

# R22-05 Player testing with alternative specification drivers

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## 1 Overview

In 2007-2008, initial research was conducted to study the effects of increasing the accuracy requirements and limiting the spring-like performance of drivers. Early simulation, robot, and player testing was followed by several rounds of player testing using developmental tour players.

Early tests compared modern drivers to prototype 250cc magnesium drivers having a Moment of Inertia (MOI) of 2,600 g cm<sup>2</sup> and a 20-inch bulge radius. Later tests compared modern drivers to 250cc titanium drivers with similar properties to the prototype heads, designed in cooperation with a major Taiwan-based OEM. These tests included driving range competitions of both male and female professional golfers and tournament-condition testing for males. It was found that drive distances decreased by 16-17 yards on average, and that participants took more skill/care in driving, with significant awareness of increased challenge.

## 2 Initial work

Simulations were conducted using three-dimensional models to predict the effects of off-centre hit for drivers with different moments of inertia. These simulations were compared to the results from mechanical golfer tests using existing golf clubs and variable-MOI machined prototypes constructed for the purpose of testing. It may be noted that there are several factors involved in determining distance sensitivity to hit location of which moment of inertia is primary, but also includes other design factors such as bulge, roll, and centre of gravity location.

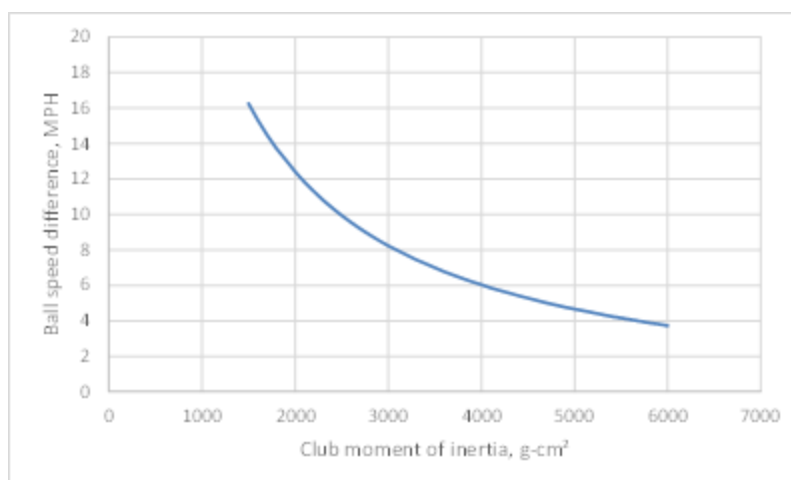


Figure 1: Simulated results of 22mm (7/8 inch) off-centre hit effects on distance versus MOI, assuming all other design parameters are held constant. Note. The limit on MOI is 5,900 g cm<sup>2</sup>

Figure 1 illustrates theoretical and experimental effects of changing moment of inertia on a 22mm (7/8 in.) off-centre impact.

Early simulation and testing confirmed the following:

- a. The primary penalty for off-centre hits with wood clubs was distance reduction.
  - a. Though there was more curve to the trajectory of such hits, bulge on wood drivers was appropriately designed so that the ball carries back to the middle of the fairway.
- b. A 250cc titanium club (a commercially available model, popular in the mid-90's) did *not* show similar curve for off-centre hits. Such hits more closely resemble pushes or pulls.
- c. Even with modern, multilayer golf balls, both wood drivers and thick-faced drivers show significant distance reduction for all hits.

### 3 Driver design

Prototype golf clubs were developed for player testing. These clubheads were designed to have the appearance of a 250 cm<sup>3</sup> clubhead but create a more significant penalty for off-centre hits. The driver was therefore developed with a flatter face (20 in. bulge instead of 10 in., Figure 2) such that off-center impacts would result in hook and slice trajectories that landed farther from the target line. These clubs were also constructed with a CT of about 170 $\mu$ s.

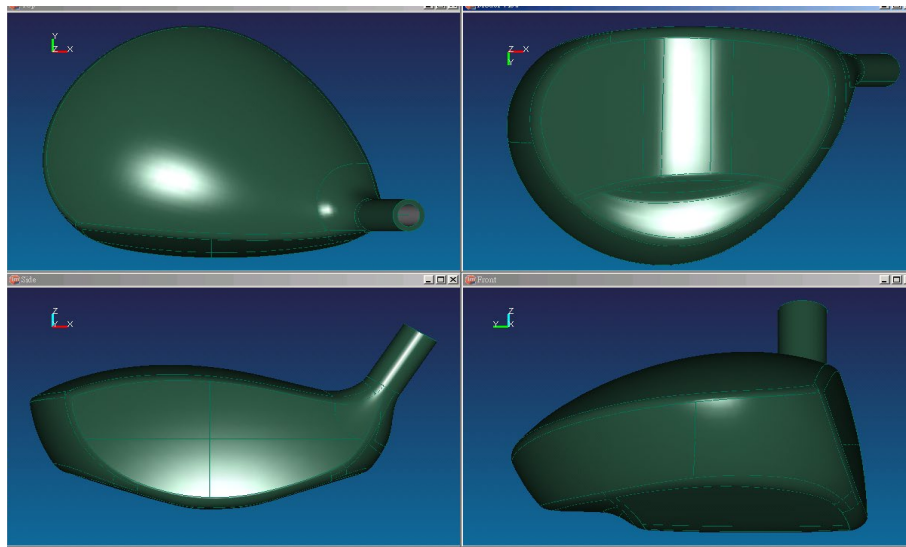


Figure 2: Club design as developed by a major OEM.

### 4 Player test results

Four rounds of amateur and professional player testing were conducted. This included driving range testing with financial rewards for distance, but with a penalty for missing a marked 30-yard wide 'fairway'. In addition, a competitive round using these drivers was held with male professional golfers. This testing revealed the following:

- a. The driver, as designed, was more challenging for the participating professional golfers.
  - a. Male professionals showed statistically significant accuracy reductions of 8% and 9% on average over two rounds of testing.
  - b. In surveys conducted after on-course testing, male professional golfers overall indicated that the driver's forgiveness was "much worse" than their modern driver, and "hurt" their game.

- b. Male and female professionals had drives that were 15-17 yards shorter with this type of driver (Table 1) compared to using their own, modern driver.
- c. On average, male survey respondents responded slightly positively to playing this type of driver if everyone else were required to play with them (4.1).

Table 1: Player testing results. \*No statistically significant change to accuracy was observed.

Player Type	Participants	Distance	Accuracy
Amateur M/W	14	-17	*
NGA/Hooters	28	-16	-9%
NGA/Hooters	44	-16	-8%
Duramed/ Futures	40	-15	*

#### 4.1 On-Course Testing Survey Responses

An 18-hole stroke play competition was held at Lake Chesdin GC, VA, a 6,900-yard course. This followed a four-day tournament at the same course, all participants in the 18-hole round were required to use the driver described in this paper. This club had been built to the same specifications as their usual driver (shaft model, flex, length, grip, swingweight).

Overall, participants rated the club's distance as and accuracy as worse (Figure 3 through Figure 4). Participants indicated that use of this club hurt their game somewhat (Figure 5), but responses were neutral about adopting such a club.

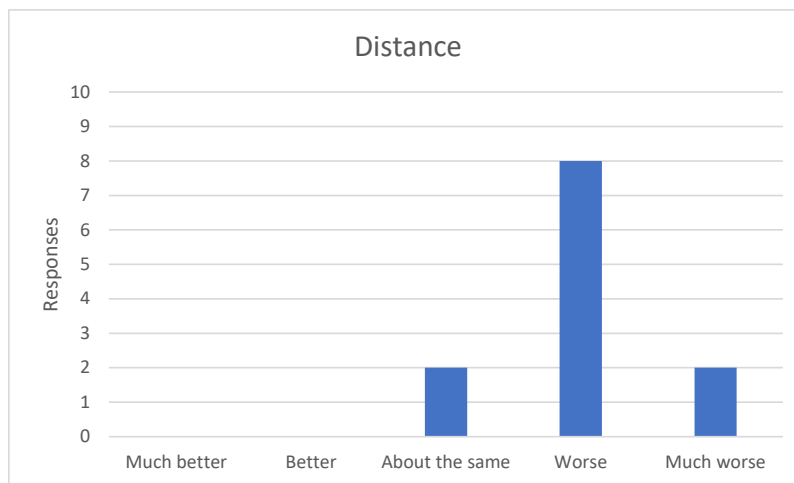


Figure 3: Survey responses to the question: Compare the driver you used today with your normal driver (distance).

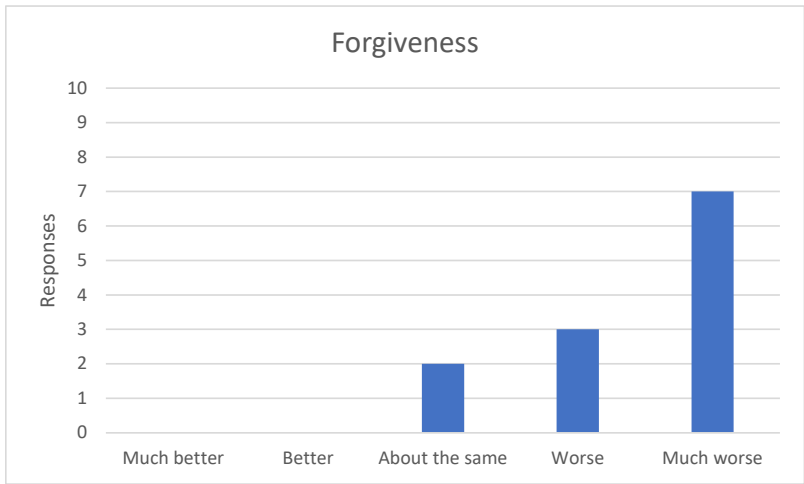


Figure 4: Survey responses to the question: Compare the driver you used today with your normal driver (forgiveness).

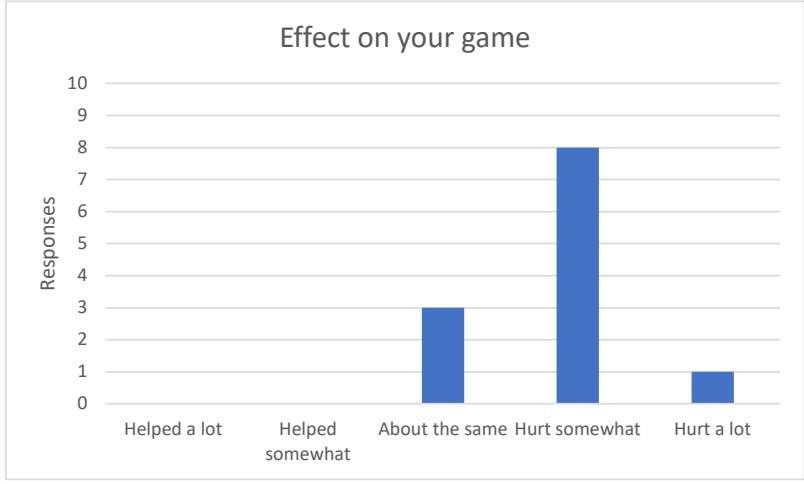


Figure 5: Survey responses to the question: Did you feel that the driver you used today helped or hurt your game?

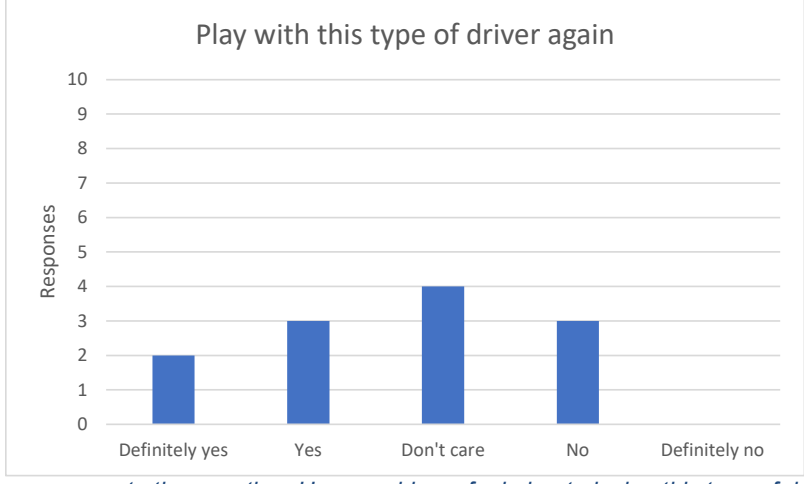


Figure 6: Survey responses to the question: How would you feel about playing this type of driver in the future, provided that everyone else uses a driver with the same level of performance?

#### 4.1.1 Interviews

In interviews after the round, a number of participants felt that given more time to get used to the club and more scope to tinker with it (changing shaft type, flex), they felt that they would be able to get better results with it.

Whilst the clubs had been matched for length, swingweight, and shaft model and flex to the participants' own clubs, some of them felt that these specifications were not necessarily best suited to them using a club with the prototype head. A number of the participants commented that the head was more akin to that of a modern 3-wood, and as such they would have preferred to use it with a 3-wood length shaft.

Furthermore, it was felt that since the club did not have a particularly deep head compared to contemporary drivers, some felt that even with the increased penalty of the club face, if the club had a deeper face then they would have been able to use it with a greater degree of success.

#### 4.1.2 Selected participant comments

- “[The low MOI, 250cc] club is shorter, less accurate! It is fair if everyone uses it. It would set golf back 50 years. Golf courses would have to completely change.” – *Competition winner*
- “I can definitely see how technology has changed the game, especially off the tee. I would like it to be limited however. I do like the workability of this smaller driver yet is much more challenging.” – *Last place golfer*

#### 4.2 Conclusions

Tests comparing modern drivers to a 2,600 g cm<sup>2</sup>, 250cc driver designed to be more demanding, including driving range competitions of both male and female professional golfers and tournament-condition testing for males, found that drive distances decreased by 16-17 yards on average, and that participants took more skill/care in driving, with significant awareness of increased challenge.