

# How Does COR Affect Your Golf Game?

Industries, companies, and organizations love to use acronyms because the abbreviations of longer terms slash syllables and easily roll off the tongue.

One such acronym that has been a buzzword since 1998 in the golf equipment industry is **COR – Coefficient of Restitution**.

Experienced golfers know the COR is a number which represents how “hot” the face of their clubhead(s) is made – or rather how much ball speed and resulting distance they can achieve for their swing speed. COR made its way into the golf industry’s vernacular back in 1998 when the United States Golf Association was concerned about the distance the pros were hitting the driver. Acting before ever doing any testing, the USGA blamed the pros’ distance increase on the use of the relatively new (at that time) titanium drivers and enacted a rule that placed a limit on the COR of all driver faces. The limit of 0.830 COR was based on the highest measured COR among all drivers the USGA had approved as conforming prior to the policing of the COR.

COR is a measurement of the energy transfer in a collision of two objects which is expressed as a number between 0 and 1. For example, when the USGA put a COR limit of 0.830 on driver faces, that meant no driver would be deemed to be conforming to the rules if more than 83% of the energy in the collision of the driver head with a golf ball were transferred from the head to the ball. Thus a collision which yields a COR of 0 means no energy is transferred between the two objects while a COR of 1 indicates a perfectly elastic collision in which all energy is transferred from one object to the other.

The COR rule also became known as the “spring face rule.” This term is misleading because in fact, a higher COR clubface does not really act like a spring. When you think of a spring face, it is logical to think the ball causes the clubface to flex inward, and upon flexing back out the ball is propelled as in the manner of a trampoline sling-shotting a gymnast upward.

Higher COR clubfaces do not work in the manner of a spring. In the collision between the clubface and the ball, there is always some energy lost. This is

because of several reasons but mainly due to the face flexing inward while the ball is compressed against the face. Both actions result in a loss of energy.

Of the two, the ball loses by far the most energy during impact because it can compress as much as 30% of its diameter against the face of the driver. To contrast the face loses less energy because the face only flexes inward at most a little over 1/16" as a result of impact. In a normal shot hit with an low COR thick face stainless steel metal wood, scientists calculate that 80% of the energy loss in such an impact came from the ball being compressed while the other 20% came from the very slight flexing of the more rigid clubface.

The idea of a higher COR face design, whether created for a driver or any other clubhead, is to allow the face to flex inward a little more so that the ball is not compressed as much against the face. When that happens, the face loses a tiny bit more energy because of the small increase in face flexing but the ball is able to lose a lot less energy because it is compressed so much less due to the slight increase in face flexing.

The net result? The ball takes off at a higher velocity and flies farther for the same clubhead speed and same loft angle on the clubface. Hence a high COR means more distance regardless of your clubhead speed.

If you like math and you're interested to know more about the relationship of the factors that control ball speed as a result of impact or how much more distance you can get with a higher COR clubhead, here is the tried and true mathematical relationship between all of the elements that contribute to the speed the ball leaves the clubface:

$$V_{\text{ball}} = \frac{V_{\text{clubhead}} \times (1 + \text{COR})}{1 + \frac{W_{\text{ball}}}{W_{\text{clubhead}}}}$$

$V_{\text{ball}}$  = speed of the ball in mph

$V_{\text{clubhead}}$  = clubhead speed in mph

$W_{\text{ball}}$  = weight of the ball in grams (a constant at 45.93 grams)

$W_{\text{clubhead}}$  = weight of the clubhead in grams

A 1mph increase in ball speed = 1.8 yds increase in carry distance

A 1mph increase in clubhead speed = 2.8 yds increase in carry distance

**Tom**

