

MATERIAL HANDLING IN DRIVE LINE ASSEMBLY: A CASE STUDY

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Abstract

The current paper focus on the material handling methods and equipment used in the assembly of the driveline in a tractor manufacturing company. Driveline refers to the transmission unit in the automobile and tractor. Drive line is the assembly of power train i.e. engine together with the gearbox and the drive axles. When number of parts is to be assembled, then efficient handling and proper positioning become the most important part of any assembly line. To ensure smooth running of production and improving productivity of the production system planned material flow with good Equipment and skilled labour is required. This paper highlights the different equipment and methods that are being used in a tractor plant to ensure efficient material handling.

Keywords: *Principles, Trollies, hoists, conveyor.*

1. Introduction

Material is the backbone of and manufacturing firm, form the raw material to the finished material. As such a huge material is there in the manufacturing firm its efficient handling is a big challenge to the organizations. Efficient handling means there should not be any delay in the material procurement, no shortage, minimum cost of transportation, no damage to the material, minimum rejection, maximum utilization of the space available with the organization, minimum labour and holding cost, easy to move, and safe to the employee. The paper also deals with the principles of the material handling, the equipment and methods used for the movement of the material units from the supplier to the assembly line. The material handling cost in a manufacturing industry is about 10- 20% which is sufficiently high thus it is of ought most importance to take care of the functionality of the material handling system so the minimum cost is incurred in material handling and high productivity is achieved. Also it must ensure the employee`s safety and the environment protection. The paper focus on the material handling methods and equipment used in the

assembly of the driveline in a tractor manufacturing company. Driveline refers to the transmission unit in the automobile and tractor. Drive line is the assembly of powertrain i.e. engine together with the gearbox and the drive axles. When number of parts is to be assembled, then efficient handling and proper positioning become the most important part of any assembly line.

2. Literature Review

P.Sunderam (et al) stated that in last several years material handling system has direct influence on the cost of logistics. According to paper, efficient material handling means getting the right product, at right time and at the right place. Material handling is the movement of the material form one location to the other with in the plant. The paper also state that the material handling mean material handling cost varies from 10-30% of the actual production cost.

Guilherme Bergmann Borges Vieira (et al), focused on the advancement in the material handling system, and influence of the material handling on the travel time, service level and utilization of the resources. The research focuses on the material handling equipment, methods adopted and the steps used to achieve the objective of organization. Material handling advancement has good impact on the production.

Vikas Gupta (et al) states that material handling system ensures that required quantity of material, at right place with minimized cost and with maximum safety of the employee. It indicates the new inventions in the material handling equipment which are available in the market. It emphasizes on the technique that material handling system must be adopted in such a manner so that manufacturing cost get minimized and also reduce the cost of failure and damage, enhances the productivity of organization.

3. Principles in material handling

- **Planning** – In material handling is the very first principle among the principles of material handling in planning phase a proper plan should be prepared with the discussion with all the peoples who will be using the material .To ensure more effective material handling plant involvement of all the levels are necessary it includes the component manufacturer consultants suppliers quality department logistics manufacturing department design department etc. Plan must show the objectives and should guide towards its fulfilment.
- **Standardization** - It must be ensured that the important tools fixtures must be standardized, which means the tools and equipment must be universal throughout the plant for example the trolleys the trolleys are designed in such a way that they can be used for different model without any difficulty. Other examples are-
 - Spanners and the wrenches of same torque values and dimensions for the most of the models.
 - Input and output doors of all the washing machines are designed with the same height of the trolleys for every loading and unloading of components and all components can be washed without any problem.
 - the size of circuits are also variable for different soft and models but the installation process and tools is standardized
- **Work principle** – According to this principle we have to minimize the work of material handling so that the higher productivity can be achieved. This can be achieved by using simple process of material handling like roller conveyor and hoist crane for lifting heavy components, to reduce the work associated with the unloading of the material from the trucks a special area is developed which is inclined and the height of the deck is exactly equal to the height of the truck floor which means the material can be easily unloaded from the truck without any use of special equipment with the help of gravity.

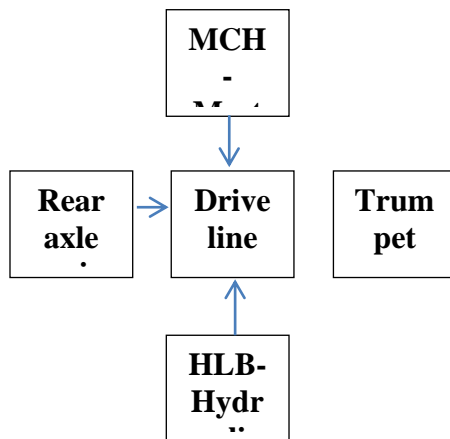


- **Ergonomics-** It states that the material handling workplace must be safe to the operator and the employees and must compliance with the other physical and mental abilities of the operator.
 - Example if the lifting of heavy equipment there must be a host friend for lifting it and the movement of heavy equipment of the power person must be used.
- **Unit Load Principal-** The principle states that the unit load is the minimum size. It also states that the material must be easy to disintegrate and should be divided in the much easier parts and segments which can be easily transported with Minimum Effort.
- **Space Utilization-** This principle in ensures that the most optimum utilization of available space in the plant. Layout must be designed in such a way that the material movement is minimized inside the plant and the space utilization is maximized. It may also leads to clubbing of different assembly lines. Storage is done in the multi height storage racks for the maximum utilization of the space

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- **System principle-** System must be planned in such a way that integrate as many handling activities as possible and regulates in completion of operations like material receiving, material storage, production, material receiving, material inspection, material packing, warehousing, material supply and material transportation.
- **Automation principle-** It states that there must be automation in the material handling where ever it is feasible and economic. Automation and shows error free operational efficiency of material and increases with increasing level of automation.
- **Environmental principle** – The environment protection must be ensured while designing such material handling systems less polluting vehicles must be used examples are battery operated trucks are used for material movement
- **Life Cycle Cost-** Cost analysis must be conducted for the cost involved for the complete life cycle of all the material handling systems the life cycle cost of material handling includes equipment cost planning course training cost maintenance cost and repair cost and disposal cost.

4. Material handling equipment's in assembly line



Material handling system in the driveline assembly consists of

- Bins
- Trollies
- Power pushers
- Fork lifts
- Conveyors
- Tow trucks
- Hoists

Bins- bins are the smallest part of the material handling system in the plant. Bin is rectangular box with the cavity in it. It is widely used at different stages in the plant for the material of small sizes ranging from the nuts, washes, pipes, hoses, spanner, and many more.



Bin

Trollies: - Talking about the trollies, I would trollies are the back bones of the assembly plant as there are large varieties of the parts to be assembled. There is wide variety of trollies used in the tractor assembly plant, and the name of the trolley is specified by the material they are dealing with. The trolley the carries the axle casing is named as the axle casing trolley, similarly the trolley that carries the assembled rear axle is known as the axle trolley.



AXLE CASING TROLLEY
 AXLE TROLLEY

GOLDEN ZONE TROLLEY
 SUBASSEMBLY TROLLEY



Golden zone trolley is the trolley with the rectangular section on it which contains the parts like spacers, nuts, bolts, screws, glue, o rings, circlips, and many more items. The name golden zone is given to this trolley because all the area over the trolley is in the hand reach of the operator and contains the items that are of frequent use during the assembly line.



Power pusher- Power pusher is used to push the trollies are loaded with the heavy components or the heavy sub-assemblies, which are difficult to move with the human effort. Power pusher is the electrically driven two wheel vehicle that is capable of pushing the trollies at slow speed in the plant.

TRUMPET TROLLEY
 TRUMPET CASING TROLLEY

Fork lifts: forklifts are used in to move the heavy subassemblies like the drive lines from the drive line area to the engine buckle up area. Also for the transfer of the power trains from the inventory area to the assembly area. Fork lifts are heavy duty vehicle that can lift heavy components and can lift it to certain height, must convenient in the load and unloading of material from the certain height.

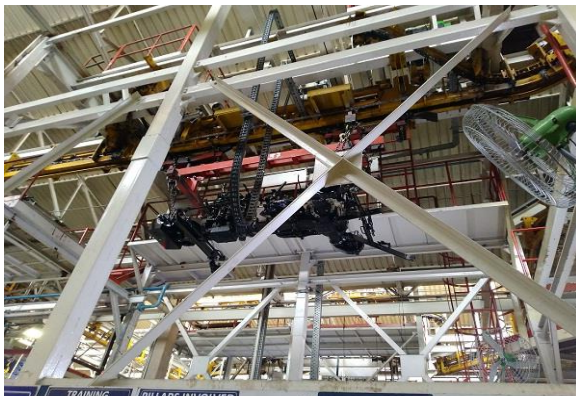


Power pusher



Fork lift

Conveyor- In the assembly plant conveyors are mainly used for the paint shop, assembly line conveyors. The main aim of the conveyors is to move the heavy material from one position to the other in quick and efficient manner. Also the conveyor eliminates the use of the human in the transportation of the material from one point to the other and thus reduces the chances of human error in the system. In the tractor assembly plant the conveyor is used for the paint shop. It is an overhead type conveyor that lifts the sub assembled tractor from before paint line, takes it to the paint shop and after painting drops it to the final after paint line for the complete assembly.



Overhead paint shop conveyor

Tow trucks- Tow trucks are used for the towing of the sub assembly trolleys from one station to the other. Also tow trucks fetch many types of commodities like the liquid nitrogen tanks from the inventory area. For the movement of the parts (painted parts like fenders, hoods, from paint shop,) also tyres from the tyre ward.



Tow truck

Hoists: Hoists are used at every station in the assembly line area where there is a need for the lifting of assemblies and sub-assemblies. At the end of every line (sub assembly and assembly) there is a hoist to lift the part from the line to the trolley and vice-versa at the start of the assembly line. Hoists in the plant are of different ranges varying from 250 kg to 2500kg depending upon the application in different areas.



Hoist

5. Conclusion

The case study on the material handling system in the tractor assembly plant concluded that there is standardization for the material handling at each station. A variety of trolleys are used for the material handling as per the requirement. The system for the material handling used in the company is too simple no complex system is implemented, which makes the people working in the plant more eager to work. The case study also

concludes that there is very less automation in the material handling in the plant. There are certain area where the automation can bring more productivity in the material handling and the profit to the company in long term. The tow trucks used in the plant are battery driven thus emission free which is contributing to the environment protection.

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