Potential savings by optimized material flow at Tetra Pak Packaging Materials AB

– A study of optimizing Automated Guided Vehicle routes

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Background

The increased global competition with constant pressure of producing fast and with short lead times requires a continuous work with improvements. As Tetra Pak Packaging Material AB (TPPM) holds a leading position in developing and producing solutions for liquid food worldwide, the company strives to improve the internal efficiency at the production site.

TPPM experienced an unsatisfied situation regarding the material flow in and around the production site. The main reason was regarding the movements between the warehouses were raw material enter, were the goods are refined and finally were the finished goods are transported (figure 1).

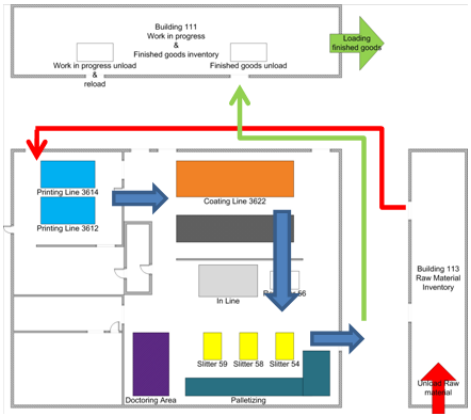

Figure 1 - Present Production site at TPPM

At the production site at TPPM all the material movements are done by Automated Guided Vehicles (AGV), a forklift without driver which is navigating by a GPS system. Since the material flow is not efficient the material is transported long distances both indoor and outdoor. This is not desirable since the material is to be used in the food industry and the hygiene aspect is crucial. In addition, the warehouse which holds finished goods are located deep into the production site which decreases the safety level since trucks enter and exit in the middle of the production site on a daily basis.

The insufficient material flow conducted by Automated Guided Vehicles at the production site, combined with a desire to restructure the production logistics through a transformation (swop) in warehouse location, have been an issue for the company for several years.

Purpose

The purpose of this Master Thesis was to map the material flow in the production site in order to find possible improvements. The questions that needed an answer where:

- *Is a change physically possible?*
- *What transformations would a change require?*

- *What are the effects of the transformations regarding the material flow?*
- *What potential savings could be achieved?*

Delimitations

When taking all aspects in consideration the project becomes very big and it has been necessary to limit the project to fit within a Master thesis.

The main focus was the issue of the internal material flow and transports. To achieve a better flow through the production the efficiency would increase and waste could be reduced. Both the AGV's and the manual transports would be highly affected by a transformation in the warehouses, and potentially reduce costs for Tetra Pak.

Methodology

The thesis is a dynamic, logistical project with several depending factors which needs to be considered at the same time and a solution will be specific for Tetra Pak Packaging Material Lund AB.

A target was also to provide information of a practical solution in order to ease future implementation. The information was gathered as a mixture of quantitative and qualitative approaches, as information was extracted by databases and similar as well as through personal interviews. Also observations at the production site along with case studies of the Automated Guided Vehicles were necessary to determine the present situation. The different ways of gathering information is assumed to increase the credibility of the thesis.

Theoretical framework

The thesis was relying on three different theoretical frameworks which have a concrete connection to movement and waste in production environment. The well known LEAN production philosophy's[1] was used regarding waste (time, defects etc.). In order to measure performance of the AGV's the Overall Equipment Efficency (OEE)[2] key performance indicator was also used as a supportive framework to break down smaller parts of a problem and distinguish deviations.

These two highly theoretical frameworks were then supported with theories of alternative material handling methods.

Conclusions and recommendations

With a deeper knowledge of the situation at Tetra Pak Packaging Material AB this Master Thesis reveals that several improvements can be made in order to optimize the material flow.

A restructuring of the two considered warehouses is possible, which leads to an optimized route for both internal and external transports of goods, see figure 2.

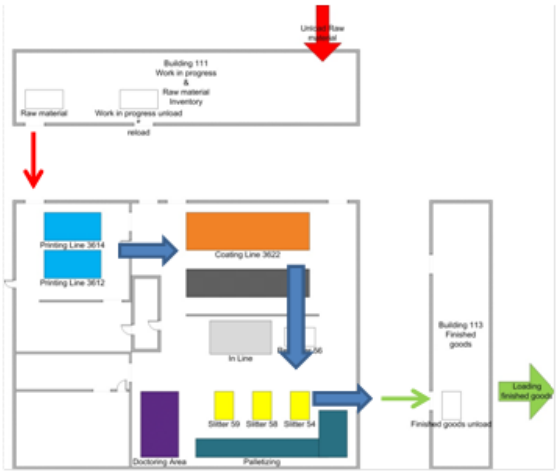

Figure 2 - Possible layout of production site

During the thesis difficulties regarding the material movement in the last step of production were discovered. The major problem was a garbage terminal with entering trucks that interfered with the AGV routes for material handling, see figure 3. The situation led to different alternatives of how to manage the problem in the most efficient way. The decision was to enable the material flow without any interfering with in or outgoing trucks along with a possible cut down of operating AGV's, see figure 4.

[1] Taichi Ohno. Toyota Production System, Productivity Press, 1988.

[2] Eric Ståhl. Industriella Tillverkningssystem, första upplagan, serie 4. Sid 68-69.

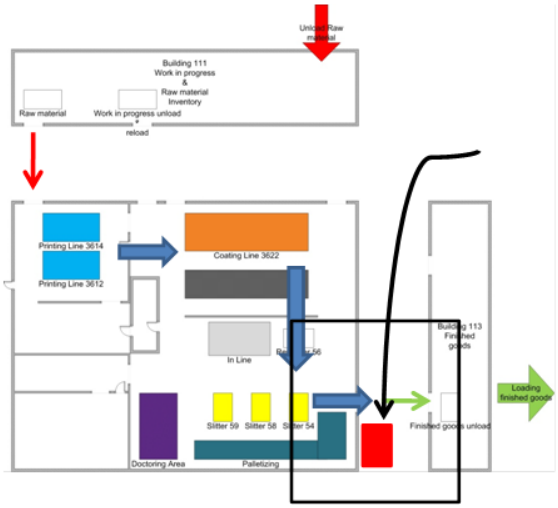

Figure 3 - Location of garbage terminal

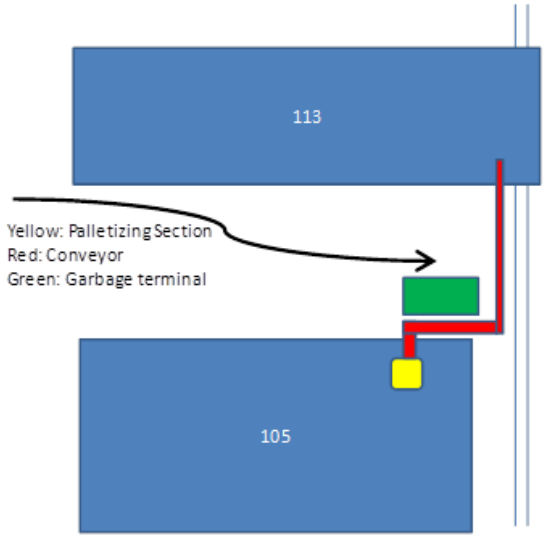

Figure 4 - Suggested route of material movement

The improvements of the material flow along with a possible AGV cut down enables potential savings at TPPM.

The savings can be divided into three main categories as the optimization cover several areas:

- *Economical*
- *Environmental*
- *Safety*

As each AGV brings cost to TPPM a cut down of number of required vehicles at the production site will of course have a positive impact on savings. Also shorter roads will give reduced maintenance costs of the roads.

Although economical savings is crucial for the new layout, the environmental and safety benefits will be important factors for the future. The reason of why the environmental and safety improvements are important is related to the World Class Manufacturing (WCM)[3] work at TPPM. The aim of the WCM is to prioritize safety and environment with a high quality focus. With a reduced number of operating AGV's and shorter distances at the production site, less attrition on the roads occurs. Less attrition means that a better maintenance level will be able on the roads. A prevention of accidently transporting dirt and dust into the production with the AGV's will then be possible.

With an optimization of the routes less AGV gates will be used which is another source of incoming dirt into the production. These benefits will have ha high value to TPPM as the hygiene level is high due to the food packaging production. The new layout provides a solution where the AGV's will not interfere as they do today with the present layout. Other important improvements with a new layout is the possibility to reduce AGV gates and thereby accidents related to insufficient visibility. This will be an important progress in order to improve safety for employees at the production site and it cannot be valued in money.

[3] TPM Activity Report 2010. Tetra Pak Packaging Material Lund AB