# PROPOSAL OF PRESSING PLANT ORGANIZATION USING PROCESS DESIGNER

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***Keywords:*** production process, optimization of space, Process Designer
***Abstract:*** This contribution is focused on optimizing the usage of space in the production process using software Process Designer. The aim of this contribution is to suggest possible improvements to the existing layout of the selected production process. Using the software Process Designer was chosen production process created in the 3D environment. Subsequently, we have proposed the possible solution of weaknesses in production and this proposal was again created in the 3D environment.

## 1 Introduction

Production, deployment and optimization of workplace are an important part of the production enterprise. Today every enterprise is trying to optimize and improve the production. Through these processes enterprise becomes faster [2]-[9]. The aim of this paper is to optimize the workplace through Tecnomatix – Process Designer.

## 2 Characteristics of pressing plant and component for optimization

Automotive Plant is a major part of the automotive industry chain, where is performed the production of different vehicles types in certain production facilities. Production of vehicles, i.e. basic principles and procedures in production are relatively uniform across all producers. Automotive Plant consists of the following operations [7]:

1. Pressing Plant,
2. Welding Plant,
3. Paint shop,
4. Assembly,
5. Control.

We focused on one part of the production facilities, on the Pressing Plant. Pressing Plant is the first operation in the Automotive Plant (Figure 1).

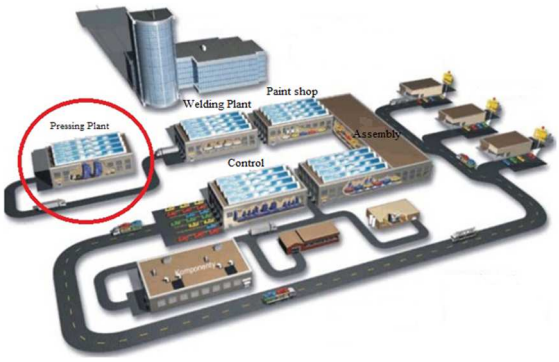


*Figure 1 The main operations in the automotive industry*

In this operation there are produced different body parts either external or internal, for example roof, doors, flooring parts, splash-board, etc. [6].

The main inputs and outputs in the production process of the front splash-board are shown in figure 2 [4].

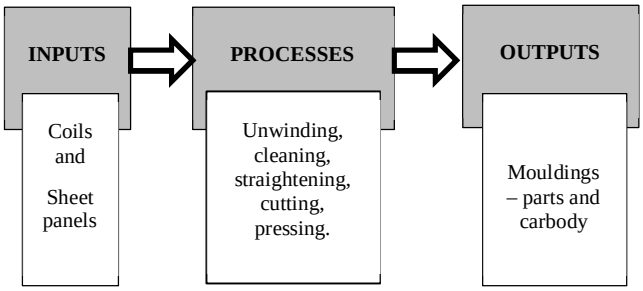


*Figure 2 Inputs and outputs of production process*

The front splash-board is the part of car body, whose function is mainly to cover up part of the inner wheel curve and splash-board and to protect bogie components against external influences. From an aerodynamic point of view it is very important the panel, which by its shape and location serves the function of bypass air abstraction when the car is in motion, because around wheel curves and wheels themselves are places with a strong division and resistance to air flow. In figure 3 it is shown a 3D model of the outside front splash-board for Audi A6.

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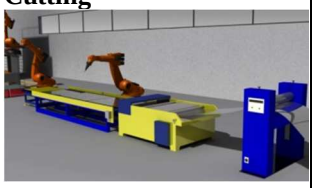
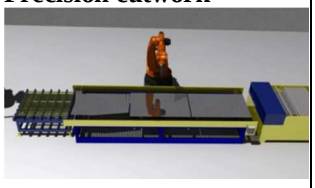
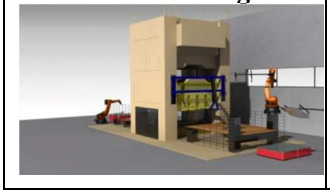
*Figure 3 3D model of the outside front splash-board*

## 3 Technological process of production and material flow

Technological process of production of the outside front splash-board from aluminium alloy Al – Mg with marking 5050 is shown in table 1 [8].

*Table 1 Technological process of production of the outside front splash-board*

| | | |
|---|---|---|
| **Sheet straightening**  | Sheet straightening on the levelling devices due to the persistence of shape deformation after sheet unwinding. | Levelling machine |
| **Cutting**  | Sheet metal cutting to size 1250 (w) x 1800 (l) by table shears embedded in the straightening machine. | Table shears |
| **Precision cutwork**  | Cutting the profile of semi-product for further laser beam processing. | KUKA HA – 100 (High Accuracy) |
| **Sheet metal forming**  | Sheet metal forming through mechanical forming technology. | Press ŽĎAS – EBS and DBS |
| **Precision trimming**  | Trimming of allowances for forming. | KUKA HA – 100 |

Material flow comprising the production of components consists of the stages shown in figure 4.

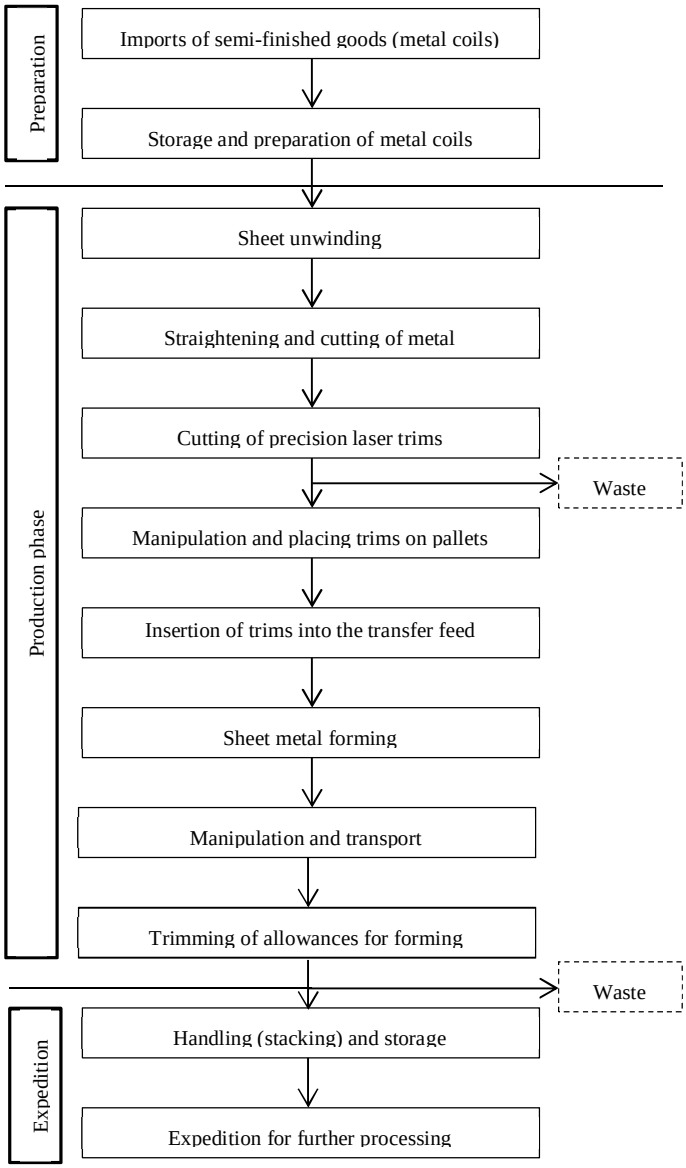



*Figure 4 Material flow*

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## 4 Layout of the enterprise

Material flow in this case starts with import (resp. delivery) of sheet metal rolls into the production plant, where they are stored and prepared for future operations. After delivery and preparation of the semi-finished product are sheet metal rolls with the unwinding devices unwind and they are then straightened in the straightener.

Together in the straightener are integrated table shears, with which material is divided into metal sheets with a thickness of 0.7 mm and dimensions 1250 x 1800 mm. After cutting, occurs laser cutting of trims, which are then fed into the press feeder, where trims are shaped. After forming, the mouldings are trimmed and cut out to the exact shape, from which are then exported for further processing. The layout of the Pressing Plant is shown in figure 5.

Given the character of the contribution we will not further describe each step to create workplace in Process Designer, while workplace, i.e. Pressing Plant and distribution of individual workplaces can be seen in figure 6.

The last part of this program is the creation of Pert Viewer for the selected department (Pressing Plant). This diagram shows the duration of the splash-board production, respectively the duration of every workplace (stations) and their individual operations (Figure 7).

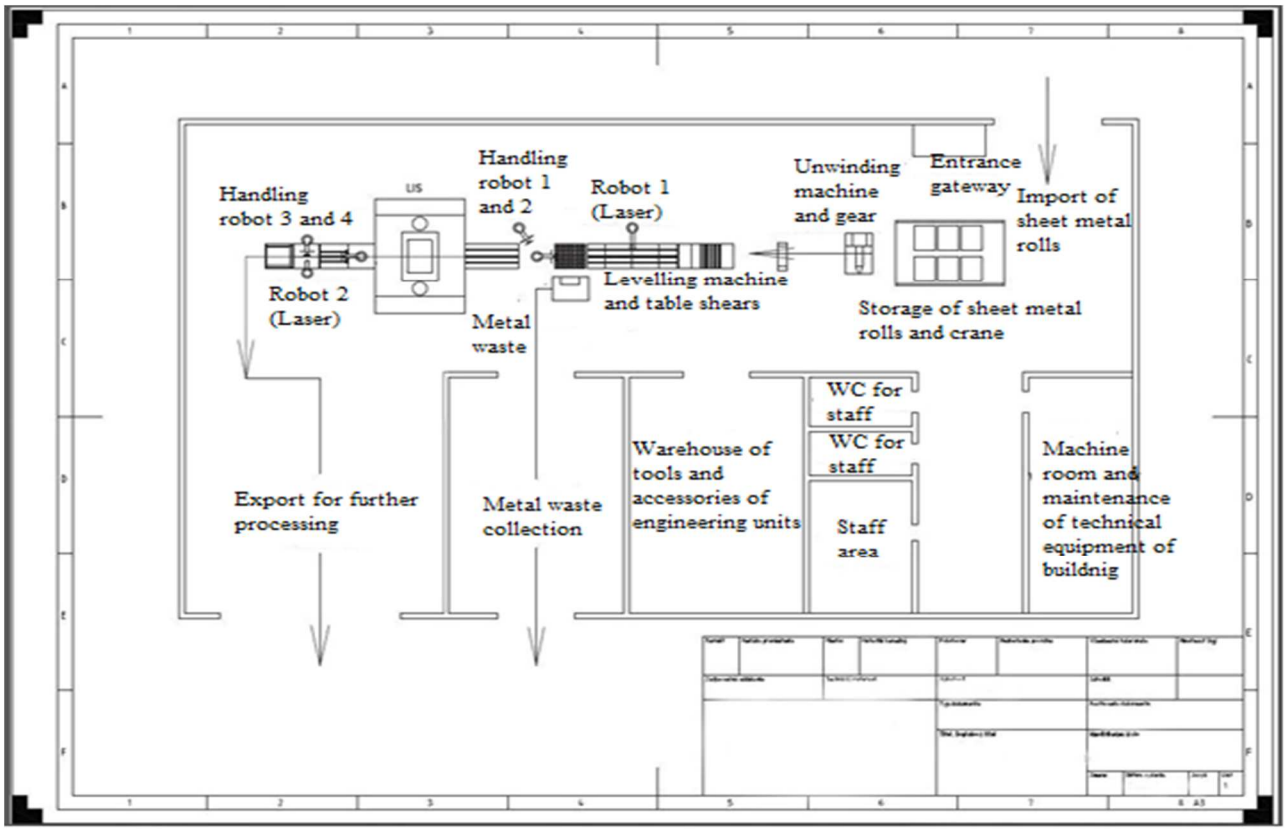


*Figure 5 Layout of Pressing Plant*

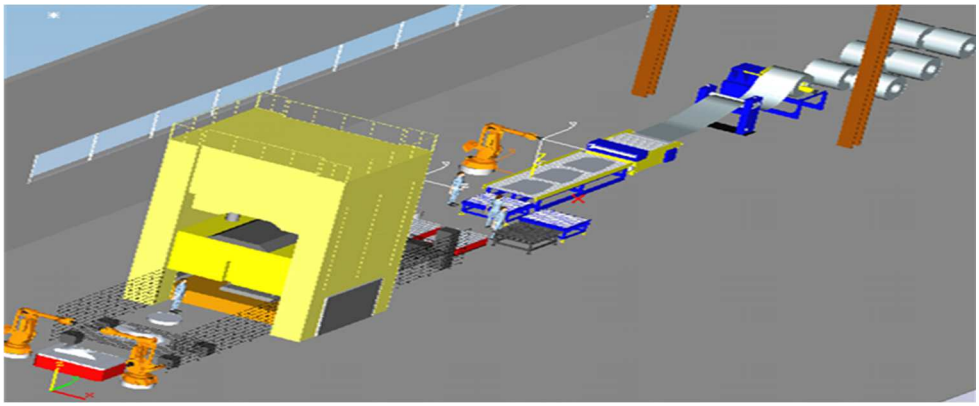

*Figure 6 Pressing Plant in Process Designer*

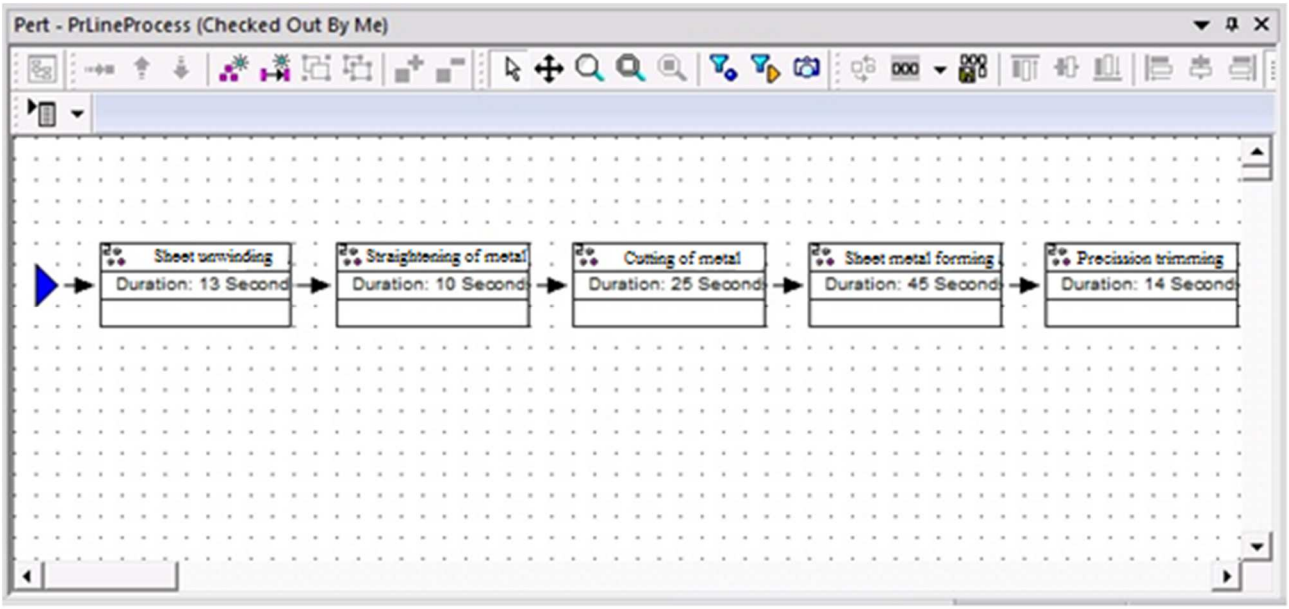


*Figure 7 Pert Viewer – before optimization*

## 5 Proposal of workplace optimization

As the Pressing Plant is not fully automated, and at individual workplaces are located workers, the production time of the splash-board is longer than with fully automated lines. On the non-optimized workplace is the duration of the production of the front splash-board 107 seconds. On the Pert Viewer (Figure 7) we can see, that the longest duration is on the station of sheet metal forming, i.e. concretely 45 seconds. Therefore, optimization will be focused on this station.

For this reason, we propose the replacement of, workers with robots and then the unification of conveyors.

This change will have a positive impact on the whole production process of the front splash-board. The replacement of workers with robots will mean that the duration of the sheet metal forming will be about 20 seconds shorter. This can be seen in figure 8.

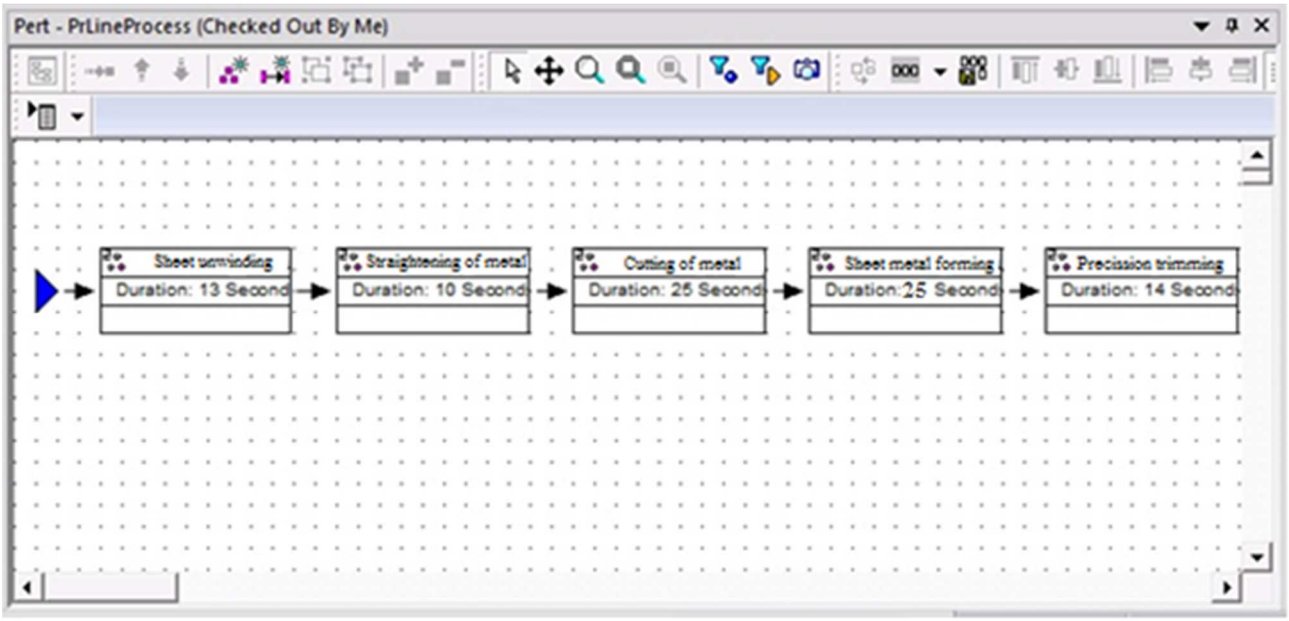


*Figure 8 Pert Viewer – after optimization*

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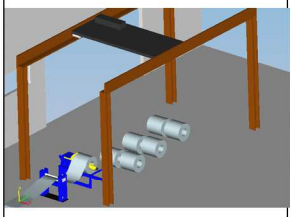
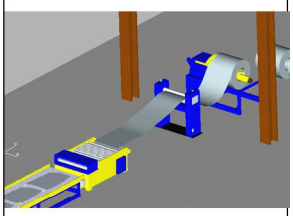
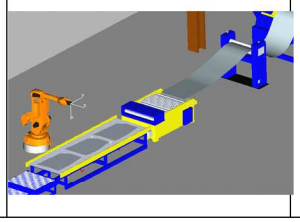
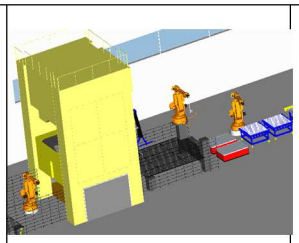
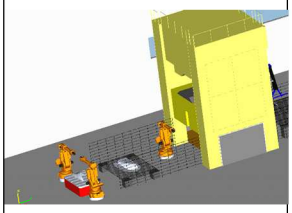
In this workplace we had to create a place for two robots and uniform conveyors. With the realization of this change we have achieved:

- Increased productivity.
- We removed defections associated with the production.
- Production is flexible.
- We reduced the operation duration in the workplace

Table 2 shows the individual workplaces, in which are realized certain operations, operation visualisation and duration of operation before and after the workplace optimization. From Tab. 2 we can deduce that the optimization in terms of workplace layout and the replacement of workers with robots resulted in shortening of the production time of the front splash-board in the Pressing Plant about 20 seconds [8].

*Table 2 Duration of operations before and after optimization*

| Workplace | Visualisation of operation | Duration of operation | |
|---|---|---|---|
| | | Before | After |
| Sheet unwinding |  | 13 | 13 |
| Straightening of metal |  | 10 | 10 |
| Cutting of metal |  | 25 | 25 |
| Sheet metal forming |  | 45 | **25** |
| Precision trimming |  | 14 | 14 |

The parts of optimized workplace are shown on figures from figure 9 to figure 12.

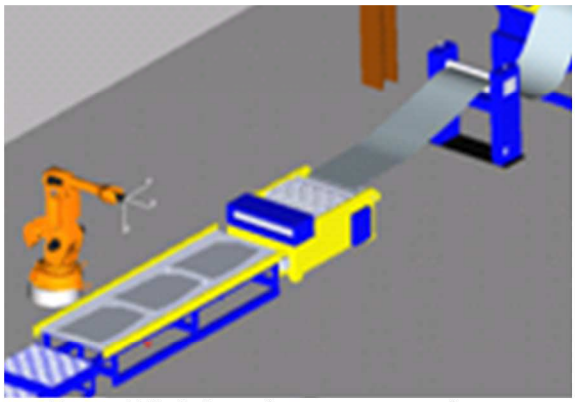


*Figure 9 Workplace after optimization – first part*

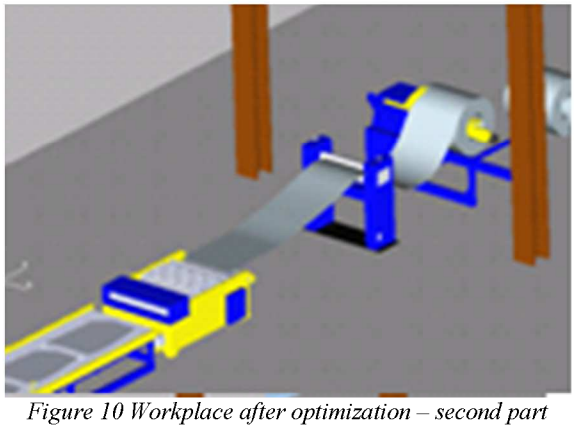


*Figure 10 Workplace after optimization – second part*

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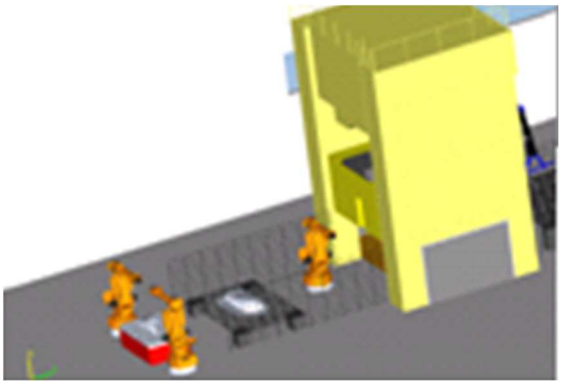

*Figure 11 Workplace after optimization – third part*

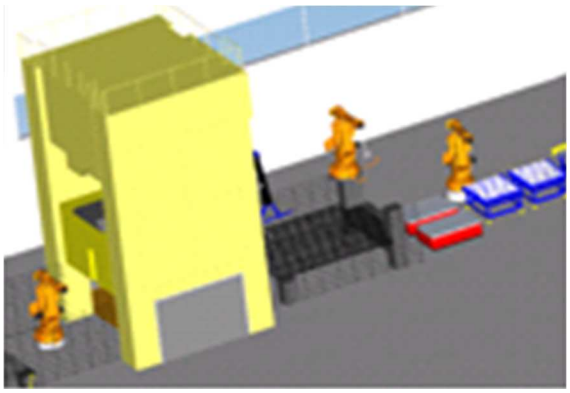

*Figure 12 Workplace after optimization – fourth part*

## Conclusion

Based on the proposal, which was presented in the previous part of this article – e.g. better placement of conveyors and replacement of workers with robots – it is possible to notice that this application can contribute to more efficient production, time reduction and faster and more fluent production of front splash-board. With these changes we optimized the production in that way that the production time is shorter about 20 seconds.

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