Improving waste management at Toyota Motor Manufacturing (UK)

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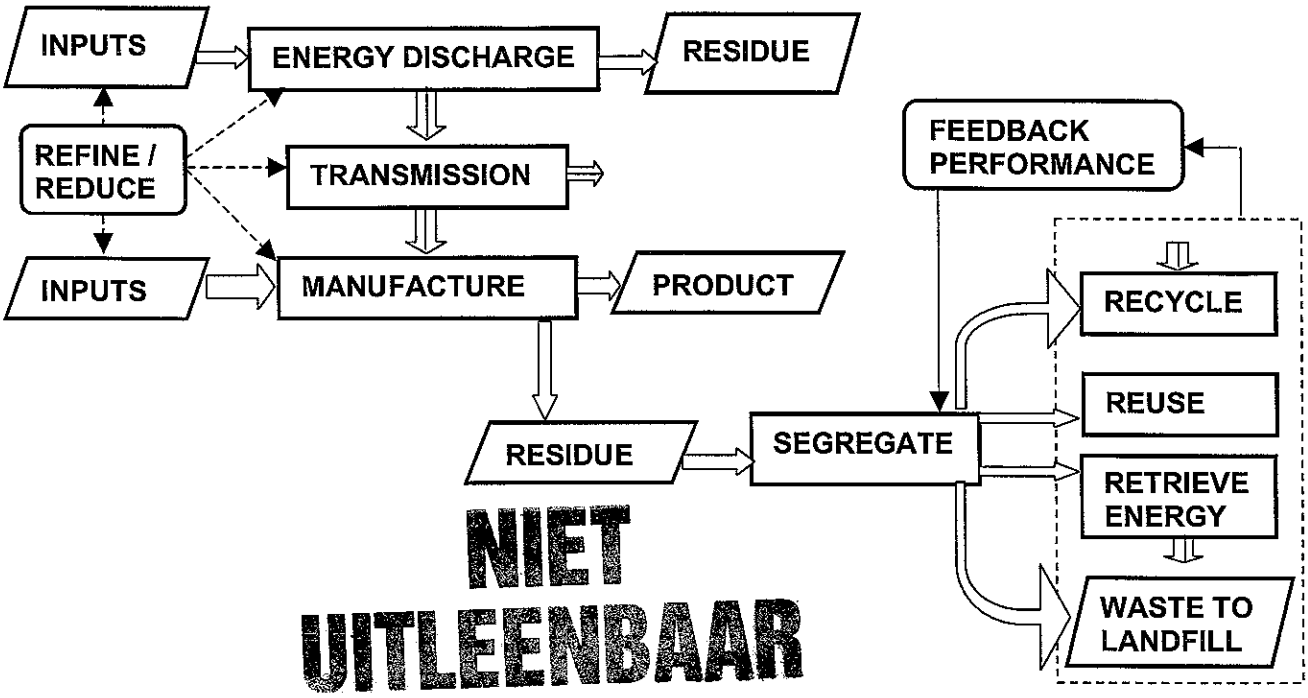
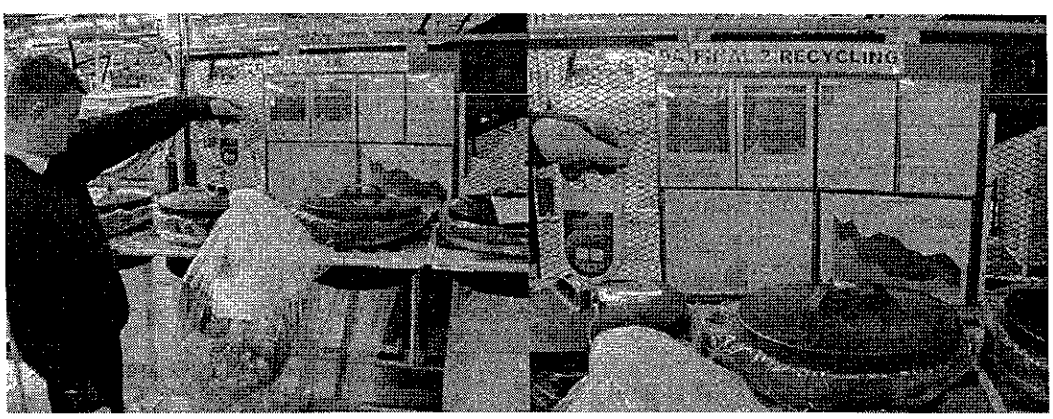


Achieving Zero waste to Landfill in assembly 1 through Empowerment



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Burnaston, Derbyshire
2000 / 2001

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Improving Waste Management

at

Toyota Motor Manufacturing (UK)

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Abstract

This report describes a nine-month waste reduction project that has been carried out at Toyota UK Ltd. During the project shop floor members were empowered and involved in redesigning waste management systems. By letting these members perform their own data collection and create their own feedback reports, a tight and fast control loop has been created. These activities resulted in a 46% reduction in waste to landfill for the Avensis assembly shop and a high segregation quality for recyclable and / or reusable residues.

Executive Summary

The Toyota Motor Corporation (TMC) was born in Japan in 1937. Toyota brought the ideas from the Ford Conveyor belt to Japan, and adjusted them in order to better suit the Japanese environment. The mass production ideas were converted into a more flexible production system, in order to more directly respond to the customer's requirements. Set up times were minimised and inventory was reduced as much as possible. After initial success with The Toyota Production System in Japan, the first overseas plant was set up in Brazil in 1959. After this first global step was taken, expansion increased fast in Africa, South America, South East Asia, Australia and North America. It was not until 1990 that production was brought to Europe. Both an engine plant and an assembly plant were opened in the U.K. to produce cars for the European market.

Throughout its history, Toyota has been dealing with environmental issues, as for example pollution reduction or resource conservation. Initially the individual plants were mostly responsible for their own environmental performance and complying with local regulations. But in 1992 TMC started giving more direction and created the first Toyota Earth Charter to consolidate the environmental performances of the different plants worldwide. Every plant had to create a five-year action plan in which they showed what their environmental targets were and how these would be achieved. The first action plans ran from 1996 to 2000. In 2000 a new earth charter was released, stating that Toyota had now become one of the leaders in environmental management in the car industry, but this was not sufficient. New goals were set to further improve environmental performance and environmental issues were said to be the highest priority for the company.

One of the main issues of the new Toyota Earth Charter is also the main topic for this Master's thesis; "Zero Waste to Landfill". There is less and less space for new landfill sites in different countries and new laws on waste to landfill will be introduced in the future. TMC has planned to achieve zero waste to landfill for all its Japan plants in 2002 and also Toyota U.K. is working hard to achieve the zero waste to landfill target. In 2000, the assembly plant of Toyota U.K. sent 1802 tonnes or 10.6 kg /car of waste to landfill. A breakdown of this figure is shown in figure 1.

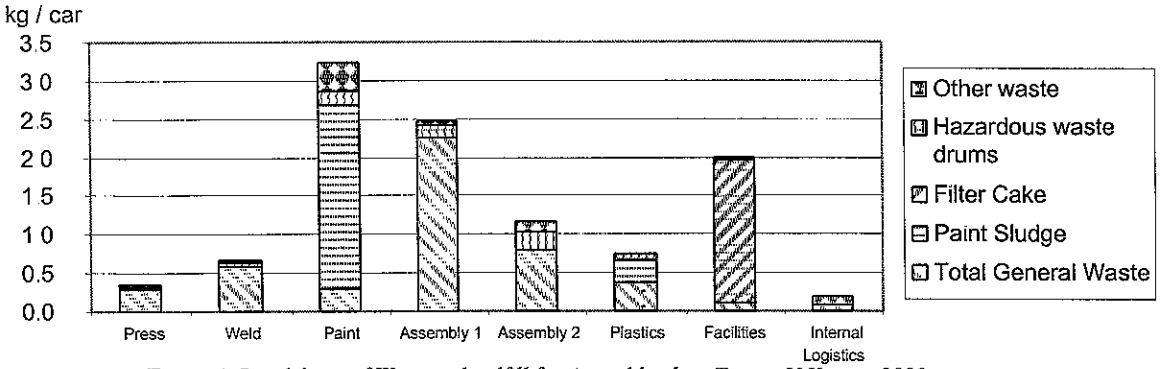

Figure 1 Breakdown of Waste to landfill for Assembly plant Toyota U.K. over 2000

Three different areas are responsible for more than 70% of the waste to landfill from Toyota U.K.'s assembly plant. Paint shop's main waste stream is paint sludge. In order to effectively paint the cars, it is required to have a certain amount of paint that does not hit the car; over-spray. This paint is washed off the floor of the spray booth with water and chemicals. The resulting substance is called paint sludge, consisting of a high percentage of water. This waste stream can be reduced by different strategies, for example further optimising the effectiveness of the robots, reducing the water content in the paint sludge or recycling the paint sludge. The paint industry

would be best capable of processing the paint sludge and reusing it as a substance for new paint. But this would only be beneficial to the paint industry if large amounts of paint sludge were being returned to them. Currently, the paint industry is not willing to take the paint sludge from a single company, therefore, future discussions between the paint industry and industries using the paint are required to set up recycle activities for the paint sludge.

A second big waste stream is the filter cake from facilities. The filter cake consists of residues from the wastewater treatment plant. Water from different areas of the plant (mainly from the paint shop), is fed to the wastewater treatment plant. At this plant, the water is treated with chemicals. The chemicals bind the different substances in the water into "filter cake" which is sent to landfill. It might be possible in the future to recycle the filter cake by using it for example in cement.

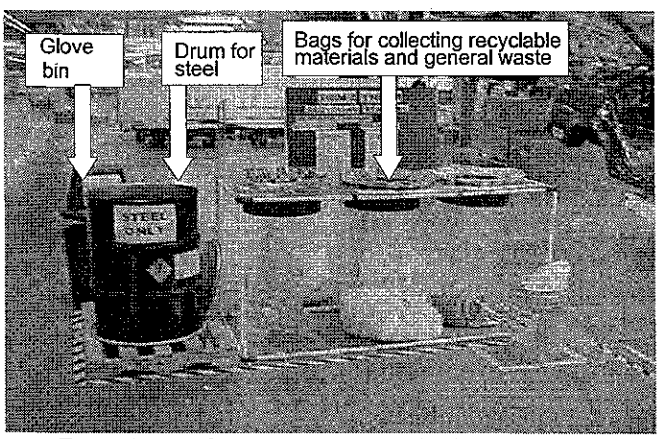

Figure 2 Recycling station at Toyota (UK)

The main waste stream in other shops is general waste. General waste is non-hazardous waste that is sent to landfill and for which no further breakdown over time is available with regard to material content. Before 2000, the general waste consisted of large amounts of recyclable materials. During the last months of 1999 and first months of 2000, recycling stations had been built for each line in the assembly shops (see figure 2) in order to segregate recyclable materials and separate them from the non-recyclable general waste. Although there was a significant reduction in general waste after the recycle stations were set up, assembly 1 still had high general waste figures (see figure 3).

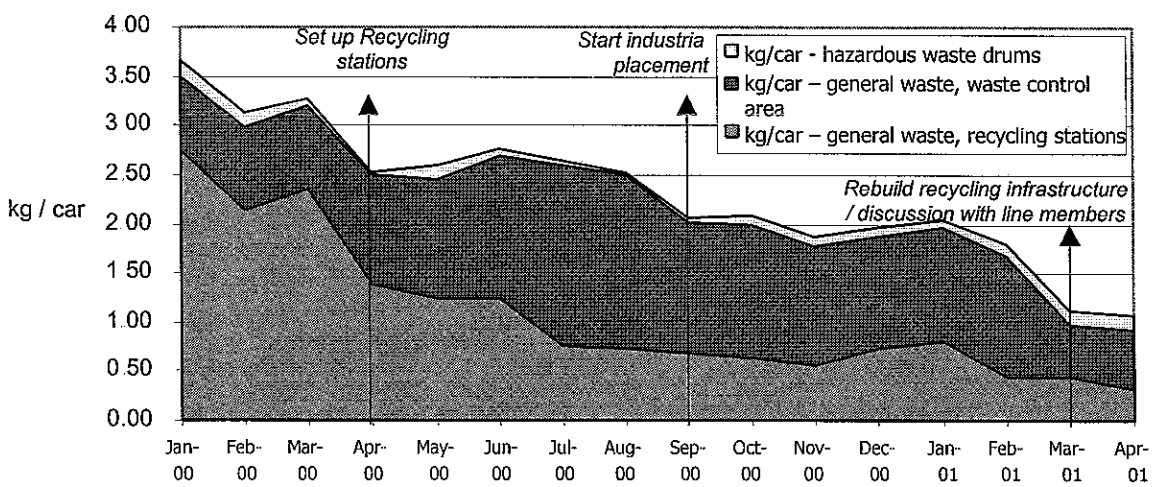

Figure 3 Waste to landfill in Assembly 1 from Jan. '00 to April '01

The total amount of waste to landfill can be broken down by distinguising three waste sources (see figure 3). Most of the waste to landfill at the start of the project came from the waste control area. This waste stream had already been a significant part of the waste to landfill from the assembly shop before the recycling stations were set up, but had increased after April 2000.

The waste control area is an area in the back of the assembly shop, where the different residue materials from all over site are collected and initially processed (mainly packaged for transport). In this area there is a landfill waste cart, in which the general waste from the waste control area is placed. According to the standards, no waste should be placed in this cart besides floor sweepings from the waste control area. But in reality large amounts of waste are placed in this cart. The amount of waste from this area is highly variable (see figure 4).

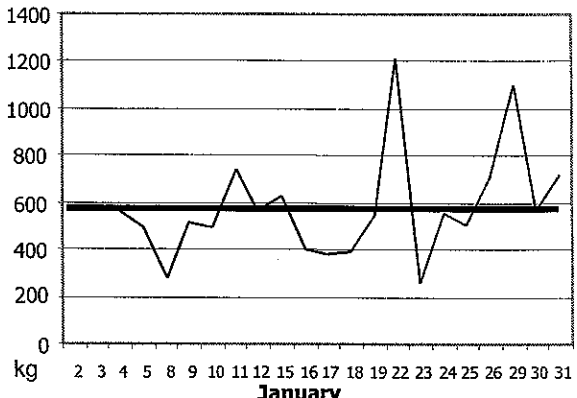

Figure 4. Variation of waste from WCA

The main sources for the high waste in this area were waste from cardboard cages, bags of recyclable materials that contained contamination and segregated recyclable materials that were not picked up by recyclers and were placed in the cart.

In most shops, there are different cardboard cages, in which only cardboard should be placed. But before the start of the project, members also put different residues in the cardboard cages, which then ended up in the waste control area and were sent to landfill. Also bags of recycled material that were not perfectly segregated mostly ended up in this cart. Finally, it occurred that recyclers were late in picking up residue materials and that there was no space any more to store the residues and that these were therefore sent to landfill.

The residue segregation and waste reduction processes were being managed by using non-conformance notes, by auditing the recycling stations and by tracking waste data. A non-conformance note is written out if a bag is found that contains different recyclable materials. After a note is written out, the line should segregate the bag before it will be picked up.

After both the residue processing and the management of residue processing were analysed, the systems were then redesigned. Redesigning the systems was done together with shop floor members that manage the segregation processes on a daily basis; the recycling window members. Ideas were generated by the window members, the Environmental Affairs department and line management. All ideas were discussed with all three parties until the ideas were understood by all parties and consensus was achieved. The redesign was carried out in three stages, redesign of the processes, redesign of the control instruments and redesign of the information flows.

Redesign of segregation processes

A localisation strategy was set up in order to more focus on line side segregation. Whereas before the output was controlled (recycling station) now the focus went to the processes (line side segregation). Small recycling stations of one or two bins were built next to the processes in order to give the team members more responsibility for the recycling activities. All the bins were made transparent with a picture on the bin for clear visual control. All black and yellow bins were removed. One of the main reasons for using the localisation strategy was to make it easier for the members to place the residues in designated bag, instead of placing them in a black bin or in the cardboard cages. After the line side segregation was improved, a strict non-conforming policy was set up for the cardboard cages. But because the improved infrastructure was effective, there was little need for non-conforming cardboard cages.

Redesign of control instruments
By making all line side segregation transparent, it became easier to control the line side segregation, but in order for the visual control to be effective, there need to be members who check the segregation. Therefore the minimum job standards for the team leaders were updated to have the team leaders check the segregation on a daily basis. But controlling the current residue segregation only controls items that are currently being segregated. In order for the system to become more learning and adaptable, also general waste was tracked. The general waste tracking can be used for controlling the general waste in two ways (see figure 5).

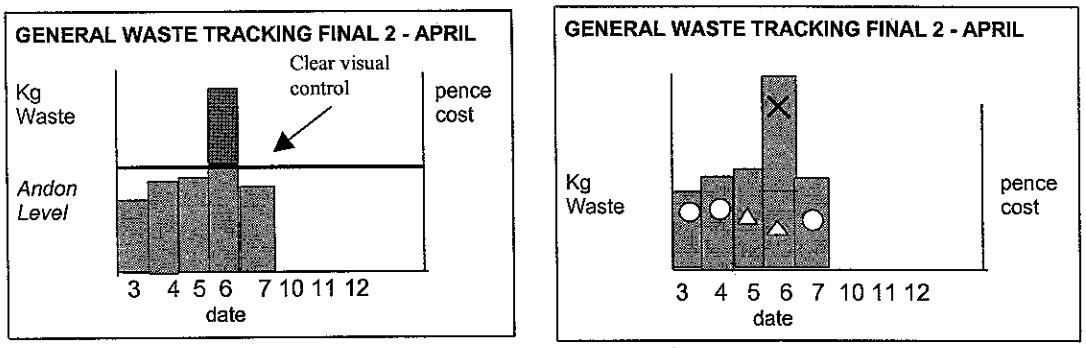

Figure 5 Two possible ways of using general waste tracking for controlling the waste level

If the general waste figures are stable over time, a critical level or 'Andon-level' can be determined. If the waste figures are higher then this Andon level then the window member and / or group leader should take action to reduce the waste. Another possibility is to evaluate every bag of general waste that is measured (see right figure). A cross means that multiple recyclable items were found in the general, a triangle means that only general waste and cups and cans were found and a circle means that the general waste only consists of non-recyclable waste. If the general waste figures for a line are variable, then the second strategy seems most applicable. The first strategy (Andon line) can be used if the general waste levels are quite stable over time and also if the daily data is grouped into weekly data, which is in generally more stable over time.

Redesign of information flows
The main change in the information flows was feedback to the line members on a monthly basis. Both the general waste info for a line and the recycling station audit information for a line, are placed on the recycling station control board. The group leader should go the control board once a month and discuss the results with the line members. Also, the general waste information per line can be used by the senior group leader, manager or Environmental Affairs department in order to determine how much each line contributes to the total amount of general waste.

Although reduction of general waste was the main topic of the project, also project were carried out to reduce hazardous waste and to reuse certain residue materials (part accessories). With all the projects, a total cost saving of £ 79,451 per year was achieved (see table 1). The achieved reduction in waste to landfill (in kg) in Assembly 1 was 46% (April '01 vs. Jan '01).

Table 1. Total achieved cost savings

Reduction of butyl drums (hazardous waste)	£ 1,618 / year
Reduction of urethane waste (hazardous waste)	£ 23,643 / year
Reduction of general waste (non-hazardous waste)	£ 11,400 / year
Reuse of part accessories (residue material)	£ 42,790 / year
TOTAL	**£ 79,451 / year**

Conclusions

C1 Segregation of waste is not a top priority on the shop floor of Toyota U.K., changing this is very difficult. There are three main reasons for this. Firstly, Toyota U.K. is far ahead of the legal requirements and therefore there is no legal reason for further reducing waste. Secondly, the total cost savings that are obtained by recycling are relatively small compared to the total costs the company is dealing with. Thirdly, many members can influence the segregation quality and controlling it is a complex task.

C2 Before the start of the project 65% of waste to landfill from the Avensis Assembly shop came from the one single cart that was remaining in the shop.

C3 Before the start of this project, line members and group leaders had not received any feedback on the waste reductions that were achieved with setting up the recycling activities.

C4 Participation of shop floor members in redesigning waste management systems has been very effective. Many shop floor members showed a good understanding of the problems with the recycling activities and came up with ideas how to improve the recycling.

C5 Recycling stations audits and writing out non-conformances are only effective as tools for controlling the segregation if they are fed back to all line members by the group leader, since all the members on a line can influence the segregation quality.

C6 The waste contractor, Stirchley Technical Services, that is responsible for picking up waste in the different shops can have a big influence over the waste figures if they do not carry out their job according to the standards.

Recommendations

R1 For the waste tracking to be more effective, weekly general waste figures per line should be placed on the new control board that is being used in assembly shop 2 and will become the new standard control board for lines An 'Andon' line should be determined, which should trigger waste reduction activities.

R2 Recycling window members should not be held responsible for the quality of segregation and waste figures of a production line. Instead the whole line should be responsible and waste figures and recycling stations and waste area audit information should be fed back to all the line members by the group leader.

R3 Environmental Affairs should monitor the general waste figures from the Waste Control Area on a weekly basis. If the amount of general waste from the Waste Control Area exceeds a set target ('Andon line') then Environmental Affairs should investigate the increase in waste and set up countermeasures accordingly.

R4 When the waste figures for assembly shop 1 are sent to the shop manager, the figures should distinguish between the general waste from the recycling stations and general waste from the Waste Control Area.

R5 If there is a waste non-conformance note written out, then Stirchley Technical Services should leave a copy of the non-conformance at the group leader's desk or give it to the group leader. The group leader should brief his shift about the non-conformance and hand it to the opposite group leader, who should do the same for his shift.

R6 The processes of segregating waste into the right bin should be put into the Job Element Sheets when new car models are introduced, in order to make the segregation one of the standardised tasks that have to be carried out by the members.