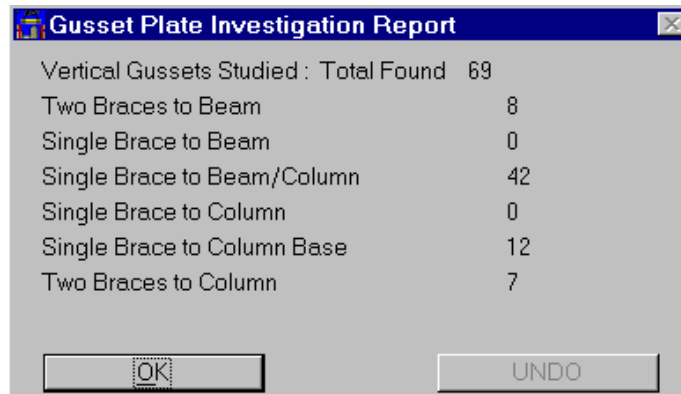
The SDNF file may also be specified with the SDNF name keyin field. If this option is utilized, both the name & path should be supplied.

# ACE Automated Gusset Plates for Vertical Bracing Documentation

## Automated Gusset Plates - Basic Operation (continued)

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

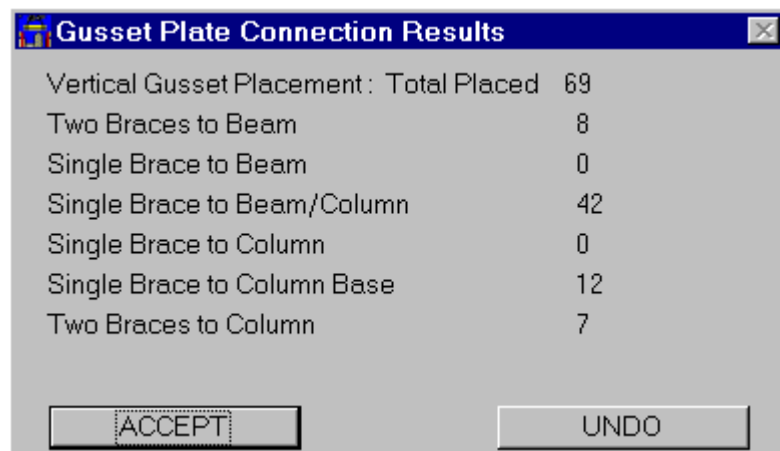
Investigate and Report is an optional step. Very large structures may require significant processing time. The investigate and report is always faster than the actual placement process (large numbers of solid placement is slow). When the investigate and report button is pressed, the following dialog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

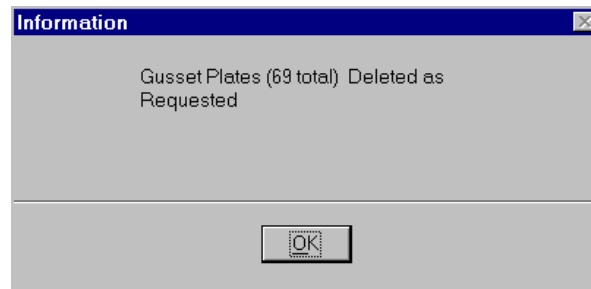
At this point the gusset plates may be accepted or rejected (immediately undone). Pressing the “UNDO” button will cause all of the previously placed gusset plates to be deleted and the following message dialog box will appear.



# ACE Automated Gusset Plates for Vertical Bracing Documentation

## Automated Gusset Plates - Basic Operation (continued)

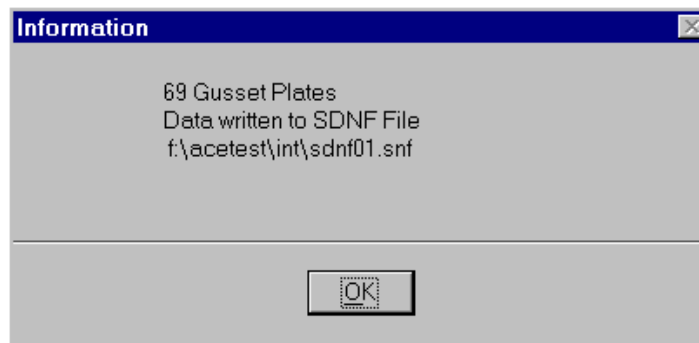
Execute the “Process Gusset Plates” option (step 7) continued



### 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.

# **ACE Automated Gusset Plates for Vertical Bracing Documentation**

## **Important Notes**

### **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).

### **Basic Framing & Connectivity Requirements**

All rules and requirements are outlined in the companion reference document “Modeling Gusset Plates for Interference Detection”. The basic framing and connectivity requirements are also outlined below:

1. The connection plane must form a vertical plane (parallel to z axis)
2. Braces may have end-offsets
3. Braces with offsets may not form a non-vertical plane when any 3 of the 4 endpoints are considered
4. Beams must be flat (lie in xy plane) and may not have end offsets
5. Columns must be vertical (parallel to z-axis) and may not have offsets
6. Braces (both offset & non-offset) and beam and/or column members must lie in the same vertical plane
7. None of the members may be colinear
8. Brace framed endpoint must lie on a column or beam CP line (generally a endpoint is acceptable). The brace framed endpoint is also termed the theoretical or resolved endpoint. The framed endpoint is the original endpoint before a brace offset is placed.

In addition to the above minimum requirements, connection specific detailed checks are performed during the attempt to size and place a gusset plate for a specific vertical brace end. The detailed checks and rules for each connection type are outlined in detail in the companion reference document “Modeling Gusset Plates for Interference Detection”.

# ACE Automated Gusset Plates for Vertical Bracing 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\_GPA.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\_GPA.DEF). A complete name and location of a definition file may be also specified with the environment variable ACE\_GPA\_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\_GPA\_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\_GPA.DEF is found in this directory, it is used.
3. If there is a c:\ace\_gpa.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      SAMPLENAME
PAR  1      .45    4      A42      SLA
PAR  2      .35    4      A42      SLA
PAR  3      .5     4      A42      SLA
PAR  4      .35    3      A36      SOL
PAR  5      .5     3      A50      SOL
PAR  6      .35    3      A42      WAL
CON  1      18.    2.    24.    2.5  19.0  3.75  1.75  19.0  11.0  8
CON  2      18.    2.    20.    2.5  19.0  3.75  1.75  19.0  11.0  8  20.0  0.0  3.1
CON  3      18.    2.    20.    2.5  19.0  3.75  1.75  19.0  11.0  8
CON  4      18.    2.    20.    2.5  19.0  3.75  1.75  19.0  11.0  8  20.0  2.6
CON  5      18.    2.    20.    2.5  19.0  3.75  1.75  19.0  11.0  8  0.0  2.6  3.0
CON  6      18.    2.    20.    2.5  24.0  3.75  1.75  19.0  11.0  8
NAM  SPE  GPA-
```

# ACE Automated Gusset Plates for Vertical Bracing Documentation

## Definitions File - Command Definition

- **Valid Primary Keyword Commands:** (UNI, GEN, CON, PAR, TOL, NAME, VCS)
- 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\_GPA.DEF definition file
- Definition file path may be defined with environment variable ACE\_\_DEF\_PATH
- ACE\_DEF\_PATH=d:\mydir\  
(the DEF file ACE\_GPA.DEF will be looked for in the directory d:\mydir)
- Definition file may be defined with environment variable ACE\_GPA\_DEF
- ACE\_GPA\_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*    *sSDNFfile*

where :

iScope	: 0-All Members 1-Selection Set - Initial Value
iSDNFcreate	: Toggle for ASCII SDNF file creation 1-On – 0-Off - Initial Value
sSDNFfile	: 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 variables

**CON**      *iConnection\_type*   *fDminimum*   *fDext*      *fWminimum*   *fWext*   *fBoltDisMin*  
                                 *fEdgeDis1*   *fEdgedis2*   *fBoltDisArea*   *fBraceRefArea*   *iRound*  
                                 *fMinAngle*   *fDexts*      *fWexts/fDgapmin*

where :

<b>iConnection_type:</b>	Connection Type 1 thru 6 (default 1) 1 - Two Brace to Beam 2 - Brace to Beam 3 - Brace to Beam-Column 4 - Brace to Column 5 - Brace to Column Base 6 - Two Brace to Column
<b>fDminimum</b> :	Minimum Gusset Depth for this Connection Type (inch or mm units)
<b>fDext</b> :	Gusset Plate extension for Depth for this Connection Type (inch or mm units)
<b>fWminimum</b> :	Minimum Gusset Width for this Connection Type (inch or mm units)
<b>fWext</b> :	Gusset Plate extension for Width for this Connection Type (inch or mm units)
<b>fBoltDisMin</b> :	Gusset Plate Min Bolting Distance for this Connection Type (inch or mm units)
<b>fEdgeDis1</b> :	Edge Distance from brace computed end to 1 <sup>st</sup> bolt for this Connection Type (inch or mm units)
<b>fEdgeDis2</b> :	Edge Distance from brace end to 1 <sup>st</sup> bolt for this Connection Type (inch or mm units)
	<b>Note:</b> non-offset braces will always use EdgeDis1 offset braces may be EdgeDis1 or EdgeDis2 depending on offset
<b>fBoltDisArea</b> :	Gusset Plate Bolting Distance for this Connection Type (inch or mm units) if Brace Area = fArea
<b>fBraceRefArea</b> :	Reference area for fBoltDisArea for this Connection Type (inch**2 or mm**2 units)
<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
<b>fMinAngle</b> :	Minimum angle where special treatment for Connection Types 2 or 4 occurs Angle measured from normal line to beam to brace Range for special treatment is 0 to fMinAngle (fMinAngle of 0.0 would essentially deactivate except for condition where brace is normal (90 degrees) to beam)
<b>fDexts</b> :	Gusset Plate extension for Depth start for Connection Type 4 or 5 (inch or mm units)
<b>fWexts/fDgapmin:</b>	fWexts - Gusset Plate extension for Width start for Connection Type 2 (inch or mm units) fDgapmin - specifies minimum allowable gap between Column Base (BOS) and the bottom of the Gusset Plate for Connection Type 5 (inch or mm units)

# ACE Automated Gusset Plates for Vertical Bracing Documentation

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

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

**PAR**        *sConnection\_type*   *fThick*   *iClass*   *sGrade*   *sSolidType*

where :

**sConnection\_type:**        Connection Type 1 thru 6 or ALL  
                                 1 - Two Brace to Beam  
                                 2 - Brace to Beam  
                                 3 - Brace to Beam-Column  
                                 4 - Brace to Column  
                                 5 - Brace to Column Base  
                                 6 - Two Brace to Column  
                                 ALL - use for all connection types

#### NOTES:

The last parameter command encountered controls  
For instance -. ALL could first be specified  
                                 then 2 could be specified to override settings for type 2

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

### TOL Command - Tolerance Command defines connectivity tolerance

**TOL**        *fUORTol*

where

**fUORTol**                : The number of UORS to use in tolerance calculations (default value – 2 UORs)  
Exact computations will work with perfect situations & precise framing. However, a small tolerance is generally required for correct computations. Generally the default value of 2 UORs should be adequate for most situations. For an English model with working units of: (Ft, In, 2032 PU), 2 UORs is equivalent to 2/2032 inch or 1 thousandth inch. For Metric models with: (M, MM, 80 PU), 2UORs is equivalent to 2/80 mm or 1 thousandth of an inch. For loose framing with irrational endpoint coordinates, increasing the tolerance may be beneficial. In many case changes from 2 to 4 UORs may be very beneficial. The value of fUOTtol may range from 0 to the number of positional units (PU). Thus for English the high end is typically 2032 and for Metric 80. Extremely large number are not generally required nor recommended. If fUORTol is specified larger than PU, fUORTol is set to PU.

### 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  
                                 SPEcified        : 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”)  
  
                                 AUTo                : FrameWorks assigns names by type and sequence number  
                                                                (name\_prefix not required or utilized)  
                                 CONstant        : Use this name for all gusset plates

# ACE Automated Gusset Plates for Vertical Bracing Documentation

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

### VCS Command - Vertical Connection Specification Command defines VCS file (optional command to define a Vertical Connection specification file)

**VCS**                    *sVCSfile*

where

*sVCSfile*                    : Name of VCS (vertical 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, VCV file which fulfills VCS  
                                 specification is used for specific connection  
                                 else definition file is utilized

SEE ACE\_GPA documentation for sVCSfile format (following pages) for a  
detailed explanation

### 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.**

# ACE Automated Gusset Plates for Vertical Bracing Documentation

## VCS & VCV Files

The VCS file, vertical connection specification file, defines VCS sets. Each VCS set is a case, which is essentially a brace condition, with a corresponding VCV 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 VCV file used for the connection variables. If none of the cases are valid, the connection variables specified in the ACE\_GPA definition file are utilized. The case structure can be mixed as desired and can include either brace class or brace area or brace section (profile) or brace 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 VCS file.

## VCS File

### Sample VCS File

Typical VCS File w/ name *anything.VCS* (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 Braces"	spl_name	LI	"SPL"
CAS	"Class Range 3-6"	class_range	BE	3      6

For each connection placed, the ACE\_GPA application starts with the first VCS case looking for a fulfilled condition. If a case condition matches, the specified VCV 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\_GPA definition file is utilized.



# ACE Automated Gusset Plates for Vertical Bracing Documentation

## VCV File

The VCV file carries basic gusset plate sizing & type information. The primary function of this file is to allow extreme flexibility in the automated application for vertical gusset plates. The automated application allows for the utilization of specific VCV files for specific brace criteria. Brace criteria can be: section size, name, class, or cross-sectional area. Cross-section area and class may be specified as ranges, greater than or less than. Section profile and name may be specified as matching or “like”. The interactive application is a great tool for experimenting with connection variables and creating VCV files.

When the VCV file is processed (read), existing connection variable & parameter values are replaced by valid values found in the VCV file. If a VCV specifies only a subset of the information (i.e. for instance CON 1) only that specific variable information is replaced.

### Sample VCV File (this sample created by this application)

(Note: This file has been edited to fit single line – some zeros removed)

**VCV file created on Sat Nov 04 11:51:55 2000**  
**UNIts ENGLISH**  
**PAR ALL 0.375000 2 A42 SLAB**  
**CON 1 18.00 2.00 24.00 2.50 19.00 3.75 1.75 19.00 11.00 8 0.00 0.00 0.00**  
**CON 2 18.00 2.00 20.00 2.50 19.00 3.75 1.75 19.00 11.00 8 45.00 0.00 3.10**  
**CON 3 18.00 2.00 20.00 2.50 19.00 3.75 1.75 19.00 11.00 8 0.00 0.00 0.00**  
**CON 4 18.00 2.00 20.00 2.50 19.00 3.75 1.75 19.00 11.00 8 45.00 2.60 0.00**  
**CON 5 18.00 2.00 20.00 2.50 19.00 3.75 1.75 19.00 11.00 8 0.00 0.00 0.00**  
**CON 6 18.00 2.00 20.00 2.50 19.00 3.75 1.75 19.00 11.00 8 0.00 0.00 0.00**

# ACE Automated Gusset Plates for Vertical Bracing Documentation

## Vertical Connection Specification File Format

### VCS 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 VCS file is specified in the ACE\_GPA definition file
- The Vertical Connection Specification file must have a .VCS 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 VCV 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)

# ACE Automated Gusset Plates for Vertical Bracing Documentation

## VCV 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 INT directory for VCV files

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

UNIT {UNITTYPE}

**CON**    *iConnection\_type*   *fDminimum*   *fDext*   *fWminimum*   *fWext*   *fBoltDisMin*   *fEdgeDis1*  
          *fEdgeDis2*   *fBoltDisArea*   *fBraceRefArea*   *iRound*   *fMinAngle*  
          *fDexts*        *fWexts/fDgapmin*

## PAR Command - Parameters Command defines general parameters

(this command pertains only to the VCV file)

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

where :

<i>sCon</i>	:	Connection Type 1 thru 6 or ALL - <i>sCon</i> is ignored but must be present note: the last parameter command encountered typically controls (i.e. last set of valid data)
<i>iClass</i>	:	9 >= class >= 0
<i>sGrade</i>	:	Grade value for Gusset Plate (if valid grade not found – remains unchanged)
<i>fThick</i>	:	Thickness value (inch or mm units)
<b><i>sSolidType</i></b>	:	SOL for solid, SLA for slab or WAL for wall (default solid)

# **ACE Automated Gusset Plates for Vertical Bracing Documentation**

## **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).