UNIVERSITI TEKNOLOGI MARA

BUILDING DEPARTMENT

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

OCTOBER 2012

It is verified that this report is prepared

By

NURHAMIZAH BINTI MD ANUAR

2010844876

entitled

Construction of Cast In Situ Bored Pile

is accepted as to fulfill the requirement in 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 through practical training that I did for 5 months from 21st May 2012 until 6th October 2012 with Trans Resources Corporation Sdn. Bhd. It is also one of the requirements to passed this course, DBN307, and accepted to fulfil the requirement to obtain Diploma in Building.

.....

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Thank you.

ABSTRACT

This report briefly explained the work methodology of Construction of Cast In Situ Bored Pile. In this report, various important aspects involved to make it work as well as it is a fundamentally important element especially in infrastructure development. This report is completed during the practical training at the construction site of Kelana Jaya (KLJ) Railway Extension Project in Trans Resources Corporation Sdn Bhd for 5 months. This report has been divided into sections for ease of understanding to those who read it. This section starts from the introduction, company background, and the work methodology (practical). This study includes theoretical study of resource website, interviews with individuals who are experienced and study for 5 months. During the practical training are on site, the construction work for bored pile works is not as easy as in thought. This is because the work involves a lot of work to be done. For example, the construction work should be completed boring a hole, the borehole need to be clean and free from soil collapse. The study results found that, the management relies heavily on the outcome of the discussions between the parties involved in the project compared with reference to the clauses contained in the contract for the work - this bored pile work. In addition, there are also have more exposure gained on the process of infrastructure work undertaken in accordance with the field that related to Diploma in Building.

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LIST OF ABBREVIATIONS

Title		Pages
mm^2	milimeter square	4
N	Newton	4
PKK	Pusat Khidmat Kontraktor	8
CIDB	Construction Industry Development Board Malaysia	8
G	grade	8
TRC	Trans Resources Corporation Sdn. Bhd	8
KLJ	Kelana Jaya	20
LRT	Light Rail Transit	20
Ch	Chainage	20
P66	Pier 66	18
16T32	16 no's of rebar, T= High Tesile Steel, 32 = Diameter	34
16T16	16 no's of rebar, T= High Tesile Steel, 16 = Diameter	34
T12-150	Link diameter=12, Spacing=150mm	34
RQD	Rock Quality Density	39

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CHAPTER 1.0

PREFACE

1.1 Introduction

According to Merriam-Webster dictionary, foundation is determined as an underlying base or support. As the time flies by, the technology were enhanced and improved. Ideas are generated to overcome those problems regarding pile foundation on poor ground conditions. Cast in-situ bored pile are commonly used in Malaysia as foundation to support heavily loaded structures such as high-rise buildings and bridges in view of its low noise, low vibration, and flexibility of sizes to suit different loading conditions and subsoil conditions. Such attributes are especially favored in urban areas where strict restrictions with regards to noise and vibration are imposed by relevant authorities which restricted the use of other conventional piling system, e.g. driven piles.

Cast in situ bored pile work has to be done by specialist bored piling contractor, normal piling contractor can't be done without experience and knowledge about bored piles. Bored piling is one of the common and modern-day techniques for building a solid pile foundation for construction of various building types and structures. Bored piling is a process whereby steel circular casings are installed into the ground by the simultaneous process of drilling and soil removal. This is then followed by the concreting of the piles, which then forms a strong pile foundation for the structure. This process is usually required when soil replacement instead of soil displacement is required. In many of today's rapidly-developing cities, redevelopment and new construction works commonly require the use of bored piles.

This is usually the case when surrounding site conditions, especially adjacent structures require minimal vibration and noise. This method also offers flexibility in pile length, ground and soil conditions, without the disturbing the large excavations and subsequent backfill of soil. The main advantages of bored piles over conventional footings or other types of piles are piles of variable lengths can be extended through soft compressible or swelling soils, into suitable bearing material, piles can be extended to depths below frost penetration, and seasonal moisture variation, large excavations and subsequent backfill are eliminated, adjacent soil is not disturbed or remolded, absence of vibration will not disturb adjacent piles or structures, extremely high capacity caissons can be obtained by expanding the base of the shaft up to three times the shaft diameter, thus eliminating construction of caps over multiple pile groups, for many design situations bored piles offer higher capacities with potentially better economics than driven piles (Vincent, 2012).

Method for calculating the concrete volume is by using simple cylinder formula which is :

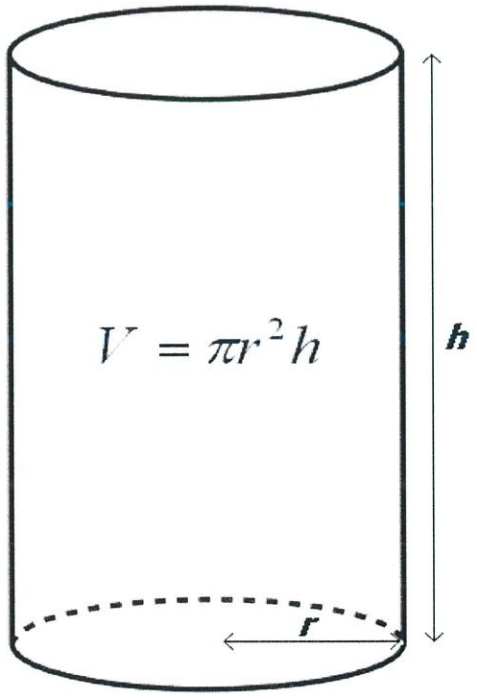

Photo 1.1 The Formula of Cylinder

Source : Autoworld (2008)

Photo 1.1 above showed that the formula of cylinder. So, the theoretical volume could be obtained and can be used when ordering the concrete from the batching plant.

There are lots of method revealed during the construction progress which happened only on the site. In conclusion, this report will provide the method for construction of cast in situ bored pile in details to the readers.

The piles will be constructed from a platform at existing ground level. The piling rig will be set up in position over the pile centre positions as marked. Safety fencing for edge protection shall be erected around each pile position to prevent falls into the hole until the concrete is poured (e.g. when the auger is removed for the magnetometer). When the rig is set up over the pile position, the auger is screwed into the ground a short distance to loosen the soil at the head of the pile. A length of temporary casing is lowered into the open bore and then rotated into the ground. Additional lengths of casing are added and the spoil inside removed until the casing reaches the bedrock to seal off any unstable ground. The rock socket is then bored out below the casing to the required depth, which may be under water. On completion of the bore, the base is cleaned mechanically. The pile reinforcement cage is lowered to the correct level and restrained. The concrete is placed by a central tremie pipe to the base of the bore and progressively raised in stages always maintaining a suitable head of concrete until the concrete has displaced all of the water in the bore. Pile concrete is left at ground level. The temporary outer casing is then withdrawn in sections and the concrete topped up as necessary (Kier Construction Limited, 2011).

Kelly bars can be of single or telescopic construction to reach the required depth. The geotechnical investigations carried out so far give expected depths in the region of 20 to 25m. Boring tools are available to cope with different strata. The range includes general purpose augers, rock augers, boring buckets and coring barrels amongst others. The piles are to be straight sided (i.e. not under-reamed) and 880mm diameter. In suitable strata it is possible to construct a dry bore; in water bearing strata it is often necessary to progress the bore under flooded conditions, i.e. water, bentonite or polymer. Then, the detailed pile design will determine the grade of concrete to be used. Concrete grades up

to 40N/mm^2 are common, and higher grades can be used where necessary. Where the pile bore is dry, a hopper with a short tube is used to direct the concrete down the centre of the reinforcement. Under flooded conditions a full-length tremie pipe is used. In both situations it may be practical to terminate the concrete at a low level so that the tested piles finish at a level below any road construction. It is not practical to remove piles after testing and they cannot be re-used as they are effectively tested to failure (Kier Construction Limited, 2011).

1.2 Objectives

Based on the title chosen, there are some objectives to be determined of :

i. To identify the equipment used in cast in-situ bored pile construction.
ii. To identify the construction method of cast in situ bored pile.

1.3 Scope

Based on the objectives, there are a few of scope to be explored, such as :

i. To identify the purpose for each of the equipment that have been used.
ii. To study the sequences of equipment used in construction of cast in situ bored pile.
iii. To study the sequences of work methodology for construction of cast in situ bored pile.

1.4 Methodology

There are a few of methods that are being using to find the info for this report, which are :

1.4.1 Reading material

Information is gathered from articles from internet, method statement and specification.

1.4.2 Discussion

Topic has been chosen by the student. Topic that has been discussed includes the topics about the chosen location, the technology and the sequences of work done.

1.4.3 Site visit

After getting some knowledge of the topic that is necessarily to study, the site engineer took the trainee to the chosen site area for showing the work.

1.4.4 Interview

Collecting data by interviewing the site engineer, the site supervisor, and the assistant of site engineer to give more explanation on construction of cast in situ bored pile.

1.4.5 Making a report

After all the information is gathered, the report is provided.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction

Trans Resources Corporation Sdn Bhd (TRC) is based in Ulu Klang, Malaysia. TRC subsidiary of TRC Synergy Bhd. TRC was incorporated in 1984 to fulfill the growing need for caliber Bumiputera contractors to serve the country's rapid economic expansion. With over more than 20 years of experience in the construction industry, TRC has now established itself as one of the most reputable contractors in the country, capable of undertaking major construction projects like roads, bridges, railway, airport facilities, hospital, prison, submarine base and other infrastructure works.

TRC is registered with Pusat Khidmat Kontraktor (PKK) under Class A and the Construction Industry Development Board Malaysia (CIDB) under grade G7, Category B, CE and ME. TRC was accorded the ISO 9001:2000 certification in 2002 for its construction services.

It is key achievements includes the successful completion of fast track design and build projects such as the National Hockey Stadium at Bukit Jalil, the Labuan Airport, Westport Rail Link projects, Decompression Chamber and Bentong Prison (TRC, 2012).

2.2 Company Profile

Table 2.1 Company Profile

Company Name :	TRC Synergy Berhad
Company Registration No. :	(413192-D)
Board of Director :	**Executive Chairman :** Dato' Sri Sufri bin Hj. Mohd Zin **Executive Director :** Dato' Abdul Aziz bin Mohamad **Senior Independent Non-Executive Director :** General (R) Tan Sri Mohd Shahrom Bin Dato' Hj Nordin **Independent Non-Executive Director :** Encik Noor Zilan bin Mohamed Noor **Independent Non-Executive Director :** Encik Rahman Bin Ali
Key Personnel	**Group General Manager :** En. Muhamad Shahaizi bin Abdul Hai **Chief Financial Officer :** Mr. Yeoh Sook Keng

Key Personnel	**Chief Operating Officer :** Dato' Richard Khoo Teng San **General Manager Contracts :** Mr. Loh Leh Wong **Auditor :** Aljeffridean Public Accountants (AF 1366) **Company Secretaries :** Abdul Aziz bin Mohamed (LS 007370) **Principal Bankers :** EON Bank Berhad Malayan Banking Berhad Affin Bank Berhad RHB Bank Berhad **Solicitors :** Messrs C.C Choo, Hazila & Teong. Messrs Noorzilan & Partners Stock Exchange Listing Main Market, Bursa Malaysia Securities Berhad (Construction Sector) Stock No: - 5054 - 5054LA - 5054WA - 5054WB

Key Personnel	**Share Registrar :** Mega Corporate Services Sdn Bhd Level 15-2, Sheraton Imperial Court, Jalan Sultan Ismail 50774 Kuala Lumpur Tel : Fax : 03-27325388 **Registered Office :** TRC Business Centre, Jalan Andaman Utama, 68000 Ampang Selangor Darul Ehsan Tel: Fax: 03-4108 7016 email: info@trc.com.my **Branch Office :** Lot 3626, Block 16, KCLD, Taman Timberland, Lorong Rock 2, 93200 Kuching, Sarawak Tel: Fax : 082-421 998

Source : Trans Resources Corporation for Kelana Jaya (KLJ) Railway Extension Project, 2011

2.3 Organization Chart

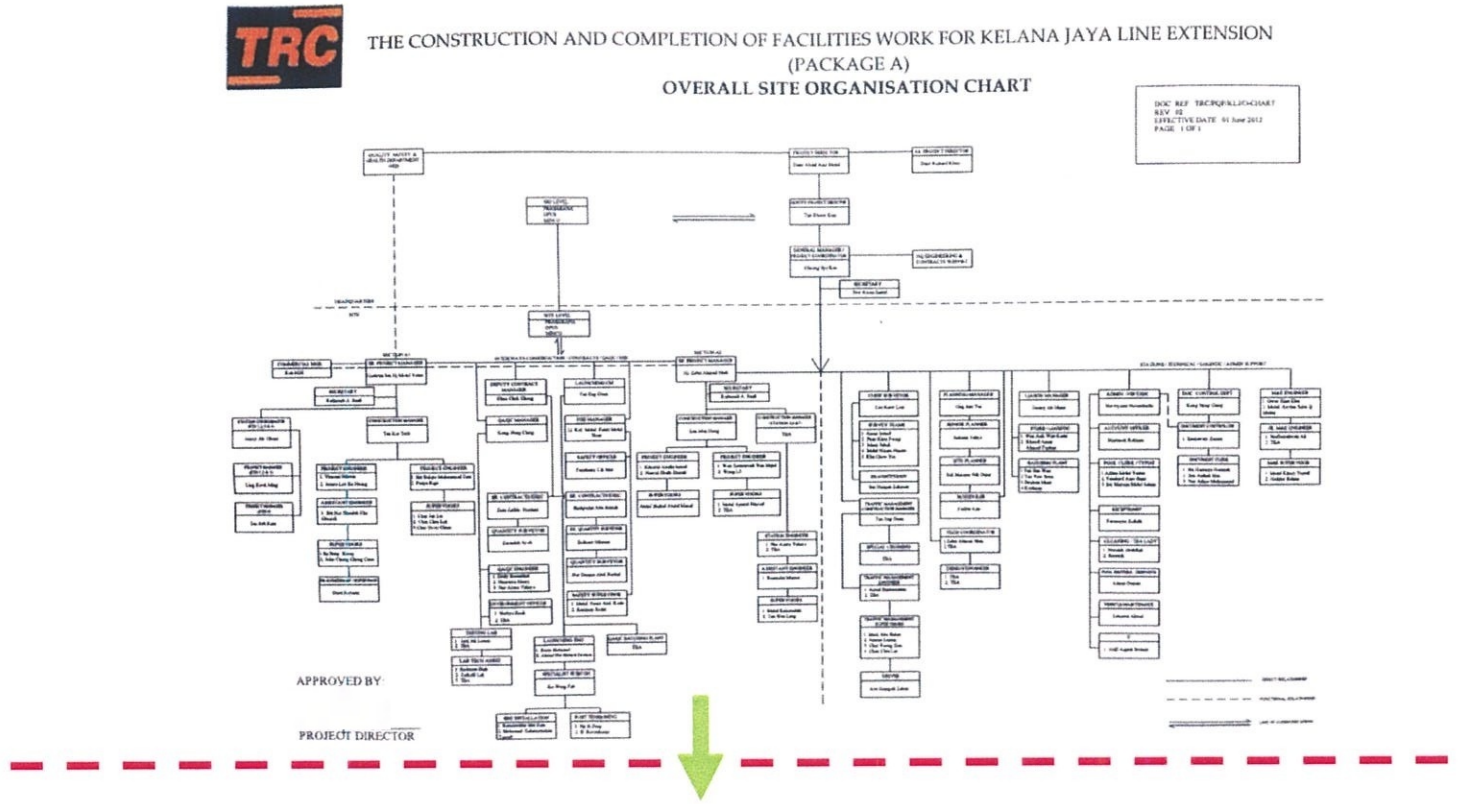

Figure 2.1 The Organization Chart of Trans Resources Corporation Sdn. Bhd. for Kelana Jaya (KLJ) Railway Extension Project (Appendix A)

Source : Trans Resources Corporation Sdn. Bhd. for Kelana Jaya (KLJ) Railway Extension Project,2011

2.4 List of Project

List of project of the company can be divided into two parts, which are, list of major current project and list of major completed project. Below are the lists

2.4.1 Major Completed Project

Table 2.2 Major Completed Project

No.	Project Name	Contract Sum	Year Awarded	Year Completed	Remarks
1.	Refurbishment work and Upgrading Parliament Malaysia: Multipurpose Hall to be made as the Senate and Representatives House for temporary.	RM24,000,000.00	March 2011	January 2012	
2.	Proposed Development of RTG G-Block and Associated Works at Container Terminal One (CT1).	RM 45,980,000.00	December 2008	May 2011	
3.	Design & Build Contract For The Construction Of The New Submarine Base At Sepangar Bay, Sabah.	RM 410,476,487.00	January 2004	July 2009	

No.	Project Name	Contract Sum	Year Awarded	Year Completed	Remarks
4.	Runway Extension of Kuala Terengganu Airport (Package 3).	RM 199,980,000.00	January 2004	October 2008	
5.	Construction Of The New District Police Complex In Dang Wangi, Kuala Lumpur.	RM 125,000,000.00	October 2006	March 2009	
6.	The Proposed Construction Of Pedestrian Bridge & Local Action Centre LK4 At Precinct 5, Putrajaya.	RM 19,998,900.00	September 2003	February 2005	

Source : Trans Resources Corporation Sdn. Bhd. for Kelana Jaya (KLJ) Railway Extension Project, 2011

2.4.2 Major Current Project

Table 2.3 Major Current Project

No.	Project Name	Contract Sum	Year Awarded	Year Completed	Remarks
1.	Package DPT1 : Construction and Completion of Sungai Buloh Maintenance Depot, Administration Building, External Works and Other Associated Works for Project Mass Rapid Transit Lembah Kelang : Jajaran Sungai Buloh - Kajang	RM 458,980,000.00	May 2012	January 2016	
2.	The Construction and Completion of the Main Contract and Associated Works for the Proposed Alteration and Addition Works to Existing Complex Dayabumi (Phase 2)	RM 36,000,000.00	March 2012	May 2014	

No.	Project Name	Contract Sum	Year Awarded	Year Completed	Remarks
3.	Proposed Development 14 Units 2 Storey Terrace House and 14 units 2 Storey Semi-Detached House and 72 Units 2 Storey Terrace House at Precint 14, Putrajaya	RM 38,080,069.88	November 2011	January 2013	
4.	Modernization of Brunei International Airport Terminal.	RM 318,903,000.00	October 2011	April 2013	
5.	Construction and Completion of Facilities Works (Package A) for the Kelana Jaya (KLJ) Line Extension Project.	RM 950,000,000.00	January 2011	July 2015	

Source : Trans Resources Corporation Sdn. Bhd. for Kelana Jaya (KLJ) Railway Extension Project, 2011

CHAPTER 3.0

CASE STUDY

3.1 Construction of Cast In Situ Bored Pile

Bored piles are so important to this project because it is the most important element of foundation that will be used to support the superstructure in this project. Bored pile is stated as to reinforced concrete pile which to support high structure with heavy vertical load. Another types of piles are also can be used for this project but the bored pile are the most suitable according to the capability to withstand the load, the construction cost, and less noise pollution (Rodriguez, 2012).

Photo 3.1 Station 3, Jalan Lapangan Terbang Subang (P66)

The construction cast in situ bored pile for this case study is located at Pier 66 along Jalan Lapangan Terbang Subang. Photo 1 shows the location of the site area. The pier is in Station 3 area which is to construct for the guide way pier. The bored pile was labeled as P66-3 because it is the third pile for Pier 66.

Process that will take parts in this construction included of the preparatory work, drilling the hole, to set depth of the bored pile, cleaning the hole, inserting the reinforcement bar, concreting work, and extracting casing. A very well supervision is needed for this pile as there is so much aspect to be considered and each pile conditions are different from the other piles.

3.2 Project Background

The Proposed Kelana Jaya (KLJ) Line extension alignment starts from the existing Lembah Subang LRT Depot and terminates at Putra Heights Integrated Terminal. The length of the alignment is approximately 16.6km on elevated guide way and 800m will be at grade. The construction for the LRT Extension Line will be carried out under two packages, namely Package A and Package B, the first package being Packaged A from Ch 0 – Ch 9.25km. the contract package (Package A) consist of the construction and completion of the facilities all along the project route from Ch 0 at Taman Emas, Petaling Jaya to Ch 9250 along Persiaran Kewajipan, Subang Jaya and the location map and the site layout map as in Appendix B. It is divided into two section as follows :

- Package A1 : Ch 0 – Ch 4570
- Package A2 : Ch 4570 – Ch 9250

The Scope of Facilities Works comprises the primary elements of guide way substructures, elevated guide way, stations, traction power sub-stations complete with appurtenant, architectural finishes, mechanical and electrical services, access roads, signage graphics, landscaping, etc.

The total cost for this project is amounted to RM 950,000,000.00 for 30 months starting on 20th July 2011 until 20th July 2013. If the project is delayed within the prescribed period, the late penalty was set at RM 228,000.00 per day. Thus, Trans Resources Corporation Sdn. Bhd. was doing construction in line with the expectations of the framework that have been agreed in the contract.

Necessarily, there must be a parties directly involved in the success of a construction project. The parties involved in this project are OPUS International (M) Berhad – Ace Vector Consortium as Project Consultant. In addition, the Design Consultant is Minconsult Sdn. Bhd. and Trans Resources Corporation Sdn. Bhd. as Main Contractor (TRC, 2011).

3.3 Definition of Bored Pile

According to bored pile is another type of reinforced concrete pile which is used to support high building which has heavy vertical load. Bored pile is a cast-in-place concrete pile where the bored piles have to be cast on construction site, while other concrete piles like Spun Pile and Reinforced Concrete Square Pile are precast concrete pile which they're cast in the factory (Lee, 2008).

3.4 Classification of Piles

Types of piles are divided into two groups which are displacement piles and non-displacement piles. As in Figure 1, there are following types of piles :

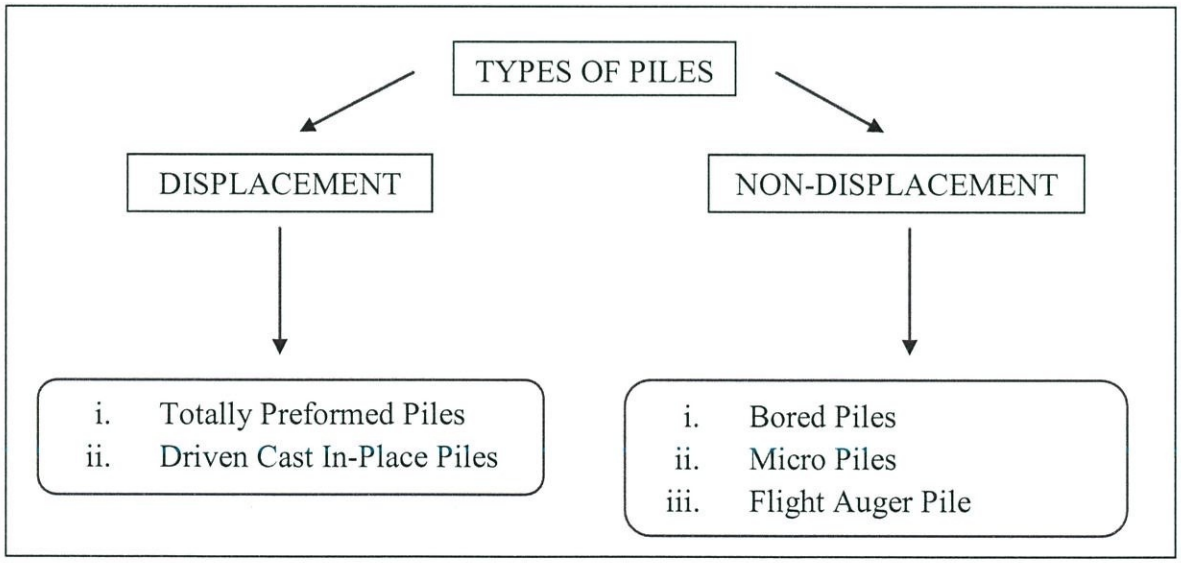

Figure 3.1 Classification of Pile

Source : Muhammad Kamal Ahmad, 2009

Piles can be classified into two types of piles which are displacement piles and non-displacement of piles. Displacement piles cause the soil to be displaced radials as well as vertically as the pile shaft is driven or jacked into the ground. With non-displacement piles, soil is removed and the resulting hole filled with concrete or a precast concrete pile is dropped into the hole and grouted in. Bored piles are non displacement piles as

shown in Figure 3.1, which are commonly used where large vertical loads or bending moments must be carried by a single unit.

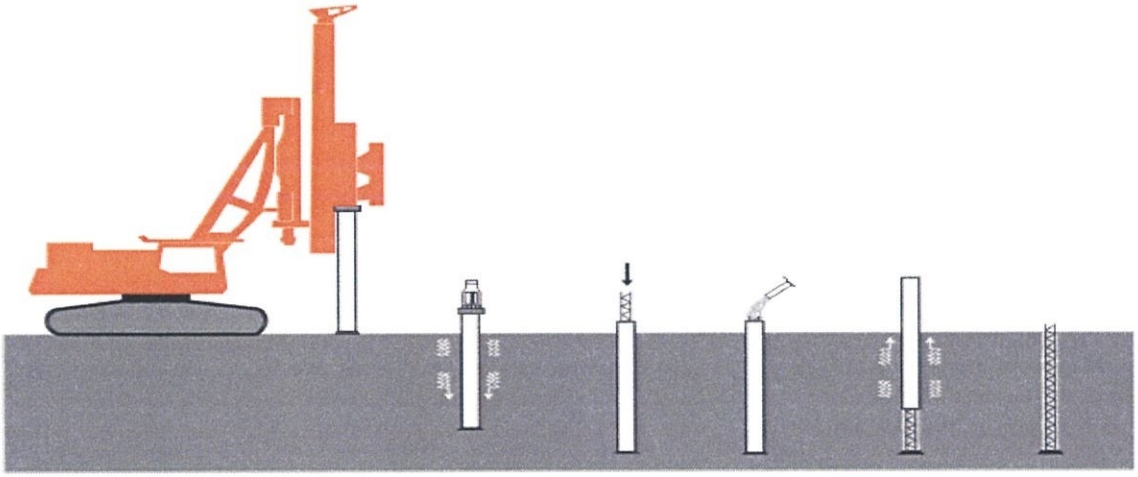

Photo 3.2 Non-Displacement Piles

Source : Projektana (2012)

Bored piles founded in rock provide an effective means of minimizing foundation settlements and a small number of high capacity bored piles can often provide significant savings in pile cap costs over other, lower capacity, pile types. Being non displacement type piles, bored piles can be installed with little or no vibration, and with much lower noise levels than driven piles. As shown in Photo 3.2. Large range of equipment available for the execution of bored piles ranging from limited equipment to modern all hydraulic machines capable of drilling holes in soil and rock. Soil and or rock is removed using purpose designed drill tools including soil and rock augers, drilling buckets, core barrels, and down hole hammer drills. Various methods of support for the sides of bored piles during construction are available. These can be selected to suit the type of formation being drilled, the ground water regime encountered, and site environmental control (Geoforum, 2009).

3.5 Equipments for Construction of Cast In Situ Bored Pile

Photo 3.3 Hydraulic Boring Rig Machine

The photo 3.3 above showed a hydraulic boring rig machine. It is functioned to drill the soil and produce borehole in the ground.

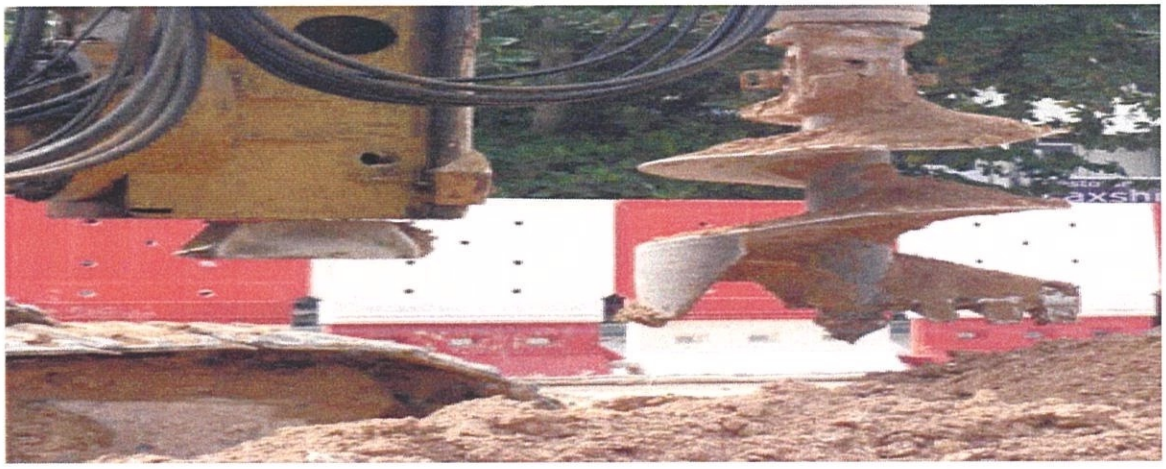

Photo 3.4 Drilling Auger

Photo Credit : Nurhamizah (17th July 2012)

Drilling auger is supposedly to drill the hole. It can penetrate the layer of soft soil. The picture of the drilling auger is shown as in Photo 3.4.

Photo 3.5 Drilling Bucket

Photo 3.5 above showed the picture of the drilling bucket. The drilling bucket is utilized in non-cohesive soil conditions such as sand, silt, or gravel and also when there is the presence of water or mud.

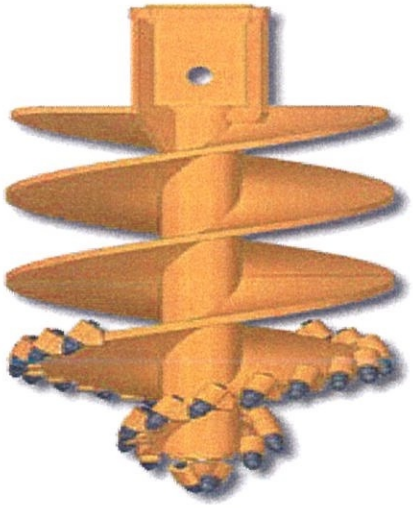

Photo 3.6 Rock Auger

Source : Geoequip (2012)

The rock auger is generally used in hard drilling conditions of rock and very compact material such as sandstone and the picture of the rock auger is showed in Photo 3.6.

Photo 3.7 Rock Bucket

The rock bucket is useful in hard drilling conditions of rock and very compact material such as fractured rock formation. Photo 3.7 above showed the picture of the rock bucket.

Photo 3.8 Core Barrel

Photo 3.8 above showed the core barrels which are mainly used when drilling into rock layers, boulders, and even cement.

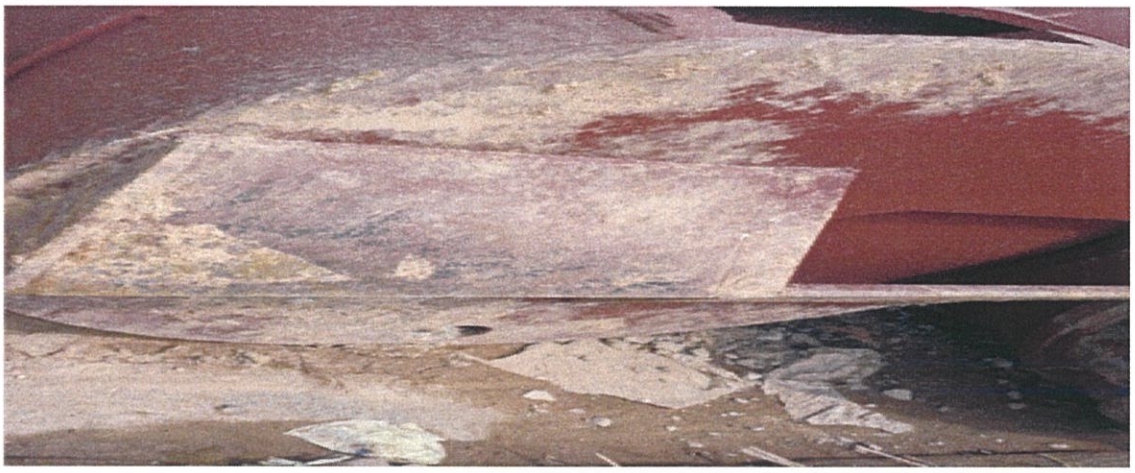

Photo 3.9 Cleaning Bucket

Cleaning buckets are used to clean the bottom of the drilled piles and are utilized in order to avoid leaving any extra soil at the bottom of the drilled hole. Photo 3.9 showed the picture of the cleaning bucket.

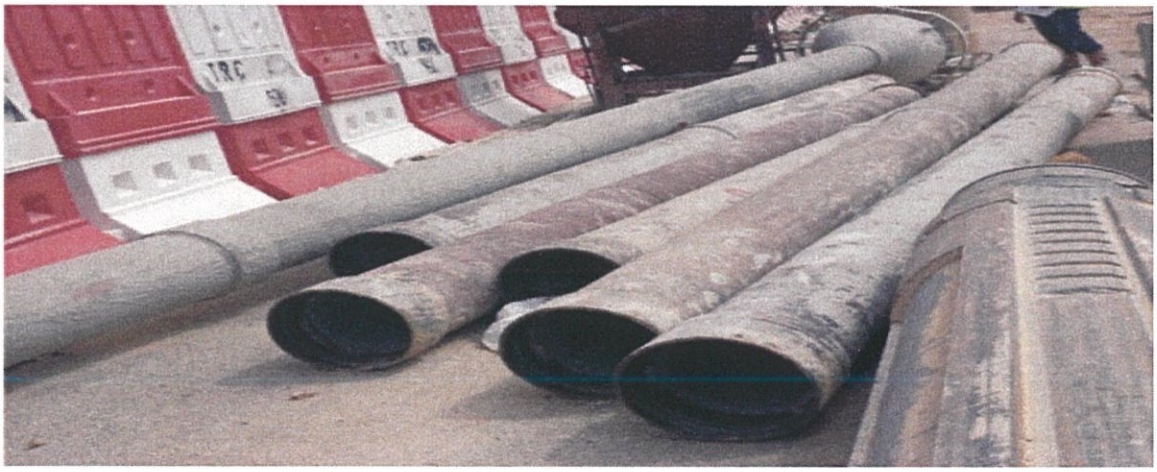

Photo 3.10 Tremie Pipe & Funnel

A tremie pipe is used to ensure that the concrete is placed correctly and that no separation of aggregate occurs during the drop from the top to the bottom of the pile. Usually a funnel would be attached on the top of tremie pipe. Photo 3.10 showed the picture of the tremie pipe and funnel.

Photo 3.11 Crawler Crane

Photo 3.11 showed a picture of a crawler crane. It is a type of machine, generally equipped with a hoist, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places.

Photo 3.12 Vibro Hammer

The function of vibro hammer is to drive the temporary casing into the soil or to extract from the soil. Photo 3.12 showed the picture of the vibro hammer.

Photo 3.13 Temporary Casing

Temporary casing is to hold the unstable soil from collapsed. Photo 3.13 above showed the picture of the temporary casing

Photo 3.14 Concrete Ready-Mix Truck

Photo 3.14 above showed the picture of the concrete ready-mix truck. It purposes is to utilized for the transportation of concrete from the plants to a job or to the construction site.

3.6 Work Methodology for Construction of Cast In Situ Bored Pile

3.6.1 Preparatory Work

This method consists of few steps to be carried out on site. All steps would definitely in precise and accurate method. The preparatory work will includes of survey for pegging to set out the pile point. Therefore, ensure the location clear from obstruction including any underground services and safe from erosion. Besides that, prepare a smooth traffic control during the working session.

3.6.2 Concrete Testing

Photo 3.15 Slump Test

Photo 3.16 Set of cubes for cube test

Photo 3.15 and Photo 3.16 showed picture for slump test and cube test. Close control of the mixing of the concrete shall be exercised and cube strength tests shall be carried out in accordance with BS1881. There are slump test and cube test will be carried out as in Appendix C, while the number of set of cubes taken for each pile casting shall follow the sampling rate. For each set of 3 cubes, 2 numbers of the cube

shall be tested for 28 days strength, while 1 numbers of the cube shall be tested for 7 days strength.

3.6.3 Pre-drilling Work

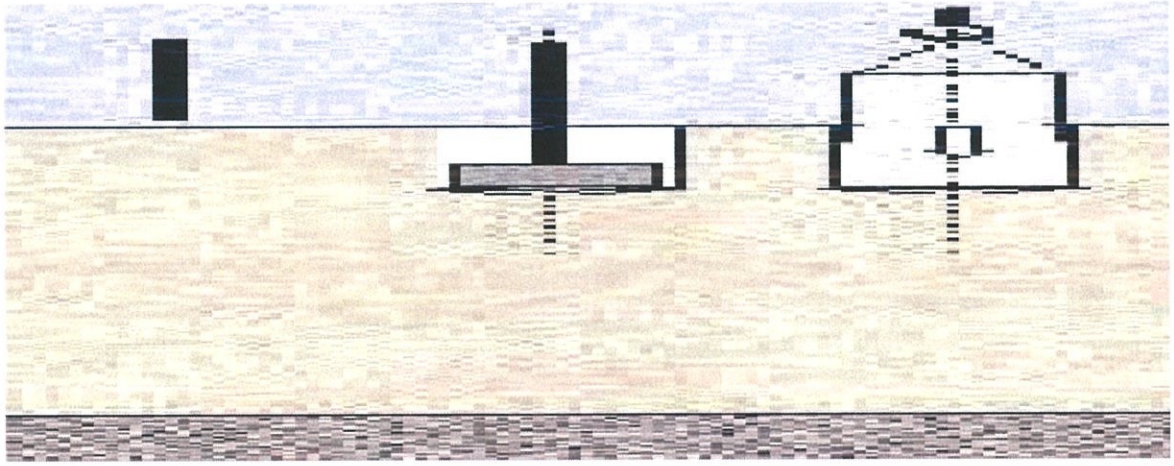

Photo 3.17 Pre-drilling Work Sequences

Source : Nippon Sharyo (n.d)

Firstly, the hydraulic boring rig machine must be placed to a right position that will able it to drive the kelly bar into the soil. The boring plant will be moved to the pile point intended for excavation. The kelly bar mounted with an auger is placed just above the pile point. The verticality of the kelly bar should be checked by means of the spirit level. Adjustment should be made so that the centre of the auger is nearest to the pile point. The auger is then lowered and boring operating commences. All steps have been carried out may be refer as shown above in Photo 3.17. Reasonable care should be taken so that the pile position and verticality are constructed within the specified tolerance.

A pre-drilling bore hole must be held as to install the temporary casing for hold the soil structure from being collapse and lengthen the drilling process and refer to Photo 3.17 above. The pre-drilling is held about 3m into the soil. Then, a vibro hammer will be used to penetrate the casing into the soil. During the process of boring a pile through strata liable to collapse, temporary casing of approved quality or an approved alternative method shall be used to maintain the stability of bore. The

contractor shall ensure that there is no collapse of the side of borehole from any uncased stratum at all stages of boring. Temporary casing are to be free from significant distortion and of uniform cross section throughout each continuous length. During concreting they shall be free from encrusted concrete or any internal projections that might prevent the proper formation of the pile.

3.6.4 Boring Work

Boring commence after the position of the boring plant is checked. Usually an auger of the required size is used to excavate the hole. During excavation, the hole is collapsible, a temporary, a temporary casing of the same size should be installed to prevent collapse. Excavation of the hole can then continue until the required depth.

Photo 3.18 The borehole is cleaned by the cleaning bucket by lift out the drilled material

If hard material is encountered during the excavation, other drilling tools may be utilized to break up the hard stratum, if necessary. After reaching the required depth, a cleaning bucket will be used to clean up the bottom of the borehole. Refer to Photo 3.18 above. A joint measurement of the depth should be made before lowering of reinforcement and concreting.

Piles shall not be bored close to the other piles which have recently been cast and which concrete of insufficient strength, in such manner that movement of concrete could be induced or damaged be caused to either pile. Upon completion of boring the excavation of boring the excavation shall be cleaned of all loosed disturbed and remolded soil to expose a base of undisturbed material. The final cleaning should be carried out using an approved tool, whether the borehole is dry or wet, and should only take place immediately in the strength of the soil. The time interval between commencements of boring and concreting shall be kept to a minimum.

Each borehole shall be requested by the Engineer prior to the placing of concrete in to ensure that there is no collapse from the uncased stratum. Then, the auger will be lower down to drill the soil to designed level. The auger will be lowered down and pull out the drilled material. This process will be repeated until it reached the hard layer called rock stratum which an auger cannot passed through it. The existing borehole depth before rock coring will be measure by using measuring tape. Make sure that the borehole is drill far apart from the other pile. Then, the auger will be replaced with the rock trimmer, for rock coring. It has varies of size and number of blade. The rock drilling or rock coring will be drilled about 5-6 meter. But for this method there is only hard layer available. The test have been done before commence the boring. After done with coring, the borehole need to be clean by using the cleaning bucket to moved out all of the mud and drilled material. For this moment, a lots of form have been fill up to ensure that a proof for work done.

3.6.5 Installing The Reinforcement Cage

Photo 3.19 Crawler crane lifting the reinforcement cage

After that, the reinforcement cage was inserted into the bore hole. The service crane will take over the place of boring rig machine to lift the reinforcement from the ground into the hole as shown in Photo 3.19 above. For this P66-3 borehole it reached about 38.8m depth, so each set is only about 6 meter and lapping process is required to extend the length and need to be welded. This process will be continued for every lapping. The type of reinforcement may be refer to Appendix D and Appendix E.

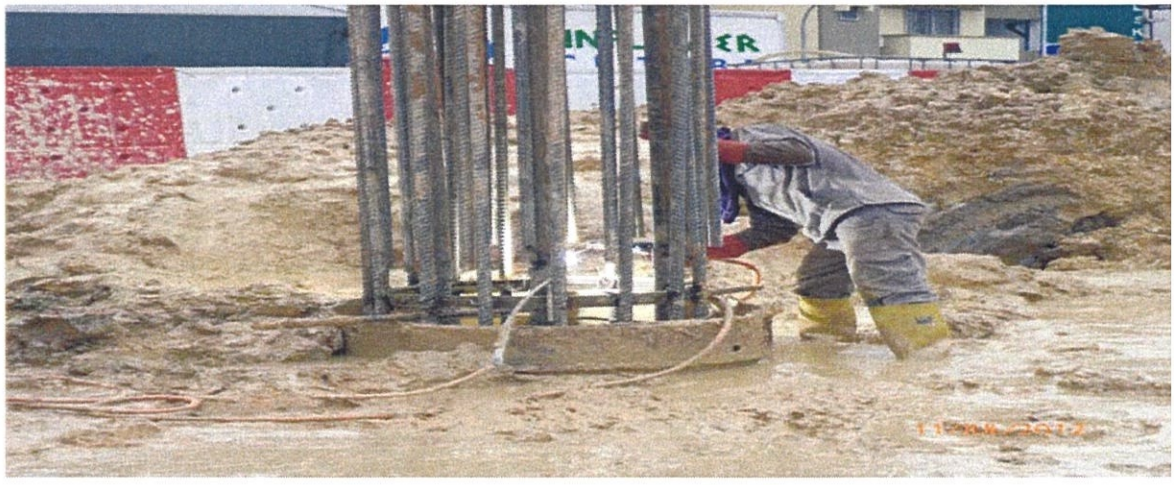

Photo 3.20 A worker was welding the reinforcement lap

Reinforcement to bored piles will be pre-fabricated in the reinforcement yard and transported to the borehole for placing. The helical links will be tack welded to the main reinforcement after fabrication by the bar benders. Laps are also to be welded sufficiently so that there are intact during transportation and may be refer as in Photo 3.20. 150mm diameter round spacer will be welded to the reinforcement to provide the cover to the reinforcement against the soil during concreting. The reinforcement will be lowered to the completed borehole, prior to concreting, by means of the service crane and to be adjusted to the correct level. The laps are designed as stated in the drawing which is 50xDiameter of the main bar. Therefore, this pile are been using reinforcement 16T32 and 16T16 with the helical links T12-150. The details for the reinforcement being used can be referring in Appendix E.

3.6.6 Concreting Work

Photo 3.21 The tremie pipe was been assembled by the workers

Once the reinforcement work is complete, the tremie pipe will be installed. The tremie pipe was been assembled by the workers as in Photo 3.21. For concreting, basically six ready mix concrete will be order for a bore hole, another ready mix concrete will be order if there still not enough. Before commenced concrete works, a sample will be took from each truck for slump test and cube test. The grade of concrete that has been used in this project are G40T2 which means Grade 40 by using tremie pipe because of the used of wet concrete. The concrete is poured until

there is no more mud and drilled material been seen as can be determined by no yellowish colour. The tremie pipe are about 37.3m because after been deducted to 1.5m which the tremie pipe shall not hit the bottom of borehole for ease the flow of the concrete. The tremie pipe may be in various lengths, but for this pile, 6 numbers of 6m and a 3m of tremie pipe with the funnel being attach to complete the work.

Photo 3.22 Concrete Ready-Mix Truck

Concrete conforming to the specification will be delivered to site by a ready-mix supplier. The delivery of the concrete must in interval of 5 minutes each of the truck as in Appendix. Photo 3.22 above showed the truck arrival are well planned. Piles shall be cast in ordinary Portland cement concrete batched either on site or delivery by a ready-mix supplier in accordance to BS1296 and BS4251 and with prior approval of the Engineer. The borehole contains water drilling mud the concrete shall be placed by the tremie method. BS8004 should be used as a guide on the concrete mix requirements as stated in Appendix G.

Photo 3.23 Slump Test was been carried out by the worker

The mix shall be designed to give minimum works cube strength as specified in the tender document at 28 days with a slump of 175mm-225mm. as shown in Photo 3.23, as the concrete ready-mix truck arrived at site, the sample will be tested. There were 12 cubes to be taken as sample for truck number two and six as stated in Appendix. The mix mass incorporate a plasticizer and retarder to minimize the water cement ratio and allow concrete to be placed up to 4 hours after mixing. The specification of the concrete may be referring as in Appendix C. The method of placing shall be such as to ensure that the concrete in its final positions shall be dense and homogeneous. The piles shall be concreted in one continuous operation immediately after the excavation has been completed and inspected where inspection is required by the Specifications. If the continuity of placing the concrete is interrupted, no further concrete shall be placed without the prior approval of the Engineer.

Both the dry hole mix and the tremie mix due to their high slumps are self-compacting and will produce a sound homogeneous mass without the use of vibrators. While there may be exceptional circumstances in which vibration of the pile head with the dry hole mix might be considered, the tremie mix shall under no circumstances be vibrated since this tends to introduce deleterious matters to the head of the piles. No vibrator shall be used to compact concrete inside a temporary

casing. As this concreting by tremie pipe, may have their specification as in Appendix G.

3.6.7 Extracting The Temporary Casing

Photo 3.24 Extraction of The Temporary Casing

All temporary casing are to be extracted immediately after completion of concreting as shown in Photo 3.24. A vibro-hammer will be used to extract the casing. As for this pile, about 19.1m length of temporary casing is been used. When the casing is being extracted a sufficient quantity of concrete shall be maintained within it to ensure that external water or soil pressure is exceeded and that the pile is not reduced in section not contaminated. No further concrete is to be placed in the boring once the bottom of the casing has been lifted above the concrete level. Temporary casings shall be extracted while the concrete within them remains sufficiently workable to ensure that the pile is not damaged in any way. Reasonable care should be taken to ensure that the concrete level is above the cut-off level after extraction of casing.

Photo 3.25 A worker was with the measuring tape to ensure the final actual level of concrete

Photo 3.26 The worker was measured the final level of actual concrete

Concrete shall be taken well above the theoretical cut-off level to ensure that all concrete at and below cut-off level is homogeneous and free of laitance and deleterious matter. In Photo 3.25 and Photo 3.26, the designed of cut-off level is at 21.317m while the actual is at 20.017m. So the actual level is between the acceptable measurement because the tolerance is between $\pm$ 2.7m. More details are as in Appendix C.

Besides that, a proper waterway, earth bund and water tank with pump must be provided and maintained at all time to prevent erosion and contamination to surrounding area during the installation and concreting of bored pile. All excess

water is contained within the working area and pump to the water tank provided. If required, additional water tank and transport shall be provided during raining

3.6.8 Records

All bore piling records are to be recorded in the Bore Log provided in Appendix C. A copy is enclosed for reference. The Contractor shall keep comprehensive records of each and every pile installed and shall furnish signed copies to the Engineer daily. The sign document shall be part of the construction records for the piling works. The piling records are to contain the following :

i. Identification No. or reference position of pile
ii. Reduced level of existing ground
iii. Diameter of pile shaft
iv. Top and bottom elevation of pile shaft and cut-off level
v. Depth of boring
vi. Depth of rock coring, RQD
vii. Details of all strata bored
viii. Depth of water table
ix. Details of in-situ tests such as SPT carried out at various levels and at bottom of boring
x. Details of temporary casing
xi. Details of drilling fluid used
xii. Volume of concrete used in forming the pile shaft
xiii. Length, diameter and other details of reinforcement cage before and after concrete is poured.
xiv. Date and time of starting, stopping, delays, if any and finishing of pile shaft
xv. Any usual occurrences that could affect the integrity of bored pile construction

CHAPTER 4.0

CONCLUSION AND SUGGESTION

This researched have exposed on job training in construction activities which is focused on construction of cast in situ bored pile. Information and experienced throughout from the industrial training is obtained which are on the types, the sequences of equipment used and the sequences of the work methodology. These elements are really important and being useful for beginner individuals or team and professional individuals and team.

Based on the case study, a lots of preparatory works, waterways, precaution steps, safety elements, and management plans should be properly done to ensure all area are within control and comply the environmental aspect as there are various of impact and aspect could happened in future. Skillful and experienced workers also need to be chose in providing better work flow and work phased. In future, a Malaysian should have an experienced worker to handle this work as it needed a very reasonable care from the Engineer and the Site Supervisor. They should play their role in this work as best as they could.

Therefore, in conclusion, the work must be done with a sense of responsibility to avoid any problems during the construction period. Good quality of materials and work performance must be used and practiced and been considered in producing the perfect quality of construction.

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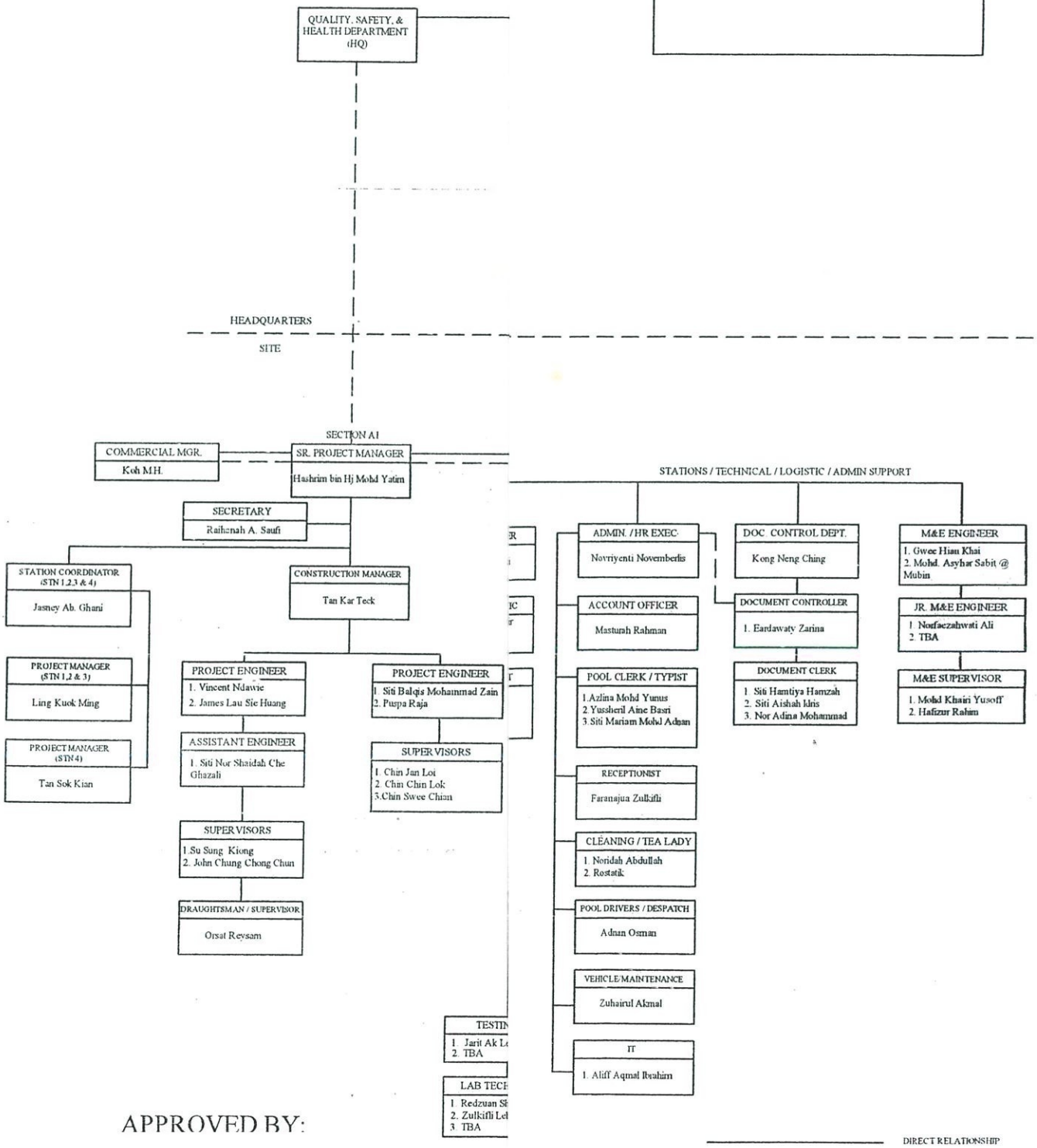
APPENDIX A

Organization Chart

THE CONSTJAYA LINE EXTENSION

DOC. REF : TRC/PQP/KLJ/O-CHART
REV : 02
EFFECTIVE DATE : 01 June 2012
PAGE : 1 OF 1



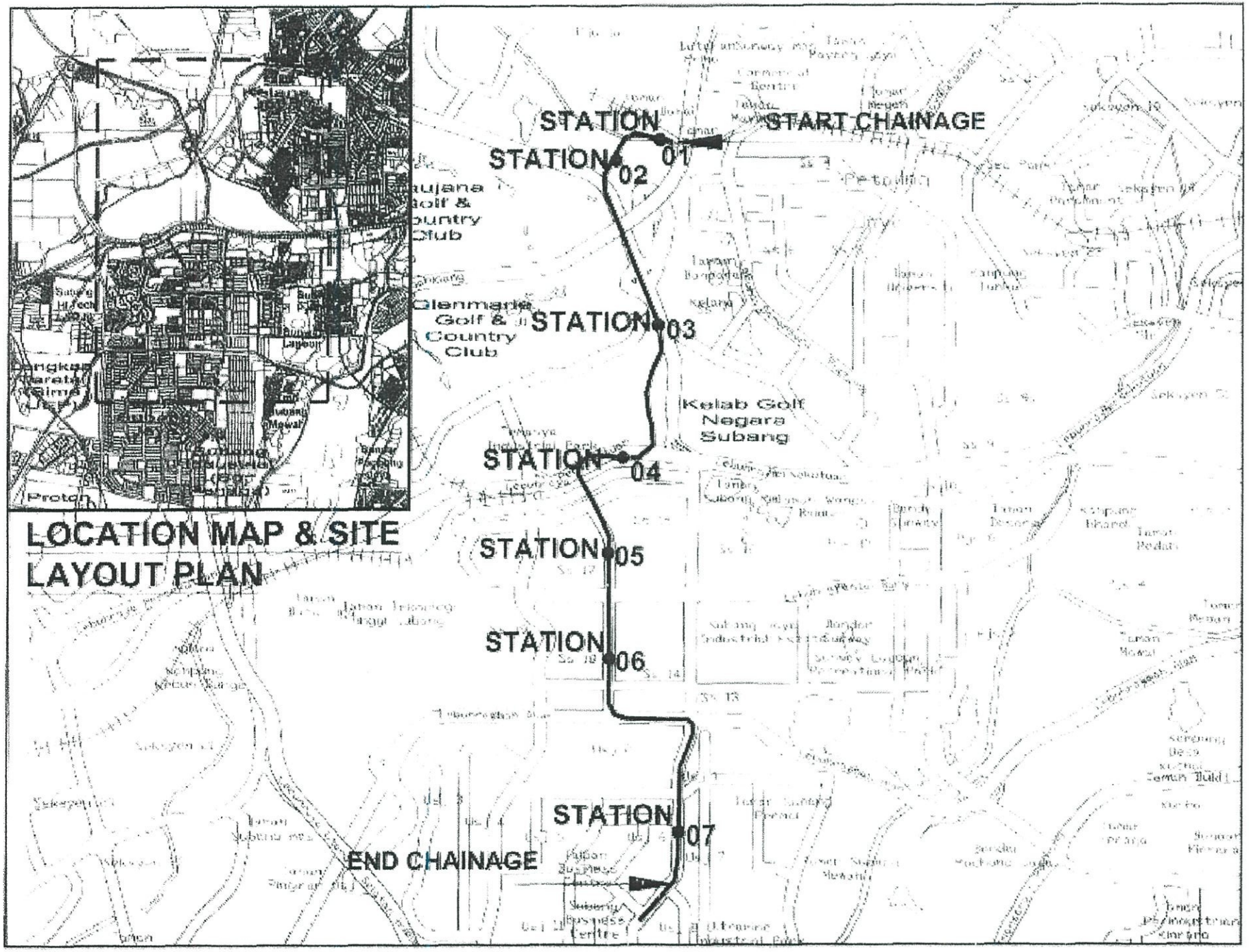
APPROVED BY:

PROJECT DIRECTOR

FOR INFORMATION ONLY

APPENDIX B

Location Map & Site Layout Plan


STATION 01
START CHAINAGE
STATION 02
STATION 03
STATION 04
STATION 05
STATION 06
STATION 07
END CHAINAGE
Kelab Golf Negara Subang
Glenmarie Golf & Country Club
LOCATION MAP & SITE LAYOUT PLAN

APPENDIX C

Bore Log

Main contractor :
Trans Resources Corporation Sdn. Bhd.

Consulting Engineer :
MINCONSULT SDN BHD

Project :
THE CONSTRUCTION AND COMPLETION OF FACILITIES WORKS (PACKAGE A) FOR THE KELANA JAYA (KLJ) LINE EXTENSION PROJECT

Contract No. : PRASARANA/LSD/CTT/2.0275/2010

KLJ

BORED PILE RECORD

RIN NO. : TRC/KLJ/RIN/C&S/ 7075

PILE DETAILS	
Pile Reference	P66-3
Location of Pile	2009.33
Diameter of Pile	1000mm
Working Load of Pile	5500 KN
BORING DATA	
Boring Time Start 16/07/12	09:40
Boring Time End 18/07/12	13:08
Depth of Bore Hole	38.8
Length of Temporary/Permanet Casing	19.1
Length of ~~Rock Socket~~ hard layer	15.1m
Date Commence Boring	16/07/12
REDUCED LEVELS	
Existing Working Platform Level	24.044
Cut Off Level of Pile	21.317
R.L. of Rock Stratum	
R.L. of Toe of Pile	-14.756
T.O.P.C.	24.666
R.L. of Top of Concrete	22.544
REINFORCEMENT DATA	
Main Reinforcement	16T32+16T32+16T16+16T16
Binders Diameter / Pitch	T12-150
Length of Reinforcement	12m+12m+12m+6.2m
MACHINERY DATA	
Name of Operator	Johari
Name & Type of Boring Unit	BG25
Water Level During Boring :	

BORING DATA	
Depth/Time	Description
16/07/12 09:40	
	· Medium stiff, yellowish reddish yellow silty sand.
10	
	· Stiff, yellowish dark grey sandy mixed.
20	
17/07/12	Hit Hard Layer at 23.7m.
09:00	Hard Layer. · Light grey mottled dark grey and light yellow mod weathered coarse grained Granite (Grade III).
30	
18/07/12 13:08	End of Bore at 38.8.
40	

REMARKS :
Instructed to drill to 36m (from EL)
Proceed with concreting by

Date Concreted	18/07/12
Concreting Time Start	13:39
Concreting Time End	18:05
Concrete Pay Length	36.073
Concrete Slump	200±25
Concrete Grade	GHOT2
Concrete Volume Ordered	38.0 m³
Discharge Method	Tremie
Concrete Cube No.	

Contractor	TRC	Consultant's Representative
KELANA JAYA SDN BHD (254817-H)	Name : Su Sung Kiang	Name : SHAHRUL AZRIN ADNAN
Signature :	Signature :	LRT3 EXTENSION PROJECT
Name: FAKHRI Date: 18/07/12	Date : 18/7/2012	Signature :
		Date : 18-7-2012

Ref. : TRC/PQP/KLJ/CSW025 Revision : 2 Effective Date : 21st November 20

FOR INFORMATION ONLY

Main contractor : Trans Resources Corporation Sdn. Bhd.	Project : THE CONSTRUCTION AND COMPLETION OF FACILITIES WORKS (PACKAGE A) FOR THE KELANA JAYA (KLJ) LINE EXTENSION PROJECT
Consulting Engineer : MINCONSULT SDN BHD	Contract No. : PRASARANA/LSD/CTT/2.0275/2010 — KLJ

Pre-Concreting Checklist (External Works)

Project	: KLJ	RIN No.	: TRC/KLJ/RIN/GS/70
Location	: P66-3	Date	: 18/7/2012
Drawing No	: W/KLJ/F/GWL/ST/4402-Rev 01	Block No	: -
Gridline/Zone	: -	Level	: -
Element	: Bored Pile	Grade of Concrete	: G40/12

Item	Description	Acceptability TRC Yes	TRC No	RE Yes	RE No	Remarks
Formwork						
1	Dimension (Width & Depth)					
2	Setting Out Line (Control Points)					
3	Transfer Level					
4	Concreting Level (Mark on Rebar)					
5	Cast in / Box up					
6	Ridigity of Props					
7	Tightness of Joints					
8	Drop / Step Down					
9	Cleanliness					
10	Mould Oil					
Reinforcement						
1	Rebar / ~~BRC - Size~~ / Nos / Type 16T32 + 16T32 + 16T16 + 16T16	✓				
2	Rebar / BRC conditions	✓				
3	Link - Size / Nos / Type T12-150	✓				
4	Anchorage	✓				
5	Spacing	✓				
6	Cover	✓				
7	Laps	✓				
8	Additional Rebars / Trimmer Bars	✓				
Water Proofing						
1	Application of Waterproofing Materials					
M & E and ESS Services						
1	M & E Services Checked					
Others						

N/A

N/A

R.E / C.O.W. Comment :

1) Non-Conformances

3) Re-Inspection

2) Disposition / Correction

4) Comments

TRC	COW	RE
Name : Su Sung Kiong	Name : SHAHRUL AZRIN ADNAN, CLERK OF WORKS	Name : CHONG KWONG YEAN, ASST. RESIDENT ENGINEER
Signature :	Signature :	Signature :
Date : 18/7/2012	Date : 18-7-2012	Date : 18/7/12

Main contractor : Trans Resources Corporation Sdn. Bhd.	Project : THE CONSTRUCTION AND COMPLETION OF FACILITIES WORKS (PACKAGE A) FOR THE KELANA JAYA (KLJ) LINE EXTENSION PROJECT	
Consulting Engineer : MINCONSULT SDN BHD	Contract No. : PRASARANA/LSD/CTT/2.0275/2010	KLJ

REINFORCED CONCRETING REPORT (EXTERNAL WORKS)

Project : KLJ.
Location : P66-3.
Drawing No : W/KLJ/F/GWY/ST/4402 - Rev 01
Gridline/Zone : 2099-33.
Element : Bored pile.

RIN No. : TRC/KWJ/RIN/GES/70
Date : 18/07/12.
Block No : -
Level : -
Grade of Concrete : GHOT2.

Mixer Truck No.	Volume Delivered (m^3)	Time of Loading	Time of Delivery	Time of Placing	Measured Slump (at site) (mm)	Cube Identification no.	Remarks
MT157	5.0	15:33	15:35	15:39	190		
MT151	5.0	15:40	15:42	16:00	200		+ 6nos cube
MT159	5.0	15:44	15:50	16:18	190		
MT161	5.0	15:52	15:56	16:32	190		
MT162	5.0	15:57	16:00	16:40	200		
MT155	5.0	16:02	16:04	16:57	200		+ 6 nos cube.
MT160	5.0	16:08	16:09	17:10	190		
MT153.	3.0	17:21	17:23	17:33	185		

IKHMAS JAYA SDN BHD (254017-H)

LRT-KJL EXTENSION (PACKAGE A)
Name: FAKHRI Date: 18/07/12.

Date for the Testing Cube at 7 days : 25/07/12
at 28 days : 15/08/12.

Remarks :

TRC	COW	RE
Name : Su Sung Kiong	Name : SHAHRUL AZRIN ADNAN LR	Name : CHONG KWONG YEAN ASST. RESIDENT ENGINEER
Signature :	Signature :	Signature :
Date : 18/7/2012.	Date : 18-7-2012	Date : 18/7/12

CONCRETE PROGRESS CHART

PROJECT: THE CONSTRUCTION AND COMPLETION OF FACILITIES WORKS (PACKAGE A) FOR THE KELANA JAYA (KLJ) LINE EXTENSION PROJECT

CONTRACT NO.: PRASARANA/LSD/CTT/2.0275/2010

LOCATION/BLOCK/PIER : P66 | PILE NO. : 3 | PROJECT REF. : KLJ .

DATE CONCRETED : 18/07/12 . | CUT-OFF LVL. : 21.817 m | GROUND LVL. : 24.044 m

THEORETICAL VOL. : 28.3 cu.m | ACTUAL VOL. : 38.0 cu.m | CASING LENGTH : 19.1 m

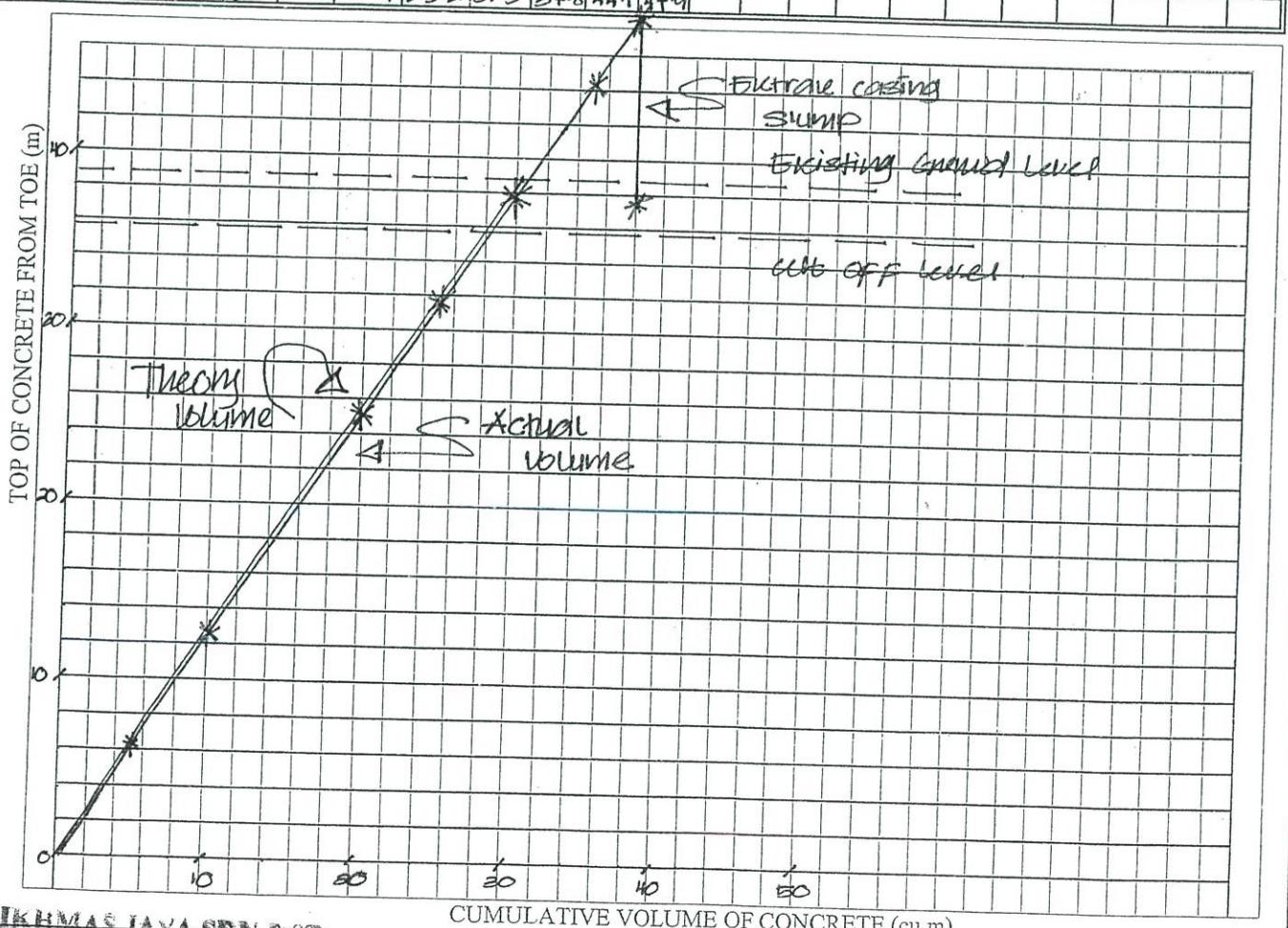
OVERBREAK : 34.3 % | PILE DIA. : 1000 mm | SUPPLIED BY : TRC

CONCRETING START TIME : 15:39 am/pm | END TIME : 18:05 am/pm | CONCRETE GRADE : GHOT2 .

CONC.TYPE : N / T1 / T2 / P / | BORED LENGTH : 38.8 m

CUBE REFERENCE :

Truck no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Vol. of concrete(cu.m)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.0											
Cumul. Vol.(cu.m)	5.0	10.0	15.0	20.0	25.0	30.0	35.0	38.0											
Conc. Lvl. Fr. Grd.(m)	32.5	26.2	19.9	13.6	7.3	1.0	-5.3	9.1											
Conc. Lvl. Fr. Toe.(m)	6.3	12.6	18.9	25.2	31.5	37.8	44.1	47.9											



IKHMAS JAYA SDN BHD (253017-H)

IKHMAS JAYA's REP

CONSULTANT'S/OWNER REP.

SHAHRIN AZRIN ADNAN

LRT-KLJ EXTENSION (PACKAGE A)

Name: FAHMI Date: 18/07/12

LRT-KLJ EXTENSION PROJECT 18-7-2012

FOR INFORMATION ONLY

TRC Concrete Industries Sdn Bhd

(Company Reg. No. 151401 V)
H.Q. : TRC Business Centre, Jalan Andaman Utama, 68000 Ampang, Selangor.
Tel: Fax: 603-4108 0104
Site : KELANA JAYA (KLJ) LINE EXTENSION
PT 223, Jalan Lapangan Terbang Subang, 41050 Shah Alam, Selangor.
Tel:

D. O. No. : K 18389

USTOMER'S COPY

Date : 18/07/2012

ustomer Name	Delivery Address / Site Name
Ikhmas Jaya Sdn Bhd	Site P66 Bored Pile (P66-3)

Specification	Cement Type	Max Aggregate Size (mm)	Admixture Type	Additional Charges Other Description
40 MPA	Mascrete - LH	20MM	P100RI, G133	

Concrete Grade	Specified Slump
G40T2	200+/-25

Total Order (Cu Meter)	This load (Cu Meter)	Progress Total (Cu Meter)
35.00	5.00	5.00

Truck No	Driver	Batcher	Batching Time
MT157	Sallehuddin	Ibrahim	3:33:59 PM

Slump At Site (mm)	Arrival Time	Departure Time
34°C Slump 190mm	15:35	15:56

IKHMAS JAYA SDN BHD (254017-H)
Goods received in accordance with the standard conditions of sale and delivery.
LRT-KJL EXTENSION (PACKAGE A)
Name: Company's Stamp and Signature Date: 18/07/12

TRC Concrete Industries Sdn Bhd

(Company Reg. No. 151401 V)
H.Q. : TRC Business Centre, Jalan Andaman Utama, 68000 Ampang, Selangor.
Tel: Fax: 603-4108 0104
Site : KELANA JAYA (KLJ) LINE EXTENSION
PT 223, Jalan Lapangan Terbang Subang, 41050 Shah Alam, Selangor.
Tel:

D. O. No. : K 18390

STOMER'S COPY

Date : 18/07/2012

tomer Name	Delivery Address / Site Name
khmas Jaya Sdn Bhd	Site P66 Bored Pile (P66-3) 9 nos cube.

Specification	Cement Type	Max Aggregate Size (mm)	Admixture Type	Additional Charges Other Description
0 MPA	Mascrete - LH	20MM	P100RI, G133	

Concrete Grade	Specified Slump
40T2	200+/-25

Total Order (Cu Meter)	This load (Cu Meter)	Progress Total (Cu Meter)
35.00	5.00	10.00

Truck No	Driver	Batcher	Batching Time
T151	Adin	Ibrahim	3:40:59 PM

mp At Site (mm)	Arrival Time	Departure Time
33°C Slump 200mm	15:42	16:08

IKHMAS JAYA SDN BHD (254017-H)
Goods received in accordance with the standard conditions of sale and delivery.
LRT-KJL EXTENSION (PACKAGE A)
Name: Company's Stamp and Signature Date: 18/07/12

FOR INFORMATION ONLY

TRC Concrete Industries Sdn Bhd

(Company Reg. No. 151401 V)
H.Q. : TRC Business Centre, Jalan Andaman Utama, 68000 Ampang, Selangor.
Tel: Fax: 603-4108 0104
Site : KELANA JAYA (KLJ) LINE EXTENSION
PT 223, Jalan Lapangan Terbang Subang, 41050 Shah Alam, Selangor.
Tel:

D. O. No. : K 18391

Date : 18/07/2012

CUSTOMER'S COPY

Customer Name	Delivery Address / Site Name
Ikhmas Jaya Sdn Bhd	Site P66 Bored Pile (P66-3)

Specification	Cement Type	Max Aggregate Size (mm)	Admixture Type	Additional Charges Other Description
40 MPA	Mascrete - LH	20MM	P100RI, G133	

Concrete Grade	Specified Slump
G40T2	200+/-25

Total Order (Cu Meter)	This load (Cu Meter)	Progress Total (Cu Meter)
35.00	5.00	15.00

Truck No	Driver	Batcher	Batching Time
MT159	Rosli	Ibrahim	3:44:59 PM

Slump At Site (mm)	Arrival Time	Departure Time
34°C Slump 190 mm	15:50	16:22

IKHMAS JAYA SDN BHD (254017-H)
Goods received in accordance with the standard conditions of sale and delivery.

LRT-KJL EXTENSION (PACKAGE A)
Name: Company's Stamp and Signature Date: 18/07/12

(4)

TRC Concrete Industries Sdn Bhd

(Company Reg. No. 151401 V)
H.Q. : TRC Business Centre, Jalan Andaman Utama, 68000 Ampang, Selangor.
Tel: Fax: 603-4108 0104
Site : KELANA JAYA (KLJ) LINE EXTENSION
PT 223, Jalan Lapangan Terbang Subang, 41050 Shah Alam, Selangor.
Tel:

D. O. No. : K 18392

Date : 18/07/2012

JSTOMER'S COPY

Customer Name	Delivery Address / Site Name
Ikhmas Jaya Sdn Bhd	Site P66 Bored Pile (P66-3)

Specification	Cement Type	Max Aggregate Size (mm)	Admixture Type	Additional Charges Other Description
40 MPA	Mascrete - LH	20MM	P100RI, G133	

Concrete Grade	Specified Slump
G40T2	200+/-25

Total Order (Cu Meter)	This load (Cu Meter)	Progress Total (Cu Meter)
35.00	5.00	20.00

Truck No	Driver	Batcher	Batching Time
MT161	Megat	Ibrahim	3:52:59 PM

Slump At Site (mm)	Arrival Time	Departure Time
33°C Slump 190 mm	15:56	16:38

IKHMAS JAYA SDN BHD (254017-H)
Goods received in accordance with the standard conditions of sale and delivery.

LRT-KJL EXTENSION (PACKAGE A)
Name: Company's Stamp and Signature Date: 18/07/12

FOR INFORMATION ONLY

TRC Concrete Industries Sdn Bhd

(Company Reg. No. 151401 V)
H.Q. : TRC Business Centre, Jalan Andaman Utama, 68000 Ampang, Selangor.
Tel: Fax: 603-4108 0104
Site : KELANA JAYA (KLJ) LINE EXTENSION
PT 223, Jalan Lapangan Terbang Subang, 41050 Shah Alam, Selangor.
Tel:

5

D. O. No. : K 18393

CUSTOMER'S COPY

Date : 18/07/2012

Customer Name	Delivery Address / Site Name
Ikhmas Jaya Sdn Bhd	Site P66 Bored Pile (P66-3)

Specification	Cement Type	Max Aggregate Size (mm)	Admixture Type	Additional Charges Other Description
40 MPA	Mascrete - LH	20MM	P100RI, G133	

Concrete Grade	Specified Slump
G40T2	200+/-25

Total Order (Cu Meter)	This load (Cu Meter)	Progress Total (Cu Meter)
35.00	5.00	25.00

Truck No	Driver	Batcher	Batching Time
MT162	Zainal	Ibrahim	3:57:59 PM

Slump At Site (mm)	Arrival Time	Departure Time
33°C Slump 200	16:00	16:45

IKHMAS JAYA SDN BHD (254017-H)
Received the above in accordance with standard conditions of sale and delivery.

LRT-KJL EXTENSION (PACKAGE A)
Name: Company's Stamp and Signature Date: 18/07/12

FOR INFORMATION ONLY

TRC Concrete Industries Sdn Bhd

(Company Reg. No. 151401 V)
H.Q. : TRC Business Centre, Jalan Andaman Utama, 68000 Ampang, Selangor.
Tel: Fax: 603-4108 0104
Site : KELANA JAYA (KLJ) LINE EXTENSION
PT 223, Jalan Lapangan Terbang Subang, 41050 Shah Alam, Selangor.
Tel:

D. O. No : K 18394

JSTOMER'S COPY

Date : 18/07/2012

Customer Name	Delivery Address / Site Name
Ikhmas Jaya Sdn Bhd	Site P66 Bored Pile (P66-3) 60 6 nos cube.

Specification	Cement Type	Max Aggregate Size (mm)	Admixture Type	Additional Charges Other Description
40 MPA	Mascrete - LH	20MM	P100RI, G133	

Concrete Grade	Specified Slump
G40T2	200+/-25

Total Order (Cu Meter)	This load (Cu Meter)	Progress Total (Cu Meter)
35.00	5.00	30.00

Truck No	Driver	Batcher	Batching Time
MT155	Razali	Ibrahim	4:02:59 PM

Slump At Site (mm)	Arrival Time	Departure Time
32°C - Slump 200mm.	16:04	17:05

IKHMAS JAYA SDN BHD (254017-H)
Received the above in accordance with standard conditions of sale and delivery.

LRT-KJL EXTENSION (PACKAGE A)
Name: Company's Stamp and Signature Date: 18/07/12

TRC Concrete Industries Sdn Bhd

(Company Reg. No. 151401 V)
H.Q. : TRC Business Centre, Jalan Andaman Utama, 68000 Ampang, Selangor.
Tel: Fax: 603-4108 0104
Site : KELANA JAYA (KLJ) LINE EXTENSION
PT 223, Jalan Lapangan Terbang Subang, 41050 Shah Alam, Selangor.
Tel:

D. O. No. : K 18395

CUSTOMER'S COPY

Date : 18/07/2012

Customer Name	Delivery Address / Site Name
Ikhmas Jaya Sdn Bhd	Site P66 Bored Pile (P66-3)

Specification	Cement Type	Max Aggregate Size (mm)	Admixture Type	Additional Charges Other Description
40 MPA	Mascrete - LH	20MM	P100RI, G133	

Concrete Grade	Specified Slump
G40T2	200+/-25

Total Order (Cu Meter)	This load (Cu Meter)	Progress Total (Cu Meter)
35.00	5.00	35.00

Truck No	Driver	Batcher	Batching Time
MT160	Rizal,Zakaria	Ibrahim	4:08:59 PM

Slump At Site (mm)	Arrival Time	Departure Time
33°C Slump 190mm	16:09	17:27

Concrete received in accordance with the standard conditions of sale and delivery.
IKHMAS JAYA SDN BHD (254017-H)
LRT-KJL EXTENSION (PACKAGE A)
Name: Company's Stamp and Signature
Date: 18/07/12

FOR INFORMATION ONLY

TRC Concrete Industries Sdn Bhd

(Company Reg. No. 151401 V)
H.Q. : TRC Business Centre, Jalan Andaman Utama, 68000 Ampang, Selangor.
Tel: Fax: 603-4108 0104
Site : KELANA JAYA (KLJ) LINE EXTENSION
PT 223, Jalan Lapangan Terbang Subang, 41050 Shah Alam, Selangor.
Tel:

(8)

D. O. No. : K 18404

JSTOMER'S COPY

Date : 18/07/2012

Customer Name	Delivery Address / Site Name
Ikhmas Jaya Sdn Bhd	Site P66 Bored Pile (P66-3)

Specification	Cement Type	Max Aggregate Size (mm)	Admixture Type	Additional Charges Other Description
40 MPA	Mascrete - LH	20MM	P100RI, G133	

Concrete Grade	Specified Slump
G40T2	200+/-25

Total Order (Cu Meter)	This load (Cu Meter)	Progress Total (Cu Meter)
35.00	3.00	38.00

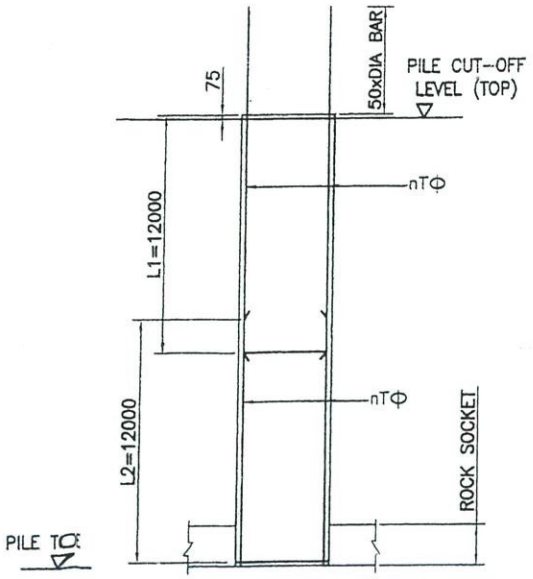
Truck No	Driver	Batcher	Batching Time
MT153	Rahman,Kadir	Ibrahim	5:21:59 PM

Slump At Site (mm)	Arrival Time	Departure Time
32°C / 185mm	3:23 pm	18:05

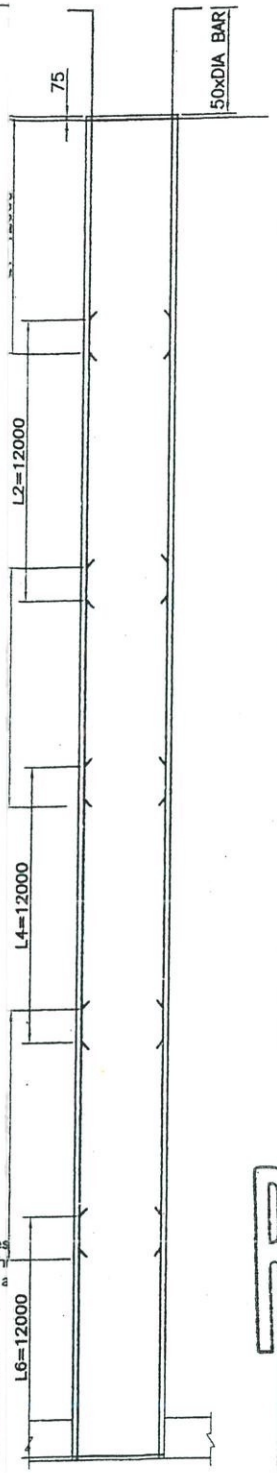
Concrete received in accordance with the standard conditions of sale and delivery.
IKHMAS JAYA SDN BHD (254017-H)
LRT-KJL EXTENSION (PACKAGE A)
Name: Company's Stamp and Signature
Date: 18/07/12

APPENDIX D

Schedule of Pile Reinforcement (Sheet 1)



L ≤ 20



L ≥ 52

LEGEND:

n = nv. OF BARS
T = HIGH YIELD STEEL BARSF BARS (fy = 460 N/mm²)
Φ = DIAMETER OF BARS

Proposed Installation and Testing of Preliminary Piles

It is proposed that preliminary piles be installed and tested prior to the construction of working piles in order to validate design assumptions. The proposed piles shall be designed and installed to achieve its Designed Axial and Design Lateral Capacities. The details of the proposed of preliminary piles and proposed locations are shown in Tables 1 and 2.

Table 1: Details of Preliminary Piles for Guideway

	Pile size [mm]	AMLT[1]	LLT[2]	PDA[3]	CSL[4]	Instrumentation	
						Inclinometer	SG & TTE[5]
TP1	800	Yes	No	Yes	Yes	No	Yes
TP2	800	Yes	No	Yes	Yes	No	Yes
TP3	1000	Yes	Yes, with TP4	Yes	Yes	Yes	Yes
TP4	1000	No	Yes, with TP3	No	Yes	Yes	No
TP5	1000	Yes	No	Yes	Yes	No	Yes
TP6	1000	Yes	No	Yes	Yes	No	Yes
TP7	1000	Yes	No	Yes	Yes	No	Yes
TP8	1200	Yes	Yes, with TP9	Yes	Yes	Yes	Yes
TP9	1200	No	Yes, with TP8	No	Yes	Yes	No
TP10	1200	Yes	No	Yes	Yes	No	Yes

1 Axial Compression Maintained Load Test
2 Lateral load Test
3 Dynamic Load Test (PDA+CAPWAP)
4 Cross Hole Sonic Logging Test
5 Strain gauges and tell-tale extensometers

DRAWING

OF

QUATITIES (BQ)

RMATION ONLY

KERAJAAN MALAYSIA
KEMENTERIAN PENGANGKUTAN

KELANA JAYA (KLJ) LINE EXTENSION PROJECT

Project Package:
THE CONSTRUCTION AND COMPLETION OF FACILITIES WORKS FOR KELANA JAYA LINE EXTENSION (PACKAGE A)

Director General of Railways

Asset Owner :
prasarana
Syarikat Prasarana Negara Berhad
B-20-1, LEVEL 20,
MENARA UOA BANGSAR,
No. 5 JALAN BANGSAR UTAMA 1,
59000 KUALA LUMPUR.
Tel :
Fax : 603-22991919

Project Consultant :
OPUS Konsortium
3rd Floor, Tower 2, Faber Towers,
Jalan Desa Bahagia, Taman Desa,
58100 Kuala Lumpur,
Tel :
Fax : 603-76256208

Lead Consultant :
MINCONSULT SDN. BHD.
(Company No. : 58635-P)
minco
Lot 6, Jalan 51A / 223,
46100 Petaling Jaya, Selangor, Malaysia.
Tel :
Fax : 603-79547373, 79547575

Design Consultant :

RECEIVED
30 DEC 2010
KLJ (SITE)

Rev	Date	Description	Drwn	Chk	App

Designed By	PKB
Drawn By	MM
Checked By	PKB
Approved By	AAE
CAD file no	W-KLJ-F-GWY-ST-4400
Scale	AS SHOWN
Date	APRIL 2010

Drawing Title :
SCHEDULE OF PILE REINFORCEMENT (SHEET 1)

KLJ

Drawing No. : W/KLJ/F/GWY/ST/4400
Rev 00

APPENDIX E

Schedule of Pile Reinforcement (Sheet 3)

No.	CHAINAGE	PIER REF	Diameter of Pile (mm)	Number of Piles	Pile Length (m)	PILE REINFORCEMENT (nTΦ)						LINK REINFORCEMENT (TΦ - SPACING)					
						L1	L2	L3	L4	L5	L6	L1	L2	L3	L4	L5	L6
61	1398.56	P45a	1000	6	33.0	16 T 32	16 T 32	16 T 25	16 T 20			T12-150	T12-150	T12-150	T12-200		
62	1415.01	P46	1000	6	33.0	16 T 32	16 T 32	16 T 25	16 T 20			T12-150	T12-150	T12-150	T12-200		
63	1431.72	P47 **	1000	6	28.0(1.0)	16 T 32	16 T 32					T12-150	T12-150				
64	1458.86	P48 **	1000	6	28.0(1.0)	16 T 32	16 T 32					T12-150	T12-150				
65	1488.86	P49 **	1000	6	28.0(1.0)	16 T 32	16 T 32					T12-150	T12-150				
66	1518.33	P50 **	1000	6	28.0(1.0)	16 T 32	16 T 32					T12-150	T12-150				
67	1554.33	P51 **	1000	6	28.0(1.0)	16 T 32	16 T 32					T12-150	T12-150				
68																	
69																	
70		P52 - P55 REFER PILING LAYOUT DRAWINGS FOR VARIOUS SPECIAL CROSSING															
71																	
72	1775.33	P56 **	1000	6	34.0	16 T 32	16 T 32	16 T 25	16 T 20			T12-150	T12-150	T12-150	T12-200		
73	1811.33	P57	1000	5	34.0	24 T 32	24 T 32	24 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
74	1847.33	P58	1000	5	34.0	24 T 32	24 T 32	24 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
75	1883.33	P59	1000	5	34.0	24 T 32	24 T 32	24 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
76	1913.33	P60	1000	4	34.0	16 T 32	16T32	16 T 25	16 T 16			T12-150	T12-150	T12-150	T12-200		
77	1943.33	P61	1000	4	34.0	16 T 32	16T32	16 T 25	16 T 16			T12-150	T12-150	T12-150	T12-200		
78	1973.33	P62	1000	4	34.0	16 T 32	16T32	16 T 25	16 T 16			T12-150	T12-150	T12-150	T12-200		
79	2009.33	P63	1000	4	30.0(2.0)	16 T 32	16 T 32	16 T 16				T12-150	T12-150	T12-150			
80	2036.33	P64	1000	4	30.0(2.0)	16 T 32	16 T 32	16 T 16				T12-150	T12-150	T12-150			
81	2063.33	P65	1000	4	30.0(2.0)	16 T 32	16 T 32	16 T 16				T12-150	T12-150	T12-150			
82	2099.33	P66	1000	4	30.0(2.0)	16 T 32	16 T 32	16 T 16				T12-150	T12-150	T12-150			
83	2135.33	P67	1000	4	30.0(2.0)	16 T 32	16 T 32	16 T 16				T12-150	T12-150	T12-150			
84	2171.33	P68	1000	4	30.0(2.0)	16 T 32	16 T 32	16 T 16				T12-150	T12-150	T12-150			
85	2207.33	P69	1000	4	30.0(2.0)	16 T 32	16 T 32	16 T 16				T12-150	T12-150	T12-150			
86	2243.33	P70 **	1000	6	30.0(2.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
87	2243.33	P70a **	1000	6	30.0(2.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
88	2279.33	P71 **	1000	6	30.0(2.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
89	2279.33	P71a **	1000	6	30.0(2.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150	T12-200		
90	2315.33	P72	1000	5	30.5(1.5)	24 T 32	24 T 32	24 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
91	2351.33	P73	1000	5	30.5(1.5)	24 T 32	24 T 32	24 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
92	2387.33	P74	1000	5	30.5(1.5)	24 T 32	24 T 32	24 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
93	2423.90	P75	1000	5	30.5(1.5)	24 T 32	24 T 32	24 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
94	2453.90	P76	1000	5	30.5(1.5)	24 T 32	24 T 32	24 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
95	2474.00	P77 **	1000	6	30.5(1.5)	16 T 32	16 T 32	16 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
96	2495.00	P78 **	1000	8	30.5(1.5)	16 T 32	16 T 32	16 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
97	2522.00	P79 **	1000	8	30.5(1.5)	16 T 32	16 T 32	16 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
98	2549.00	P80 **	1000	8	30.5(1.5)	16 T 32	16 T 32	16 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
99	2576.00	P81 **	1000	8	30.5(1.5)	16 T 32	16 T 32	16 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
100	2600.00	P82N **	1000	6	33.0	16 T 32	16 T 32	16 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
101	2587.08	P82S **	1000	6	33.0	16 T 32	16 T 32	16 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
102	2627.00	P83N **	1000	6	33.0	16 T 32	16 T 32	16 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
103	2614.08	P83S **	1000	6	33.0	16 T 32	16 T 32	16 T 20	16 T 16			T12-150	T12-150	T12-150	T12-200		
104	2654.00	P84N **	1000	6	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
105	2641.08	P84S **	1000	6	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
106	2681.00	P85N **	1000	6	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
107	2668.08	P85S **	1000	6	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
108	2705.00	P86 **	1000	8	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
109	2732.00	P87 **	1000	8	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
110	2759.00	P88 **	1000	8	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
111	2786.00	P89 **	1000	8	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
112	2810.00	P90 **	1000	8	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
113	2834.00	P91N **	1000	6	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
114	2824.08	P91S **	1000	6	20.5(4.0)	16 T 32	16 T 32	16 T 20				T12-150	T12-150	T12-150			
115	2861.00	P92N **	1000	6	42.0(1.0)	16 T 32	16 T 32	16 T 25	16 T 20	16 T 20		T12-150	T12-150	T12-150	T12-200	T12-200	
116	2851.08	P92S **	1000	6	42.0(1.0)	16 T 32	16 T 32	16 T 25	16 T 20	16 T 20		T12-150	T12-150	T12-150	T12-200	T12-200	
117	2888.00	P93N **	1000	6	42.0(1.0)	16 T 32	16 T 32	16 T 25	16 T 20	16 T 20		T12-150	T12-150	T12-150	T12-200	T12-200	
118	2878.08	P93S **	1000	6	42.0(1.0)	16 T 32	16 T 32	16 T 25	16 T 20	16 T 20		T12-150	T12-150	T12-150	T12-200	T12-200	
119	2913.50	P94 **	1000	6	42.0(1.0)	16 T 32	16 T 32	16 T 25	16 T 20	16 T 20		T12-150	T12-150	T12-150	T12-200	T12-200	
120	2940.50	P95N	1000	5	42.0(1.0)	24 T 32	24 T 32	24 T 20	16 T 16	16 T 16		T12-150	T12-150	T12-150	T12-200	T12-200	

02

* = THE FIRST FIGURE INDICATES TOTAL ESTIMATED PILE LENGTH.
THE FIGURE GIVEN IN BRACKET INDICATES LENGTH OF ROCK SOCKETING.

FOR CONSTRUCTION

NOTE 1. PIER INFORMATION FOR THE PIER MARKED SHOWN WITH DOUBLE ** (ASTERISK) ARE BEING SUPERCEDED WITH ALTERNATIVE FOUNDATION DESIGN. FOR DETAILS NEW NUMBER SERIES WITH W/KLJ/F/GWY/ST/13001..... SHALL BE REFERRED.

KLJ

FOR INFORMATION ONLY

WORKING DRAWING

[Infrastructure Div] 3499 C:\Old Data\projects\3608020-kt\PACKAGE A-WORKING DRAWINGS\MAIN CONTRACT-PACKAGE A\PILE REINFORCEMENTS\ W-KLJ-F-GWY-ST-4402-REV02.dwg Mon, 21 May 2012 - 11:09am

KERAJAAN MALAYSIA
KEMENTERIAN PENGANGKUTAN

KELANA JAYA (KLJ) LINE EXTENSION PROJECT

Project Package:
THE CONSTRUCTION AND COMPLETION OF FACILITIES WORKS FOR KELANA JAYA LINE EXTENSION (PACKAGE A)

Director General of Railways

Asset Owner :
prasarana
Syarikat Prasarana Negara Berhad
B-20-1, LEVEL 20,
MENARA UOA BANGSAR,
No. 5 JALAN BANGSAR UTAMA 1,
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Tel :
Fax : 603-22991919

Project Consultant :
OPUS KONSORTIUML
3rd Floor, Tower 2, Faber Towers,
Jalan Desa Bahagia, Taman Desa,
58100 Kuala Lumpur,
Tel :
Fax : 603-76256208

Lead Consultant :
MINCONSULT SDN. BHD.
(Company No. : 58835-P)
minco
Lot 6, Jalan 51A / 223,
46100 Petaling Jaya, Selangor, Malaysia.
Tel :
Fax : 603-79547373, 79547575

Design Consultant :

RECEIVED
07 AUG 2012
KLJ (SITE)

Rev.	Date	Description	Drwn	Chk	App
01	28-07-2011	NOTE 1 REGARDING ALTERNATE FOUNDATION DESIGN IS ADDED	ANBA	PKB	AAE
02	16-05-2012	REVISED AS CLOUDED	MM	PKB	AAE

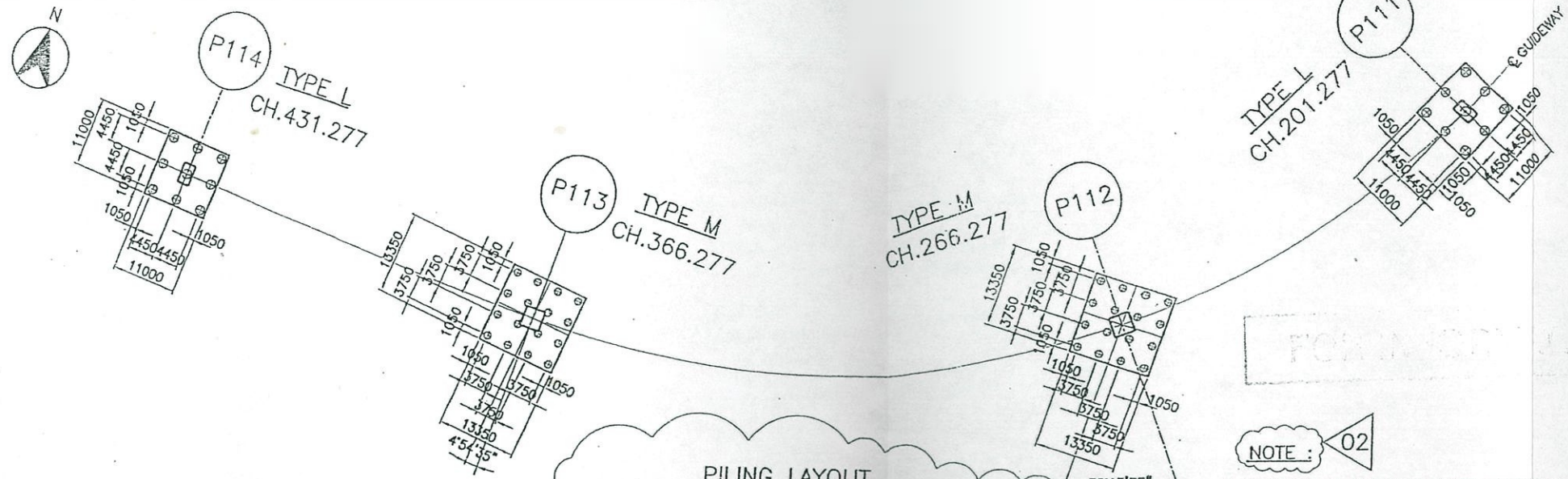
Designed By	PKB
Drawn By	MM
Checked By	PKB
Approved By	AAE
CAD file no	W-KLJ-F-GWY-ST-4402
Scale	AS SHOWN
Date	APRIL 2010

Drawing Title :
SCHEDULE OF PILE REINFORCEMENT (SHEET 3)

Drawing No : W/KLJ/F/GWY/ST/4402
Rev 02

APPENDIX F

Piling Layout



NOTE : 02

1. FOR TYPE OF PILE CAPS REFER DRAWING NO. W/KLJ/F/GWY/ST/4503 TO 4508.
2. 'PILE LENGTH' INDICATE TOTAL LENGTH INCLUDING ROCK SOCKET LENGTH.
3. IF ROCK IS ENCOUNTERED, PRIOR TO THE TERMINATION OF PILE AS PER ESTIMATED LENGTH, THE PILE LENGTH SHALL BE CONFIRMED WITH THE ENGINEER.

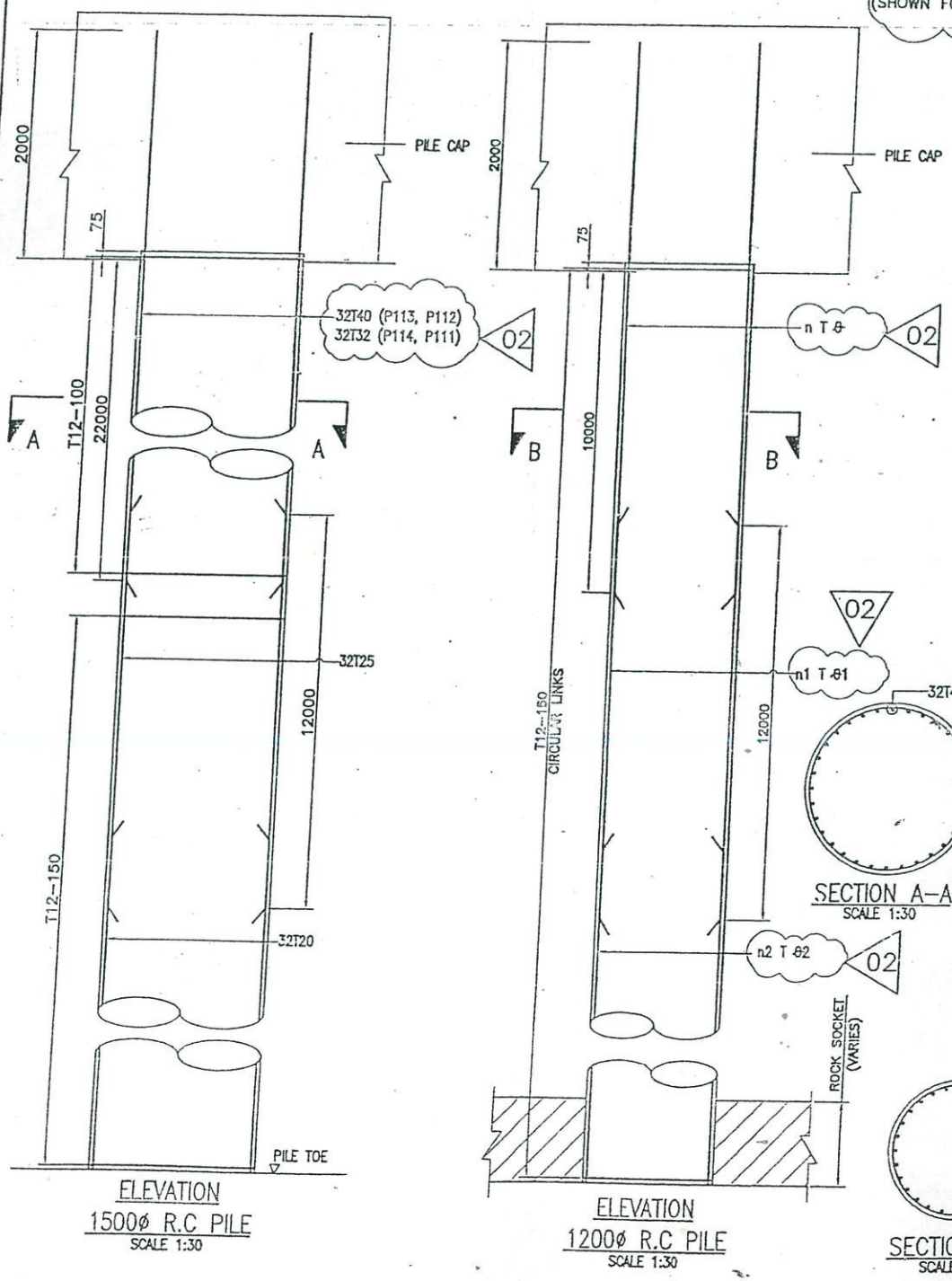


TABLE 1

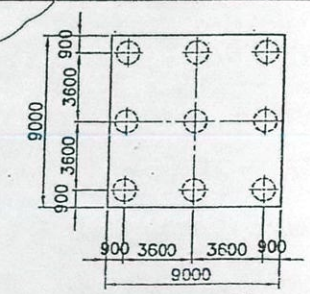
PIER MARK	No. OF PILES	DIA. OF PILES	PILE LENGTH (m)	ROCK SOCKET LENGTH (m)	PILECAP SIZE (m)	PIER SIZE (m)	PILECAP TYPE
P111	9	1500	57	-	11x11x3.0 DEEP	2.0 x 3.3	L
P112	16	1500	47	-	13.350x13.350x3.0 DEEP	3.3 x 3.3	M
P113	16	1500	47	-	13.350x13.350x3.0 DEEP	3.3 x 3.3	M
P114	9	1500	57	-	11x11x3.0 DEEP	2.0 x 3.3	L
P135	9	1200	27	-	9x9x2.8 DEEP	2.0 x 3.3	I
P136	12	1200	35	1.0	10.8x13.8x3.0 DEEP	3.3 x 3.3	K
P137	12	1200	35	1.0	10.8x13.8x3.0 DEEP	3.3 x 3.3	K
P138	9	1200	23	-	9x9x2.8 DEEP	2.0 x 3.3	I
P207	9	1200	34.5	-	9x9x2.8 DEEP	2.0 x 3.3	I
P208	12	1200	37.5	2.5	10.8x13.8x3.0 DEEP	3.3 x 3.3	K2
P209	12	1200	37.5	2.5	10.8x13.8x3.0 DEEP	3.3 x 3.3	K
P210	9	1200	34.5	-	9x9x2.8 DEEP	2.0 x 3.3	I
P225	9	1200	34.5	-	9x9x2.8 DEEP	2.0 x 3.3	I
P226	12	1200	40	1.0	10.8x13.8x3.0 DEEP	3.3 x 3.3	K
P227	12	1200	40	1.0	10.8x13.8x3.0 DEEP	3.3 x 3.3	K
P228	9	1200	34.5	-	9x9x2.8 DEEP	2.0 x 3.3	I

02

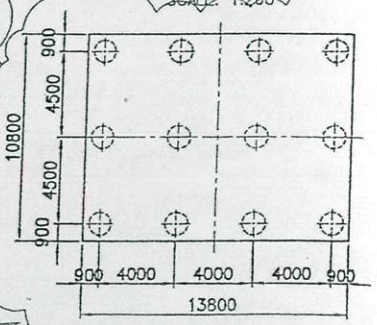
TABLE 2

PIER MARKED	n T ø	n1 T ø1	n2 T ø2
P135	26T32	26T25	26T20
P136	28T40	28T32	28T20
P137	28T40	28T32	28T20
P138	26T32	26T25	26T20
P207	26T32	26T25	26T20
P208	24T40	24T32	24T20
P209	24T40	24T32	24T20
P210	26T32	26T25	26T20
P225	26T32	26T25	26T20
P226	32T40	32T32	32T20
P227	26T40	26T32	26T20
P228	26T32	26T25	26T20

02

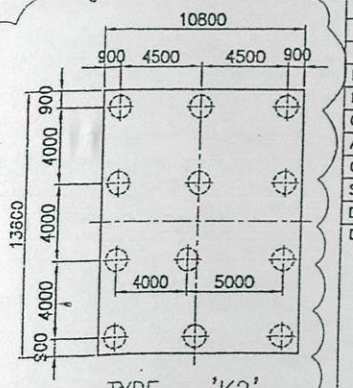


TYPE – 'I'
SCALE: 1:200



TYPE – 'K'
SCALE: 1:200

02



TYPE – 'K2'
SCALE: 1:200

KERAJAAN MALAYSIA
KEMENTERIAN PENGANGKUTAN

KELANA JAYA (KLJ) LINE EXTENSION PROJECT

Project Package:
THE CONSTRUCTION AND COMPLETION OF FACILITIES WORKS FOR KELANA JAYA LINE EXTENSION (PACKAGE A)

KLJ

Director General of Railways

Asset Owner :
prasarana
Syarikat Prasarana Negara Berhad
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Fax : 603–76256208

Lead Consultant :
MINCONSULT SDN. BHD
(Company No. : 58833
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46100 Petaling Jaya, Selangor, Malaysia.
Tel :
Fax : 603–79547373, 79547575

Design Consultant :

27 JAN 2012

KLJ (SITE)

Rev	Date	Description	Drwn	Chkd
01	23–12–2010	REVISED AS CLOUDED	MM	PKB
02	15–07–2011	ADDED PILCAP TYPE COLUMN & REVISED AS CLOUDED	MM	PKB

Designed By	PKB
Drawn By	ANBA
Checked By	PKB
Approved By	AAE
CAD file no	W–KLJ–F–GWY–ST–2022
Scale	AS SHOWN
Date	7 SEPTEMBER 2009

Drawing Title :

PILING LAYOUT

SPECIAL CROSSING
(65–100–65 - CONTINUOUS)

Drawing No : W/KLJ/F/GWY/ST/2022

Rev 0

[Infrastructure Div] 3499 C:\Old Data\projects\3608020–Irt\PACKAGE A–WORKING DRAWINGS\MAIN CONTRACT–PACKAGE A\65–100–65 CONTINUOUS\ W–KLJ–F–GWY–ST–2022–REV02.dwg Tue, 09 Aug 2011 – 12:25pm

APPENDIX G

Concrete Mix Design Proposal

TRC CONCRETE INDUSTRIES SDN BHD

CONCRETE MIX DESIGN PROPOSAL

ESIGN FOR:	CONCRETE CLASS: 40 TREMIE
PROJECT	DATE: 28.06.2011
NTRACTOR	MIX REF NO: G40T2C

CHARACTERISTIC STRENGTH AT 28 DAYS		40 N/mm2
SLUMP		200 ± 25 mm
STANDARD DEVIATION		9 N/mm2
MARGIN	(K= 1.64)	15 N/mm2
TARGET MEAN STRENGTH		55 N/mm2
FREE WATER/CEMENTITIOUS RATIO		0.37
(Specified Maximum)		

CEMENT TYPE	MASCRETE LH
CEMENT BRAND	
SILICA FUMES	NIL
DOSAGE	0 kg per cubic meter
FINE AGGREGATE TYPE	WASHED SAND
COARSE AGGREGATE TYPE	20mm GRADED
ADMIXTURE 1	P100RI
DOSAGE	500 ml per 100 kg cement
ADMIXTURE 2	Glenium 133
DOSAGE	1000 ml per 100 kg cement

SPECIFIC GRAVITIES OF MATERIALS			
CEMENT	2.98	FINE AGGREGATE	2.63
SILICA FUMES	2.00	COARSE AGGREGATE	2.65

MAXIMUM AGGREGATE SIZE	20 mm Graded
GRADING OF FINE AGGREGATE	Zone 1
PROPORTION OF FINE AGGREGATE	45.00 %
(Specified Maximum)	
SPECIFIC GRAVITY OF COMBINED AGGREGATE	2.64
TOTAL AGG. CEMENT RATIO	4.21

(Specified Maximum)			
FREE WATER REQUIREMENT	155	KG/m3 =	155 LITERS / m3
CEMENT CONTENT	420	KG/m3 =	140.94 LITERS / m3
(Specified Maximum)			
SILICA FUMES	0	KG/m3 =	0.00 LITERS / m3
AIR CONTENT	3.5	% =	35 LITERS / m3
TOTAL AGGREGATE CONTENT		=	669.06 LITERS / m3
		=	1766 KG / m3
FINE AGGREGATE CONTENT	45.00	% =	795 KG / m3
COARSE AGGREGATE CONTENT	55.00	% =	971 KG / m3
DESIGNED DENSITY OF CONCRETE		=	2341 KG / m3

REMARKS

SUMMARY OF BATCH WEIGHTS (SSD) PER CUBIC METER OF CONCRETE

CEMENT OPC	SILICA FUMES	WATER	FINE SAND	COARSE AGG	P100RI	Glenium 133	DESIGN VOLUME Cubic Liter	REMARK
							1000	
420 kg	0 kg	155 kg	795 kg	971 kg	2.10 litre	4.20 litre		

(Specified Maximum)