INDUSTRIAL INTERNSHIP REPORT

ANALYSIS OF SHELL KILN FABRICATION MANHOUR ESTIMATION IN THE NON-CEMENT INCUBATION BUSINESS WORKSHOP OF PT. SEMEN PADANG

Submitted as One of the Requirements for Settlement
Industrial Internship Program

By

YAVID JAYA PRADANA

Student ID Number. 16067029/2016

MECHANICAL ENGINEERING VOCATIONAL EDUCATION

FACULTY OF ENGINEERING

UNIVERSITAS NEGERI PADANG

2020

FACULTY APPROVAL

The Report was Submitted as One of the Requirements for Settlement
Industrial Internship Program Faculty of Engineering UNP

Semester……

By:

YAVID JAYA PRADANA
Student ID Number. 16067029/2016
Department of Mechanical Engineering
Mechanical Engineering Vocational Education Study Program

Checked and Authenticated by
Industrial Internship Supervisor

NIP…….

*On behalf of Dean of Faculty Engineering
Head of Industrial Relations Unit

NIP…….

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_____	_____
NIP……..	NIP……..

Head of

_____

NIP……..

FOREWORD

Alhamdulillaahirabbbil'alamin. Thanks to Allah SWT for all the gifts that are always poured out to the author so that the author can complete the refort Industrial Internship with the title " **Analysis of Manhour Estimation for Kiln Shell Fabrication at the Non Cement Incubation Business Workshop at PT. Semen Padang** ". Salawat and greetings are always bestowed on the Prophet Muhammad SAW by saying Allahhumaa Sholli'Ala Sayyidina Muhammad, who has brought mankind to the present era with sophisticated and modern science.

During the writing of this thesis the author received a lot of guidance, advice, motivation and assistance from various parties, either directly or indirectly. For that, with all humility the writer would like to thank".

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In closing the author's gratitude, only the prayers that the author can say for the contributions of those who have helped the author in completing the Job Training Report. May Allah the Most Merciful will reward every kindness with the best reward from His side. Perfect belongs only to Allah, therefore the author expects constructive criticism and suggestions for the better in the future. Finally, I hope that this Industrial Internship Report will bring benefits to readers, especially for the author himself.

Padang, 24th February 2020

Yavid Jaya Pradana

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INTRODUCTION

A. Background

Education is a very important process to increase intelligence and develop human potential to become creatures who believe and have devotion to God Almighty, enhance character, strengthen personality, are intelligent, creative and responsible. Therefore, humans are required to follow the development and progress of science in a good direction, because education involves human survival. Humans do not only need to grow with instinct, but they need guidance and encouragement from outside themselves (education) so that they become useful humans.

As a form of state concern, the government is trying to improve the quality of education. The promotion of the quality of education is always adjusted to the advancement of science and technology. Advances in science and technology will make the development of the nation and region better and able to develop the potential of the nation or region that is owned.

The efforts made by the government in improving the quality of education include improving the quality of teachers, updating the curriculum, adding various learning facilities, and so on. Even though these efforts have been made, there are still many schools that produce less qualified graduates. Therefore education is not only the responsibility of the government but also the responsibility of the community, parents, teachers and students themselves.

Industrial Field Practice is one of the intracurricular activities in the subject group for all students. In general, the implementation of Industrial Internship is aimed at the knowledge, skills, and attitudes of students in the technological or vocational fields through direct involvement in activities in the industrial world.

Industrial Field Practice Activities ultimately refer to the formation of professionalism in the engineering or vocational field that includes insight into the cognitive, affective, and psychomotor fields that students need to have. Such abilities are expected that engineering students will be able to process the knowledge and skills they have as well as the experience gained in Industrial Internship.

At the end of the Industrial Field Practice, mechanical engineering students are also required to prepare an Industrial Field Practice report. The report is prepared in accordance with what they obtained during Industrial Field Practice or discussing the tools or used by PT. Semen Padang.

1. Objectives

b. General purpose

Students can observe the production process and operations directly so that they can know and adapt to the actual situation and conditions in the industry and in the end will add insight and knowledge about new technologies that have never been obtained in college. Students in this case are also task bearers in both institutions and industry.

c. Special purpose

The specific objectives to be achieved in Industrial Field Practice are so that the practicum is able to:

1) Understand the application of Mechanical Engineering in the industrial world, especially at Semen Padang Ltd.
2) Get a real picture of work operations and their application in an effort to operate a production recommendation including management management and work regulations.
3) Get a real-life picture of the process tool and its operation that serves as production advice.
4) Knowing and analyzing the factors that influence determining job estimates.

5) To complete the S1 study program, Department of Mechanical Engineering Education, Faculty of Engineering, Universitas Negeri Padang.

2. Benefits

The benefits made from the implementation of Industrial Internship are as follows:

a. For Students

1) Knowing the real condition of a company both in terms of applied management, physical conditions, technology used, employee performance and industrial production processes.
2) Gaining experience to improve technical skills that are relevant to our major.
3) Knowing and being able to follow the development of science and technology in accordance with the demands of industrial development.
4) Can foster good relations with industry so that it is possible to work in the industry where the Job Training is held.

b. For the University

1) There is a good relationship between the Department of Mechanical Engineering Education, Faculty of Engineering, State University of Padang and Semen Padang Ltd (Persero), thus enabling labor and other collaborations.
2) Can establish good relationships with educational institutions, especially the Faculty of Engineering, State University of Padang, so that it is increasingly recognized by educational institutions as suppliers of labor and the public as consumers.

c. For Companies

1) It is possible to obtain new graduates from educational institutions through students who are and have done Industrial Field Experience.

2) Can establish good relationships with educational institutions, especially the Faculty of Engineering, Universitas Negeri Padang.

3. Scope of problem

The formulation of the problem from the research carried out on the Non-Cement Business Incubation at Semen Padang Ltd is how to conduct an Estimation Analysis of Shell Kiln Fabrication Manhour Estimation at the Non Cement Incubation Business Workshop of PT. Semen Padang, so that knowledge is obtained in estimating the manhour kiln shell fabrication.

4. Time and Place

In accordance with the application letter for Industrial Field Experience submitted, Industrial Field Experience is carried out in the Non-Cement Incubation Business at Semen Padang Ltd, held on January 6 to March 6 2020. Working days Monday to Friday, 08.00 to 17.00 WIB.

5. References

The writing methods used in the preparation and preparation of this report are:

c. Ststudy literature, namely by conducting studies from books, or instruction manuals, userguides, and technical data as well as from libraries according to the topics discussed.
d. Field review, which is monitoring the object to be written.
e. Discussion with field supervisors.
f. Discussion.
g. Conclude the results of the discussion.

B. Overview of The Company

Semen Padang Ltd was founded in 1910 and is the oldest cement factory in Indonesia. The factory is located in Indarung, Padang, West Sumatra, Indonesia, about 200 meters above sea level (asl) and approximately 13 kilometers from the port of Teluk Bayur, Padang. Semen Padang Ltd has

five factories with a total capacity of 5,240,000 tons per year with 2,376 employees as of April 2003.

Semen Padang Ltd (Company) was established on March 18, 1910 under the name NV Nederlandsch Indische Portland Cement Maatschappij (NV NIPCM) which was the first cement factory in Indonesia. Then on July 5, 1958 the Company was nationalized by the Government of the Republic of Indonesia from the Government of the Netherlands. During this period, the Company underwent a revival process through rehabilitation and expansion of the Indarung I plant's capacity to 330,000 tons / year. Furthermore, the factory transformed the factory capacity development from wet process technology to dry process with the construction of Indarung II, III, and IV factories.

In 1995, the Government transferred its share ownership in Semen Padang Ltd to PT Semen Gresik (Persero) Tbk in conjunction with the development of the Indarung V factory. Currently, the Company's shareholders are PT Semen Gresik (Persero) Tbk with 99.99% share ownership. and Semen Padang Large Family Cooperative with a stake of 0.01%. Semen Padang Ltd (Persero) Tbk itself is majority owned by the Government of the Republic of Indonesia at 51.01%. The other 48.09% shareholders are owned by the public. Semen Padang Ltd (Persero) Tbk. is a company whose shares are listed on the Indonesia Stock Exchange.

Initially two Dutchmen, Ir. Carel Christopher Lau and Ir. Koninjberg found rocks in the Ngalau and Karang Putih areas which are thought to be used as raw material for cement making. After being examined at the Landerzoek Voor Materials laboratory in the Netherlands, it was shown that the aid was the raw material for cement making, namely limestone (Lime Stone) and silica (Silica Stone) assistance.

1. The Period of Semen Padang

The history of Semen Padang Ltd in general can be seen in several periods, namely:

a. Period I 1910-1942

Semen Padang Ltd, which is the oldest cement factory in Indonesia, was built by the Dutch in 1910. Led by Christoper with one Kiln with a capacity of 50 tons per day. The highest production ever achieved, namely in 1939 with the amount of 170,000 tons, which was the highest production in that period.

b. Period II 1942-1945

In this period there was a second world war in which Japan controlled Indonesia, and this factory was taken over by the Japanese government. At that time all company activities were left to Asano Cement, where the war continued to flare up and the company did not escape from the enemy (the Allies). Which resulted in many machines being damaged so that production was very low.

Figure 1.1 Semen Padang Ltd during the period 1942-1945

c. Period III 1945-1947

This period is the period of the war for independence of the Republic of Indonesia (Revolutionary Period). The factory at that time was controlled by the Indonesian people themselves, the company was taken over by the Indonesian government and changed its name to "Kilang Semen Indarung". Production at that time was virtually non-existent because the government was busy repairing and replacing cement damaged by the war.

d. Period IV 1947-1958

In 1947 this factory took over NV.NIVCM under the name Padang Portland Maatschappy (NV.PPCM), the new factory started production in 1949 because of the many damages it suffered, and in 1957 it produced the highest production of 154,000 tons.

e. Period V 1958-1961

The cement factory was again taken over by the Indonesian government which was managed by a Mining Industry Agency (BPPT), in accordance with Presidential Decree No. 50/1958 on July 5, 1958.

During this period cement production was as follows:

1958: 80,828 tonnes

1959: 120,714 tonnes

1961: 107,695 tonnes

f. Period VI 1961 - 1972

On April 17, 1961 in accordance with PP. 19/1960 or LNL No. 59 in order to create a guided economy, this company was made a state company under the name PN Semen Padang. Then based on PP No.7 / 1971 states that on July 4 1972 there was a change from PN Semen Padang to Semen Padang Ltd (Persero) by the board of directors approved by the President, all of whose shares were owned by the Republic of Indonesia, the highest production for this period was 172,071 tonnes. a year.

g. VII period 1972-1995

On July 19, 1973, President Soeharto inaugurated the first stage of rehabilitation with a production capacity increasing from 120,000 tons per year to 220,000 tons per year. The second rehabilitation was inaugurated by the Minister of Mines and Energy M. Yusuf and production increased to 330,000 tons per year.

On March 18, 1980 President Soeharto inaugurated the Indarung II factory with a production of 660,000 tons per year. Then

it was continued with Indarung III A and III B projects which were completed in 1983. Indarung III a was inaugurated as Indarung III on December 29, 1983 while Indarung IV was inaugurated on July 23, 1987.

h. VIII period 1995 until now

During this period, Semen Padang Ltd started to implement the production capacity increase program with the construction of the Indarung V factory.

Currently, Semen Padang Ltd has become a public company by selling shares through PT Semen Gresik. Semen Padang Ltd has five factory units with a capacity of 3,270,000 tons per year or twenty one times the production in 1958 which was only 154,000 tons per year.

Figure 1.2 The change of Logo Semen Padang Ltd Overtime

2. Vision and mission of the company

a. Vision

To be a reliable, superior and environmentally friendly cement company in western Indonesia and Southeast Asia. "To become a reliable, leading and environment friendly cement industry".

b. Mission

1) Producing and trading cement and other related products oriented towards customer satisfaction.
2) Developing competent, professional and high integrity human resources.
3) Improve engineering and engineering capabilities to develop the national cement industry.
4) Empowering, developing and synergizing company resources that are environmentally and insightful.
5) Increasing corporate value in a sustainable manner and providing the best to stakeholders.

In achieving this mission and supporting economic growth and increasing non-oil and gas exports, the company continues to increase production by developing and establishing new factories.

3. Culture Company

a. Compete with a Clear & Synergized Vision.
b. Have a High Spirit for Continuous Learning.
c. Act with High Accountability.
d. Meet Customer Expectation.
e. Perform Ethicaly with High Integrity.
f. Strengthening Teamwork.

4. Company Strategy

a. Increase productivity and efficiency.
b. Perform verification / differentiation (product and technical service).
c. Strengthening the implementation of participatory management and information systems and supervision.
d. Make gradual efforts to reduce external dependence on several important resources.
e. Building a global distribution network and increasing the use of strategic network partners and increasing internship synergy partners.

f. Making efforts to improve capabilities and activities in the design, construction, engineering and manufacturing of cement plant equipment.
g. Maintain harmonious relations with local governments, related agencies, and the surrounding community.
h. Make efforts to increase the role of supporting institutions and subsidiaries and develop a strong Semen Padang Ltd Group.

5. Company Achievements

a. SNI Award 2009.
b. The Best of Improvement of ISO 14001: 2004.
c. Platinum in the field of Social Indonesian CSR Award 2011.
d. Gold Economy Sector Indonesian CSR Award 2011.
e. Gold for Consumer Sector, Indonesian CSR Award 2011.
f. The Most Commited Company in Participating All Categories of ICA 2011
g. Gold for Human Rights, Indonesian CSR Award 2011.
h. Gold for the Environment, Indonesian CSR Award 2011.
i. Best III for Individual Category CSR Offier Management Level.
j. SICS Award 2006.
k. 2009 SICS Award.
l. 2010 SICS Award.
m. Superbrand Charter.

Figure 1.3 Award Charter of Semen Padang Ltd

6. Company Certification

a. Integrated Management System.

b. Occupational Health and Safety Management System.

c. SNI ISO 9001: 2008 - Quality Management System.

Figure 1.4 Certification of Semen Padang Ltd

7. Organizational structure of the company

Organizational structure in a company is a reflection of a series of activities in the implementation of company management. Based on a structured and coordinated organizational structure, activities in each position can be controlled so that the activities carried out do not deviate or conform to procedures and the cooperative relationship between each work unit can run smoothly.

The organizational structure set at Semen Padang Ltd is an organizational structure with a staff line system (staff and line). Semen Padang Ltd is led by three boards of directors who are appointed and dismissed by the Minister of Industry. One of the three boards of directors is appointed as the main director, while the other two lead the special fields, namely:

b. Director of Operations.

c. Director of Finance.

These two directors are called the Board of Directors or direct managers. In their operations, each director is assisted by subordinates who are at the Department, Bureau and Division levels. Meanwhile, the

highest leadership lies in the Board of Commissioners, which is the indirect manager.

a. President Director

The main director is the company leader and the highest position holder at Semen Padang Ltd. The main director has the duty and authority to lead the company. In addition, the president director also formulates general policies related to production, financial marketing, employment, and other matters concerning the company's future and retirement.

b. Director of Operations

The operations director reports directly to the president director and will oversee several departmental units, namely:

1) Department of Production Planning and Control
2) Department of Mining and Raw Material Management
3) Slag Production Department
4) Cement Production Department
5) Maintenance Department
6) Deputy of Maintenance Department

c. Director of Finance

The finance director will be responsible directly to the main director. This finance director is in charge of several departments, including:

1) Finance Department.
2) Human Resources and General Affairs Department.

Structurally, the organization of Semen Padang Ltd, the Department of Human Resources (HR) is directly responsible for the main director and finance, human resources (HR) has a mission to plan, recruit, select, and carry out coaching and development of human resources (HR) in order to meet company goals.

d. Internal Audit

The main task of this supervisory unit is to supervise all unit activities functionally. If in one analysis and evaluation there is an error or deviation, then this unit has the right to propose improvements in the form of suggestions or recommendations on how to prevent the problem. In carrying out its duties, this internal supervisory unit is assisted by:

b. Department of Communications and Corporate Law.
c. Non-Cement Business Incubation.

C. PLI's Activities Planning

1. Definition and Properties Cement

Cement is a hydraulic substance in which the compounds it contains will have adhesive power if the cement has reacted with water. These hydraulic properties will cause cement to be:

a. Does not harden immediately if mixed with water
b. Water soluble
c. Can harden when in water

Some of the main properties of cement are:

a. Hydration Properties of Cement

Cement hydration is the reaction that occurs between components / compounds of cement and water to produce hydrate.

b. *Setting* and Hardening

Setting (Binding) of the cement dough with water is a symptom of the occurrence of cement stiffness which is usually expressed by the setting time, which starts from the occurrence of the dough until the cement begins to stiffen. Hardening (hardening), namely the process of cement starting to harden and provide strength.

c. Material Strength

That is the property of cement to be able to withstand (bear) compressive loads. Usually the compressive strength is expressed at the age of 28 h.

d. Depreciation

Namely the shrinkage of the volume of concrete due to the evaporation of water in the cement mixture.

e. Resistance

The resistance of cement to the influence of the pervasive surrounding conditions so that it cannot reduce its compressive strength.

2. Products of Semen Padang Ltd

The products produced by Semen Padang Ltd are as follows:

a. Portland Cement

All of these types are hydraulic adhesive cement produced from grinding clinker which is usually mixed with a little gypsum. Clinker is a cement compound whose main content is calcium silicate and calcium alumilnate. Portland cement has 5 types, namely:

1) Portland Cement Type I

This cement is used for general construction purposes which do not have special requirements for heat, hydration and initial compressive strength. Suitable for use on soil and water containing 0.0% - 0.10% sulfate and can be used for residential houses, high rise buildings, and others.

2) Portland Cement Type II

This cement is used for building construction of mass concrete that requires sulfate resistance (on land and water locations containing sulfate between 0.10 - 0.20%) and moderate hydration heat, for example buildings on the edge of the sea, buildings with swampy soil, irrigation channels mass concrete for dams and bridge platforms.

3) Portland Cement Type III

This cement is used for construction of buildings that require high initial stress in the initial phase after bonding occurs, for example for the construction of concrete roads, high-rise buildings, buildings in water that do not require resistance to sulfate attack.

4) Portland Cement Type IV

This cement is used for the construction of buildings on soil / water containing sulfates exceeding 0.20% and is very suitable for factory waste treatment plants, construction in water, bridges, tunnels, ports, and nuclear power plants.

b. Super Mansonry Cement

This cement can be used for the construction of residential buildings, roads and irrigation with a maximum concrete structure of K225. It can also be used as raw material for making concrete roof tiles, hollow bricks, paving blocks, tiles and other building materials.

c. *Oil Well Cement, Class* G-HSR (High Sulfate Resistance)

A special cement used for the manufacture of oil and natural gas wells with the construction of sub-sea and earth oil wells, the OWC that has been produced is class G-HSR also known as “BASIC OWC” adaptive can be added for use at various depths and temperatures.

d. *Portland Composite Cement (PCC)*

Cement meets the quality requirements of Portland Composite Cement SNI 15-7064-2004. Can be widely used for general construction of all concrete. Multi-storey building structures, bridge structures, concrete road structures, building materials, pre-pressed and pre-printed concrete, masonry, stucco and plaster, concrete panels, paving blocks, hollow bricks, concrete blocks, roof tiles, tile pieces, easier to work with, concrete temperature lower so it is not easy to crack, more resistant to sulfates, more waterproof, and a smoother plaster surface.

e. Super "Portland Pozzolan Cement (PPC)"

Cement that meets the quality requirements of Portland pozzoland cement SNI 15-0302-2004 and ATSM C 595 M-05 S. can be widely used, such as:

1) Mass concrete construction (dams, dams and irrigation).
2) Concrete construction that requires resistance to attack.
3) Sulfate (waterfront buildings, marshlands).
4) Buildings / installations that require a higher tightness.
5) Spouse work and stucco.

Figure 1.5 Cement Products Semen Padang Ltd

3. Raw Materials for Making Cement

The main components in cement making are limestone, clay, silica and iron sand. The components of mixing cement raw materials are as follows:

a. Limestone (Lime Stone)

Limestone whose deposits are found in white coral hills (+/- 2 km from the factory) is used as much as ± 80%. Limestone is the main source of oxides which have the formula CaCO3 (Calcium Carbonate), generally mixed with MgCO3 and MgSO4. Limestone which is good in the use of cement making has a moisture content of ± 5%.

b. Clay (Clay)

Clay obtained around Kuranji District (Padang City) is used as much as ± 8%. The clay chemical formula used in the production of SiO2Al2O3.2H2O cement. clay which is good for use has a moisture content of ± 20%, the SiO2 content is not too high, ± 46%.

c. Iron sand

Imported from Cilacap. Iron sand has the chemical formula Fe2O3 (Ferric Oxide) which is generally always mixed with SiO2 and TiO2 as impurities. Fe2O3 is used as much as 2% as a conductor of heat in the process of making cement slag. A good level in cement making is Fe3O3 ± 75% - 80%.

d. Silica Stone

Silica rock whose deposits come from the Ngalau hill (± 1.5 km from the factory). Silica sand is used as much as ± 10%. Silica sand has the formula SiO2 (Silicon Dioxide). In general, silica sand is present with other metal oxides, the purer the SiO2 content the whiter the silica sand, the less SIO2 the red or brown color, besides that, the easier it is to clump because of its high water content. Silica sand is good for cement making is with ± 90% SiO2 content.

e. Gypsum

Natural gypsum and synthetic gypsum from PT Petro Kimia Gresik. Gypsum functions as a retarder or slows down the hardening of the cement area. The amount of gypsum used is ± 2 - 5% and put it before grinding the clinker and gypsum will decompose at a temperature of 120oC.

Therefore, clinker and gypsum grinding operations in cement mill must be kept below 120oC, loss of water crystals, gypsum crystals cause loss or decrease in the properties of gypsum as a retarder.

D. PLI's Activities Implementation

1. Cement Production Process

In general, the cement production process consists of several stages:

a. The quarry stage. The basic ingredients for cement are limestone, clay, iron sand and silka sand. These materials are mined using heavy equipment and then sent to the cement factory.

b. This raw material is examined in the laboratory, then mixed with the right proportion and the initial grinding stage of the raw material begins with a crusher so that it is in the form of powder (raw mix).

c. The material is then heated in a preheater.

d. heating is continued in the kiln so that it reacts to form clinker crystals.

e. The clinker crystals are then cooled in a cooler with the help of wind. The heat from this cooling process is returned to the preheater to save energy.

f. The clinker is then refined again in a rotating tube lined with steel balls so that it becomes a fine cement powder.

g. The refined clinker is stored in a silo (cement storage similar to Pertamina's oil tank).

h. From this silo, cement is packaged and sold to consumers.

2. Cement Making Process

The cement manufacturing process can be distinguished by:

a. Process Wet

All raw materials are mixed with water, crushed and evaporated, then burned using fuel oil and fuel (bunker crude oil). This process is rarely used due to the problem of limited fuel energy.

b. Dry Process

Using milling and blending techniques then burned with coal fuel. This process includes five stages of management, namely:

1) The process of drying and grinding raw materials in the tube mill.

2) Mixing process to get a homogeneous mixture.
3) Raw mix combustion process to produce slag (clinker: semi-finished material needed for cement production).
4) Slag cooling process.
5) The final grinding process where the clinker and gypsum are ground with a cement mill.

From the cement-making process above, evaporation will occur due to combustion with temperatures reaching 900oC, resulting in; insoluble residues (waste), sulfur trioxide, dissolved silica, iron and aluminum oxides, iron oxides, calcium, magnesium, alkalis, phosphorus, and camphor.

3. Product Quality Control / Guarantee

Quality control is carried out continuously starting from raw materials, ingredients fuel up to the finished material thoroughly with high accuracy which aims to guarantee product quality so that it always meets standardized requirements.

To ensure the quality of the resulting product meets requirements standard, Semen Padang Ltd Laboratory refers to the ISO Guide 25 management system equipped with the following equipment:

- QCX System (Quality Control by X-Ray Analyzer and Computer)
- Instrument Analysis
- Microscopic Observation
- Oil Well Cement Laboratory
- Cement Application Laboratory

a. Marketing area

Semen Padang Ltd has several locations for the packaging and distribution of products, particularly for the marketsincountry. Semen Padang Ltd has 12 silos near the factory with a capacity of 100,000 metric tons and 9 silos at the Teluk Bayur seaport (± 14 km from the factory site) with a capacity of 90,000 metric tons. It also has packing facilities in Belawan (North Sumatra), Batam (Riau Islands), Tanjung

Priok, Lampung (packing plant) and Jakarta. The marketing area of PT. Semen Padang is divided into two, marketing areas, namely:

1) Domestic

   The current marketing area of Semen Padang Ltd for type I Super Masonry Cement covers the entire region of Sumatra and parts of the island of Java.

2) Overseas

   If the domestic supply is sufficient, the excess will be exported. For export, so far, Semen Padang Ltd has supplied to Bangladesh, Taiwan, Papua New Guinea, Maldives, Mauritus, Philippines, Sri Lanka and others. Semen Padang Ltd has distributed almost 63% of cement through sea transportation in sack and bulk packages, while the rest uses land transportation in sack, big bag, and bulk packages. Distribution to market areas via land transportation such as West Sumatra, South Tapanuli, Riau, Bengkulu, and Jambi are bagged at the Teluk Bayur packing factory. Apart from packing plants in Teluk Bayur, Semen Padang Ltd also has packing plants in Belawan, Batam, Lampung and Tanjung Priok.

CHAPTER III
DISCUSSION

A. Definition of Cement Plant Kiln

Figure 2.1 Rotary Kiln

(Source: Personal Documentation)

Kiln is a pyroprocessing device used to raise the temperature of the material to a high temperature (calcination) in a continuous process.

Tool kilns in the form of cylinders with a diameter of 5 m at the Indarung II, III, and IV cement factories, 5.6 m at the Indarung V plant, and 5.5 m at the Indarung VI factory and ± 80 m long. The combustion process takes place in the kiln, the fuel used is coal, while for preheating Industrial Diesel Oil (IDO) is used. For heating in the burner, secondary air is obtained from the grate cooler and primary air obtained from the outside air. Primary air is obtained by using a primary fan. On the walls of the kiln, refractory

stones are installed which function to protect the kiln when the combustion process occurs. Refractory is a material that has advantages such as:

1. Resistant to high temperatures and drastic changes.
2. Resistant to molten slag, glass, hot gases, etc.
3. Withstands loads in service conditions.
4. Resistant to abrasive forces.
5. Reduce heat (conserve heat).
6. Low coefficient and low heat expansion.
7. Does not contaminate the processed material (load).
8. Low heat conductor (thermal conductivity).

The function of the refractory in cement manufacturing:

1. As protection (operating safety) the kiln shell against high temperatures.
2. As a material to extend the technical life of the kiln shell or protect metal parts from direct contact with flames or very hot solids.
3. As a heat insulator (heat sink).

B. Principlesof Kiln Working

In the kiln there will be all chemical processes for clinker formation from the raw material (raw mix). Broadly speaking, the kiln is divided into 3 zones, namely the calcination zone, the transition zone, and the sintering zone (clinkerization). Technological developments resulted in part of the calcination zone being transferred to the suspension preheater and calciner, so that the process that occurs in the kiln is more effective in terms of heat consumption. The heat transfer process in the kiln is largely determined by the radiation process so that a good insulator is needed to prevent the heat from being wasted out. The insulator is a refractory stone and the coating formed during the process. Because the function of refractory stone in each part of the process is different, the type of refractory stone is adjusted to its function. The factors that influence the coating formation include:

1. raw mix chemical composition
2. thermal conductivity of refractory stones and coatings

3. feed temperature when in contact with the coating
4. coating surface temperature when in contact with the feed
5. flame shape and temperature

In the liquid phase sintering zone is very necessary, because the clinkerization reaction takes place more easily in the liquid phase. However, the number of liquid phases is limited to 20-30% to facilitate the formation of a coating that functions as an insulator for the kiln.

In a kiln without tertiary air, almost all of the gas from combustion and for combustion of some of the fuel in the calciner goes through the kiln. Because a high temperature is required in the kiln to carry out the clinkerization process, the excess fuel combustion air in the kiln is limited to a maximum of about 20-30%, depending on how easy it is to burn rawmeal (burnability of the rawmix). Thus the maximum fuel burned in the in-line calciner is about 20-25%. In general, this type of calciner works with fuel combustion in the range of 10% to 20% of all fuel requirements, because combustion in the calciner will also produce a higher gas temperature out of the top cyclone which means a waste of energy as well. The remaining fuel, which ranges from 80% to 90%, is burned in the kiln. To estimate how much excess combustion air is in the kiln in order to obtain a good kiln operation, a separate calculation will be carried out. Tertiary airless kilns can operate with a planetary cooler so that installation is simpler and consumes less electrical power compared to kiln systems that use grate type coolers.

In a kiln with tertiary air, the fuel burned in the kiln can be reduced to about 40% (even up to about 35%), while the remaining 60% is burned in the calciner. Thus the heat load suffered in the kiln is reduced to around 300 kcal / kg of clinker. Since the dimensions of the kiln are very dependent on the amount of fuel burned, the theoretical production capacity of a certain size kiln is around 2.5 times for a kiln system with tertiary air compared to a kiln without tertiary air. For example, for a capacity of 4000 tons per day (TPD), a tertiary airless kiln requires a diameter of about 5.5 m. Whereas for kilns of

the same size in tertiary air systems, for example the SLC system can operate at a maximum capacity of around 10,000 TPD.

The main equipment of the kiln, apart from the shell of the kiln itself, is the burner and refractory. The shape of the fire produced by the combustion process greatly determines the heat transfer process that occurs and will ultimately determine the quality of the clinker. Meanwhile, refractory bricks, in addition to protecting the kiln shell and reducing heat flowing into the environment, also affect the formation of coatings.

The working system of the Rotary Kiln requires a gas analyzer. This gas analyzer functions to control the gas levels of O2, CO2 and NOx in the exhaust gas if there is an excess and a lack, then the amount of fuel and air will be adjusted. The inside of the Rotary Kiln is covered with refractory stone. The Kiln feed from the Cyclone Stage four SLC which has been calcined in the Preheater enters the Kiln at the Inlet Kiln. The material in the Kiln will experience four stages of the process or as if the Kiln is divided into four stages of the process, namely:

1. Calcination Zone (900 - 1000ºC), material which has not been calcined in the Preheater will undergo further Calcination in the Calcining Zone. The process that occurs in this zone is the process of maximum decomposition of the reactive elements contained in the material is still in the form of powder and the inside of the Kiln is used a layer of alumina bricks.
2. Transition Zone (1000 - 1200ºC), the material begins to change its phase from solid phase to liquid phase. In this zone a reaction occurs between CaO and SiO2Al2O3 and Fe2O3 compounds. The Kiln area is protected by a layer of High Alumina bricks
3. Sintering Zone (1200 - 1350ºC), in this area the material will melt (Sintering) to form Clinker minerals as Kiln products. Sintering Zone 8 is often referred to as Burning Zone. The process that occurs in this zone is the melting of all materials and the maximum reaction between CaO and SiO2Al2O3 and Fe2O3. This mineral compound forms the main clinker

compound, namely C3S (Alite), C2S (Belite), C3A (Celite) and C4AF (Felite). This reaction is called the clinkerization reaction.

4. Cooling Zone, the material will experience pre-cooling before entering the Cooler. The process in this zone, the material undergoes a phase change away from the gun burner. The temperature will drop to 1200 oC, because of the Kiln rotation, some of the material will be granular.

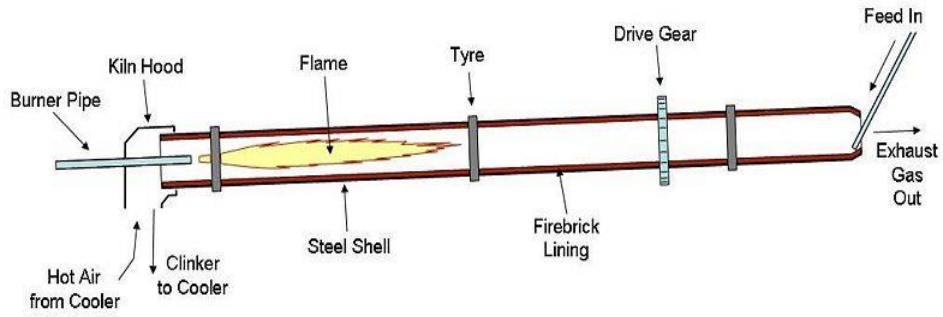

Figure 2.2 Principles of Kiln Work

(Sourcehttp://www.cementkilns.co.uk/)

C. Kiln Components

The components of the kiln are as follows:

1. Shell

Figure 2.3 Shell Kiln

(Personal Documentation Resources)

2. **Refractory**

Figure 2.4 Refractory

(Personal Documentation Resources)

3. **Tire**

Figure 2.5 Tire Kiln

(Personal Documentation Resources)

4. **Roller**

Figure 2.6 Roller Kiln

(Personal Documentation Resources)

5. **Thruster**

Figure 2.7 Thruster Kiln

(Personal Documentation Resources)

6. **Gear Box**

Figure 2.8 Gear Box

(Personal Documentation Resources)

7. **Burner**

Figure 2.9 Burner

(Personal Documentation Resources)

D. Definition of Shell Kiln

The shell of the kiln is made of steel plate of sufficient thickness. The thickness of this shell kiln is different in different parts of the kiln according to the needs or of the zone concerned. The shell on the kiln is rolled usually 15 to 90 mm thick. The plate is then formed into a cylinder with a diameter of up to 6 m.

1. The Shell Kiln Formation Process

The process of forming a plate into a shell kiln goes through many processes in order to produce a quality shell kiln, the shell kiln manufacturing process itself is as follows:

a. Check plate specifications

This check consists of:

1) Check plate thickness
2) Check plate length
3) Check plate width
4) Checking the head number on the plate
5) Checking plate certificates
6) Country of Origin (COO) Check
7) Country of Manufactur (COM) Check

b. Check the diagonal of the plate.

If the plate is not diagonal, a diagonal cut will be made.

The diagonal cutting process starts from handling, cutting, and grinding.

c. Beveling / Join Preparation

The work of making beveling can use Cutting Touch, Grinding, and Hand Beveler.

d. Forming (Rolling)

The forming process is done using a rolling machine

e. Assembly

In this assembly process, the tension bolt and injack bolt are assembled. After that, do the assembly on the plate so that the plates

are fused and form a cylinder. Welding (welding) is carried out using GMAW (Gas Metal Arc Welding) welding.

f. Prepare the Turning Roll

g. Setting up Scaffolding

h. Doing Pre Heat

Pre heat is needed so that during the welding process there is no damage to the plate and avoiding the HAZ (heat-affected zone), after that, grinding is done.

i. Ovality

In the ovality process, there are several activities that are carried out, such as:

1) Handling
2) Ovality check
3) Rolled plate back
4) Handling
5) Ovality check

If the results of the ovality check have been completed, it can be continued in the next process

j. Bracing installation

Bracing installation is divided into several steps such as:

1) Asembly
2) Welding
3) Prepare the knot plate
4) Hand Cutting / CNC Cutting
5) Cutting using a shearing machine

If the shell kiln is made for more than one section, asambly and welding activities are required between one section and another (as needed).

E. Analysis of Shell Kiln Estimates

Table 2.1 Estimated Manhour Shell Kiln

NO.	Type of work	Estimate (hour)	Ket
1.	**Checking Plate Specifications**		
	- Thick - Long - Wide - Head Number - Certificate - Country Of Origin (COO) - Country Of Manufactur (COM)	0.01 0.01 0.01 0.01 0.01 0.01 0.01	
		0.09	
2.	**Checking the Diagonal Plate 1200 X 2000 mm pl 25 mm 14 pcs**		
	- Handling - CNC Cutting - Rolls	0.40 0.30 0.60	
		1.30	
3.	**Beveling / Join Preparation**		
	- Cutting torch - Burrs - Hand Beveler	3.0 1.50	
		4.50	
	Join Plat (7,893.25 x 2000)		
	- Handling - Marking	0.20 3.30	

	- Grinding	5.0	
	-	**8.50**	
4.	**Forming (Rolling) Ø 5m**		
	- Cool Forming / Appeal - Handling	6.0 1.30	
		7.30	
5.	**Assembly**		
	- Handling - Tension Bolt and Welding - Press Bolt (Injack Bolt) - Assembly - Welding (GMAW)	1.0 6.0 4.0 2.0	
		13.0	
6.	**Prepare the Turning Roll**	**1.0**	
7.	**Setting up Scaffolding**	**1.0**	
8.	**Preheat**	2.30	
	- Welding (GMAW + SAW) - Burrs	6.50 3.0	
		11.80	
9.	**Ovality**		
	- Handling - Ovality check - Roll repetition - Handling	2.50 0.40 2.30 1.30	
		7.30	

10.	**Bracing Installation**		
	- Assembly - Welding - Prepare the Knot Plate • Cnc cutting • Cutting using a shearing machine - Grinding Finishing	7.00 5.25 0.30 1.00 7.00	
		20.55	
	Total	**74.35 Hours**	

Table 1. Manhour Shell Kiln Estimation

So Manhour estimation results were obtained for the manufacture of shell kiln for 74.35 hours. The kiln was made using a 25 mm thick plate. Kiln diameter 5000 mm, section length 2000 mm.

CHAPTER III
CONCLUSION

A. Conclusion

In the process of implementing Industrial Internship (PLI) at PT. Semen Padang, Department of Inquiry Business; stale Non-Cement, the author can take the following conclusions:

1. Estimates are useful as initial planning in making Shell Kiln so that the manufacturing process is optimal and benefits the company.
2. The shell making in the kiln uses a plate with a thickness of 15 to 90 mm.
3. The plates are then rolled and joined to an inner diameter of 4750 to 6000 mm.
4. The plate that has been rolled is then checked for ovality where an acceptable tolerance is 3 mm.
5. It is important to understand the work processes in estimating the manhour kiln shell.
6. The manhour estimation result from this shell kiln is 74.35 hours. Where for one section the kiln shell is made using a plate with a thickness of 25 mm. The shell kiln is made with a section length of 2000 mm, and an inner diameter of 5000 mm.
7. The shell kiln manufacturing process consists of many sections according to the required kiln length.

B. Recommendations

After following this Industrial Field Practice (PLI), the authors can provide suggestions as follows:

1. Do industrial field practice seriously, because the knowledge and experience gained is very useful.
2. While following industrial field practice always use safety for safety at work.

3. Establish good relationships between the supervisor and the participants in the industrial field practice as a means of learning and work processes.
4. Learn systems and knowledge from references obtained during industrial field practice.
5. In estimating, the estimator must be very careful in making it so that there are no losses in the process of working on a project.

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Vol.2, No.2 November 2016 ENTHALPY – e-ISSN Mechanical Engineering Student Scientific Journal: 2502-8944.

Format Nilai Akhir PLI

Isikan Nomor Seksi Mata Kuliah				
7	0	0	9	2

DAFTAR NILAI MAHASISWA
MATA KULIAH PENGALAMAN LAPANGAN INDUSTRI
SEMESTER.....

Nama Dosen Pembimbing..... Delima Yanti Sari, S.T., M.T., Ph.D
Jurusan ..... Teknik Mesin.

No	Nama Mahasiswa	NIM/TM	Nilai Supervisor	Nilai Dosen Pembimbing	Total (Nilai Akhir dan Huruf)
1.	YAVIO JAYA PRADANA	16067029/2016	90	85	87,5

Padang... 10 - Juli - 2020
Dosen Pembimbing,

(Delima Yanti Sari, ST, MT, Ph.D)
NIP. 19780114 200312 2003

- Nilai Supervisor dan Nilai Dosen Pembimbing di ambil dari format yang khusus untuk itu.
- Nilai Akhir adalah Nilai rata-rata dari jumlah Nilai Supervisor dan Dosen Pembimbing ***(dalam bentuk angka dan huruf)***

LEMBARAN PENILAIAN DOSEN PEMBIMBING TERHADAP MAHASISWA PLI

Nama Mahasiswa (Praktekan) : YAVIO JAYA PRADANA NIM 16067029
Jurusan : TEKNIK MESIN
Judul Laporan : Analisis Estimasi Manhour Fabrikasi Kiln Shell di
: Workshop Bisnis Inkubasi Non Semen PT. Semen Padang
Jadwal Kegiatan : 6 Januari 2020 s.d 6 Maret 2020
Nama Dosen Pembimbing : Delima Yanti Sari, S.T., M.T., Ph.D
Ketentuan :

1. Sasaran penilaian adalah kemampuan mahasiswa menghasilkan laporan PLI yang sesuai dengan persyaratan yang ditetapkan pada bagian penulisan laporan.
2. Kualitas fisik buku laporan dan faktor lain yang tidak menggambarkan kemampuan mahasiswa menulis laporan tidak termasuk komponen yang dinilai. Tetapi dituntut sebagai pesyaratan pengeluaran nilai PLI.
3. Penilaian dilakukan secara menyeluruh dalam arti harus dipisah menurut isi laporan.
   Pelaksanaan: skor atau biji nilai diperoleh dari pengisian kolom ***range penilaian*** berikut:

ASPEK YANG DINILAI	RANGE PENILAIAN					
	Mengulang <65	Cukup Baik (65-69)	Baik (70-74)	Baik Sekali (75-79	Sangat Baik Sekali (80-84)	Dengan Pujian (85-100)
1. Penggunaan Kaidah penulisan karya ilmiah di dalam Bahasa Indonesia						85
2. Kemampuan menyerap dan menginterprestasikan informasi ide petunjuk yang diberikan oleh dosen pembimbing						85
3. Kemampuan mengemukakan dan mempertahankan ide secara sistematis selama melakukan konsultasi laporan PLI dengan dosen pembimbing						85
4. Kemampuan menentukan sendiri kejanggalan yang terdapat pada tulisan (isi laporan)						85
5. Inisiatif mengemukakan dan melengkapi data/informasi yang diperlukan						85
Jumlah Skor	=	=	=	=	=	=
Total Skor (jumlahkan semua Jumlah Skor) =						

BIJI NILAI Dosen Pembimbing = $\frac{\text{Total Skor}}{5} = \frac{425}{5} = 85$

Catatan:

1. Isilah kolom penilaian dalam bentuk angka sesuai Dengan ***range penilaian***
2. Lembaran penilaian ini harus diserahkan ke kantor Unit hubungan Industri (UHI) bersama laporan Akhir PLI (sesudah diisi oleh dosen pembimbing)

Padang, 10 Juli 2020
Dosen pembimbing

(Delima Yanti Sari, S.T., M.T., Ph.D)
NIP. 19780114 200312 2 003

CATATAN KONSULTASI LAPORAN DENGAN DOSEN PEMBIMBING

Nama Mahasiswa....YAVID JAYA PRADANA
Jurusan/NIM/TM....Teknik Mesin / 16067029 / 2016
Tempat PLI/PKN....PT. Semen Padang

Tanggal	Topik/Masalah yang dibahas	Saran Perbaikan	Paraf Dosen Pembimbing
10 - Maret - 2020	BAB III	Penambahan Gambar	
17 - Maret 2020	BAB III	Penambahan materi	
16 - April 2020		Perbaikan penulisan yang salah.	

Diketahui oleh:
Dosen Pembimbing

(Delvira Yanti Sari, S.T., M.T., Ph.D)
NIP. 19780114 200312 2 003

NILAI

NO	URAIAN	ANGKA	HURUF
1	DISIPLIN	90	Sembilan Puluh
2	KERAJINAN	91	Sembilan Puluh Satu
3	TINGKAH LAKU	91	Sembilan Puluh Satu
4	KERJA SAMA	89	Delapan Puluh Sembilan
5	KREATIVITAS	90	Sembilan Puluh
6	KEMAMPUAN KERJA	89	Delapan Puluh Sembilan
7	TANGGUNG JAWAB	90	Sembilan Puluh
8	PENYERAPAN / PELAPORAN	90	Sembilan Puluh
	RATA - RATA	90	
	KRITERIA		BAIK SEKALI

Keterangan

90 - 100 = BAIK SEKALI
80 - 89 = BAIK
70 - 79 = CUKUP
60 - 69 = KURANG

Padang, 28 Februari 2020

ZAMRIS

PT SEMEN PADANG

SEMEN INDONESIA GROUP

SERTIFIKAT

Nomor : 0000505/HM.04.03/STF/60003870/3000/02.2020

DIBERIKAN KEPADA :

NAMA	: **YAVID JAYA PRADANA**
No. NISN / BP	: **16067029/2016**
JURUSAN	: **TEKNIK MESIN**
PERGURUAN TINGGI	: **UNIVERSITAS NEGERI PADANG**

Telah selesai melakukan Kerja Praktek di Bisnis Inkubasi Non Semen PT Semen Padang dari tanggal 06 Januari 2020 s/d 06 Maret 2020 dengan hasil :

BAIK SEKALI

Padang, 28 Februari 2020
Unit Operasional SDM

M. Irwan Prasetyo
Kepala