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Technical Bullet Series on Clay Brick Pavers

#5 – Bedding & Joint Sand

Abstract – This Technical Bullet discusses the role of bedding and joint sand. The importance of using a hard ASTM C33 Sand to prevent sand loss and using Polymeric Sands in place of joint sand.

The role of sand in a sand-set paving system is often minimized on segmental paving projects. Poorly graded or incorrect sands compromise the interlock of a sand set system. Without interlock, paver movement and contact between pavers occurs resulting in paver creep, chippage and other forms of pavement system failure.

The role of sand is key:

- The sand bed, along with full joints of sand, creates friction between individual pavers producing vertical and rotational interlock. The sand joint also plays a “cushioning” role in preventing paver-to-paver contact and subsequent chippage. Angular or course sand works the best in creating interlock. Round particle sand, like mason’s sand, complicates this process because the particles don’t want to stay together, reducing friction, leading to sand loss.
- The sand bed needs to function as a drainage layer for water penetrating through the joints. A saturated sand bed can create what Knapton and Cook refer to as a “lubricating slurry” destabilizing the bed and reducing the amount of load transfer capability. Therefore, washed sand, void of fine material (< 1% passing 200 sieve), is necessary to allow for free flow of water and the prevention of sand segregation.

ASTM C33 Sand

The vast majority of bedding specifications call for a washed, well-graded coarse sand that conforms to ASTM C33-Specification for Concrete Fine Aggregates, commonly referred to as Concrete Sand. (See Table 1)

In the recognition that fine particles create moisture retention problems, the gradations for bedding sand specifications generally include the modification that less than 1% of materials pass through the #200 sieve. *For pavements under heavy traffic load, this requirement is often decreased to less than .3 % for #200 size material.*

Sieve Size	Percent Passing
3/8 in.	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	5 to 30
No. 100	0 to 10
No. 200	Less than 1

Table 1: ASTM C33 Sand Gradation w/ No. 200 modification

Sand hardness can play a role as well. Softer materials can break down under load, particularly under vehicular traffic, and alter the original gradation. Given appropriate conditions, care should be taken to determine the hardness of the specified sand. Sands made up of silica minerals are generally harder and more wear resistant.

Sand angularity can also be a concern particularly with manufactured, crushed rock sands or stone screenings. Even if the rock is relatively hard, Knapton and Cook found that sharp edges would chip away creating more rounded and finer particles over time. They recommended only naturally occurring silica sands mixed with sub-angular & sub-rounded particles for heavy channelized traffic.

Bedding Sands to Avoid

ASTM C144 commonly referred to as Mason's Sand is fine sand that derives its name from the sand used in mortar mix for masonry construction. Given the small nature of the particle sizes

plus their rounded shape, mason's sand is not suitable for bedding sand as the sand will settle differently across the pavement causing an uneven surface and potential drainage problems.

Much debate occurs over the use of stone screenings in segmental pavements. Many practitioners use screenings regularly for pedestrian applications and some vehicular applications. As a result, these manufactured sands get used on jobs whether specified or not. Screenings typically contain a high percentage of fine material and are subject to breakdown over time. Given these problems as reviewed above, stone screenings are not recommended and strongly discouraged for vehicular applications. Testing at Clemson University documents that some types of screenings (as well as aggregates) will cause efflorescence. Limestone based screening (and aggregates) should be avoided, if possible, for this reason.



Picture 1: ASTM C33 Sand

Due to the critical role sand plays in a segmental paving system, the designer may want to include specification requirements calling for sieve analysis and certification of all aggregates to be used on segmental paving projects.

Recent Sand Studies

Studies by ICPI on effective, well performing sands that good performing sands have the following characteristics.

- Higher permeability
- Higher coarseness

- Lower shale, carbonate and chert content
- Predominance of silica content

Joint Sand

ASTM C33 is specified for joint sand because it compacts better and it is more convenient and economical to have one sand type at the job. However, there are particle sizes of C33 that will not fit into a 1/8" joint and can wedge at the joint top, preventing other smaller particles from filling the joint. In general practice, the installer works around the larger particles through extra sweeping and sand applications till the joints are full. The larger particles are then swept off at the end along with any excess sand. Some installers avoid extra sweeping by sieving the sand on-site or having the sand sieved by the aggregate supplier.

Some specifications allow a finer sand like ASTM C144 to be used to fill the joints. The main reason is that finer sand is easier to get into the joint and it helps to insure that the joints will be completely full. The easier a sand goes into the joints, the easier it will come out. Loss of joint sand can create loss of interlock, which can ultimately result in damage to the pavement. As a result, do not specify finer joint sands, particularly on vehicular pavements.

Joint Sand Retention

Joint sand naturally seals over a period of time as fine silt and debris settles in the top of the joint. There are special circumstances where encouraging sand retention is a prudent action.

Joint sand loss is the most common cause for vehicular pavement failures and the reasons are many: excessive run off, tire suction, poor drainage, inadequate bedding or joint sand, poor base design, street cleaning. Sand loss can be a problem in pedestrian applications as blowers and pressure washers can remove joint sand and prevent the natural sealing process.

Polymeric Sands

Polymeric Sands have become increasingly popular over the years especially in residential applications. Their primary function is to help minimize sand loss, minimize water penetration and prevent weeds from growing between the pavers.

Polymeric sands can leave a **haze** on the pavers if installed when the pavers are wet or excess sand is not removed from the pavers prior to activating. Please follow the manufacturer's installation instructions found on the bag. In the event that you get polymeric haze on your pavers please call the polymeric sand manufacturer for the best way to remove it.

A couple polymeric sands that work well on clay brick pavers and have shown to have less of a propensity to cause haze include *SEK's SureBond's PolySweep* and *Techniseal's HP NextGel*.