PROTECTED CULTIVATION AND POST HARVEST TECHNOLOGY (ASAE3204)

MATERIAL HANDLING

INTRODUCTION

- Material handling includes series of operations that are performed manually or mechanically.
- Mechanical devices have replaced human drudgery.
- The operation are easier and less time consuming.
- The material cost have also reduced.
- The most common type of material handling systems are:
 - Belt conveyer
 - Screw conveyer
 - Pneumatic conveyer and
 - bucket elevator

Principles of conveying equipment

- 1. The characteristics of products need to be conveyed.
- 2. The stability of conveyer must be tested.
- 3. Capacity and speed limits must be checked.
- 4. Dead load must be low.
- 5. Products may be conveyed through gravity flow.
- 6. Spillage of conveyed product must be avoided.



- It is an endless belt operating between two pulleys with the load supported on idlers.
- It consists of a belt, drive mechanism and end pulleys, idlers and loading and discharge devices.
- It has high mechanical efficiency.
- The materials carried on belt have no relative motion with the belt.
- The materials are transported horizontally to longer distances.
- The initial cost of belt conveyer is high for short distances.
- It is generally used for paddy and others grains.

- The belt speed is limited to3.5m/s.
- For transportation of grain belt speed of 2.5-2.8m/s is desired.
- The width of belt depends on: Speed of operation Angle of inclination Trough angle and depth



Capacity of belt is calculated by following formula: = area of cross section(m2)*belt speed(m/min)*60





The belt conveyer are made up of rubberized conveyer belt made up of carcass. Types of idlers

- 1. Flat belt
- 2. Troughing idler with 20° trough
- 3. Troughing idler with 35° and 45° trough

IDLER SPACING

- The spacing influences the retention of correct troughing.
- Spacing between the successive idlers should be approximately equal to width of belt.
- Spacing is limited to 1.2m.
- The main function of roller is to withstand the designed workloads and protect the bearings.
- Large rollers have longer life.

BELT TENSION:

- It is the tension developed at drive pulley in transmitting the required power to move the loaded belt.
- Effective tension is given by

Te=power required to move the belt(KW)/belt speed(m/s)

SCREW CONVEYER

- It consists of tubular or U-shaped trough in which a shaft with spiral screw revolves.
- The rotation of screw help in movement of material along the trough.
- It is used in grain handling facilities.
- Conveyance and Mixing of materials is possible.
- It is effective for short distance transport as it require more power and is easy to wear.
- The pitch of screw is equal to its diameter.



- It has no tensioning device so initial capital cost is less.
- It can move horizontally and vertically(90°)
- The different parts are:

Screw blade or flight, screw shaft, coupling, trough, bearings and drive mechanism.

- The flight is a continuous one piece helix made up of steel.
- Different shapes of trough available are;
 - U-shaped
 - Flared trough
 - Tubular trough

<u>The capacity of screw conveyer</u> <u>depends on</u>: 1.Screw diameter 2.Screw blade inclination 3.Blade speed 4.Shaft diameter 5.Cross section of loading

Capacity, m3/hr = 47.2(D2-d2)*p*n D= screw diameter P=pitch,m d=shaft diameter, m N= rpm

Power requirement

Horse power = QLWF/4560 Q= conveyer capacity,m3/hr L= conveyer length, m W= bulk material, kg/m3 material factor(paddy=0.4)



ADVANTAGES OF MATERIAL HANDLINGPNEUMATIC CONVEYER

BUCKET ELEVATOR



- It consists of bucket attached to a chain or belts that revolve around two pulleys one at the top and other at the bottom.
- The vertical lift height is upto 50m.
- Capacity is between 2-1000 t/hr.
- It is of two types:

1.SPACED BUCKET (lifting grains)	2.CONTINOUS BUCKET
Centrifugal discharge	Super capacity
Marine leg discharge	Internal discharge
Positive discharge	

BUCKET ELEVATOR

- It has high capacity and dust free in nature.
- The conveyer belt with buckets runs over pulley at the upper and lower end.
- Top pulley is driven pulley and lower pulley is return or tension pulley.
- Buckets are ,made up of steel/plastic and bolted to the belt.
- The curved hood is designed for proper discharge of grains.

> High speed belt of 2.5-4 m/s can be used. > If belt speed is low, dischare is not effective and if belt speed is fast then feeding is difficult. > The product flow is discharged by two ways: --Gravity or centrifugal force > Centrifugal discharge results complete discharge.

The capacity of bucket elevator is calculated as:

Capacity(t/hr) = {capacity(m3/hr)*material density(kg/m3)}/1000

The magnitude of centrifugal force which is oriented outward is:

Cf = WV²/gr

W= weight of grainV= velocity of product mass,R=radius of wheel plus one half of projection area.

PARTS OF BUCKET ELEVATOR

- a. Elevator Head section
- **b.** Elevator Boot section
- c. Elevator leg
- d. Belts
- e. Buckets

Head section;

- It should have smooth contours.
- It should avoid back logging(Ineffectively throwing material into discharge chute)
- A cutoff plate is therefore provided to avoid back logging.



Boot section:

Grain entry can be on either side of boot.

Elevator legs:

The up and down moving strings of bucket elevator are enclosed in elevator legs.

> It limits the emission of dust.

Elevator belt:

> It has no support between drive and return pulley.

- > The total stretch of belt should not exceed 1-2% of belt length.
- Conveyer belt should be covered with natural/synthetic rubber to overcome wear.



Bucket:

- Top angle is generally 80° and bottom angle is 20-30°.
- Conveying capacity depends on no of buckets per metre of belt length.
- Theoretical horse power is calculated by:
- Hp=QHF/4562
- Q= capacity of bucket elevator, kg/min
- H= lift of elevator, m
- F= factor(1.5 for elevated loaded at upside and 1.2 for elevated loaded at bottom side)

