STUDY ON CONVEYOR BELT ISSUES IN MATERIAL HANDLING

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BACHELOR OF TECHNOLOGY

Submitted by

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MECHANICAL ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

Under the Supervision of

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DEPARTMENT OF MECHANICAL ENGINEERING

BONAFIDE CERTIFICATE

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This thesis/dissertation/project report entitled titled **STUDY ON CONVEYOR BELT ISSUES IN MATERIAL HANDLING** by- **Pramod kumar Yadav- 18021011957, Utkarsh Singh- 18021011959** is approved for the degree of bachelor of technology in mechanical engineering.

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1. Project report title: "STUDY ON CONVEYOR BELT ISSUES IN MATERIAL HANDLING"**.**
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4. Specifications regarding thesis format have been closely followed.
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6. The report has been prepared without resorting to plagiarism.
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8. The report has not been submitted elsewhere for a degree.

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ABSTRACT

There are predominant categories of belt shipping enterprise; those in fashionable belongings control including those transferring packing containers inside the factory and lots of holdings similar to the ones used for big shipping capability of agricultural sources and assets. Conveyor belt retention does no longer clearly contain right care of the belt itself however also includes the renovation of the body and equipment. Same way of life of a conveyor the belt depends not only on its pleasant construction and production however additionally at the care and attention it receives when it is stored and service. Significant damage occurs in the mass transfer system due to adherence to the existing material migration and damage due to chemical reactions and are also present causing failure due to reversal product. Problems and failures require permanent care. Removal of adhesive materials maybe its miles executed in two approaches, the usage of a rotary machine that puts below the conveyor belt; will dispose of the adhesion building materials because the conveyor rotates in circular motion. There may be any other technique to this hassle is to use a jet spray underneath conveyor belt for adhesive material.

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CHAPTER 1

INTRODUCTION

A conveyor belt is the carrying medium of a belt conveyor system. A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys, with an endless loop of carrying medium the conveyor belt that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. There are two main industrial classes of belt conveyors. First in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport large volumes of resources and agricultural materials, such as grain, salt, coal, ore, sand, overburden and more.

The belt conveyor comprises of a belt that rests on top of a smooth metal bed or rollers. When the distance is long, belt conveyors with rollers are the most suitable option, as the rollers help to reduce friction. It is not necessary for belt conveyors to be straight. They also can turn corners with a special attachment. In such a case, the shape of the belt for the corners will be concentric, to provide smooth movement around the corners.

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1.1 Conveyor Belts used in Bulk Material Handling

The most commonly Conveyor Belts that are used in Handling Bulk Material are: -

1.1.1 **Roller:** Roller conveyors are a form of conveyor belt that utilizes rollers evenly-spaced rotating cylinders to allow objects to roll across its surface. They move material from one place to another place, and this is done by small motors. The transported material must have a rigid riding surface that is supported by a minimum of three of the rollers. The rollers can reduce the inertia of products at a higher speed, making them useful conveyors after high-speed sorting machinery.

1.1.2 **Skate-wheel Belt:** A Skate-wheel conveyor is also non-motorized. It is designed with metal or plastic wheels that roll a package down to a lower level by gravity. These conveyors are called skate-wheel conveyors because the rollers on the conveyor resemble the wheels on roller skates. These wheels are equally spaced along the length of the conveyor so that every box and package is supported by more than one row of wheels. A benefit of skate-wheel conveyors is that they are lightweight and portable for a variety of delivery applications.

1.1.3 **Cart-on-track conveyor:** This is a type of conveyor that consists of individual carts that ride on a track a few feet above floor level. The carts use a rotating shaft while a drive wheel is attached to the cart's bottom, and at an angle to the rotating shaft which drives the cart forward. By regulating the contact between drive wheel and rotating shaft, the cart is controlled. This system allows the cart to be positioned with high accuracy.

1.1.4 **Overhead trolley conveyor:** An overhead trolley conveyor, consists of multiple trolleys, usually equally spaced along a fixed track. A chain system, through the links of which an individual trolley passes, provides the motion power to propel the trolleys along the overhead rail track. There is a load connected to each trolley, so as the trolleys move along the track the individual loads also move. The trolleys are connected together and moved along the track by means of a chain or cable that forms a complete loop.

1.2 Advantages of Conveyor Belt

There are different advantages of Conveyor Belts. Some of them are mention below: -

- Can be operated over long distances over any kind of terrain.
- Having high load carrying capacity and carry all kinds of loads.
- Noiseless as compared to chain conveyors.
- Much simpler to maintain and don't require any major lubrication system like chain conveyors.
- Their reliability has been proved over a long period by its use in the industry.
- Environmentally more acceptable.
- Low labour and low energy requirements.

- Unlike screw conveyors, belt conveyors can be easily used for performing processes functions in a production line.
- Maintenance costs for belt conveyors are extremely low compared with many other means of transporting bulk materials.
- The Conveyor system can be operated through sensor technology which, eliminates the need to employ an operator.
- Conveyor systems also come with security features that lower the risk of accidents.

1.3 Different Components of Belt Conveyors

The different components of the belt conveyor system are:

a) The conveyor belt: Belt is main part of the belt conveyor system. In belt conveyor system materials are transported from one station to another through these belts. The belt conveyor system (BCS) consists of:

- Drive unit (electric motor, coupling multistage gearbox)
- Pulleys (drive pulley and other)
- Belts (textile or with steel cords) with their joints
- Idlers
- Other (belt cleaning systems, control system, etc)

b) Drive Unit: The drive unit consist of electric motor, damping coupling, two or three stage gearbox and coupling that connect output shaft with pulley. A crucial object in this subsystem is gearbox. According to the industry even 14% of gearboxes may be replaced each year due to unexpected failures.

c) Pulleys: Pulleys are generally made of steel fabricated construction. The pulley shell is connected to the two hubs one at each end with the help of two diaphragms. Rubber lagged pulleys are supplied to increase the friction in between the belt and the pulley. The lagging is either plain or herring plain bone grooves. The mining pulley consists of two bearings, shaft, shell and coating (special material in order to improve belt-pulley contact).

d) The idlers: The idlers consist if seamless steel tube rolls enclosed by pulley heads at each end and fitted with stationary shaft, anti-friction bearing and seals. The generally used idlers are:

- Toughing idler
- Toughing trainer
- Return idler
- Return trainer
- Impact idler.

The failure analysis of idlers and belts are a bit different issue. Idlers are used for supporting belts with transported materials. In some sense idlers are similar to pulleys and consist of bearings and shells. Worn bearings in idlers will significantly increase external load for drive units so power consumption will increase. Damaged idlers and pulleys may be the reason of damage for belts.

e) Take-ups: Belt conveyors are provided with take ups which perform the following functions:

- Maintain necessary slack side tension for the drive to operate the belt.
- Keep sag of the belt between the idlers at appoint when required horse power will be at a minimum and load will move with least disturbance over idlers.
- Permit length variation due to belt elongation or shrinkage.

f) Skirt boards:

Skirt boards are used in conjunction with delivery chutes at tail end of the conveyor, to guide the material while loading. It essentially consists of a fabricated frame firmly supported on the conveyor structure. A skirt rubber is attached at the bottom keeping uniform pressure on the belting.

g) Scraper: Scrapers are provided at the discharge pulley to clean the carrying side of the belt and to avoid the wear of return idlers to build up of material. A scraper is provided at the tail end pulley to clean the inner surface of the belt and to avoid any material going inside the gap between tail pulley and belt. Generally steel blade or rubber / fabric scrapers are used.

h) Safety devices: The following safety devices are normally incorporated in the belt conveyor systems.

- Anti-roll back devices.
- Limit switches.
- Zero speed switches.
- Sequence protection switches

CHAPTER 2

LITERATURE REVIEW

In the analysis of conveyor belts as suggested by Xiaohua Xia and Others et al [1] Three types of band conveyor are comparable: solitary drive band conveyor, solitary-brace drive band conveyor and compound-drive band conveyor. Based on speculation made by information providers, research shows that the introduction of less expensive compound-drive conveyor transmissions will upshot in equal yearly levy savings. Yusong Pang & others [2] scrutinize which criterion can represent the scientific ambience of non-functional belts for the intention of surveil the condition. The conveyor rig trial belt is mounted in the lab bench. Calefaction and reverberation sensors are used to audit idle rolls caused by various types of missteps. M. A. Alspaugh et al [3] Demand for bulk transportation has extended to pressure the conveyor band monopoly to carry high tones over long orbits and on different passages. To continue, significant technological overture have been made in the field of structure layout, scrutiny and numerary counterfeit. R. Vijayakumar & T.M. Sakthimuruga [4] the maintenance of the conveyor belt no longer simplest consists of right renovation of the band itself but also includes preservation and protection of the body and device. The identical manner of existence of a conveyor belt relies upon no longer best on precise construction and production however also at the care and interest it receives from storage and preservation. Daijie Hea, Yusong Panga et al. [5] Belt play an important role in the process of handling large quantities of dry goods. Speed control is a promising way to reduce the power consumption of belts. However, improper temporary operation may result in accidents such as spillage of equipment away from the belt connector. Unexpected accidents limit the speed limit. Ramzan Nazim Khan et al. [6,7] Wearing a conveyor belt is a vital attention inside the multi-factor managing industry. We define the four-band abrasion average metrics and evolve a carve to predict the aging standards for the preparation of a new sender using a sector database that says includes ultrasonic intensity measurements, transmitter characteristics, and conveyor output. Solutions to increase the capacity of bulk band so that they can increase the flow of material and reduce the cost of transportation.

Nilesh B. Kardile et al. [8] Transportation systems are used to transport large quantities of goods at faster speeds and at a lower cost than manual labour. Conveyors are often used for the transport of solid and less durable materials that have no power or have strong conveys and both have their advantages and disadvantages. Gabriel Lodewijks et al. [9] a three-step tenor that can be used to regulate the ideal velocity accelerator for a quick-moving belt.

Factors to be avoided to increase the life of conveyor belts:

- Ignoring the manufacturer's advice before buying a heavy or unfamiliar belt condition.
- Buying a low-quality belt because it is cheap at first, although not suitable for work expected.
- Harm to the cover or edges carelessly during the set-up of the sender.
- They may be no longer square with a belt, for that reason inflicting the belt to head crooked and the edges worn.
- Neglected to use those heat-resistant belts to treat hot items.
- Insufficient loading tubes, which cause jam and congested material to wear seat belts prematurely.
- Not giving laziness has the effect of rubber on the loading area where the load is large to bump.
- Neglected immediately repairs any damage to the cover of fabric.
- Insufficient lubrication of the lazy, resulting in deterioration of the belt cover due to dirt.

CHAPTER 3

METHODOLOGY

1. **Scrapper system:** The return gadget on the return aspect is the primary motive why the conveyor bands are changed, the return idlers and sheaves are changed and the shape is tattered. The development of the band material and machinery causes tracing issue with a purpose to result in harm main to the current band and current laziness. We suggest to apply scrapers on the pinnacle sheave and hoes ahead of the tail sheave as to save you injury on your repair association. A few sticky items gift a real venture when it comes to stopping recurrence. We would really like to offer a hardly latest additional supplementary on a way to manipulate those products. Eliminated belts can be reversed to allow for higher launch within the discharge location.

2. **Roller System:** Scrub brush solutions can work better and usually have a longer life. They are also very bendy, appropriate for a huge range of solicitation. The conveyor band is cleaned with a brush and a cleansing utility such as hot aqua. The rolling brush is always in contact with the belt and is cleaned with a low brush that is slightly immersed in the cleaning liquid. Then a squeegee roller dries the belt and an air knife can be added to completely dry the belt. The water mist on the band cover and the contact blades will constructively disconnect most products from the cover coating. A series of lazy out-of- cycle (camera-shaped) returnees will also help with cleaning. These lazy wounds are wound up from the edges to the middle of the lazy and work on the structure of the rotating bit bar system.

3. **Jet Spray System:** A jet spray bar is a plumbing system fitted with several spray holes. Spray tubes are used to disperse liquids, usually water, in the desired pattern. Spray mounds can be used to disperse liquids into the area, increase the surface area of the liquid or create a tactile impact area. Water is still pumped over the belt surface or mixed with water-soluble materials, forming mud or mud, to be

effectively extracted from the top with a scraper tape. Otherwise, water is used to touch the surface to remove particles from the belt surface and to flow away from the water during the scrubbing process. Depending on the characteristics of the transmitters and the target application, spray pressure and pattern play an important role in achieving your outcome. Typically located between the primary and secondary scraper, the spray bar is designed to place spray nozzles in a highly efficient position relative to the transmission belt area. Both the distance and the angle in the belt area need to be improved in order to use the high cleaning efficiency.

Conveyor Belt Issues (Bulk Material Handling):

1. CARRYBACK: Convey lower back is the substance that stays on it after dispense and is possibly the maximum not unusual war among conveyor operators. deliver back creates messy and potentially dangerous paintings surroundings, because it receives into the underpinning and encircling location of the conveyor. This could purpose disruption and escalate the time ardent to cleansing and protection.

WHAT CAUSES CARRY BACK: Bring lower back is basically the end outcome of the conveyed material's aspects and proneness for shying. In fashionable, a fabric with a better dampness smug is much more certainly to paste to the band. Sticking may also arise whilst condensation is produced due to hot climate variation among cloth and the band.

HOW TO PREVENT CARRYBACK: The satisfactory way to save you deliver back is to exploit one or greater band cleansers. Band cleansers are installed up at each of the top and hound sheave and be in the service to experience in opposition to the conveyor belt, knocking over any material that may be cleave to the band

2. CONVEYOR BELT MISTRACKING: Chasing refers to the manner in which the band rides at the grounder. Conveyor bands ought to usually tune centrally. Mistracking takes place whilst the conveyor belt rides raggedly on rollers, upholding the prejudice over the alternative.

WHAT CAUSES MISTRACKING: In view that conveyor and band calibration are cautiously stabilized, any range of component may be the origin of mistracking, building it tough to spot out the beginning of the hassle. capacity reasons of mistracking consist of wrong loafer spacing, seized or worn rollers, a misaligned

body, cloth build-up on any piece of the conveyor, immoderate band straining, and a tattered or injured band, to call some.

HOW TO PREVENT MISTRACKING: Conveyors can drop out of excellent calibration through ordinary placed on and tear. As a end output, mechanically examining calibration of the conveyor shape and its many numerous facilitate to save from mistracking. due to the fact that mistracking can be caused by fabric construct-up, it’s also important to hold the belt conveyor, idlers, and pulleys smooth. this could reduce put on on components, that may additionally cause mistracking.

3. SLIPPAGE: Belt slippage usually takes place all over the pressure/head sheave and occurs while the band and sheave do not have sufficient clasp ability to effectively flip the band around the sheave. Belt skidding reduces productive capacity and performance, spawning manner unsettled, or preventing the actual quantity of substance from being conveyed. it is able to additionally reason belt wear and harm, and positioned introduced pressure on the motor, ensuing in oversoon failure.

WHAT CAUSES SLIPPAGE:

- Frigidness (cold climate can lessen the proprtion of grip among the sheave and band).
- indelicate mounted sheave dallying
- build-up on sheave
- scant band anxiety
- tattered head sheave
- the heaviest load on the conveyor

HOW TO PREVENT SLIPPAGE: There are several methods to prevent slippage. preserving a good enough belt anxiety is vital to preventing slippage. whilst there isn't enough grip among the pulley and the belt, do not forget installing lagging. Lagging is a cloth brought to the floor of the pulley for elevated traction.

CHAPTER 4

PROBLEM DISCRIPTION

1. Problem description

While starting with the study we came across many problems some of them are listed below:

- Some sticky objects present a real challenge when it comes to preventing recurrence.
- Belts may be adjusted to allow for better release in the discharge area.
- A dual scraper system on a head pulley is a common way to eliminate carrying a product back.
- Water spray on belt cover and wiper blades will effectively remove most products from the coating of the cover.
- Common failures of pulley are: bearings and shells. Gearboxes number failure related to tires of 50%.
- Another important failure is the damage to the input shelves (possibly due to overcrowding). It is possible Surprisingly, carrying errors are less common in gearboxes.

Failure of the transport system is not only due to belt damage but also due to faults occurring in related parts, such as pulleys, motor, shaft, bearings, etc. In gearboxes the number of failures related to the wheels is fixed by 50%. Another important failure is the damage to the input shelves. Many of the failures caused by related parts of the conveyor belt will be due to specific reasons such as overloading, overloading, and due to specific installation problems. Chemical action and causes failure in the related parts of the transmission belt. Regular maintenance is essential to avoid these failures resulting in significant losses to the company.

CHAPTER 5

RESULT AND DISCUSSION

BELT CONVEYOR MAINTENANCE & CHECK LIST

Check list of the belt conveyor system, don't touch any machine in running condition. Where ever needed power cutting with positive isolation is must.

A) GEAR BOX:

a) Check the oil level through glass gauge or dip stick.

b) Check the temperature of the gear box.

c) Check the cleanliness of the gear box.

d) Check the foundation bolt of the gear box.

e) Check any vibration in the gear box.

f) Check any leakage from the gear box.

g) Check the input and output shaft coupling conditions.

B) PULLEY:

a) Check the coupling flange condition.

b) Check the lagging condition on the pulley.

c) Check the eccentricity of the pulley during rotation.

d) Check the shell condition of pulley if lagging damage.

e) Check the shaft and drum of the pulley.

C) PLUMBER BLOCK:

a) Check the temperature of the plumber block.

b) Check the lubrication of the plumber block.

c) Check the base bolt of plumber block.

d) Check the position of labyrinth of the plumber block.

e) Check the vibration of the plumber block.

f) Check any abnormal sound coming from plumber block.

g) Check the cleanliness of the plumber block.

h) Check the grease point and felt is ok or not.

D) SCRAPER:

a) Check the effectiveness of the scraper.

b) Check blade condition, its mounting condition and blade holder condition.

E) BELT:

a) Check the condition of belt covers and its ply.

b) Check the joint conditions.

c) Check the edge of the belt.

d) Check the swaying profile of the belt.

e) Check the tension of the belt.

F) GENERAL:

a) Lightning, Cleanings, Proper hand railing, Gratings, Platforms, Switch boards at every transfer point, and unsafe conditions etc.

CHAPTER 6

CONCULSION AND FUTURE SCOPE

1.1 Conclusion

Problems found in a different transport system were the inconsistency of the idlers, the belt running on the tail sheave, excessive erode under the band and rust on the fixture.
We use the defense plan of action as the primary step in our project, with this saving of upcoming savings costs. Regular care and proper anointing can keep the balance of the lazy. Adjust the loading material to fit the load in the middle to help lower the belt running on the tail sheave. Painting and gloss can turn down rust on fixtures and drums. The use of a twin snap system, brush system and rubber snip facilitate the efficient operation of the conveyor band. By following these technique , the trend of declining conservation decreases and moderately the annual conservation costs are thus increasing thus making companies more profitable.

1.2 Future scope

- Scope future market potential of conveyor & transmission belts is linked to new projects likely to be set up or expansion of the existing projects.

- The market for conveyor belt is expected to increase at the rate of 5-10% per annum including the replacement market. Accordingly, the market potential for conveyor belts estimated to increase.

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Paper II

Conveyor Belt Issues in Material Handling

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Abstract: There are predominant categories of belt shipping enterprise; those in fashionable belongings control including those transferring packing containers inside the factory and lots of holdings similar to the ones used for big shipping capability of agricultural sources and assets. Conveyor belt retention does no longer clearly contain right care of the belt itself however also includes the renovation of the body and equipment. Same way of life of a conveyor the belt depends not only on its pleasant construction and production however additionally at the care and attention it receives when it is stored and service. Significant damage occurs in the mass transfer system due to adherence to the existing material migration and damage due to chemical reactions and are also present causing failure due to reversal product. Problems and failures require permanent care. Removal of adhesive materials maybe its miles executed in two approaches, the usage of a rotary machine that puts below the conveyor belt; will dispose of the adhesion building materials because the conveyor rotates in circular motion. There may be any other technique to this hassle is to use a jet spray underneath conveyor belt for adhesive material.

Keywords

Conveyor Belt, Jet Spray, Roller System

Introduction:

A conveyor A conveyor machine is a quick and efficient handling tool that routinely transports loads and production materials domestically. This application reduces human mistakes, reduces place of job danger and reduces labour expenses - among different advantages. They are beneficial in assisting to transport huge or heavy gadgets from one point to every other. The transportation system may use a belt, wheels, rollers, or chain to transport items. It may be horizontal or inclined or your mixture of each may be adjusted skip critical boobing and incline.

Those are specially two types of conveyor band: - flat and troughed. A flat band is broadly used for a bag; a flagon, a bin, and other packaging, despite the fact that under sure situations unfastened fabric, such soap will also be treated satisfactorily. The loaded ability can be improved through extra than 60% without the risk of spillage and is appropriate for fairly any pile in a dry, wet or spilled place and is appropriate for a bit of pile stuff in a dry, very hard or barely wet environment. The entity of a conveyor band relies upon not best on its construction and manufacturing but additionally on the ministration and scrutiny it gets when it's miles stored and operated. As suggested by Xiaohua Xia and Others et al [1] Three types of band conveyor are comparable: solitary drive band conveyor, solitary-brace drive band conveyor and compound-drive band conveyor. Based on speculation made by information providers, research shows that the introduction of less expensive compound-drive conveyor transmissions will upshot in equal yearly levy savings. Yusong Pang & others [2] scrutinize which criterion can represent the scientific ambience of non-functional belts for the intention of surveil the condition. The conveyor rig trial belt is mounted in the lab bench. Calefaction and reverberation sensors are used to audit idle rolls caused by various types of missteps. M. A. Alspaugh et al [3] Demand for bulk transportation has extended to pressure the conveyor band monopoly to carry high tones over long orbits and on different passages. To continue, significant technological overture have been made in the field of structure layout, scrutiny and numerary counterfeit. R. Vijayakumar & T.M. Sakthimuruga [4] the maintenance of the

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Ignoring the manufacturer's advice before buying a heavy or unfamiliar belt condition.

Buying a low-quality belt because it is cheap at first, although not suitable for work expected.

Harm to the cover or edges carelessly during the set-up of the sender.

They may be no longer square with a belt, for that reason inflicting the belt to head crooked and the edges worn.

Neglected to use those heat-resistant belts to treat hot items.

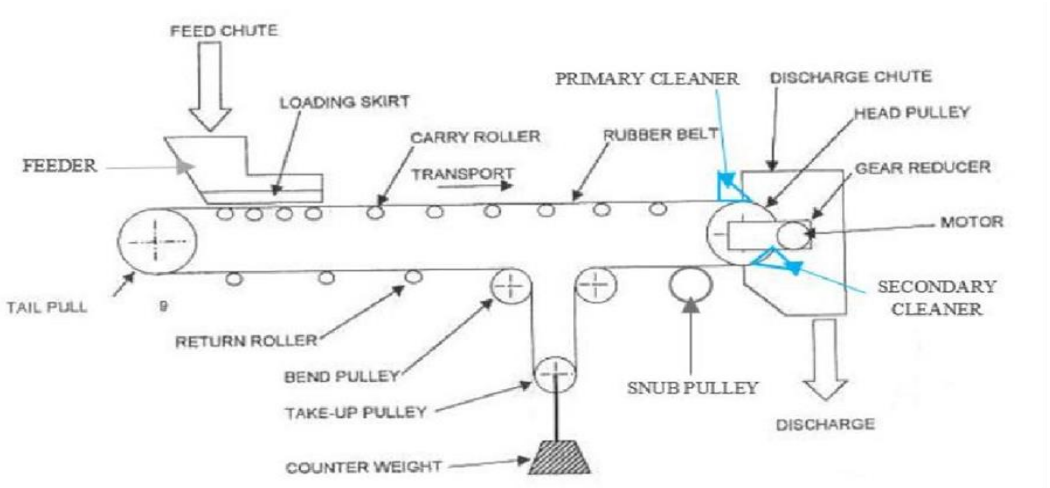
Insufficient loading tubes, which cause jam and congested material to wear seat belts prematurely.

Not giving laziness has the effect of rubber on the loading area where the load is large to bump.

Neglected immediately repairs any damage to the cover of fabric.

Insufficient lubrication of the lazy, resulting in deterioration of the belt cover due to dirt.

Conveyor Parts and Each of Their Functions:



1. Feed Chute

The feed chute is the entry point for items to be delivered by the carrier. The items to be delivered are placed in the feed chute before they are in the rubber band.

2. Loading Skirt

The loading skirt or barrier is part of the conveyor mounted to the left and right of the belt in the loading area. This partition is usually made of metal or wood to be installed directly or at an angle to prevent the goods being transported from being spilled.

3. Manage Scrolls

Carry rolls are the basis of a rubber band that used to transport items, usually found on the top of a vehicle and directly under the rubber belt.

4. Rubber Belt

The rubber band is part of a conveyor that operates to detect the transfer of movement energy from the rotating pulley, the belt will move the goods from one end of the conveyor belt to the other. The belt is usually made of rubber with a rough surface.

5. Remove Chute

Shipping outlet for goods sent by the sender.

6. Head Pulley

The head pulley is the pulley located at the end of the belt where the goods are transported. In some cases, this pulley is used as a driving pulley connected directly to the motor.

7. Gear reduction

The gear reducer is part of the vehicle that works to reduce the speed of the driving vehicle. The motor speed is usually high by rpm, so it is not possible to attach directly to the conveyor.

For this reason, a gear reducer is required so that the speed of the rubber belt conveyor speed is not as fast as the car and can be easily controlled at the speed we want.

8. Motor

The motor is part of a conveyor that acts as a major driving force. Without an engine, the consignor will not be able to move goods from one place to another.

9. Primary cleaner

Basic cleaning is a key component of a conveyor cleaner used to clean the surface of the belt from the remaining material that remains attached to the belt.

10. Discharge

To clear the area where the goods will be delivered or delivered to the sender.

11. Second Cleaner

The second vacuum cleaner on the conveyor has the same function as the main cleaner that works to clean the belt from dirt after loading the items. The second cleaner is treated as a backup if the dirt goes beyond the first cleaning phase.

12. Counter Weight

The weight of the counter is part of the vehicle that acts as a load to maintain the stability of the sturdy rubber band. With this weight of the counter, the opportunity to build a hole due to the folding of the rubber band can be avoided and the transport of goods becomes smoother.

13. Take-up Pulley

The take-up pulley is part of a conveyor installed to keep the belt tight and compensate for the extension of the belt during operations.

14. Bend Pulley

Bend pulley is a pulley that has the function of bending or changing the direction of the belt.

PROBLEM IDENTIFICATION:

A few sticky items gift a real challenge in relation to preventing recurrence.

Belts can be adjusted to permit for higher launch inside the discharge vicinity.

A twin scraper device on a head pulley is a commonplace manner to get rid of sporting a product returned.

Water spray on belt cover and wiper blades will correctly take away maximum merchandise from the coating of the cover.

Not unusual failures of pulley are: bearings and shells. Gearboxes range failure related to tires of 50%.

Any other critical failure is the damage to the enter shelves (probably due to overcrowding). It is viable

Surprisingly, carrying errors are less common in gearboxes.

Conveyor Belt Failure

Collapse of the delivery machine is not simplest due to belt damage but also due to faults taking place in associated components, inclusive of pulleys, motor, shaft, bearings, etc. In gearboxes the number of failures related to the wheels is fixed by 50%. Every other vital failure is the harm to the input cabinets. A number of the disasters caused by related components of the conveyor belt may be due to particular motives along with overloading, overloading, and due to particular installation issues. Chemical action and reasons failure inside the associated parts of the transmission belt. Normal protection is crucial to avoid those disasters resulting in vast losses to the company.

1. **CARRYBACK:** Convey lower back is the substance that stays on it after dispense and is possibly the maximum not unusual war among conveyor operators. deliver back creates messy and potentially dangerous paintings surroundings, because it receives into the underpinning and encircling location of the conveyor. This could purpose disruption and escalate the time ardent to cleansing and protection.

WHAT CAUSES CARRYBACK: Bring lower back is basically the end outcome of the conveyed material's aspects and proneness for shying. In fashionable, a fabric with a better dampness smug is much more certainly to paste to the band. Sticking may also arise whilst condensation is produced due to hot climate variation among cloth and the band.

A WAY TO SAVE FROM THRUSTBACK: The satisfactory way to save you deliver back is to exploit one or greater band cleansers. Band cleansers are installed up at each of the top and hound sheave and be in the service to experience in opposition to the conveyor belt, knocking over any material that may be cleave to the band

2. **CONVEYOR BELT MISTRACKING:** Chasing refers to the manner in which the band rides at the grounder. Conveyor bands ought to usually tune centrally. Mistracking takes place whilst the conveyor belt rides raggedly on rollers, upholding the prejudice over the alternative.

   WHAT REASONS MISTRACKING: In view that conveyor and band calibration are cautiously stabilized, any range of component may be the origin of mistracking, building it tough to spot out the beginning of the hassle. capacity reasons of mistracking consist of wrong loafer spacing, seized or worn rollers, a misaligned body, cloth build-up on any piece of the conveyor, immoderate band straining, and a tattered or injured band , to call some.

   HOW TO PREVENT MISTRACKING: Conveyors can drop out of excellent calibration through ordinary placed on and tear. As a end output, mechanically examining calibration of the conveyor shape and its many numerous facilitate to save from mistracking. due to the fact that mistracking can be caused by fabric construct-up, it's also important to hold the belt conveyor, idlers, and pulleys smooth. this could reduce put on on components, that may additionally cause mistracking.

3. **SLIPPAGE:** Belt slippage usually takes place all over the pressure/head sheave and occurs while the band and sheave do not have sufficient clasp ability to effectively flip the band around the sheave. Belt skidding reduces productive capacity and performance, spawning manner unsettled, or preventing the actual quantity of substance from being conveyed. it is able to additionally reason belt wear and harm, and positioned introduced pressure on the motor, ensuing in oversoon failure.

   WHAT REASONS SLIPPAGE:
   - Frigidness (cold climate can lessen the proprtion of grip among the sheave and band
   - indelicate mounted sheave dallying
   - build-up on sheave
   - scant band anxiety
   - tattered head sheave
   - the heaviest load on the conveyor

   A WAY TO SAVE YOU SLIPPAGE: There are several methods to prevent slippage. preserving a good enough belt anxiety is vital to preventing slippage. whilst there isn't enough grip among the pulley and the belt, do not forget installing lagging. Lagging is a cloth brought to the floor of the pulley for elevated traction.

4. **MATERIAL SPILLAGE:** Fabric knocking over of the conveyor is also a usually stumbled muddle. whilst spillage can crop up at any factor alongside the conveyor course, no longer enormously, it's miles maximum not unusual at load and switch factors. cloth blabbing off of the conveyor band shrinks fecundity and coherence, animate upshot/fabric deprivation, and escalates abrasion on machinery. farther, as stated, emission can be a widespread protection risk, plunging on workmen and growing the probability of personnel slithering or collapsing.

WHAT REASONS MATERIAL SPILLAGE: In well known, it isn't unusual to see a few level of earthly emission. Imprudent elusive cloth, but, in all likelihood stipulate an elemental issue. usual genesis of extra emission include band concealed, band harm or abrasion, high-effect stacking, and channel concealed.

THE WAY TO PREVENT MATERIAL SPILLAGE: Emission in well-known is controlled with the aid of a nicely-anticipated conveyor gadget. the wield of baseboards and buff choose-off factors are beneficial in lowering the capability for cloth emission. insuring that channels are clean and placed halfway above the lading area may also assist to stave off the emession. moreover, effect beds for hefty stacking save you the band from blobing, which also can release exile material.

METHODOLOGY

1. Scrapper system:

The return gadget on the return aspect is the primary motive why the conveyor bands are changed, the return idlers and sheaves are changed and the shape is tattered. The development of the band material and machinery causes tracing issue with a purpose to result in harm main to the current band and current laziness. We suggest to apply scrapers on the pinnacle sheave and hoes ahead of the tail sheave as to save you injury on your repair association. A few sticky items gift a real venture when it comes to stopping recurrence. We would really like to offer a hardly latest additional supplementary on a way to manipulate those products. Eliminated belts can be reversed to allow for higher launch within the discharge location.

2. Roller System

Scrub brush solutions can work better and usually have a longer life. They are also very bendy, appropriate for a huge range of solicitation. The conveyor band is cleaned with a brush and a cleansing utility such as hot aqua. The rolling brush is always in contact with the belt and is cleaned with a low brush that is slightly immersed in the cleaning liquid. Then a squeegee roller dries the belt and an air knife can be added to completely dry the belt. The water mist on the band cover and the contact blades will constructively disconnect most products from the cover coating. A series of lazy out-of- cycle (camera-shaped) returnees will also help with cleaning.
These lazy wounds are wound up from the edges to the middle of the lazy and work on the structure of the rotating bit bar system.

3. Jet Spray System

A jet spray bar is a plumbing system fitted with several spray holes. Spray tubes are used to disperse liquids, usually water, in the desired pattern. Spray mounds can be used to disperse liquids into the area, increase the surface area of the liquid or create a tactile impact area.
Water is still pumped over the belt surface or mixed with water-soluble materials, forming mud or mud, to be effectively extracted from the top with a scraper tape. Otherwise, water is used to touch the surface to remove particles from the belt surface and to flow away from the water during the scrubbing process.
Depending on the characteristics of the transmitters and the target application, spray pressure and pattern play an important role in achieving your outcome. Typically located between the primary and secondary scraper, the spray bar is designed to place spray nozzles in a highly efficient position relative to the transmission belt area. Both the distance and the angle in the belt area need to be improved in order to use the high cleaning efficiency.

CONCLUSION

Problems found in a different transport system were the inconsistency of the idlers, the belt running on the tail sheave, excessive erode under the band and rust on the fixture.

We use the defense plan of action as the primary step in our project, with this saving of upcoming savings costs. Regular care and proper anointing can keep the balance of the lazy. Adjust the loading material to fit the load in the middle to help lower the belt running on the tail sheave. Painting and gloss can turn down rust on fixtures and drums. The use of a twin snap system, brush system and rubber snip facilitate the efficient operation of the conveyor band. By following this technique, the trend of declining conservation decreases and moderately the annual conservation costs are thus increasing thus making companies more profitable.

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LIST OF PUBLICATION

Paper I

Paper 1; -Utkarsh Singh, Pramod Kumar Yadav, Shrikant Vidya.

"Finite element analysis of vehicle composite propeller shaft"

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"Study on Conveyor Belt Issues in Material Handling"

Status: - In Process

Paper I

Finite element analysis of vehicle composite propeller shaft

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Finite element analysis of vehicle composite propeller shaft

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ABSTRACT

When designing a new automobile, weight reduction has become a common practice. In order to comply with stricter environmental regulations, it is necessary to reduce weight. If you'll pardon my technical jargon, manufacturers have been working hard to reduce the overall weight of their vehicles since the prototyping stage. A passenger car's propeller shaft was analyzed and optimized for weight reduction in this study. The shaft's natural frequency and durability were studied using finite element analysis and testing. Based on the structural analysis, it is found that propeller shaft weight reduced by 6.1%.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Materials, Machines and Information Technology-2022.

1. Introduction

As governments around the world step up their efforts to reduce greenhouse gas emissions, electric vehicles, hybrid electric cars, plug-in hybrids, and fuel cells are becoming more popular. On the other hand, automobiles powered by internal combustion engines still make up a significant portion of the market. However, a new Wood Mackenzie report predicts that 44% of all global transportation will still be powered by ICEs by the year 2050, contrary to predictions made by the International Energy Agency (IEA). In order to meet the ever-increasing legal requirements, carmakers producing ICE vehicles must adapt their designs and manufacturing processes.

According to this study, the development of ICE vehicle propeller shafts should include a lightweight design process. Fuel efficiency and harmful emissions can be improved by reducing the weight of a vehicle. Rear- or four-wheel-drive vehicles use propeller shafts to transfer engine torque from the transmission to the front and rear axles.

Propeller shafts that take vibration and strength into account can be designed using case studies or optimization techniques. Structural performance was taken into consideration when designing the tube's discrete structure, as suggested by Li H. X. [1] using an anisotropic material and classical mechanics, Hu et al. [2] analyzed the forces on a composite-material drive shaft. James Prasad Rao and his colleagues [3] used finite element analysis to study composite materials like which have been examined in several studies [4-6]. As early as Kuk et al. [7] and Moon et al. [8] examined propulsion shaft system components, a layout taking their strength into account. V Jose Ananth Vino et al. [9] discussed propeller shaft replacement using a composite shaft. The weight of the shaft was a primary consideration in the design process. SOLIDWORKS software was used for the modelling. ANSYS was used to analyze stress, deflection, and natural frequency under varying loads. Shinde et al. [10] and others explained the torque, shear stress and critical rpm requirements for Mahindra for propeller shaft design. It was reported that replacement of the conventional shaft with epoxy and aluminium is also possible. Salaisivabalan et al. [11] focussed on the propeller shaft of the MARUTI OMNI in order to design a shaft with the smallest possible dimensions. After that, NX 8.5 was used to create the part, and NX NASTRAN was used to perform torsional buckling analysis and model analysis. The results of the experiment were compared to each other. An investigation into the use of composite materials to reduce the weight of the shaft was conducted by Prasad et al. [12]. CATIA was used to design the shaft and ANSYS was used to perform the analysis. Automotive front wheel drive shaft failure analysis was studied by Gezu et al. [5]. It is common for the drive shaft to be under torsional and bending stress, which can lead to fatigue and fractures. Manufacturing defects and design flaws are among the most common causes of failure. Shinde et al. [13] studied the design and analysis of drive shaft. Genetic algorithm was applied for weight optimization in the composite shaft. Static, buckling, and model analysis of both shafts were carried out using ANSYS software, which is used in conjunction with CAD software. Design and analysis of composite drive shafts for light commercial vehicles was addressed by Jones et al. [14]. ANSYS was used for design and analysis.

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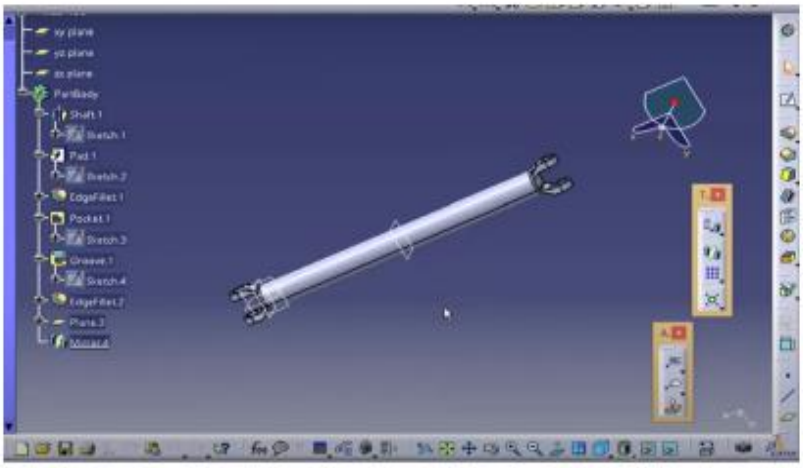


Fig. 1. Propeller shaft model.

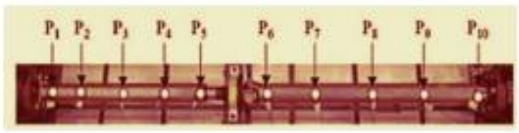
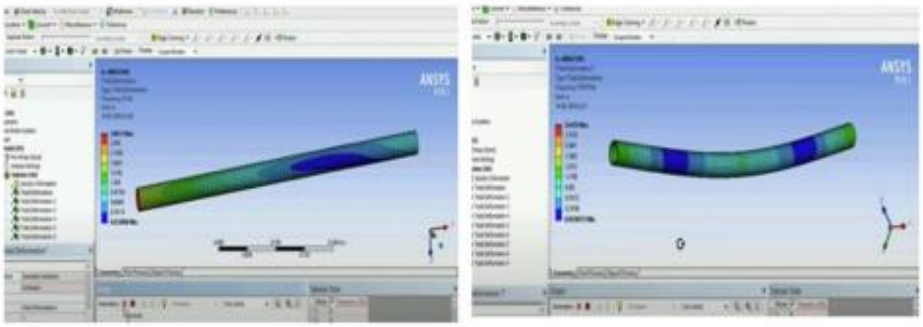
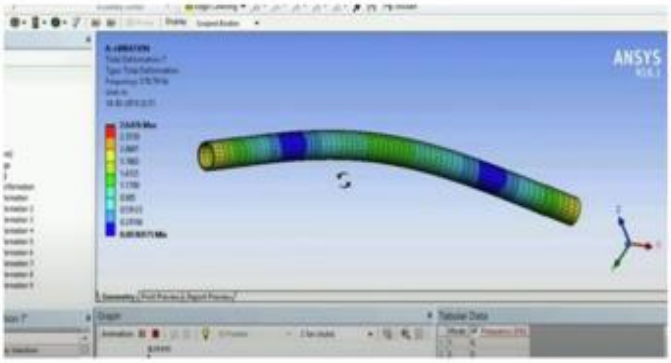


Fig. 2. Mode Shapes.

Despite the fact that each study has made a significant contribution, the critical performance of durability has been left out of the equation. This investigation is focused on a passenger car's propeller shaft. A central bearing connects each of the bike's 12 forks to the front and back wheels. It is made from steel. To save weight, the propeller shafts at the front and rear are hollow tubes. This product's tube thickness and structural



(a) (b)



(c)

Fig. 3. FEM models.

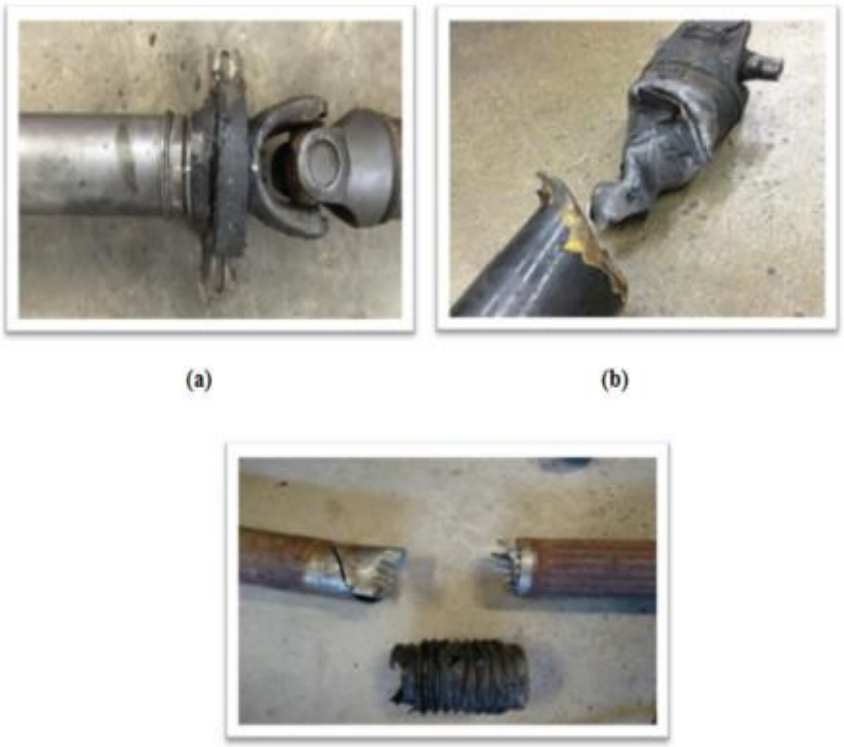


Fig. 4. Fatigue Testing of Propellar Shaft.

performance have been determined and tested by the part supplier who manufactures it. This study's goal is to develop a propeller shaft that is both strong and light. Traditional methods for solving this problem included the use of finite element analysis and testing of structural properties such as natural frequency and durability. It's a necessary step in the creation of a prototype. For a lightweight propeller shaft design that met the length and thickness of the front and back tubes were taken into account as design variables. The propeller shaft finite element model uses solid elements. It is extremely difficult to optimize in the shape optimization category because tube thickness and length are design variables. The proposed optimal solution reduced propulsion shaft weight by 6.1%.

2. Initial design

On the propeller shaft, there are forks and yoke forks as well as fork and yoke forks in the bearing assembly. Using high-frequency heat treatment on the yoke and sliding outer, the propeller shaft, which rotates rapidly while carrying a load, is made more durable. In order to secure the inner yoke to the vehicle, the centre bearing assembly is used. While in bouncing mode, it helps keep the front and rear tubes horizontally aligned. This study didn't take friction welding into account, which may have a negative impact on the product's longevity. Fig. 1 depicts the propeller shaft's initial CAD model. In terms of actual size, the tiniest part measures only 5 mm in diameter. In order for the shaft to rotate, the shaft's inner contact points must be considered contact elements.

As depicted in Fig. 1, the initial design has been completed using CATIA. Propeller shafts have been developed and manufactured by the same company for many years, so the design was based on their experience. Based on the proposed prototype design, finite element analysis is conducted.

3. Structure evaluation and testing

Mass and stiffness distribution determine the natural frequency of a structure. A resonant frequency should be checked to see if it is present. There are four strokes in an engine that produces 25 Hz at 650 rpm, while if the maximum vehicle speed is 5000 rpm, the frequency is 200 Hz when the engine is running. Propeller shaft prototype natural frequencies were predicted using ANSYS/Workbench finite element analysis, and the impact hammer test was used to confirm this.

Propeller shaft torsional loads occur when driving a car. A product's ability to withstand repeated cycles of torsional loads is critical when developing it. Calculated fatigue life was based on conditions in the part manufacturer's laboratory durability test in order to study propeller shaft fatigue, engineers used ANSYS/workbench in conjunction with the manufacturer's fatigue testing machine.

4. Tests based on natural frequencies

A central bearing's degrees of freedom had been fixed on all external surfaces of the propeller shaft. During the test, accelerometers were attached in the following locations, starting at position1 and going all the way up to position 10. The mode shapes for each natural frequency are depicted in the Fig. 2.

At the first frequency, a rigid body motion known as a bounce mode is there. Couplings and a centre bearing are stiff. First frequency is now replaced by the second one, which corresponds to the motion of a rigid body. There are two sets of tubes that bend in opposite directions around the centre bearing, which is known as the nodal point. "Three-frequencies" are when both front and back tubes bend in the same direction vertically. At least 210 Hz was required to meet the first natural frequency design criterion.

The propeller shaft's natural frequencies were calculated through ANSYS/Workbench simulations using the same boundary conditions as the test. Finite element models like this one can be seen in the Fig. 3. Fig. 3(a) shows a rigid body mode in which the second natural frequency takes precedence over the first. Fig. 3 (b) and (c) show that the front and rear tubes oscillate significantly differently. There are three ways to view the results. For example, the second frequency has a 4.1% error rate and the third frequency is 7.0% inaccurate. As a result of this tolerable error, the CAE model used in this investigation can be considered accurate.

5. Fatigue evaluation and testing

If a propeller shaft fails to meet its durability requirements and breaks, an accident or significant damage can occur. Because of this, it is imperative that the product's durability be thoroughly evaluated during the design phase. The product's long-term durability was investigated using finite element analysis in this study. It is necessary to apply 1 Hz torsional loads ranging from 110 to 1470 N-m to the test specimens.

Fig. 4(a) depicts the torsional fatigue testing machine in action. Propeller shaft couplings and centre bearing are held in place while the other end of the test machine is subjected to a cyclic load. Fig. 4 (b) shows the prototypes that have been broken apart. Fig. 4(c) shows damage to the front and rear propeller shaft sections. Durability is not a problem with any of the three prototypes.

The same torsional load of 110–1470 N m at a constant frequency was used in the fatigue analysis, which was carried out using ANSYS/Workbench. Both the analysis's and test conditions' boundary conditions were assigned the same values. It was set to use the ANSYS/Workbench option, with strain life, SWT theory and equivalent von Mises stress all selected for analysis. Fig. 5(b) shows a fractured tube after 6.1469 × 10^5 cycles, while Fig. 5(c) shows a fractured spider after 8.1601 × 10^5 cycles, the propeller shaft is surrounded by a roller bearing. However, if the spider is not replaced soon enough, it will be damaged. The tube is broken in both the test and the simulation, with the exception of the spider cap. Figure shows that the crack started on the tube side of the propeller shaft at the friction welded point, which is where each unit is attached to the shaft.

There is a 4.1 percent deviation from the first mode in the above natural frequency analysis and test results. There are also similar results in the fatigue life analysis and test results: the tube is damaged, with the exception of the spider cap, which has a fatigue life of about 600,000 cycles. Therefore, the validity of the finite element model for optimization can be established because the analysis model in this study does not differ significantly from the test results.

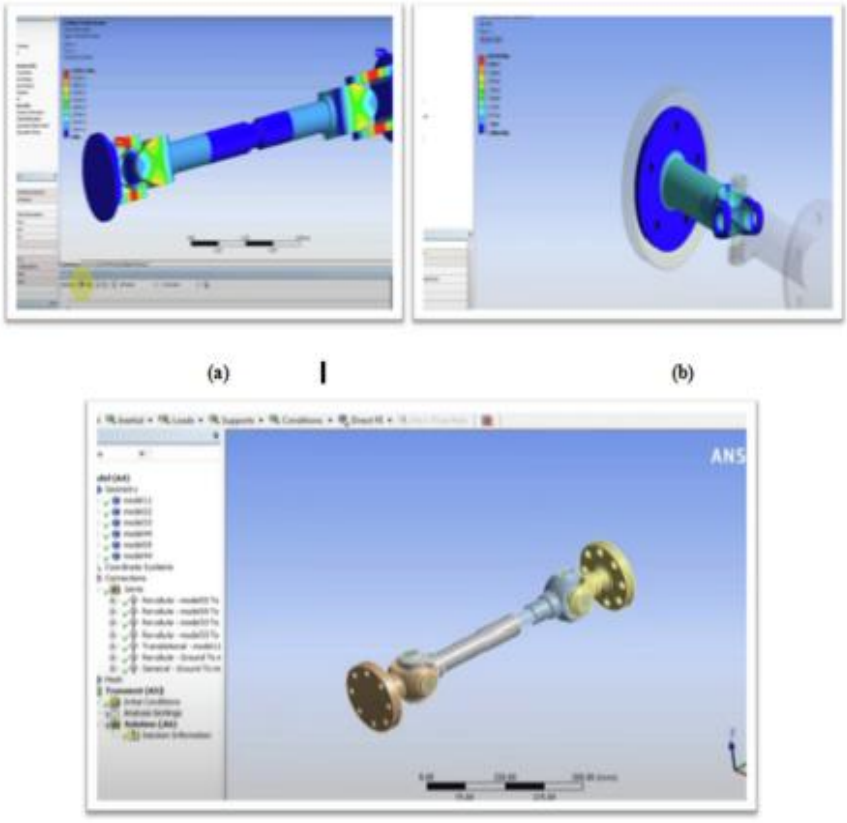


Fig. 5. FEM Analysis of Propellar Shaft.

6. Conclusions

Propulsion shaft designers have access to a design method during this phase. Test results were used to determine the model's reliability from the base design of a propeller shaft. After that, the weight of the propeller shaft was reduced. At this stage, a series of finite element analyses and fatigue life tests were carried out on the hollow shaft propeller shaft developed for weight reduction.

First, the finite element analysis found 252.4 Hz for the first natural frequency of interest. An error of 4.1% has been found. The validated finite element model was used to reduce the propeller shaft's weight. A 6.1% weight reduction in the propeller shaft's weight was achieved, while maintaining the same level of performance.

CRediT authorship contribution statement

Utkarsh Singh: Conceptualization, Methodology. **Pramod Kumar Yadav:** Data curation, Writing – original draft, Visualization. **Shrikant Vidya:** Supervision. **K.S. Srikanth:** Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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