WHAT FLEX DO YOU NEED?

Our tests show how your shaft bends when you swing—and that may change the way you choose your equipment

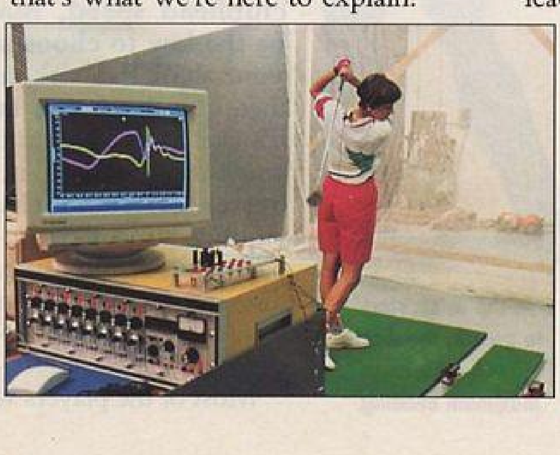
BY ED WEATHERS

Curtis M. is 29 years old, 6-foot-2 and 240 pounds. A 10-handicapper, he takes a big long rip at a golf ball, now and then blasting it 300 yards or more. With a driver, his clubhead speed at impact frequently exceeds 100 miles per hour—up in the pro range.

John L. is 65 years old, six feet tall, 210 pounds. The quick-swinging 7-handicapper hits his best drives maybe 230 yards. With a driver, his clubhead speed at impact rarely exceeds 89 m.p.h.—good for an amateur, but nowhere near the strongest pros.

Big-hitting young Curtis needs a stiffer shaft in his driver than shorter-hitting John, right?

Not necessarily. In fact, John may need a stiffer shaft than Curtis. Heck, John L. may need a stiffer shaft than *John Daly*. Why? Because . . . well, that's what we're here to explain.



PLUM PROFILES

At the research labs of True Temper, in Olive Branch, Miss., we recently tested what happens to a shaft during the golf swing. With the help of True Temper's research staff, we looked at 19 players—men and women, high handicappers and low handicappers, hard swingers and easy swingers. Each player swung four drivers, identical in every way except one: They had steel shafts of different flexes—L (weakest flex), R (medium), S (stiff) and X (extra stiff). Strain gauges to measure bending had been attached to the shafts, a clubhead-speed gauge sat next to the ball, and everything was hooked up to a computer. As the players swung, the computer displayed five measurements:

1. How much the shafts bent in a "toe-up/toe-down" direction.
2. How much the shafts bent in a "lead-lag" direction.
3. How long a player took from the time he began to "load" his shaft at the top of the swing until impact.
4. What the player's clubhead speed was at impact.
5. What the player's "kick velocity" was.

At True Temper's testing lab (left) computers measure several of the ways shafts bend during the swing.

We'll explain our terms in a minute. The important thing is this: What we discovered may change the way you choose shafts for the rest of your golfing life. On the following pages are the highlights.

Figure A

Approaching the top of the swing, the shaft begins to bend, or "load."

• The biggest bend in your shaft comes in the toe-up direction. Few players understand this. "Toe-up" means if you were holding the club at address, the shaft would be bent up in such a way that the club's toe would be pointing at the sky.

Figure A shows how this bending happens during the swing: If your club's shaft reaches parallel at the top of your swing, then as you begin your downswing, the toe of your clubhead (if you have a typical club rotation in the backswing) is pointing more or less down at the ground. Then, as you begin to swing back around on the downswing, the clubhead lags behind the rest of the shaft, causing the shaft to bend. Even though the clubhead is bent toward the ground at the top of the swing, it is still called "toe-up" *because that's how the club would be if it were bent the same way and placed in the address position.* For nearly all players, toe-up bend is far greater than any other bending of the shaft during the swing. It peaks for most players somewhere in the middle of the downswing (Figure B).

• In most swings, "lead-lag" bend does not occur significantly until just before impact. This is the bend that most players think of when they think of shaft bend. If a club is held in the address position, lead-lag would describe the bending of the club back or forward along the target line. If it is bent back, the clubhead "lags" behind the shaft (see Figure C); if it is bent forward, the clubhead "leads" (see Figure D).

For most of the players we tested, the lead-lag bending is less than half the toe-up/toe-down bending.

• A long hitter does not necessarily bend the shaft more during the swing than a short hitter. Now comes the interesting stuff.

When the club begins to bend on the downswing, the player is said to be "loading" the club. "Load" is another word for the amount of bending-pressure put on a club during a swing. Loading begins for most players just as their hands begin to slow down at the top of the backswing.

Every one of the players we tested had some toe-up bend during the swing. But one thing was remarkable: *The biggest hitters did not necessarily put the most load on the shaft.*

For example, the smallest toe-up bend, or "deflection," we found was 1.3 inches. (That is, the end of the shaft was 1.3 inches from the place it would be if the shaft were straight.) This small deflection, interestingly, came with an X shaft in the swing of 31-year-old Lori B., a former LPGA Tour player who hits a relatively long ball—often up to 240 yards. Now compare Lori to 65-year-old Marge W., whose very best drives rarely reach 180 yards: Marge actually deflected this same X shaft over two inches in the toe-up direction—*nearl*- *twice as much as Lori, the pro.*

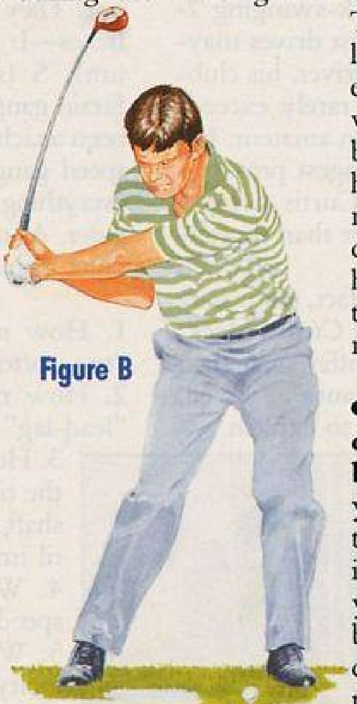


Figure B

As the wrists start to uncock, the shaft will achieve maximum bending.

In other words, Marge, who rarely achieves a clubhead speed more than 60 m.p.h., put more load on the shaft than Lori, whose clubhead speed exceeds 85 m.p.h. In fact, Marge deflected the shaft (toe-up) more than two of the men whose clubhead speeds exceeded 90 m.p.h. Even in the lead-lag direction, Marge proves that clubhead speed at impact does not measure how much stress you put on a shaft: little Marge's lead-la deflection of the S shaft was more than 50 percent greater than that of 6-foot-2 Joe B., the hardest hitter we tested, who has a clubhead speed more than 110 m.p.h. When it comes to bending shafts, then, it's possible for the shortest hitters to be right up there with—and sometimes beyond—the big boys.

The biggest toe-up deflection we found, by the way, was a massive 8.5 inches. That came, predictably, from quick-swinging, long-hitting Joe B., using an L shaft. Along these lines, True Temper's engineers like to tell the story of an ex-hockey player who was so strong "he could break every shaft we had" because he put so much load on the shaft so quickly—but his clubhead speed was only in the moderately-fast 95 m.p.h. range.

• Acceleration, not clubhead speed, may be the key to choosing your shaft flex. It's just theory at this point, but it's likely that how much you bend the shaft is a better criterion than clubhead-speed-at-impact (or its result: driving distance) for determining what shaft flex you should try.

Most of the players we

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tested had, over the years, come to prefer shafts that gave them between 2 and 3½ inches of toe-up deflection—a bit more for the big-hitting quick swingers. More than that, the theory goes, and the club is bending too much to control; less, and you don't have any feel for the club. (True Temper has tested a shaft so stiff that it "feels like a telephone pole," and found that players hate it. The researchers suspect that's because a player times his club-release in part based on his feel for how his shaft is bent on the downswing. If it never bends, he loses that feel altogether.)

How can you determine how much you bend your shaft? Unless you work for a major shaft manufacturer or have other access to strain gauges hooked to computers, you probably can't. That's the bad news.

The good news is there's another factor you probably *can* measure—or at least estimate—to help you determine the load you put on the shaft. That's acceleration. With some exceptions, we found players who had quick downswings put more load on the shaft than players with long, slow downswings, if their final clubhead speed was the same. Thus, a Nick Price, with his quick downswing, probably puts much more stress on a shaft than John Daly, with his loooong downswing—even though Daly achieves a higher final clubhead speed. (In fact, Price has used a stiffer shaft than Daly.)

Howard Butler, vice president of research at True Temper, compares this phenomenon to our experience with automobiles. "To make a car go from zero to 60 miles per hour in six seconds requires a more powerful engine than to make one go from 0 to 90 miles per hour in 12 seconds, even though the second car reaches a higher final speed," says Butler. "It may be the same with shafts: You may need a stronger shaft if you reach an 80 mile-per-hour clubhead speed with a quick downswing than if you reach 100 miles per hour with a much slower downswing."

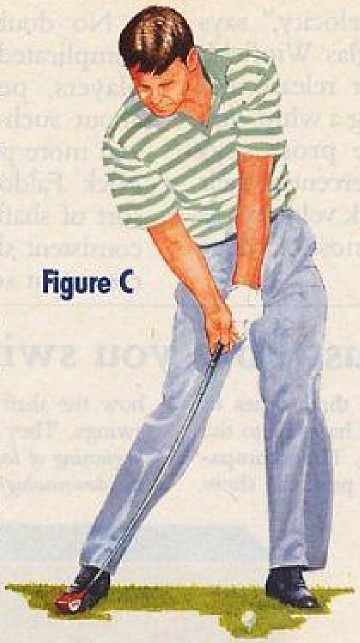


Figure C

Shortly before impact, the clubhead commonly "lags" behind the shaft.

In other words, the key may be acceleration—the ratio of your final swing speed to your load-up time. Example: If you reach a 100 m.p.h. clubhead speed in .5 seconds, your acceleration is 100 m.p.h./.5 seconds, or 200 m.p.h./second.

(To apply these principles to your own shaft selection, see sidebar, p. 86.)

• Changing your shaft flex will not affect your clubhead speed at impact. This will surprise some people: None of the players tested showed any difference in clubhead speed from shaft to shaft. If their impact speed with an X flex was 90 m.p.h., then their impact speed with an L flex was 90 m.p.h.—and the same with an R flex or an S flex. This puts the lie to one of the oldest myths about shafts—namely, that a whippier shaft will give you greater clubhead speed. It won't.

• Kick velocity can add more than 10 m.p.h. to your clubhead speed. As your club approaches the ball, the head will be lagging a bit (Figure C). Then, just before impact, it will unbend, snapping forward to a "lead" position (Figure D). This snapping generates "kick velocity," which can add to your clubhead speed (and hence the distance you hit the ball). Ideally, you'd like the shaft to be exactly straight at impact; that's the point at which it releases all its stored-up energy. Beyond that point, when the shaft is in a "lead" position, some energy has already been released. Nevertheless, nearly all players, including pros, contact the ball with the shaft in the lead position.

In our study, the highest kick velocity we found came in the swing of Curtis M., who gained 11 m.p.h. from his kick velocity. Lee M., on the other hand, gained the least—only 2.6 m.p.h.—from kick velocity. Interestingly, Curtis M. achieves a clubhead speed of about 99 m.p.h., while Lee M. has a clubhead speed of about 91 m.p.h.; the difference can be accounted for almost entirely by the difference in their kick velocities.

(Note: Kick velocity and "kick point" are entirely different things. Kick point describes the point of maximum bending in a shaft. It may or may not affect the ball's launch angle. It was not an object of study in this test.)

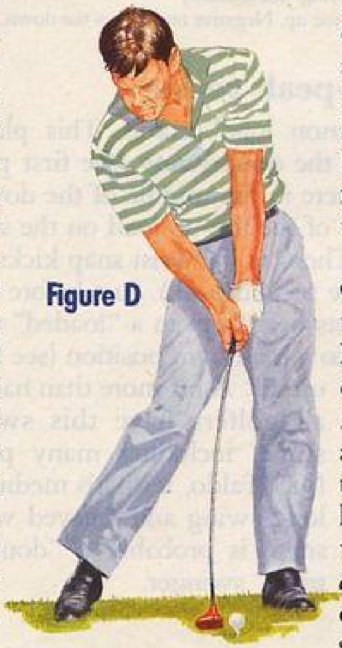


Figure D

For most golfers, the clubhead "leads" the shaft at the moment of impact.

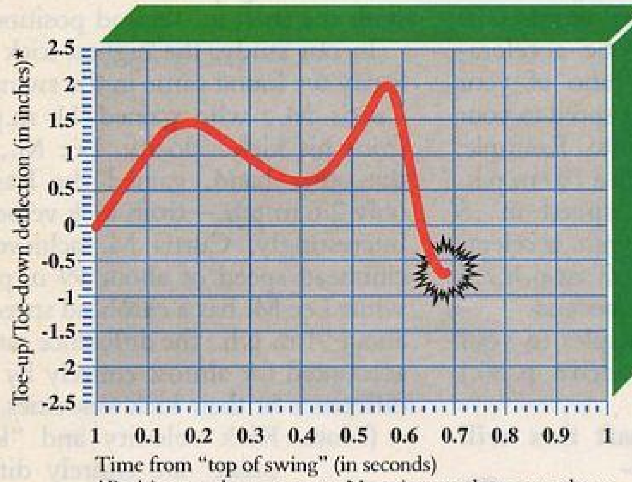
• To increase your kick velocity, delay your release. How can you increase your kick velocity? A change in shafts isn't the answer. Although most of the players we tested had higher kick velocities with whippier shafts, their *overall* clubhead speed didn't change with whippier shafts. Somewhere in the swing, they were losing overall speed equivalent to what they gained in kick velocity.

No, the only way to increase your kick velocity meaningfully is to change the shape of your swing. True Temper's studies have shown that players who delay their wrist snap (or "release") get the most kick velocity. "If you flail at the ball, releasing early and swinging the club the way most people swing a baseball bat, you don't get much kick velocity," says research engineer Douglas Winfield. "But if you delay your release and swing more like cracking a whip, you can get a lot." Some pros, says Winfield, get up to 10 percent of their clubhead speed from kick velocity—a good way to make the most of whatever shaft you use.

No doubt the charts below are complicated on first glance. Many players, perhaps most, don't care about such technicalities. But more and more professional tour players—Nick Faldo is one—are doing this sort of shaft analysis. Why? Because consistent shaft behavior is crucial to consistent scoring.

It's not how hard you swing, it's just how you swing

Every player has a distinct way of bending the shaft—as distinct as his fingerprint. In the toe-up/toe-down direction (which, again, is the most extreme bending in most swings) there are basically three types of swings, as defined by what happens to the shaft during the downswing. The accompanying charts, called "load profiles," show how the shaft bends during each of these swings. They chart shaft-bending *from the beginning of load (just before the beginning of the downswing) to impact.*



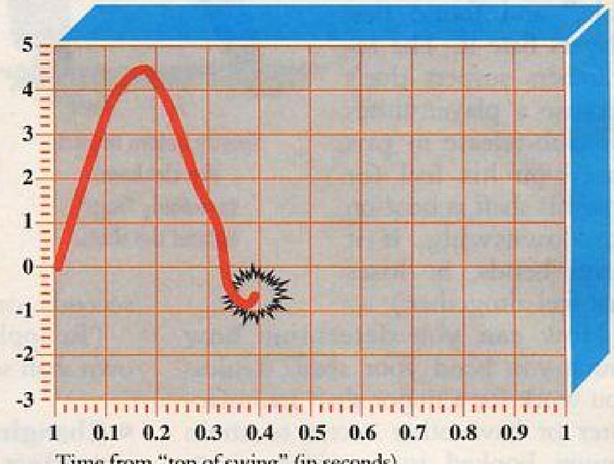


Chart 1: Double-peak swing

This is the most-common load profile. This player bends the shaft early in the downswing (the first peak and Figure B). Somewhere in the middle of the downswing, he releases some of the toe-up load on the shaft (the dip in the graph). Then, as his wrist snap kicks in, he re-loads the shaft (the second peak). Just before impact, the shaft, which has been kept in a "loaded" toe-up position, unbends into a toe-down position (see Figure E). A bit more than half of all golfers have this swing shape, including many pros. Nick Faldo, with his medium-long swing and delayed wrist snap, is probably a "double-peak" swinger.

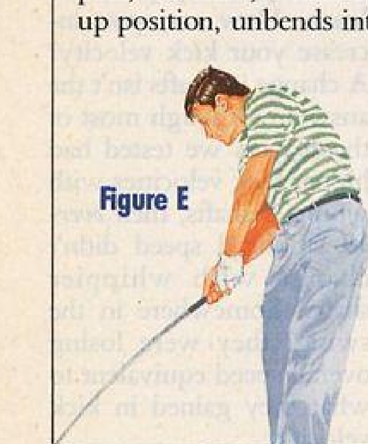


Figure E

Chart 2: Single-peak swing

This is the swing shape common to many strong players with very quick downswings. The player shown here, for example, takes only .38 seconds for his downswing, compared to nearly .70 seconds for the player in Chart 1.

Single-peak players put an immediate load on the shaft near the beginning of the downswing (Figure B), then, never giving the shaft a chance to unbend, release the load suddenly at impact. Such players often put a tremendous load on the shaft; note that this player bends the shaft more than 4 inches, while the player in Chart 1 bends it less than two inches.

Our tests suggest that about 20 percent of all golfers fit the single-peak profile. Quick-hitting Nick Price and Dan Pohl are probably "single-peak" swingers.

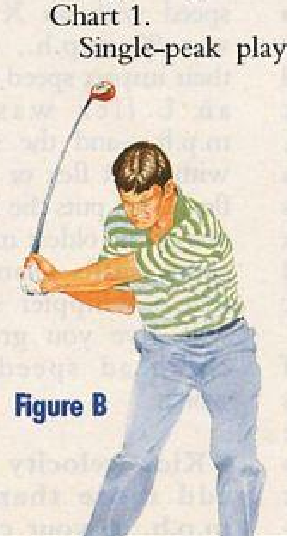


Figure B

Just what, then, is the point of these "load profile" charts? Simply, it is that your golf swing affects your shaft in a way that's unique to you, and that your choice of shaft flex should depend on more than just your final clubhead speed or how far you hit the ball.

Right now the technology isn't available at your golf shop to give you an exact description of your load profile. Within a couple of years, we suspect, it will be. When it is, you'll want to buy a shaft that lets you repeat your load profile consistently.

In the meantime, though, analyze what you do know of your downswing: Is it quick or is it slow? How far can you hit the ball? If you have a long, slow downswing, whether you hit it short or far, you might experiment with a not-too-stiff shaft. If you have a quick swing and hit it far, you probably bend the shaft a lot and need a stiffer shaft than the average player—maybe even stiffer than the John Dalys of the world.■

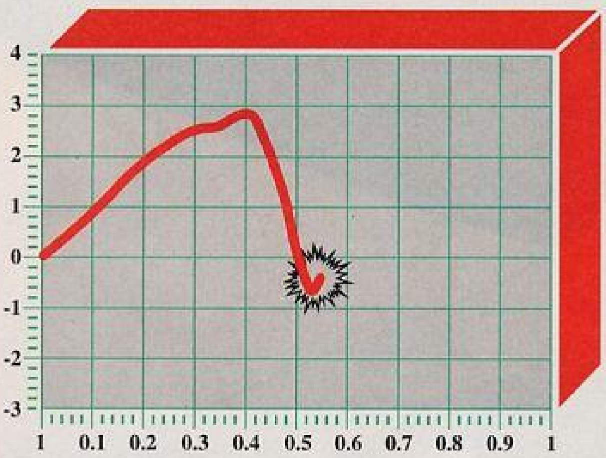


Chart 3: "Ramp-up" swing

About a third of all golfers have a "ramp-up" load profile, which is characterized by a gradual building of pressure on the shaft, with no drop in shaft load during the swing. The "ramp-up" player takes longer to reach maximum load than the single-peak player, who loads the shaft as quickly as he unloads it. Some ramp-up players have very long swings and build pressure on the shaft quite slowly, with downswings longer than .7 seconds. They rarely bend the shaft as much as single-peak hitters, although they can build to significant shaft bend. John Daly and Larry Mize, with their long swings, are probably ramp-up players.

A new way to narrow your shaft choices

Estimate your acceleration to determine your ideal shaft flex. In our tests, the slowest swinger took .73 seconds from the time he began to load his shaft, near the top of his swing, to impact. This is called "load-up time." The quickest swinger's load-up time was .35 seconds—twice as fast as the slowest. (Again, these times were with a driver.) All the players were remarkably consistent in their load-up time, rarely varying by more than a hundredth of a second or so from swing to swing.

To estimate your acceleration, get a friend to time your downswing with a stopwatch. Have him start the watch when your hands reach the top of your swing and stop when you contact the ball. Practice until your friend gets fairly consistent numbers. The numbers should be in the .25- to .65-second range. (The reason your numbers will be smaller than in our test is that our computer measured from the beginning of shaft bending, which comes just *before* the top of your swing; your friend will begin *at* the top of your swing.) If you carry your well-hit drives about 230 yards, your swing speed is about 90 m.p.h.; if your downswing time is .45 seconds, then your acceleration rate is 200 m.p.h./second. That's about in the upper-middle range of men; most players in this range probably can use an S shaft—or at least nothing weaker than an R. If your acceleration rate is higher than that, you might look into stronger shafts; if it's lower, you might look into weaker shafts.

Shaft preference is an inexact science, though, and depends to a large extent on personal feel. There's no simple formula that says "this acceleration means you need this shaft." But knowing your acceleration might help you narrow your choices, and it's almost certainly better than going by clubhead speed alone.

In the near future, devices you can attach to your club to measure acceleration (as opposed to just velocity) should be available in the marketplace. Then you can forget your friend with the stopwatch and get a more accurate reading.