



ACE Structural Engineering Applications LLC

ACE FrameWorks FPL Utilities

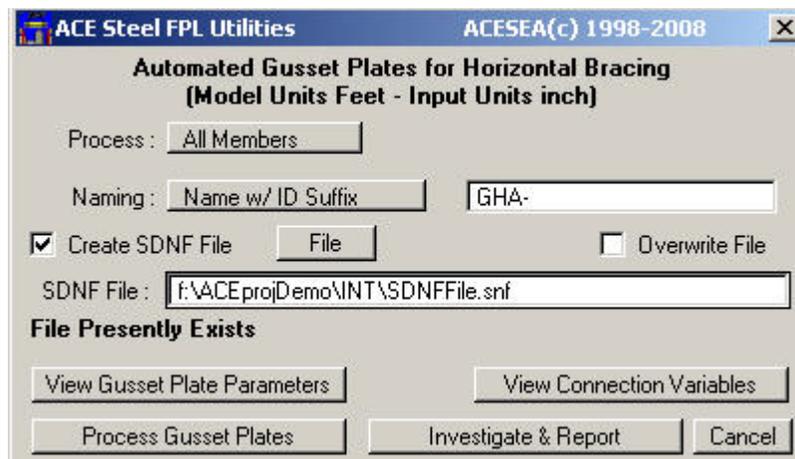
Automated Gusset Plates for Horizontal Bracing Documentation

Mar 15, 2013

Automated Gusset Plates for Horizontal Bracing (ACE_GHA.MA)

(Versions - FWP 3.1.x.x/3.2.x.x rel 2.0.6 & FWP 7.0.x.x rel 7.0.6 & FWP 7.1/7.2/7.3 rel 6.0.6 & FWP 8.0.x.x rel 8.0.6 & FWP 9.0.x.x rel 9.0.6 & FWP 10.0.x.x rel 10.0.6 & FWP 11.0.x.x rel 11.0.6 & FWP 12.0.x.x rel 12.0.6)

The *Automated Gusset Plates for Horizontal Bracing* application both sizes and places gusset plates at each horizontal brace (HBRACE) end for the entire model (includes FWP attached models) or subset of the model defined by a selection set. The resulting gusset plate is usually rectangular (warped plate possible w/ brace to two beam connection) 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 Horizontal 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 and braces must be FrameWorks horizontal braces. The connection end of a non-offset brace endpoint must either intersect a beam cardinal point (CP) line or intersect a beam 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 Horizontal Bracing (ACE_GPH) utilize the same connection types and sizing techniques. This utility allows defining a set of connection variable files with the HCS/HCV capability (pages 4 & 16). The ACE_GPH is an excellent tool to determine values for the configurable connection variables, to create HCV files and to study connection behavior in general. The ACE_GHA application is designed to place large numbers of gusset plates in one fell swoop. This application also provides the option to create a SDNF (steel detailing neutral) file, which can be transmitted to fabricator to define allowable gusset plate limits.



Automated Horizontal Bracing 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 Horizontal Bracing Documentation

Connection Types

This utility supports the following four horizontal bracing connection types

- Type 1 - One Horizontal Brace to Two Beam (Priority 10)
- Type 2 - Three Horizontal Braces to Beam (Priority 9)
- Type 3 - Two Horizontal Braces to Beam (Priority 8)
- Type 4 - One Horizontal Brace to Beam (Priority 7)

Each horizontal 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 horizontal 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 horizontal braces. The number actually placed is generally much less due to the two brace to beam or three brace to beam connections.

Automated Horizontal Bracing Gusset Plates Primary Dialog Box Features

This Gusset Plate application, ACE_GHA, has been designed to automatically size and place horizontal bracing gusset plates for the entire structure or optionally a subset of the structure. This FrameWorks Plus FPL application is limited to horizontal 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 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.

ACE Automated Gusset Plates for Horizontal Bracing Documentation

Automated Horizontal Bracing 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 Horizontal Bracing application, ACE_GPH. The ACE_GPH application is valuable for studying horizontal bracing connections and determining appropriate gusset plate sizing variables for an organizations connection standards and practices. ACE_GPH is also valuable for special connection situations where a custom gusset plate might be desired. ACE_GHA is the workhorse application which is intended for 95% plus of the horizontal 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 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.

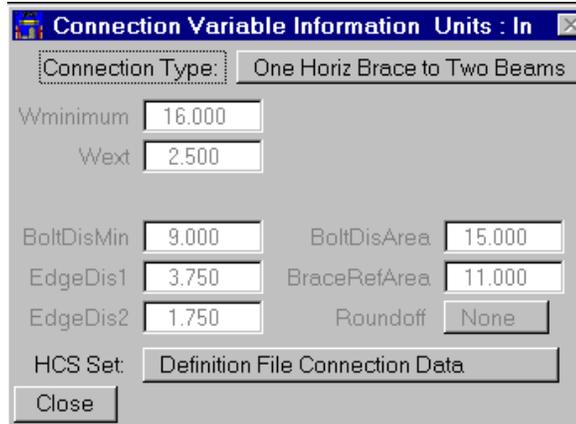
Each of the above steps is discussed in greater detail in the ensuing pages.

ACE Automated Gusset Plates for Horizontal Bracing Documentation

Automated Horizontal Bracing Gusset Plates - Basic Operation (continued)

View Connection Variables (step 1)

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



Variable	Value
Connection Type	One Horiz Brace to Two Beams
Wminimum	16.000
Wext	2.500
BoltDisMin	9.000
BoltDisArea	15.000
EdgeDis1	3.750
BraceRefArea	11.000
EdgeDis2	1.750
Roundoff	None
HCS Set	Definition File Connection Data

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 HCS (horizontal connection specification file) may be specified in the definitions file if so desired. If a HCS file is specified, the dialog box will look like above in that it references HCS set. A HCS 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 HCS set may be seen via the option button shown in the dialog box. Above, the default definition variables are shown. The HCS 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.

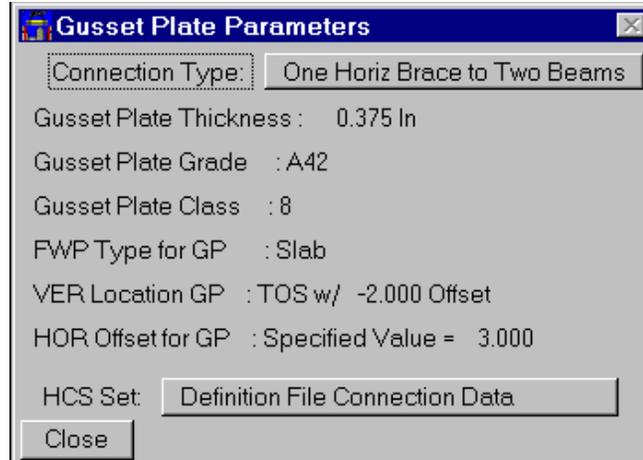
The definitions file, HCS and HCV files are discussed toward the end of this document. These files are critical for successful utilization of this application. The companion application, ACE_GPH, is a tremendous tool for studying connections and determining connection variables for a project or organization. ACE_GPH can also be utilized to create HCV files, which are the connection variable files for a HCS sets. **The reference document, “Modeling Horizontal 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 Horizontal Bracing Documentation

Automated Horizontal Bracing Gusset Plates - Basic Operation (continued)

Automated Horizontal Bracing 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, solid type, HOR offset and VER location. A HCS (horizontal connection specification file) may be specified in the definitions file if so desired. If a HCS file is specified, the dialog box will look like above in that it references HCS set. A HCS 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 HCS set may be seen via the option button shown in the dialog box. Above, the default definition variables are shown. The HCS 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.

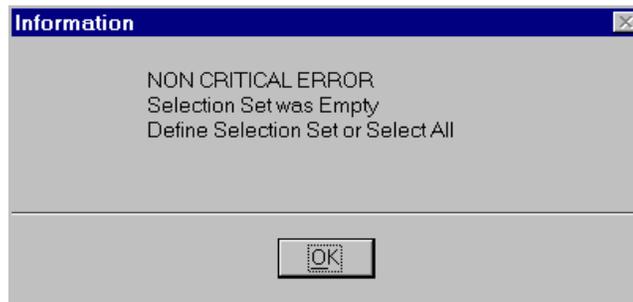
The definitions file, HCS and HCV files are discussed toward the end of this document. These files are critical for successful utilization of this application.

ACE Automated Gusset Plates for Horizontal Bracing Documentation

Automated Horizontal Bracing 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)

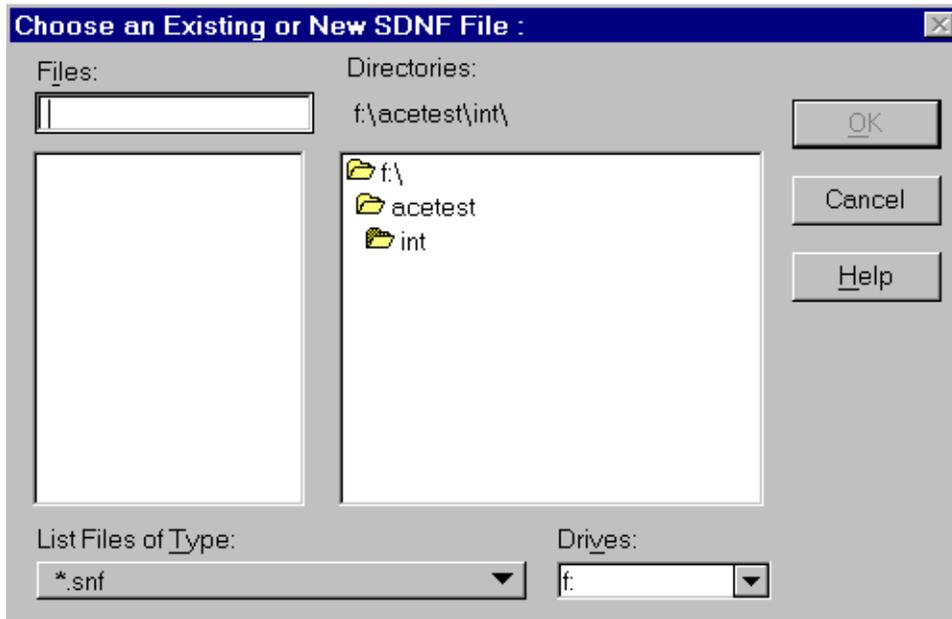
The gusset plate placed consists of one FrameWorks solid element (type: solid, slab or wall - specified in definition file) and may be named depending upon the naming option selected. The name may be a constant name or it may be a prefix with the FrameWorks gusset plate solid member ID (FWP ID) appended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

Automated Horizontal Bracing 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.

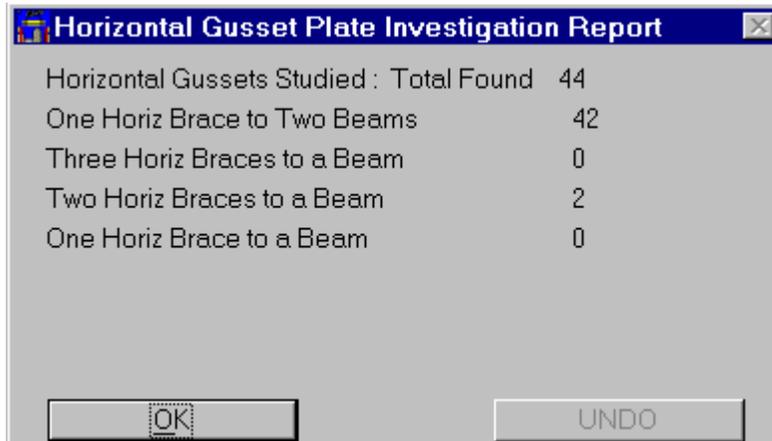
The SDNF file may also be specified with the SDNF name keyin field. If this option is utilized, both the name & path should be supplied.

ACE Automated Gusset Plates for Horizontal Bracing Documentation

Automated Horizontal Bracing Gusset - Basic Operation (continued)

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

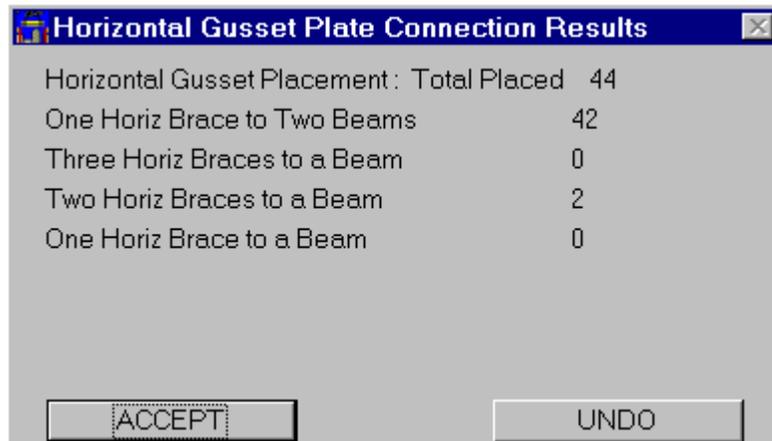
Investigate and Report is an optional step. Very large structures may require significant processing time. The investigate and report is always faster than the actual placement process (large numbers of solid placement is slow). When the investigate and report button is pressed, the following dialog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

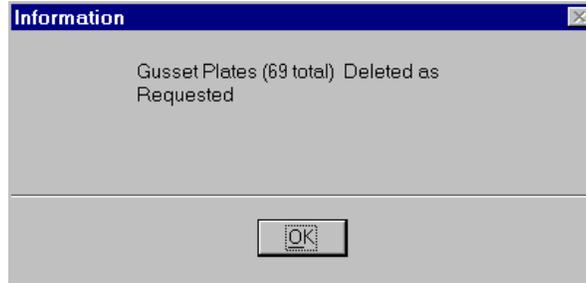


Process Gusset Plate Results Dialog Box

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 Horizontal Bracing Documentation

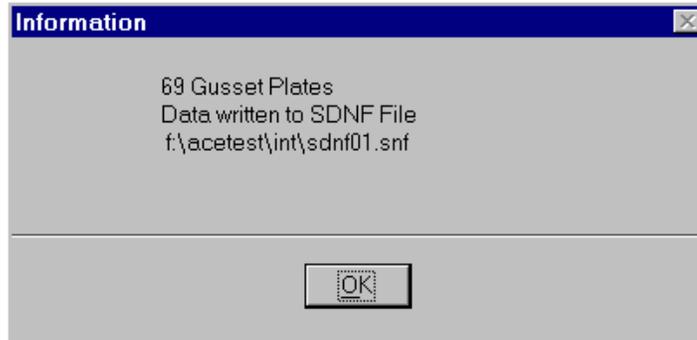
Automated Horizontal Bracing Gusset Plates - Basic Operation (continued)
Execute the “Process Gusset Plates” option (step 7) continued



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 Horizontal 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 horizontal plane (parallel to XY plane).
2. Horizontal braces must be flat (i.e. same Z).
3. Horizontal braces may have end-offsets.
4. Horizontal braces with offsets must have same Z offset at both ends (must be flat – lie in XY plane).
5. Beams must be flat (lie in XY plane) and may not have X and/or Y end offsets (beam Z offsets ignored).
6. Non-offset endpoints of brace and beam members must lie in the same horizontal plane (i.e. same Z).
7. None of the members may be collinear (i.e. no two members may not form a straight line).
8. Horizontal brace framed endpoint must lie on a beam CP line (generally an endpoint is acceptable). The horizontal brace framed endpoint is also termed the theoretical or resolved endpoint. The framed endpoint is the original endpoint before a horizontal brace offset is placed.
9. Connections involving multiple horizontal braces must share a common framed endpoint (the theoretical or resolved endpoint).

In addition to the above minimum checks, connection specific detailed checks are performed each time a member is selected for a specific connection type. The detailed checks and rules for each connection type are outlined in detail in the companion reference document “Modeling Horizontal Bracing Gusset Plates for Interference Detection”.

ACE Automated Gusset Plates for Horizontal 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_GHA.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_GHA.DEF). A complete name and location of a definition file may be also specified with the environment variable ACE_GHA_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_GHA_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_GHA.DEF is found in this directory, it is used.
3. If there is a c:\ace_gha.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 default file is provided below. The commands for the definition file are outlined in detail in following pages.

Sample Definitions File

Typical Definition File :

```
UNI  ENG
GEN   0      1      SDNFFile
PAR   1      .375  8  A42  SLA
PAR   2      .375  7  A42  SLA
PAR   3      .375  6  A42  SLA
PAR   4      .375  5  A36  SOL
HOR   ALL  SPE      OFF      3.00
HOR   3    AUTO
HOR   4    SPE      DEP
VER   ALL  TOS      -2.0
VER   2    BOS
CON   1     0.    0. 16. 2.5 9.0 3.75 1.75 15.0 11.0 0
CON   2    14.    2. 18. 2.5 9.0 3.75 1.75 15.0 11.0 8
CON   3    14.    2. 16. 2.5 9.0 3.75 1.75 15.0 11.0 8
CON   4    14.    2. 15. 2.5 9.0 3.75 1.75 15.0 11.0 8 2.6 20.0
NAM  SPE  GHA-
HCS  c:\HCSdata\test.hcs
```

ACE Automated Gusset Plates for Horizontal Bracing Documentation

Definitions File - Command Definition

- **Valid Primary Keyword Commands** : (UNI, GEN, CON, PAR, HOR, VER, TOL, NAME, HCS)
- 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_GHA.DEF definition file
- Definition file path may be defined with environment variable ACE_DEF_PATH
- ACE_DEF_PATH=d:\mydir\
(the DEF file ACE_GHA.DEF will be looked for in the directory d:\mydir)
- Definition file may be defined with environment variable ACE_GHA_DEF
- ACE_GHA_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 :

<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>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

ACE Automated Gusset Plates for Horizontal Bracing Documentation

Definitions File - Command Definition (con'd)

CON Command - Connection Command defines default connection parameters
(if not locked - values may be altered via Edit Connection Variables)

CON *iConnection_type* *fDminimum* *fDext* *fWminimum* *fWext* *fBoltDisMin* *fEdgeDis1*
 fEdgeDis2 *fBoltDisArea* *fBraceRefArea* *iRound* *fWexts* *fMinAngle*

where :

- iConnection_type** : Connection Type 1 thru 4 (default 4)
 1 - One Horizontal Brace to Two Beams
 2 - Three Horizontal Braces to Beam
 3 - Two Horizontal Braces to Beam
 4 - One Horizontal Brace to Beam

- fDminimum** : Minimum Gusset Depth for this Connection Type (inch or mm units)
- fDext** : Gusset Plate extension for Depth for this Connection Type (inch or mm units)
- fWminimum** : Minimum Gusset Width for this Connection Type (inch or mm units)
- fWext** : Gusset Plate extension for Width for this Connection Type (inch or mm units)
- fBoltDisMin** : Gusset Plate Min Bolting Distance for this Connection Type (inch or mm units)
- fEdgeDis1** : Edge Distance from brace computed end to 1st bolt for this Connection Type (inch or mm units)
- fEdgeDis2** : Edge Distance from brace end to 1st bolt for this Connection Type (inch or mm units)
- Note:** non-offset braces will always use EdgeDis1 - offset may be EdgeDis1 or EdgeDis2
- fBoltDisArea** : Gusset Plate Bolting Distance for this Connection Type (inch or mm units)
 if Brace Area = fArea
- fBraceRefArea** : Reference area for fBoltDisArea for this Connection Type (inch**2 or mm**2 units)
- iRound** : 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
- fWexts** : Gusset Plate extension for Width start for Connection Type 4 (inch or mm units)
- fMinAngle** : Minimum angle where special treatment for Connection Type 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)

VER Command - Horizontal Command defines gusset plate vertical offset settings

VER *sCon* *sVerOpt* *fOffset*

Where

- sCon** : Connection Type 1 thru 4 or ALL
 note: the last parameter command encountered typically controls
 (i.e. last set of valid data)
- sVerOpt** : TOS, BOS
 TOS - Place GP TOS at Brace Offset CP line
 BOS - Place GP BOS at Brace Offset CP line
- fOffset** : Vertical offset value between Brace Offset CP line & GP (TOS/BOS) (inch or mm units)
 (default value is 0.0)

ACE Automated Gusset Plates for Horizontal 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)

HOR Command - Horizontal Command defines gusset plate horizontal offset settings

HOR *sCon* *sHorMode* *sHorOpt* *fOffset*

where :

sCon : Connection Type 1 thru 4 or ALL
 note: the last parameter command encountered typically controls
 (i.e. last set of valid data)
sHorMode : AUTo or SPEcified
sHorOpt : if sHorMode is SPEcified
 then sHorOpt can be WEB, WIDth, DEPth or OFFset
fOffset : Horizontal offset value (inch or mm units)
 only if sHorType is SPEcified & sHorOpt is OFFset
 fOffset >= 0.0

ACE Automated Gusset Plates for Horizontal Bracing Documentation

Definitions File - Command Definition (con'd)

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

HCS Command - Horizontal Connection Specification Command defines HCS file

(optional command to define a Horizontal Connection specification file)

HCS *sHCSfile*

where

sHCSfile : Name of HCS (horizontal 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, HCV file which fulfills HCS
specification is used for specific connection
else definition file is utilized

SEE ACE_GHA documentation for sHCSfile format (following pages) and
more detailed explanation

ACE Automated Gusset Plates for Horizontal Bracing Documentation

Definitions File - Command Definition (con'd)

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 Horizontal Bracing Documentation

HCS & HCV Files

The HCS file, horizontal connection specification file, defines HCS sets. Each HCS set is a case, which is essentially a brace condition, with a corresponding HCV 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 HCV file used for the connection variables. If none of the cases are valid, the connection variables specified in the ACE_GHA 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 HCS file.

HCS File

Sample HCS File

Typical HCS File w/ name *anything*.HCS (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_GHA application starts with the first HCS case looking for a fulfilled condition. If a case condition matches, the specified HCV 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.

HCV File

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

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

Sample HCV File (this sample created by application ACE_GPH)

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

HCV file created on Sat Oct 28 09:48:53 2000

```
UNItS ENGLISH
PAR ALL 0.3750 2 A36 SLAB
VER ALL BOS -2.00
HOR ALL SPE WEB
CON 1 0.00 0.00 15.00 2.50 9.00 3.000 1.750 15.00 11.00 4
CON 2 13.00 2.00 18.00 2.50 9.00 3.750 1.750 13.00 11.00 8
CON 3 14.00 2.00 15.00 2.50 9.00 3.250 1.750 15.00 11.00 8
CON 4 14.00 2.00 14.00 2.50 9.00 3.500 1.750 14.00 11.00 4 2.60 25.00
```

ACE Automated Gusset Plates for Horizontal Bracing Documentation

Horizontal Connection Specification File Format

HCS 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 HCS file is specified in the ACE_GHA definition file
- The Horizontal Connection Specification file must have a .HCS 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 HCV 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 Horizontal Bracing Documentation

Horizontal Connection Variables File Format HCV File - Command Definition

- Valid Primary Keyword Commands : (UNI, CON, HOR, VER, 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 HCS directory for HCV files

The **UNI, CON, HOR, PAR & VER** 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* *fWexts* *fMinAngle*

HOR *sCon* *sHorMode* *sHorOpt* *fOffset*

VER *sCon* *sVerOpt* *fOffset*

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

ACE Automated Gusset Plates for Horizontal 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).