

## Design of Natural Filter

When seepage water flows from a soil with relatively fine grains into a coarser material there is a danger that the fine soil particles may wash away into the coarse material.

Over a period of time, this process may clog the void spaces in the coarser material. Such a situation can be prevented by the use of a filter or protective filter between the two soils.

For example, consider the earth dam section shown in Figure 1. If rock fills were only used at the toe of the dam, the seepage water would wash the fine soil grains into the toe and undermine the structure. Hence, for the safety of the structure, a filter should be placed between the fine soil and the rock toe (Figure 1). For the proper selection of the filter material, two conditions should be kept in mind.

1. The size of the voids in the filter material should be small enough to hold the larger particles of the protected material in place.
2. The filter material should have a high permeability to prevent buildup of large seepage forces and hydrostatic pressures in the filters.

Based on the experimental investigation of protective filters, Terzaghi and Peck (1948) provided the following criteria to satisfy the above conditions:

$$\frac{D_{15(F)}}{D_{85(B)}} \leq 4 - 5 \text{ to satisfy condition 1} \quad (1)$$

$$\frac{D_{15(F)}}{D_{85(B)}} \geq 4 - 5 \text{ to satisfy condition 2} \quad (2)$$

where

$D_{15(F)}$  = diameter through which 15% of filter material will pass

$D_{15(B)}$  = diameter through which 15% of soil to be protected will pass

$D_{85(B)}$  = diameter through which 85% of soil to be protected will pass

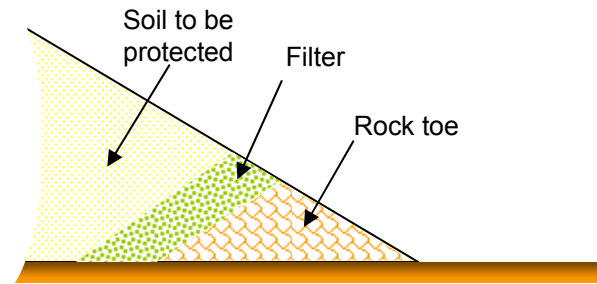
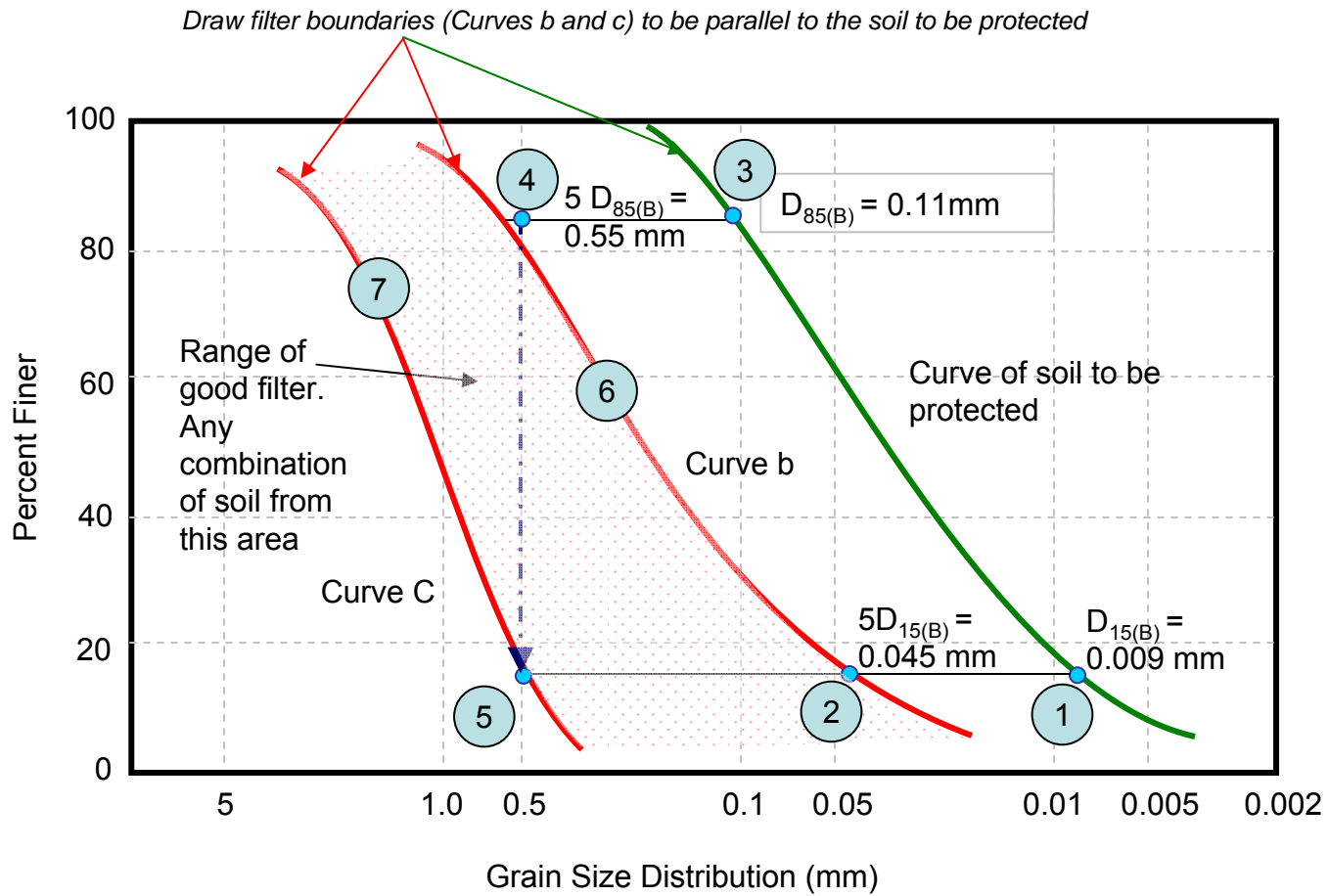


Figure 1. Use of filter at the toe of an earth dam.



Determination of grain size distribution of soil filters using Equations 1&2.

x Step #