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Effect of Chopping Board Material on Edge Longevity

Video: https://youtu.be/_IktWJKFP2k

So you've put a certain amount of effort into sharpening your knives, and understandably you want that sharp edge to last. Have you ever wondered why your knives go blunt from cutting soft food? It is a question that has confronted me for years: why my kitchen knives go less and less sharp every time I take them out of the knife stand even though they only cut meat and veggies. I was starting to believe that they magically go blunt sitting in my knife stand, until I thought "maybe it is my cutting board?"

Common sense would suggest that if you have a board made from a hard material, it may cause your knife edge to roll. To get firm facts, we've designed a systematic study into effect of chopping boards on the edge longevity. This study is to tell us which cutting board may be dulling knives.

We've obtained a variety of commonly used chopping boards, to estimate their effect on the edge:
end-grain chopping boards versus long-grain (the long-grain is also called face-grain or edge-grain);
by wood type, namely hardwood vs Bamboo; and
by plastic type: poly**vinyl** vs poly**ethylene** vs poly**propylene** plastic boards.

We will take a closer look at the board materials later on as we test them.

TESTING STAND

We need some sort of a testing stand for controlled load on the knife as the knife slices the cutting board. We modified the edge stability tester given to us by the BESS Sharpness tester inventor Mike Brubacher. It has a linear roller resting on the knife spine, and a platen for adding weights to exert consistent load on the knife.

Next, we need a sharpness tester to quantify the change in sharpness, enabling us to compare the numbers and draw conclusions. On the BESS sharpness tester the lower score - the sharper the edge.

TEST KNIVES

For this experiment we use Victorinox SWIBO knives out of the box with the factory edge. These are quality mainstream stainless steel knives. For reference, the knife steel is X50CrMoV15, ie stainless 0.5 % carbon with a little molybdenum ad vanadium, HRC 56-58.

SWIBO knives have factory edge angle of 32 to 40 degrees, depending on the model. Knives used in the test have edge angle of 32 degrees included, 16 dps. Victorinox catalogue ID of the knives is 5.84.11.25. The factory edge out of the box is shaving sharp.

New identical knives with factory edge were used for this test on purpose, to rule out other variables and focus on the chopping board material. Overall, we used 9 new knives in this test.

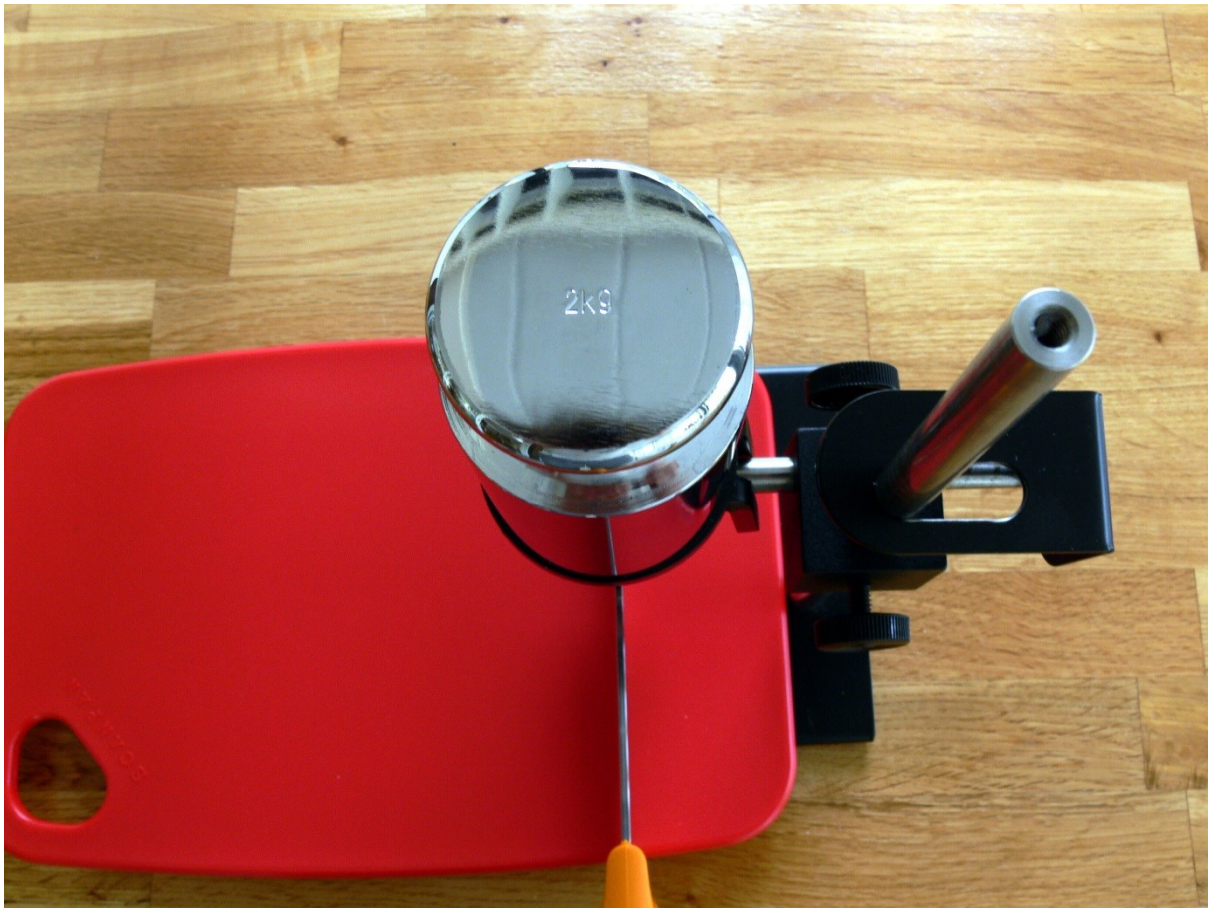
CUTTING LOAD

First we needed to get an idea about the forces required to cut food in the kitchen.
By research in the meat plant we know that in meat cutting the cutting moment peaks to near 20 Nm. The force of cutting motion is measured in Newton-metre units of torque or moment. The duller the knife and the denser the material we are cutting, the more force is required. Because 1 Newton-meter translates to 0.1 kg-m, that research finding means our stand needs a 2 kg load.

To give you a visual example, the early BESS sharpness tester is well suited for that, by removing the test fixture. I bought this tester in the same year the inventor patented it. Cutting potato and onion with one of the test knives shows between 1.5 and 2.5 kg on this tester.

TESTING STAND LOAD

Now we have an indication of typical cutting force, we can apply a similar load to our test stand by adding a **2 kg weight**.



It goes without saying that our testing stand cannot completely mimic natural slicing motions, however, in this experiment we are not researching which slicing technique is better - we are researching the effect of cutting boards on edge retention, and what really matters is that the testing load is in the same ball-park as the natural cutting load. Our test stand is different from natural cutting load in that it will be under **constant peak load**, but it is still within the natural limits.

Our testing method is to measure knife sharpness after every 200 slices to 2000 slices. The initial and end sharpness is measured 3 times, and the sharpness number averaged. Sharpness numbers are recorded, allowing us to compare how each type of chopping board affects the edge sharpness.

With this experimental setup we are ready to start our testing.

END-GRAIN vs LONG-GRAIN

In theory, end-grain boards (these are also called "butcher block") are supposed to keep a knife sharper. Think of the wood fibers that make up wood like bristles on a brush. The common belief is that on end-grain you are cutting between the wood fibers, keeping the edge sharper for longer. While on long grain, it's like the brush is lying left to right, and you're chopping those fibers in half.

But the chopping board is not the same as a wooden block. The edge-grain chopping board is made from many pieces of wood fused together, so the factor to consider with the end-grain boards is the glue used in them and transitions between the pieces of wood the board is made of, as it can all affect the edge of the knives.

To get factual data, we compare end-grain versus long-grain chopping boards made of the same wood. In our experiment we use boards made of Acacia. Acacia Janka Hardness Index of near 5000 N is comparable to that of Maple, widely used in cutting boards in the USA.

Results are shown in the following table. We've found no significant change in edge sharpness in either board - the long-grain board is as good as the end-grain in keeping your edge sharp.

LOAD 2000 GRAMS
Victorinox SWIBO X50CrMoV15, HRC 56-58
factory edge 16 dps

Board material	**Sharpness (BESS)**	
	Initial	**2000 cuts**
Acacia long-grain	125	115
Acacia end-grain	130	110

WOOD TYPE

Soft woods are not commonly used to make cutting boards, due to their porous nature. Acacia and Bamboo are most commonly used material for natural cutting boards, at least in Australia.

Wood hardness is estimated by Janka Hardness Index. Acacia Janka Hardness Index is about 5000 N; but the Bamboo is much harder, near 7000 N. Bamboo boards also have intermittent nodes. In the chopping board, these nodes are denser than the rest of the grain.

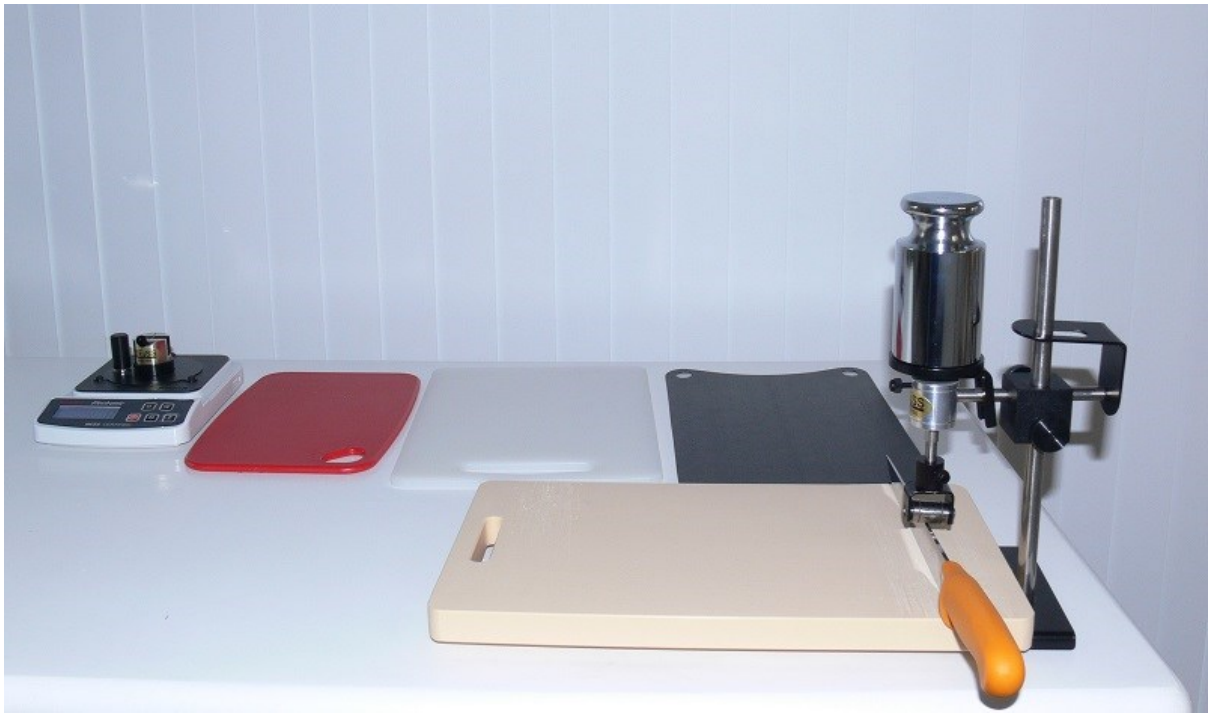
Similarly to Acacia, we've obtained the sharpness numbers for Bamboo, end-grain and long-grain, shown in the following table.

LOAD 2000 GRAMS
Victorinox SWIBO X50CrMoV15, HRC 56-58
factory edge 16 dps

Board material	**Sharpness (BESS)**	
	Initial	**2000 cuts**
Bamboo long-grain	195	175
Bamboo end-grain	165	**210**

Unlike Acacia, the Bamboo starts dulling the knife by 2000 cuts; however, contrary to our expectations, it is the Bamboo end-grain board dulls, not the long-grain. Even when we sliced the knife on the dense bamboo nodes in the long-grain board, we saw no dulling. The common belief that on end-grain board your knife edge stays sharp for longer, contradicts what we've seen in our Bamboo 2000-cuts test.

PLASTIC BOARDS



Polyethylene and polypropylene boards are ubiquitous, while the polyvinyl acetate board was sent to us from Japan by its only producer Yoshihiro. The Yoshihiro Hi-Soft vinyl acetate cutting board costs like a premium knife and is regarded the most edge friendly - we will put it to the test also.

We compare the Yoshihiro poly**vinyl acetate** board to:
- Linear Low-Density poly**ethylene** chopping board from Ikea (PE-LLD);
- High Density poly**propylene** board by Scanpan; and
- Low Density poly**propylene** flexible cutting board/mat found in budget shops – specs often state just “polypropylene”.

The following table compares the plastic boards.

LOAD 2000 GRAMS
Victorinox SWIBO X50CrMoV15, HRC 56-58
factory edge 16 dps

Board material	**Sharpness (BESS)**	
	Initial	**2000 cuts**
Yoshihiro Hi-Soft poly**vinyl acetate**	160	115
Low Density poly**ethylene**	120	90
High Density poly**propylene**	120	70
Low Density poly**propylene**	120	**195**

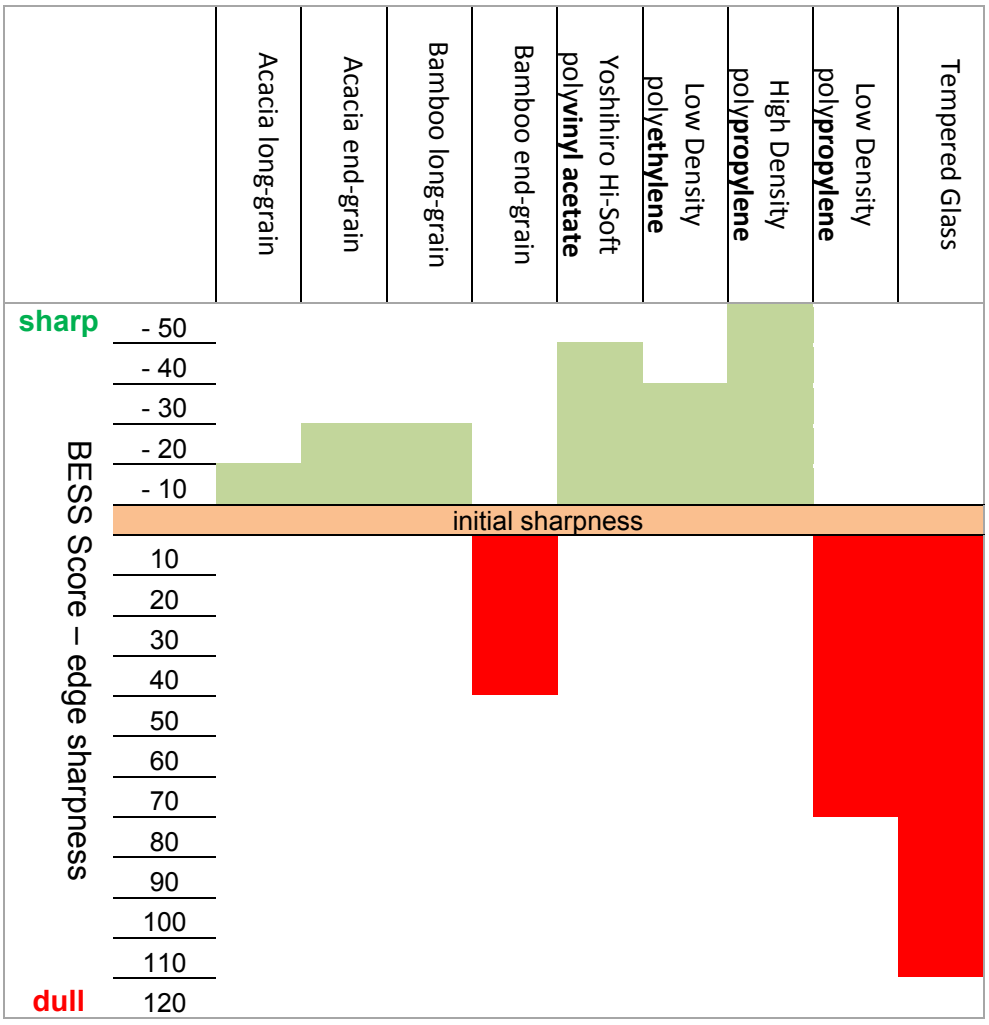
GLASS BOARDS

We also tested a tempered glass cutting board from a boutique store; the results are below in the summary graph.

SUMMARY GRAPH

Now that we have obtained some sharpness data, we can range the cutting boards by their effect on edge longevity. In the following graph, the scale indicates difference in sharpness after performing 2000 slices: edge-friendly boards are above the *initial sharpness* line, and edge-hostile fall below this line - the lower, the more detrimental to the edge the board is.

Difference between sharpness after 2000 cuts and initial sharpness



COUNTER-INTUITIVE CONCLUSIONS

Important is that the testing was done with the load within natural cutting forces.

We were flabbergasted by the test results. Edge-friendly boards were undoubtedly making knives sharper as we continued cutting - this effect was more pronounced in plastic boards than in wooden, peaking in the high density polypropylene board. For the lack of a better term, we called this phenomenon ***edge-refining effect.***

The Edge-refining effect of edge-friendly chopping boards is due to burnishing of the metal off the sides of the edge near the apex and smoothing away the apex irregularities. The tiny grooves on the board from slicing cuts are important for this effect to develop in full.

The experimental data tell us that the sharpness improvement starts immediately due to cleaning the microburr, smudge and residues from the edge, and stripping the oxidation layer off the edge, but fully develops only after hundreds of cuts, where we believe burnishing at the sides of the apex comes into play and continues, till the sharpness comes to an improved plateau after 1000-2000 cuts.

Of edge-hostile boards, which include end-grain Bamboo, Low Density Polypropylene and tempered glass, the glass is the worst of all for the knives. You will see glass cutting boards in some shops, and cheap plastic boards in every thrift shop. Let's set the record straight. There is no way in hell that you will keep your knife sharp using glass board or a board of Low Density Polypropylene.

Of all plastic boards, the most edge-friendly is the ubiquitous high density polypropylene, while the expensive Yoshihiro Hi-Soft board is nothing to rave about in comparison.

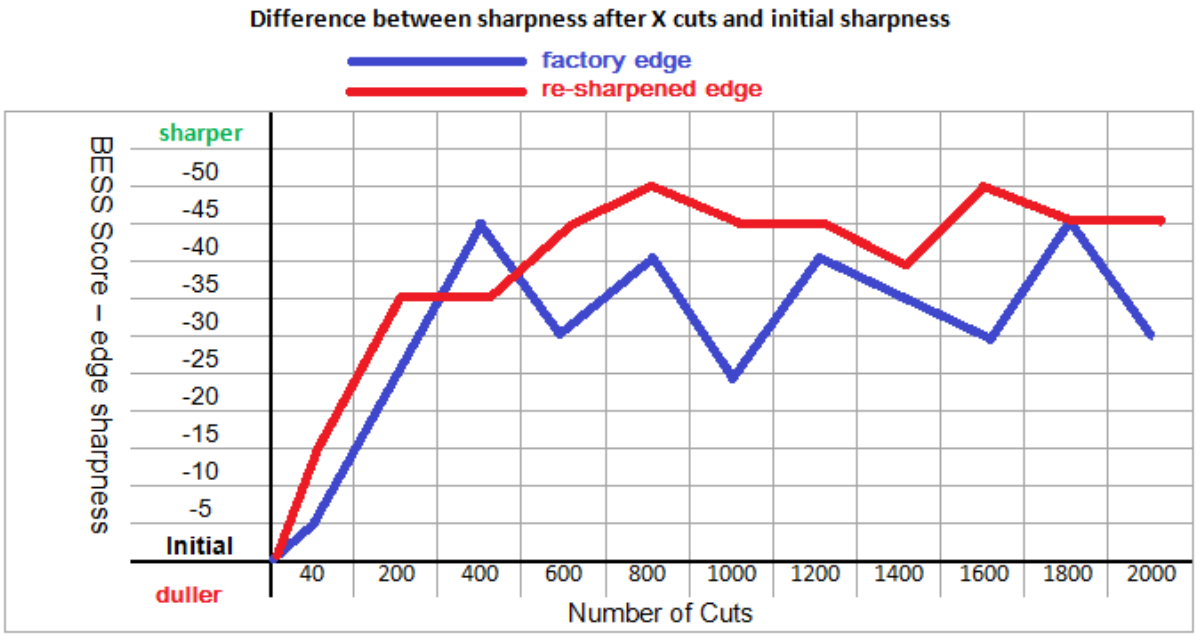
Acacia end-grain chopping board has no advantage over the long-grain in keeping your knife sharp; while the end-grain bamboo board is definitely bad. Comparing the long-grain acacia (Janka Hardness Index approx. 5000 N) to long-grain bamboo (Janka Hardness Index approx. 7000 N) we conclude that wood hardness as such does not affect the edge longevity.

We can summarise that the best board contender that is low maintenance for knives and long lasting are polypropylene and polyethylene plastic boards of trusted brands. These are most often used in commercial kitchens as well, and have the benefit of being able to toss in a dish washer. Even if you are a knife aficionado, our test results suggest no advantage in the expensive vinyl acetate and end-grain wooden boards. The cheaper high-density polypropylene, low-density polyethylene or long-grain wooden boards are also easy on your knives. Moreover, we've found the Yoshihiro Hi-Soft vinyl acetate cutting board too soft for chopping - it is favoured by sashimi and sushi chefs, but in an ordinary kitchen can be used only for portioning cuts and fine slicing of cooked and soft food.

With these data on hand, we can suppose that if the knife fails early on an edge-friendly chopping board, it is due to incorrect technique and chiefly due to the edge rolling.
Knives dull by two mechanisms: abrasion and edge rolling.
In our test, the knives are perpendicular to the chopping board and if they dull it is due to abrasion. If the cutter often scrapes the board laterally, or holds the knife out of the vertical, edge rolling will

prevail. For example, the habit of scraping food pieces off the board using the spine of the knife rather than the edge eliminates one cause of rolling.

Re-sharpened knives, provided they are cleanly deburred, become even sharper with use on the edge-friendly boards and hold this added sharpness better, as has been shown in additional experiments.
We re-sharpened the knife used in our chopping board experiment at the same 16 dps, using our sharpening and deburring procedure for mainstream stainless steel knives. The edge angle was controlled with our computer software for Tormek, and verified with a laser protractor.
We started sharpening on a coarse grit #80 CBN wheel to remove the metal affected by factory sharpening, and then followed our standard procedure on CBN wheels #400, #1000 and deburred as described on our website http://knifegrinders.com.au/06Procedures_SS.htm



To validate edge-dulling properties of the low-density propylene board, we repeated the same testing on a different thicker board, with the same knife as was used in the first test, but re-sharpened as above. Results confirmed the initial finding, and can be seen in the Experimental Data in the end of this paper.

Please see all sharpness numbers in the Experimental Data on the next page.

EXPERIMENTAL DATA

LOAD 2000 GRAMS

Victorinox SWIBO X50CrMoV15 HRC 56-58

Factory edge 16 dps

Board material	**Number of cuts / Sharpness (BESS)**											
	Initial	**40**	**200**	**400**	**600**	**800**	**1000**	**1200**	**1400**	**1600**	**1800**	**2000**
Acacia long-grain	**125**	120	145	150	155	150	150	135	150	125	140	**115**
Acacia end-grain	**130**	120	145	120	155	165	155	130	135	140	125	**110**
Bamboo long-grain	**195**	185	205	240	230	200	170	160	205	200	190	**175**
Bamboo end-grain	**165**	165	145	185	140	130	130	170	160	210	190	**210**
Yoshihiro Hi-Soft poly**vinyl acetate**	**160**	135	115	120	100	95	100	110	110	110	90	**115**
Low Density poly**ethylene**	**120**	115	95	75	90	80	95	80	85	90	75	**90**
High Density poly**propylene**	**120**	110	85	65	60	75	70	70	100	90	90	**70**
Low Density poly**propylene**	**120**	100	140	140	190	165	155	170	165	185	185	**195**
Tempered Glass	**175**	145	150	130	235	250	240	235	265	230	260	**290**

Re-sharpened at 16 dps

LOAD 2000 GRAMS
Victorinox SWIBO X50CrMoV15, HRC 56-58, 16 dps
Low Density poly**ethylene** cutting board

Knife	**Number of cuts / Sharpness (BESS)**											
	Initial	**40**	**200**	**400**	**600**	**800**	**1000**	**1200**	**1400**	**1600**	**1800**	**2000**
Factory edge	**120**	115	95	75	90	80	95	80	85	90	75	**90**
Re-sharpened edge	**110**	95	75	75	65	60	65	65	70	60	65	**65**

Low Density polypropylene retest

Knife	**Number of cuts / Sharpness (BESS)**							
	Initial	**40**	**200**	**400**	**600**	**800**	**1000**	**1200**
Re-sharpened edge 16 dps LDPP thick board	**100**	75	75	70	80	100	**115**	**140**