DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

THE INSTALLATION OF COLUMN AND BEAM FOR THE CONSTRUCTION OF TWO STOREY HANGAR BUILDING

Prepared by:

NUR AMIRA SYUHADA BINTI MOHAMAD SALLEH

2016614214

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

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(PERAK)

DECEMBER 2018

It is recommended that the report of this practical training provided

By

Nur Amira Syuhada Binti Mohamad Salleh

2016614214

entitled

The Installation of Column and Beam for the Construction of Two Storey Hangar Building

Accepted in partial fulfillment of requirement has obtaining Diploma In Building.

Report Supervisor : Dr. Dzulkarnaen Bin Ismail.

Practical Training Coordinator : En. Muhammad Naim Bin Mahyuddin.

Programme Coordinator : Dr. Dzulkarnaen Bin Ismail.

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STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original references stated herein, prepared during a practical training session that I underwent at Thames Integrated Sdn Bhd for duration of 14 weeks starting from 3 September 2018 and ended on 7 December 2018. It is submitted as one of the prerequisite requirements of DBG307 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

Name : Nur Amira Syuhada Binti Mohamad Salleh

UiTM ID No. : 2016614214

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Alhamdullillah, praise to Allah, the Most Merciful, the Most Graceful.

I would like to extend my heartfelt for the guidance, advice and help rendered throughout the period of training by the following group of amazing individuals. First and foremost, I would like to thank Dato' Kamarul Hisham Bin Hashim for the opportunity, give, of being training in his esteem company. His team of professionals comprising of En Rosnizam Jali, En. Muhd Asyraf bin Kamsani, En Ariff Bin Amir Sharifuddin, have enabled me to learn and develop my understanding, knowledge and feel of real time projects, and the theory involved in analysis of structures, building and civil works. They are also responsible towards streamlining and assessing my training. Also

I would also like to thank ALL the UiTM lecturers that have taught and nurtured me in becoming a better student and person. I would also like to extend my deepest appreciation to the lectures who are directly involved during my training stint. To Dr. Dzulkarnaen bin Ismail, Supervising Lecturer, En Muhammad Naim bin Mahyuddin, Practical Training Coordintator and Dr.Dzulkarnaen bin Ismail, Programme Coordinator, I value the time, effort, encouragement and ideas that they have contributed towards the successful completion of my training, this report and the valuable knowledge that have been shared over the last few semester.

Last but not least, my special thanks to my beloved parents for their sacrifices over the years.

Thank you so much.

ABSTRACT

The erection of structural steelwork consists of the assembly of steel components into a frame on site. "I" beams have a variety of important uses in the structural steel construction industry. The observation and information is based on 14 weeks (3 months 1 weeks) on site. This case study are focus on how the method of installation between H-pile to column and beam. The main topic discussed in this report is related to the structure of the building based on project "Cadangan membina sebuah bangunan hangar 2 tingkat (Part Task Trainer) di Atas Sebahagian Lot Pt 12135, Pangkalan Udara Subang". This report describe the installation of column and beam for the construction of 2 storey hangar building. To complete this report requires observation and interviews with related individuals. In conclusion this report also contains the problem during the construction and how to overcome it to give a very good building in every aspect of safety.

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CHAPTER 1.0

INTRODUCTION

1.1 Background and Scope of Study.

Building construction is the techniques and industry involved in the assembly and erection of structures, primarily those used to provide shelter. Building construction is an ancient human activity. It began with the purely functional need for a controlled environment to moderate the effects of climate. Constructed shelters were one means by which human beings were able to adapt themselves to a wide variety of climates and become a global species (Chang, 2014)

Structural steel is a category of steel used for making construction materials in a variety of shapes. Many structural steel shapes take the form of an elongated beam having a profile of a specific cross section. Structural steel shapes, sizes, chemical composition, mechanical properties such as strengths, storage practices, are regulated by standards in most industrialized countries.

Next, most structural steel shapes, such as I-beams, have high second moments of area, which means they are very stiff in respect to their cross-sectional area and thus can support a high load without excessive sagging.

Moreover, practically all industries have major applications of structural steel from industry equipment to finished products, structural steel is used everywhere. Buildings, bridges, high-rise buildings and warehouses are made using structural steel sections. Industry experts prefer the use of structural steel over any other building material for construction, but as everything else in the world, there are pro and cons of using structural steel in building structures.

Besides, the scope of study was conducted to understand the method of installation column and beam. This study covers the construction process method, the machineries used and the material used at "Cadangan Membina Sebuah Bangunan Hangar 2 Tingkat (Part Task Trainer) di Atas Sebahagaian Lot PT 12135, Pangkalan Udara Subang, Jalan U7, 40150 Shah Alam, Selangor Darul Ehsan." In addition this study aims to describe the problems that occurred at a construction site.

1.2 Objectives

The objective of these studies is to learn and gain more detail about the installation of column and beam. The objective are:

1. To study the construction of holding down bolt.
2. To study the column installation method.
3. To study the upper beam installation method.

1.3 Methods of Study

Generally, this report is done by applying these following methods:

1. Observation

   This observation method is done during practical training directly by site visit. The information collected based on what happen at site construction guided by site supervisor. The technology as camera and cell phone was used to record any important information such as progressing of construction, equipment and machineries that used while construction.

2. Interview

   Interview is very important sources that can help us to know the detail the installation of column and beam. By interview we can get more information from the surrounding people such as the pro and cons. For this interview I has choose for interview the supervisor that in charges at the site.

3. Document reviews

   Document reviews are several of the literature studies for the construction detail of column and beam are from the drawing plan of project at the site office. Such as architectural drawing plan and structural drawing plan.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

Figure 2.1: Logo of company

Thames Integrated Sdn Bhd (formally known as CA&S Intergrated Sdn Bhd) was established in the year 2003 and is a wholly-owned bumiputera construction company. Thames Integrated Sdn Bhd was registered with Lembaga Pembangunan Industri Pembinaan Malaysia (CIDB Malaysia) and holds G7 grade license with Bumiputera status.

The combination of key personnel who came from various industries and experience are the advantage in providing the customers with the 'state of the art' results.

Thames Integrated Sdn Bhd core competencies can be generalized as follows:

1) General Building Construction

2) Civil Works

3) Mechanical & Electrical Works

4) Project Management

Thames Integrated Sdn Bhd adopt quality management system in operations to ensure that all the tasks and projects given are delivered on time, with success and satisfaction. Thames Integrated Sdn Bhd organization has been certified as ISO 9001: 2008 compliant by UKAS.

Thames Integrated Sdn Bhd continue to develop, sustain and build pool of human capital and nurture people in achieving their full potential and providing them with conducive working environment where integrity, honesty and mutual respect is valued and rewarded.

2.1.2 Mission and Vision of Company

To fulfils the best service towards country and people, Thames Integrated have devoted their hard work into their mission and vision:

Mission and Vision

- We aim to become a major construction company in the country within the next five years
- We are always committed to providing services and works that meet the highest standards set by the customer.
- We are determined to give value for money to the customer by producing high-quality work within timely manner.
- We emphasize on the environmental friendly procedures and encourage the green technology approaches.

2.1.3 Business Philosophies of Company

The construction industry is a challenging and competitive field. Therefore there are always adhere to the company's corporate philosophy in facing the industry to focus on achieving the best required results and to remain competitive. Thames Integrated Sdn Bhd drive the organization with the following corporate philosophies:

1) System

- Applying the management system of strict financial controls to ensure that financialcompanies are always in good health. The financial health is key to the success of a business.

2) Efficient

- Always ensure efficient and systematic corporate management by following the guidelines of international standards ISO9001:2008 in order to achieve the high level of quality management.

3) Ethics

- Adhere to business ethics because it is one of the key elements in strengthening the relationship and trust in business. It is also a moral and social responsibility.

4) Welfare

- Always give priority to the welfare of the staff because the staff is the main asset of the company and always ensure that employees always have the latest knowledge and skills in the industry.

2.2 Company's Profile

Company Name	Thames Integrated Sdn. Bhd. (formly known as CA & S Integrated Sdn. Bhd.)
Company Registration No.	611542-K
Registered Address	No 16-1, Jalan 2/23A Taman Danau Kota Off Jalan Genting Kelang 53300 Kuala Lumpur Wilayah Persekutuan
Business Adress	D - 10 – 10 – 1, Block D Pusat Perdagangan Dana 1 Jalan PJU 1A/46, PJU 1A 47301 Petaling Jaya Selangor
Tel. and Fax	Tel : Fax :
Email	admin@thames.com.my

Tables 2.1: Shows the company profile.

2.3 Organization Chart

There are the organization chart of Thames Integrated Sdn. Bhd.

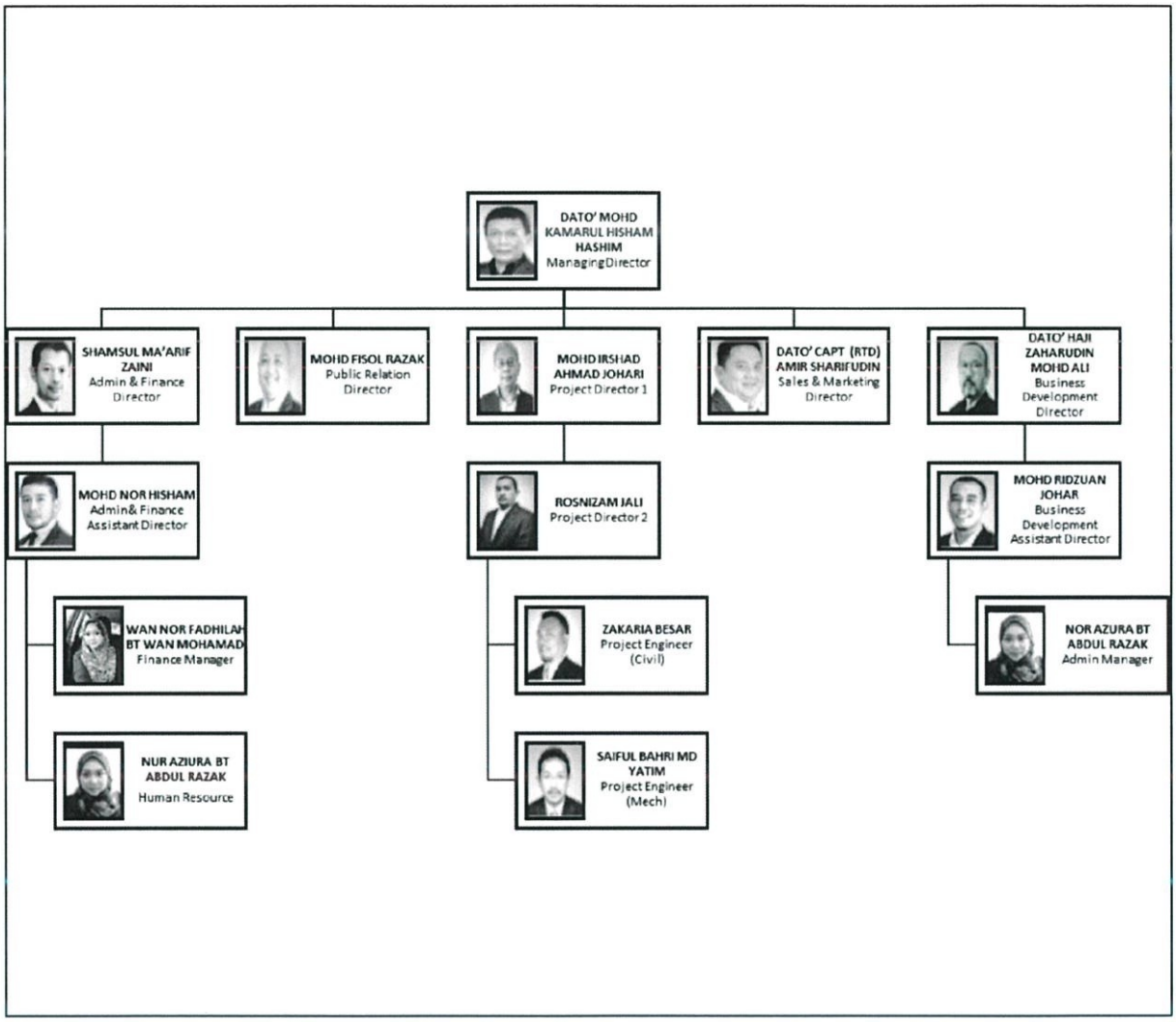

Figure 2.2: Shows organization chart of company.

2.4List of Project

2.4.1 Completed Projects

NO.	PROJECT TITTLE	CLIENT	CONTRACT VALUE (RM)	DURATION	DATE COMPLETED
1.	Cadangan Membina dan Menaiktaraf Tandas Awam Di Tempat-tempat Pelancongan Di Langkawi, Kedah Darul Aman	Kota Mahsuri Corporation Sdn Bhd	2,249,000.00	18 Months	Feb 2009
2.	Cadangan Membina Tambahan Bangunan Baling Inn, Majlis Daerah Baling, Kedah Darul Aman	Kota Mahsuri Corporation Sdn Bhd	2,763,763.00	14 Months	Jul 2010
3.	Membina Jalan Lencongan Timur Dari Persimpangan Pekan Simpang kuala Ke Persimpangan Jalan Tun Razak, Jalan LanAlor Star, Kedah Darul Aman	Realship Engineering (M) Sdn Bhd	18,000,000.00	24 Months	May 2011

NO.	PROJECT TITTLE	CLIENT	CONTRACT VALUE (RM)	DURATION	DATE COMPLETED
4.	Cadangan Membina Bangunan Kediaman (454 Unit) Di Atas Lot Mukim Semenyih, Daerah Hulu Langat, Selangor Darul Ehsan	Kueen Lai Engineering (M) Sdn Bhd	22,567,167.00	36 Months	Jun 2012
5.	Cadangan Kerja-kerja Penambahbaikan Pusat Latihan Rela di Bukit Selambau Kedah Darul Aman	Amna Construction	10,000,000.00	13 Months	Sep 2013
6.	Ubahsuai Unit Kondominium Putri Palma IOI, Putrajaya	Skudio Ventures Sdn Bhd	230,000.00	8 Months	Apr 2014
7.	Tawaran Semula Cadangan Membina dan menaiktaraf Tempat Letak Kereta dan Motosikal Di Bawah Rentis TNB Stesen Komuter Jalan Parang Satu 19/18A Seksyen 19, Shah Alam, Selangor Darul Ehsan	Majlis Bandaraya Shah alam	2,351,841.00	8 months	Sep 2014

Tables 2.2: Shows the list of past project.

2.4.2 Project in Progress

NO.	PROJECT TITTLE	CLIENT	CONTRACT VALUE (RM)	DURATION	DATE COMPLETED
1	Perkhidmatan Pengendalian Dan Penyelenggaraan LapangSasar Udara (Lasarud) Kota Belud, Sabah	Kementerian Pertahanan	32,400,000.00	6 years	In Progress
2	Projek Pembinaan Jalan GRAVEL Sepanjang 4km Dan Jambatan Konkrit Di Site 2 Lapang Sasar Udara (LASARUD) Kota Belud , Sabah	Kementerian Pertahanan	570,000.00	1 years	In Progress
3	Cadangan Pembangunan Infrastruktur Bagi Pengoperasian Part Task Trainer (PTT) Bagi Pesawat A400M Di Pengkalan Udara Subang, Selangor Darul Ehsan.	Kementerian Pertahanan	2,918,155.08	1 years	In Progress

Tables 2.3: Shows the list of current project.

CHAPTER 3.0

CASE STUDY

The project was carried out in the practical training was " *Cadangan Membina Sebuah Bangunan Hangar 2 Tingkat (Part Task Trainer) di Atas Sebahagaian Lot PT 12135, Pangkalan Udara Subang, Jalan U7, 40150 Shah Alam, Selangor Darul Ehsan'*. The total cost of construction project cost was two millions nine hundred eighteen thousand one hundred fifty five ringgit and eight cents. (RM 2,918,155.08). The duration of the construction contract and the completion of this project are 48 weeks starting 10 November 2016 and the expected completion date is on 10 November 2017, but anyway this project was hold because of the sub-contractor were not doing the work although they had been paid to do so. This project are extend to achieve all their work until May 2019. This project is a design and build project. Hence, the contractor are the leader of the construction. There several parties involved in this project. It is Kementerian Pertahanan Malaysia as a client or owner, Arkitek Zamryz as architect, Expert Engineers Sdn Bhd as a civil and structural engineer, Abu Rauf Consult as a mechanical & electrical engineer, AAS Associates as quantity surveyor and Kemalak Sdn Bhd as a Contractor. Kemalak Sdn Bhd are the group company of Thames Integrated Sdn Bhd.

The 2 storey hangar building consists of hangar, two electrical room, mechanical room,, roles store, hydraulic room, genset room, 4 hose reel room, meeting room, class room/ hall, prayer rooms, pantry and toilets.

There are the officers in charge on site to ensure the smooth running of the project is En. Muhammad Nizam as a project director, En. Muhammad Ashraf bin Kamsani as a project manager and En. Ariff bin Amir Sharifuddin as a site supervisor, Muhammad Noor Amin bin Saiful as a safety site supervisor. They are among the responsible persons in the event of any problems on the site.

List of consultant

Consultant	Specialist	Address
ARCHITECK ZAMRYZ	Architecture	10-3, Jalan 15/48A, Sentul Raya Boulevard, 51000, Kuala Lumpur.
EXPERT ENGINEER SDN BHD	Civil Engineer	47C, Jalan Sg 3/10, Taman Sri Gombak, 68100 Batu caves, Selangor Darul Ehsan.
ABU RAUF CONSULT	Mechanical and Electrical Engineer	14 B, Jalan 2/16, Dataran Templer, Bandar Baru Selayang, 68100 Selayang, Selangor Darul Ehsan.

Tables 3.1: Shows the list of consultant.

Photo 3.1: The project signboard.

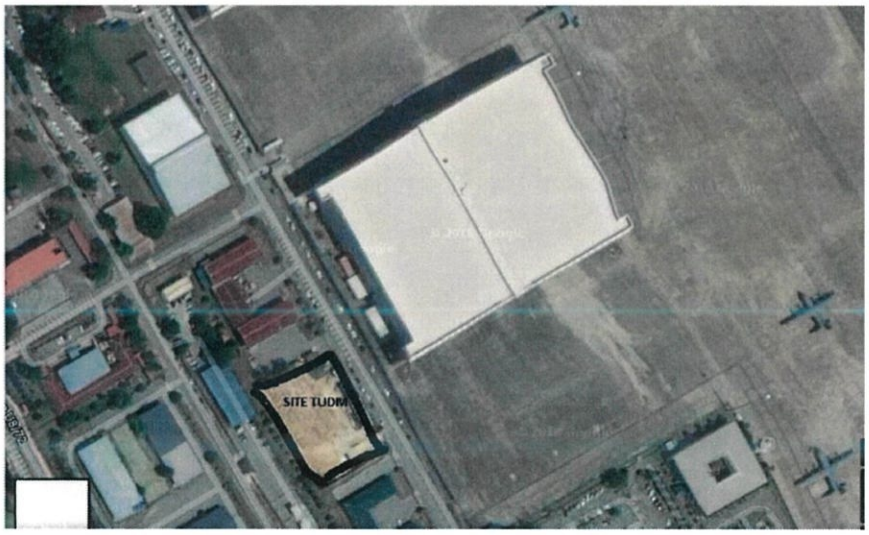

Figure 3.1: The location plan of Pengkalan Udara Subang.

Steel structure is a metal structure which is made of structural steel components connect with each other to carry loads and provide full rigidity. All industries have major applications of structural steel. From industry equipment to finished products, structural steel is used everywhere. Buildings, bridges, high-rise buildings and warehouses are made using structural steel sections. Industry experts prefer the use of structural steel over any other building material for construction.

Steel is tensile, it has a high strength to weight ratio which means it has high strength per unit mass. So no matter how large the overall structure is, the steel sections will be small and lightweight, unlike other building materials. Steel can be easily fabricated and produced massively. Steel sections can be produced off-site at shop floors and then assembled onsite. This saves time and increases the efficiency of the overall construction process.

The Process Flow of Erection "*Cadangan Membina Sebuah Bangunan Hangar 2 Tingkat (Part Task Trainer)*" on site.

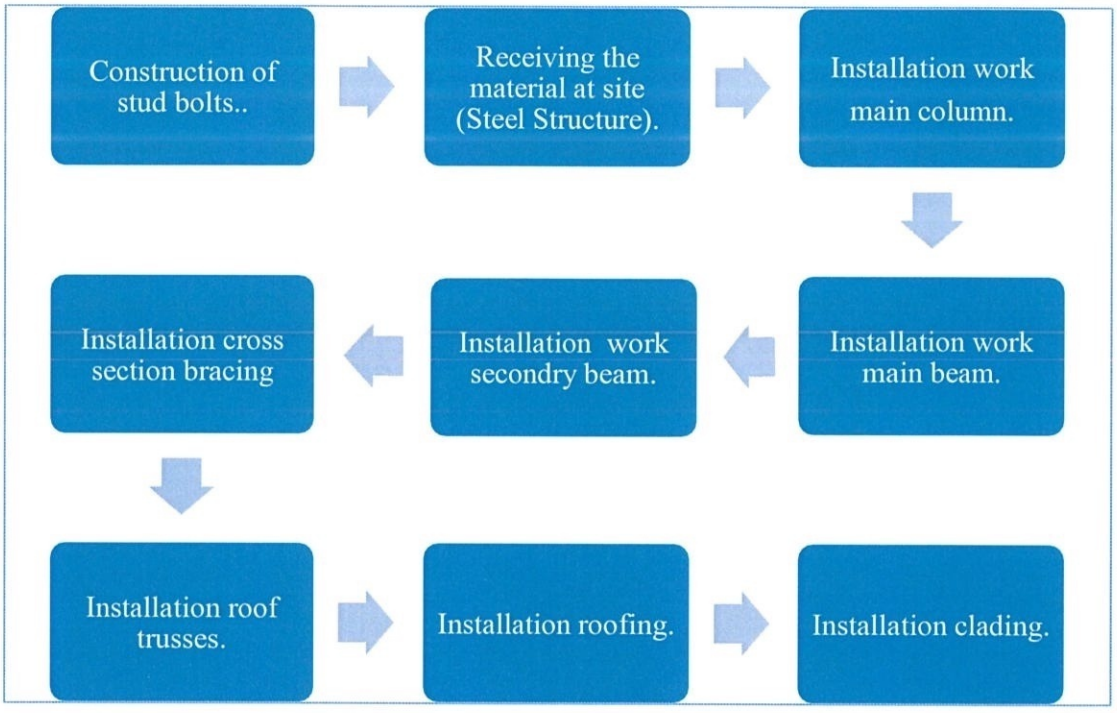

Figure 3.2: Shows the process flow of erection hangar.

For this case study, the focus will be on the method installation of column (I-beam) and beam due to process of construction is not very complex and heavy. The installation of column must be install stage by stage starting from point A to point C. After installation column finish at point A, beam will be install. The flow will repeated again at point B and Point C. This is because if we install all the 12 no's of column, the column cannot support the own self. The beams are support the column.

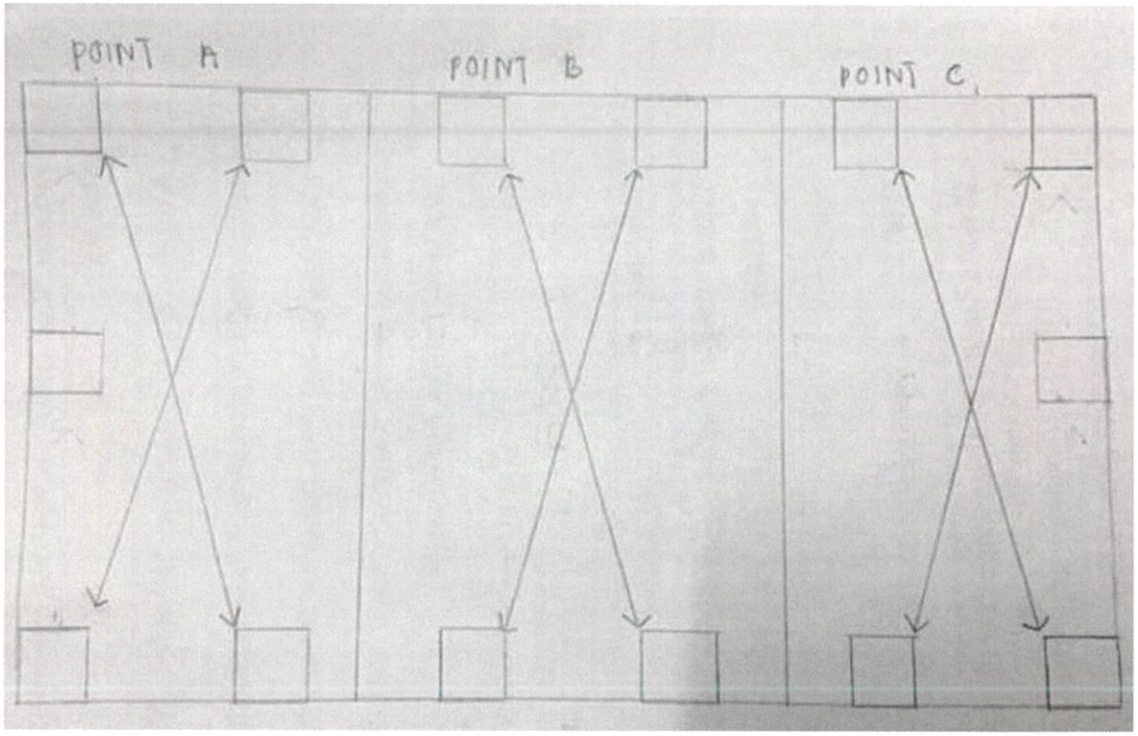

Photo 3.2: The sketching to install the column and beam.

3.1 Method Installation of holding down bolts.

The holding down bolts is 100% completely install during on first day intern. Holding down the bolts use T16. Every formwork must have 8 no's of holding down bolts. There are 12 no's of columns and expected to have 96 no's of holding down bolts.

Photo 3.3: Shows the ground slab completely finish.

Photo 3.4: Show the holding down bolts completely install.

3.2 Receiving the materials at site.

The steel structure is the main materials to install for the hangar. The materials are from Perkasa Teknik Enterprise, when the steel structure receiving at the site, the materials placing just on the site as photo 3.5. The mobile crane were lift up the materials when to install.

Photo 3.5: Shows the materials just placing on the site.

3.3 Method installation of column (I-beam)

An I-beam, also known as H-beam (for universal column, UC) is a beam with I or H-shaped cross-section. The horizontal elements of the "I" are known as flanges, while the vertical element is termed the "web". I-beams are usually made of structural steel and are used in construction and civil engineering.

The web resists shear forces, while the flanges resist most of the bending moment experienced by the beam. Beam theory shows that the I-shaped section is a very efficient form for carrying both bending and shear loads in the plane of the web. On the other hand, the cross-section has a reduced capacity in the transverse direction, and is also inefficient in carrying torsion, for which hollow structural sections are often preferred.

The installation of I-beams are started from the foundation. Foundation is one of the most important elements of erecting the steel building. The foundation started with work below lowest floor finish. The first step to install the column (I – beam) is when all the underground work below and ground work are complete and site ready to receive the material.

Photo 3.6: Shows the holding down rates are ready to receive materials.

The photo 3.6 shows the stud bolt are ready to receive I beam, the hole at the I-beam are ready to in-place in the stud bolt. The I-beam was lifting by using mobile crane due to the heavy material.

Photo 3.7: The I-beam are ready to install.

Besides, when the I-beam was in-place properly, the next step is to check the verticality as per specification and requirements using total station. Next, the temporary bracing was required to ensure the verticality of steel columns.

Photo 3.8: Using the total station to check the verticality and temporary bracing were installed.

Moreover, after check the verticality as per specification, the next step is to tighten the bolt and nut, but before that, install the washer screw, then install the nut and tight the nut using torque wrench spanner. A torque tool or wrench is useful equipment for tightening the nuts & bolts. Usually, these wrenches have handles that need a set force to be applied to the torque tool. After the torque is achieved, the device produces a click for fastening or tightening bolts.

The last step is, to check the diagonal of the I-beam (column) use laser measurement for check final verticality.

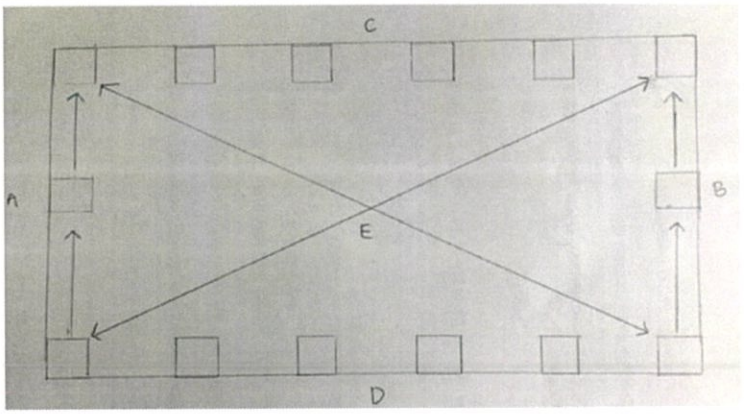

Photo 3.9: To check the diagonal.

The Laser Distance Meter sends a pulse of laser light to the target and measures the time it takes for the reflection to return. First check the verticality of Point A, Point B, Point C, Point D and the last one to check the accurate verticality as per specification is Point E. If the reading on the laser distance meter as per requirements, means the verticality of the column is good.

Photo 3.10: The all columns are completely install.

3.4 Method Installation of beams.

I. Primary beams

Primary Beam is a horizontal beam connecting columns (simply supported or shear connected.) and the function are will transfer the load from secondary beam to the columns.

There are various prefabricated beam sections are available to be used in the construction multi story steel frame structure. Beams commonly transfer loads from floors and roof to the columns. Steel beam members can span up to 18m, but the most usual range of steel beam spans rang from 3m to 9m.

The first method to install the beams are ensure all the columns (I-beams) are completely finish install, then lifting the beams by use mobile cranes due to heavy material.

Photo 3.11: The mobile cranes were lifting by mobile cranes.

Next, the signal man give instruction to the operator to place the beam and there are workers will in place the beams, if the verticality of the column (I- beam) are not exactly as per specification, it may be problem to install the beam, it is because the beams already cutting as per specification at fabrication yard. It may be problem to in-place the beams between the two columns. The installation of primary beams are using

tighten by bolt and nut. The beams and columns are already have hole to tighten by bolt and nut. The workers will install the bolt and nut through the hole and tighten by torque wrench spanner.

Photo 3.12: The workers are tighten the bolt and nut.

II. Secondary beam

Secondary Beam is a horizontal beam connecting primary beams. The Function is will transfer the load to the primary beam and not directly connected to the columns. In this construction, the secondary beam also using steel structure. After all the primary beams are install, the next step is to install secondary beams. The first method of install the secondary beam is the beam must be lifting using mobile cranes due to there are heavy material.

Photo 3.13: Shows the secondary beam was lifting by mobile crane.

After the secondary beams was in at the right place. The method to install the secondary beams are welded type. Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool causing fusion. Welding is distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal.

There are 4 popular types of welding procedure:

1) Shielded Metal Arc Welding (SMAW)

Shielded metal arc welding (SMAW), also known as manual metal arc welding (MMA or MMAW), flux shielded arc welding or informally as stick welding, is a manual arc welding process that uses a consumable electrode covered with a flux to lay the weld.

To strike the electric arc, the electrode is brought into contact with the work piece by a very light touch of the electrode to the base metal. The electrode is then pulled back slightly. This initiates the arc and thus the melting of the work piece and the consumable electrode, and causes droplets of the electrode to be passed from the electrode to the weld pool.

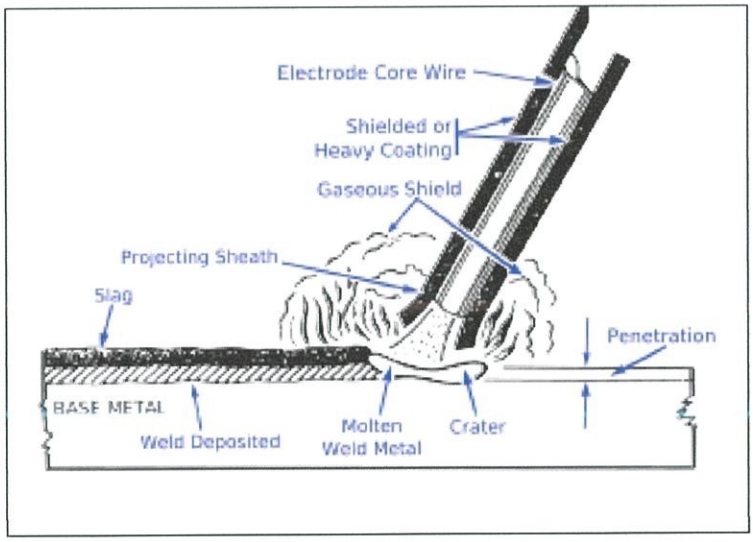

Figure 3.3: Shows the SMAW weld area.

Source: https://en.wikipedia.org/wiki/Shielded_metal_arc_welding

2) Flux Cored Arc Welding (FCAW)

Flux-cored arc welding (FCAW or FCA) is a semi-automatic or automatic arc welding process. FCAW requires a continuously-fed consumable tubular electrode containing a flux and a constant-voltage or, less commonly, a constant-current welding power supply. An externally supplied shielding gas is sometimes used, but often the flux itself is relied upon to generate the necessary protection from the atmosphere, producing both gaseous protection and liquid slag protecting the weld. The process is widely used in construction because of its high welding speed and portability.

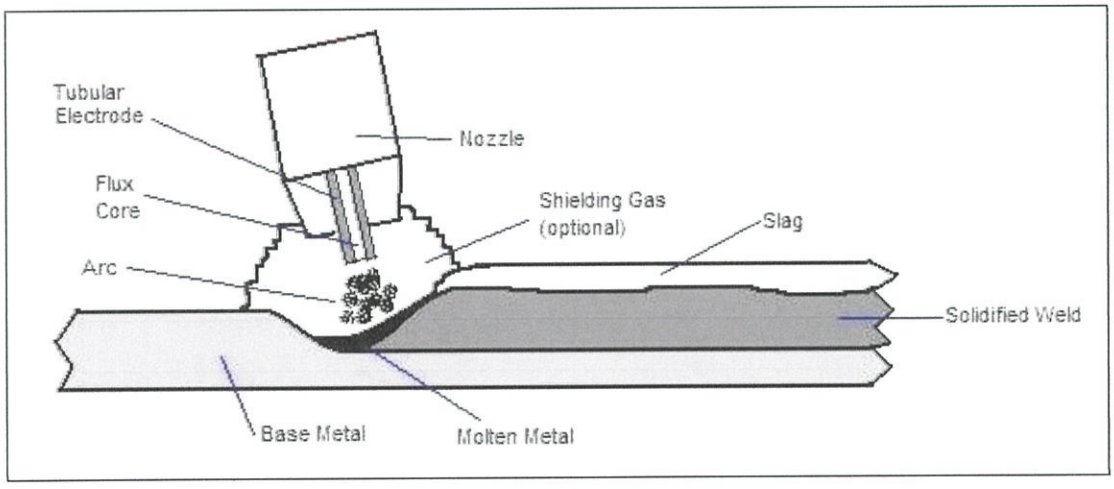

Figure 3.4: Shows a drawing of FCAW at the weld point.

Source: https://en.wikipedia.org/wiki/Flux-cored_arc_welding

3) Gas Metal Arc Welding (GMAW/MIG) This style of welding is also referred to as Metal Inert Gas (MIG).

Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas (MIG) welding or metal active gas (MAG) welding, is a welding process in which an electric arc forms between a consumable wire electrode and the work piece metal(s), which heats the work piece metal(s), causing them to melt and join. Along with the wire electrode, a shielding gas feeds through the welding gun, which shields the process from contaminants in the air.

The process can be semi-automatic or automatic. A constant voltage, direct current power source is most commonly used with GMAW, but constant current systems, as well as alternating current, can be used. There are four primary methods of metal transfer in GMAW, called globular, short circuiting, spray, and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations.

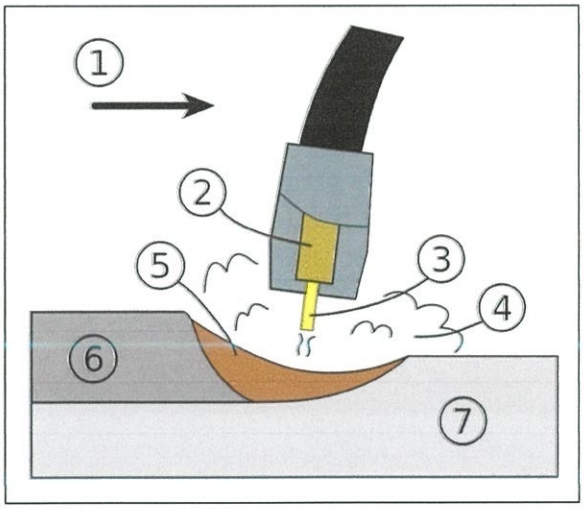

Figure 3.5: Show GMAW weld area.

Source: https://en.wikipedia.org/wiki/Gas_metal_arc_welding

(1) Direction of travel, **(2)** Contact tube, **(3)** Electrode, **(4)** Shielding gas, **(5)** Molten weld metal **(6)** Solidified weld metal, **(7)** Work piece

For this secondary beams, there are use Shielded Metal Arc Welding (SMAW) for the welding method and the fillet welding for jointed the secondary beams with primary beams. Fillet weld are the one method of welding joints.

Photo 3.14: Shows the workers were doing fillet weld.

Fillet welding refers to the process of joining two pieces of metal together whether they be perpendicular or at an angle. These welds are commonly referred to as Tee joints which are two pieces of metal perpendicular to each other or Lap joints which are two pieces of metal that overlap and are welded at the edges.

There are the advantages for welding joint:

1. As no hole is required for welding, hence no reduction of area. So structural members are more effective in taking the load.

2. Welded joints are more economical as less labor and less material is required.

3. The efficiency of welded joint is more than that of the riveted joint.

4. The speed of fabrication is faster in comparison with the riveted joints.

5. The alternation and addition to the existing structure is easy.

6. The welding process requires less work space in comparison to riveting.

7. Any space of joint can be made with ease.

After completely finish fillet welding works, a cleaning proper is a must because a material surface with dirt or impurities can lead to inclusions or issues such as porosity. Surface cleaning and preparation can also impact the appearance of the final weld as well as overall operation costs for rework and labor.

Photo 3.15: Shows the workers were cleaning process.

3.5 Problems that will occur during the construction works.

1) The diameter at the column base plate are not accurate.

The I-beam (column) are made at the fabrication yard. If the diameter of the hole are not same as per specifications and requirements that are the problems to in-place the I-beams in the stud bolt. The best suggestion for this problems is make a hole by using cutting torch. The diameter of hole on the base plate is must accurate as per specification.

2) Ensure the verticality of I-beams (columns)

To check the verticality of I-beams are using the laser measurement. The verticality of columns is important for the next step of erection the hangar. If the verticality of columns are not exactly as per specifications, there will be have problem when to install the beams. The beams are cut in the fabrication yard and refer the specification details and requirements. If there have many problems for the verticality of the column (I-beams), there have the problems of install the beam.

3) Safety of the workers

The workers did not use the Personnel Protective Equipment (PPE) when working at height during the installation of beam. Working at high have a high tendency to fatal or injuries. So the Site Safety Supervisor (SSS) are responsible to monitor or give out fine to them who are not using the PPE. Moreover, the SSS should remind the workers about the important of PPE during Tool Box Meeting.

CHAPTER 4.0

CONCLUSION

4.1 Conclusion

In conclusion, in this report a lot of information about erection of I-beams and beams for the hangar using steel structure. In addition, using steel structure will help an individual, company or team to create or build projects fast and efficiently. Furthermore, in the construction sector, given the time period is a very important in this sector, as it exhibits the integrity of a company. Even the action will not be imposed by the client if in a timely manner.

In addition, the production of prefabricated building structure such as, I-beam, beam, portal frame are enough help from a contractor to carry out the task of building quickly. This is supported, because the production of these materials no longer requires as in-situ concrete and wood to be used as formwork. Even spending during construction site can be minimized and wastage of cement and wood are no longer arise. Through this system, the installation of structural steel requires only cranes and a few labour only. Thus, it can save the budget and cost of project.

Finally, the most preferred in the preparation of this steel structure is the quality. If the production of a quality product structures, it will be able to produce a very strong building structure, and it will ensure the safety of user. The authors suggest the best quality is should be seriously considered for production of building structures to ensure the safety of consumers.

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