DEPARTMENT OF BUILDING

UNIVERSITY TEKNOLOGI MARA

(PERAK)

THE INSTALLATION METHOD OF U-BEAM AND BOX GIRDER

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DECEMBER 2018

By

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Entitled

The Installation Method of U-beam and Box Girder

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

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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 Jetson Construction Sdn. Bhd. For duration of 14 weeks starting from 3rd of September 2018 and ended on 7th of December 2018. It is submitted as one of the prerequisite requirements of DBG307 and accepted as a partial fulfillment of the requirement for obtaining the Diploma in Building.

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UiTM ID No. : 2015315635
Date: 18/12/18

ACKNOWLEDGEMENT

The internship opportunity I had with Jetson Construction SBN. BHD. (JCSB) was a great chance for learning and professional development. Therefore, I consider myself as a very lucky individual as I was provided with an opportunity to be part of it. I am also grateful for having a chance to meet many professionals who led me through this internship period. I would like to extend my sincere thanks to all of them.

I am highly indebted to Encik Sofi (Project Manager) and Encik NurFirdaus (Site Supervisor) for their guidance and constant supervision as well as providing necessary information regarding the project, in spite of being extremely busy with their duties.

I express my deepest thanks to Miss Sandra (Site Engineer) for contributing her time to teach and guide on so many important matters such as construction drawings and office works and documentations. Then, I would like to thank Encik Shahril (M&E Engineer) and Shahfeeq (Surveyor), who was never too busy to spare some time to share their knowledge and experiences.

Also, not forgetting, the rest of Jetson site staff for their support and endless help. Then, I would like to thank my lecturer, Puan Normila Ahmad, who is the person in charge for my internship for her valuable guidance and advice.

Last but not least, special thanks to my family and friends for their constant encouragement and support. I perceive this opportunity as a big milestone in my career development. I will strive to use these gained skills and knowledge in the best possible way.

ABSTRACT

Beam is one of the basic components in construction. This report discussed more about beams, specifically, pre-stressed concrete u-beams and box girders. It explains about the types of beams that are available, the meaning and the installation method of prestressed concrete u-beams together with box girders. Besides that, it also describe the problems that occured during the u-beam launching and the documentation process of it. In addition, the list of equipment, machineries and manpower are included in this report. The purpose of this prestressed concrete u-beams and box girders is mainly for elevated highways across Kuala Lumpur which will provide faster travelling time, less traffic congestion and shorter distances for users.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

CHAPTER 1.0

INTRODUCTION

1.1 Background and Scope of Study

Beam is a long, sturdy piece of squared timber or metal used to support the roof or floor of a building (google.com). In a more descriptive way, a beam is a structural element that is used to resist load that is applied laterally to its axis. Bending is the way a beam shows how it is deflected. There it will produce reaction forces on the beam's support points when load is applied. Shear forces and bending moments are produce with the total effect of all forces combined that is acting on the beam. Beams can be classified into few types such as their support, geometry, shape of cross-section, equilibrium conditions, and materials.

The first type is support, so there is five category which are simply supported beam, cantilever beam, overhanging beam, continuous beam and fixed beam. Simply supported beam is a beam that is pinned at one end and has a roller on the other end. This type of beam undergoes shearing and bending depending on the load applied. Next is cantilever beam, this one is a beam that is fixed at one end and free on the other. Overhanging beam is a beam that has one or both end portions extended beyond its support. Continuous beam is a beam which has more than two supports distributed along its length. Lastly, fixed beam is a beam that is fixed at both ends .

Secondly, types of beam based on their geometry. There are three categories in this type of beam, which are straight beam, curved beam and a tapered beam. All three serves different functions. As for example, the curved beam is usually used in bridges, roofs and outdoor decks to make sure water does not pool.

Next type is shape of cross section. There are I-beam, T-beam and C-beam. I-beams are usually use for support trusses or main framework. As for T-beam, it is more effective to use for resisting sagging moment acting on it.

Last but not least, materials of beams. There is a few types of materials that can be used for making beams such as timber, steel and concrete. Different materials have different advantages and disadvantages as well as their strength.

1.2 Objectives

i. To know the installation method of u-beam launching
ii. To observe the problems occured during launching of u-beam
iii. To study the process of preparing documents for u-beam launching

1.2 **Methods of Study**

The few methods of studying this report are:

i. Observation - Observed the method of launching U-beam at late night with other workers. It took more than five hours to complete the four U-beam launching from a pier to another pier. The whole preparation took place before the actual launching which is in the evening. Started with excavation of soil at the sides of the column which will then be laid with crusher run. This is to assemble access at the side or behind (which ever that does not obstruct the mobile crane) of pier.

ii. Interview - Interviewed the site's engineer on the procedures and methods on constructing piers.Also interviewed the site's supervisor, about the steel bar sizes that is used on the site, the process of concreting pile caps, parapet walls and piers, installation of berm drain and box culvert, road widening and formwork. Not forgetting Gulam Mustoffa, the site's head of workers,whom explained the daily work progress on site.

iii. Document Review - Referred construction drawings, company profile, monthly and daily progress report, building quantities, request for inspection.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

It is founded in 1977, with the main purpose of solely provide construction services. But today, it has combined first-rate engineering technology with global capabilities in Construction, Property Development and Manufacturing of Anti-Vibration systems, Chemicals and Plastic Products.

Jetson also holds a leading title in this industry, which is through their work quality, exceptional client service and passion for construction and manufacturing. Besides that, Jetson was listed on Bursa Malaysia Securities Berhad in 1994.

- Company's Vision

Jetson aspire to be the preferred provider in the area of Construction and Property, and Manufacturing with a reputation built upon quality, trust, integrity and community consciousness.

To achieve their vision they are committed to:

1. Adhering to the highest standards of their corporate ethics, exercising good corporate governance, transparency, integrity and accountability in management.

2. Creating a corporate culture that fosters growth, education and career advancement for their staff.

3. Delivering sustainable value and returns to their stakeholders through disciplined management process, which emphasizes current and long term planning and profit optimization.

4. Adhering to high quality standard in improving efficiency and reducing cost to provide excellence in all aspects of the business.

2.2 Company Profile

Jetson's company profile is as shown in table

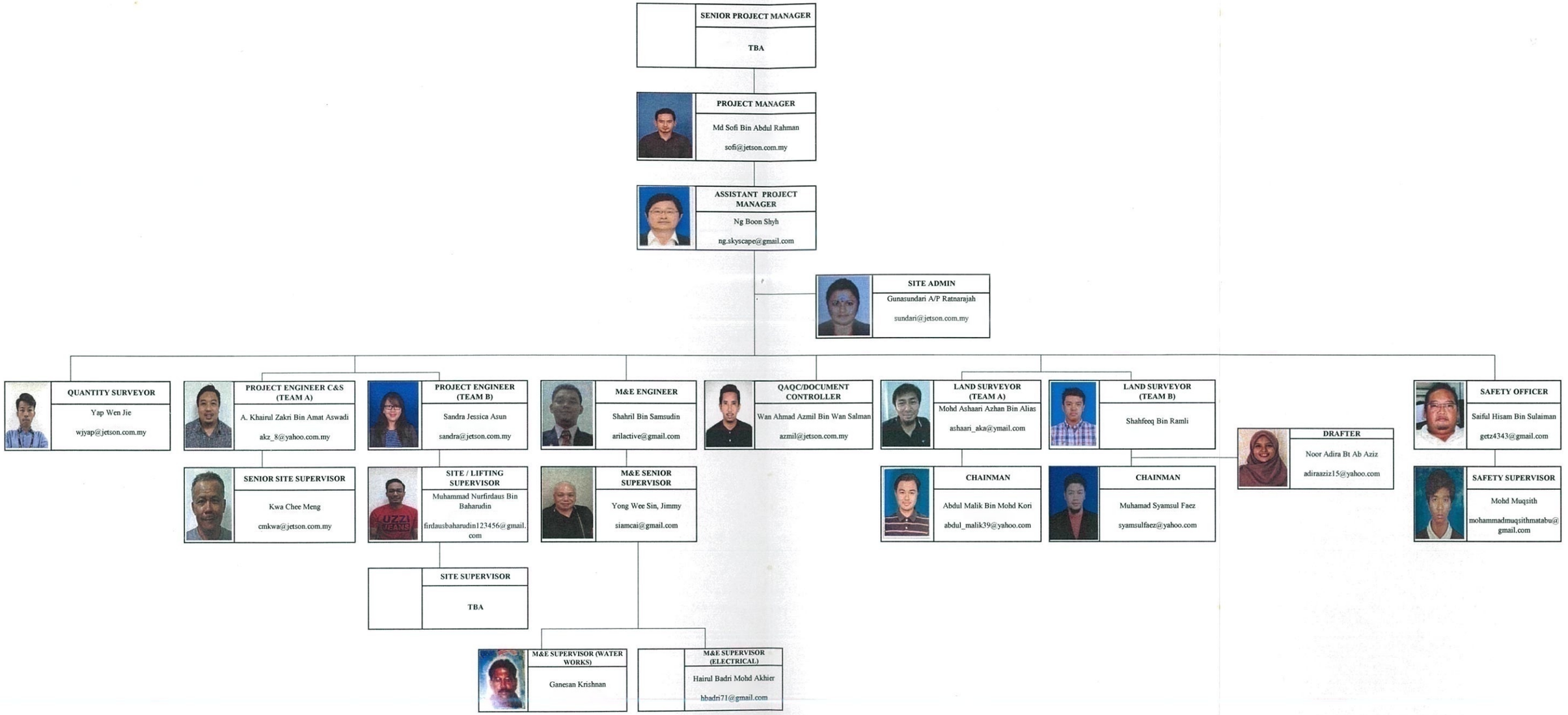
Table 2.1 : Jetson's company profile

Company's Name	: Kumpulan Jetson Berhad
Business Address	: 11th Floor, Menara Tokio Marine Life, No. 189, Jalan Tun Razak, 50400 Kuala Lumpur, Malaysia.
No. Tel / Fax	:
Date of Incorporation	: 1997
Main Business	: Construction, Property Development, and Manufacturing
Email	: corporate@jetson.com

This is the location of Jetson's headquarters in Kuala Lumpur from google maps:

Figure 2.1 : Site Office location

2.3 ORGANIZATION CHART



2.4 List of Project

Jetson's list of completed and on going projects are:

Completed Projects

Table 2.2 : List of completed projects

Project	Year
1. Pembinaan Pembangunan 1 blok 38 tingkat Pangsapuri Servis (260 unit) yang mengandungi: **i. 8 - tingkat 'Duplex Soho' (jenis B)** **ii. 1 - tingkat 'Sky Loggias'** **iii. 20 - tingkat pangsapuri servis (jenis A & C)** **iv. Kolam renang & kemudahan penghuni di atas bumbung podoium** **v. 7 - tingkat tempat letak kereta (TLK) dan 1 - tingkat separuh besmen TLK.** **di atas LOT3267, 6189-6194, jalan tenteram, JB, Johor.**	**2016**
2. Cadangan Pemulihan Projek Perumahan Terbengkalai Bandar Alam Perdana, Peringkat 1 (fasa1, PT No.3861 di atas sebahagian Lot PT No.2909-2919 dan PT No.2943-2945) Bukit Cherakah, Mukim Ijok, Daerah Kuala Selangor, Selangor.	**2012**
3. Cadangan Membina 240 unit 4 blok Pangsapuri Kos Sederhana 5 tingkat di Mukim Damansara, Petaling, Selangor.	**2005**
4. Mixed Development Alam Perdana Phase 1: Design & Construction Package 2 Comprising of 2500 units Low Cost Flats, 3 Blocks of Single Storey Shops (30 units), 6 No. Of TNB Sub-stations, 2 No. Of Kindergarten, 2 No. Of Surau, 1 No. Of Multi-purposed Hall, and All Associated Infrastructure Works at Bukit Cerakah, Ijok, Kuala Selangor.	**2005**
5. Cadangan Membina 12 unit Rumah Teres 1 Tingkat dan 2 Unit Kedai 1 Tingkat di atas Lot232, Mukim Kamunting, Daerah Larut & Matang, Perak.	**2011**
6. Proposed 120 units of Terrace Houses for Skim Perumahan di atas Tanah Kerajaan, Lot232, Mukim Komunting, Perak.	**2007**
7. Cadangan Membina 1 buah Banglo 3 Tingkat Serta Loteng, Termasuk Satu Kolam Renang, Jalan Bukit Setiawangsa, Mukim Setapak.	**2006**
8. Construction & Completion of Main Building Works for 7 units, Bungalow and 4 units Semi-Detached Houses at Mukim Semenyih.	**2005**
9. Mixed Development in Alam Perdana Phase 1 Package 1A Comprising of 203 units of type A4 Double Storey Terrace Houses, 1 No. Of TNB Substation and all Associated Infrastructure Works at Bukit Cerakah, Kuala Selangor.	**2004**

Projects in Progress

Table 2.3 : List of on going projects

Project	Year
1. Cadangan Pembangunan yang mengandungi 4 blok Pangsapuri Servis Suites (140 unit) yang mengandungi: **i. Blok A (51 tingkat, 40 unit)** **ii. Blok B (55 tingkat, 27 unit)** **iii. Blok C (60 tingkat, 42 unit)** **Dengan 1 tingkat ruang servis M&E (di aras separa bawah tanah) di atas Lot 95, Seksyen 43, Jalan Yap Kwan Seng, KL.**	**2021**
2. Cadangan Pembangunan Perdagangan Berstrata yang mengandungi : **i. Fasa 1 - blok bangunan pangsapuri perkhidmatan 39 tingkat (menara 1 - 385 unit)** **ii. Fasa 2 - 1 blok bangunan pangsapuri perkhidmatan 41 tingkat (menara 2 - 324 unit)** **Dia atas Lot Pt 15294, Bandar Bukit Jalil, Off Lebuhraya Bukit Jalil, Mukim Petaling, KL.**	**2020**
3. Projek Penswastaan Lebuhraya Bertingkat Sungai Besi - Ulu Kelang Package CB5 - Construction and Completion of Mainline and other Associated Works from CH.21200 to CH.24000	**2019**
4. Bridgework for Package 2,3,4,5,6 & 8 for proposed Lebuhraya Putrajaya to KLIA (MEX2) - Commencing from Putrajaya Interchange and Terminating at KLIA	**2019**

CHAPTER 3.0

CASE STUDY

3.1 Introduction To Case Study

Traffic congestion has been one of the major problem here in Kuala Lumpur and Selangor, due to the rising number of community, vehicles and increasing in the city's development. Therefore, this report will explain on the new PROLINTAS'S project which is the SUKE Highway. SUKE is a 24.4km, three-lane, dual carriageway, elevated expressway running from Sri Petaling to Ulu Kelang. It has 14 interchanges and reaches out to over 60 residential areas as well as connects to major highways and roads in Kuala Lumpur. The aim of this project is to save user's journey time by 50 minutes per day. Next, SUKE also provides both smoother traffic and no traffic lights for unnecessary stops which saves more in the wear and tear sense of a vehicle. SUKE CB-5 compromises of two ramps and one pedestrian bridge. Ramp1 has about 45 piers and an Abutment B (RC wall) in total. On the other hand, Ramp2 consist of 16 piers. Basically, the pier structures, starts with bore piling, followed by pile caps, columns, cross head, pedestal, crossing slab and parapet wall. With this new elevated highway, there will be less traffic jams and will provide easier and faster access for anyone travelling through this route.

In this project, SUKE CB - 5, which took part in the stretch from LS Motor to Bukit Antarabangsa, they are using two types of beam, which are the U-beam and also Box Girder. U-beam is more widely used for highway project across the city in Kuala Lumpur. Curently, U-beam is one of the most innovative beam for it is easier to control during installation, high quality and durability and fireproof. By using precast concrete beam, allows much control over the site and schedule thus can attain a high quality product that require less on site labour and less impact on construction site. Next, it also provides cleaner and safer construction site. Besides that, another advantage of using precast concrete beam is, it has high wear and tear lifespan. Last but not least, it is fireproof which is a huge plus point. The photos of u-beam are as shown as below:

Figure 3.1 and 3.2 : Example of U-beam

Secondly, box girder is also used in this project. A box girder is actually a beam comprises of girders (hollow box). They are three types which are the pre-stressed concrete girder, structural steel girder or a composite of steel and reinforced concrete girder. The pre-stressed concrete girder is chose for this project. The advantages of box girder is that the interior of box girder bridges can be used to accommodate service such as gas pipe, water mains and etc. Other than that, the bottom flange could be used as another deck that accommodates traffic and it's maintenance is easier plus, the interior space is directly accessible without the use of scaffolding. The photos of box girder as shown as below:

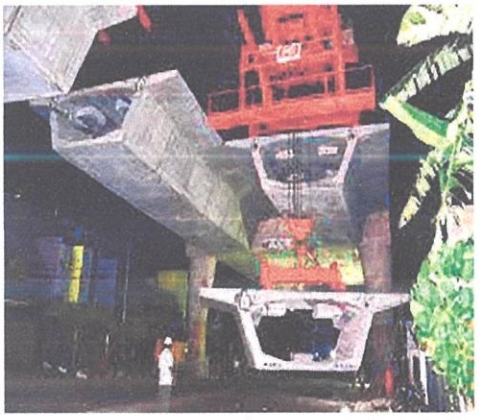


Figure 3.3 & 3.4: Example of box girders

The use of reinforcing steel in masonry construction permits the design of flexural masonry members such as lintels, beams and girders to span horizontal openings. This give a continuity of materials, finishes and fire ratings by eliminating the

introduction of other materials solely for flexural spans. The examples of reinforcement concrete are as shown below:

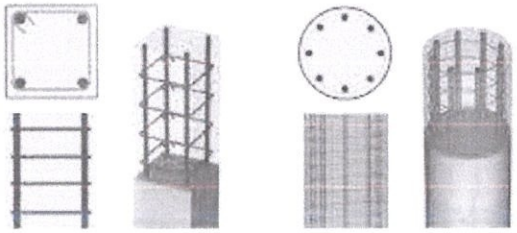


Figure 3.5: Example of reinforced concrete

The design of reinforced masonry beams and girders is based on the straight-line theory of stress distribution. The required steel is determined by actual calculated stress on the member. The reinforcement needed to resist this stress is then provided in the necessary amounts and locations. The member must be designed to resist at all sections the maximum bending moment and shears produced by dead load, live load, and other forces determined by the principles of continuity and relative rigidity.

Steel bars (also known as rebar), are basically made from twisted strands with ridges on them that anchor them firmly inside the concrete without any risk slipping around inside it. There are many materials to reinforce concrete, but usually steel is used because the box frame system of lateral load transfer requires proper connection of shear walls and diaphragms. Connections may be required to transmit axial loads, shear stresses, and bending moments acting separately or in combination with one another. Connections can be made with anchor bolts, reinforcing dowels, mechanical devices, or welding, and may be either fixed or hinged. Although neither complete restraint nor a completely hinged condition actually exists, these assumptions may be made for purposes of calculation. Each individual condition will dictate the type of connection needed, and a variety of solutions can usually be designed for a given problem.

Next, the principles and applications of prestressed concrete. If a material has little tensile strength it will fracture immediately its own tensile strength is exceeded, but if such a material is given an initial compression then when load-creating tension is applied the material will be able to withstand the force of this load as long as the

initial compression is not exceeded. By combining concrete with steel reinforcing bars to the correct area and pattern, ordinary concrete can be given an acceptable amount of tensile strength. Prestressing techniques are applied to concrete in an endeavour to make full use of the material's high compressive strength.

In normal reinforced concrete the designer is unable to make full use of the high tensile strength of steel or of the high compressive strength of the concrete. When loaded above a certain limit, tension cracks will occur in a reinforced concrete member, and these should not generally be greater than 0.3mm in width, as recommended in BS 8110: *Structural Use Of Concrete*. This stage of cracking will normally be reached before the full strength potential of either steel or concrete has been obtained. In prestressed concrete the steel is stretched and securely anchored within its mould box before the concrete is placed. After concreting the steel will then try to regain its original length, but because it is fully restricted will be subjecting the concrete to a compressive force throughout its life.

The high quality strength concrete specified for prestress work should take into account the method of stressing. For pre-tensioned work a minimum 28-day cube strength of 40N/mm^2 is required, whereas for post-tensioned work a minimum 28-day cube strength of 30N/mm^2 is required. Steel in the form of wire or bars used for prestressing, covers steel wire is manufactured from cold-drawn plain carbon steel. The wire can be plain round, crimped or indented with a diameter of 2 to 7 mm. Crimped and indented bars will develop a greater bond strength than plain round bars. Another form of stressing wire or tendon is strand, which consists of a straight core wire around which are helically wound.

To ensure close contact of the individual wires in the tendon the straight core wire is usually 2% larger in diameter than the outer wires, which are helically wound around it at a pitch of 12 to 16 times the nominal diameter of the strand. Tendons of strand can be used singly or in groups to form a multi-strand cable. Two major advantages are:

- A large prestressing force can be provided in a restricted area.
- It can be produced in long flexible lengths and can therefore be stored on drums, thus saving site space and reducing site labour requirements by eliminating the site fabrication activity.

This works in the same way that compressing several bricks together stops the middle ones falling out. A prestressing force inducing precompression into a concrete member can be achieved by anchoring a suitable tendon at one end of the member and applying an extension force at the other end, which can be anchored, when the desired extension has been reached. These are the examples of prestressed concrete:


Figure 3.6 & 3.7: Example of prestressed concrete

Other than that, box girder, which is a beam comprises of girders (hollow box). There are three types which are the pre-stressed concrete girder, structural steel girder or a composite of steel and reinforced concrete girder. Box girder are usually prefabricated in a fabrication yard, then transported and emplaced using cranes. It is lifted into place by crane, with sections connected by bolting or welding. Besides that, the conventional box girder systems offer an aesthetically appealing solution for bridge structures in large urban areas. Because of the short segment length,

temporary support is required until the segments of an entire span are erected and post-tensioned together. Use of simple falsework may cause traffic disruption, rendering the system unfeasible. Therefore, the span-by-span (SBS) segmental construction is generally performed using a special assembly truss spanning between permanent piers. The examples of box girders are as shown:

Figure 3.8 & 3.9: Example of box girders

3.2 The Method Statement of Precast U Beam Launching

Next is plant, equipment and machinery. It comprises of wire rope, mobile crane, cutting and bending machine, welding set, oxy cutter and heavy duty working platform. The wire ropes are used for lifting and hoisting in cranes. And as for the This work method statement addresses the methodology and sequence of works for the launching of precast U beam. Precast beams are cast off-site and will be transported to the site in the day of launching. The suitable method of beam launching is direct launching.

There are a few things that are compulsory to use, things to be prepared and people to handle the situation during the commencing of u-beam launching. All of these need to be check listed and approve by the consultant.

So the first one is materials used. The materials are precast u-beam, rubber bearing pad, epoxy mortar, reinforcement bars, and timber wedges. The application of rubber bearing pad is actually to endure the pressure of heavy weights, it absorbs shock and promotes movement. As for the epoxy mortar, it used as an adhesive and paste for structural repair.
platform, it is for the workers and manpowers to reach to the top of the pier.

Lastly is manpower. The manpower that needs to be at the site during the beam launching are project manager, construction manager, project engineer, site supervisor, general worker, flagman, mobile crane operator, and rigger. The duty of a project manager is to manage the overall works to be carried out. Meanwhile, construction manager need to make sure all the works to be carried out according to the specifications. Flagman wil control the traffic during construction. And rigger will give signals to the opearator during lifting work.

Lifting Plan and Construction Sequence for Precast U Beam

- Stage 1

Pole trailer was used for transporting precast U beam from casting factory to launching job site.

Figure 3.10: Example of U-beam

- Stage 2

Mobile crane was parked at the position as in lifting plan. Two mobile crane will lift up U beam and position onto bearing pad. The beam will be secured by using chain block 1 tonne and 16mm sling.

Photo 3.1: Lifting of beam

- Stage 3

After the first beam is fully secured, the second precast U beam was transferred to site. The second precast U beam was lifted up and launched into the respective position. The workers welded the starter bar of the beam to tie and brace the beam against each other.

Figure 3.11: Example of u-beam on piers

- Stage 4

The same sequence is repeated for the third precast U beam until the last beam.

Photo 3.2: Lifting of second beam

- Stage 5

Upon completion, all beam were checked for safety and demobilize the machineries and manpower.

3.3 Observation of Problems That Occured During The U-beam Launching

The problems that is observed during the u-beam launching are:

First, there is a slow preparation work progress. Only left with few hours before starting the launching at that night, they was just about to start excavating at the sides of the pier for laying crusher run. There was also a misunderstanding between the main contractor and the sub contractor on the exact time for the beam launching and the number of beams that will arrive. Next, there was also limited lighting such as spotlights. But on the whole, everything went well, and all the manpower did their part to solve the problems immediately.

3.4 The Study of The Documentation Process of U-beam Launching

The documentation process are as below:

It starts with crane details, including the PMA (Permit Mesin Angkut), crane operator together with his license, the lifting plan, the traffic management plan, the sequence of beam launching plan, the list of manpower, and machineries, and safety and health documents. Next, project engineer will prepare a slide along with drawings based on the documents as listed as before, and present it to the main contractor and also to the consultant. After that, they will open up an RFI (Request For Inspection) document for the launching work.

CHAPTER 4.0

CONCLUSION

In this report, overall is about the installation method of u-beam and box girder. Detailed and proper preparation is very needed to make sure every work is done accordingly and in time.

It is very important to have a supportive group of workers to work with, and to solve any problems together. It cannot be underestimated by how much the construction environment has changed in recent decades. Specifically, elevated highways has helped so many people to connect and to get to their destinations much easier and faster. Since Kuala Lumpur's residents has increased, highways will be more helpful to them.

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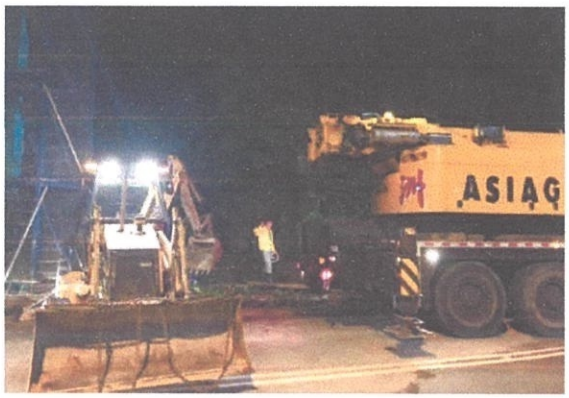
www.corrosionpedia.com
www.rubbercal.com
www.dailycivil.com
www.mech4study.com

APPENDIX

These are the preparation and progress photo before and during the u-beam launching for two consecutive nights:

Excavation and laying crusher run to make good access

Assembling access at the side of the pier



Parking of crane before the beam launching

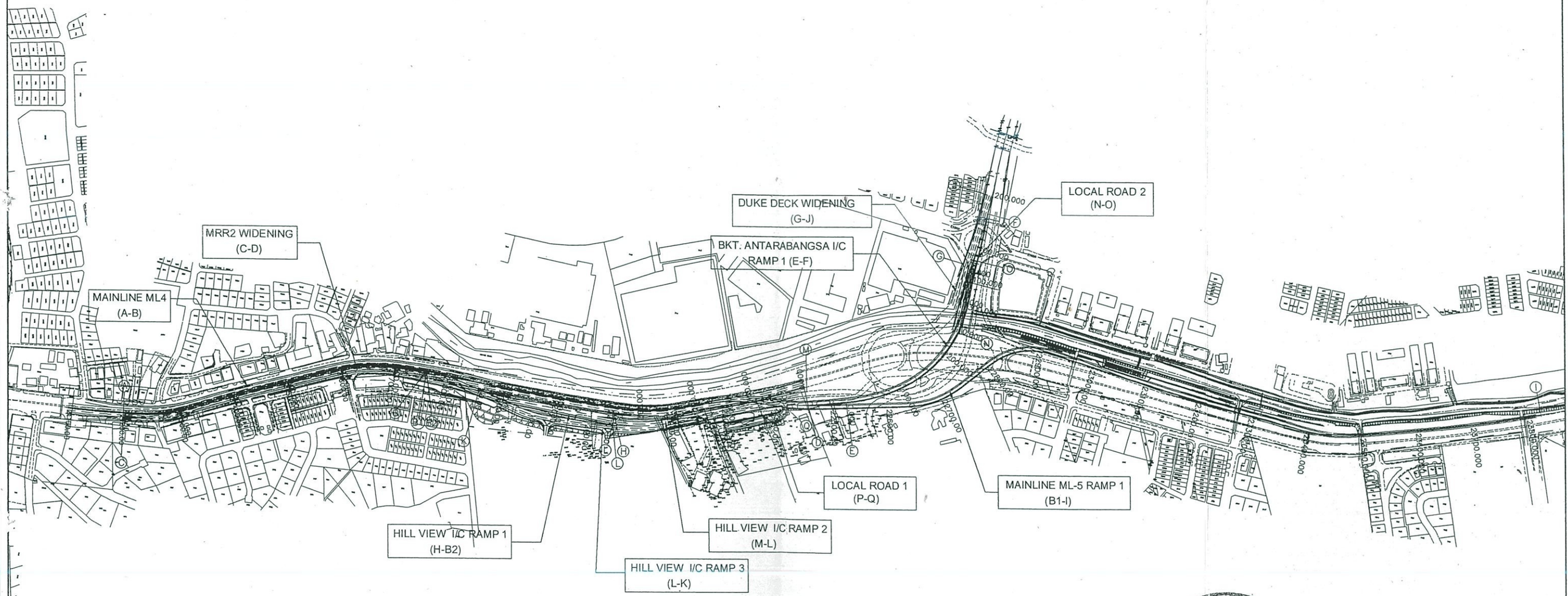
Quick and final briefing about the procedures with the workers

Doa recitation and safety briefing with the safety officers

The first u-beam launching

The first u-beam launching for the second night at different piers

Second u-beam launching for the second night



CONSTRUCTION DRAWING

REV.	DATE	DESCRIPTION	APP.

CONCESSION COMPANY

SUKE
Lebuhraya Sungai Besi - Ulu Kelang

PROJEK LINTASAN SUNGAI BESI - ULU KLANG SDN. BHD.
12th FLOOR, MENARA PNB
201-A, JALAN TUN RAZAK
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PROJEK LITASAN SG. BESI - ULU KLANG SDN. BHD.

CONSULTING ENGINEERING FIRM

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SELANGOR DARUL EHSAN
Tel: Fax:

DESIGNED BY	FAIZAL	DRAWN BY	AZ-ONE
CHECKED BY	Ir. DARUS	DATE	AUG. 2016

LEMBAGA LEBUHRAYA MALAYSIA
LEMBAGA LEBUHRAYA MALAYSIA
(MALAYSIAN HIGHWAY AUTHORITY)

KETUA PENGARAH
LEMBAGA LEBUHRAYA MALAYSIA

SCALE
1:3500

PROJEK PENSWASTAAN LEBUHRAYA BERTINGKAT
SUNGAI BESI - ULU KELANG
(SEKSYEN B - CHERAS KE ULU KELANG)

DRAWING TITLE
DRAWING INDEX (PACKAGE B12)

DRAWING NO. : W/SUKE/11133/B12/CW/DI/LAY-01

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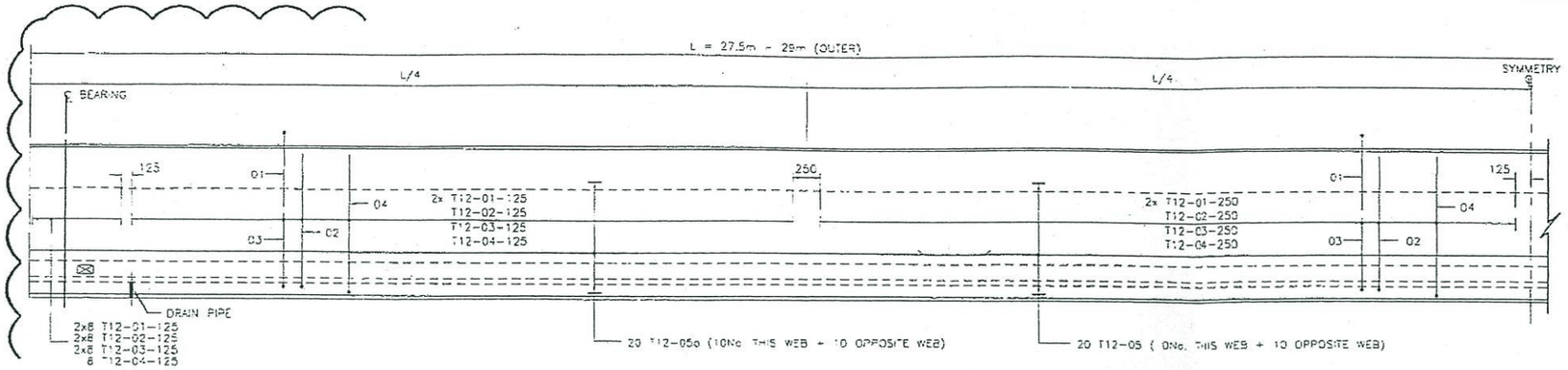
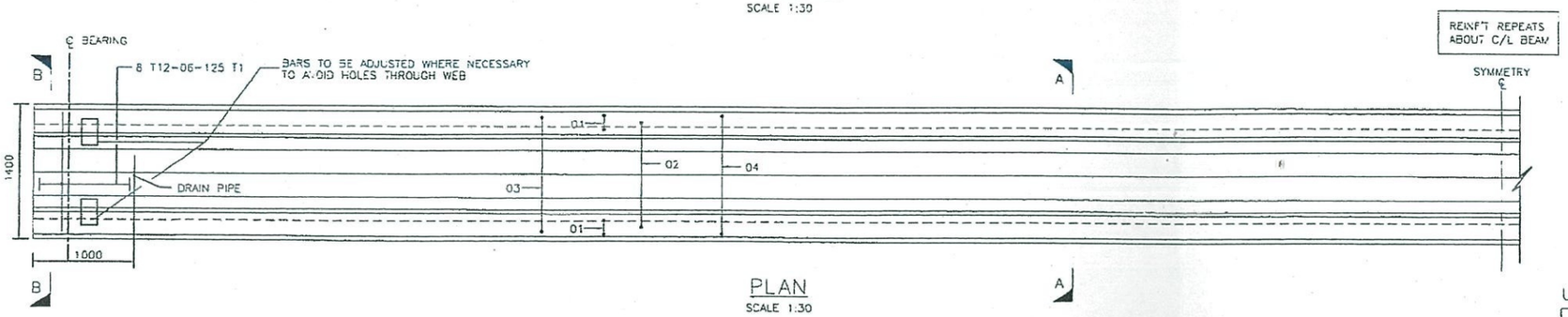
SUB-CONTRACTOR COPY



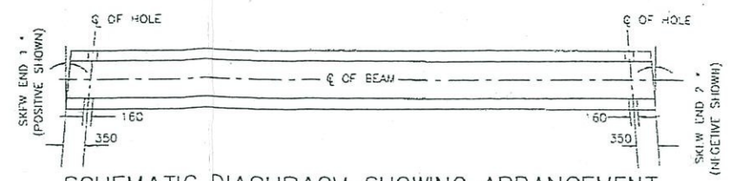
ELEVATION

SCALE 1:30



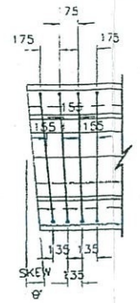
PLAN

SCALE 1:30



SCHEMATIC DIAGHRAGM SHOWING ARRANGEMENT OF HOLES AT BEAM ENDS

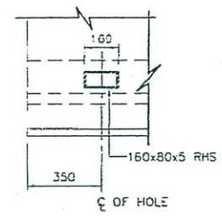
N.T.S



PART PLAN AT END OF BEAM

SCALE 1:30

(DETAIL APPLICABLE FOR BARMARK 01, 02, 03, 04, AND 06 TO SUIT SKEW END OF BEAM)

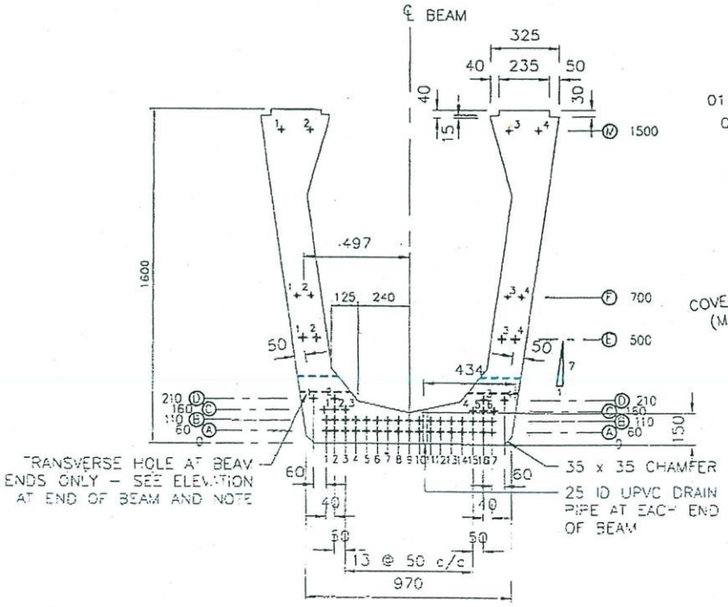


ELEVATION AT END OF BEAM

SCALE 1:15

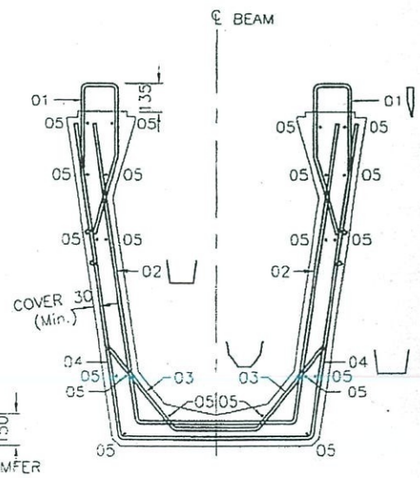
U12 STRAND MARK (OUTER BEAM) TYPE 1

DEBONDED LENGTH FROM BOTH ENDS	STRAND MARK	NO. OF STRAND
4000	A6, A7, A13, A14, B2, B4, B16, B18	8
6000	A4, A5, A15, A16, B8, B12	6
8000	A2, A9, A11, A18, E2, E3,	6
10000	A8, A10, A12, C4, C16	5
NO DEBONDING	A3, A17, B3, B5, B6, B7, B9, B10, B11, B13, B15, B14, B17 C2, C3, C17, C18, D1, D3, D17, D19 E1, E4, M1, M2, M3, M4, F1, F2, F3, F4	31
	TOTAL NO. OF STRANDS	56



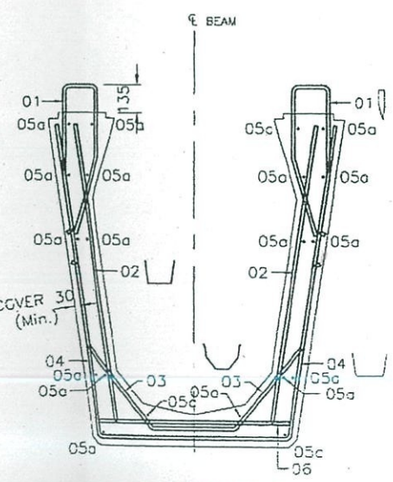
TYPICAL BEAM SECTION

SCALE 1:20



SECTION A-A

SCALE 1:20



SECTION B-B

SCALE 1:20

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. MINIMUM CUBE STRENGTH AT 28 DAYS IS 60N/mm^2.
3. MINIMUM 28 DAY MODULUS OF ELASTICITY SHALL BE 34 kN/mm2.
4. MINIMUM CUBE STRENGTH AT TRANSFER IS 50N/mm^2
5. MINIMUM COVER REINFORCEMENT IS 30mm UNLESS OTHERWISE STATED.
6. ALL PRESTRESSING STRAND WERE 15.2mm DIA. SEVEN WIRE SUPER LOW-RELAXATION (TYPE CLASS 2) PRESTRESSING STRAND IN ACCORDANCE WITH B.S. 5896:1980.
7. MINIMUM ULTIMATE STRENGTH PER STRAND IS 260.7 kN.
8. ALL STRANDS WERE STRESSED TO 196kN PER STRAND AT THE TIME OF CONCRETING.
9. ALL REINFORCEMENT WERE OF HIGH TENSILE STEEL/MILD STEEL CONFORMING TO B S 4449
10. THE CONTRACTOR SHALL SUBMIT DETAILED SHOP DRAWINGS FOR THE REVIEW AND APPROVAL OF THE ENGINEER PRIOR TO THE CASTING OF THE BEAMS.
11. TOLERANCE ON BEAM LENGTH BETWEEN +0 TO -20mm.
12. THE CONTRACTOR SHALL RECORD BEAM HOGGING AND BOWING IMMEDIATELY AFTER PRESTRESS TRANSFER
13. TOP OF ALL BEAMS WERE ROUGHENED BEFORE ANY DECK CONCRETE IS CAST ON TOP.
14. THE CONTACT SURFACE BETWEEN THE BEAMS AND THE IN-SITU END DIAPHRAGM WERE ROUGHENED BEFORE CONCRETING THE DIAPHRAGM.
15. REFER TO THE BEAM LAYOUT DRAWINGS FOR THE TABULATION OF THE EXACT BEAM LENGTHS

21 NOV 2017

27 NOV 2007

CONTROLLED COPY

Date : .....

CONSTRUCTION DRAWING

NO.	DATE	DESCRIPTION	SEB
1	141117	AMEND DETAILS OF U-BEAM	

CONCESSION COMPANY

PROJEK LINTASAN SUNGAI BESI ULU KELANG SDN. BHD

12th FLOOR, MENARA PNB, 201-A, JALAN TUN RAZAK, 50400 KUALA LUMPUR

Tel: Fax:

PROJEK LINTASAN SG. BESI ULU KELANG SDN. BHD

CONSULTING ENGINEERING FIRM

DNP CONSULT SDN BHD

CONSULTING CIVIL & STRUCTURAL ENGINEERS

NO 39 JALAN RUBBI 33/2 TADISMA BUS NEGS PARK SECTION 13, 40100 SHAH ALAM SELANGOR DARUL EHSAN

Tel: Fax:

DESIGNED BY: DRAWN BY: CHECKED BY: APPROVED BY:

LEMBAGA LEBUHRAYA MALAYSIA

LEMBAGA LEBUHRAYA MALAYSIA (MALAYSIAN HIGHWAY AUTHORITY)

KETUA PENGARAH LEMBAGA LEBUHRAYA MALAYSIA

SCALE: AS SHOWN (A1), AS SHOWN (A3)

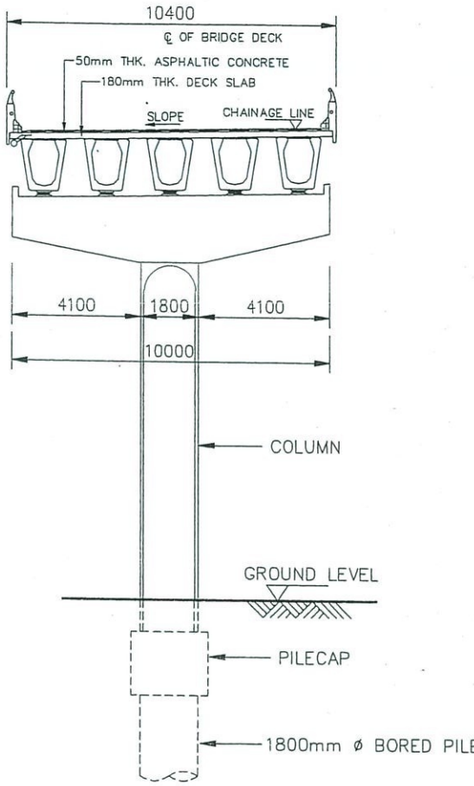
PROJEK PENSWASTAAN LEBUHRAYA BERTINGKAT SUNGAI BESI - ULU KELANG (SEKSYEN B - CHERAS KE ULU KELANG)

BUKIT ANTARABANGSA INTERCHANGE - RAMP 1

U12 PRETENSIONED BEAM DETAILS-TYPE 1

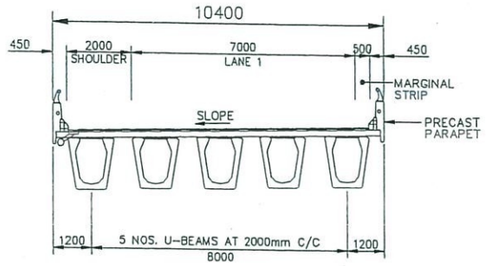
W/SUKE/11/33/B12/S1/BA/R1/1.48

SHEET NO. 9 REV



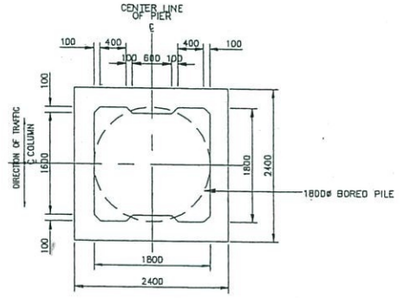
TYPICAL SECTION AT PIER

SCALE 1 : 150



TYPICAL SECTION AT MID-SPAN

SCALE 1 : 100



TOP OF PILECAP

SCALE 1 : 40

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL REDUCE LEVELS AND CHAINAGE ARE IN METERS.
3. ALL CHAINAGES, COORDINATES AND LEVELS ARE TO BE READ IN CONJUNCTION WITH RELEVANT ALIGNMENT DRAWINGS AND VERIFIED ON SITE. ANY DISCREPANCY TO BE NOTIFIED TO THE ENGINEER PRIOR TO COMMENCEMENT OF WORKS.

LEGENDS:

1. FR = FREE
2. FX = FIXED
3. FGL = FINISHED GROUND LEVEL
4. EJ = EXPANSION JOINT

CONSTRUCTION DRAWING

REV.	DATE	DESCRIPTION	APP.

CONCESSION COMPANY

SUKE Lebuhraya Sungai Besi - Ulu Kelang

PROJEK LINTASAN SUNGAI BESI - ULU KLANG SDN. BHD.
12th FLOOR, MENARA PNB
201-A, JALAN TUN RAZAK
50400 KUALA LUMPUR
Tel: Fax:

PROJEK LITASAN SG. BESI - ULU KLANG SDN. BHD.

CONSULTING ENGINEERING FIRM

DNP CONSULT SDN. BHD.
CONSULTING CIVIL & STRUCTURAL ENGINEERS
NO. 30, JALAN RUGBI 13/30
TADISMA BUSINESS PARK
SECTION 13, 40150 SHAH ALAM
SELANGOR DARUL EHSAN.
Tel: Fax:

DESIGNED BY	IR. AFR	DRAWN BY	KAMAL
CHECKED BY	IR. Hi-KRUL	DATE	AUGUST 2016

LEMBAGA LEBUHRAYA MALAYSIA
(MALAYSIAN HIGHWAY AUTHORITY)

KETUA PENGARAH
LEMBAGA LEBUHRAYA MALAYSIA

SCALE
AS SHOWN (A1)
AS SHOWN (A3)

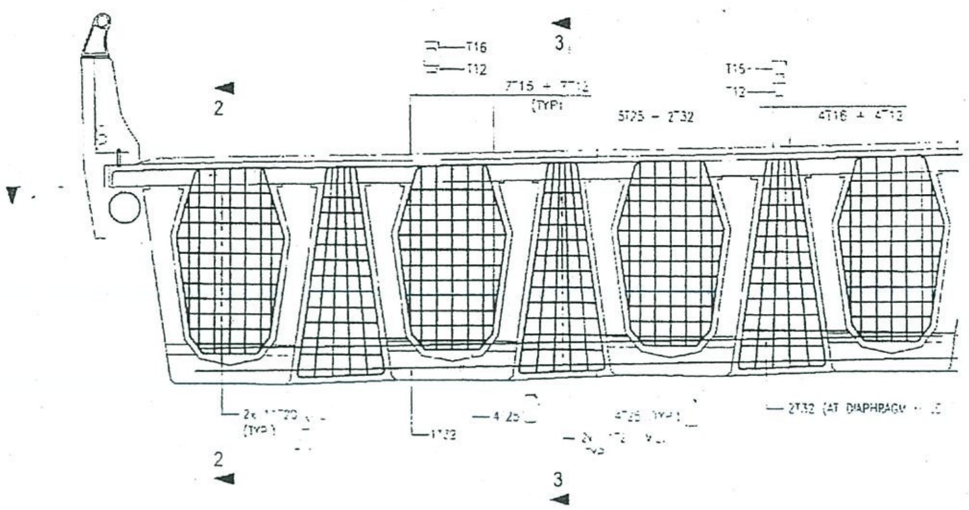
PROJEK PENSWASTAAN LEBUHRAYA BERTINGKAT SUNGAI BESI - ULU KELANG (SEKSYEN B - CHERAS KE ULU KELANG)

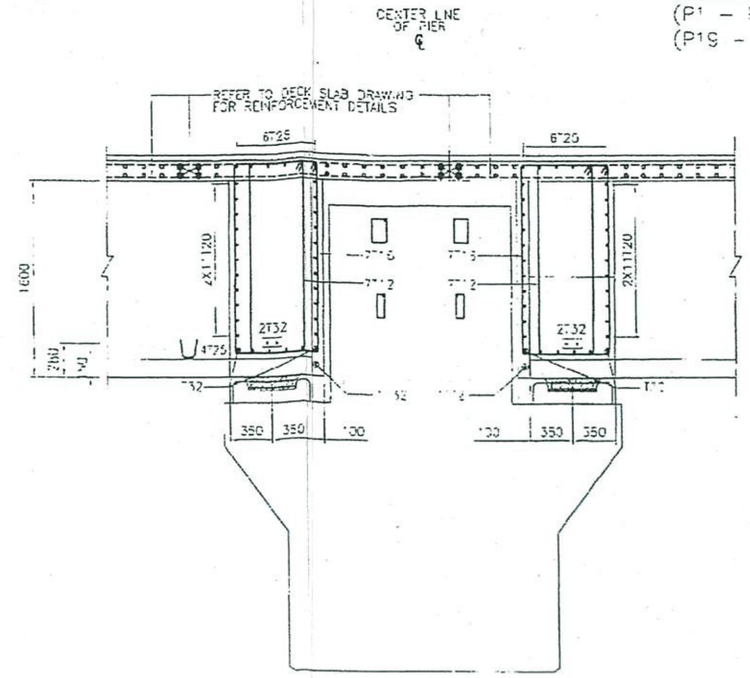
DRAWING TITLE
TYPICAL SECTION

DRAWING NO: W/SUKE/11133/B12/ST/BA/R1/1.6

ISSUE: 0 REV: 0

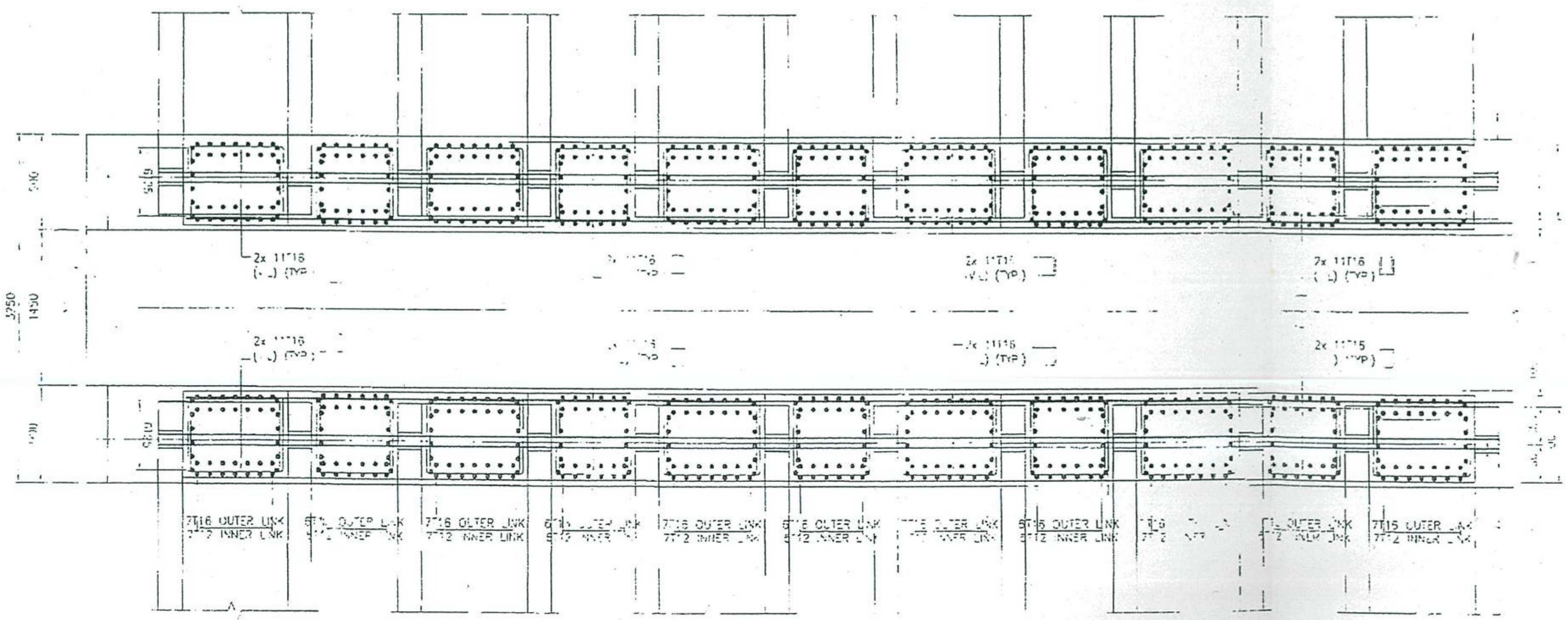
FOR PIER NO:
(P1 - P4)
(P19 - P26)





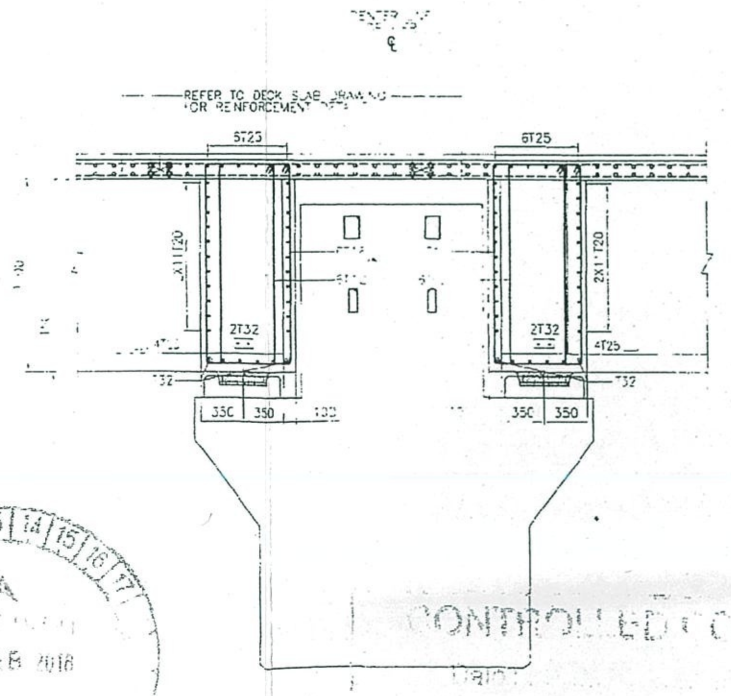
SECTION 2-2

SCALE 1:30



SECTION 1-1

SCALE 1:30



SECTION 3-3

SCALE 1:30

2

CONSTRUCTION DRAWING

REV	DATE	DESCRIPTION	APP.
1	02/12/17	REVISED AS PER CLOUD	
2	04/01/18	REVISED AS PER CLOUD	

CONCESSION COMPANY

PROJEK LINTASAN SUNGAI BESI - ULU KELANG SDN. BHD.
2th FLOOR, MENARA PNB
201-A JALAN TUN RAZAK
50400 KUALA LUMPUR

PROJEK LINTASAN SG. BESI ULU KELANG SDN BHD

CONSULTING ENGINEERING FIRM

DNP CONSULT SDN. BHD.
CONSULTING CIVIL & STRUCTURAL ENGINEERS
NO 30 JALAN RUGBI 13/30
TADISMA BUSINESS PARK
SECTION 13, 40100 SHAH ALAM
SELANGOR DARUL EHSAN

DESIGNED BY: YAN
DRAWN BY: FOJ
CHECKED BY: IR. ARIFFIN
DATE: JULY 2017

LEMBAGA LEBUHRAYA MALAYSIA
(MALAYSIAN HIGHWAY AUTHORITY)

KETUA PENGARAH
LEMBAGA LEBUHRAYA MALAYSIA

SCALE: AS SHOWN

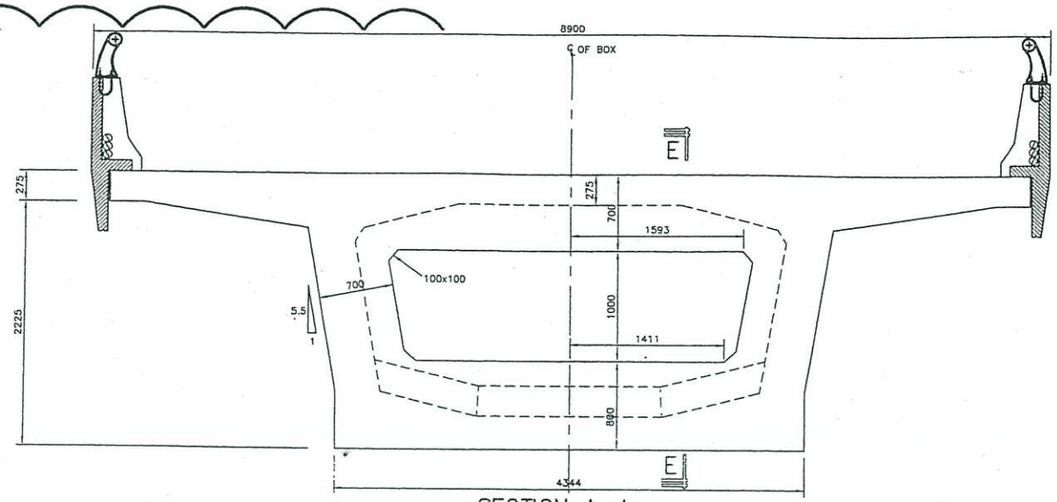
PROJEK PENSWASTAAN LEBUHRAYA BERTINGKAT SUNGAI BESI - ULU KELANG
(SEKSYEN B - CHERAS KE ULU KELANG)

DRAWING TITLE:
BUKIT ANTARABANGSA INTERCHANGE - RAMP 1
TYPICAL DIAPHRAGM BEAM DETAIL
(TYPE 1)

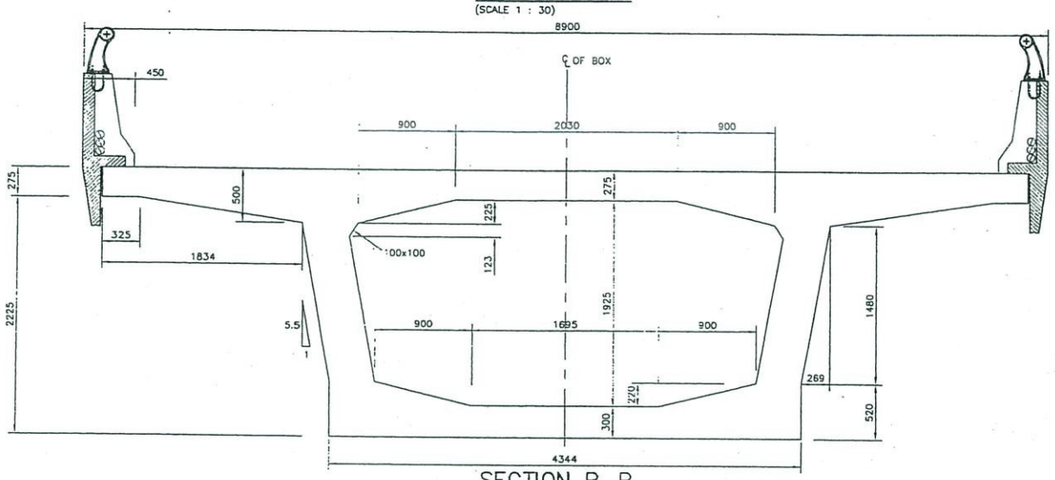
DRAWING NO: W/SUKE/B12/11133/ST/BA/R1/149

ISSUE: 0 REV: 2

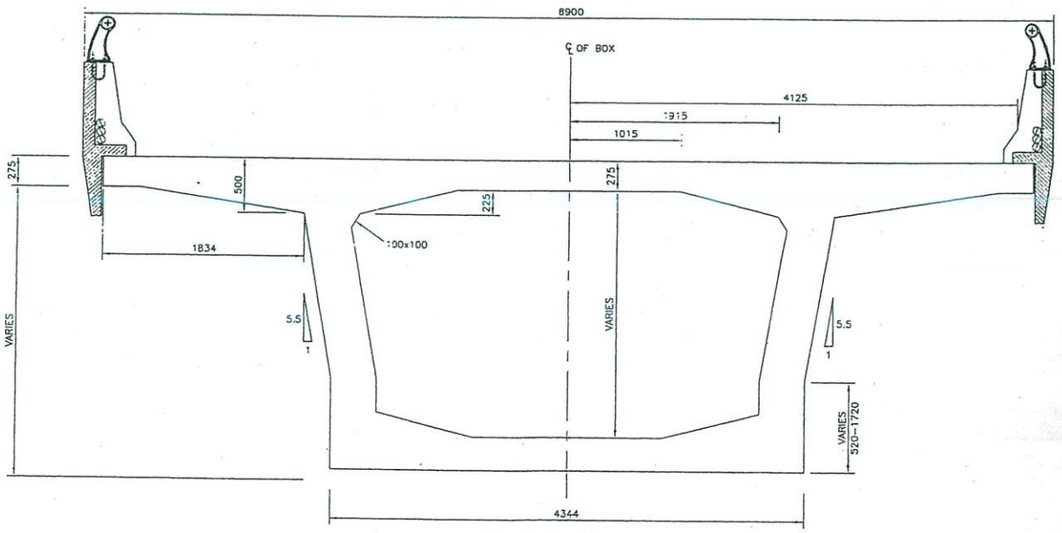
SUB-CONTRACTOR COPY



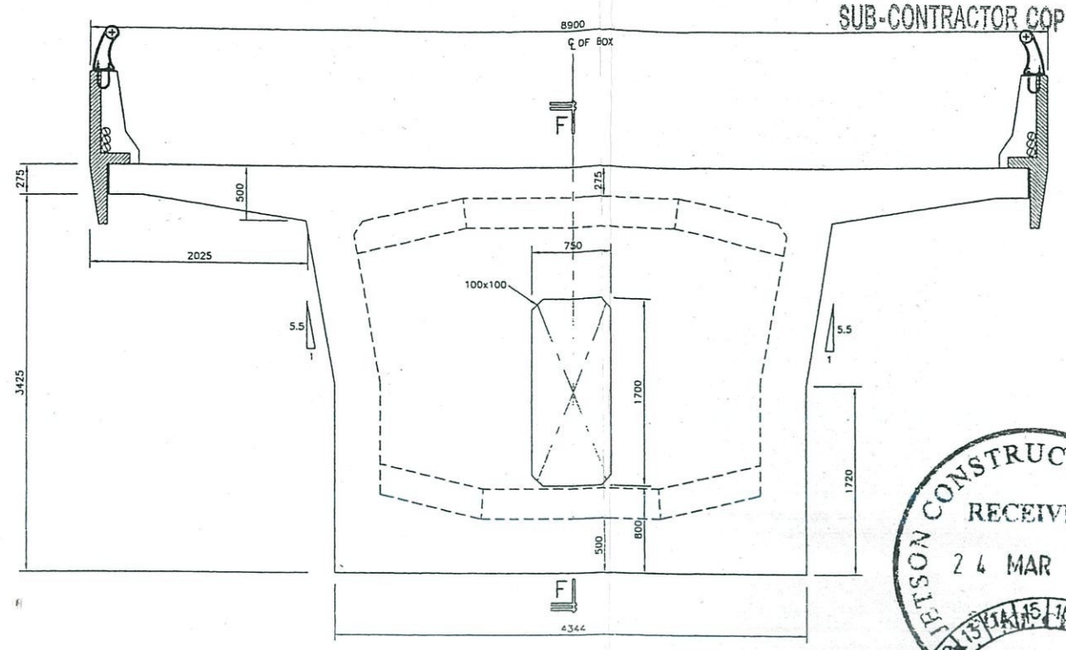
SECTION A–A
(SCALE 1 : 30)



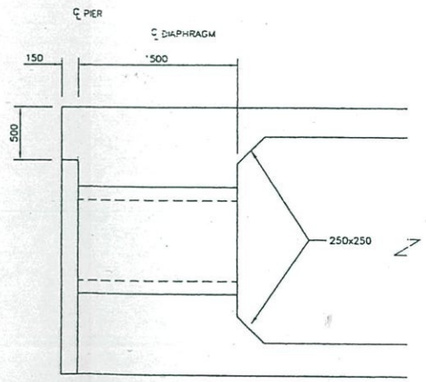
SECTION B–B
(SCALE 1 : 30)



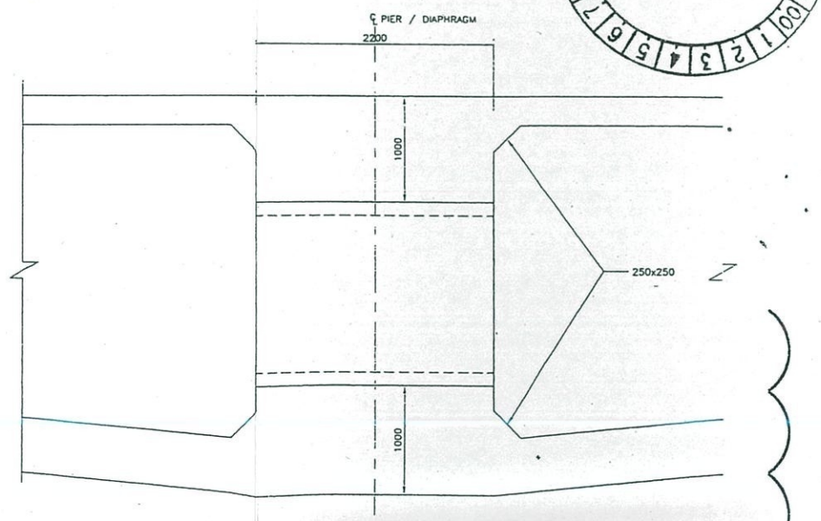
SECTION D–D
(SCALE 1 : 30)



SECTION C–C
(SCALE 1 : 30)



SECTION E–E
(SCALE 1 : 30)



SECTION F–F
(SCALE 1 : 30)

CONTROLLED COPY
Date : .....

NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETER UNLESS OTHERWISE STATED.

1

CONSTRUCTION DRAWING

DATE	DESCRIPTION	APP.
03/16	REVISED AS PER CLOUD	

CONCESSION COMPANY :
SUKE Lebuhraya Sungai Besi - Ulu Kelang
PROJEK LINTASAN SUNGAI BESI - ULU KELANG SDN. BHD.
12th FLOOR, MENARA PNB
201-A, JALAN TUN RAZAK
50400 KUALA LUMPUR
Tel: Fax:

PROJEK LINTASAN SG. BESI - ULU KELANG SDN. BHD.

CONSULTING ENGINEERING FIRM :
dnr
DNP CONSULT SDN. BHD.
CONSULTING CIVIL & STRUCTURAL ENGINEERS
NO. 30, JALAN RUGBI 13/30
TADISMA BUSINESS PARK
SECTION 13, 40150 SHAH ALAM
SELANGOR DARUL EHSAN.
Tel: [illegible] Fax:

DESIGNED BY : YANI	DRAWN BY : PDU
CHECKED BY : IR. ARIFFIN	DATE : JULY 2017

LEMBAGA LEBUHRAYA MALAYSIA
LEMBAGA LEBUHRAYA MALAYSIA (MALAYSIAN HIGHWAY AUTHORITY)

KETUA PENGARAH
LEMBAGA LEBUHRAYA MALAYSIA

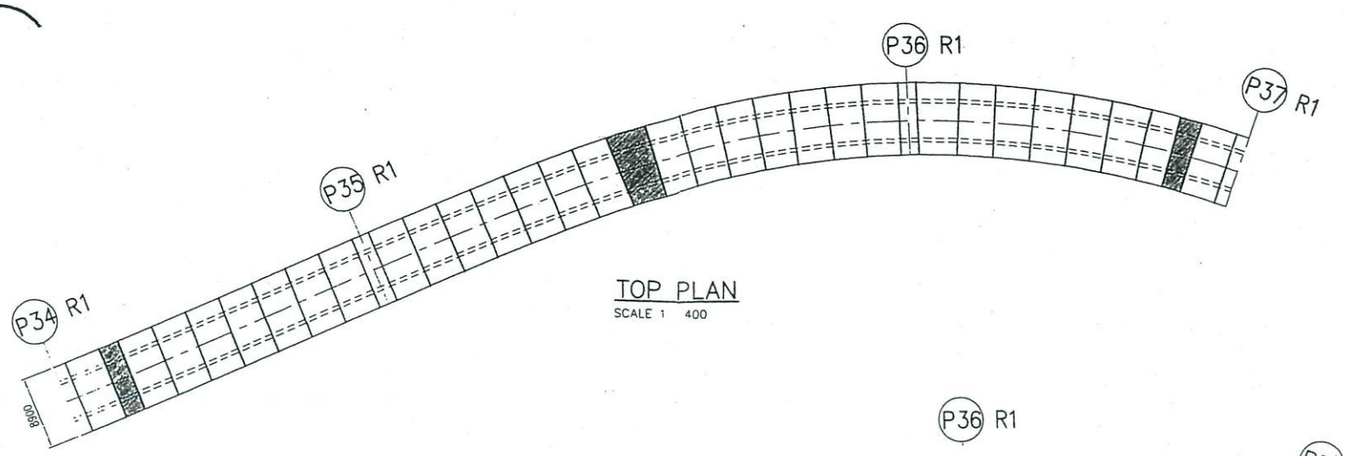
SCALE : AS SHOWN

PROJEK PENSWASTAAN LEBUHRAYA BERTINGKAT SUNGAI BESI - ULU KELANG
(SEKSYEN B - CHERAS KE ULU KELANG)

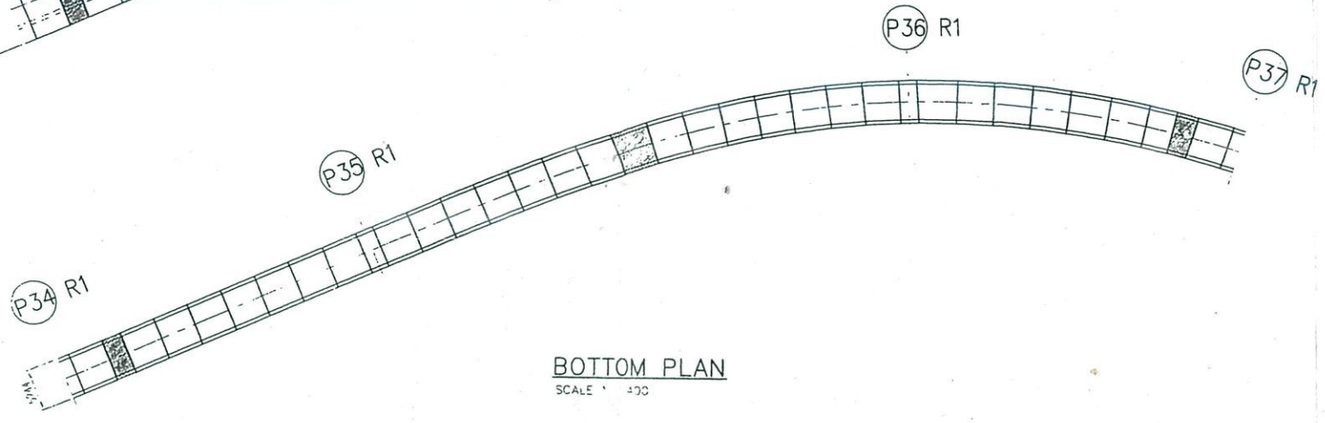
DRAWING TITLE :
BUKIT ANTARABANGSA INTERCHANGE - RAMP 1
BOX GIRDER CONCRETE OUTLINE (SHEET 2 OF 2)

DRAWING NO : W/SUKE/11133/B12/ST/BA/R1/1.53
ISSUE: 0
REV: 1

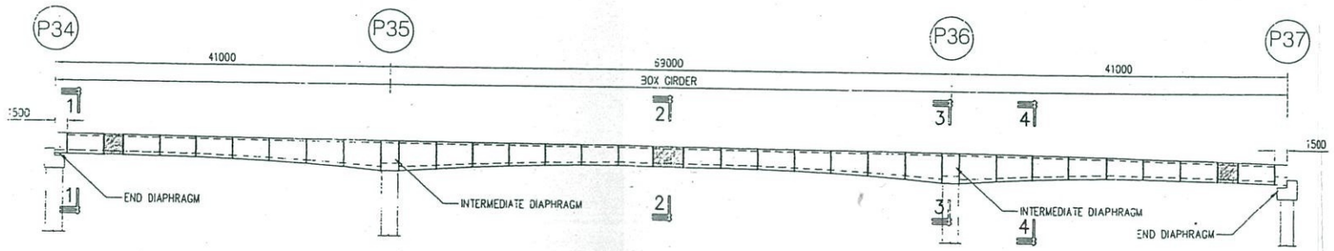
SUB-CONTRACTOR Copy



TOP PLAN
SCALE 1 : 400



BOTTOM PLAN
SCALE 1 : 400



SEGMENT NO.		SB		S7	S6	S5	S4	S3	S2	S1	SP	S1	S2	S3	S4	S5	S6	S7		S7	S6	S5	S4	S3	S2	S1	SP	S1	S2	S3	S4	S5	S6	S7		SB	
DEPTH OF BOX GIRDER	(m)	2500	2500	2500	2500	2500	2533	2633	2800	3033	3333	3700	3333	3033	2800	2633	2533	2500	2500	2500	2500	2600	2533	2633	2800	3033	3333	3700	3333	3033	2800	2633	2533	2500	2500	2500	2500
BOTTOM FLANGE THICKNESS	(m)	300	300	300	300	400	400	400	500	500	500	500	500	500	500	400	400	400	300	300	300	400	400	400	500	500	500	500	500	500	500	400	400	400	300	300	300
WEB THICKNESS	(m)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
DISTANCE	(mm)	1500	4400	2500	4500	4500	4500	4500	4500	4500	2200	4500	4500	4500	4500	4500	4500	4500	3800	4500	4500	4500	4500	4500	4500	4500	2200	4500	4500	4500	4500	4500	4500	4500	2500	4400	1500

ELEVATION
SCALE 1 : 400

JETSON CONSTRUCTION SDN BHD
RECEIVED
24 MAR 2018
SUKE CB-5
★ 213416-P ★

RECEIVED
24 MAR 2018

CONTROLLED COPY
Date : .....

1

CONSTRUCTION DRAWING

NO.	DATE	DESCRIPTION	APP.
	3/18	REVISED AS PER CLOUD	

CONCESSION COMPANY
SUKE
Lebuhraya Sungai Besi - Ulu Kelang
PROJEK LINTASAN SUNGAI BESI ULU KELANG SDN. BHD.
12th FLOOR, MENARA PNB
201-A, JALAN TUN RAZAK
50400 KUALA LUMPUR
Tel Fax.

PROJEK LINTASAN SG. BESI ULU KELANG SDN. BHD.

CONSULTING ENGINEERING FIRM :
DNP CONSULT SDN. BHD.
CONSULTING CIVIL & STRUCTURAL ENGINEERS
NO. 30, JALAN RUGBI 13/30
TADISMA BUSINESS PARK
SECTION 13, 40150 SHAH ALAM
SELANGOR DARUL EHSAN.
Tel Fax

DESIGNED BY : YANI	DRAWN BY : PDU
CHECKED BY : IR. ARFFIN	DATE : JULY 2017

LEMBAGA LEBUHRAYA MALAYSIA
(MALAYSIAN HIGHWAY AUTHORITY)

KETUA PENGARAH
LEMBAGA LEBUHRAYA MALAYSIA

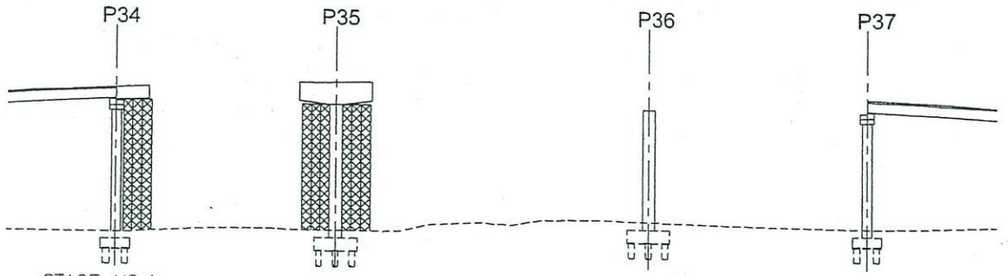
SCALE : AS SHOWN

PROJEK PENSWASTAAN LEBUHRAYA BERTINGKAT
SUNGAI BESI - ULU KELANG
(SEKSYEN B - CHERAS KE ULU KELANG)

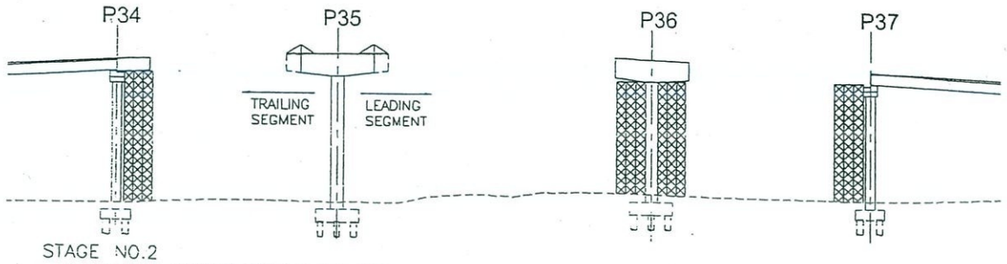
DRAWING TITLE :
BUKIT ANTARABANGSA INTERCHANGE - RAMP 1
BOX GIRDER - CONCRETE OUTLINE (SHEET 1 OF 2)

DRAWING NO : W/SUKE/11133/B12/ST/BA/R1/1.52

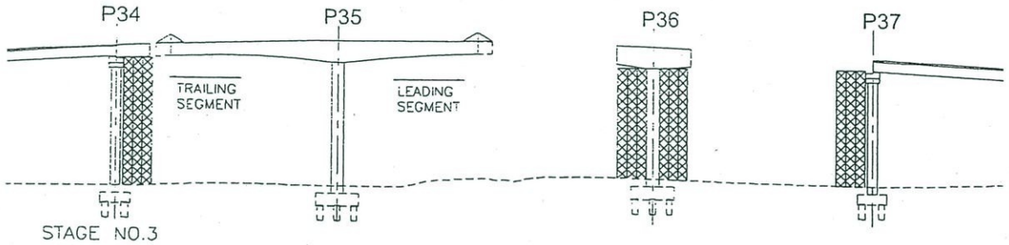
ISSUE: 0 REV: 1



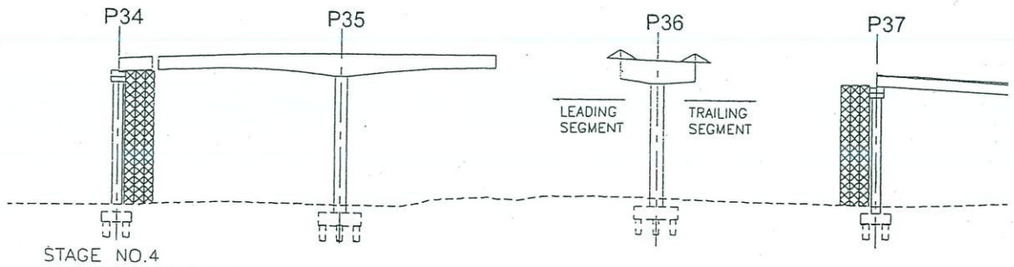
STAGE NO.1
1) CONSTRUCTION OF HAMMERHEAD AT PIER P35
2) STRESS CANTILEVER CABLES C1
3) ERECTION OF SHORING SYSTEM FOR SPAN 1 WITH OVERHANG AT SPAN 2
4) CONSTRUCTION OF SPAN 1 AND PART OF SPAN 2



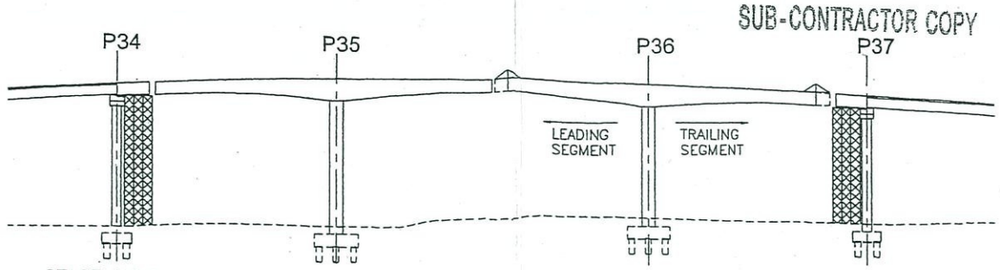
STAGE NO.2
1) ASSEMBLE TRAVELER FORM AT PIER P35
2) BEGIN CANTILIVER CONSTRUCTION WITH CASTING OF LEADING SEGMENT S2 FOLLOWED BY TRAILING SEGMENT S3. THIS IS COMPULSORY SEQUENCE
3) STRESS CANTILEVER CABLES C2 & C3
4) CONSTRUCTION OF HAMMERHEAD AT PIER P36
5) ERECTION OF SHORING SYSTEM FOR SPAN 3 WITH OVERHANG AT SPAN 2



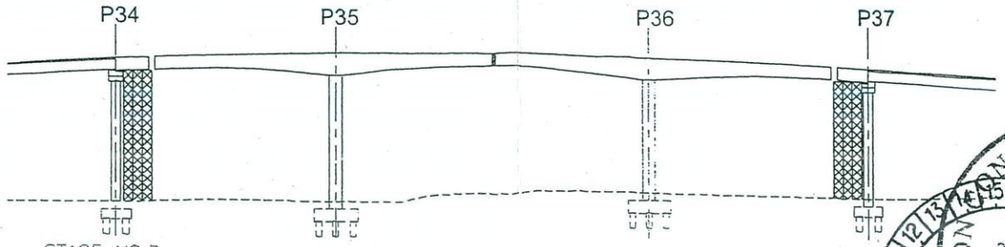
STAGE NO.3
1) MOVE TRAVELER FORM FORWARD TO THE NEXT SEGMENT
2) CAST CANTILEVER LEADING SEGMENT (S4) AND FOLLOWED BY THE TRAILING SEGMENT (S5). STRESS CANTILEVER CABLES C4 & C5
3) REPEAT ITEM (1) & (2) UNTIL THE END OF CANTILEVER CONSTRUCTION
3) STRESS CABLE C6 AT PIER P36



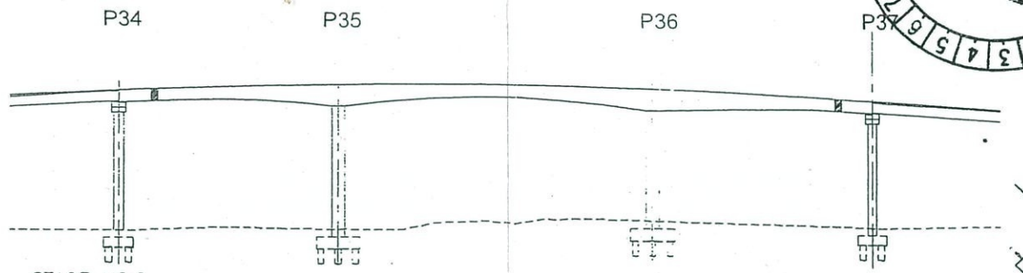
STAGE NO.4
1) REMOVE TRAVELER FORM AND SHIFT IT TO PIER P36
2) CONSTRUCTION OF SPAN 3 AND PART OF SPAN 2
3) CAST CANTILEVER LEADING SEGMENT (S2) AND FOLLOWED BY THE TRAILING SEGMENT (S3). STRESS CANTILEVER CABLES C7 & C8



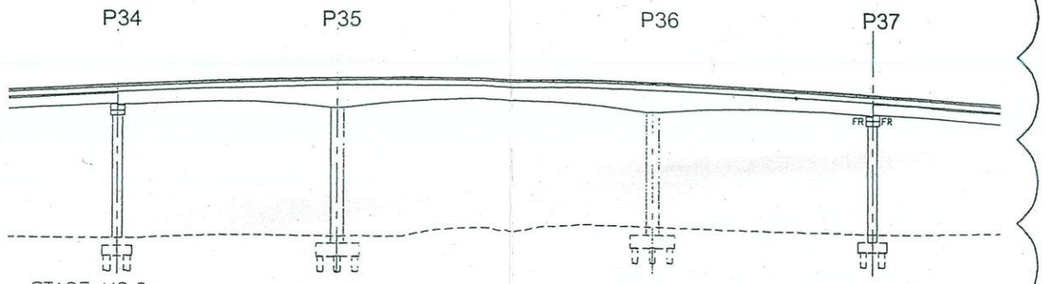
STAGE NO.6
1) MOVE TRAVELER FORM FORWARD TO THE NEXT SEGMENTS
2) CAST CANTILEVER LEADING SEGMENT (S4) AND FOLLOWED BY THE TRAILING SEGMENT (S5). STRESS CANTILEVER CABLES C9 & C10



STAGE NO.7
1) INSTALL FORMWORK FOR SEGMENT AT MID SPAN
2) CONSTRUCT MID SPAN STITCH
3) STRESS BOTTOM CONTINUITY CABLES C11 & C12



STAGE NO.8
1) INSTALL FORMWORK FOR SEGMENT AT BOTH ENDS
2) CONSTRUCT CLOSURE STITCH AT BOTH ENDS
3) STRESS ALL BOTTOM CABLES C13, C14, C15 & 16



STAGE NO.9
1) CONSTRUCTION OF RC PARAPET AT REMAINING SPAN 1 & 3
2) LAYING OF PREMIX
3) INSTALLATION OF EXPANSION JOINT

1

CONSTRUCTION DRAWING

DATE	DESCRIPTION	APP.
/03/18	REVISED AS PER CLOUD	

CONCESSION COMPANY :
SUKE Lebuhraya Sungai Besi - Ulu Kelang
PROJEK LINTASAN SUNGAI BESI - ULU KELANG SDN. BHD.
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Tel: Fax:

DESIGNED BY : YANI	DRAWN BY : PDU
CHECKED BY : IR. ARIFFIN	DATE : JULY 2017

LEMBAGA LEBUHRAYA MALAYSIA
(MALAYSIAN HIGHWAY AUTHORITY)

KETUA PENGARAH
LEMBAGA LEBUHRAYA MALAYSIA

SCALE :
AS SHOWN

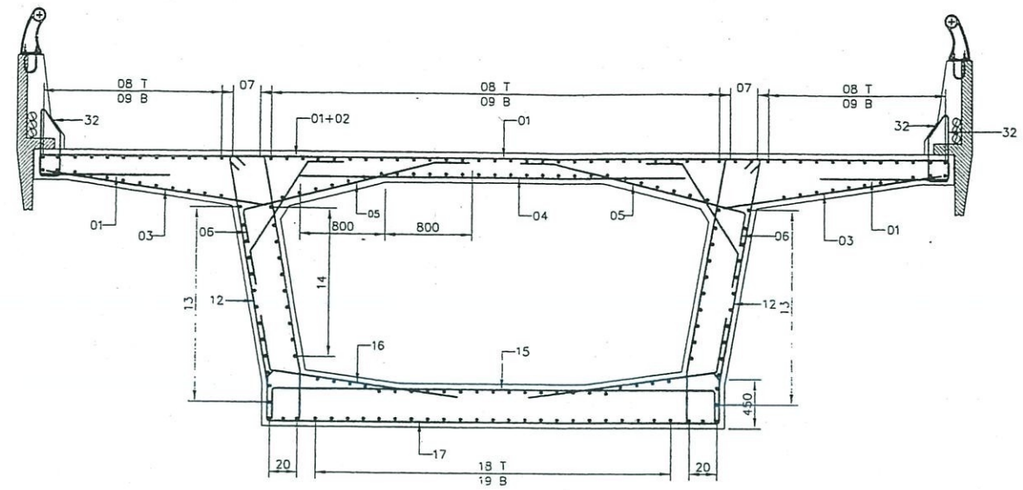
PROJEK PENSWASTAAN LEBUHRAYA BERTINGKAT SUNGAI BESI - ULU KELANG
(SEKSYEN B - CHERAS KE ULU KELANG)

DRAWING TITLE :
BUKIT ANTARABANGSA INTERCHANGE - RAMP 1
BOX GIRDER CONSTRUCTION SEQUENCE

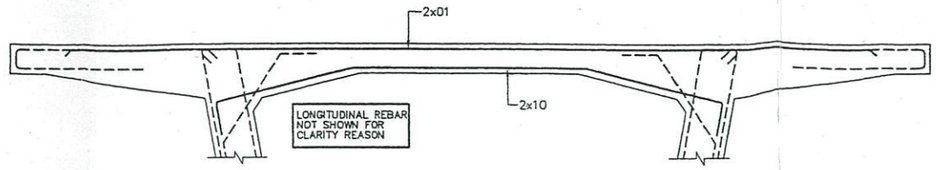
DRAWING NO : W/SUKE/11133/B12/ST/BA/R1/1.51

ISSUE:	REV:
0	1

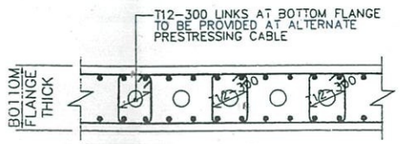
SUB-CONTRACTOR COPY



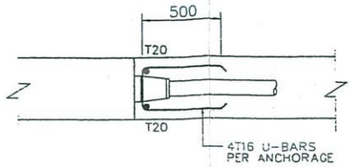
SECTION 1–1
(SCALE 1 : 25)



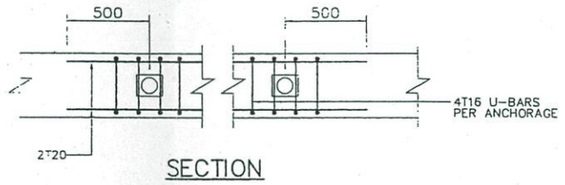
DETAILS OF SPLITTING AT ANCHORAGE FACE
(SCALE 1 : 30)



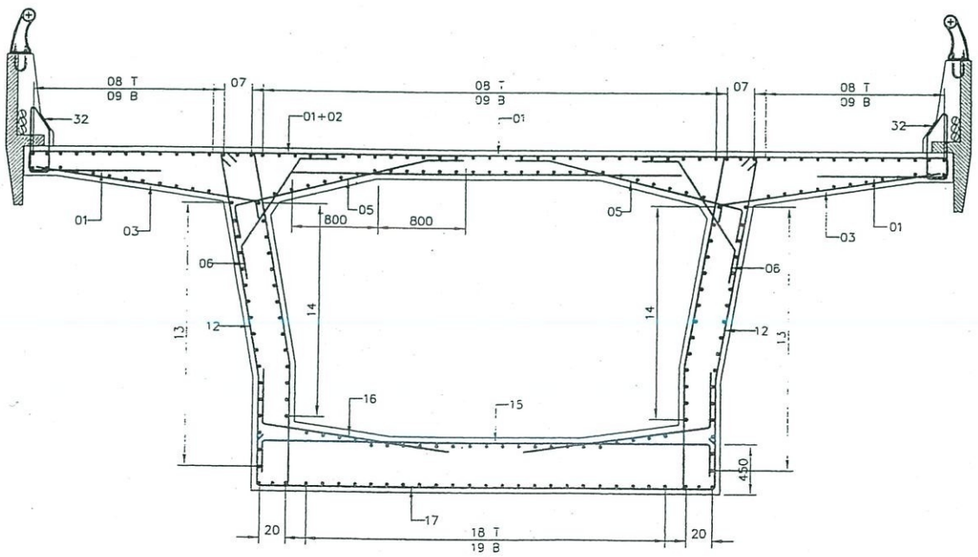
LINK REINFORCEMENT AT BOTTOM FLANGE
(SCALE 1 : 20)



ELEVATION
(SCALE 1 : 20)



SECTION
TYPICAL REINFORCEMENT FOR ANCHORAGE OF CENTRIC CABLES
(SCALE 1 : 20)



SECTION 2–2
(SCALE 1 : 25)

NOTE:
1. PRESTRESSED BLISTER AT THE BOTTOM FLANGE NOT SHOWN FOR CLARITY. DIMENSIONS AND REINFORCEMENT DETAILS OF BLISTER SHALL BE REFERRED TO RELEVANT DRAWING.
2. PRESTRESSING DUCTS AND ANCHORAGE IS NOT SHOWN IN THIS DRAWING FOR CLARITY REASON.
3. ALL THE FRONT FACE SURFACES SHALL BE ROUGHEN TO EXPOSE AGGREGATE AND COATED WITH APPROVED BONDING AGENT PRIOR TO CASTING OF NEW SEGMENT TO IT.
4. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH GENERAL NOTE DRAWING.
5. ALL LAPPING LENGTH SHALL BE REFER TO GENERAL NOTES DRAWING, UNLESS NOTES OTHERWISE.

CONSTRUCTION DRAWING

DATE	DESCRIPTION	APP.
/3/18	REVISED AS PER CLOUD	

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KETUA PENGARAH
LEMBAGA LEBUHRAYA MALAYSIA

SCALE : AS SHOWN

PROJEK PENSWASTAAN LEBUHRAYA BERTINGKAT SUNGAI BESI - ULU KELANG
(SEKSYEN B - CHERAS KE ULU KELANG)

DRAWING TITLE :
BUKIT ANTARABANGSA INTERCHANGE - RAMP 1
BOX GIRDER - SECTIONS R.C. DETAILS

DRAWING NO : W/SUKE/11133/B12/ST/BA/R1/1.59
ISSUE: 0 REV: 1