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Śląska**

**WYDZIAŁ MECHANICZNY TECHNOLOGICZNY**

**DOKTORAT WDROŻENIOWY**

**PRACA DOKTORSKA**

**Optymalizacja procesu wytwarzania ram naczep kurtynowych  
w oparciu o metodę równoważenia obciążeń linii produkcyjnych**

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# **Abstract of the doctoral thesis**

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**Topic: Optimization of the production process of curtain semi-trailer chassis based on the analysis of load balancing of production lines**

The doctoral thesis presents the process of optimizing the production of chassis for standard curtain semi-trailers. In the first stage, an analysis of the current state of production of semi-trailer frames was carried out, where the capacity of the production line was at the level of 3.3 frames per change, which, with a three-shift production system, gave ~10 chassis per day. The assumption was to increase the capacity to 5 pieces per shift, which would consequently allow the production of 15 pieces per day, increasing the number of frames produced by 50%. In order to achieve the assumed efficiency, the production process was analyzed in terms of: method of organization of the production line (machine and jigs layout), the length of the tact and cycle time, the number of human resources, production and transport of subassemblies and semi-products between the production departments of the Z1 plant. For the purposes of research in the field of modification and proper balancing of the production line, a simulation model of the line was developed in the Autodesk Process Analysis environment. Each technological operation at each station of the production line consisting of five stations was described in detail and dimensioned. A methodology was developed consisting in the use of such methods as: measurement and analysis of the current time, design of a simulation model in ADFD and calibration for the measured time, line balancing using the Yamazumi method, numerical verification of the optimized line design using ADFD and verification by measuring time. Then, the concept of the production line was developed, in which the main assumption was to reduce the number of technology operations at the stations. Based on the concept, a detailed line design was developed, which resulted in a 3D CAD model of the complete production line. As a result, the C5 production line was extended by one station for the preparation and execution of tack welds, which made it possible to transfer technological operations from other stations. The C5 balanced production line, after modernization, consists of 6 stations where technological operations are performed, resulting in the production of the frame of the M4 curtain semi-trailer in the assumed tact time. The following technological operations are performed at the individual stations of the line:

1. Station No. 1 - assembling and tact welding the frame in the jig,
2. Station No. 2 - assembly and initial welding,
3. Station No. 3 - Panasonic robotic welding,
4. Station No. 4 - ABB robotic welding,
5. Station No. 5 - manual welding (finishing)
6. Station No. 6 - manual welding (finishing)

Reorganization activities that took place in the production plants of WIELTON S.A., the purpose of which was to:

1. improvement of the production process of component preparation at the W1 department
2. improvement of the material flow process in departments W1, W2, W3,
3. balancing the load on production stations in the C5 line - W3 department

allowed the implementation and achievement of the assumed goals and opened the way and showed the direction of further optimization of processes in order to achieve better and better results of the WIELTON S.A. factory.