Summary

This research was carried out for Hunter Douglas a major worldwide manufacturer of window coverings and architectural products. One of Hunter Douglas's main European production sites is located in Kadan, Czech Republic. This factory consists out of a number production and assembly departments. One of these departments is the powder coating facility which powder coats aluminium profiles and small parts for a number of assembly units in Kadan. The powder coating department copes with a relatively low output compared to the average accepted output in the powder coating industry. The initial goal set by the management in Kadan was a minimum production of 28m² of coated surface per shift per operator. Because of the complexity of this particular value it was decided to work with a new defined target. Based on a comparison between the initial target and the output of the system in the first 4 months of 2011 the decision was made to attempt to decrease the average process time with 13%.

Powder coating process can be divided in 5 separate sub-processes: hanging, pre-treatment, painting, baking and unloading. The aluminium parts will enter the system at the hanging process where they are attached to a rail system by a set of hangers. These hangers will carry the parts through the following processes. After the hanging the parts will be cleaned in the pre-treatment facility. At this step the parts will be lifted by a crane and dipped in 5 different baths. The pre-treatment process ends with an oven drying the cleaned parts. Hereafter the parts will enter a painting cabin where they will be sprayed with a layer of powder. The powdered parts will then enter another oven where the baking process takes place. At the end of the baking process the parts will be taken out of the oven and will be unloaded onto carts from where they will be collected by the operators from their destination departments. The analysis of these subsystems indicated that the limiting factor of powder coating system in the current situation is the pre-treatment process. With a maximum output of 32 traverses per shift the output of the pre-treatment process remains far behind the output of the other processes.

process	Traverses per shift
Hanging	120
Pre-treatment	32
Painting	60
Baking	57
Unloading	96

The crane (carrier) of the pre-treatment facility most of the time delivers only 4 traverses per hour where it should deliver 7 to match the pace of other processes in the system. Despite the fact that in the past extra capacity is made available on the carrier to transport multiple traverses simultaneously, this extra capacity is left unused because of a lack of proper equipment and work instructions. In the current situation the great majority of the hangers aren't suitable for simultaneous transportation on the carrier because of their size and shape. When occasionally two sets of hangers could be fitted on the carrier simultaneously, the operators at the hanging process fail to feed the pre-treatment process with the hangers in the correct manner because of a lack of work instructions.

In the broader sense the current problems in the powder coating system are created because of the absence of function and process controls at the hanging and pre-treatment processes. To solve these problems the current hangers were analyzed and modified so that extra capacity on the crane carrier could be used. However it once again became clear that the new equipment was not used correctly because of the absence of clear guidelines and work instructions in the hanging and pre-treatment processes.

Therefore a planning program was designed which will act as the function control for both the hanging and the pre-treatment process. This program receives the order data as input and will with the help of the newly designed hangers calculate the best possible profile hanger combinations to minimize the number of traverse for each particular order. The calculations results should be used as work instructions for the operators at these two processes. To have the planning program up and running several changes have to be made in the production facility. However before the changes can take place the program was already tested and the results were compared with the current performance of the system. To avoid the model from getting extremely complex from the start, the decision was made to only analyze the order which only contained profiles. Thus the profiles containing small parts were left out of the equation. Despite the fact that the mathematical model in the program was only capable of handling 33% of the total orders (orders which only contain profiles) the results of a 9 days testing period showed that the planning program is able to shorten the overall process time with 5.7%. This number is lower than the required 13% set the beginning of this report. However the results show a reduction of the process time with 30% compared to the actual process time of the analyzed orders (33% of the total).With the addition of the small parts in the mathematical model the other 67% of the orders can be analyzed and planned in the same way. The expectation is that such an expansion of the program will have proportional positive effects on the system.