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BSI Bridge Software Institute NEWSLETTER

In this issue, we discuss recently developed features for FB-MultiPier v5.2.

The Bridge Software Institute (BSI) encourages all of our clients to communicate suggestions for improvements to our software. These suggestions may be general or very specific to project needs. We firmly believe that you are in the best position to know what those needs are!

In this release of FB-MultiPier, the following listed improvements were all a result of YOUR suggestions:

a) Expanded member end release options for Extra Members.
b) Automated calculation of Rayleigh Damping parameters for time-history analysis.
c) User-defined bearing pressure vs vertical displacement curve for pile cap bearing.
d) User-defined coordinate input for the superstructure spine beam.
e) Program-wide ability to export tabulated data to Excel/PDF.
f) Improved graphics and intuitive cursors for all 3D windows.
g) Enhancements to Printable Graphs feature in Force Results windows.

Several of the enhancements are highlighted below.

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What's New at BSI

We are pleased to announce the release of FB-MultiPier v5.2. This program and other structural analysis software are available for download from the **BSI** website. The new version of FB-MultiPier contains fixes to the latest reported errors and also includes a number of new features.

Program Enhancements

Expanded Member End Release Options for Extra Members

Extra members, as available in FB-MultiPier, were originally added as a feature to provide the ability to add struts between pier columns. Then demand dictated that we expand the usefulness of this feature to a general all-purpose structural element. Displayed in **Fig. 1** is an example of a braced fender where extensive use of Extra Members was needed to complete the design application. Shown in **Fig. 2a** is the newly enhanced Extra Members (X-Members) page of the Model Data window. The Extra Member Custom End Fixity dialog (**Fig. 2b**) can be accessed by clicking the "Custom Fixity" button. The new dialog for custom extra member end-fixity provides for a range of restraint or release possibilities at either, or both, of the I-end and J-end of each Extra Member element.

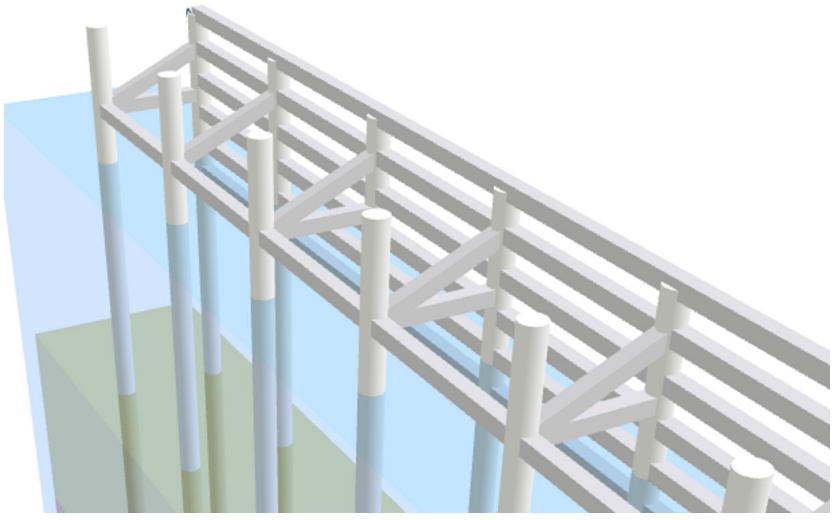

Figure 1. 3D Model View of fender fitted with Extra Members that act as wales and bracing.

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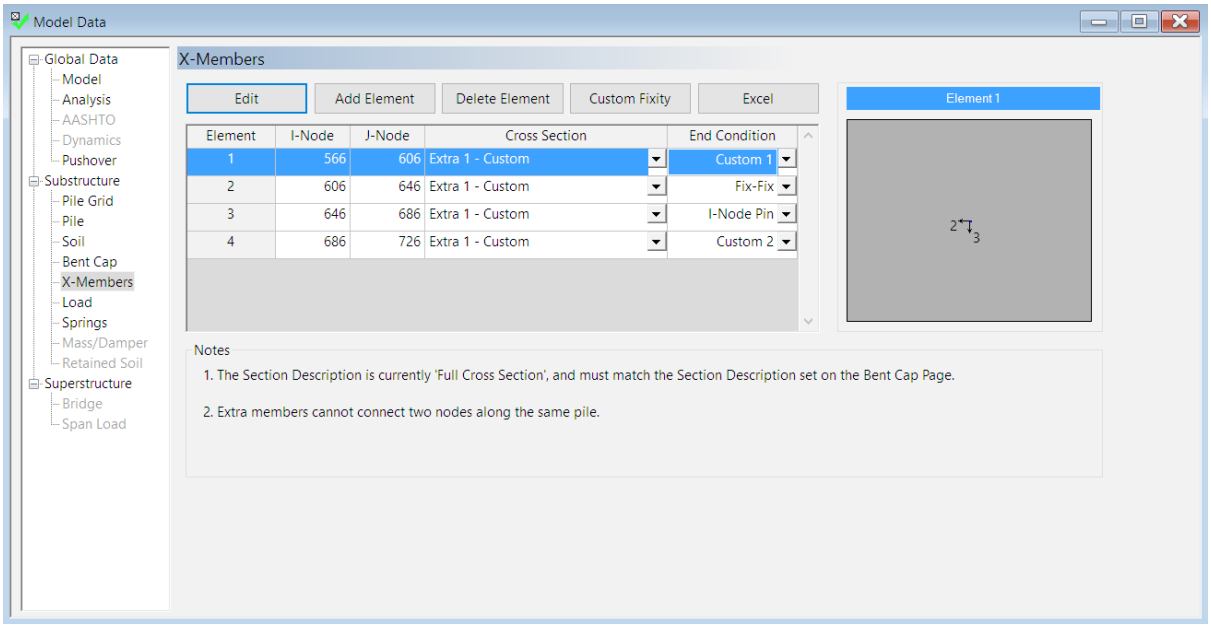

Figure 2a. X-Members page

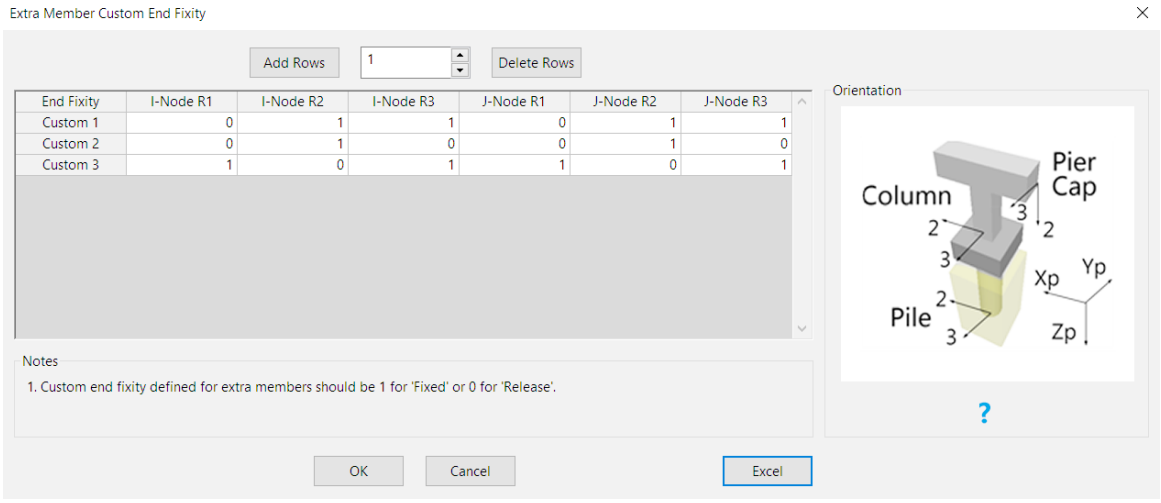

Figure 2b. Extra Members Custom End Fixity dialog

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Automated Calculation of Rayleigh Damping Factors for Time-History Analysis

In static analysis of a system, equilibrium is satisfied when the product of stiffness and system displacements balances the externally applied loads. In contrast, for dynamic time-history analysis, inertia and damping also enter into the equilibrium calculation process. In other words, inertia and damping act in conjunction with stiffness to balance externally applied loads. Therefore, damping constitutes an important consideration when carrying out time-history analyses.

FB-MultiPier offers numerous ways of modeling damping, particularly for portions of structures that are embedded in soil (radiation, hysteresis, force-dependent). One convenient means of modeling damping for an entire system in FB-MultiPier is by supplying Rayleigh Damping Factors in the Dynamics page (**Fig. 3**). As an added convenience to engineers, the process of calculating Rayleigh Damping Factors has been automated as part of FB-MultiPier v5.2.

The option for automated calculation of Rayleigh Damping Factors can be accessed for any time-history analysis model by clicking the "Advanced" button on the "Dynamics" page. The "Dynamics - Advanced" dialog will then appear (**Fig. 4**), which contains the option to "Calculate Rayleigh Damping Factors", enter two vibration modes of interest (e.g., mode 1 and mode 5), and enter the desired level of damping as a percentage of critical damping (e.g., 5%). When this feature is utilized, Rayleigh Damping Factors are automatically calculated as part of a pre-analysis, and then automatically incorporated into the subsequent time-history analysis. Upon completion of the time-history analysis, the engineer may view the Rayleigh factors that were calculated and utilized by the software. Note that the automatically calculated Rayleigh factors are applied system-wide (to Pier, Pile, and Soil degrees of freedom). Alternatively, if Rayleigh Damping Factors have been previously calculated, they can be supplied directly (**Fig. 3**), or imported by clicking the "Import" button on the "Dynamics" page.

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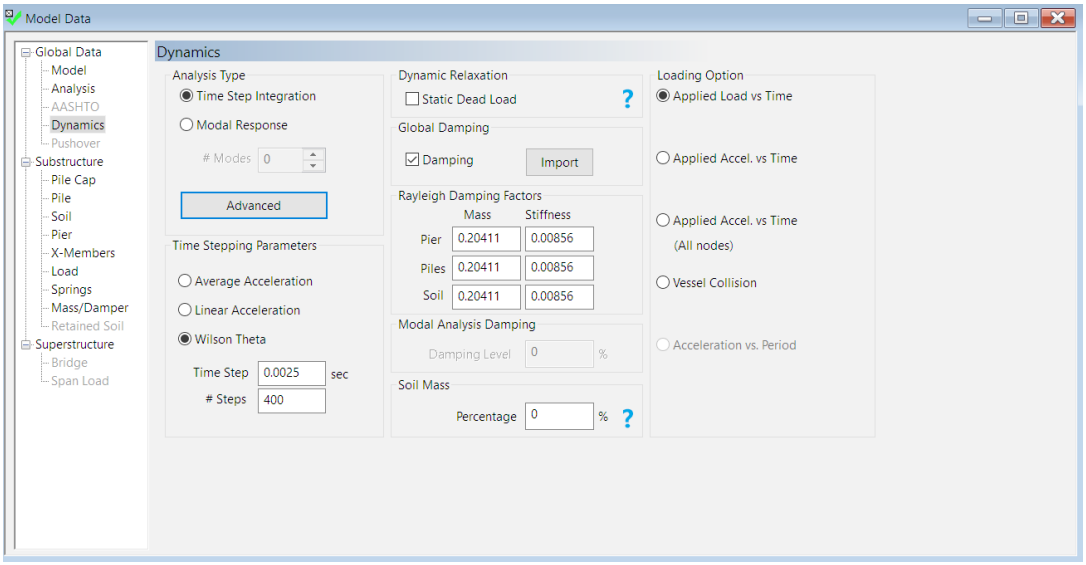

Figure 3. Rayleigh damping input options available on the Dynamics page

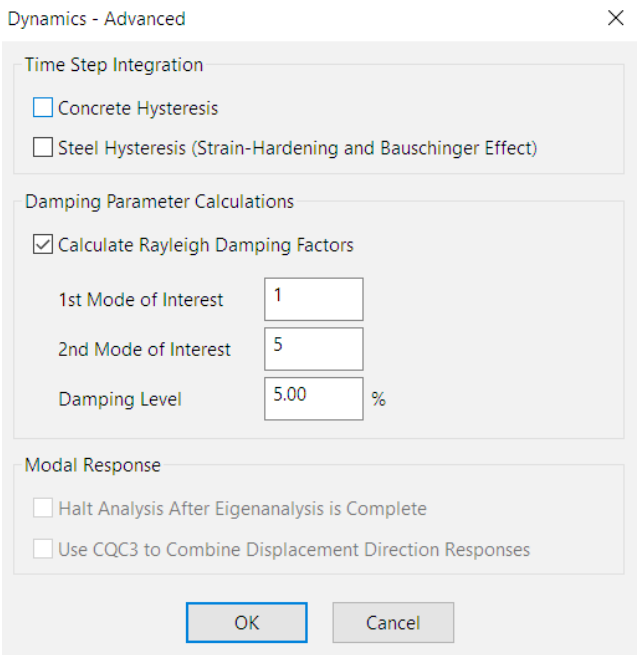

Figure 4. Dynamics - Advanced dialog containing input for automated calculation of Rayleigh Damping Factors for any time-history analysis

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Bearing Pressure vs Vertical Displacement Curve for Pile Cap Bearing

User defined vertical bearing pressure curves can be input and assigned to nodes of one or more elements within pile caps and footings. These curves are unrestricted in terms of shape, and allow for greater flexibility in modeling footings that bear upon (or are embedded within) soil. In model terms, the custom bearing pressure curves can be defined and applied to any selection of shell elements in FB-MultiPier models for configurations where the pile cap (footing) midplane is located at or below the ground surface elevation.

As a simple illustration, consider a 24 ft x 24 ft x 6 ft footing (**Fig. 5a**). The footing is supported upon material characterized using the custom bearing curve displayed in **Fig. 6**, where a vertical (compressive) displacement of 0.25 inches generates a soil bearing stress of 0.024 ksi. Further, the footing is loaded at the center with a vertical load of FZp = 1000 kips and a moment of MYp = 4,000 kip-ft (**Fig. 5b**). For this case, the bearing stresses at the left and right edges of the footing are manually computed as 0.000 ksi (essentially zero) and 0.024 ksi. The FB-Multipier plot of computed cap displacements (**Fig. 7**) agree with the expected deformation, given the manually computed stresses.

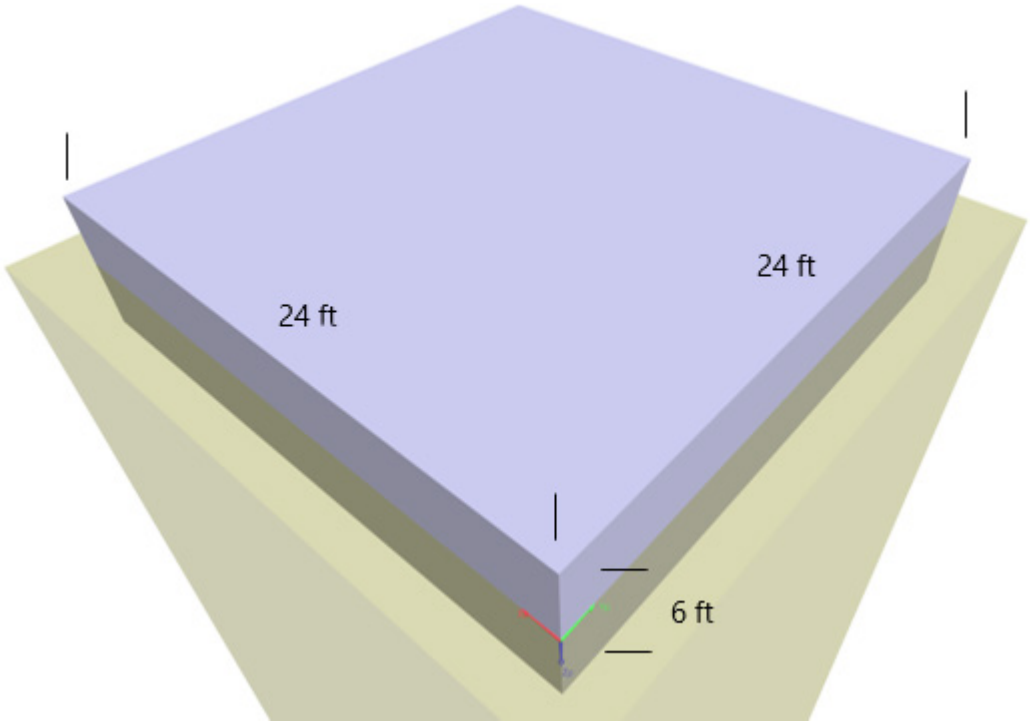

Figure 5a. Structural model of footing

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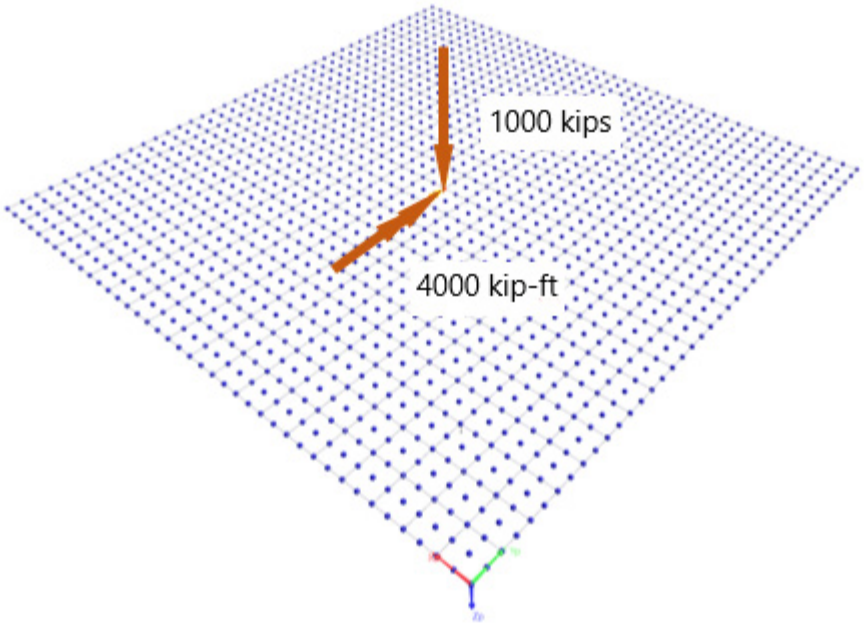

Figure 5b. Numerical model of footing

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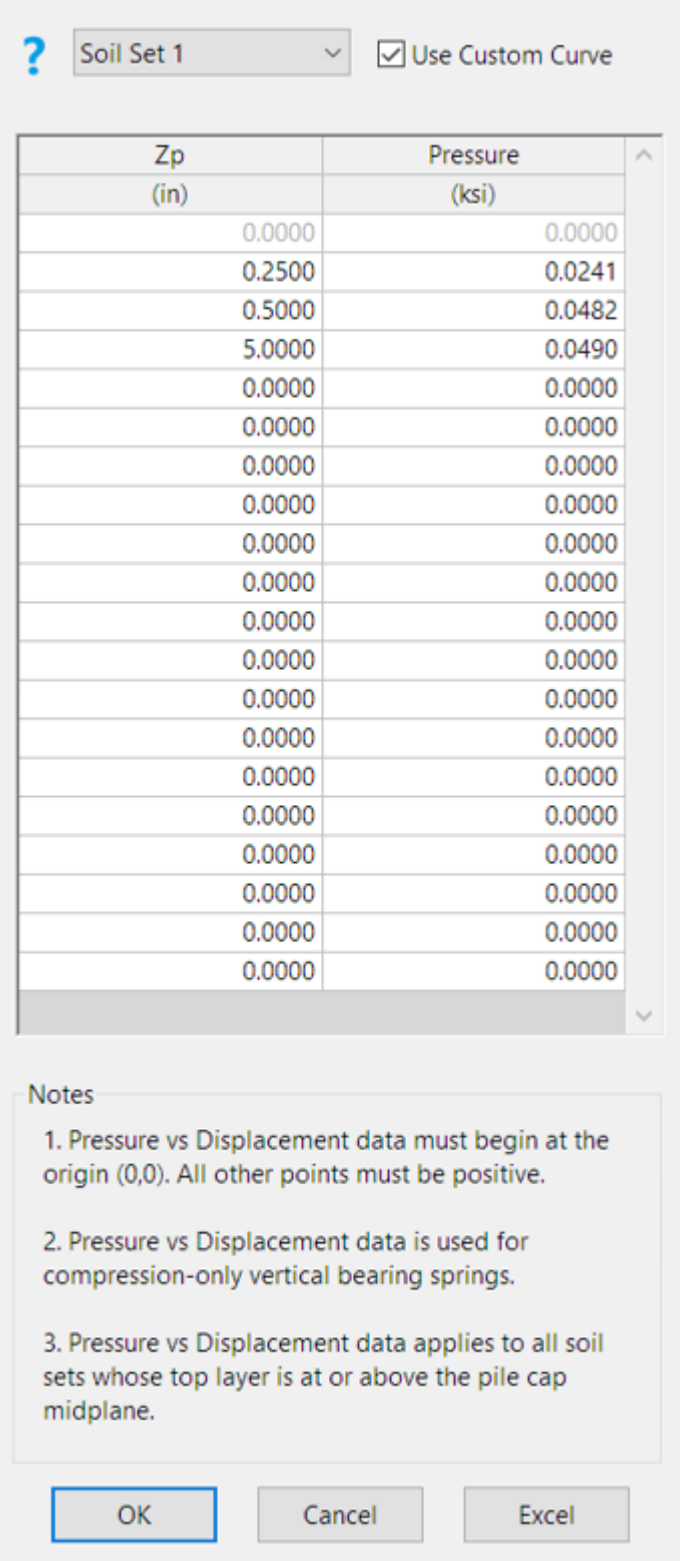

Figure 6. Custom Pressure vs Displacement Curve dialog

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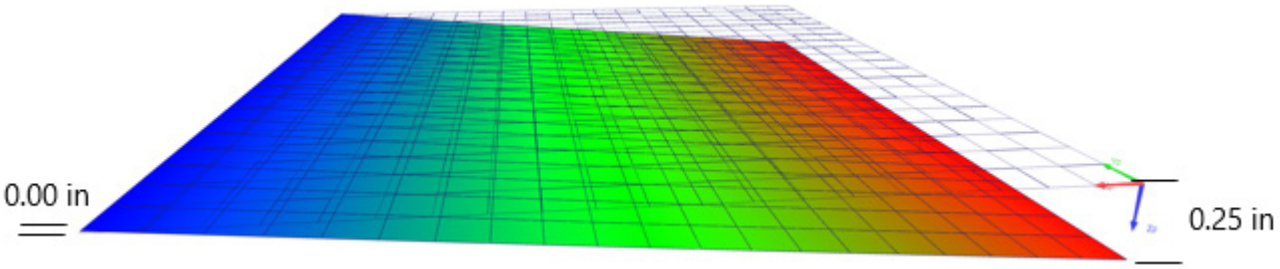

Figure 7. Contour plot of footing Zp displacements

Program-wide ability to export tabulated data to Excel/PDF:

'Export Format' can be used to setup the format that will be used to export the data out of FB-MultiPier windows. Go to "Control" menu -> "Program Settings". The export can be in Excel or PDF format (**Fig. 8**).

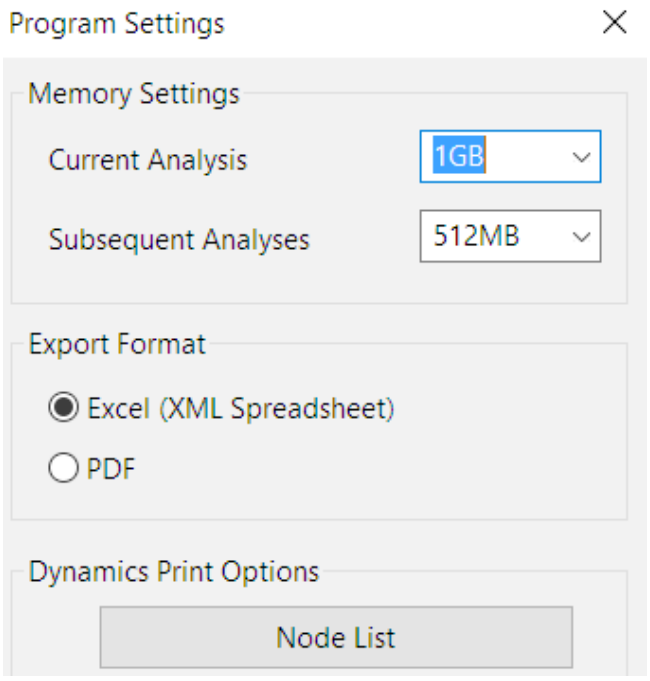

Figure 8. Program Settings dialog

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Additionally, dialogs with table information can now be copied and pasted in their entirety including the header information. Shown is **Fig.9**, is "Printable Forces" dialog, where the headers of the table can also be selected to facilitate copying the entire table.

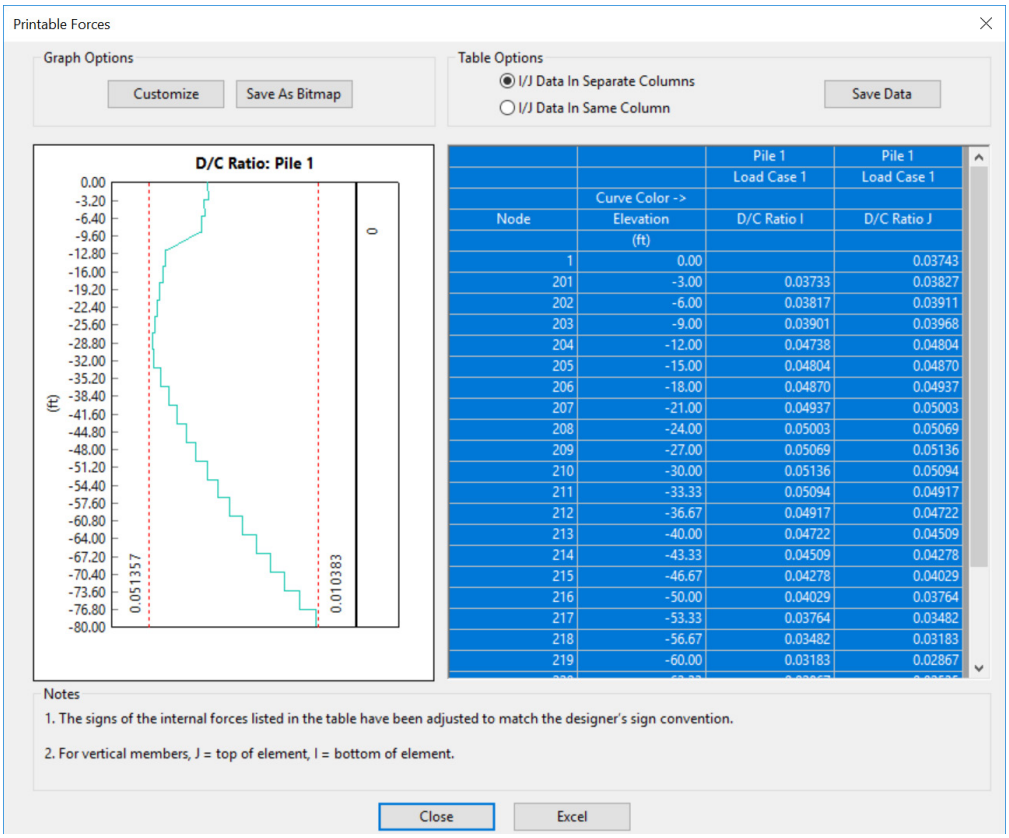

Figure 9. Printable Forces dialog

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For Technical Support

Technical Support Tips:

Location of model files: When running an analysis with FB-MultiPier, the input file should always be located on the local machine, and not on a network server. FB-MultiPier creates binary files during the analysis. Binary files are written to and read by FB-MultiPier. If an input file is located on a server, network latency can result in these binary files not being written and read fast enough to keep up with the engine process. This can cause the program to crash when running the analysis. Thus, it is best practice to create a folder on the local machine, and save the input file to this location. Once the model has been analyzed, the input (.in) and output (.out) files can be copied back to the server location (for permanent storage, or for access by other end users).

License codes: Unlocking codes created by the license wizard to unlock a program license can only be used one time. Each time the license wizard is opened, it creates a new session. When the need arises to contact BSI for license unlocking codes, please provide the current "Session Code" and "MachineID" to receive new unlocking codes.

Tips for Maximizing Technical Support Effectiveness:

Correspondence with BSI engineers: When requesting technical support for any BSI software, it is recommended that engineers email the input file (.in file for FB-MultiPier and Atlas or .spc file for FB-Deep) to bsi@ce.ufl.edu along with a brief explanation and any supporting documentation of the issue. This will allow BSI support staff to provide prompt technical support to our users.

Identifying the program version: It is important that users have the most current version of the BSI software. Thus we recommend that users regularly visit the home page of the BSI website. To identify the current version of a program installed on your computer, open the program and go to Help -> About to see the program version number.

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BSI Program Status

FB-MultiPier v5.2 Download a FREE demo today!

Released: Nov 16, 2017 - Continuing Development - Technical Support Available

FB-MultiPier allows for the modeling of bridges, bridge piers, pile bents, and other foundation structures. In addition to allowing for multiple load cases and AASHTO load combinations, FB-MultiPier is also capable of performing dynamic analysis (time-history and RSA). For more information about FB-MultiPier, click here.

FB-Deep v2.04 Download a FREE demo today!

Released: May 28, 2012 - Continuing Development - Technical Support Available

FB-Deep is used to estimate the static axial capacity of drilled shafts and driven piles. The methodology is based upon Federal Highway Administration (FHWA) reports. FB-Deep guides the user through pile and shaft materials data, shape and dimensional inputs, soil properties, and boring log info. For more information about FB-Deep, click here.

Atlas v7.0

Released: June 13, 2017 - Limited Web Support Available

Atlas is a finite element analysis program that is used for the design/analysis of cable supported traffic signal systems. The Atlas program models dual cable supported systems including single-point, and two-point attachments systems. For more information about Atlas, click here.

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Contact BSI

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