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* (*always remember, we can simply measure an average length and average width from a plan sheet to manually calculate 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 229-230 in the *Day 1 Seminar 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 69-71. But such fixed-depth options produce volumes (and graphical documentation) based on a vertical perimeter cut face—limitations which we can avoid by using better options like those 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 86).

- More sophisticated methods allow staging of the new intermediate surface into another surface, retain 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 91). New surface and staging functions are also included in AGTEK's **Apply Survey** utility (page 101), **Stage Over-Ex** utility (pages 106-113, 149-162, 220-225, 229-235), **Apply Template** utility (pages 122, 134) and **Lowest Surface** utility (pages 130-133), and we'll put them to good use in corresponding examples.

- Finally, the **Subtraction Method** for a specified rock undercut (page 142) isolates the removal volumes and eliminates the risks 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 volume **Subtraction** in a specified clay removal example (page 163) to correct for any double-counted remove/replace volumes.