



CapillaryConcrete

Bunker Specification & Installation Instructions

Capillary Concrete Installer

For added protection and peace of mind, Capillary Concrete offers a 10-year Performance Guarantee and in order to take part, **the following conditions must be followed. Furthermore, this document must be read carefully and the fields for signatures below must be signed and then sent back to Capillary Concrete BEFORE the start of the installation.**

Appoint a person who is responsible for the installation and confirm that it is done according to the Installation Guidelines and who will submit the installation approval as described below. This must be done before the installation can start. The installation must be carried out exactly as specified in the Installation Guidelines found in this document.

The following test procedure must be followed to the point in all bunkers:

1. After the Capillary Concrete has been allowed to cure for at least 24 hours (48 hours if conditions are wet and/or cold) and it has been cleaned according to the instructions, carefully check that the surface is smooth and that there are no areas anywhere in the bunker where the material is loose in any way.
2. Using a hose, go over the entire bunker floor and apply water at a rate comparable to a garden hose.
3. Make sure the entire surface drains perfectly and that there is no standing water anywhere a few minutes after application

I WILL NOT add sand to the bunkers until the golf course owner's representative confirms the above-mentioned tests were completed and successful.

Name & Signature of Responsible Person

Date

Club Name:

Club Address:

Email Address and Phone Number:

After completing the requested information, please do one of the following:

1. **Sign, scan to PDF-file, and send to the email address below (unless using DocuSign):**

hunter.smith@capillaryconcrete.com

2. **Sign and mail to the address below:**

Capillary Concrete, 610 Sycamore Street, Suite 305, Celebration, FL 34747

Bunker Specification & Installation Instructions

Capillary Concrete®, is a patented product to build sports ground profiles. Here we will cover the use and method to line and protect golf bunkers. **Capillary Concrete®**, is a specially formulated mixture of acceptably sized aggregate, various proprietary additives and water that comes pre-mixed, delivered in a concrete truck. The product is a homogenously blended mixture that is poured from the mixer into heavy-duty utility vehicles, transported to the bunker, and placed inside the bunker at a minimum depth of 2 inches (50mm). The surface of the product is compacted with a roller and covered in plastic for a minimum of 24 hours to allow for adequate curing and until sand is placed on top of the product. The result is a strong, homogenous, and uniformly-bonded bunker liner base that allows for rapid drainage of any rain storm and also reduces wash-outs and/or contamination of bunker sand.

PRE-CONSTRUCTION PLANNING

Prior to installation of **Capillary Concrete®**, the Contractor, Owners Representative, or Superintendent shall confirm that the perimeter area around the bunker does not channel excessive water into the bunker area, that the bunker subgrade is positively pitched, stable under foot, smooth, compacted, free of debris, and meets the Architect's design specifications. It must also be ensured that all bunker trenches have been excavated and constructed to specifications; and that drainage pipes and bedding gravel (table 1) have been installed to the Architect's drainage specifications as dictated by site conditions.

At the lowest point of the bunker subgrade, a 2" X 2" wood frame at least 4 ft long and as wide as the trench must be placed prior to installing the **Capillary Concrete®**. If the bunker floor is large and flat, several frames must be placed to ensure that any point of the bunker floor which is less than 6 inches above the lowest point is located no more than 6 feet away from a frame which will create the drain Vaults filled with bunker sand, see page 3. This is to ensure the sand depth at the lowest points of the bunker is always enough to keep the sand dry at the surface. In the Vault, the **Capillary Bunker Wash Box** must be placed on top of the drain line, before the sand or the **Capillary Concrete®** is installed. This Patent Pending box is placed in the low point of the bunker, on the drain line, to allow for the bunker sand to be washed clean should there ever be any contamination from outside of the bunker (soil, dust, grass-clippings etc).



It is recommended that a tracer wire be installed in all drainage trenches. The drainage pipe must be flushed with plenty of water to ensure proper function prior to installation of **Capillary Concrete®** in the bunker.

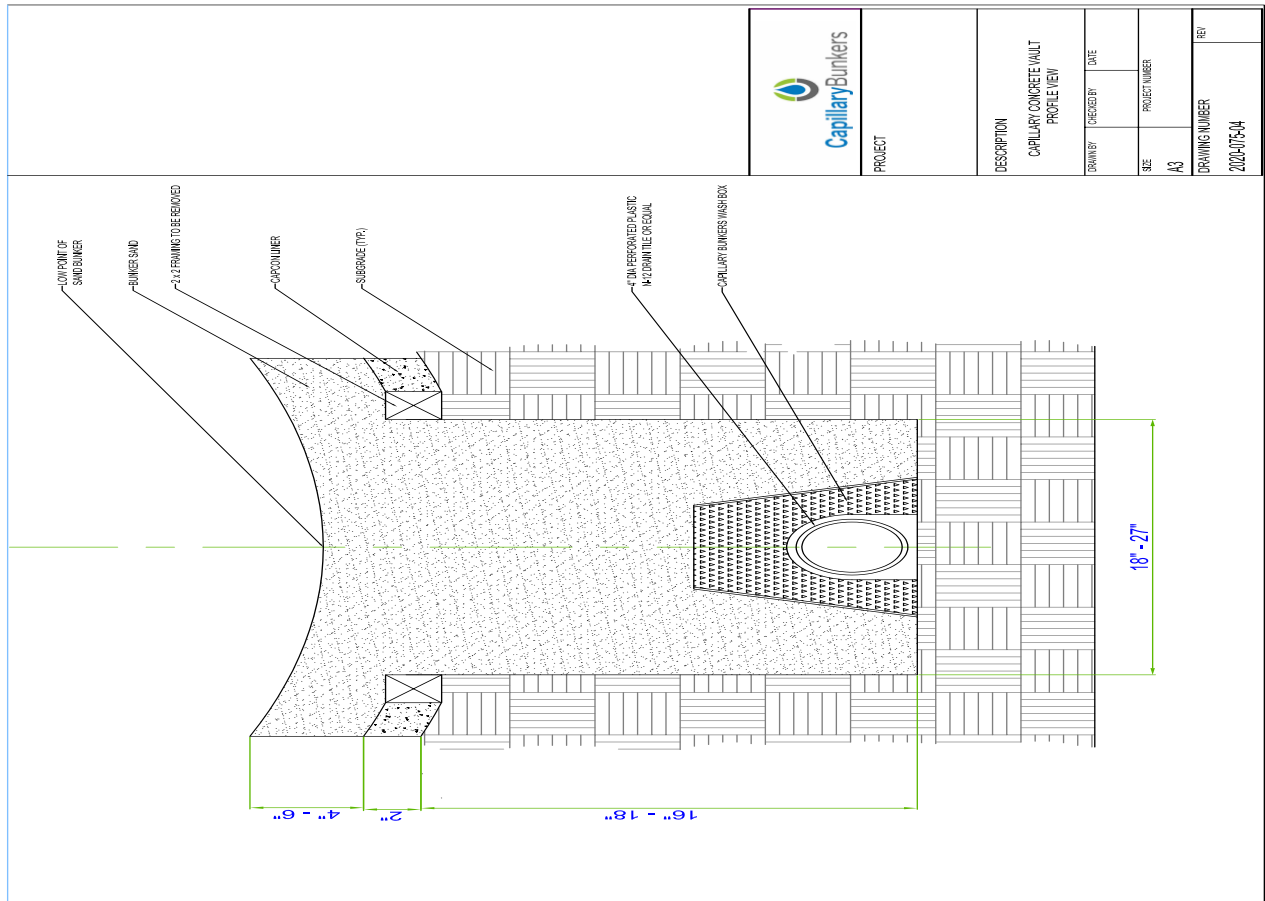
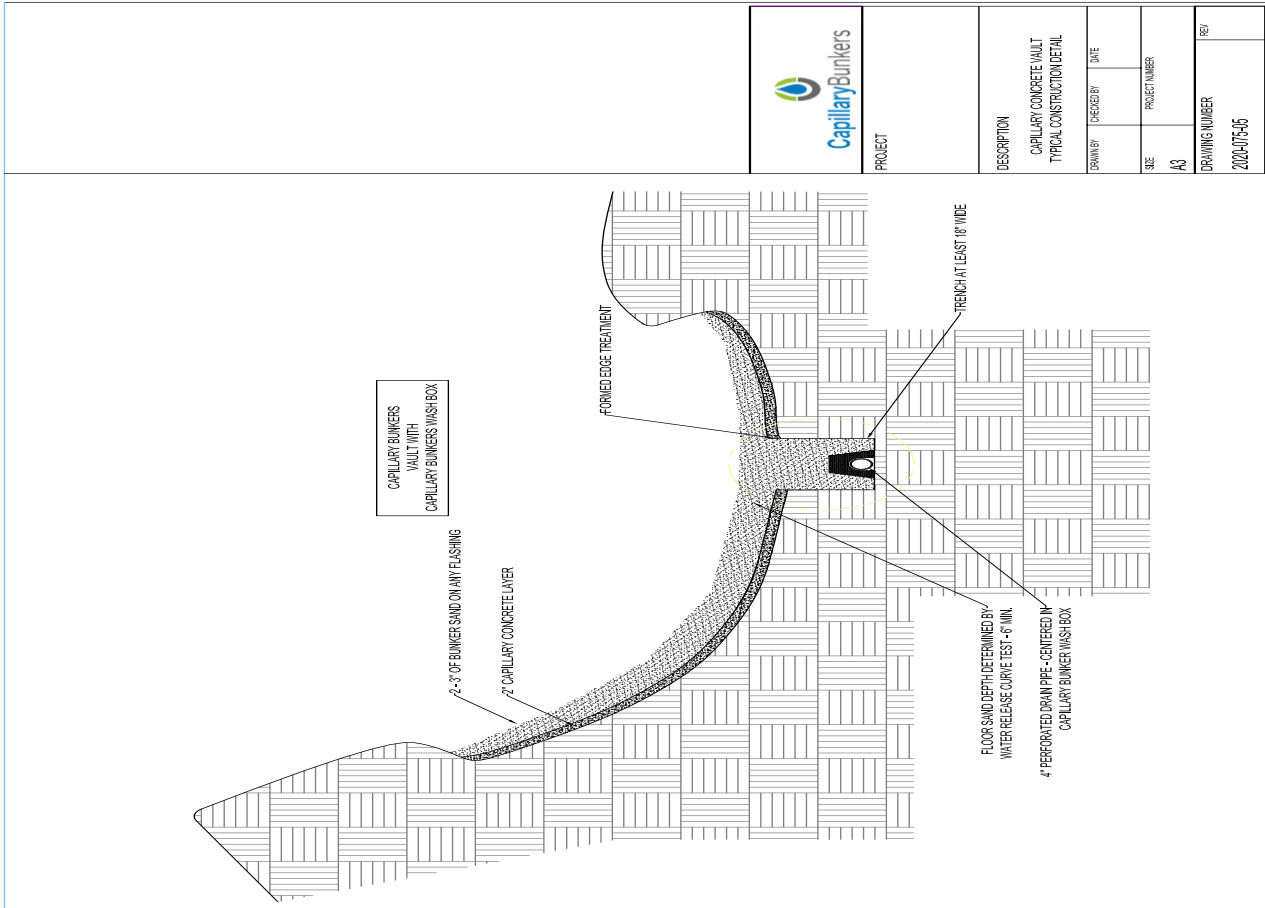


Table 1. Gravel Performance Factors for Drainage in Trenches for Capillary Concrete Installation		
Bridging Factor	D15 (gravel) D85 (rootzone)	≤ 8
Permeability Factor	D15 (gravel) D15 (rootzone)	≥ 5
Uniformity Factors	D90 (gravel) D15 (gravel)	≤ 3
		100% passing a 12-mm screen ≤ 10% passing a 2-mm screen ≤ 5% passing a 1-mm screen

THE BUNKER EDGE

To maintain the nature of the product, every effort should be made to prevent soil contamination of **Capillary Concrete®** during installation, curing, and prior to sand installation.

Two methods to safeguard your installation from contamination:

1. Grassing around the perimeter of the bunker prior to **Capillary Concrete®** installation: With this method, it is recommended that turf grass around the perimeter of the bunker should be secured to the soil by roots or staples before the installation of **Capillary Concrete®**. After installation and curing and a water test has been performed to ensure drainage function, sand can be installed in the bunker. For newly sodded bunkers, where additional irrigation is required for rooting and establishment, we recommend that a thicker layer of sand (approx. 8-10 inches high x 10 inches wide) be installed on inside perimeter of the bunker against new sod. This is done to allow the sand to act as a filter layer to catch any soil runoff during irrigation cycles on the newly placed sod. Once the sod is established and irrigation cycles are reduced, any contaminated sand around the perimeter should be removed. Bunker sand can be leveled and normal bunker maintenance practices can begin.

2. **Capillary Concrete®** installation prior to sod placement: In situations where grass cannot be installed prior to the installation of **Capillary Concrete®**, extreme care must be used to prevent soil contamination. Sand should be installed immediately after curing and the water test. As in method 1, a thicker perimeter layer of sand should be installed to reduce soil contamination prior to sod placement. After establishment, any contaminated sand around the perimeter can be removed.

Planning and Construction of The Bunker Edge

The edge detail often gives the bunker shape its distinctive style. **Capillary Concrete®** has the unique ability to be formed to fit any Architects design goals. Preserving the desired style or motif and reducing ongoing maintenance is critical to the success of any bunker restoration/renovation plan.

Some suggested edge detail methods:

1. Existing bunker and sod renovation-

The strength of **Capillary Concrete®** allows the opportunity to protect the inside wall of the bunker better than any other product. **Capillary Concrete®** has the ability to be shaped almost vertically at installation to get the least possible amount of soil in contact with the bunker sand. In this photo the subgrade under the existing turf has been excavated 3-4 inches and a layer **Capillary Concrete®** has been placed under the sod to help protect the edge from collapse and contamination. Sand is pulled up the face to hide the **Capillary Concrete®** edge.



2. New sod layer around the perimeter-

In this case, either the existing soil and grass, or sod is utilized as the edge of the bunker. The 2-inch (50mm) layer of **Capillary Concrete®** meets the edge of the bunker. Rolling the sod over the face to cover the soil is an option.

3. Thick sod pieces placed on the side-

The roots and thatch help to stabilize the edge and help keep the edge from collapsing. Place the sod pieces along the inside edge (grass side in), like in this picture, before installing the **Capillary Concrete®** layer. On steeper greenside slopes, it is recommended that a notch approximately 2" (5 cm) deep and 2" (5 cm) wide be installed around the perimeter of the bunker where the vertical lip meets the floor of the bunker to create a "footer" to support the structure. (please ask us for detailed drawings as needed or desired).





4. EcoBunker / Natural Sod.

Here, a shelf edge is created with a trowel, and carefully compacted on all sides. Two to three layers of natural sod or EcoBunker can be placed on the shelf and backfilled with acceptable material or material specified by the EcoBunker manufacturer. This provides a stable and easy to care for edge option with very little contamination potential.



Creation of Capillary Concrete Edge

Profile, 1st layers of EcoBunker done, 2 layers of natural turf to go

BUNKER SAND TESTING

Capillary Concrete® has an open structure that allows water to freely drain through the mix at hundreds of inches per hour. Once sand is placed on top of the product, the new water drainage limit will be the Ksat (saturated hydraulic conductivity) of the sand that covers the **Capillary Concrete®** product.

After gravitational water has freely drained from the sand, a certain amount of water will always be retained in the sand against the force of gravity. This is known as capillary water and the amount can be determined with a water release curve test by an accredited test lab. Every different bunker sand has its own unique amount of capillary water retention based on its particle shape and size. This capillary water retention can have an effect on playability and also help you determine how much sand is required in your bunkers to achieve desired playability based on the amount of moisture retained in the sand you select.






Sand particle size, color, shape, compaction rating, drainage characteristics, are subjective and exclusive to each project based on budget and desired playability at that particular golf course.







Capillary Concrete® requests that a USGA approved bunker sand test including a water release curve be performed on any sand considered for use in the bunker.

Pre-Construction Checklist and Instructions

Equipment and Tool Requirements

<p>1</p>	<p>Heavy-duty vehicle to haul mix from the ready-mix truck to the bunker. Examples: Toro Workman, John Deere ProGator, Tractor and dump trailer, articulating wheel loader, front dumper, etc.</p>	
<p>2</p>	<p>Plywood or similar to protect turfgrass and bunker edge and for building a ramp into the bunker if desired. Timbers, logs, etc. can also be used to create ramps.</p>	
<p>3</p>	<p>A minimum of eight pieces of 4" (100 mm) to 6" (150 mm) diameter irrigation or drainage pipe cut into 2 inch (50 mm) lengths. Use these rings to maintain the 2 inch (50 mm) required minimum depth of the Capillary Concrete® during placement. Remove the rings from the wet mix as you work out of the bunker. Attach a handle or make a wire loop on each piece of pipe to avoid losing them in the mix. A metal probe set at 2 inches (50 mm) is also acceptable.</p>	
<p>4</p>	<p>Construction of the Vault – a 2" x 2" wood frame, at least 4 ft long and as wide as the trench must be made and placed in the lowest spot of the bunker floor, on top of the trench, which must be free from gravel under the whole frame area. The Capillary Bunker Wash Box must then be placed directly on top of the drainage pipe, and the rest of the exposed pipe covered with a textile fabric. The Vault must then be filled with bunker sand up to the wood frame before installing Capillary Concrete®.</p>	

<p>5</p>	<p>Flat shovels for placement of Capillary Concrete inside the bunker.</p>	
<p>5</p>	<p>A minimum of three plastic bunker rakes-the Accuform type bunker rake with a round head is preferred. The teeth can be used to rake out footprints in the mix and spread to the mix to a 2-inch (50mm) depth, and the rounded back side can be used to smooth the mix before rolling.</p>	
<p>6</p>	<p>A minimum of two one piece metal extension handles with METAL TIPS. Telescoping handles are not necessary. Metal handles and tips are necessary to reduce flexing during rolling.</p> <p><i>Home Depot has an orange metal 5 ft. handle with a metal tip in the paint department. SKU#821-423.</i></p>	
<p>7</p>	<p>A minimum of two heavy duty 9-inch (23 cm) roller frames.</p> <p><i>Home Depot has a green Wooster Surelock handle that works well. SKU#150-345.</i></p>	
<p>8</p>	<p>A minimum of two 9 inch (23 cm) loop textured roller cartridges, if the textured roller can't be found, use a regular paint roller with the fabric removed or cover a roller with duct tape.</p> <p><i>Home Depot used to call them Goop Loop Rollers. SKU#430-546.</i></p>	

<p>9</p>	<p>At least One 12 to 14-inch pool trowel. (30-35 cm) Some installers prefer using a larger trowel for finishing the floors as well. Do not use a bull float. <i>Home Depot Part# PT144BR</i></p>	
<p>10</p>	<p>Rolls of 6 mil Clear plastic (20ft x 100ft per roll) (6 x 30 meter) Use Black when temperatures are expected to be below 40 degrees F (4 °C) during installation and the night after. Purchase adequate plastic to completely cover all the Capillary Concrete bunkers completed in a day. The plastic can be reused for the entire project. <i>Home Depot SKU#938-963</i></p>	
<p>11</p>	<p>6-inch (15 cm) metal staples to hold the plastic down after placement. Staples should be placed every 3 feet (0,9 m) round the perimeter of the bunker. Sandbags, Bricks, logs, old tires etc. are also acceptable. The idea is to hold the plastic in place during curing.</p>	
<p>12</p>	<p>Two 5 gallon (19 liter) buckets of water to keep rollers wet.</p>	
<p>13</p>	<p>A hose and quick-coupler with a misting nozzle and working shut off valve for misting of the product during installation.</p>	
<p>14</p>	<p>Optional: For easier placement of material. Marshalltown 19-1/2 in. x 4 in. Aluminum Placer <i>Home Depot SKU #959687 Model #AP753</i></p>	

INSTALLATION INSTRUCTIONS

NOTE: *Capillary Concrete® should not be installed when daily high temperatures are expected to be below 32 degrees (F) or below 28 degrees (F) within 2 days of installation. During hot weather, windy, or low humidity conditions, the product will set up faster and caution must be exercised to maintain acceptable moisture levels of the mixture and bunker base prior to installation. A light misting of the bunker subfloor may be required several times during the installation process.*

- 1 When the ready-mix truck arrives at the job site, you will need to ensure the correct consistency of the **Capillary Concrete®** before installation can begin.

Before discharging any mix, ask the driver to spin the truck 5 revolutions to adequately mix the product. (It's been mixing since it left the plant, but we find this to be a good way to ensure mix uniformity)


Now it's time to perform a **HAND SQUEEZE TEST** as shown here →




Ask the driver to discharge a small amount of the **Capillary Concrete®** mixture into the utility vehicle you are using to haul the mix to the bunker. It should be shiny and look like **melted chocolate and rock**. Take a handful of the mix and squeeze it in your hand and release. The paste must be creamy and sticky enough for the aggregate particles to adhere to the vertical surface of your hand. If the paste is dry and powdery, the mix is a little too dry and you need to ask the driver to add water to the mixer truck. **NEVER ADD MORE THAN 1 GALLON OF WATER AT A TIME** (unless otherwise instructed by an onsite **Capillary Concrete®** rep.) check after, ask the driver to turn the drum a minimum of 15 revolutions before checking the mix again. Continue this process until the mix has the feel of **melted chocolate**. Be careful not to add too much water. It's always better to add a little at a time.



We cannot take the water out once it has been put in the mixer. The paste should **NEVER** be drippy and runny when you perform the hand squeeze test. The mix should always have the consistency of **melted chocolate**. **Continue to monitor the consistency as you install-YOU MUST perform the hand squeeze test occasionally to ensure consistency during the installation.** An additional gallon of water may be required after a few loads have been installed. If so-ask the driver to add one gallon and rotate the drum 15 times before discharging more mix.

If the mix is extremely wet and runny when the ready-mix truck arrives, ask the driver to spin the drum for 5 minutes to try to dry the mix up a bit. If that doesn't work and the discharged pile for testing has clogged up void space, you should **refuse the truck, send it back to the plant, and contact your Capillary Concrete® Sales Representative immediately. DO NOT install Capillary Concrete® if the mixture is too wet.**

2	<p>If the subgrade is dry, it should be lightly misted prior to placement of Capillary Concrete®. Do not let the floor get muddy during installation, and make sure floor is always smoothed out before installation of Capillary Concrete®. NEVER WALK ON THE WET CAPILLARY CONCRETE® MIX.</p>	
3	<p>Once the batch is properly mixed, begin in one corner of the bunker by spreading the mix to a depth of 2 inches (50mm) (using depth gauge rings) Use plastic bunker rakes or the aluminum placer tools to drag out and level the product. DO NOT walk on the product in the bunker. This will compress the product and restrict water flow. We want to preserve as much open space for water flow as possible.</p>	
4	<p>Use the textured roller or trowels to finish and lightly compact the surface. The entire surface of Capillary Concrete® must be lightly compacted to provide a smooth surface and bond the product together. Keep the roller damp during the rolling process. It is important to work quickly during this step. The sooner the product is smoothed and rolled the better.</p>	
5	<p>The edge of Capillary Concrete® must be no less than 2 inches thick. A hand trowel should be used to compact and finish the edge of the material around the bunker edge. (If desired, this is also the location of the drip-line irrigation option) Care must be given to prevent loose aggregate pieces from adhering to the exposed soil edge. Any loose pieces should be removed immediately.</p>	

<p>6</p>	<p>Once an area or batch section is finished, it must be covered immediately with 6 mil plastic. Black plastic is preferred on cold days, clear plastic is preferred in the summer. Covering is important to reduce moisture loss and improve curing and strength of the mixture, and covering MUST BE performed in any weather.</p> <p>Place staples in the plastic every 3 feet around the perimeter of the bunker and as close to the mixture as possible to reduce air between the plastic and mix. If there are seams between plastic pieces, use something heavy to hold the seams down.</p>	 <p>Remember we want to reduce the amount of air getting to the product as it cures. This step also keeps debris and water from getting onto it during set up.</p>
<p>7</p>	<p>The plastic cover must remain on the product for a minimum of 24 hours. Then, remain covered until bunker sand can be installed. This helps the product cure and will keep the product clean and debris free.</p>	
<p>8</p>	<p>Before installing the bunker sand (minimum of 24 hours after installation must pass), remove the plastic and clean the base of the bunker with a backpack blower to remove any loose surface pieces that may not have adhered during the rolling phase of the installation. Check the edge for loose pieces as well and remove them from the soil edge. Do not allow concrete to turn light-grey in color. The product needs to stay hydrated before sand is applied, if not keep covered.</p>	
<p>9</p>	<p>Now perform the water drainage test to confirm that water rapidly drains through the product. This must be done to activate the Performance Guarantee. Do not “blast” high pressure water on the freshly installed Capillary Concrete® - a shower spray is preferred over a steady stream. See the film; The Test of Drainage</p>	

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| 10 | Bunker sand can now be installed (using a conveyor, loader, or utility cart etc.) to the required or specified depth <u>according to the water release curve</u> . Do not drive directly on the new Capillary Concrete® bunker during sand installation. It is recommended to begin sand installation on an edge and push the sand out across the bunker using a sand rake or similar machine while keeping vehicles on plywood on top of the sand layer. Once the sand has been installed, saturate the sand with a spray nozzle so as to not flood the sand to where fines can separate. This moisture will help the product continue to cure and help the sand firm up. |
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If requested by the CONTRACTOR, OWNERS REPRESENTATIVE, SUPERINTENDENT, or GOLF COURSE ARCHITECT, **Capillary Concrete®** will provide a technical representative for installation assistance and consultation for one (1) full day on site at the start-up of a **Capillary Concrete®** installation for the cost of basic expenses and related costs. Additional days of consultation may be requested at the same expense rate. Please provide a minimum two (2) weeks' notice to arrange this service. For more specific questions, contact **Capillary Concrete®** at:

Europe and rest of the world: Tel: +44 7979 651765 or Email: kdiamond@capillaryconcrete.com

Americas: Tel: +1 321-939-4143 or Email: hunter.smith@capillaryconcrete.com

Please visit www.capillaryconcrete.com for more information.

[Link to Bunker install instructions here:](#)

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