Current Affairs
A Window on Software Engineering

What's New with the Linker Tool in MineSight® 3.20?

Now available in MineSight® 3.20 is an all new **Linker** tool. The **Linker** dialog has been completely redesigned and the tool has numerous enhancements including new features and functions to make linking easier and faster.

The following is a brief review of what's new:

New Linker Dialog

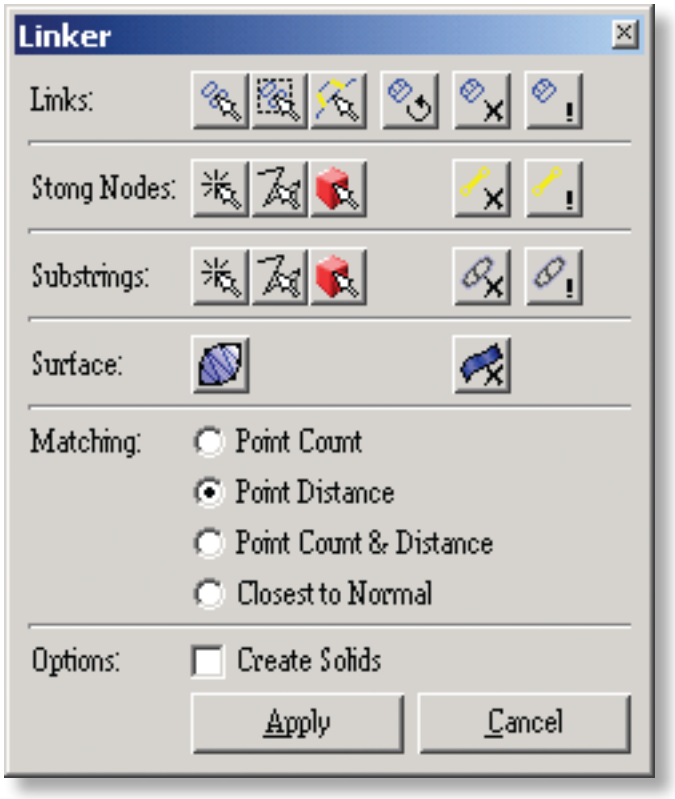

Fig. 1 New Linker tool Dialog.

The **Linker** tool now has an entirely new interface (Fig. 1). To become familiar with the new icons, use the "tool-tips" which are available by "hovering" the cursor over the function buttons. The dialog can be launched at any time, as it is no longer necessary for linked features to be selected. Start the **Linker** through either the Linker icon  or through the **Tools** or **Surface** menus.

New Linker Material Types

Linker Strong Nodes and **Linker Substrings** are now specialized MineSight® material types, with both attributed name and material types assigned (Fig. 2).

Fig. 2 Query of a Linker Strong Node and Linker Substring showing attributes.

Upon **Apply**, all strong nodes that are active in the linking session automatically get saved to the destination object attributed as **Linker Strong Nodes** elements. **Linker Substrings** are written to the destination object as soon as they are created. Once written to an object, these specially attributed elements become standard polylines and are available to edit, copy, etc. Since they are specially attributed with the **Linker** material types, they are readily available and instantly recognized by the **Linker** as strong nodes and substrings to be utilized in further linking sessions.

Utilizing Existing Strong Nodes and Substrings

Linker Strong Nodes and **Linker Substrings** elements that exist in the current destination object are automatically highlighted and active in the **Linker**. Other **Linker Strong Nodes** and **Linker Substrings** elements that exist in other objects can also be easily retrieved for further use by using the new functions **Copy Strong Nodes from Object** and **Copy Substrings from Object**. 

Copy Strong Nodes from Object will copy all **Linker Strong Nodes** attributed elements from the specified object (which must be open) to the current linker session as active strong nodes. These currently active strong nodes will then be utilized in any links created by connecting the polylines which they connect. They will only be written to the destination object upon **Apply**.

Copy Substrings from Object will copy all **Linker Substring** attributed elements from the specified object (which must be open) to the destination object as **Linker Substring** elements. These **Linker Substrings** then become available for use in linking.

Strong Nodes and **Substrings** can also be created by copying from existing polyline elements using

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the new **Copy Strong Nodes from Polyline** or **Copy Substrings from Polyline functions**. Using these functions, simply choose an existing polyline from the viewer to copy. If copying an existing polyline to become a **Strong Nodes**, it will immediately become an active **Strong Nodes** available for use in linking. If copying an existing polyline to become a **Substring**, it will immediately be copied to the destination object as a **Linker Substrings**, and then be available for use in linking.

Reverse Polyline in Preview Link

In the old **Linker** it was necessary that polylines being linked together were of consistent direction, since nodes between polylines are connected starting at the beginning of the polyline, then in order and in increasing direction. In the new **Linker**, if two polylines being linked together are of opposite direction, the link created can be fixed within the **Linker** without having to reverse the polyline direction. **Reverse Polyline in Preview Link** accomplishes this, while not permanently changing the direction of the polylines being used (Fig. 3).

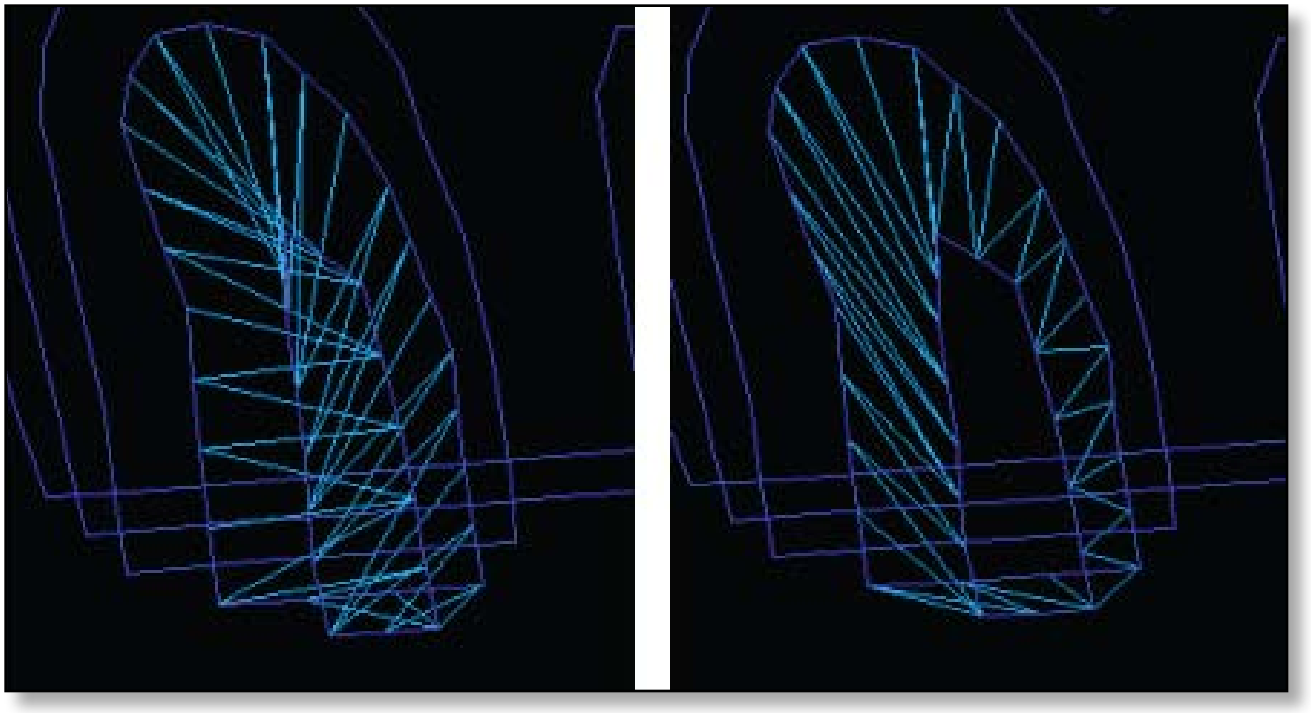

Fig. 3 Preview Link between polylines of different direction before and after Reverse Polyline in Preview Link.

Access to Object Properties

The **Object Properties** of saved **Linker Strong Nodes**, **Linker Substrings**, and of the destination object are accessible from within the **Linker**. The ! buttons provide quick access to the **Object Properties** dialogs for the these elements. Here you can change the display properties, as well as the selectability of the respective elements.

Triangulate Surface from Polyline

Now a surface can be created by triangulating inside a closed polyline with the new **Triangulate Polyline** function. Select the polyline to triangulate and a surface will be created and automatically written to the destination object, no **Apply** is necessary. This is especially useful for creating a solid by closing the ends after linking several polylines on section, as shown in the example below.

Delete an Existing Surface

The **Delete Surface** function allows you to delete any surface from within the **Linker**. This allows deletion of Applied links as well as any surface open in the viewer. Select the surface or surfaces and click-right and they will be deleted from their respective objects. If a surface is accidentally selected, use shift-click to unselect.

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The surface does not have to be selected in the viewer to be deleted with **Delete Surface**. Surfaces deleted from within the **Linker** cannot be restored using **Undo**. If you are unsure about deleting a surface, use the standard method of deleting a surface instead, by selecting then using the Delete Selection icon in the viewer. This way, the deleted surface can be restored using **Undo** if necessary.

New Point Matching Methods

The method by which points are matched in a link is now variable with four options available: **Point Count**, **Point Distance**, **Point Count and Distance**, and **Closest to Normal**. Often one of the methods will provide a superior linked surface than another, depending on the geometry and node consistency of the polylines being linked. A change in the matching method is immediately reflected in a **Preview Link**, so try them all to see what looks best with the data being used before choosing **Apply**.

Nearest Element Selector

When the element to be selected is overlapping another element or is very near another element in the viewer, there is now a **Nearest Element Selector**. This dialog prompts the user to choose which element to select. The element being selected will be highlighted in the dialog and in the viewer in yellow (Fig. 4). **Click OK** to select it. If this is not the element that should be selected, choose the next element on the list in the **Nearest Element Selector**. Then that element will be highlighted in the viewer in yellow. **Click OK** to complete the selection once the correct element is highlighted. The **Nearest Element Selector** is most useful when selecting substrings, since they usually have duplicated points with the original strings or adjacent substrings, and selecting the right substring can be difficult without it.

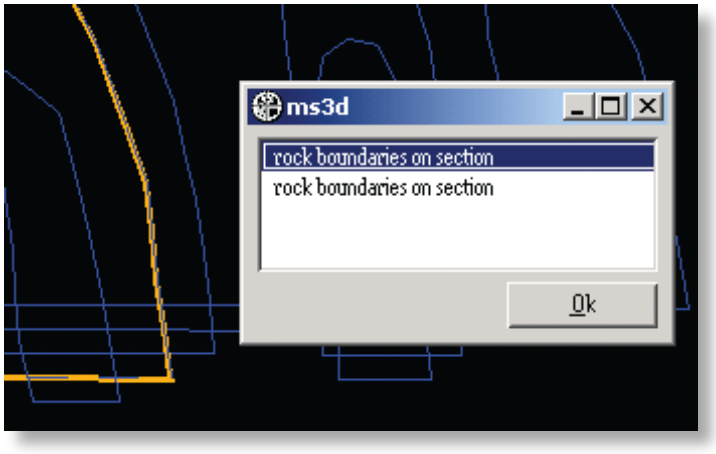

Fig. 4 Nearest Element Selector aids in selection where elements are overlapping or very close in current viewer.

Coming Soon

In MineSight® 3.30, a new function will be added to the **Linker** tool, **Extrude Polyline**,  allowing the ability to extrude polylines from within the **Linker**.

Example

The example below demonstrates the basic linking process. First prepare the polylines and add any necessary strong nodes and substrings. Next link from section to section. Then close the ends of the linked sections if creating a solid. Finally, merge the individual links to form one single surface or solid element, and verify the surface or solid for validity.

Prepare the polylines to be linked by checking the following three things: the polyline node density, polyline endpoint alignment, and polyline directions.

The general rule for polyline node density is that the nodes should be evenly spaced with a density about equal to the distance between the sections or planes being linked. For example, if the sections or planes being linked are 50 feet apart, then the polyline node density should be at least one node every 50 feet. Also, polylines being linked should have a uniform density from section to section (Fig. 5a & 5b). This allows for better surface creation by creating more uniform triangles throughout the surface.

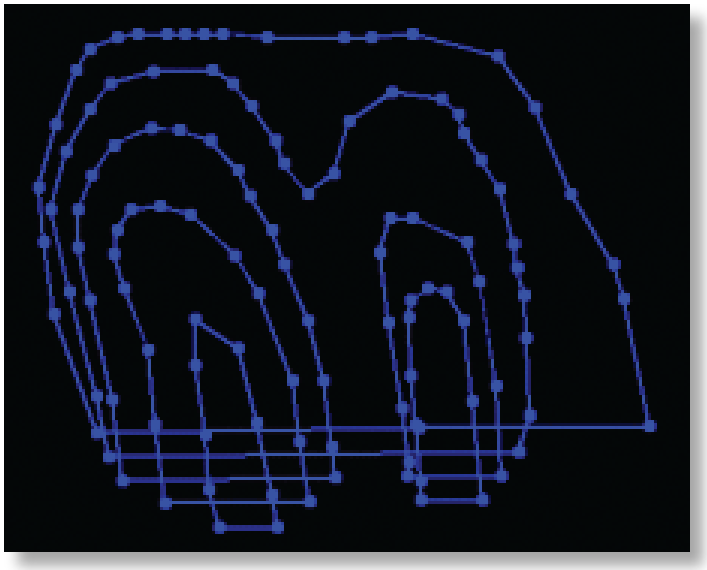

Fig. 5a Sectional polylines shown before densify.

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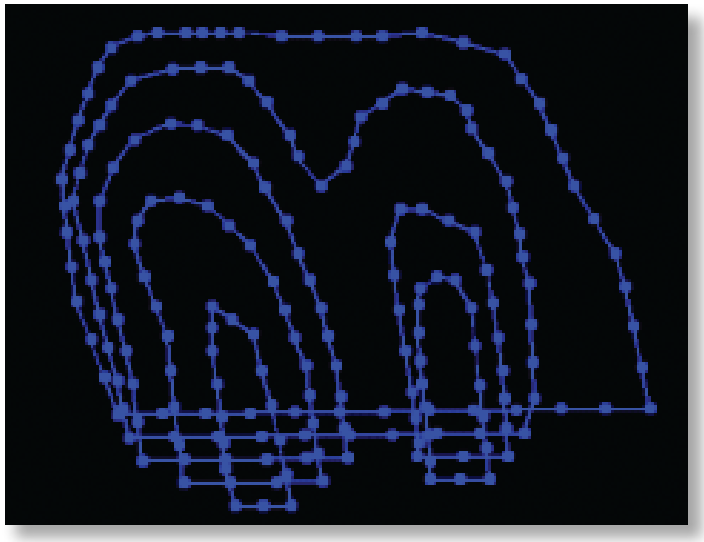

Fig. 5b Sectional polylines shown after densify.

It is also recommended, but not always necessary, that the polylines to link have their endpoints aligned (Fig. 6), because endpoints by default serve as points of direct connection in a basic link. However, if using strong nodes, the designated strong nodes override the endpoints as points of direct connection, in which case aligned endpoints aren't necessary.

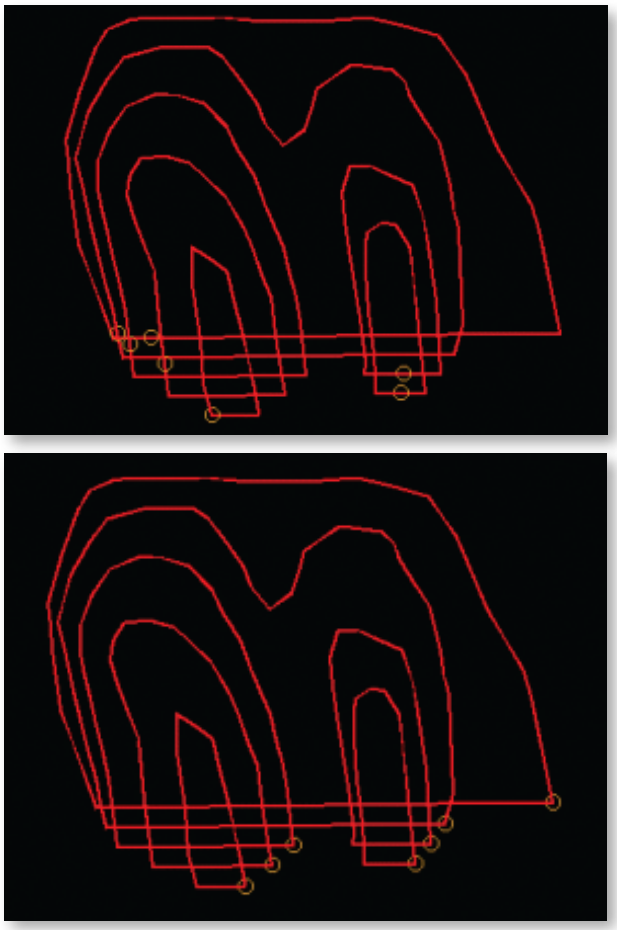

Fig. 6 Endpoints circled in yellow before (top) and after (bottom) alignment.

Polyline direction should be consistent in all the polylines used in linking, including any created substrings. However, if this is not the case prior to linking, and a polyline with inconsistent direction does occur, the new function **Reverse Polyline in Preview Link**  can temporarily reverse the direction of a polyline, only for the creation of the link.

Once the polylines are prepared, check to see if the geometry to be linked requires any bifurcations (places where a solid splits into different directions). When a single closed polyline must link to two separate closed polylines, substrings are needed to control the split. Substrings are two or more closed polylines that together form the original larger closed polyline. To create substrings, digitize a dissection line across the closed polyline to be split, and two substrings will be created (Fig. 7).

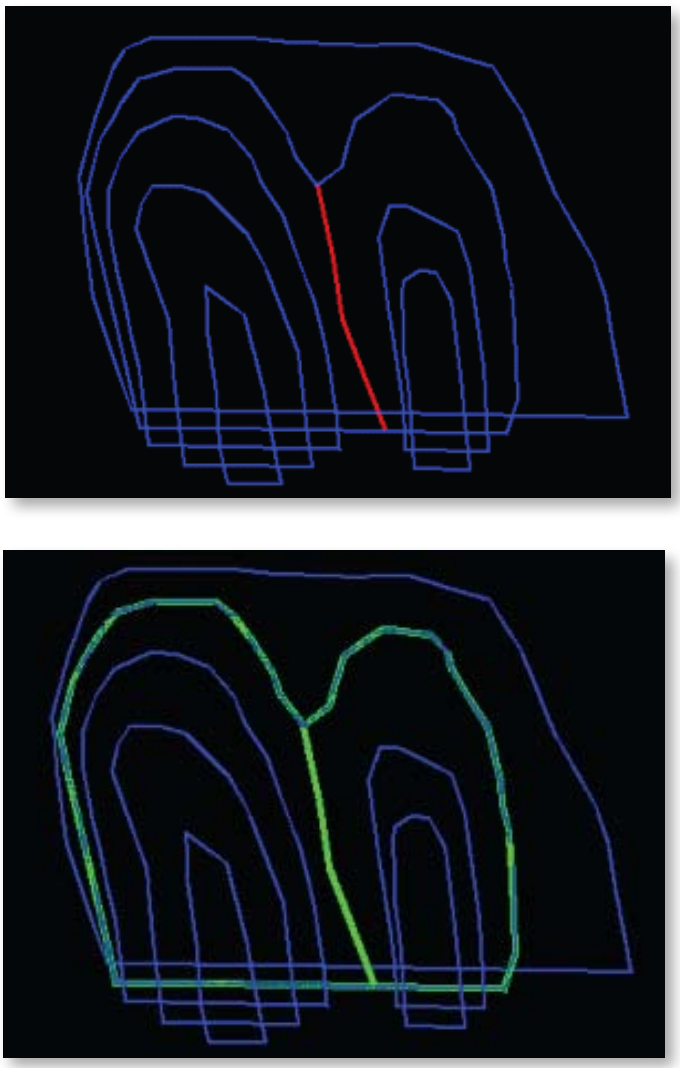

Fig. 7 Creation of a Linker Substrings by digitizing a line of dissection.

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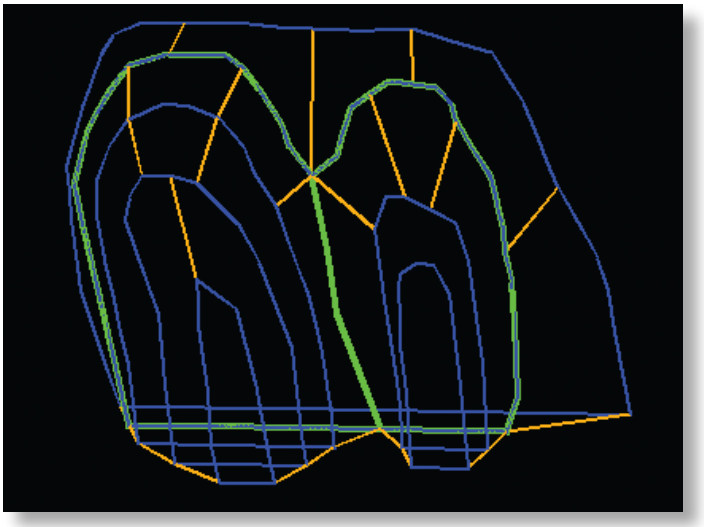
Once substrings are created, they are automatically written as **Linker Substrings** elements to the destination object. **Linker Substrings** appear in the viewer according to the display properties of the **Linker Substrings** material type, here shown in thick bright green. **Linker Substrings** used in linking should also be checked for polyline node density, polyline endpoint alignment, and polyline direction. If many substrings are required, it may be better to create all **Linker Substrings** first, then include them in the polyline preparation steps described above.

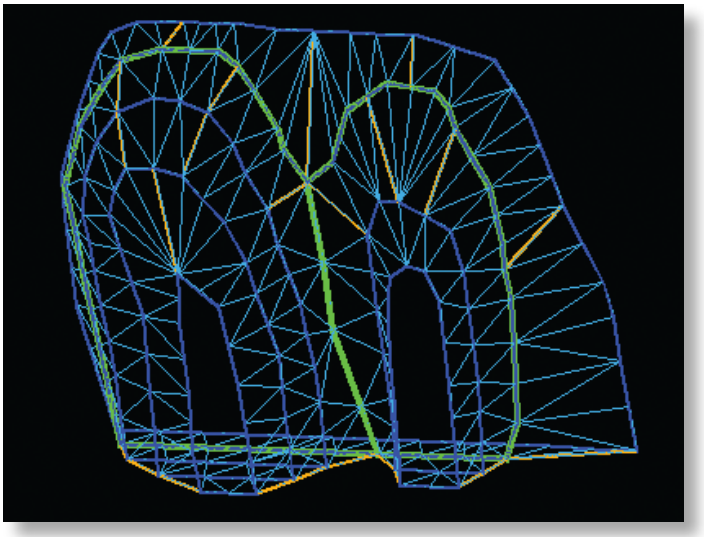
Next add strong nodes to control points of direct connection between the links. It is recommended that strong node "seams" be added along edges, ridges, etc. to provide consistency from section to section (Fig. 8). **Strong Nodes** created in a linker session are highlighted in a thick yellow and are considered currently active. They are used whenever polylines which they connect are linked. They only become permanent **Linker Strong Nodes** elements upon **Apply**. All currently active (highlighted in thick yellow) **Strong Nodes** are written to the destination object upon **Apply**, even if they were not used in any links. And, any **Linker Strong Nodes** elements that previously existed in the selected destination object, are overwritten.

Fig. 8 Currently active Strong Nodes and Substrings.



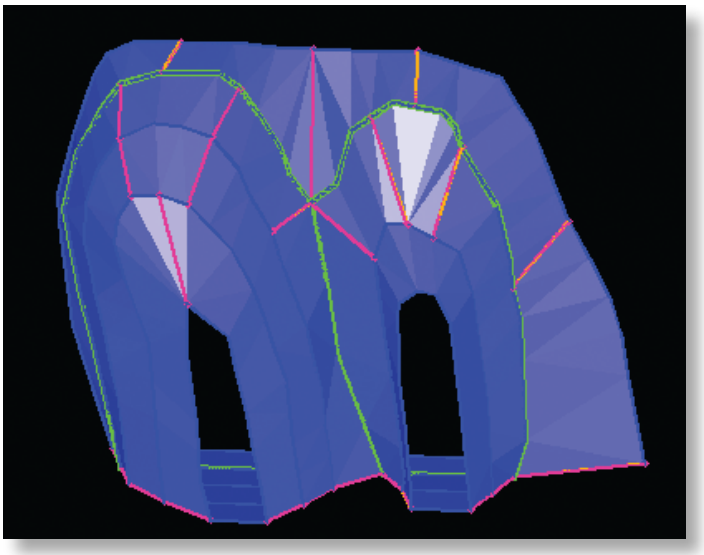
After all the substrings and strong nodes are created, link together the polylines to form surfaces (Fig. 9). Where the surface bifurcates, link a portion of the adjacent closed polyline to one **Substring**, and the other portion to the other **Substring**, thus defining the split. During **Preview** but before **Apply**, try each of the **Point Matching** methods to determine which creates the best surface appearance.

Fig. 9 Preview Link utilizing Strong Nodes and Substrings.



Once all is satisfactory, choose **Apply**. Upon **Apply**, each linked surface is written to the destination object as a separate element, as are all currently active strong nodes (Fig. 10). Once **Linker Strong Nodes** are written to the destination object, they appear in the viewer according to the display properties set for the **Linker Strong Nodes** material type, here shown in thick bright pink.

Fig. 10 Finished link.



To form a single surface or solid, these surface elements must next be merged. If a solid is desired, first close the ends of the linked sections using the **Triangulate Polyline** function on the bounding polylines (Fig. 11). To merge, select all the surfaces and use the **Surface-Merge Selected** function to create a single solid element.

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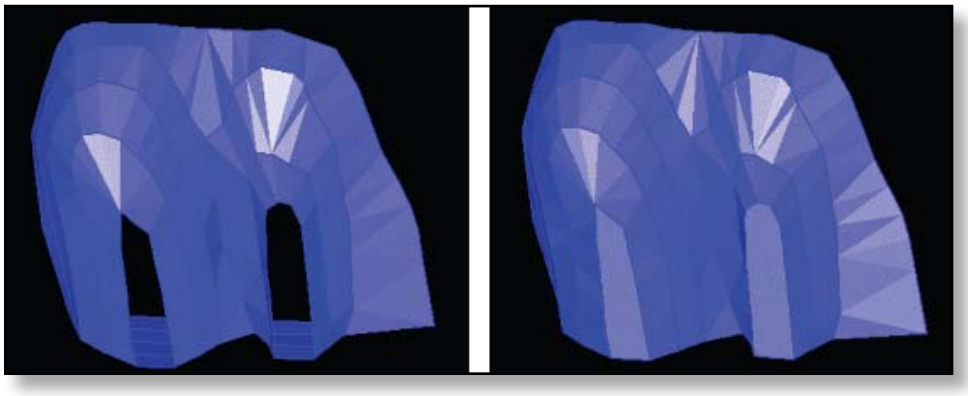

Fig. 11 Triangulate a surface at the openings to form solid.

Before utilizing the newly created surface or solid in any calculations or other functions, verify the integrity of the surface or solid. Check for *openings*, *self-intersecting faces*, and *duplicate faces*, and repair any problems. The linked surface or solid is now ready for use in any MineSight® function.

Full documentation for all **Linker** tool functions is available through the **MineSight® Help**. Help for the **Linker** can be accessed through the **Help** menu (in the **Tools** menu under **User's Guide**), or can be launched directly from the **Linker** tool using context-sensitive help. Context-sensitive help will automatically direct you to the **Linker** tool help by clicking in the **Linker** dialog, then using **Shift-F1** and clicking in the dialog again with the ? pointer. In addition, the online **Help** includes a MineSight® Tutorial, **Using the MineSight® Linker**.

Tip of the Month:

Coding from Nested Polygons in MineSight®

When coding a model from nested polygons in ms3d (e.g., to code within a ring) you do not need to orient polygons. You also do not need to create artificial back and forth "connections" to combine nested strings into one polygon.

MineSight® 3-D will nest and orient polygons for you (Fig. 1). Strings are grouped according to **Group by** selection on the 2D-Options tab of model coding dialog (see Fig. 2). Strings within each group are nested, if necessary, to form rings or even more complicated regions with holes.

Moreover, using "connected" strings for coding with the current version of ms3d may result in imperfect coding. The upcoming version (v. 3.3) of ms3d is more robust, however we still highly recommend using disconnected ring boundaries.

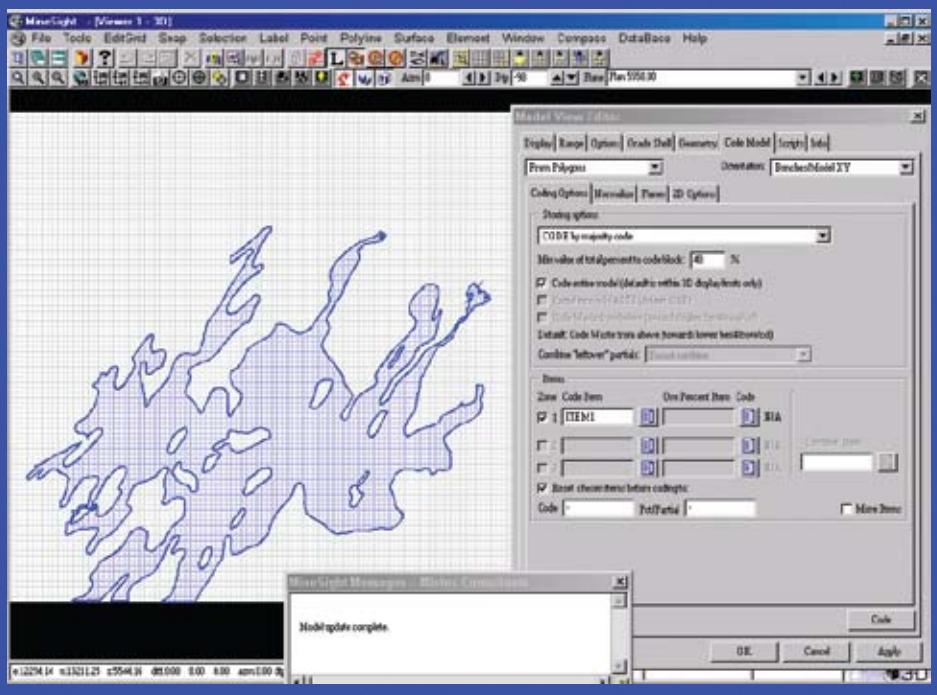

Fig. 1

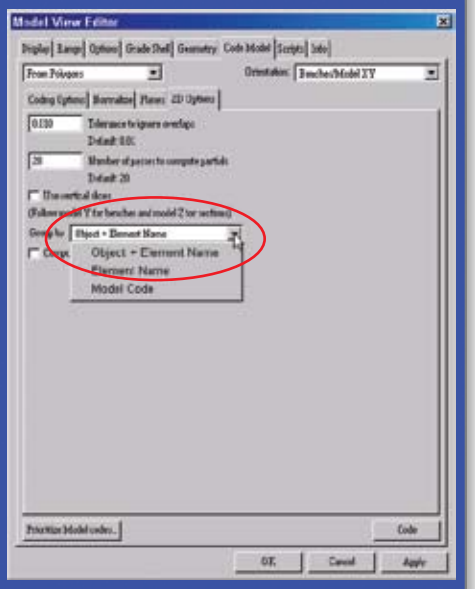

Fig. 2