



Perforated plastic 4-inch tubing serves as drain line. Worker covers drain with gravel.

Construction of The USGA Green by The Superintendent

by LOUIS E. MILLER, Golf Course Superintendent
Louisville Country Club, Louisville, Kentucky

OF THE MANY DIFFERENT methods of constructing a putting green, the USGA method is accepted as probably the most successful. The USGA method of building has been refined and tested for a number of years and, if all the proper steps are followed in sequence, the result should be a correctly built green that should last for many years.

If you are considering rebuilding one green or your entire course, the first

step is to engage a competent golf course architect. I have seen too many greens designed by the superintendent or a member of the green committee that have been disasters. At our club, we hired an architect whose work was quite reputable. His design kept the existing character of the course, yet added an innovative flare to the new greens.

A committee was established consisting of the superintendent, golf professional, and two members of the green

committee. Once the board of directors had approved the construction of three greens, the committee was to work with the architect and approve the design. The project was to be done over six years, rebuilding three greens each year.

As soon as the board approved the project, we began making our topmix. In wanting to stay away from any soil at all, we sent samples of the sand and peat to the USGA supported laboratory at Texas A&M University. The laboratory recommended we use 80 percent sand,



Making the final grade with the grader box prior to overseeding the green.

which was classified as a medium washed sand, and 20 percent Millburn peat. This material had a percolation rate of 7.4 inches per hour.

We mixed off-site beginning in June, using two front-end loaders and a Lindig soil shredder. We found that by using two loaders and mixing the material before putting it through the shredder, two men could mix about 100 tons in a six-hour period. The high sand content made it necessary to clean and change the oil on the breathers and crankcases of all equipment each day. We were able to mix 2,000 tons in about one month.

Our target date for construction was set for the day after Labor Day. Arrangements for the heavy equipment, which in our case consisted of a track-type high lift and a backhoe, were made three months in advance. A rule of thumb here is that you can budget about three days for the high lift and one day for the backhoe per green. Try to have operators who have done this type of work before, because it makes the job a lot easier.

The sod was removed from the green the morning construction was started and used to establish a temporary putting green. This lessens the shock to

the membership and gives them a satisfactory surface to putt on during construction. The architect's job is finished once he gives us the final draft of the blueprints. Staking and gradework should be handled by the superintendent (using a transit properly is part of his professional requirements). The two main stakes to be considered throughout the construction are the center stake and the backsight stake, which is established in the center of the fairway. The backsight stake is absolutely essential; it assures that the green will be properly oriented with the fairway. If a cut or fill is required, then the center stake and four others will suffice until a rough grade is reached. This just speeds things up for the operator. The green can then be staked on 16 points with the proper grade marked on each stake.

THE BASE GRADE of the new green should conform roughly to the finish grade, except that it will be 18 inches deeper. Once the base grade is established, the next step is to install the tile lines. In our case, the design of the tile system varied with each green with a minimum spacing of 12 feet and a maximum of 20 feet. The main thing to be sure of is that they all have the proper

fall. We used 4-inch plastic perforated tile with $\frac{1}{2}$ inch gravel to bed and cover the pipe. During the tiling phase, I moved to the next green site with the heavy equipment and my assistant took over the tile installation. This requires two transits, or, at minimum, one transit and a level. A transit with a plumb line and full vertical adjustment on the instrument will be required for the stake work. A level will be good enough for checking the grade work in tile installation. The soil taken from the tile trenches can be slightly mounded between the lines and rolled with a power roller. This speeds the flow of water to the tile lines while drains are functioning.

Once the lines are installed, a series of grade stakes can be driven into the base grade. Ten to 12 stakes will be enough. Come up four inches from the base grade, and using a felt-tip marker, draw a line around the stake. This will be the 4-inch grade for the gravel bed. Come up two more inches and draw another line of another color; this will act as the grade line for the 2-inch buffer layer of coarse sand between the gravel bed and the final topmix. Come up 12 more inches and draw another line, which will be a "rough" final grade line for the

green mix itself. These lines speed the filling process.

The gravel bed can be spread by one operator using a tractor with a blade or grader box and a laborer to hand-rake the tight spots next to the edge and around the stakes. The gravel can be trucked right to the green, and 10- to 12-ton loads on tandem trucks helps to reduce tracking on the course.

The coarse sand blanket can be spread in the same manner as the gravel blanket. A spot check from time to time by the superintendent helps insure the quality of this installation. A sand bunker rake is an ideal tool to level the sand blanket, especially when working around the grade stakes.

BY THIS TIME, the work force and the entire project will be well spread out. The superintendent and heavy equipment will be working on the last green or the third green, depending upon how many you plan to do. The tiling crew, supervised by the assistant, should be working on the second green, and the operator and laborer spreading the gravel and coarse sand will be working on the first green. Once you are spread out like this, there is a tendency to pick a few men from your regular crew to help with construction. Don't make the mistake of letting the routine maintenance on the course lapse simply for the sake of the construction. You still have the obligation to provide good playing conditions for the members. If turf declines, then you and everyone involved are open to criticism. If you need extra men and you are pushing against the weather and the calendar, then hire them. You should have added at least a 10 percent contingency fund to the construction budget anyway. While on the subject of contingencies — there will definitely be some. Things such as old water lines and tile lines, along with existing irrigation lines and wires, will have to be contended with. One good bite with a backhoe into a couple of dozen irrigation wires can play havoc with your day. Learn to take these things in stride. Broken pipes and delays, due to the flooding they cause,

(Top right) The mechanical sand rake is used to install the 2-inch sand layer which lies beneath the topmix.

(Right) The green is shelled-out to a depth of 18 inches and is now ready for drain lines, gravel, sand and topmix. Note original center mound grade and grade stakes.



are a way of life in reconstruction, no matter how well planned. A good supervisor will handle these contingencies efficiently without disrupting the overall project.

The irrigation to the green can be installed by a crew of three men in one day. The size and amount of pipe, heads, valves and swingjoints can be ordered in advance. The most important part of this portion of the program is the proper spacing of the irrigation heads. You might consider using some part-circle sprinklers, especially around bunkers, because the USGA green requires more water than a green of a heavy clay, and there is no need to water the sand in bunkers. A small, wheel-type trencher with a 36-inch boom and a 4- to 6-inch cutting width will be sufficient. Backfilling can be done easily with a tractor and a blade.

Once the heads are in, it is a good idea to stake them. It is easy to cover them in final grading, and hitting one with a disc or pulverizer can ruin it. We found that we can work the irrigation in with the tiling. Here again it strings the work out even more, so you find yourself constantly checking on the progress, or lack of it. We are fortunate that we have a two-way radio system on several pieces of equipment, and a lot of small problems can be handled over the radio, thus eliminating unnecessary running around.

THE BACKHOE CAN begin forming the bunkers when the highlift has just about finished the earthwork on the second green. If the bunker is extremely large, then the highlift can help with the excavation. The finish work can be left to the backhoe. After we staked the bunkers, we have found that if sections of irrigation hose are laid around the stakes, it gives the exact design of the bunker and all its curves and makes it easier on the backhoe operator. The type of backhoe we used has an added attachment called an "adjust-a-bucket." This is a smooth bucket with an extra hydraulic cylinder that permits the bucket to swing 180 degrees horizontally. The operator can follow the design of the bunker, curves and all.

A good operator can also form the base of the bunker to drain into one low area. A tile line should be installed from the low area into the main tile line exiting from the green. If the bunker is above the green, then the tile from the bunker can be tied into the tile system of the green. Lay the tile exit as far away

from the green as possible. If you run it out just a short distance from the green, you will have a lagoon by the end of the next summer. A French drain will not be good enough to handle the amount of water coming out of the green or the bunkers. Run the drain line into a drainage ditch or into the woods. Believe me, you will be glad that you did. You will do it sooner or later.

Placing the topmix on the green is probably the largest single phase of the operation. Here is where you get on the phone and use the "beg, borrow and steal" method to round up four or five dump trucks from nearby courses. All of the clubs in our area have been most generous; they often send an operator for a day or two. Two front end loaders can keep the trucks filled, especially after they are spread out, traveling from the mix area to the green site. A small track-type of highlift is ideal for handling the mix and spreading it onto the new greens.

We usually rent a Case 350 for this job. It handles the material well and compacts it nicely. Once it is in place on the green, the dump trucks drive right to the fill area and dump their topmix load. This eliminates having to push it so far with the highlift. We have never had any problem with compaction with the trucks moving out onto the green. With any kind of luck, you can fill three greens in a 12-hour day.

Remember the grade stakes that you put in earlier? Once you have reached grade lines marked on them they can be pulled. It will be necessary to have a transit set up to check the final contours on the green. You can expect to take about four hours per green putting in the final contours using the track-type highlift and a tractor with a grade box. Once the contours have been established, then get the committee together to be sure that everyone involved agrees with the final shape of the greens. I have experienced a situation where changes had to be made after seed had germinated because someone didn't approve of the architect's design. This shouldn't be a major problem if the committee knows anything at all about reading blueprints.

THE NEXT STEP IS to incorporate the starter fertilizer and seed the putting surface. We used Penncross bent at two pounds per 1,000 square feet. Knowing the size of each green, the seed was weighed and applied in three directions to insure uniform coverage. We have had our best results with lightly

raking the surface after seeding and then rolling it. The green and bunkers are then rimmed with two strips of sod. This helps to define them both and helps keep the proper design of the green.

If you have time and you have made any deep cuts in the construction, then you might want to have a pH test to check for lime requirements. Chances are that you won't have time since you are undoubtedly racing against the weather. This can be checked later and the lime could be applied over the winter. All that remains now is to grade the banks and surrounding area and prepare the final seedbed. The seed types may vary here, especially for the fairway, if needed, and the banks. Just be sure the right seed is planted in the right place. Here again, after the seedbed is prepared, add the starter fertilizer and the seed. We then mulch everything except the putting surface.

All that is left now is to turn on the water.

If you have any kind of favorable fall weather at all, then you can expect to see germination in five to seven days. We hold off placing the white sand in the bunkers until winter or the following spring, because until the grass is established around the green, you will have soil washing in the bottom of the bunkers, and this just makes the sand dirty. There are two schools of thought on this, however. Some people prefer to get the sand into the bunker and leave it in a pile until they are ready to spread it.

The next step is to repair ruts and any other damage caused by trucks during construction. Some time spent with a disc, a rake, some seed and mulch, and the problem is solved.

Some of the sprinkler heads may not turn properly around the greens. This is caused by sand working its way around the heads. All that is required here is to take them apart and clean them out. It is just part of the game.

We have been involved with constructing the USGA type of green for three years, and we are satisfied with the results. If you plan this type of construction as far in advance as possible, it will eliminate a lot of problems. It can be done smoothly and rapidly. The last four greens that we built took 22 work days from start to finish, which averages out to five and a half days per green at a cost of \$1.29 per square foot, including the white sand in the bunkers. We saved a considerable amount of money by doing it ourselves. If you plan to build a green, do it right the first time.