A Report on Industrial Practice

Anwar Cement Sheet Limited

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Military Institute of Science & Technology

Certificate of Approval

The report titled, “Industrial Practice at Anwar Cement Sheet Limited” submitted by Ashiqur Rahman Khan (201736004), Masum Mushfiq Dolon (201736011), Nazmus Shakib (201736029), Lipa Akter (201736009), MD. Niamul Ahsan (201736015) and Shariful Islam Shishir (201736042) has been accepted as satisfactory under the course “Industrial Practice” (Course No. IPE 320).

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Declaration

We do hereby declare that this attachment report has been done by us and neither this report nor part of it has been submitted elsewhere. We have no intention to make profit from this report by utilizing this for any business purpose.

Our purpose is to submit the report to fulfill the partial requirement for degree of Bachelor of Science in Industrial & Production Engineering at Military Institute of Science & Technology, Mirpur cantonment, Dhaka 1216, Bangladesh. The authors agree that the library will make it available to the borrowers under the rule of the library.

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Forwarding Letter

28th January, 2020

Priom Mahmud (Lecturer, Department of IPE, MIST)

Military Institute of Science & Technology

Mirpur Cantonment, Dhaka 1216, Bangladesh

Subject: **Submission of Report on Industrial Practice at Anwar Cement Sheet Limited**.

Dear Teachers,

We are pleased to present you this report on Industrial practice at Anwar Cement Sheet Limited for the fulfillment of the internship.

Through this report we have tried to reflect our observations, findings and theoretical knowledge applied with some innovative ideas to the projects we have worked on. It is a great opportunity for us to learn how an industry analysis can be conducted.

We have tried our best to follow your guidelines in every aspect on our report. Crossing all the challenges we are finally able to submit our report on due time. We will be grateful if you accept our report with the care of limitations. We would like to thank you for guiding us to complete this attachment. We would also like to apologize for the mistakes we are not aware of, which we request you to take into consideration and oblige thereby.

Sincerely Yours,

Ashiqur Rahman Khan (ID: 201736004)

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Preface

Engineering is the application of science to problem solving. As an Industrial and production engineer, one needs to deal with many industrial related problems like optimization, supply chain management, quality control of the product ensuring safety in the workplace etc. In an industry, these major roles are played by an Industrial Engineer. It helps to improve the productivity and efficiency of the industry as well as to make a safe and sound environment.

Industrial practice is an academic program of Military Institute of Science and Technology where a student of Department of Industrial and Production Engineering undertakes a period of training with an industry during the term break of level 3, term 2.

The compulsory supervised industrial attachment of the university gives students the opportunity to apply knowledge in real work, exposing students to work methods not taught in the university and provide access to products equipment not available in the university as well as assessing students' interest in the occupation he/she plans to undertake. It plays an important role in preparing the student for a professional career.

The impact of our journey with Anwar cement sheet through this industrial attachment can't be described in some words. Knowledge from the textbook is not sufficient to keep pace with the industrial world, rather practical knowledge is equally important. We gained much ideas about the responsibility of an Industrial engineer and how he can contribute to the industry. This attachment helps us to gain some practical knowledge, enhance our skill and be more respectful and hardworking.

We get new ideas and enrich our knowledge through the journey with Anwar Cement Sheet. The gained knowledge from Anwar Cement Sheet Ltd. will certainly help us in our future.

Acknowledgement

We hereby would like to extend our sincere gratitude to some personnel and the people without whom it would not be possible to gain some fresh ideas and know details about the various information of industrial production system.

Firstly, we are indebted and want to thank our respected course teachers. From the very beginning they helped us to understand the importance of Industrial attachment and made us to go for the development of the concepts, to implement the ideas and gain some practical knowledge from Anwar Cement Sheet Limited.

We also like to thank honorable Mr. Sajjad Hossain (Head HR at Anwar Cement Sheet Ltd), Mr. Amit Mukherjee (Production Manager) & Mr. Shohel Rana (Assistant Production Manager) for giving us their valuable time to know details about Anwar Cement Sheet Ltd. and give us all the necessary information.

We are very thankful to the people who gave us their valuable time to help us providing various information, measurement and obstacles that we might have to face. We are specially very much grateful to the Production department for their co-operations.

At last but not the least we are thankful to all the employees of Anwar Cement Sheet Ltd. for their helpful behavior and cordial reception.

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1. Introduction

Affordable and long-lasting roofing solution has long been desired by millions of low- and middle-income rural people of Bangladesh. Anwar Group has become the pioneer in providing this solution through its innovative product “Anwar Cement Sheet”. Six layered Anwar cement sheet prevents heat transmission and keeps the room relatively cool during summer and warm in winter. It is also rust free, heat resistant, fire proof and durable.

Anwar Cement Sheet Plant is one of the largest single line cement sheet manufacturing units of the world. Driven by German Technology, world class Anwar Cement Sheet is manufactured as per ISO-393: 1964 and BDS 1046: 1983 standard, and is approved by BSTI. Apart from houses, Anwar Cement Sheet is likely to bring revolutionary changes in poultry sector. Death from heat stroke is reduced by up to 90% and growth of birds is increased by up to 30%.

Anwar cement sheet is the leading manufacturer of cement sheet in Bangladesh. Head office of Anwar cement sheet is located at Dilkhusa, Dhaka, Bangladesh.The manufacturing plant of Anwar cement sheet is located at Charbhausia, Gazaria, Munsigonj.

Fig 1.1: Location of Anwar Cement Sheet

Anwar Group of Industries has been working as a development associate in building up the homeland for almost two centuries. Now at the outset of the twenty-first century, the group is even more prepared to head the challenging demands of the new millennium. Highly qualified management team, modern management techniques, and R&D have empowered the group to be forerunner in economic progress of the country. The group envisions to make at least one product of Anwar Group available at every home in Bangladesh.

The group shall be at the forefront to herald the millennium on the horizon. Anwar Group aims to more than double its cement sheet sales this year by tapping rising demand for roofing solutions among consumers. Anwar Group, one of the oldest corporate giants in Bangladesh, has set up a plant in Gazaria, Munshiganj, with the annual capacity of producing 1.08 lakh tonnes of cement sheets. Six-layered Anwar cement sheet prevents heat transmission and keeps the room relatively cool in summer and warm in winter. Cement sheets can be used to build poultry and kitchen sheds and in housing projects, instead of corrugated tin sheets. This cement sheet is rust-free, heat-resistant and fire-proof and lasts for decades. Affordable and long-lasting solution has been a long-standing demand of millions of low and middle-income rural people in Bangladesh. Anwar Group's cement sheets come in lengths between 4-10 feet, with uniform width of 3.5 feet, costing between Tk 260-650 depending on the size. These sheets will benefit the poultry industry by reducing deaths of birds from heat stroke by up to 90 percent. Growth of birds reared in the sheds made of Anwar sheets will increase by around 30 percent. In Bangladesh, most poultry farms are open sheds or manually built non-durable structures, and a very small number is environmentally-controlled. These are mostly roofed with corrugated tin sheets, leading to bad ventilation and loss in productivity of the sector. Moreover, Anwar cement sheet is 30 percent cheaper than corrugated tin.

Cement sheet is a new sector for the country. Rural people, especially in the poultry industry, will immensely benefit from the product due to heat resistance quality. The cement sheet will work as an import substitute. The company plans to export cement sheets as the consumption of the product worldwide rose to 1.69 crore tonne in 2019 from 1.61 crore tonne in 2015.

Anwar Group has 28 products and services, employing more than 12,000 people directly and indirectly. The company has interests in building material, real estate, textile, jute, automobile, ICT and steel rods.

Company Profile

Official Name: Anwar Cement Sheet Limited

Type of Company: Public Limited Company

Corporate Directory

Chief Operating Officer: Md. Musa Mia

General Manager: Vajrala Subba Reddy

HR and Admin: MD. Sazzad Hossain

Vision

Anwar Group of Industries has been working as a development associate in building up the homeland for almost two centuries. Now at the outset of the twenty-first century, the group is even more prepared to head the challenging demands of the new millennium. Highly qualified management team, modern management techniques have empowered the group to be forerunner in economic progress of the country. The group envisions to make at least one product of Anwar Group available at every home in Bangladesh. The group shall be at the forefront to herald the millennium on the horizon.

Mission

Anwar Group has built its strength on more than a century of experience. The cornerstone of the group's success is sharing knowledge to create relevant solutions- shaping the best thinking to reflect the ideas of a new age. Our corporate strategy emphasizes speed, efficiency, flexibility and innovation in every facet of the company's operation – from product development to manufacturing, and from procurement to distribution, Anwar group strives to achieve the ultimate goal of satisfying its customer. Through a nation – wide commitment to advancing this objective, Anwar Group and its many partners who share this commitment, have succeeded in creating a national and international network that compromise of many subsidiaries and affiliates. We are paving the path of our journey into a new for the next generation.

Products

- Plain Cement Sheet
- Corrugated Cement Sheet
- Tua
- Cement Mold

Factory Location

Charbausia, Gazaria, Munshigonj.

Investors of Anwar group of Industries

- The city bank limited
- BD Finance
- City general insurance company limited
- Anwar galvanizing limited

2. Manufacturing Process

2.1 Raw Material Section (RM)

Anwar Cement Sheet is the combination of the **three** types of materials **Fiber**, **Pulp** and **Cement**.

Fiber

Fiber is the first raw material of the cement sheet. In making of cement sheet **two** types of fibers are used.

Mineral Fiber: Chrysotile or **White Asbestos** is the **primary** fiber of the cement sheet. It is imported from Russia. Anwar Cement Sheet Ltd. uses **grade-6** of **Chrysotile.**

Glass Fiber: Glass fiber is the **secondary** fiber of cement sheet. Glass fiber is used for increasing the strength of the cement sheet. Here E-Glass Fiber/ Chopped is used as glass fiber.

Shredded Bag: Packaging bag of **Chrysotile** is being shredded and added as fiber to the cement sheet.

Pulp

Ready Made Garments factory waste jeans is brought in the factory from local garments and use as pulp. It is the second raw material of the required product.

Cement

Cement is the third and the major raw material of the cement sheet. Cement is brought from their sister concern company **Anwar Cement**. And Anwar Cement is best for the cement sheet because of its ingredients.

2.2 Raw Material Preparation

2.2.1 Fiber Preparation

It is under Bag Opening Device (BOD) section, in BOD section a 50kg **Chrysotile** fiber bag is pushed manually on vertical lift through a roller conveyor. Then the bag is lifted upward.

By a bag pushing system the bag is pushed forward to a belt conveyor. Two bag cutters are there for cutting the bag, one is side cutter and another is long cutter. The bag goes through the belt conveyor and the cutters cut the bag side wise and length wise.

The conveyor carries the bag to bag-hooker. The bag-hooker hooks the bag and through it to the bag shredder and then the Chrysotile fall on the lamp crusher then it goes to blender. The blender blends the **Chrysotile** fiber for 2.5 minutes.

The next destination is Edge Runner Mill (ERM). After shredding the bag and blending the **Chrysotile** fiber these are transferred to ERM Mill by blower and screw conveyor respectively. The dust is collected in dust collector and also transferred to the ERM.

In Edge Runner Mill 500 kg of blended fiber and shredded bag are stored. Then 175 liters of water being supplied to the Edge Runner Mill from a pre measuring tank. It's a total of 675 kg fiber and water. Two circular stones are set in the ERM they rotate in anticlockwise motion. Edge Runner Mill is a mixing tank of fiber and water and is done by that rotary stones. These mixing and preparation time are 6 to 7 minutes and the speed are 14 to 15 rpm.

Then the preparation is transferred to Buffer Silo by bucket elevator. Buffer Silo is one kind of storage tank. And it has 35% moisture.

From Buffer Silo 180 kg of fiber preparation is stored in another tank, called fiber weigh hopper. Fiber weigh hopper is a 180 kg measuring tank of fiber mixer.

Then 180 kg fiber is transferred into Slurry Mixing Tank (SM Tank).

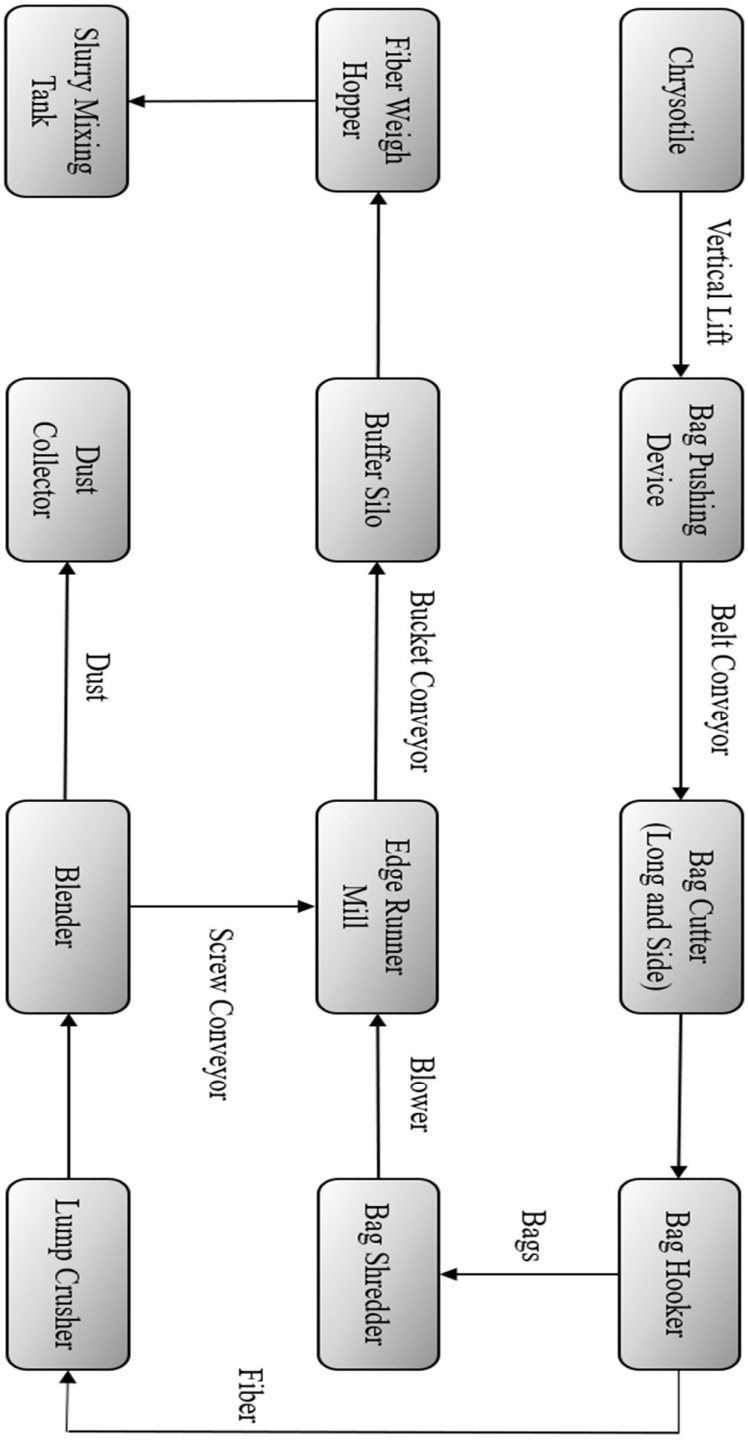

Fig 2.1: Fiber Preparation

2.2.2 Cement Preparation

Anwar Cement provides the cement for the Cement Sheet manufacturing. In cement sheet 86% of cement is used of total raw material.

Firstly, cement is brought from Anwar Cement and then is kept in Cement Silo. there are two Cement Silos for storing the cement outside of the plant. The capacity of the cement silo is 300 metric ton each. Secondly a screw conveyor is used to bring the cement in the Cement Hydration Tank. About 946 kg of cement is mixed with 1200 liter of water (for 1100 kg batch production). There is an agitator rotates at 18 to 20 rpm for 3 to 4 minutes. In cement weigh hopper 45% consistency is maintained.

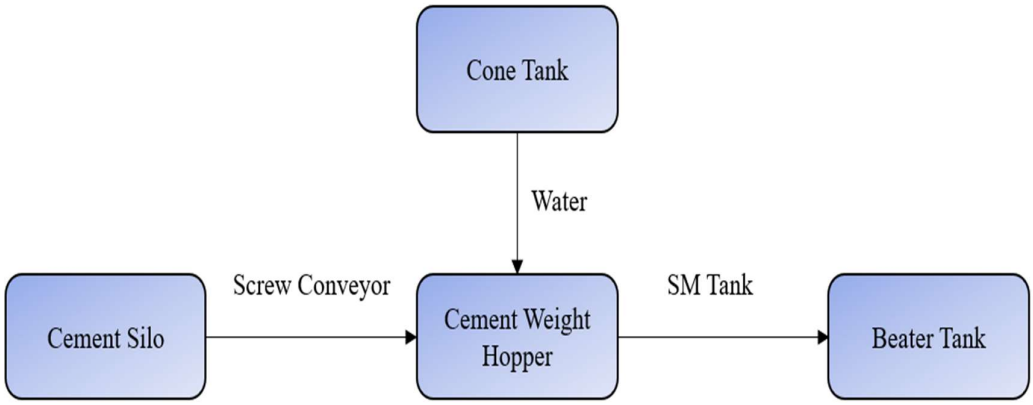

Fig 2.2: Cement Preparation

2.2.3 Pulp Preparation

Jeans is used as pulp. Local sellers, collect wasted jeans from local garments. And sell them to Anwar Cement Sheet Ltd.

At first, jeans is kept in the warehouse. Two pulp cutting machines are there which have cutting blade with 1470 rpm and 45 KW.

Next pulp is taken to the Beater Tank for mixing with freshwater. In this tank 1.2% pulp consistency is maintained. And the mixing is being held for 30 to 60 minutes. Around 8233liter fresh water is being mixed with 100 kg pulp.

From Beater Tank pulp is transferred to **Hydro Pulp Tank.** In Hydro Pulp Tank 1200liter clean water is added with pulp. Then pulp is delivered to **Day Tank**. After that pulp is being transferred to **Pulp Dozing Tank.**

Finally, pulp is measured from Pulp Dozing Tank and delivered to Slurry Mixing Tank (SM Tank). In SM tank 1% of dry pulp must be maintained. In cement sheet, pulp contributes almost 1% in the chemical mixture.

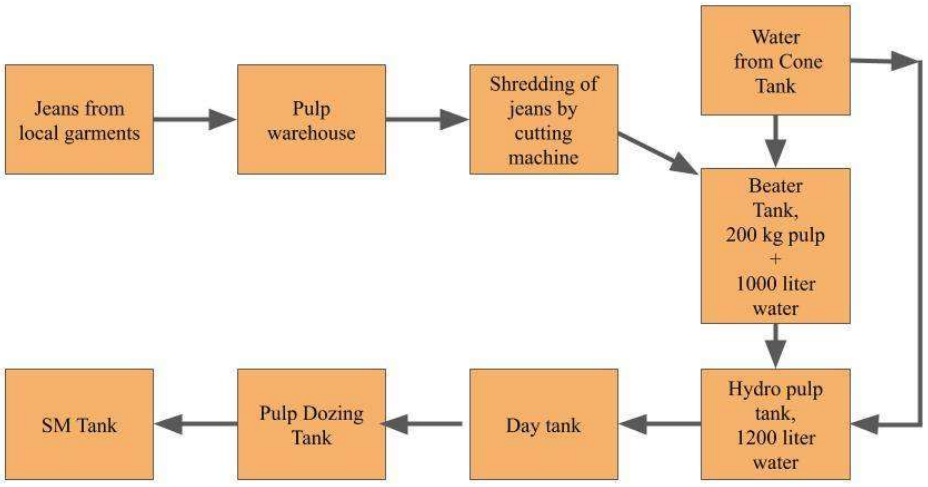

Fig 2.3: Pulp Preparation

2.2.4 Material Flow

From Cement Hydration Tank, Buffer Silo and Pulp Dozing Tank cement, fiber and pulp is delivered to SM tank.

First 180 kg fiber is delivered to SM Tank from Fiber Weigh Hopper and water is added with it. There is an agitator in SM Tank and agitate fiber and water for 180 second. Then 10 kg pulp is mixed in SM Tank and agitate for 90 second.

In SM Tank cement doesn't mixed here. Cement passes through the SM Tank after the agitating the pulp with fiber. Here 2.5 kg glass fiber and 7 to 8liter water is mixed with the flow of cement, fiber and pulp.

From SM Tank mixture goes to **Beater-1, Beater-2,** then **Storage Tank**. Finally, it goes to **Dilution Tank** from **Storage Tank.**

In Dilution Tank 5000liter clean water is added. In **Waste Dissolver Tank** wasted material of the full process is dissolved with water and return it to the Dilution Tank.

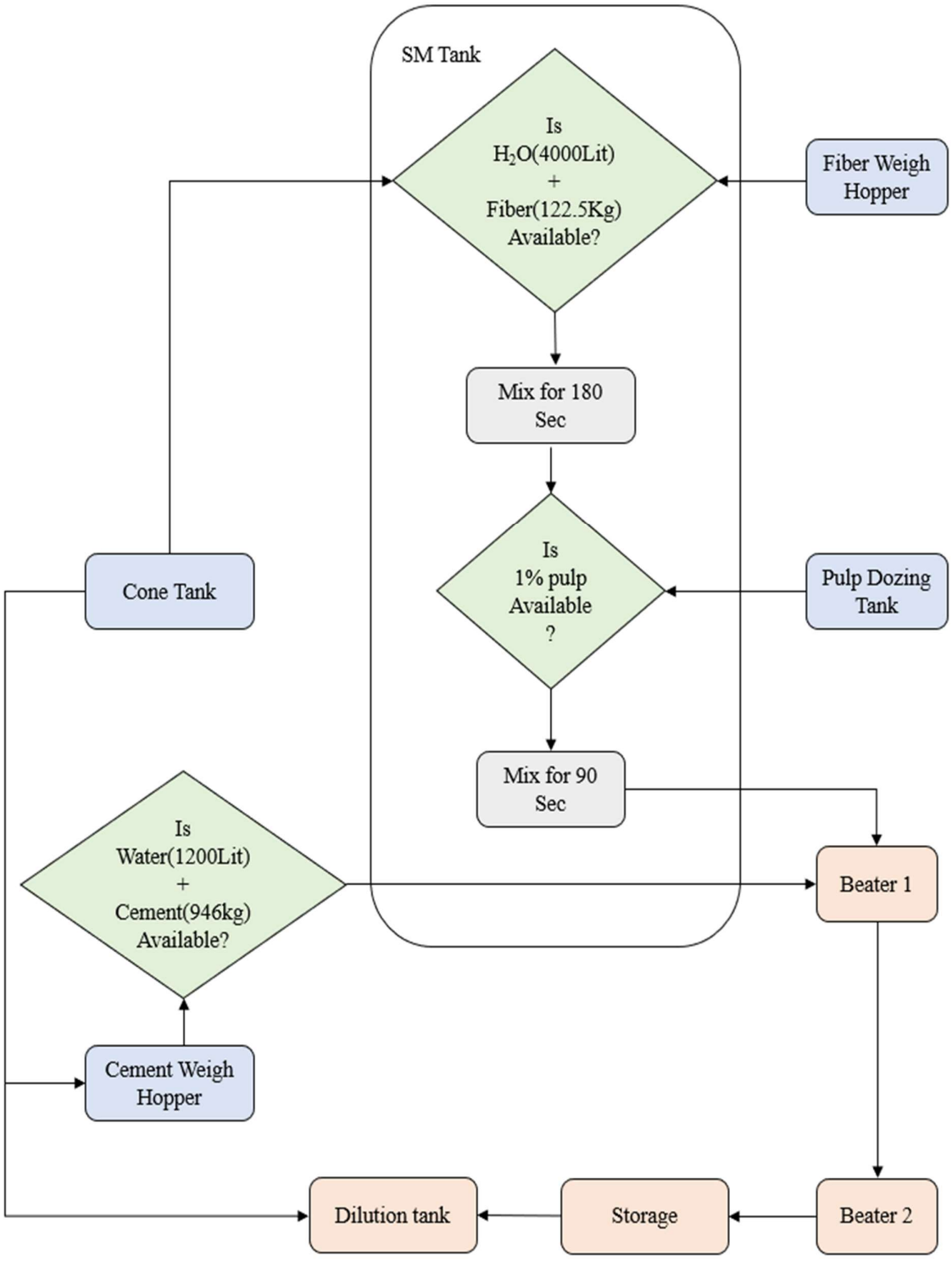

Fig 2.4: Material Mixing

2.3 Main Machine Section

This is the section where the mixture of raw materials is given a sheet like shape. This section consists of various types and sizes of rollers, a felt, and 6 tanks known as vat. These vats contain same type on equipment in each. The major objectives of the main machine are

- To give the raw materials a sheet like shape.
- To lower the green sheet moisture.
- To maintain raw material consistency.
- To maintain the thickness of green sheet.

Major Components and Process

Vat is a type of container where the materials are contained after it is taken from the dilution tank. Then the material travels through the felt several times to produce a sheet.

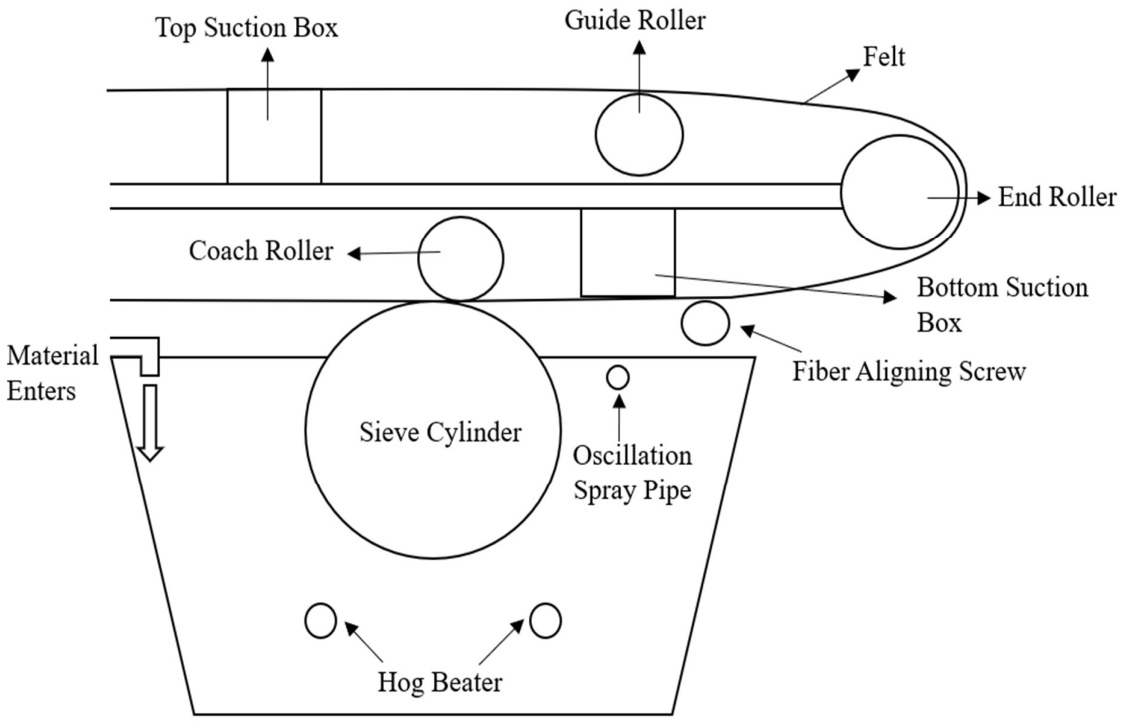

Fig 2.5: Illustration of Vat and its Components

Vat

In dilution tank the consistency is maintained 38-45%. While in vat, it become 80-90% due to the filtration of water. There are six vats where the materials can be contained and each of them contains similar components. The felt has to pass through each and every vat to produce different layers of the sheet.

Sieve Cylinder

Sieve cylinder is used for suction of water. It regulates clockwise while the raw materials get stick on its net which filters the water and take the raw materials to the felt. Two types of net are used which are 5x5 and 25x25.

Hog Beater or Vat Agitator

There are two inside of each vat. These are used for shaking up of material. They regulate constantly at 200 rpm so that the raw materials can be mixed properly with water. It is important to maintain this speed of the hog beaters otherwise the cement may fall as sediment.

Coach Roller

It helps the felt to get contact with the sieve cylinder so that the felt can get the material easily.

Oscillation Spray Pipe

Oscillation pipe is used for cleaning the net of the sieve cylinder by spraying water with high pressure. There are two buster pumps which helps the oscillation pipe for its activities. Cutting nozzle is used for controlling the width of cement sheet. Here, water is sprayed with high pressure.

Fiber Aligning Screw

Fiber aligning screw is used for spreading the fiber in the Felt.

Bottom and Top Suction Box

There are 6 bottom suction boxes and 4 top suction boxes. Which are used for lowering the moisture by sucking up the water.

Felt

It is a long belt which carry the material from the sieve cylinder to the entire path of the process. It is made of wooly material so that the cement get stick on it easily because of its natural behavior.

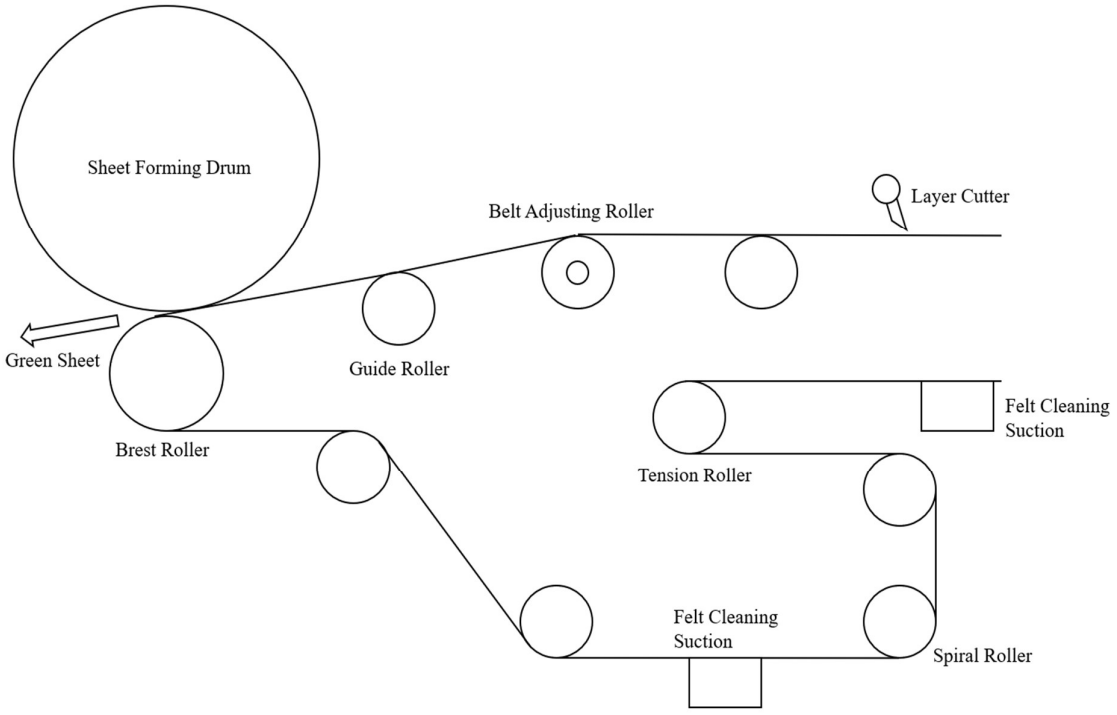

Fig 2.6: Illustration of Sheet Forming and Various Rollers

Sheet Forming Drum

Here the produced sheet spreads around the whole drum. There is a cutter which cuts every sheet at its circumference which is 6.3m. 2.0 kg/cm^2 drum load is maintained from both horizontal side of the drum.

After the felt passes through each vat, it gains a thickness of .17 mm, which becomes 1±.2 after passing 6 vats. To get 4mm thick sheet, sheet forming drum needs to rotate 4 times before releasing a green sheet. So, it gets a total of 24 layers in a 4±.2 mm sheet.

Brest roller

60±2% moisture is maintained before entering of sheet in the sheet forming drum. A breast roller is placed in the bottom part of the sheet forming drum. Then, breast roller and sheet forming drum is compressed. A blower is placed in the top section of the sheet forming drum. After passing the sheet forming drum, the moisture is converted to 35±2% in a plane sheet.

Layer Cutter

Layer cutter cuts a layer on sheet before reaching the sheet forming drum. It only cuts a layer every first time the drum makes a rotation. So, for 4 rotations of the drum, layer cutter cuts layer 1 time.

Belt Adjusting Roller

It assists the felt to hold its position so that it can not move one side too much and keep remain in center.

Tension Roller

It maintains proper tension of the belt. There may be 1 or 2 tension rollers.

Spiral Roller

It maintains the consistency of the felt before entering in vats. So that, no extra material is stick on it before the start of producing a new sheet.

Felt Cleaning Suction

It maintains the moisture of the felt before entering vats. 150 mm Hg (Min) pressure is maintained.

Guide Roller

Various guide rollers are used to assist the other rollers and carry on the process smoothly.

2.4 Water Distribution

For this whole manufacturing process huge amount water is needed. This water supply is maintained by efficient management of cone tank.

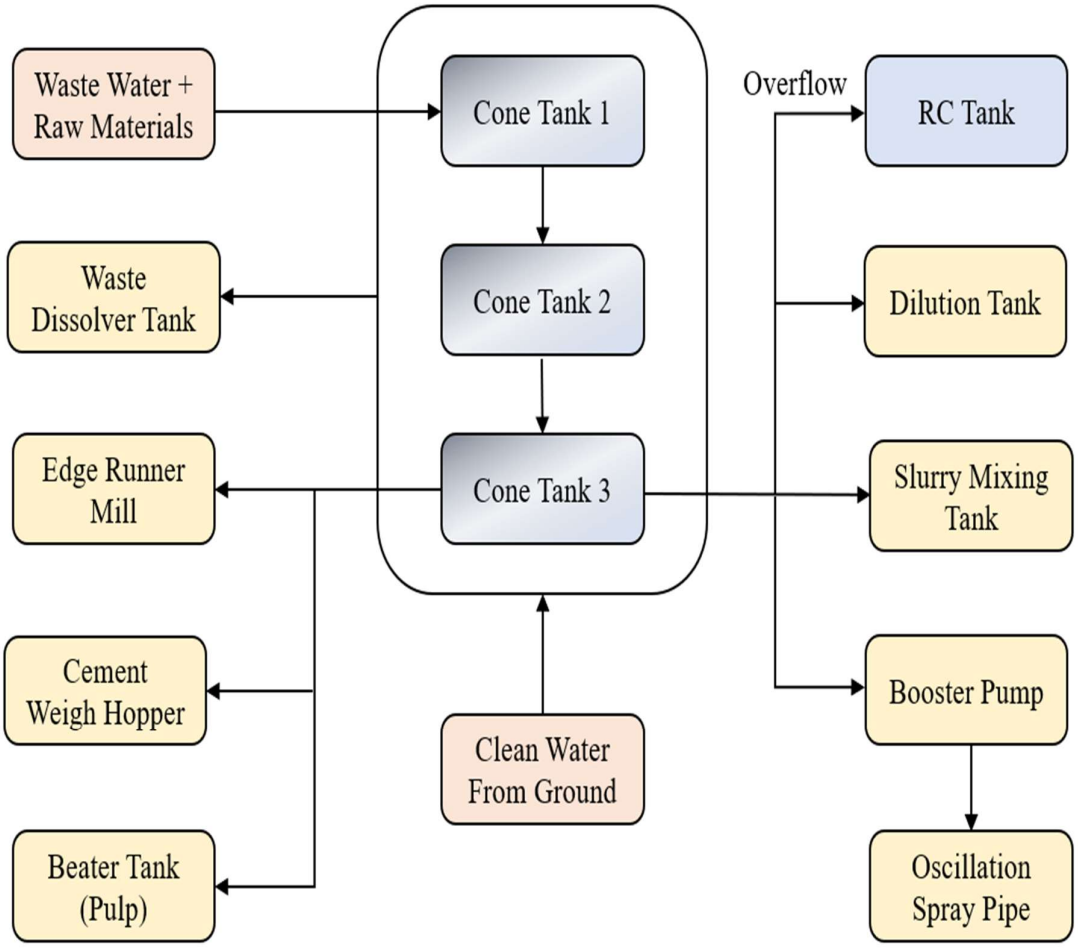

Fig 2.7: Water Distribution

2.5 Side Conveyor Section

In side conveyor the Green sheet is cut in required measurement. It is the discharged sheet from the main machine. It's almost 6.23meter long and around 2600 mm width.

In side conveyor there are three sections.

1) Conveyor - 1
2) Conveyor - 2
3) Conveyor - 3

Conveyor - 1

This conveyor receives the Green sheet from the Sheet Forming Dram of Main Machine. And convey the Green sheet to the Conveyor - 2.

Conveyor - 1 has comparatively less speed than conveyor - 2. And the speed of the conveyor-1 is 120 m/minutes.

Conveyor - 2

Conveyor - 2 receives the Green sheets from conveyor - 1. Speed of this conveyor is 122 m/minutes. In conveyor - 2, there are 4 long cutters. Two of them cut the both outer sections and two of them cut the middle section longitudinally. The speed of each long cuter is 300 rpm.

This cutting process occurs during passing of Green sheet to conveyor - 3 from conveyor - 2.

In outer sections 120 mm width is being reduced in total from both sides and 45 mm from middle section. Two Green sheets are form in conveyor - 2 after long cutting and each of them have width 1235 mm and length 6.23 meter.

Conveyor - 3

After long cutting green sheet is being passed to conveyor - 3 and stand still on it.

Cross cutting is done here in various sets of measurements, like

4 ft + 6 ft + 8 ft = 20 ft

8 ft + 4 ft + 8 ft = 20 ft

10 ft + 10 ft = 20 ft

As per market demand 1,2 or 3 is adopted for cross cutting. Cross cutters have speed of 300 rpm each.

After cross cutting VC Box is used to take green sheets from conveyor - 3 to stack. By vacuum suction system VC Box is working. And 4 to 5 bar vaccine pressure is used in this process.

There are three steps for keeping the sheet on the stack.

- Step 1: During first suction the plane sheet is given the corrugated shape by using vacuum pressure by VC Box
- Step 2: Then the corrugated sheet is kept on the forming table which has the corrugation shape on its surface.
- Step 3: Next, another VC Box is used to take the corrugated sheet from the forming table to the stack. On stack 50 green sheets are kept and separate each sheet by template.

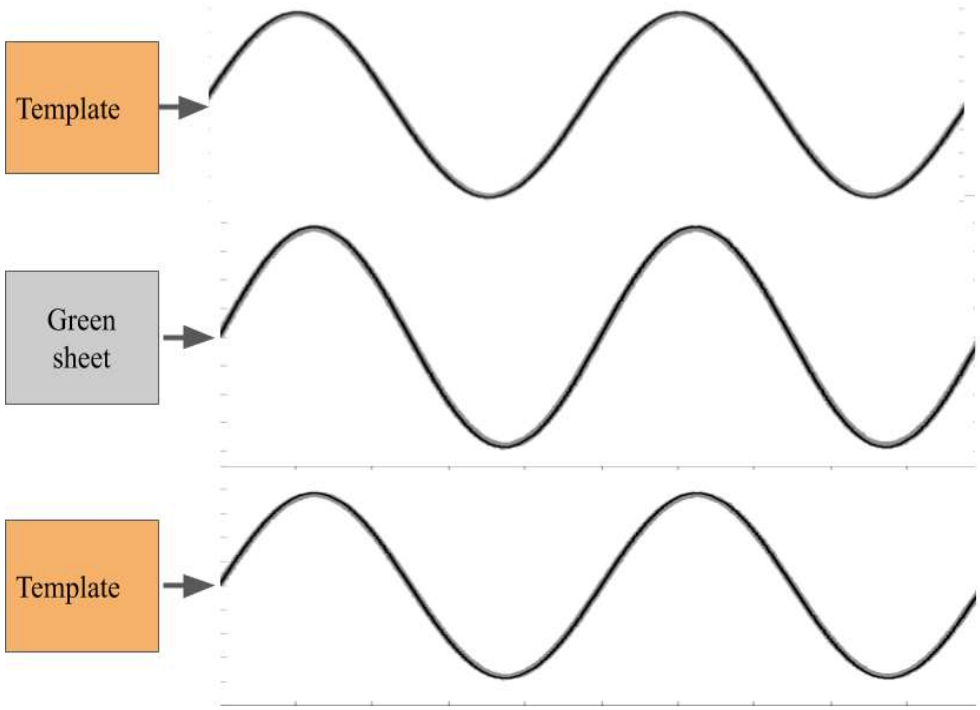

Fig 2.8: Sheet and Template Arrangement

After corrugation the Green sheet width becomes 1065 mm. Height (amplitude) of the corrugation is 21 mm and pitch (wave length) is 75 mm. And the template length and width are 6.3 meter and 1080 mm.

During the long cutting and cross cutting waste are being produced from the green sheet. Waste conveyors take the waste to the **Waste Dissolver Tank** and then from Waste Dissolver Tank it is being transferred to **Dilution Tank.**

2.6 Depiling Section

Heating Chamber

In heating chamber 60-65% temperature is maintained for 12 hours. Blower is used to push the air from outside to the inside, so that the heat generated from the heater spread uniformly.

Stripping

After leaving the heating chamber the transfer car reaches the stripping section with a stack of 50 sheets and 50 templates.

In stripping 6 sheet sucking hood move the sheets in a different stack. In each stack, 100 sheets are kept. The combined length of the sheets will be 20 feet each of them having 5 layers. Length is also expressed by running feet or RFT. The weight will be 2.5kg/ft. less than 25mm tolerance is acceptable which is measured by a laser. Here, the moisture will be 22±2%.

4 template sucking hood moves the templates in a belt conveyor. This belt conveyor moves the templates into cleaning and oiling section.

Cleaning and Oiling

After the templates enters cleaning section water enters through a pipe using a pump. Polypick wheels are used so that the templates stay in line. Here is a brush roller which cleans the templates with water, then passes it to the oiling chamber. Here are 2 brush rollers made of PVC. Diesel is used .6 liter/metric ton. As soon as the sensor detects the template oils sprayed through the MS pipe to the brush rollers. Then the brush rollers oil the whole template and push it to another belt conveyor.

Restacking

From the 2nd belt conveyor a template restacker of 8 suction hoods move the templates on T stacker on a transfer car. The height is maintained by laser. After 100 templates is restacked the transfer car returns to the piling section by template return line. Chain pusher is used to move the transfer car.

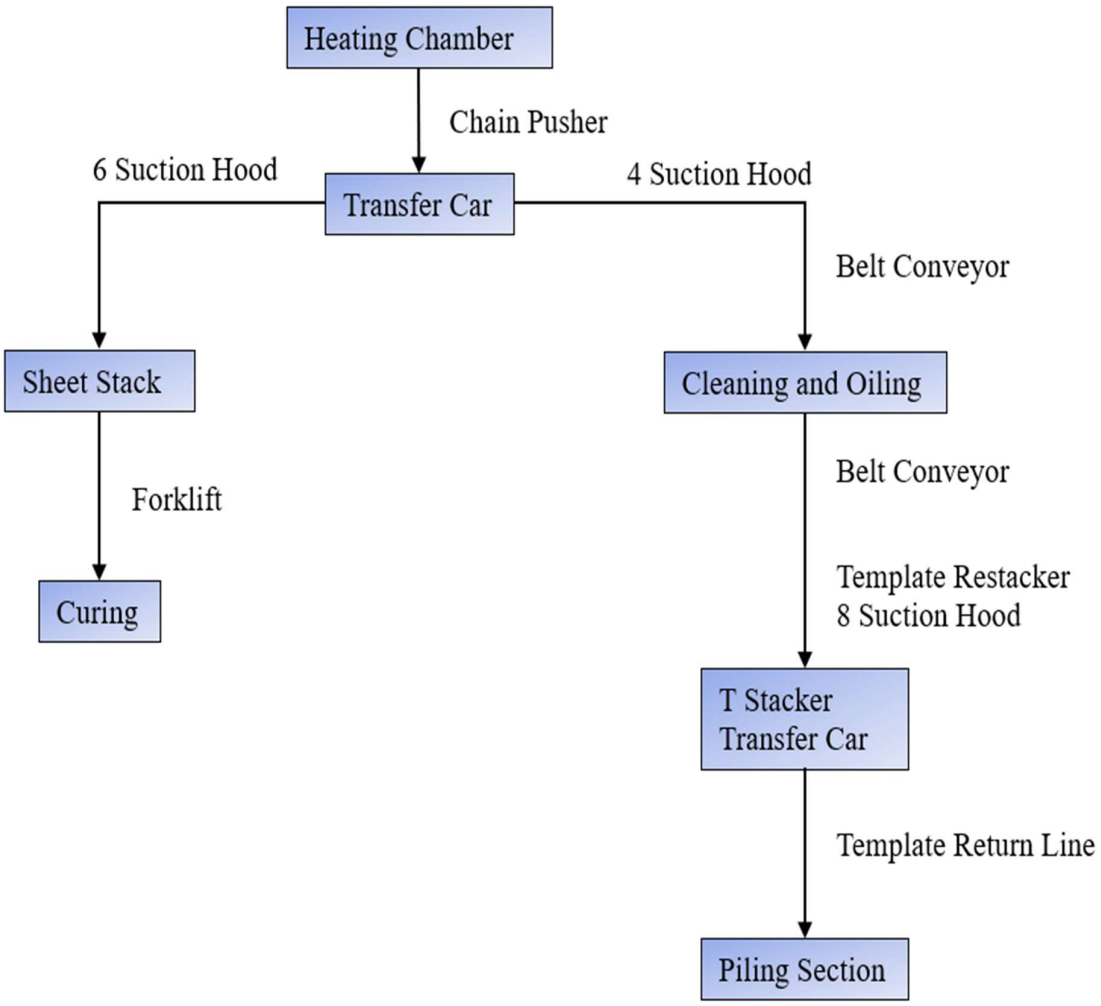

Fig 2.9: Material Flow of Depliling Section

3. Finished Goods

After striping of green sheet, bundles are made of each 100 sheets. Forklift trucks are used to carry them to the **Shades**. Before delivery Sheets are being kept for **Curing**. The time duration for curing is 28 days. And it is a standard time duration for curing. This is a ACS standard. They found the result 28 day by trial and error method.

By this experiment they found that the cement sheet gain strength 46% in 7 days, 85% in 14 days, 90% in 21 days, 99% in 28 and it gains last 1% strength for its whole life.

These **Shades** are built by the civil department of Anwar Cement Sheet Ltd. Dimension of these shades is 240 ft length, 50 ft width and 12 ft height and 5 ft truss.

Civil department also deals with cement sheet fittings. How these cement sheets should be used effectively as/on roof. And considering minimum safety factor and optimum use of cement sheets Anwar Cement Sheet Ltd. Civil department found some fittings factors.

They recommend to

- Start placing the sheets from one side to another sequentially like **Right to Left** or **Left to Right** but **not Randomly**.
- And keep the **Down Lap** at the end/edge of the roof.
- For 4,5 & 6 ft sheet use 3 purlins, for 7 & 8 ft sheet use 4 purlin and for 9 & 10 ft sheet use 6 purlin
- Only 3 inch or 1.5 corrugation is enough for overlapping sidewise, and 6 inches longitudinally.
- Where four sheets corners are overlapped, corners of two sheets must be cut which are between the top and bottom sheets. And this cutting measurement should be like the overlapping system.

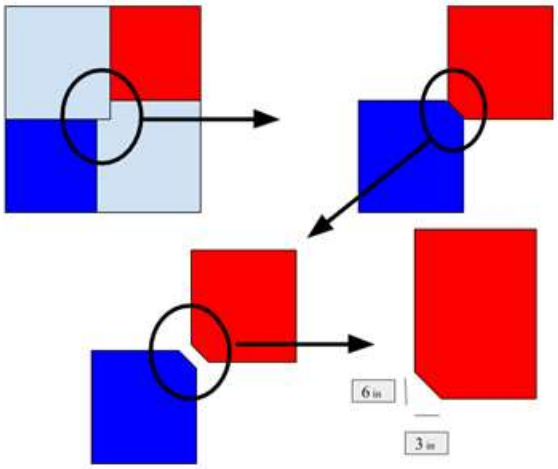

Fig 3.1 Overlapping System

- Sheets can be cut by saw or portable hand grinding machine
- Screw should be placed on upper lap, not on lower lap.
- For making whole, drill machine should be used.

4. Quality Control

Quality control plays an important role for the improvement of quality of a product or maintain the required quality.

In Anwar Cement Sheet Ltd. Quality Control department plays a vital role for improving the quality of cement sheet. In quality control lab they test raw materials fiber, pulp & cement and finished good Cement Sheet.

4.1 Physical Test of Cement

SSA (Specific surface area): With the help of **Blaine Air Permeability Apparatus** & alcoholic liquid **Dibutyl Phthalate**, we can determine the specific surface area of the cement. The expected result should be 3600(±) cm square per gm.

Consistency: With the help of **Vicat Apparatus** we can determine the percentage of water in the cement mold. The expected value is 45%.

Setting time: It means how much time a particular type of cement can take for its bonding. The standard range for setting time is 90 to 130 minutes.

4.2 Chemical Test of Cement:

Table 4.1 Chemical Test

Characteristics	Value	Standards
Calcium oxide	≤ 5%	ACL
Sulfur Trioxide	≤ 3.5%	BSTI
Chloride	≤ 0.1	BSTI
Loss of ignition test	≤ 5%	BIS
Insoluble Residue	(20 ± 2) %	ACL

Table 4.2 Fiber Test

Characteristics	Value	Standards
Moisture	(35 ± 2) %	ACSL SOP
Buoyancy	1800 cc	ACSL SOP

Table 4.3 Pulp Test

Characteristics	Value	Standards
Pulp opening	Full open	ACSL SOP
Consistency	As per furnish	ACSL SOP
SR - Value	22° - 26°	ACSL SOP

Table 4.4 Green Sheet Test

Characteristics	Value	Standards
Moisture	(35 ± 2) %	ACSL SOP
Density (Dry)	1.35 ± 0.05 gm/cc	ACSL SOP

Table 4.5 Stripping Test

Time	Moisture	Load bearing Capacity	Standards
Day - 1	(20 - 2 2) %	250 kg/m^2	ACSL SOP
Day - 28	(11 - 12) %	340 kg/m^2	ACSL SOP

Moisture test:

- Before entering the sheet forming drum, moisture is maintained (60 ± 2) %
- After passing the sheet forming drum, Green Sheet moisture is maintained (35 ± 2) %

Dimension of Corrugated Green Sheet:

Pitch = (75 ± 1) mm

Height = 21 mm

Width = (1065 ± 5) mm

No. of Corrugation = 14

No. of Up lap = 1

No. of Down lap = 1

4.3 Cement Sheet Test

LBC Test: It is the Load breaking capacity test of cement sheet. The produced cement sheet is kept for 28 days to increase its load breaking capacity.

The expected load breaking capacity of 1^{st} day is: (230-250) kg/m^2.

The expected load breaking capacity of 7^{th} day is: (270-280) kg/m^2.

The expected load breaking capacity of 14^{th} day is: (310-320) kg/m^2.

The expected load breaking capacity of 21^{th} day is: (320-335) kg/m^2.

The expected load breaking capacity of 28^{th} day is: (335-350) kg/m^2

Burn test: Cement sheet can tolerate up to 1200degree Celsius temperature without fusion.

Bend Test: This cement sheet is kept in testing yard for 4-5 hours at 30-35degree Celsius temperature. Then, water is sprayed for 15 minutes. This is the procedure of bend test for Anwar cement sheet.

Sheet Damage Test: This cement sheet is kept under water for 10 days to check whether this sheet can damage or not.

Stone Throwing Test: A stone is thrown manually from 10m, 15m and 20m to check how much load this cement sheet can take before breaking.

Some defects of cement sheet:

- Open layer can exist in cement sheet if a layer cannot connect in sheet forming drum.
- Hole mark can occur in cement sheet if hard material exists in the raw material section which did not blended properly. After passing heating chamber, this hole mark can create a large area.
- Cutting piece add is a problem in producing cement sheet. When the green sheet is cut by long cutter & cross cutter, some cutting piece can add with the cutting blade. This is the source of the problem of cutting piece add in cement sheet.
- Dry waste piece add is also a problem which sometimes exists in cement sheet. If the wastage of cement sheet is dry, then the raw material cannot mix properly with this dry cement sheet. For this reason, a breakage is observed on the produced sheet.
- Layer fall: If a layer cannot be attached in the sheet forming drum at some corners, then the layer fall problem is observed.
- Layer fold: This problem can occur in the sheet forming drum or in the Felt.

Characteristics of Anwar cement sheet:

- This cement sheet can take up to 1200degree Celsius temperature. After exceeding this temperature limit, it may occur fusion in cement sheet.
- Anwar cement sheet cannot damage if it kept under water for 10 days at a stretch.
- Anwar cement sheet can fit in all season. It increases room temperature in winter season and decreases room temperature in summer season.
- We know that rain water is very good for our health. We can drink rain water if rain water fall in the upper portion of cement sheet.

5. Recommendations

5s Methodology

5S represents Japanese words that describe the steps of a workplace organization process. English equivalent words are shown in parenthesis

- Seiri (Sort)
- Seiton (Set in order)
- Seiso (Shine)
- Seiketsu (Standardize)
- Shitsuke (Sustain)

In simple terms, the five S methodology helps a workplace remove items that are no longer needed (sort), organize the items to optimize efficiency and flow (set in order), clean the area in order to more easily identify problems (shine), implement color coding and labels to stay consistent with other areas (standardize) and develop behaviors that keep the workplace organized over the long term (sustain).

In the manufacturing plant of Anwar cement sheet, we have hardly seen to apply 5S philosophy. They should apply 5S for decreasing the wastes and for increasing the efficiency.

Less Waste Equals Improved Efficiency

A key principle of 5S is to get rid of items that are not used, and make it easier to find items that are needed. This gets rid of clutter, unnecessary tools, scrap materials and unused supplies. It organizes, labels and places close at hand those tools and materials that are needed on a regular basis. The result is that time is spent more productively and less time is wasted finding needed tools and materials.

Less Space Used for Storage Equals Reduced Costs

By eliminating unused materials, tools and equipment, and getting rid of clutter, a surprising amount of space will free up. There is a cost associated with space, not only in the rental or lease costs, but in heating/cooling, cleaning and maintaining of that space.

Clean Equals Improved Maintenance & Less Down Time

When machines, equipment, and tools are kept clean and free from clutter, it is easier to spot defects, part failures, and problems such as an oil leak. This allows preventative maintenance to address the problem before it becomes a more serious problem.

For example, if a machine is kept clean, an oil leak would immediately be noticed. The source and cause of the leak can be quickly identified and the problem fixed, before low oil levels lead to more serious damage to the machine.

Minimizing Wastes by using Lean Manufacturing

Among the seven wastes, basically these three types of wastes repeatedly occur in Anwar cement sheet

Overproduction

Among the seven wastes of lean manufacturing, overproduction is the most serious problems that are currently facing by Anwar cement sheet limited. The most serious of the wastes, overproduction can cause all other types of wastes and results in excess inventory. Stocking too much of a product that goes unused has obvious costs: storage, wasted materials, and excessive capital tied up in useless inventory.

Inventory

Inventory waste refers to the waste produced by unprocessed inventory. This includes the waste of storage, the waste of capital tied up in unprocessed inventory, the waste of transporting the inventory, the containers used to hold inventory, the lighting of the storage space, etc. Moreover, having excess inventory can hide the original wastes of producing said inventory. The environmental impacts of inventory waste are packaging, deterioration or damage to work-in-process, additional materials to replace damaged or obsolete inventory, and the energy to light—as well as either heat or cool—inventory space.

Defects

Defects refer to a product deviating from the standards of its design or from the customer's expectation.

Defective products must be replaced; they require paperwork and human labor to process it; they might potentially lose customers; the resources put into the defective product are wasted because the product is not used. Moreover, a defective product implies waste at other levels

that may have led to the defect to begin with; making a more efficient production system reduces defects and increases the resources needed to address them in the first place.

Solutions of these problems

Applying Kanban system to recover the inventory problem

How the Kanban system works

The goal of a Kanban inventory system is to continually maintain the minimum amount of stock. The Kanban system aligns inventory needs with what is actually being used. This is often referred to as 'pulling.' When the stock of a specific item is depleted, the supplier is signaled to deliver a new shipment, and the signal to place another order is tracked through the replenishment cycle. In this way, it's simple to track how often restock is needed. In a Kanban inventory system, a company can use Kanban cards or bins to signal when stock needs to be refilled.

In the Kanban bin system, companies rely on visual cues to start the restocking process. Workers have two containers of inventory and work through the supplies in one bin before moving on to the other. When the first bin is empty, it sends a trigger to reorder inventory. Ideally, by the time a worker reaches the end of a second bin, the stock will be refilled. Before determining the amount of stock in any one bin, it's important to know how long it will take to get new inventory from the supplier. Stock that can't be replenished by the time the second bin is empty will cause a lag in production.

7 Benefits of a Kanban Inventory System

Here are some of the advantages of using a Kanban inventory and management system:

Reduce Inventory Levels and Costs: When you don't have a lot of inventory to store, there's more space available to work. Additionally, only stocking the amount of inventory needed saves money, because you're not using the business income to purchase items that aren't going to be used.

Customer Demand Determines Need: You'll be able to easily identify which of your products are selling well since you're only restocking as inventory is depleted. If the parts needed for one item are rarely replenished, it is likely not a high-demand product.

No Storage in the Production Area: In Kanban, parts are only delivered to the production line when needed. This space savings provides ample room on the production line for workers to assemble the product.

Provides Managers Progress Reports: Kanban software can provide analytics that show how much product is being produced and how long it takes. Powerful Kanban inventory software can run a bevy of reports that help managers plan, organize, and improve workflow.

Reduces Obsolete Inventory: If a company over-produces inventory, it often sits in a stockroom for long periods of time, and companies have to decide what to do with the excess (sell, give away, or discard). Additionally, when stock isn't touched immediately, it can be difficult to determine if there are damaged units. You don't want to wait until the defect is discovered on the production floor, possibly six months down the line, when there's not much you can do about it.

Prevents Overproduction: When you're only pulling items needed (determined by customer demand), it's unlikely you'll end up sitting on an excess of products that aren't selling.

Lean Inventory: As noted previously in this article, Kanban works well with Lean manufacturing. When you use Kanban in conjunction with Lean manufacturing, you don't have excessive inventory which helps eliminate obsolete or defective stock items.

Eliminating Overproduction

The first step is to realize that we are doing it; understand that we are often planning our own delays and large batches just because we always have done so. Many planning packages such as ERP and MRP amplify these problems; I have often (in fact on reflection in every case) switched off the planning modules on these software packages in every company that I have been to with lead time and delivery issues. Once we understand the issues, we need to implement the principles of lean manufacturing. Using smaller, simpler, dedicated machines rather than "super machines" that have to handle every product in the factory. Once we have done, this we can use the ideas of just in time manufacturing to enable the production of product only when it is ordered, using techniques such as Kanban to enable the pull of production through processes. In doing this, we not only eliminate the overproduction in our processes but we begin to eliminate and highlight the causes of many other problems within our processes that are hidden by all of this inventory.

Using Different Grade of Fiber

Fiber plays a very important role as it is considered the backbone of the product. It holds tight all the material around it as it acts like the main structure of the product. In the production floor we used a specific grade of fiber, imported from Russia, called Chrysotile White Fiber-6. Here 6 represents the grade number of the fiber. Instead of using a constant grade, we could use the mixture of different grade. By doing this load bearing capacity (LBC) will be increased.

Upgrading Heating Chamber

It has 6 chambers for containing 5 mix-line on each chamber. Usually the heat is applied around 60-70 degree Celsius. But the temperature is not enough to reduce all the remaining free calcium in the green sheet which is reactant from the cement raw material. As a result, we inspect some white mark on the corrugated sheet while water curing. If 120 degrees Celsius of heat and 6-7 bar pressure is given to the heating chamber, the remaining calcium will be reduced. By doing so we will be able to get rid of this white mark.

Reducing Defects

There are many techniques out there to help you to identify and eliminate wastes. However, within lean manufacturing we wish to prevent them occurring in the first place. This prevention of defects is achieved by a number of different techniques from autonomation /Jidoka (machines with “human” intelligence that are able to detect when a non-standard event has occurred) through to Pokayoke devices that detect if a product is defective, either preventing the process from running or highlighting the defect for action. The most important factor however is the empowerment of teams to solve and prevent their own problems. By harnessing the talents of employees, we are able to quickly and efficiently prevent the occurrence of defects.

As per whole industry is automated and each and every part is controlled by PLC system, so every data can be documented. If a digital visualization system is built with that continuously documented data, then it will be easier to find out any kind of error, system bug or anything else. For data representation X-Bar R Chart, X-Bar S chart and for process control & detecting small changes in process **Cumulative Sum (CUMSUM) Chart** & **Weighted Average Chart** can be adopted. These type of type of chart can detect any kind of changes in continuous production process like cement sheet production.

6. Conclusion

Industrial attachment is a mandatory part of the undergraduate program. It plays a vital role for students in their professional life. By this type of program students can learn and gain a lot of practical knowledge. And they can apply these types of experience in their professional life for better performance.

Through industrial attachment students can understand and combine their theory with the practical knowledge. It helps them to cope with the job environment. It is also an opportunity for the students to apply their theoretical knowledge to develop the company's undeveloped sectors. And can recommend the most applicable methods for cost effective production and maximum profit.

We learned a lot from Anwar Cement Sheet Ltd. Here we learned about the manufacturing of cement sheet. From raw material to finished each and every detail were described to us very nicely by the managers and the workers. Staffs of the Anwar Cement Sheet Ltd. are very helpful and cooperative. Industrial attachments also help the staff of the company to increase and develop their leadership and mentoring skills, to create exposure for the company, bring new perspectives and fresh ideas by sharing knowledge with the students.