UNIVERSITI TEKNOLOGI MARA

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

SEPTEMBER 2015

It is recommended that the report of this practical training provided

By

Muhammad Nasaruddin Bin Mat Zaid

2013655408

Entitled

Steel Circular Column Formwork System

Accepted in partial fulfillment of requirement has for obtaining Diploma in Building

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DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

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(PERAK)

OCTOBER 2015

STUDENT DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original reference stated herein, prepared during a practical training session that I underwent at Pingat Harmoni Development Sdn. Bhd. for duration of 25th May and ended 9th October 2015. It is submitted as one of the prerequisite requirements of DBN307 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

.....

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UiTM ID No : 2013655408

Date : 10th October 2015

ACKNOWLEDGEMENT

With the name Allah,

Alhamdulillah, all praises and thanks to the Almighty Allah for His mercy and compassion that allowed me to done this practical report completely and successfully.

I would like to extend my heartfelt gratitude for the guidance, advised and help rendered throughout the period of training by the following group of amazing individuals. First and foremost, I would like to thank Mr. Mohd. Rasid Bin Mohamad, Mr. Rohazmi Bin Md Rasid, Mr. Tuan Faizol Bin Tuan Hassan, Ustaz Wan Mat Zain Bin Wan Yusof and Mr. Ghazali Bin Harun for all the guidance, supports and assistance that have been given to me from the very beginning of this practical report until it has been done.

I would like to thank all the UiTM lecturers that have thought and nurtured me in becoming a better student and person. I also would like to extend my deepest appreciation to lecturers who are directly involved during my training stint. To Dr. Mohd Rofdzi Bin Abdullah as a supervising lecturer, Pn. Rizalinda Binti Ishak as a practical training coordinator and Pn. Nurhasyimah Ahmad Zamri as a visiting lecturer, I appreciate 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 semesters.

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

Thank you so much.

ABSTRACT

Formwork system is very important thing to elaborate, therefore, this report will discuss about a type of formwork that can make a construction project become more efficient and less complicated. This report was conducted for formwork system at Cadangan Pindaan dan Ubahsuai ke Atas Masjid Kampung Laut (Al-Hidayah) 2 Tingkat Sediada di atas Lot 1501, Mukim Kampung Laut, Daerah Sungai Pinang, Tumpat, Kelantan. The project was led by Mr. Mohd Rasid bin Mohamad as project manager. The formwork system that will be discussed in this report is steel circular column formwork. The main purpose of this report is to investigate the characteristic of steel circular column formwork system that is different from the normal wall system which is timber formwork system. The objectives of this report is to identify the characteristic of steel circular column formwork system in construction, to study the advantages of using steel circular column formwork system and to investigate the method statement of steel circular column formwork system. One of method in conducting this report is through the observation. It helps to approach the construction of the formwork system. Interview and discussion is very important to conduct this report because it helps in collecting more information about the case study. Beside the above stated methods, the mass media and electronic media is one of the methodologies of study. It is the way to find the information with easy and fast. The selection system for a building of the formwork is very important for a building. This is because it will determine whether the building will function properly or not. Errors in the selection of the formwork will lead to the loss of a project. Therefore the formwork system needs to be choosing wisely and efficiently.

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CHAPTER 1

PREFACE

1.1 Introduction

The selection system for a building of the formwork is very important for a building. This is because it will determine whether the building will function properly or not. Errors in the selection of the formwork system will lead to the loss in a project. Therefore the formwork systems need to be choosing wisely and efficiently.

Formwork is the temporary structure which moulds concrete into the desired shape, and holds it in the correct position until it is able to support the loads imposed upon it. It also imparts the required surface finish. Formwork and its supports or falsework is a structural system and must be designed and built accordingly. The actions or loads on it may be temporary but they can be extremely large. Frequently they are different in nature to those imposed on the finished concrete structure.

1.2 Objectives of Study

Objective of the study is very important things because with the objective we can know how to make a scope of study and also as guide's line to complete this report.

The objectives of the study are as followed:

i. To explain the methods of steel formwork system used.
ii. To explain method and step of mosque construction.

1.3 Scopes of Study

Scope of study will focus on the mosque at the site. The information that can get about the construction of mosque is at the site construction. The scope of study for the construction of mosque is connected the entire process of this construction project according to its types, characteristic, function on typical area and method of installation. It also involves the introduction for each types of mosque that has been used.

The scopes of study area will be limited to:

i. Material of that been applied at site.
ii. Step of installation the mosque at site.

1.4 Methods of Study

There are several ways that been used in gaining information to prepare this practical report. These are the common ways used to gain the information needed to finish the practical report successfully and effectively. Some of the ways that been used are:

i. Observation.

In gaining information, observation is one of the best methods. By observation, it is easier to learn and understand especially if it involves methods or actions.

ii. Reference.

References such as notes given by lecturers, books, drawings and also journals from library and internet can be used as guidance on preparing this practical report. The information can also been referred to the staff members or related person at the site especially the contractor and developer which specialized to infrastructure works.

iii. Interview.

Meeting and interviewing with the parties related to the topic for the practical report is one of the method used for searching the information that is needed to prepare this report.

iv. Electronic Media.

Electronic media also can be medium that can be support and can give the information about the case study. This is because, so many information has been uploaded into the internet because it can make easy to the people to get an information.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

Figure 2.1: Pingat Harmoni Development Sdn. Bhd. head quarters

Founded on March 18, 2014, Pingat Harmoni Development Sdn. Bhd. with registration no 1085282-D is located at 3317, Top Floor, Taman Pasir Pekan, 16250 Wakaf Bharu, Kelantan is one of a group of companies Pingat Harmoni Sdn. Bhd.

Pingat Harmoni Development Sdn. Bhd. is a company formed by carrying out work on housing development, real estate, building construction contract, infra, engineering works privately owned and for the government.

To further enhance the efficiency and quality performance of the company, the absorption of professionals in the management of Pingat Harmoni Development Sdn. Bhd. has been realized very well. Furthermore, the quality of work and services by sub-contractors will find we are very encouraging and we are delighted to be able to realize your dream home successfully.

Pingat Harmoni Development Sdn. Bhd. has taken a further step forward to have adequate machinery and have their own machine manufacture and supply of raw materials such as bricks, sand, cement and ready-mixed. We also promised to continue to keep strong and sustained excellence in performance.

2.2 Company Profile

Company Name	: Pingat Harmoni Development Sdn. Bhd.
Date Established	: 18th March 2014
Company No.	: 1085282-D
Directors	: 1. Md. Rasid Bin Mohamad
	2. Rohazmi Bin Md Rasid
	3. Wan Hazimah Binti Wan Mat
	4. Rohaiza Bin Md Rasid
	5. Rohaida Binti Md Rasid
Registered Address	: No, 4959-A, 1 Km1 / 2 Jalan Pengkalan
	Chepa, 15400 Kota Bharu, Kelantan
Business Address	: Pt 3317 Tingkat Atas,Taman Srikota Pasir
	Pekan, 16250 Wakaf Bharu, Kelantan
Phone No. /Office Fax No.	:
Bankers	: Cimb Islamic Bank Berhad (Wisma Square Point, Kota Bharu)

Company Secretary	: Kb Tax Consultants & Management Services No. 4959-A, 1 ½ Km, Jln Pengklan Chepa, 15400 Kota Bharu, Kelantan.
Auditors	: Jalil & Co. Chartered Accountant No. 83, Tingkat 1, Jalan Sultan Ismail, 20200 Kuala Terengganu,Terengganu

2.2.1 List of Key Share PHDSB

Table 2.1: List of Key Share PHDSB

NO	NAME	POSITION	RACE
1	Md Rasid Bin Mohamad	Director	Malay
2	Rohazmi Bin Md Rasid	Director	Malay
3	Wan Hazimah Bt Wan Mat	Director	Malay
4	Rohaiza Bin Md Rasid	Director	Malay
5	Rohaida Bt Md Rasid	Director	Malay

Total Capital Stock (Ordinary Shares RM 1.00)

= RM 400,000.00

2.3 List of Staff of Pingat Harmoni Development Sdn Bhd

Table 2.2: List of Staff of Pingat Harmoni Development Sdn Bhd

NO	NAME	AGE	POSITION	ELIGIBILITY
1	Aini Suhada Bt Mohamad Fauzi	27	Account Manager	Bachelor Degree (Hons) Accountancy (UiTM Dungun)
2	Tuan Hasmadi Bin Tuan Hassan	36	Assistant Director	SPM
3	Norzafriana Bt Ab Roni	26	Marketing Agent	STPM
4	Siti Rosnani Bt Zakaria	26	Assistant Marketing And Sales	SPM

2.4 Project Background

Tanah Merah

Taman Kota Harmoni was a housing project undertaken on the edge of Tanah Merah, Kelantan.

Basic facilities which accomodate for a broad range of client needs and in line with the fundamental client. The location is strategic and appropriate to the business activities that will organise. The design is different from the existing house. The area of this project is 22 hectares (54 362 acres).

To create a more residential area, we have allocated significant capital for this project in line with the current development of a project.

2.4.1 Previous Projects

Table 2.3: The Type and Number of Houses

NO	TYPES OF BUILDING	UNITS
1	1 Storey Terrace House	201
2	2 Storeys Terrace House	16
3	1 Storey Detached House(Semi-D)	36
4	2 Storeys Detached House (Semi-D)	4
5	1 Storey Bungalow	16
6	2 Storeys Bungalow	14
7	2 Storeys Shop	36
8	3 Storeys Shop	41
9	4 Storey Shop	6
	Total	370

2.4.2 Projects Under Construction

Table 2.4: List Project Under Construction

NO	LOCATION	BROADNESS	COMPONENT	READINESS
1	Taman D'semerak Harmoni		-12 Lot Bungalow	100%
2	Taman Hidayah Harmoni Lot 344-360 Mukim : Bandar Tanah Merah Daerah : Kusial		-44 Lot 2 Storey Terrace	100 %
3	Mata Air Kemubu Lot 319-349 Mukim : Gong Pachat Daerah : Semerak, Pasir Putih	2.116 Hectare 5.228 Acres	- 28 Lot Bungalow	
4	Taman Harmoni Sungai Petai Lot 1471-1500 Mukim : Gong Pachat Daerah : Semerak, Pasir Puteh	1.6910 Hectare 4.178 Acres	- 12 Lot Bungalow - 16 Lot Semi-D	
5	Jerteh Lot 5132-5144 Mukim : Bukit Kenak, Darang Buaya Daerah : Besut	1.136 Hectare 4.178 Acres	- 13 Lot Bungalow	
6	Kg Raja 1 Mukim : Kg Raja Daerah : Besut	4147 Hectare 1024 Acres	-3 Lot Office Shop - 5 Lot Bungalow	100 %

CHAPTER 3

CASE STUDY

3.0 INTRODUCTION TO PROJECT

Masjid Al-Hidayah Kampung Luat is located in Palekbang, Tumpat, Kelantan and it is nearby with Sungai Kelantan and it is located at centre of Bandar Tumpat and bandar Kota Bharu. The building also located at the strategic area because it is built nearby a main road from Bandar Tumpat to the Bandar Kota Bharu. The building is constructed on a 1.7 acres of land. The project is handled by Pingat Harmoni Sdn Bhd which is a bumiputera's company located at Wakaf Bharu, Kelantan. This mosque built starts in 9th July 1969 and done on 17th 1971 and the company started the renovation of the mosque starts on 1st April 2014. With about RM 2.7 million cost of contract for the this renovation.

The construction and renovation is expected to be done on 31st February 2016, the building has complete about 70 percent.

3.1.1 Location and Plans

Masjid Al-Hidayah Kampung Laut is located at lot 1501, Kampung Laut, Palekbang, 16040 Tumpat, Kelantan Darul Naim. The building is constructed on a 1.7 acres of land and the location of building can be considered as a strategic place because and it is nearby with Sungai Kelantan as mineral resources and can also be for domestic use to the villagers and it is also built nearby a main road from Bandar Tumpat to the Bandar Kota Bharu.

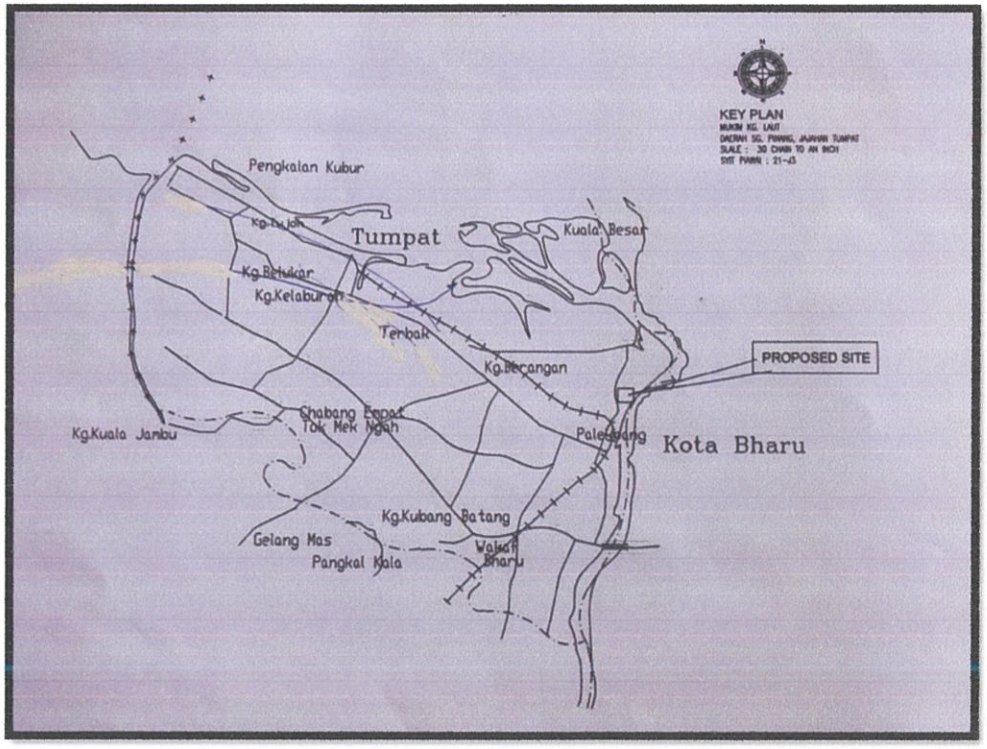

Figure 3.1: The location of site Masjid Al-Hidayah Kampung Laut.

Source: Drawing plan of Masjid Al-Hidayah Kampung Laut

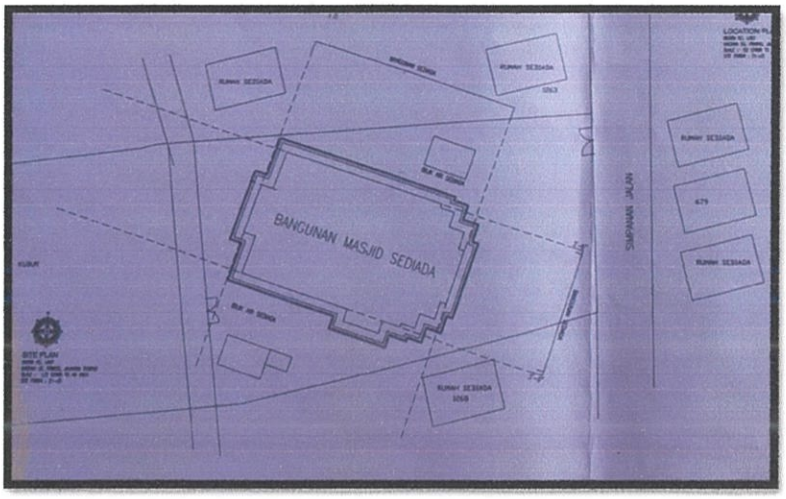

Figure 3.2: The site plan of the building

Source: Drawing plan of Masjid Al-Hidayah Kampung Laut

3.1.2 Building Illustration

Photo 3.1: The front elevation of the building

Photo 3.2: The rear elevation of building

Photo 3.3: The right elevation of building

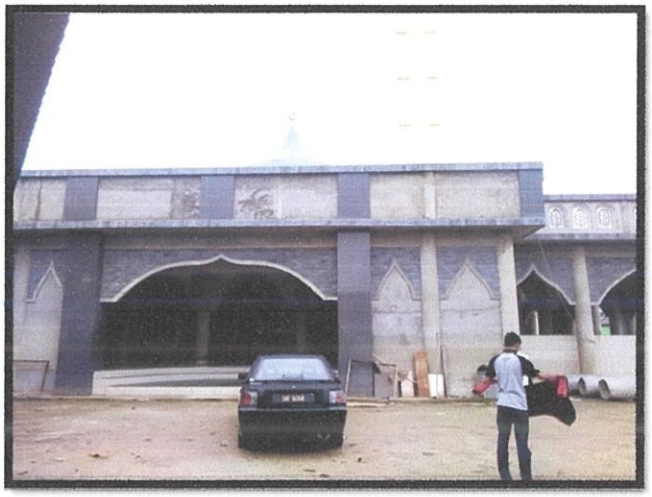

Photo 3.4: The main entrance of the building

3.1.3 Project Drawing

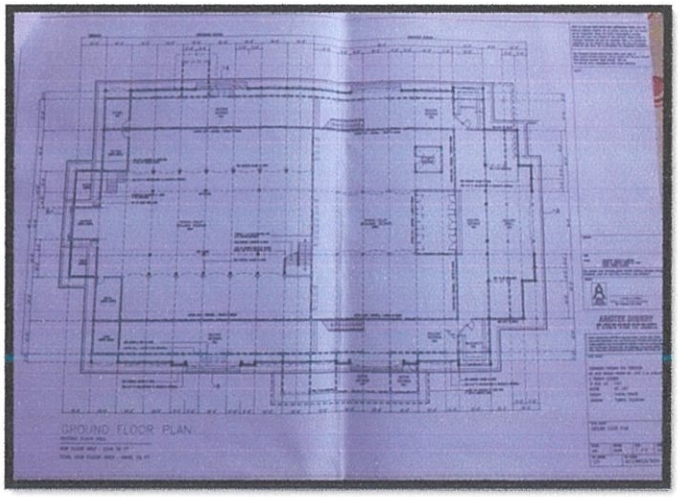

Figure 3.3: Ground floor of the building

Source: Drawing plan of Masjid Al-Hidayah Kampung Laut

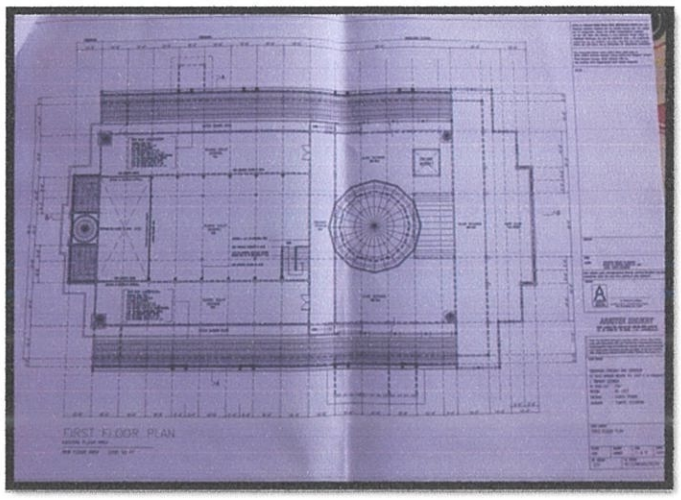

Figure 3.4: First floor of the building

Source: Drawing plan of Masjid Al-Hidayah Kampung Laut

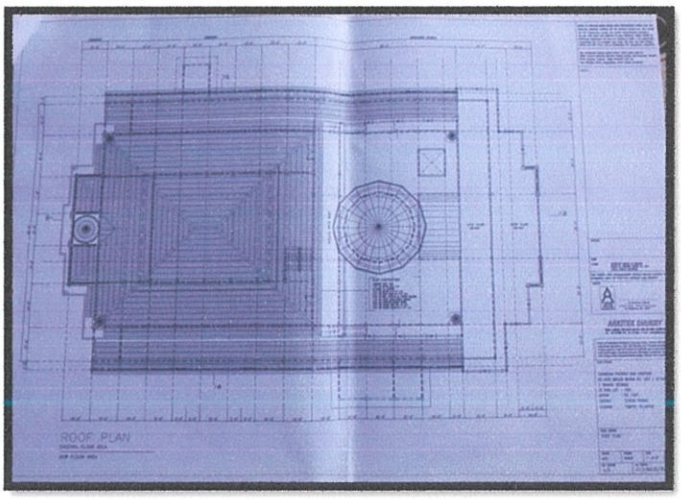

Figure 3.5: Roof plan of the building

Source: Drawing plan of Masjid Al-Hidayah Kampung Laut

3.2 CASE STUDY

INTRODUCTION OF FORMWORK SYSTEM

Formwork is the temporary structure which moulds concrete into the desired shape, and holds it in the correct position until it is able to support the loads imposed upon it. It also imparts the required surface finish. Formwork and its supports or falsework is a structural system and must be designed and built accordingly. The actions or loads on it may be temporary but they can be extremely large. Frequently they are different in nature to those imposed on the finished concrete structure. Concrete is an extremely plastic and mouldable material which will accurately reflect the shape, texture and finish of the surface against which it is cast. Any imperfection or inaccuracy in this surface will be indelibly inscribed on the concrete surface. Form-face materials must therefore be chosen both to achieve the required surface finish and, in conjunction with all the supporting elements, to maintain accuracy and stability under all the loads imposed during erection and concreting, and for some days into the life of the concrete structure.

At early ages, the concrete will not be able to support the loads imposed on it. Until it is able to do so, the formwork (and falsework) will therefore continue to be a loadbearing structure. Only when the concrete has achieved sufficient strength can the formwork be removed without any detrimental effect to the concrete structure. Failure to meet the accuracy, stability and strength requirements will lead to formwork failures in the form of bowing, warping, misalignment, etc. reflected in the final structure. It could even lead to the catastrophic collapse of part or all of the form.

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

3.2.1 Purpose and Use of Formwork

The formwork serves as mould for concrete structural components unless such mould is provided by the soil, other structural components and more. It moulds the placed-fresh concrete, which in this stage normally is viscous, to the shape specified in the drawing.

Consequently, the formwork must already be available when the necessary steel reinforcement and concrete mix are placed. Proper making of formwork decides on the accuracy to size, strength and surface finish of the concrete components. Formwork is required wherever monolithic concrete and reinforced concrete structures or structural components are constructed, such as for:

- solid structures (foundations, columns)
- structures with special functions (containers, chimneys, hydraulic structures)
- structures to meet great statical requirements (bridges, towers)
- reconstruction of structures
- public buildings and structures of irregular arrangement.

Generally, each formwork is of provisional nature and is to be removed after hardening of the concrete placed. The formwork is not to be built as strong as possible but as strong as necessary only.

Therefore, formwork stripping must always be kept in mind when erecting the formwork.

To avoid unnecessary difficulties of work and prevent damage from formwork parts, the following recommendations should be followed:

- Do not drive in too many nails.
- Use only as many timbers, braces, tie wires, etc. as necessary.
- Consider which board, panel or squared timber is to be stripped first, to fix them so as to permit easy removal in the proper sequence.

Formwork making the necessary strength but also considering aspects of economical use of material and easy formwork stripping calls for extensive specialized knowledge of the direction of forces when placing the concrete mix.

Improperly made formwork, which gives way or breaks when the concrete is placed, results in heavy material damage or, in the worst case, may cause serious injury of persons.

On the other hand, an excessively strong formwork requires high physical efforts of the persons stripping the formwork and normally results in the complete destruction of the formwork parts.

3.2.2 Functional and Load Requirements of Formwork

Formwork Requirements

The formwork is the main means of work in the moulding process of the concrete. Basically the process of formwork making has to meet the following requirements:

- The structural component to be produced is to be moulded with the projected dimensions keeping the admissible tolerances.
- The dead loads of the fresh concrete and of the reinforcement as well as the temporary load of persons and working tools must be safely resisted and carried off to the soil or supporting members of the structure.
- The concrete must be protected against too high or too low temperatures as well as vibrations.
- The thin concrete mix must not flow out of the formwork.
- The future concrete component must have a surface finish meeting the required quality after stripping.
- The placement of necessary steel reinforcements must be easily possible during the erection of the formwork.
- Stripping of the concrete components produced must be uncomplicated.

Loading of vertical formwork

Vertical formwork is used for strip foundations, concrete walls and columns. Immediately after placement in the formwork until achievement of its inherent stability, the concrete mix, under the effect of its own load and of compaction by vibration, exerts lateral pressure on the formwork which is called lateral pressure of the concrete mix.

The lateral pressure of the concrete mix depends on the following factors:

- Composition and properties of the concrete mix (density, type of cement, quality of concrete).
- Concrete placing technology (concreting speed, compaction, vibration depth, total height of the concrete mix)
- Ambient conditions (temperature, air humidity).

Tie wires (tie rods) are used to take up the lateral pressure of the concrete mix. They are to be included in the formwork project.

The maximum lateral load with external vibration occurs at the foot of the formwork and with internal vibration above the foot. In addition to the lateral pressure of the concrete mix, the concrete mix also produces buoyant forces which may cause lifting of the formwork. This can be the case particularly with foundation formwork. To avoid this, the formwork is to be anchored in the subsoil.

Another way is loading the formwork by means of concrete parts.

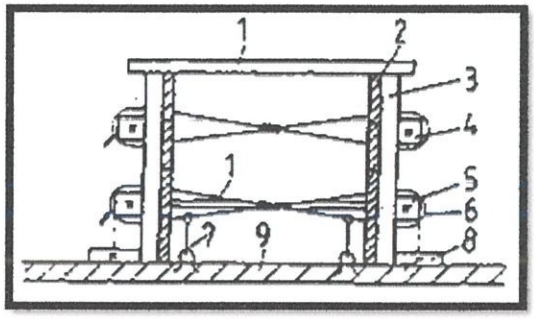

Figure 3.6: Formwork tying in the subsoil by means of tie wires

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) stulls, 2) sheeting boards, 3) post, 4) upper water, 5) lower waler (additionally supported) 6) tie wire, 7) tieing in the concrete bottom (tie wire), 8) thrust-board, 9) concrete bottom

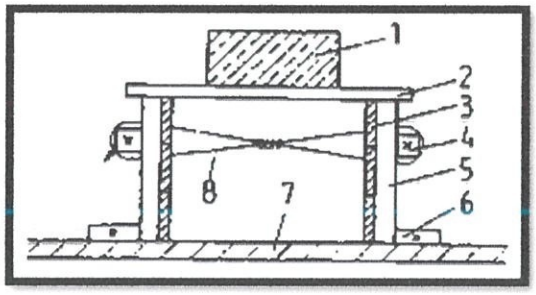

Figure 3.7: Formwork tying by loads on the formwork

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) concrete sheeting, 2) formwork bearer, 3) main bearer, 4) columns, 5) formwork pressure (surface pressure), 6) carrying off to the columns (linear)

Loading of horizontal formwork

Horizontal formwork is used for ceilings and beams. Horizontal formwork is subjects to vertical loads which are to be carried off to solid subsoils through formwork bearers and main bearers as well as columns.

Vertical loads are produced by:

- the concrete mix weight in the specified height
- reinforcements
- concrete cones on the concrete pouring spot
- concrete pouring impact on the formwork
- persons and working tools
- dead load of the formwork.

In addition to vertical loads, there are also horizontal loads which are produced by:

- wind effects
- inclined position of columns
- backing up

The horizontal forces are taken up by auxiliary structures, such as braces and struts, or rigid connection to existing structural components, such as walls and columns.Formwork walls and columns are to be backed up from all sides.

3.2.3. General Construction of Formwork

The formwork sheeting

The formwork sheeting is in direct contact with the concrete and can be considered as mirror image of the concrete components to be produced.

It is the moulding element of the formwork and has the greatest influence on the quality of the concrete surface. The formwork sheeting has to resist heavy stress. It takes up surface pressure and carries it off to lineary acting supports.

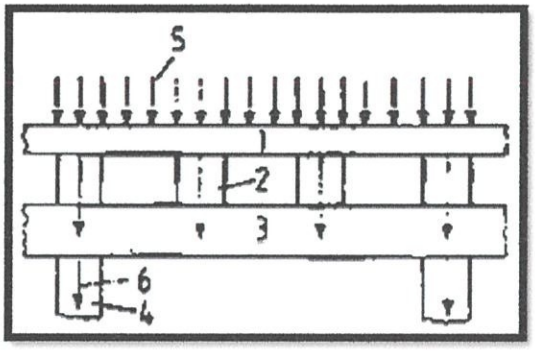

Figure 3.8: Formwork pressure distribution

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) formwork sheeting, 2) formwork bearer, 3) main bearer, 4) columns, 5) formwork pressure (surface pressure), 6) carrying off to the columns (linear)

It is typical of the formwork sheeting that, because of the heavy stress and direct contact with the concrete, it is the part of the formwork to wear first. Sheeting boards and prefabricated wooden panels can be used as sheeting material. Formwork sheeting of individual boards normally consists of 25 mm thick and approximately 140 mm wide boards. The heartwood side must always lie towards the concrete. Sheeting boards have great advantages because of their easy workability, such as by sawing, planing, boring and nailing.

Disadvantages are the high expenditure of working time required for formwork making, the short service life, loss by waste wood.

In the event of repeated use of formwork of the same design, such as for foundation strips, sheeting panels can be prefabricated from individual boards using squared timbers as frame.

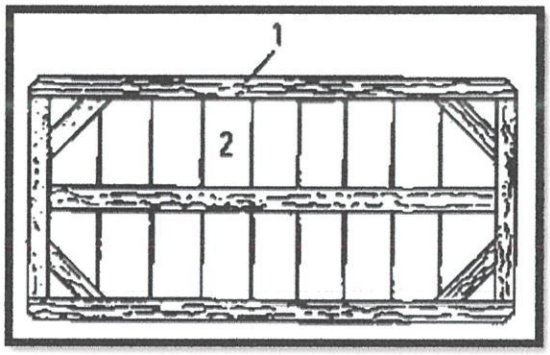

Figure 3.9: Sheeting panel for repeated use

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) sheeting panel frame, 2) holes for steel wedges

The sheeting panels are prefabricated in a workshop. The advantage of sheeting panels is that they considerably reduce the time required for the erection of the formwork on site.

The disadvantages of sheeting panels in terms of service life are similar to those of sheeting boards.

Normally both types of formwork sheeting are used on site in a combined manner.

The formwork bearers

The formwork bearers directly support formwork sheeting. They carry off the forces through falsework structures to supporting members, the soil and formwork ties. The formwork bearers normally consist of squared timbers. The cross sections of the beams depend on the loads to be resisted. Because of their good workability, wooden beams have a wide field of application. In addition to wooden beams, prefabricated steel parts (steel beams, clamps etc.) are also used. Clamps are mainly used for column formwork.

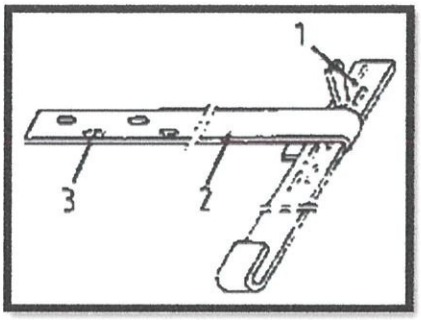

Figure 3.10: Steel clamp comer point for column formwork

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) steel wedge, 2) clamp, 3) holes for steel wedges

The formwork ties

With vertical formwork, the horizontally acting formwork pressure is mostly taken up by tieing the two form-work faces to each other by formwork ties. It is done by slinging a steel wire (3.1 mm to 4.2 mm, annealed) around the formwork bearers, guiding it through boreholes in the formwork sheeting and tightening it by twisting. Immediately near the tie wire a stull is to be mounted to maintain the necessary width of formwork.

When placing the concrete, the stull if made of wood is to be remove because the concrete mix assumes the bracing function (pressure).Another way of bracing is screwing by means of steel screws.

The elements of falsework structures

Falsework structures are those parts of the formwork which take up and carry off the load from the formwork sheeting and formwork bearers. The main elements of such formwork structures are columns and main bearers. The column takes up the load directly from the formwork bearer and carries it off. Round timber braces and specially made metal tube structures adjustable in height may be used as columns. In the case of round timber columns, double wedges are to be placed at the foot to prevent lowering of the formwork when stripping.

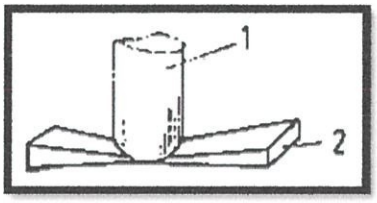

Figure 3.11: Column foot with wedge support

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) column, 2) wedge support

Other falsework elements are the main bearers which are horizontally arranged. One main bearer takes up the load from several formwork bearers and carries it off to the columns. Main bearers can be made of amply dimensioned squared timbers. But they may as well consist of metal tube structures of lattice type. Lattice-type metal tube structures are indispensable for big widths where columns cannot be laced at close intervals. Further falsework elements are bracing members which are required for both vertical and horizontal form-work. They ensure that the admissible unsupported length of columns is kept and secure the formwork against displacement and canting. Their arrangement and fixing according to the project is decisive for the stability of the formwork. Bracing members may be boards, squared timbers and round timbers.metal, tube structures, steel ropes and steel sections.

3.2.4 Types of Formwork

Foundation Formwork

Foundation formworks can be designed in various ways. Basically there is a difference between formwork for individual foundations, normally designed as socket foundations, and formwork for strip foundations. The type of design is dictated by the size, mainly by the height of the foundation formwork.

The formwork for individual foundations is similar to column formwork and the formwork for strip foundations is similar to the formwork. Normally sheeting panels with formwork bearers in the form of walers are used for foundation formwork. Individual foundations are also secured by means of walers but of rim type. Bracing is by squared and round timbers as well as boards diagonally arranged. Tie wires as well as metal screws are used as formwork ties.

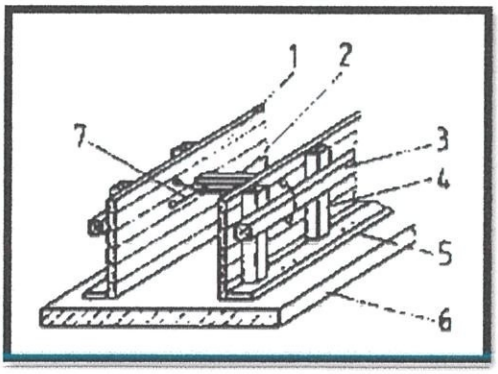

Figure 3.12: Foundation formwork

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) formwork sheeting, 2) stull, 3) waler, 4) post, 5) thrust-board, 6) concrete bottom, 7) tie wire

Wall Formwork

Wall formwork consists of vertically arranged upright timbers (formwork bearers) to which sheeting boards are nailed at the concrete side. The upright timbers are diagonally braced by means of boards at both sides. On cleats situated at every third upright timber, there are horizontally arranged walers. The opposite walers are tied at specified distances. Prefabricated sheeting panels may also be used instead of sheeting boards. Cleaning holes are to be provided at the foot of the formwork.

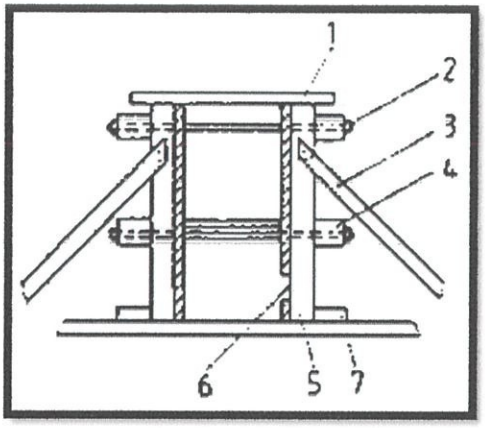

Figure 3.13: Wall formwork

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) stull, 2) screw tie, 3) bracing, 4) waler 5) post, 6) cleaning hole, 7) thrust-board

Ceiling Formwork

Ceiling formwork is the type of formwork mostly found in structures/buildings. The formwork sheeting may consist of sheeting boards or prefabricated sheeting panels. The formwork sheeting may consist of sheeting boards or prefabricated sheeting panels. The formwork sheeting lies on squared timber formwork bearers which are arranged on main bearers carrying off the forces to round timber columns. With smaller rooms, the main bearer together with two columns forms a trestle. Diagonal board bracings are provided to take up horizontally acting forces. The round timber columns are placed on double wedges which serve as stripping aid and correction device.

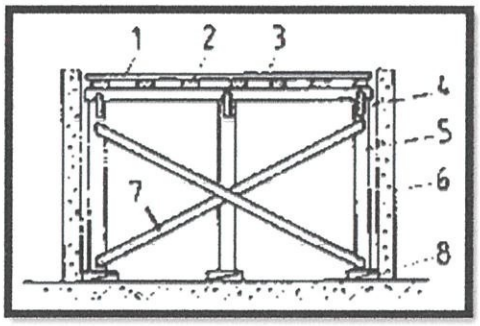

Figure 3.14: Ceiling formwork

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) formwork sheeting, 2) formwork bearer, 3) main bearer, 4) cleat, 5) column, 6) wall, 7) bracing, 8) support wedges

Beam Formwork

Beam formwork has prefabricated formwork sheeting parts which are sheeting bottom and side sheeting panels. Such individual parts are manufactured based on the beam dimensions specified in the project. For prefabrication of the formwork sheeting parts, a special preparation table must be manufactured on site.

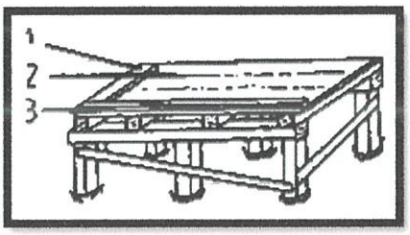

Figure 3.15: Preparation table

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) square strip, 2) post, 3) stop rail

The sheeting bottom and the side panels consists of sheeting boards nailed together by means of cover straps. Depending on the size of the beam, the width of the sheeting bottom is dimensioned so as to accept, at both sides of the width of the reinforced concrete column, the tickness of the sheeting and cover straps and the width of a thrust-board (approximately 100 mm).

The sheeting bottom can be placed on a pedestal support (a trestle formed by a waler connected with two columns by means of cleats) or on a round timber column also supporting a waler with cleat connection. In the latter case, the round timber column is located under the centre of the beam. By diagonal board bracing the round timber column and the waler above it, a composite triangle is formed. The side sheeting is erected on the sheeting bottom and held by a thrust-board. At the upper edge of the side sheeting a waler is mounted at both sides holding together the formwork by wire or spindle ties.

A stull-batten is to be nailed on the formwork immediately above the ties to ensure that the projected beam width is kept when tieing the formwork. The waler and the columns are additionally braced by diagonal boards.

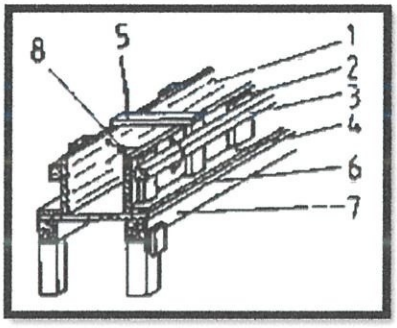

Figure 3.16: Beam formwork

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) side panel, 2) cover strap, 3) waler, 4) thrust-board, 5) stull, 6) formwork bottom, 7) trestle, 8) tie wire

Column Formwork

Similar to beam formworks, the sheeting of column formworks is prefabricated according to the column dimensions from sheeting boards connected by cover straps. The sheeting panels are placed in a foot rim which is anchored in the soil by steel bolts. The foot rim consists of double-nailed boards. The foot rim must be exactly measured-in because it is decisive for the exact location of the column. It has the same functions as the thrust-board for foundation or beam formwork. When the sheeting panels have been inserted in the foot rim, vertical arch timbers are placed to take up the forces from the cover straps of the formwork sheeting.

Around the arch timbers, which have the function of walers, column clamps of flat steel are clamped with wedges or a rim of boards is arranged similar to the foot rim. Additional formwork tieing by tie wires or steel screws is not necessary. The distances of the clamps are specified in the formwork project. Normally they are approximately 700 mm. The column in the formwork is laterally tied by diagonal board braces.

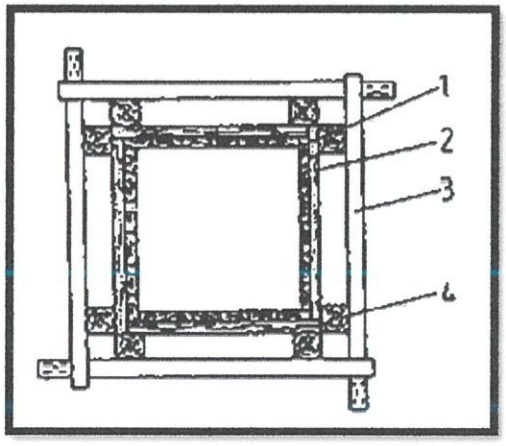

Figure 3.17: Column formwork

Source: http://thacampbell.typepad.com/class_handouts/Formwork.pdf

1) formwork sheeting, 2) cover strap, 3) clamp, 4) arch timber

A lateral cleaning hole is to be provided at the foot of the formwork for removal of any impurities in the form-work before the concrete is placed.

If a steel reinforcement is to be erected in the column formwork, two sides of the column only are to be provided with formwork first to permit easy erection of the reinforcement. After erection of the reinforcement, the remaining two sides of the column formwork can be mounted. The two sides mounted first are to be arranged cornerwise to ensure provisional stability.

Preparation and After Treatment of Formwork

Before placing the concrete, the formwork is to be cleaned and checked again for proper execution. After cleaning, the cleaning holes of wall and column formworks are to be tightly closed since the maximum pressure of the concrete mix is occurring at the foot of the formwork where the cleaning holes are situated. For this purpose, the sheeting pieces of the cleaning holes are always to be put against the thrust-board and against formwork bearers. If necessary, additional formwork bearers are to be mounted. Immediately before concreting, the formwork is to be thoroughly wetted with water because thereby less water will be extracted from the concrete mix and later stripping will be facilitated. When placing the concrete, it is to be made sure that no changes take place with the formwork.

Stripping of the formwork must not be started unless the site engineer in charge has given the respective express instructions. Too early removal of the formwork parts may cause heavy damage to the structure and/or injury of persons.

Stripping is to be done very carefully. Neither the concrete nor the formwork timbers must be damaged. Emergency columns are the last to be removed. All nails are to be removed from the stripped formwork timbers, and the stripped timbers are to be cleaned and overly stacked. The strict observance of labour safety regulations is of special importance for stripping work because of the danger of falling-down formwork parts.

3.2.5 Materials for Formwork

Formwork can be constructed in a variety of ways and from a number of materials. The size and nature of the project is most likely to determine which materials and which systems are likely to prove both technically sound and economic. For example, on some projects, particularly small ones, certain formwork elements are likely to be used only a relatively few times. Considerable cutting and fitting may be involved with consequent wastage of materials. The use of lower grade materials may then be justified, provided safety is not jeopardised. On larger projects, or even between project and project, the use of made-up elements leads to overall economy. Standardisation and interchangeability then become particularly important.

Before the final selection of the formwork material is made for a particular job, a number of factors should be considered, including:

- the size of the forms
- the shape of the forms
- the surface finish required
- the accuracy required
- the number of re-uses required
- the handling methods proposed
- the methods of compaction proposed
- the methods of curing proposed
- safety.

Material Uses

1) Timber

Commonly used for studs, bearers, joists, walers, etc. as it is readily available and easily worked with conventional tools. Has good load-carrying capacity and some suitable species are relatively light in weight.

2) Steel

Steel sections are used in formwork framing, particularly in patented systems. Strong and robust, steel-framed formwork is capable of multiple re-uses but requires a measure of standardization to warrant its additional cost. It is particularly used for repetitive work.

3) Coated plywood

Commonly used for soffits or as form liners in beams, columns and similar elements. Readily worked, coated plywood (properly handled) is capable of multiple re-uses.

4) Cardboard

Has been used in column and waffle forms. Normally suitable for one-off use only.

5) Glass reinforced cement (GRC) or plastic

Commonly used as permanent formwork, where it provides a decorative finish, or as the moulds for intricate shapes, particularly precast elements. Is relatively durable and capable of multiple re-uses.

6) Concrete

Precast concrete elements are used as permanent formwork – where the precast element is exposed to view in the completed structure. Also used to provide permanent forms in precast concrete factories where it is very economical for standard elements or components.

7) Rubber, thermoplastic and polystyrene materials

Used as form liners to provide intricate effects and for decorative finishes. Rubber and thermoplastic sheeting is used for the latter and is capable of multiple uses.

3.3 Circular and Octagonal Columns

- Circular column formwork
- Fabricated steel, usually two piece, and often with a hinge.
- Fibre cement pipes which are left in place as perm anent formwork.
- Timber sheathing tied with standard column clamps. Corners need to have infill pieces. Alternatively, metal strap can be used without the need for corner infills.

3.3.1 Advantages of steel circular column formwork

- Steel forms are stronger, durable and have longer life than timber formwork and their reuses are more in number
- Steel forms can be installed and dismantled with greater ease and speed.
- The quality of exposed concrete surface by using steel forms is good and such surfaces need no further treatment.
- Steel formwork does not absorb moisture from concrete.
- Steel formwork does not shrink or warp

3.3.2 Disadvantages of steel circular column formwork

- Limited size or shape
- Excessive loss of heat
- A very smooth surface will be produced which would give problems for finishing process
- Limited fixing

3.2.3 Formwork failures

Formwork failures are the cause of many accidents and failures that occur during concrete construction which usually happen when fresh concrete is placed. Generally some unexpected event causes one member to fail, then others become overloaded or misaligned and the entire formwork structure collapses. Improper stripping and shore removal, inadequate bracing, vibration, unstable soil under mudsills, shoring not plumb, inadequate control of concrete placement, lack of attention to formwork details, inadequate cross bracing and horizontal bracing of shores. Forms sometime collapse when their shores/ jack are displaced by the vibration caused by passing traffic, movement of workers & equipment on the formwork and the effect of vibrating concrete to consolidate it

3.4 Method Statement

Installation of Circular Column Formwork

Step 1

Setting out

- Measure out the height of the column that will be constructs.
- Decide the location to construct the column according to drawing plan

Step 2

Placed the formwork

- Put the two piece of circular column formwork at the place that wants to construct the column

Photo 3.5: Installation of the formwork

Step 3

Formwork tie

- Tie up the two pieces of circular column formwork by using wires.

Photo 3.6: Tie using wires.

Step 4

Bracing

- Put the bracing to the formwork as it function to support the formwork

Photo 3.7: Support the formwork with bracing

Step 5

Cover the hole

- Put the wedges at the foot of the formwork to cover the hole so that it can prevent the concrete leakage

Photo 3.8: Cover the hole

Step 6

Surface treatment

Certain amount of deflection in structure is unavoidable. It is therefore desirable to give an upward camber in the horizontal member of conc. Structure to counteract the effect of deflection.

CHAPTER 4.0

CONCLUSION

4.1 Conclusion

The selection system for a building of the formwork is very important for a building. This is because it will determine whether the building will function properly or not. Errors in the selection of the formwork system will lead to the loss in a project. Therefore the formwork systems need to be choosing wisely and efficiently.

Circular column formwork system is a type of formwork system that is very economic and efficient to be applied. Although the functions of the circular column formwork are the same as the other formwork system, it may contain more benefit compared to the other formwork system. There are many benefit of using steel circular column formwork system such as Steel forms are stronger, durable and have longer life than timber formwork and their reuses are more in number, steel forms can be installed and dismantled with greater ease and speed, the quality of exposed concrete surface by using steel forms is good and such surfaces need no further treatment, steel formwork does not absorb moisture from concrete and steel formwork does not shrink or warp.

Besides, the method of construction and maintenance of this steel circular column formwork system is less complicated compared to the timber formwork system. This situation will allow the construction and maintenance work became more efficient. As the conclusion, the system is an economic formwork system that should be applied in construction because of the benefit.

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