



University of Massachusetts Lowell Baseball Research Center

Title: Continued Research on the Relationship between Baseball Bat Design and Performance – Solid Barrel Bats
 Sponsor: The MetalWood Bat Company

Summary of Hits				
5.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
138.503	23.118	0.689	0.449	90.4
138.931	22.859	0.686	0.446	90.1
138.464	23.077	0.689	0.449	90.4
AVERAGE		0.688	0.448	90.3
STANDARD DEVIATION		0.002	0.002	0.180

Summary of Hits				
5.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
137.939	25.119	0.691	0.455	91.1
138.667	25.945	0.696	0.461	91.8
138.146	25.967	0.697	0.462	91.9
137.906	26.290	0.699	0.465	92.3
136.846	25.054	0.692	0.456	91.2
136.984	24.640	0.689	0.452	90.8
AVERAGE		0.694	0.458	91.5
STANDARD DEVIATION		0.004	0.005	0.558

Summary of Hits				
6.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
135.414	26.946	0.694	0.463	92.0
135.593	27.343	0.697	0.466	92.3
135.842	26.731	0.692	0.460	91.7
136.025	27.333	0.696	0.465	92.2
136.547	26.652	0.690	0.458	91.5
135.957	26.454	0.690	0.457	91.4
AVERAGE		0.693	0.461	91.8
STANDARD DEVIATION		0.003	0.004	0.403

Summary of Hits				
6.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
134.516	26.917	0.681	0.451	90.7
133.148	27.158	0.685	0.456	91.2
133.215	27.713	0.689	0.461	91.7
AVERAGE		0.685	0.456	91.2
STANDARD DEVIATION		0.004	0.005	0.533

Bat ID	
MW007	
Manufacturer	Model
MetalWood	MW363
Barrel Material	
Laminated Bamboo	
Length (in.)	Weight (oz.)
32.964	31.670
MOI (oz in ²)	
10012	
Barrel Diameter at Sweet Spot	
2.425 in. @ 5.5 in.	

1st Bending Mode Frequency
155 Hz
1st Bending Mode Node
6.75 in.
2nd Bending Mode Frequency
501 Hz
2nd Bending Mode Node
4.75 in.

Test Date	
1/19/2010	
Ball Lot	<e>
R87	-0.005

Max BESR	Location
0.694	5.5 in.
Max BBCOR	Location
0.461	6.0 in.
Max BBS (mph)	Location
91.8	6.0 in.



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Summary of Hits				
5.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
136.428	24.634	0.689	0.464	91.8
138.203	24.453	0.685	0.459	91.3
136.851	24.862	0.690	0.465	92.0
AVERAGE		0.688	0.463	91.7
STANDARD DEVIATION		0.003	0.003	0.341

Summary of Hits				
6.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
134.639	27.375	0.698	0.479	93.5
134.705	26.067	0.689	0.467	92.1
136.721	27.655	0.697	0.477	93.3
135.811	27.356	0.697	0.476	93.2
135.691	26.588	0.691	0.470	92.5
135.474	27.403	0.697	0.477	93.3
AVERAGE		0.695	0.474	93.0
STANDARD DEVIATION		0.004	0.005	0.551

Summary of Hits				
6.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
133.002	28.420	0.694	0.478	93.4
132.966	27.768	0.690	0.472	92.8
133.636	27.578	0.687	0.469	92.4
AVERAGE		0.690	0.473	92.9
STANDARD DEVIATION		0.004	0.005	0.503

Bat ID	
MW008	
Manufacturer	Model
MetalWood	MW363
Barrel Material	
Solid Ash	
Length (in.)	Weight (oz.)
32.955	30.750
MOI (oz in ²)	
9616	
Barrel Diameter at Sweet Spot	
2.419 in. @ 6.0 in.	

1st Bending Mode Frequency
165
1st Bending Mode Node
6.75 in.
2nd Bending Mode Frequency
572
2nd Bending Mode Node
5.00 in.

Test Date	
1/19/2010	
Ball Lot	<e>
R87	-0.005

Max BESR	Location
0.695	6.0 in.
Max BBCOR	Location
0.474	6.0 in.
Max BBS (mph)	Location
93.0	6.0 in.



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Summary of Hits				
5.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
138.401	26.051	0.711	0.465	92.9
138.161	26.086	0.712	0.466	93.0
138.378	26.230	0.712	0.467	93.1
AVERAGE		0.712	0.466	93.0
STANDARD DEVIATION		0.001	0.001	0.091

Summary of Hits				
5.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
137.769	29.067	0.720	0.480	94.6
138.286	27.972	0.711	0.470	93.4
138.564	27.961	0.711	0.469	93.3
138.531	28.155	0.712	0.471	93.5
137.620	28.974	0.719	0.480	94.5
138.577	29.288	0.720	0.481	94.6
AVERAGE		0.716	0.475	94.0
STANDARD DEVIATION		0.005	0.006	0.641

Summary of Hits				
6.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
136.676	29.463	0.711	0.473	93.7
136.944	29.673	0.712	0.475	93.9
135.554	28.017	0.702	0.463	92.5
AVERAGE		0.708	0.470	93.4
STANDARD DEVIATION		0.006	0.007	0.741

Bat ID	
L666	
Manufacturer	Model
Louisville	I13
Barrel Material	
Solid Ash	
Length (in.)	Weight (oz.)
33.014	30.400
MOI (oz in ²)	
10422	
Barrel Diameter at Sweet Spot	
2.442 in. @ 5.5 in.	

1st Bending Mode Frequency
133 Hz
1st Bending Mode Node
6.50 in.
2nd Bending Mode Frequency
476 Hz
2nd Bending Mode Node
5.00 in.

Test Date	
1/19/2010	
Ball Lot	<e>
R87	-0.005

Max BESR	Location
0.716	5.5 in.
Max BBCOR	Location
0.475	5.5 in.
Max BBS (mph)	Location
94.0	5.5 in.



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Summary of Hits				
4.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
140.012	23.918	0.707	0.460	92.3
138.870	24.237	0.711	0.465	92.8
141.317	24.034	0.705	0.459	92.2
AVERAGE		0.708	0.461	92.4
STANDARD DEVIATION		0.003	0.003	0.332

Summary of Hits				
5.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
139.895	25.986	0.708	0.466	92.9
138.593	25.116	0.704	0.460	92.3
138.721	26.883	0.716	0.476	94.1
138.078	25.758	0.709	0.467	93.1
139.135	25.979	0.709	0.467	93.1
137.310	25.946	0.712	0.470	93.4
AVERAGE		0.710	0.467	93.1
STANDARD DEVIATION		0.004	0.005	0.569

Summary of Hits				
5.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
137.405	25.915	0.697	0.456	91.9
136.452	26.939	0.707	0.467	93.1
137.526	27.023	0.705	0.466	93.0
AVERAGE		0.703	0.463	92.7
STANDARD DEVIATION		0.005	0.006	0.663

Summary of Hits				
6.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
135.357	27.809	0.701	0.464	92.7
136.344	27.202	0.695	0.457	91.9
135.601	26.651	0.692	0.454	91.5
AVERAGE		0.696	0.458	92.1
STANDARD DEVIATION		0.005	0.006	0.615

Bat ID	
BBB013	
Manufacturer	Model
BamBooBat	110R33
Barrel Material	
Laminated Bamboo	
Length (in.)	Weight (oz.)
33.030	30.470
MOI (oz in ²)	
10305	
Barrel Diameter at Sweet Spot	
2.434 in. @ 5.0 in.	

1st Bending Mode Frequency
115 Hz
1st Bending Mode Node
6.25 in.
2nd Bending Mode Frequency
397 Hz
2nd Bending Mode Node
4.75 in.

Test Date	
1/20/2010	
Ball Lot	<e>
R87	-0.005

Max BESR	Location
0.71	5.0 in.
Max BBCOR	Location
0.467	5.0 in.
Max BBS (mph)	Location
93.1	5.0 in.



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Summary of Hits				
4.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
139.689	22.071	0.693	0.452	91.1
138.867	21.761	0.692	0.451	90.9
140.449	21.399	0.687	0.445	90.3
AVERAGE		0.691	0.449	90.8
STANDARD DEVIATION		0.003	0.004	0.413

Summary of Hits				
5.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
138.153	24.834	0.702	0.466	92.7
139.244	25.842	0.708	0.474	93.5
139.748	24.264	0.695	0.459	91.9
139.885	25.433	0.704	0.469	93.0
138.828	25.023	0.703	0.467	92.8
140.294	26.304	0.710	0.476	93.8
AVERAGE		0.704	0.468	93.0
STANDARD DEVIATION		0.005	0.006	0.677

Summary of Hits				
5.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
137.384	25.433	0.694	0.460	92.0
139.610	27.113	0.703	0.471	93.3
138.166	25.949	0.697	0.463	92.4
AVERAGE		0.698	0.465	92.6
STANDARD DEVIATION		0.005	0.006	0.641

Summary of Hits				
6.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
135.320	26.291	0.689	0.458	91.8
136.693	27.098	0.693	0.463	92.4
135.965	26.268	0.688	0.457	91.7
AVERAGE		0.690	0.459	92.0
STANDARD DEVIATION		0.003	0.003	0.361

Bat ID	
BB049	
Manufacturer	Model
Brett Bros.	271
Barrel Material	
Laminated Bamboo	
Length (in.)	Weight (oz.)
33.037	30.405
MOI (oz in ²)	
10031	
Barrel Diameter at Sweet Spot	
2.368 in. @ 5.0 in.	

1st Bending Mode Frequency
128 Hz
1st Bending Mode Node
6.50 in.
2nd Bending Mode Frequency
437 Hz
2nd Bending Mode Node
5.00 in.

Test Date	
1/19/2010	
Ball Lot	<e>
R87	-0.005

Max BESR	Location
0.704	5.0 in.
Max BBCOR	Location
0.468	5.0 in.
Max BBS (mph)	Location
93.0	5.0 in.



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Summary of Hits				
5.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
140.036	25.237	0.702	0.462	92.4
137.727	24.539	0.701	0.460	92.1
138.394	24.625	0.700	0.459	92.1
138.554	25.071	0.703	0.463	92.5
137.332	25.006	0.705	0.464	92.7
140.241	23.984	0.693	0.451	91.1
AVERAGE		0.701	0.460	92.2
STANDARD DEVIATION		0.004	0.005	0.546

Bat ID	
S013	
Manufacturer	Model
Sam Bat	RB8
Barrel Material	
Solid Maple	
Length (in.)	Weight (oz.)
32.974	30.055
MOI (oz in ²)	
10136	
Barrel Diameter at Sweet Spot	
2.334 in. @ 6.0 in.	

Summary of Hits				
5.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
137.486	26.776	0.704	0.467	93.0
138.159	26.220	0.699	0.461	92.3
137.761	26.340	0.700	0.463	92.5
137.946	26.494	0.701	0.464	92.6
137.662	26.400	0.701	0.463	92.6
137.285	26.515	0.702	0.465	92.8
AVERAGE		0.701	0.464	92.6
STANDARD DEVIATION		0.002	0.002	0.232

1st Bending Mode Frequency
137 Hz
1st Bending Mode Node
6.50 in.
2nd Bending Mode Frequency
495 Hz
2nd Bending Mode Node
5.00 in.

Summary of Hits				
6.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
134.944	28.214	0.704	0.472	93.5
137.389	27.937	0.698	0.465	92.7
136.272	27.552	0.697	0.463	92.5
136.740	28.127	0.701	0.468	93.0
136.275	28.777	0.706	0.474	93.8
137.094	28.387	0.702	0.469	93.2
AVERAGE		0.702	0.469	93.1
STANDARD DEVIATION		0.003	0.004	0.462

Test Date	
1/15/2010	
Ball Lot	<e>
R87	-0.005

Max BESR	Location
0.702	6.0 in.
Max BBCOR	Location
0.469	6.0 in.
Max BBS (mph)	Location
93.1	6.0 in.

Summary of Hits				
6.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
133.624	28.332	0.693	0.463	92.4
134.227	28.658	0.695	0.465	92.6
134.318	28.029	0.690	0.459	91.9
AVERAGE		0.692	0.462	92.3
STANDARD DEVIATION		0.002	0.003	0.333



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Summary of Hits				
4.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
141.441	20.938	0.683	0.443	90.0
139.501	20.448	0.682	0.441	89.8
138.956	21.574	0.691	0.452	91.0
AVERAGE		0.685	0.445	90.3
STANDARD DEVIATION		0.005	0.006	0.651

Summary of Hits				
5.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
140.159	23.557	0.690	0.455	91.4
139.736	23.428	0.690	0.454	91.3
138.813	25.019	0.703	0.470	93.1
138.027	24.506	0.700	0.467	92.7
139.620	25.744	0.707	0.475	93.6
138.179	24.791	0.702	0.469	93.0
AVERAGE		0.698	0.465	92.5
STANDARD DEVIATION		0.007	0.009	0.950

Summary of Hits				
5.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
135.583	26.089	0.701	0.472	93.3
136.431	26.036	0.700	0.470	93.1
136.530	26.092	0.700	0.470	93.1
137.290	25.585	0.695	0.464	92.5
137.343	25.300	0.693	0.462	92.2
137.214	25.274	0.693	0.462	92.2
AVERAGE		0.697	0.467	92.7
STANDARD DEVIATION		0.004	0.005	0.509

Summary of Hits				
6.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
136.747	27.992	0.700	0.474	93.5
136.088	27.585	0.698	0.471	93.2
136.070	27.013	0.694	0.466	92.7
136.508	27.375	0.696	0.469	93.0
136.670	27.147	0.694	0.466	92.7
136.653	27.475	0.696	0.469	93.0
AVERAGE		0.696	0.469	93.0
STANDARD DEVIATION		0.002	0.003	0.326

Bat ID	
R309	
Manufacturer	Model
Rawlings	P460M
Barrel Material	
Solid Maple	
Length (in.)	Weight (oz.)
32.993	29.110
MOI (oz in ²)	
9886	
Barrel Diameter at Sweet Spot	
2.400 in. @ 5.0 in.	

1st Bending Mode Frequency
142 Hz
1st Bending Mode Node
6.25 in.
2nd Bending Mode Frequency
494 Hz
2nd Bending Mode Node
5.00 in.

Test Date	
1/15/2010	
Ball Lot	<e>
R87	-0.005

Max BESR	Location
0.698	5.0 in.
Max BBCOR	Location
0.469	6.0 in.
Max BBS (mph)	Location
93.0	6.0 in.



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Summary of Hits				
5.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
139.287	23.242	0.689	0.471	92.5
137.496	21.908	0.682	0.462	91.4
138.813	23.136	0.689	0.471	92.4
AVERAGE		0.687	0.468	92.1
STANDARD DEVIATION		0.004	0.005	0.600

Summary of Hits				
5.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
137.847	26.013	0.697	0.484	94.0
137.430	25.238	0.692	0.478	93.3
136.845	23.616	0.681	0.464	91.8
136.970	24.512	0.688	0.472	92.7
138.630	25.842	0.695	0.482	93.7
137.723	25.196	0.692	0.477	93.2
AVERAGE		0.691	0.476	93.1
STANDARD DEVIATION		0.006	0.007	0.798

Summary of Hits				
6.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
135.812	25.802	0.685	0.472	92.7
135.814	25.888	0.686	0.473	92.8
137.324	25.829	0.683	0.470	92.5
AVERAGE		0.685	0.472	92.7
STANDARD DEVIATION		0.001	0.002	0.180

Bat ID	
E584	
Manufacturer	Model
Easton	ProStix 73FT
Barrel Material	
Solid Ash	
Length (in.)	Weight (oz.)
32.808	28.045
MOI (oz in ²)	
9158	
Barrel Diameter at Sweet Spot	
2.346 in. @ 5.5 in.	

1st Bending Mode Frequency
128 Hz
1st Bending Mode Node
6.50 in.
2nd Bending Mode Frequency
485 Hz
2nd Bending Mode Node
5.25 in.

Test Date	
1/19/2010	
Ball Lot	<e>
R87	-0.005

Max BESR	Location
0.691	5.5 in.
Max BBCOR	Location
0.476	5.5 in.
Max BBS (mph)	Location
93.1	5.5 in.



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Summary of Hits				
5.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
138.763	21.160	0.674	0.458	90.4
139.533	21.064	0.673	0.456	90.2
139.087	22.657	0.685	0.471	91.8
AVERAGE		0.677	0.462	90.8
STANDARD DEVIATION		0.007	0.008	0.908

Summary of Hits				
5.5 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
137.187	23.510	0.680	0.468	91.5
137.336	24.576	0.688	0.477	92.6
137.626	23.889	0.682	0.471	91.9
137.018	22.897	0.676	0.462	91.0
138.137	24.702	0.688	0.477	92.6
137.276	24.456	0.687	0.476	92.5
AVERAGE		0.683	0.472	92.0
STANDARD DEVIATION		0.005	0.006	0.670

Summary of Hits				
6.0 in.				
Velocity In (mph)	Velocity Out (mph)	BESR	BBCOR	BBS (mph)
137.239	24.922	0.677	0.467	91.5
136.418	25.407	0.681	0.472	92.1
135.799	25.383	0.682	0.473	92.2
AVERAGE		0.680	0.471	91.9
STANDARD DEVIATION		0.003	0.004	0.398

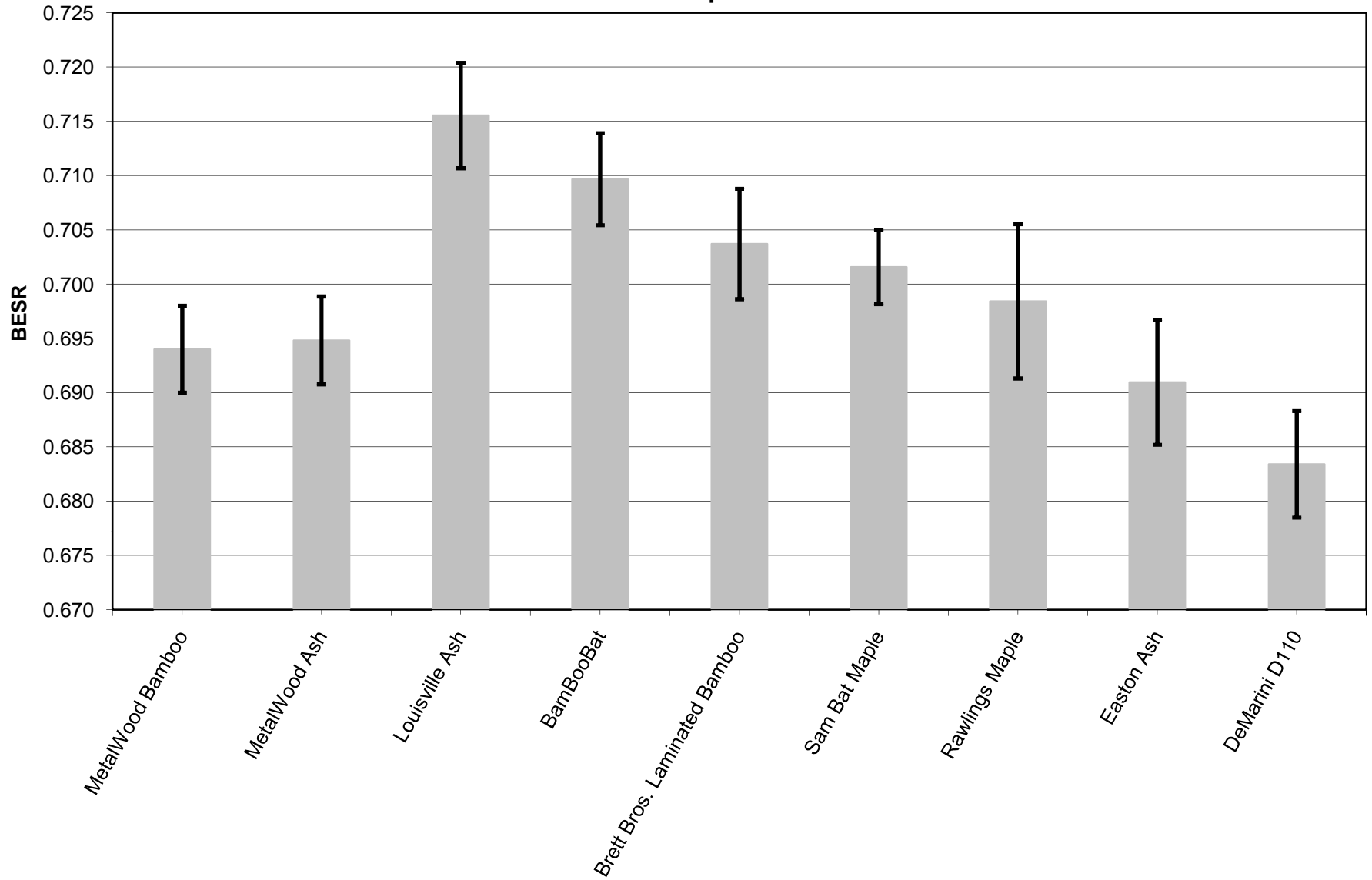
Bat ID	
D183	
Manufacturer	Model
DeMarini	D110
Barrel Material	
Maple/Composite	
Length (in.)	Weight (oz.)
32.840	30.320
MOI (oz in ²)	
9032	
Barrel Diameter at Sweet Spot	
2.320 in. @ 5.5 in.	

1st Bending Mode Frequency
134 Hz
1st Bending Mode Node
6.75 in.
2nd Bending Mode Frequency
461 Hz
2nd Bending Mode Node
5.00 in.

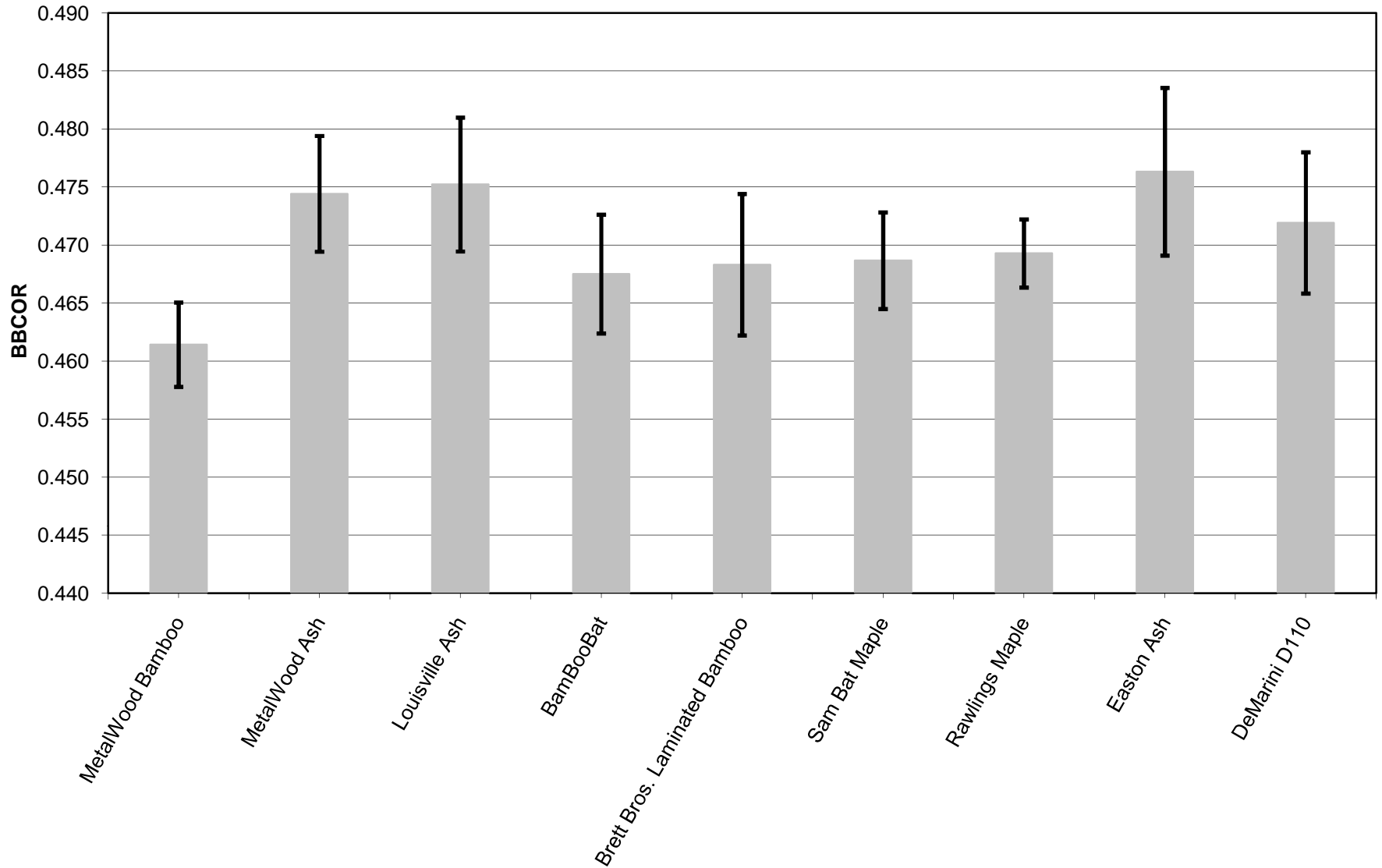
Date	
1/15/2010	
Ball Lot	<e>
R87	-0.005

Max BESR	Location
0.683	5.5 in.
Max BBCOR	Location
0.472	5.5 in.
Max BBS (mph)	Location
92.0	5.5 in.

BESR Comparison



BBCOR Comparison



BBS Comparison

