DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

ROOF CONSTRUCTION (MILD STEEL TRUSS) OF CAFETERIA AND STUDENT AFFAIRS BUILDING AT UNIVERSITY TUN HUSSEIN ONN MALAYSIA

Prepared by:

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DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

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It is recommended that the report of this practical training provided

by:

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Entitled

Roof Construction (Mild Steel Truss) of Cafeteria and Student Affairs Building at University Tun Hussein Onn Malaysia

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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 Rosha Dynamic 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 fulfilment of the requirements of obtaining the diploma in building.

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

Thank you so much.

ABSTRACT

Roof is part of building envelope. It is an important structure found in all types of buildings regardless of size and shape. Besides, it is an important element that has to be applied to protect the building occupants from hot and rainy weather, it also provides protection from animals and bad weathers. As noted, the using of wood trusses is widely used for generations before. With the growing construction technology on this time, there are other alternatives to replace wood truss that is widely use before with steel roof truss. Therefore, this study was undertaken to identify the types of component used in steel trussing system. It is also, to determine installation method of trusses and to identify the advantages and disadvantages of using steel truss compared to timber trusses. However, this report was conducted for the educational buidings at one lot in Uthm near Fakulti Kejuruteraan Awam Dan Alam Sekitar (FKAAS).

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CHAPTER 1.0

1.1 Introduction

Nowadays construction is the major sector in our country that is same level compared to developing country. Especially for the big cities as Kuala Lumpur, Johor Bahru, Shah Alam and others. Moreover, government also put a special focus on this sector because these sectors are smart investment to the country. Government had a plan to build many buildings or many infrastructures to make sure this country can be a competitor to others country. The government also put a high budget to this sector, to make sure our country can achieve the targets. Many buildings, facilities, highways are being plan and been construct.

As our country is developing towards advancements. Along with the advancement of today's technology, mass media, telephone and line, the construction industry is growing with its success. Many buildings are built either sky-scrapers buildings or other buildings. Today, so learning in this area has been spearheaded by many, but the construction application is bear or true as construction industry is reaching its advancement in technology, many newly built buildings integrated the construction to suit the needs of physical surroundings. Application in building is a very important role to keep the building long term.

Therefore, the adoption of new methods or materials in construction is an important thing to be in line with today's technological advances. So, the construction industry is not left behind in achieving developing countries. For example, the application of industrialized building system (IBS) like steel framing system. This system is mainly to the roof frame in the construction of roof. The installation of roof frame using mild steel trusses which is only use bolt & nut helps to facilitate and accelerate work so that it can be completed within the prescribed period since the period is only for 52 weeks to be completed. So basically, this system involving the use of components consisting of cold form and steel portal frame based as an alternative to the process

and materials manufacture. Along with the methods of installation that offers faster installation in site and the reduction of labour in comparison with other types of IBS.

1.2 Background and scope of study

This study was conducted to understand the methods of construction of a roof using mild steel trusses. This study focuses only on the construction of a roof in University Tun Hussein Onn Malaysia at *cadangan membina dan menyiapkan sebuah bangunan gunasama kegiatan pelajar dan cafeteria pusat di atas sebahagian ptd 21870; H.S.(D) 71254 mukim sri gading, daerah batu pahat, johor darul takzim.* However, this study aims to describe in detail the construction of roofing which using mild steel trusses.

1.3 Objectives

This report is prepared to provide the types of steel trusses used in the construction of the roofing. The objectives of conducting this study are:

- To identify the types of component used in the construction of roofing.
- To determine the methods of installation of trusses in the building.
- To identify the advantages and disadvantages of steel trusses.

1.4 Method of study

Many methods that use to complete this report and all of the method give some new knowledgeable in construction site:

I. References

Books are used to obtain information for all the specifications for executing any work that include in steel trusses. Besides, it aims is to find out regarding the construction about roofing and the components involved through relevant books, articles and thesis at Tunku Tun Aminah Library, UTHM. Books as well as a source of reference for all the information needed in further details.

II. Internet Sources

Internet is the most popular tools for finding information and facts. Information about trusses can be accessed more quickly than with other methods. The information in internet was used to support the actual trusses done on site. As we know internet can be accessed anywhere and everywhere today.

III. Observation

The next method applied is by observing visually and physically. The observation method is applied when there is no practical action required. Observation in advance, involving keep on eye the workmanship, the changes occurred, monitor the progress etc. To know how to construct roofing, observation of workers when they do that job is needed and asking them what we didn't know to ensure the problem.

IV. Interviews

Interview is the first and major method used to study the cases involved. Interview in fact increases theoretical knowledge directly of the exact situation. This method could embrace more than one party that involved in the construction, the site supervisor, project coordinator and the workers who work in a particular field itself. Hence, information obtained is sufficient where no technical information required. Interview had been done to several figures related on construction. Information obtained shall be kept for future abstraction.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of company

Rosha Dynamic Sdn Bhd started off from a humble beginning in a construction background. With the inception of its inception often engage in small projects before becoming active in the relatively large scope of the project. As time progresses Rosha's has steadily established a name for itself as a reliable general contractor in the construction industry.

Despite their emphasis on construction industrial facilities compared to other construction. Rosha's experience in the construction industry is enough to qualified themselves to venture into other construction works in the industry for example, ground improvement works. Moreover, the success of Rosha's lies on their strong support from material suppliers and with good financial standing. With financial stability, good track record coupled with its vast experience in construction industries makes Rosha's Dynamic one of the preferred contractors amongst its client.

With good market acceptance and good support from various parties and customers the company has remained intact since its inception. This is because the quality shown is comparable to the services offered and this is evidenced by the success of the Rosha's project that can be seen from previous projects.

2.2 Company profile

Figure 2.1: Logo's of company

Rosha Dynamic Sdn Bhd was incorporated on 26 July 2003 to capitalize on the growing property development industry. At the beginning of his establishment, Rosha became a sub-contractor with small-scale projects and engaged in large-scale projects. Initially, Rosha was built with the name Rosha Bina in 2001.

After the company began to grow rapidly within 2 years Rosha was upgraded with the name of Rosha's Dynamic Sdn Bhd. The company is a partnership company with 3 directors at the beginning namely En Shavarein, En Rosni and En Shahril. This company name is derived from the combination of the names of the three directors. Two of the 3 directors have left the company in 2004, En Shahril left the company and was followed by En Rosni in 2005. The company's organization has been re-updated by adding a number of directors as co-directors since July 2003.

Next, under the leadership of the current board of En Shavarein and Pn Azlina Sugang since July 2003, Rosha Dynamic Sdn Bhd has been an active participant in the industry and has grown from strength to strength to its present position.

2.3 Corporate information

Company Name	**ROSHA DYNAMIC SDN BHD**
Date of incorporation	26 July 2003
Company registration no.	623099-H
Shareholders	1. Shavarein Sulong 2. Norazlina Sugang 3. Sukiman Sulong 4. Mohd Syazwan Shavarein
Business address	No 11 A, Jalan Sejahtera 11, Taman Desa Skudai,81300 Skudai, Johor Darul Takzim.
Secretary	Sn Southern Management Services, No 31, Jalan Seri Impian 1, Taman Impian Emas, 81300 Skudai, Johor Darul Takzim.
Auditor	Ridzuan Johari&Co (Chartered Accountants) No.G-54,2-54 ,Jalan Pinang52, Taman Daya,81100, Johor Bahru, Johor Darul Takzim.
Bankers	Bank Muamalat Malaysia Berhad, Cawangan Kulai Malayan Banking Berhad(Maybank)
Company lawyer	Y.A MOHD No. S19-02B Tingkat 2, Jalan Tembusu, 81800 Ulu Tiram,Johor Bahru,Johor Darul Takzim.

Table 2.1: Corporate information

2.4 Organisation chart

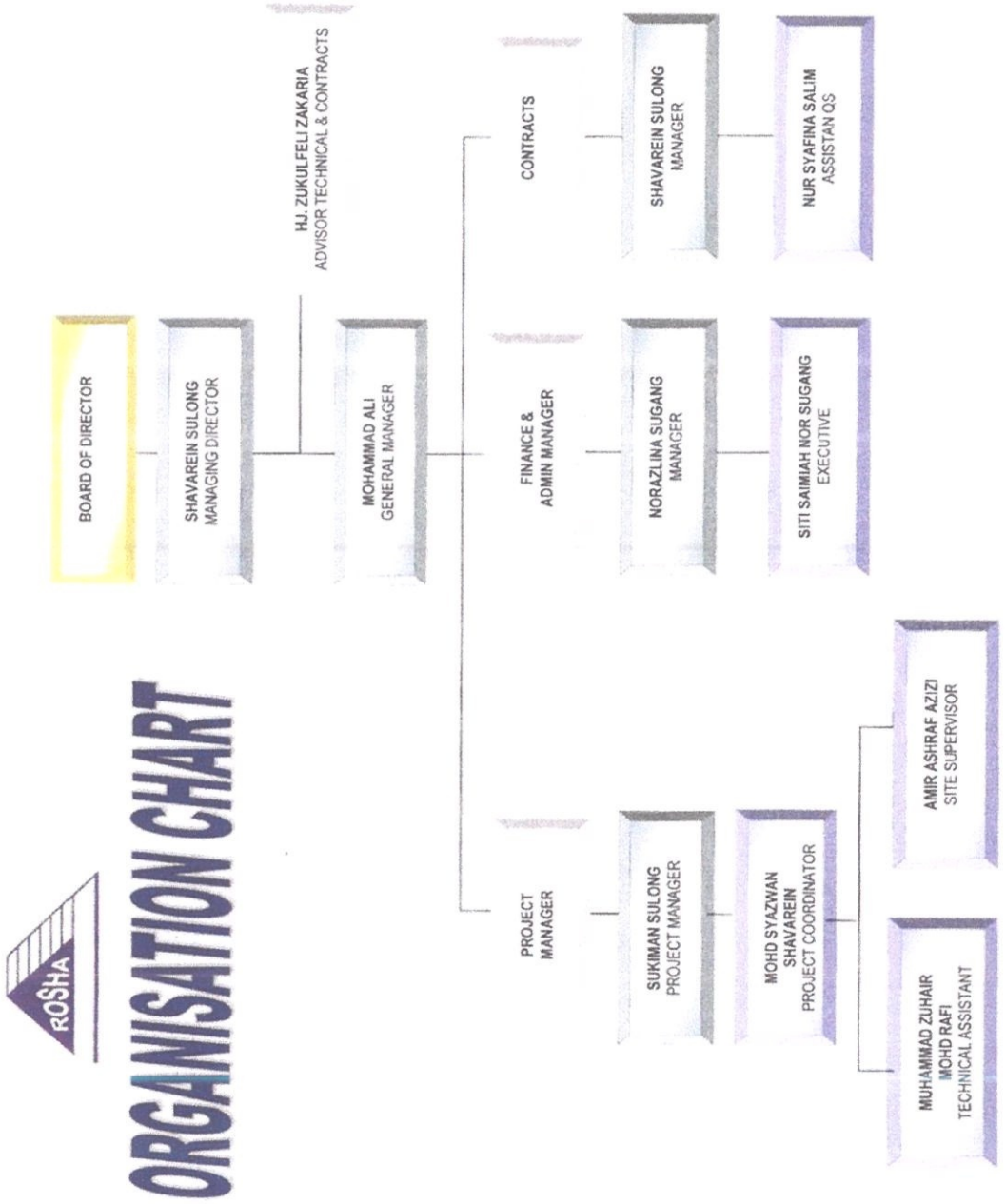


Chart 2.1: Organisational chart

2.5 Safety policy

ROSHA DYNAMIC SDN BHD is committed to conducting all aspect of its business and activities in an environmentally responsible, sustainable manner and to provide a safe and healthy workplace to all employees and persons under the control of this organization.

We will achieve this by:

- Comply with all applicable environmental, safety & health legal and other related requirements.
- Take measures to prevent environmental pollution, occupational injury and ill health at workplace for all employees and person under the control of the organisation.
- Continually improve environmental, safety & health of performance and management systems.
- Ensure competent employees and persons under the control of the organisation in the implementation of environmental, safety & health management systems.

and

- To hold each member of the management and staff accountable for the achievement of environmental, safety & health objectives.

2.6 Vision and mission of company

Vision

- To be the preferred contractor of choice. A company that our customers want to work with and our employees are proud to work for.
- To perform for our customer, the highest level of quality construction services at fair and market competitive prices.

Mission

- To deliver high-quality, cost-effective projects on schedule by employing and supporting motivated, flexible, and focused teams.
- To maintain the highest levels of professionalism, integrity, honesty and fairness in our relationships with our suppliers, subcontractors, professional associates and customers.
- To expand into new areas or construction project that differs from usual, for instance various industrial, distribution, manufacturing, office, retail, recreational, healthcare and commercial projects.

2.7 Company's location

Figure 2.2: Location Plan

Figure 2.3: 3D view of company location plan

Figure 2.4: Front view of company

2.8 Financial resources and credit facilities for building materials & machinery.

NO'S	SUPPLIERS	MATERIALS &MACHINERY	CREDIT LIMITED (RM)
1	Ipmuda Selatan Sdn Bhd	Building Material	1,000,000.00
2	Swee Premix (Johor) Sdn Bhd	Premix & Aggregates (Deed of Assignment With JKR)	3,000,000.00
3	Teleraise Corporation Sdn Bhd	Building Material/Quarry Product	500,000.00
4	Hanson Quarry Sdn Bhd	Quarry Product, Premix and Aggregates	500,000.00
5	Dyson Enterprise Sdn Bhd	Plumbing Material	100,000.00
6	Lien Hoe Sdn Bhd	Building Sterial /Timber	200,000.00
7	Best Light Sdn Bhd	Electrical Fittings	100,000.00
8	Super Crane Sdn Bhd	Heavy Machineries	100,000.00
9	Govinji Construction	Road Machineries	200,000.00
10	Oka Concrete Products Sdn Bhd	Concrete Products	200,000.00
11	Global Aluminium &Glass	Aluminium & Glass Products	100,000.00
12	Hormat Mulia Sdn Bhd	Road Furniture	100,000.00
13	Hanson Building Materials Malaysia Sdn Bhd	Ready Mixed Concrete & Concrete Products	80,000.00
14	Steco Sdn Bhd	Genset & Pump	50,000.00
15	Plentong Granite Industries Sdn Bhd	Quarry Product	50,000.00
16	Paint Marketing Co (M) Sdn Bhd	Paint	20,000.00

Table 2.2: Financial resources

2.9 List of projects

2.9.1 Completed project (2017)

NO	PROJECT	DATE	VALUE
1	Cadangan Membina Masjid Bandar Sri Alam, Jalan Tasek, Pasir Gudang, Johor Bahru,Johor.	15.01.2017	RM 6,448,612.00
2	Cadangan Ubahan & Ubahsuai Ke Atas Seunit Kilang 1-Di Atas Lot No.8, Jalan Kempas 5/2, mukim Tebrau, Daerah Johor Bahru,Johor.	8.05.2017	RM 1,157,229.40
3	Cadangan Membina Dan Menyiapkan 1 Unit Pondok Pengawal Dan Pagar Di Kawasan Perindustrian Zon 12 B (Fasa2) Pasir Gudang,Johor Darul Takzim.	14.02.2017	RM 679,118.68
4	Nominated Sub-Contractor for Landscaping Works for Cadangan Membina Satu Blok Hospital Pakar Antarabangsa Swasta 9 Tingkat (150 Katil) Di Atas Sebahagian Lot Ptd 163180, Johor Bahru, Johor Darul Takzim Untuk Tetuan Bandar Dato' Onn Specialist Hospital Sdn Bhd. Nominated Sub-Contractor for Perimeter Fencing and Entrance Gate.	3.12.2017	RM 507,770.00
5	Cadangan Kerja-Kerja Landskap Bagi Cadangan Menyiapkan Kerja-Kerja Tertangguh Sekolah Menengah Vokasional Di Atas Lot 3497, Pagoh, Johor Darul Takzim.	3.12.2017	RM 114,090.00

Table 2.3: Completed project

2.9.2 Project in progress

NO	PROJECT	DATE	VALUE
1	Cadangan Membina Dan Menyiapkan Sebuah Bangunan Gunasama Kegiatan Pelajar Dan Cafeteria Pusat Di Atas Sebahagian Ptd 21870 H.S(D) 71254, mukim Sri Gading,Daerah Batu Pahat, Johor Darul Takzim Untuk University Tun Hussein Onn Malaysia.	Start 24.12.2018 End 26.12.2018	RM 7,203,804.94
2	Cadangan Menaiktaraf Jalan Utama Gelang Patah –Ulu Choh (J7) Sepanjang 2.15km Di Taman Nusantara, Gelang Patah, Johor Darul Takzim.	Start 15.12.2018 End 15.12.2019	RM 6,727,608.00
3	Menggantikan Jambatan Sedia Ada Di Laluan FT005 Batu Pahat N0 FT005.146.70 Jambatan Parit Nibong.	Start 24.4.2018 End 24.4.2020	RM 6,703,208.00
4	Ground Improvement Works for PMU 275/132KV Ujong Pasir, Melaka.	Start 27.8.2018 End 27.8.2019	RM 9,750,000.00
5	Ground Improvement Worls for PMU 132/33KV Vallambrosa, Meru, Selangor.	Start 30.3.2018 End 30.3.2019	RM 5,200,000.00

Table 2.4: Ongoing project

CHAPTER 3.0

CASE STUDY

3.1 Introduction to case study

This practical report will be based on the contract document of "*Cadangan Membina dan Menyiapkan Sebuah Bangunan Gunasama Kegiatan Pelajar dan Kafeteria Pusat Di Atas Sebahagian PTD 21870; H.S(D) 71254 Mukim Sri Gading, Daerah Batu Pahat, Johor Darul Takzim.*" The total of construction project cost was Ringgit Malaysia seven million two hundred and three thousand eight hundred and ninety-four cents (RM 7,203,804.94). The price stated is plus with goods and services tax (GST). For the duration of project is about 52 weeks and shall be completed on 24th December 2018 and the clients give an extension of time until end of February before the buildings is hand over to them.

In the process of completion, there are a group of persons in charge involved directly in the success of this building consist of the Site Supervisor, Project Coordinator, Safety Supervisor, Civil & Structures consultant and Mechanical & Electrical consultant at the site office. Their cooperation towards the progress either monthly or weekly of this construction project. Moreover, there are other parties also involved consist of contractors, sub-contractors, clients and consultant. For instance, a row of quantity surveyors and architects.

Figure 3.1: Project signboard

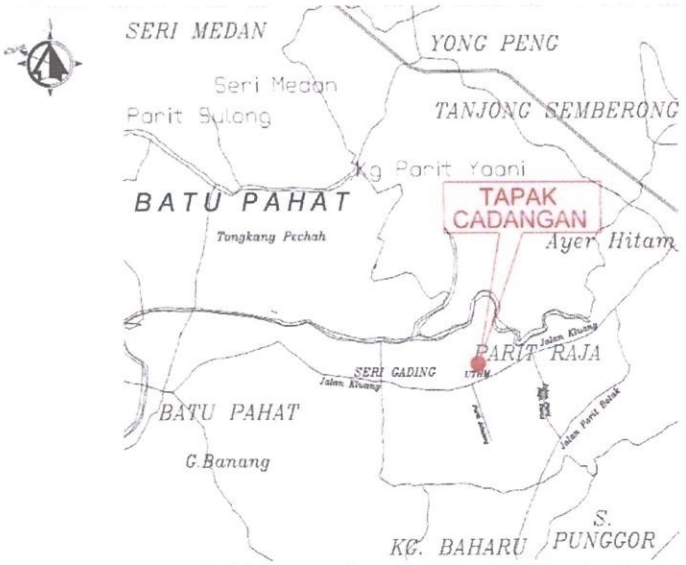


Figure 3.2: Key plan of project

This project built a one storey building students affairs, a two storey of cafeteria building and student club room, and another three services building which is bin house, fire water tank & VRV room, and generator room. In order to make the services in these educational buildings went smooth.

However, this report will focus on the constructions of roofing out of all the superstructure construction. The types of roof structure that used a steel structures are an attractive value been applied through the educational buildings included the services building. From the first process to the last process required less workers, less machineries and fast completion whereby the weekly target can be achieved successfully as a scheduled.

3.1.1 Project particulars

Figure 3.3: Site

Project title	Cadangan Membina Dan Menyiapkan Sebuah Bangunan Gunasama Kegiatan Pelajar Dan Cafeteria Pusat Di Atas Sebahagian Ptd 21870: H.S(D) 71254, Mukim Seri Gading, Daerah Batu Pahat, Johor Untuk Uthm
Client's name	UTHM
Contractor name	Rosha Dynamic Sdn Bhd
Contract price (GST)	RM 7,203,804.94
Date	26.12.2017 – 24.12.2018
Contract period	52 weeks
Tender number	UTHM(K) 05/005/2017 (8)

Table 3.1: Project particulars

3.1.2 Definition of roof

The roof is the top the top most structure of the building structure flat and steep. The structure of the roof is constructed of wood, steel or concrete to bear the self-loads, roof cover loads and wind loads. The roof also plays an important role in the structure of a house apart from being a protector of hot and rainy weather, it also provides protection from animals and bad weathers.

There are many types of roof with various advantages and disadvantages. Each serves a purpose and each one is designed to keep the inside of the house warm in the winter and cool in the summer. The roof is designed to keep the house free of moisture whether rain. For example, in the rainy weather drainage factors have to be taken seriously as the main purpose of a roof is to protect the inside of a building. This is done by draining the water from the roof, then the water goes onto the ground or into the storm sewer.

However, all types of roofs have the same functionality. It needs to be built to meet the desired requirements and functions such as stability, strength, resistance, weather resistance, fire, thermal insulation properties and the shape of the building itself. Basically, the roof is made of a rafter and usually supported by ceiling joist. When all braces and shapes are united, they form a roof. In some cases, the roof should be supported by more than the outer wall. This means there are more roof components involved in the construction of various roof shapes.

In the construction of roof, there are others factor to be considered as the roof selection factor. For example, the size of the building, the shape of the building, aesthetic value and the economy. For the process and the way of construction, in the present there is a conventional and prefabricated way.

3.1.3 Types of roof on site

At the site of construction, there are two educational buildings namely the cafeteria and student's affairs building (HEPA) and three services buildings to support the educational buildings service being constructed namely bin house, VRV room & fire water tank and generator room. All the buildings are built with the same roof. The type of roof being built is a shed roof. Shed roof is the most commonly used in the construction of roofing as it is a roof which having only one sloping plane, no hips, ridges or valleys. It is also known as lean to roof due to its shape. If viewed from the top corner, the roof looks like a flat roof. but from the other side, it's obviously a little different.

For the materials of roof construction, the roof is constructed using steel structures. The steel used is of the type of mild steel trusses. First, the mild steel trusses are being fabricated at the factory which include some of the process which is welding, anti-rust paint and then for the finishing. Besides, this preparatory method that applied industrialized building system (IBS) in the construction of roofing are the prefabricated technique that has been used long time ago.

The construction of roofing which used steel structures has been identified as one of the parts of IBS which is under the steel framing system. This system is mainly to the roof frame is so used in the construction of high-rise buildings and are commonly used with panels of precast concrete slabs and walls in the structure with the fast. This system involving the use of components consisting of cold form and steel portal frame based as an alternative to the process and materials manufacture. That offers faster installation in site and the reduction of labor in comparison with other types of IBS.

3.2 The components of roof

3.2.1 Components of roof truss

1. Rafter

A rafter is a structural component that is used as part of a roof construction. Rafters are generally laid in series, side by side, providing a base to support roof decks, roof coverings and so on. On site, there are types of rafter with different length for example truss T1 for lower roof at cafeteria is 16.0m and for truss T1 for lower roof at HEPA is 14.5m. For the upper roof there are 3 types of rafter which called truss T 2, truss T 2A, truss T 3. The connection method for rafter is by using bolts and nuts.

Figure 3.4: Rafter

2. Purlin (C- Channel)

Purlins are horizontal beams that are used for structural support in buildings. It is a major components of roof structures. Purlins are being supported by rafters and then roof deck is being laid over the purlins. The materials of purlins are from steel roof purlins because it offers durability and cost that low. The length of purlins is 1.2m centre to centre. All length are uniform either on HEPA block or cafeteria.

The materials of purlin on site is:

- C-channel: The shape of these types of purlins is that of a square 'C'. C-channel are used as purlins over the rafters.

Figure 3.5: Purlin

3. Anti-sag rod

Anti-sag rod is a component that aims to prevent the purlin from falling or slipping from rafters. Anti-sag rod is being installed in between the purlin to another purlin in a parallel way.

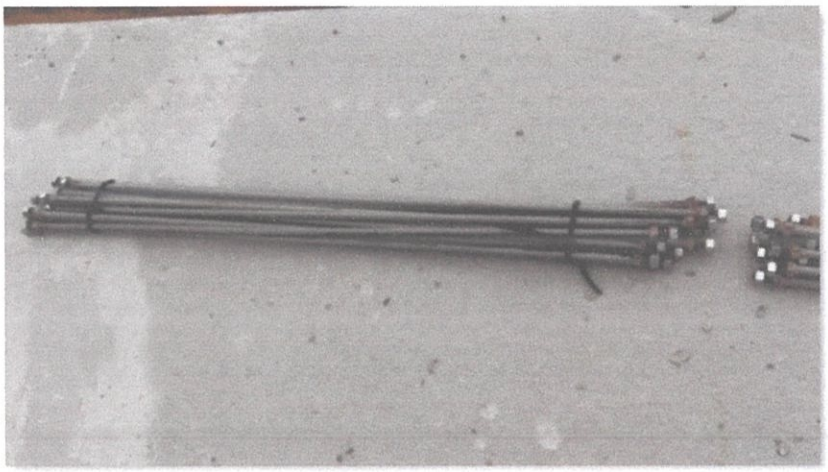


Figure 3.6 Anti-Sag Rod

4. Web

The web member is a component located in the entire truss. It is a member who joints the top chord and the bottom chord. The function of web members is to support the overall truss from any failure. In addition, web members are members who break down or distribute loads such as wind loads to avoid structural failure.

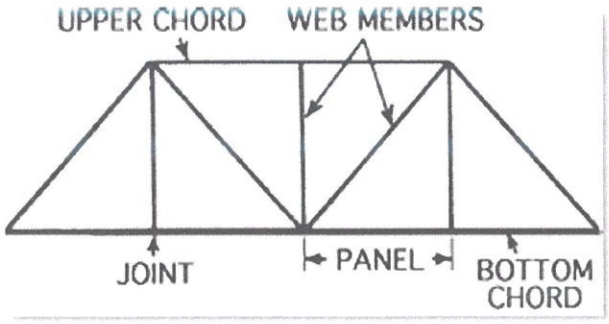


Figure 3.7: Web members

Sources: https://encyclopedia2.thefreedictionary.com/web+members

Figure 3.8: Web members in a steel trusses

3.2.2 Components of roof covering

1. Aluminium foil

Aluminium foil is ideal for the economical efficient insulations of roof. This is because, aluminium foil is a good thermal insulator that reflects radiation heat due to its low emissivity. Thus, the application of aluminium foil is the important thing to prevent from direct sunlight. So aluminium foil protecting as a radiant barrier from direct sunlight and to keeps the buildings cool. Aluminium foil is being applied for the first layer before the wool blanket lay.

Figure 3.9: Aluminium foil being lay on the ground

2. Glass fibre wool (eco wool)

Wool blanket act as an insulator too, it is a specifically designed glass mineral wool for many purposes such as fire safety, thermal and acoustical insulation. Besides, it is soundproof as the sound transmitted for example when rain. Glass fibre wool are being applied as a second layer after aluminium foil.

Figure 3.10: Glass fibre wool

3. Metal deck

Metal deck is a sheet of thin that covers the upper most of overall roofing, it has many materials that can be used as a deck whether it is an aluminium, zinc and many. The types of deck being used on site is from brand AJIYA. It is a clip lock metal deck which it's the easiest way to install the roof.

Figure 3.11: Front of metal deck

Figure 3.12: Back of metal deck

3.2.3 Components of roof plumbing

1. Gutter and bracket gutter

Gutter is a component of water discharge system for building. It is located at the edge of the corner which according to the steepness of the roof and running water. It holds rainwater first before being released into the downpipe rainwater. The materials used is usually from PVC, because its effectiveness and low costs compared to others material like metal. For the bracket gutter, its function is to hold the gutter.

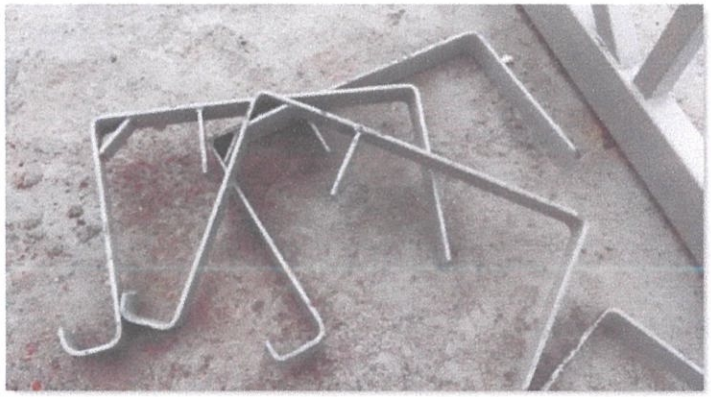


Figure 3.13: Bracket gutter

Figure 3.14: Gutter on roof

2. Rainwater downpipe

Rainwater downpipe is a pipe that is used to direct rainwater away from a building, typically from roof guttering to a drainage system. A downpipe is typically vertical and extends to ground level. They are most commonly found attached to the corners of a building.

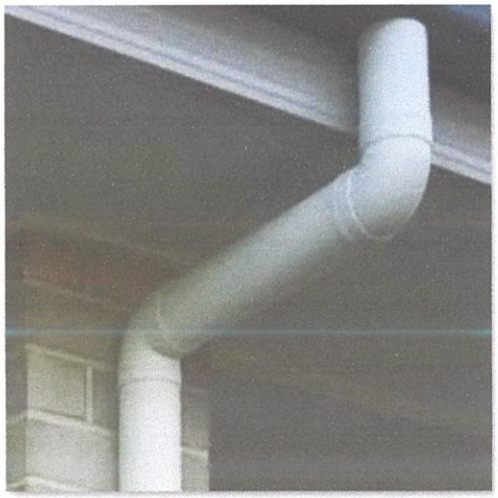


Figure 3.15: Rainwater downpipe

3.2.4 Components of roof finishes

1. Cement board

Cement board is being used on the exterior of buildings as a roof finishes, it been used at the front of roof, to cover from rainy, to prevent from bird and wind, and more to avoid seeing a roof like structural section like trusses. Cement board can be nailed or screwed to wood or steel studs. But on site, cement board is being screwed on trusses. The size of cement board is 4x8 and on site being cut to required size.

Figure 3.16: Sample of cement board

Figure 3.17: Cement board attached to trusses

2. Metal strip ceiling

Same as cement board, strip ceiling gives an aesthetic value on roof. Besides, it helps to facilitate maintenance works easily in the future. Strip ceiling is connected to the trusses by screwing to the purlins.

Figure 3.18: Sample of metal strip ceiling

Figure 3.19: Strip ceiling attached to trusses

3. Flashing

Flashing is a sheet of thin, impervious material used to prevent water penetration or seepage into a building and to direct the flow of moisture in walls. The types of flashing used is exposed flashings. This flashing are partially exposed to the outside and usually made of a sheet metal, flashing has to be engineered and installed with care so that water is deflected away from the building. Improper installation can result in water being directed into a building.

Figure 3.20: Flashing

4. Fascia Board

Fascia is the trim right below the roof that runs the perimeter of a structure to help keep water from running into the structure. Besides, the functions of fascia are giving aesthetic value.

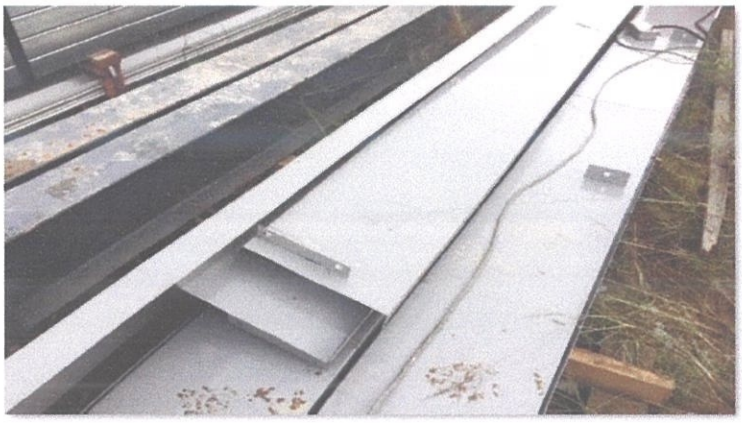
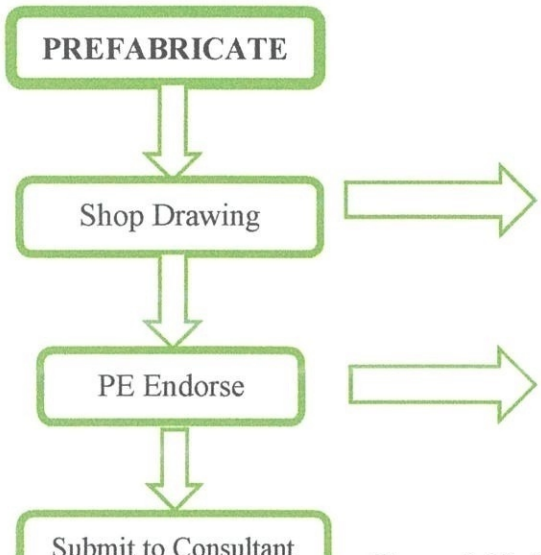


Figure 3.21: Fascia board on site

3.3 Methods of Installation of Roofing

3.3.1 Prefabricated & Fabrication Process



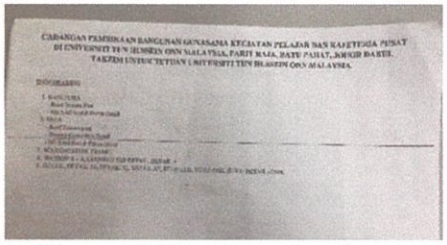


Figure 3.22: Shop drawing

Figure 3.23: Professional engineer endorsement

Figure 3.24: Measuring the steel

Figure 3.25: Hollow steel

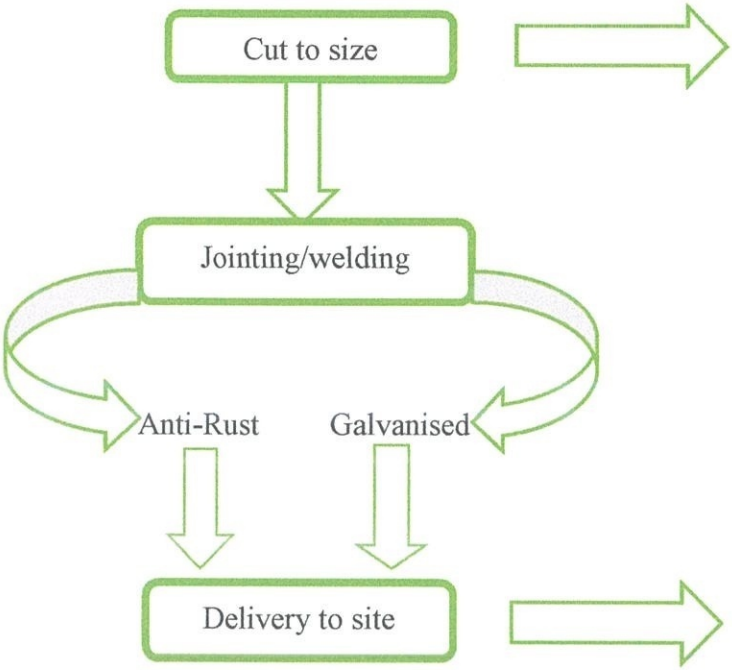


Figure 3.26: Cutting machine

Figure 3.27: Delivery to site

Chart 3.1: Flow chart of prefabricated & fabricated process

3.3.2 The method of jointing the trusses

1. Welding

This type of jointing is being used whether on site or in factory. Welding is a fabrication process that joints materials usually metals. Welding is the process of joining metal parts by using and filling in with molten metal from electrode. Welding produce neat, strong and more efficient joints.

Figure 3.28: Welding on site

2. Bolts and nuts

This method of jointing is being used as the connector for trusses to another trusses, purlin, anti-sag rod, fascia and others component. When doing any measure infrastructure installation such as construction of a building, bridges or railway. Besides bolts and nuts helps to easier inspection, easier replacement of parts in much faster way of doing maintenance.

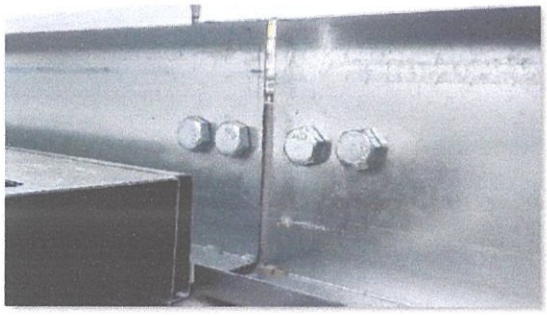


Figure 3.29: Bolts and nuts

3.3.3 Types of machineries

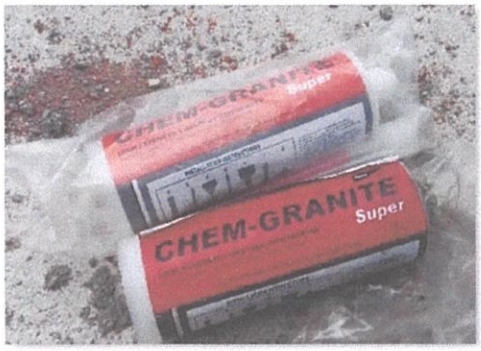
NO	EQUIPMENT NAME	PICTURE
1	Rod welding machine	 **Figure 3.30:** Rod welding machine
2	Cutting machine	 **Figure 3.31:** Cutting machine
3	Lorry	 **Figure 3.32:** Lorry

4	Mobile crane	 **Figure 3.33:** Mobile Crane

Table 3.2: Types of machineries

3.3.3.1 Types of tools and equipment

NO	EQUIPMENT NAME	PICTURE
1	Measuring tape	 **Figure 3.34:** Measuring tape
2	Grinder machine	 **Figure 3.35:** Grinder machine

3	Chem-granite glue	 **Figure 3.36:** Chem-granite glue
4	Hand drill machine	 **Figure 3.37:** Hand drill
5	Hammer	 **Figure 3.38:** Hammer
6	Pump	 **Figure 3.39:** Pump

7	Thread	 **Figure 3.40:** thread
8	Plyer	 **Figure 3.41:** plyer
9	Spana rachet	 **Figure 3.42:** Spana rachet
10	Metal chisel	 **Figure 3.43:** Metal chisel

11	Bolts and nuts	 **Figure 3.44:** Bolts and nuts
12	Washer	 **Figure 3.45:** Washer
13	Screw	 **Figure 3.46:** Screw
14	Anti-rust paint	 **Figure 3.47:** Anti-rust paint

15	Rod	 **Figure 3.48:** Rod for welding

Table 3.3: Types of tools and equipment

3.3.4 Procedures

Roof truss installation

Step 1: Mark the centre line of all roof beam where the trusses will sit on.

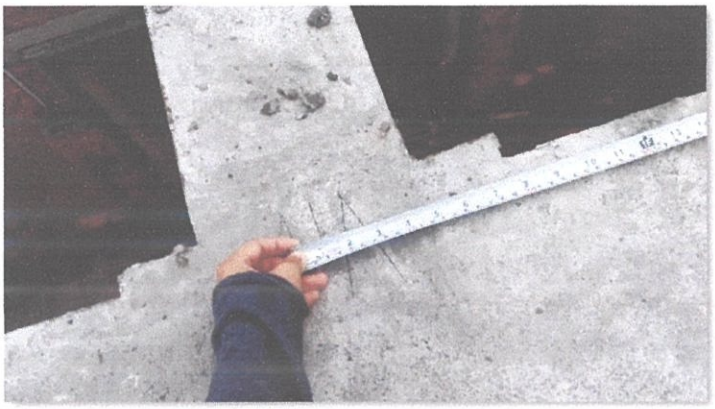


Figure 3.49: Measuring and marking

Step 2: Lift and hoist the trusses T1 and place it on the marked centre line of roof beam

Figure 3.50: Lifting trusses

Figure 3.51: Placing T1 trusses

Step 3: Lift and hoist truss T1 A and attached it across to trusses T1 using bolts and nuts.

Figure 3.52: Truss T1 A

Step 4: Next, lift and hoist truss T1 B to T1 and secure it using bolts and nuts.

Figure 3.53: Truss T1 B

Step 5: Repeat the processed until all trusses in completed formation.

Figure 3.54: Repeating the process

Step 6: After completion of the roof truss formation, tie a guide thread at the first T1 truss to the last T1 truss to ensure the roof truss formation is straight and inline.

Figure 3.55: Guide thread

Step 7: Make a hole on the roof concrete structure using hand drill machine. Remove fine dust from the hole using a pump to prevent loose bolt.

Figure 3.56: Drilling

Figure 3.57: Remove fine dust

Step 8: Fill the hole with chem-granite glue and insert the bolt.

Figure 3.58: Insert

Figure 3.59: Secure bolt

Step 9: Adjust the trusses to required level by adding washer under the trusses.

Figure 3.60: Insert washer

Step 10: Tie a thread and install fascia board to roof trusses by following the thread line as a guide to make sure the fascia is straight. Secure it using bolt and nut.

Figure 3.61: Installation of fascia

Step 11: Install purlin to truss t1 using bolts and nuts. Install anti-sag rod to prevent the purlin from sagging.

Figure 3.62: Purlin installation

Roof Covering Installation

12. Lay aluminium foil followed by glass fibre (Eco wool blanket)

Figure 3.63: Lay the aluminium foil and glass fibre

Step 13: Install metal deck clip by screwing it down to purlin through the glass fibre.

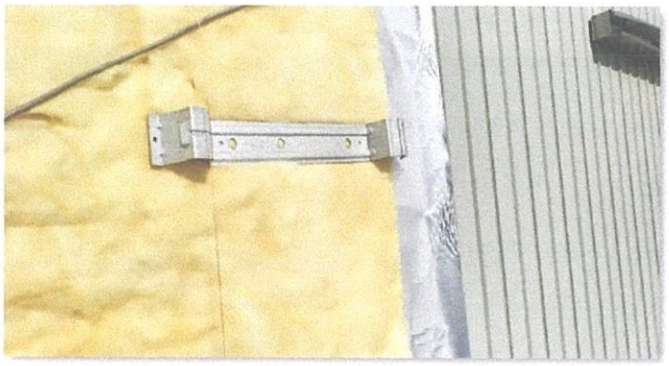


Figure 3.64: Clipping the wool with aluminium foil

Step 14: Lastly, install metal deck by pressing it down to lock the clip and install flashing to prevent rainwater from entering the roof.

Figure 3.65: Metal deck installation

Figure 3.66: Flashing installation

Figure 3.67: Finished installation

3.4 The advantages and disadvantages of using steel trusses in the construction of roof.

3.4.1 Advantages of using steel trusses

1. Long Lasting

Steel roof trusses are usually more expensive than wooden trusses, but they do last a lot longer than timber and require very little maintenance. Unlike timber trusses they have to be protect by applying pest resistance. Steel trusses are long lasting due to its durability and strong than other trusses.

2. Faster construction times

By using steel, the duration or time to be completed is faster than using other trusses. This is because, the trusses and all of the components are precast from factory so that the connection method is just using bolts and nuts. Thus, the target or the progress can be achieved as scheduled.

3. It is uniform.

Steel trusses are completely true to form because they are pre-fabricated in factories with quality control. Therefore, the trusses that arrive at the site are constructed exactly as designed. Steel trusses are uniform because in the manufacturing process, it is being cut by following the specifications required. Thus, the complete formation of trusses can be seen as perfect formation.

4. Fire-resistant.

As we know, steel is resistance towards fire. It is because, a steel structural member is expected to have fire resistance to prevent any structural failure for a determined period of time to give the building occupants time to escape. Moreover, if the steel members do not have any protection, the building is considered as less function.

3.4.2 Disadvantages of using steel roof trusses.

1. Vulnerability to corrosion.

Steel trusses are more likely to corrosion as it exposed to wind, sunlight and water. This is because, the components of trusses are overall made from steel so the probability to being rust is high.

2. Steel is emissive

The characteristics of steel is reflecting. This is because, steel reflect the light, heat and radiant direct from sun.

3. Steel roof trusses allow sound to be more easily transmitted.

As a result, when it comes to rainy day or when there is a strong wind the sound can be heard easily. Although the roof has applied roof covering such as aluminium foil and glass fibre wool.

4. Specialized skills required.

For the installation of trusses, it required a skills worker to erect and construct them as per manufacturer's instructions. As a result, lack of the proper skills or tools can result in either poorly installed trusses or increased labour costs.

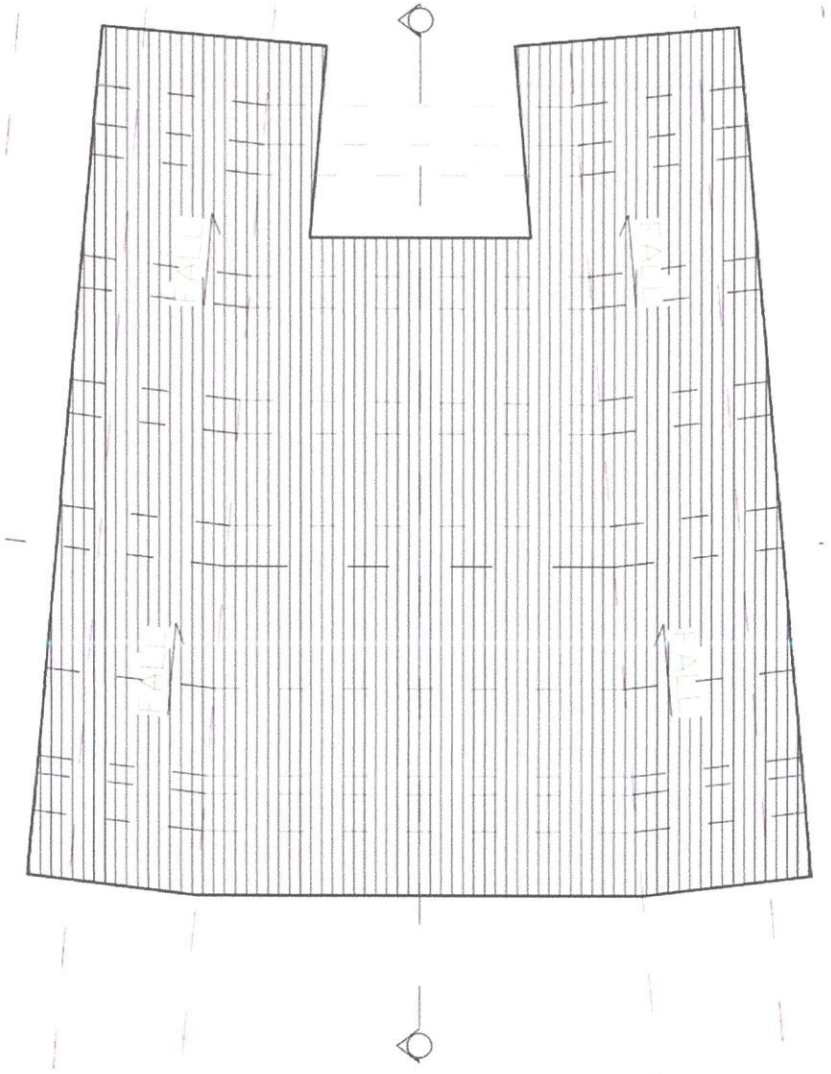
CHAPTER 4.0

PROBLEMS AND SOLUTIONS

4.1 Problems in the construction of roof.

1. There was a slight change in the metal deck arrangement due to rainwater drainage factors. Rainwater drops with a considerable amount during the rainy season resulting in many runoffs falling to the ground.

Figure 4.1: Upper roof deck problems



Sources: Autocad drawing

4.2 Solutions

2. After an agreement between the client, subcontractors, the consultant and the contractor, the metal deck arrangement is changed to the middle to put the gutters, then the rainwater runs will drop from the metal deck to the gutter and go to rainwater downpipe.

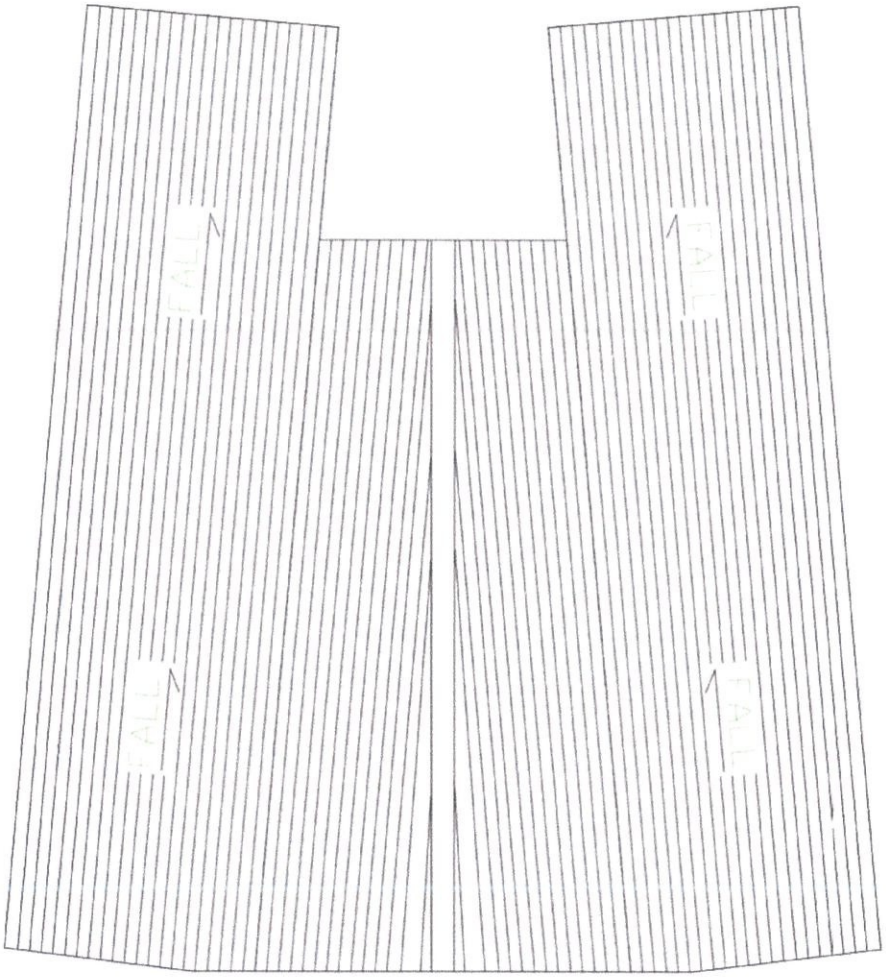


Figure 4.2: Upper roof after solution

Sources: Autocad drawing

CHAPTER 5.0

CONCLUSION

Construction industry is an industry is largest and important for development for our country. This industry already contributes a lot of income to country. It can be clearly seen with the existence of all over the construction project located throughout country. Country development depends fully to this construction industry. With these industrial development citizens get various benefits including comforts of life and unlimited jobs offer that mainly giving newly graduates the opportunity to live their life. Individual will also more successful with their involvement in this industry. Thus, construction is the important element in country.

This report has explained a little bit about construction of roofing using steel trusses which is mild steel trusses. This report had been made by observation on site visit, the observation on construction site at UTHM. From the observation that had been learned is about the components of roofing, the method installation and the advantages and disadvantages regarding the roofing. The roofing construction that had been observe is the installation of roof truss, roof covering and roof finishes. During construction of the roof include the problem on how to comply the arrangement of metal deck with the drainage factor as the upper roof of whole roof is the main problem. This problem is happened when the rainwater falls in biggest amount the quantity of water fall can cause flood and many else problems.

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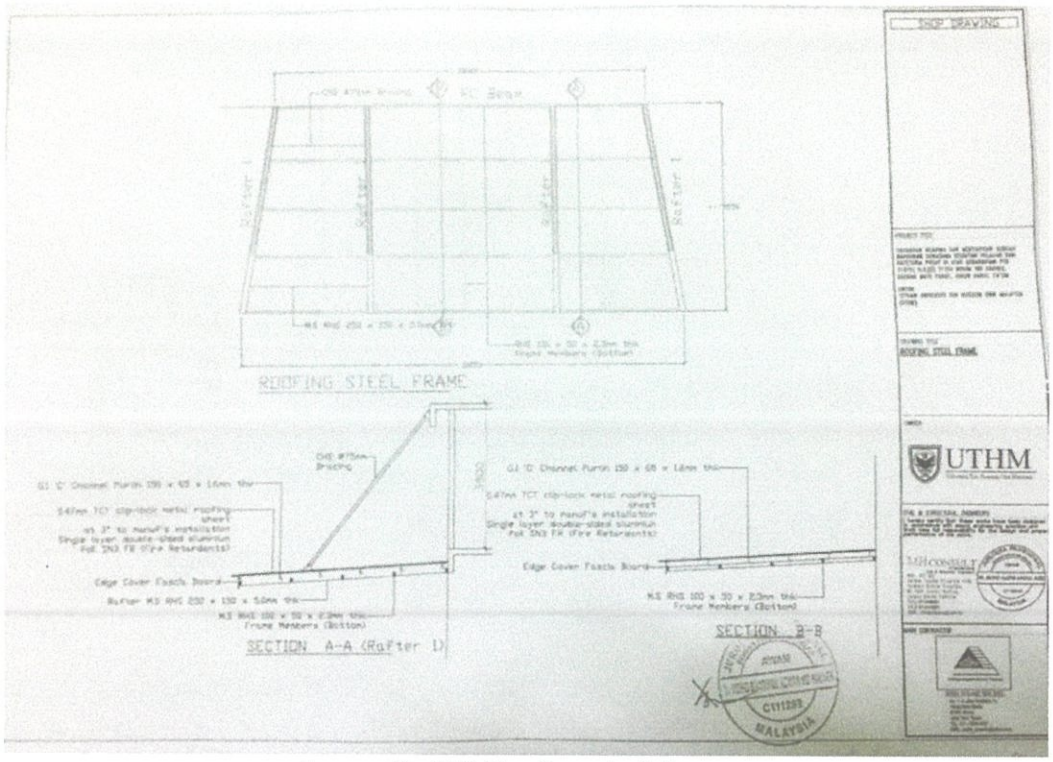
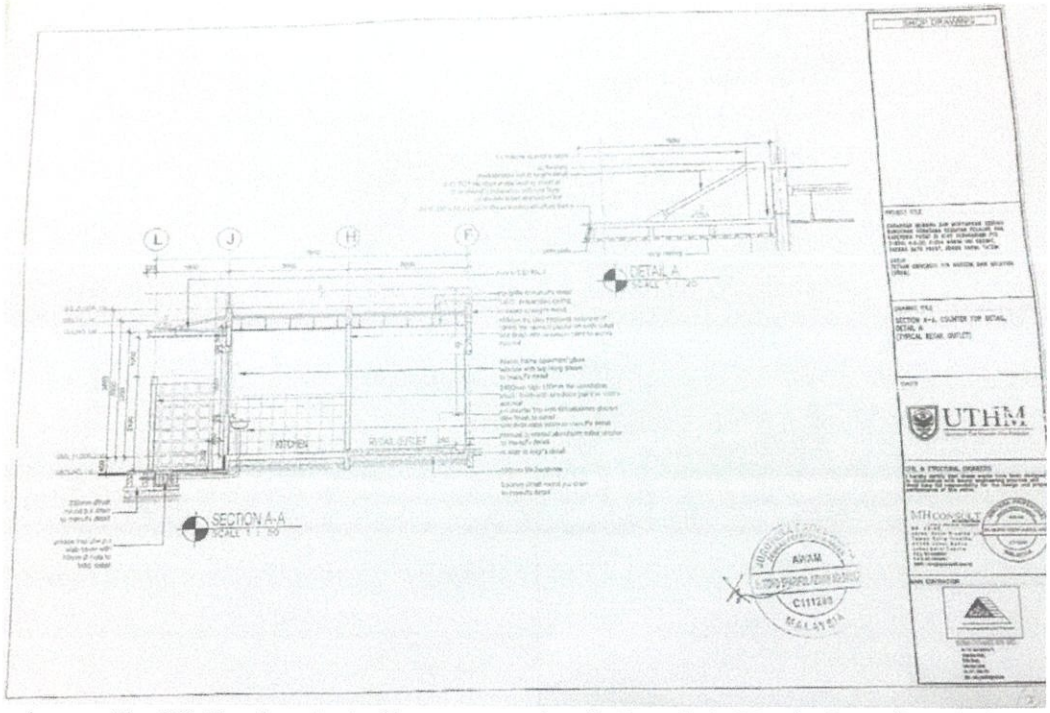
APPENDIXES



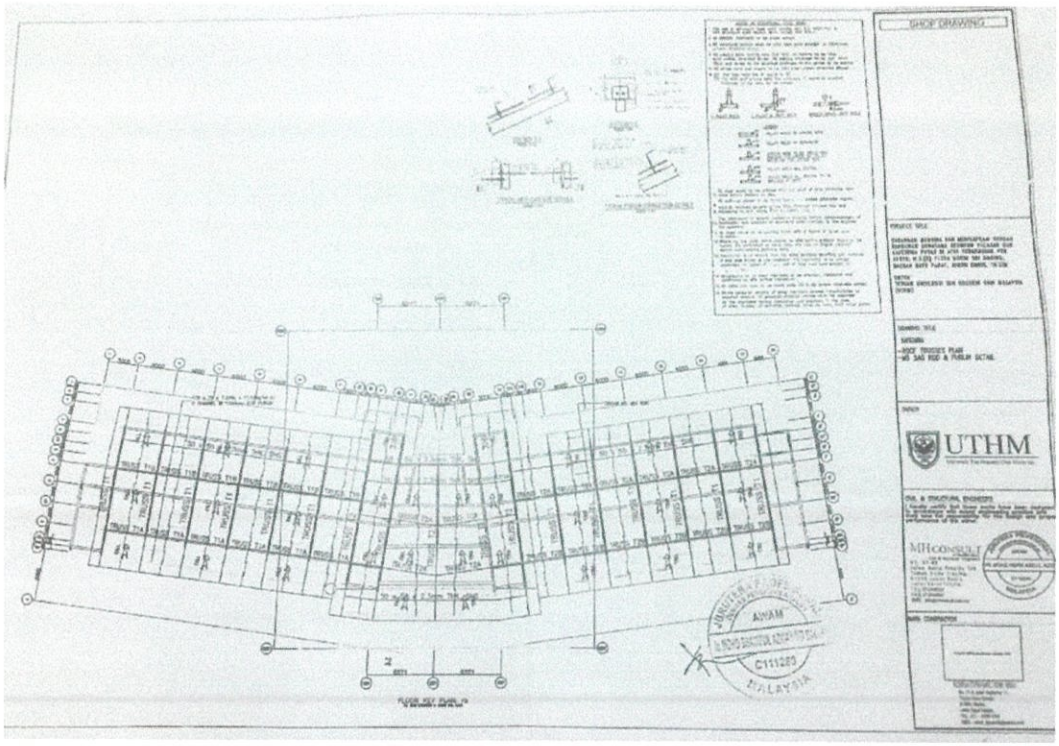
Appendix (A) Roofing steel frame

Sources: Site office



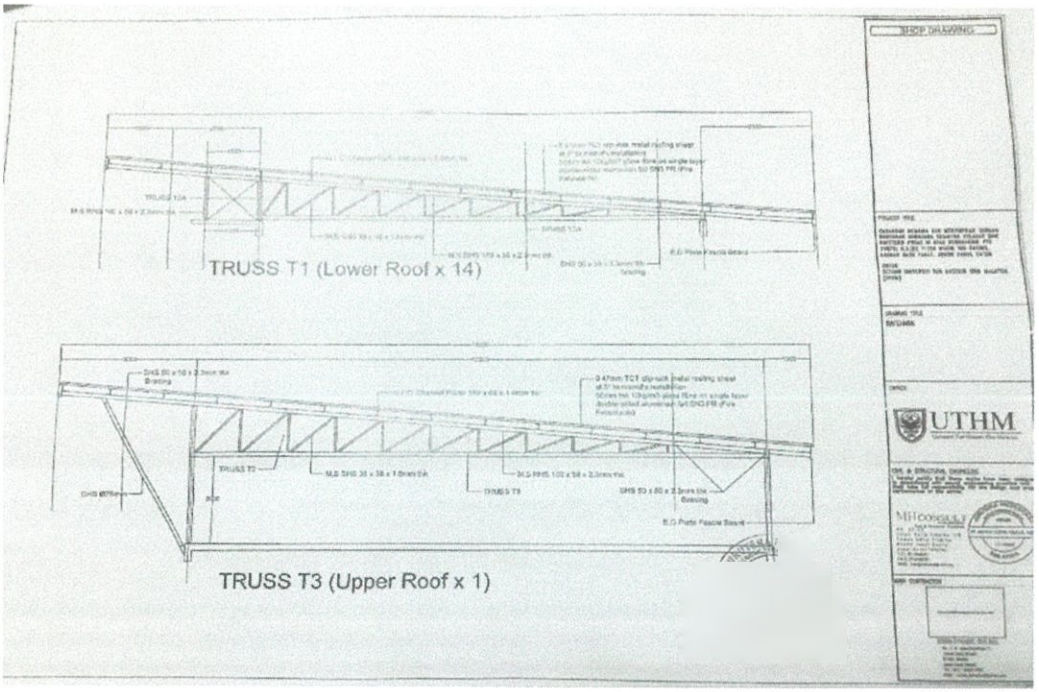
Appendix (B) Section A-A, Counter top detail, Detail A (Typical retail outlet)

Sources: Site office



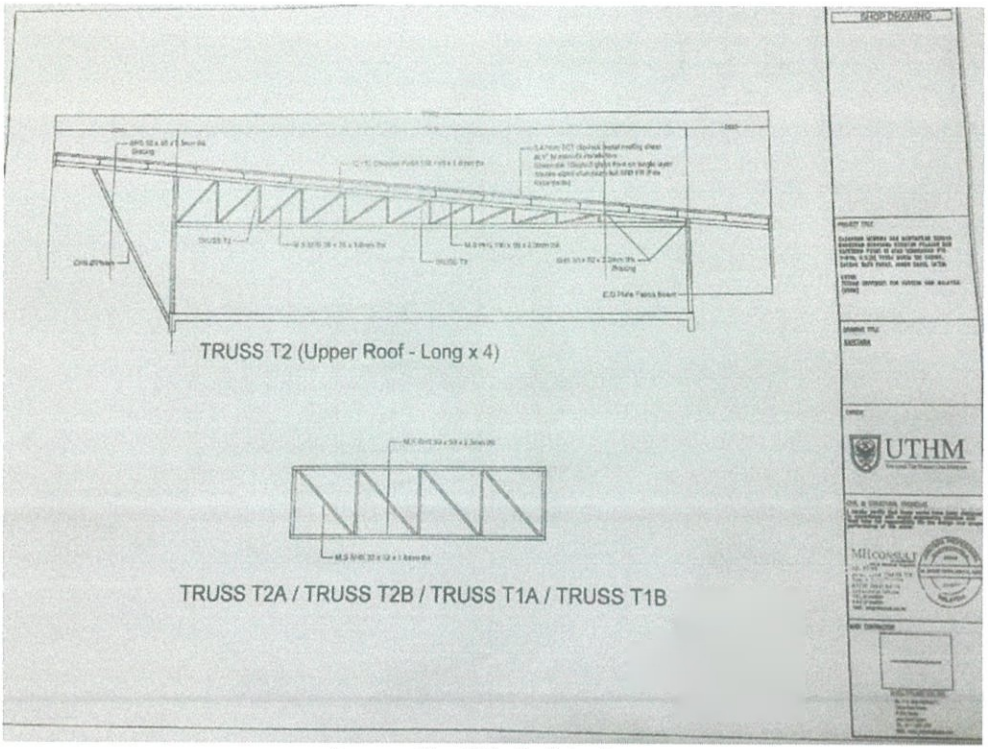
Appendix (C) Roof trusses plan, MS sag rod & purlin detail.

Sources: Site office



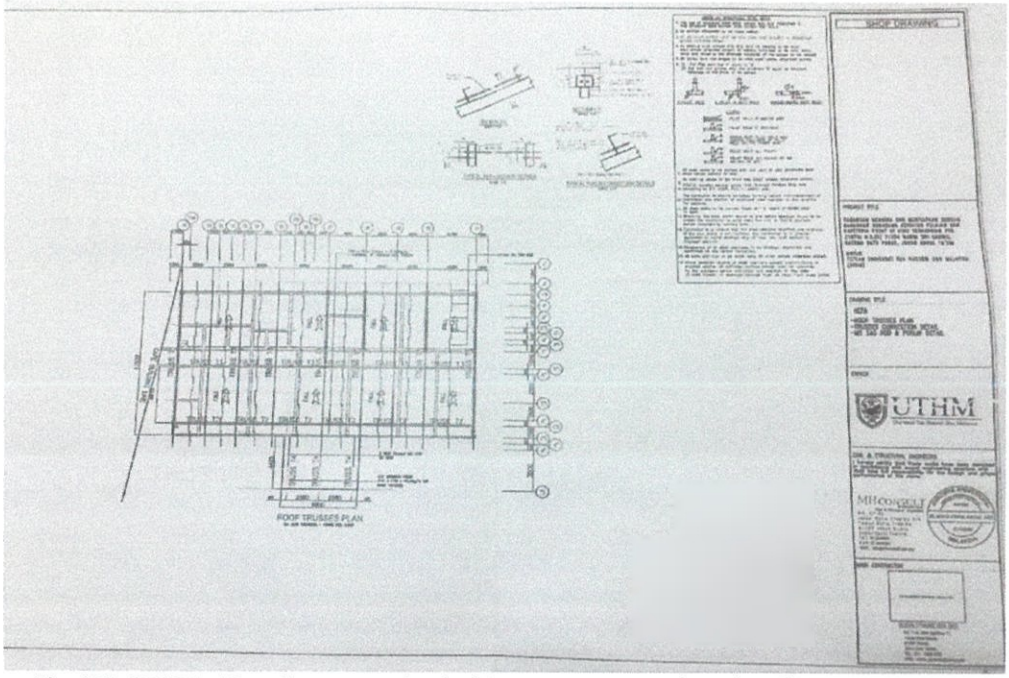
Appendix (D) Cafeteria

Sources: Site office



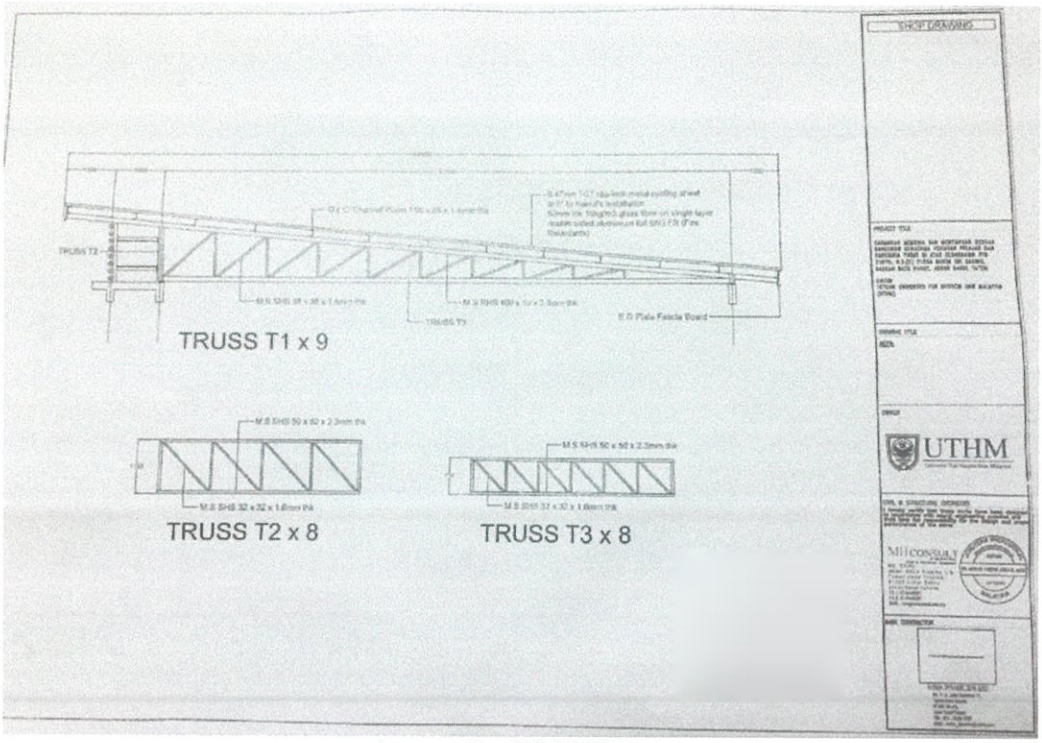
Appendix (E) Cafeteria

Sources: Site office



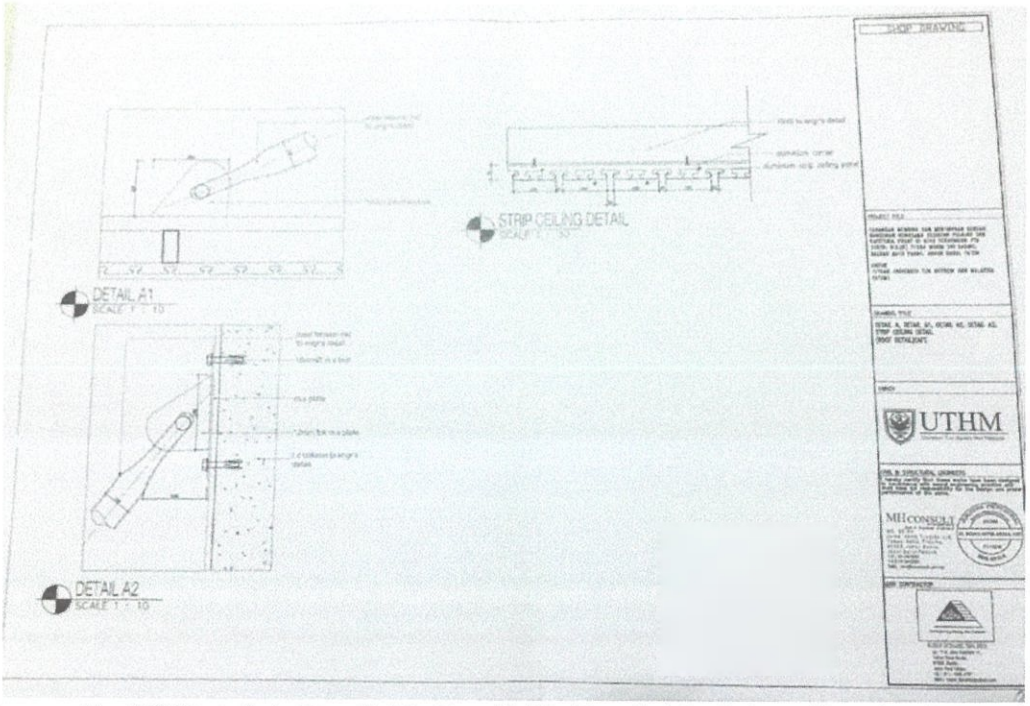
Appendix (F) HEPA (Roof trusses plan), (Trusses connection detail), (MS sag rod & purlin detail).

Sources: Site office



Appendix (G) HEPA

Sources: Site office



Appendix (H) Detail A, Detail A1, Detail A2, Detail A3, Strip ceiling detail (Roof detail) Cafe.

Sources: Site office