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 Zulfikaar Hariri Bin Mazlan

2013806966

entitled

Bridge Construction

accepted in partial fulfilment of requirement has for obtaining Diploma In Building

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OCTOBER 2015

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 JKP SDN BHD for duration of 5 months starting from 25 May and ended 9 October 2015. It is submitted as one of the prerequisite requirements of DBN307 and accepted as a partial fulfilment of the requirements for obtaining the Diploma in Building.

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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 Puan Noor Sahidah binti Samsudin, Supervising Lecturer, Puan Nurul Huda binti Abdul Hadi, Visiting Lecturer, Puan Noor Rizallinda binti Ishak, Practical Training Coordinator and Dr. Mohd Rofdzi bin Abdullah, Faculty 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.

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

Thank you so much.

ABSTRACT

Bridge are structures design to connect between two areas which are separate by sea, river or any natural earth surface. Bridge also function as to short the road from the existence road by crossing it and make it easier for people. In simple words, span of bridge is a span between two piers and there is road on the span that will use by people. The objective this report is investigate the sequence of bridge construction. This report covered the company profile, followed by the process of bridge construction. The construction of bridge needs to take the serious action, to avoid problems in future. Safety is also one of the important parts in the bridge construction especially in health and life aspect towards the labour. Bridge works are followed the specification requirements by Jabatan Kerja Raya (JKR).

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CHAPTER 1.0

1.1 Introduction

The state government's efforts to improve and provide facilities for the residents in the vicinity of Kuala Terengganu, a bridge linking Estimated catty and Gulf Island Vase with a new 4-lane road is under construction to provide an alternative route not only to avoid congestion on existing routes in Bridge Skilled Mahmud Bridge during peak hours, but can accelerate the entry and exit to Kuala Terengganu. Bridge and a new road is a link to LPT2.

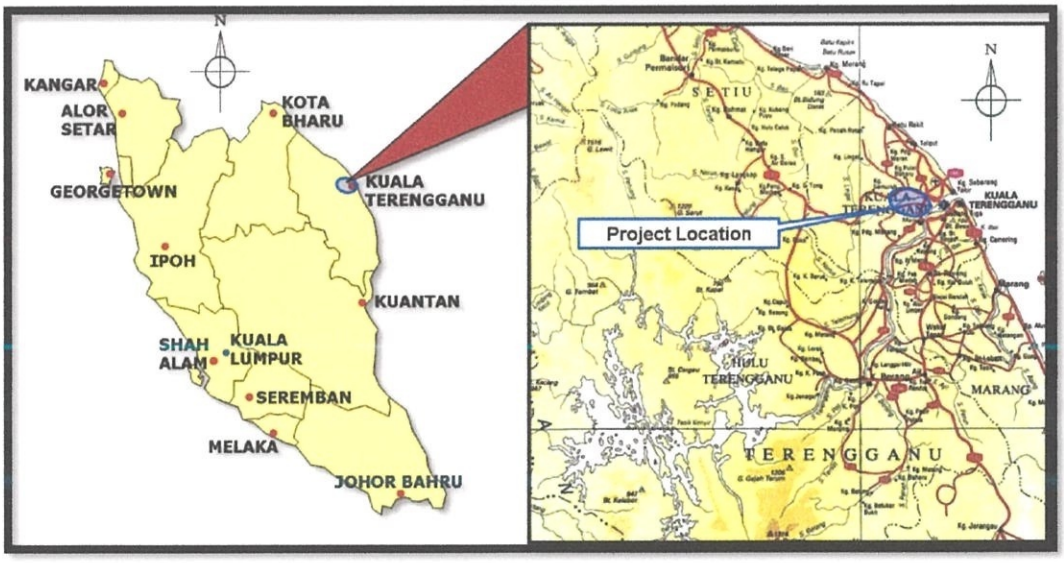


Figure 1.1: Project Location

Source: Jabatan Kerja Raya Kuala Terengganu

Users around Kuala Terengganu have several options to Kuala Nerus constituency. They can use either the Sultan Mahmud Bridge or Pulau Sekati bridge which in the process of construction to connect directly to the rapids and Kg. Tok Kong. Among

the benefits of the development of this project is to warrant comfort to consumers, increase the value of real estate and a shortcut to Kota Bharu/Kuala Terengganu.

Figure 1.2 Propose Location

Source: Jabatan Kerja Jaya Kuala Terengganu

Design and Construct new bridge with JKR R5 standard 4-lane dual carriageway which will connect Kampung Banggol Tuan Muda (Teluk Pasu) to Losong (approximately 3.539 km include new road). The bridge is the continuously of phase 2 Kampung Jeram to Kampung Banggol Tuan Muda project.

1.2 Objective

This report will provides information on the bridge construction from piling works until parapet work with respect to the method of work for this element. Therefore, the objectives of this report are:

1. To investigate the sequence of bridge construction (a span of bridge)
2. To identify the safety measure and procedure for construction works.

1.3 Scope of Works

The scopes of work for this report the bridge construction at Pulau Sekati which includes the design and construction of four lane dual carriageway with JKR R5 standard approximately 3.539 km which include about 1.580 km structure (Bridge Work) and approach roads on Teluk Pasu and Losong that includes the following such as general items, pavement works, road furniture works, structure works and traffic management and control.

1.4 Method of Study

There are several methods used to gather information for preparation of this report. Methods that been used for this report are:

i. Observation

In gaining information, observation is one of the method is used because the author can learn and get some skill by workers to apply any construction work like pour concrete into a pile cap.

ii. Reference

References like notes given by lecturers, books, drawings, company module and journals from library can be used as guidance on preparing this practical report.

iii. Interview

Interview with person related to the topic for practical report such as sub-contractor, project manager, JKR, site supervisor and soon. Interview method can get information directly from them. This is because they have more experience in construction industrial

iv. Electronic Media

Electronic media is very useful to obtain information or solve problem any problems. Example for this method is use internet to find some information about construction industry.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction

Zainal @ Shariff Ibrahim Sdn. Bhd. (ZSISB) was establish on 1982 with the intention of participating in the construction and development sector throughout the nation.

Since its inception, ZSISB were fortunate to rise rapidly as one the construction company that has been able to deliver each and every project promptly and efficiency. With such reputation, ZSISB has been actively consolidating its internal structure of management, manpower and resources to prepared and undertake any assignments, cost effectively and with quality in the future.

ZSISB is a forerunner in the construction sector, and has proven by its track record that and smart work will pay off in the long run. ZSISB are privileged to have participated in all aspects of professional practice. While experience is a most valuable assets, our commitment to get the job and done right has enabled ZSISB to take on and complete projects successfully.

Better performance means more challenges and especially in the ever changing construction industry ZSISB will always reaffirm its commitment to serve its client and meet all the requirements.

Zainal @ Shariff Ibrahim Sdn. Bhd. is committed in using the up to date technology in meeting its clients' need.

2.1.1 Vision

Approaching year 2020, value added developments will be the inherent trait in the construction sector. To meet these challenges, strength, resources and competency must be pooled and be synergistic to each other. As such, we will be unimproved organization and be able to participate in all aspects of nation building.

2.1.2 Mission

i. To perform par excellence and to complete each and every projects promptly and with quality.
ii. To always maintain good relationships with clients and suppliers.
iii. To provide the best affordable services to satisfy and meet client's requirements and needs.

2.2 Company Information

The name of Company	:	ZAINAL@SHARIFF IBRAHIM SDN. BHD.
Date of Incorporation	:	30^{th} June 1982
Registration Number	:	86876-P
Authorized Capital	:	RM 5,000,000.00
Paid up Capital	:	RM 1,200,000.00
Directors and Shareholders	:	Dato' Hj. Zainal bin Ibrahim
		Pn. Hjh. Zalipah binti Ibrahim
		Dato' Hj. Mohd Rozi bin Ibrahim

Office	:	466-B, Jalan Kenanga, Off Jalan Kmaruddin, 20400 Kuala Terengganu.
Telephone Number	:	
Facsimile	:	
Email Address	:	zsisb@yahoo.com
Banker	:	MAYBANK PERBANKAN ISLAM Kuala Terengganu No.1j Jalan Air Jernih 20300 Kuala Terengganu CIMB BANK Jalan Sultan Ismail 21200 Kuala Terengganu Terengganu Darul Iman
Company Secretary	:	DITAX Management Services No. 134F, Tingkat 1, Jalan Sultan Zainal Abidin, 20000 Kuala Terengganu.
Private Lawyer	:	ZAMANI MOHAMAD & CO 1170e, Tingkat 2, Jalan Pejabat, Off Jalan Sultan Ismail, 20200 Kuala Terengganu.

2.2.1 Company Registration

ZAINAL@SHARIFF SDN. BHD. is registered with the body of:

i. Pusat Khidmat Kontraktor Kelas A Wibawa
ii. Kementerian Kewangan
iii. Cidb Gred G7
iv. Petronas Gas Bhd.
v. Indah Water Sdn. Bhd.
vi. Tenaga Nasional Bhd.

2.2.2 List of Company Plant and Machineries

i.	Lorry Tipper	-	17 units
ii.	Backhoe	-	6 units
iii.	Roller Bomag	-	2 units
iv.	Excavator	-	5 units
v.	Van	-	5 units
vi.	Grader	-	1 units
vii.	Mobile Crane 20 Tonne	-	3 units
viii.	Concrete Mixer 8 Tonne	-	25 units
ix.	Water Pump 34"	-	10 units
x.	Vibrator	-	17 units
xi.	Scaffolding	-	30,000 units
xii.	Furniture Machinery	-	22 units
xiii.	Road Cutter	-	4 units
xiv.	Hand Compactor	-	9 units
xv.	Bar Bender / Cutter	-	8 units
xvi.	Compressor	-	4 units

2.3 Company Organization Chart

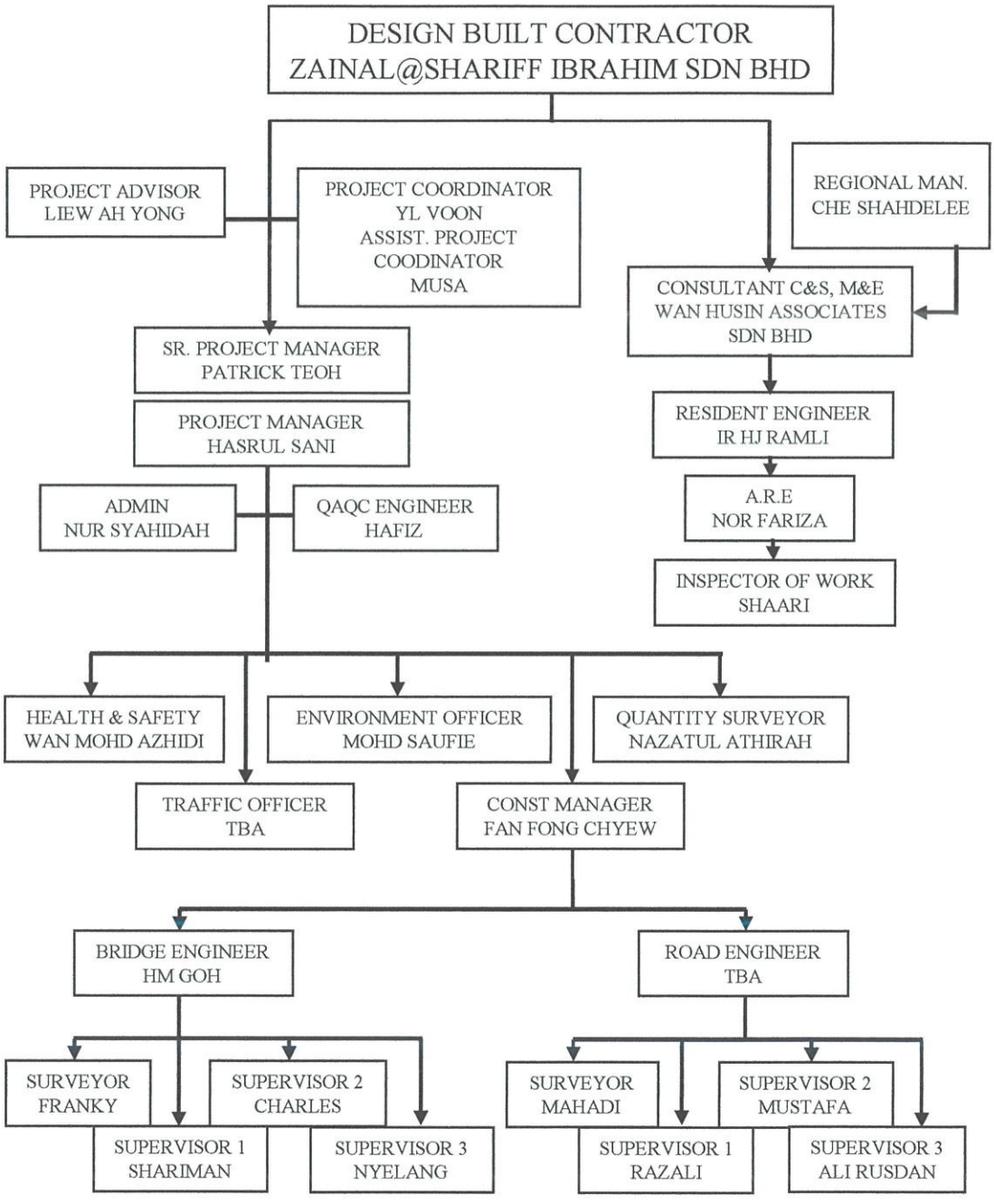


Figure 2.1: Organization Chart of Zainal @ Shariff Ibrahim Sdn. Bhd.

2.4 Company Projects

2.4.1 Completed Projects

Table 2.1: List of Completed Projects

No.	Project/Location	Client	Start Date	Completed Date	Contract Value
1	Merekabentuk membina dan menyiapkan 383 unit rumah teres mampu milik dan kerja-kerja berkaitan dengannya di kampong Bukit Gasing, mukim Pulau-pulau Kerengga, Daerah Marang, Terengganu, Terengganu Darul Iman.	SUK	25/04/ 2010	20/08/ 2013	RM38,800 ,000.00
2	Cadangan Merekabentuk, Membina Dan Menyiapkan Sebuah Masjid Di Kampung Kubang Ikan, Chendering, Kuala Terengganu	SUK	19/03/ 2012	18/03/ 2013	RM10,665 ,000,00
3	Cadangan Membangunkan 10 Blok (120 Unit) Kondo Rakyat di Chendering, Daerah Kuala Terengganu Secara Reka dan Bina	SUK	01/06/ 2009	23/07/ 2013	RM19,600 ,000.00

4	Cadangan Pembinaan Pejabat Pentadbiran Istana Badariah, Kuala Terengganu	SUK	13/06/ 2011	19/03/ 2012	RM3,990, 000.00
5	Projek Lebuhraya Pantai Timur Fasa @ Pakej 1B : Dari CH3750, Felda Neram 1 ke CH6700, Sg. Jabur, di Daerah Kemaman, Terengganu	JKR	18/02/ 2009	31/03/ 2010	RM40,763 ,080.60
6	Cadangan Pembangunan Projek Pendidikan Bagi Sek. Men. Keb. Seri Cheneh Kemaman Yang Mengandungi 30 Bilik Darjah di Daerah Kemaman Terengganu	KPM	24/12/ 2007	07/07/ 2010	RM20,500 ,000.00
7	Pembinaan Bangunan Asrama dan Bangunan Tambahan di Sek. Men. Keb. Belara, Kuala Terengganu	JKR	15/05/ 2002	14/04/ 2003	RM14,914 ,290.00
8	Pembinaan Bangunan Asrama dan Bangunan Tambahan di Sek. Men. Keb. Belara, Kuala Terengganu	JKR	15/05/ 2002	14/04/ 2003	RM14,914 ,290.00

10	Cadangan membina dan menyiapkan Rumah Berkembar di lokasi Perdana, Puchong	SWASTA	2004	2009	RM401,000,000.00

2.4.2 Project in Progress

Pembangunan Jambatan di Atas Sungai Terengganu ke Pulau Sekati, Kuala Terengganu, Terengganu (30/04/2012 – now) – RM 242,000,000.00

CHAPTER 3.0

BRIDGE CONSTRUCTION

3.1 Introduction of Project

Bridges are an essential part of any infrastructure. They span countless obstacles to connect the roads of our highway systems. Bridges can be found in variety of setting to reduce traffic congestion areas to under-populated rural locations to beloved park environments. The vast majority of the world's bridges are short and moderate spans. It is not these most common bridges, but rather the monumental long-span bridges that are the most noticeable and striking due to their size and often scenic settings. Many long span monumental bridges are considered works of structural arts. The much more prevalent short and moderate span bridges simply remain functional and nondescript. Although these more moderate-sized bridges dominates highway landscape, they typically fail to catch even the imagination of the engineers who design them.

Rapid advances in the state of the art of engineering design, materials and construction provide engineers with many new options for short and moderate span bridge design. Designed for economy and function alone, standard highway bridges often detract from, rather than enhance, the environmental in which they are built. (Fu, 2005)

Bridges are classified on the basis that how the four forces namely shear, compression, tension and moment are distributed in the bridge structure. A structure built to span and provide passage over a river, chasm, road or any other physical hurdle. The function required from the bridge and the area where it is constructed decides the design of the bridges. (WebTechTix, 2014)

Project Layout Plan

Figure 3.1: Project Layout Plan

Source: Jabatan Kerja Raya Negeri Terengganu

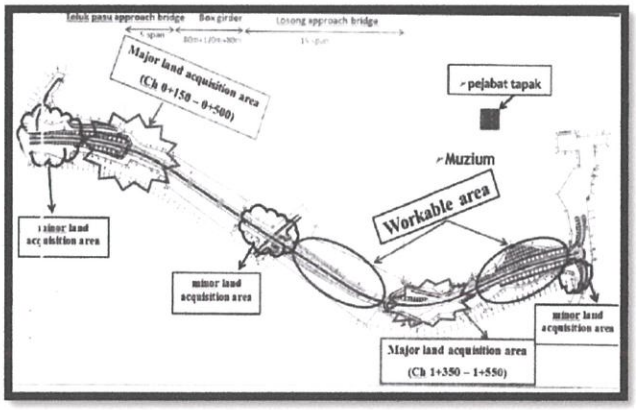


Figure 3.2: Project Details Plan

Source: Jabatan Kerja Raya Negeri Terengganu

Balance Cantilever bridges crossing Sungai Terengganu utilized Box Girder with a span of 80m, 120m, 80m. The bridge also has 2 numbers of Underpass at Teluk Pasu (Jalan Teluk Pasu, Jalan Masjid).

The project involves the construction of new roads from Kg. Banggol Tuan Muda (Teluk Pasu) 4-lanes two way street to meet the standard JKR R5 is 1.6km long, over 1.8km of new road construction detail are as follows:

- Teluk Pasu Approach Bridge (T-Beam) 5 span – 180m long

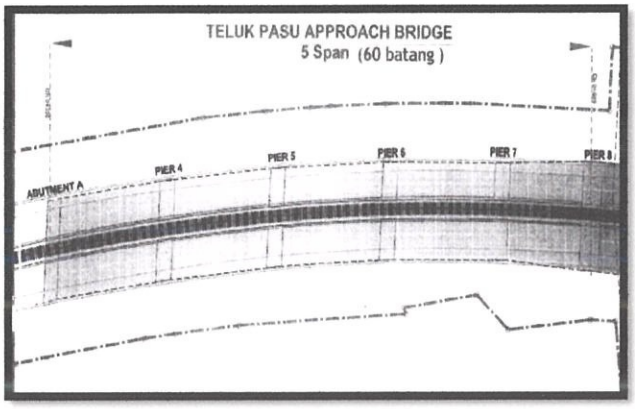


Figure 3.3: Structure Layout at Teluk Pasu

Source: Jabatan Kerja Raya Negeri Terengganu

- One (1) balance cantilever bridge crossing Sg. Terengganu (Box Girder) 3 span – 280 span long.

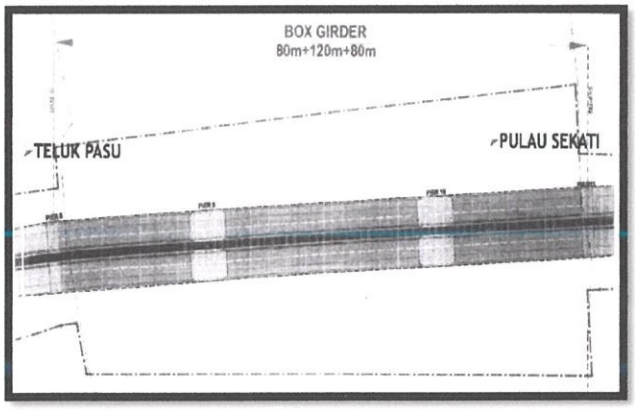


Figure 3.4: Structure Layout at Box Girder

Source: Jabatan Kerja Raya Negeri Terengganu

- Losong Approach Bridge 9T-Beam) 15 span – 600m long

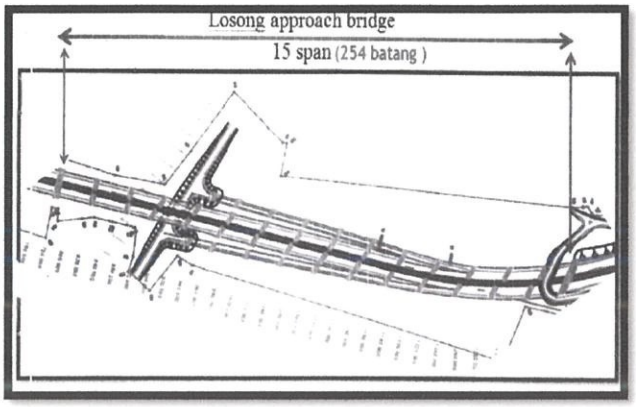


Figure 3.5: Structure Layout at Losong

Source: Jabatan Kerja Raya Negeri Terengganu

3.2 Case Study

The construction of bridges varies widely depends on the material and design, however, there are many components that are common to all bridges. In general, these components may be classified either as parts of a bridge superstructure or as parts of a bridge substructure.

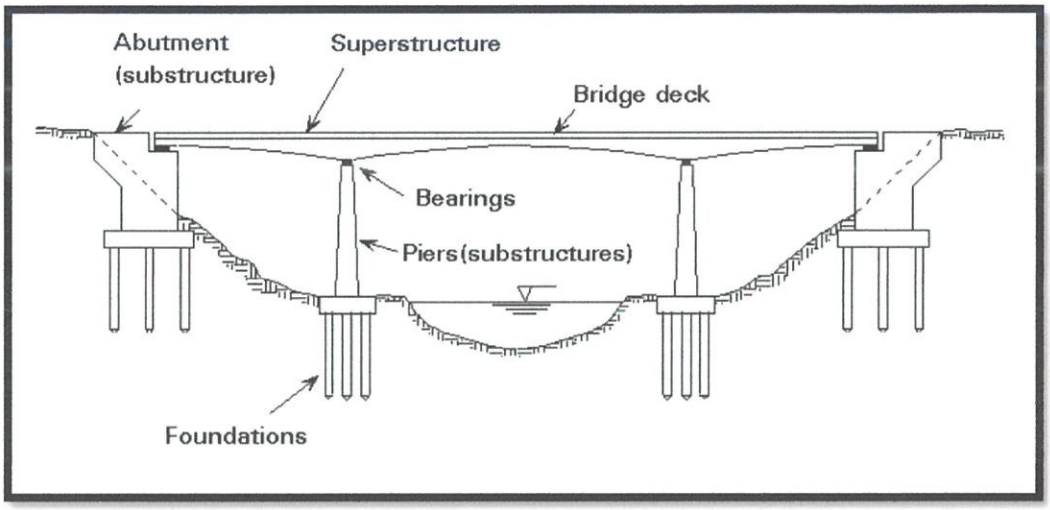


Figure 3.6: Component of Bridge

Source: (Spannweiten, 1975)

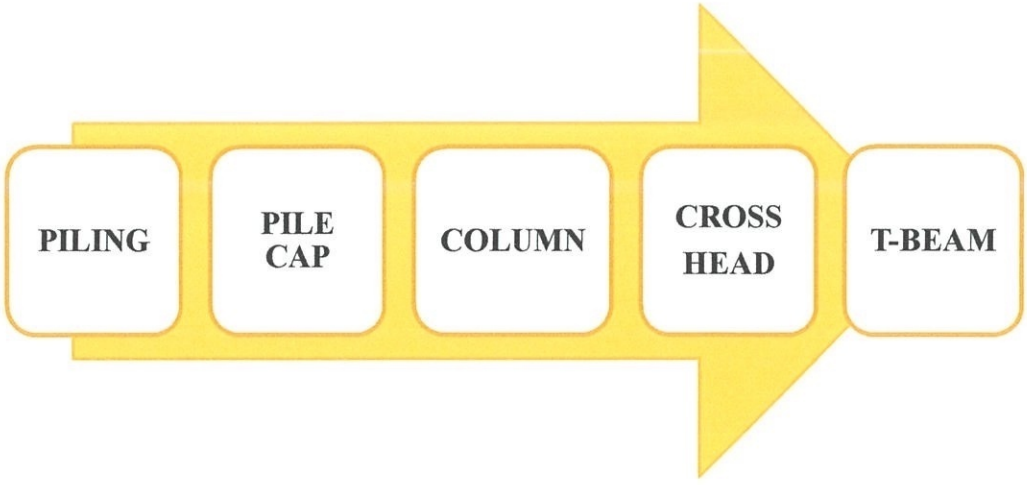


Figure 3.7: Bridge construction work flow

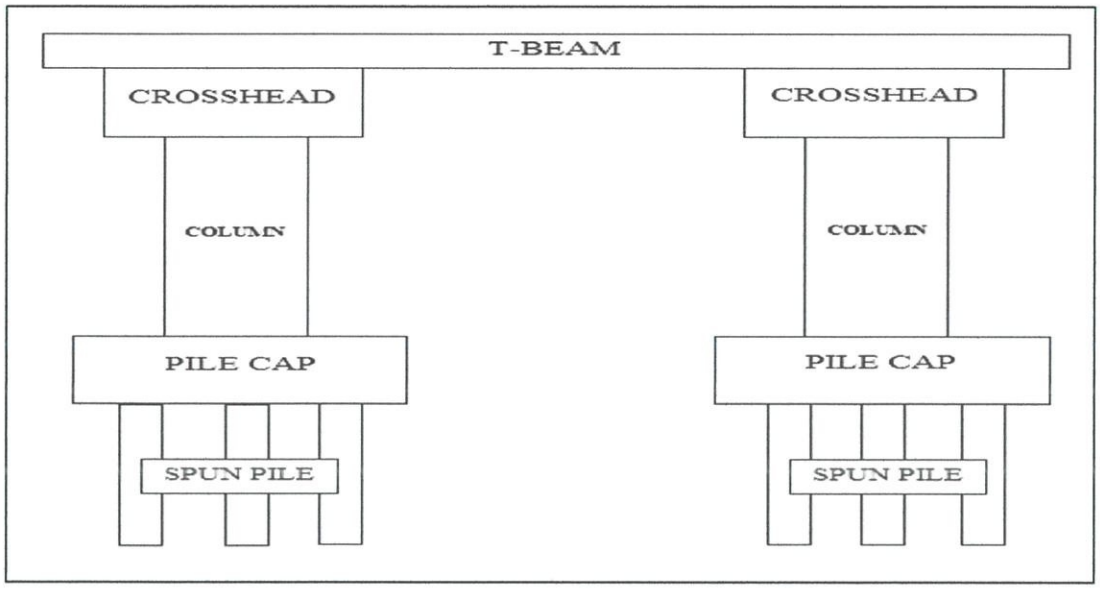


Figure 3.8: Span of Bridge

3.2.1 Substructure

A substructure is any structural, load-supporting component generally referred to by the terms Abutment, Pier, Retaining Wall, Foundation or other similar terminology. Substructure units function as both axially load and bending members. These units resist both vertical and horizontal loads applied from superstructure and roadway Embankment.

Many factor influence the selection of substructure and foundation materials, types, configurations, positions and orientations. Often, existing constraints will limit the range of options lead the designer to only or few feasible solutions.

3.2.1.1 Foundation

A bridge foundation is part of the bridge substructure connecting the bridge to the ground. A foundation consists of man-made structural elements that are constructed either on top of within geologic materials. The function of a foundation is

to provide support for the bridge and transfer loads or energy between the bridges structure to the ground. (Hodgkinson, 1986)

A deep foundation is a type of foundation where the Embankment is large than its maximum plane dimension. The foundation is design to be supported on deeper geologic materials because either the soil or rock near the ground surface is not competent enough to take the design loads or it is more economical to do so.

Photo 3.1: Bridge Foundation

A deep foundation occupies a relatively smaller area of the ground surface. Deep foundations can usually take larger loads than shallow foundations that occupy the same area of the ground surface. Deep foundations can reach deeper competent layers of bearing soil or rock, whereas shallow foundations cannot. Deep foundations can also take large uplift and lateral loads, whereas shallow foundations usually cannot.

Bridge foundations can be individual, grouped, or combination foundations. Individual bridge foundations usually include individual footings, large-diameter drilled shafts, caissons, rock sockets, and deadman foundations. Grouped foundations include groups of caissons, driven piles, drilled shafts, and rock sockets. Combination foundations include caisson with driven piles, caisson with drilled shafts, large-diameter pipe piles with rock socket, spread footings with anchors, dead man with piles and anchors.

For small bridges, small-scale foundations such as individual footings or drilled shaft foundations, or a small group of driven piles may be sufficient. For larger bridges, large-diameter shaft foundations, grouped foundations, caissons, or combination

foundations may be required. Caissons, large diameter steel pipe pile foundations, or other types of foundations constructed by using the cofferdam method may be necessary for foundations constructed over water.

In this project, type of deep foundation has been used which are as below :

1) Precast Pre-stressed Spun Concrete Pile

   Pile sections are normally 12 m long and are usually welded together using steel end plates. Pile sections up to 20 m can also be specially made. Precast pre-stressed spun concrete piles require high-strength concrete and careful control during manufacture. Casting is usually carried out in a factory where the curing conditions can be strictly regulated. Special manufacturing processes such as compaction by spinning or autoclave curing can be adopted to produce high strength concrete up to about 75 MPa. Such piles may be handled more easily than precast reinforced concrete piles without damage.

Photo 3.2: Precast Pre-stressed Spun Concrete Pile

This type of piles is generally less permeable than reinforced concrete piles and may be expected to exhibit superior performance in a marine environment. However, they may not be suitable for ground with significant boulder contents. In such cases, pre-boring may be required to penetrate the underground obstructions. Spalling, cracking and breaking can occur if careful control is not undertaken and good driving practice is not followed. In this project, the specifications of pre-stressed spun concrete piles are listed below:

- Length : 12m
- Diameter : 600mm
- Minimum effective stress : Class A : 5.2N/mm^2
  Class B: 7.0N/mm^2
- Minimum cube strength : at transfer 30 N/mm^2
  At 28 days 78.5 N/mm^2
- The production of spun pile shall be in accordance with MS 1314
- All welding shall be in accordance with BS 5135
- Pre-stressing bar shall be 'ulban' or equivalent
- Spiral shall be drawn to BS 4482
- Other reinforcement to be M.S or H.T bars to MS 146
- Test load on pile shall be twice the design load.
- Piles are design as frictional and end bearing piles
- Electrode used shall comply with BS 639 or equivalent

Safety for piling works is very important, the table show safe work practice for piling works:

Table 3.1: Safety practice for piling works

General	Protect workers from injuries associated with piling installation procedures
Application	Piling installation is an integral part in construction of structures.
Protective Mechanisms	Safe work procedure Site survey PPE ERP (Emergency Response Plan) Pile driving rig data Permit System
Selection and use	As per safe work procedures Manufacturers Specifications

Supervisor Responsibility	Supervisors are responsible to facilitate and/or provide proper instruction to their workers on protection requirements and training Inspect worksite Review piling subcontractor safe work procedures (if applicable)
Worker responsibility	1. Set up signs and barricades. 2. Line locations and scope of locations. 3. Hand expose lines and cables. 4. Maintain minimum clearance from *underground*, overhead lines and structures. 5. Be aware of pinch points. 6. Ensure tag lines are utilized. 7. Ensure proper isolation/ barricading/ covering/ of open excavations/ cages/ drive piles. 8. Ensure proper off-loading of piling materials. 9. Ensure that augering or drilling equipment is on stable ground and anchored properly. 10. Ensure you are visible at all times to the rig operator. 11. Follow piling safe work procedure step by step.

3.2.1.2 Pile Cap

Post-tensioning is used to reduce the necessary size of the pile cap and the required steel area. The concentrated application of the posttensioning anchorage forces is well suited to strut and tie methods of design for this element.

Photo 3.3: Pile Cap Reinforcement

3.2.1.3 Pier

Piers are an integral part of the load path between the superstructure and the foundation. Piers are designed to resist the vertical loads from the superstructure, as well as the horizontal superstructure loads not resisted by the abutments. The magnitude of the superstructure loads applied to each pier shall consider the configuration of the fixed and expansion bearings, the bearing types and the relative stiffness of all of the piers. The analysis to determine the horizontal loads applied at each pier must consider the entire system of piers and abutments and not just the individual pier. The piers shall also resist loads applied directly to them, such as wind loads, ice loads, water pressures and vehicle impact.

Piers need located to provide a minimum interference to flood flow. The piers is placed parallel with the direction of flood flow. Make adequate provision for drift and ice by increasing span lengths and vertical clearances, and by selecting proper pier types. Special precautions against scour are required in unstable streambeds. Navigational clearance must be considered when placing piers for bridges over navigable waterways. Coordination with the engineer performing the hydraulic analysis is required to ensure the design freeboard is met, the potential for scour is considered, the hydraulic opening is maintained and the flood elevations are not adversely affected upstream or downstream.

In the case of railroad and highway separation structures, the spacing and location of piers and abutments is usually controlled by the minimum horizontal and vertical clearances required for the roadway or the railroad. Other factors such as utilities or environmental concerns may influence the location of the piers. Sight distance can impact the horizontal clearance required for bridges crossing roadways on horizontally curved alignments.

Photo 3.4: Pier Constructed

Cost may also influence the number of piers, and therefore the number of spans, used in final design. During the planning stages, an analysis should be performed to determine the most economical configuration of span lengths versus number of piers that meet all of the bridge site criteria.

3.2.1.4 Damage Risks to Bridge Sub-structure

The most common cause of bridge failure is from floods when scour causes failure of bridge piers and abutments. Scour occurs progressively as supporting material under a footing is removed during flood events and is replaced with material that has little or no bearing capacity. Barge and ship collisions with bridges are common worldwide, and can represent a significant cause of damage to bridge substructure. Although damage to substructures can be similar to that from an

earthquake, impact damage primarily affects the bridge substructure and there is a comparatively low risk of reduced soil support.

Loss of capacity in bridge piers and abutments can occur either over a period of time resulting from alkali-silica reaction, freeze-thaw damage, corrosion of reinforcement, and unconstrained thermal movements, or because of sudden floods, earthquake, or vessel impact. The long-term damage conditions can be evaluated using a variety of local tests including impact-echo, groundpenetrating radar, and corrosion-potential measurements. However, damage caused by floods, earthquake, and vessel impact is more difficult to evaluate locally for buried portions of bridge substructures, and thus global bridge evaluation and monitoring methods are more suitable.

3.2.2 Superstructure

The basic purpose of the superstructure is to carry loads from the deck across the span and to the bridge supports. The superstructure is that component of the bridge which supports the deck or riding surface of the bridge, as well as the loads applied to the deck. The function of the superstructure is to transmit loads. Bridges are named for their type of superstructure. Superstructures may be characterized with regard to their function. Loads may be transmitted through tension, compression, bending, or a combination of these three. (Lohnes, 2012)

3.2.2.1 Crosshead

Crosshead is one important structure in bridge construction. Engineers have to put extra effort to design the crosshead. From the project that I have been directly involved, I can observe the process of crosshead construction in detail. In the beginning of the construction of crosshead, certain aspects need to be considered and manual calculation. The things that need to be considered for crosshead:

a) Value for each section which is applied load and dead load.\
b) Parapet wall load

c) Object load which is always change from time to time

d) Dead load

Photo 3.5: Installation of platform for crosshead

Photo 3.6: The fixing and tie in reinforcement bar.

Photo 3.7: Inspection reinforcement bar for crosshead

Photo 3.8: Installation of timber formwork for crosshead

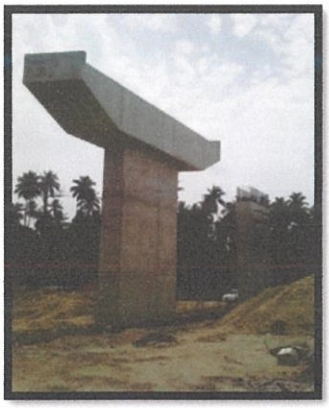


Photo 3.9: Finished Crosshead

3.2.2.2 Beam and T-Beam

Beam bridges are the oldest known bridges and tend to be the simplest to design and build. They consist of vertical piers and horizontal beams. A beam bridge's strength depends on the strength of the roadway and can be increased by adding additional piers. While beam bridges can be quite long, the span, or distance between adjacent piers, is usually small.

T-beam bridge decks are one of the principal types of cast-in place concrete decks. T-beam bridge decks consist of a concrete slab integral with girders. T-beam, used in construction, is a load-bearing structure of reinforced concrete, wood or metal, with a t-shaped cross section. The top of the T-shaped cross section serves as a flange or compression member in resisting compressive stresses. The web of the beam below the compression flange serves to resist shear stress and to provide greater separation for the coupled forces of bending.

A beam and slab bridge or T- beam bridge is constructed when the span is between 10 -25 m. The bridge deck essentially consists of a concrete slab monolithically cast over longitudinal girders so that the T-beam effect prevails. To impart transverse stiffness to the deck, cross girders or diaphragms are provided at regular intervals. The number of longitudinal girders depends on the width of the road. Three girders are normally provided for a two lane road bridge. T-beam bridges are composed of deck slab 20 to 25cm thick.

3.2.3 Pre-stressed Concrete Bridge

A) Pre-stressed Concrete

Prestressed concrete is a material that has had internal stresses induced to balance out, to a desire degree, stresses due to externally applied loads. Since tensile stresses are undesireble in concrete structural members, the objective of prestressing is to create compressive stresses (prestress) at the same locations as the tensile stresses within the member so that the tensile stresses will be diminished or will dissappear altogether.

The elimination of tensile stresses within the concrete will result in members that have fewer cracks or are crack-free at service load levels. This one of the advantages of prestressed concrete over reinforced concrete. Because beam cross sections are primarily in compression, diagonal tension stresses are induced and the mbeams are stiffer at service loads. Also, sections can be smaller, resulting in less dead weight. Despite the advantages, the following must be considered :

Some items that must be considered when using prestressed concrete :

- The higher unit cost of stronger materials.
- The need for expensive accessories.
- The necessity for close inspection and quality control.
- In the case of precasting, a higher initial investment in plant.

B) Post-Tensioned

Post-tensioned concrete bridges have constructed with the efficiency of construction method for concrete structures with high strength of prestressing steel. Post-tensioning is a method of reinforcing (strengthening) concrete or other materials with high-strength steel strands or bars, typically referred to as tendons. Post-tensioning applications include office and apartment buildings, parking structures, slabs-on-ground, bridges, sports stadiums, rock and soil anchors, and water-tanks. In many cases, post-tensioning allows construction that would otherwise be impossible due to either site constraints or architectural requirements.

Post-tensioning makes possible the cost-effective construction of high quality bridges over a wide range of conditions and span lenghts including highway alignment. Bridge structures constructed using post-tensioning have high intrinsic durability and are able to be built quickly with minimal impact on the human and natural environment. Futher, structures constructed using post-tensioning also benefit from the methods ability to limit cracking, reduced structural depth, ease of accommodating curved roadway alignment and low maintenance costs. And, these benefits do not come at the expense of aesthetic expression. (Williams, 1995)

Cast-in-place cantilever construction has become the preferred method of building long-span concrete bridges as well as concrete arches with the help of temporary

towers and stays. It is a proven cost-effective means of building spans ranging from 200-feet (60 m) to more than 1,000-feet (300 m). It has been used to cross major bodies of water, deep mountain canyons, and densely populated urban areas. Further, post-tensioning can be used effectively to build bridges on alignments that are curved in plan.

For Pulau Sekati bridge project, the precast T-Bean stressing and grouting work:

1. All dimension shown are in (mm) millimetres unless otherwise stated construction drawing.
2. The minimum 150mm concrete cube strength at 28 days shall be 50N/mm²
3. Pre stressing steel must comply with ASTM A416-90a.

   Nominal diameter of strand : 15.24 mm
   Minimum Breaking Load : 260.7 KN
   Nominal Steel Area : 140.0mm²
   Young's Modulus : 195 KN/mm²

4. The pre stressing system is the BBR Cona Compact Multi Strands system.
5. The drawing is to be read in conjunction with the relevant engineer's drawing
6. Mild steel reinforcement to conform to M.S 146 general reinforcement details as per engineer's drawing.
7. Concrete cover to:
   a. Pre stressing tendon to be minimum 50mm
   b. Mild steel reinforcement to be minimum 35mm at the web and minimum 50mm at bottom flange.
8. The sequence of the pre stressing in the following order: Cable B (50%) to Cable C (100%) to Cable D (100%) to Cable A (100%) to Cable B (50%)
9. Pre stressing done in two stage as follows:

   Stage 1. For lifting the beam a minimum of 35N/mm² concrete cube strength shall be attained before stressing is carried out.

   Stage 2 – Pre stress shall be carried out as soon as minimum concrete cube strength of 45 N/mm² is attained.

Note: Stage 1 stressing way be waived if there are sufficient number of casting beds provided.

10. The beam cannot be moved or lifted during the first 24hours following grouting.
11. Jacking force T-Beam include drawing losses of 6mm
12. Sheathing accurately positioned and tie to be reinforcing cage at 1.00m spacing.
13. Recesses provide for anchorages shall be concreted by main contractor after stressing and grouting of tendons.
14. The grout shall be mixed and have a composition of one 50kg bagged Ordinary Portland Cement : 5 gallons of water (22.7 litres) : 1sachet (227 gms) Conbex 100 grout additive, water cement ratio = 0.45
15. Grout shall be pumped into each duct until grout pours out of the outlet. The high pressure cork at this end shall be closed and pumping continued until a pressure of 0.41 N/mm² (60 psi) is attained. The high pressure cork shall remain close and in position for a period of one hour after grouting.
16. Bursting reinforcement shall be surprised and installed by main contractor to both ends.
17. Calculated elongation shown are at jacking pressure. (before lock-off)
18. Coefficient of friction u = 023/rad
    Wobble factor, k = 0.0033 rad/m
    Relaxation of strand = 2.5%

Stressing works to be mentioned in specialist engineers drawings.

(a) (b) (c)

Photo 3.10 (a), (b), (c): Stressing Works for T Beam

Grouting works to be mentioned in specialist engineers drawings.

(a) (b) (c)

Photo 3.11 (a), (b), (c): Grouting Works for T Beam

Post-tensioned superstructures, which can be built quickly and without touching the land or water below the bridge, are a relatively low impact structural system and optimal solution. For longer spans (commonly up to 300-feet or more), shallowed girder depths and continuously curved superstructures, post-tensioning offers ductility and seismic performance as well as superior aesthetics to precast designs. Post-tensioning also provides more flexibility in the layout of span length, bent configurations and roadway geomatics that precast I-girders of reinforced concrete box girders. (Ryall, 2012)

C) Grouting of Post Tensioned Tendons

The grouting of the ducts surrounding post-tensioning tendons provides the necessary mechanical connection to transfer the stresses between the tendons and the concrete and also protects the tendons from corrosion. The bonding of the grout to the post-tensioning steel accomplishes this in a manner that is similar to the bond developed by rebar in concrete.

Photo 3.12 : Grouting works for T-Beam

Grout is the primary protection for the post-tensioning system; terefore, careful attention must be given to the grouting process. Cementitious grout provides an alkaline environment that passivates the surface of the steel which inhibits the corrosion process.

The grout must surround and be bonded with the steel to be effective. Specially blended grout materials, correctly mixed and effectively pumped into the tendon, are key to a successful grouting operation. The durability of the structure is directly effected by the quality of the grouting. It is essential that an adequate grout plan be developed and executed. (Ramachandran, 1996)

Quality grouting is achieved through :-

- Careful selection of the based materials comprising cement, water and admixtures.
- Consistency in the grout properties by a high level of quality control.
- Use of appropriate mix design and mixing procedures adapted to the specific materials, environment and equipment.

- Trials to test grout systems for any particular set of factors.
- Execution of grouting on site by qualified personnel following approved method statements.
- In addition to the pure grouting activity, there needs to be appropriate design and detailing of the structure for a particular application and operational environment.

D) Post Tensioned Strengthening

For stengthening pre-stressed concrete beams or slabs, simple externally bonded strengthening system may not be sufficient. In these situations the strengthening system may need to be tensioned to provide an active strengthening system and be able to enhance the load carrying capacity of the concrete structure in conjuction with the existing built-in-pre-stressing system. In most cases the post-tensioning system is designed with the following external components: fixed anchorage system located towards each end of the beam/slab and post-tensioning cable that tensioned between the two anchors then locked in a tensioned state.

The tensioning cable can be regular high tensile multi-strand steel, rigid carbon fiber rod or carbon fiber fabric. The post-tensioning cable can be bonded or unbonded along its entire length. The end anchorage system can be made of either concrete that is doweled into the existing concrete or could be manufactured of structural steel that is bolted to the structure. The pre-stressing process nof the stree strengthening system is the same as the process used for any other conversional post-tensioned project.

Photo 3.13 : Hydraulic Jack

Photo 3.14 : Prestressing work for T-beam

E) Grouting on Site

Grouting work on site is a complex activity. It needs to be well prepared. Once it has started it should not be interrupted. The assessment of the quality of grout during injection is still based to some degree on judgement of an individual, example for decision when the quality of grout is acceptable to close a particular vent. Most, if not all, activities during grouting are on the critical path, in particular for grout mixes which show an early start of setting. The actual grouting works can be physically quite demanding, are dirty, and involve safety risks, example if the human skin or eyes get in direct contact with the grout.

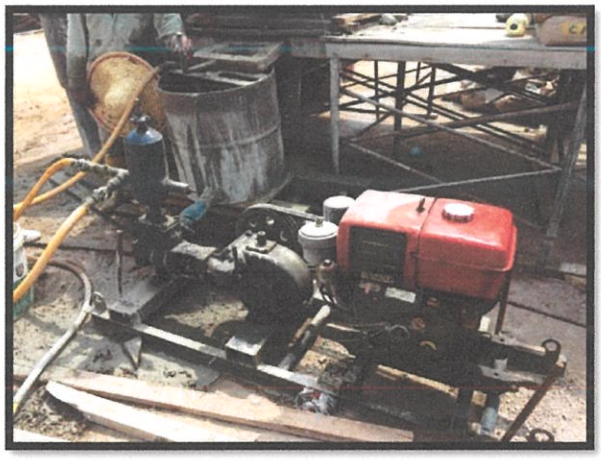


Photo 3.15 : Grouting Equipment

For all the above reason, grouting work needs to be planned and supervised by experienced technician with a through understanding of the behaviour of grout and awareness of the potential implications of poor grouting on the durability of a post-tensioned structure. Hence, only such experienced technicians should be qualified to plan and supervise grouting works. These technichian should be capable of training the labour used for grouting, usually on site as needed for the anticipated activities.

A satisfactory quality of grouting works can only be achieved if grouting equipment of a suitable capacity adapted to the particular project is used. Such equipment should bo confirmed prior to the actual grouting work during suitability testing to be able to produce a sufficiently homogeneous grout mix. A post-tensioning tendon can only reliably and completely be filled if the entire tendon and duct system, including anchorages, hoses is leak tight. Hence, careful detailing of the tendon and duct system is essential. Improvised connections between ducts and anchorages or improvised sealing of anchorages and vents present risks which may lead to grouting defects. (Nonveiller, 1989)

Excess water in the grout has been consirmed as a major cause of grouting and durability problems. Hence, control of the water added to the grout is essential. This includes water eventually present in the duct system. Threfore, duct systems need to be kept adequately sealed on site at all times to avoid ingress of rain or other water before grouting.

3.2.4 Concrete Quality Control

Quality concrete means a concrete right or correct to reach the level of strength and specifications. It will go throungh soem tests and tests that are commonly held to test the quality of the concrete is:

a) Slump Test

Apparatus:

Photo 3.16: Mould (cone) and Base Plate

Photo 3.17: Steel Rod 600mm long

Photo 3.18: Trowel

Photo 3.19: Measuring Tape

Procedure to conduct slump test:

i. Place the cone on the base plate, which is on top of smooth surface area

ii. Fill the mould with 3 layers of concrete of same thickness each layer

iii. Compact each layer of concrete mix by blow in 25 times with steel rod

iv. Level the top surface of fresh concrete with trowel and then lift cone from the concrete raising it vertically and slowly.

v. Measure the slump to the nearest by using the measuring tape to determine the height of cone and highest point of requirement.

vi. Height and shape of slump obtained varies from one mix another depending on the mix workability.

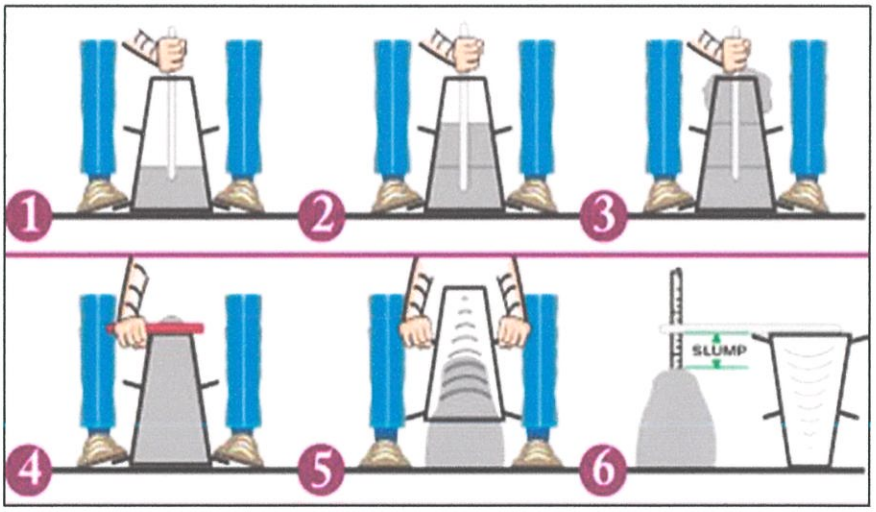


Figure 3.9: Procedure Slump Test

Sources : (L&M Construction Chemicals, Inc., 2008)

b) Cube Test

Concrete cube testing is a primary compliance check on gthe specified design characteristic compressive strength of concrete mix supplied to the site. Concrete cube is prepared by placing 3 layer of the concrete into mould. Cube mould must be oiled before placing the concrete. Each layer is compacted using rod for 35 times. Then, it is cured in a tank of water for 3

days, 7 days and 28 days. On the 3rd, 7th and 28th day, cube will be taken out for compressive strength test.

Photo 3.20: Mould of cube

Photo 3.21: Compacting process

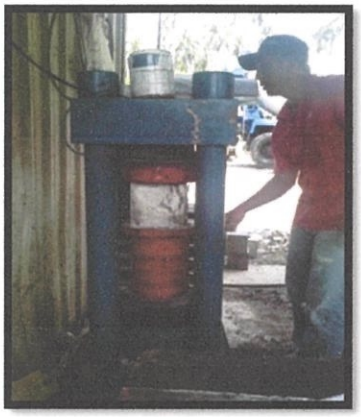


Photo 3.22: Compression Test

Photo 3.23: Weighing

Photo 3.24: Destructive cube concrete

3.2.5 Launching of T-Beam

i. Site preparation works

Area will be cleared for preparation of access road for transportation of the girder. Machineries involved in the land clearing and access road preparation are mainly Excavator and Dumper trucks. Steel plate will be also be used if the site condition required the use of it such as soft ground condition where crusher run base is not sufficient.

Meanwhile, site clearing and disposable of material from site shall be conducted by using Dumper Trucks. Excavator shall be used to load and unload all disposable materials.

An access road for the prime mover to load up the precast girder will be fully compacted. Each launching span also will be provided with a specific area for the double crane (160 ton each) to park and lift up the precast girder.

ii. Traffic Diversion

Most of the precast T-beam will be launch within the specific boundary of construction area which will have minimum implication on the public road and the local traffic management system. However, there would still be precaution measure to manage the traffic flows along the main road during the launching works.

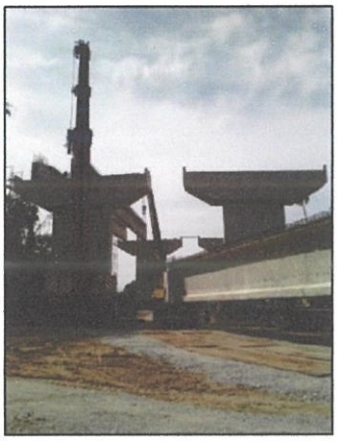
All traffic on both side of the launching area will be closed for one lane. This will be done by the mean of placing specific signage and barricade on the specific boundary during launching sequences. Two workers to redirect the traffic flows will also be place on the both end of the area to ensure flowing traffic.

iii. Launching of T-beam

T-Beam will be load up using 2 cranes (160 ton each) on both end of the T-Beam at casting yard onto a prime mover. The prime mover will then transport the beam to the specific span area. The 2 cranes (160 ton each) will then be relocated to the launching span. Steel plate will be provided

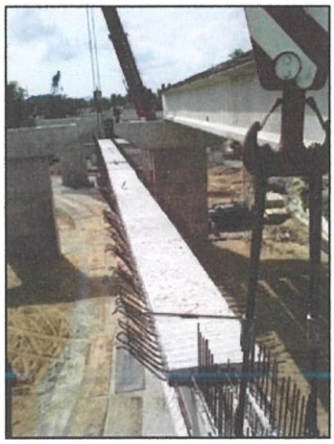
for the crane parking area to ensure stability and safety of the whole launching work. Coordination between the crane will be done by the mean of a team of qualify workers to fully control the whole launching sequences.

(a) Lifted T-beam by two crawler crane



(b) Lifted T-beam by two crawler crane

(c) Lifted T-beam by two crawler crane



(d) Lifted T-beam by two crawler crane

(e) Lifted T-beam by two crawler crane

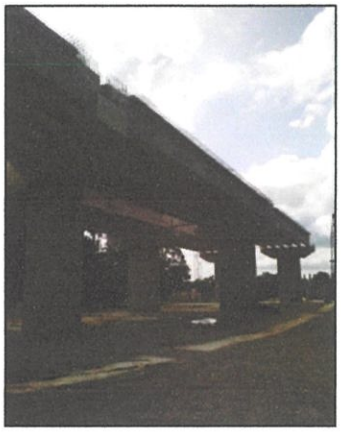
(f) Lifted T-beam by two crawler crane

(g) Delivery T-beam by two prime mover

(h) Lifted T-beam on crosshead

(i) Lifted T-beam by two crawler crane

(j) Lifted T-beam by two crawler crane



(k) Done for launching work

Photo 3.25: Launching for T-Beam

3.2.6 Safety Plan on Site

The following safety measures are essential and shall be followed by all staff and workers:

a. Ensure that safety levels at worksites are satisfactory.
b. Ensure that all construction personnel are given adequate briefing and information on safety at construction site.

Photo 3.26: Toolbox Briefing

c. Create a safer, healthier and more organized working environment

Photo 3.27: Clear site entry

d. Provide personnel with full range of protective and safety equipment (PPE) such as safety helmet.

Photo 3.28: Labours are wearing personal protection equipment

e. Provide adequate safety tools and erect safety signs at points that may pose risk of accidents.
f. Regular housekeeping is necessary to maintain site cleanliness.
g. Adequate and proper lightings to be provided for night works.
h. The supervisor/foreman shall guide the machinery operator especially during lifting work.

Photo 3.29: Supervisor guide the machinery during lifting concrete bucket

i. Supervisor and crane operator shall ensure that ground condition is safe for crane prior to conduct lifting work. If required steel plate shall be used as crane platform. (Roughton, 2003)

CHAPTER 4.0

CONCLUSION

4.1 Conclusion

Lots of experience and knowledge have been gain by students during five month of industrial training. Students are exposed directly to the real working environment in construction industry. Bridge construction is one of the types of construction in construction industry. Its need to be designed greatly to ensure the structures are stable and can be safe to use for a long time. There are many aspects need to be taken during the construction of bridge, so that the sequence of the construction will be work smoothly without worst problem. There are many of bridge design either long span of bridge, prevalent short or moderate span of bridge can be designed and construct unless it is still functional well. Bridges structure can be classified on the basis of four forces; shear, compression, tension and moment. Many factor influence the selection of substructure likes foundation material, types, configurations, positions and orientation, if any possible problems outcome, there must be a quickly solution to overcome it. All the material used should be more durable to provide support of bridge and transfer loads or energy between the bridges structure to the ground.

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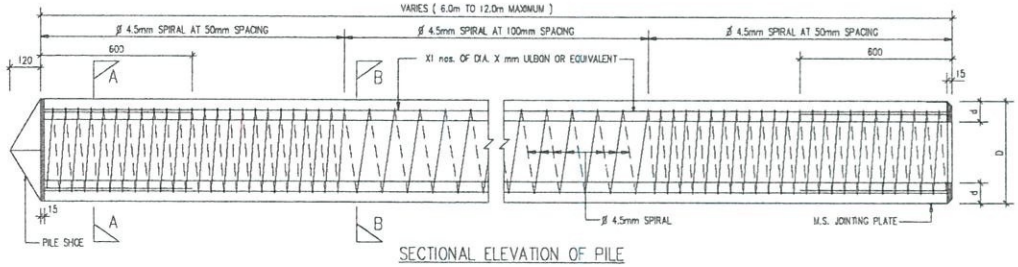
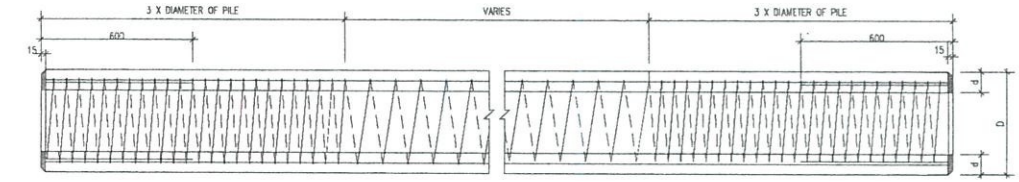
APPENDICES



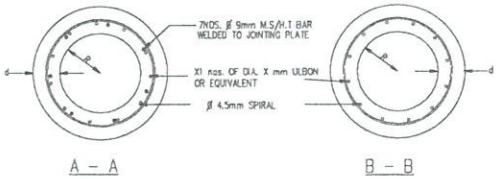
SECTIONAL ELEVATION OF PILE

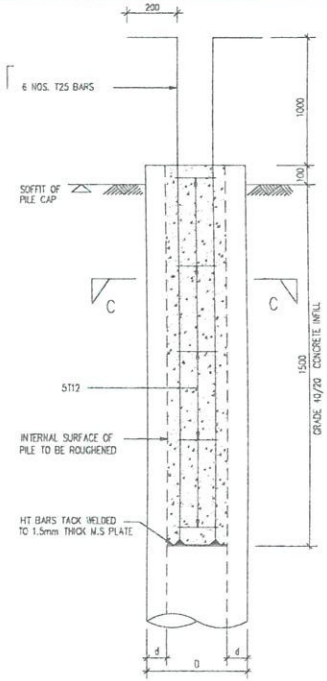


SECTIONAL ELEVATION OF EXTENSION PILE

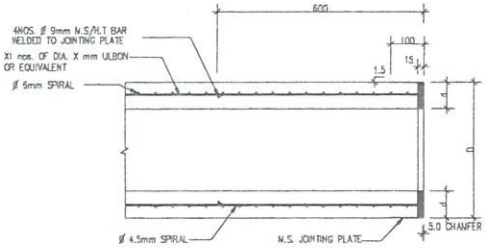
TABLE 1

DIAMETER OF PILE (mm)	D (mm)	d (mm)	R (mm)	PRESTRESSING BAR DIA. X (mm)	X1 (nos)	STRUCTURAL CAPACITY (kN)	CLASS OF PILE	EFFECTIVE PRESTRESS (N/mm)
600	600	100	400	9.0	14	2930	B	5.2
600	600	100	400	10.7	14	2860	C	7.0

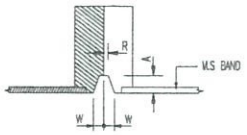




SECTIONAL ELEVATION



DETAIL OF JOINTING PLATE

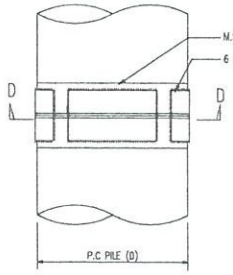


DETAIL 'X'

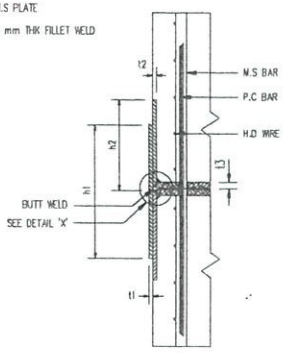
TABLE 3

WELDING JOINT DETAIL

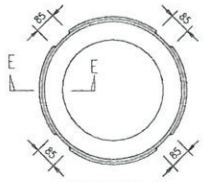
OUTER DIAMETER OF PILE D(mm)	THROAT THICKNESS A(mm)	W (mm)	ROOT R (mm)
600	12	5.0	1.5



EXTENSION JOINT



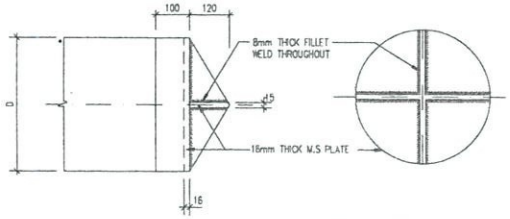
SECTION E–E



SECTION D–D

	M.S COLLAR		M.S BAND		M.S PLATE
DIA.	t1	h1	t2	h2	t3
600	8	220	8	175	19

NOTES:
M.S COLLAR SHALL BE INSTALLED TO PILE JOINT LOCATED AT DEPTH OF LESS THAN 4.0m BELOW GROUND LEVEL.



DETAILS OF POINTED PILE SHOE

TABLE 2

MAINLINE M1 & M2

STRUCTURE	NUMBER OF PILE		ESTIMATED* LENGTH OF PILE (m)	DESIGN LOAD (kN)	CLASS OF PILE
	VERTICAL	RAKED			
PIER 12 (M1+M2)	18	–	42	1500	B
PIER 13 (M1+M2)	18	–	42	1500	B
PIER 14 (M1+M2)	18	–	42	1500	B
PIER 15 (M1+M2)	18	–	42	1500	B
PIER 16 (M1+M2)	18	–	42	1500	B
PIER 17 (M1+M2)	19	–	42	1500	C
PIER 18 (M1+M2)	19	–	42	1500	C
PIER 19 (M1+M2)	19	–	42	1500	C
PIER 20 (M1+M2)	19	–	42	1500	C
PIER 21 (M1+M2)	25	–	42	1500	C
PIER 22 (M1+M2)	25	–	42	1500	C
PIER 23 (M1+M2)	22	–	42	1500	C
PIER 24 (M1+M2)	22	–	42	1500	C
PIER 25 (M1+M2)	22	–	42	1500	B
ABUTMENT B	27	–	42	1500	B

* ACTUAL PILE LENGTH MAY VARIES SUBJECT TO SITE CONDITION

DETAILS OF PILE HEAD

NOTES:

1. THE PRODUCTION OF SPUN PILE SHALL BE IN ACCORDANCE WITH MS 1314.
2. PRESTRESSING BAR SHALL BE 'ULBON' OR EQUIVALENT.
3. MINIMUM EFFECTIVE PRESTRESS =
   CLASS B = 5.2N/mm²
   CLASS C = 7.0N/mm²
4. SPIRAL SHALL BE HARD DRAWN TO BS 4482.
5. OTHER REINFORCEMENTS TO BE M.S OR H.T. BARS TO MS 146
6. MINIMUM CUBE STRENGTH:
   (a) AT TRANSFER 30 N/mm²
   (b) AT 28 DAYS 78.5 N/mm²
7. ALL WELDING SHALL BE IN ACCORDANCE WITH BS 5135.
8. ALL DIMENSION ARE IN mm UNLESS OTHERWISE STATED.
9. PILE LENGTH SPECIFIED IN TABLE 2 IS FOR TENDERING PURPOSES ONLY. ACTUAL LENGTH SHALL BE DETERMINED BY S.O AFTER LOAD TEST.
10. TEST LOAD ON PILE SHALL BE TWICE THE DESIGN LOAD SPECIFIED IN TABLE 2.
11. PILES ARE DESIGNED AS FRICTIONAL AND END BEARING PILES.
12. ELECTRODES USED SHALL COMPLY WITH B.S. 639 OR EQUIVALENT.
13. FOR FIRST RUN OF WELDING DIAMETER 2.6mm ELECTRODE IS RECOMMENDED.

I HEREBY CONFIRM THAT THE DESIGNS SHOWN IN THIS CALCULATION/ DRAWINGS/SPECIFICATIONS WAS DESIGNED BY ME OR UNDER MY DIRECTION AND SUPERVISION AND TO THE BEST OF MY KNOWLEDGE COMPLY WITH THE RELEVANT STANDARD AND CODES OF PRACTICE, AND LOCAL AUTHORITIES BY LAW AND REGULATIONS.

TARIKH	PINDAAN	RUJUKAN	SKALA

WAN HUSIN & ASSOCIATES SDN. BHD.
CIVIL, STRUCTURE, MECHANICAL AND ELECTRICAL ENGINEERING CONSULTANT.
No. 2-8-1, JALAN 3/50, DIAMOND SQUARE, OFF JALAN GOMBAK, 53000 KUALA LUMPUR

DIREKABENTUK OLEH : Ir. ZAINUDIN JASMANI
DILUKIS OLEH : MASZURA | DISEMAK OLEH : JAMALUDDIN HARUN
DILULUSKAN OLEH : DATO' Ir. HJ. WAN HUSIN HJ. WAN EMBONG

PENGARAH KERJA RAYA NEGERI TERENGGANU
(HJ. SHAFII BIN MOHAMAD)

KETUA PENOLONG PENGARAH (JALAN)
(IBRAHIM BIN AWANG)

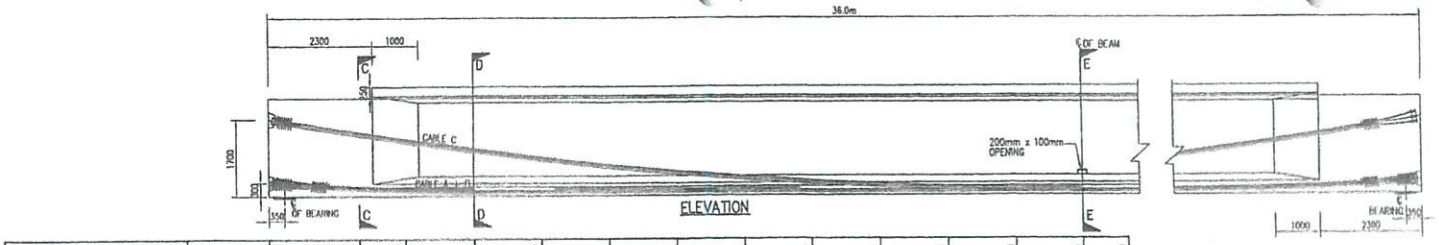
PENOLONG PENGARAH JALAN (PEMBANGUNAN)

JABATAN KERJA RAYA
NEGERI TERENGGANU

CADANGAN PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KE PULAU SEKATI, KUALA TERENGGANU

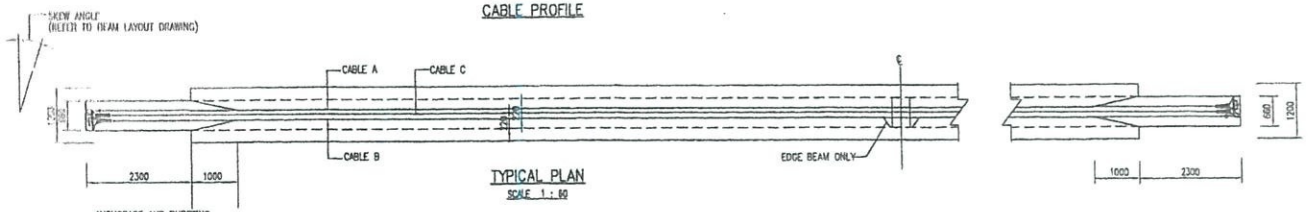
LOSONG APPROACH BRIDGE
Ø600mm SPUN CONCRETE PILES

TARIKH : DECEMBER 2012 | NO LUKISAN : JKR/T/KT/2012/1542/LO/ST05(R1) | 71

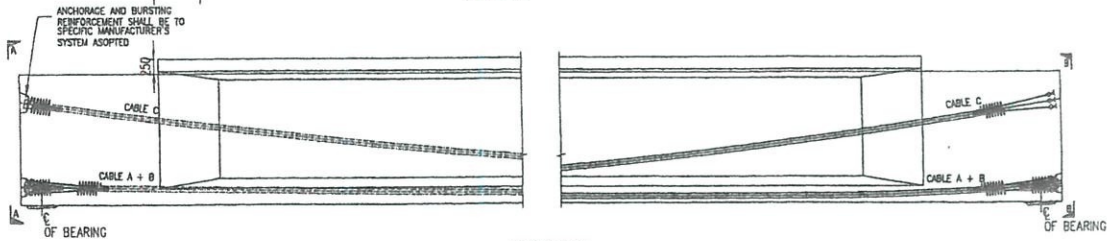


DISTANCE FROM ℄ OF BEAM (M)	CABLE MARK	18.00	16.50	15.00	13.50	12.00	10.5	9.00	7.50	6.00	4.50	3.00	1.50	1.00	0.00	
HEIGHT OF CENTERLINE OF CABLE FROM SOFFIT OF BEAM (MM)	CABLE C	1720	1354	1214	1021	814	648	505	384	285	209	154	121	113	110	CABLE C
	CABLE A & B	300	105	131	110	110	110	110	110	110	110	110	110	110	110	CABLE A & B

CABLE PROFILE



TYPICAL PLAN
SCALE 1 : 60



END BLOCKS
SCALE 1 : 40

NOTES:

CONCRETE

1. MINIMUM CONCRETE STRENGTH :
   AT STRESSING = 40N/mm2
   AT WORKING = 50N/mm2
2. CONCRETE COVER TO:
   a) PRESTRESSING TENDON TO BE NOT LESS THAN 50mm.
   b) STEEL REINFORCEMENT AT BOTTOM FLANGE TO BE 50mm.
   b) STEEL REINFORCEMENT AT WEB TO BE 35mm.
3. SHEATHING SHALL BE ACCURATELY POSITIONED AND TIED TO THE REINFORCING CAGE AT 1000 mm SPACING.
4. BEFORE GROUTING, THE DUCTS SHALL BE FLUSHED WITH WATER AND BLOWN OUT WITH COMPRESSED AIR. GROUT SHALL BE PUMPED INTO EACH DUCT UNTIL GROUT POURS OUT AT THE OUTLET HIGH PRESSURE CORK SHALL BE CLOSED AND PUMPING CONTINUED UNTIL A PRESSURE OF 0.69 N/mm2 IS ATTAINED

REINFORCEMENT

5. REFER TO GENERAL NOTES ON REINFORCEMENT.

PRESTRESSING STEEL

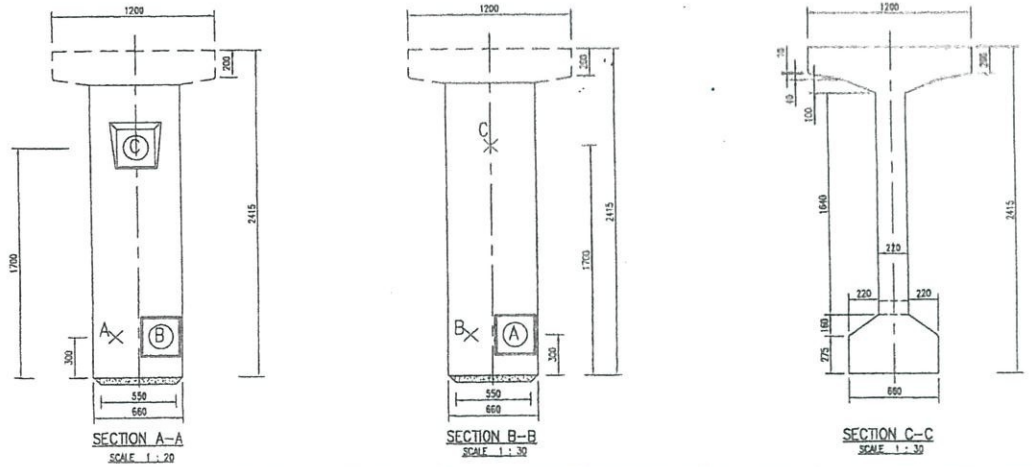
6. SEVEN WIRE STEEL STRAND SHALL CONFORM TO BS 5896.
7. PRESTRESSING STRAND TO BE OF 15.24mm NOMINAL DIAMETER AND THE TENSILE STRESS TO BE 1.86kN/mm2.
8. RELAXATION OF THE PRESTRESSING STEEL SHALL NOT BE GREATER THAN AFTER 1000hrs AT 20° FROM 70° INITIAL LOAD.

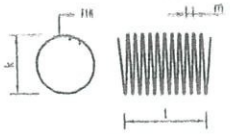
TENSIONING:

9. PRESTRESSING SHALL BE DONE IN ONE STAGE.
10. TENSION PARTICULARS FOR THE CABLES ARE AS SPECIFIED IN TABLE 1.
11. THE JACKING FORCE IN THE TABLE INCLUDES DRAW-IN LOSS BASED ON ANCHORAGE SLIP OF 6mm.
12. ALL STRANDS IN THE CABLE SHALL SHALL BE STRESSED SIMULTANEOUSL
13. AT LOCKING, THE STRESS IN THE TENDON SHALL NOT EXCEED 70% UTS
14. JACKING FORCE MAY BE INCREASED TO 80% UTS DURING STRESSING PI ADDITIONAL CONSIDERATION IS GIVEN TO SAFETY, STRESS-STRAIN CHARA OF TENDON AND TO ASSESMENT OF FRICTION LOSSES.
15. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

TABLE 1

CABLE MARK	DUCT DIAMETER (mm)	NO OF STRANDS (15.24mm ø)	ANGLE AT ANCHOR PLATE (degree)	1 STAGE STRESSING	
				JACKING FORCE (kN)	CALCULATED EXTENSION (mm)
A	80	12	1.8462	2349	241
B	80	12	1.8462	2349	241
C	80	12	40.4890	2349	232



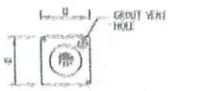


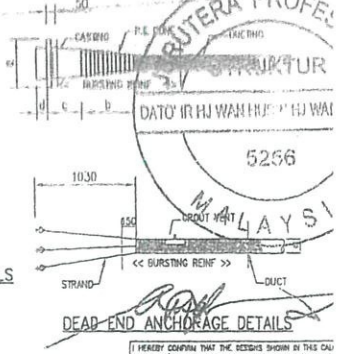
15.24mm DIA	k	l	m
12 Nos	315	465	50
7 Nos	265	395	50

BURSTING REINFORCEMENT DETAILS (SPIRAL LINKS)

15.24mm DIA	n	b	c	d	e
12 Nos	285	415	100	65	80
7 Nos	215	345	85	65	65

STRESSING END ANCHORAGE DETAILS





DEAD-END ANCHORAGE DETAILS

15 MAR 2013

DRAWING

JURUTERA PROFESIONAL
STRUKTUR
DATO' IR HJ WAN HUSIN HJ WAN
5256
MALAYSIA

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TARIKH	PINDAAN	RUJUKAN	SKALA

WAN HUSIN & ASSOCIATES SDN. BHD.
CIVIL, STRUCTURES, MECHANICAL AND ELECTRICAL ENGINEERING CONSULTANT.
No. 2-6-1, JALAN 3/50, DIAMOND SQUARE, OFF JALAN SOMBAK, 50000 KUALA LUMPUR

DIREKABENTUK OLEH : Ir. ZAHUDIN JASMAN
DILUKIS OLEH : MASZURA | DISEMAK OLEH : JAMALUDDIN HARUN
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PENGARAH KERJA RAYA NEGERI TERENGGANU (HJ. SHAFII BIN MOHAMAD)
KETUA PENOLONG PENGARAH (JALAN) (IBRAHIM BIN AWANG)
PENOLONG PENGARAH JALAN (PEMBANGUNAN)

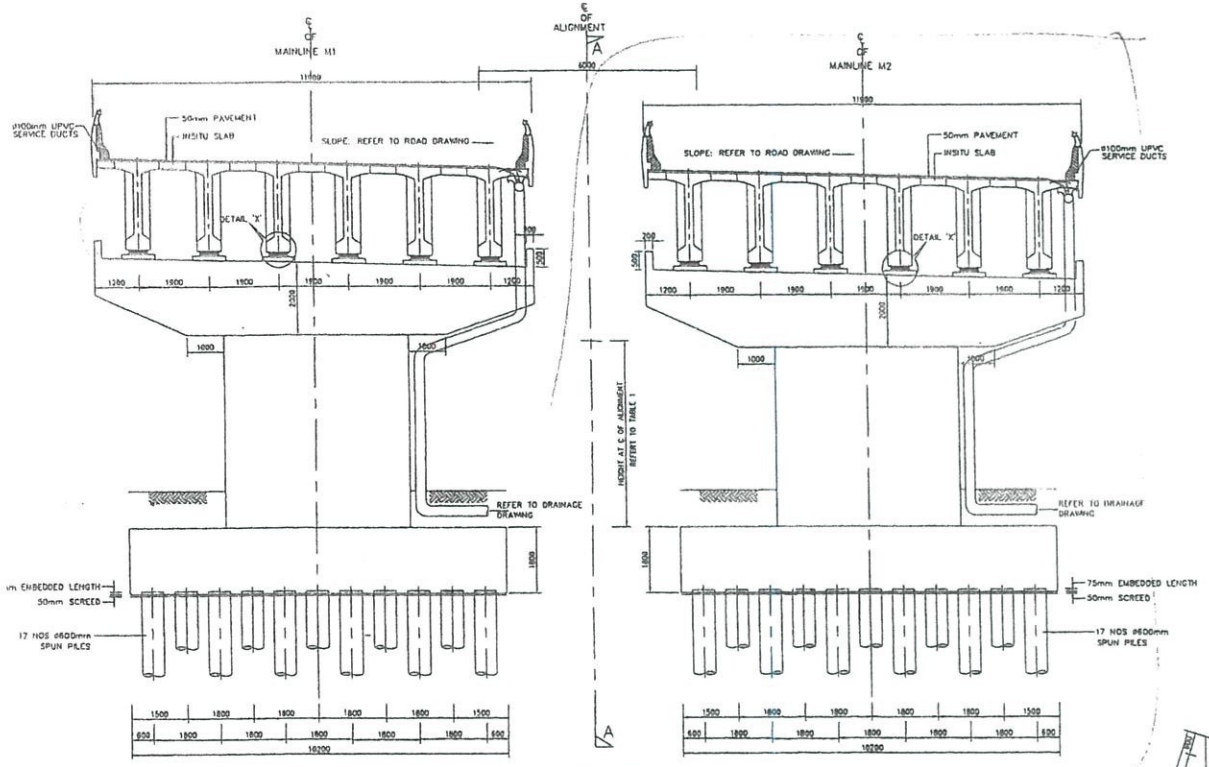
JABATAN KERJA RAYA NEGERI TERENGGANU

CADANGAN PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KE PULAU SEKATI, KUALA TERENGGAN

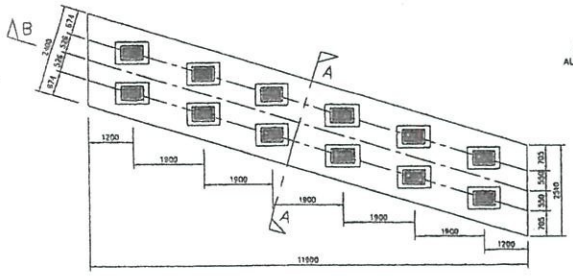
TELUK PASU APPROACH BRIDGE

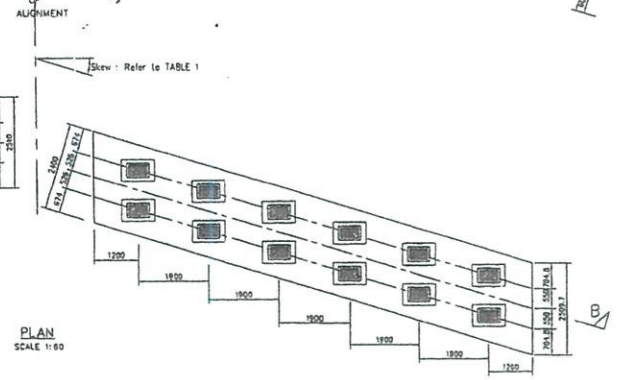
36m POST-TENSIONED TEE BEAM - CONCRETE & PRESTRESSIN

TARIKH : NOVEMBER 2012 | NO LUKISAN : JKR/T/KT/2012/1542/TP/ST09

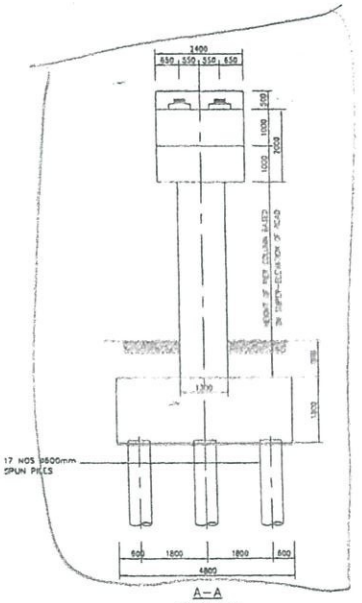


TYPICAL CROSS SECTION B–B
SCALE 1:50

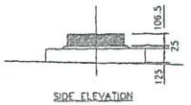




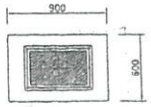
PLAN
SCALE 1:60



A–A
SCALE 1 : 50



SIDE ELEVATION



DETAIL 'X'
PLAN
PEDESTAL
SCALE 1 : 25

TABLE 1

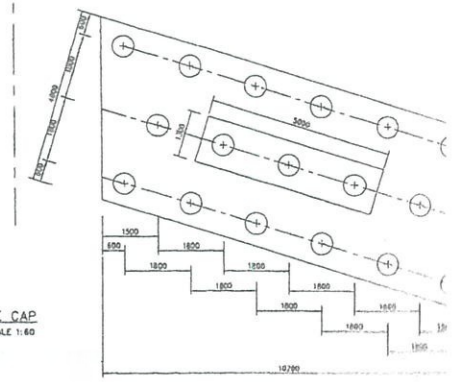
STRUCTURE	SKEW	HEIGHT AT ℄	CHAINAGE
PIER 4 ML1	10°	6.586m	CH: 365.960
PIER 4 ML2	10°	6.586m	CH: 365.960
PIER 5 ML1	7°	8.620m	CH: 402.400
PIER 5 ML2	7°	8.620m	CH: 402.400
PIER 6 ML1	5°	9.666m	CH: 438.840
PIER 6 ML2	5°	9.666m	CH: 438.840
PIER 7 ML1	2°	11.693m	CH: 475.280
PIER 7 ML2	2°	11.693m	CH: 475.280

15 MAR 2013

CONSTRUCTION DRAWING

NOTES:

1. CONCRETE SHALL BE OF GRADE 40/20.
2. COVER TO REINFORCEMENT SHALL BE 50mm
3. ALL DIMENSION ARE IN mm UNLESS OTHERWISE S



PILE CAP
SCALE 1:60

JURUTERA PROFESIONAL
STRUKTUR
DATO' IR HJ WAN HUSIN HJ WAN EMBONG
5256
MALAYSIA

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TARIKH	PINDAAN	RUJUKAN
/2012	1) SPAN 1,2 AND 3 OMITTED	

SKALA

WAN HUSIN & ASSOCIATES SDN. BHD.
CIVIL, STRUCTURE, MECHANICAL AND ELECTRICAL ENGINEERING CONSULTANT.
No. 2-6-1, JALAN 3/99, DIAMOND SQUARE,
OFF JALAN GOMBAK, 53000 KUALA LUMPUR

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PENGARAH KERJA RAYA NEGERI TERENGGANU
(HJ. SHAFI BIN MOHAMAD)

KETUA PENDLONG PENGARAH (JALAN)
(IBRAHIM BIN AWANG)

JKR
JABATAN KERJA RAYA
NEGERI TERENGGANU

CADANGAN PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KE PULAU SEKATI, KUALA TERENGGANU
TELUK PASU APPROACH BRIDGE

ZAINAL @ SHARIFF IBRAHIM SDN BHD

CULVERT VERIFICATION REPORT

PROJECT : PEMBANGUNAN PROJEK JAMBATAN ATAS SUNGAI TERENGGANU KE PULAU SEKATI.KUALA TERENGGANU.

CONSULTANT ENGINEER :	WAN HUSIN ASSOCIATES SDN BHD	DATE :	
CONTRACT NUMBER :	JKRNT (T) KT/10/2012	SECTION :	

CULVERT DETAILS

Location/No. : _____

	AS DESIGNED	AS PROPOSED ON SITE
Chainage	: _____	: _____
Culvert Size (m)	: _____	: _____
Type	: _____	: _____
Class	: _____	: _____
Length (m)	: _____	: _____
Skew	: _____	: _____
Fill Above Crown (m)	: _____	: _____
U/S I.L. (m)	: _____	: _____
D/S I.L. (m)	: _____	: _____
Bedding Type	: _____	: _____
Inlet Structure	: _____	: _____
Outlet Structure	: _____	: _____
Others	: _____	: _____

SITE DETAILS (Pre-construction stage as observed status)

Foundation Condition : _____

Results of Probing : _____

Flow Condition : _____

Upstream Site Details : _____

Downstream Site Details : _____

Remarks : _____

: _____

SKETCH (Section showing Lengths, Level, Height and the Ground Profile)

Certified By :

_____

(Construction Manager/Site Engineer)
CONTRACTOR

Approved By :

_____

(Assistant Resident Engineer/Inspector of works)
CONSULTANT

** Delete whichever is not applicable*

Contractor :	ZAINAL@SHARIFF IBRAHIM SDN BHD	PROJECT : PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KE PULAU SEKATI, KUALA TERENGGANU.	
Consulting Engineer :	WAN HUSIN & ASSOCIATES SDN BHD	CONTRACT NO: JKRNT (T) KT/10/2012	

PRECAST SPUN PILE DRIVING RECORD

ɔcation :.....

:ructure :..... Element :.....

Date Driven :.....

Pile Reference No. :.....

ass of Pile :.....

No. of Joints :.....

ength of Piles Used :.....

Pile Type / Size :.....

Platform level :.....

Cut off Level-R.L :.....

Pile Shoe Installed :.....

ammer Weight :..... Tonnes

Hammer Drop :.....mm

Total penetration in "M" :.....m

Final Set for Last 10 Blows :.....mm

Dolly Used (Yes/No) :.....

ɛnetration (m)	No. of Blows	Penetration (m)	No. of Blows	Penetration (m)	No. of Blows	Penetration (m)	No. of Blows	Penetration (m)	No. of Blows
0.5		11.5		22.5		33.5		44.5	
1		12		23		34		45	
1.5		12.5		23.5		34.5		45.5	
2		13		24		35		46	
2.5		13.5		24.5		35.5		46.5	
3		14		25		36		47	
3.5		14.5		25.5		36.5		47.5	
4		15		26		37		48	
4.5		15.5		26.5		37.5		48.5	
5		16		27		38		49	
5.5		16.5		27.5		38.5		49.5	
6		17		28		39		50	
6.5		17.5		28.5		39.5		50.5	
7		18		29		40		51	
7.5		18.5		29.5		40.5		51.5	
8		19		30		41		52	
8.5		19.5		30.5		41.5		52.5	
9		20		31		42		53	
9.5		20.5		31.5		42.5		53.5	
10		21		32		43		54	
10.5		21.5		32.5		43.5		54.5	
11		22		33		44		55	

JINTLY AGREED BY

For Site Manager:.....

Name:.....

( )

For ARE:.....

Name:.....

Recorded By:

Signature :.....

Name :.....

( )

Date :...../...../.....

ZAINAL@ SHARIFF IBRAHIM SDN BHD

P0570- CADANGAN PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KU PULAU SEKATI,KUALA TERENGGANU

TENDON PROFILE RECORD

Date of checking .....

Structure / Beam mark .....

Tendon No. .....

Dia. Of Strand .....

Total no of Strand .....

O.D. of Duct .....

DISTANCE (M) FROM CENTER TO END A	THEORETICAL CABLE A	CABLE B	CABLE C	CABLE D		SITE MEASUREMENT CABLE A	CABLE B	CABLE C	CABLE D	
0.00	110	110	110	280						
1.00	110	110	113	284						
2.00	112	112	121	294						
3.00	114	114	135	312						
4.00	118	118	154	337						
5.00	122	122	178	368						
6.00	127	127	208	407						
7.00	133	133	243	453						
8.00	140	140	284	506						
9.00	148	148	330	566						
10.00	157	157	383	634						
11.00	167	167	439	708						
12.00	178	178	502	790						
13.00	190	190	570	878						
14.00	203	203	643	974						
15.00	217	217	722	1077						
16.00	232	232	807	1187						
17.00	247	247	897	1305						
18.00	264	264	992	1429						
19.00	281	281	1093	1561						
20.00	300	300	1200	1700						
H/D	165	165	330	330						

DISTANCE (M) FROM CENTER TO END B	THEORETICAL CABLE A	CABLE B	CABLE C	CABLE D		SITE MEASUREMENT CABLE A	CABLE B	CABLE C	CABLE D	
0.00	110	110	110	280						
1.00	110	110	113	284						
2.00	112	112	121	294						
3.00	114	114	135	312						
4.00	118	118	154	337						
5.00	122	122	178	368						
6.00	127	127	208	407						
7.00	133	133	243	453						
8.00	140	140	284	506						
9.00	148	148	330	566						
10.00	157	157	383	634						
11.00	167	167	439	708						
12.00	178	178	502	790						
13.00	190	190	570	878						
14.00	203	203	643	974						
15.00	217	217	722	1077						
16.00	232	232	807	1187						
17.00	247	247	897	1305						
18.00	264	264	992	1429						
19.00	281	281	1093	1561						
20.00	300	300	1200	1700						
H/D	165	165	330	330						

Note :

1. Height Of Cable (A , B, C,D) Measured From Soffit Of Beam To Center Tendon.
2. The Tolerance In The Location Of The Center Tendon Shall Be +/- 10mm

Remarks : .....

.....

.....

Prepared & Record by :	Witnessed & Checked by : Main Contractor Representative	Checked & Approved by : Consultant Representative
Name :	Name :	Name : .....
Date :	Date :	Date : .....

Contractor : ZAINAL @ SHARIFF IBRAHIM SDN BHD	Project: PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KE PULAU SEKATI,KUALA TERENGGANU
Consulting Engineer: WAN HUSIN & ASSOCIATES SDN BHD	Contract no : JKRNT (T) KT/10/2012

Concrete Works Check List

Chainage: _____ RFI No: _____

Drawing No : _____ Date: _____

Element: Slab/ beam/ Column/ Wall/ liftcore/staircase/Sump Grade of Concrete

Item	Description	Acceptability				Remarks
		Contractor Rep		A.R.E/I.O.W		
		OK	Not OK	OK	Not OK	
Form work ✓						
1	Dimension (width & Depth)					
2	Setting out line (Control points)					
3	Transfer Level					
4	Concreting Level (Mark on Rebar)					
6	Cast in/ box up					
7	Rigidity of props					
8	Tightness of Joints					
9	Drop /Step Down					
10	Cleanliness					
11	Mould Oil					
Reinforcement ✓						
1	Rebar/BRC-size / Nos /type					
2	Rebar/BRC conditions					
3	Link-Size Nos /Type					
4	Anchorage					
5	Spacing					
6	Cover					
7	Laps					
8	Additional Rebars /Trimmer bas					
Water Proofing						
1	Application of waterproofing Materials					
M&E Services						
1	M&E Services Checked					
Others						

ARE/IOW Comment	
1.Non conformances	3. Re-Inspection
2 . Disposition	4. Comments

Contractor	ARE/IOW
Name : HASRUL SANI BIN ISMAIL Signature: Project Manager ZAINAL@SHARIF IBRAHIM SDN. BHD. (88576-P) Date:	Name : Signature: Date:

BBR CONSTRUCTION SYSTEMS (M) SDN BHD
NO.17 JALAN PJS 11/2, SUBANG INDAH, BANDAR SUNWAY
46150 SUBANG JAYA, SELANGOR

Stressing Report

Project : ____________________ Block : ____________________

Floor : ____________________ Date : ____________________

Type : ____________________ Page : __________ of __________

Beam / Slab Marking	Tendon Marking	% Diff	Average Extension % Diff	Remarks.

Remarks / Remedial Action (if any)

....

....

....

....

Recorded by :

....

BBR's Supervisor

Name :

Date :

Verified & Approved By :

....

BBR's Engineer

Name :

Date :

Contractor : ZAINAL @ SHARIFF IBRAHIM SDN BHD	Project: PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KE PULAU SEKATI,KUALA TERENGGANU.
Consulting Engineer: WAN HUSIN & ASSOCIATES SDN BHD	Contract no : JKRNT KT/10/2012

Roadbase Check List

Chainage: _____ RFI No: _____

Drawing No : _____ Date: _____

Item	Description	Acceptability				Remarks
		Contractor Rep		A.R.E/I.O.W		
		OK	Not OK	OK	Not OK	
1	Height control being set up 10m interval					
2	Survey level of underlaying layer taken					
3	Thickness of underlying layer acceptable (refer to profille checking details)					
4	Localised Depression /undulating profile being rectifed and made good					
5	Localised segregation of aggregate being rectifed(overlaid with quarry sand)					
6	Scarify loose silty / clayey material from top surface of subbase					
7	Acceptability of subbase moisture content (must not exceed OMC +1.5%)					
8	Road base layer thickness and compaction					

ARE/IOW Comment	
1.Non conformances	3. Re-Inspection
2 . Disposition	4. Comments

Contractor	ARE/IOW
Name :	Name :
Signature: ..... PATRICK TEOH	Signature:
Date: PROJECT MANAGER	Date:

Contractor : ZAINAL @ SHARIFF IBRAHIM SDN BHD	Project PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KE PULAU SEKATI,KUALA TERENGGANU.
Consulting Engineer WAN HUSIN & ASSOCIATES SDN BHD	Contract no : JKRNT (T) KT/10/2012

Subbase Check List

Chainage: _____ RFI No: _____

Drawing No : _____ Date: _____

Item	Description	Acceptability				Remarks
		Contractor Rep		A.R.E/I.O.W		
		OK	Not OK	OK	Not OK	
1	Height control being set up 10m interval					
2	Survey level of underlaying layer taken					
3	Thickness of underlying layer acceptable (refer to profille checking details)					
4	Localised Depression /undulating profile being rectifed and made good					
5	Loose /soft silty material at edges removed					
6	Cracking subgrade (water to be added)					
7	Soggy Subgrade (drying needed)					
8	Subbase layer thickness and compaction					

ARE/IOW Comment 1.Non conformances	3. Re-Inspection
2 . Disposition	4. Comments

Contractor Name : Signature: Date:	HASRUL SANI BIN ISMAIL Project Manager ZAINAL@SHARIF IBRAHIM SDN. BHD. (86876-P)	ARE/IOW Name : Signature: Date:

Contractor : ZAINAL @ SHARIFF IBRAHIM SDN BHD	Project PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KE PULAU SEKATI,KUALA TERENGGANU.
Consulting Engineer WAN HUSIN & ASSOCIATES SDN BHD	Contract no : JKRNT (T) KT/10/2012

Drainage works Check List (Reinforced Concrete pipe/subsoil)

Chainage: _____ RFI No: _____
Drawing No : _____ Date: _____
(if Required) Level: _____

Item	Description	Acceptability				Remarks
		Contractor Rep		A.R.E/I.O.W		
		OK	Not OK	OK	Not OK	
	BEFORE LAYING					
1	Ensure pipe use approved product (class)					
2	Setting out /Alignment check					
3	Check Excavation level					
4	Dimensional Check of pipe					
	DURING LAYING					
1	Check bedding thickness					
2	Proper pipe handling					
3	Proper pipe Laying /Cutting					
4	Proper Jointing					
	AFTER LAYING					
1	Proper back filling / Compaction					

ARE/IOW Comment 1.Non conformances	3. Re-Inspection
2 . Disposition	4. Comments

Contractor Name : Signature: Date:	ARE/IOW Name : Signature: Date:

BASRUL SANI BIN ISMAIL
Project Manager
ZAINAL @SHARIF IBRAHIM SDN BHD
95073-P

Contractor :	ZAINAL @ SHARIFF IBRAHIM SDN BHD	Project :	PEMBANGUNAN PROJEK JAMBATAN DI ATAS SUNGAI TERENGGANU KE PULAU SEKATI,KUALA TERENGGANUU.
Consulting Engineer :	WAN HUSIN & ASSOCIATES SDN BHD	Contract no : JKRNT (T) KT/10/2012	
PACKAGE NO.:		SECTION:	

DELIVERY OF READY MIXED CONCRETE

Report no.:

Structure :..... Element/ component:.....

Date & Time of concreting :..... Chainage:..... Ref:. Inspection No.:.....

Specified concrete Grade :..... Specified slump:..... ... Approval Chit No:.....

Mixer Truck No.	D.O no.	Volume Delivered (m^3)	Time of Delivery	Time of Placing	Measured Slump at site (mm)	Cube Identification no.	Remarks

Date of testing of Cube at 7 days : .....

at 28 days : .....

Remarks: .....

.....

Signature :.....	Signature :.....
Name :..... (Clerk of works)	Name :..... (Laboratory Technician)
Date :...../...../2013	Date :...../...../2013