



## **Design And Analysis Of Conceptual Mobile Belt Conveyor Material Handling System**

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### **Abstract**

During the construction of slabs in civil structure, the continuous supply of construction material is needed. This is usually done with the help of labors, sometimes; a temporary material lift is fabricated for this. Both this process is labor intensive and costly. In this project we are undertaking design of material handling system which can supply construction material continuously to the top end of the construction site, and also to ensure the mobility of this system.

For more than 200 years, belt conveyors are in use in many industries, especially in mining, cement, steel and agricultural industries. Belt conveyors have had an increasing importance and use during the past century. Today, they have the significant role in mining, cement factories, grain manipulation, etc. By time, applications of transporting materials from one point to another extended its boundaries; by requiring longer transfer distances, much faster speeds and much higher capacities. While expectations from belt conveyors are growing bigger, problems to be solved grew in parallel.

Hence there is a need to design a mobile conveyor material handling system, so we will design the mobile belt conveyor material handling system to automate this process, to save time and minimize the human effort. In the proposed work we will be generating optimized CAD model considering the on field work parameters. Also, Finite element Analysis will be done on the generated CAD model using Hypermesh to know the actual stresses, and forces that will generate in the Mobile belt conveyor material handling system to optimize and improve the life of the design. .

**Keywords:** Material Handling , CAD , Hypermesh.

### **1. Introduction**

Material-handling process is that which relate to the movement of material, storage of good and products, arrangement and protection of storage throughout the process of Product industries. Material handling equipment is generally categorized into the following: storing and material handling, engineered systems, industrial trucks, and bulk material handling.

Belt Conveyor is the material handling equipment to convey the material from one point to another using the belt drive. The material is fed on the belt at one end and it is discharged at other end. The conveyor belt changed the face of the industrial economy around the world. Today, it has significant uses in almost every industries, such as transportation and food services. A conveyer is a arrangement for handling bulk materials by following an assembly line of the material handling conveyer or elevator in horizontal, vertical or inclined direction. As stated in the 85% industrial units face difficulties in handling bulk material packaging. The difficulties usually occur when it is essential to convey a bulk material through a linear distance as well as a certain height. Conventional ways are responsible for material wasting, time wasting & above all a poor management. In order to overcome those draw backs Belt conveyers are used.

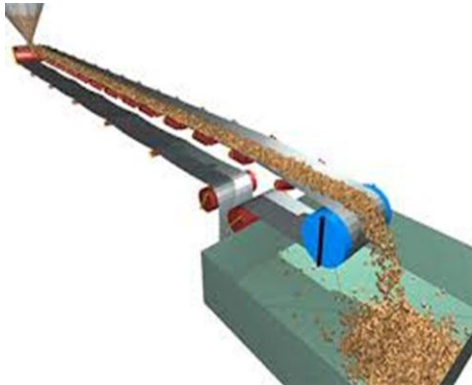


Fig 1: material handling system

## 2. Literature Review

### Design, Manufacture and Analysis of Belt Conveyor System used for Cooling of Mould- Seema S. Vanamane[1]

In this paper the study is carried out on DISA pattern moulding machine to meet the requirement of higher weight castings. From the DISA specification the belt conveyor system is designed by using different standards like CEMA (Conveyor Equipment Manufacture's Association) standards, some handbooks of belt conveyor system etc. then this parameter are verified by using Belt Comp software. The result got from the Belt Comp software is in close agreement of theoretical results. After the design the manufacturing is done and the installation is done on the manufacturer's site. The trials are carried out on the belt conveyor system successfully and the problems occurs during the trials are overcome in the analysis by taking proper steps.

### Automation of Material Handling with Bucket Elevator and Belt Conveyor Ghazi Abu Taher[2]

This paper is mainly based on the combination of Belt & Bucket Conveyers to perform complex task within a short time and successfully in a cost effective way. Belt conveyor & Bucket elevator are the media of transportation of material from one location to another in a commercial space. Belt conveyor has huge load carrying capacity, large covering area simplified design, easy maintenance and high reliability of operation. Belt Conveyor system is also used in material transport in foundry shop like supply and distribution of molding sand, molds and removal of waste. On the other hand Bucket

elevator can be of great use during bulk material handling. On account of this, a machine and its physical description is covered here with some basic calculation.

### DESIGN AND SELECTING THE PROPER CONVEYOR-BELT - Konakalla Naga Ananth[3]

Belt conveyor is the transportation of material from one location to another. Belt conveyor has high load carrying capacity, large length of conveying path, simple design, easy maintenance and high reliability of operation. Belt Conveyor system is also used in material transport in foundry shop like supply and distribution of molding sand, molds and removal of waste. This paper provides to design the conveyor system used for which includes belt speed, belt width, motor selection, belt specification, shaft diameter, pulley, gear box selection, with the help of standard model calculation.

**A JAGTAP[4]**This paper discusses the design calculations and considerations of belt conveyor system for biomass wood using 3 rolls idlers, in terms of size, length, capacity and speed, roller diameter, power and tension, idler spacing, type of drive unit, diameter, location and arrangement of pulley, angle and axis of rotation, control mode, intended application, product to be handled as well as its maximum loading capacity in order ensure fast, continuous and efficient movement of crushed biomass wood while avoiding fatalities during loading and unloading. The successful completion of this research work has generated design data for industrial uses in the development of an automated belt conveyor system which is fast, safe and efficient.

### ANALYSIS OF BELT CONVEYOR USING FINITE ELEMENT METHOD[5]

Belt conveyors are the most common material handling conveyor in use today. They are generally the least expensive powered conveyor and are capable of handling a wide array of materials. Depending on the type chosen, belt conveyor can carry everything. Today, belt conveyors are in use in many industries, like mining industry, belt conveyors has an increasing importance and use. They have important part of mining and cement factories, grain manipulation, etc. For a belt conveyor longer than one kilometer, viscoelastic properties of the belt is unnegligible and longer-life with healthy operation for conveyors design require detailed engineering calculation. In this study, a real conveyor project is taken into account. Wave propagation speeds are calculated. Studied belt is divided into finite number



of beam elements all of which are represented by mass, spring and a dashpot.

**A.W. ROBERTS and A. HARRISON[6]** This paper outlines recent research in the area of belt conveying. A review of design trends associated with long overland conveyors is presented indicating the influence of economic and technical considerations in the design methodology. Aspects of conveyor dynamics are discussed and research and development work concerned with specific subjects including belt drum friction, rolling resistance and bulk solid and conveyor belt interaction. A test rig for examining stability between bulk solids and conveyor belts during transportation is described.

**Dr. Kurt Serpil., Assist.Prof. Dr. Gerdemeli .Cengiz C. [7]** In this study, a real conveyor project is taken into account. Wave propagation speeds are calculated. Studied belt is divided into finite number of beam elements all of which are represented by mass, spring and a dashpot. Motions of equations are derived by obtaining mass, stiffness and damping matrices. Initial conditions are specified and effecting forces are calculated. Equations of motions formed a linear, second order ordinary differential equation system and it's transformed into state-space equations. By using MATLAB's Control System Toolbox commands, the system is simulated for a step input. Results are separated as velocities and displacements. The conveyor is examined on carry and return sides. Return side and carry side reactions are compared. In the light of obtained data and drawn graphs, belt strength and mill diameters or materials are advised to be revised due to the excessive forces occurred in transient stage.

**Harshavardhan A. Kadam, Nilesh S. Hyalij[8]** For the continuous transportation of material a belt conveyor are used in the transport of coal and mineral powder it gives high efficiency and environmental protection. In some cases according to requirement if increase conveyor inclination up to 170 to 180 the impact on the whole assembly of shaft occur due to this impact of material on conveyor shaft it break or bend within few month. An analysis of stress and impact creates on roller shaft with the help of Hypermesh and to develop design of shaft for 170 to 180 create model Analysis using hyperwork. By using design failure modes and effects Analysis (DFMEA) for systematic, proactive method for identifying where and how it might fail..

**Deepak Gupta [9]** Material handling equipment are designed for many advantage such as easy, cheap, fast and

safe loading and unloading condition. Belt conveyor systems are design for easy handling of materials in terms of weight and height. This paper discusses the design and considerations of belt conveyor system for sample weight, in terms of size, length, capacity and speed, roller diameter, location and arrangement of pulley, angle and axis of rotation, control mode, intended application, product to be handled.

**LARRY M. STRECKER and PAUL CROOKS[10]** This case involves three competing warehouse designs requiring time study analysis, economic analysis, layout analysis and sensitivity analysis of business changes to evaluate trade-offs between automated and conventional equipment and between capital and operating expenses.

#### 4. Problem Formulation

During the construction of slabs in civil structure it was revealed that, the continuous supply of construction material is very much needed. This is usually done with the help of labors, sometimes; a temporary material lift is fabricated for this. Both this process is labor intensive and costly and time consuming. Supply of material may sometime also lead to accidents or injuries to workers. In this project we are undertaking design of material handling system which can supply construction material continuously to the top end of the construction site, and also to ensure the mobility of this system.

Hence there is a need to design a mobile conveyor material handling system, so we will design the mobile belt conveyor material handling system to automate this process, to save time and minimize the human effort. In the proposed work we will be generating optimized CAD model considering the on field work parameters. Also, Finite element Analysis will be done on the generated CAD model using

#### 5. Research Methodology

In this proposed project we are performing design of belt conveyor material handling system which can supply construction material continuously to the top end of the construction site, and also to ensure the mobility reliability of this system. This will reduce the cost of labor at the construction site significantly. Also, it will ensure the higher productivity at minimum required time. The proposed work for the topic is as follows:



1. To accumulate the data regarding existing process
2. To conceptualize the design and form the design calculation.
3. To generate the CAD model of mobile belt conveyor system by using SolidWorks.
4. To perform Finite Element Analysis by using FE software's.
5. To optimize the design using the data obtained from FEA

Methodology Used:

For Design: SolidWorks.

For Analysis: Finite Element Analysis Method.

## 6. Conclusion

In this proposed project we are performing design of belt conveyor material handling system which can supply construction material continuously to the top end of the construction site, and also to ensure the mobility reliability of this system. This will reduce the cost of labor at the construction site significantly. Also, it will ensure the higher productivity at minimum required time.

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