# "REVIEW OF THE OPTIMUM DESIGN PARAMETERS OF CHAIN CONVEYOR SYSTEM"

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## ABSTRACT

*As we know that chain is the most important element of the industrial processes required for transmitting of various types of materials in industry. As these chains operate under various forces due to this failure of chain is the major problem. Causes of these failures are improper material selection, uncertainties in the manufacturing, faulty manufacturing processes and improper dimensions. It is very important to study the influence of these parameters on the strength of the chain which governs the failure modes of the chain. About 60 percent processes in sugar factories are based on roller chain conveyers. Apart from that, other industries also use these chains frequently for process atomization. However, failure of this chain is perennial problem in these industries which causes huge losses to these industries along with its dependants and in turn economical growth of the state. So, roller chain is the most important element of the industrial processes. Most of the times, chain is under tension which causes failure of chain assembly which is the major problem for industrial sector. Causes of this failure are improper design, improper material selection, and uncertainties in manufacturing and faulty manufacturing processes. It is important to study the influence of these parameters. All these parameters can be considered simultaneously and chain link can be designed optimally. Optimization is the process of obtaining the best result under given circumstances in design of system.*

**Keywords:**- *Roller chain conveyor, material selection, slat conveyor*

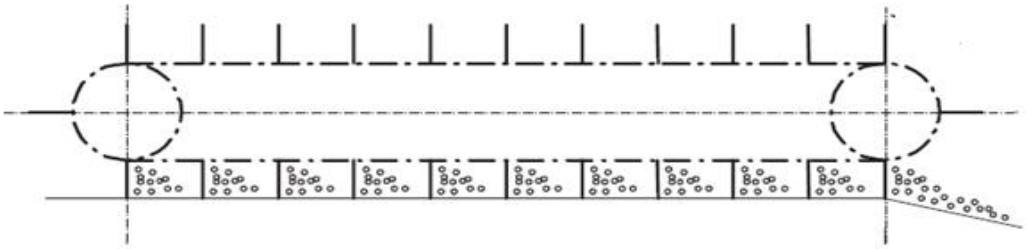
## 1. INTRODUCTION

The aim of this paper is to study existing parts of chain of chain conveyor system and optimize the critical parts like Roller, to minimize the overall weight of assembly and material saving. Chain is one of the most widely used moving medium in material handling systems, being robust and very adaptable, but it is also one of the most neglected component with in such equipments when general or routine maintenance is carried out. In many cases this product is attended to when problem is occur, normally when the chain is already damaged or need corrective maintenance and required replacement. This research is based on how to improve the tensile loading capacity of thechain to prevent tensile failure. Chain links are machine elements that are subjected to extreme service conditions,such as high tensile loads, friction, and sometimes aggressive operating environment (e.g. presence of

humidity, seawater, chemicals). Apart from tensile overload fracture, double shear is also an important failuremechanism which occurs under lower applied loads. As these chains operate under various forces, failure of chainassembly is the major problem. Causes of these failures are improper material selection, uncertainties in manufacturing, faulty manufacturing processes. Most of the time chain is under huge tension which causes elastic and\ plastic stresses which results into elongation of chain.

## 2. PROBLEM STATEMENT

A suitable type of chain is to be selected for horizontal slat conveyor for transportation of anthracite coal in a sugar factory. Conveyor chain is to be designed, analyzed and optimized for weight reduction for carrying coal in sugar factory. Transported material: Anthracite coal Conveyor length: 19.0 m Flow: 28 T/h Conveyor conduit width: 320 mm Conveyor conduit height: 280 mm Roller Diameter: 210 mm Number of chains: 1 Load distribution: even



**Concept Structure of Chain Conveyor**

## 3. OBJECTIVE

In this paper basically we are dealing with roller chain system for transportation of granular material and the considered environment is found to be dusty, moist and material is prone to corrosion. So the objectives of project are

1) Study the metallurgical failure of roller chain.
2) Finding a suitable material for roller chain which can withstand stresses and which should be corrosion free.
3) Finding optimized design parameters for roller chain.
4) Weight reduction of the roller chain by varying geometry of roller chain.
5) Validating the FEA results by experimental results.

## 4. DESIGN OF CONVEYOR CHAIN LINK

A typical roller chain consists of alternate outer links and inner links. The outer links, which are sometimes known as "pin links," consist of spaced link plates each having a pair of openings or apertures. Pins are tightly fitted in the oblong openings of the outer links. The inner links, which are sometimes known as "bushing links," consist of spaced link plates each having a pair of oblong openings or apertures. Bush is tightly fitted in the apertures. The bush freely rotates about the pins, so that the inner links are pivotally connected to the outer links or able to articulate with respect to the outer links. Pin of drag conveyor chain are assembled in chain with the help of temporary fastening arrangement. When this endless chain are moves in between drive and non drive ends of drag conveyor than through flight or projection a bed of bulk material are drags from feeding end to discharge end. This dragging action of material is applies forces on the flights of chain later on this forces are transmitted to the outer chain link and cause deformation of outer chain link. The deformation of outer link is apply forces on fasteners and tries to remove the fastener and break the temporary joint.

## 5. EXISTING DESIGN OF DRAG CONVEYOR CHAIN

In the existing design of drag conveyors chain nut is used as a fastener and they are fitted on the two threaded ends of pin. For preventing removal of nut due to rotation, vibration and sudden shocks a split dowel pin is pivoted in the holes at the ends of pin. This type of chain is failed due to following reasons. Forces applied due to the dragging of material another reason of chain failure are miss alignment. If a chain is not properly aligned than at the time of contact of sprocket and chain that time sprocket is applies impact on the two inner link plates later on this impact

will transfer in form of force to the outer link plate and cause removal of nuts. In the figure 3 assembly and disassembly of existing design of chain is shown. This type of chain assembly mainly consist six parts and they are inner link, outer link, bush, pin, nut and split dowel pin. To enable the most suitable chain to be selected for a particular application it is necessary to know full application details such as the following:

1. Type of conveyor.
2. Conveyor center distance and inclination from the horizontal.
3. Type of chain attachment, spacing and method of fixing to the chain.
4. Number of chains and chain speed.
5. Details of conveying attachments, e.g. weight of slats, buckets, etc.
6. Description of material carried, i.e. weight, size and quantity.
7. Method of feed and rate of delivery.

## 6. FACTORS OF SAFETY

Chain manufacturers specify the chain in their product range by breaking load. Some have quoted average breaking loads; some have quoted minimum breaking loads depending upon their level of confidence in their product. To obtain a design working load it is necessary to apply a "factor of safety" to the breaking load and this is an area where confusion has arisen. As a general rule, for most applications a factor of safety of 8 is used.

## 7. A SUITABLE TYPE OF CHAIN HAS TO BE SELECTED FOR HORIZONTAL SLAT CONVEYOR-

Transported material: Anthracite coal
Conveyor length: 19.0 m
Flow: 28 T/h
Conveyor conduit width: 320 mm
Conveyor conduit height: 280 mm
Roller Diameter: 210 mm
Number of chains: 1
Load distribution: even

## 8. MODELING OF CHAIN LINK

**Part design workbench**

The part design workbench is a parametric and feature-based environment, in which user can create solid models. The requirement for this is a sketch. The sketch for the feature is drawn in the sketcher button from the sketcher toolbar. User can draw the sketch using the tools in this worktable. While drawing a sketch, various applicable constraints manually.

**Wire frame and Surface Design workbench**

The wire frame and surface design workbench is also a parametric and feature based Environment, in which user can create wire frame or surface models .The only difference is that the tools in the environment are used to create basic and advanced surfaces. Users are also provided the required shape.

**Assembly design workbench**

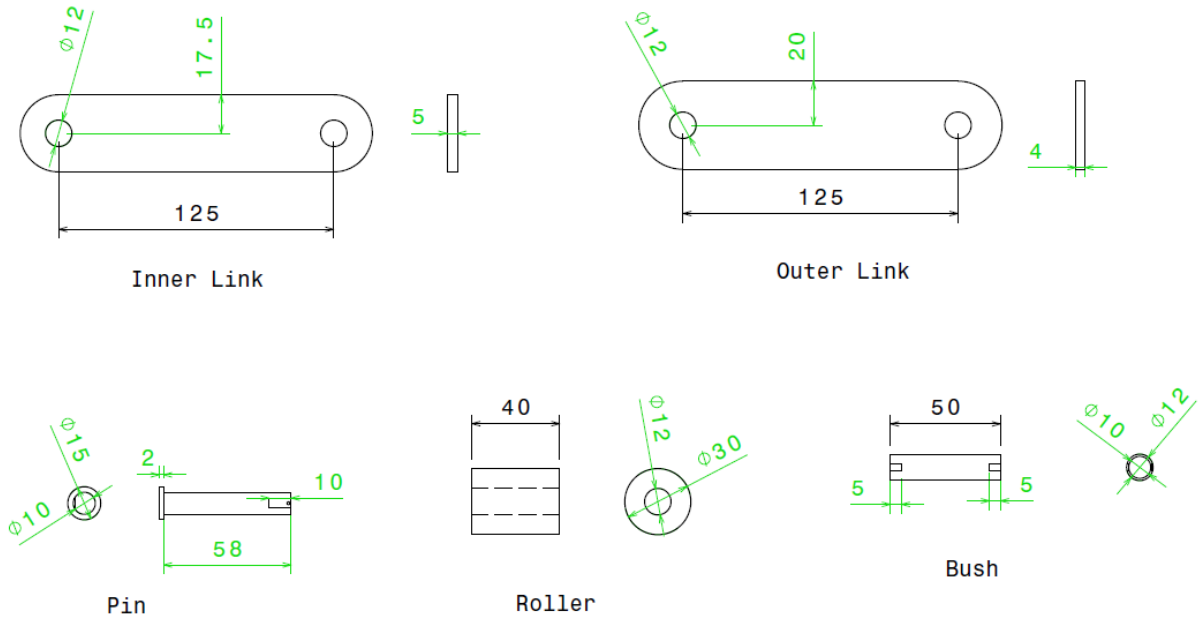
The Assembly Design workbench is used to assemble the components using the assembly constraints available in this workbench.

**Drafting Workbench**

The drafting workbench is used for the documentation of the parts or assemblies created earlier in the form of drawing views and their detailing. There are two types of drafting techniques:

1. Generative drafting 2. Interactive drafting

The generative drafting technique is used to automatically generate the drawing views of the parts and assemblies, the parametric dimensions added to the component in the part of design workbench during its creation can also be generated and display automatically in the drawing views. The generative drafting is bi-directionally associative in nature. User can also generate the bill of material (BOM) and balloons in the drawing views in interactive drafting ,user needs to create the drawing views by sketching them using the normal sketching tools and then adding the dimensions




**2D drawing of chain link**

## 9. CONCLUSION

After studying existing system we found that problems associated with existing chain link that weight of the link is higher & there is scope for reduction in dimensional parameters like thickness outer link, outer diameter of roller also there is scope for change in material of chain link

## BIOGRAPHIES

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