CHAPTER 4

Summary and Cost Comparison

30-foot radius water retention test for slicing installation.

4.1 Cost Comparison Information

Labor rates, equipment rental or purchase vary around the United States, so no attempt was made to tie down actual dollar figure cost savings for this verification. Only cost savings in terms of man-hours were calculated for each installation method.

One of the clearest advantages of the static slicing method of silt fence installation over all trenching-based methods tested as part of this evaluation is the greater productivity associated with static slicing. This higher productivity translates into the ability to install silt fence much faster and with a smaller crew (typically consisting of two men) than trenching-based methods.

The static slicing method of silt fence installation required 0.33 man-hours per 100 linear feet using the Tommy static slicing apparatus and a two-man crew. This compares to trenching-based systems requiring as much as 1.01 man-hours per 100 linear feet, depending on the amount of hand labor employed, and the extent and sequence of installation tasks. This productivity advantage accompanies the benefits of a system that consistently performs as good as or better than the very best installed trenching-based system.

4.2 Additional Observations

As noted in Table 1, additional test segments were installed on three sites to evaluate the practical benefits of static slicing when installing silt fence using tight radii and in uniquely challenging conditions, such as on steep slopes, in rocky soils, and through wetlands.

Maneuverability

Often an effective silt fence installation requires that the end of the silt fence run be turned up-slope to assure containment of runoff. These up-turns or J-hooks, as they are often called, require the installation equipment to be able to make tight radius turns. Similar maneuverability may be beneficial when installing silt fence in subdivisions and around other obstacles. Tests #21, 27, 33, and 34 demonstrated that slicing is much more effective when used in tight radius installations than is a minimum trenching-based installation.

Steep Slopes

A 3:1 slope was available on Site #2 and used to evaluate the relative ease of installing silt fence by static slicing versus trenching. In both cases, the steepness of the slope tended to encourage the equipment to drift down-slope. However, the static slicing apparatus and tractor were much more resistant to this down-slope drift, apparently because the inserted blade helped anchor the equipment on the slope and because the ability to install at a faster rate maintains the equipment's momentum across the slope. Conversely, trenching across the slope is very difficult to maintain in a straight line. The trenching bar must be forced down to cut the trench, which in turn tends to pick the back end of the trencher up off the slope. This decreases contact with the slope and allows the trencher to drift downslope. In comparison to trenching, static slicing provides much straighter, faster installation of silt fence across steep slopes.

Rocky Soils

Site # 3 provided very rocky soil conditions in which to compare static slicing and trenching. While large buried rocks are able to disrupt both installation methods, static slicing appeared to be significantly more resistant to being "kicked" out of the ground, tending rather to bend around the obstruction or lifting the obstruction itself out of the ground. Additionally, it was apparent that the chain on the trenching machine would be damaged by digging in rocky soils and would require more maintenance. Also, a large number of rock fragments fell back into the trench, requiring the trench to be shoveled clean prior to fabric installation. In rocky conditions, the static slicing method provides a more dependable installation–presumably with fewer maintenance problems –than does trenching.

Saturated Soil

Site # 4 was an area surrounding a small drainage way at the low point of a site that was under development. The area extended to the base of the rather steep graded area of the site. In order to provide some relatively flat area adjacent to the silt fence to provide retention area, the silt fence was placed within an area saturated with water. The wet, organic soils and abundant vegetation made it practically impossible to remove the soils from a trench, install fabric, and then replace and compact clean soil in the trench without first stripping the area or importing clean fill. Conversely, the static slicing apparatus was able to insert the fabric deep into the wet soils and compaction was performed without substantially disrupting the soil.

4.3 Lessons Learned

This evaluation was initially envisioned as a simple comparison between silt fence installed using the traditional trenching-based installation procedures and silt fence installed using the more fully mechanized static slicing method made possible with the Tommy silt fence machine. It quickly became apparent that there is no such thing as a single traditional trenching-based installation procedure. At best, there are minimum specifications such as ASTM D 6462, which reflect common practices and imply, but does not explicitly require, important installation details, such as complete backfilling of the trench and thorough compaction of backfill.

Additionally, the minimum specification encourages installation of posts prior to fabric installation and trench backfilling, which can actually interfere with thorough compaction efforts. Therefore, it is easily understandable that many (if not most) trenching-based silt fence installations could be excessively costly and provide unsatisfactory performance.

Performance trends provide a clear indication that a greater level of compaction (higher density) corresponds to better performance (greater water retention). System comparisons showed that slicing resulted in installations that had both higher densities and greater water retention than all trenching-based installations.

Trenching-based installations were affected by the inability to compact backfill effectively when posts were installed first, when insufficient backfill material was placed in the trench, or when inadequate compaction effort was provided. Still, it should be noted that the installations using static slicing also required reasonable compaction efforts to perform properly.

During the field testing, compaction densities were measured with a nuclear density gauge and a handheld cone penetrometer. There was a significant correlation between the cone penetrometer readings and the nuclear density measurements. This may indicate that the much easier, and less expensive, hand penetrometer can be effectively used as a field quality assurance tool.

4.4 Verification Summary

The objectives of this verification as stated in Section 1.3 were to:

- determine if the slicing method of silt fence installation (using the Tommy Silt Fence Machine) is superior to the trenching method;
- determine if the slicing method is more cost-effective to install than the trenching method; and,
- detail the implementability, including ease of operation and installation of each method.

In general, both the static slicing method and the Spec + + trenching installation technique performed quite well in runoff retention tests, although the Spec + + required triple the time effort to achieve this comparable result. Trenching techniques meeting only minimum specification requirements fared quite poorly. As far as installation efficiencies are concerned, the static slicing method provided much quicker, easier, and higher quality installations than any trenching method installation attempted. Cost-effectiveness between the two installation methods is detailed in Section 4.1.

Runoff retention tests measured the ability of a “smile” segment of installed silt fence to retain runoff. Poorly performing test segments generally experienced excessive seepage and, in the worst case, subsequent blowout of soil in the trench. No blowouts were experienced by segments installed using slicing or the Spec + + trenching techniques. Those segments installed using the minimum specification requirements generally experienced both excessive seepage and blowout. This happened, even though the high clay content of soils made them significantly resistant to piping.

The static slicing method also offers practical advantages over traditional trenching-based methods, including maneuverability and ease of installation on steep side slopes, in rocky soils, and in saturated soils.

From the field testing performed for this evaluation, there appear to be two possible ways to achieve maximum silt fence performance – static slicing or Spec + + trenching-based installations. However, there is no clear, generally accepted specification to obtain this “best” trenching-based installation and all trenching-based installations require considerably more time than slicing-based installations. The static slicing method is included in ASTM D 6462 and should be strongly considered for incorporation into future project specifications where the existing trench specification is vague or loosely defined.