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#### “OPTIMIZATION OF A VEHICLE ASSEMBLY LINE”

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#### ABSTRACT

*Assembly industry plays a vital role in fulfilling the demands of the customer, while dealing with the rapid change in demands. Assembly Line Balancing is the problem of assigning operations to workstations along an assembly line. The minimization of the number of workstations and maximization of the production efficiency are the most common goals in the line balancing.*

*This study was conducted at AARI Benelli (Hyderabad). From this study, NVA activities, the standard time, utilization, and recommendation for manpower planning could be established. The necessary changes were suggested in the workplace to minimize the stress creating unproductive movements.*

**Key Words:** Assembly Line, Line balancing, NVA.

#### I. INTRODUCTION

For fulfilling the customer demand, while maintaining the quality and cost of the product and fast delivery mass production is a common method. In vast manufacturing plants such demands are met through assembly line systems. In Discrete Manufacturing Industries, the final product is produced through large no of small components which are assembled on each other in a sequence. The major issue faced in such industries are Assembly Line Balancing, which can be achieved by reducing the workstations, manpower and costing for the company, through minimizing the NVA activities and redistribution of workload over the workstations.

**Assembly Lines:** Assembly line is a flow-oriented system which caters to the industrial production of making standardized parts. Line restructuring or rearranging the work sequence can be effective to improve the throughput of the assembly lines. It consists of a series of workstations and substations in a sequential order to produce standardized products. The tasks performed on the assembly line are repetitive and they are performed on the workstation as the production flows. The Distribution of workload and the activities that do not contribute any value to the final product or upskilling of workers or any communication between workstation to workstation, while their maintenance are the key points to be focused for increasing the productivity for the Company.

**NVA:** Non-Valuable Activities are the activities that do not contribute any value to the final product. These activities usually become the fatigue for the operator and can be identified by Analysing the line while keeping the proper standards and parameters. While working on a line certain NVA's are necessary which makes it "Necessary Evil" and in most of the time elimination of NVA provides great results in an Assembly Line. Elimination of these activities can be done by reviewing workflow, analysing processes under proper process parameters.

**Improvement in Line Balancing:** Line balancing problem is to arrange individual process and assembly tasks at each workstation in such sequential order that the final standardized product is received at the end of the last workstation. To achieve a good line balance, the workload distribution should be done in such a way that the workload percentage at each station should be approximately equal and thus a smooth workflow will be achieved.

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## II. LITERATURE REVIEW

**Muhammad Ayat et al.** They did the line balancing for a large-scale manufacturing industry using the Largest Candidate Rule, the objective was Distribution of Equal Workload at Each Workstation, and smooth workflow across the line by reassigning the workload. With a simple methodology followed (Process Analysis, Data Collection, Time Study) the time balancing / line balancing for a certain company was done.[1]

**Richa Rashmi Sarmah and Debashish Gogoi** Reviewing the Assembly Lines, workload, and workforce, while aiming to improve the productivity for the company. Research was conducted. while considering recent trends and techniques. Studying the Cycle time, Lead Time, Bottleneck and working on lean manufacturing. Comparing all the work studies, creating a database, and reviewing the process to get the best results.[2]

**Ankit Sagwekar et al.** This research deals with the study of an Assembly Line workflow, for a large scale 4-wheeler door manufacturing company. Assembly lines are studied in this paper, understanding the moving pace conveyor, and the workflow. The purpose of this study was to level the work cycle by restructuring the activities between the workstations. During the research they did work on efficiency improvement, reduction of manpower and workstations, and methods of cost saving for the company.[3]

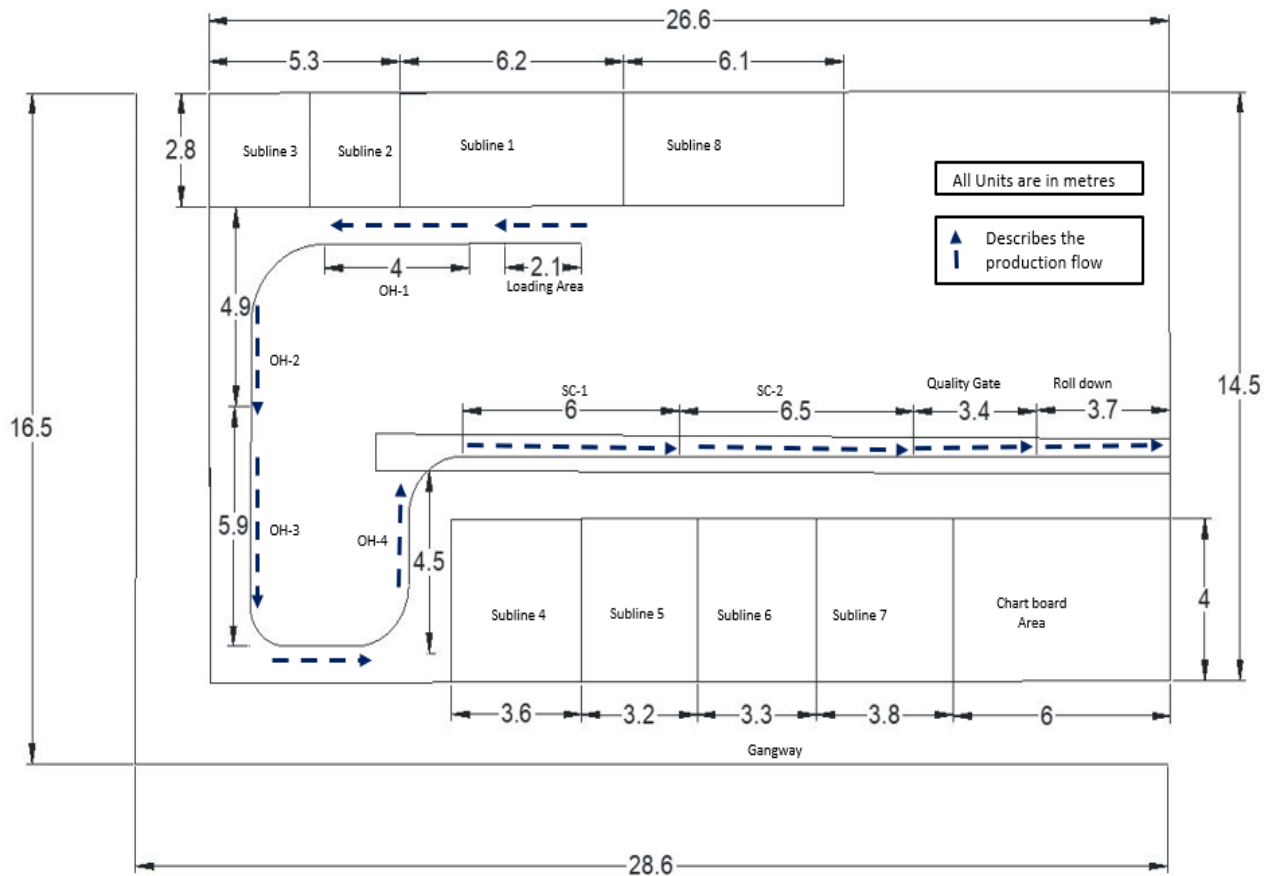
**Prashant Rao Meshram and Rupendra Marre** This paper highlights a methodology developed for minimization of non-productive activities (NVA) and minimization of fatigue in manufacturing line by using Maynard's Operation Sequence Technique (MOST) revealed the excessive movements of operators. Work study in productivity improvement could be done in two approaches, which are method study and time study. Thus, this research will use process mapping as the method study and Maynard Operation Sequence technique (MOST) as the time study method. All this is initiated by performing work study on the manual operators' activities. From this study, NVA activities, the standard time, utilization, and recommendation for manpower planning could be established. The necessary changes were suggested in the workplace to minimize the stress creating unproductive movements. These results could be used for optimization of time at the company.[4]

**Ankit Tomar and Ashish Manoria** In this research paper the various heuristic methods namely COMSOAL, Ranked Positional Weight and Largest Candidate Rule is described for assembly line balancing problems. The simplistic aim is to reduce workstations, manpower costing and improve overall efficiency for the company.[5]

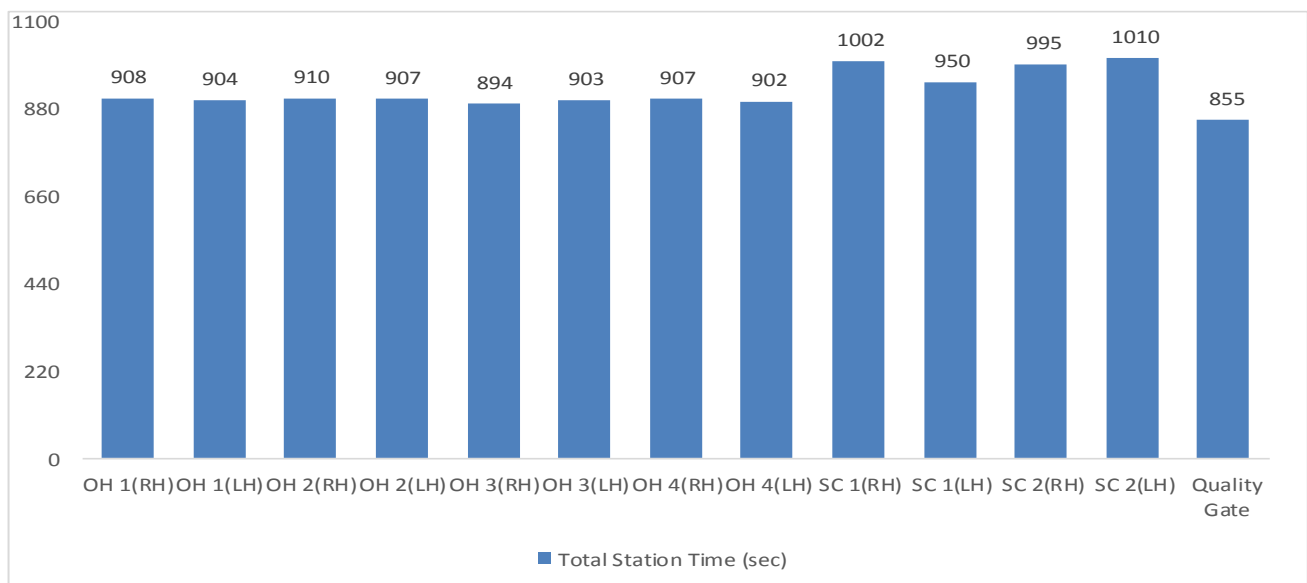
## III. METHODOLOGY

**Layout Study:** - Layout is the arrangement of machines, work areas and service areas within a factory. It involves the development of physical relationships among building, equipment and production operations, which will enable the manufacturing process to be carried on efficiently. In our study the assembly line is divided into two parts. Firstly, is the main line which consists of 4 overhead conveyors, 2 slat conveyors, one quality gate. Secondly there are 8 substations (subline). The stations are aligned in such a manner that the standardized product is received at the end of the last mainline station. In the current layout, for production of a premium bike. There are 16 stations and 23 manpower in total with the capacity of producing 30 bikes per day and can be enhanced up to production of 200 bikes per day by increasing stations, substations, and manpower.

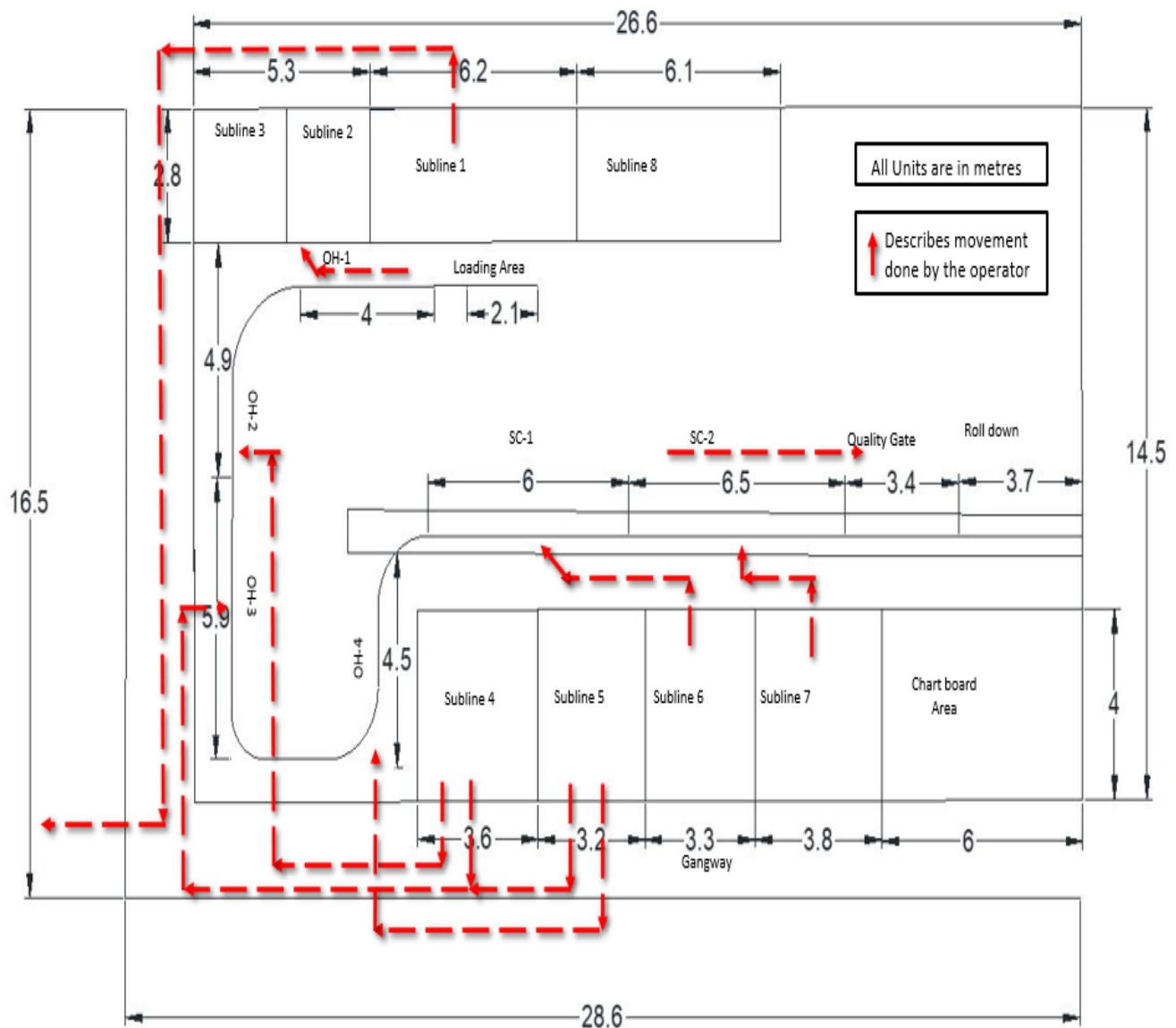
**Procedure Study:** - To create a standardized product Standard Operating Procedure (SOP) is required. Standard tools, parts, materials, and components need to be there. The SOPs should be in sequential form such that the final product does not lack/miss any component.



Data Recording: - Recording all the data in a sequential order to create a database of the ongoing processes, for the further analysis which will include the observation of Total Time in subline and in main line while the marking of NVA activities in lines.

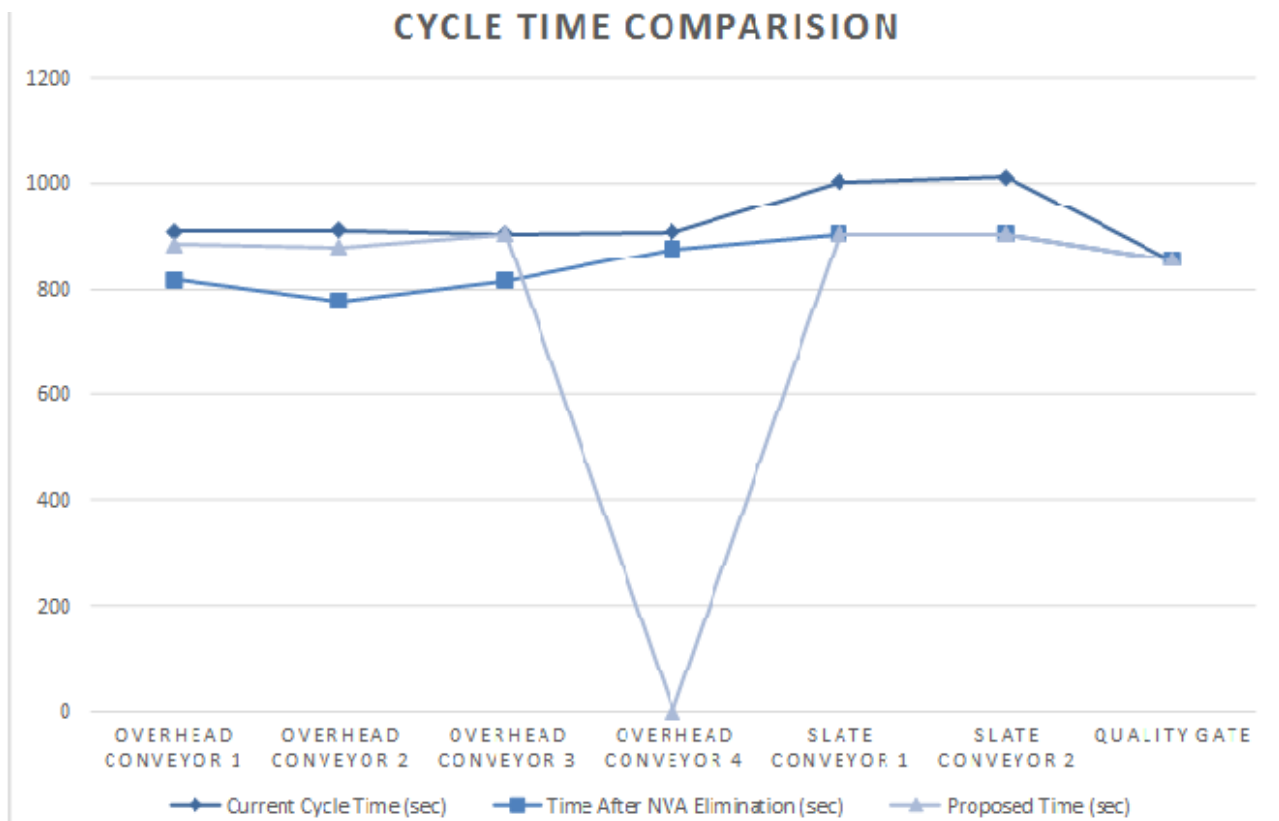


Data Analysis: - Analysing, studying, and comparing all the data in such a way to understand the desired activities and undesired activities on the assembly line. Understanding the NVAs that can be eliminated and NVAs that cannot be eliminated.



#### IV. CONCLUSION

As per the data and the analysis done, the cycle time for the production of a single bike has been managed to drop from 17.3 minutes to 15.1 minutes. While the number of manpower engaged on the production line has also been reduced from 23 manpower to 20 manpower. The proposed work contents give operators, proper fatigue while making it feasible for industry. The changes which have been imposed are done in well consideration of cost feasibility and efficient work flow distribution giving each operator to work while reducing the chances to make numerous errors and also making the production line highly efficient.



## V. CALCULATION

- Shift Timing = 540 min
- Lunch Time = 30 min, Tea Break = 10 min\*(2), Meeting Time = 10 min
- Actual Time = 540 – (Lunch Time + 2 × Teatime + Meeting Time) = 480 min
- Current Manpower = 23, Current Stations = 23
- Current Cycle Time = 16.8 min
- Current Production Plan = Shift Time / Cycle Time = 28.6 units per day
- Cycle Time After Elimination of NVA (With 23 Manpower) = 15.1 min
- Production Plan after Elimination of NVA = Shift Time / Cycle Time = 31.8 units per day
- Optimized Cycle Time with 20 Manpower = 15.1 min
- Proposed Production Plan = Shift Time / Cycle Time = 31.8 units ≈ 32 units per day
- NOTE – Cycle time is highest time of all workstations.

## REFERENCES

- [1] Muhammad Ayat, et. Al., Assembly Line Balancing in A Manufacturing Industry Using Largest Candidate Rule Algorithm, 2017, <https://www.researchgate.net/publication/321194686>.
- [2] Richa Rashmi Sarmah, et. Al., A Review on Assembly Line Balancing, 2019, DOI URL: <http://dx.doi.org/10.21474/IJAR01/9685>.
- [3] Ankit Sagwekar, et. Al., Workload balancing of assembly line in an automobile manufacturing industry, 2019, <https://www.researchgate.net/publication/331248194>.
- [4] Prashant Rao Meshram et. al., Process Optimization By Elimination Of NVA Activities Through ‘Most’ Technique, <http://iraj.in>/ISSN: 2320-2092.
- [5] Ankit Tomar et. Al., Increasing Line efficiency with COMSOAL, RPW and LCR Methods of Assembly Line Balancing Problem, 2016, <https://ijournals.in/wpcontent/uploads/2017/06/5.4108-Ankit.compressed.pdf>.