



DEPARTMENT OF BUILDING
UNIVERSITI TEKNOLOGI MARA
(PERAK)

INSTALLATION METHODS OF PRECAST CONCRETE BEAMS & COLUMNS,
CAMPUS UNiSZA TEMBILA, BESUT

Prepared by:

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It is recommended that the report of this practical training provided

by

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entitled

Practical Report Title

Installation Methods of Precast Concrete Beams & Columns,

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be accepted in partial fulfillment of the requirement for obtaining the Diploma In Building.

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(PERAK)

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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 are stated herein, prepared during a practical training session that I underwent at WRA Services Sdn Bhd for a duration of 14 weeks starting from 2 September 2018 and ended on 6 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.

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ABSTRACT

Industrialised Building Systems (IBS), also known as prefabrication, involves the manufacture of components off-site ready for installation. This report was prepared for the installation of IBS beams and columns at Library Building University Sultan Zainal Abidin in Tembila, Besut. The prime objective of building construction is to make sure that the performance of the building can be continued to the utmost throughout its design life. The objectives of the report are to identify the construction method of IBS beams and columns, determine the types of column and beam, determine the equipment and machineries that used for construction. The method of study used is interview, case study and literature review will be helped in making this report. To illustrate, the construction industry makes a vital contribution to the competitiveness and prosperity of the economy. A modern and efficient infrastructure is a key driver of productivity, and the construction industry has a major role in delivering the built infrastructure in an innovative and cost-effective way.

ACKNOWLEDGEMENTS

Alhamdulillah, I thank the Almighty Allah for protecting us from the harmful and unwanted accidents or incidents during the industrial training, for life, for pretty much the same reason.

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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 lecturers who are directly involved during my training stint. To Dr Hayroman Bin Ahmad, Supervising Lecturer, En Muhammad Naim Bin Mahyuddin, Practical Training Coordinator and Dr. Ida Nianti Binti Mohd Zin, 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 semesters.

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CHAPTER 1.0

PREFACE

1.1 INTRODUCTION

Building construction is the techniques 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 the means by which human beings were able to adapt themselves to a wide variety of climates and become a global species. (Chang, 2014)

Building is some to extent determined by availability of material and skilled operatives, therefore local, regional and national factor will also be responsible for some variation. Supplementary study material and detail can be obtained from professional journals, legislative paper, manufactures product literature, the many cross-references in the text and attending exhibits and seminars. The most valuable learning resource is observing and monitoring construction in progress (Roy Chudley, 1982)

Building construction is procured privately or publicly utilizing various delivery methodologies, including hard bid, negotiated price, traditional, management contracting, construction management-at-risk, design & build and design-build bridging.

Building construction is the process of adding structure to real property. The vast majority of building construction projects are small renovations, such as addition of a room, or renovation of a bathroom. Often, the owner of the property acts as labourer, paymaster, and design team for the entire project. However, all building construction projects include some elements in common - design, financial, and legal considerations. Many projects of varying sizes reach undesirable end results, such as structural collapse, cost overruns, and/or litigation reason, those with experience in the field make detailed plans and maintain careful oversight during the project to ensure a positive outcome.

Civil engineering is the oldest and one of the most versatile branches of engineering. Every structure that we see around today is a creation of civil engineering. Civil engineering is the oldest and broadest engineering discipline among all the engineering fields. The field deals with the planning, designing, and construction of buildings and various other structures. From huge dams to sky high buildings, from suspension bridges to offshore drilling platforms, every physical concrete structure comes under civil engineering. (Raunekk, 2014).

Therefore, it is essential to provide building construction for residential building especially in Terengganu area in order to keep develop more building for citizen in future.

1.2 SCOPE OF STUDY

This report provides information regarding implementation of the first stage to the final stage on the building construction of Precast Concrete for column at Library Building, Tembila, Besut. This stage involves the planning and development activities associated with building construction and consists of two closely related processes:

- i. Determining the type of material used.
- ii. Preparing and carrying out the construction works.

1.3 OBJECTIVE

1.3.1 Aim

- To conduct the building construction using precast concrete for beams and columns at Library Building Unisza, Campus Tembila, Besut.

1.3.2 Objectives

- i) To identify the precast concrete beam and column
- ii) To determine the methods installation of precast concrete beams and columns.

1.4 METHOD OF STUDY

1.4.1 Primary Data

i. Interview

Interview sessions with several people who are responsible for the site construction. Several of those people are the supervisor, sub – contractor, skilled worker, unskilled worker and much more.

ii. Case Study

Case study were made by observation method during practical training through site visit. The information collected was based on what happened on site construction guidance by the site supervisor. As camera and cell phone was used to record any important information such as progressing of construction, equipment and machineries that were used while construction.

1.4.2 Secondary Data

The main reason for doings literature review is to can study and find out regarding the building construction about the steps to construct a ground slab, the material used and how to construct it through relevant books, articles and thesis at National library and UiTM Seri Iskandar library, Perak.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 INTRODUCTION OF COMPANY

WRA Services Sdn. Bhd is a bumiputera construction company which is actively involved in construction of buildings and civil engineering works. WRA is registered with Pusat Khidmat Kontraktor and Construction Industry Development Board. Since it's establishment in 1993, WRA has successfully completed many building projects, stadium, road and installation of water supply pipes. WRA also has experience in managing and constructing projects under 'Design and Build' concept whereby WRA is responsible for appointment of a team of consultants for preparing a building design complete with all necessary electrical and mechanical services that meet clients needs and constructing the same in accordance with agreed design.

The success of WRA in discharging its obligations to the clients, to a great extent, is due to a team of dedicated and committed management staff who are ever ready to accept any challenge. Solid support from bankers, suppliers and specialist sub-contractors is also important factor which help WRA in successfully completing its undertakings and give confident to WRA to advance to a higher level of success.

WRA's main aim is to become a resilient Bumiputera construction company which is capable to deliver quality projects that meet clients need.

2.2 Official Logo & Symbols

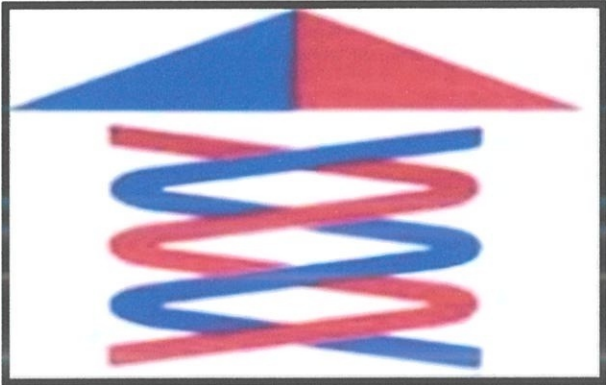


Figure 2.1: WRA Services Sdn. Bhd logo & symbols

2.3 COMPANY PROFILE

Table 2.3 Company Profile

1.	Company Name	WRA Services Sdn Bhd
2.	Company Address	No. 51 A, Tingkat 1, Jalan Tok Lam, 20100 Kuala Terengganu, Terengganu Darul Iman
3.	Board Director	Dato' Wan Rezali Bin Wan Abdullah Dato' Mazuki Bin A. Aziz
4.	Contact	No phone: Fax no: Email: wraservices@yahoo.com
5.	Date of incorporation	03/11/1998
6.	CIDB registration no.	TR012896-19
7.	PKK registration no.	1961109-TR012896
8.	Company Number	264479H
9.	Company Auditor	Zuki & Rashid Tax Accountants 66/23, 1 st Floor, Taman Seri Intan, Jalan Sultan Omar, 20300 Kuala Terengganu
10.	Malaysia finance ministry registration number	357—2-52939
11.	Prime Bank	<ul style="list-style-type: none"> • CIMB Kuala Terengganu 3083, Jalan Sultan Ismail, 20200 Kuala Terengganu, Terengganu • CIMB Kuala Lumpur Taman Tun Dr Ismail, Kuala Lumpur
12.	Scope of works	Specialization: - <ul style="list-style-type: none"> • Building work • Civil Engineering • Mechanical & Electrical Engineering

Source: WRA Services Sdn. Bhd.

2.4 Quality Policy

The management and employees of WRA Services Sdn. Bhd. are committed, and by all means strive to provide the cost-effective services that can deliver only the best, which meet and exceed the expectations of our customers. In order to achieve these, we will continuously:

WARRANT the highest quality of products and services to customers by ensuring all employees are highly competent with the highest degree of knowledge, expertise, skills, integrity and quality. 'Do It Right the First Time, And All the Time' is a work culture practiced throughout the organization.

RECOGNIZE the Quality Management System as certified by the **ISO 9001:2008**, as a foundation to systemically and continuously execute, control, measure, analyse and improve the activities within the organization to ensure the continuity of organisation's profit, growth, competency and survival.

ADHERE to the requirement of society as expressed in laws, statues and rules regarding environment, safety, health, energy and social aspect

ORGANIZATION CHART

2.5 Overall WRA Services Sdn. Bhd.

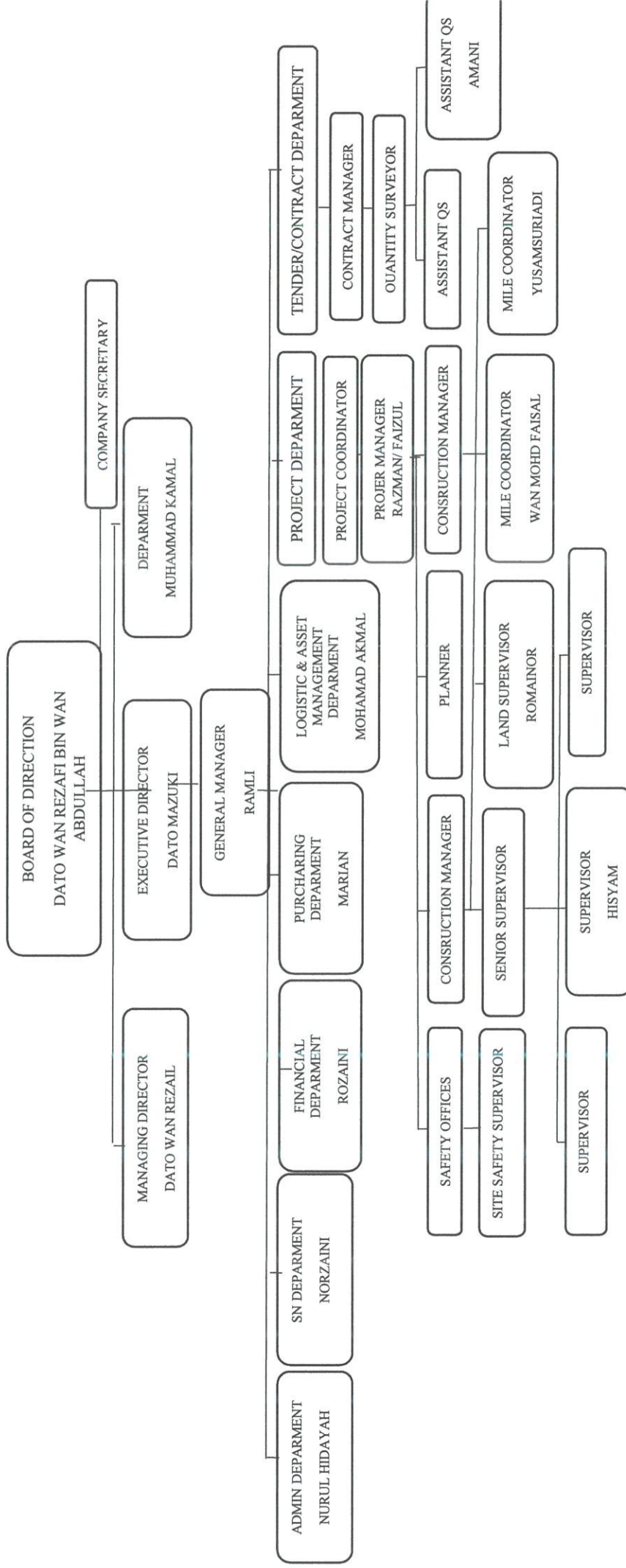


Figure 2.5 Organization Chart



Figure 2.5(i) CIDB SPKK Certificate

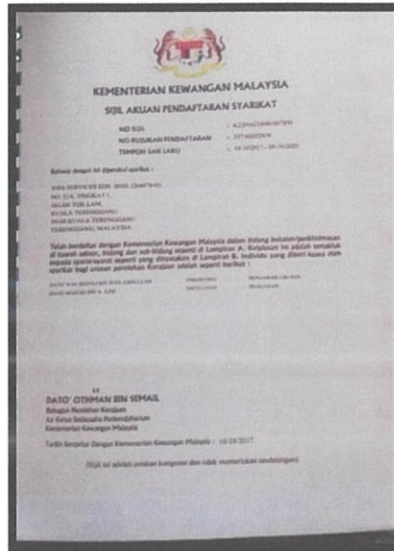


Figure 2.5(ii) Bumiputera Contractor Certificate



Figure 2.5(iii) ISO Certificate



Figure 2.5(iv) Registration Certificate



Figure 2.5(v) Bumiputera Contractor Certificate

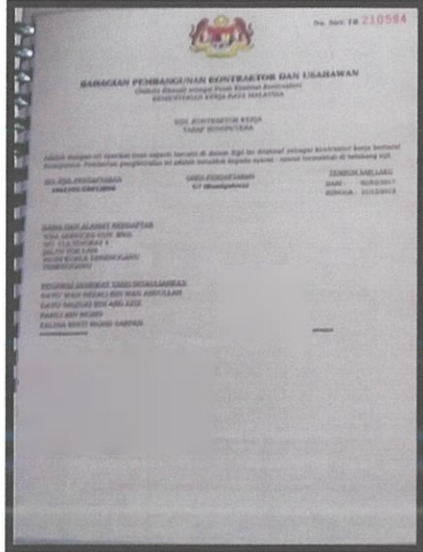


Figure 2.5(vi) Bumiputera Contractor Certificate

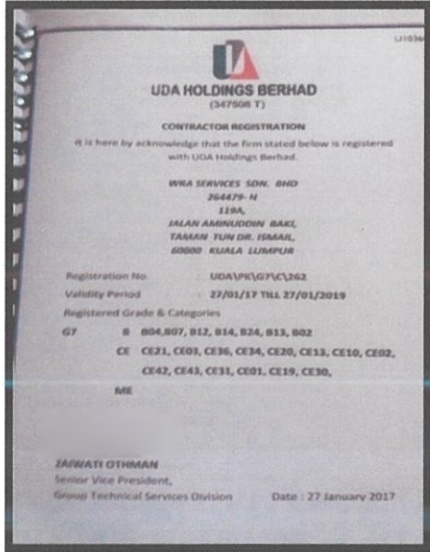


Figure 2.5(vii) Bumiputera Contractor Certificate

2.6 LIST OF PROJECTS

2.6.1 Completed Projects

Table 2.3.1 List of completed projects

NO.	Project	Owner	Amount (RM)
1.	Stadium Hoki Lembah Pantai, Kuala Lumpur	Kementerian Belia & Sukan	18,082,306.00
2.	Department of Farmacy & Science, University Malaya, Lembah Pantai, Kuala Lumpur.	University Malaya	15,002,028.20
3.	The Design, Construction, Equipping & Commissioning of Ambulatory Care Centre, Hospital Tengku Ampuan Afzan, Kuantan, Pahang Darul Makmur.	Hospital Tengku Ampuan Afzan	56,805,750.00
4.	Redevelopment of Kuala Terengganu Airpot Project – Terminal Building, Kuala Terengganu.	JKR Malaysia	123,168,685.60
5.	Paya Bunga Square	Pmint	95,000,000.00
6.	Institut Latihan UiTM in Enstek, Nilai.	UiTM	101,000,000.00
7.	Interior work for cineplex at Paya Bunga Sentral.	Pmint	7,954,861.55
8.	Renovate Department of Emergency in Hospital Sultanah Nur Zahirah, Kuala Terengganu.	Hospital Sultanah Nur Zahirah	14,930,000.00
9.	Sekolah Menengah Ketengah Jaya 2, Dungun, Terengganu	Kementerian Pelajaran Malaysia	13,000,000.00

Source: WRA Services Sdn Bhd

2.6.2 Ongoing Projects

Table 2.3.2 List of ongoing projects

NO.	Project	Owner	Amount (RM)
1.	Library of University Sultan Zainal Abidin in Campus Tembila, Besut, Terengganu.	University Sultan Mizan Zainal Abidin	14,726,374.36
2.	28 unit of commercial building in Banding, Kemaman, Terengganu	KETENGAH	10,587,880.00

Source: WRA Services Sdn Bhd.

3.0 CASE STUDY

3.1 Introduction of Project

University Sultan Zainal Abidin Campus Besut have planned to construct a 3 storey Unisza Library Building. The project commenced on June 2017 and is expected to complete by June 2019. The total cost for this project is RM14,726,374.36.



Figure 3.1(i): Front view of Unisza Library Building in Tembila, Besut

Taman Ilmu location is strategic and full of accessibility because it is located beside the main road to Kuala Terengganu-Besut. Unisza Campus Tembila is the one of the universities have opened up at Taman Ilmu which started in 2015.

**UNIVERSITI SULTAN ZAINAL ABIDIN (UniSZA)
PEMBINAAN BANGUNAN PERPUSTAKAAN KAMPUS TEMBILA**

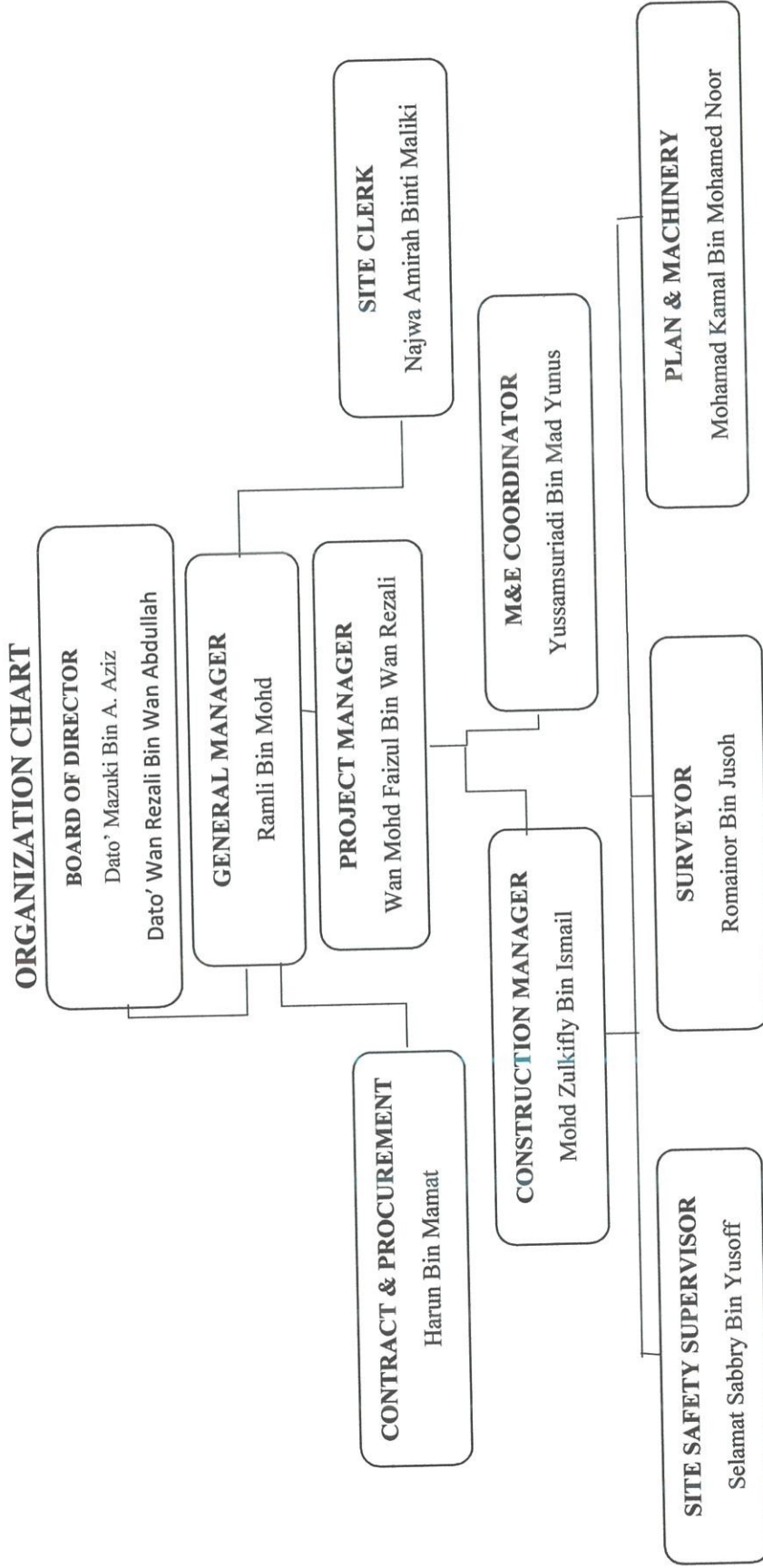


Figure 3.1(ii) Site Organization Chart

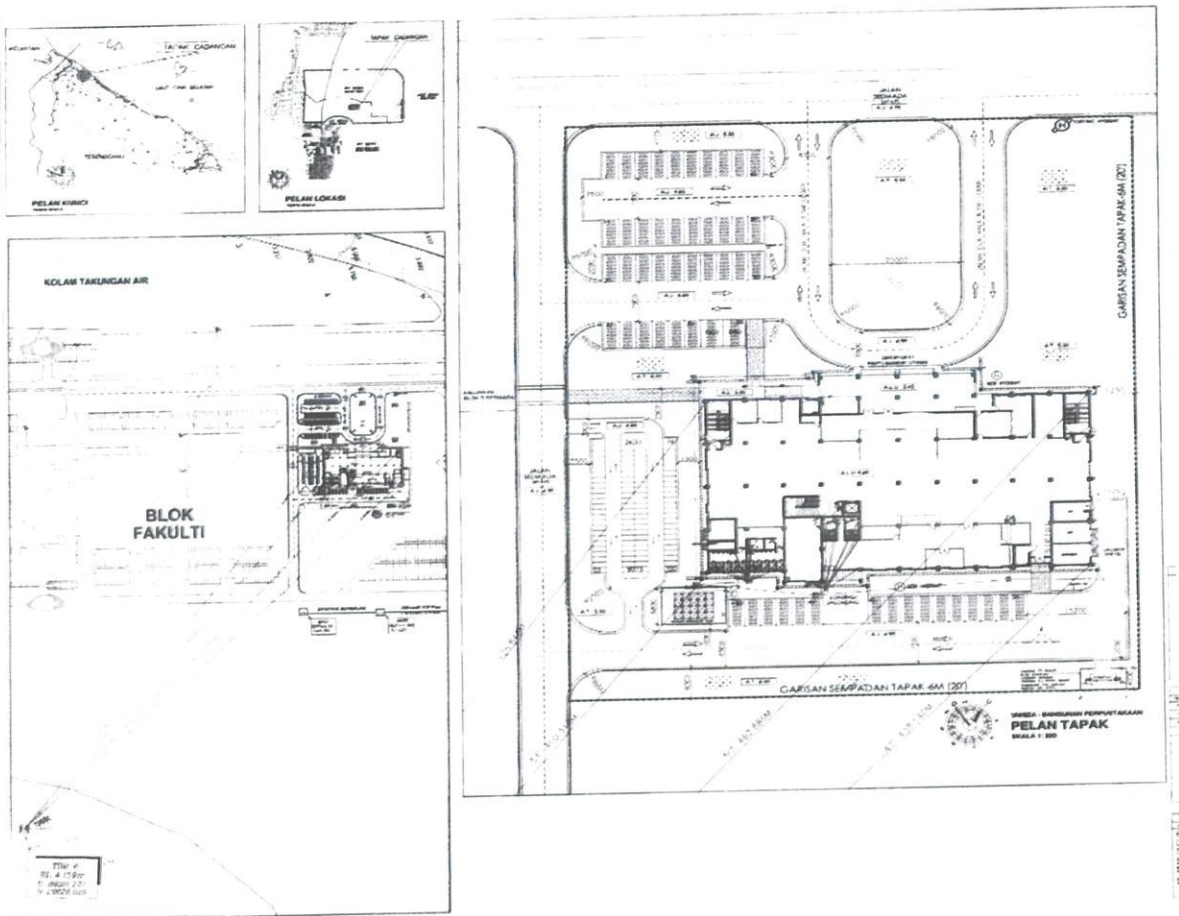


Figure 3.1(iii) Key Plan

Source: WRA Services. Sdn Bhd.

For this case study, the focus will only be on the **construction of precast columns and beams** as a suitable topic due to process of construction is not very complex. The precast columns and beams are the only works easy to conduct and manage because its can save costs and increase of better quality.

Owner	University Sultan Mizan Zainal Abidin	University Sultan Zainal Abidin, Campus Gong Badak, 21300 Kuala Nerus, Terengganu Darul Iman.
Architect	JKR Malaysia	Bahagian Fasiliti Pengajian Tinggi Ibu Pejabat JKR, Tingkat 8, Menara Tun Ismail Mohammad Ali, No. 25, Jalan Raja Laut, 50582 Kuala Lumpur.
Civil & Structure Engineering	JKR Malaysia	Bahagian Fasiliti Pengajian Tinggi Ibu Pejabat JKR, Tingkat 8, Menara Tun Ismail Mohammad Ali, No. 25, Jalan Raja Laut, 50582 Kuala Lumpur.
Mechanical & Electrical Engine	JKR Malaysia	Bahagian Fasiliti Pengajian Tinggi Ibu Pejabat JKR, Tingkat 8, Menara Tun Ismail Mohammad Ali, No. 25, Jalan Raja Laut, 50582 Kuala Lumpur.
Contractor	WRA Services Sdn Bhd	No 51A Tingkat 1, Jalan Tok Lam, 20100 Kuala Terengganu

Table 3.1 List of consultants

Source: WRA Services Sdn. Bhd.

3.2 CASE STUDY

3.2.1 Precast concrete column

Precast concrete columns may be of single or double storey height. The method of connection to the foundation and to the column above will vary with the manufacturer. Foundation connection may be via a base plate connected to the column or by reinforcing bars projecting from the end of the column passing into sleeves that are subsequently filled with grout. Alternatively, a column may be set into a preformed hole in a foundation block and grouted into position.

Column-column connections may be by threaded rods joined with an appropriate connector; with concrete subsequently cast round to the dimensions of the cross-section of the column. Alternatively, bars in grouted sleeves, as described above, may be used. This results in a thin stitch between columns while the previous approach requires a deeper stitch. Connections may be located between floors, at a point of contra-flexure, or at floor level.

Columns are provided with necessary supports for the ends of the precast beams (corbels or cast-in steel sections). There will also be some form of connection to provide beam-column moment connection and continuity. For interior columns this may be by holes through which reinforcing bars pass from one beam to another. For edge columns, some form of bracket or socket is required. The types of precast concrete column used at level three is CB44, CB45, CB46, CB47, CB48, CB49, CISC, CB50, CB51, CB52. **(REFER APPENDIX III)**



Figure 3.2.1: Precast Concrete Column

3.2.2 Precast concrete beam

Beams are typically considered structural components and are made in one of three key shapes:

- Rectangular
- Inverted tee beams
- L- Beams

Beams are horizontal components that support deck members like double tees, hollow core, solid slab, and sometimes other beams. They can be reinforced with either prestressing strand or conventional reinforcing bars. This will depend on spans, loading conditions, and the precast producer's preferred production methods.

The reinforcements can be placed at centre of that beam. The sizes of main reinforcement play important role in determine the strength of a beam. Precast beam usually does not have secondary beam, only has primary beam.

There are 5 type of beam;

1) Main Beam

Main beam is the beam that stretch over from column to column where it is main beam to transfer the whole upper load to column that consist inside the building structural.

2) Secondary Beam

This type of beam is stretches over the main beam. This beam is also transmitted to the load of the main beam. The function is reducing a length that support the structure or catch the load of structure.

3) Tertiary Beam

It's the beam across between the columns and the main beam and its function is distributing the load from the beam to column.

4) Tie Beam

Beam that stretches over a column and its purpose to binding are both columns. This is to support stability of structure.

5) Edge Beam

Function as binding beam to stretches between the external columns.

(Liwei, 2012)

There are different between size of precast beam and reinforcement bar for roof level three for each unit of precast concrete beam because it has calculated for design purpose (**REFER APPENDIX I, II**)

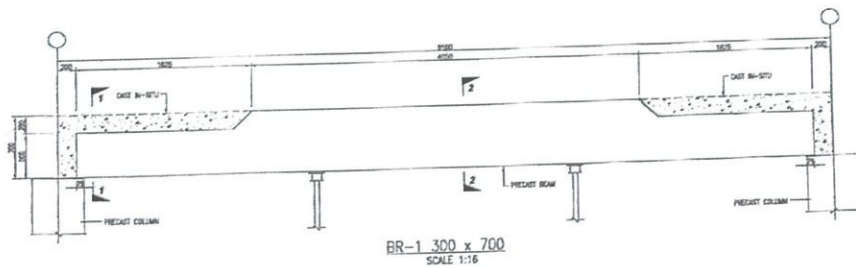


Figure 3.2.2(i): Precast concrete beam BR-1

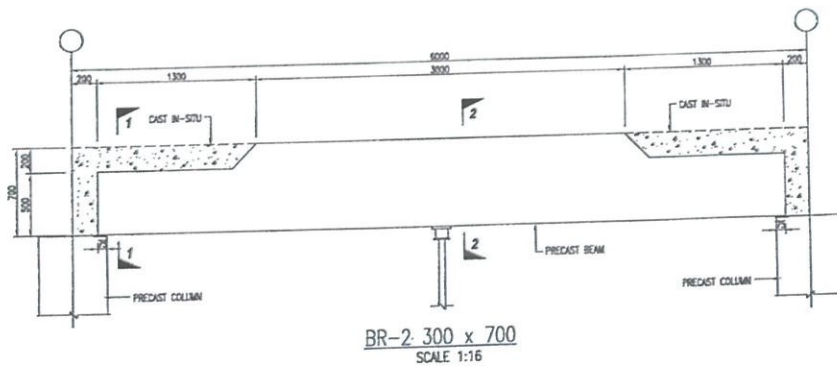


Figure 3.2.2(ii): Precast concrete beam BR-2

3.3 Methods construction of precast concrete beam and column

The process of installation of precast concrete beam and column are shown in figure 3.1 below: -

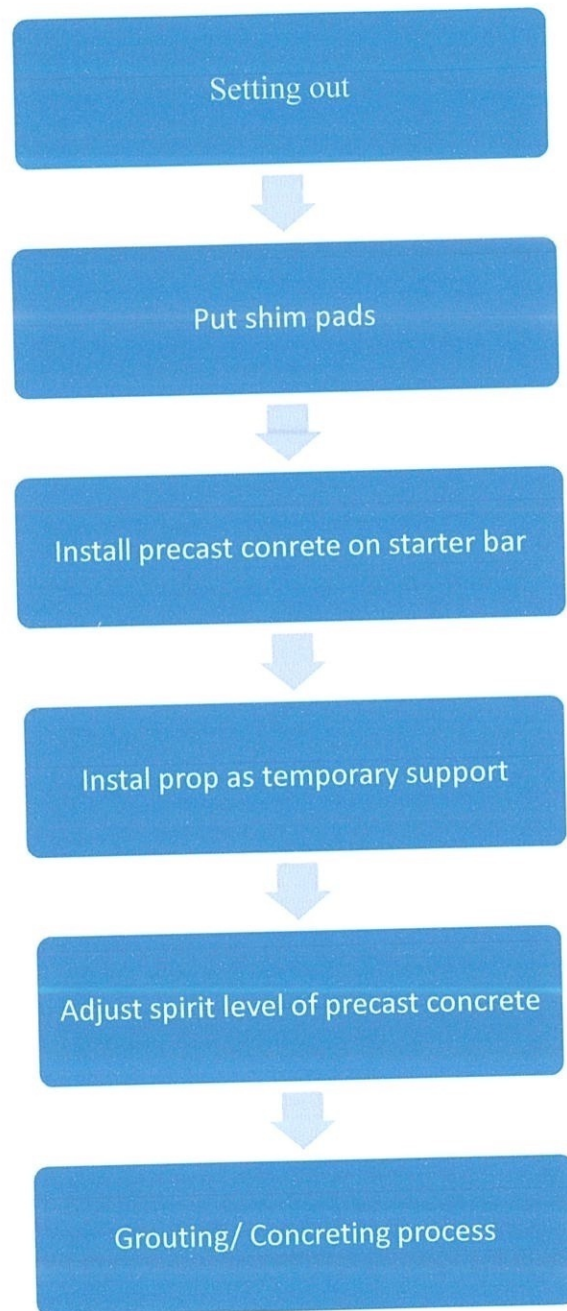


Figure 3.3: Flowchart of installation of precast concrete beam and column

Manpower:

NO	Description	Roles and Responsibilities	No. of Person
1.	Project Manager	Responsible of project Technical, drawings and construction activities.	1 Person
2.	Site Engineer/ Site Supervisor	Coordinating, Planning and Supervising site Activities	1 Person
3.	Site Safety Supervisor	To ensure, control and monitor the safety, health and environment aspects on site.	1 Person
4.	Worker	To carry out construction work as planned	1 Team

Table 3.3 Manpower and responsibilities on site

3.3.1 Installation of precast concrete column

I. Setting out



Set reference line and offset line to determine the position of the precast beams to be installed. For precast column component, check the positions and the alignment of the starter on the slab before hoisting before installation.

Picture 3.3.1(i) Setting out work

II. Put shim pad (level pads)



Shim pads will be used in case of height difference between one pole and the other. The bottom of the pole will be covered by shim pads. It consists of asbestos and plastic shim. Shim pads also as setting level of the element.

SHIM PAD

Picture 3.3.1(ii) Put shim pad on slab

III. Install the precast concrete column



At each column, at the top of the middle section there is a place to be hooked to aim for the easy process of settlement. Usually the tools for lifting crane suppliers will use wire ropes or lifting chains. The column will be placed on the starter bar available according to the marked position at the beginning of the job. Make sure the column has been installing at setting out area.

Picture 3.3.1(iii) Installation of precast column

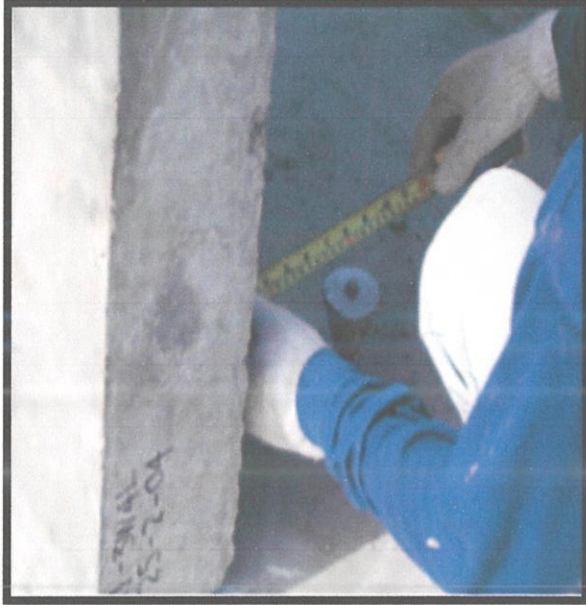
IV. Install the prop



After the pole is positioned, the prop will be used for the as temporary support and gaining strength on the pole. Prop dimensions are not set depending on the suitability of a project.

Picture 3.3.1(iv) Installation of prop

V. Alignments the precast concrete column



Check the alignment and vertically of the panel. If necessary, adjust the temporary propping to achieve the level of precast concrete column. In this process of alignment, the bubble level and the plum bob method are used.

Picture 3.3.1(v) Alignment work using plum bob

VI. Prepare the grouting cement



Prepare and apply non-segregated grouting (NSG) cement grout to seals the gaps along the bottom edge of inner side of the panel. NSG cement should be prepared in accordance with the specifications.

Picture 3.3.1(vi) Prepare NSG cement

VII. Grouting process

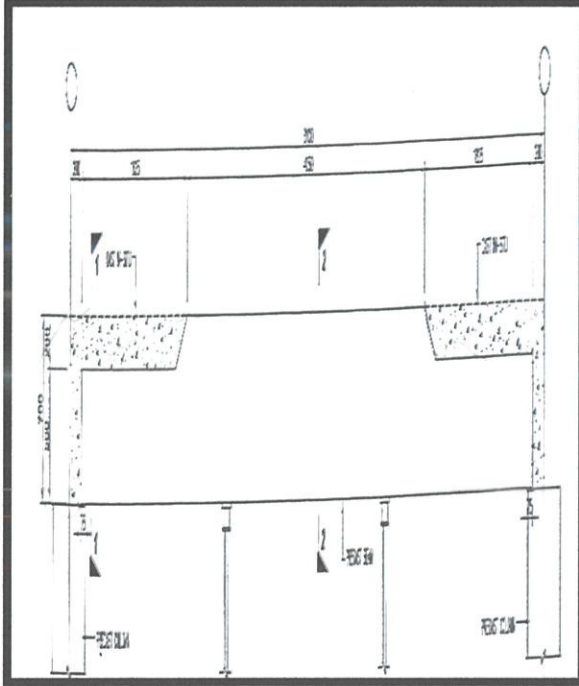


Grouting process is the process to tie precast column with the starter bar on the floor. Usually the precast column that has been in the grout will be left to harden for 10-12 hours. After that, the installation of the beam can be installed.

Picture 3.3.1(vi) Grouting process

3.3.2 Installation of precast concrete beam

I. Setting out



Set reference line and offset line to determine and required alignment and level of the precast beam elements during installation. Overlapping the beam and column is 75mm. Put the shim plates on the overlapping area. Before hoisting, check that the dimensions and the alignment of starter bar, to prevent any obstruction during installation process.

Picture 3.3.2(i) Dimension for overlapping between beam and column

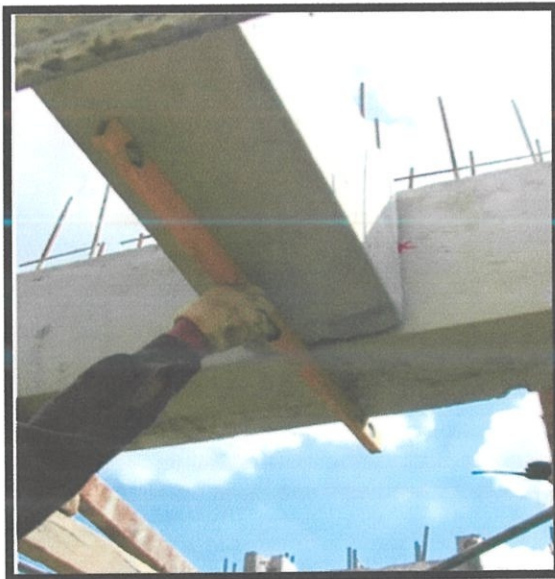
II. Installation of precast concrete beam



Lift the precast beam to designated location with us wire ropes. To control from twisting during the assembly process, the lifting line will be strapped on both sides of the beam. Approximate length of the rope is approximately 8-10 meters.

Picture 3.3.2(ii) Lift and install work beam

III. Alignment the precast beam



Align and check the level to suit the required setting out after been install the precast beam by using bubble level. It is important to check on the levelness of the precast beam as well as between the column before proceeding the to do jointing works

Picture 3.3.2(iii) Alignment work of beam using
Bubble level

IV. Casting of joints



Picture 3.3.2(iv) Rebar the joints between beam and column

For components with cast in-situ, place and lap the rebars as required. The joint rebar should be correctly placed in accordance with the design specifications. Set up the formwork for the casting joint and supporting beam can be designed to form part of the formwork for the casting of joint.

V. Casting process



Picture 3.3.2(v) Casting joints between beam and column

The panel of precast beam is then connected at both end covering the covering the starter bar and the rebar jointing of beam that was lapped at the column. Concrete Grade 37JKR used for the jointing between the panel. Make sure the concrete is vibrated by using vibrator poker.

CHAPTER 4.0

CONCLUSION

4.1 CONCLUSION

IBS should be innovative improvement in the construction industry. It is imperative that IBS is seen as an evolution of construction using new and innovative techniques rather than a revolution. Overall after involvement in the construction field at Unisza Campus Tembila, Besut, precast concrete of beam and column is one of the major things that used for structure in construction material. A proper care for the material is a must so that it would not cause problem in the future. A few precautions have been established when someone in unloading panel of concrete by using mobile crane and stacking the panel concrete must arranged carefully.

In completing this report, the method of installation of precast concrete column and beam in explained in detail. The construction of precast concrete starting with lifting the panel and make sure the panel put in properly. After that, install the prop at the column as the temporary support before grouting process. Grouting process is a process to make the joint stick together with starter bar by using cement grouting (NSG).

Many machineries such as, mobile crane, bar bender and bar cutter were used while the construction. This equipment and machineries will give new experience and knowledge for student practical. The surroundings of site construction full of equipment like nail, hammer, and reinforcement bar. This situation will be created intention to learn something new and develop this skill using this equipment for benefit.

For safety and health, it can be concluded that construction site area is safe to enter. Although, there are certain worker not wearing personal protective equipment (PPE) and protective clothing, there are no injuries or fatal cases that occur during the construction work process.

Therefore, it is recommended to all parties to taken safety precaution regarding the installation of precast concrete column and beam to minimize other contribution factor in building defect and human injury.

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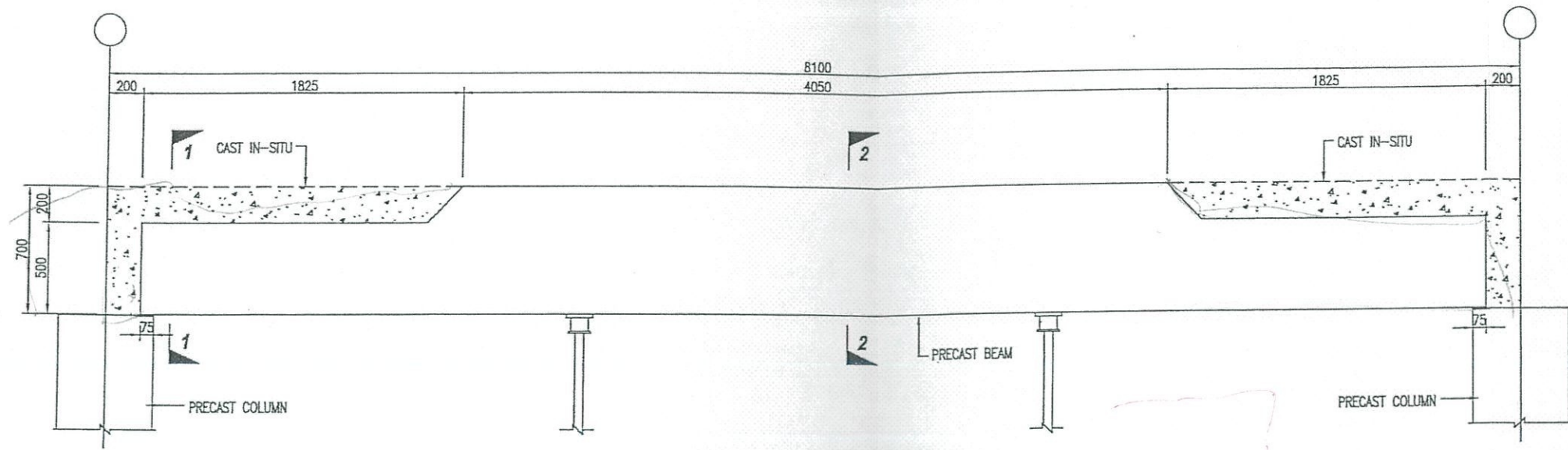
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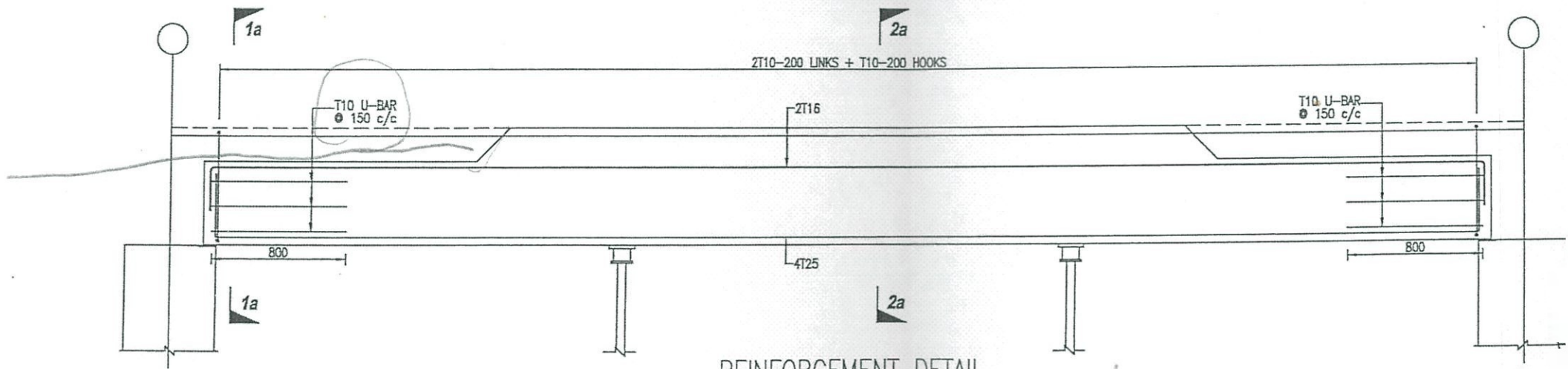
Bca.com. (2008). Methods of precast concrete. Retrieved at 8/11/2018

<https://www.bca.gov.sg/Professionals/IQUAS/others/precastinstallation.pdf>

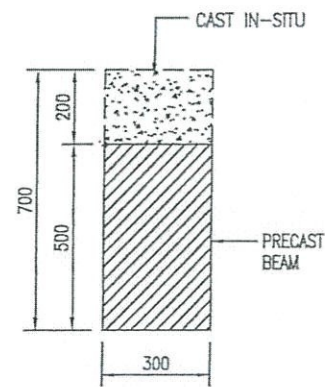
APPENDICES



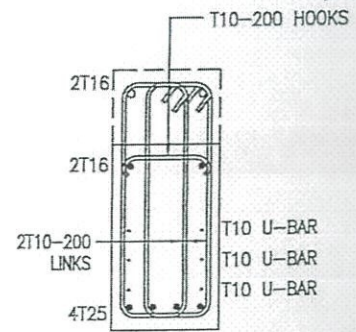
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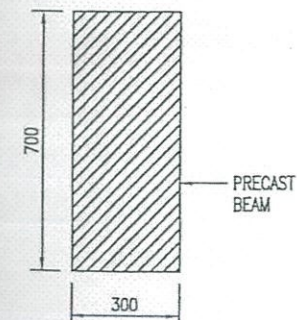
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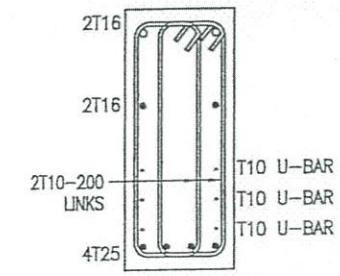
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SECTION 1a-1a
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SECTION 2-2
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SECTION 2a-2a
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ARAS DUA - ARAS BUMBUNG ATAS
PRECAST BEAM DETAIL (BR-1)

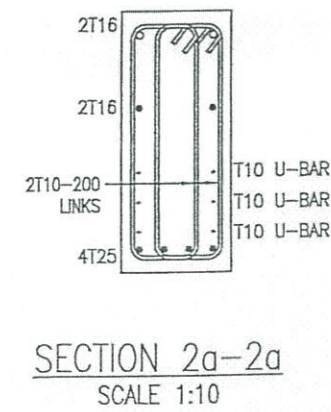
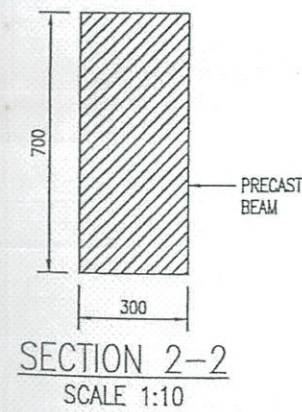
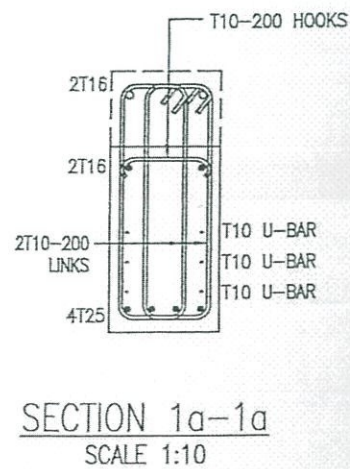
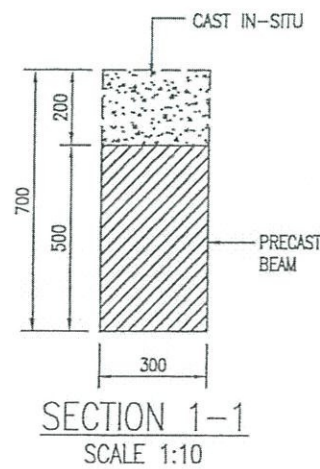
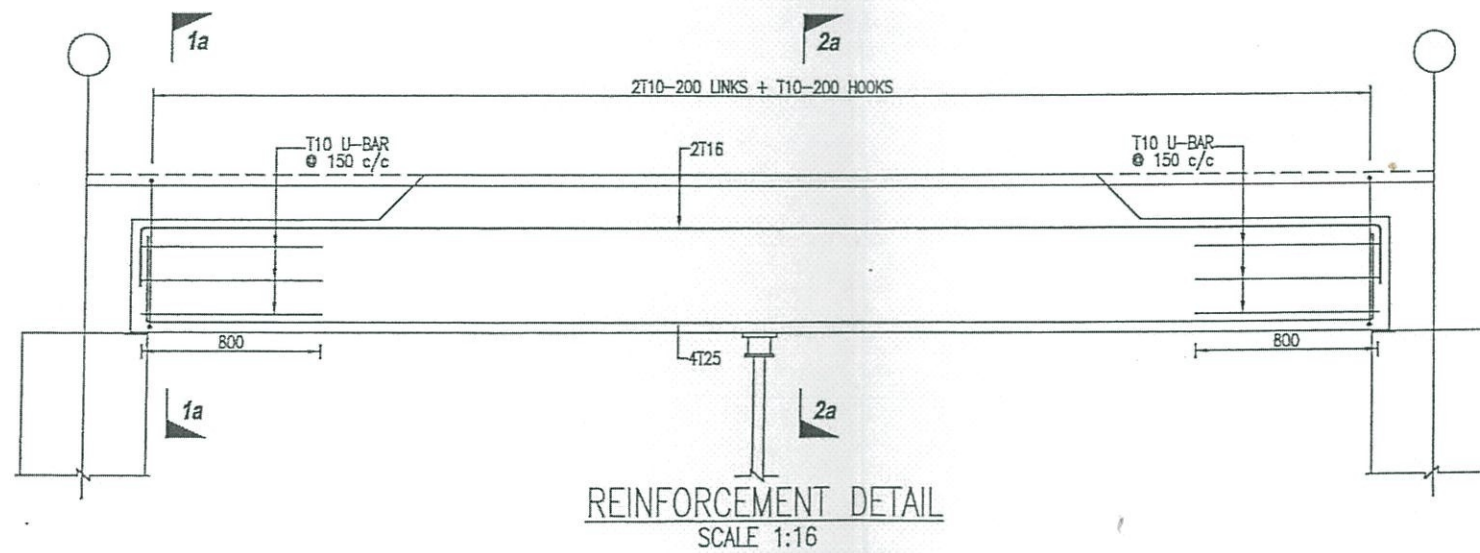
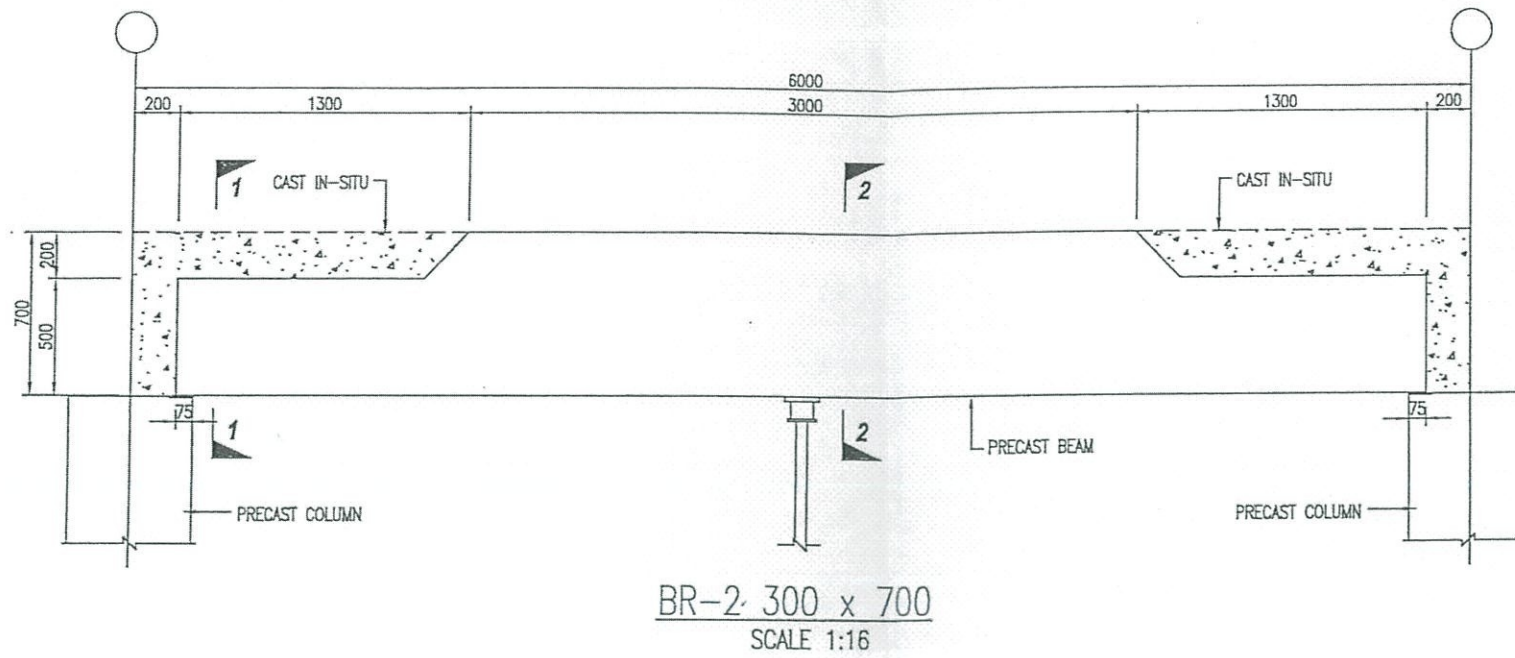
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TAJUK LUKISAN:
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ARAS DUA - ARAS BUMBUNG ATAS
PRECAST BEAM DETAIL (BR-2)

TARIKH: NOVEMBER 2017 SKALA: AS SHOWN
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APPENDIX III



KERAJAAN MALAYSIA
KEMENTERIAN KERJA RAYA



JABATAN KERJA RAYA

NO.	TARIKH	CATATAN	DILULUSKAN OLEH
1	14/03/18	REDUCE HEIGHT REINF. BAR	

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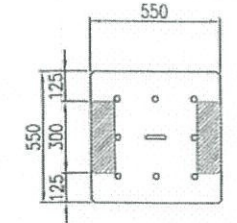
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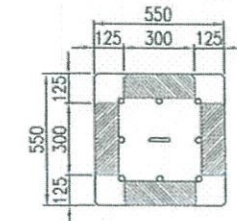
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TALUK LURISAN:
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PRECAST COLUMN DETAILS

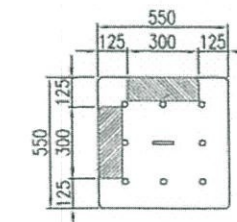
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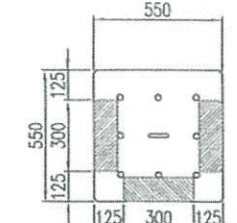
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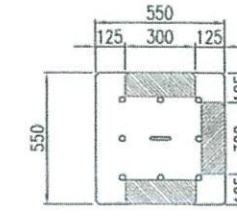
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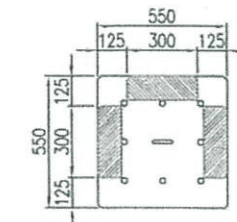
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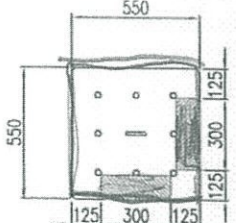
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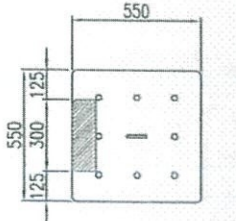
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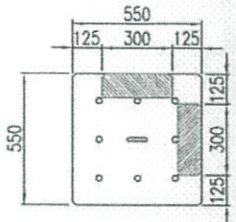
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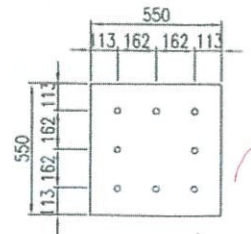
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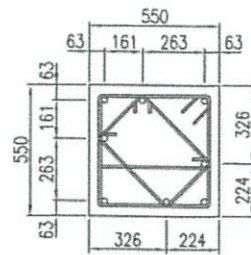
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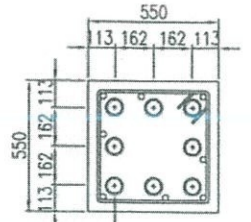
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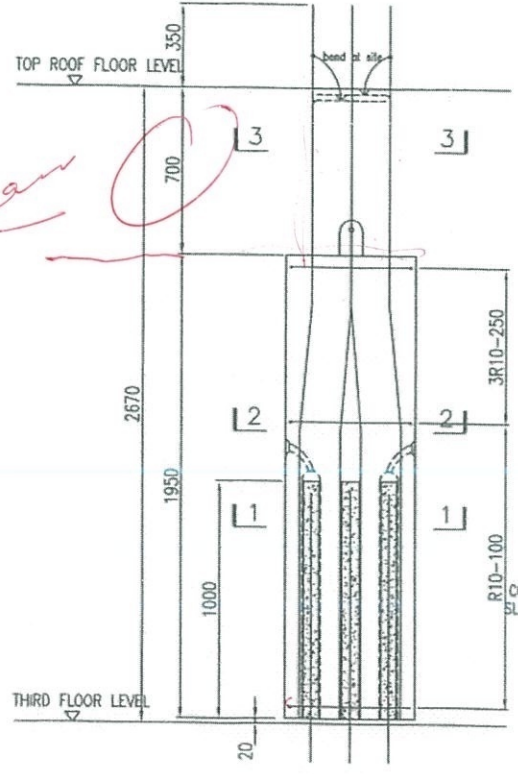
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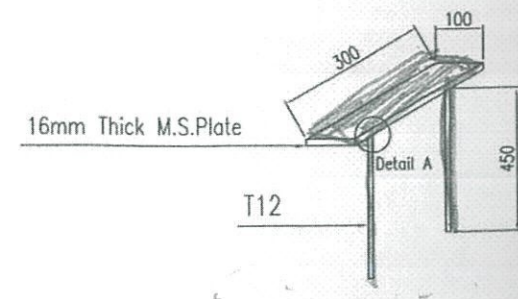
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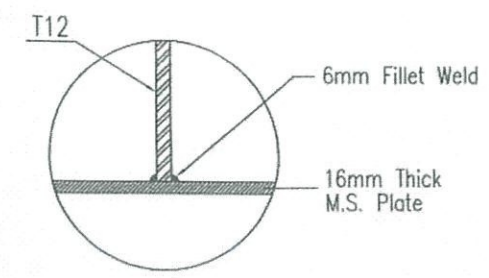
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PRECAST COLUMN
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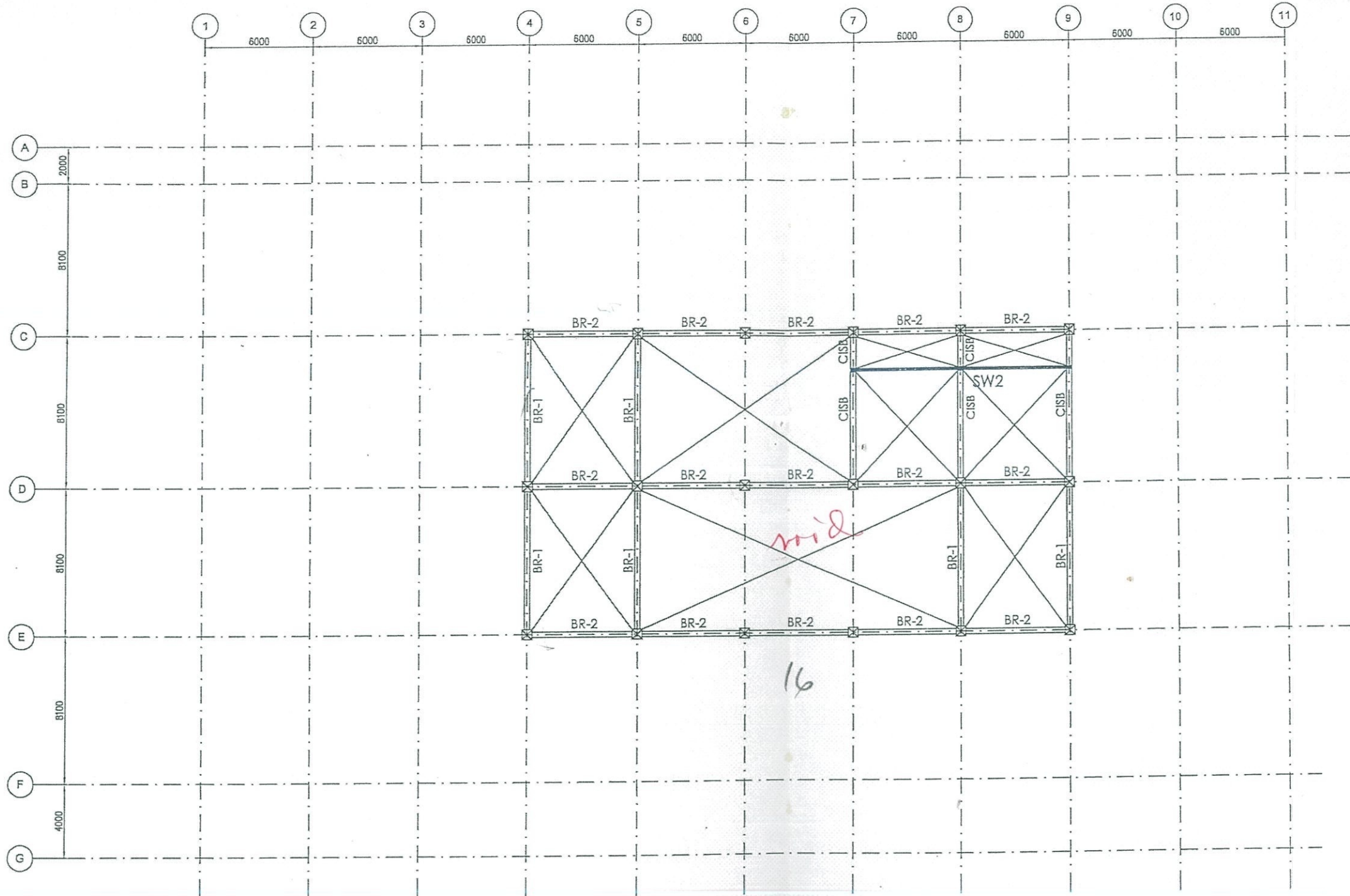


Typical Plate Bearing to Be Cast in
Precast Column
N.T.S



Detail A





PELAN ARAS BUMBUNG ATAS

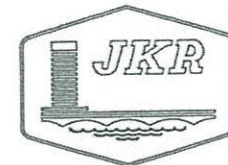
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NOTE:

- 1- ALL PRECAST COLUMN SHALL BE 550mm x 550mm U.O.S
- 2- BR - DENOTES PRECAST BEAM 300mm x 700mm U.O.S
- 3- CISB - DENOTES CAST IN-SITU BEAM
- 4- INFORMATIONS FOR CAST IN-SITU CONCRETE ELEMENTS TO BE REFERRED TO SEPARATE DRAWINGS



KERAJAAN MALAYSIA
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