

**REPORT ON SCORING AND C.A.T.S. RESULTS
FROM THE WORLD RANKING MASTERS**

JULY 19 – 23, 2003



5 SEPTEMBER, 2003

Introduction

The 2003 World Ranking Masters tournament was held in Lake Wales, Florida at the Kegel Training Center. The tournament was unique in several ways. This was the first time the WRM was held in the USA. It was the first time that more than one conditioner pattern was used during competition. The lane surface was the flattest and truest that had ever been seen in international competition due to the unique adjustable lane structure built into the Kegel Training Center. And finally, the Computer Aided Tracking System (C.A.T.S.), which is installed on every lane, recorded every shot thrown during the tournament.

What this meant for the bowlers and officials attending the event was that another step had been taken toward creating the fairest playing field for all bowlers. Lanes that were adjusted to be the flattest possible eliminated topography as a variable in how the lanes played and scored. The use of two different patterns brought the skill of versatility into play. Recording the velocity, ball positions, and pinfall of every shot thrown has allowed us to analyze the event like never before. This report summarizes this analysis.

Methods

With so much data collected, the task of analyzing it can be daunting. More than 20,000 shots were thrown during the four days of competition. To manage the task of analyzing this data, we broke it down into parts.

- Scoring data was measured by gender and by pattern
- Individual scoring data for each pattern was compared
- “Strike Profiles” were created for each lane and for different genders and patterns
- Strike, spare, and open percentages were calculated for each gender and pattern

Results

The data on the following pages show the results of the various analyses done. Notes are included with each of the tables and graphs to indicate how the data was collected and what it means.

Men's Results – Pattern Average Comparison

Last	First	Short Pattern		Long Pattern		Both Patterns		Pattern Avg. Diff.
		Games	Average	Games	Average	Games	Average	
Ohman	Anders	16	211.94	16	221.88	32	216.91	-9.94
Hoffman	Bill	15	202.67	17	220.88	32	212.34	-18.21
Shaheen	Ahmed	16	219.94	14	203.36	30	212.20	16.58
Ong (L)	Remy	14	198.36	13	225.54	27	211.44	-27.18
King	Chester	14	206.86	13	215.23	27	210.89	-8.37
Baeza (L)	Marcos	13	206.46	13	213.31	26	209.88	-6.85
Falconi	Daniel	15	213.00	14	203.36	29	208.34	9.64
Konsteri	Sami	12	195.08	12	221.00	24	208.04	-25.92
Luoto (L)	Mika	12	206.00	12	209.42	24	207.71	-3.42
Carlsson	Goran	12	198.58	12	214.42	24	206.50	-15.84
Verbruggen (L)	Gery	12	206.92	12	205.67	24	206.29	1.25
Ferreira	Jose	13	208.62	14	203.93	27	206.19	4.69
Al-Shafi (L)	Bandar	12	204.17	12	202.33	24	203.25	1.84
Sebelen	Rolando	12	195.08	12	209.17	24	202.13	-14.09
Al Muraikhi (L)	Mubarak Ali	12	200.33	12	203.83	24	202.08	-3.50
Romero	David	12	209.25	12	193.42	24	201.33	15.83
Andersson	Robert	12	192.00	12	207.67	24	199.83	-15.67
Hernandez	Arturo	12	190.17	12	208.92	24	199.54	-18.75
Gross	Thomas	12	194.25	12	203.92	24	199.08	-9.67
Larsen	Martin	12	206.92	12	189.00	24	197.96	17.92
Frawley	Andrew	12	187.75	12	204.83	24	196.29	-17.08
Rivera	Engelberto	12	195.25	12	197.17	24	196.21	-1.92
Gomez	Andres	12	193.33	12	198.08	24	195.71	-4.75
Nepomuceno (L)	Paeng	12	184.17	12	199.83	24	192.00	-15.66

Average -6.21

+ higher average on short pattern

- higher average on long pattern

- Bowler data is sorted by descending combined average
- 50% of male bowlers had greater than 10 pin average difference between patterns
- 71% of male bowlers averaged higher on the long pattern
- The average difference between patterns is 6.21 pins
- Three of the top four averages had vastly different averages on the two patterns
- Only two bowlers were in the top eight on each condition
- Only five of the top eight would have made the finals on either condition

Women's Results – Pattern Average Comparison

Last	First	Short Pattern		Long Pattern		Both Pattern		Pattern Avg. Diff.
		Games	Average	Games	Average	Games	Average	
Broendsted	Britt	15	215.40	15	211.27	30	213.33	4.13
Schwarz	Patricia	16	204.63	16	210.31	32	207.47	-5.68
Mizrachi	Margalit	14	203.00	14	207.36	28	205.18	-4.36
Lunden	Reija	13	198.54	14	209.43	27	204.19	-10.89
Contreras (L)	Ingelimar	13	195.77	14	209.93	27	203.11	-14.16
Chai	Wendy	13	195.62	13	209.85	26	202.73	-14.23
Del Rosario	Liza	12	190.50	12	212.17	24	201.33	-21.67
Penny	Kirsten	15	194.47	15	205.73	30	200.10	-11.26
Guerra	Aumi	13	193.54	13	206.46	26	200.00	-12.92
Guerrero	Clara	12	193.00	12	206.08	24	199.54	-13.08
Petty	Tanya	12	204.17	12	194.00	24	199.08	10.17
Kin Ngoh (L)	Lai	12	191.75	12	206.25	24	199.00	-14.50
Zulkifli	Shalin	12	201.67	12	196.33	24	199.00	5.34
Granda	Sofia	12	203.50	12	193.83	24	198.67	9.67
Vargas	Sara	12	199.08	12	197.67	24	198.38	1.41
Tan	Jennifer	12	199.17	12	196.50	24	197.83	2.67
Teo	Valerie	12	205.50	12	189.58	24	197.54	15.92
Lund (L)	Bettina	12	181.92	12	211.00	24	196.46	-29.08
Van Den Boogaart	Annemik	12	199.58	12	191.25	24	195.42	8.33
Yap	Sarah	12	194.75	12	195.58	24	195.17	-0.83
Johnsson	Helen	12	194.25	12	193.25	24	193.75	1.00
Hyman	Diandra	12	182.50	12	202.25	24	192.38	-19.75
Granillo	Aida	12	181.67	12	189.75	24	185.71	-8.08
Ho	Jesmine	12	184.50	12	183.08	24	183.79	1.42

Average -5.02

+ higher average on short pattern

- higher average on long pattern

- Bowler data is sorted by descending combined average
- 50% of female bowlers had greater than 10 pin average difference between patterns
- 58% of female bowlers averaged higher on the long pattern
- The average difference between patterns is 5.02 pins
- The top three bowlers had similar averages on the two patterns
- Only three bowlers were in the top eight on each condition
- Only three of the top eight would have made the finals on the short condition
- Six of the top eight would have made the finals on the long condition
- Two women who made the finals did not finish in the top eight on either condition

Comparison of Short and Long Patterns by Gender

Gender	Short Pattern		Long Pattern		Both Patterns		Pattern Avg. Diff.
	Games	Average	Games	Average	Games	Average	
Men	308	201.70	306	207.78	614	204.73	-6.08
Women	304	196.51	302	201.66	606	199.08	-5.15
Both	612	199.12	608	204.74	1220	201.92	-5.62

Average -5.62

+ higher average on short
pattern

- higher average on long pattern

- Women and men have similar differences between the patterns

Strike, Spare, and Open Percentage for Male Bowlers

Last	First	Short Pattern			Long Pattern			Both Patterns		
		Strike %	Spare %	Open %	Strike %	Spare %	Open %	Strike %	Spare %	Open %
Al Muraikhi	Mubarak Ali	46.32	81.25	15.63	53.73	75.61	17.07	50.00	79.05	16.19
Al-Shafi	Bandar	51.15	84.91	13.21	47.76	86.27	9.80	49.43	85.58	11.54
Andersson	Robert	46.38	67.86	26.79	55.64	65.12	27.91	50.92	66.67	27.27
Baeza	Marcos	52.74	66.67	21.57	52.78	86.21	12.07	52.76	77.06	16.51
Carlsson	Goran	45.86	86.79	7.55	59.40	84.62	7.69	52.63	85.87	7.61
Falconi	Daniel	54.44	82.76	8.62	46.20	89.39	7.58	50.46	86.29	8.06
Ferreira	Jose	53.15	73.81	14.29	50.96	83.02	9.43	52.00	78.95	11.58
Frawley	Andrew	45.45	75.00	20.83	56.30	70.45	27.27	50.94	72.83	23.91
Gomez	Andres	42.75	75.41	19.67	50.00	73.08	21.15	46.39	74.34	20.35
Gross	Thomas	45.24	74.14	24.14	48.92	89.29	10.71	47.17	81.58	17.54
Hernandez	Arturo	42.54	87.72	5.26	52.17	73.91	15.22	47.43	81.55	9.71
Hoffman	Bill	50.90	67.24	17.24	63.92	78.43	17.65	57.89	72.48	17.43
King	Chester	50.32	88.89	7.94	56.46	88.00	10.00	53.31	88.50	8.85
Konsteri	Sami	42.03	79.03	16.13	61.59	75.68	10.81	51.81	77.78	14.14
Larsen	Martin	50.37	79.55	6.82	51.15	76.09	23.91	50.75	77.78	15.56
Luoto	Mika	53.03	79.55	15.91	52.27	91.30	2.17	52.65	85.56	8.89
Nepomuceno	Paeng	40.46	71.43	23.21	45.99	86.21	10.34	43.28	78.95	16.67
Ohman	Anders	53.93	75.00	17.19	61.33	80.39	9.80	57.66	77.39	13.91
Ong	Remy	44.52	82.26	8.06	64.86	78.95	18.42	54.46	81.00	12.00
Rivera	Engelberto	50.75	74.47	21.28	46.62	76.09	10.87	48.69	75.27	16.13
Romero	David	56.62	83.33	9.52	46.56	76.00	20.00	51.69	79.35	15.22
Sebelen	Rolando	46.51	82.14	12.50	54.01	83.33	14.58	50.38	82.69	13.46
Shaheen	Ahmed	62.98	89.13	8.70	53.16	95.74	0.00	58.41	92.47	4.30
Verbruggen	Gery	57.35	76.19	23.81	56.39	82.22	17.78	56.88	79.31	20.69

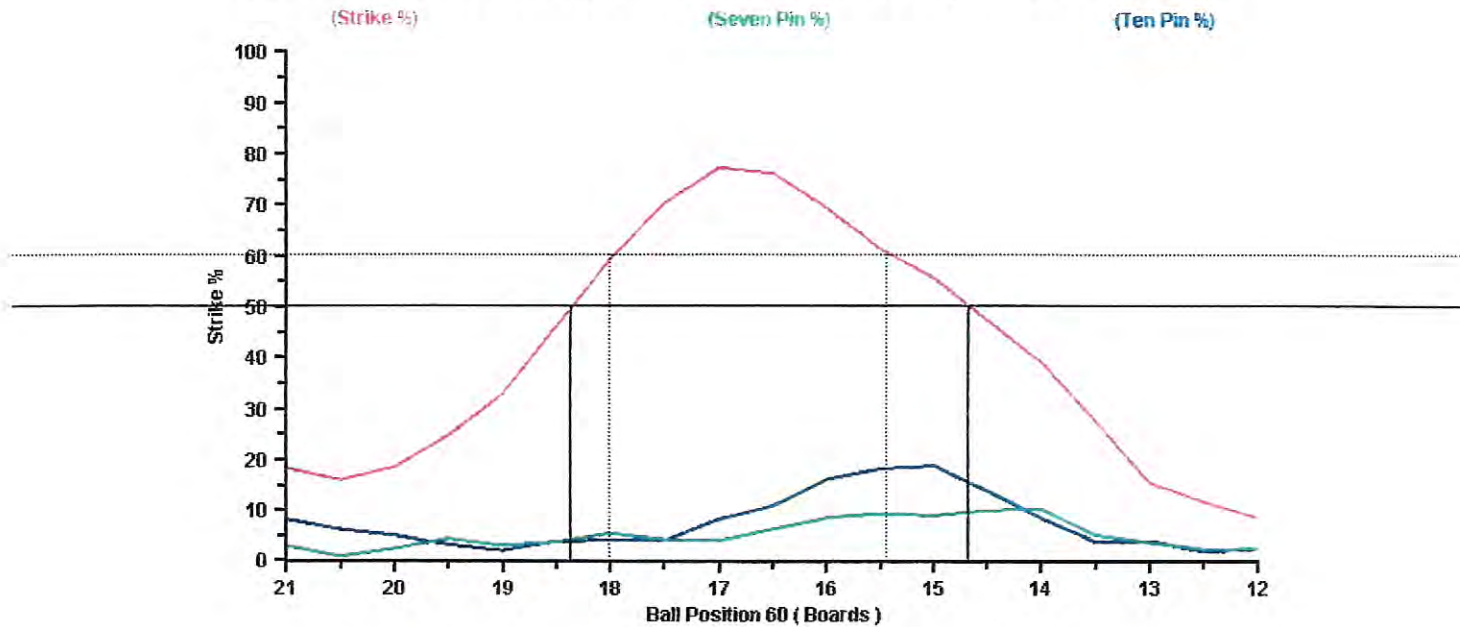
Average Percentage	50.36	79.10	17.82	54.53	82.12	16.98	52.11	80.34	16.31
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- Strike percentages are based on first ball shots
- Spare and open percentages are based on second ball shots

Strike, Spare, and Open Percentage for Female Bowlers

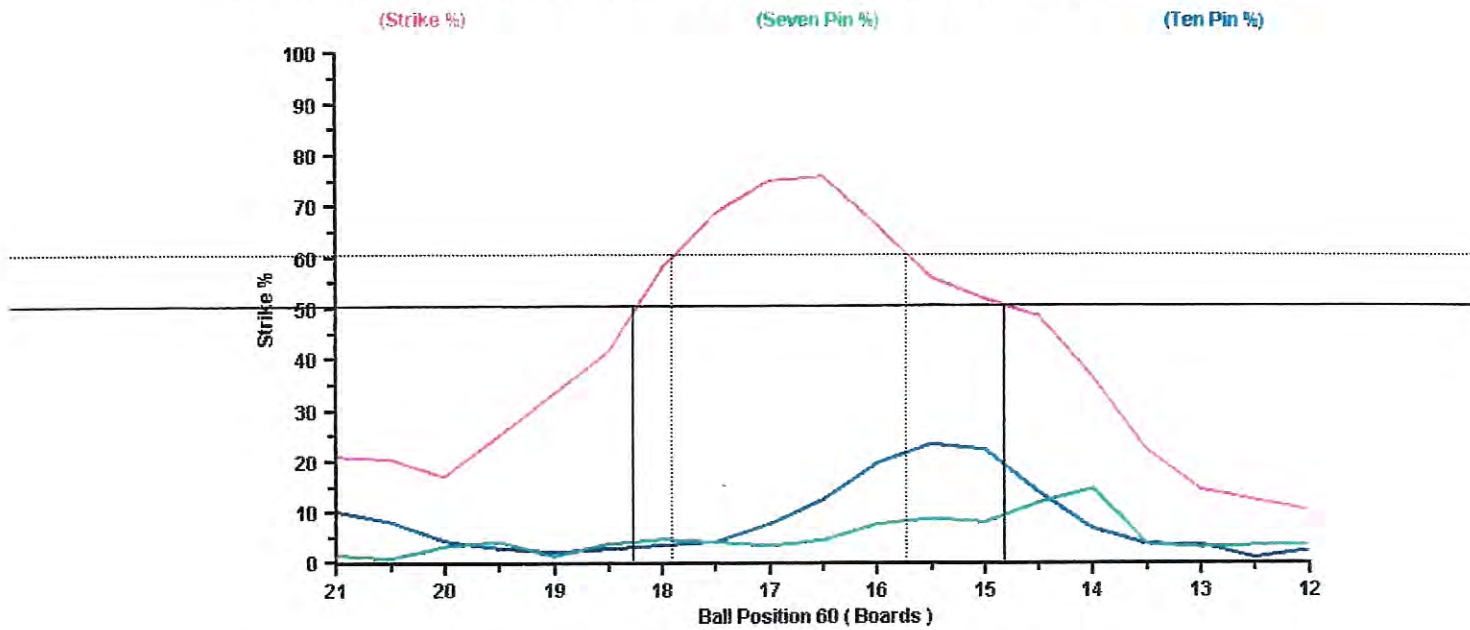
Last	First	Short Pattern			Long Pattern			Both Patterns		
		Strike %	Spare %	Open %	Strike %	Spare %	Open %	Strike %	Spare %	Open %
Broendsted	Britt	54.97	84.62	12.31	54.44	88.33	8.33	54.71	86.40	10.4
Chai	Wendy	50.70	80.00	14.00	53.33	86.27	11.76	51.99	83.17	12.8
Contreras	Ingelimar	42.36	86.57	11.94	55.84	62.79	27.91	49.33	77.27	18.1
Del Rosario	Liza	41.04	73.44	23.44	54.35	82.61	4.35	47.79	77.27	15.4
Granda	Sofia	47.73	87.72	12.28	41.53	77.36	13.21	44.80	82.73	12.7
Granillo	Aida	33.85	83.10	16.90	40.91	71.67	20.00	37.40	77.86	18.3
Guerra	Aumi	45.00	61.29	30.65	51.72	89.29	8.93	48.42	74.58	20.3
Guerrero	Clara	40.00	90.00	10.00	44.44	81.25	14.06	42.22	85.82	11.9
Ho	Jesmine	35.34	86.76	11.76	37.88	72.73	25.76	36.60	79.85	18.6
Hyman	Diandra	38.93	63.16	29.82	47.37	92.86	5.36	43.18	77.88	17.7
Johnsson	Helen	46.62	77.05	21.31	41.79	79.31	13.79	44.19	78.15	17.6
Kin Ngoh	Lai	42.22	74.58	16.95	50.37	87.72	10.53	46.30	81.03	13.7
Lund	Bettina	35.66	80.00	15.00	51.91	82.00	8.00	43.85	80.91	11.8
Lunden	Reija	44.52	82.61	14.49	52.87	84.91	7.55	48.84	83.61	11.4
Mizrachi	Margalit	48.72	79.10	14.93	53.21	87.50	12.50	50.96	83.21	13.7
Penny	Kirsten	40.83	81.01	15.19	48.05	84.13	11.11	44.27	82.39	13.3
Petty	Tanya	46.32	80.70	14.04	42.74	82.76	15.52	44.62	81.74	14.7
Schwarz	Patricia	54.75	74.58	20.34	55.00	81.03	12.07	54.87	77.78	16.2
Tan	Jennifer	49.25	86.27	9.80	34.09	91.89	5.41	41.73	89.60	7.2
Teo	Valerie	48.51	85.71	10.71	39.10	78.79	16.67	43.82	81.97	13.9
Van Den Boogaart	Annemik	40.60	84.62	10.77	42.42	75.44	15.79	41.51	80.33	13.1
Vargas	Sara	44.78	83.64	12.73	45.86	78.18	18.18	45.32	80.91	15.4
Yap	Sarah	43.38	84.48	13.79	45.59	82.14	17.86	44.49	83.33	15.7
Zulkifli	Shalin	47.76	86.54	9.62	46.97	79.25	15.09	47.37	82.86	12.3
Average Percentage		45.31	81.40	17.55	48.34	82.44	15.73	46.55	81.48	15.0

Strike Profile for All Games, All Lanes, Both Patterns



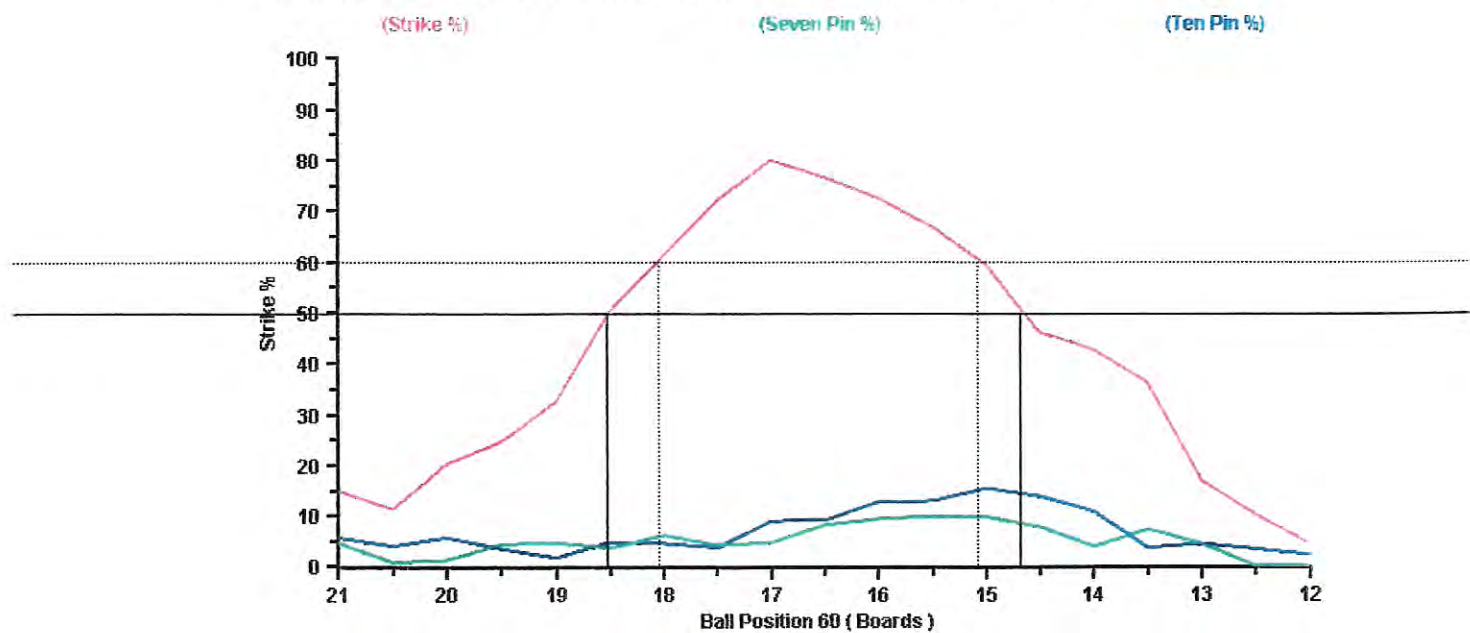
- Strike profiles show the percentage of strikes based on the location of the ball as it hits the pins
- The range we selected is based on the area at the pins where the ball hits the head pin but does not cross over
- For all graphs, the percentage of strikes generally increases from very light hits (near 12 board) to approximately the 17 board
- For all graphs, the percentage of strikes generally decreases from the 17 board to the very high hits (20-21 board)
- The blue line shows the percentage of 10 pins left and the green line shows the percentage of 7 pins left based on where the ball hits the pins.
- The pocket width can be estimated by choosing a percentage of strikes (50% or 60% in the above example)
- The 50% pocket width is from 14.6 to 18.4 boards, or a width of 3.8 boards. The 60% pocket width is from 15.4 to 18.0 boards, or a width of 2.6 boards.

Strike Profile for Female Bowlers, All Lanes and Patterns



- 50% Pocket width, 14.8 to 18.3 boards, a 3.5 board area
- 60% Pocket width, 15.7 to 17.9 boards, a 2.2 board area

Strike Profile for Male Bowlers, All Lanes and Patterns

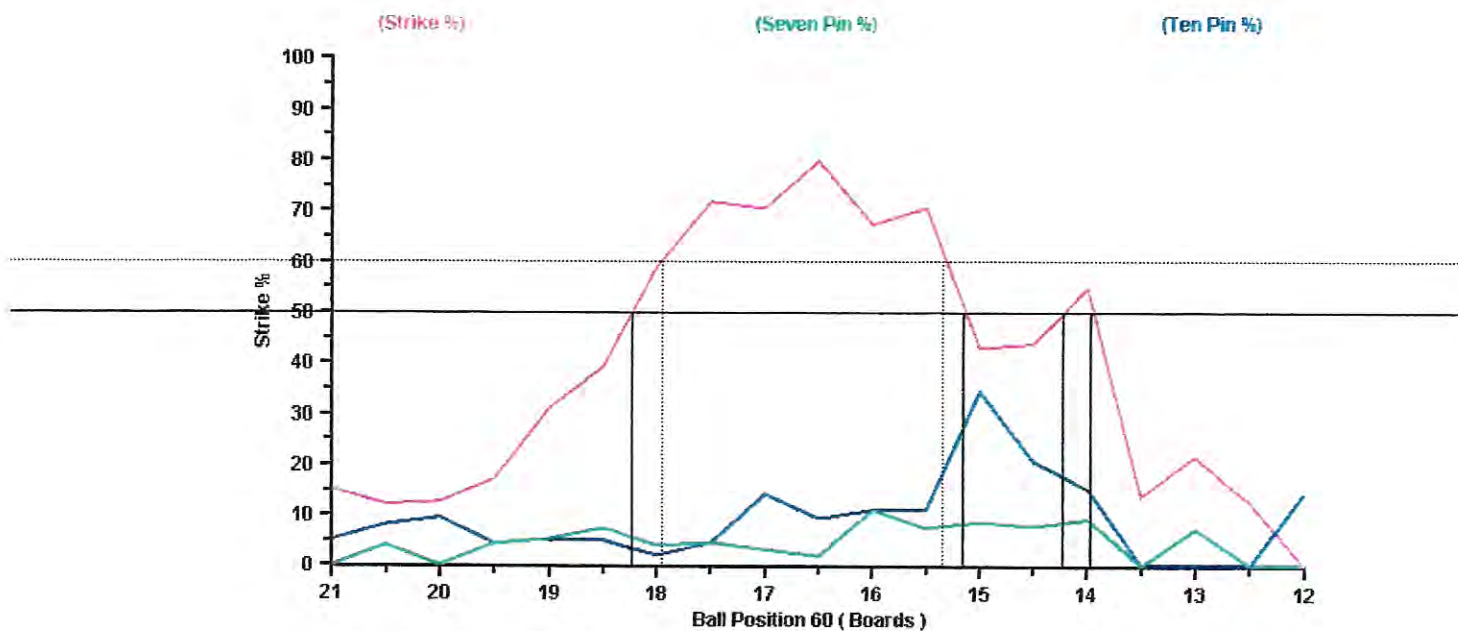


- 50% Pocket width, 14.7 to 18.5 boards, a 3.8 board area
- 60% Pocket width, 15.1 to 18.1 boards, a 3.0 board area

One of the most interesting features, or rather lack of features, of these graphs is the absence of the “dip” in the graph that has previously been found in this kind of testing. Testing conducted by ABC/WIBC several years ago found that the strike profile was typically a two-peak curve. It would peak in the vicinity of the 13-15 board at anywhere from 40-70%, would then drop in the 15-16 board range to a value from about 20-40%, then would rise again to its maximum peak in the 16-18 board range. This “dip” is the area where a corner pin is typically left on an otherwise good looking shot. In our results the 7 and 10 pin areas are still there but the strike percentage does not drop. This is likely due to the fact that the “light” strikes, in the 13-15 board range, are lower in our testing than they were in the previous ABC/WIBC tests.

The “dip” was not totally lacking in our testing. Following is a strike profile graph from lane 1 during the World Ranking Masters.

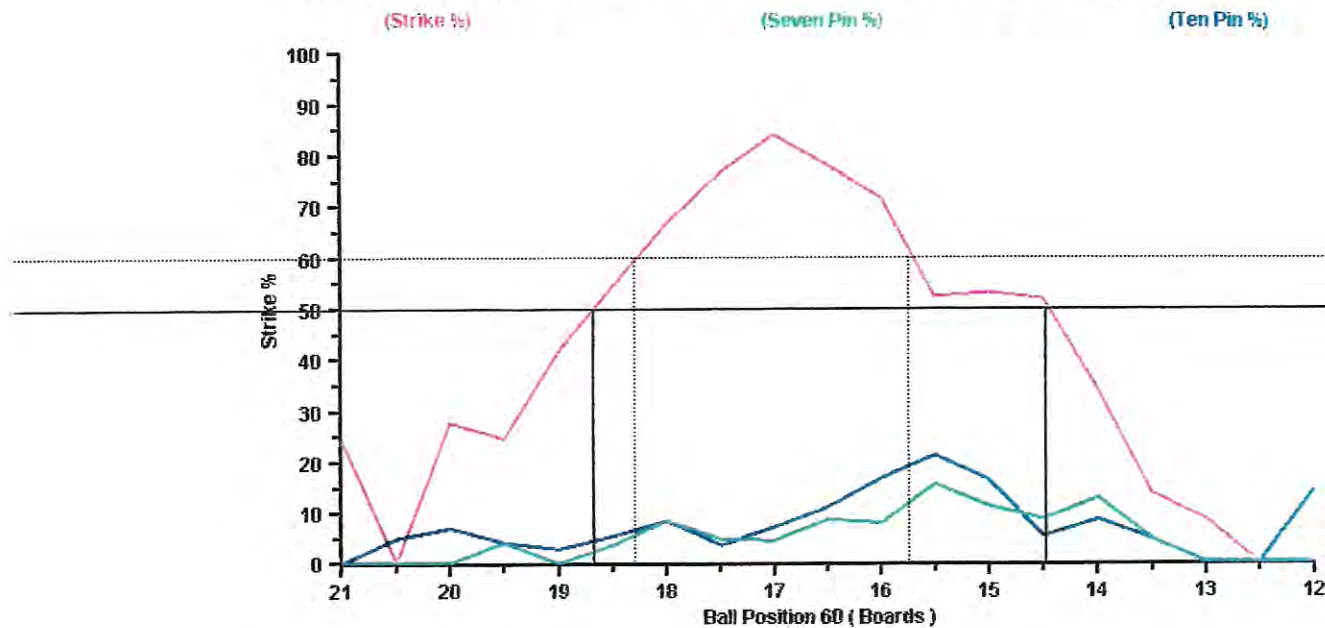
Strike Profile for Lane 1, All Bowlers and Patterns



- 50% Pocket width, 13.9 to 14.2 and 15.1 to 18.2 boards, a 3.4 board area
- 60% Pocket width, 15.4 to 17.9 boards, a 2.5 board area

As can be seen in the above graph, there is a distinct drop in the curve between 14.5 and 15 board. In the same area the percentage of 10 pins increases sharply. This is rather typical of what has been seen in the past. However, we did not see much of this. Only lanes 2 and 12 showed an even somewhat similar shape. Most lanes gave the same shape as the previous graphs.

Strike Profile for Lane 6, All Bowlers and Patterns



- 50% Pocket width, 14.4 to 18.7 boards, a 4.3 board area
- 60% Pocket width, 15.7 to 18.3 boards, a 2.6 board area

While this graph shows a “shelf” from 15.5 to 16.5 board, there is no dip. Each lane had a slightly different shape to its strike profile, which is simply another justification for having bowlers move lanes after every game.

Conclusions

This was but a sampling of all the information gathered during the World Ranking Masters tournament. But even from this sampling several conclusions can be drawn. The scoring data reveals a number of interesting facts alone. For both the men and women the scoring difference between patterns was greater than 10 pins for half the bowlers. This suggests that the two patterns challenged the versatility of the bowlers to score well on both conditions. If one or the other pattern had been used exclusively then a rather different group of bowlers would have made the finals. A most interesting thing is that the winner for both the men and women finished in the top three on BOTH conditions.

The strike, spare, and open data was very interesting as well. Men struck about 5.5% more than women, but the women were better at making spares (by just over 1%) and not leaving open frames (also by just over 1%). The short pattern was more challenging for all bowlers overall. The strike and spare percentage were both lower on the short pattern and the open percentage was higher.

The strike profile graphs were the most surprising. They do not have the “double hump” of previous graphs produced by ABC/WIBC. Instead the graphs show a steady

rise and fall from light to high hits. More testing will need to be done to find out why, but the result is that the strikes are more predictable this way. As one gets closer to the pocket, the likelihood of a strike increases. This was not universal on every lane, but came out that way as an average of all shots thrown by both women and men. As the graph of lane 1 shows, this lane had the "double hump" graph. Even though all lanes were perfectly flat and presumably were built to be equal, the strike profile for each lane was unique. While all had a pocket peak in about the same area, they all had somewhat different slopes, with some having ledges (see lane 6 graph) and some having extra small peaks in different areas.

Another aspect of the tournament that does not come out in the data but became apparent from watching the competition is the balance of the styles that was created. While both winners were "tweeners", the second place finishers were both power players. There were players that played rather straight and those that hooked the ball a great deal in the finals. This happened to a large extent because of the two patterns used. Looking at the players who did well on the conditions, it was generally true that power players and crankers were dominant on the long pattern, and strokers and straight players were best on the short pattern. The two patterns brought versatility to the forefront.