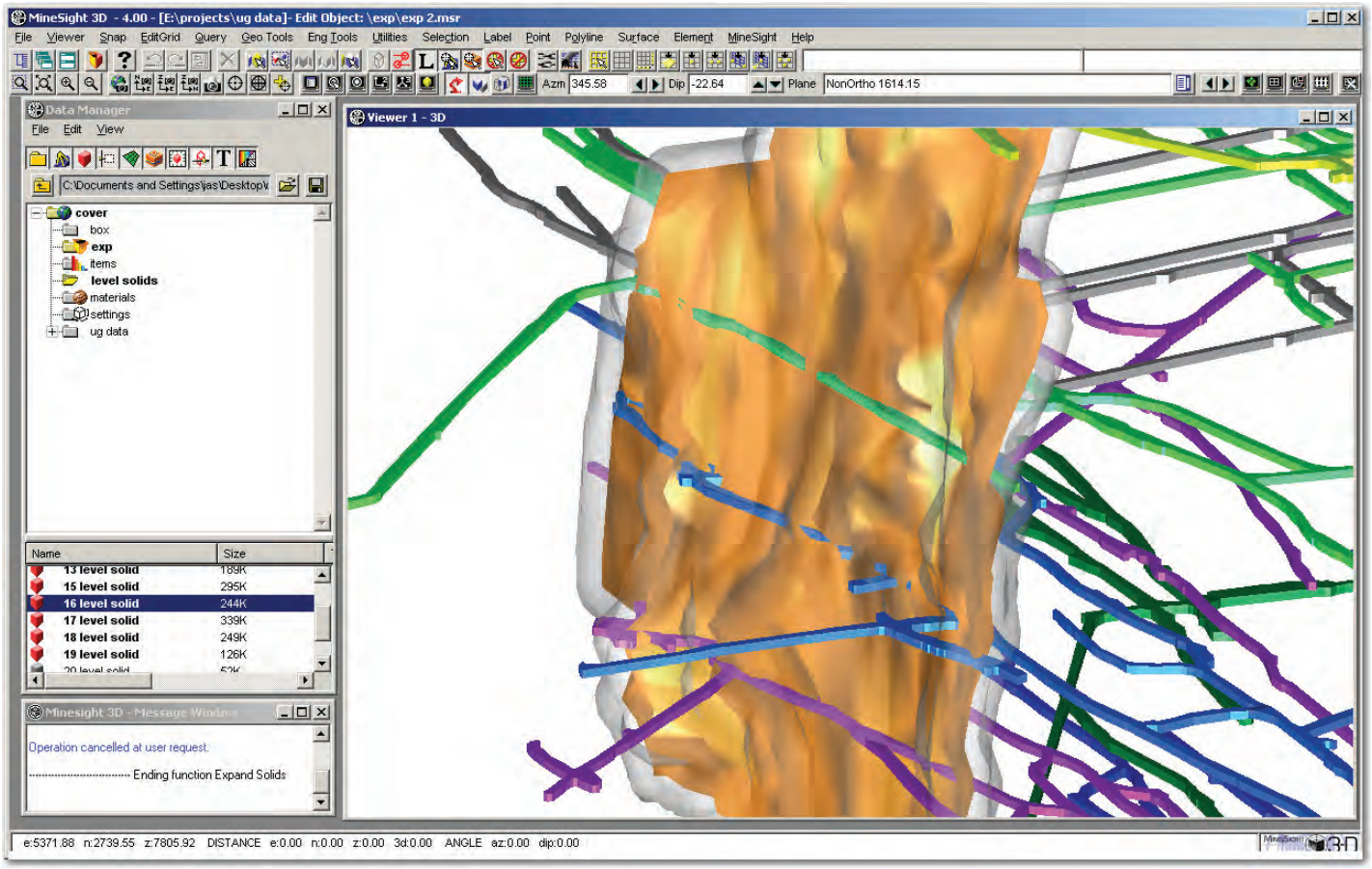
TIPS from Tech Support

Introducing the Solid Expansion Tool



MineSight® is constantly being improved and new tools are being added. One such new tool in MineSight® 4.0 is the much anticipated **Solid Expansion Tool**.

This tool is designed to help in many mining tasks that involve the creation and manipulation of solids whether it is for underground design, modeling geologic structures, or creating elements of a structural design. The **Solid Expansion Tool** can play an important role in the evaluation and planning of a mine. It can also be used to represent abstract elements such as an ore zone or area of influence which can be essential in research.

In MineSight®, the **Solid Expansion Tool** is presented in a dialog that follows all the standard MineSight® conventions for data selections, setting options, and saving results. The dialog has two tab panels where users can specify one of four types of expansion operation, set the expansion width (negative for solid shrinking), define expansion directions, set level of accuracy for the expansion operations, and specify other options. This tool can be found under the **Surface Menu** in MineSight® 4.0.

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What is solid expansion?

Solid expansion can be described as the process of finding a set of points that are located at a specified distance from the original solid. Triangulating these points together produces the expansion solid.

Unlike a simple scaling, where all the geometrical proportions of the original solid stay the same, the result of the solid expansion can significantly differ from the original shape. The extent of such difference depends on the shape of the original solid and the amount of expansion.

The extents of the solid expansion are controlled by a parameter called **Expand width** that can take any signed values. If the value is positive, the expanding solids are growing larger. If the value is negative, they shrink.

What kind of objects can I expand?

MineSight® requires data to be selected before the **Solid Expansion** dialog is enabled. Expansion operations can be performed on individually picked solids or on a whole selection. The tool preserves the attributes of the selected solids in the result.

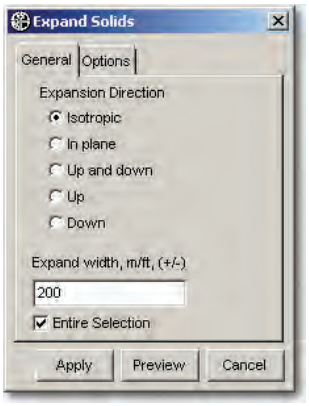
Only perfectly closed solids can be used for the expansion operation. All usual requirements for solids used in tools elsewhere in MineSight® apply here as well. This includes absence of openings, internal walls, and self-intersecting faces.

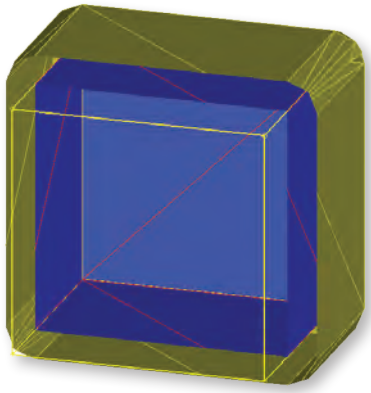
What are the different types of Expansion?

The **Solid Expansion** engine offers one unrestrained expansion (**Isotropic**) and four restrained expansions (**In plane**, **Up and down**, **Up**, and **Down**).

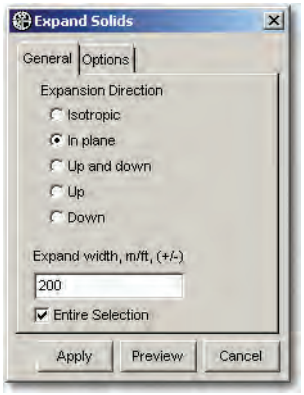
In an un-restrained **Isotropic** expansion, the solid is expanded and/or shrunk equally in all directions while in other operations, each triangle of a solid is being expanded or shrunk in a specific direction. By default, the **Solid Expansion Tool** uses horizontal planes to define expansion direction. This can be changed with an option **Define expansion direction by Edit Grid** in the desired orientation. For one- and two-directional expansions, the expansion (in the dialog, expansions are marked as **Up and Down** and **Up**) solids are expanded orthogonally to the edit grid plane.

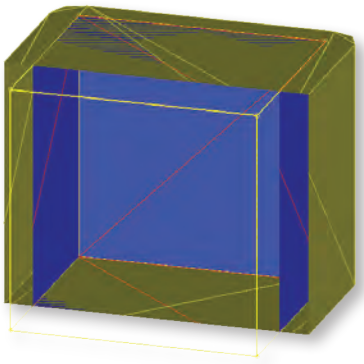
The examples of different operation are shown in the illustrations in the next column:



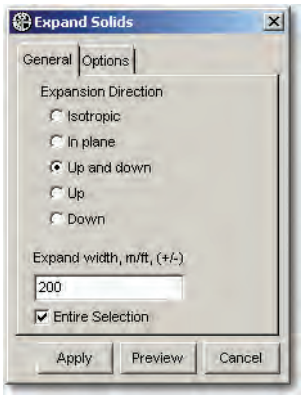


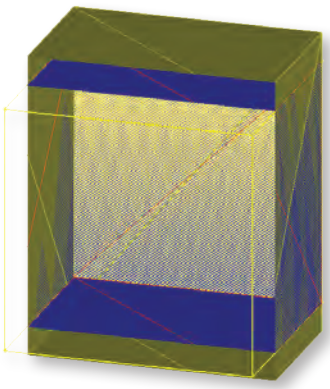
Isometric *expansion*



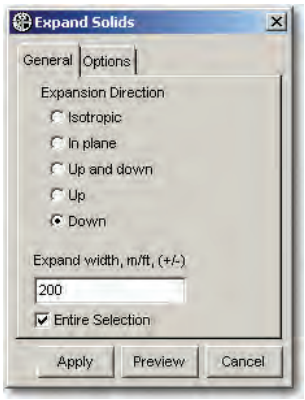


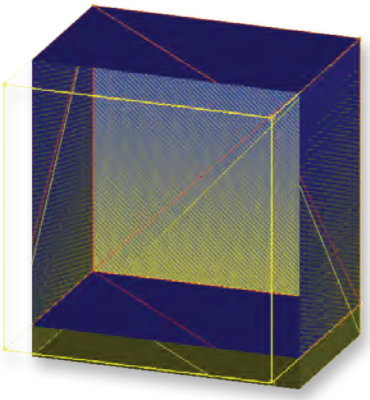
Expansion **In plane**





Up and Down *expansion*





Down *expansion*

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Plane expansion is an expansion of a solid in directions that are co-linear to the user supplied plane. There is not any expansion in any direction orthogonal to the plane.

One- and two-directional expansions are expansions of a solid in directions that are co-linear to the user supplied line where one-directional expansion further limits the expansion to just one side of the line. There is no expansion in any direction orthogonal to the line for these operations.

Regardless of the initial shape, a large expansion width will always try to produce a sphere as a result for isotropic expansion. For large expansion in a plane, the expansion tool would produce a 3-D disk and for expansion along the line it would produce a prism.

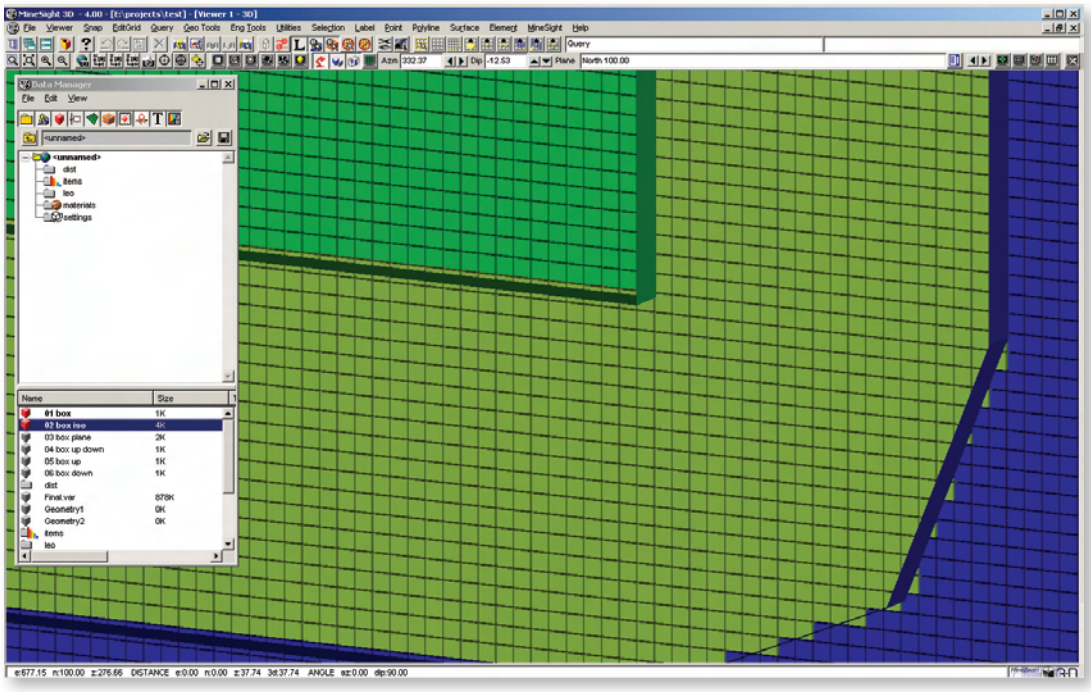
How can I use the Solid Expansion Tool?

The generic nature of the mathematical methods used by the **Solid Expansion Tool** makes it useful in a wide range of applications including structural 3-D CAD design, geological modeling, or scientific research.

Creating and validating solids can be a complex and tedious trial and error filled process, especially when the initial data used for their construction is sparse or not accurate as is often the case in geological modeling.

Here are some examples of how the **Solid Expansion Tool** could be used:

1. **Validation**—When dealing with data that is not very accurately defined, it is often important to estimate how sensitive it is to variations in the parameters that were used for its creation. In such cases, it can be interesting to know what shape or volume some particular geometric structure would take if it gets expanded or shrunk by a specified offset distance. A series of expansions could act almost as a series of optimal pits that could be analyzed and evaluated in order to arrive at an ideal or at least a validation of the original.
2. **Physical Process Modeling**—Inspecting the dynamics of how particular solids are changing at different expansion rates may also be useful to get a better understanding of the physical processes that these solids present. The Solid Expansion tool can also be used to find the areas of influences of solid objects distributed in 3-D. This could have applications in any sort of physical geological modeling.
3. **Model Interpolation**—Creating transition zones which could be a few meters outside the main solid of modeling. The expansion tool will now allow you to create "dummy", "pseudo" solids outside the main solid which can flag certain blocks for example, and thus allow the user to interpolate them with different parameters than the originally coded blocks. This can apply for the blocks that are just outside or around certain structures such as mineral zones or faults, etc.



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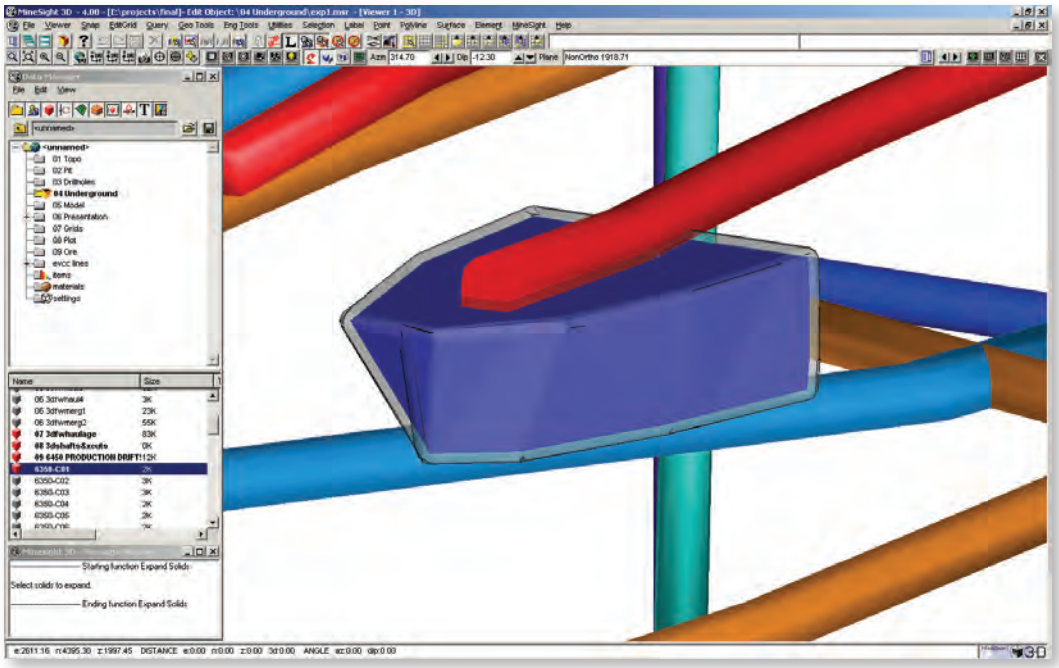
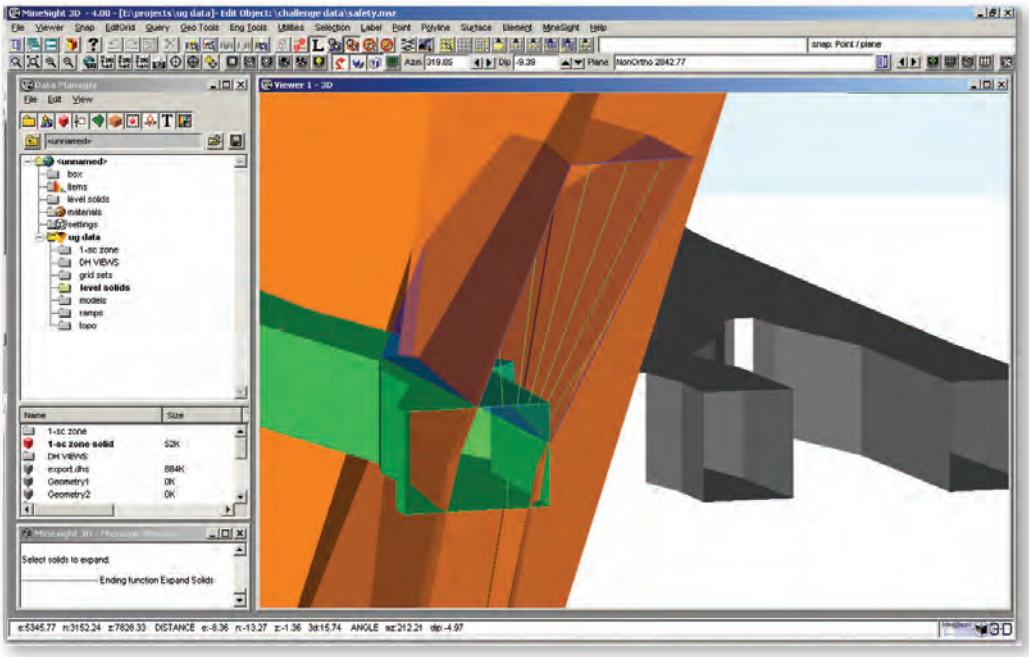
4. **Dilution**—Reserve calculations often involve the concept of a dilution zone or a factor by which the original mining "grabs" waste material surrounding it. The solid expansion tool is ideal for representing this dilution zone as the difference between the original and the expanded solid. Also ideal for coding, this expanded solid could act as the defining area for blocks that could be flagged with a code or could be populated with a percentage to help in the calculation of dilution.



5. **Bootleg Tagging**—Underground Blast Safety is an important part of any underground operation. One common task is finding the drillholes that intersect the area of influence of a blast. These holes become a hazard during an explosion as the pressure from the blast could find an escape route through a hole and could throw the collar cap considerable distance at high velocities causing damage and more importantly, injury. This "Blast zone" can be represented by a solid and the bootleg tagging zone as an expanded solid around the blast zone. Any drillholes that are found within this solid can be tagged by the **Spear** function in the drillhole view. This ensures that any drillholes within this zone can be isolated and all personnel and equipment can be cleared from near the collar of these holes.



The blast zone is determined by the blasthole design.

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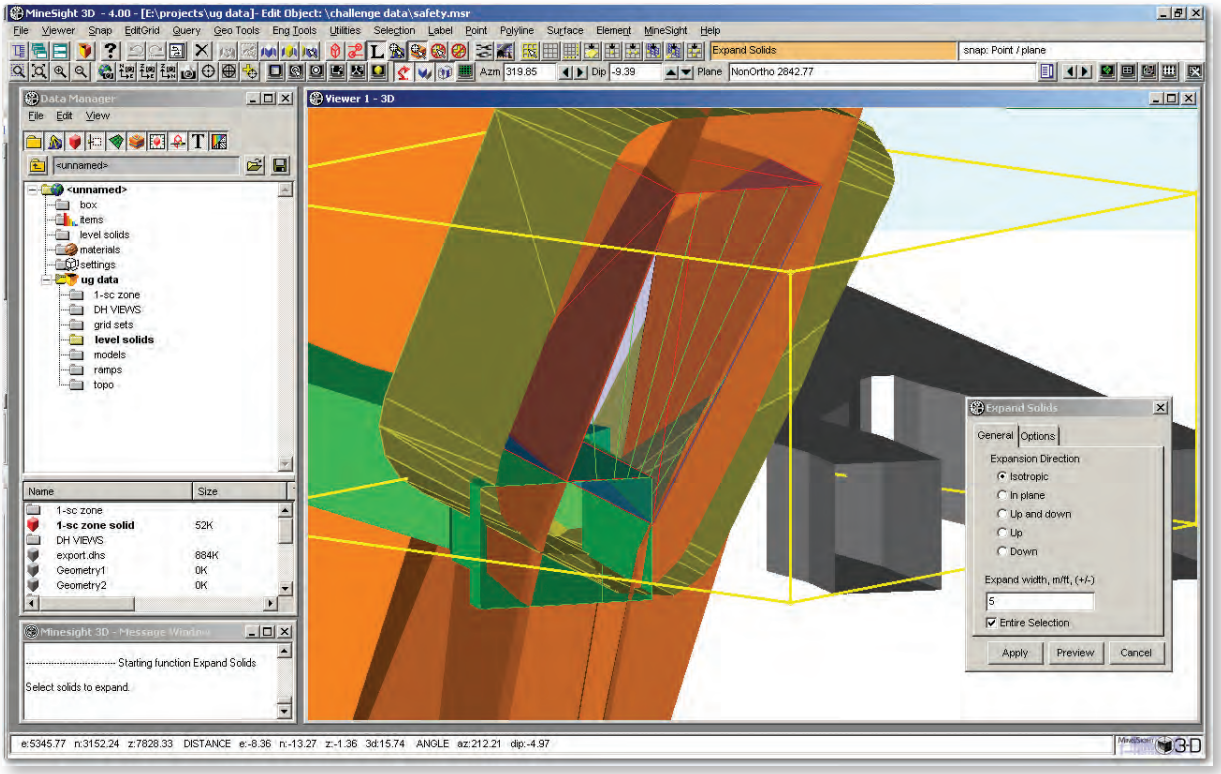
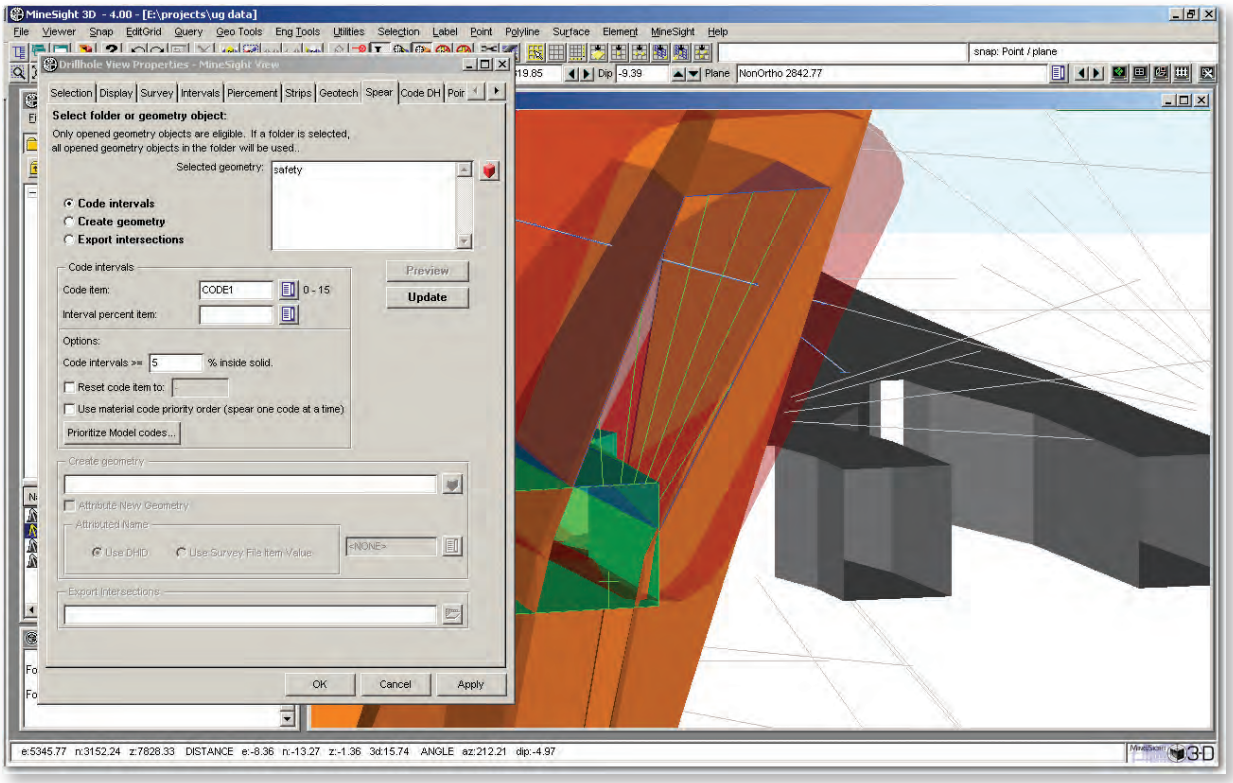


The blast zone is expanded to a predetermined safety area.



Any drillhole intervals that fall in the safety zone can be tagged and those drillholes can then be listed as the bootleg holes.

The **Solid Expansion Tool** is a new tool, and here at Mintec we are committed to the investment in research and development necessary to bring such tools to our clients. We look forward to seeing what other applications our clients will find for it. If you are using this tool and have any questions, concerns, or have come up with a new application for it, please feel free to contact Mintec Technical Support (TS@mintec.com).