

# The Fine Line of Fair Competition: How To Avoid Hole Location Disasters

By Mark Sweeney and Martin Carroll  
[www.aimpointgolf.com](http://www.aimpointgolf.com)

## 1. Introduction

Part of what makes a major golf championship “major” is the uniquely difficult competitive environment. The Masters, U.S. Open, British Open, and PGA Championship all strive to draw from the golfers their very best by requiring the highest levels of performance. The golf world is well aware that at times in recent years the competitive environment was elevated a bit *too* high, yielding conditions that were virtually unplayable. The U.S. Open tournaments of 1998 at the Olympic Club and 2004 at Shinnecock Hills are the now classic examples as far as putting conditions are concerned. In both instances particular greens became unexpectedly slick, and as a result, each year as the Open approaches we get replays of a frustrated Kirk Triplett using his putter to stop a ball from rolling off Olympic Club’s 18<sup>th</sup> green; and of the course superintendent at Shinnecock Hills dragging a hose out to the seventh green to keep it from burning in the New York sun. These images get nearly as much play as Payne Stewart’s famous fist pump/leg kick at Pinehurst in 1999. Hole placements and green speeds are hot topics for all the Major venues: at the Masters each year we hear about Augusta’s vast and undulating greens, for the British Open we typically hear about how the wind dries out a putting surface, and the PGA Championship always does its share to insure highly challenging adventures on the short grass.

The Tournament Coordinators for grand events like these make so many *right* decisions one would be challenged to count them all. Yet one or two risky decisions that turned out bad are dragged out and called into question each and every year as we head into summer.

## 2. What is Fair?

When the ‘performance levels’ of a golf course are pushed to maximum tolerances, the management of the course becomes increasingly tricky. For example, under

ordinary conditions the placement of a hole on a gentle grade is perfectly acceptable – it works in that the players are challenged by breaking putts, yet the ball will stop rolling as the green flattens out below the hole. But cut that same green down to where the grass is just about the stubble on a five o’clock shadow and suddenly that ball will not stop rolling. This can be a nightmare for both players and tournament officials.

For the purpose of our research, let’s assume that a “fair” hole location has at minimum the following characteristics:

1. A player can putt from within 30 feet and have the ball stop within 1 foot of the hole.
2. A putt from within 5 feet is not unrealistically difficult to make.

The first item falls in line with regulation par, which provides for two putts once a player reaches the green. The first putt does not necessarily have to be makeable to be fair, but a two putt should be attainable. For the second item we are not suggesting that everything inside of five feet should be a gimme—but close putts should not require a miracle to be holed.

The average number of putts a PGA TOUR player makes from 5 feet is about 1.2, meaning they make about 80% of them. A difficult hole location would be one where the average putts from inside of 5 feet was dramatically higher than 1.2, or towards the far right side of a normal bell curve. A disastrous hole location is one where the average number of putts is outside a normal curve, either because the player cannot stop the ball within a foot of the hole, or because the break around the hole is so severe that it makes dramatic turns as it slows.

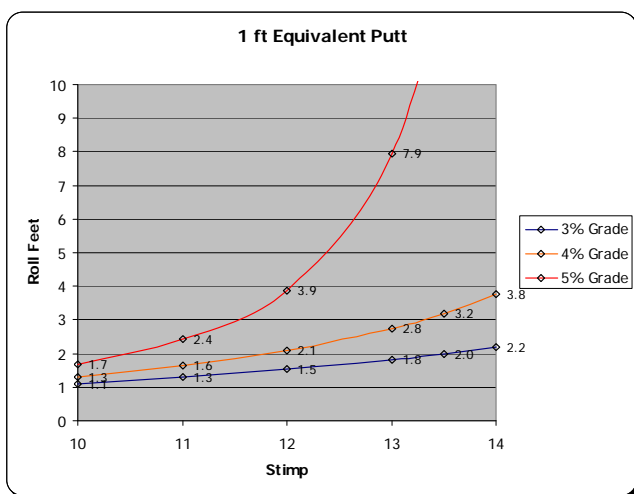
Typically, such difficulties occur where the primary elements of grade and green speed have been stretched *too far* and combine for golf’s version of “the perfect storm.”

### 3. Grade vs Friction

Let's take a closer look at the relationship between grade and friction. Gravity steadily and consistently pulls the ball toward the center of the earth at a rate of 32.2 ft/sec<sup>2</sup>. Friction is the resistive force which slows the ball down due to its contact with the grass. The longer the grass, the greater the friction. A ball on a perfectly flat putting surface will not roll on its own, however, as the slope or grade of that surface is increased, there will come a critical point at which the frictional force is overcome and the ball will begin rolling. That critical point is dependant on the green speed, or stimpmeter reading. For typical tournament green speeds of 12, the grade at which the ball will roll off its position, or accelerate while rolling over, is 5.9%.

Now consider that every green has a minimum grade of 1% to allow water to drain off properly; that leaves a maximum theoretical window of 1%-5.9% for placing a hole on at typical tournament green speeds. However, the issue still remains that a player should be able to stop the ball within 1 foot of the hole. Let's take a closer look at this theoretical window.

Imagine how hard a player would have to strike a ball to have it travel exactly one foot on a perfectly flat green reading 12 on the stimpmeter. It is a very delicate little stroke. Now tilt that surface to a 5% grade and strike the ball again directly downhill with the same force; it will travel almost 4 feet before stopping. Raise the green speed to 13 on the stimpmeter, and the ball will travel almost 8 feet--twice as far. Raise the green speed again to 14, and the ball will not stop rolling. From this we can begin to see how the ball will roll exponentially farther as green speeds increase. The following chart shows the relationship:



Note that there is a critical intersection of green speed and grade that occurs above stimpmeter readings of 12 and grades greater than 4%. If a tournament official puts a hole on greater than a 4% grade and green speeds unexpectedly get a little too fast due to unexpected conditions, then the situation arises where players cannot stop the ball within any reasonable distance from the hole, whether on approach, when chipping, or while putting. Furthermore, the golf ball will make dramatic turns and keep rolling in the downhill direction near the hole due the lack of friction which would normally cause it to stop. Both of our fairness benchmarks are missed. This leads to the first guideline for fair hole placement:

**1. Holes should not be located on greater than 3% grade.**

### 4. Elevation and Rollout

Similar to grade, there is a second, equally important, way in which hole location and fairness can be analyzed. While the grade of a slope simply tells us how steep a portion of the green surface is, "rollout" describes how far a ball will roll down a given change in elevation. In other words, we could be discussing a 10 foot putt or a 20 foot putt. The grade percentage is not relevant. The key to analysis is the change in elevation.

Where is the rollout zone? The rollout zone represents how far a ball, dropped to the ground from just off the surface at the top of a steep grade (a grade on which the ball accelerates), would roll downhill. In essence it is the softest possible putt in that the ball begins to roll without even being struck by a putter.

The following chart shows the expected roll distances for a ball dropped at the top of a severe grade (>6%) which then levels out to 2%, assuming a green speed of 12.

<b>Elevation Change</b>	<u>1'</u>	<u>2'</u>	<u>3'</u>	<u>4'</u>
Roll Distance	18'	35'	50'	70'

If you have a one foot change in elevation, *regardless of grade %*, leveling out to a 2% grade, a dropped ball will roll a total distance of about 18 feet. Therefore, if you are placing a hole near a severe grade which represents a 1 foot change in elevation, then the hole should be cut no closer than 17 feet from the highest point of the severe slope. The important point here is that it is not the severity of the grade which determines how far the ball will roll, but rather the amount of elevation change down which that ball has to roll.

Why 17 feet? This goes back to our first criteria of fairness: the player must be able to putt a ball to within one foot of the hole.

These are bare minimum guidelines, and assume that a golfer who is putting down a tier is capable of putting with such a degree of speed control that he can cause the ball to arrive at the top of the slope with practically no speed, just enough to allow gravity alone to accelerate it down the slope toward the hole. A ball entering the top of the tier with a speed greater than almost zero will obviously travel farther than the chart above states. With the 18 foot rollout starting from a ball that has not even been struck by a putter, we must stress that 17 feet would be the bare minimum and could even exceed 18 feet, perhaps 20 or 21 to allow for the additional velocity a putted ball would have vs. a dropped ball.

And now we arrive at our second guideline for fair hole placement:

**2. Holes should not be located within the rollout zone of a severe grade.**

## **5. Conclusion**

By following these two guidelines concerning grade and rollout zones, tournament officials will be able to secure fair putting conditions even when environmental factors get out of their control:

- 1. Holes should not be located on greater than 3% grade.**
- 2. Holes should not be located within the rollout zone of a severe grade.**

Competitors will have an opportunity to stop putts within at least one foot of the hole, and putts inside of five feet will not be unrealistically difficult to make. Do these parameters mean the putting game will be easy? No. When it comes to major golf championships, high performance golf courses will have fast and tricky greens which are highly sensitive to putting errors, yet receptive to good putts. The boundaries of fairness will be much more clearly drawn and decisions will have new cushions of safety as officials set the highest of standards for the world's best players. And who knows, in a number of years perhaps the past difficulties of course setup will be forgotten, the relatively few negative instances simply lost among an enormous stockpile of challenging yet fair championship putts.