Effective layouts developed by modern technology

CAD modeling produces new drilling techniques

This story is as much about how it happened as it is about the results that occurred. A situation presented itself when I received a phone call from Chuck Gardner, the new PBA tour representative for Brunswick. Chuck explained that he wanted to know what would be the most effective drilling techniques for his pro staff to use during the upcoming PBA Plastic Ball Championship. I had to tell him that I did not know, but would research it and get back to him. That was the beginning.

I called Steve Freshour of Parkersburg, WV, MoRich's CAD expert, and presented him with the question. We decided to model a traditional pancake weight block ball, the type core used in the plastic balls for that tournament. After modeling the ball, we decided to model it further with gripping holes in it. Recently, at MoRich, we have been using this technique to design balls with Steve's assistance. Modeling the balls with gripping holes allows us to see the mass properties of the drilled balls. This tells how balls with different drilling techniques will roll. As I wrote in my "The truth about drilled balls" article in BTM's January issue, the mass properties of the drilled ball, in combination with the coverstock, will dictate the ball motion of that drilled ball. The term mass properties refers to the RGs and differentials of the ball. In this specific case, it was the drilled bowling ball. We got some interesting results when we modeled the drilled plastic ball. We found that the following layout produced the most dynamic results.

For this layout (Diagram 1), the CG/top of the pancake weight block is placed 4 inches from the bowler's PAP at 45 degrees to the VAL, using "Dual Angle" terminology. The balance hole is placed at the intersection of a line drawn from the center of the bowler's grip through the CG and the VAL. When using this technique, only make the balance hole big enough for the resulting static weights to be legal. The reason the CG/top of the weight block is placed 4 inches, not 3-3/8 inches, from the PAP is that the low RG axis of the ball moves to the right when holes are drilled into the ball.

The particular information for which we were looking was the intermediate (sometimes called the asymmetrical) differential and the total differential of the drilled ball. That layout produced an intermediate diff of .011 inches and a total diff of .020 inches.

Let's compare those numbers with the undrilled ball and a standard label drilled ball. The undrilled ball had no intermediate diff and a total diff of .026

Mo Pinel is the ball designer for MoRich bowling balls and is an Advanced IBPSIA Certification Lead Instructor

Diagrams by Steve Freshour

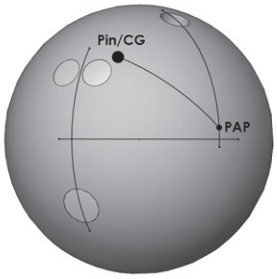

Diagram 1
Plastic Ball Pancake Weight Block 4" Pin to PAP; 45° VAL Angle

Diagram 2
Freshour Core - Symmetrical

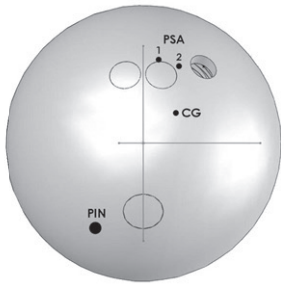

Diagram 3
Symmetrical Core - Aggressive Full Roller. CG 1" right and up from center of grip; Pin 3-3/8" from center of grip
1. High RG axis after drilling pre-balance hole
2. High RG axis after drilling for 7/8" balance hole
2.5" deep pitched 1"

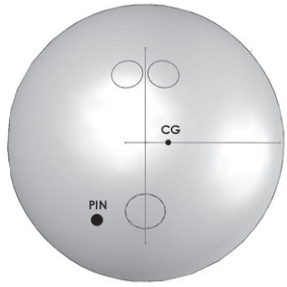

Diagram 4
Symmetrical Core - Standard Full Roller CG is 3/4" from Center of grip; Pin 3-3/8" from center of grip. No BAL Hole

Diagram 5
MoRich Mania - Asymmetrical Core

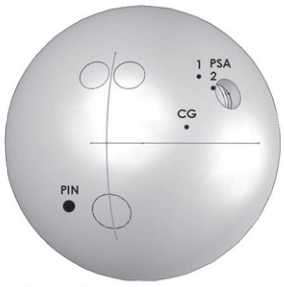

Diagram 6
Asymmetrical Core - Aggressive Full Roller CG 2.5" right of center of grip .5" above midline
1. High RG axis after drilling pre-balance hole
2. High RG axis after drilling for 1.25" balance hole

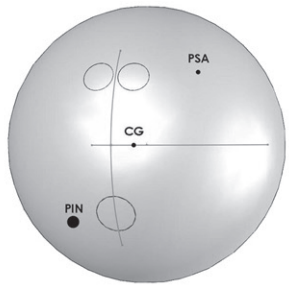

Diagram 7
Asymmetrical Core - Standard Full Roller CG is 3/4" from center of grip; Pin 3-3/8" from center of grip

inches. The standard label drilled ball had an intermediate diff of .005 inches and a total diff of .015 inches. In looking at those numbers, we were able to increase the total diff of the drilled ball 33 percent with this layout when compared to the standard label drilling. We increased the intermediate diff much more (120 percent) when compared to the standard label drilling. This is very significant since the increased intermediate diff will result in the ball reading the pattern much harder and transitioning much faster. This should result in increased pin carry ...AND IT DID since the winner, amateur Brian Zeisig, and the third place finisher, Walter Ray Williams, both used the layout. Many other bowlers also finished high in the standings using this layout.

An additional benefit is that this drilling increases performance of ALL pin in, low differential balls, such as entry level urethane and reactive resin balls. Some of the balls that this layout works well on are pin in (pins out less than 1 inch) versions of Brunswick's New Slingshot, Brunswick's Avalanche, Ebonite's Tornado, the original Hammer designs, and all pin in balls with total diffs of less than .039 inches.

New Aggressive Full Roller Drillings

For the last three months, I have been moderating a technical forum called "Mo and Friends" with Paul Ridenour, former Senior Research Engineer for the USBC Equipment

and Specifications Department., Steve Freshour, Morich's CAD expert, and John Jameson of Innovative Bowling Products on http://forum.bowlingchat.net. We have had a great time answering technical questions from interested, passionate bowlers and ball drillers.

We received several inquiries about drillings for full rollers, bowling's forgotten players. As a result of those inquiries, Steve and I decided to investigate how to maximize ball dynamics for full rollers. We applied the same technique used in developing the plastic ball layout for Chuck Gardner. We modeled modern high performance bowling balls with different drillings. Again, our goal was to maximize the mass properties of the drilled balls for full rollers.

We found that we needed different drillings for symmetrical and asymmetrical balls. The determining factor separating the two different types of balls was the location of the preferred spin axis (PSA) after the gripping holes were drilled into the ball. We know that placing the balance hole in the PSA would enhance both the intermediate and total diffs of the drilled balls. We also know that the PSA will end up in a different place for drilled symmetrical balls and drilled asymmetrical balls before the balance hole is added. We needed to know where the PSA was in the two types of drilled balls to place the balance hole in the correct spot for both types of balls. The best balls to use for both of the aggressive full roller drillings are undrilled balls with 2.5 to 3.5 ounces of top weight and pins out 4+ inches.

Let's start by looking at pictures comparing the NEW aggressive full roller drilling to the standard full roller drilling for symmetrical balls. First, here is the diagram (#2) of the ball with the Freshour symmetrical core used in this CAD modeling (See previous page).

Here are the pictures (Diagrams 3&4) comparing the new aggressive full roller drilling to the standard full roller drilling for symmetrical balls.

The mass properties of the undrilled ball are:
- a low RG of 2.494 inches
- an intermediate diff of .000 inches
- a total diff of .050 inches

The mass properties of the drilled ball using the standard full roller drilling are:
- a low RG of 2.504 inches
- an intermediate diff of .007 inches
- a total diff of .049 inches

The mass properties of the ball with the new aggressive full roller drilling are:
- a low RG of 2.516 inches
- an intermediate diff of .019 inches
- a total diff of .063 inches

The change in the value of the low RG axis is insignificant, but the increase of .012 inches in the intermediate diff and the increase in the total diff of .014 inches will result in the ball with the new aggressive full roller drilling flaring more, hooking more, and reading the oil pattern substantially harder than the ball with the standard full roller drilling for symmetrical balls.

For this drilling, we drilled the finger holes 4 inches deep (or as deep as you can on your drill press, up to 4 inches deep) to increase the diffs of the drilled ball. The center of the balance hole on the aggressive symmetrical full roller drilling is placed 1-½ inches to the right of, and slightly above, the ring finger hole. The balance hole is pitched 1 inch away from the ring finger hole to avoid hitting it.

Let's look at pictures comparing the NEW aggressive full roller drilling to the standard full roller drilling for asymmetrical balls. Here is the core diagram (Diagram 5) of the MoRich Mania used in this CAD modeling.

Now, here are the pictures comparing the new aggressive full roller drilling to the standard full roller drilling for asymmetrical balls. (Diagrams 6&7)

The mass properties of the undrilled ball are:

- a low RG of 2.486 inches
- an intermediate diff of .013 inches
- a total diff of .051 inches

The mass properties of the drilled ball using the standard full roller drilling are:

- low RG of 2.496 inches
- an intermediate diff of .019 inches
- a total diff of .048 inches

The mass properties of the ball with the new aggressive full roller drilling are:

- a low RG of 2.496 inches
- an intermediate diff of .032 inches
- a total diff of .060 inches

The change in the value of the low RG axis is, again, insignificant, but the increase of .013 inches in the intermediate diff and the increase in the total diff of .012 inches will also result in the ball with the new aggressive full roller drilling flaring more, hooking more, and reading the oil pattern substantially harder than the ball with the standard full roller drilling for asymmetrical balls.

What can we learn from this article? First of all, modern bowling technology which includes CAD modeling and graphical analysis, makes it much more efficient and accurate to develop improvements in the science of ball dynamics, bowling balls, and ball drilling. The next step is to utilize this new information to enhance bowler's enjoyment of the game. The basis of bowling improvement is still fundamental execution. Taking advantage of improvements in bowling balls and ball drilling will allow people to enjoy better ball motion and improve their scoring potential. Hopefully, this increased enjoyment will result in more bowlers enjoying bowling more, and, therefore, bowling more often.

If you enjoy reading about and discussing bowling balls, ball drilling, ball technology, and ball development, please join us at http://forum.bowlingchat.net. We'll be there!