How can we evaluate sharp edges in an objective and repeatable way?

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In the field of mechanical tests for furniture, different standards (EN 16121, UNI EN 14073-2, EN 14749, etc.) require that accessible parts shall be chamfered or rounded in order to prevent harm hazards to the user or persons in the near area.

"Accessible parts" are defined as all edges that a person might reasonably come into contact with during normal use.

The standards mentioned above, require that a check shall be performed before mechanical testing begins, but without providing a method of verification, making the **evaluation** of the requirement particularly **subjective**.

After some studies performed internally on wood-based panels edged through industrial edging process, we got some results that can determine the hazard of an edge, applying an **objective and repeatable criteria**.

The study is based on **three knowledge**:

1. Criteria for choosing accessible parts in a piece of furniture
2. Knowledge of linear edging processes
3. Survey of people's perception of edge's danger

1. Criteria for choosing accessible parts in a piece of furniture

As already mentioned before, accessible parts are those which a person could reasonably come into contact with.

In the proposed example is explained through an image of a bathroom wall unit, which edges are accessible (circled in green color) and which are not (circled in red color).

2. Knowledge of linear edging processes

After the definition of the accessible parts of a piece of furniture, we analyze the producing and gluing of edges for wood-based panels, searching a connection between industrial process and sharp edges.

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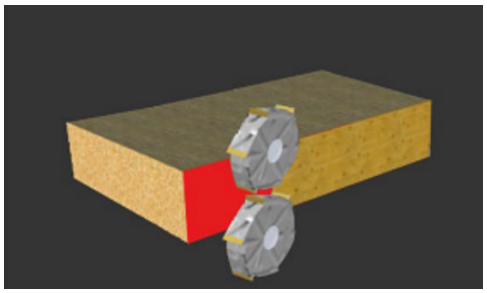
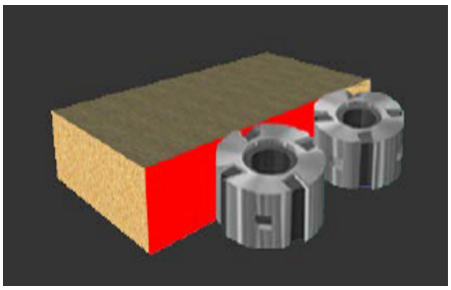
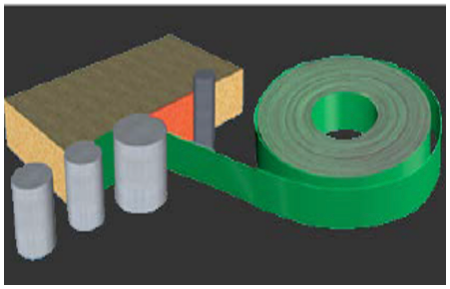
Step 1: the double hogger consists of two horizontal motors, to which specific tools are coupled to remove large quantities of material from the side surface of the panel during the squaring process.



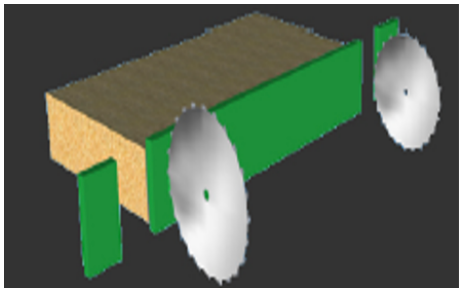
Step 2: the premilling process aims to make the surface of the panel perfectly smooth, in preparation for the next gluing phase.



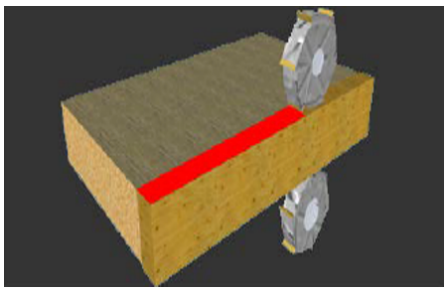
Step 3: the gluing unit that includes the edge loading area, the application of the adhesive and the pressing is the real heart of the edgebander, as it represents the functional group that allows the edge to be bonded to the panel.



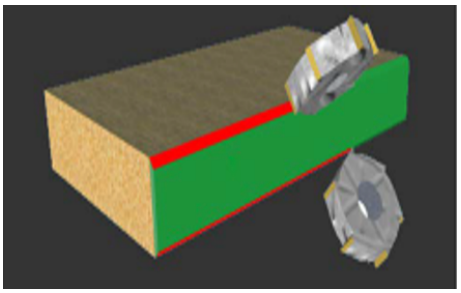
Step 4: it is a working station consisting of one or two motors, with respective blades, for cutting the excess front and rear edge.
The blades can cut both roll edges and solid wood of various thicknesses.



Step 5: the working station carries out a rough trimming process in the case of the application of roll edges and a finishing process in the case of solid wood edges. The trimming unit consists of two horizontal motors equipped with specific tools capable of removing the excess of the upper and lower edge.
Residual material at the end of the process on roll edges: 2 mm
Residual material at the end of the process on solid wood edges: 0 mm..

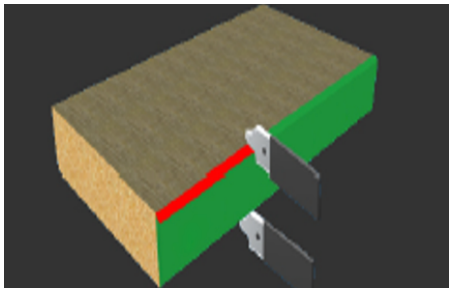


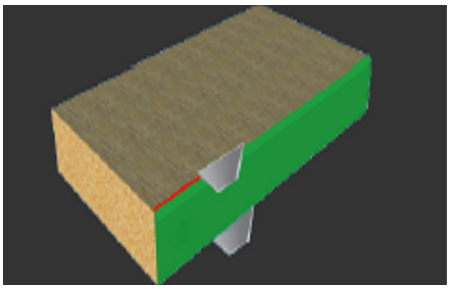
Step 6: this unit, placed immediately after the rough trimmer, performs a finishing process in the case of thin edges (normally up to 0.5 mm thick) while with thicker edges (normally from 0.6 m to 3 mm) the finishing process is carried out afterwards by the edge scraper unit. The fine trimming unit consists of two motors with specific tools capable of removing the top and bottom edge excess. The quantity of residual material must be the optimal one, that is 0.2 mm, for the subsequent processing carried out by the edge scraper unit.



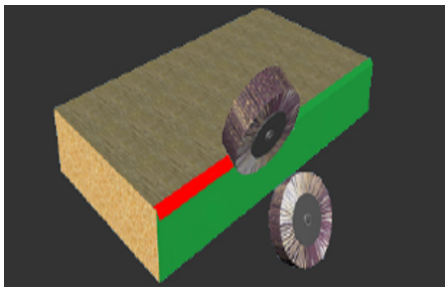
Step 7:it consists of two small knives capable of scraping the top and bottom edge excess previously left by the fine trimming. At the end of the processing, the surface of the scraped edge will be radiated and perfectly smooth and there will be no more edge excess than the panel. This process is called **"Edge scraper"**. **This process IS NOT performed on edges with thickness less than 0,6 mm** in order to prevent the possibility of leave the wood based panel thickness on sight.

Step 8: It consists of two slats (flat scraper) capable of removing the excess adhesive present at the top and bottom panel-edge joint.





Step 9: cleaning and polishing of the machined surfaces through two motors equipped with brushes that operate together with cleaning fluid



3. Survey of person's perception of edge's danger

In order to get representative touch sensations, at the data collection step of the survey we proposed 13 parts with different thickness edges at 10 persons , with the following introduction:
"Touch the marked edges and evaluate if they could cause physical damage (cut) when in use."
The parts tested were as follows:

- 1 panel with 0.3 mm edge-thickness.
- 4 panels with 0.4-mm edge-thickness.
- 4 panels with 0.6mm edge-thickness.
- 4 panels with 1.0mm edge-thickness.

At the end of the survey, we got the results represented in the table and graph below.

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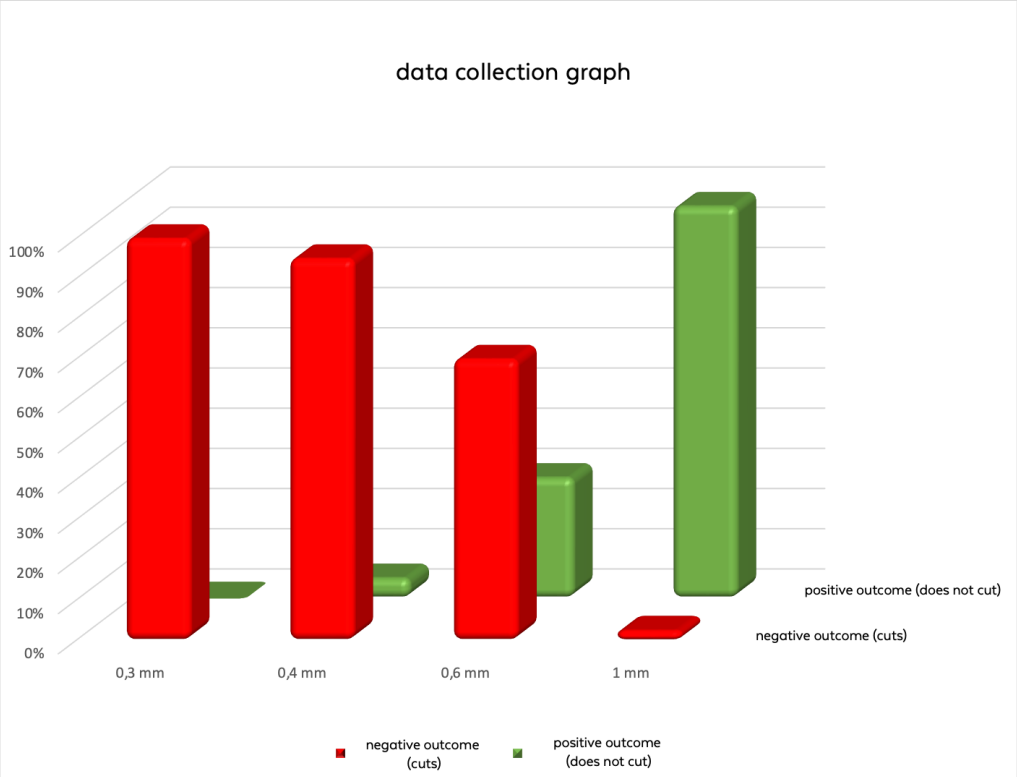
1 panel with 0.3 mm edge-thickness	
Results comply (it doesn't cut)	Result does not comply (it cuts)
0	10

4 panels with 0.4-mm edge-thickness	
Results comply (it doesn't cut)	Result does not comply (it cuts)
2	38

4 pannelli con bordo da 0,6mm di spessore	
Results comply (it doesn't cut)	Result does not comply (it cuts)
12	28

4 pannelli con bordo da 1,0 mm di spessore	
Results comply (it doesn't cut)	Result does not comply (it cuts)
39	1



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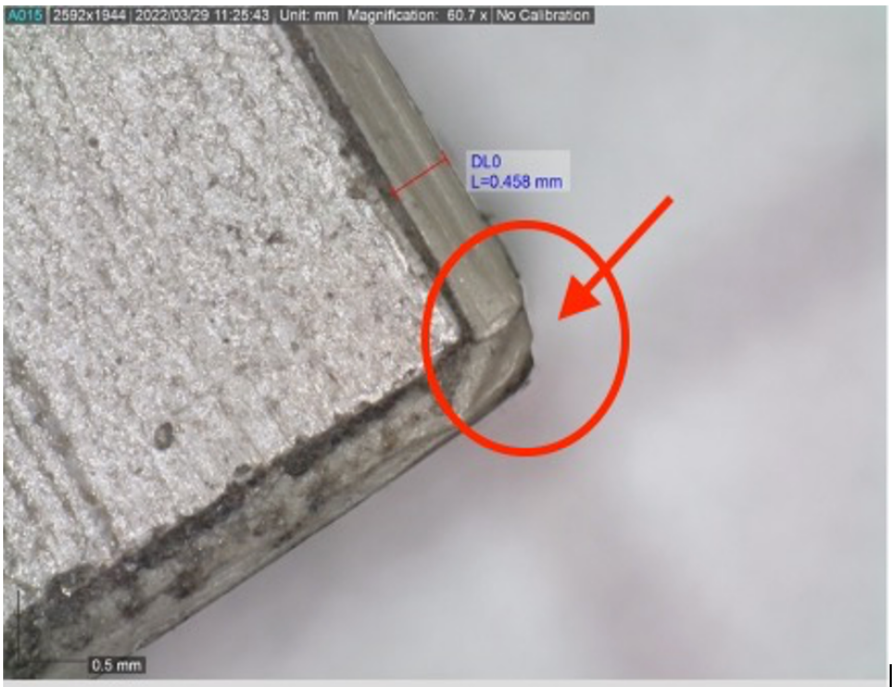
Remarks

We noticed from the survey's results that the most part of the people considers "sharp" all wood based panel where edges with thickness < 0,6 mm have been applied and not "sharp" edges with a thickness > 0,6 mm. We can state that to avoid danger perception touching edges, all wood based panel with accessible parts must be subjected to "edge scraper" finishing process (step 7 of linear edging processes) and so, have an edge with thickness ≥ 0,6 mm.

This study allowed us to identify an objective and repeatable criteria to define the hazard of accessible parts understood as edges of wood-based panels: **edges with thickness < 0,6 mm do not meet the requirements of the reference standards, instead edges with thickness ≥ 0.6 mm comply with them.**

Two examples of panels with edges of different thicknesses (< 0.6 mm and > 0.6 mm) **analyzed under the microscope** are proposed below:

The captured image represents the detail of a **sharp edge.**



Confirming what said before above, **the thickness of the edge** applied on the panel **is 0.4 mm**.

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The red line that is above the green circle show the thickness measure, which is 1.0 mm.
This is exactly why the edge is **NOT sharp** (see results of the hazard perception survey).

At the moment, Catas is trying to get as much data on this argument in order to confirm this criteria and be able to propose it as a requirement in the current standards as soon as possible.

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