

# Design and Analysis of Belt Conveyor for Finishing House Pulper

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**ABSTRACT:** The main objectives of our project "Design and Analysis of Belt Conveyor for Finishing House Pulper " is to reduce the human effects and labour cost. Tamil Nadu Newsprint And Papers Limited is one of the most leading paper production company in India. The target of this company is to produce 1400mega tonnes of paper per day. This target is quite difficult to achieve everyday because of some delays in some processes. Among those processes, the process of repulping the damaged papers is an important one. The delay in this process is due to the manual paper feeding into the finishing house pulper. So, we have planned to reduce the human effects and processing time by designing a belt conveyor for feeding the damaged papers into the pulper.

**KEYWORDS:** Conveyorbelt, Finite Element Analysis (FEA), Creoparametric, ANSYS Software, Structural analysis

## I.INTRODUCTION

Conveyors are durable and reliable components used in automated distribution and warehousing. In combination with computer controlled pallet handling equipment this allows for more efficient retail, wholesale, and manufacturing distribution. It is considered a labour saving system that allows large volumes to move rapidly through a process, allowing companies to ship or receive higher volumes with smaller storage space and with less labour expense.

Rubber conveyor belts are commonly used to convey items with irregular bottom surfaces, small items that would fall in between rollers or bags of product that would sag between rollers. Belt conveyors are generally fairly similar in construction consisting of a metal frame with rollers at either end of a flat metal bed. The belt is looped around each of the rollers and when one of the rollers is powered (by electrical motor) the belting slides across the solid metal frame bed, moving the product. In heavy use applications the beds which the belting is pulled over are replaced with rollers. The roller allows weight to be conveyed as they reduce the amount of friction generated from the heavier loading on the belting. Belt conveyors can now be manufactured with curved sections which use tapered rollers and curved belting to convey products around a corner. These conveyor systems are commonly used in postal sorting offices and airport baggage handling systems. A sandwich belt conveyor uses two conveyor belts, face-to-face, to firmly contain the item being carried, making steep incline and even vertical-lift runs achievable.

Belt conveyors are the most commonly used powered conveyors because they are the versatile and the least expensive. Product is conveyed directly on the belt so both regular and irregular shaped objects, large or small, light and heavy, can be transported successfully. These conveyors should use only the highest quality premium belting products, which reduces belt stretch and results in less maintenance for tension adjustments. Belt conveyors can be used to transport product in a straight line or through changes in elevation or direction. In certain applications they can also be used for static accumulation or cartons.

## II.OBJECTIVES

Our main aim of the project we have planned to reduce the human effects and processing time by designing a belt conveyor for feeding the damaged papers into the pulper.

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### III. MATERIALS AND METHODS

Sl.No	Component	Material	Quantity No.
1.	Conveyor belt	PVC	1
2.	Conveyor pulley	Mild steel	2
3.	Electric motor	Cast iron	1
4.	Gear box	Steel	1
5.	Shaft	Mild steel	4
6.	Bearing	Stainless steel	4
7.	Cleats	PVC	18

### IV. SPECIFICATIONS OF CONVEYOR BELT SYSTEM

Total length of belt = 16.36m  
 Centre to centre distance = 7.9m  
 Belt width = 1.2m  
 Belt thickness = 0.008m  
 Troughing angle =  $27.61^{\circ}$   
 Feeding height = 0.7m (loading)  
 Outer feeding height = 4.36 m (unloading) Type of belt = PVC conveyor belt  
 Drive unit = Gear Motor driven roller dia 0.18 m  
 At one end and idler roller at other end with tension arrangement  
 Conveyor speed = 47.7mpm  
 Control panel = Push button switch for conveyor  
 Forward / Reverse, Emergency switch provided.

### V. MATERIAL PROPERTIES POLY VINYL CHLORIDE FOR CONVEYOR BELT

PVC has high hardness and mechanical properties. The mechanical properties enhance with the molecular weight increasing but decrease with the temperature increasing. The mechanical properties of rigid PVC are very good; the elastic modulus can reach 1500-3000Mpa. The soft PVC(flexible PVC) elastic is 1.5-15 Mpa.

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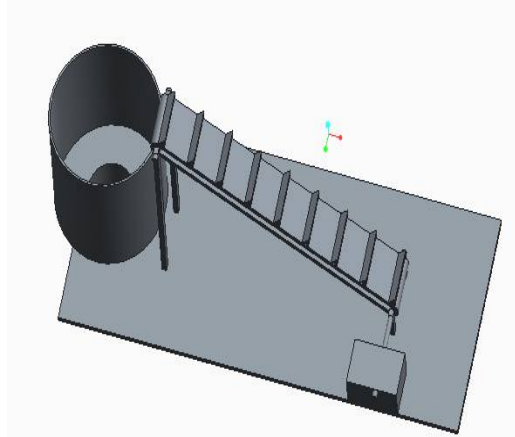
Material Properties	Value	Unit
Density	1.42	g/cm <sup>3</sup>
Young's Modulus	2.7	Gpa
Poisson's ratio	0.4	-
Bulk Modulus	4.7	Gpa
Shear Modulus	1.0	Gpa
Yield Strength	1450	Psi
Compressive Strength	7250	Psi
Tensile Strength	7300	Psi

### VI. MATERIAL PROPERTIES ASTM A36 HOT ROLLED STEEL FOR STRUCTURES

A-36 steel bar is one of the most widely used carbon steel bars for construction and manufacturing. A36 bar is a hot rolled steel bar that is weldable, formable and machinable. Intermediate tensile strength carbon steel for use in riveted, bolted or welded construction of bridges and buildings, manufactured parts and equipment.

### VI. MODELING OF CONVEYOR BELT SYSTEM

Creo Parametric is the standard in 3D CAD, featuring state of the art productivity tools that promote best practices in design while simultaneously ensuring compliance with industrial and company standards. This 3D CAD software is powerful, easy to use, flexible and also fully scalable. It features the industry's broadest range of 3D solid modeling and design capabilities for creating high quality designs in minimum time.



CAD Model image of conveyor belt system

### VIII. ANALYSIS OF CONVEYOR BELT SYSTEM

#### A. Introduction to Finite Element Analysis

The basis of FEA relies on the decomposition of the domain into a finite number of sub-domains (elements) for which the systematic approximate solution is constructed by applying the variation or weighted residual methods. In effect, FEA reduces problem to that of a finite number of unknowns by dividing the domain into elements and by expressing the unknown field variable in terms of the assumed

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approximating functions within each element. These functions (also called interpolation functions) are defined in terms of the values of the field variables at specific points, referred to as nodes. The finite element method is a numerical procedure that can be used to obtain solutions to a large class of engineering problems involving stress analysis, heat transfer, electro-magnetism, and fluid flow.

### **B. Introduction to ANSYS software**

ANSYS is general-purpose Finite Element

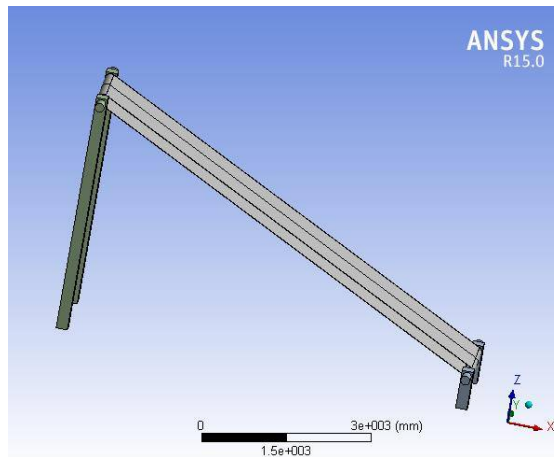
Analysis (FEA) software package. The ANSYS computer program is a large-scale multipurpose finite element program. It is used for solving several engineering analyses. The analysis capabilities of ANSYS include the ability to solve static and dynamic structural analyses, steady-state and transient heat transfer problems, mode frequency and buckling Eigen value problems, static or time varying magnetic analyses and various types of field and couple field application. Finite Element Analysis is a numerical method of deconstructing a complex system into very small pieces (of user designed size) called elements. The software implements equations that govern the

Material Properties	Value	Unit
Density	7800	Kg/m <sup>3</sup>
Young's Modulus	2*10 <sup>5</sup>	Mpa
Poisson's ratio	0.26	-
Bulk Modulus	1.3889*10 <sup>11</sup>	Pa
Shear Modulus	7.9365*10 <sup>10</sup>	Pa
Tensile Yield Strength	250	Mpa
Compressive Yield Strength	250	Mpa
Tensile Ultimate Strength	400	Mpa
Compressive Ultimate Strength	0	Mpa

behavior of these elements and solves them all; creating a comprehensive explanation of how the system acts as a whole. The ANSYS Workbench environment is an intuitive up-front finite element analysis tool that is used in conjunction with CAD systems and/or Design Model. ANSYS Workbench is a software environment for performing structural, thermal, and electromagnetic analyses. The Workbench focuses on attaching existing geometry, setting up the finite element model, solving, and reviewing results. After geometric modeling of the conveyor belt system with given specifications it is subjected to analysis. The Analysis involves the following discretization called meshing, boundary conditions and loading.

### IX. STEPS INVOLVED IN ANALYSIS

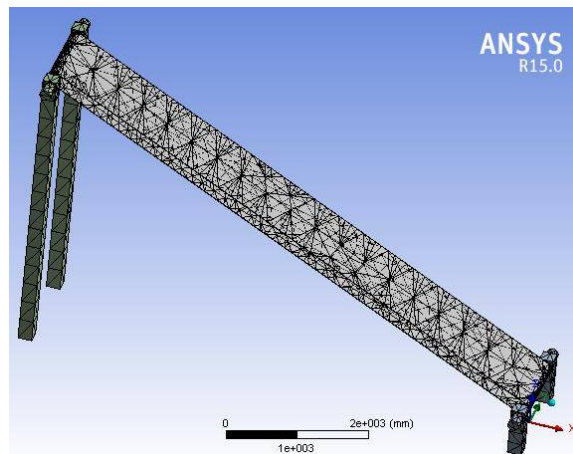
#### A. Import the geometry



**Geometry model of conveyor belt system**

#### B. Meshing

Type of Elements : Tetrahedrons  
Number of Nodes : 11256  
Number of Element : 5066



**Meshed model of conveyor belt system**

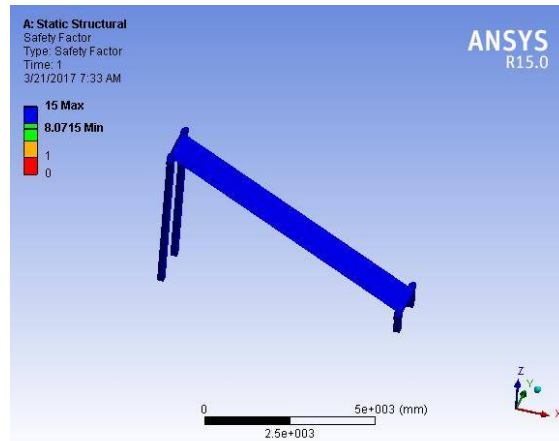
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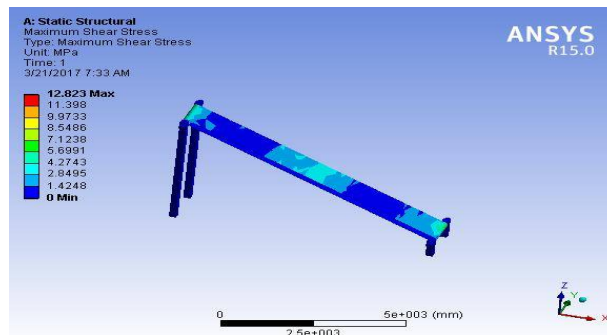
## C. Apply boundary condition



**Fixed support**

The base structure is to be fixed. Force(load) 4905N is applied on the top of the belt surface. The load is Uniformly Distributed Load.

## D. Solution



**Total Deformation**

The maximum deformation induced in belt conveyor system is 0.6403mm at near the tail pulley side belt surface.

## X. CONCLUSION

Our project “**DESIGN AND ANALYSIS OF BELT CONVEYOR FOR FINISHING HOUSE PULPER**” is very help full for carrying the paper to the pulper machine. Today conveyors are widely used for load transmitting process. Thus our project reduces and saving the time, labour cost and manpower. Thus conveyor helps to transfer the load in inclined direction to move material for long distances. Our project design of belt conveyor for finishing house pulper was analyzed and tested by the plant engineering of **TNPL** and it will be implemented in the upcoming years.

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