

FOCUS: Smash Factor (continued)

But do note that if you are hitting the very common high durability range balls the effective COR can easily be as low as 0.73 which will limit the smash factor realistically to about 1.41!

How much does the smash factor vary from club to club?

By using the equation above and assuming standard loft as being the SPIN LOFT and average male club head weights, the theoretical optimal smash factor throughout the set is shown in Table 1. For illustration, the corresponding club head speed and ball speed is shown where the club head speed has been scaled to match the average for the PGA TOUR.

CLUB	CLUB SPEED [mph]	SPIN LOFT [deg]	BALL SPEED [mph]	SMASH FACTOR []
Driver	112.6	10.0	167.9	1.49
3 wood	107.0	15.0	158.4	1.48
5 wood	103.0	21.0	149.6	1.45
3 iron	97.8	21.0	142.1	1.45
4 iron	95.8	23.5	137.2	1.43
5 iron	94.3	26.0	132.4	1.40
6 iron	92.3	29.0	126.7	1.37
7 iron	90.0	33.0	119.2	1.33
8 iron	86.8	37.0	111.0	1.28
9 iron	85.3	41.0	103.3	1.21
PW	83.2	46.0	93.7	1.13
SW	80.7	56.0	75.1	0.93

Table 1: Optimal smash factor from spin loft. Assuming premium ball being used.

The results in Table 1 agree very well with our observations of male and female tour pros for longer irons and woods. Some examples are presented in Table 2.

CLUB	OPTIMAL from SPIN LOFT	PGA #1	PGA #2	PGA #3	LPGA #1	LPGA #2
Driver	1.49	1.50	1.48	1.48	1.49	1.49
3 wood	1.48	1.47		1.47	1.48	1.48
5 wood	1.45				1.48	1.48
3 iron	1.45	1.40	1.40		1.48	
4 iron	1.43	1.40	1.40	1.46	1.48	1.46
5 iron	1.40	1.38	1.39	1.45	1.44	1.42
6 iron	1.37	1.36	1.38	1.41	1.44	1.40
7 iron	1.33	1.32	1.34	1.40	1.39	1.35
8 iron	1.28	1.28	1.31	1.37	1.35	1.34
9 iron	1.21	1.22	1.26	1.34	1.30	1.27
PW	1.13	1.19	1.21	1.28	1.27	1.21
SW	0.93			1.14		
Club Speed 5 iron		98.4	94.9	93.9	82.1	78.0
Club Speed Driver		109.8	107.6	114.8	94.6	91.2

Table 2: Smash factor of PGA and LPGA players.

In general, both the PGA and LPGA players seem to be right at the optimal smash factor - and sometimes actually slightly above. In particular on the shorter irons, the pros are achieving a higher smash factor than what is reasonably expected from the club loft. The likely explanation for these high smash factors is that the spin loft is actually lower than the club loft which will be the case if the ball is impacted with the hands leading the club head.

Another interesting observation in Table 2 is that LPGA players seem to generate higher smash factors for the longer irons in particular. A possible explanation for this is that there is a small increase in club/ball COR at lower club head speeds. Also the ladies tend to use more cavity back type of clubs which has slightly higher COR and slightly lower loft than corresponding blade type which is preferred by most PGA Tour players.

Have you come across any smash factors on the pro scene that stand out, positive or negative?

One thing I have found very remarkable is how consistently the tour pros are able to produce smash factors of 1.48 and above with their drivers.

One of the biggest concrete surprises I have had was when we had the Danish European Tour player Mads Vibe-Hastrup in front of TrackMan™ with his driver.

Mads initially had a smash factor of 1.42 (110 mph club head speed, 156 mph ball speed)! Interestingly enough, he was launching the ball at 14 degrees with a spin rate of 2500 rpm, so if you only looked at the ball speed, launch angle and spin rate, the data would look very close to optimal. But by measuring club head speed and ball speed independently, thus having a fully measured smash factor result, we could immediately see that something was very far from optimal.

It turned out that Mads was hitting significantly down on the ball and impacted the ball high on the club face, slightly towards the heel. As you can read elsewhere in this newsletter, Mads achieved the 1.48-1.49 smash factor with a significant distance increase in return for his hard work on TrackMan™.

Another surprise was LPGA player Natalie Gulbis during Wendy's 3-Tour Challenge in 2007 (see also newsletter #2). She was consistently getting smash factors around 1.42. So despite her very nice positive attack angle, she was at this event losing about 12 yards carry compared to her potential.

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