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Design, development and analysis of Roller Conveyor

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Abstract - *In the present work, an attempt is made to reduction in weight of existing roller conveyor by optimizing the critical parts of (e.g. Roller,) conveyor without hampering its structural strength. Upon completion of the experimentation, the assembly is observed for any visible damage to the conveyor units. As the roller in which changes are made in existing design are standard (the weight of the physical model is slightly more than the optimized model values).So made easily available in market.*

1. INTRODUCTION

A transport framework is bit of mechanical hardware used to transfer the material from one place to another. These are used in transport the material which are having heavy weight and bulky material. Conveyor system allows the quick and efficient transport for a variety of material and having a very popular material in handling and packing industries. There are many types of conveyor system are used in present and used according to needs used in various industries. Conveyors are safely to transport the material from one level to another level and they can reduce the human labor and it is expensive. In that Roller Conveyor is one of them which consist of use of channels, rollers and shaft that are heavy by virtue of their structure

Need of Roller Conveyor Machine:

To transport material from one point to another point.

To prevent damage to boxes while transportation.

To reduce human efforts.

1.1 Methodology

Study of concept drawing provided to enlist parts used. Alongside technical specification list is also made.

Design calculations are done simultaneously with material selection.

Process planning, comparative planning is done. First the foundation is designed and then the driven design is made. Then bought-out parts are selected. Failure identification is done.

Then using FEA the design is analyzed. If analysis fails then material selection and successive activities are performed again and if it is passed, final material costing, final welding costing, fabrication drawings are made and bill of material is made.

2. Selection of Material

2.1. Material Selection for Frame

Function- To support the load Objective-To reduce the Weight Constraint- Forces and Length Variable-Size and material selection

2.2. Ashby Chart

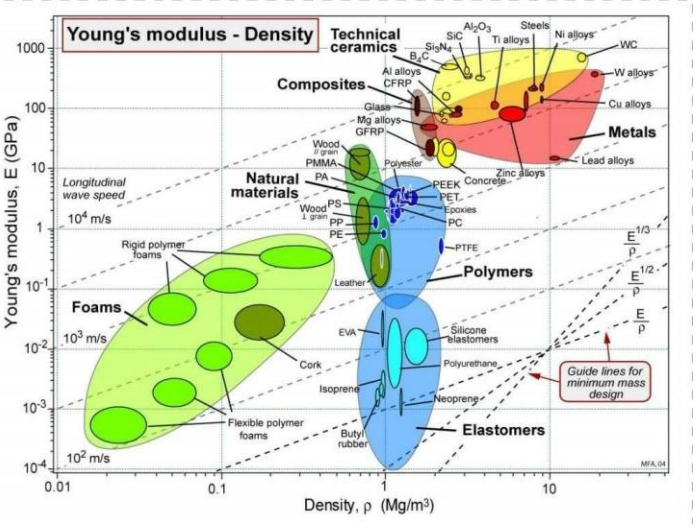

Chart -1: Young's Modulus vs Density

2.3. Guidelines

Density-7800-7900 Kg/m^3
Strength-415-755 Mpa

2.4. Potential Material

ASTM A29 Grade 1005

Stainless Steel 400C
ASTM A815

2.5. Material Property

ASTM (American Society for testing and materials):For Material Properties and ChemicalComposition

Table -1: Material Properties

Material	Density Kg/m^3	Young's Modulus	Yield Strength
ASTM A29 Grade 1005	7900	215	811
Stainless Steel400C	7800	210	445
ASTM A815	7800	220	240

2.6. Scaled Value

Table -2: Scaled Values

Material	Density	Young's Modulus	Yield Strength
ASTM A29 Grade1005	98	97	100
Stainless Steel400C	100	95	54
ASTM A815	100	100	29

2.7. Calculating Weighing Factor

Weighing Factor – Positive Decisions / Total

Table -3: Weighing Factor

Property	Positive Decisions	Weighing Factor
Density	4	0.33
Young's Modulus	3	0.25
Yield Strength	2	0.16
Total	12	

2.8. Calculating Performance Index

Table -4: Performance Index

Material	Performing Index
ASTM A29 Grade1005	94.34
Stainless Steel 400C	89.69
ASTM A815	83.12

The material with the highest Performance index is selected
i.e. ASTM A29 Grade 1005.

3. FEA Analysis

On the basis of numerical work and material selection for the frame, roller of the roller conveyormachine. Now, Validation of the numerical work and design work is done with the help of Solidworks software. All the potential material selected are applied one by one on the parts to be analyzed by giving input parameters as load on frame, torque on roller, etc. and simulation of respective part is done. After the simulation work the results are critically analyzed and reports of simulation work is generated.

3.1. Analysis of Side Frame

Material selected for frame is ASTM A29 Grade 1005. Selected material is applied to frame and simulation is done. Frame is designed in rectangle shape due to the constrain of hinges. To selectproper size of side frame, various sizes of frameareanalyzed and the correct size on the basis of results of analysis is selected for frame, which achieves goal of weight reduction of frame by taking load of all theassemblies in the machine.

Considering the load of rollers and other components of the machine which relays onframe (51,620 N) is applied on frame. The base of the frame is fixed and simulation is done.The result of simulation includes:

Maximum stress in N/mm2.FOS

Yield strength in N/mm2Deformation in mm Strain

Weight in kg

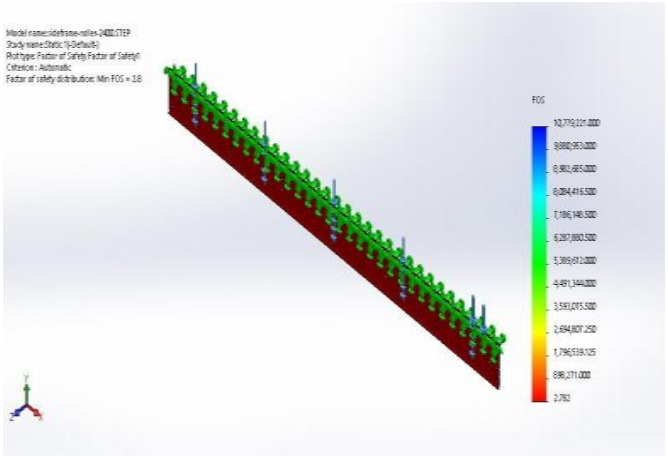

Fig -1: Analysis of Side Frame

3.2. Result of Side Frame

Table -5: Result Table for Side Frame

Parameters	Size – 2400×194 x 2.5mm
Stress (N/mm2)	65.138
Deformation (mm)	0.727
FOS	2.8
Strain	0.00
Yield strength (N/mm2)	811
Weight(kg)	41

3.3. Analysis on Roller

For the simulation of roller, it is fixed at boththeends with bearing geometry. Torque is applied on the roller to get the results. The analysis is done to knowthe lifecycle and deflection level of roller under loading condition. EN24T is selected as the material of the roller during selection from all the potential materials. For validation of the material selection all the potential materials are analyzed and the resultsare noted.The result of simulation includes:

Maximum stress in N/mm2.FOS

Yield strength in N/mm2 Weight in kg.

Life Cycle.

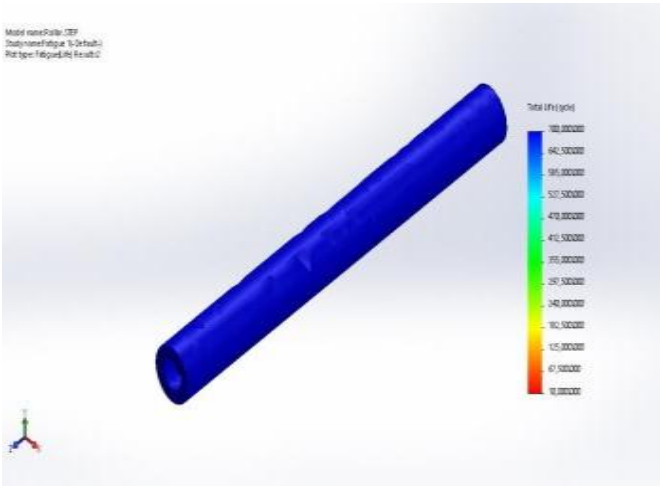

Fig -2: Analysis of Roller

3.4. Result of Roller

Table -6: Result Table for Roller

Parameters	
Stress (N/mm2)	330.638
Deformation (mm)	0.364
FOS	2.58
Strain	0.00
Yield strength (N/mm2)	650
Weight(kg)	0.711
Life Cycle	7,00,000

4. CONCLUSIONS

In this paper, we propose design and material selection calculations for roller and side frame.EN24T and ASTM A29 Grade 1005 were chosen forthe Roller and Side Frame respectively. According to the FEA analysis, the roller life cycle was increased to 7, 00,000 revolutions from 3, 00,000 revolutions.

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