A Report on

"A CONCEPT DESIGN OF ECONOMICAL MATERIAL HANDLING SYSTEM FOR STONE MINING (QUARRY) INDUSTRIES"

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न हि ज्ञानेन सदृशं पवित्रमिह विद्यते।

Smt. S. R. PATEL ENGINEERING COLLEGE

A Project Report on

"A Concept Design of Economical Material Handling System for Stone Mining (Quarry) Industries"

Submitted to

SMT S.R.PATEL ENGINEERING COLLEGE

Affiliated with

GUJARAT TECHNOLOGICAL UNIVERSITY

In partial fulfillment of the Project Assigned to 8th Semester of

Bachelor of Engineering (BE)

In

MECHANICAL ENGINEERING

Prepared by

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Under the guidance of

Praful K. Patel (Ext. Guide)

Under the guidance of

Prof. Jayendra B. Patel

CERTIFICATE

This is to certify that following students of B.E. Final year Mechanical Engineering have satisfactorily completed their project on **"A Concept Design of Economical Material Handling System for Stone Mining (Quarry) Industries"** towards the partial requirement of VIII semester, B. E. Mechanical degree curriculum. The project work is a bona fide record carried out by them during academic year 2015-2016 in Department of Mechanical Engineering, Smt. S. R. Patel Engineering College, Unjha.

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External Examiner

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ABSTRACT

In rock/stone mining industries large stone as raw material need to be transported from deep mine to ground floor and from ground floor to crusher plant. The distance of material/raw material handling is varying from mine to mine. Material handling equipment are designed such that they facilitate easy, cheap, fast, safe and continuous material handling with least human interference. For instance belt conveyor and crane system can be employed for easy handling of materials beyond human capacity and conventional vehicles like trucks and tractors in terms of weight and height.

This project works on selection of material handling equipment, basic design, considering belt conveyor system and crane. For crushed stone with maximum loading capacity, in order to ensure fast, continuous and efficient movement. It is able to give appropriate work at different site locations.

After completion of this project work achieved data can be used for industrial application and also beneficial for belt conveyor and crane development which is capable to work easy, fast and economical as compare to current scenario.

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Business Model Canvas (Report)	**Completed**
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Business Model Canvas (Report)	**Completed**
Patent Drafting Exercise (PDE)	**Completed**
Final Plagiarism Report	**Completed**
Final Project Report	**Completed**

Name of Student : Patel Bhavikkumar Kantilal Name of Guide : Mr. Jayendra Bholabhai Patel

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CHAPTER: 01

INTRODUCTION

1.1 PROJECT BACKGROUND

In mining industries large stone as raw material need to be transported from deep mine to ground floor and from ground floor to crusher plant. The distance of material/raw material handling is varying from mine to mine. Material handling equipment are designed such that they facilitate easy, cheap, fast, safe and continuous material handling with least human interference. For instance belt conveyor and crane system can be employed for easy handling of materials beyond human capacity and conventional vehicles like trucks and tractors in terms of weight and height. This project works on selection of material handling equipment, basic design, considering belt conveyor system and crane. For crushed stone with maximum loading capacity, in order to ensure fast, continuous and efficient movement. It is able to give appropriate work at different site locations.

Mining in Gujarat are found that working on conventional methods today, they use industrial trucks for raw material handling form mine to plant. It also facing problem of high consumption of diesel in excavators. Problem of fine dust is also most challenging problem in this type of industries.

1.2 PROBLEM STATEMENT

This project is about to solve out the problem of cost of material handling and man power cost by using semi-automatic material handling system. It will reduce the dusting at unloading location somehow.

1.3 PROJECT OBJECTIVE

By changing of material handling system, aim is reduce the cost of material handling system which is most affecting cost in this type of industries.

1.4 PROBLEM IN CURRENT SITUATION

- In last few years prices of land/raw material of mining is increased unexpectedly and hence price of aggregate increased. Now a days it is necessary to reduce cost somehow.
- Before today mining industries of Gujarat are choose to go for long distance rather than high depth due to cost.
- In current situation, truck and tractors are used to material handling from mine to crusher plant. The distance between plants to mine is varying from industry to industry, but distance is not more affecting factor then depth/slope.
- Truck and tractor have large fuel consumption and high maintenance work in slope area in terms of wear of tyre, Gear box, piston, oil, and labour etc.
- To overcome problem of cost, it is only possible way if we can reduce cost of material handling.
- Another problem of storage and safety of large fuel tank, because it is not practically possible to go for filling fuel, it is time consuming and costly.

1.5 INTRODUCTION TO MATERIAL HANDLING

- The industrial development has led to the growth of the factory or plant size. The growth of the factory or plant size has created huge demand for the material handling systems.
- Material Handling Process Consists of three activities
    1. Loading (Picking up the load)
    2. Transporting the load
    3. Unloading (Setting the load down)
- The material handling does not add any value to a product, it adds a significant elements of cost. In general, *the material handling cost ranges from 10% to 35% of cost of product.*
- As the material handling cost constitutes a large portion of the product cost, the material handling engineer's primary function is to minimize the material handling. It is said that, ***"The best handling is the least handling!***

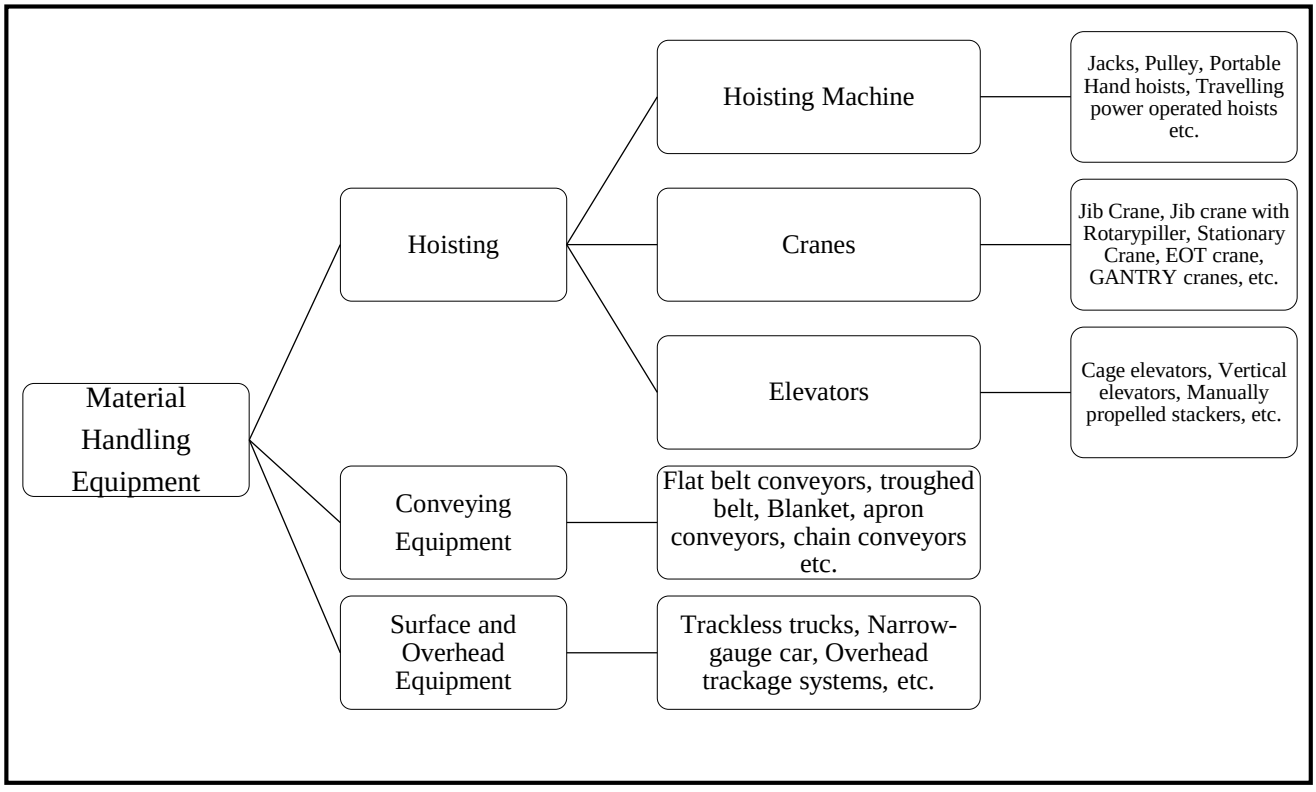
1.6 INTRODUCTION TO MATERIAL HANDLING EQUIPMENT

- Material handling equipment are used for moving loads in factories or plants, construction sites, mines, ports, storages centres, etc.; in horizontal, vertical, or inclined directions over comparatively short distance of tens or hundreds of metres and occasionally thousands of metres. It ensures a constant load transfer between two or several point connected by the common activities.

1.7 CLASSIFICATION OF MATERIAL HANDLING EQUIPMENT[1]

The material handling equipment are classified into three groups

1. Hoisting Equipment
2. Conveying Equipment
3. Surface and Overload Equipment



[Table : 1 Classification of MH Equipment]

1.8 OBJECTIVES OF MATERIAL HANDLING SYSTEM[1]

1. **Accuracy in transporting load to destination:**
   - The material handling system should transport the loads to the destination with fair degree of positional accuracy.

2. **Precision in pick-up of load:**
    - The material handling system should pick-up the loads from their position within the shortest time with minimum invention.

3. **Transporting loads in scheduling time:**
    - The material handling system should move the loads to their destination in the scheduled time.

4. **Transporting loads of required quantity:**
    - The material handling system should deliver the load to the department or place in the required quantity.
    - The rate of supply of material, by the material handling system, is very important parameter affecting the performance of the plant, especially in continuous flow of bulk load.

5. **Transporting load without damage:**
    - The material handling system should not damage the load, being transported, at the time of loading, unloading or transportation.

6. **Automation with minimum manpower**:
    - The material handling system should be mechanized to the fullest possible extent so as to minimize the manpower requirement for operation and control.

7. **Low initial and operational cost:**
    - The material handling system should have low initial as well as running cost.

8. **Simplicity and easy maintenance**:
    - The material handling system should have simple arrangement.
    - The hoisting and conveying equipment are now-a-days assembled from standard units. The different standard mechanical and structural components or units are assembled to form the material handling system.
    - The standardization improves the performance of system and reduces its cost.
    - The standard units not only simplify the arrangement but also are convenient in servicing. The unit needing repair can be easily replaced and repairs can be carried out at specialized workshops, thus minimizing the requirement of onsite maintenance facility.

9. **Operational safety:**
    - The material handling system should be safe in operation. It should have sufficient number of in-built safety devices, so as to ensure the safe working environment.

1.9 GUIDELINES IN SELECTING MATERIAL HANDLING EQUIPMENT

The following factors are considered while selecting the material handling equipment for given operation.

1. **Direction of load travel:**
    - The direction of load travel is one of the most important parameter in selecting the material handling equipment for the given application.
    - If the direction of load travel is vertical or close to vertical, the equipment used are: hoists, cranes or elevators.
    - If the direction of load travel is horizontal or close to horizontal, the various types of conveyor are used.

2. **Length of travel:**
    - If the length of load travel is large, conveyors are used; whereas if the length of load travel is small, hoists or cranes are used.

3. **Types and properties of load to be handled:**
    - The type of load to be handled is considered while selecting the material handling equipment for the given application.
    - For example hoisting machines are suitable for unit loads; whereas conveyors are suitable for bulk loads.
    - In addition, the various properties of load need to be taken into account while selecting the material handling equipment for given application.
    - The properties of unit load are: weight, convenient bearing surface, part of suspension, brittleness, hardness, surface finish, etc.
    - The properties of bulk loads are: lump size, density, chemical properties, temperature, etc.

4. **Required load moving capacity of unit:**
    - If the required load moving capacity is large, then the continuous type devices, like conveyor are used.

- However, if the required load moving capacity is moderate to low, then the devices like electrically operated overhead crane or power driven trucks can be used.

5. **Characteristic of production process:**
   - This is one of the most significant factors in selecting the material handling equipment.
   - For example, assembly lines and paint shops use conveyors; forging and welding shops employ cranes, whereas mines use conveyor and elevator

6. **Method of stacking loads at initial and final points:**
   - The methods of stacking load at loading point and unloading point influence the selection of material handling equipment.
   - If the bulk load are stored in pile from which can either flow by gravity or can be scooped by some means on to the transporting facility, conveyors are used.
   - If the unit loads are placed on the floor, cranes or hoists are used.

7. **Local conditions:**
   - The local condition influencing the selection of material handling equipment are :
     A. Size and shape of area.
     B. Type and design of building.
     C. Safety requirement.
     D. Types of energy available.
     E. Climatic conditions.

8. **Initial and operational cost:**
   - The initial and operational costs are important in selecting the material handling equipment for given application.

1.10 SYSTEM CONCEPT FOR MATERIAL HANDLING

Any solution of material handling problem must satisfy the following conditions:

1. The solution of material handling problem should not transfer the problem into other areas of the production cycle.
2. The solution should not only resolve the immediate problems, but also take care of problems for a reasonably long period of time.
3. The solution should be as simple as possible and easy to adopt.

4. The solution should be such that the initial cost as well as operational cost should be minimum.
5. The rate of return on investment should justify the solution.

1.11 TYPES OF LOAD HANDLED BY MSTERIAL HANDLING SYSTEM

The load handled by material handling system can be classified into two types:

1. Bulk Loads 2. Unit Loads

1. Bulk Loads :

- The bulk load consist of a large number of homogeneous particles or lump of any material.
- The examples of bulk load are: coal, mineral ore, sand, stone, clay, cement, etc.

2. Unit Loads :

- The unit load is a rigid single mass which is handled and transported as one piece.
- The examples of unit load are: machines, boxes, containers, etc.

CHAPTER: 02

LITRETURE REVIEW

2.1 RESEARCH PAPERS

1. Arthur B Cummins et. al. suggested lump size for any material, The belt width should be equal to 3.5 times the longest dimension of the occasional lump.

2. Pitor Kasza et. al. Give clarification about various design parameters of belt conveyor as per CEMA (Conveyor Equipment Manufacturer's Association of the USA.) give bulk material designation characteristic. Also recommend maximum inclination of belt for rock excavated with shovel is 22˙ and angle of repose between 30^0 - 44^0.Gave relationships between various parameters to be selected.

3. W. Roberts et. Al. done research for belt length and cost per unit length, For conveyor lengths beyond 1 km, the cost per unit length increases. Also suggest to use number of shorter belt in series is economically beneficial. The idler resistance is somewhat insensitive to idler diameter.
   The relative costs of storing and transporting bulk materials are, in the majority of cases, quite significant. It is important that handling systems be designed and operated with a view to achieving maximum efficiency and reliability.

4. Peter Saxby et. Al. It is now becoming common to find under- ground conveyors with 400 m lifts. This technology is challenging conventional shaft and winders in underground mining applications.
   In one application, it was found that delivery of 1,000 tph ore from a 1,000 m deep mine could be economically achieved by either conventional shaft and winder or a three flight conveyor system. The issue that ultimately drove the decision in favour of a shaft and winder system was geotechnical, not economic.

5. Jack de la Vergne et. al. suggested criteria for belt design as, Compare payload to dead load ratio of conveyor and trucks. The ton-mile cost of transport by belt conveyor may be as low as one-tenth the cost by haul truck. Factor of safety for belt tension can be reduced from 10:1 to 8:1 for fabric belts and from 7:1 to 6:1 for steel cord belts. Suggest criteria to be define for belt design

6. A. Harrison et. Al. give the necessary parameters for design Conveyor belt idler resistance taking into account belt rubber hardness, sag, troughing configuration, idler/belt indentation and ambient operating temperature.

7. Taiwo A. et. Al. stated that, The peculiarities of a belt conveyor is that it is easy and cheap to maintain, it has high loading and unloading capacity and can transport dense materials economically and at very high efficiency over long distance allowing relative movement of material.

8. Ogedengbe, et. At. The design of an effective and efficient material handling system which will increase productivity and minimize cost, the guidelines normally followed are:

    1. Designing the system for continuous flow of material (idle time should be zero);
    2. Going in for standard equipment which ensures low investment and flexibility;
    3. Incorporating gravity flow in material flow system; and
    4. Ensuring that the ratio of the dead weight to the payload of material handling equipment is minimum.

9. A. Daniyan et. Al. A belt conveyor consists of an endless and flexible belt of high strength with two end pulleys (driver and driven) at fixed positions supported by rollers. In this work, 3 roll idlers are required for adequate support of materials transported and protection of the belt along its length. Pulleys are used for providing the drive to the belt through a drive unit gear box powered by an electric motor. It also helps in maintaining the proper tension to the belt. The drive imparts power to one or more pulleys to move the belt and its loads.

The design of belt conveyor system involves determination of the correct dimension of the belt conveyor components and other critical parameter values so as to ensure optimum efficiency during loading and unloading conditions. Some of the components are: Conveyor belt, motor, pulley and idlers, rollers, etc.

Author suggested calculation for crushed limestone as follows:

1. Belt width (mm):1200
2. Length of Conveyor (m) :100
3. Basic belt length (m) :200
4. Belt speed (m/sec) :1.25
5. Height of Conveyor (m) :10
6. Angle of inclination(degree) :10
7. Troughing angle (degree) :35
8. Conveyor capacity (tonnes/hr) :355
9. Idler spacing (m) :1.0
10. Material density (kg/m3) :1500
11. Belt thickness (mm) :21

2.2 PATENTS

Title of Invention: Bulk material handling system and method

Patent No. : US 8,955,667 B

Name of Inventor: Merton F Dibble

In view of the foregoing, it is an object of the present invention to provide improved bulk material handling systems and methods. According to an embodiment of the present invention, a bulk material handling system includes a first loading boom assembly. The first loading boom assembly has a horizontal boom frame extending along a boom axis between first and second boom frame ends and a vertical boom frame supporting the horizontal boom frame between the first and second boom frame ends. A boom frame rotation mechanism engages the vertical boom frame and is operable to rotate the vertical and horizontal boom frames about a vertically-extending boom rotation axis intersecting the boom axis between the first and second boom frame ends. A boom conveyor mechanism is operable to convey bulk material there along, and extends between first and second boom conveyor ends. The boom conveyor mechanism is slid ably mounted to the horizontal boom frame extending along the boom axis and intersecting the rotation axis. The first boom conveyor end is oriented toward the first boom frame end and the second boom conveyor end is oriented toward the second boom frame end. A boom conveyor displacement mechanism engages the boom conveyor mechanism and is operable to slide the boom conveyor mechanism along the boom axis in a first boom direction, where the first and second boom conveyor ends move, respectively, away from and toward the rotation axis, and a second boom direction opposite thereto. A receiving hopper is mounted to the horizontal boom frame over the boom conveyor mechanism. The receiving hopper extends along the rotation axis and is configured to receive bulk material and subsequently direct bulk material to the boom conveyor mechanism. A discharge spout is arranged at the first end of the boom conveyor and slidable therewith, and configured to receive bulk material from the boom conveyor and subsequently discharge bulk material.

Title of Invention: CONVEYOR SYSTEM, CONVEYOR APPARATUS AND TROUGHED PULLEY

Patent No. : US 2014/0048388 A1

Name of Inventor: Hefner Kenneth Monroe

Conveyor systems can be relatively large systems (e. g., conveyor systems found in coal electric generating plants) or relatively small systems (e. g., conveyor systems found in commercial retail centres). Conveyor systems typically include a pulley that rotates With

respect to a frame and that drives a belt surrounding the pulley. Conveyor systems also typically include a motor that drives a gear reducer, which, in turn, drives one or more pulleys that, in turn, drives movement of the belt coupled to the pulleys. It should be appreciated that conveyor system may include additional conveyor apparatuses Which may or may not include a troughed pulley described herein, however, for convenience of discussion purposes, conveyor system has been illustrated as including only first conveyor apparatus and second conveyor apparatus.

Title of Invention: MINING METHODS AND SYSTEMS USING MOBILE CONVEYORS

Patent No. : 20100308641

Name of Inventor: (1)Lezius Ruben E (2)Lurie Martin S (3)Brewka Christof

Name of Applicant: ThyssenKrupp Robins Inc., Greenwood Village, US

The conveyor system may include a first conveyor line extending from an overburden side of the mine to a stack side of the mine, and a second conveyor line extending from the overburden side of the mine to the stack side of the mine. The first conveyor line may include at least one mobile bridge conveyor, and the second conveyor line may include at least one mobile bridge conveyor. The first conveyor line may be operatively associated with excavation equipment operating at a first location in the mine, and the second conveyor line may be operatively associated with excavation equipment operating at a second location in the mine. The first conveyor line may transport at least a portion of the material excavated from the first location in the mine to a third location in the mine, and the second conveyor line may transport at least a portion of the material excavated from the second location in the mine to a fourth location in the mine. In some embodiments, the system may further include a third conveyor line extending from the overburden side of the mine to the stack side of the mine. In such embodiments, the third conveyor line may include at least one mobile bridge conveyor, may be operatively associated with excavation equipment operating at a fifth location in the mine, and may transport at least a portion of the material excavated from the fifth location in the mine to a sixth location in the mine.

The first mobile bridge conveyor may include a first conveyor positioned above a second conveyor. The first conveyor may be operatively associated with excavation equipment operating at a first location in the mine. The second conveyor may be operatively associated with excavation equipment operating at a second location in the mine. The first conveyor may transport at least a portion of the material excavated from the first location in the mine to a third location in the mine. The second conveyor may transport at least a portion of the material excavated from the second location in the mine to a fourth location in the mine.

Title of Invention: METHOD FOR DETERMINING THE SPECIFIC POWER REQUIREMENT OF A BELT CONVEYOR SYSTEM FOR BULK MATERIALS IN OPERATION WITH NONCONSTANT LOADING

Patent No. : CN101583548 B

Name of Inventor: ZIEGLER MANFRED

Name of Applicant: RWE POWER AKTIENGESELLSCHAFT

Belt Conveyor Belt Conveyor power demand on the one hand and the mass flow rate of feed on the other hand with different resistance to movement about the belt conveyor, according to the alignment state of the resistance movement belt, pollution status or different situations roller maintenance status and different. That has a different load conveyor cross-section along its length. We can only measure the motor drive power and set the time required by a conveyor scale only measures the current mass flow. To be able to infer the maintenance status of the tape device, and must be removed due to the observed mass flow in the experiments confirmed that between the drive power and the load cannot be launched with a univocal function of such hypothetical exercise resistance friction values or units of data with large uncertainties.

2.3 TYPES OF CONVEYORS

1. Chute conveyor
2. Wheel conveyor
3. Roller conveyor (a) Gravity roller conveyor (b) Live (powered) roller conveyor
4. Chain conveyor
5. Slat conveyor
6. Flat belt conveyor
7. Magnetic belt conveyor
8. Troughed belt conveyor
9. Bucket conveyor
10. Vibrating conveyor
11. Screw conveyor
12. Pneumatic conveyor (a) Dilute-phase pneumatic (b) Carrier-system pneumatic conveyor
13. Vertical conveyor (a) Vertical lift conveyor

    (b) Reciprocating vertical conveyor

14. Cart-on-track conveyor

15. Tow conveyor

6. Trolley conveyor

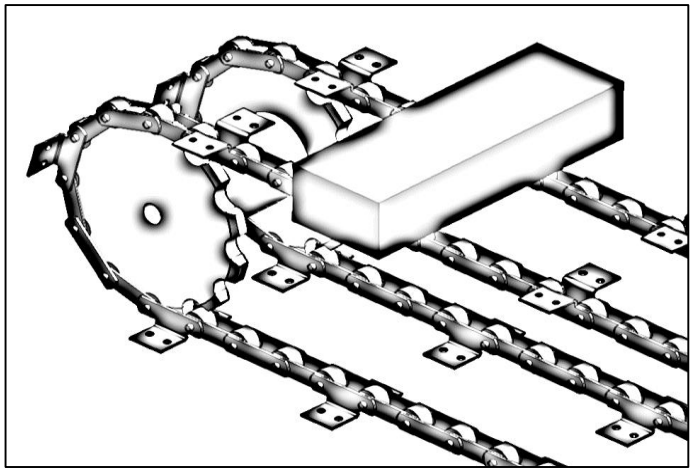
17. Power-and-free conveyor

18. Monorail

19. Sortation conveyor (a) Diverters (b) Pop-up devices (c) Sliding shoe device (d) Tilting device (e) Cross-belt transfer device

1. Chain conveyor

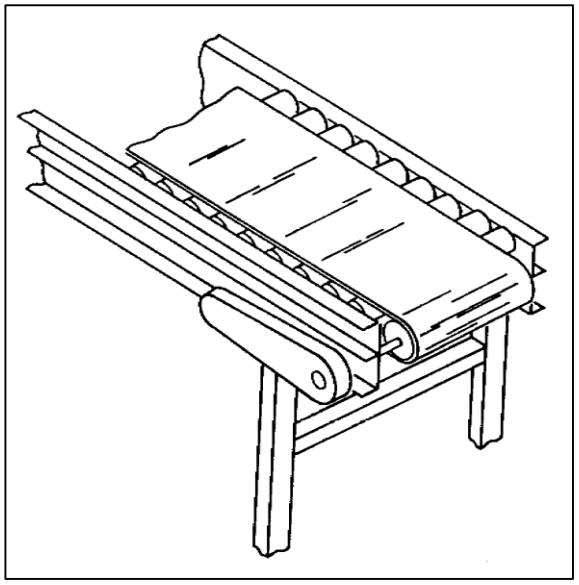
- Unit + In-/On-Floor + No Accumulation
- Uses one or more endless chains on which loads are carried directly
- Parallel chain configuration used as (chain) pallet conveyor or as a pop-up device for sortation
- Vertical chain conveyor used for continuous high-frequency vertical transfers, where material on horizontal platforms attached to chain link (cf. vertical conveyor used for low-frequency intermittent transfers)



[Figure: 2.3.1]

2. Flat belt conveyor

- -Unit + On-Floor + No Accumulation
- For transporting light- and medium-weight loads between operations, departments, levels, and buildings
- When an incline or decline is required
- Provides considerable control over the orientation and placement of load
- No smooth accumulation, merging, and sorting on the belt
- The belt is roller or slider bed supported; the slider bed is used for small and irregularly shaped items



[Figure: 2.3.2]

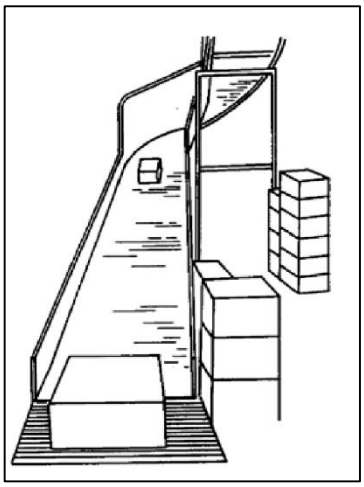
- Conveying hot or abrasive substances in order to have both sides wear equally(13)

- Telescopic boom attachments are available for trailer loading and unloading, and can include ventilation to pump conditioned air into the trailer (14)

{ 13 Gardner, M., 1995, New Mathematical Diversions, Washington, DC: Mathematical Assoc. of America.
14 MMH, 2000, Modern Materials Handling, 55(12):35.}

3. Chute conveyor

- Unit/Bulk + On-Floor + Accumulate
- Inexpensive
- Used to link two handling devices
- Used to provide accumulation in shipping areas
- Used to convey items between floors
- Difficult to control position of the items

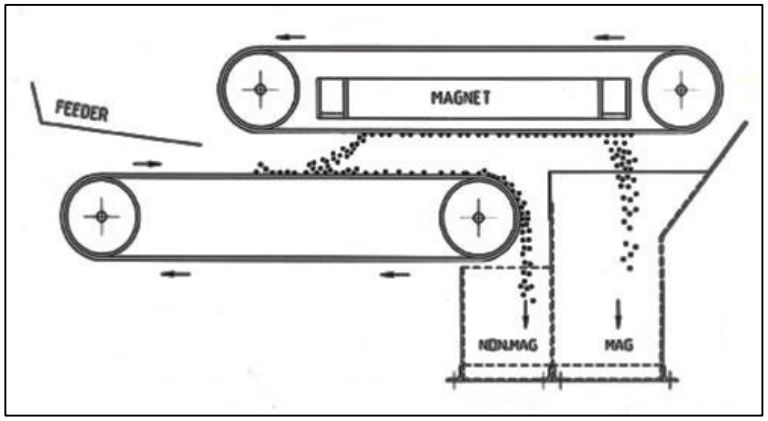


[Figure: 2.3.3]

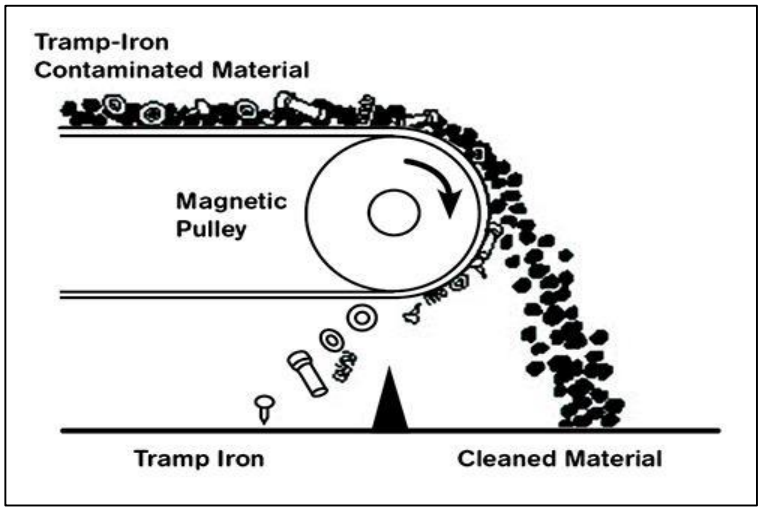
4. Magnetic belt conveyor

- Bulk + On-Floor

- A steel belt and either a magnetic slider bed or a magnetic pulley is used To transport ferrous materials vertically, upside down, and around corner.



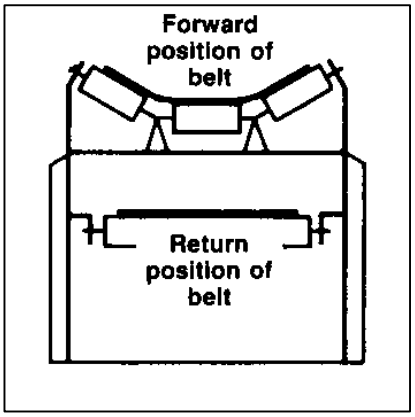
[Figure: 2.3.4(a)]



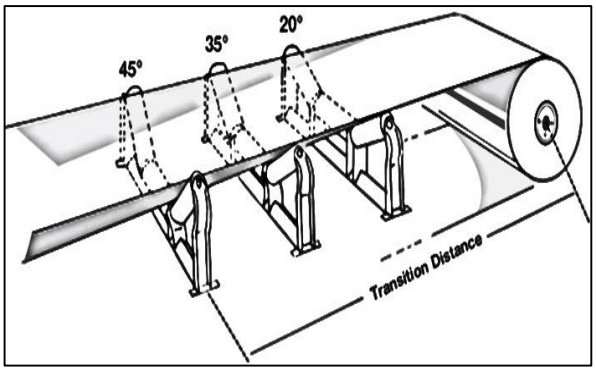
[Figure: 2.3.4(b)]

5. Troughed belt conveyor

- Bulk + On-Floor
- Used to transport bulk materials
- When loaded, the belt conforms to the shape of the troughed rollers and idlers



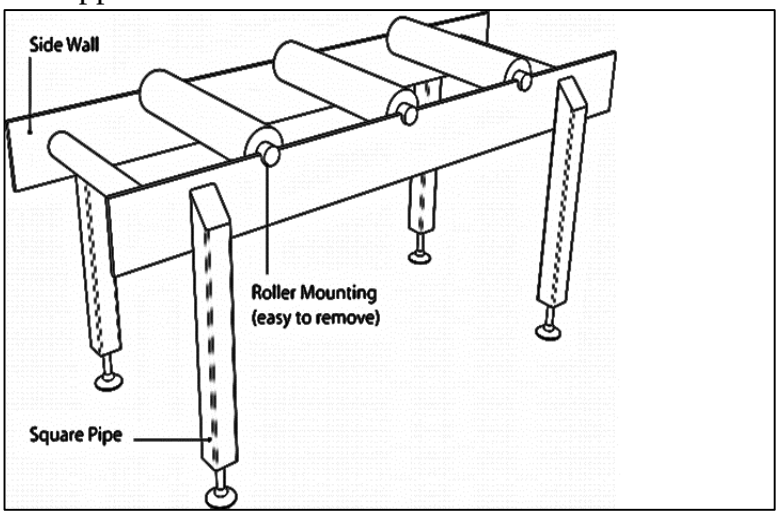
[Figure: 2.3.5(a)]



[Figure: 2.3.5(b)]

6. Roller conveyor

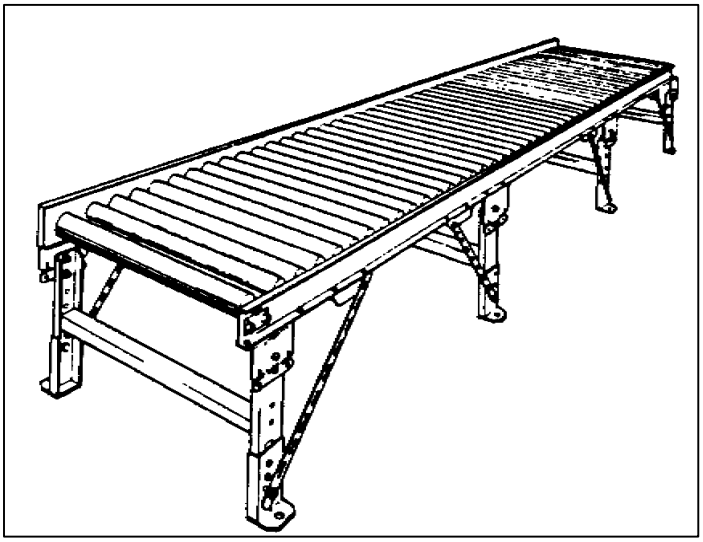
- Unit + On-Floor + Accumulate
- May be powered (or live) or non-powered (or gravity)
- Materials must have a rigid riding surface
- Minimum of three rollers must support smallest loads at all times
- Tapered rollers on curves used to maintain load orientation
- Parallel roller configuration can be used as a (roller) pallet conveyor (more flexible than a chain pallet conveyor because rollers can be used to accommodate are greater variation of pallet widths)



[Figure: 2.3.6]

6(a) Gravity roller conveyor

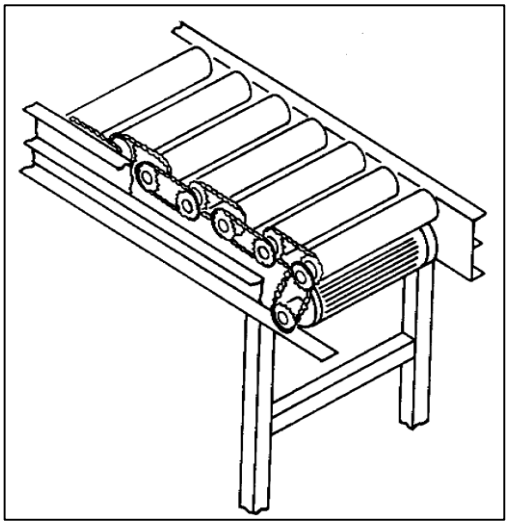
- Alternative to wheel conveyor
- For heavy-duty applications
- Slope (i.e., decline) for gravity movement depends on load weight
- For accumulating loads



[Figure: 2.3.7]

6(b) Live (powered) roller conveyor

- Belt or chain driven Force-sensitive transmission can be used to disengage rollers for accumulation
- For accumulating loads and merging/sorting operations
- Provides limited incline movement capabilities



[Figure: 2.3.8]

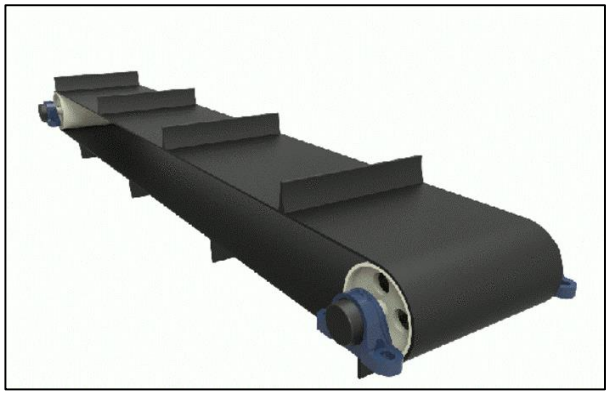
7. Wheel conveyor

- Unit + On-Floor + Accumulate
- Uses a series of skate wheels mounted on a shaft (or axle)
- Spacing of the wheels is dependent on the load being transported
- Slope for gravity movement depends on load weight
- More economical than the roller conveyor
- For light-duty applications
- Flexible, expandable mobile versions available

8. Slat conveyor

- Unit + In-/On-Floor + No Accumulation
- Uses discretely spaced slats connected to a chain

- Unit being transported retains its position (like a belt conveyor)
- Orientation and placement of the load is controlled
- Used for heavy loads or loads that might damage a belt

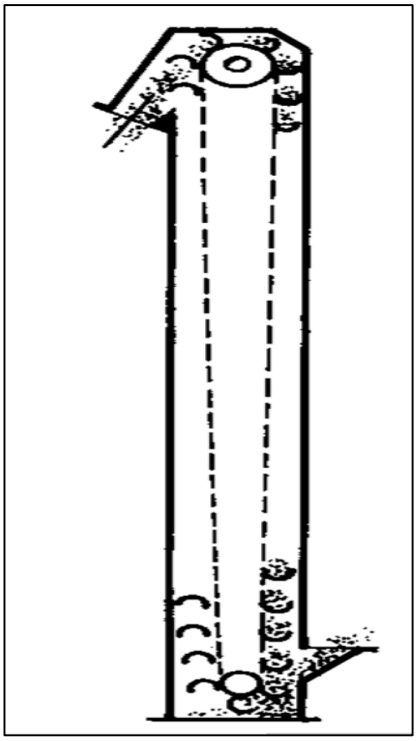


[Figure: 2.3.9]

- Bottling and canning plants use flat chain or slat conveyors because of wet conditions, temperature, and cleanliness requirements
- Tilt slat conveyor used for sortation

9. Bucket conveyor

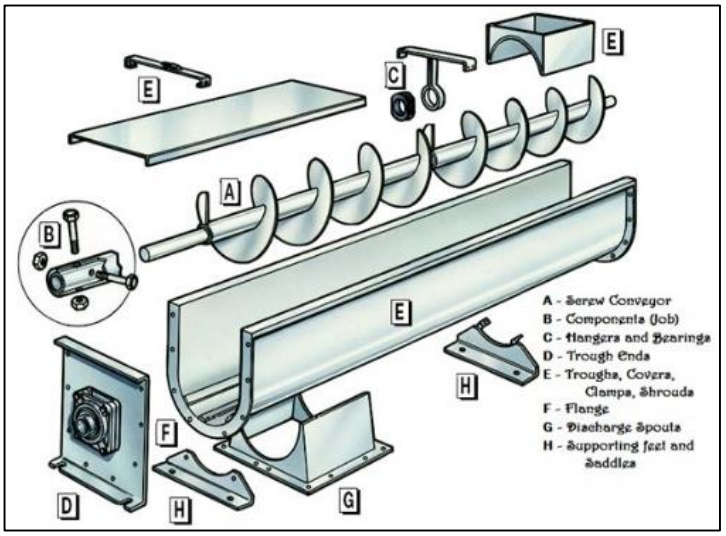
- Bulk + On-Floor
- Used to move bulk materials in a vertical or inclined path
- Buckets are attached to a cable, chain, or belt
- Buckets are automatically unloaded at the end of the conveyor run



[Figure: 2.3.10]

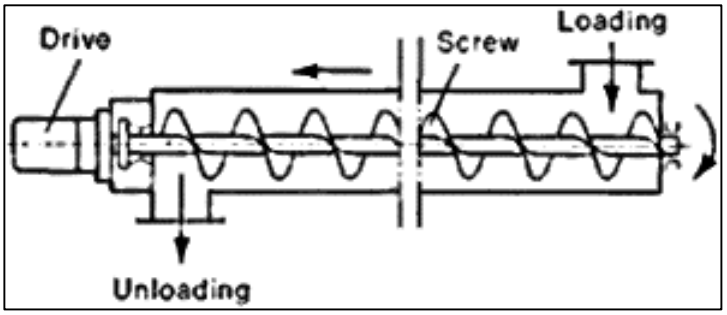
10. Screw conveyor

- Bulk + On-Floor
- Consists of a tube or U-shaped stationary trough through which a shaft-mounted helix revolves to push loose material forward in a horizontal or inclined direction



[Figure: 2.3.11(a)]

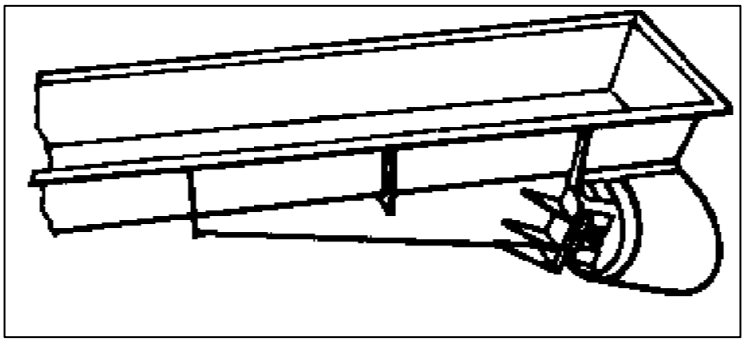
- One of the most widely used conveyors in the processing industry, with many applications in agricultural and chemical processing.
- Straight-tube screw conveyor sometimes referred to as an "auger feed" Water screw developed 250 BC by Archimedes



[Figure: 2.3.11(b)]

11. Vibrating conveyor

- Bulk + On-Floor
- Consists of a trough, bed, or tube
- Vibrates at a relatively high frequency and small amplitude in order to convey individual units of products or bulk material.
- Can be used to convey almost all granular, free-flowing materials



[Figure: 2.3.12]

- An Oscillating Conveyor is similar in construction, but vibrates at a lower frequency and larger amplitude (not as gentle) in order to convey larger objects such as hot castings

12. Vertical conveyor

- Unit + On-Floor + No Accumulation
- Used for low-frequency intermittent vertical transfers a load to different floors and/or mezzanines (cf. vertical chain conveyor can be used for continuous high-frequency vertical transfers) Differs from a freight elevator in that it is not designed or certified to carry people Can be manually or automatically loaded and/or controlled and can interface with horizontal conveyors Alternative to a chute conveyor for vertical "drops" when load is fragile and/or space is limited

12(a) Vertical lift conveyor

- Series of flexible conveyor-carriers rotate in a loop, where empty carriers flex perpendicularly to provide access to loaded carriers moving past them in opposite direction

12(b) Reciprocating vertical conveyor

- Carrier used to raise or lower load Can be powered (hydraulic or mechanical) or non-powered

- Non-powered version only be used to lower a load, where counterweight used to return empty carrier to top

13. Pneumatic conveyor

- Bulk/Unit + Overhead
- Can be used for both bulk and unit movement of materials
- Air pressure is used to convey materials through a system of vertical and horizontal tubes Material is completely enclosed and it is easy to implement turns and vertical moves

13(a) Dilute-phase pneumatic conveyor

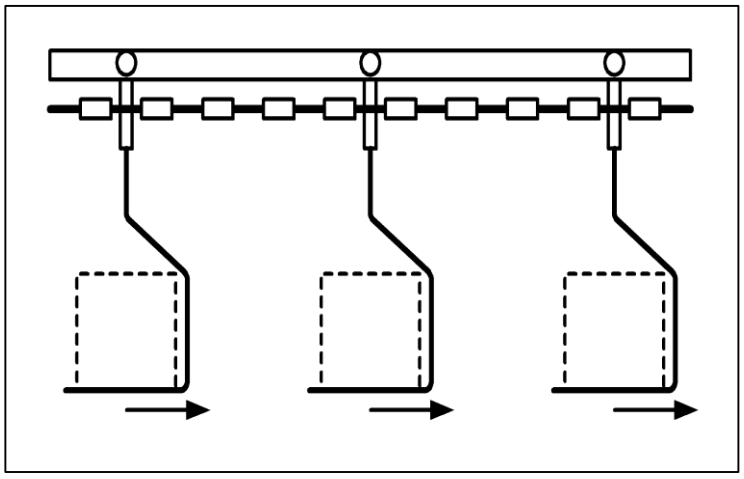
- Moves a mixture of air and solid Push (positive pressure) systems push material from one entry point to several discharge points Pull (negative pressure or vacuum) systems move material from several entry points to one discharge point Push-pull systems are combinations with multiple entry and discharge points

13(b) Carrier-system pneumatic conveyor

- Carriers are used to transport items or paperwork Examples: transporting money to/from drive-in stalls at banks and documents between floors of a skyscraper

14. Trolley conveyor

- Unit + Overhead + No Accumulation
- Uses a series of trolleys supported from or within an overhead track
- Does not provide for accumulation
- Trolleys are equally spaced in a Closed loop path and are suspended from a chain Carriers are used to carry multiple units of product

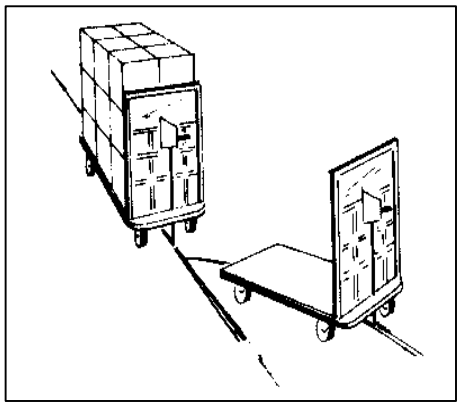


[Figure: 2.3.13]

- Commonly used in processing, assembly, packaging, and storage operations

15. Tow conveyor

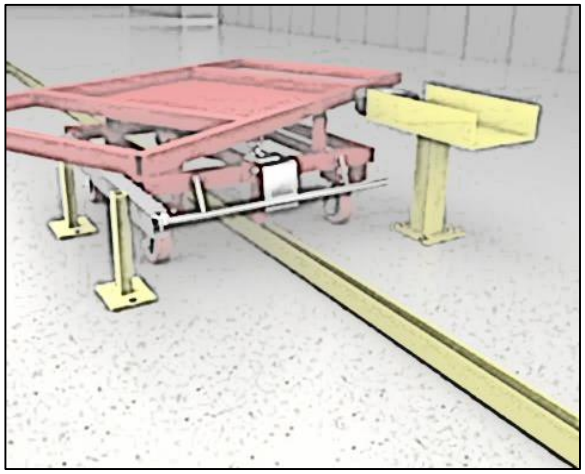
- Unit + In-Floor + Accumulate
- Uses towline to provide power to wheeled carriers such as trucks, dollies, or carts that move along the floor
- Used for fixed-path travel of carriers (each has variable path capabilities when disengaged from towline)
- Although usually in the floor, the towline can be located overhead or flush with the floor Selector-pin or pusher-dog arrangements used to allow automatic switching (power or spur lines)
- Generally used when long distance and high frequency moves are required



[Figure: 2.3.14]

16. Cart-on-track conveyor

- Unit + In-Floor + Accumulate
- Used to transport carts along a track
- Carts are transported by a rotating tube
- Drive wheel connected to each cart rests on tube and is used to vary the speed of the cart (by varying angle of contact between drive wheel and the tube)
- Carts are independently controlled
- Accumulation can be achieved by maintaining the drive wheel parallel to the tube



[Figure: 2.3.15]

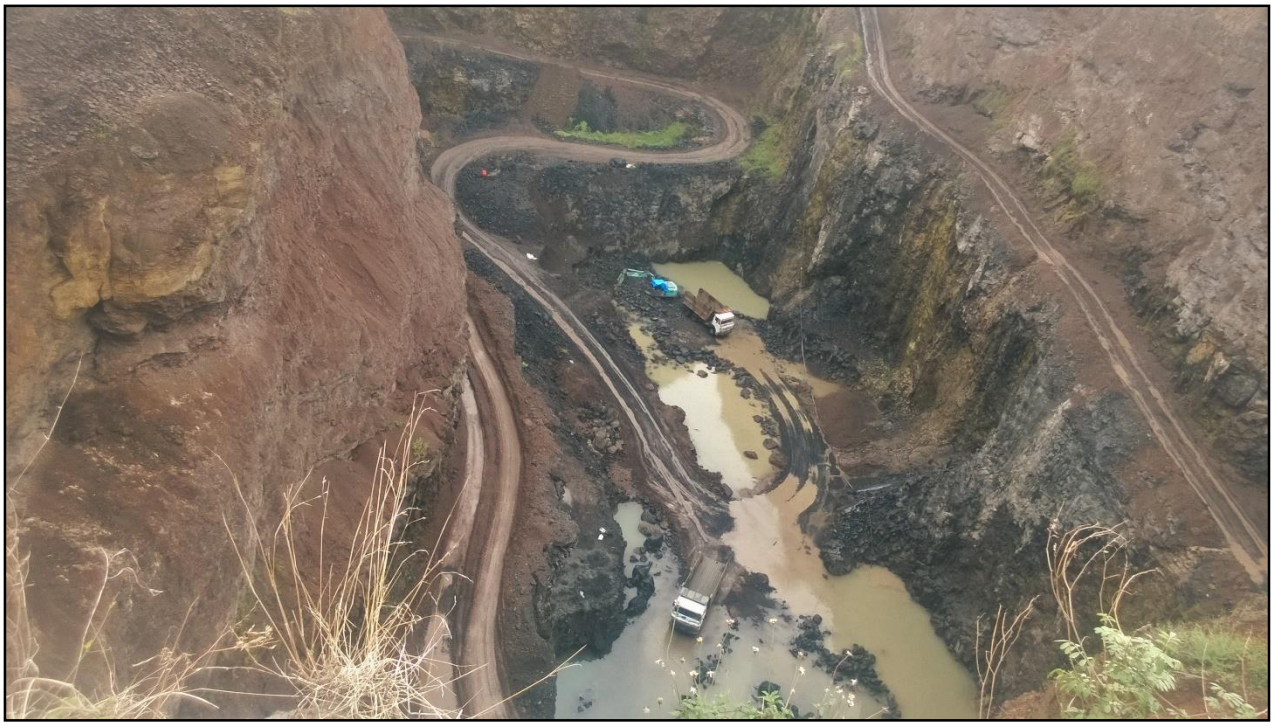
17. Power-and-free conveyor

- Unit + Overhead/On-Floor + Accumulate
- Similar to trolley conveyor due to use of discretely spaced carriers transported by an overhead chain; however, power-and-free conveyor uses two tracks: one powered and the other non-powered (or free)
- Carriers can be disengaged from the power chain and accumulated or switched onto spurs
- Termed an Inverted Power-and-Free Conveyor when tracks are located on the floor

[Figure: 2.3.16]

18. Monorail

- Unit + Overhead + Accumulate
- Overhead single track (i.e., mono-rail) or track network on which one or more carriers ride
- Carriers: powered (electrically or pneumatically) or non-powered
- Carrier can range from a simple hook to a hoist to an intelligent-vehicle-like device Single-carrier, single-track monorail similar to bridge or gantry crane Multi-carrier, track network monorail similar to both a trolley conveyor, except that the carriers operate
- Independently and the track need not be in a closed loop, and a fixed-path automatic guided vehicle (AGV) system, except that it operates overhead
- Termed an Automated Electrified Monorail (AEM) system when it has similar control characteristics as an AGV system.



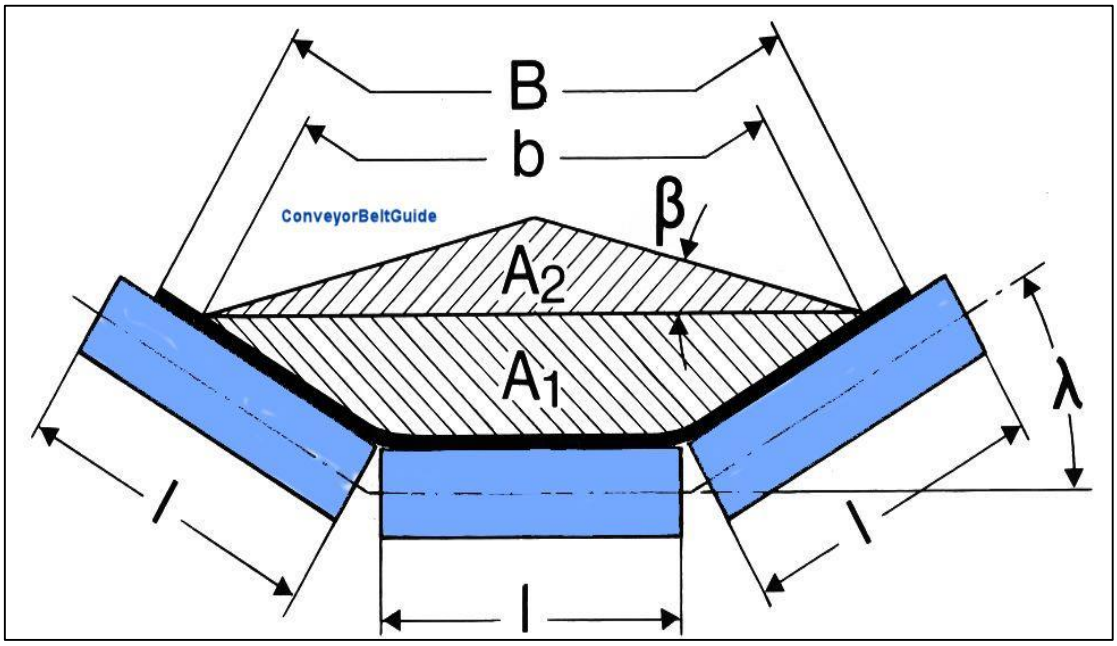
[site loaction]

CHAPTER: 03

DESIGN & CALCULATIONS OF CONVEYOR

3.1 Calculation of Covered Area

For a Belt Running over the troughed idler the cross sectional area of the material is the sum of the trapezium and the circular section as shown in figure of cross-section of troughed belt:

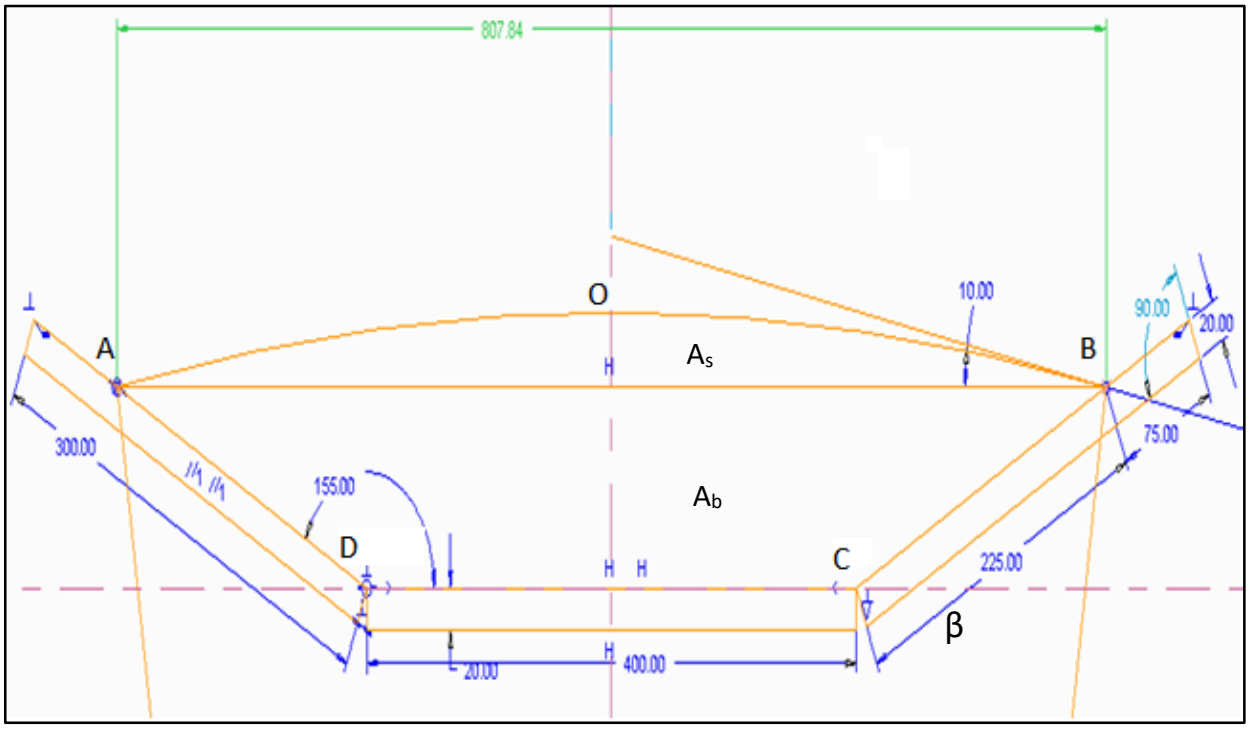


[Figure: 3.1.1][10]

The area is given as :

$$A_1 = A_b = \frac{L + l}{2}\, m\, sin\beta$$

$$A_2 = A_s = \frac{\pi r^2\, 2\alpha}{360} - r^2 \frac{\sin 2\alpha}{2}$$



[Figure :3.1.2]

L =807.84 mm
l = 400.0 mm
m = 225.0 mm
$\alpha = 10^0$
$\beta = 25^0$

$A_b = (807.84+400)/2 * 225 * \sin 25^0$

$= 57426.214\ mm^2$

$= 0.0574262\ m^2$

$A_s = (\pi * (2326.54)^2 * (2*10^0))/360 - ((2326.54)^2 \sin 20^0)/2$

$= 944230.8604 - 925641.3273$

$= 18589.5331\ mm^2$

$= 0.0185895331\ m^2$

Total area of covered section is

$A = A_b + A_s$

$= 0.0574262 + 0.018589533$

$A = 0.076015 m^2$

3.2 Idler Selection [As per IS F1159:2000] & Friction Calculation

- Carrying:
  - Edge clearance= 75mm (for 3through idler same length)
  - Length of idlers= 380mm
  - Dia. of idlers= 168.3mm
  - Idler spacing 1m
  - Mass of idler =35kg

$t_c = L / (Z_c+1)$

$Z_c=99$

T = idler spacing (1m as per IS)
L = length of belt (m)
Z_c= no. of idlers

- **Return**
  - Edge clearance=75mm
  - Idler length 600mm (v-type)
  - Dia= 133mm
  - Base clearance=40mm

$t_r = L/ (Z_r+1)$

$Z_r= 54$

- **Frictional resistance due to idlers**
  - Carrying:

$F_{cr}= f_c[m_m+m_b+(m_i* Z_c/L)]*gL$

Where,
F_{cr}= friction force due to carrying idlers; N
m_m=mass of material carried by conveyor; kg/m
m_b = mass of belt per unit length; 15.5 kg/m
m_i= mass of each carrying idlers; [35kg]
f_c =frictional factor[0.025] ; [table 8.6 MD2]
Z_c= number of carrying idlers

F_{cr}= 4007.465N

  - RETURN:

$F_{rr} = fc[m_b+(m_i*Z_r/L)]gL$

Where,
F_{rr}= friction due to return run idler; N
m_b= mass of belt per unit length ; 15.5kg/m
m_i = mass of each return idlers; [24kg]

f_c =frictional factor [0.025];[table 8.6 MD2]
Z_r = number of return idlers

F_{rr}=735.993N

- **Friction resistance due to cleaning station (f_{cl}):**

$F_{cl}= K_{cl}*g*B$

Where,

K_{cl}=50 (CLEANING FACTOR) (MD2)

B= belt width; m

F_{cl}=50*9.81*1

F_{cl}=490N

- **Friction resistance at unloading station(f_u):**

$F_u= (3.4)*m_m*g*B$

F_u =3588.081N

- **Calculation for resistance[1] :**

MASS OF MATERIAL

m_m =C/ V

m_m =101.703 kg/m

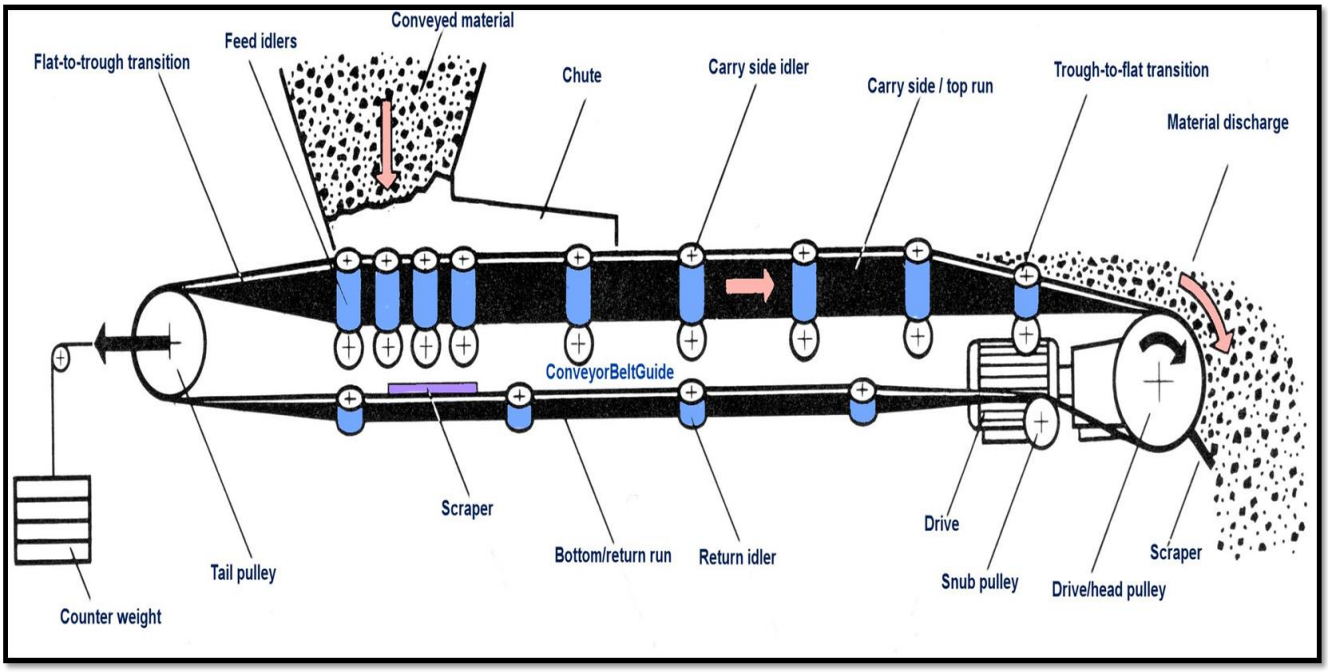
WEIGHT OF MATERIAL:-

W_m=m*l*g

=109776.84

LOAD RESISTANCE= **M_m * g* h**

= 30410.9 N



[Figure: 28]

3.3 Suitability of a belt conveyor

Material	Angle	Rise in m per 100 m	Material	Angle	Rise in m per 100 m
Cement-Loose	22°	40.4	Coal-Bit Slack	23°	42.4
Clay-Fine Dry	23°	42.4	Coal-Anthracite	16°	28.6
Clay-Wet	18°	32.5	Coke oven run	18°	32.5
Coal-Mine Run	16°	28.6	Coke-Sized	16°	28.6
Coal-Sized	16°	28.6	Coke-Breeze	18°	32.5
Concrete-Wet	15°	26.8	Ore-Sized	18°	32.5
Earth-Loose	20°	36.4	Packages-Paper Wrap.	16°	28.6
Glass-Batch	21°	38.4	*Rock-Fine Crushed*	*22°*	*40.4*
Grain	16°	28.6	*Rock-Mixed*	*18°*	*32.5*
Gravel-Bank Run	18°	32.5	*Rock-Sized*	*18°*	*32.5*
Gravel-Screened	15°	26.8	Salt	20°	36.4
Gypsum-Powdered	23°	42.4	Sand-Dry	15°	26.8
Lime-Powdered	23°	42.4	Sand-Damp	20°	36.4
limestone	18°	32.5	Sand-Tempered Foundry	24°	44.5
Ore-Fine	20°	36.4	Sulphur-Powdered	23° 42.4	
Ore-Crushed	18°	32.5	Wood-Chips	2r 50.9-G	

[Table : 3.1]

3.4 Capacity of Belt

$C = \rho*V*A*3600*K$

Here, K=slope factor [2]

A=load C\S area (m2)

V=belt velocity (1m/s)

P= material density (kg/m3)

C =366130.8 kg/hr

= 101.703 kg/sec.

3.5 Calculation of forces

- $F_1 = F_{slack} + F_{cl}$

Here, $F_{cl} = K_{cl}*g*B$

Where,

K_{cl}=50 (CLEANING FACTOR)

B= belt width; m

F_{cl}=50*9.81*1

F_{cl}=490N

So, $F_1 = F_{slack}$+490

- **$F_2 = F_1 + F_{rr}$**

Where, $F_{rr} = fc[m_b+(m_i*Z_r/L)]gL$

Where,

F_{rr}= friction due to return run idler; N

m_b = mass of belt per unit length ; 15.5kg/m[1]

m_i= mass of each return idlers; [24kg] [5]

f_c = frictional factor [0.025] [1]

Z_r= number of return idlers

F_{rr}=1051.938562N

SO, $F_2 = F_{slack}$+ 1541.93856 N

- **$F_3=F_2$+ friction due to tail pulley**

  $= F_2+ (1+\varepsilon_{p1})F_2$

  Where ε_{p1} is snub factor for pulley 1=0.06

  $F_3=1634.4548+1.06\ F_{slack}$

- **$F_4= F_3$+ friction at loading centre**

  1634.4548+ [capacity *velocity of belt]

  $F_4=$ 1736.1578+1.06F_{slack}

- **$F_5=F_4+F_{cr}$**

  $F_{cr}= = f_c[m_m+m_b+(m_i* Z_c/L)]*gL +M_mgh$

  Where,

  Sinα=h/L => h=32.16m

  F_{cr}= friction force due to carrying idlers; N

  m_m = mass of material carried by conveyor; kg/m

  m_b = mass of belt per unit length; 15.5 kg/m [1]

  m_i= mass of each carrying idlers; [35kg] [5]

  f_c = frictional factor [0.025] [1]

  Z_c= number of carrying idlers

  F_{cr}= 44689.99N

  F_5= 46426.4178 + 1.06F_{slack}

- **$F_{tight} = F_5 (1+\varepsilon_{p2})$**

  Where, ε_{p2} is snub factor for pulley 2=0.06

  F_{tight}= 49211.71667+1.1236Fslack

NOW,

$F_{tight}/F_{slack} = e^{\mu\theta}$

Here,

μ=0.4

θ=3.490658 rad

F_{tight}= 4.4007F_{slack}

F_{tight}= 111758.6152N

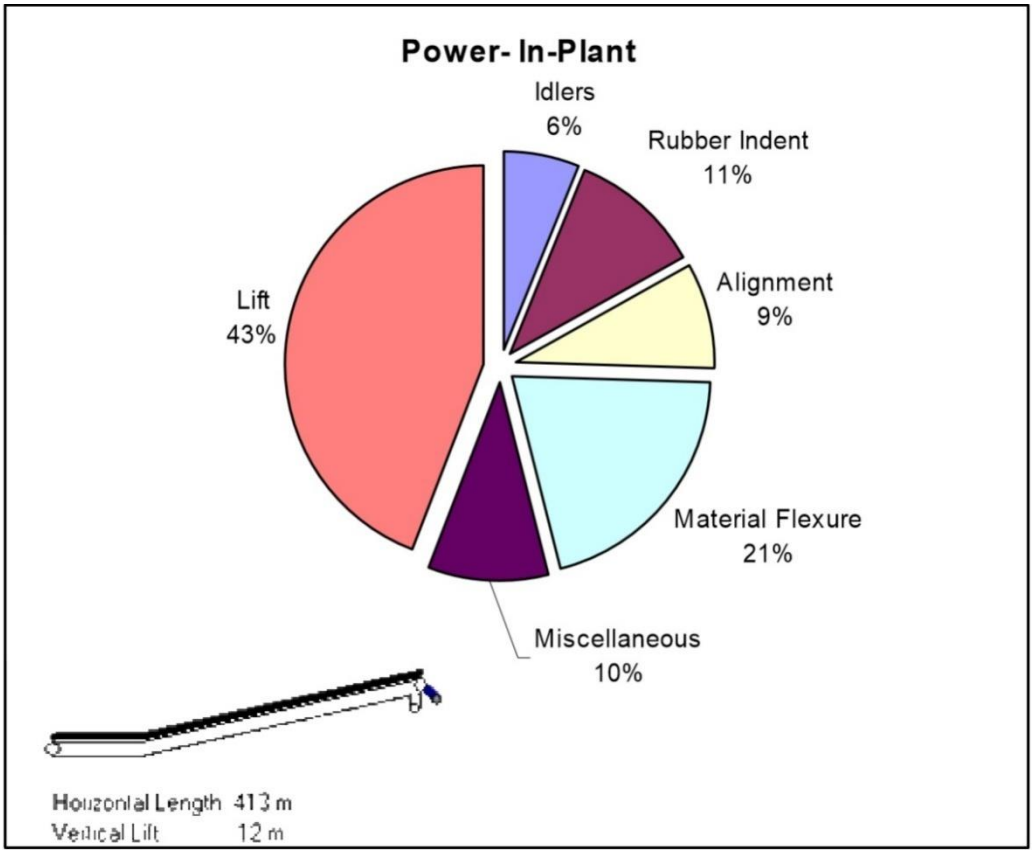
F_{slack}=25395.6450N

3.6 POWER REQUIRED:

$$P = \frac{(\mathrm{Ft} - \mathrm{Fs})\mathrm{v}}{1000}$$

P = 51.297KW

P = 68.8 HP



[FIG: 3.6.1]

3.7 SELECTION OF BELT (1):

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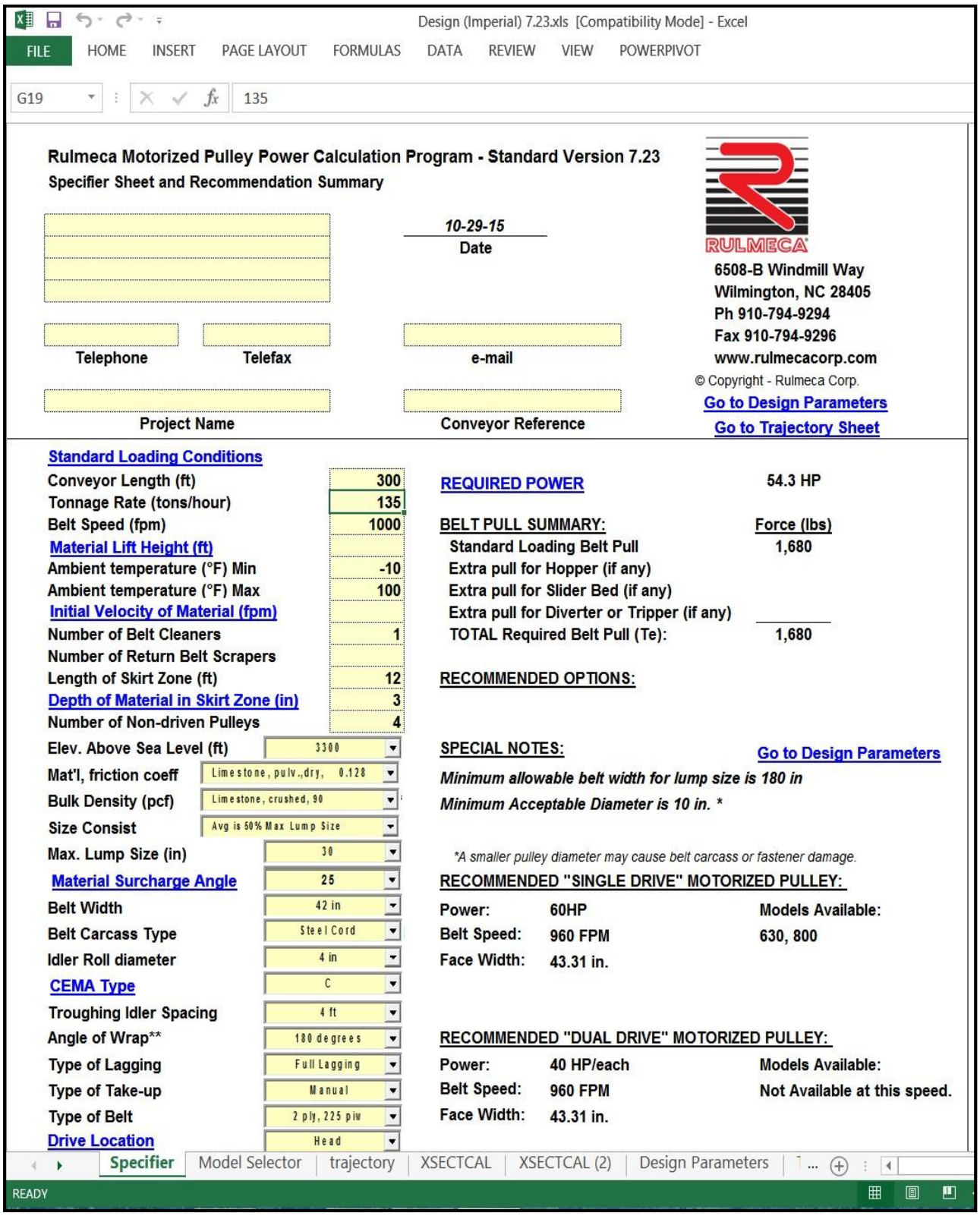

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G19 135

Rulmeca Motorized Pulley Power Calculation Program - Standard Version 7.23

Specifier Sheet and Recommendation Summary

10-29-15
Date

RULMECA

6508-B Windmill Way
Wilmington, NC 28405
Ph 910-794-9294
Fax 910-794-9296
www.rulmecacorp.com

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Go to Design Parameters
Go to Trajectory Sheet

Telephone | Telefax | e-mail

Project Name | Conveyor Reference

Standard Loading Conditions	
Conveyor Length (ft)	300
Tonnage Rate (tons/hour)	135
Belt Speed (fpm)	1000
Material Lift Height (ft)	
Ambient temperature (°F) Min	-10
Ambient temperature (°F) Max	100
Initial Velocity of Material (fpm)	
Number of Belt Cleaners	1
Number of Return Belt Scrapers	
Length of Skirt Zone (ft)	12
Depth of Material in Skirt Zone (in)	3
Number of Non-driven Pulleys	4
Elev. Above Sea Level (ft)	3300
Mat'l, friction coeff	Limestone, pulv.,dry, 0.128
Bulk Density (pcf)	Limestone, crushed, 90
Size Consist	Avg is 50% Max Lump Size
Max. Lump Size (in)	30
Material Surcharge Angle	25
Belt Width	42 in
Belt Carcass Type	Steel Cord
Idler Roll diameter	4 in
CEMA Type	C
Troughing Idler Spacing	4 ft
Angle of Wrap**	180 degrees
Type of Lagging	Full Lagging
Type of Take-up	Manual
Type of Belt	2 ply, 225 piw
Drive Location	Head

REQUIRED POWER 54.3 HP

BELT PULL SUMMARY:

	Force (lbs)
Standard Loading Belt Pull	1,680
Extra pull for Hopper (if any)	
Extra pull for Slider Bed (if any)	
Extra pull for Diverter or Tripper (if any)	
TOTAL Required Belt Pull (Te):	1,680

RECOMMENDED OPTIONS:

SPECIAL NOTES: Go to Design Parameters

Minimum allowable belt width for lump size is 180 in
*Minimum Acceptable Diameter is 10 in. **

**A smaller pulley diameter may cause belt carcass or fastener damage.*

RECOMMENDED "SINGLE DRIVE" MOTORIZED PULLEY:

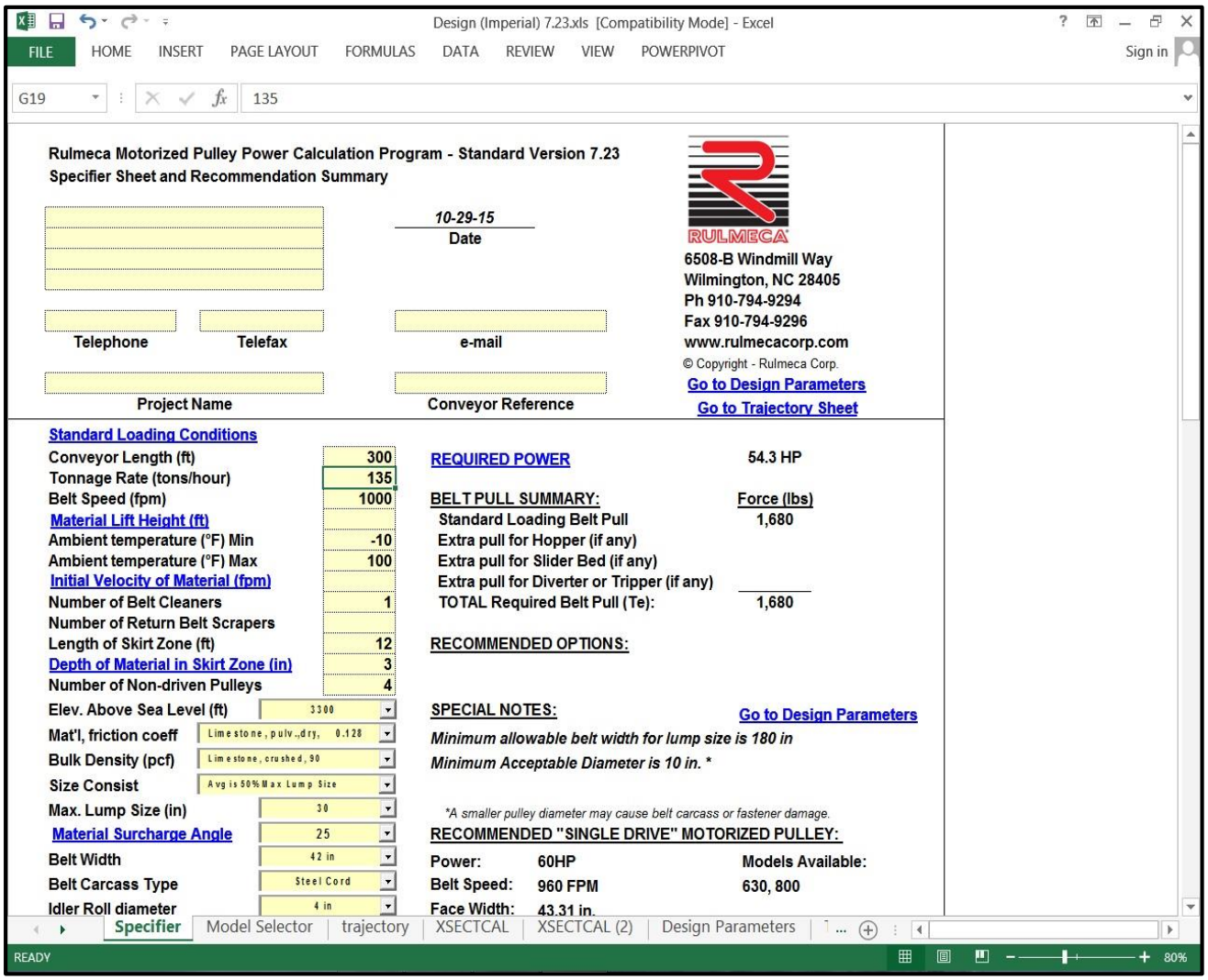
Power:	60HP	Models Available:
Belt Speed:	960 FPM	630, 800
Face Width:	43.31 in.	

RECOMMENDED "DUAL DRIVE" MOTORIZED PULLEY:

Power:	40 HP/each	Models Available:
Belt Speed:	960 FPM	Not Available at this speed.
Face Width:	43.31 in.	

Specifier | Model Selector | trajectory | XSECTCAL | XSECTCAL (2) | Design Parameters

READY



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Rulmeca Motorized Pulley Power Calculation Program - Standard Version 7.23
Specifier Sheet and Recommendation Summary

10-29-15
Date

RULMECA
6508-B Windmill Way
Wilmington, NC 28405
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Fax 910-794-9296
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Telephone | Telefax | e-mail

Project Name | Conveyor Reference

Go to Design Parameters
Go to Trajectory Sheet

Standard Loading Conditions

Conveyor Length (ft)	300
Tonnage Rate (tons/hour)	135
Belt Speed (fpm)	1000
Material Lift Height (ft)	
Ambient temperature (°F) Min	-10
Ambient temperature (°F) Max	100
Initial Velocity of Material (fpm)	
Number of Belt Cleaners	1
Number of Return Belt Scrapers	
Length of Skirt Zone (ft)	12
Depth of Material in Skirt Zone (in)	3
Number of Non-driven Pulleys	4
Elev. Above Sea Level (ft)	3300
Mat'l, friction coeff	Limestone, pulv.,dry, 0.128
Bulk Density (pcf)	Limestone, crushed, 90
Size Consist	Avg is 50% Max Lump Size
Max. Lump Size (in)	30
Material Surcharge Angle	25
Belt Width	42 in
Belt Carcass Type	Steel Cord
Idler Roll diameter	4 in

REQUIRED POWER 54.3 HP

BELT PULL SUMMARY:	Force (lbs)
Standard Loading Belt Pull	1,680
Extra pull for Hopper (if any)	
Extra pull for Slider Bed (if any)	
Extra pull for Diverter or Tripper (if any)	
TOTAL Required Belt Pull (Te):	1,680

RECOMMENDED OPTIONS:

SPECIAL NOTES: Go to Design Parameters

Minimum allowable belt width for lump size is 180 in
*Minimum Acceptable Diameter is 10 in. **

**A smaller pulley diameter may cause belt carcass or fastener damage.*

RECOMMENDED "SINGLE DRIVE" MOTORIZED PULLEY:

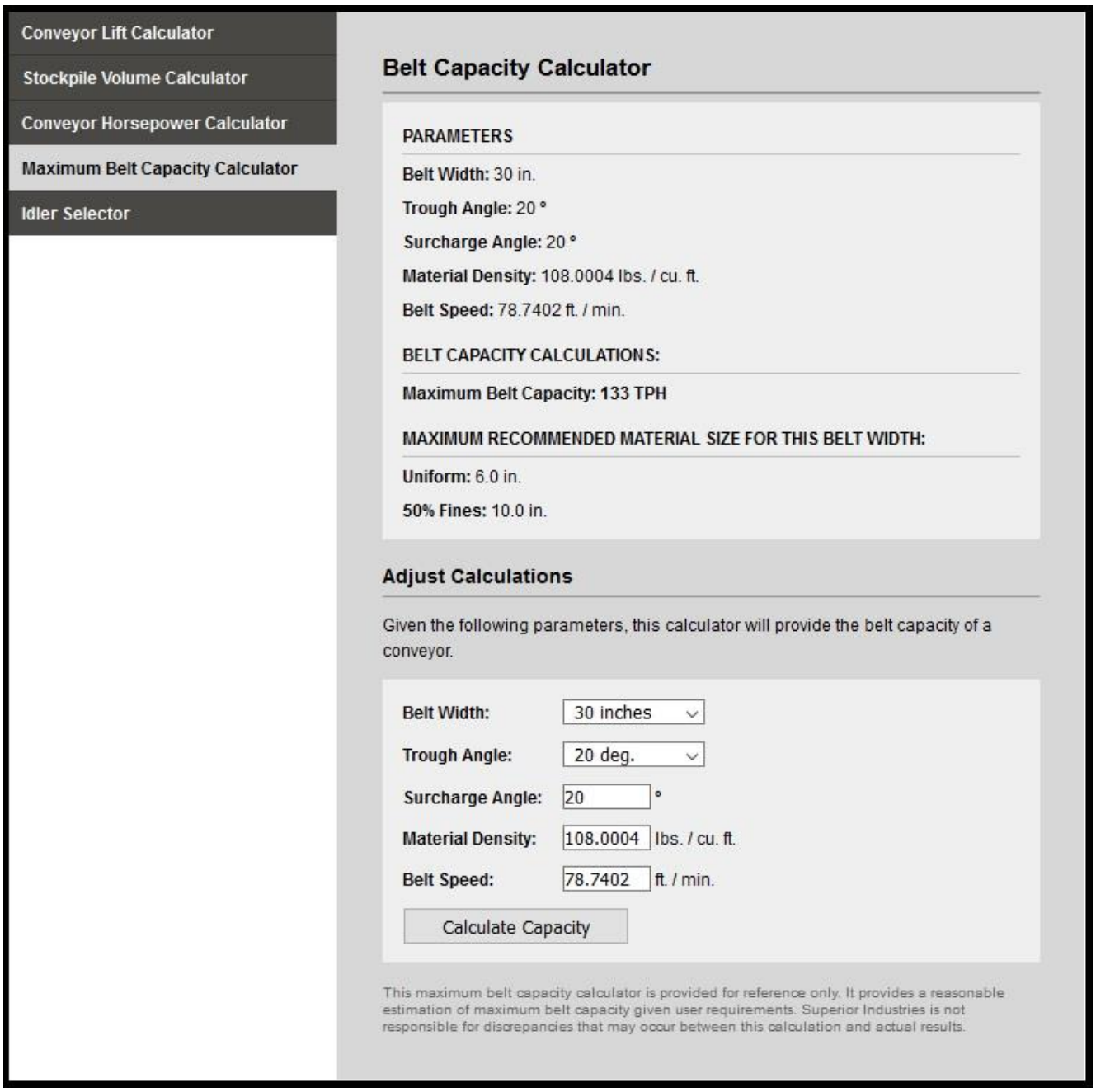
Power:	60HP	Models Available:
Belt Speed:	960 FPM	630, 800
Face Width:	43.31 in.	

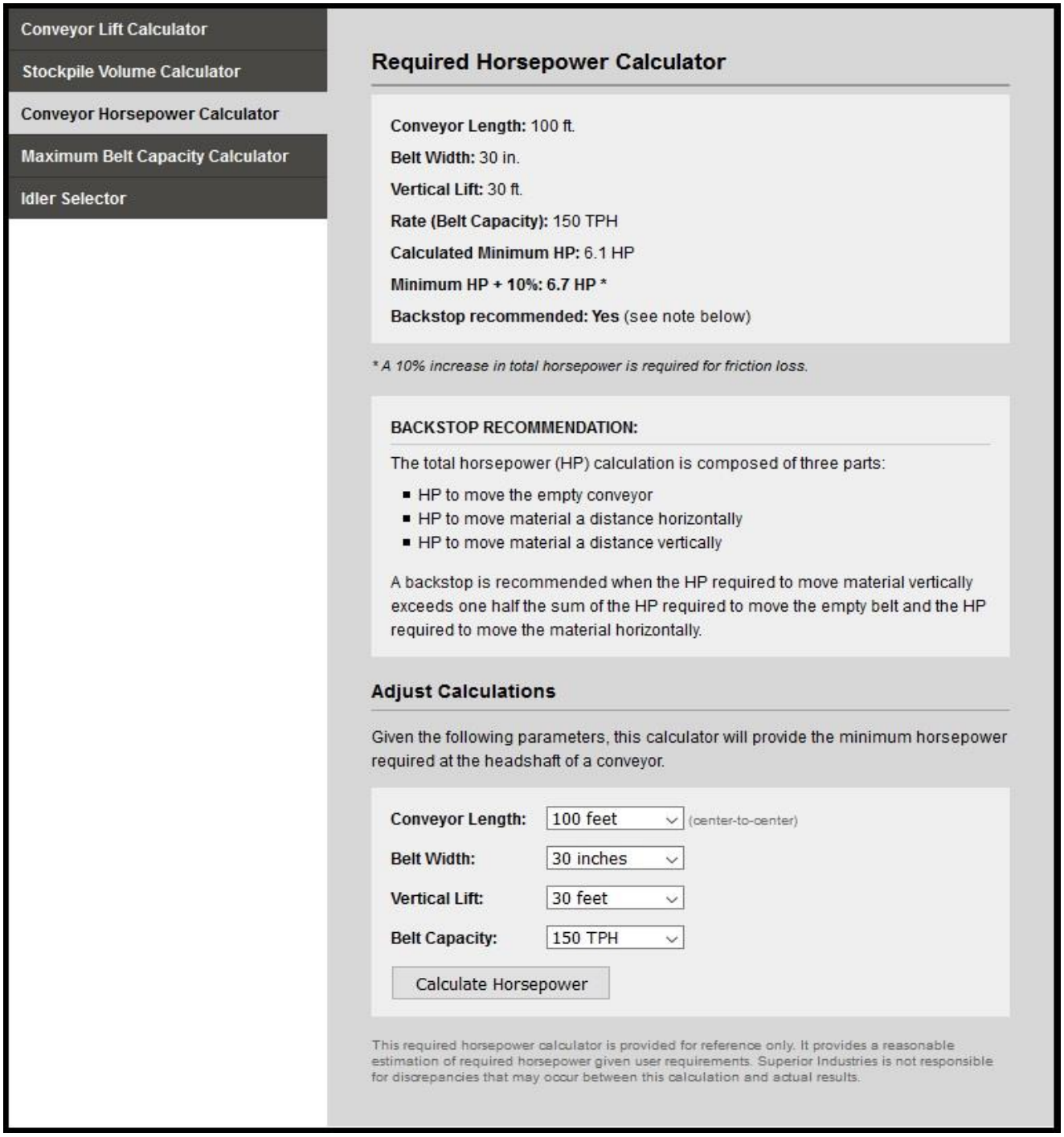
Specifier | Model Selector | trajectory | XSECTCAL | XSECTCAL (2) | Design Parameters

READY 80%

SELECTION OF BELT (2):

[http://catalog.jamiesonequipment.com]





Conveyor Lift Calculator
Stockpile Volume Calculator
Conveyor Horsepower Calculator
Maximum Belt Capacity Calculator
Idler Selector

Required Horsepower Calculator

Conveyor Length: 100 ft.
Belt Width: 30 in.
Vertical Lift: 30 ft.
Rate (Belt Capacity): 150 TPH
Calculated Minimum HP: 6.1 HP
Minimum HP + 10%: 6.7 HP *
Backstop recommended: Yes (see note below)

** A 10% increase in total horsepower is required for friction loss.*

BACKSTOP RECOMMENDATION:

The total horsepower (HP) calculation is composed of three parts:

- HP to move the empty conveyor
- HP to move material a distance horizontally
- HP to move material a distance vertically

A backstop is recommended when the HP required to move material vertically exceeds one half the sum of the HP required to move the empty belt and the HP required to move the material horizontally.

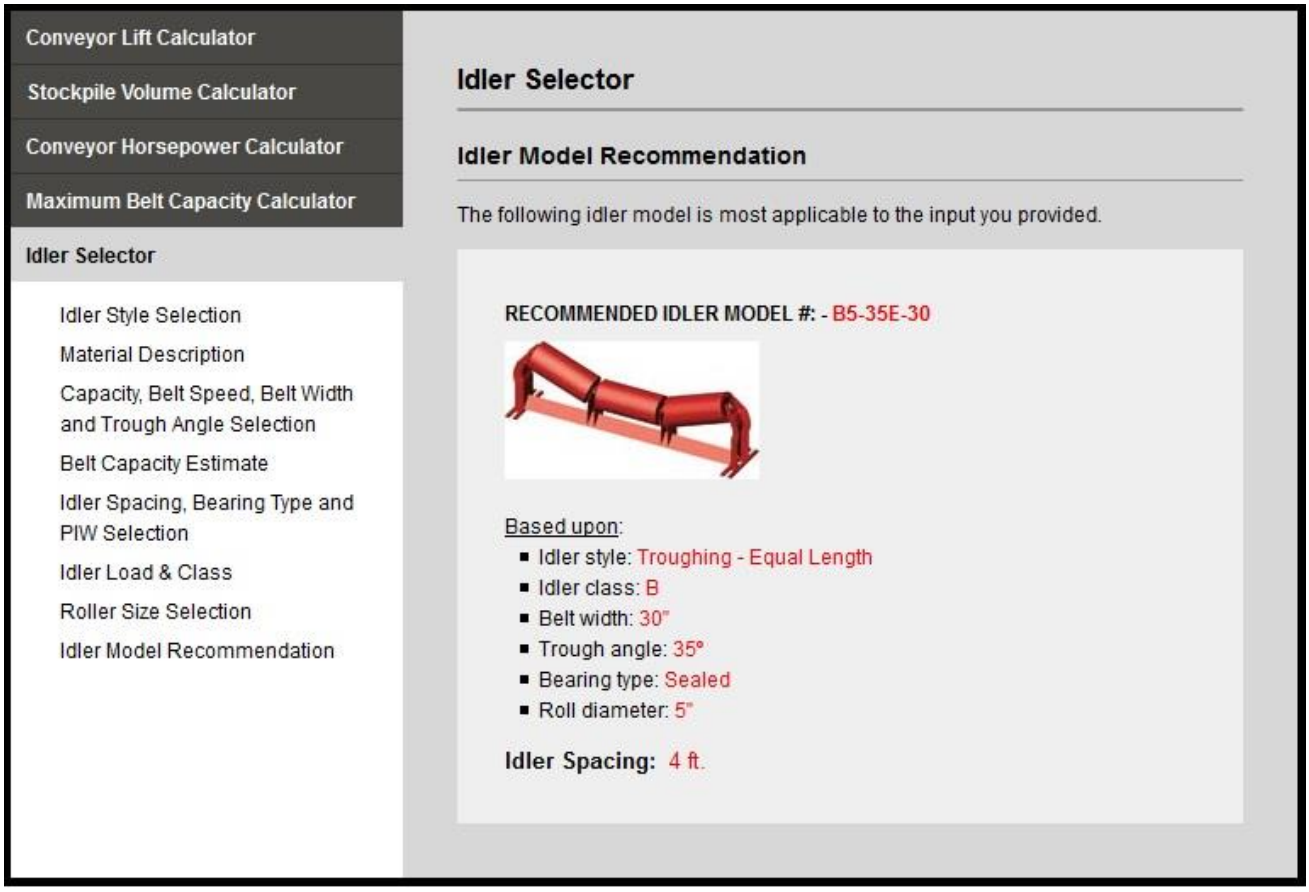
Adjust Calculations

Given the following parameters, this calculator will provide the minimum horsepower required at the headshaft of a conveyor.

Conveyor Length: 100 feet (center-to-center)
Belt Width: 30 inches
Vertical Lift: 30 feet
Belt Capacity: 150 TPH

Calculate Horsepower

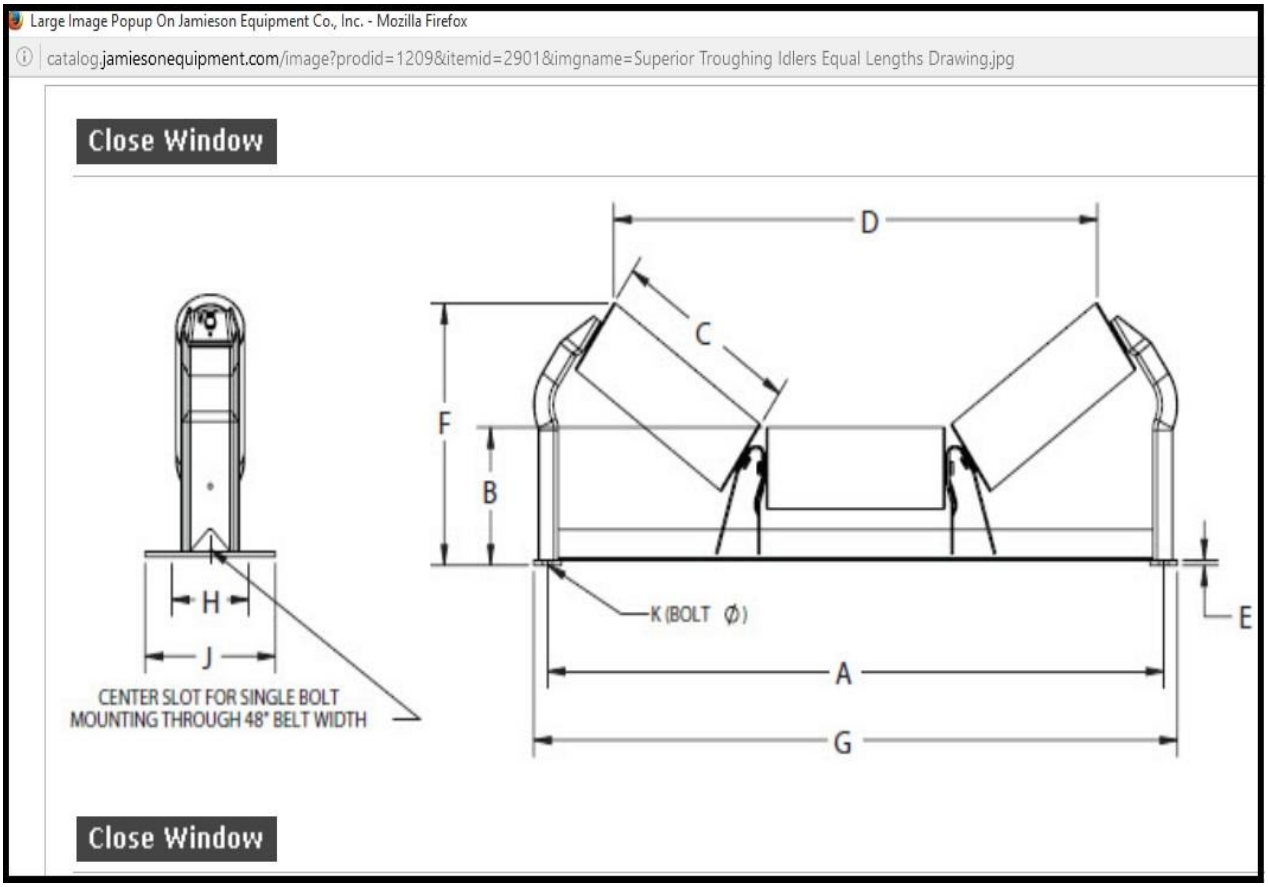
This required horsepower calculator is provided for reference only. It provides a reasonable estimation of required horsepower given user requirements. Superior Industries is not responsible for discrepancies that may occur between this calculation and actual results.



IDLER MODEL : B5-35E-30

[http://catalog.jamiesonequipment.com/item/rs-cema-b-idlers-cema-b-superior-industries-idlers/troughing-idler-equal-length-rolls-cema-b/b5-35e-30]

IDLER MODEL : B5-35E-30 (GEOMETRY)



3.8 SPECIFICATION OF IDLER

Specifications	
CEMA Rating	CEMA B
Roller Diameter	5 in
Troughing Angle	35 °
Belt Width	30 in
Dimension A	39 in
Dimension B	7 1/2 in
Dimension C	10 15/16 in
Dimension D	30 1/4 in
Dimension E	3/16 in
Dimension F	14 in
Dimension G	41 in
Dimension H[1]	6 in
Dimension J	8 in
Dimension K	1/2 in
Weight	51 lb
Manufacturer	Superior Industries
[1] Recommended Bolting Pattern	

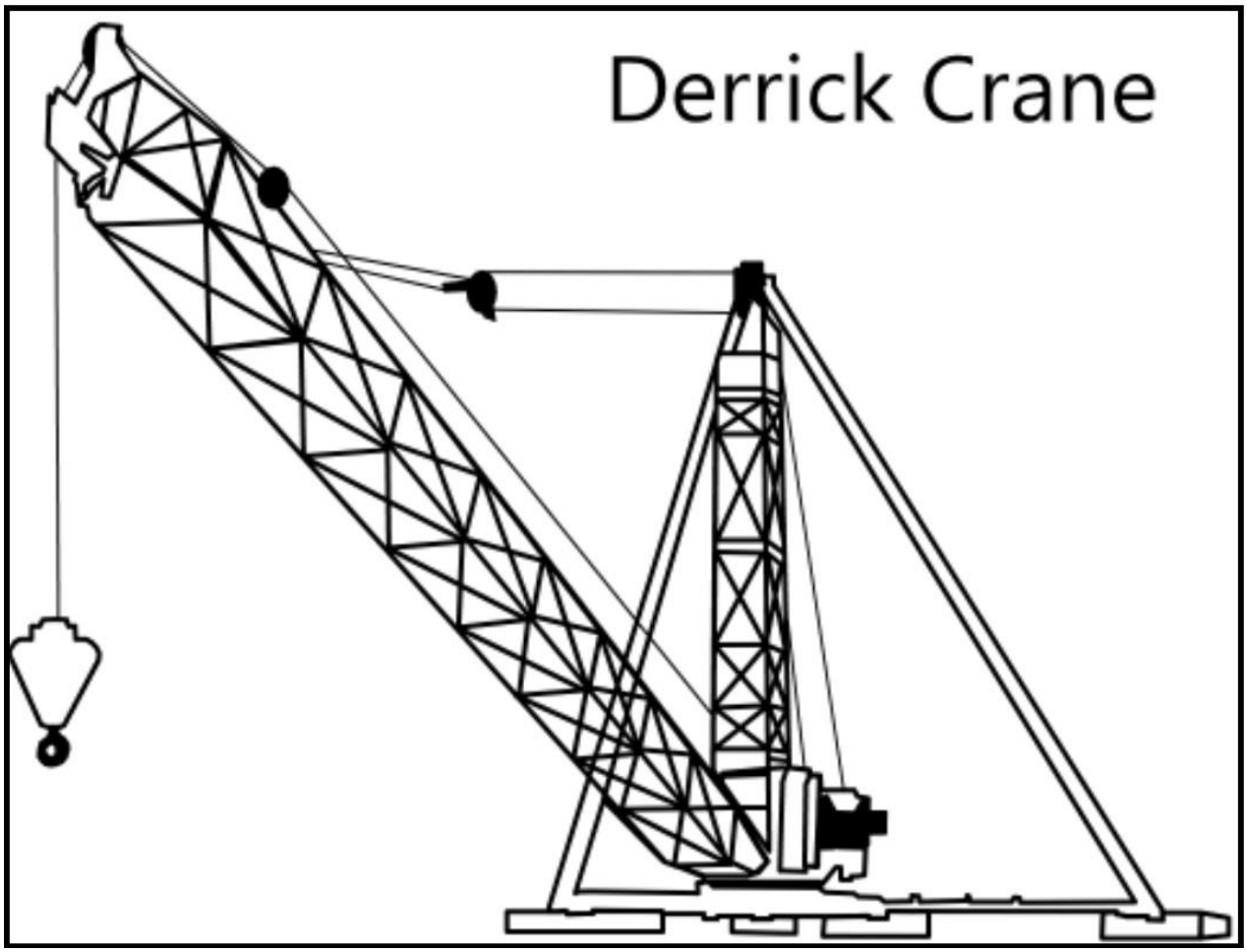
3.9 RESULTS

No.	Parameter	Value
1	Belt Width(mm)	1000
2	Length of Conveyor(m)	110
3	Belt Length(m)	220
4	Speed of Belt(m/s)	1
5	Height of conveyor(m)	30.48
6	Angle of Inclination	16.7^0
7	Troughing angle	25^0
8	Surcharge angle	25^0
9	Conveyor capacity(tones/hr)	125
10	Carry idler spacing(m)	1
11	Material Density(kg/m^3)	1730
12	Warp angle(degree)	180^0
13	Dia. of idlers (mm)	168.3
14	Length of Idlers (mm)	380
15	Mass of Material (kg/m)	101.7
16	Power requirement (kW)	51.2
17	Power requirement (Hp)	68.8

[TABLE : 3.9.1]

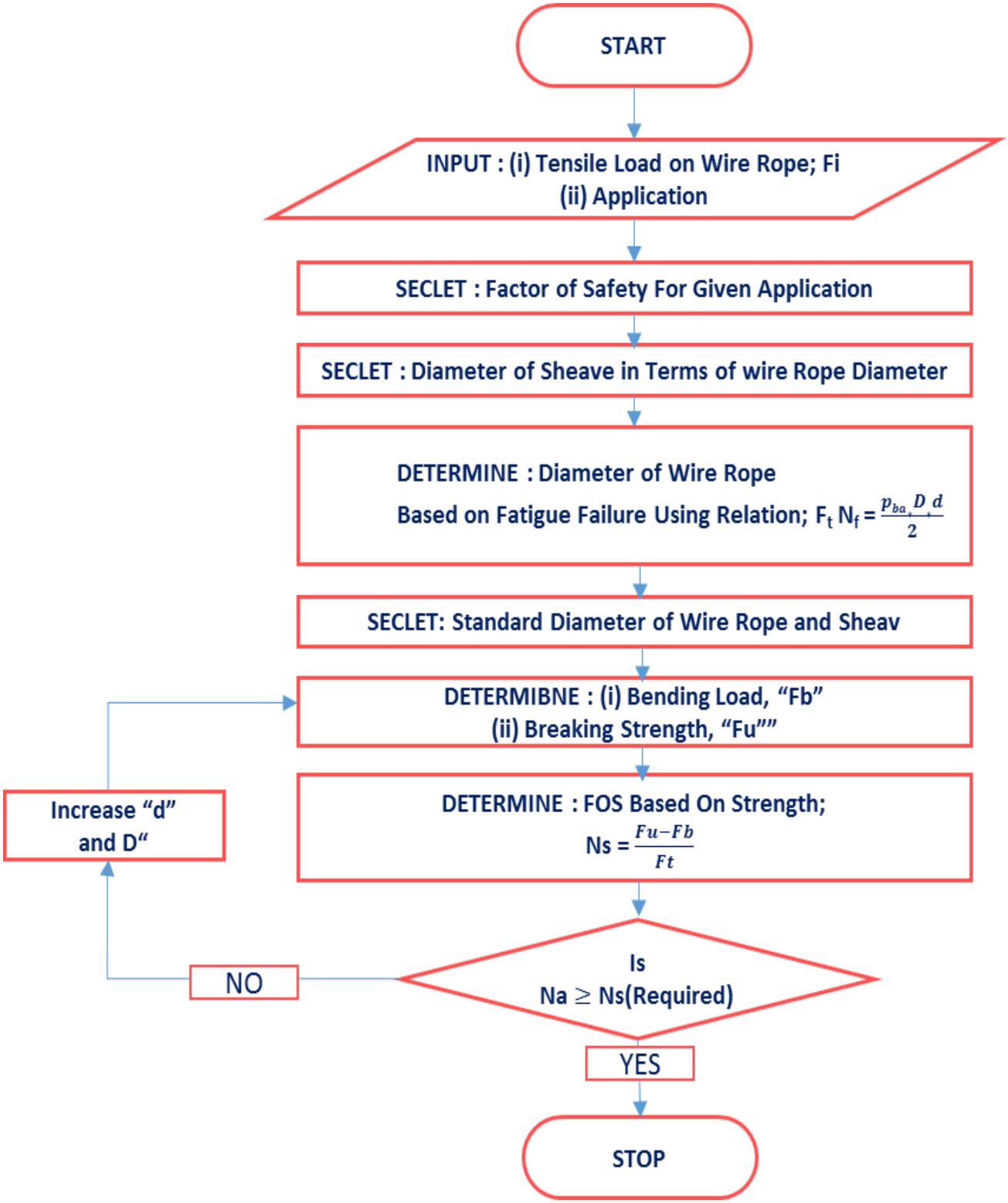
CHAPTER: 04

DESIGN & CALCULATIONS OF CRANE

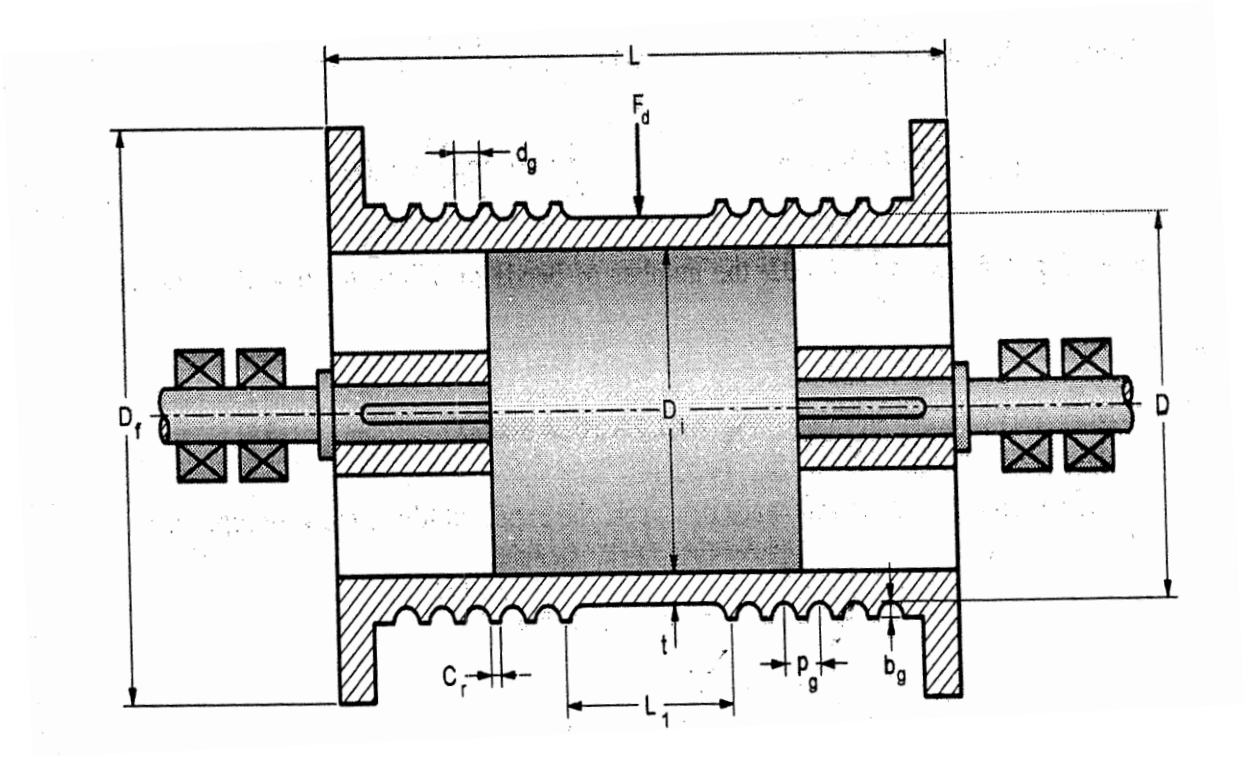


[FIG: 4.1.1]

4.1 SELECTION OF WIRE ROPE



NOM. ROPE DIA. mm	NOM. ROPE DIA. in	APPROX. MASS kg/100m	MINIMUM BREAKING FORCE GALVANISED & UNGALVANISED ROPE GRADE			
			1770 N/mm²		1960 N/mm²	
			kN	tonnes	kN	tonnes
8		26.1	40.3	4.1	44.7	4.6
9		33.2	51.0	5.2	56.5	5.8
10		40.8	63.0	6.4	69.8	7.1
11		49.4	76.2	7.8	84.4	8.6
12		58.8	90.7	9.2	101.0	10.3
	1/2	66.0	102.0	10.4	113.0	11.5
13		69.2	107.0	10.9	118.0	12.0
14		80.2	124.0	12.6	137.0	14.0
16	5/8	104.0	161.0	16.4	179.0	18.3
18		132.0	204.0	20.8	226.0	23.0
20		163.0	252.0	25.7	279.0	28.4
22		197.0	305.0	31.1	338.0	34.5
	7/8	201.0	311.0	31.7	345.0	35.2
24	15/16	235.0	363.0	37.0	402.0	41.0
	1	263.0	407.0	41.5	450.0	45.9
26		276.0	426.0	43.4	472.0	48.1
28		320.0	494.0	50.4	547.0	55.8
32	1.1/4	418.0	645.0	65.8	715.0	72.9
36		531.0	817.0	83.3	904.0	92.2
40		655.0	1010.0	103.0	1120.0	114.0
44		793.0	1220.0	124.0	1350.0	138.0
48	1.7/8	943.0	1450.0	148.0	1610.0	164.0
52		1111.0	1700.0	173.0	1890.0	193.0
56		1281.0	1980.0	202.0	2190.0	223.0
60	2.3/8	1471.0	2270.0	231.0	2510.0	256.0



[FIGURE : 4.2.2 Schematic Dia. Of Rope Drum]

4.2 ROPE DRUM DESIGN

Diameter of rope drum

V = $\frac{\pi DN}{60*1000}$; m/s

d=2.54 mm

Nf=1.2

V = 20/60 rpm

D= 764 mm

Total Load on Drum

Fd = Mg+ Mf

= (40000*9.81)+(40000*1.2)

= 440400 N

Dimensions of rope drum:

(1) Wall thickness

t = 0.02D+8

=23.28 mm

(2) Inner Dia. Of rope drum

Di = D- 2t

= 716 mm

(3) **Flange Dia. Of Rope drum**

Df = D + 6d

= 916.4 mm

(4) No. of groove on drum per rope system

Zg = Hi/πD + 2

= 30.57

(5) **Dia. Of groove on drum**

Dg = d+2.4

= 27.8 mm

(6) Min. clearance between ropes

Cr = 2.5 mm

(7) Pitch of groove on rope drum system,

Pg=dg+Cr

= 30.5 mm

(8) **Depth of groove on rope system**

Bg = 0.1d

= 2.54 mm

(9) **Length of rope drum**

L= $(\frac{2Hi}{\pi D} + 12)$Pg + L1

= 2219.20 mm

= 1219.20 mm

CHAPTER: 05

COST CALCULATION & COMPARISON

4.1 Cost conventional material handling system

Cost calculation of conventional material handling system as follows:

Company Name: Uma-Ashish Quarry Works, Dhansura, (N.G)

Capacity of Truck	25

Cost for 1 tonne = ₹ 17.00 Tones/Turn

Price of Truck	

1 Truck = ₹ 29,00,000.00 (Including Loan)

Usage Time	

Time = 4.5 Years
54 Months

Consumption (In Tonnes)		

Daily = 400
Monthly = 12000
Yearly = 144000

Diesel Consumption	

1 Truck = 3 litre Per Turn

Major Maintenance	

Tyres = ₹ 4,10,000.00

4.2 Cost of Belt Conveyor

Approximate Cost of designed belt conveyor for particular site location is as follow [11]:

Conveyor belt and structure(Foundation) cost : Rs. 95,00,000

Cost is estimated by: Jagruti Conveyor Enterprise, Ahmedabad

Handling Cost : 13.8 Rs./Tonne

4.3 Cost of Crane

Approximate Cost of Designed Crane For particular site location is as follow:

Crane and foundation cost: Rs.53,00,000

Handling Cost : 12.6 Rs/ tonne

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The Business Model Canvas

Design for: A Concept Design Of Economical Material Handling System For Stone

Design by: (1) RUCHIL A. PATEL
(2) KAVIT M. PATEL
(3) BHAVIK K. PATEL

Date: 29Mar.2016

TEAM ID : 54108

Key Partners

- ROCK MINERS
- MATERIAL-HANDLING EQUIPMENT MANUFACTURERS
- CONTRACTORS
- RESEARCHERS

Key Activities

- EASY HANDLING
- FAST & CONTINEOUS HANDLING
- SAFE HANDLING
- ECONOMIC

Key Resources

- MINING EQUIPMENTS
- BELT CONVEYORS
- CRANE, LIFTS

Value Propositions

- REDUCE COST
- MAKE EASY-SAFE
- LESS LABOUR REQUIRED
- NO CONTINEOUS ATTENTION
- ACCURATE MATERIAL HANDLING
- SINGLE CONTROL HANDLING

Customer Relationships

- FREE SERVICE
- FREE DEMO
- 24*7 LIVE SERVICE
- TRAINED OPERATORS

Channels

- ONLINE MEDIA
- NEWS PAPER
- JOURNALS
- MARKETING REPRESENTATIVE

Customer Segments

- MATERIAL HANDLING EQUIPMENTS MANUFACTURERS
- MINE BEGINERS
- EARTH MOVER CONTRACTORS
- SUPPLIERS
- OLD MINERS

Cost Structure

- COLLEGE ADMINISTRATION
- MINING INDUSTRIES
- MH MFG. INDUSTRIES

Revenue Streams

- MODERNIZATION
- EASY TO HANDLE LONG TERM ECONOMIC
- CONTRACTORS

BMC REPORT

❖ Main Titles

1. Customer Segment
2. Value Propositions
3. Channels
4. Customer Relationship
5. Revenue Streams
6. Key Resource
7. Key Activities
8. Key Partnerships
9. Cost Structure

❖ Description:

Customer Segment: To make easy material handling for stone/rock mining and reduce cost of material handling.

- MATERIAL HANDLING EQUIPMENTS MANUFACTURERS
- MINE BEGINERS
- EARTH MOVER CONTRACTORS : they will use it for economic cost and less man power needed.
- SUPPLIERS
- OLD MINERS

Value Propositions:

- REDUCE COST : it will reduce cost drastically
- MAKE EASY-SAFE : it's operation is is safe for workers
- LESS LABOUR REQUIRED : because of semi-automation, very less number of labors required
- NO CONTINEOUS ATTENTION
- ACCURATE MATERIAL HANDLING : quantity is very accurate during supply
- SINGLE CONTROL HANDLING

The value propositions may be:

- Quantitative- price and efficiency
- Qualitative- overall customer experience and outcome

Channels:

- ONLINE MEDIA
- NEWS PAPER
- JOURNALS
- MARKETING REPRESENTATIVE

A company can deliver its value proposition to its targeted customers through different channels. Effective channels will distribute a company's value proposition in ways that are fast, efficient and cost effective. An organization can reach its clients either through its own channels (store front), partner channels (major distributors), or a combination of both.

Customer Relationship:

- FREE SERVICE
- FREE DEMO
- 24*7 LIVE SERVICE
- TRAINED OPERATORS

To ensure the survival and success of any businesses, companies must identify the type of relationship they want to create with their customer segments. Various forms of customer relationships include:

- Personal Assistance: Assistance in a form of employee-customer interaction. Such assistance is performed either during sales, after sales, and/or both.
- Dedicated Personal Assistance: The most intimate and hands on personal assistance where a sales representative is assigned to handle all the needs and questions of a special set of clients.
- Self Service: The type of relationship that translates from the indirect interaction between the company and the clients. Here, an organization provides the tools needed for the customers to serve themselves easily and effectively.

Revenue Streams:

- **MODERNIZATION**
- **EASY TO HANDLE**
- **CONTRACTORS**

The way a company makes income from each customer segment. Several ways to generate a revenue stream:

- Asset Sale - (the most common type) Selling ownership rights to a physical good. e.g. Wal-Mart
- Usage Fee - Money generated from the use of a particular service e.g. UPS
- Subscription Fees - Revenue generated by selling a continuous service. e.g. Netflix
- Lending/Leasing/Renting - Giving exclusive right to an asset for a particular period of time. e.g. Leasing a Car
- Licensing - Revenue generated from charging for the use of a protected intellectual property.
- Brokerage Fees - Revenue generated from an intermediate service between 2 parties. e.g. Broker selling a house for commission
- Advertising - Revenue generated from charging fees for product advertising.

Key Resource:

- MINING EQUIPMENTS
- BELT CONVEYORS
- CRANE, LIFTS

The resources that is necessary to create value for the customer. They are considered an asset to a company, which are needed in order to sustain and support the business. These resources could be human, financial, physical and intellectual.

Key Activities:

- EASY HANDLING
- FAST & CONTINEOUS HANDLING
- SAFE HANDLING
- ECONOMIC

The most important activities in executing a company's value proposition.

Key Partnerships: In order to optimize operations and reduce risks of a business model, organization usually cultivate buyer-supplier relationships so they can focus on their core activity. Complementary business alliances also can be considered through joint ventures, strategic alliances between competitors or non-competitors.

Cost Structure:

- COLLEGE ADMINISTRATION
- MINING INDUSTRIES
- MH MFG. INDUSTRIES

GTU Innovation Council

Patent Drafting Exercise (PDE)

FORM 1 **THE PATENTS ACT 1970** **(39 OF 1970)** **&** **THE PATENTS RULES, 2003** **APPLICATION FOR GRANT OF PATENT**	**(FOR OFFICE USE ONLY)** **Application No:** **Filing Date:** **Amount of Fee paid:** **CBR No:**_____

1. Applicant(s) :

ID	Name	Nationality	Address	Mobile No.	Email
1	Patel Kavit Mahendrabhai	Indian	Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.	9724727417	kavit73@gmail.com
2	Patel Bhavikkumar Kantilal	Indian	Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.	9574428249	patelbhavik2095@gmail.com
3	Patel Ruchil Ashokbhai	Indian	Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.	9426722411	ruchilpatel_251@yahoo.com

2. Inventor(s):

ID	Name	Nationality	Address	Mobile No.	Email
1	Patel Kavit Mahendrabhai	Indian	Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.	9724727417	kavit73@gmail.com
2	Patel Bhavikkumar Kantilal	Indian	Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.	9574428249	patelbhavik2095@gmail.com
3	Patel Ruchil Ashokbhai	Indian	Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.	9426722411	ruchilpatel_251@yahoo.com

3. Title of Invention/Project:

4. Address for correspondence of applicant/authorized patent agent in india

Name: Patel Ruchil Ashokbhai
Address: Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technological University.
Mobile: 9426722411
Email ID: ruchilpatel_251@yahoo.com

5. Priority particulars of the application(S) field in convention country

Country	Application No.	Filing Date	Name of the Applicant	Title of the Invention
N/A	*N/A*	*N/A*	*N/A*	*N/A*

6. Particulars for filing patent co-operation treaty (pct) national phase Application

International application number	International filing date as alloted by the receiving office
N/A	N/A

7. Particulars for filing divisional application

Original(First) Application Number	Date of filing of Original (first) application
N/A	N/A

8. Particulars for filing patent of addition

Original(First) Application Number	Date of filing of Original (first) application
N/A	N/A

9. DECLARATIONS:

(i) Declaration by the inventor(s)

I/We, the above named inventor(s) is/are true & first inventor(s) for this invention and declare that the applicant(s). herein is/are my/our assignee or legal representative.

Date : 10 - April - 2016

	Name	Signature & Date
1	Patel Kavit Mahendrabhai	_____
2	Patel Bhavikkumar Kantilal	_____
3	Patel Ruchil Ashokbhai	_____

(ii) Declaration by the applicant(s) in the convention country

I/We, the applicant (s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.applicant(s)

(iii) Declaration by the applicant(s)

I/We, the applicant(s) hereby declare(s) that:-

- [x] I am/We in possession of the above mentioned invention.
- [x] The provisional/complete specification relating to the invention is filed with this aplication.
- [x] The invention as disclosed in the spcification uses the biological material from India and the necessary permission from the competent authority shall be submitted by me/us before the grant of patent to me/us.
- [x] There is no lawful ground of objection to the grant of the patent to me/us.
- [x] I am/we are the assignee or the legal representative of true & first inventors.
- [x] The application or each of the application,particulars of each are given in the para 5 was the first applicatin in the convention country/countries in respect of my/our invention.
- [x] I/we claim the priority from the above mentioned applications(s) filed in the convention country/countries & state that no application for protection in respect of invention had been made in a convention country before that date by me/us or by any person
- [x] My/Our application in india is based on international application under Patent Cooperation Treaty (PCT) as mentioned in para 6
- [x] The application is divided out of my/our application(s) particulars of which are given in para 7 and pray that this application may be treated as deemed to have been filed on _____under section 16 of the Act.
- [x] The said invention is an improvement in or modification of the invention particulars of ehivh are given in para 8.

10. Following are the attachments with the application:

- [x] (a) Provisional specification/Complete specification
- [x] (b) Complete specification(In confirmation with the international application) / as amended before the international Preliminary Examination Authority (IPEA),as applicable(2 copies),No.of pages.....No.of claims.....
- [x] (c) Drawings (In confirmation with the international application)/as amended before the international Preliminary Examination Authority(IPEA),as applicable(2 copies),No.of sheets....
- [x] (d) Priority documents
- [x] (e) Translations of priority documents/specification/international search reports
- [x] (f) Statement and undertaking on Form 3
- [x] (g) Power of Authority
- [x] (h) Declaration of inventorship on Form 5
- [x] (i) Sequence listing in electronic Form
- [x] (j) ..... Fees Rs.XXX in Cash /Cheque/Bank Draft bearin No.XXX Date: XXX on XXX Bank.

I/We hereby declare that to the best of my /our knowledge, information and belief the fact and mtters stated herein are correct and I/We request that a patent may be granted to me/us for the said invention.

Dated this **10** day of **April** , **2016**

	Name	Signature & Date
1	Patel Kavit Mahendrabhai	_____

2 Patel Bhavikkumar Kantilal _____

3 Patel Ruchil Ashokbhai _____

FORM 2
THE PATENTS ACT, 1970
(39 OF 1970)
&
THE PATENTS RULES, 2003
PROVISIONAL SPECIFICATION

1. Title of the project/invention :

A Concept Design Of Economical Material Handling System For Stone Mining(Quarry) Industries

2. Applicant(s) :

Patel Kavit Mahendrabhai (Indian)
Address : Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.

Patel Bhavikkumar Kantilal (Indian)
Address : Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.

Patel Ruchil Ashokbhai (Indian)
Address : Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.

3. Preamble to the description :

The following specification describes the invention.

4. Description :

a. Field of Application / Project / Invention :

Mechanical & Mining (Material Handling Equipment and Methods)

b. Prior Art / Background of the Invention / References :

In last few years prices of land/raw material of mining is increased unexpectedly and hence price of aggregate increased. Now a days it is necessary to reduce cost some how. In current situation, truck and tractors are used to material handling from mine to crusher plant. The distance between plant to mine is varying from industry to industry, but distance is not more affecting factor then depth/slope.Before today mining industries of Gujarat are choose to go for long distance rather than more depth due to cost.
Truck and tractor have large fuel consumption and high maintenance work in slope area in terms of wear of tyres, Gear box, piston, oil, and labour etc. To overcome problem of cost, it is only possible way if we can reduce cost of material handling. Another problem of storage and safety of large fuel tank, because it is not practically possible to go for filling fuel, it is time consuming and costly.

c. Summary of the Invention/Project :

There are number of material handling system available in market, but it is necessary to choose appropriate one.
(1) Conveyor Belts
(2) Cranes
(3) Storage Lifts
(4) Industrial Trucks
(5) Manual
A common approach to the design of MH systems is to consider MH as a cost to be minimized.
This approach may be the most appropriate in many situations because, while MH can add real value to a product, it is usually difficult to identify and quantify the benefits associated with MH; it is much easier to identify and quantify the costs of MH (e.g., the cost of MH equipment, the cost of indirect MH labour, etc.). [2]
Once the design of a production process (exclusive of MH considerations) is completed, alternate MHS designs are generated, each of which satisfies the MH requirements of the production process. The least cost MHS design is then selected.

In this project, selection of suitable material handling is done according to requirements of site location (mostly of gujrat) like depth of mine, distance of mine to crusher plant, capacity of plant, available mine area, availability of time and few other.

d. Objects of the Invention/Project :

main object is to select best MH system which one is suitable for proper mine & fulfill it's requirements; it must be economic, fast, safe, long life and least human interference and allowed by gov. rules and regulations.

e. Drawing(s) :

54108_Drawing1

f. Description of the Invention :

"A Concept Design Of Economical Material Handling System For Stone Mining(Quarry) Industries"
Problem in current situation ;
Cause of problem (e.g. increase of land and petroleum prices);
Available alternate solution of that problem(e.g. Belt, Crane, Lift);
sorting of that problem according to application(e.g. depth, distance, capacity);
select best solution ;
design that for site situation;
find out power consumption for designed solution;
calculate installation cost, operating cost and other;
compare benefits with last one;
calculate current economy for material handling;
calculate future scope and make prediction about that;
comes to single solution with best outcome.

g. Examples :

CALCULATION OF AREA COVERED BY MATERIAL:

The area is given as:
Ab =(L + l)/2 m sin
As =(r^2 2)/360- r^2 sin2/2

Ab = (807.84+400)/2 * 225 * sin 250
= 57426.214 mm2
= 0.0574262 m2

As = (*(2326.54)2 *(2*100))/360 – ((2326.54)2 sin 200) /2
= 944230.8604 – 925641.3273
= 18589.5331 mm2
= 0.0185895331 m2

Total area of covered section is
A = Ab + As
= 0.0574262 + 0.018589533
= 0.076015 m2

std. area by " IS.11592.2000" for belt conveyor = 0.0765 m2
SELECTION AND DESIGN OF BELT CONVEYORS — CODE OF PRACTICE(First Revision)
ICS 53.040.10
B U R E A U OF INDIAN STANDARDS

h. Unique Features of the Project :

Unique feature is that miners are not prefer belt conveyor because of high capacity and too much bulky material of higher density, and stone have different sizes fin every blast so it is not practically possible to design and convey material by belt conveyors with same same capacity.
Here solution of that problem is that install primary crusher in mine at bottom ground level for large mine industry, it will more economic for longer time period

5. Date & Signature :

Date :13 - April - 2016

_____
Sign and Date
Patel Kavit Mahendrabhai

_____
Sign and Date
Patel Bhavikkumar Kantilal

_____

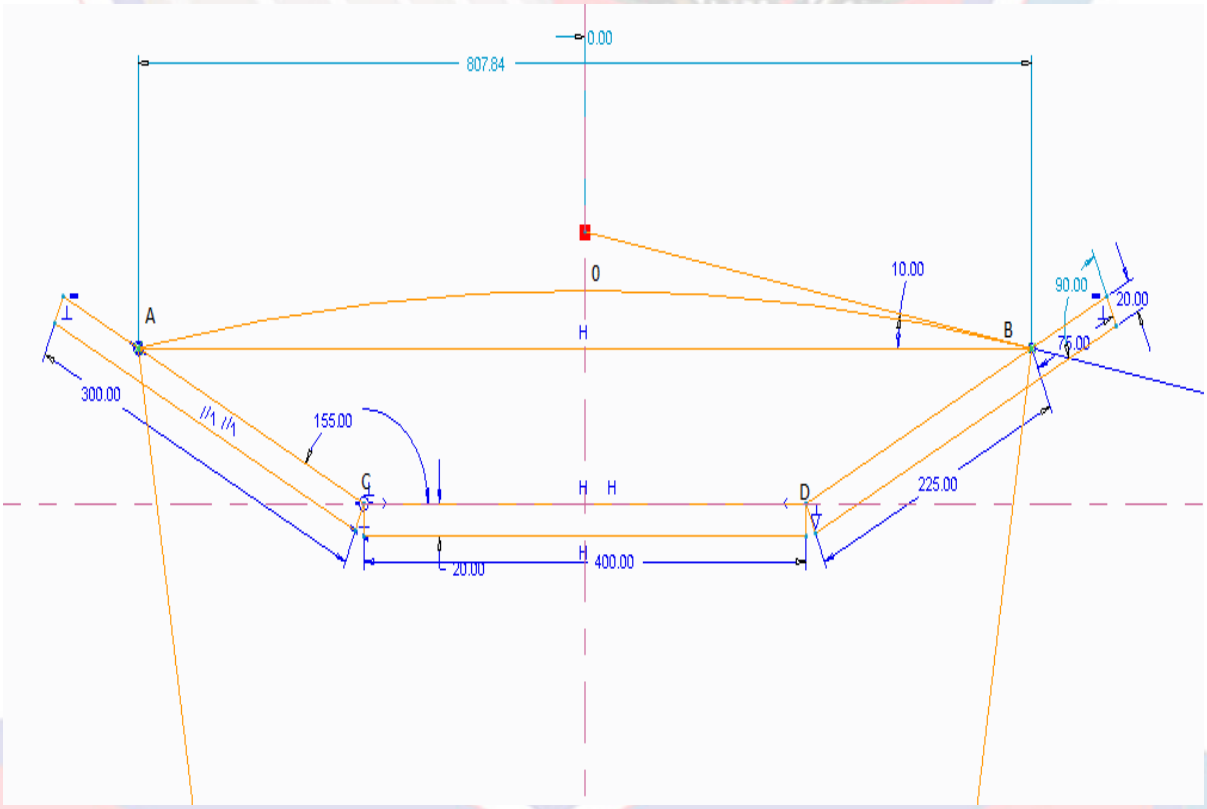
Sign and Date
Patel Ruchil Ashokbhai

6. Abstract of the project / invention :

In rock/stone mining industries large stone as raw material need to be transported from deep mine to ground floor and from ground floor to crusher plant. The distance of material/raw material handling is varying from mine to mine. Material handling equipment are designed such that they facilitate easy, cheap, fast, safe and continuous material handling with least human interference. For instance belt conveyor and crane system can be employed for easy handling of materials beyond human capacity and conventional vehicles like trucks and tractors in terms of weight and height. This project works on selection of material handling equipment, basic design, considering belt conveyor system and crane. For crushed stone with maximum loading capacity, in order to ensure fast, continuous and efficient movement. It is able to give appropriate work at different site locations.After completion of this project work achieved data can be used for industrial application.

Drawing Attachments :

54108_Drawing1



FORM 2
THE PATENTS ACT, 1970
(39 OF 1970)
&
THE PATENTS RULES, 2003
PROVISIONAL SPECIFICATION

1. Title of the project/invention :

A Concept Design Of Economical Material Handling System For Stone Mining(Quarry) Industries

2. Applicant(s) :

Patel Kavit Mahendrabhai (Indian)
Address : Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.

Patel Bhavikkumar Kantilal (Indian)
Address : Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.

Patel Ruchil Ashokbhai (Indian)
Address : Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.

3. Preamble to the description :

The following specification describes the invention.

4. Description :

a. Field of Application / Project / Invention :

Mechanical & Mining (Material Handling Equipment and Methods)

b. Prior Art / Background of the Invention / References :

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5. Date & Signature :

Date :13 - April - 2016

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Sign and Date
Patel Kavit Mahendrabhai

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Sign and Date
Patel Bhavikkumar Kantilal

_____

Sign and Date
Patel Ruchil Ashokbhai

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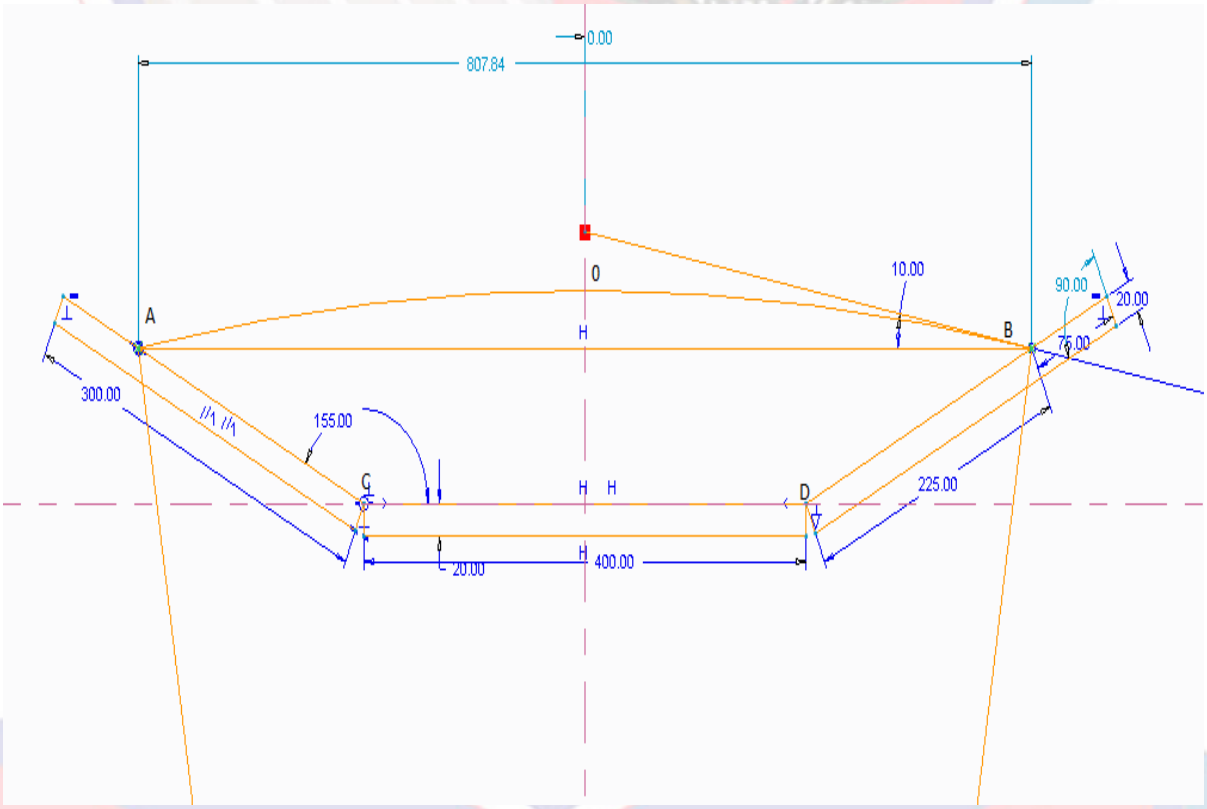
Drawing Attachments :

54108_Drawing1



FORM 3
THE PATENTS ACT, 1970
(39 OF 1970)
&
THE PATENTS RULES, 2003
STATEMENT AND UNDERTAKING UNDER SECTION 8

1. Declaration :

I/We, Patel Kavit Mahendrabhai ,
Patel Bhavikkumar Kantilal ,
Patel Ruchil Ashokbhai

2. Name, Address and Nationality of the joint Applicant :

Patel Kavit Mahendrabhai (Indian)
Address :Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.

Patel Bhavikkumar Kantilal (Indian)
Address :Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.

Patel Ruchil Ashokbhai (Indian)
Address :Mechanical Engineering , Smt. S. R. Patel Engineering College , Gujarat Technologycal University.

Here by declare :

(i) that I/We have not made any application for the same/substantially the same invention outside India.

(ii) that the right in the application(s) has/have been assigned to,

Name of the Country	*Date of Application*	*Application Number*	*Status of the Application*	*Date of Publication*	*Date of Grant*
N/A	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

(iii) that I/We undertake that up to the date of grant of patent by the Controller , I/We would keep him inform in writing the details regarding corresponding application(s) for patents filed outside India within 3 months from the date of filing of such application.

Dated this **13** day of **April** , **2016**

3. Signature of Applicants :

Sign and Date
Patel Kavit Mahendrabhai

Sign and Date
Patel Bhavikkumar Kantilal

Sign and Date
Patel Ruchil Ashokbhai

To
The Controller of Patent
The Patent Office, at **Mumbai.**

PRINT BACK

Enrollment No :	120780119023	**College :**	Smt. S. R. Patel Engineering College
Student Name :	Patel Ruchil Ashokbhai	**Department :**	Mechanical Engineering
Mobile No :		**Discipline :**	BE
Email :		**Semester :**	Semester 8

PPR Details

Time Interval : -

Periodic Progess Report : First PPR

Project : A Concept Design Of Economical Material Handling System For Stone Mining(Quarry) Industries

Status : Reviewed (Freeze)

1. What Progress you have made in the Project ?

We have find out CRANE as alternative solution for very deep mines like: 215-240 feet., DERRICK-CRANE is most suitable option for deep mines and it is also economic.

2. What challenge you have faced ?

A Big challenge is to meet the hourly demand of crusher is very large in quantity. for old running mines, and other side crane has low operating speed.

3. What support you need ?

Need support of contact of mining industries for different case study for optimum design for mostly suitable foe mines

4. Which literature you have referred ?

THE MODERN STIFFLEG DERICK WITH CRANE BOOM BOOKLET

Comments

Comment by Internal Guide :

good

PRINT BACK

Enrollment No : 120780119023
Student Name : Patel Ruchil Ashokbhai
Mobile No :
Email :
College : Smt. S. R. Patel Engineering College
Department : Mechanical Engineering
Discipline : BE
Semester : Semester 8

PPR Details

Time Interval : 0 days, 22 hours, 55 minutes, 59 seconds

Periodic Progess Report : Second PPR

Project : A Concept Design Of Economical Material Handling System For Stone Mining(Quarry) Industries

Status : Reviewed (Freeze)

1. What Progress you have made in the Project ?

-DERRICK-CRANE Concept Design, Leg design for Mine of 225ft. depth. -DRUM DESIGN IS VERY CRUCIAL PART FOR CRANE. -SELECTION OF PROPER STEEL WIRE IS DONE IN THIS PHASE

2. What challenge you have faced ?

-MAKING OF CREO drafting FOR DERRICK CRANE IS VERY DIFFICULT.

3. What support you need ?

NEED SUPORT FROM CRANE MANUFACTURER FOR UNDERSTANDING FOR REAL APPLICATION PROBLEMS.

4. Which literature you have referred ?

Types of Cranes Requiring Certified Crane Operators Telescoping Inner & outer tower

Comments

Comment by Internal Guide :

good

PRINT BACK

Enrollment No : 120780119023
Student Name : Patel Ruchil Ashokbhai
Mobile No :
Email :

College : Smt. S. R. Patel Engineering College
Department : Mechanical Engineering
Discipline : BE
Semester : Semester 8

PPR Details

Time Interval : 4 days, 15 hours, 44 minutes, 20 seconds

Periodic Progess Report : Third PPR

Project : A Concept Design Of Economical Material Handling System For Stone Mining(Quarry) Industries

Status : Reviewed (Freeze)

1. What Progress you have made in the Project ?

- Design for rope drum. - Selection of Wire material. - Gear box selection.

2. What challenge you have faced ?

- Design of Drum

3. What support you need ?

-Need support for gear box design

4. Which literature you have referred ?

i.s.6938.2005

Comments

Comment by Internal Guide :

good

PRINT BACK

Enrollment No : 120780119023
Student Name : Patel Ruchil Ashokbhai
Mobile No :
Email :

College : Smt. S. R. Patel Engineering College
Department : Mechanical Engineering
Discipline : BE
Semester : Semester 8

PPR Details

Time Interval : 1 days, 20 hours, 6 minutes, 26 seconds

Periodic Progess Report : Forth PPR

Project : A Concept Design Of Economical Material Handling System For Stone Mining(Quarry) Industries

Status : Reviewed (Freeze)

1. What Progress you have made in the Project ?

-Design of derrick crane in CreO 2.0 -Verify the data obtained by calculation with the online software.

2. What challenge you have faced ?

-problem in making model of belt conveyor

3. What support you need ?

-need support for model maikng

4. Which literature you have referred ?

-design data book & selection guide for wire selection and drum design.

Comments

Comment by Internal Guide :

good