Packed Aggregate Base- Installation Procedures

March 26, 2003

Product Storage

1. Geotextile

Store all geotextile and joint adhesive in a dry storage area.

2. Packing Aggregate

If base is to be installed when temperature is near freezing during the day and below 0*C during the evening, than the aggregate materials should be stored in a large pile. Access for loading should be though one location only. This will allow the outer “frozen cap” to protect the inner stored material from freezing. Proper compaction cannot be completed using frozen clumps of aggregate.

Tools Needed

1. Must Have Tools

a. Standard Tools for Moving Aggregate
Shovels, earth rakes, wheelbarrows etc.

b. Standard Tools for Site Layout
Tape measure, masonry string, sledge hammer, stakes etc.

c. Standard Tools For Site Cleaning
Brooms, leaf rakes, grain shovels etc.

d. Standard Tools For Mechanical Compaction
Rolling, Vibrating “Bomag” Style Packer
For sufficient compaction, use rolling, vibrating compactor instead of vibratory tamper.

e. Standard Tools for Manual Compaction
Hand (manual) tamper for edges.
Garden hose to water packed surface.

f. Heavy Duty Knife
Olfa (or equivalent) heavy duty cutting knife for geotextile.

g. Chalk Line
To mark off the site for accurate determination of the size of the area. To check usage of bulk surface materials.

2. Optional Tools

a. Stone Slinger
Used to place loose aggregate rapidly into areas that have multiple obstructions which prevent access by leveling and delivery machinery.

b. Skid Steer-Bobcat or Equivalent
For larger surface areas, which require delivery of large volumes of aggregate.

3. Consumables

a. Site Protection Lumber
If skid steer or other excavation equipment is to be used over landscaped areas, plywood, lumber etc should be used to protect the area from damage.

Site Survey

1. Orientation

Although the final orientation of the installed surface may not be a matter of choice, some consideration should be given to the following items.

a. Direct Sunlight.
SofSURFACES Inc.'s products are made from recycled rubber. Rubber absorbs heat from infrared light. (i.e. Surface heat is from exposure to direct sunlight, not from exposure to atmospheric temperature). If the surface area is exposed to direct sunlight, design considerations should include lighter colors that reflect infrared (although variance in color only has a modest impact on surface temperatures).
Rubber surfacing products, in direct sunlight exposure, typically will have a surface temperature that is 10*C (average) higher than adjacent asphalt. On a bright sunny day, with exposure to the south or west, the surfaces will be hot to touch. However, on north or east exposure and in areas that receive partial shading the surface will be close to the same temperature as the atmosphere. In northern climates, warmer surface temperatures during the cooler days of the early spring and late fall are often preferred.

b. Continual Shade or Damp Areas
Installation sites with complete, 100% continual shade may remain damp resulting in mildew and/or mold growth. In shaded areas, surfaces should be steam cleaned (or power washed) regularly (see cleaning and maintenance section) using any form of industrial carpet cleaner with disinfectants (mel-actant or counter-actant).

2. Accessibility

Determine the method of aggregate delivery. How will the aggregate be brought to the final base area? Can a truck drive over adjacent surfaces without damages? Is a skid steer needed? If so, can it drive across adjacent surfaces without damage? Will a stone slinger be needed for more efficient delivery and placement of the aggregate material?
Is this a rooftop installation? If so, how will the large volume of final tiles and raw materials be brought to the site?
Is there fence that needs to be removed?
Consideration must be given to each of the above questions prior to commencement of the sub-surface installation in order to plan for the tools need and the work flow process.

3. Work Time Restrictions

Is the installation in a residential area thus preventing early or late installation hours? Will access be allowed to the site for full 24 hour periods?

4. Necessity for Security

In order to protect work in progress (Finished surface grading and compaction, Wet pour, Curing adhesive etc), will additional, site security be necessary? From when? Till when?
Will construction barrier tape need to be set up for pedestrian safety.

5. Utilities Accessibility

Water will be needed for compaction. Is this locally available? Are electrical outlets available?

Sub-Surface Drainage

A properly designed and installed water collection system is often overlooked during SofTILE site planning stages because in many cases a planner's mind is focused on impervious surfaces (i.e. concrete or asphalt, etc.) where sub-surface drainage may not need to be installed. Due to SofTILE's porosity, it is critical that a proper sub-surface drainage system be planned and implemented or the SofTILE surface may not stay level and ultimately may become damaged due to hydraulic pressure.

1. Evaluate Existing Drainage

a. Naturally Draining Sub-Surface

If the installation site is elevated (higher than adjacent grades) with natural drainage (adjacent grades slope away from the installation site at more than 1" in 12"), and does not currently collect water, then additional storm water management may not be necessary. The surface water will percolate through the resilient or safety surface (rapidly on lower density products (<50lbs/cft i.e. cast in place) and much slower on the higher density products (>60lbs/cft. i.e. commercial grade resilient surfaces) and through the tile joints. It will then drain across the top of the compacted or solid sub-surface, directed by the channels in the base of the tiles, and out the edges of the installation.

It is recommended that an individual with drainage experience (such as soil or civil engineer) inspect the site prior to commencement of the installation.

b. Non Draining, Sub-surface.

If the installation area is lower than the adjacent grades and tends to collect water, or if water has standing puddles on the sub-surface, then a sub-surface water management system must be installed.

2. Install Water Collection/Drainage System

a. For Packed Aggregate

If the sub-surface needs to have a water collection system, then perforated PVC pipe should be used. The perforated PVC pipe must be installed under and surrounding the sub-base area (see details) and tied into the external storm water collection system (ditch, storm sewer, etc). The perforated PVC should be placed below the top plane of sub-surface aggregate and encapsulated in ¾" clear crushed stone. Keep in mind that packed aggregate, when using variant sized granules is not very porous and therefore the sub-surface should be sloped towards the water collection PVC pipe.

a. Excavate trenches to contain perforated PVC pipe.

b. Install perforated PVC pipe with correct slope. Connect ends.

c. Back fill trenches with ¾" crushed stone wrap to a diameter of approximately 12".

d. Tie drainage system into existing storm sewer or ditch.

e. For Concrete/Asphalt

If the sub-surface is solid (concrete or asphalt) and water collects on the surface, (deeper than 1/8" (.125")), these non level areas must be filled with patch materials such as Mapei Planicrete EP or Mapecem PRP 145, fast setting, one component, polymer modified, cement based, pre-mix mortar. (see surface preparation section).

If the solid sub-surface is surrounding a pool or any other high water/moisture producing source, it is important that the sub surface be sloped, a minimum of 2%, towards water collection drains. In areas where little or no moisture is expected to come in contact with the resilient surface (interior-non pool areas), sub surface drainage is not necessary.

Site Preparation-Pre Sub-Surface

1. Site Preparation as Separate Contract

Base preparation is normally covered under a separate contract from the resilient or safety installation, however the following information is provided as a guideline.

2. Remove all sod and topsoil.

Continue to remove topsoil until solid, packed and stable sub-soil is visible and level.
Retain materials on site for potential future use as back fill too resilient or safety surface. Remove excess material.

3. Test Sub-soil for Rebound.

If sub-soil is of poor quality then there is a possibility that geotextile cloth may be necessary between the sub-soil and the granular sub-surface. The sub-soil can be compaction tested by driving a vehicle over the area. If the sub-soil compresses and rebounds greater then 1" (25mm) additional compaction or increased granular base thickness will be needed.

4. Install Drainage Collection System (If needed) Prior to Sub-Surface Installation

Drainage system installed as described above prior to installation of sub-surface.

5. Install Retainer Edge (As necessary)

a. Increase Depth Edge
If the resilient surface is adjacent to a loose (soil, sod, gravel, sand) surface, the edge of the granular base can be sloped under this loose material. The extent of the sloped run and rise is depended on the potential for the adjacent surface to become disturbed. If the adjacent surface is to have sod/grass and is not expected to be used frequently a 12” run at a 1:1 slope will provide a sufficient edge.
If however, the adjacent surface is sand and/or is expected to receive heavy use, this edge should extend for at least 24” in a 1:2 slope.

b. Solid Retainer Edge-Buried
A suitable, solid retainer edge for the packed aggregate sub-surface could be made from concrete (curb) or pressure treated wood. Ensure that the design of this wall will allow for soil movement due to frost or other forces. Typically this would require a minimum of a 12” tall wall at 6” wide. If the wall is to be pressure treated 6x6, it should be supported with vertical support posts, set in concrete every 72” on center.
The top surface of the retainer wall should be low enough to allow for the resilient or safety surface to be installed on it while providing the finish surface at the elevation required. The resilient surface installed over this wall should be attached using the full spread adhesive (FSA) method.

c. Solid Retainer Edge-Exposed
Follow similar installation instructions to that shown above except that the placement of the wall will allow for it to be exposed.
Adhesive must be installed in FSA pattern over the entire edge of both the retainer and rubber surface being installed against the exposed retainer edge.
If the exposed retainer edge surrounds a play area, it must meet minimum distance from the play structure as specified in ASTM F1487 Standard for Public Play

d. Solid Retainer Edge-Existing
Concrete walkways, asphalt pathways, building walls and retainer walls are just a few examples of retainer edges that typically are existing and surround the site prior to most installations.

Sub-Surface Installation-Packed Aggregate

A solid sub-surface (i.e. Concrete, Asphalt,) is the recommended base for all resilient surfacing products due to the predictable nature of these surfaces. However, packed aggregate sub-base MAY be a suitable alternative for some areas and/or budget constraints.

1. Sub-Soil Geotextile-If Necessary

Install geotextile fabric over subsoil (if necessary. See above.) This is needed only if the subsoil is not stable. Overlap joints by 12". Seal joints using polyurethane adhesive. (Bulldog Grip PL (LePage's) or equivalent).

2. Install 4-8" Granular Packing Aggregate

If base is sandy (drains quickly) and is stable (well packed) and/or in low frost, low moisture areas, 4" of packing granular (Granular A or equal) gravel should provide sufficient base for a pedestrian use surface. (Contact local soil engineers or paving stone installers for detailed, local aggregate specifications and performance expectations). In higher moisture and/or high frost areas, 8" of granular material will likely be necessary.

Install the granular materials in 3" layers. Level and pack each layer separately.

3. Rolling Packer

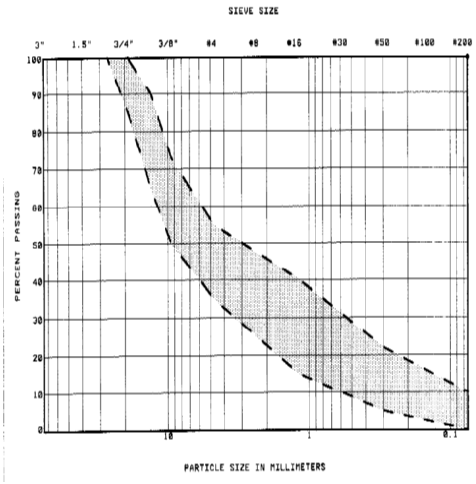
It is critical that the base be properly compacted. Without adequate sub-surface compaction the planarity of the finish surface will be changed as the sub-surface planarity changes.

Use a rolling (Bomag or equivalent) vibrating, packer to reach 98% SPD (Standard Proctor Density). In most cases, it will be impossible to obtain adequate compaction with vibrating packers alone. Rolling and vibrating "Bomag" style packers provide best packing.

Complete multiple roller passes in each direction.

4. Aggregate Grading Curve

Granular base aggregate should match the grading curve for OPS specification for Granular A aggregate shown below. Any local aggregate supplier will provide, on request, a grading curve chart (similar to the one shown below) for the aggregate that they are proposing as a substitute. It is important that the curve of the materials they are proposing to supply, matches (as closely as possible) the curve shown next.



The above sieve analysis is the "ideal" curve for simple and long lasting packed aggregate sub-surface. Since a packed aggregate base is subject to potential movement, we recommend staying within the above gradient to reduce sub-surface movement possibility.

5. Assist Packing by Soaking Aggregates

Soak the area with water. Allow the water to percolate through the aggregate and partially dry. Then re-pack with the roller compactor once again. Once materials have been adequately packed, a compaction test (nuclear densometer or equivalent) is recommended for both client and installer assurance of quality. However, a simple "heel test" is adequate for an approximation of compaction. Kick the packed aggregate at an angle with boot heel. If heel can be pushed into aggregate, it is not properly packed.

6. Assist Packing by Adding Cement

If after completing the above steps, the aggregate supplied still does not reach the specified density of 98% SPD, than packing can be enhanced by spreading 1 88lb (40kg) bag of cement over 200sqft of aggregate base. Water this cement to allow it to percolate into the aggregate. Repeat the above procedure. Pack with rolling packer after completion of cement addition.

7. Re-Pack Aggregate Around Adjacent Structure

Special attention must be paid to the areas around posts that support adjacent structures such as play centers, patio decks, retainer walls etc. It is critical to emphasize to the installer of these adjacent structures the importance of packing the granular backfill in these areas. Most third party installers, not being responsible for the surface, will normally just fill the holes full and "tap" them slightly on the surface and then leave. If a resilient or safety surface installation is completed directly over these poorly packed holes, the sub-surface will settle after the first rainstorm and the surface around the poles will become uneven.

The backfill material placed into the excavated hole must be thoroughly packed every 4" of depth. Since it is not possible to know for certain if the sub-surface installation contractor completed the aggregate packing to specifications it is important to have third party contractors sign a base preparation agreement (see attached). If the client or sub-surface installer has not opted to fill the holes to the top with concrete, upon arrival at the site, we recommend removing some of the pre-filled material around the post holes. Then soak the material that is left around the base of the pole. Then re-install the granular materials and pack every 4" of vertical depth. In addition, a small cap of concrete could be poured over the last 4" of depth before installing the final resilient surface.

8. Level Sub-Surface Aggregate to +- 1/4" over 10' Measured in Any Direction

Most packing aggregate (that falls into the same gradient curve as granular A) will have a size ranging from "dust" (microns) to 3/4". This is difficult product to get smooth enough for a proper surface installation due to the percentage of larger (>1/2" stone) material in the mix. These "larger" stones prevent an even, smooth application of a leveling screed bar.

Since the planarity of the granular base will determine the planarity of the final surface we recommend installing a thin layer of ¼" minus "chips & dust" or granite screenings (actual terminology varies by geographic region) over the final compacted and leveled sub-surface. This "chips and dust" is used to "fill in" the minor undulations in the planarity of the packed aggregate.

9. Extend Granular Base 3-6" Past Actual Edge of Installation.

The edge of any surface is the area of greatest use and misuse. Lawn mowers, tractors, vehicles etc., often come in contact with the edge. Extending the sub-surface aggregate base 3-6" past the anticipated final edge of the resilient or safety surface installation will assist in stabilizing the edge in the future.

10. Taper Edge of Packed Aggregate Base When Adjacent to Non-Solid Edge

When no solid retainer is going to be used at the edge of the SofTILE installation, then the granular base must be sloped off at a 4"(rise) in 12"(run) slope for 12" linear inches or until packed sub-surface is 4" below finished grade of adjacent surface. This prevents a tripping hazard in the event the adjacent loose surface erodes and exposes edge of SofTILE.

11. Base Surface Slope to Be 2% or Greater

In order for adequate water drainage, base surface slope should be a minimum of 2%. (About 1/4" in 12")

12. Inspect Final Packed Aggregate Base

It is important to carefully inspect any base (solid or packed aggregate) supplied by an outside contractor. Often, clients assume that commencement to install SofTILE over the prepared base indicates acceptance and responsibility for the base. Because the cost to remove and replace good SofTILE over poor base is significant, it is important to emphasize to the client that commencement of an installation over any type of base prepared by another contractor in no way indicates approval of the base compaction and stability. It is only an indication that the installer of the resilient surface is satisfied with the planarity of the base. However, at the same time, it is important that you provide the client as much assistance as possible to ensure their prepared base will not fail.

Installation of Geotextile Over Granular Base

(Geotextile is not needed over concrete or asphalt installations. It is installed to provide stability between the top rubber surfacing layer and the granular base materials)

1. Cut and Place Lengths of Geotextile

(Terrafix 200 or 270R or equivalent). Position the first 3m wide width beside and parallel to the area that has the most cuts for posts and other adjacent supports. Cut the edge of this piece to fit adjacent supports. Allow it to extend at least 12" past the posts.

2. Overlap (by 12") and Continuously Seal Joints

Overlap the joints by at least 12". Continuously seal joints with polyurethane adhesive (same material used for tile to tile and tile to base adhesive). In addition, seal joints where the product has been cut multiple times.

3. Stretch Geotextile.

After adhesive has partially cured (or joint is additionally supported with duct tape) stretch the geotextile material as tight as possible.

4. Retain Geotextile at Edges

Retaining the geotextile at the edges can be done using staples to wooden retainer, adhesive to concrete retainer or buried under the soil at increased depth edges.

Sub-Surface Installation-Solid

1. Test Planarity

Water will collect on the surface if the slope is less then 2% or if the area is subject to heavy rains and if the planarity of the surface is not consistent. If water collects on Asphalt or Concrete bases, the adhesive can be affected over time. To test planarity, flood the area with water and mark puddles with chalk. Puddles deeper then ¼" (2 stacked quarters) should be patched with Mapei Planicrete EP or Mapecem PRP 145, fast setting, one component, polymer modified, cement based, pre-mix mortar
Rough concrete (variances more then 1/8") should also be patched.

2. Inspect Concrete Finish

Concrete should have a light broom finish for best surface adhesion. A heavy broom finish will result in a higher then normal adhesive usage. Ensure that there are no cracks and the area is generally level.

3. Test Drainage

The surface should be able to accommodate 25 year storm water volume. If significant water volumes cannot escape from the sub-surface and water backs up under the tiles, the hydraulic pressure could result in a damaged installation.

4. Preparation of Asphalt or Concrete Sub-Surface

A properly prepared asphalt or concrete sub-surface is ideal for SofTILE. Asphalt or concrete sub-surfaces are essential in any commercial applications, water parks (subjected to hydraulic uplift pressure) and in installations that will be subject to vehicular traffic (subject to pull/tear from wheel turns).

a. Confirm that the Concrete or Asphalt has Fully Aged/Cured

The very first and most important step when installing over concrete or asphalt is to ensure that they have cured/aged sufficiently. Normally this is a minimum of 28 days for either asphalt or concrete.

b. Make sure Concrete and Asphalt Surfaces are Dry

The single biggest reason for adhesive failure is too much moisture at time of installation. If the asphalt/concrete base is wet and/or the mats are wet, they must be allowed too completely dry before installation begins. Less then 3lbs moisture per 1000 square feet is the ideal dryness level before applying adhesive. This can be tested with anhydrous calcium chloride test kit. Another "layman's" moisture test would be to leave a rubber mat lying over the floor for 24 hours. If moisture is visible on the back of it when it is lifted up, the floor is still curing or there is too much moisture from other sources.

c. Acid Etch to Enhance Cleaning

Curing and Adhesion (optional) Etching the concrete increases the adhesion by opening the surface pores of the concrete. Mix 25% Muriatic acid by volume to water (1 parts Muriatic Acid to 3 parts water). Wash the entire area with this solution. A light broom scrub will be sufficient. This will also assist in removing any spills of diesel or oil from installation equipment. After complete area has been etched, carefully (rinse) the entire surface.

d. Power Wash Older Concrete.

Power washing is recommended on older concrete to properly clean the area. The importance of a clean surface is proportionate to the age of the concrete. If the concrete or asphalt base is new, it will likely be sufficiently clean to eliminate the need to power wash.

5. Preparation of Wooden Sub-Surface

Wooden surfaces can either be solid plywood or deck planking (provided the spaces between planks do not exceed ¼"). Secure any loose pieces. Countersink protruding nail heads. Replace any damaged or rotting wood. Like all other sub surfaces, make sure the surface is clean and dry prior to adhesive installation.
Since the wooden surface will collect moisture (due to the porosity of the tile), treating the wood prior to installation of the tiles is recommended to retard rotting due to moisture. However, even with treated wood, expect rapid deterioration of the wooden sub-surface. Concrete board and extruded, recycled plastic timber are ideal substitutes for traditional "wooden" sub-surfaces.

Date: _____

Granular Base Installation Agreement for a SofCRETE™/SofTILE™ Surface

Between;

The Client: And

The Supplier:

_____
Sof Surfaces Inc

_____
1702 London Rd, Sarnia ON N7T 7H2

The Client, hereby acknowledges that granular base at

_____
_____(site) ___,
was not installed by the Supplier, therefore the Supplier is not responsible for the planarity, compaction, drainage and composition of the base and cannot be held responsible for the immediate and long term performance of the installed granular base or changes that may occur to the installed surface materials due to granular base failure. The Client hereby accepts full responsibility for any labor and/or material costs to remove and replace the resilient surface in the event of granular base failure.

The Supplier recommends that the granular base under a typical playcenter safety surface area be completed by the client or subcontractor by following these steps:

a. Excavate and remove all sod and topsoil in the surface area to be installed.

b. Remove debris

c. Pack subsoil base with vibrating, compaction roller.

c. Install correct thickness of base aggregates in 3" layers and level out to rough grade.

d. Install playcenter posts (or any other footings) using plywood templates (with correct diameter holes cut in them) to prevent excavated subsoil (during the auguring process) from contaminating the base aggregate materials.

e. Fill all playcenter post holes from bottom to top with concrete. SSi does NOT recommend packing the holes full of granular material because of the risk of future sinking after exposure to multiple rainstorms. If/when a client elects to absorb the risk associated with filling the holes with granular material then the material must be put into the hole in 4" layers and carefully packed (normally with an inverted sledgehammer) at each layer.

f. Carefully pack all of the granular base to 98% SPDD. Use water to enhance packing if necessary. Pay special attention to edges and other areas were the base soil may have been disturbed.

g. Spread granite screenings (fines) over the aggregate base and level to plus/minus 1/8" over 10' planarity.

If the Supplier, upon arrival at the site, determines that the base installation does not meet specifications, the Client will be informed. and be given the option of having the Supplier rectify the surface at _____/hr/man or having the installation crew standby while the Client rectifies the granular base. Standby charge would be _____/hr/man

Signed at _____, _____;

The Client:

The Supplier:

_____

_____

Name_____

_____