# VirtualWork
A newsletter for customers and friends of IES

# Slender Bracing Elements in VA

**Steel rod bracing techniques and issues**

Slender steel rods or single-angle shapes are often used for bracing of steel structures, other bracing members may also be rather slender. VisualAnalysis provides features that you can use to analyze and design these slender members in your models, but there are some things that could upset you or cause productivity to sag.

## Connecting Cross Bracing

When sketching members in VA the software tries to help you connect them rationally. When two members cross, VA will automatically split and connect them (and combine them as shown in the center image below). For X-braces that carry primarily axial load this is not typically what you want because it complicates the model. There are two ways to avoid this midpoint connection:

- Hold the **Alt** key while sketching the second brace
- Delete the center node (if members are 'combined').

All three options below will work OK in most circumstances. Whichever you choose, you must make sure to follow-through and specify the unbraced length properly for design checks.
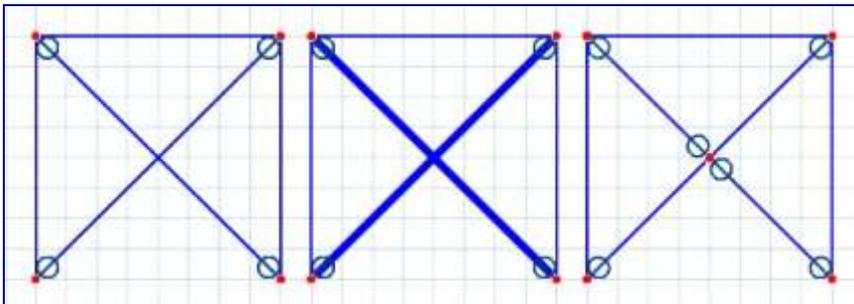


## Self-Weight & Bending

Just because you will design these braces for axial forces (primarily tension) does not prevent them from bending. End releases will prevent moments from entering the element from outside, but self-weight will cause bending. Sometimes this bending can result in significant stress that will cause members to fail. You may wish to ignore this bending, using some sound engineering judgment, in which case you could use a "weightless" material in your VA model to prevent bending. Alternately you might allow X-brace members to split and connect at the crossing and reduce the bending span length.

## Tension-only Bracing

VA does not perform full-blown **buckling** analysis, but will do an iterative one-way member analysis so that you can assume the braces are not effective in compression. Note that this feature is not available for Combined member elements. This nonlinear analysis can be tricky, especially if you have too many tension-only members or the model becomes unstable when they are removed from the stiffness matrix during iterations.

## Cable Elements

For really slender bracing, or bracing that is "pretensioned", the Advanced Level of VA offers a true cable element with a catenary sag. Again this is a nonlinear

solution that may not converge and is very sensitive to your initial conditions. To get a pretension in a cable element you specify the catenary length as shorter than the straight-line length between nodes. You must calculate the shortened distance to effect the correct pretension force.

### P-Delta and AISC DAM

Second order analysis can also further complicate the use of slender "buckling" type members because the analysis exposes bending deflections and magnified moments due to deflections. In the case of **Direct Analysis** there are also notional loads and stiffness reductions to further weaken the already slender members!

### Conclusions

The bottom line is that while VA provides many options and features to help you model slender bracing members you must make a number of important modeling decisions based on your experience and judgment. Your solution may vary from project-to-project based on the specific goals and requirements of the model!

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# Free Updates

**Critical Updates, Bug Fixes, Improvements**

We have been working very hard to improve the quality of our tools by closely monitoring crash reports and technical support issues. Please take advantage of all this work and spend just a couple minutes updating all your IES products to the latest releases!

The following products were updated recently:

- VisualAnalysis 9.0
- ShapeBuilder 6.0
- QuickMasonry 3.0
- QuickConcreteWall 2.0

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# Retired IES Products

**Housecleaning at IES**

### A Legacy-Product Policy

Software years are something like dog years. Programs we used just a few years ago just do not measure-up in terms of reliability and performance. At IES we are committed to providing you with cutting-edge tools that are current with respect to design standards and codes. As we release new versions we retire old versions, but generally have supported them for "life", where life means as long as YOU can keep it running on your machine(s).

Retired products do not receive any updates or bug fixes, unless something really ugly is exposed within a year of retirement. We will make available downloadable installation files and provide license keys for **three years** after a product is replaced by a newer major version.

### Preserving Your Stuff

After that 3 year retirement period, we label the product-version dead. Dead products will not count toward an upgrade to the current version. It will be up to you to archive your installation and license key. IES will not provide any services for dead products, including license transfers, or technical support. We will officially announce the death of products via the newsletter or on our web site and give you time to upgrade before the death.

### Dead Product-Versions

The following product-versions (and all prior versions) will be officially dead as of May 2012. You have until then to upgrade these old versions.

- VisualAnalysis 5.5
- ShapeBuilder 4.0
- AnalysisGroup 3.0
- QuickFooting 1.0
- QuickRWall 1.5
- QuickMasonry 1.0

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# Software Archives

**Keeping Software Projects Available Forever**

The world has changed since the days of "paper trails" and more and more our data is locked up inside software products and proprietary data files. How should an engineer document and record information to be accessible in the distant future? There are a number of issues you should consider with regard to projects created in IES software tools. Consider the scenario of a future lawsuit: How will you prove your procedure and results? Consider too the scenario of a remodel or addition to an old project: Wouldn't it be great if you could just open that old project file and get to work with the necessary modifications?

## Future Access?

Structural drawings are used to document your final designs, but what about your final analysis models or design calculations? If that data is locked up inside a .VAP project file--who will be able to get at that information in 7 years when the software world has moved far beyond VisualAnalysis 9.0?

Of course, at IES we work hard to preserve upgrade compatibility. We try to make sure your old project files will open into newer versions of our products. However as features change it is not always possible to guarantee equivalent behavior or calculations with that data! "Converting" a project from one version to the next may give you different (hopefully better and more accurate) results, but different nonetheless.

## Document Your Results

It seems fairly obvious to store reports in some "standard" format like PDF or even plain text and you may still be required to print your documents for storage in a calculation binder. This is suitable for most projects and results, and will allow you to understand your work in the future.

If you save your "project files" from your software products, will you own a future version of the software that will treat that data in the same way? If you have switched software vendors the old data may be locked up and innaccessible to you in the future!

## Standard Engineering File Formats?

Another potential solution would be for the engineering community to get together to define and standardize "open" file formats for engineering data. Things like BIM standards for exchanging data could provide a nice archive format. **If your software product supports saving data to other file formats you might use this today to have additional future options for bringing data into other tools.** We should all work toward more standardized and flexible file formats for our engineering data!

## Keep Software **and** License Keys?

A perhaps safer approach is to store your project files along with a copy of the program (installer) used to generate that project data and the license key to unlock that software! While there is no guarantee that this tool will install and run

on Windows 14 in the distant future, you may be able to track down a dusty old Windows 7 box to restore the data.

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# IES Unit Systems

## Understand unit styles and precision

The IES Visual* products and ShapeBuilder all share a common platform for managing the input and display of physical quantities. We've tried to build a simple, yet flexible and powerful system to make engineering work easy. With a few key tips you'll be on your way to mastering these features. Note: Our Quick* products have similar but slightly different systems.

## Selecting Styles

The first task you have when you start a project is to select a "Unit Style". Typically this is as easy as selecting from a drop-down list in the toolbar or near the upper right-corner of the Window. This style sets the stage for how physical quantities will be displayed by the software. For more fine-grained control use the "Edit Units" option.

## Input and Output

While the unit style defines how numbers will be output by the software, they only partially dictate your input. You may TYPE values in any unit you like! Simply replace the displayed text with your full entry including the value and any acceptable unit. You can even enter expressions or ft-in-16ths notation.

## Precision Settings

Each unit style has an associated precision setting that is used to help format data nicely. This setting roughly determines how many significant digits are displayed when displaying values in the user interface and graphics. Reports tend to use a fixed-format display so that numbers in tables line up nicely, but the precision setting will affect these too. Occassionally there can be round-off issues if your precision setting is small and the value getting displayed for editing is very small in the current unit style--just something to watch for.

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