GOOD GROUND IS NOT BY CHANCE...

By SAF (Safe Arena Footing)

Good ground for rodeo footing is not something that comes about by chance. Just using the local dirt alone and/or with added clay or sand amendments is not likely to produce acceptable equestrian footing material. Of course, arena preparation and soil moisture are critical elements and can even compensate for deficiency in the soil properties.

Critical aspects of arena cushion soil include the proportions of sand, silt, and clay. The distribution of the particle sizes within the sand fraction is a major factor in footing stability. Silt is less desirable in a cushion soil and the proportion of silt compared to clay (as well as total silt+clay content) should be carefully considered.

The size and distribution of sand sizes is evaluated by determining the sand-D_{50} and the sand-C_u value. The D_{50} is the median particle size or the size in which 50% of the sand is finer than that size and 50% of the sand is larger than that size. The higher the sand-C_u value, the wider is the sand size distribution and the more stable the sand. Finer and more uniform sands tend to be less stable. Typically sand is defined as the particle sizes from 0.05 mm (#270 sieve) and 2.0 mm (#10 sieve) but for the purposes of equestrian footing the range is extended to include the coarser fraction up to 3.35 mm (#6 sieve, technically a fine gravel fraction).

Sands are granular material and the stability of a sand is imparted by grain-to-grain interlock and simple friction. The size contrast from 0.05 mm to 3.35 mm is a 67X difference. As coarser sand particles form a certain spatial packing, stability is increased if medium sand particles are also included and reside as material which inter-packs within the voids which are created by the coarse particles. If in turn even finer sand grains inter-pack within the void space of the medium sand particles, then stability increases further. While water content increases the cohesion within a sandy skeletal matrix, the influence of moisture (especially higher moisture content) has less of an influence. What this means is that sand tends not to lose its stability with increasing soil moisture content.

Within a sandy skeletal matrix, the addition of silt+clay increases the cohesion between sand grains. This characteristic is primarily from the clay fraction and if the silt content is too high it actually detracts from the cohesiveness of the clay fraction. Thus the silt/clay ratio is as important an aspect as is the total silt+clay. If the silt/clay ratio is too high, the cohesiveness of the clay is negated and the resultant silt+clay is prone to movement via migration and layering features could develop. Ideally, if a properly size and graded sand is utilized, then the addition of a clay amendment (with low or no silt content) is

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preferred. A good clay at proper moisture can overcome deficiency in sand size distribution. However, if the clay (or silt+ clay) become higher in moisture (reaching what is termed as the "liquid limit") the cohesive and plastic properties of the moist clay are lost and without inherent stability from the sand fraction, then the stability of the entire profile.

In addition to the sand size relationships, the mineralogy and shape of the sand grains are important. A general trend is that more angular grains are most stable. Rounded sand grains are less stable. It is important for the stability of an arena cushion to avoid the extremes of very-angular and round grains (instead using sub-angular to sub-rounded sand grains). Mineralogy is also important in sand grain internal stability. Silica (quartz grains) are the hardest and most stabile while feldspar and mica grains are much less stable. Many sands contain soil carbonates and these minerals may be particularly problematic.

Carbonates are semi-soluble minerals and can cause crusting and soil cementation. The effective solubility of carbonates increases as the grain size of the carbonates decreases. Fine grain carbonates are much more reactive than large grains of carbonates. Carbonates detract from clay cohesive properties.

Use of poor quality water for watering the arena can also promote carbonate accumulation over time. Sodium in the water can also lead to the accumulation of soil carbonates. At the same time, sodium can disperse clay and cause it to lose its cohesiveness. Having an awareness of the water quality and factors for managing the impact of poor quality water are critical.

In short, to have proper materials, which can be managed and prepped for safe footing requires a grasp of ideal cushion soil (target values) and a sampling /testing scheme to evaluate cushion materials against those target values. The best philosophy when it comes to arena footing is to…..

TEST, NOT GUESS!

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