CAESAR II Configuration

– is Part of your Input too.

Quick Agenda

- Overview
- How Program Configuration Works
- Using the Configuration Editor
- Configuration Highlights
  - Computational Control
  - Database Definitions
  - FRP Properties
  - Geometry Directives
  - Graphics Settings
  - Miscellaneous Options
  - SIFs and Stresses
- Reporting Configuration Settings

Overview

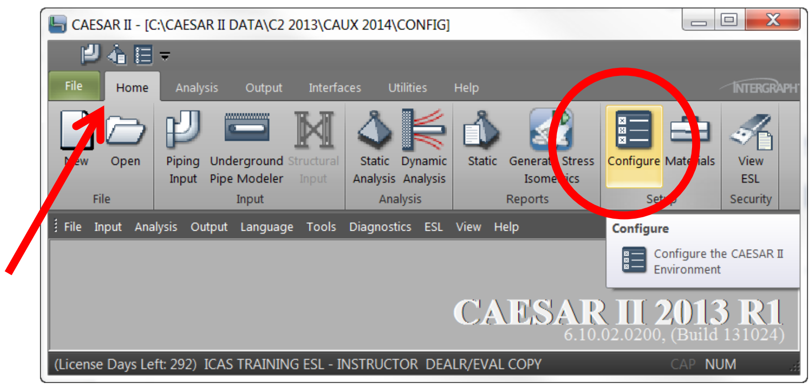
- In addition to the specific model data there are many general controls that can be set for all CAESAR II analysis at the folder level.
- These settings reside in the Configuration File under the name CAESAR.CFG.
- Based on your project requirements, your out-of-the-box settings may not adhere to your data and analysis requirements.
- CAESAR II offers many general “switches” to provide you great latitude in program operation; controlling:
  - Display
  - Data
  - Calculation
- This session examines the many settings found in “Config”, some which may improve or simplify your work.

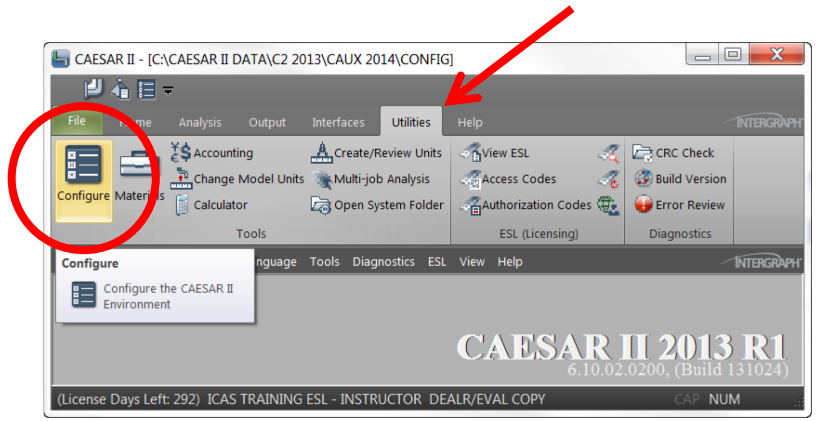
CAESAR.CFG – How it works

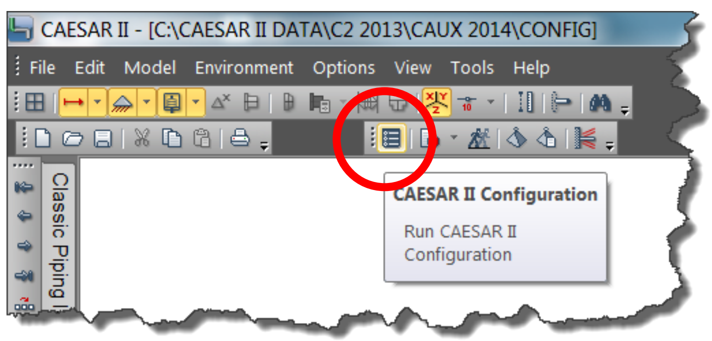
- A Config file is initialized when you install CAESAR II
  - Your can “tune up” your Config file at this point but most users click right through this step
- CAESAR II will access data from the Config file
  - On a new input session:
    - To initialize default values and set data sources (e.g., ambient temperature and nominal pipe sizes)
  - While entering input:
    - To automatically add data and control display (e.g., coefficient of friction for added restraints and displaying subsystems using Node/CNode connections)
  - During error check / analysis:
    - To control the error display and analysis (e.g., loop closure tolerance and use of corrosion in stress calculation)
  - In the output processor:
    - To control reports (e.g., changing report units)

The Configuration Process

- Config file changes are made through the Configuration Editor
- This processor is accessible through the Main Menu (two locations) and in the Input Processor

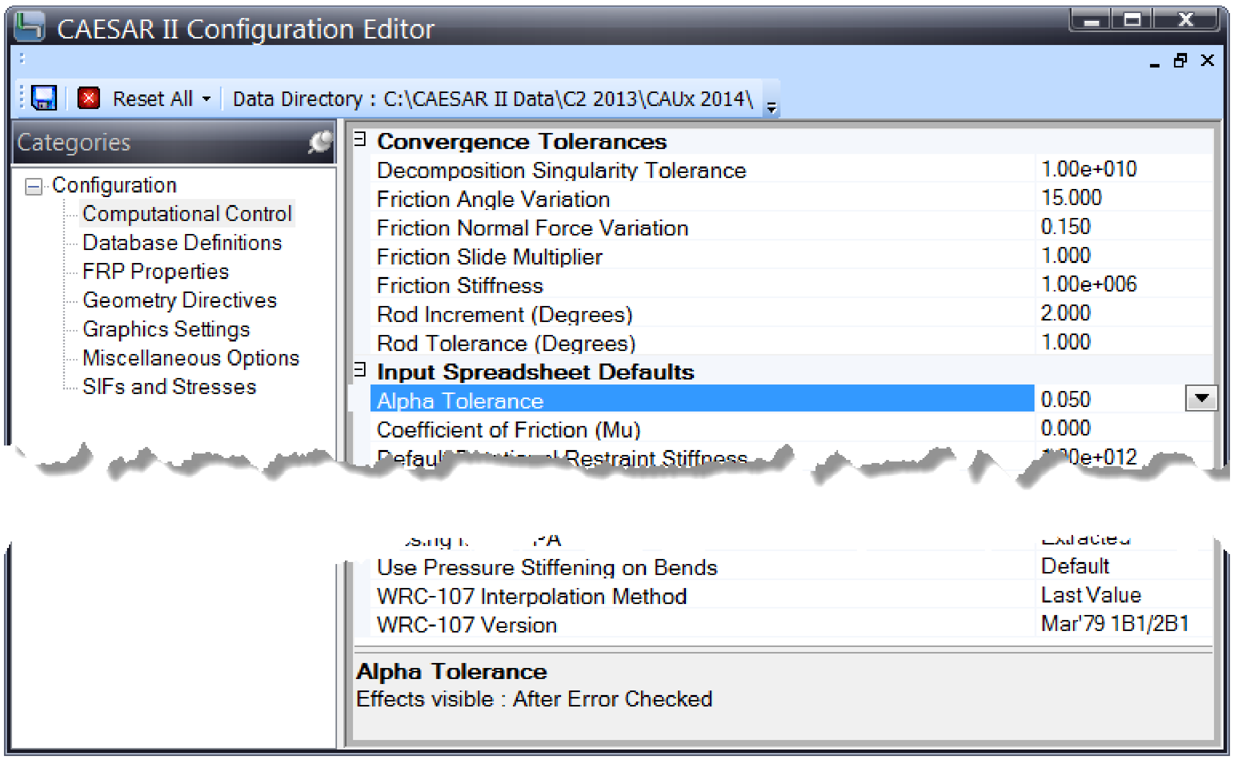






CAESAR.CFG – How it works

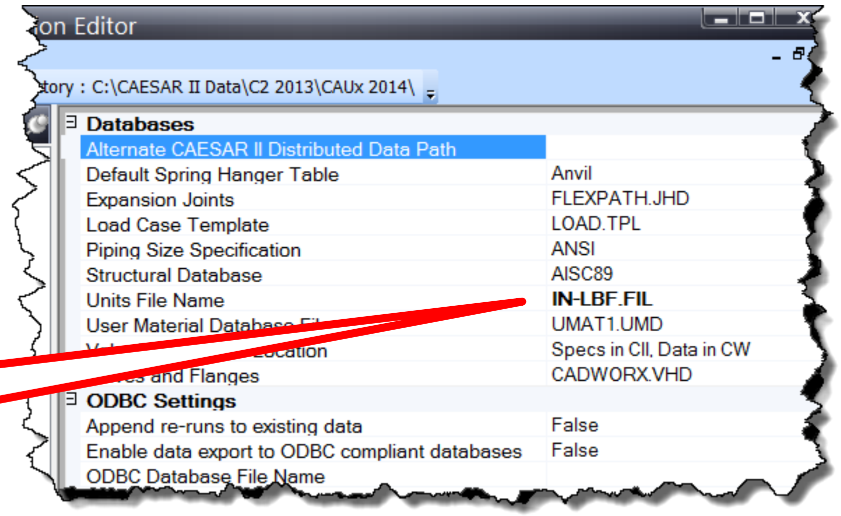
- Starting the processor will display this screen:



- Parameters can be reviewed and modified.

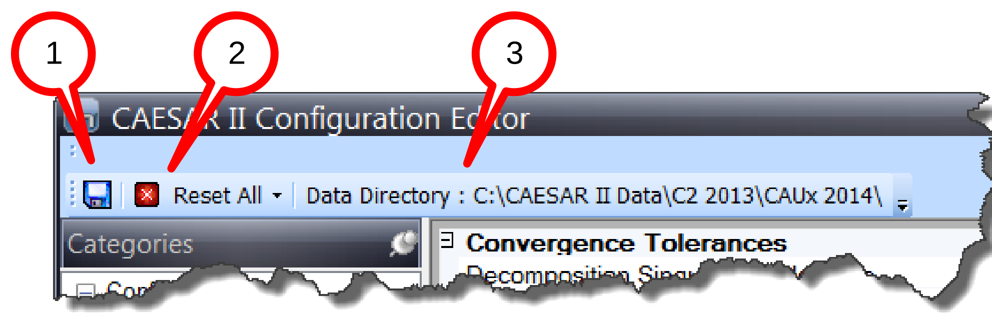
CAESAR.CFG – How it works

- Default settings are in normal text. Bold items indicate changed parameters.



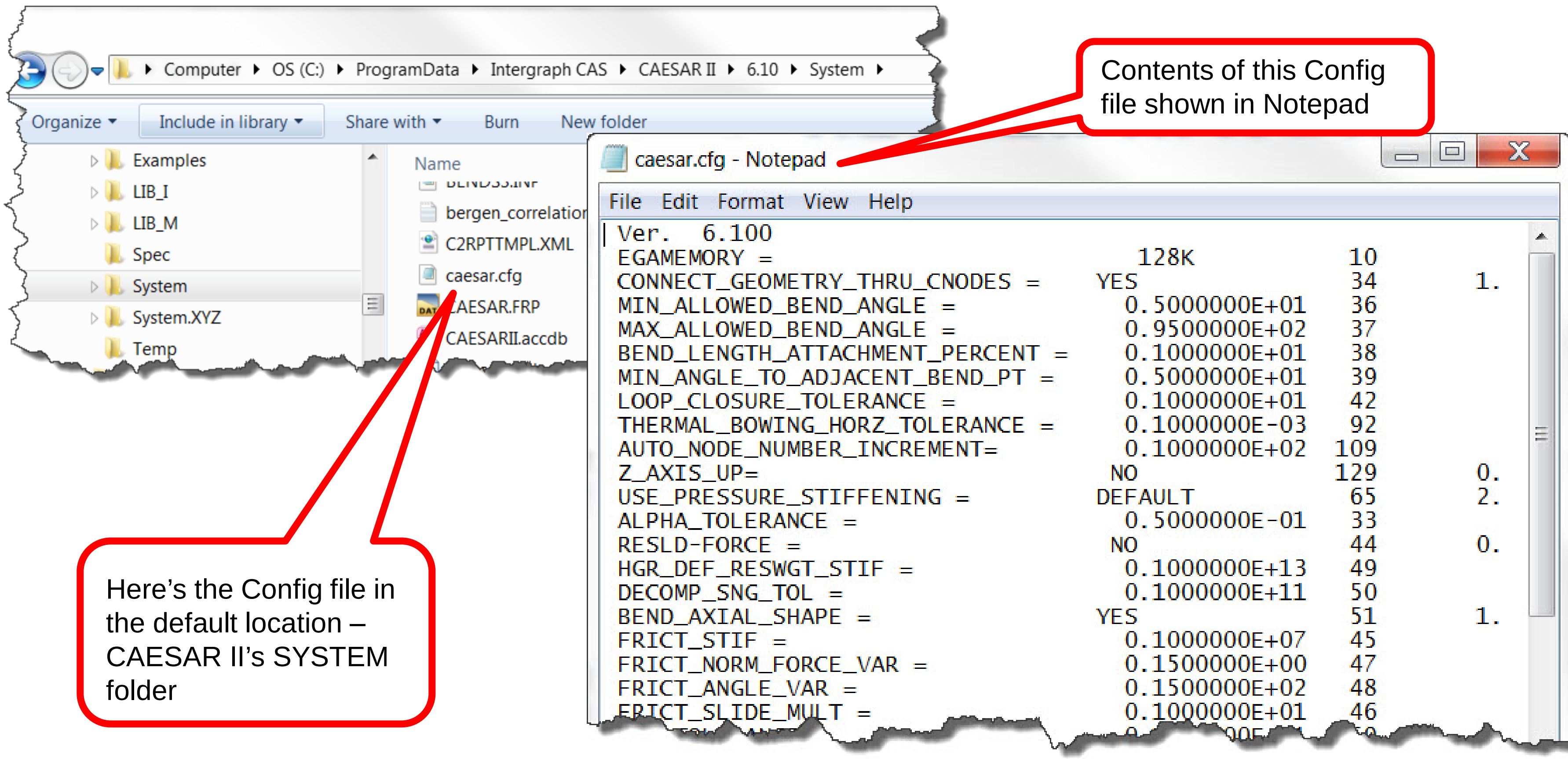
Here, a customized units file is to be used.

1. Changes are stored by clicking the Save button.
2. The Reset All button removes all bold items.
3. The location of this Config file is also identified.



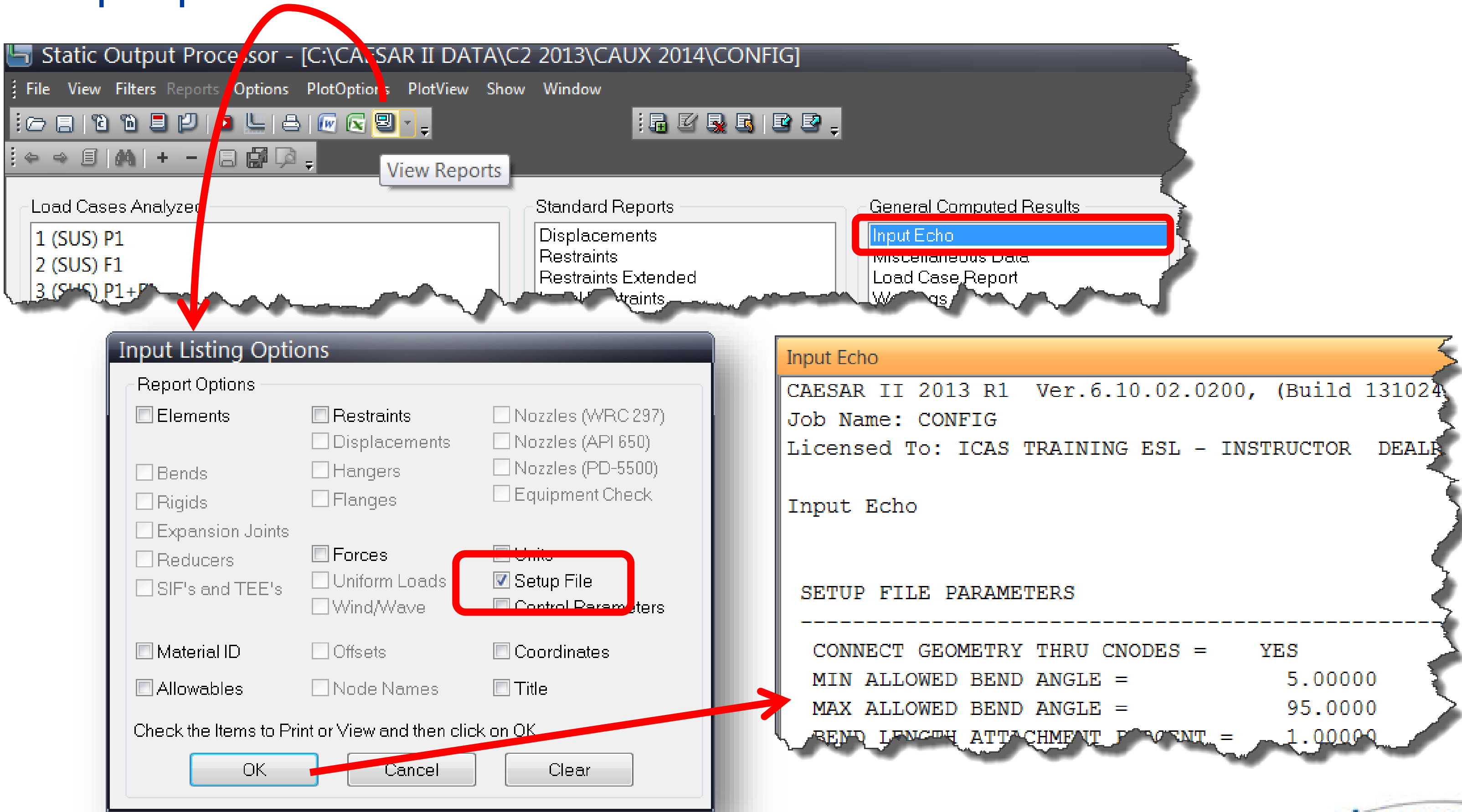
CAESAR.CFG – How it works

- Data is stored in a text file named CAESAR.CFG.



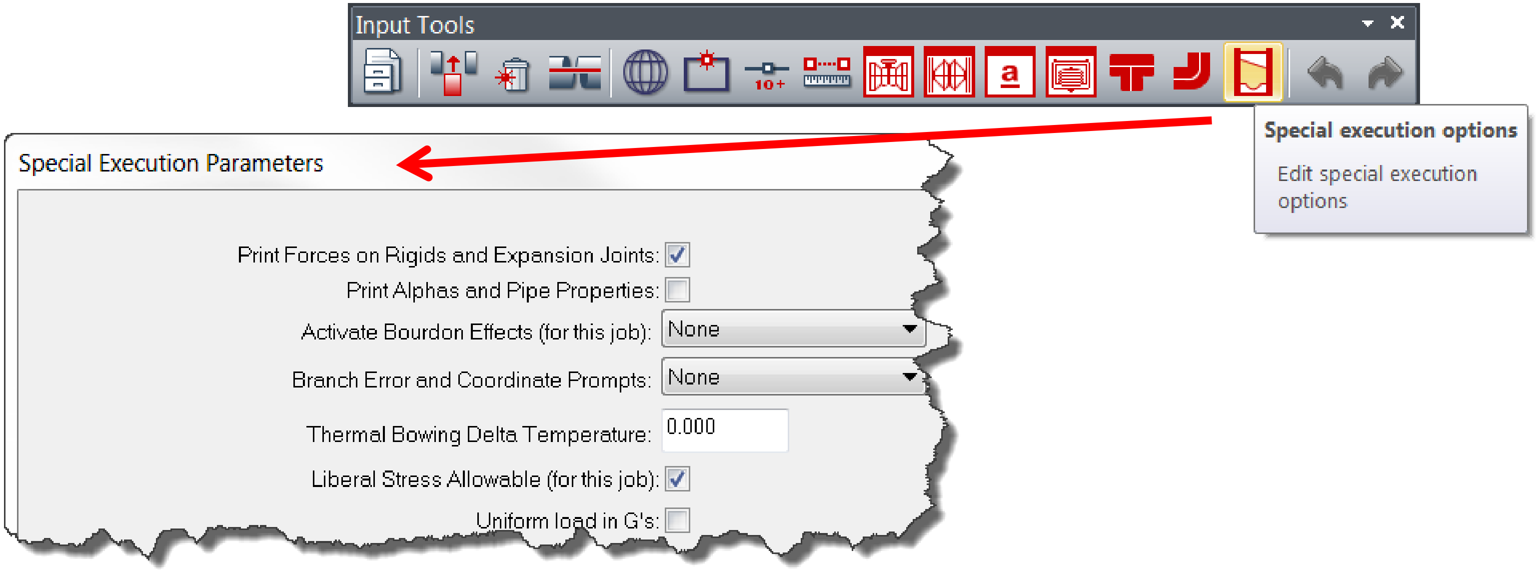
CAESAR.CFG – How it works

- A report of current Config settings can also be listed through the output processor.



Other, similar Controls

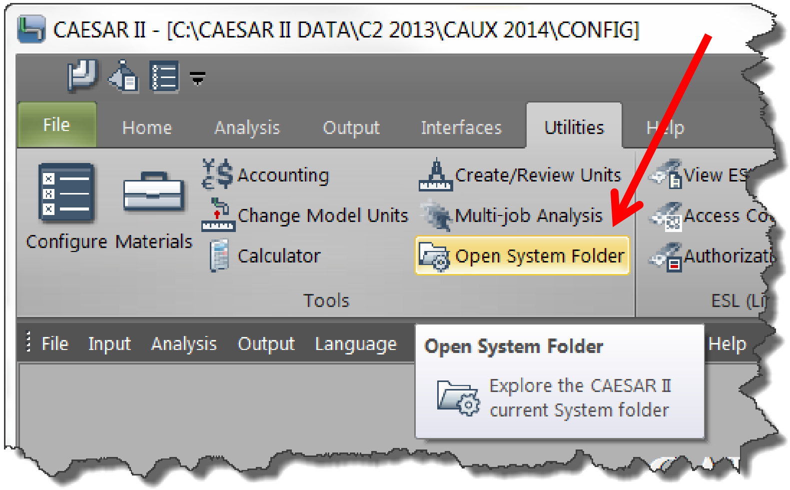
- Be aware that CAESAR II has other sources of performance control
  - Some Config settings can be locally controlled in individual models through Special Execution Parameters from the input processor:



  - Also, the current state of the input display is stored in the PC's Registry
    - Toolbar positions
    - Open windows on the Plot "Home"
    - Plot colors

CAESAR.CFG – Where is it?

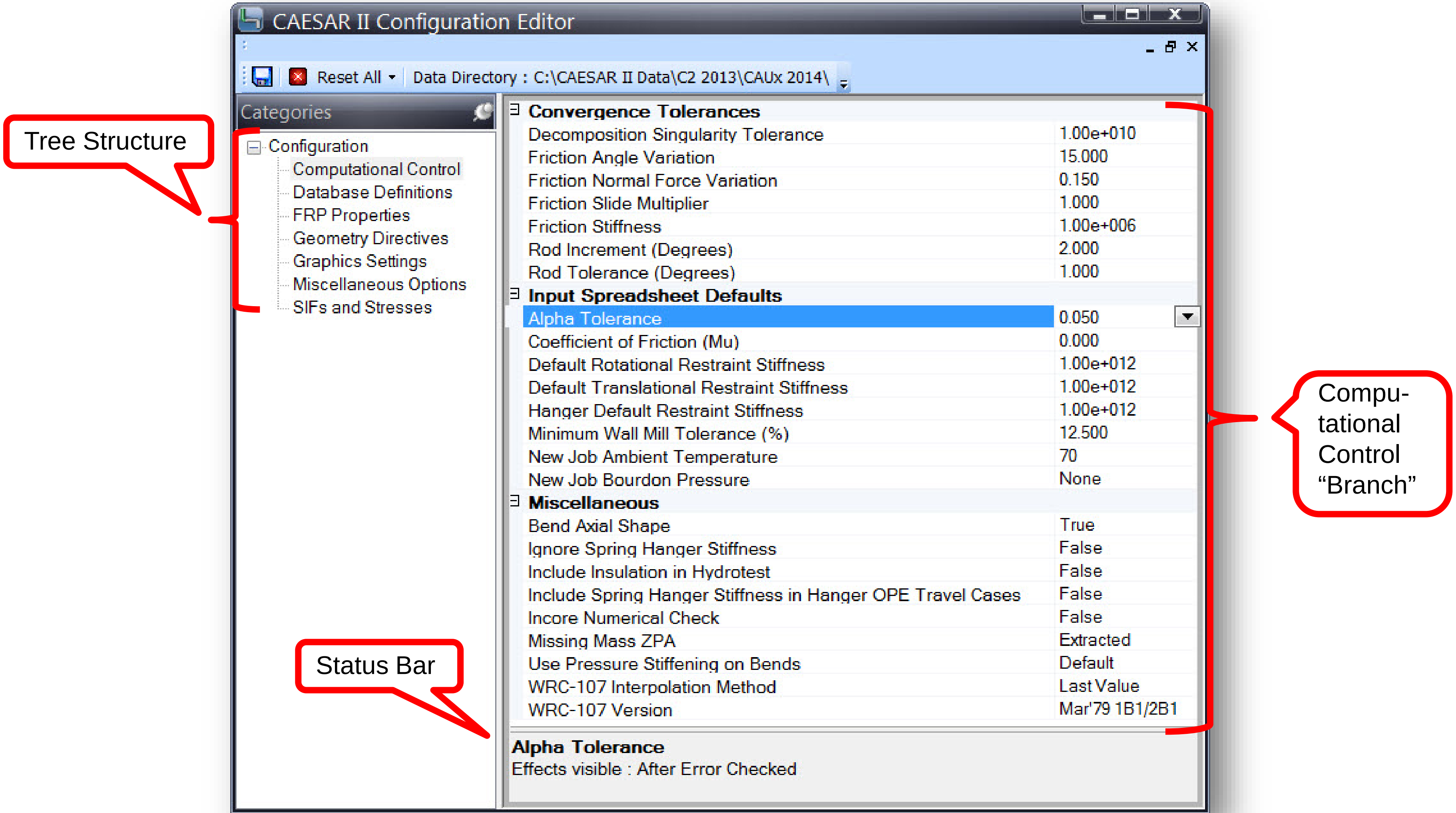
- Program installation initializes the content of CAESAR.CFG in the /SYSTEM folder
- Complete path for a typical CAESAR II installation: C:\ProgramData\Intergraph CAS\CAESAR II\7.00
- You can open this folder from the Utilities tab on the Main Menu:



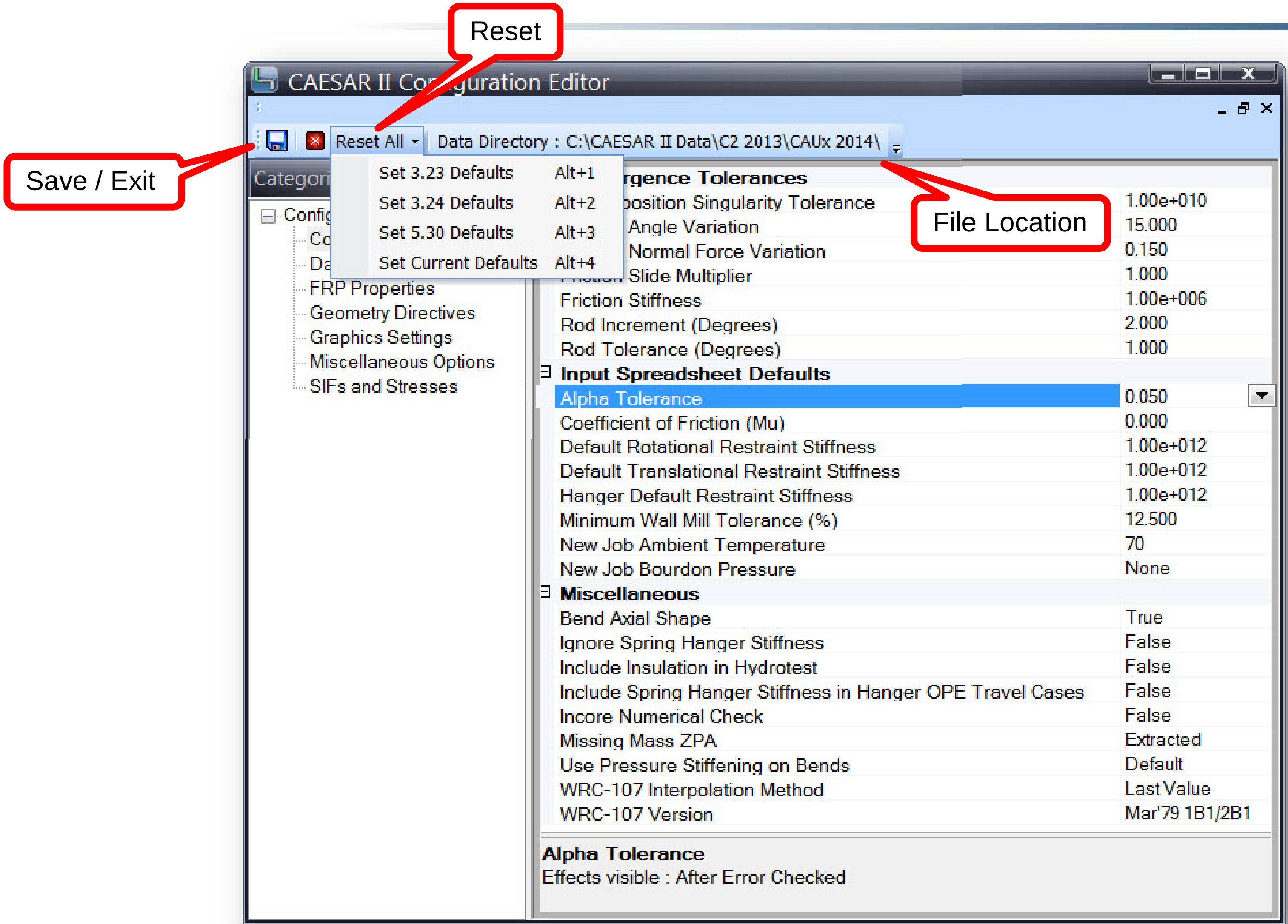
CAESAR.CFG – Where is it?

- A Config file in the local folder will control models in that folder
- With this structure, different folders can have their own set of controls – an advantage when running different projects on the same PC
- If no CAESAR .CFG file exists in the local folder, the CAESAR.CFG in the /SYSTEM folder is used

Using the Configuration Editor

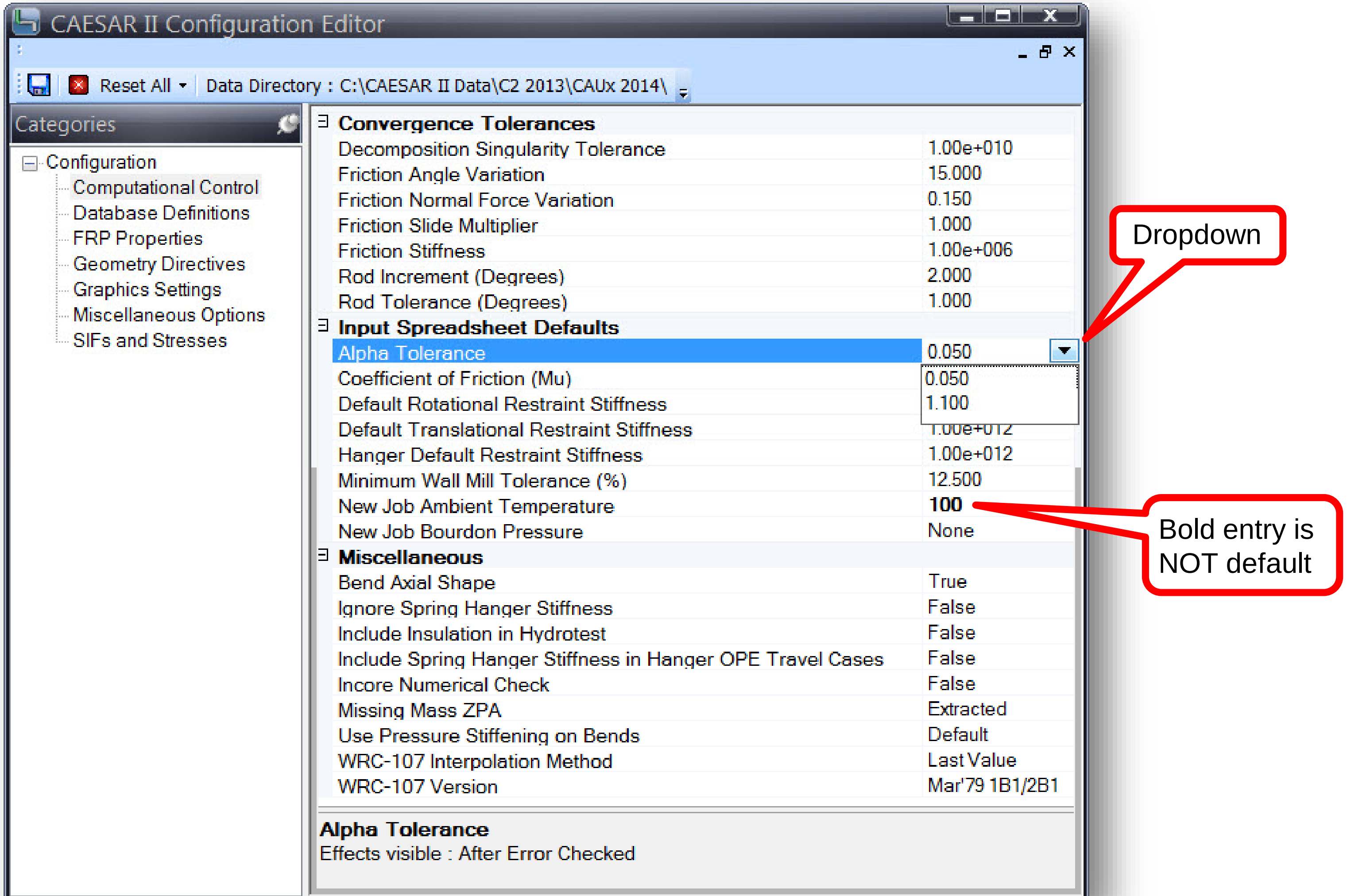


Using the Configuration Editor



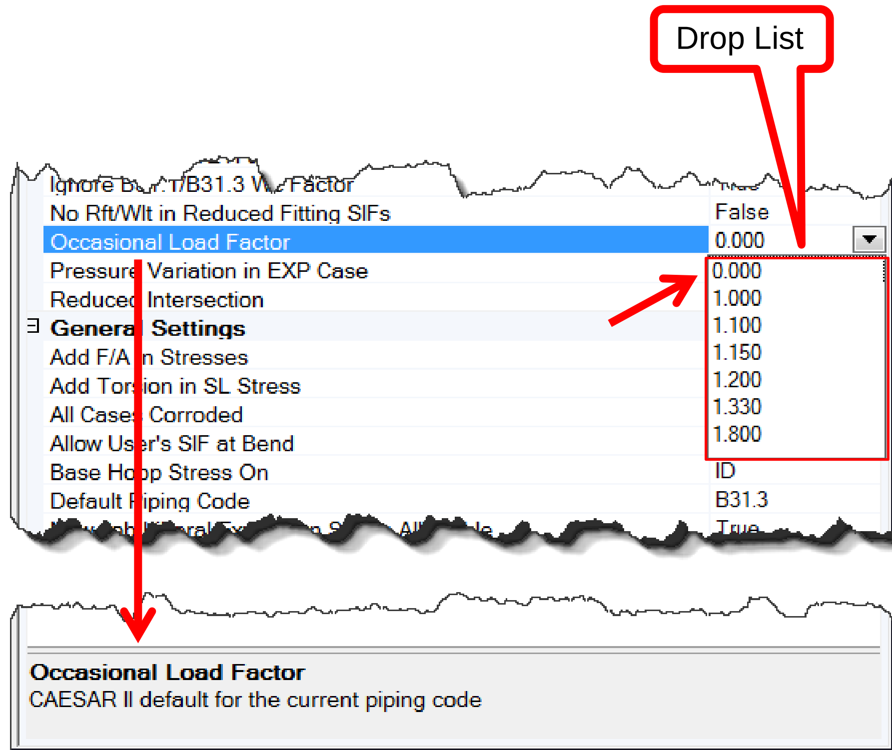
INTERGRAPH

Using the Configuration Editor



Using the Configuration Editor

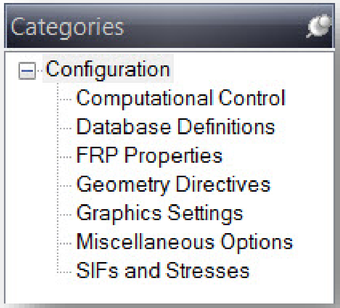
- Data may be entered directly, or by
- Using the Dropdown list:
  - True / False
  - Text List
  - Numeric List
- A note on numeric dropdowns:
  - These lists may show zero as a selection but this selection indicates “default”.
  - For example, the value 0.00, to the right, indicates CAESAR II will use the default based on the specific piping code in use (i.e., 1.33 for B31.3)
- Press F1 for Help



INTERGRAPH

Highlights of Configuration Content

- Computational Control
- Database Definitions
- FRP Properties
- Geometry Directives
- Graphics Settings
- Miscellaneous Options
- SIFs and Stresses



Computational Control

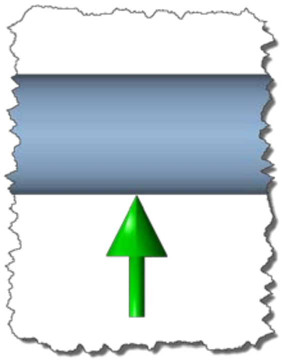
Convergence Tolerances	
Decomposition Singularity Tolerance	1.00e+010
Friction Angle Variation	15.000
Friction Normal Force Variation	0.150
Friction Slide Multiplier	1.000
Friction Stiffness	1.00e+006
Rod Increment (Degrees)	2.000
Rod Tolerance (Degrees)	1.000
Input Spreadsheet Defaults	
Alpha Tolerance	0.050
Coefficient of Friction (Mu)	0.000
Default Rotational Restraint Stiffness	1.00e+012
Default Translational Restraint Stiffness	1.00e+012
Hanger Default Restraint Stiffness	1.00e+012
Minimum Wall Mill Tolerance (%)	12.500
New Job Ambient Temperature	70
New Job Bourdon Pressure	None
Miscellaneous	
Bend Axial Shape	True
Ignore Spring Hanger Stiffness	False
Include Insulation in Hydrotest	False
Include Spring Hanger Stiffness in Hanger OPE Travel Cases	False
Incore Numerical Check	False
Missing Mass ZPA	Extracted
Use Pressure Stiffening on Bends	Default
WRC-107 Interpolation Method	Last Value
WRC-107 Version	Mar'79 1B1/2B1

INTERGRAPH

Background on Nonlinear Solution in CAESAR II

Computational Control

- A brief description of the CAESAR II solution for nonlinear boundary conditions
  - The stiffness matrix [K] is linear. CAESAR II assumes a condition (active or inactive) then tests that assumption by running the load case.
  - Here's a resting support (+Y) example:



- Weight Alone:
  - Assume active, add 1E12 to node's Y stiffness in [K].
  - Run load case "W"
  - Load on this restraint is negative
  - Response is proper
  - Finished here
- Operating Case:
  - Assume active, add 1E12 to node's Y stiffness in [K].
  - Run load case "W+P1+T1"
  - Load on this restraint is positive
  - Response is not proper
  - Assume inactive, remove 1E12 from node's Y stiffness in [K]
  - Run load case "W+P1+T1"
  - Y deflection at this point is positive
  - Response is proper
  - Finished here

INTERGRAPH

Background on Nonlinear Solution in CAESAR II

Computational Control

- Another nonlinear condition – friction – is a little more complicated
  - The support can stick
    - If the piping load at the restraint (load perpendicular to the support) is less than μN,where N is the restraint load, the pipe cannot move. During solution CAESAR II will add two restraints, mutually perpendicular to the defined restraint, to prevent the pipe from sliding.
  - Or the support can slip
    - If the piping load at the restraint is greater than μN,the pipe can move. In this case, during solution, CAESAR II will instead include a friction load in the analysis:
      - The magnitude of the load is μN
      - The direction of the load is applied opposite the previous slide or previous sticking load
  - Response is tested for the stick/slip condition, AND
  - Response is tested for changes in the direction of the friction force and changes in the restraint (normal) load.

Background on Nonlinear Solution in CAESAR II

Computational Control

- Things can get complicated when nonlinear restraints interact with one another. A consistent solution may not be identified.
- For example:
  - A friction support can prevent a pipe from sliding.
  - This “line stop” causes an inactive resting support to become active.
  - With the support now active, the normal load on the previous friction load drops and now that node slides.
  - This slide causes now active resting support to lift off,
  - and the cycle continues without converging to a complete satisfaction of all nonlinear boundary conditions.
- For each Load Case, active and inactive supports must be consistent for the loads applied.
- Additionally, when including friction, the friction vector (direction and magnitude) must be consistent for the loads applied.

INTERGRAPH

Friction Angle Variation & Friction Normal Force Variation

Computational Control

- In addition to the active/inactive test, a consistent solution with friction requires that
  - The vector of pipe slide or friction load has the same direction as the previous iteration to solution
  - The normal load used in calculating the friction force is the same magnitude as the previous iteration to solution and
- CAESAR II has a tolerance on these two friction convergence tests:
  - By default, a friction vector (measured by the motion of the pipe or the friction load vector at the restraint) that changes less than 15 degrees between the previous iteration and the current iteration is considered within tolerance. No additional iteration at this restraint is required.
  - By default, a normal load which changes less than 15% between the previous iteration and the current iteration is considered within tolerance. No additional iteration at this restraint is required.

Friction Angle Variation & Friction Normal Force Variation

Computational Control

- These two default settings: Friction Angle Variation and Friction Normal Force Variation can be changed in the Configuration File

Convergence Tolerances	
Decomposition Singularity Tolerance	1.00e+010
Friction Angle Variation	15.000
Friction Normal Force Variation	0.150
Friction Slide Multiplier	1.000
Friction Stiffness	1.00e+006
Rod Increment (Degrees)	2.000

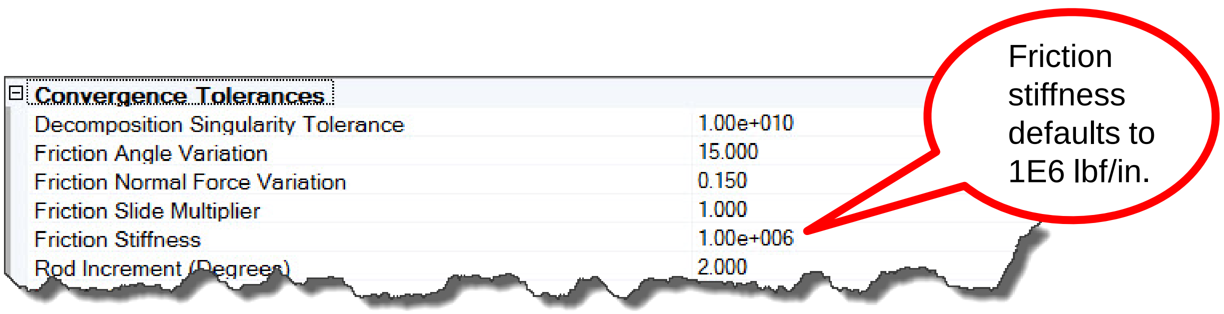
Considered converged if the change is friction angle is less than 15 degrees and if the change in normal load is less than 15%.

- Note that these changes can also be made during the CAESAR II analysis.
  - Caution here: Changing convergence tolerance during the analysis may produce a solution that is unique to the iteration at which the change was made.

Friction Stiffness

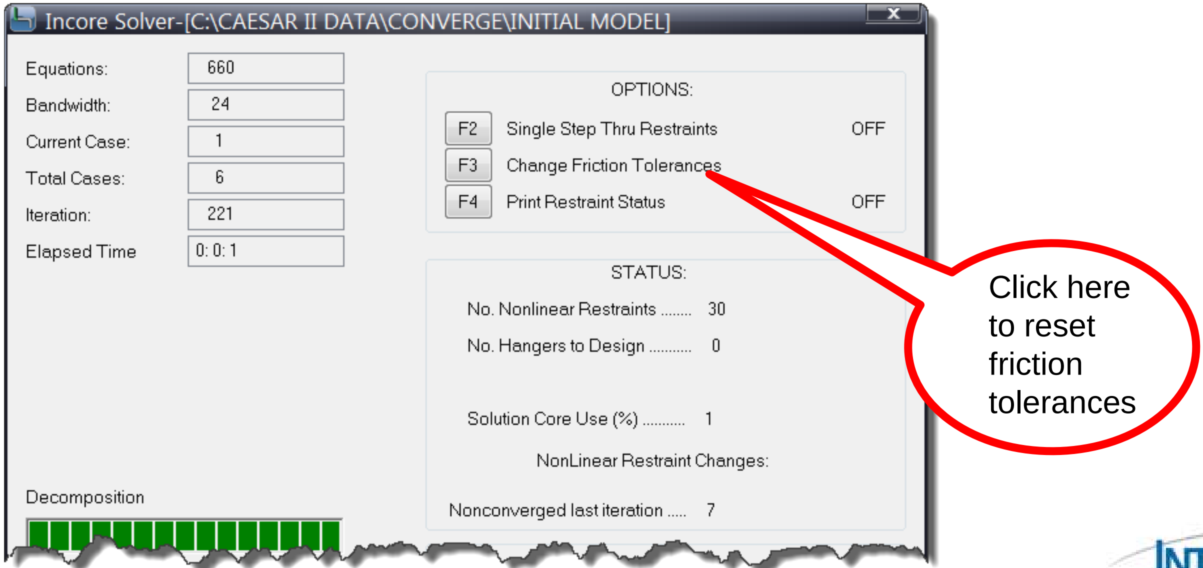
Computational Control

- Mentioned earlier, if a friction restraint "sticks" rather than "slips", CAESAR II will insert two mutually perpendicular restraints perpendicular to the normal load generating the friction force. For example, so that a Y restraint with friction cannot slide, CAESAR II will insert X and Z restraints for the next analysis iteration.
- CAESAR II has a default stiffness of 1E6 lbf/in for these friction "restraints". Compare this to 1E12 as the default stiffness for <u>rigid</u> restraints.



Friction Stiffness

- You can modify friction restraint stiffness
  - A lower value may reduce the iterations required to converge since the friction load more quickly disperses through the model (rather than passing load from one friction support to the next down the line)
  - But a lower stiffness introduces more error in the friction evaluation
- Like Friction Variations for Angle and Normal Load, this setting can also be changed during solution. Similar caution applies.



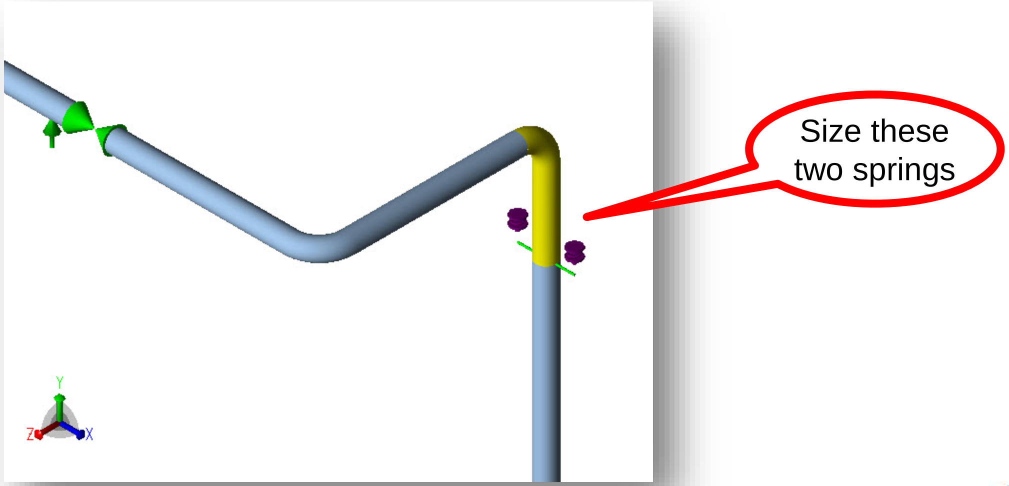
Hanger Default Restraint Stiffness

Computational Control

- Here's an example of a setting that may be used to "tune up" a model.

Input Spreadsheet Defaults	
Alpha Tolerance	0.050
Coefficient of Friction (Mu)	0.000
Default Rotational Restraint Stiffness	1.00e+012
Default Translational Restraint Stiffness	1.00e+012
Hanger Default Restraint Stiffness	1.00e+012
Minimum Wall Mill Tolerance (%)	12.500
New Job Ambient Temperature	70
New Job Bourdon Pressure	None

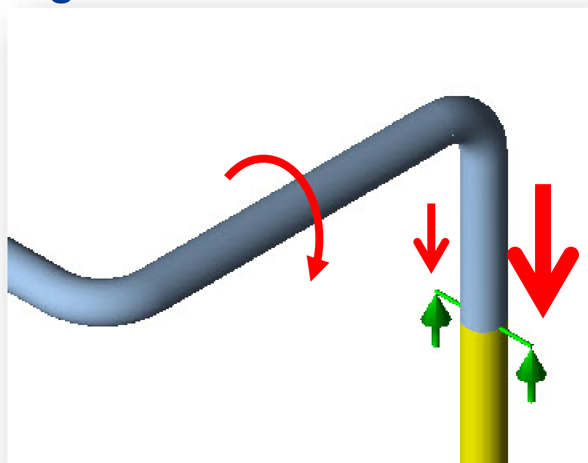
- Let's say you have a riser where springs will be carrying weight through trunnions on either side of the pipe.



Hanger Default Restraint Stiffness

Computational Control

- The operating loads on these springs will be calculated from a weight analysis with rigid +Y restraints:



- But, here, there is a large deadweight moment which throws more deadweight to the right support.

NODE	NO. REQD	FIG N		ERTICAL EMENT (in.)	HOT LOAD (lb.)	THEORETICAL INSTALLED LOAD (lb.)	LOAD (lb.)	PRING RATE (lb./in.)	HORIZONTAL MOVEMENT (in.)
120	1	82	11	542	1568.	1937.	0.	680.	0.289
		ANVIL					LOAD	VARIATION =	24%
220	1	B-268	8	0.600	651.	741.	0.	150.	0.223
		ANVIL					LOAD	VARIATION =	14%

Left spring

Right spring

Hanger Default Restraint Stiffness

Computational Control

- One way to reduce this imbalance is to soften the rigid +Y restraints added to this weight calculation:

Input Spreadsheet Defaults	
Alpha Tolerance	0.050
Coefficient of Friction (Mu)	0.000
Default Rotational Restraint Stiffness	1.00e+012
Default Translational Restraint Stiffness	1.00e+012
Hanger Default Restraint Stiffness	**1.00e+004**
Minimum Wall Mill Tolerance (%)	12.500
New Job Ambient Temperature	70
New Job Bourdon Pressure	None

- These more flexible supports will allow the system to better share the load between the two hangers:

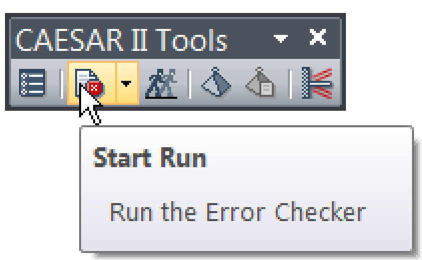
NODE	NO. REQD	FIG. NO.	SIZE	VERTICAL MOVEMENT (in.)	HOT LOAD (lb.)	THEORETICAL INSTALLED LOAD (lb.)	ACTUAL INSTALLED LOAD (lb.)	SPRING RATE (lb./in.)	HORIZONTAL MOVEMENT (in.)
120	1	B-268 ANVIL	9	0.539	1060.	1168.	0.	200.	0.300
							LOAD VARIATION =		10%
220	1	B-268 ANVIL	9	0.603	1002.	1122.	0.	200.	0.236
							LOAD VARIATION =		12%

INTERGRAPH

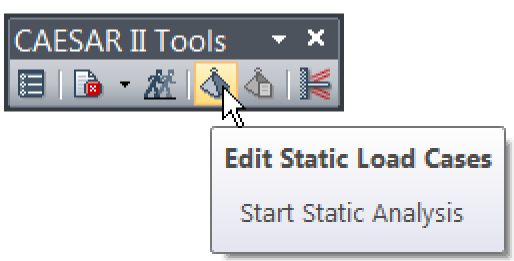
A Note on Applying Configuration Changes…

- Be aware that configuration parameters such as hanger Default Restraint Stiffness must be incorporated with the model before analysis.
- Include any configuration changes into the analysis by executing the Error Checker.
- Running analysis without the error check will not include such configuration changes in the analysis.

YES



NO!



New Job Ambient Temperature

Computational Control

- Notice how the Configuration Parameter states: "New Job Ambient Temperature"

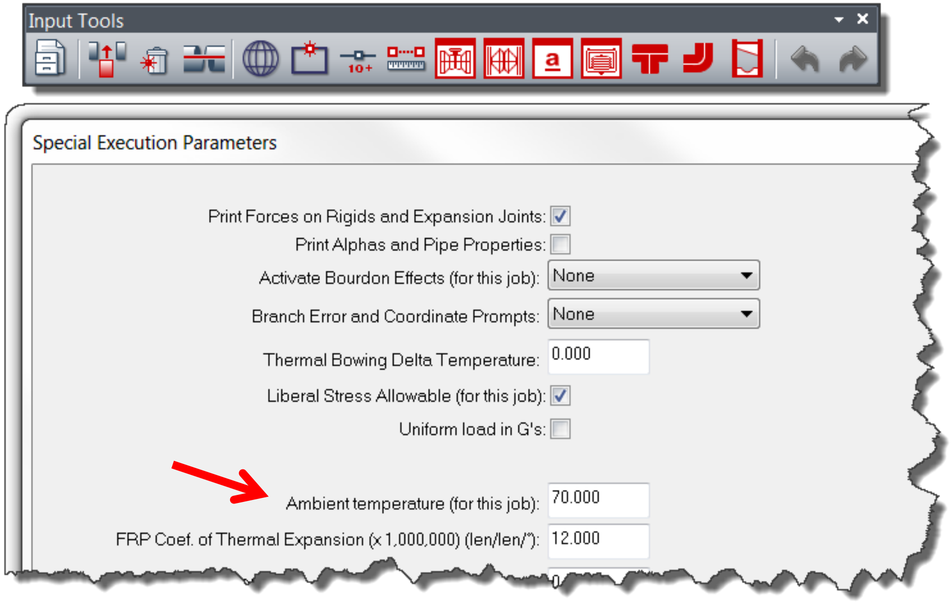
Input Spreadsheet Defaults	
Alpha Tolerance	0.050
Coefficient of Friction (Mu)	0.000
Default Rotational Restraint Stiffness	1.00e+012
Default Translational Restraint Stiffness	1.00e+012
Hanger Default Restraint Stiffness	1.00e+012
Minimum Wall Mill Tolerance (%)	12.500
New Job Ambient Temperature	70
New Job Bourdon Pressure	None

- This parameter will be seeded into any new model when it is created.
- It is stored with the Special Execution Parameters.

New Job Ambient Temperature

Computational Control

- You can change this value in an existing model, by updating the Special Execution Parameters:



- Note that, here, the value is labeled “Ambient Temperature (for this job)”

INTERGRAPH

Ignore Spring Hanger Stiffness

Computational Control

- Shown in the Load Case Options
- Used to match simpler, hand calculations (ignore stiffness and apply only hot load)
- NOT RECOMMENDED

Miscellaneous	
Bend Axial Shape	True
Ignore Spring Hanger Stiffness	False
Include Insulation in Hydrotest	False
Include Spring Hanger Stiffness in Hanger OPE Travel Cases	False
Incore Numerical Check	False
Missing Mass ZPA	Extracted
Use Pressure Stiffening on Bends	Default
WRC-107 Interpolation Method	Last Value
WRC-107 Version	Mar'79 1B1/2B1

Static Analysis - [C:\CAUX\SELECTING SPRINGS\C2 DATA\ZERO LOAD 1]

File Edit

INTERGRAPH

Load Case Editor | Load Case Options | Wind Loads | Wave Loads

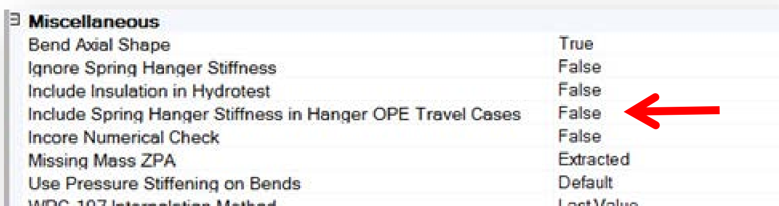
	Load Case Name	Outpu t Status	Outpu t Type	Comb Metho d	Snub bers Active ?	Hanger Stiffness	Elastic Modulus	Elbow Stiffening Pressure	Elbow Stiffenir Elastic Modulu
L1	WEIGHT FOR HANGER LOADS	Sup	Dis		☐	Rigid	EC	PMax	EC
L2	OPERATING FOR HANGER TRAVEL	Sup	Dis		☐	Ignore	EC	PMax	EC
L3	OPERATING CASE CONDITION 1	Kee	Dis		☐	Ignore	EC	PMax	EC
L4	SUSTAINED CASE CONDITION 1	Kee	Dis		☐	Ignore	EC	PMax	EC
L5	EXPANSION CASE CONDITION 1	Kee	Dis	Alg	☐			PMax	EC

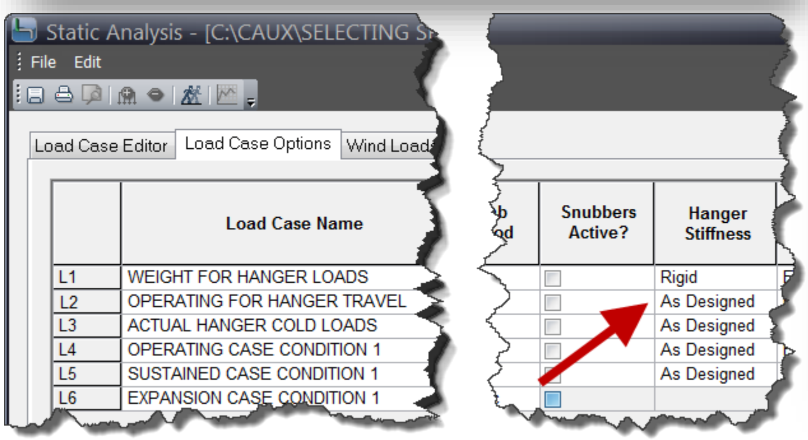
INTERGRAPH

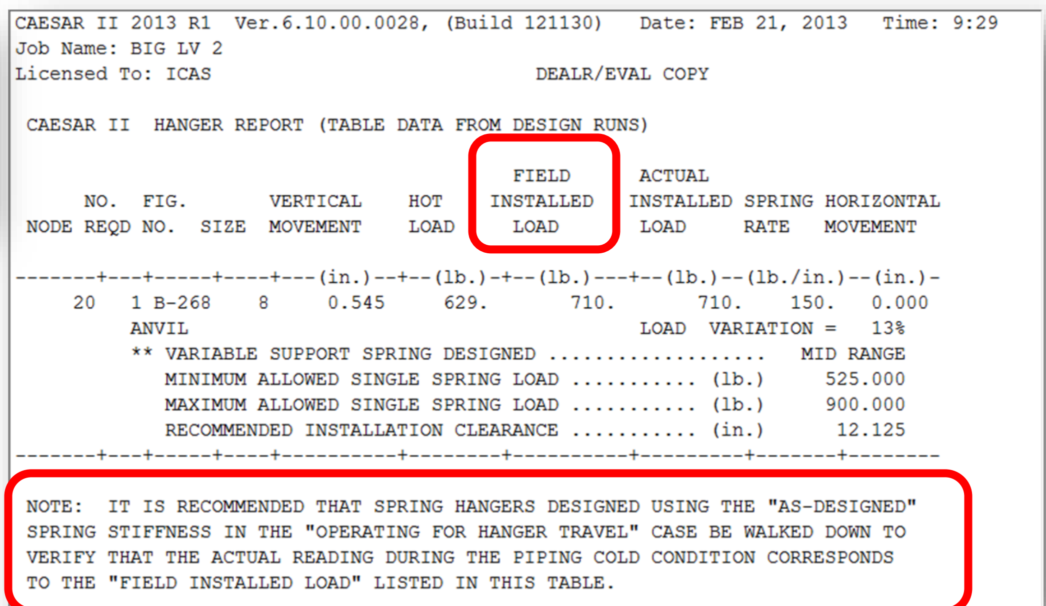
Include Spring Hanger Stiffness in Hanger OPE Travel Cases

Computational Control

- This can reduce the travel demand on the hanger
- Sets Hanger Stiffness for “Operating for Hanger Travel” to “As Designed” (instead of “Ignore”)
- Renames Theoretical Cold Load as Field Installed Load
- Be careful. Confirm.







```
CAESAR II 2013 R1  Ver.6.10.00.0028, (Build 121130)   Date: FEB 21, 2013   Time: 9:29
Job Name: BIG LV 2
Licensed To: ICAS                            DEALR/EVAL COPY

 CAESAR II  HANGER REPORT (TABLE DATA FROM DESIGN RUNS)

                                                   FIELD      ACTUAL
     NO.  FIG.          VERTICAL      HOT       INSTALLED  INSTALLED SPRING HORIZONTAL
 NODE REQD NO.  SIZE  MOVEMENT      LOAD        LOAD        LOAD      RATE   MOVEMENT

-------+---+-----+----+---(in.)--+--(lb.)-+--(lb.)---+--(lb.)--(lb./in.)--(in.)-
     20    1 B-268    8      0.545     629.        710.        710.    150.   0.000
           ANVIL                                               LOAD  VARIATION =   13%
           ** VARIABLE SUPPORT SPRING DESIGNED .................... MID RANGE
              MINIMUM ALLOWED SINGLE SPRING LOAD ........... (lb.)     525.000
              MAXIMUM ALLOWED SINGLE SPRING LOAD ........... (lb.)     900.000
              RECOMMENDED INSTALLATION CLEARANCE ........... (in.)      12.125
-------+---+-----+----+----------+--------+----------+---------+-------+--------

 NOTE:  IT IS RECOMMENDED THAT SPRING HANGERS DESIGNED USING THE "AS-DESIGNED"
 SPRING STIFFNESS IN THE "OPERATING FOR HANGER TRAVEL" CASE BE WALKED DOWN TO
 VERIFY THAT THE ACTUAL READING DURING THE PIPING COLD CONDITION CORRESPONDS
 TO THE "FIELD INSTALLED LOAD" LISTED IN THIS TABLE.
```

Use Pressure Stiffening on Bends

Computational Control

- Pressure in a bend may reduce the bend's tendency to ovalize in cross section under (in plane) bending load.
- This is more significant in piping with a large D/t ratio and at higher pressures.
- This effect makes the bend stiffer and stronger (a lower bend flexibility, k, and lower stress intensification factor, i).
- Choices are Default, Yes and No.
- This switch may be useful in replicating stress calculations of other piping codes or earlier piping code editions.

Miscellaneous	
Bend Axial Shape	True
Ignore Spring Hanger Stiffness	False
Include Insulation in Hydrotest	False
Include Spring Hanger Stiffness in Hanger OPE Travel Cases	False
Incore Numerical Check	False
Missing Mass ZPA	Extracted
Use Pressure Stiffening on Bends	Default
WRC-107 Interpolation Method	Last Value
WRC-107 Version	Mar'79 1B1/2B1

Database Definitions

- Anyone not using US Customary units is familiar with this group as this is where you specify the units to be used for building new models and for output review.
- Settings here also control the source of reference data.
- We will look at two:

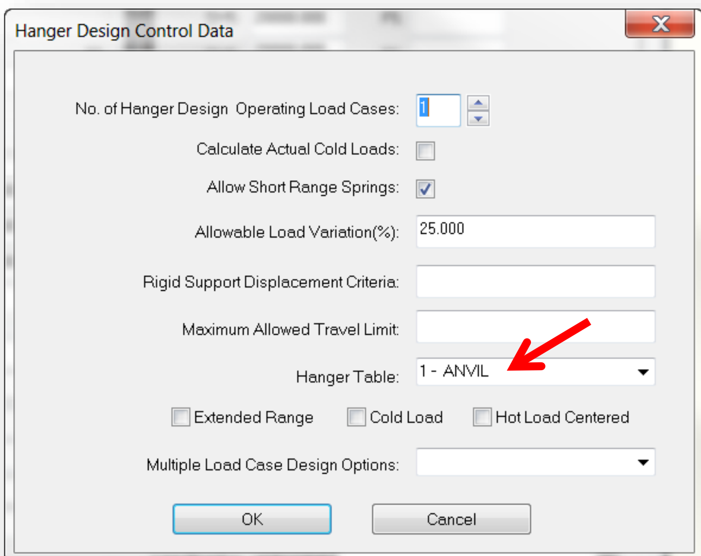
Databases	
Alternate CAESAR II Distributed Data Path	
Default Spring Hanger Table	Anvil
Expansion Joints	FLEXPATH.JHD
Load Case Template	LOAD.TPL
Piping Size Specification	ANSI
Structural Database	AISC89
Units File Name	ENGLISH.FIL
User Material Database Filename	UMAT1.UMD
Valve/Flange Files Location	Specs in CII, Data in CW
Valves and Flanges	CADWORX.VHD
ODBC Settings	
Append re-runs to existing data	False
Enable data export to ODBC compliant databases	False
ODBC Database File Name	

Default Spring Hanger Table

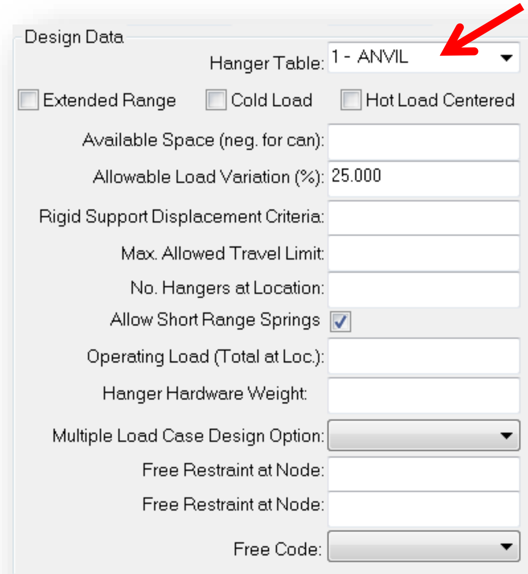
Database Definitions

- CAESAR II can select spring hangers from 32 spring catalogs.
- By resetting the default catalog in Config, you will not be required to change the Hanger Design Control Data for each model or redefine each individual hanger.

: Hanger Design Control Data



Hangers : Individual Hanger Selection

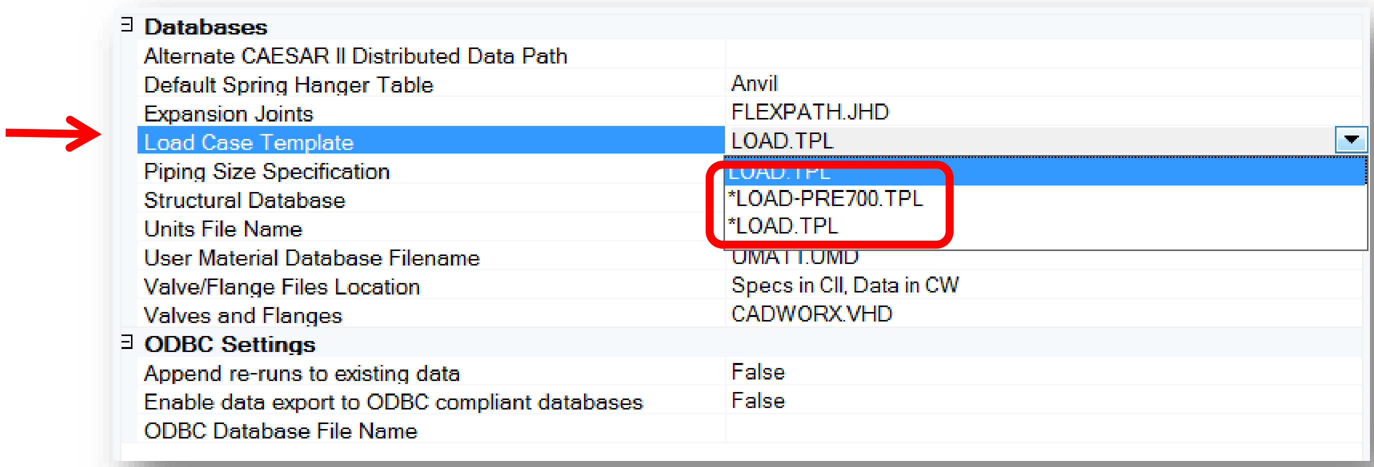


INTERGRAPH

Load Case Template

Database Definitions

- CAESAR II uses a control file to set the recommended load cases – LOAD.TPL – in the SYSTEM folder.
- The next release of CAESAR II will offer an important choice between two recommendations
  - LOADPRE700.TPL will hold the existing stress range evaluations – installed to operating
  - LOAD.TPL will hold new logic to include range calculations between operating sets



Load Case Template

Database Definitions

- For three temperatures and three pressures, CAESAR II would develop this list of basic load definitions:

Loads Defined in Input
W - Weight
T1 - Thermal Case #1
T2 - Thermal Case #2
T3 - Thermal Case #3
P1 - Pressure Case #1
P2 - Pressure Case #2
P3 - Pressure Case #3
WW - Water Filled Weight
WNC - Weight no contents

- Here is a comparison of the new versus old "Recommended Load Cases":

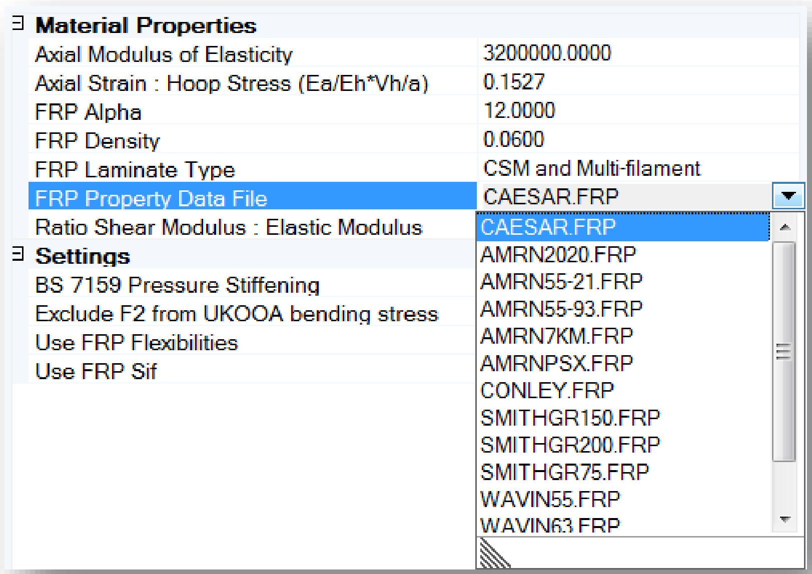
	Load Cases	Stress Type
L1	W+T1+P1	OPE
L2	W+T2+P2	OPE
L3	W+T3+P3	OPE
L4	W+P1	SUS
L5	W+P2	SUS
L6	W+P3	SUS
L7	L1-L4	EXP
L8	L2-L5	EXP
L9	L1-L2	EXP
L10	L3-L6	EXP
L11	L1-L3	EXP
L12	L2-L3	EXP

: New format adds range calculations between operating cases as defined in LOAD.TPL

	Load Cases	Stress Type
L1	W+T1+P1	OPE
L2	W+T2+P2	OPE
L3	W+T3+P3	OPE
L4	W+P1	SUS
L5	W+P2	SUS
L6	W+P3	SUS
L7	L1-L4	EXP
L8	L2-L4	EXP
L9	L3-L4	EXP

: Continue using the existing format by selecting LOADPRE700.TPL

FRP Properties



INTERGRAPH

FRP Property Data File

- Physical data for Fiberglass Reinforced Plastic (FRP) Pipe varies greatly between manufacturers and even between products.
- As an orthotropic (rather than isotropic) material, more data is required to define and evaluate FRP pipe.
- Such data can be stored and selected from the SYSTEM directory (e.g. AMRN2020.FRP shown below)
- You can add your own data sets there as well.
- These data must be defined in the configuration file before material 20 – FRP – is selected in the CAESAR II piping input

```
*
* THIS IS THE AMERON BONDSTRAND SERIES 2020 FRP PIPE PROPERTIES
*
 .1000000E+05    1.45041E+02  FRP_Emod_(axial) =
 .6400000E+00    1.           FRP_Ratio_Gmod/Emod_(axial) =
 .4000000E+00    1.           FRP_Ea/Eh*Vh/a =
 3.              0.           FRP_Laminate_Type =
 .1800000E+02    5.55600E-01  FRP_Alpha =
1.8000000E+03    3.61272E-05  FRP_Density =
 .2325000E+05    1.45041E+02  Hoop Modulus of Elasticity
0.0032           1.           BS 7159 Design Strain
*
* UKOOA envelope for straight, ell, tee
 .3200000E+02    1.45041E+02  Su(0:1), Straight
 .7400000E+02    1.45041E+02  Su(2:1), Straight
 .1480000E+03    1.45041E+02  Sh(2:1), Straight
 .3800000E+03    1.45041E+02  Sh(1:0), Straight
```

Geometry Directives

Bends	
Bend Length Attachment Percent	1.000
Maximum Allowable Bend Angle	95.000
Minimum Allowable Bend Angle	5.000
Minimum Angle to Adjacent Bend Point	5.000
Input Items	
Auto Node Number Increment	10
Connect Geometry Through CNodes	True
Horizontal Thermal Bowing Tolerance	0.0001
Loop Closure Tolerance	1.0000 in.
New Job Z-Axis Vertical	False

Minimum Allowable Bend Angle

Geometry Directives

- Very small angles on short radius bends can cause numerical problems during solution.
- To avoid such problems, CAESAR II maintains a minimum bend angle of 5 degrees by default.
- An error will be generated should your overall bend angle fall below that value:

	Message Type	Message Number	Element/ Node Number	Message Text
1	ERROR	5E	10-20	Bend angle on element 10 TO 20 is 4.00 Deg; it must be between 5.00 and 95.00 Deg.

- Where the radius of the bend is large, such as in a cross-country pipeline, it is not uncommon to find bends with angles more shallow than 5-degrees, especially when using the buried pipe modeler.
- In these situations, the error can be cleared by reducing the minimum bend angle. In many cases, though, a very long radius, shallow bend has no bend flexibility and the SIF will be 1.0. It's straight pipe.

INTERGRAPH

Graphics Settings

Flange	255, 0, 255
Hanger CNode	87, 255, 255
Hangers	128, 0, 128
Nozzles	255, 0, 255
Pipes	166, 202, 240
Restraint CNode	87, 255, 255
Restraints	0, 255, 0
Rigids	0, 255, 0
Sifs/Tees	255, 0, 255
Steel	192, 192, 192
⊞ Marker Options	
⊟ Miscellaneous Options	
Default Operator	Zoom to Window
Default Projection Mode	Orthographic
Default Render Mode	Phong Shaded
Default View	SE Isometric
Disable Graphic Tooltip Bubble	False
Force Black and White Printing	True
Idle Processing Count	50
Optimal Frame Rate	10
Restore Previous Anchor Size	True
Restore Previous Hanger Size	True
Restore Previous Operator	True
Restore Previous Projection Mode	True
Restore Previous Render Mode	True
Restore Previous Restraint Size	True
Restore Previous View	True
Video Driver	OpenGL
⊞ Output Colors	
⊞ Text Options	
⊞ Visual Options	

INTERGRAPH

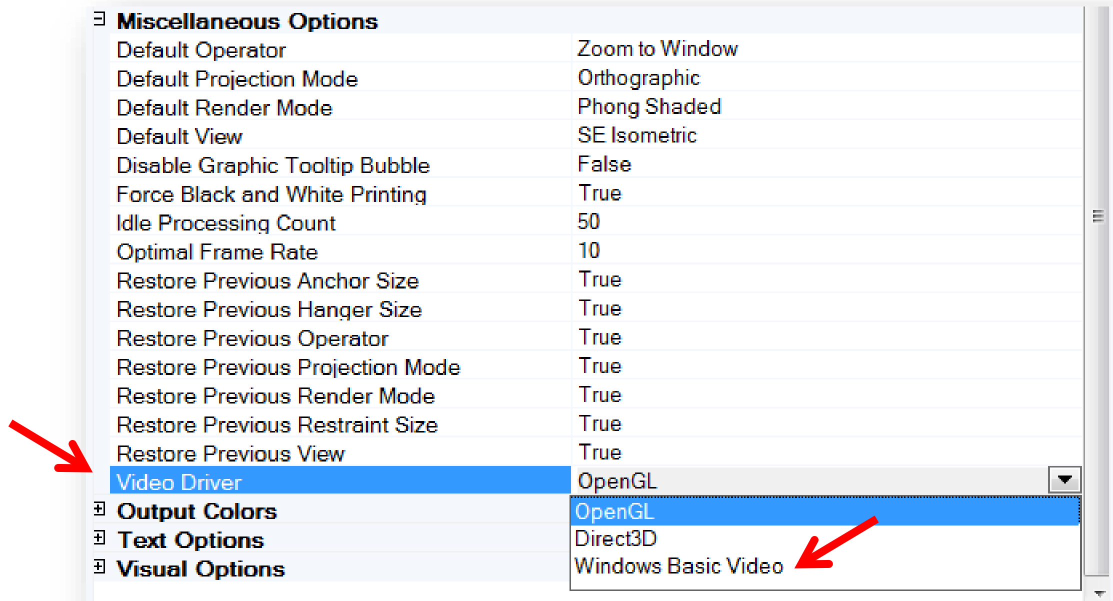
Video Driver

- Occasionally a properly functioning program may shut down while displaying graphics.
- Many times this error can be cleared by updating the driver for the computer’s video card.

Video Driver

Graphics Settings

- Another way to quickly address this issue is to change the video Driver selection in the configuration file from the default OpenGL to Windows Basic Video



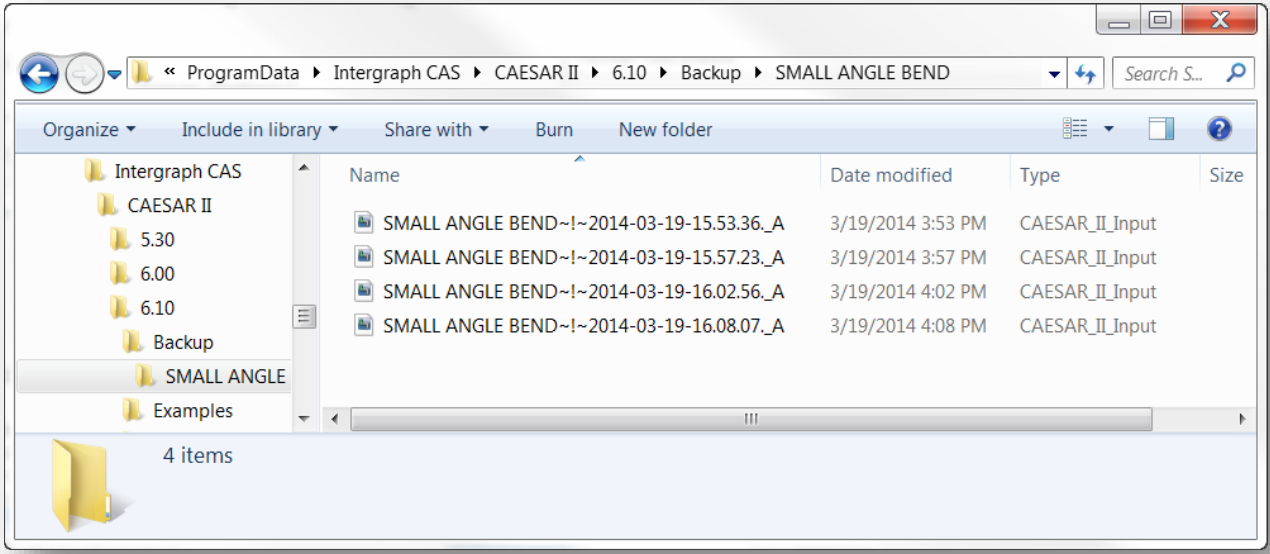
Miscellaneous Options

Input Items	
Autosave Time Interval	30
Disable 'File/Open' Graphic Thumbnail	False
Disable Undo/Redo Ability	False
Dynamic Example Input Text	Max
Enable Autosave	True
Prompted Autosave	True
Output Items	
Displacement Reports Sorted by Nodes	True
Output Reports by Load Case	True
Output Table of Contents	True
Time History Animation	True
System Level Items	
Compress CAESAR II Files	True
Memory Allocated (Mb)	12
User ID	

Autosave Time Interval & Prompted Autosave

Miscellaneous Options

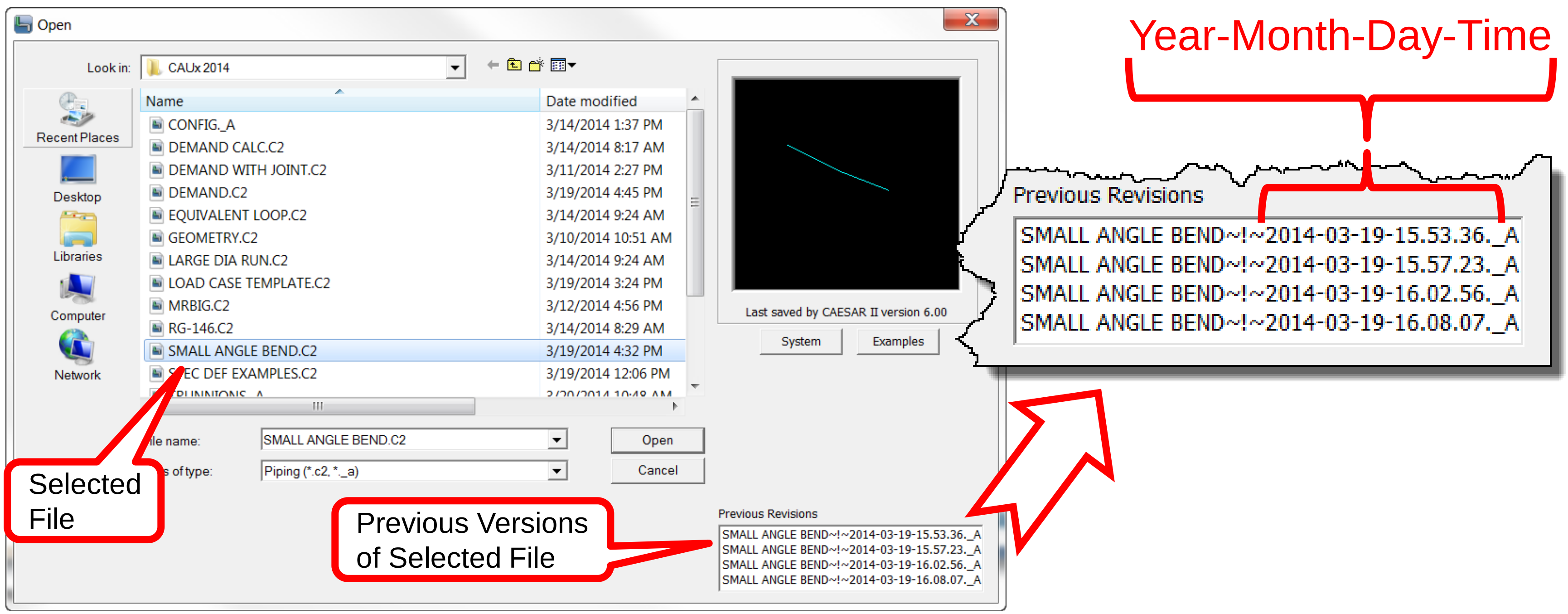
- This feature has long been part of CAESAR II – how often to save (in minutes) and whether or not to prompt for the save.
- This ties in rather well with a more recent addition – model archival.
- CAESAR II maintains copies of the last 25 saves of your input file, i.e., the ._A file.
- These archived files reside in like-named folders under Program Data:



Autosave Time Interval & Prompted Autosave

Miscellaneous Options

- You can access these archived models from the Open File window.
- This offers a simple way to “roll back” your model.

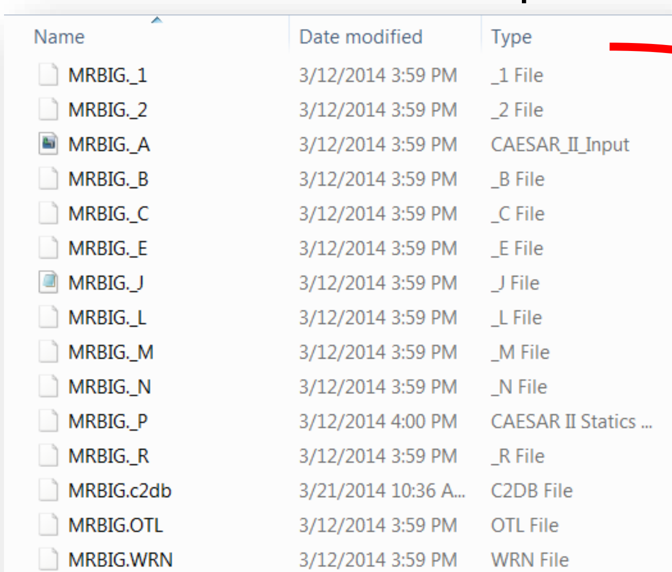


Compress CAESAR II Files

Miscellaneous Options

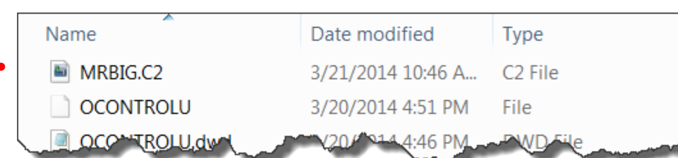
- Your model input file will be saved in JOBNAME._A
- This begins a family of files with the same name but different extensions – each extension indicating a separate data set.
- When you close CAESAR II or change models, the program will zip this family of files into JOBNAME.C2

The active model – uncompressed.



Name	Date modified	Type
MRBIG._1	3/12/2014 3:59 PM	_1 File
MRBIG._2	3/12/2014 3:59 PM	_2 File
MRBIG._A	3/12/2014 3:59 PM	CAESAR_II_Input
MRBIG._B	3/12/2014 3:59 PM	_B File
MRBIG._C	3/12/2014 3:59 PM	_C File
MRBIG._E	3/12/2014 3:59 PM	_E File
MRBIG._J	3/12/2014 3:59 PM	_J File
MRBIG._L	3/12/2014 3:59 PM	_L File
MRBIG._M	3/12/2014 3:59 PM	_M File
MRBIG._N	3/12/2014 3:59 PM	_N File
MRBIG._P	3/12/2014 4:00 PM	CAESAR II Statics ...
MRBIG._R	3/12/2014 3:59 PM	_R File
MRBIG.c2db	3/21/2014 10:36 A...	C2DB File
MRBIG.OTL	3/12/2014 3:59 PM	OTL File
MRBIG.WRN	3/12/2014 3:59 PM	WRN File

Now inactive – compressed



Name	Date modified	Type
MRBIG.C2	3/21/2014 10:46 A...	C2 File
OCONTROLU	3/20/2014 4:51 PM	File
OCONTROLU.dw[illegible]	[illegible] 4:46 PM	[illegible]

INTERGRAPH

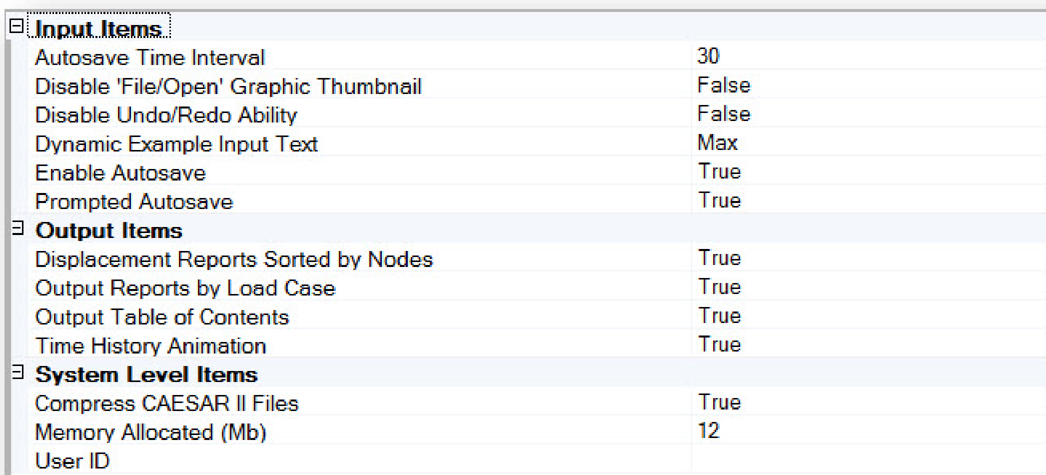
Compress CAESAR II Files

- Setting the configuration switch to FALSE will prevent this compression.
- Many files created by CAESAR II are temporary and can be quickly regenerated during the next CAESAR II session – they are scratch files.
- Users wishing to reduce file storage can delete these scratch files. Deleting these files is simpler if the files are not compressed.

Memory Allocated

Miscellaneous Options

- CAESAR II allocates 12 Mb of RAM by default. (CAESAR II 2014 will increase this allocation to 32 Mb.)
- This is adequate for most analyses.
- The drop list shows memory reallocation as large as 1024 Mb
- Why would you wish to increase memory allocation?



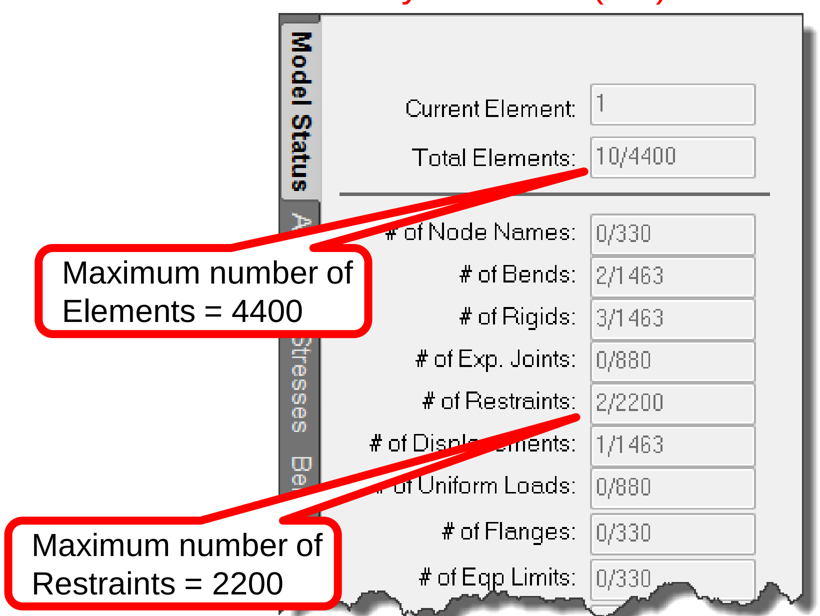
Input Items	
Autosave Time Interval	30
Disable 'File/Open' Graphic Thumbnail	False
Disable Undo/Redo Ability	False
Dynamic Example Input Text	Max
Enable Autosave	True
Prompted Autosave	True
Output Items	
Displacement Reports Sorted by Nodes	True
Output Reports by Load Case	True
Output Table of Contents	True
Time History Animation	True
System Level Items	
Compress CAESAR II Files	True
Memory Allocated (Mb)	12
User ID	

Memory Allocated

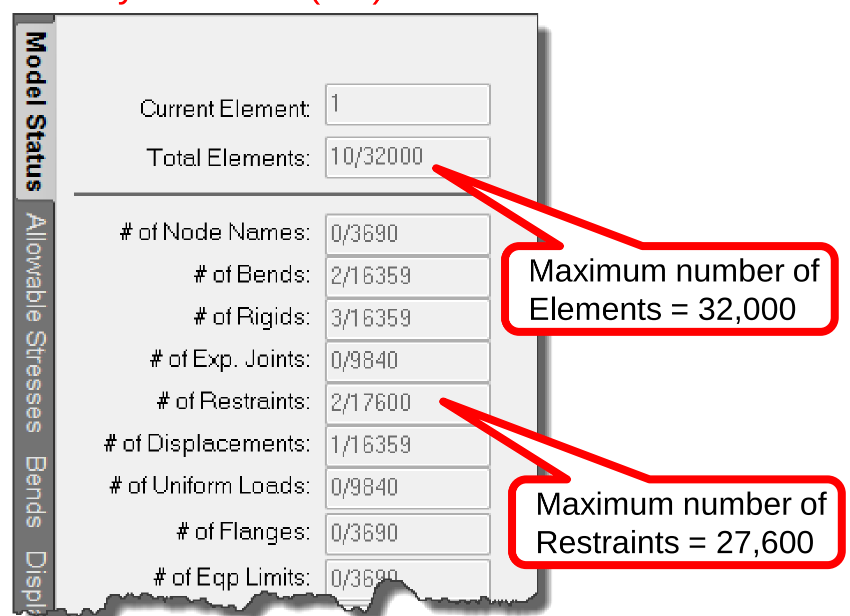
Miscellaneous Options

- Why would you wish to increase memory allocation?
  - Provide more data storage for your model
    - More memory means large models can be defined
    - Allocation is displayed in the Auxiliary Data area under the model status tab

Memory Allocated (Mb) = 12 Mb



Memory Allocated (Mb) = 128 Mb

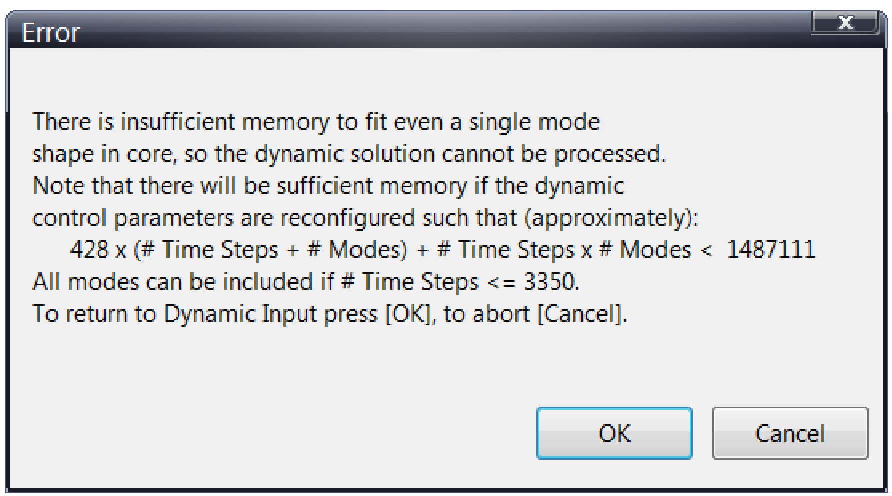


INTERGRAPH

Memory Allocated

Miscellaneous Options

- Why would you wish to increase memory allocation?
  - Provide more data storage for your model
  - Provide more data storage for dynamic analyses
    - Time history analysis may require much more memory
    - Memory is a function of number of time steps, number of modes of vibration and number of time history loads
    - CAESAR II will display an error if memory is insufficient (see below)
    - Clear the error by increasing allocated memory



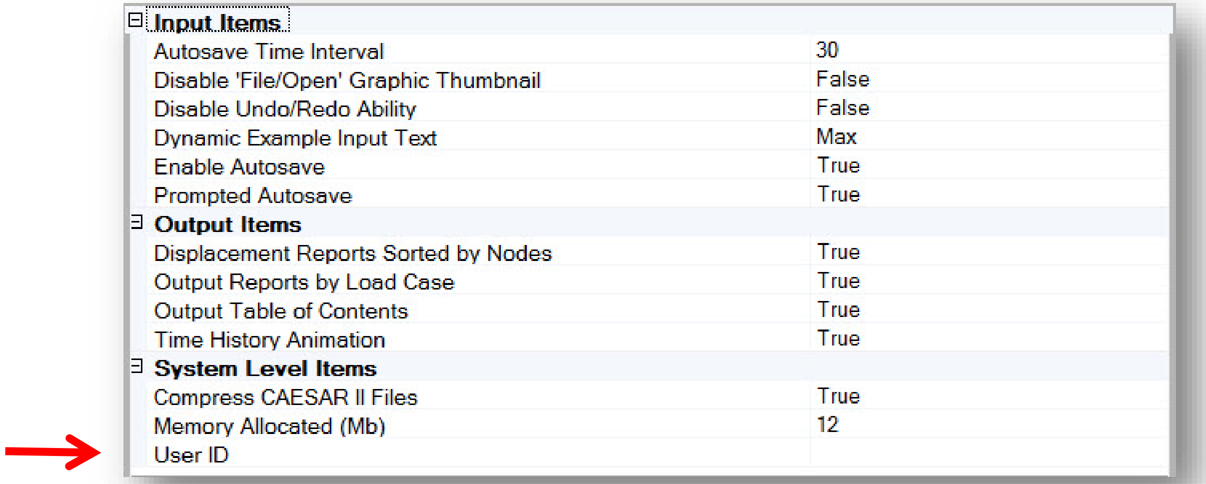
Memory Allocated

- Why would you wish to increase memory allocation?
  - Provide more data storage for your model
  - Provide more data storage for dynamic analyses
- Can you request too much memory?
  - Yes, memory allocated to CAESAR II cannot be used by other programs. These other programs may resort to using hard disk space as memory – severely slowing the application.
  - Fortunately, many PCs today have abundant RAM

User ID

Miscellaneous Options

- The last entry under Miscellaneous Options is User ID. What is the purpose of this entry?
- You probably noticed another file stored in your data directory – CONTROLU (previously CONTROL).
  - This file identifies the last model that was handled by CAESAR II in this folder. Other files are written to the folder for similar purposes.
- Such a structure prevents two or more people accessing the same data folder at the same time.

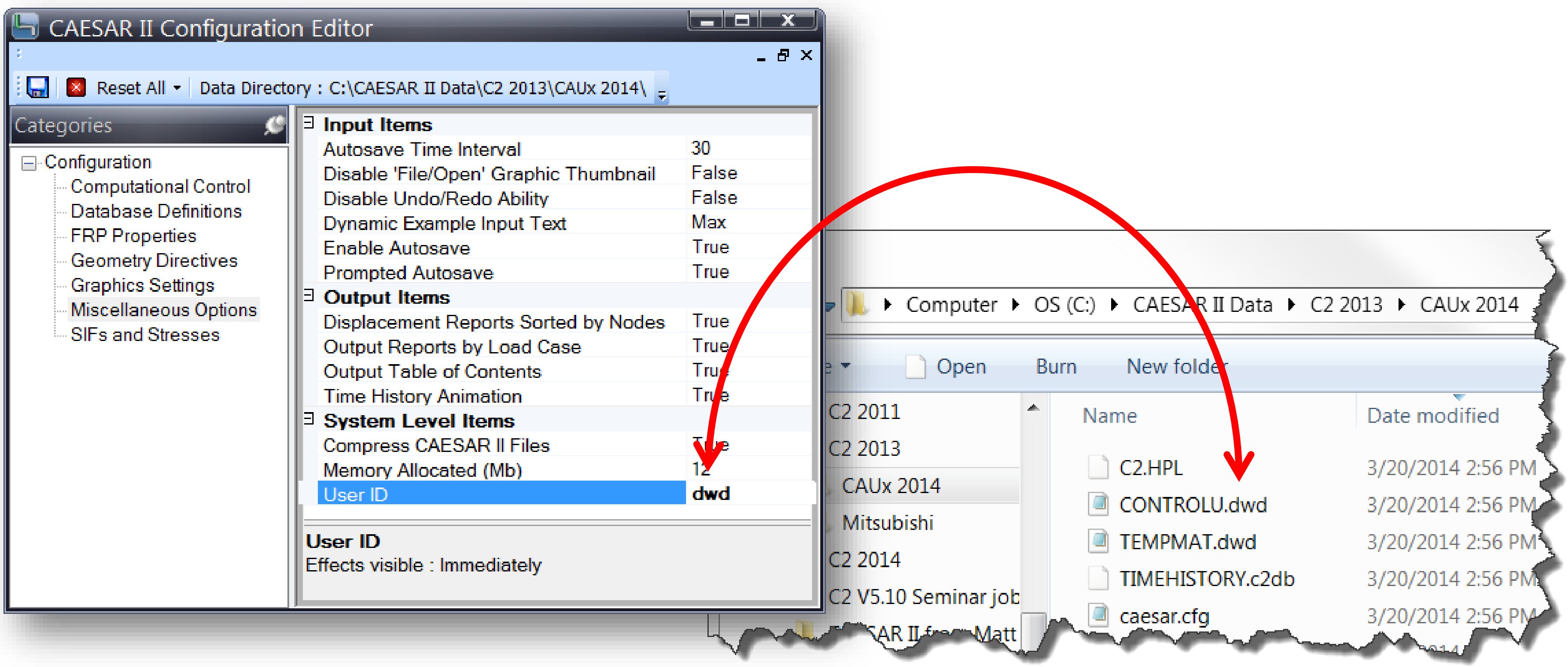


INTERGRAPH

User ID

Miscellaneous Options

- Once User IDs are in place, each use would have their unique ID as the extension to the CONTROLU file:



SIFs and Stresses

Advanced Settings	
Class 1 Branch Flexibility	False
Use Schneider	False
Use WRC 329	False
B31.3 Code-Specific Settings	
Apply Para. 319.2.3(c) Saxial	No (Default)
Implement Appendix P	False
Set Sustained SIF Multiplier	1.0000
Use SL Formulation Para 320 (2010)	True
Code-Specific Settings	
B31.1 Reduced Z Fix	True
B31.1/B31.3 Verified Welding/Contour Tees	False
EN-13480/CODETI use In-Plane/Out-Plane SIF	False
Ignore B31.1/B31.3 Wc Factor	True
No Rft/Wlt in Reduced Fitting SIFs	False
Occasional Load Factor	0.000
Pressure Variation in EXP Case	Default
Reduced Intersection	B31.1 (Post 1980)
General Settings	
Add F/A in Stresses	Default
Add Torsion in SL Stress	Default
All Cases Corroded	False
Allow User's SIF at Bend	False
Base Hoop Stress On	ID
Default Piping Code	B31.3
New Job Liberal Expansion Stress Allowable	True
Use PD/4t	False
Yield Stress Criterion	Max3DShear

Implement Appendix P

- B31.3 Appendix P provides alternative rules for evaluating expansion stress range.
- The key word here is “alternative”:
  - Either
    - Use the expansion stress range evaluation in the base Code
  - Or
    - Use the expansion stress range evaluation AND the operating stress evaluation found in Appendix P.
- This configuration file switch identifies which path the engineer wishes to take in evaluating expansion stress range.
- Set “Implement Appendix P” to TRUE if you wish to take that path.

B31.1/B31.3 Verified Welding/Contour Tees

- Appendix D of these piping codes provides a flexibility characteristic (h) for tees. The stress intensification factor for the tee is a function of this characteristic, h.
- An exception to this calculation exists for Welding tees and Welded-in contour inserts (e.g., weld-o-lets).
  - If sufficient material is included in these branch connections, credit may be taken for their higher strength. This higher strength is reflected in a larger calculated h which gives a lower stress intensification factor.
  - If the stress engineer can verify the these components meet specific dimensional criteria, the higher h is permitted.

B31.1/B31.3 Verified Welding/Contour Tees

- Specifically, if:
  - The radius of curvature of the external contoured portion of outlet ≥ 1⁄8 outside diameter of the branch
- And if:
  - The crotch thickness of the branch connection ≥ 1.5 nominal thickness of the matching pipe
- The larger h may be used.

- CAESAR II implements this exception through the configuration setting:
  - “B31.1/B31.3 Verified Welding/Contour Tees” to TRUE
  - This indicates that ALL tees identified as “3-Welding” or “5-Weldolet” have these critical dimensions checked and verified.

EN-13480/CODETI use In-Plane/Out-Plane SIF

- The ASME process and power codes (B31.3 & B31.1) apply stress intensification factors (SIFs) differently. The process code has unique in-plane and out-plane SIFs for component stress calculation and the power code employs a single SIF for the component.
- The European Standard for metallic industrial piping, EN-13480, and the French code for the construction of industrial piping, CODETI, allow the designer to choose between these two applications of the SIF.
- CAESAR II, by default, calculates these Code stresses with a single SIF. The user can direct the program to use in- plane and out-plane SIFs by setting:
  - “EN-13480/CODETI use In-Plane/Out-Plane SIF” to TRUE

All Cases Corroded

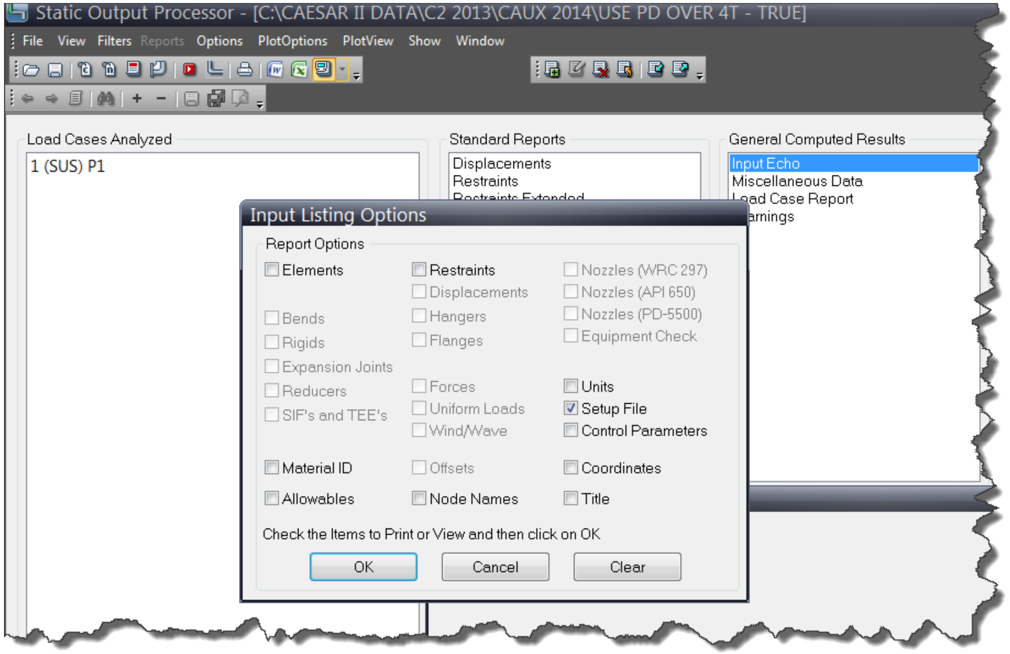
- Users can define corrosion in their piping input.
- How is corrosion reflected in structural analysis?
  - Corrosion will not be used in calculating pipe stiffness.
  - Corrosion will not be used in calculating pipe weight.
- How does corrosion affect typical code stress calculation?
  - Collapse evaluation - corrosion will be used to reduce wall thickness in calculating stress that may lead to collapse – the sustained and occasional stresses. (This will reduce the A in F/A and the Z in M/Z.)
  - Fatigue evaluation – corrosion need not be considered in calculating expansion stress range.
- But corrosion is a fatigue accelerator.
- If you wish to include corrosion in all stress calculations, set
  - "All Cases Corroded" to TRUE

Use PD/4t

- Piping codes reflect methods of analyses that were common when the codes were developed. The computer of the day was a slide rule.
- Many code calculations could be simplified for slide rule use but still provide safe solution.
- Longitudinal pressure stress may be approximated by the equation PD/4t. A more accurate formula takes the form $P(A_{in}/A_{xs})$.
- Piping codes also allow for more rigorous approach to evaluating piping systems. This more exact longitudinal pressure stress formula is more rigorous.
- For those piping codes which do not have a stated equation for longitudinal pressure stress, the lower stress from $P(A_{in}/A_{xs})$ will be used if:
  - "Use PD/4t" is FALSE

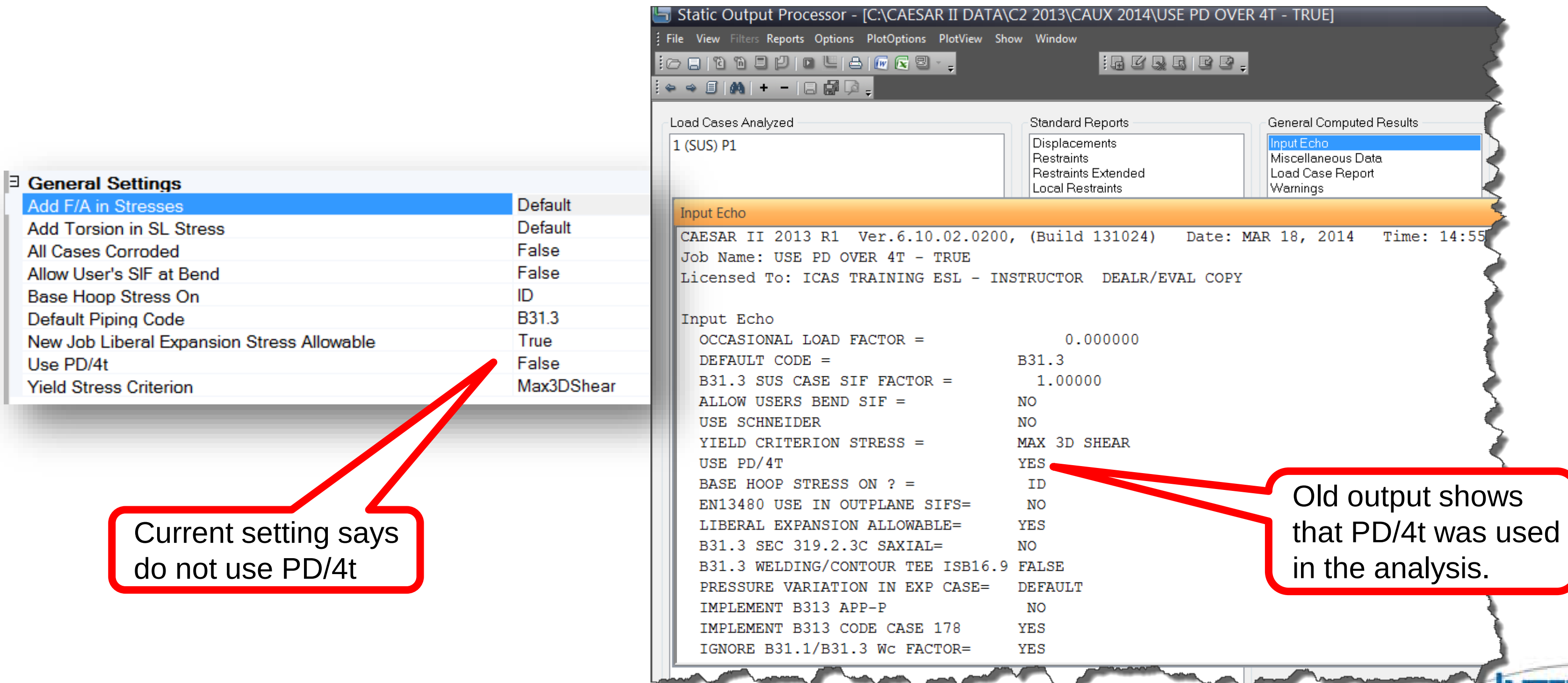
What Configuration was Used?

- Configuration settings that affect the program analysis are available in the CAESAR II output processor.
- Select Input Echo under General Computed Results, clear the list, then
- Check Setup File, then OK



What Configuration was Used?

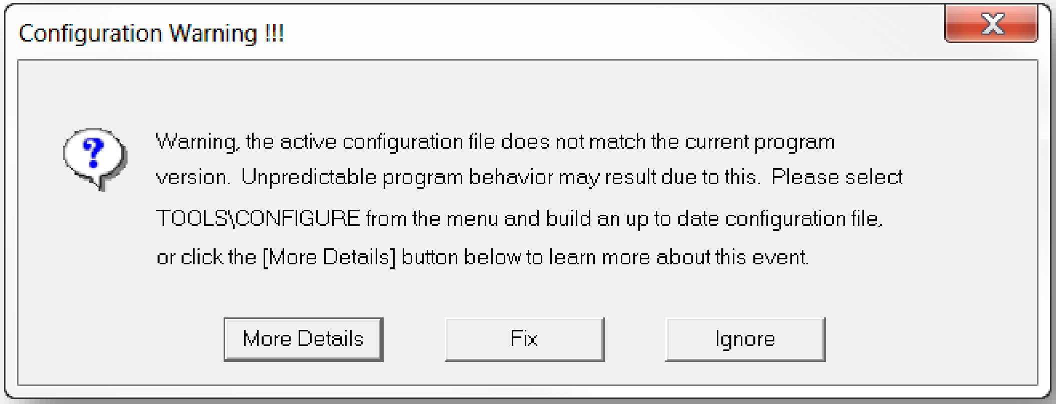
- The program's current Configuration setting for Use PD/4t is FALSE.
- The results for the model below were analyzed with that setting as TRUE.
- Note that the Configuration echo shows "Use PD/4t YES"



INTERGRAPH

Updating CAESAR II

- Configuration file contents may change from one version of CAESAR II to the next.
- Should you open a CAESAR II input file in a folder with an older CAESAR.CFG, the program will automatically open the Configuration Editor so that the new items can be confirmed or updated.



What We Covered

- Overview
- How Program Configuration Works
- Using the Configuration Editor
- Configuration Highlights
  - Computational Control
  - Database Definitions
  - FRP Properties
  - Geometry Directives
  - Graphics Settings
  - Miscellaneous Options
  - SIFs and Stresses
- Reporting Configuration Settings

Using CAESAR II Configuration

Questions?

Comments?

Ideas?

CAESAR II Configuration

Thank You