PLASTIC INJECTION SIMULATION

Case description: A plastic injection simulation work will be done on an internal mask of a car door handle to improve its visual appearance after being painted. The main inconvenience is manifested after the finishing step of the piece, the coating.

It was found that weld lines were the major cause of visual defect to optimize.

The available simulation tools were used to analyze the possibility of relocating the weld lines generated and / or modify the properties of them.

Fig. 1 – CAD Model CAD of the analyzed piece

Development: The first step was to take the CAD model provided by the customer to a finite element model. Considering the objective of this work weren´t modeled mold cooling channels nor injection channels. The injection point indicated in Fig. 3 corresponds to the original injection mold.

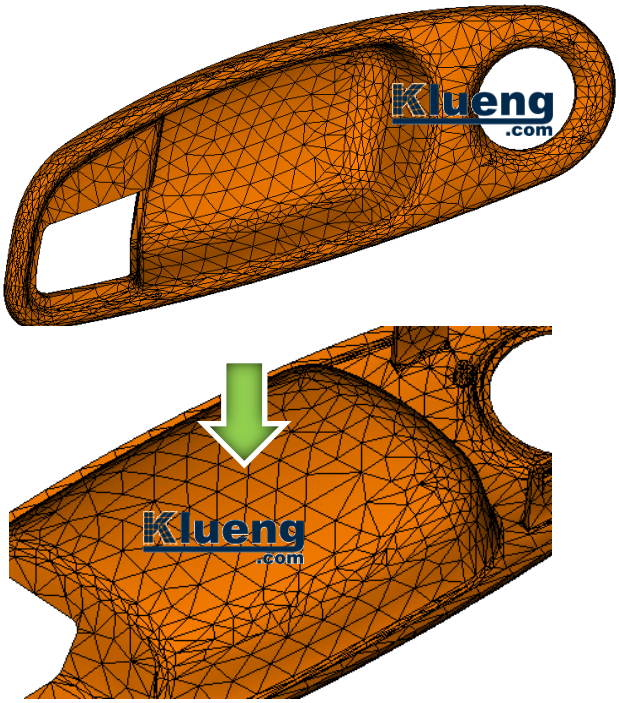

Fig. 3 – Injection Point Location

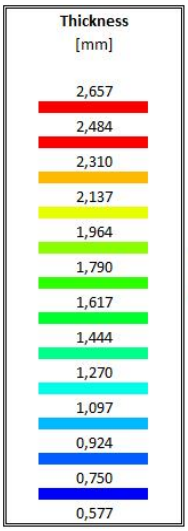

Fig. 4 – Piece Thickness

The Fig. 4 shows the thickness distribution of the piece.

A filling analysis of the piece for the original process conditions was run.

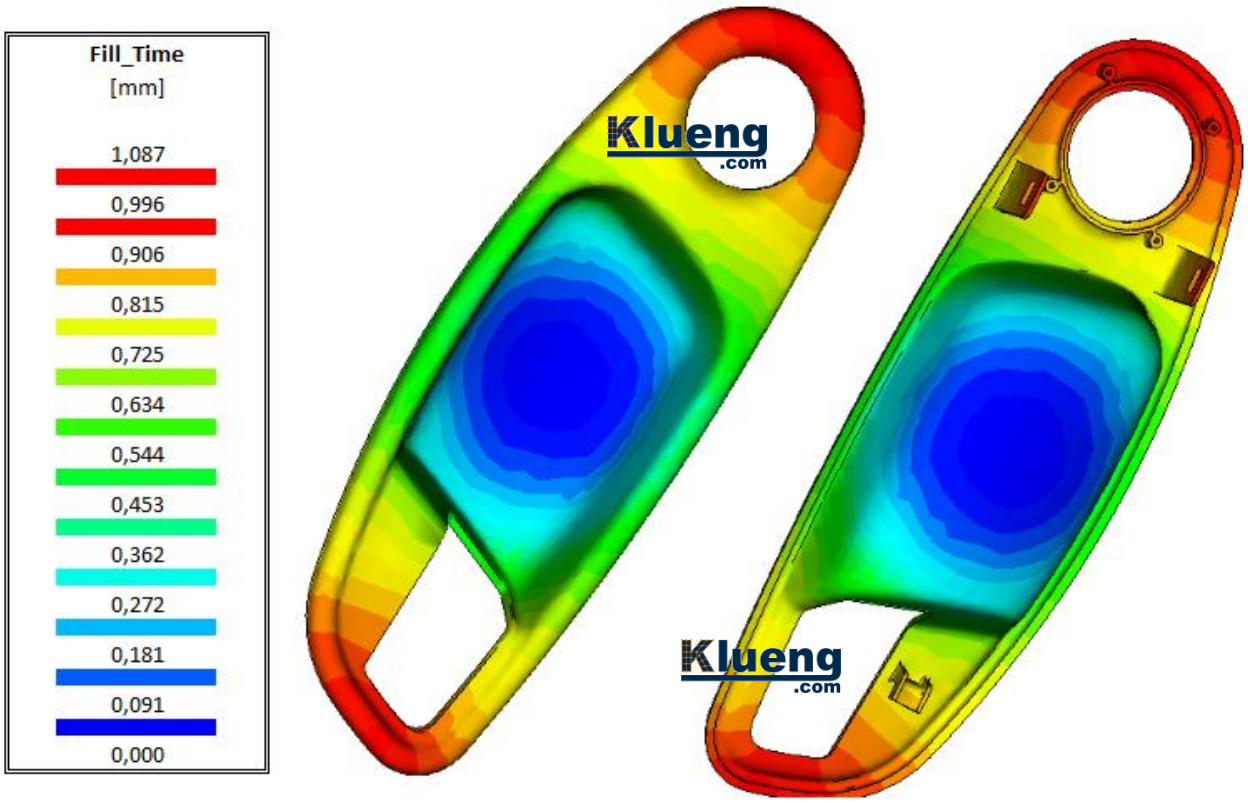

Fig. 5 – Fill time of the piece

Considering the piece geometry the filling of it is appropriate, being a balanced injection process.

The position of the original weld lines were highlighted in Fig. 6, having a weld line of significant dimension in an area exposed to the user's view and perpendicular to the reflected light (as seen by the user), which amplifies the generated visual effect with the coating finishing.

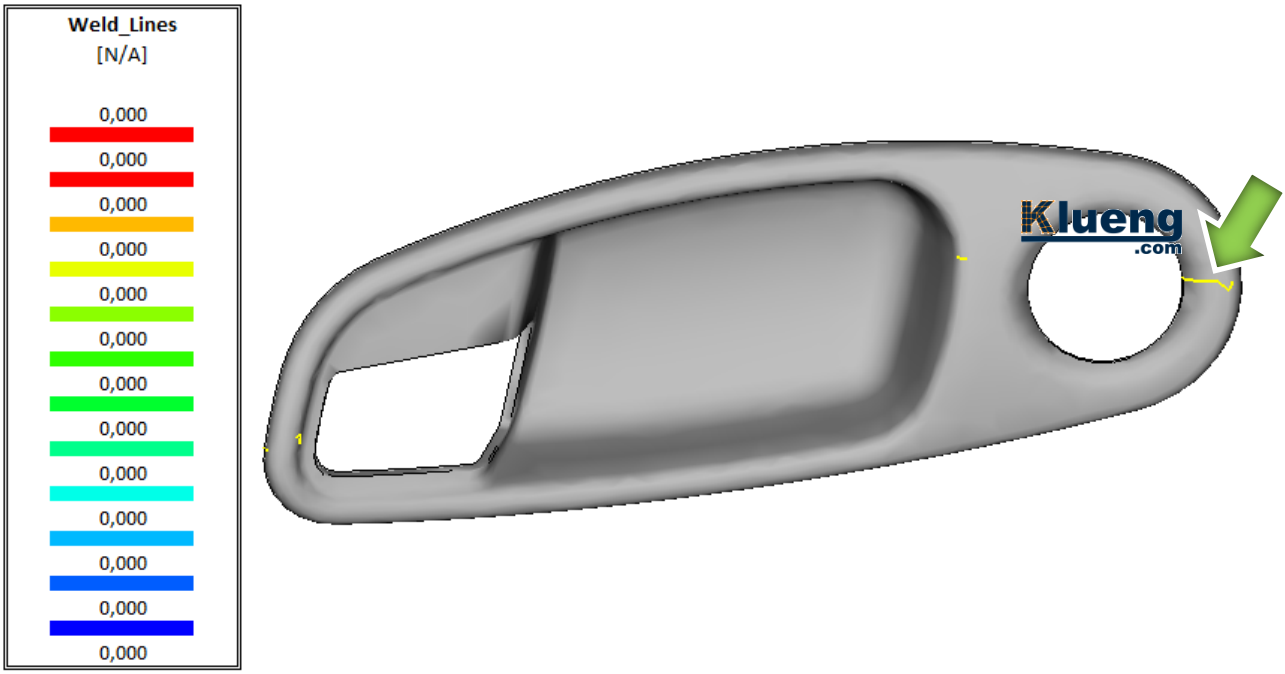

Fig. 6 – Weld lines

The completely remove of the weld line isn´t a possible alternative, but the relocation of it through a reengineering of the thickness of the piece could be possible.

The limitations imposed by several reasons, the most significant is the existence of an injection mold in production, were the following ones:

- Maximum thickness of 2.6 mm
- Gate injection location limited to the zone shown in Fig. 7.

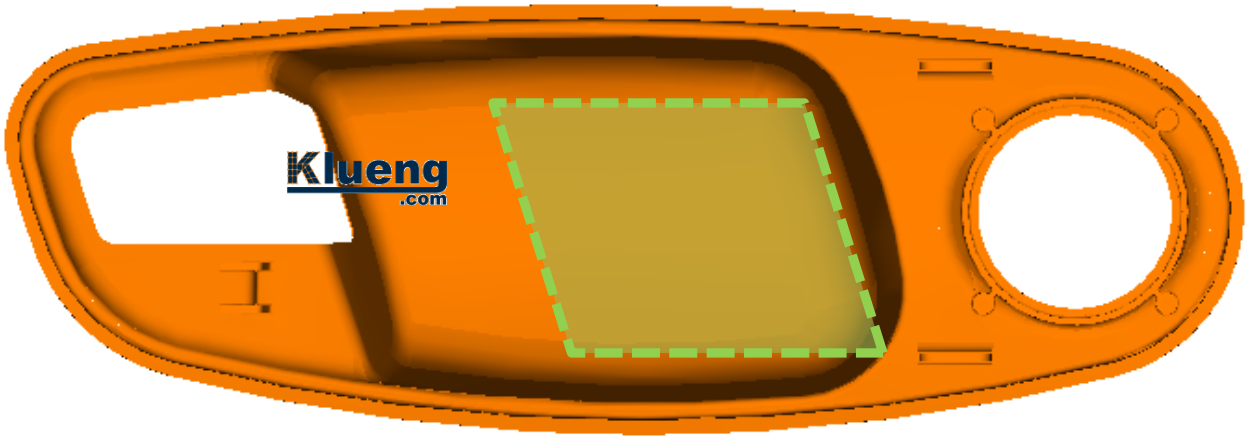

Fig. 7 – Zone available to the injection point relocation

After several optimizations runs, was reached the following distribution of thickness:

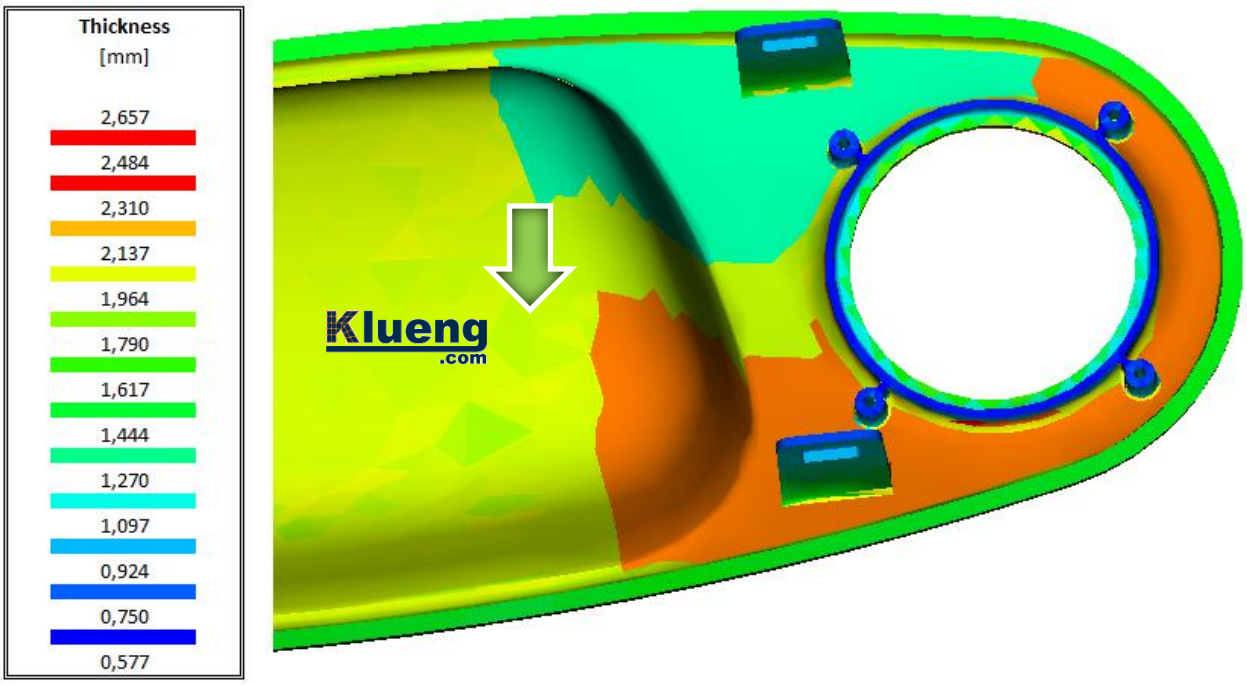

Fig. 8 – New thickness distribution and gate location (green arrow)

It was also repositioned the injection point into the target zone. Finally, the results obtained were the followings:

Fig. 9 – New position of the weld line

With the new distribution of thicknesses and relocation of the injection point was achieved the goal of the simulation, resulting in a much better position from the esthetic point of view of the piece, being the defect less noticed by the user. Furthermore temperatures and also speeds at which the material flow fronts joins were improved, resulting weld lines of better quality. The thickness variation in the piece doesn't bring visible contractions of the material.

Conclusions: The initial goal of the simulation was achieved. The weld line was repositioned in the piece being less exposed to the view of the user, is now covered by the control of the rearview mirror and in a more "parallel" position respect to the ambient light in the car cabin.

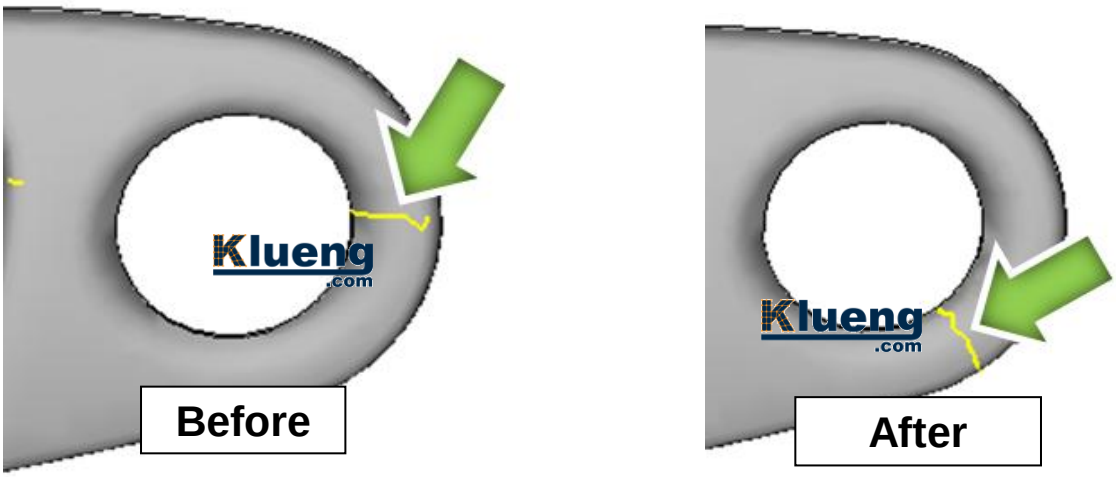

Fig. 10– Position change of the weld line

The strategy used for the relocation of the weld line brought about a slight increase in the shrinkage of the material in the area adjacent to the weld line, but within the tolerated limits, being predominant the improvement achieved in the relocation of the weld line. As in any engineering process, the corresponding commitment situation must be reached.

Finally, using the finite element method was possible to know the parameters to be modified to reach the proposed goal.

It wouldn't have been possible to perform this type of work without being able to simulate the changes made previously. The injection mold was reused and the supplier of this piece achieved the satisfaction of his client in the short term, with low investment and minimal SCRAP.