ACE Structural Engineering Applications LLC
ACE FrameWorks Utilities
Gusset Plates for Horizontal Bracing Documentation

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Gusset Plates for Horizontal Bracing (ACE_GPH.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 *Gusset Plates for Horizontal Bracing* application both sizes and greatly simplifies the placement of gusset plates for horizontal bracing framing. The resulting gusset plate is typically rectangular (provisions for special warped case included) 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 also provides the option to create a steel detailing neutral (SDNF) file which can be transmitted to fabricator to define allowable gusset plate limits.
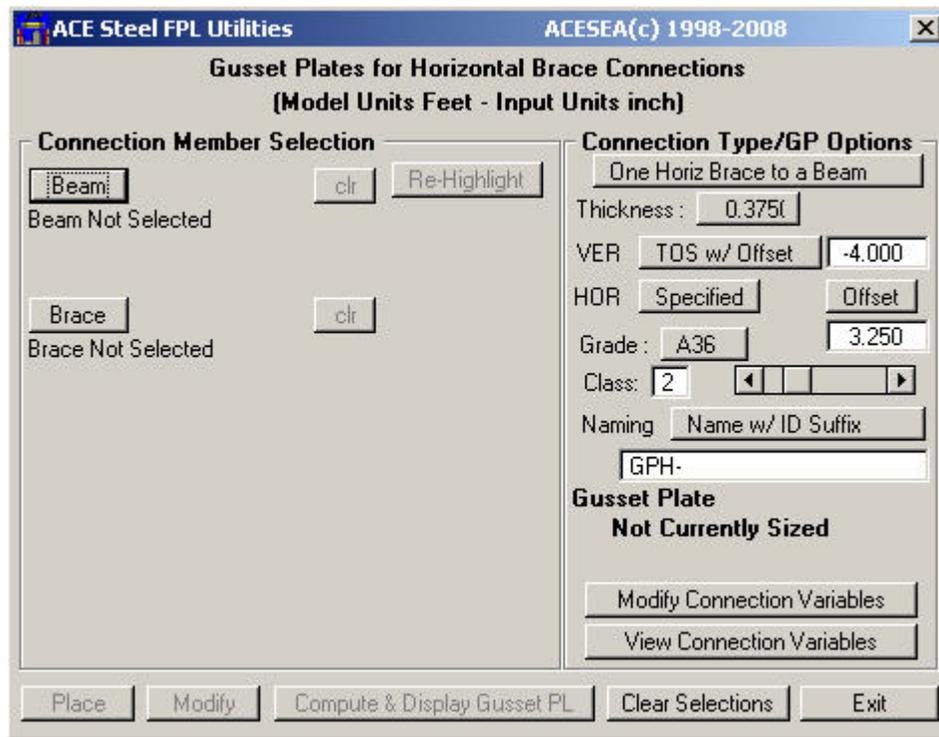
**Gusset Plates for Horizontal Bracing - Primary Dialog Box**

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 Gusset Plates for Horizontal Bracing Documentation

Connection Types

This utility currently supports four connection types:

Type 1 - One Horizontal Brace to Two Beam
Type 2 - Three Horizontal Braces to Beam
Type 3 - Two Horizontal Braces to Beam
Type 4 – One Horizontal Brace to Beam

One Horiz Brace to Two Beams
▶ Three Horiz Braces to a Beam
Two Horiz Braces to a Beam
One Horiz Brace to a Beam
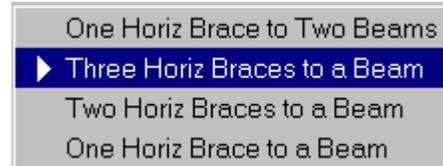
Gusset Plates for Horizontal Bracing Primary Dialog Box Features

This Gusset Plate application, ACE_GPH.MA, has been designed to greatly facilitate both the sizing and placement of horizontal bracing gusset plates. This FrameWorks Plus FPL application is limited to horizontal bracing gusset plates only and features the following controls on the Gusset Plates for Horizontal Bracing - Primary Dialog Box:

- Option button to select connection type
    - Buttons to select connection components (Beam(s) and Horizontal Brace(s))
    - Buttons to highlight or clear connection components
- Option button to select grade
    - up to 10 choices
    - may be user defined
- Option button to select vertical GP location relative to brace CP line (TOS/BOS, w or w/o Offset)
- Option button(s) to select horizontal GP offset from beams
    - May be "auto" computed
    - May be specified as beam web thickness, width, depth or a specified distance
- Option button to select thickness (up to 9 choices)
    - Choices may be user defined
    - A thickness may be keyed in
- Slider/Keyin to select class (0 to 9)
- Naming option Parameters
    - Option button to select naming technique
    - Name keyin field (if autoname not selected)
    - Toggle for Mbr_ID suffix during placement (dynamic naming)
    - Name input during placement (dynamic naming)
- Button to modify connection variables
- Button to view connection variables
- Button to modify a sized gusset plate
- Display of a currently sized gusset plate
- Button to clear all selections

Gusset Plate Naming

The gusset plate placed consists of one FrameWorks solid (type: solid, slab or wall - specified in definition file) element 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 solid member ID (FWP ID) appended as a suffix. The default prefix is GPH, however a different prefix may be specified in the definition file or supplied at runtime. Other naming options include: dynamic naming at placement time; a constant specified name; or FrameWorks normal naming for individual components (autoname). Dynamic naming allows the name to be selected (or remain the last name selected) at placement time with or without appending the FWP ID to the name.

# ACE Gusset Plates for Horizontal Bracing Documentation

Gusset Plates for Horizontal Bracing - Basic Operation

The process of placing a gusset plate is initiated by first selecting a connection type. Once a connection type is selected, selection buttons for proper component types are activated. Whenever the connection type is changed, previously selected components and gusset plate if sized is cleared. The connection components may be selected in any order. To select a component, press the desired button and then select the FWP member with the data button. As each component is selected, a detailed set of connection checks is performed to assure rule compliance.   The connection checks include both minimum general checks (described later in this document) as well as connection type specific checks (detailed in the companion document "Modeling Horizontal Bracing Gusset Plates for Interference Detection").

If the connection component does not pass the extensive rules checks, a message detailing the violation is displayed in an information message dialog box (typical failures are shown below).
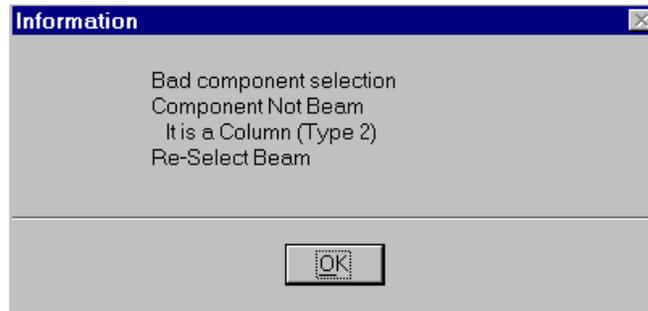
Incorrect Component Selection

**Failed Horizontal Plane (Flatness) Check**
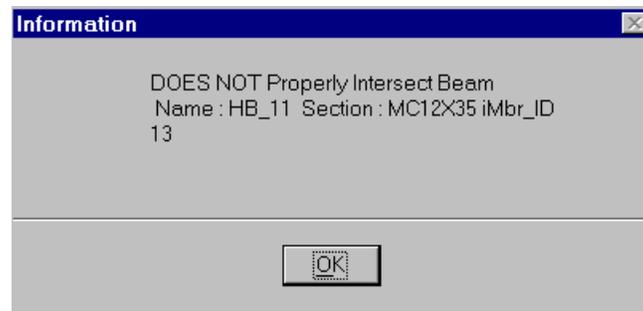
Failed Intersection Check

The checks each member goes through during the selection process are extensive to say the least. There are over 25 possible failure messages. The rules for connection types are outlined in detail in the reference document "Modeling Horizontal Bracing Gusset Plates for Interference Detection".

ACE Gusset Plates for Horizontal Bracing Documentation

Gusset Plates for Horizontal Bracing - Basic Operation (continued)

For each horizontal brace or beam selected which passes the rules check, the accept/reject dialog box shows it's name, profile name, FWP_ID/model, and pertinent coordinate information. Beams display X & Y start and end coordinates & elevation (Z offset if beam is offset). Braces display depends upon whether or not the brace has end point offset(s). If the brace has no end offsets, start & end coordinates are displayed along with message that there are no offsets. If the brace has offsets, the non-offset end point(s) (NOEP) are displayed along with the offset value(s). Sample for a beam and horizontal braces with and without offsets are shown below.
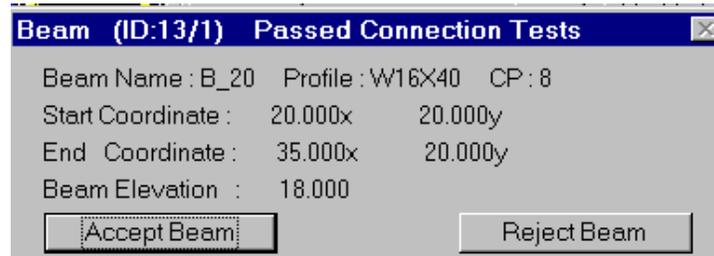

Accept/Reject Component Dialog Box for Beam
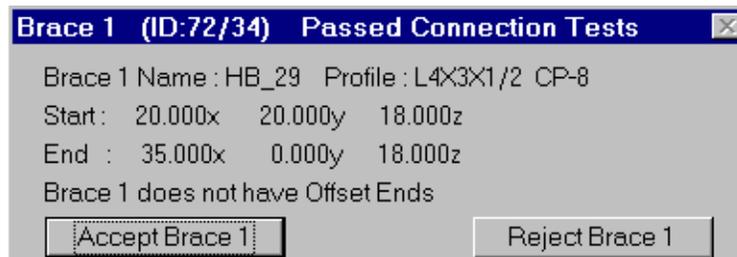
Accept/Reject Component Dialog Box for Brace w/o Offset

Brace Offset Notes

The above example shows a brace where end offsets are not present. Brace end offsets can significantly affect the size and location of the resulting gusset plate (Beam Z offsets have no effect). The connection point (a very important point) is not influenced by end offsets. The connection point is the original framed end point of the brace end participating in the connection. If there are no offsets, the original framed point is simply the end point of the brace. If there are end offsets, the original framed end point (also termed theoretical end point or non-offset end point (NOEP)) is the connection point and is computed as the sum of the displayed end point and the offset vector. The FWP command "Review Member" will show the displayed end points and the offset vectors. The visual location of the brace end is the offset end point (OEP). The ACE FrameWorks utility, Remove/Show Offsets (ACE_OU), can be helpful in understanding and/or removing end offsets. End offsets are discussed at length in the documentation for this utility. The next dialog box shows a brace with end offsets. The offset brace was the brace utilized in the ensuing sample. The non-offset brace (above) was included in attempt to clarify the difference between offset and non-offset braces.
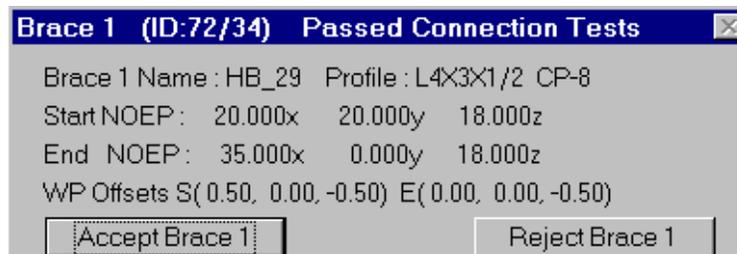
Accept/Reject Component Dialog Box for Brace w/ Offset

Gusset Plates for Horizontal Bracing - Basic Operation (continued)

ACE Gusset Plates for Horizontal Bracing Documentation

The following dialog box illustrates the situation once all necessary components for a specific connection type have been selected and accepted. Note that in the dialog box below the visual end point for the brace (in this case an offset end point - OEP for the brace end) is shown. This dialog box always displays the visual end point for braces (i.e. the visually displayed end point as opposed to the original framed or theoretical end point).
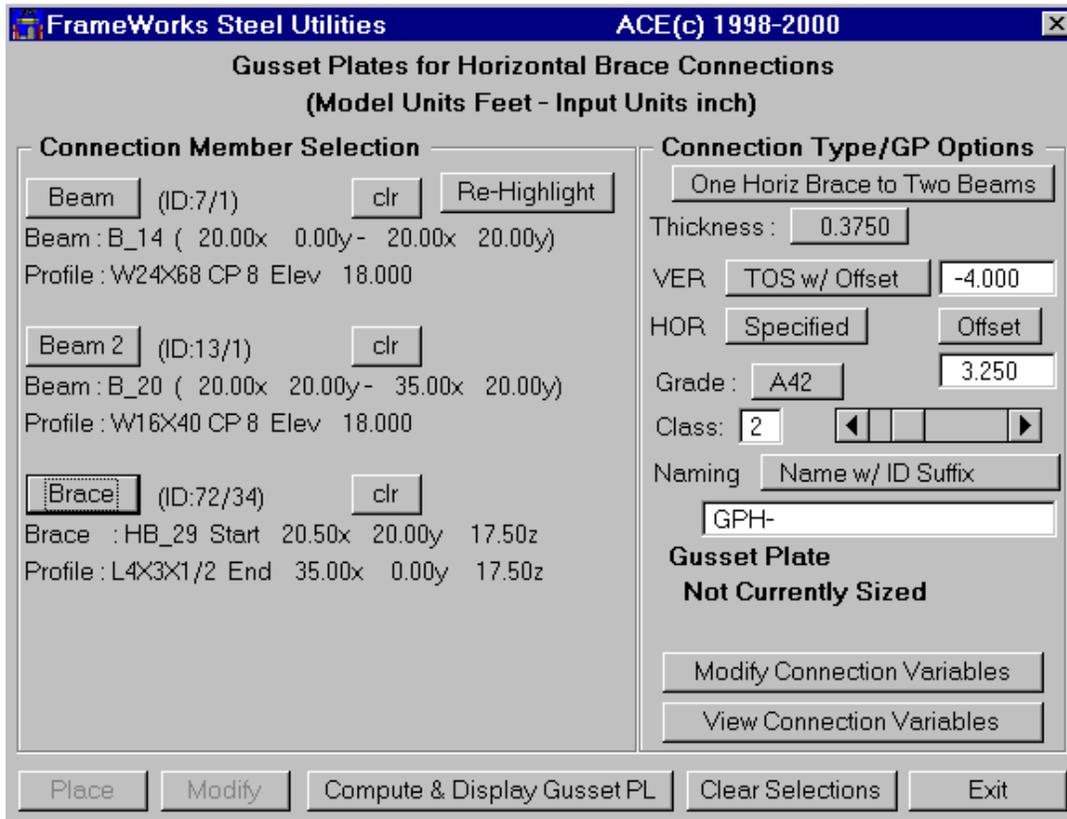

Gusset Plate for Connection Type 1 - Components Selected - Ready for Sizing

In the figure above, a gusset plate for connection type 1 is being sized. Proper components (two beams and a horizontal brace) have been selected (all components have passed both minimum and detailed checks). Once proper connection components have been selected, the "Compute & Display GP" button activates as shown above. At this point, the thickness, VER (vertical offset specification), HOR (horizontal offset specification), grade, class, naming, or connection variables may be changed and the connection components will remain selected. If the connection type is changed (even momentarily), all components will be cleared (same effect as pressing the "Clear Selections" button). Once selected, a individual beam and/or brace component may be cleared by pressing the corresponding "clr" button. A selected component may be reselected, however the rule checking will verify that the newly selected member passes rules checks with the existing (currently selected) members. If the newly selected member does not pass checks, an error message will be displayed. If this occurs, clear the offending component(s) before reselecting new component.

If the "Compute & Display Gusset PL" button is pressed, a gusset plate will be sized and displayed as shown in the next figure.

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Gusset Plates for Horizontal Bracing - Basic Operation (continued)
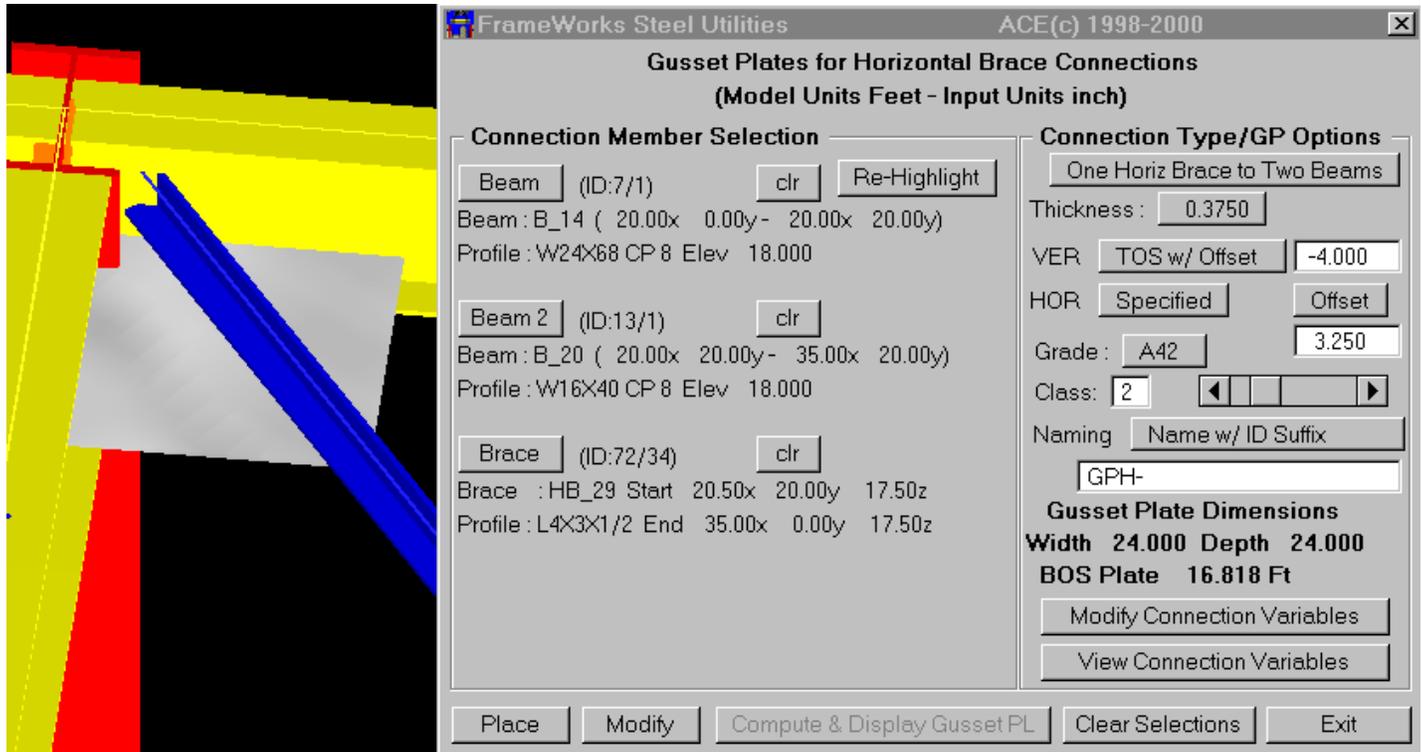
Gusset Plate for Connection Type 1 - Ready for Place or Modify or Changes

As mentioned, when the Compute & Display GP button is pressed, the gusset plate is sized and a MicroStation element is temporarily placed and displayed. The gusset plate size is shown on the primary dialog box and the "Place" & "Modify" buttons are activated (un-dimmed). The gusset plate size is dependent upon the connection variables. At this point, the gusset plate can be placed or modified (Modify button) or changed (changing variables).

The changes can be non-destructive, semi-destructive or destructive. Non-destructive changes are items on the dialog box that may be modified without changing the connection. For instance the following non-destructive items may be changed: grade, class and name. Semi-destructive changes require that the gusset plate be re-sized. The thickness, VER setting or HOR setting of the connection may be modified prior to placement, however this will cause the "Place" button to deactivate, the element to be deleted and the "Compute & Display GP" button to activate. Pressing the "Compute & Display GP" button will resize and display the new gusset plate. Another semi-destructive change would be a change in the connection variables. When connection variables are changed, the gusset plate must be re-sized. The connection variables may be changed "on the fly" by pressing the "Edit Connection Variables" button (provided this feature is not locked). NOTE: Changing the connection type (even momentarily) is a destructive change (same as pressing the "Clear Selections" button).

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Gusset Plates for Horizontal Bracing - Basic Operation (continued)
Editing the Connection Variables
When the Modify Connection Variables button is pressed, the following dialog box appears.
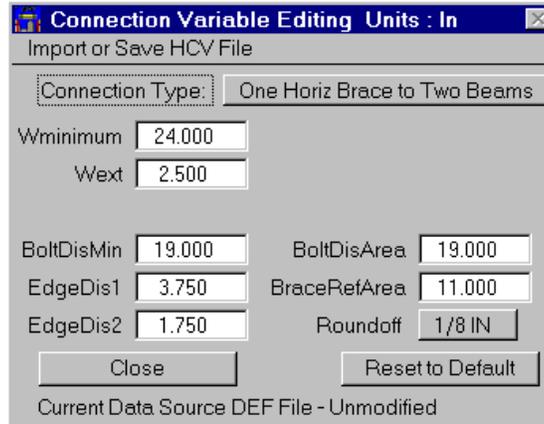
Dialog Box for Editing Connection Variables

All of the values may be edited by simply changing the values in the text input boxes. All four of the connection types may be edited from this dialog box. The original definition file (or internal program defaults) connection variables may be reinstated by pressing the button "Reset to Default". The text at the bottom of the dialog box tells the source of the data and whether or not it has been modified. If the source is a definition file or a HCV file, the name of the file is displayed in the MicroStation message area. If a definition file is initially read, the default data is the data contained in the definition file. If a definition file was not read, internal program values are the default. It is highly recommended that custom definition files be used for this application. It is highly unlikely that internal program values will produce optimum results.

Importing/Saving HCV Files
The edit dialog box also allows importing and/or saving HCV files. HCV files are essentially subset definition files that contain connection parameters, which include: connection variables for all four connection types, HOR & VER offset settings, thickness, grade, class and solid type. These files are discussed in details at the end of this document. HCV files can be utilized effectively with the automated Horizontal Gusset Plate application to further control gusset plate sizing and placement. To save a HCV file, select "Save HCV File" from the "Import or Save HCV File pulldown menu. The following dialog box will appear:
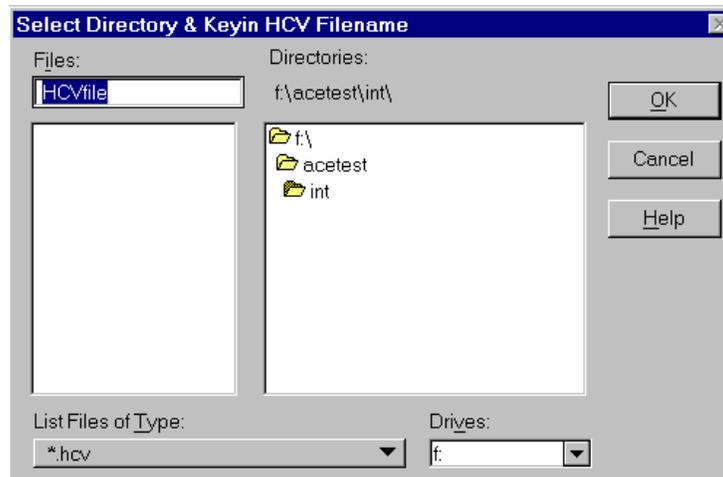
SAVE HCV File Dialog Box

ACE Gusset Plates for Horizontal Bracing Documentation

Gusset Plates for Horizontal Bracing - Basic Operation (continued)

Simply keyin a desired HCV file name and press enter. By default the HCV file will be saved in the directory defined by the environment variable ACE_GPH_HCV if defined or if not defined the project INT directory. If desired, a different directory may be selected.   If a HCV extension is not on the filename, an HCV extension will be added to the filename. After an HCV file is saved, the edit connection variables dialog box will indicate that connection values are from that HCV file with no modifications. To import an HCV file, select "Import HCV File" from the "Import or Save HCV File" pulldown menu. The following dialog box will appear:
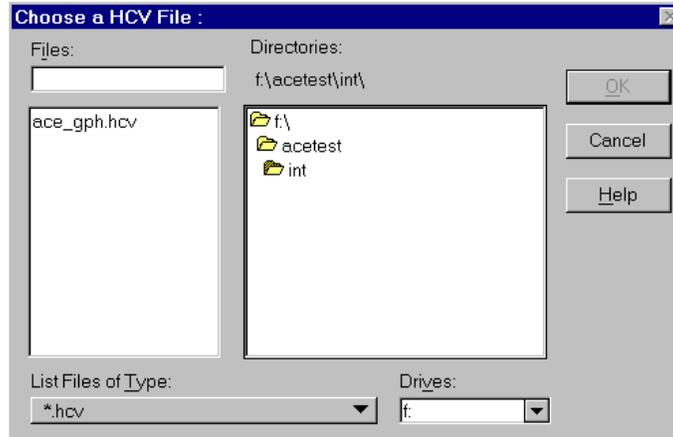
IMPORT HCV Dialog Box

The application will check to see if environment variable ACE_GPH_HCV is defined. If it is, that directory will be displayed. If not, the project INT directory will be displayed. Select the desired HCV file and press OK. The HCV file will be read and the new connection variables and parameters will be displayed in appropriate dialog boxes. After an HCV file is imported, the edit connection variables dialog box will indicate that values are from that HCV file with no modifications.

Whenever the connection variables are modified, the gusset plate element is deleted and the "Compute and Display GP" button is re-activated. A revised gusset plate can be sized and displayed by pressing the button. At this point the gusset plate may be modified or placed.

Viewing Connection Variables

The connection variables may be displayed at any time by pressing the "View Connection Variables". Displaying the connection variables will not alter the current status (i.e. no changes will occur).
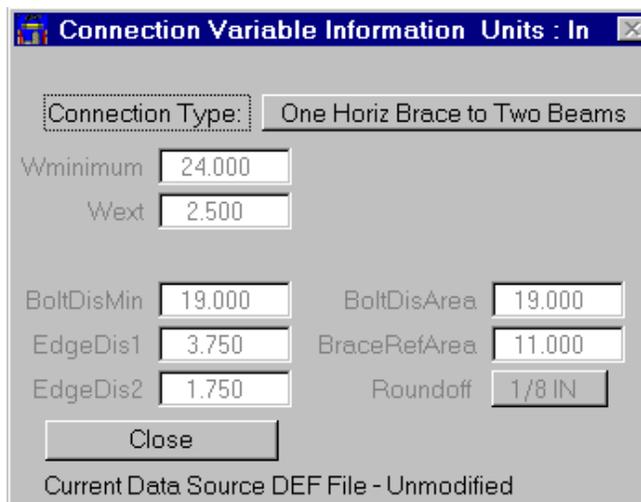
Dialog Box for Viewing Connection Variables

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Gusset Plates for Horizontal Bracing - Basic Operation (continued)
Modify Button - Modifying a Sized Gusset Plate
When the "Modify" button is pressed, the following dialog box appears:
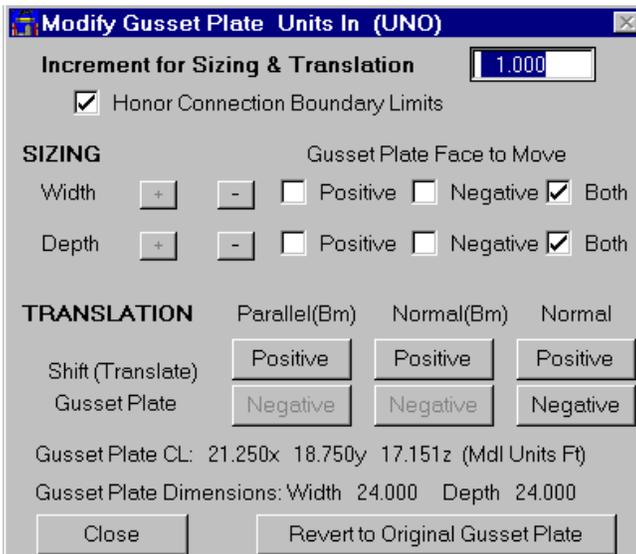
The modify capability allows resizing and/or moving the gusset plate. The modify dialog box has a toggle option "Honor Connection Boundary Limits". If it is toggled on, the gusset plate cannot grow or translate into connection boundaries. At any time, the original connection may be obtained by pressing the "Revert to Original Gusset Plate" button. Once the gusset plate modification is finished, the dialog box should be closed and the gusset plate may then be placed. At that point, the gusset plate could again be modified by pressing the modify button. Once changed, the modified connection geometry remains active unless either the "Revert to Original Gusset Plate" button is pressed or the connection data is altered and the gusset plate re-sized and displayed.

Dialog Box for Modifying Gusset Plate

Place Button – Placing a FrameWorks Gusset Plate Solid Element
The "Modify Gusset Plate" operation has no effect on the status of the "Place" button on the main dialog box. When the "Place" button is pressed, a FrameWorks solid element (slab, solid or wall type - specified only in definition file - solid is the default) will be placed, the MicroStation elements will be deleted and connection components as well as other data will be cleared on the primary dialog box. Before placement, many of the items on the dialog box may be modified without changing the connection. For instance the following items may be changed: grade, class and name. The thickness, VER and/or HOR setting of the connection may be modified prior to placement, however this will cause the "Place" button to de-activate, the element to be deleted and the "Compute & Display GP" button to re-activate. Pressing the "Compute & Display GP" button will resize and display the new gusset plate. If the gusset plate was previously modified, the modifications will again be necessary. When the "Place" button is pressed, a gusset plate will be placed as a FrameWorks solid (slab, solid or wall element).

If dynamic naming has been selected as the naming option, the following dialog box is displayed when "Place" is pressed.

Dynamic Naming Dialog Box

If "OK" is pressed, the gusset plate will be placed. If "Abort Placement" is pressed, the placement process is terminated and the situation prior to pressing place will be restored (i.e. gusset plate will still be sized and all connection components will be highlighted).

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Gusset Plates for Horizontal Bracing - Basic Operation (continued)

After the first gusset plate is placed during a session, the "Exit" button changes to [Exit & Save]
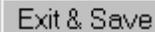
If gusset plate(s) have been placed, the following alert occurs upon exit (either from "Exit & Save" or other method such as closing dialog box, selecting another model or the new command).
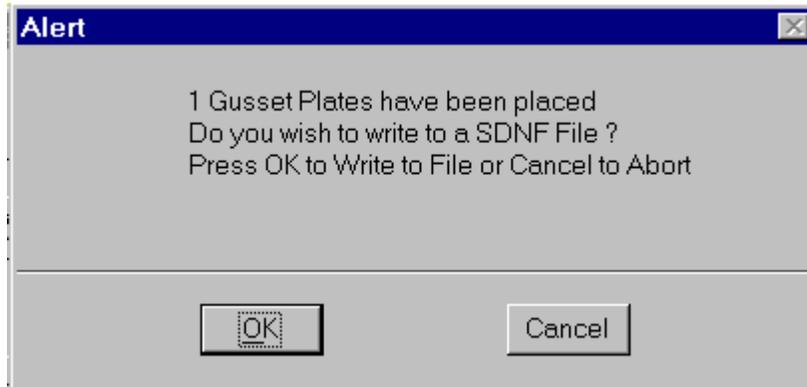
Option to Write SDNF File

If cancel is pressed, the application will be exited without writing a SDNF file. Note however that a binary history file is always written (if it exists – appended) for each model. This file is placed in the project INT directory and is named ModelName.ACE. Both vertical & horizontal gusset plates are written to the same file.

If OK is pressed, a dialog box requesting name and location for SDNF file appears
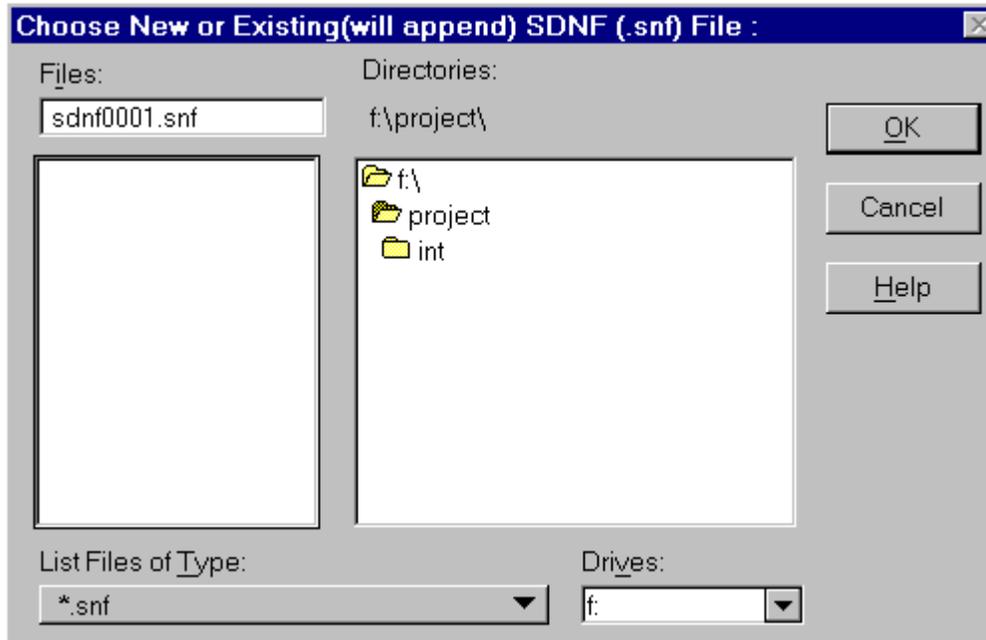
SDNF File Location Dialog Box

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 will be written and the application will be terminated after successful write message. Note that an existing file may be selected (the file may contain both vertical and/or horizontal bracing gusset plates). If an existing file is selected, new SDNF data will be appended to the existing file.

ACE Gusset Plates for Horizontal Bracing Documentation

Basic Member Component Checks

Planarity, Colinearity, Connection Plane, Flatness, Offsets & Intersection Checks - minimum checks

All rules and requirements are outlined in the companion reference document "Modeling Horizontal Bracing 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 a 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 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_GPH.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_GPH.DEF).   A complete name and location of a definition file may be also specified with the environment variable ACE_GPH_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_GPH_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_GPH.DEF is found in this directory, it is used.
3. If there is a c:\ace_gph.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 :

```
     Sample Definition File for
     Gusset Plate for Horizontal Bracing Utility  (11/04/2000)
      (All records that start with a blank are comments)
      (Definition Commands are defined at bottom of this file)

UNI  ENG
GEN  4  A36     2     .375 NOLOCK   SLAB
HOR  ALL   SPE   OFF   3.00
VER  ALL   TOS   -2.0
GRA  3     A36        A42        A50
TKS  6     .25     .375     .5    .75     1.0  12.0
CON  1      0.  0. 16. 2.5 9.0 3.75   1.75   15.0   11.0    8
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 GPH-
```

ACE Gusset Plates for Horizontal Bracing Documentation

Definitions File - Command Definition

- **Valid Primary Keyword Commands: (UNI, GEN, CON, HOR, VER, GRA, TKS, TOL, NAME)**
- **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_GPH.DEF definition file**
- **Definition file path may be defined with environment variable ACE__DEF_PATH**
- **ACE_DEF_PATH=d:\mydir**
  (the DEF file ACE_GPH.DEF will be looked for in the directory d:\mydir)
- **Definition file may be defined with environment variable ACE_GPH_DEF**
- **ACE_GPH_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   iConnection_type sGrade iClass fThick sLOCK sSolidType
   where :
   iConnection_type：   Connection Type 1 thru 4 (default 1) - Initial Value
                      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

   sGrade   : Grade value for Gusset Plate (default A36)   - Initial Value
   iClass   : 9 >= class >= 0 (default 2) - Initial Value
   fThick   : Thickness value (inch or mm units) - Initial Value
   sLOCK   : LOCK - locks interactive connection variable editing (default not locked)
   sSolidType   : SOL for solid, SLA for slab or WAL for wall (default solid)

ACE Gusset Plates for Horizontal Bracing Documentation

Definitions File - Command Definition (con'd)

CON Command - Connection Command defines default connection parameters
<div align="center">(if not locked - values may be altered via Edit Connection Variables)</div>

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)

HOR Command - Horizontal Command defines gusset plate horizontal offset settings

HOR   sCon sHorMode   sHorOpt   fOffset

where :

SCon	:	Connection Type 1 thru 4 or ALL - sCon is ignored but must be present
		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

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Definitions File - Command Definition (con'd)

VER Command - Horizontal Command defines gusset plate vertical offset settings

VER   sCon   sVerOpt   fOffset
  Where

SCon	:	Connection Type 1 thru 4 or ALL - sCon is ignored but must be present
		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)

GRA Command - Grade Command defines grades options

GRA   iGrades sGrade1 ... sGraden
  where

iGrades	:	The number of grades (default value - .375 inches)
sGrades1	:	Grade definition (24 character max - should also be defined in FrameWorks GRADE.DAT)
sGraden	:	Last grade definition (10 maximum).

TKS Command - Thickness Command defines thickness options

TKS   iTks sTks1 ... sTksn
  where

iTks	:	The number of thickness for each gusset plate (default value - .375 inches)
fTks1	:	First thickness definition definition (all thickness values must be greater than 0)
fTksn	:	Last thickness definition (9 maximum).

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.

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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.**

NAME Command - Name Command defines method of naming Gusset Plates
> (defines the inital value display & values - changeable in primary dialog box)

NAME {NAME_OPTION} name_prefix
  where
{NAME_OPTION}	: Keyword - must be AUT or SPE or DYN or CON
SPEcified	: Use the supplied name and append the member ID for surface placed
	Thus each gusset plate will have a different name
	(This is the default option with the name "GPV")
DYNamic	: At placement time will display last name used with following options
	1) option to supply a new name
	2) option to request that member ID for each gusset plate placed be appended
	Thus each gusset plate will have a different name
	3) option to abort placement
AUTo	: FrameWorks assigns names by type and sequence number
	(name_prefix not required or utilized)
CONstant	: Use this name for all gusset plates

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HCV File

The HCV file carries basic gusset plate sizing & type information. The primary function of this file is to allow extreme flexibility in the automated application for horizontal gusset plates. The automated application allows for the utilization of specific HCV 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 HCV files.

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

Sample HCV File (this sample created by this application)
        (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
```

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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 INT directory for HCV files**
- **HCV file directory may be defined with environment variable ACE_GPH_HCV**
- **ACE_GPH_HCV = d:\my_hcv_files**

The **UNI, CON, HOR & 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 Command - Parameters Command defines general parameters
        (this command pertains only to the HCV file)

PAR sCon   fThick iClass   sGrade   sSolidType
  where :
        sCon: Connection Type 1 thru 4 or ALL - sCon is ignored but must be present
                                note: the last parameter command encountered typically controls
                                (i.e. last set of valid data)

        iClass   :   9 >= class >= 0
        sGrade   :   Grade value for Gusset Plate
                                                (if valid grade not found – remains unchanged)
        fThick   :   Thickness value (inch or mm units)
        sSolidType   :   SOL for solid, SLA for slab or WAL for wall (default solid)

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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).