

# Calculating Bench Reserves on the Fly

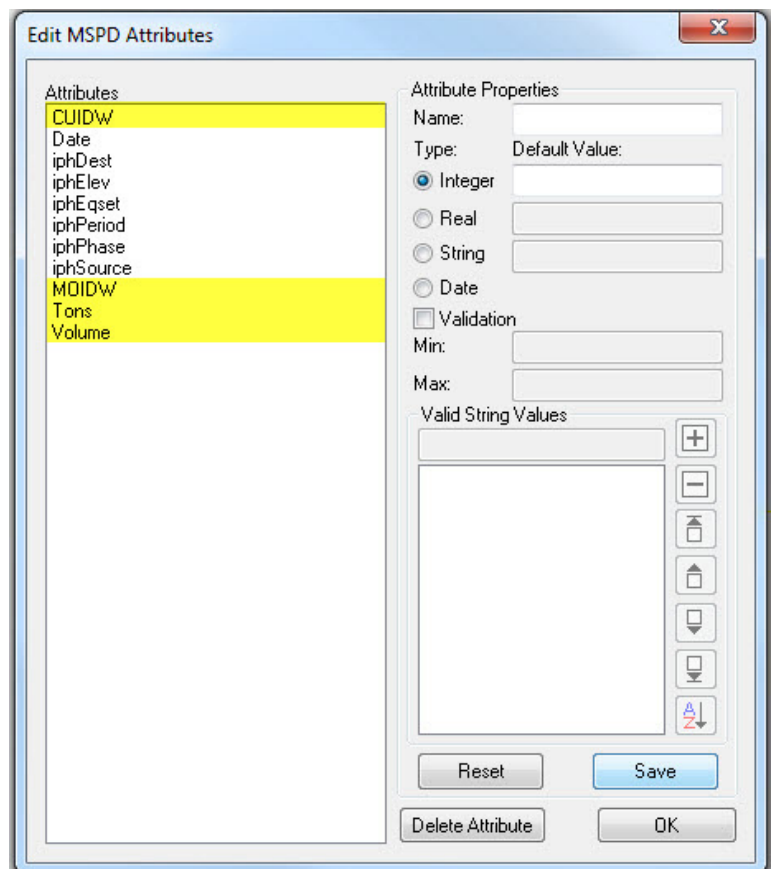
New MineSight tools now make it easier than ever to calculate tonnages and average grades throughout the creation of a pit design using the Pit Expansion Tool. These can now be calculated on the fly in MineSight Interactive Planner (MSIP) with the help of two new scripts, ipManager.pyz and ipAttributer.pyz. These scripts are designed to calculate tonnages and grades for cuts in MSIP, and to apply the results to the cuts as attributes upon import to MSIP.

This can be invaluable during the Pit Design process. While designing a pit, if tonnage and grade requirements are not being met, it will be apparent earlier in the process when reserves are being calculated on the fly. Thus, pit extents can be adjusted during design to ensure that requirements are met; without having to complete a design, compute reserves, and then go back to make changes. Apply this process to dump design requirements to help determine if additional or fewer tons are required to meet the required dump capacity.

Calculating bench reserves on the fly requires the use of the following MineSight tools:

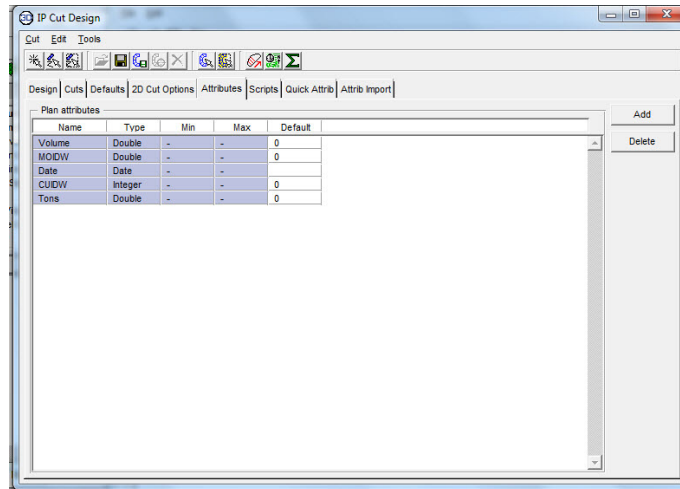
1. MineSight Planning Database (MSPD)
2. MSIP, supported by the ipManager and ipAttributer scripts
3. Pit Expansion Tool

The MSPD is the database for MSIP, where all cut geometries and calculated reserves information is stored. This should already be created and configured for use with MSIP, prior to starting this process. In addition, several attributes should be created in the MSPD prior to starting MSIP. These attributes should reflect any items you wish to report when computing on the fly reserves. Attributes can be created by using the **Edit MSPD Attributes** function, which can be found under **Utilities** → **MSPD** → **Edit MSPD Attributes**. Figure 1 below shows an example of attributes that might be configured to report Tonnes, Volume, and Grades for a copper/moly project.



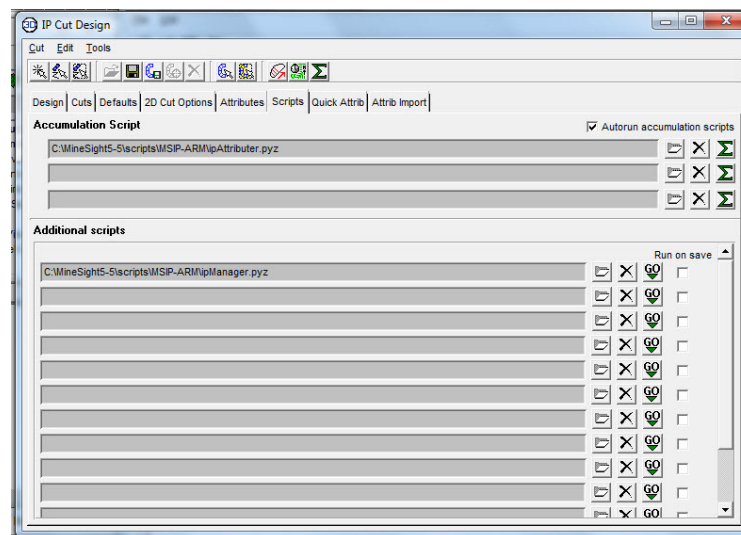
**Figure 1:** Example of Attributes that have been created to compute on the fly reserves in the Pit Expansion Tool.

Next, an MSIP plan is created and then configured based on how the bench reserves are to be calculated. The **Area** tab is set up to calculate the tons, volume, and average grade based on the Volume Reduction, Material Type, Ore% and grade items stored in the block model. The **Material Sets** tab is used to set up how the tonnages and grades are binned by zone. Once the parameters for calculating the bench reserves have been set, the new MSPD Attributes created in the previous step must be added to the IP Set from the **Design Cuts** → **Attributes** tab, as demonstrated below in Figure 2.



**Figure 2:** The newly created MSPD Attributes must be added to the IP set being used to compute bench reserves.

Once the attributes have been added to the IP plan, the scripts `ipAttributer.pyz` and `ipManager.pyz` can be added and configured. Both scripts are located in the **Scripts** → **MSIP-ARM** folder, which can be found in the MineSight installation directory. We will add the scripts to the Scripts Tab of the IP set, as demonstrated below in Figure 3. The `ipAttributer` will be selected as an Accumulation Script, with the option **Autorun accumulation scripts** selected. We choose these options for running `ipAttributer` because this is the script that is assigning values to the cuts. These options ensure that the script is run each time we create a new cut, thus calculating the reserves for the current bench. `IpManager` is placed under Additional Scripts. We configure this as an Additional Script as we only want to run this once; this is the script that determines how attribute fields are populated. Once this is configured properly, it does not need to be touched again.



**Figure 3:** Proper configuration for the `ipAttributer.pyz` and `ipManager.pyz` scripts on the Scripts tab in the MSIP IP Cut Design window.

Once the scripts have been selected within the IP set, run the `ipManager.pyz` script only, setting it to calculate the tons, volume and grade attributes. The script will have a tab called **Attribute**, containing **Cut Calculations** and **Material Classing** sections. The attribute calculations for bench reserves are set under **Cut Calculations**. First, select the attributes for Tons and Volume, then set the calculation string for each using the tokens **%(tonnes)s** and **%(volume)s**, found under **Builtin**

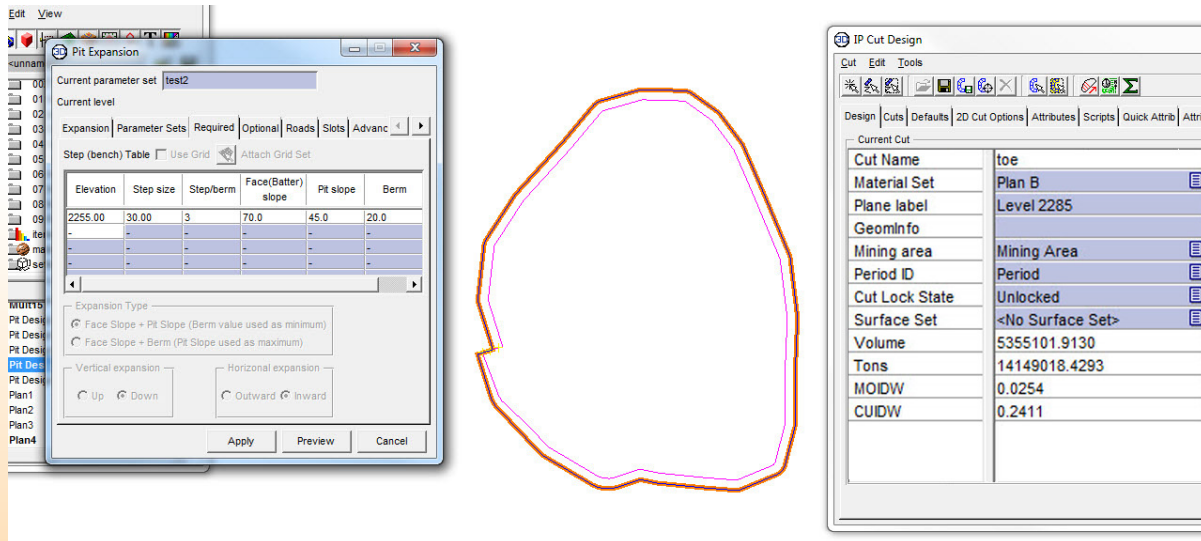
**Tokens** section. Setup the next lines to calculate the average grade of each bench. The tokens for average grade are located under the **Grade Tokens** section (**%(grdCUIDW)s** and **%(grdMOIDW)s** for this project). Once the calculations have been set, save and close the ipManager script.

	Attribute	Calculation String	Sample
1	Tons	%(tonnes)s	2212284.7185
2	Volume	%(volume)s	884913.8874
3	CUIDW	%(grdCUIDW)s	0.0
4	MOIDW	%(grdMOIDW)s	0.0
5			

**Figure 4:** Sample configuration for the **Cut Calculations** section of the ipManager script.

The ipAttributer script will calculate and store the tonnage, volume, and average grade of each cut in the IP set to our defined attributes based on how the ipManager is configured. This will be done upon the import of cuts, which will happen during the pit design process. At this point, no further configuration is needed to set up ipAttributer.

After the IP set and scripts have been configured, go to **OP Eng Tools** → **Pit Expansion Tool** and begin creating your pit design. MSIP must remain open to compute reserves while we expand our pit. Set up the pit expansion tool to use the design parameters required. Once the base string has been created, bring up the **IP Cut Design** panel. After each bench is designed, click the button **“Create new cut from a single element”**, located on the IP Cut Design panel. Then, select the toe of the bench in the viewer to import it as a cut in MSIP. When the cut for each bench is imported, the attributed tons, volume and grades will be automatically calculated by the ipAttributer in MSIP. If the tons and volume are not acceptable for the bench, it can be deleted from the IP set and redesigned. Repeat this process for each bench of the pit design.



**Figure 5:** Tonnage, Volume, and Grade have been calculated for this pit design on Level 2285.

It should be noted that by computing reserves from toe polygons, we are approximating the reserves on each bench. If a toe polygon is used, we will lose any reserves that fall in the area immediately adjacent to the face slope. This is because MSIP is making a vertical projection from the toe polygon up to the next bench, rather than taking the true face slope of the pit into account.

The pit design process can be made less daunting through the use of the two new scripts, ipManager.pyz and ipAttributer.pyz. When using the scripts, tonnage and grade can be calculated on the fly when each bench is designed. Thus, if tonnage and grade requirements are not being met, the pit geometry can be changed earlier in the process. This saves immense time, because it is not necessary to wait until the Pit Design is completed to check whether the desired reserves are obtained.