

The Money Pit

Do golfers really understand how much bunkers cost?

BY JAMES F. MOORE

USGA folks and Rules aficionados are fond of correcting golfers who refer to sand bunkers as "traps." However, given the rapidly rising cost of building and maintaining bunkers, the word *trap* might better describe the overall impact on golfers' pocketbooks. For a variety of reasons discussed in this article, bunkers may well have passed greens in terms of their ultimate cost to the consumer.

This article addresses construction, maintenance, and golfer expectations, and how each affects the overall cost of bunkers on a high-quality course. Right or wrong, these courses often define golfers' expectations of what they would like to have at their course. Unfortunately, few golfers realize how costly it would be to have what they see on television.

The figures quoted in this article are derived from extensive telephone interviews with golf course superintendents, golf course builders, sand suppliers, bunker liner distributors, and trucking companies. It should be kept in mind that the figures represent broad ranges and that all of the costs associated with the construction of bunkers are highly subject to change — largely due to the uncertainty of fuel costs.

DESIGN

Bunker design has perhaps the greatest impact on the long-term cost of maintaining bunkers. Steep, flashed sand bunker faces may be striking to the eye, but they are also extremely prone to erosion during even moderate rain events. A great deal of hand labor is frequently necessary to shovel the sand back onto the faces. Newly shoveled sand is loose and soft and thus prone to "fried-egg" lies until it has had time to compact. Heavy rain events often move not only the sand but the underlying soil as well. This soil contaminates the sand with silt and clay, quickly reducing the sand's ability to drain. Eventually, the sand becomes so contaminated that it must be completely replaced. Although bunker liners have helped reduce erosion and contamination, they are expensive to install and maintain. This is discussed in greater detail below. Grass faces



While grass faces eliminate the problem of erosion, they still require extensive maintenance — often by hand.



Drainage is critical in every bunker construction project and typically costs approximately \$5.00 to \$6.00 per linear foot.

are far less prone to erosion problems, but often they are difficult to mow and even more difficult to irrigate and fertilize. They are also far less dramatic in appearance and therefore utilized to a lesser extent by most architects.

In addition to determining the style of bunker faces, architects determine the shape of the perimeters. Bunkers with intricately shaped, serpentine lines require a great deal of extra hand labor for edging and are therefore more costly to maintain.

Perhaps the greatest single design factor affecting the cost of construction and the maintenance of bunkers is simply how many there are on the course. Most courses have from two to three bunkers per hole, but there are courses with more than 200 and courses that have no bunkers at all. Based on survey data from the Golf Course Builders Association of America (GCBAA — *Golf Course Builders Association of America 2008 Construction Guide Tool* compact disc), the average total square footage is about 100,000 square feet, with the average size of a single bunker being about 1,500 square feet.

CONSTRUCTION

Although there are many ways to build bunkers, all utilize a similar sequence of steps.

Construction of the Core, Subgrade Preparation, and Edging

This step involves the digging of the hole and the shaping of the bunker floor and edges. Large, simply shaped bunkers can often be built with small dozers and skid loaders. Small, intricately shaped bunkers require extensive hand shaping, which drives up the cost. A broad estimate of the cost of this step ranges from \$.75 to \$1.50 per square foot.

Install Drainage System

Subsurface tile drainage is utilized in most bunker construction and typically is installed by digging 8-inch-wide ditches 8 to 10 inches deep. Perforated 4-inch drainage pipe is placed in the ditches and covered with gravel. Approximately 150 linear feet of drainage tile is used in a 1,500-square-foot bunker, with an installation cost of about \$5.00 to \$6.00 per linear foot (including materials).

Liners

Liners are a relatively new concept for bunkers and are available in a very wide range of materials and designs (far too many to discuss in this article). All liners are installed between the soil floor of the bunker (subgrade) and the sand. Liners are claimed to reduce the erosion of sand from the bunker faces and, as a result, reduce the contamination of the sand with soil, thus prolonging its ability to drain. Liners fall into two broad categories — those that are rolled out over the bunker floor, much like carpet, and those that are sprayed or spread over the floor to form a sealant. The cost of liners varies widely depending on their thickness and composition, while the cost of installation varies a great deal depending on the amount of hand work necessary. Roll-out liners range from \$0.25 to \$0.75 per square foot, with installation adding \$1.00 to \$2.00 per square foot. The sealant-type liners are usually installed by the liner representative and typically range from \$1.00 to \$1.50 per square foot (including materials).

A hidden cost of all liners is the labor necessary to avoid damaging them during bunker maintenance. Sufficient sand must be continuously maintained over the liners to prevent contact by golfers and maintenance equipment. For this reason, many golf course superintendents find it necessary to hand-rake bunkers with liners. This can be extremely expensive, as discussed below under "Maintenance."

Bunker Sand

At one time, selecting a sand for use in bunkers was a fairly simple task. Typically, a mason or brick sand would be purchased from a local sand and gravel plant. The sand was then hauled the relatively short distance to the course, resulting in extremely reasonable trucking charges. Fuel surcharges were a rarity.

Things have changed. Ironically, one of the most contentious aspects of course maintenance today is the playing quality of a hazard — the bunker. In an effort to find the “perfect” sand for their bunkers, golfers seem to be willing to pay any price. In addition, it is not uncommon for courses to select a sand that must be hauled hundreds and even thousands of miles, resulting in freight and fuel charges that can far exceed the cost of the sand itself.

The cost of sand is usually made up of three factors: 1) the cost of the sand, 2) the cost of the freight, and 3) the addition of a fuel surcharge. In many states you also have to pay tax on the product or the freight (including the fuel surcharge), and in some cases both. For example, Pennsylvania taxes both at a rate of 6%.

Bunker sands today fall into two broad categories. Native sands are sand products that are mined and then screened to achieve the proper particle size distribution. As a general rule, screened native sands range from \$15.00 to \$25.00 per ton FOB (the cost at the plant in this case). Manufactured or crushed sands make up the second category. These are sands that are mined and then passed through a crushing device. They are sometimes screened after crushing. The crushing process typically doubles the cost of the sand, with manufactured sand ranging from \$30 to \$50 per ton FOB.

The sand must then be hauled to the project. In most cases, trucks carrying 23- to 25-ton loads will be used to haul the product. The cost of hauling is affected by many factors, including tolls, traffic (time), and distance. In most cases, the 23-ton load costs from \$1.75 to \$3.50 per mile. Assuming \$2.00 per mile, trucking the sand 100 miles would result in a freight charge of \$200.

Unfortunately, that will not be the final cost of the sand. Given the rapid rise of the cost of fuel, trucking companies must now add a fuel surcharge on top of the freight charge. As everyone knows, the cost of fuel varies regionally, and thus surcharges do as well. Surcharges can range from 10% to 30%. Assuming 20%, our \$200 freight charge has increased to \$240 per 23-ton load per 100 miles.

Yet another caveat regarding fuel expense is the fact that the cost per gallon of fuel can rise quickly. When contractors are trying to bid on a project, they must estimate what fuel charges will be at the time they purchase the sand. How-

ever, since sand is often not installed in bunkers until the very end of a construction project, a year might elapse between the time the bid is submitted and the time the sand is actually purchased. Does anyone want to try to guess what diesel fuel will cost a year from now? For this reason, the fuel surcharge is very likely to change from the time you first check on the cost of the trucking until the time the product is actually hauled.

Sand Installation

The cost of placing four inches of sand into a bunker cavity ranges from \$10.00 to \$14.00 per ton. Based on a telephone survey of five of the most commonly used sand suppliers across the country, new golf course construction typically utilizes from 2,500 to 3,000 tons of bunker sand, while renovations often require less — in the range of 1,500 to 2,500 tons.



Combined Cost of Construction, Sand, and Freight

Adding up these individual charges illustrates just how expensive it is to add bunkers to a golf course construction project. As an example, let's assume we are building a new course that will have three to four bunkers per hole, with each bunker approximately 1,500 square feet in area, for a total of 100,000 square feet of bunkers. We will use a liner and we will purchase a manufactured sand from a plant 300 miles away. Our project will require 3,000 tons of sand.

Intricate designs are eye-catching and dramatic. However, the extensive hand labor necessary to build and maintain them makes them extremely expensive.

Construction at \$1.00 per square foot	\$100,000
Install 1,000 linear feet of drainage at \$5.50 per foot	5,500
Purchase and install liner at \$1.50 per square foot	150,000
Purchase 3,000 tons of sand at \$35.00 per ton	105,000
Ship sand to project at \$2.00 per mile <i>(Each truckload will cost \$200. 3,000 tons will require 131 truckloads or \$26,200)</i>	26,200
Fuel surcharge of 20%	5,240
Install sand in bunkers at \$12.00 per ton	36,000
Total bunker cost	\$427,940

Based on the assumptions in the table, our bunkers will cost \$4.28 per square foot or about \$6,400 per bunker.

MAINTENANCE

As frightening as the cost to add bunkers to a course might be, an even greater expense is their perpetual maintenance. As the Green Section agronomists travel the country and visit courses of all budget levels, the most common complaints from golfers involve bunkers. Depth of sand, "fried-egg" lies, lack of consistency, and even varying moisture levels are all sources of dissatisfaction. Many golfers believe they are entitled to a certain quality of lie in a bunker and that anything less is a sign of poor maintenance or bad sand, and usually both. Unlike the other hazards on the course, bunkers now have to be "fair."

As noted earlier, architects frequently use bunkers for aesthetic reasons as well as to add challenge to the course. The bright white sand in a bunker provides a beautiful contrast to the acres of green, intensively manicured turf surrounding it. During televised golf events, aerial cameras zoom in on perfectly edged bunkers with perfectly groomed sand that come closer to resembling oriental gardens than hazards. So how do superintendents produce such "works of art"? They do so by using a lot of hand labor to complete a variety of tasks. In preparation for this article, I surveyed ten superintendents across the country at courses that are known for top-quality bunkers. What follows is a summary of their practices.

Raking

Raking is usually broken down into two types — a full raking and a touch-up procedure. Full

raking is a total grooming of the entire sand area, while touch-up simply corrects any irregularities in the sand left by careless golfers. Most of the courses hand-rake the bunkers in lieu of powered equipment. This is done to create a firmer surface and to avoid contacting the liners.

Edging/Trimming

Keeping those sharp, well-defined edges requires a lot of hand trimming. During the times of the year when grass is actively growing, the courses contacted trim weekly using line trimmers. Edging using a sidewalk edger or similar equipment is typically a monthly task in the parts of the country that use cool-season grasses, while those with bermudagrass conduct this task twice per month. After a bunker is edged, additional labor is necessary to clean up the debris.

Mowing

Courses with grass faces have to mow regularly to keep a manicured look. Floating mowers are the most common tool due to the steep slopes associated with most bunker designs. Mowing is a weekly task and one that is almost always followed by blowing clippings out of the bunker.

Leaf and Clipping Removal (Blowing)

A surprisingly high labor requirement in bunkers is the need to constantly remove leaves, grass clippings, and other debris. Most of the courses contacted for this article viewed this task as a daily necessity, involving at least two laborers with backpack blowers.

Packing Sand Faces

Few things anger golfers more than a ball plugged into a steep sand face. As mentioned earlier, the sand on these faces is often loose as a result of having to be periodically moved back onto the face from the lower part of the bunker. To reduce plugging as much as possible, the maintenance crew has to pack the faces with hand tampers. Obviously, the more often the sand is washed off the faces by rain or runoff, the more often the packing process must be done. This operation is conducted once or twice per month.

Checking Sand Depth

Keeping the sand at the proper depth on the bunker faces also helps reduce fried-egg lies. For courses with liners, it is an absolute necessity



to keep enough sand over the liner to prevent players from contacting it during a shot. The goal is to maintain a depth of 1 to 2 inches on the bunker faces. To achieve this goal, the depth must be checked weekly and reestablished with hand shoveling as necessary.

Replacing Lost Sand

Sand is gradually lost from bunkers as a result of being blasted out by players, blown out by wind, and removed by the maintenance staff. Following heavy rains it is commonplace for the sand in the lowest portion of a bunker to be covered with a thin layer of silt and clay, as well as organic debris that has blown or floated into the bunker. This layer should be removed to prevent plugging of the sand pores, which in turn will reduce the sand's ability to drain. One or 2 inches of new sand should be added annually, as opposed to adding greater amounts over a longer period. By adding smaller amounts more frequently, the problem of a deep layer of new soft sand is eliminated.

Pumping

As bunkers age, their ability to drain rapidly decreases. Heavy rains can result in older bunkers looking more like water hazards. To restore the bunkers for play as quickly as possible, crews are sent out with pumps and shovels. After the water is pumped out, the silt and clay layer is removed

and the bunker is allowed to dry out enough to hand rake.

Maintenance Summary

Given the very high labor requirements necessary to keep bunkers in top condition seven days per week, all of the courses contacted have established specialized bunker crews, often led by a bunker foreman. These teams perform all the tasks described above and are reinforced with additional crew members following heavy floods or when large volumes of new sand must be added.

Bunker crew sizes and schedules varied widely, depending on the number and design of bunkers. Keeping in mind that all ten courses are considered high-end facilities in their region, the least demanding schedule devoted 4 to 6 workers, spending 6 hours per day on the bunkers, 6 to 7 days per week, or a total of approximately 200 labor hours weekly. Another course sent out 13 employees each day for 5 hours per day, 4 to 5 times per week, for a weekly total of about 275 hours. The highest labor commitment in this survey utilized an average of 8 workers, 8 hours per day, 7 days per week, for a weekly total of about 450 hours.

With hourly wages for these workers in the \$8.50- to \$9.50-per-hour range, it is obvious that bunker maintenance has become extremely expensive. In fact, all of the superintendents contacted expressed the opinion that the cost of

Liners are effective in reducing contamination of sand with underlying soil. However, they are expensive to install and difficult to maintain.

maintaining bunkers at their courses was now approaching, and in some cases exceeding, the cost of maintaining greens.

CONCLUSION

Given the data described in this article, the reader should be convinced that bunkers are extremely expensive features to add to any golf course. They are expensive to build and even more expensive to maintain — at least at the level many golfers today are demanding. Although the wealthiest courses have the funding available to maintain bunkers at championship quality on a daily basis, the rest of the golfing world needs to be more realistic about how to best use their more limited resources. The following list of suggestions is offered with this in mind.

- Make every effort to educate players at your course concerning the cost of maintaining bunkers at a high level. This article should help.
- Eliminate bunkers on your course that seldom come into play and/or are rarely seen. At the very least, convert them to grass hollows, but do so in a professional manner. Simply removing the sand and filling the cavity with soil is not the answer. Hire a professional golf course contractor to do the work, including the reshaping of the surrounding area to create a more natural appearance.
- Convert those high, flashed sand faces to grass. Although grass faces still require a great deal of effort, they reduce erosion problems, thus prolonging the life of the sand.
- Include funding in the capital improvement budget to rebuild the bunkers every 5 to 7 years. Typically, this involves removing the old sand, installing new drains, and installing new sand. This interval can easily be stretched to 7 to 10

years if players are willing to tolerate less than ideal conditions for a few days following heavy rains.

● Bunkers do not have to be raked on a daily basis — that is, if golfers make a better effort to rake out their footprints. Unfortunately, this aspect of golf etiquette seems to have slipped even more than the fixing of pitch marks.

Courses with small budgets might even solicit the aid of their players by asking them to volunteer to touch up certain bunkers — much like the roadside litter programs popular in many states.

● Be sure to check local sands when purchasing new sand for bunkers. Have the local sands tested by an accredited laboratory before assuming that the only good sand for your bunkers is three states away.

● Of course, the biggest saving of all will come from convincing your golfers that the bunkers are hazards and that players simply cannot and should not be guaranteed a perfect lie every time. If you figure out how to do this, please contact the Green Section agronomists immediately so we can share your “cure” with the rest of the country.

ENDNOTE: The author would like to thank all those who participated in the telephone interviews. Special thanks is extended to the Golf Course Builders Association of America for their assistance. GCBAA has developed an excellent tool to help estimate the cost of construction of bunkers as well as all other areas of a golf course. This CD-based tool can be obtained by visiting www.gcbaa.org.

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The cost of bunker maintenance can be reduced by converting flashed sand faces to grass. The conversion process itself is labor intensive and expensive.

