Glass cutting optimization

Quentin Viaud[1]

1 Saint-Gobain Research Paris, 39, quai Lucien-Lefranc, 93300 Aubervilliers, France
quentin.viaud@saint-gobain.com

Keywords *: Cutting and packing, online optimization, digital twin*

1 Introduction

The Saint-Gobain Group designs, manufactures and distributes materials and solutions which are key ingredients in the well-being of each of us and the future of all. They can be found everywhere in our living places and our daily life: buildings, transportation, infrastructure and in many industrial applications. They provide comfort, performance and safety while addressing the challenges of sustainable construction, resource efficiency and climate change. Saint-Gobain Glass France (SGGF), part of the Saint-Gobain Group, is one of the world's leading glass manufacturers. It specializes in float glass manufacture and magnetron coated glass producing an array of glass types with different functions: transparency, thermal and acoustic insulation, safety, solar control, decoration, self-cleaning function, etc. The products are intended for a wide variety of domestic and commercial applications including housing equipment (windows, bay windows, interior design), facade, urban development and the realization of major projects.

2 Context and problem

Flat glass is mostly produced through a process called the " float process ". In this process, various powders (sand, soda, ...) are melted together inside a large furnace in order to create a liquid glass ribbon which is spread over a tin bath and then cooled down to solidify. The obtained infinite ribbon is then cut into large glass sheets (typically 3m x 6m) called jumbos. Afterwards, these jumbos are stacked on stillages to be sent to so-called transformers. In general, these jumbos are not used such as but are most of the time recut into smaller rectangular pieces adapted to the needs of the customers. These smaller pieces of glass are cut according to a cutting pattern which satisfies a certain amount of constraints related to the customer (order, …) or to the physics of glass (guillotine which means that a piece of glass can only be cut from one edge to the other through the propagation of a crack along a straight line). A cutting plan can be seen as a paving of the jumbo by rectangular pieces of various sizes positioned in such a way that the geometrical glass losses (remaining glass surface too small to cut a new piece) are as low as possible. Actually, the jumbos are not perfect in terms of quality and may also contain punctual defects inherent to the float process. At the exit of this process, a scanner allows, for each jumbo, to establish the map of defects (position, criticity, …). This information is stored in a database which contains the map of defects of each jumbo sold to a transformer.

During the cutting process, when a defect is positioned in a cut glass piece, it is, most of the time, rejected as a quality loss. In this case, it is necessary to recut a glass piece of the same size from the jumbo. This reduces significantly the productivity of the line. To avoid this loss, one option is to adapt the cutting plan to the defect map measured at the exit of the float process and

position the defects inside the "natural" geometrical glass losses of the cutting plan instead. This talk will detail the associated industrial ecosystem and how such re-optimization is performed. We will also discuss the importance of having a digital twin of the existing system and how it can be used to drive value.