

# Arena Construction Guidelines for Rodeo Footings

By Michael DePew

Consulting Soil Scientist with Environmental Technical Services

This article applies to an all-around equestrian footing for all arena types/events but focuses on rodeo arenas. Although footing requirements are a good deal different for reiners vs. barrel racers vs. jumpers for example, it is possible to use the same arena/cushion soil successfully (if properly constructed) for all these events by making adjustments in set up and maintenance prior to the particular event (assuming proper arena set-up and maintenance equipment is available).

## BASE

A good arena starts with a good base. For most sites this will involve removing and leveling existing site soil material. Good candidate base materials include;

1. wide-graded (non-uniform) gravel , usually angular or crushed source such as road base or fine-gravel/stone dust, also referred to as dense-graded aggregate (DGA)
2. lime-stabilized soil, and
3. clay or high-clay soils.

If utilizing clay, then it must protected from groundwater or from saturated conditions. That is, clay base should only be used where the arena is situated in an upslope position. Whichever material is utilized for the base material, it should be proctor tested for moisture-density levels and based on this proctor testing the base material should be compacted at the optimum moisture content (+/- 2%) to a  $\geq 90\%$  proctor density (with less than 2.5% variability).

Base layers are typically 6"-12" in thickness, but no less than 4" should be considered as an absolute minimum. If the underlying soil is soft, then a greater base layer thickness is required. If the underlying soil is sandy or gravelly soil, then you can get by with a smaller base thickness.

## CUSHION

The cushion layer overlies the base material and forms the basis of the footing conditions. The primary soil constituent of the cushion soil is sand. Sand typically makes up 70%-90% of the cushion soil blend. However, not just any "sand" is suitable. The sand component of a cushion soil should have a specific range of particle size as determined by particle size testing and determination of the sand coefficient of uniformity (sand-CU) and the median size (sand-D50). Safe Arena Footings (SAF, <https://www.safearenafooting.com>) provides some specific guidelines for cushion soil characteristics. This includes the "Rule of 25" and "30-30" parameters. Contact [info@safarenafooting.com](mailto:info@safarenafooting.com) for details and information.

In addition to sand, the secondary soil constituent of a cushion material is clay. Most sources of clay are not pure-clay but rather clay-type soil or loamy soils which will also have proportions of silt and sand. For the most part, we do not particularly want any silt but often material availability limitations make it impractical to avoid silt. In such cases, ideally we want the silt/clay ratio to be a value of 0.3 or less but cushion soils with silt/clay ratios as high as 1.0 may produce suitable footing conditions. When the cushion soil contains silt, the total amount of silt+clay must often be increased to provide the desired results. Clay (and silt+clay) also retain more moisture than sand and helps to prevent footing material from drying out too rapidly.

Cushion soil depth is ideally about 12" in thickness (when compacted). Although 12 inches deep, only the top 2"-4" is harrowed into a "fluff" or non-compacted state. The level of the compaction of the cushion soil underneath the harrow depth is critical and changes based upon the need of the arena for the type of event and the particular footing needs. For example, the cushion compaction level should be very high for jumping events with a shallow harrow depth of 2" or less. For barrel racing, the harrow depth may be something like 4" deep with an underlying layer of intermediate compaction of perhaps 2"-3" in thickness (often referred to as the sub-cushion layer) with the underlying cushion-soil layer at higher soil compaction level.

Note: It is not uncommon for dressage and jumper arenas to only have a 2"-3" cushion over a very hard base of gravel/stone dust. The idea is that the primary support for the footing is the base layer and that the cushion layer provides just that, a modest amount of cushion over this very hard base layer. However, if constructed of the correct materials a deep cushion layer can be compacted to a dense state with only a 2"-3" harrowed surface layer. This condition is much more favorable for the horses as it eliminates the hazard of the cushion soil layer displacing which then leaves the very hard base layer (stone dust layer) exposed to the hoof impact.

Soil carbonates are often a constituent of sands and soil. Soil carbonates are also referred to as lime or limestone. Soil carbonates are not desirable cushion constituents and excessive levels should be avoided. Candidate cushion soil amendments should typically be limited by 5% or less. Soil carbonates when moist will detract from the natural cohesiveness of clay and negatively impact cushion soil stability. When dry (or low moisture) carbonates lead to the formation of soil crusts and can create hardened subsurface layers. There are options to use soil acidifiers to assist in managing soil carbonates. Carbonates are often thought of as a problem in western (arid) locations but may also be a major issue with midwest, southern, or eastern soils and locations as well.

WATER QUALITY

Water quality is an often overlooked factor when planning, building, and managing an arena surface. Water may be a major source of salts, sodium, and bicarbonates (which leads to the accumulation of soil carbonates). Water quality assessment should be performed to determine the needs for management inputs to lower or negate the impacts from poor quality water.

OTHER FACTORS

There are other critical arena construction considerations which are not within the scope of this guide but includes grade or slope (of both the base and the cushion-surface layer), containment boards, rails, chutes, gates, watering system (either as irrigation or water truck or water tank), surface water diversion, and maintenance equipment. Salts, sodium, and carbonates should be monitored on a routine basis in the cushion soil as well as the water source. Cushion soil compaction levels, harrowing depth, and soil moisture levels are other key factors.

Fibers, binders and other additives are often used to support equestrian footing conditions. Often times, these additives are used to make up for otherwise poor cushion footing. If utilizing fiber or binder additives, it is still critical that the mechanical properties from your arena soil mineral components are correct. Fibers and binders should be added to enhance cushion soil performance rather than mask or make up for soil mechanical deficiencies.



This diagram illustrates the recommended arena soil profile layers.