Modeling Vertically-Staged Earthwork
Overview of Available Modeling Tools

By the term "vertically-staged earthwork" we mean any intermediate excavated/graded site condition (including temporary erosion control grading, removal of unsuitable soils, placement/ removal of surcharge loads, progress topos, pipe trenching, structural excavation, etc.). If AGTEK uses the Existing (Stripped) surface to represent the site's starting grade and the Design (Subgrade) surface to represent final grade, how should an intermediate grade be modeled and quantified? AGTEK provides a wide range of tools and methods for this type of problem and the short answer is: *Use the simplest method that meets our needs* (*that includes slapping an engineer's scale on a plan sheet, measuring an average length and width then manually calculating a volume based on an average depth—sometimes "old school" is good enough!*). But, when we want AGTEK's reporting and graphical documentation, our available options include the following . . .

- A fixed-depth removal over an irregularly-shaped area can be quickly quantified using AGTEK's **Length/Area** utility with an *Annotation Line* delineating the area (see pages 245-246 in the *Day 1 Handbook*). Other options include entering a **Stripping Area** or a **Sectional Area** (perhaps in a **Save As** copy of the AGTEK job file); and similar results (but without using *Stripping Areas* or *Sectional Areas*) can be obtained using techniques like those demonstrated on pages 75-77. But such fixed-depth options produce volumes (and graphical documentation) based on a vertical perimeter cut face—limitations that can be avoided by choosing better options from those listed below.

- To calculate volumes only between an intermediate grade and the Design or Subgrade surface, AGTEK's **Transfer Design/Subgrade** utility is quick and easy. This method accommodates varying grades and sloped perimeters, but it removes all other surfaces from the starting job file, limits volume calculations to the two remaining surfaces and does not produce the best-looking visual documentation (see page 93).

- More sophisticated methods allow staging of the new intermediate surface into another surface, retention of all original and new surfaces in one job file and produce great-looking (staged) graphical documentation. The first of these methods that we look at uses a combination of *AGTEK 4D*'s **New Surface** and **Stage Into** utilities (see page 98). New surface and staging functions are also included in AGTEK's **Apply Survey** utility (page 108), **Stage Over-Ex** utility (pages 113-120, 166-179, 240-245, 249-255), **Apply Template** utility (pages 130-134, 150-153), **Over-Ex Guide** (*Gradework 4D* only, pages 139-145) and **Lowest Surface** utility (pages 146-149). We'll put all of these methods to good use in the various corresponding examples.

- Finally, the old-school ***Volume Subtraction*** method applied to a specified rock undercut (page 158-163) isolates the removal volumes and eliminates the risk of over/under estimating (or double-counting) the specified removal volume. This method is a bit labor-intensive (and results in additional copies of the AGTEK job file), but it produces valid results and the various data-manipulations involved are useful to know and deserve space in the AGTEK user's toolbox. We also apply the *Volume Subtraction* method in a specified clay removal example (page 180) to correct for double-counted remove/replace volumes.