UNIVERSITI TEKNOLOGI MARA

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

APRIL 2015

It is recommended that the report of this practical training provided

By

Muhammad Aimi Bin Adzmi

2012355765

entitled

Construction Of Reinforced Concrete And Gabion Retaining Wall For A Proposed Of Upgrading Kajang Silk Highway From UNITEN Interchange To UPM Interchange

accepted in partial fulfillment of requirement has for obtaining Diploma in Building.

Report Supervisor :

Practical Training Coordinator :

Faculty Coordinator :

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING, AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

APRIL 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 Cypark Resources Berhad for duration of 5 months starting from 17 November 2014 and ended 3 April 2015. It is submitted as one of the prerequisite requirements of DBN307 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

Name : MUHAMMAD AIMI BIN ADZMI

UiTM ID No : 2012355765

Date : 7 APRIL 2015

ACKNOWLEDGEMENT

Alhamdulillah, all praises to Allah for the strengths and His blessing in completing this thesis. Special appreciation goes to my project coordinator, Mr. Mohd Faisa Bin Ngah for his supervision and constant support. His invaluable help of constructive comments and suggestions throughout the experimental have contributed to the success of this report. Not forgotten, my appreciation to my site engineer, Mr. Muhammad Rauzan Bin Rahmat and my site supervisor, Mr. Raman Shah Bin Ramdzan for the support and knowledge regarding this topic. I would like to express my appreciation to the Construction Manager at Upgrading Kajang Silk Highway from Uniten Interchange to Upm Interchange, Mr. Solan for their support and help towards during my practical training in the road construction within 5 months. My acknowledgement also goes to all the technicians and office staffs of project Upgrading Kajang Silk Highway from Uniten Interchange to Upm Interchange for their co-operations. Sincere thanks to my lecturer supervisor Mdm. Rafizah Binti Mohamed Nordin for her guidance, advice and moral support during do this report in successfully. Thanks for her concern in ensure to being success at training time. Not forget, great appreciation goes to the rest Practical Training Coordinator Mdm. Wan Nordiana Binti Wan Ali and Faculty's Coordinator Dr. Mohd Rofdzi Bin Abdullah. Last but not least, my deepest gratitude goes to my beloved parents, and and also to my siblings for their endless love, prayers and encouragement. To those who indirectly contributed in this report, your kindness means a lot to me.

Thank you very much.

ABSTRACT

Reinforced concrete retaining wall and Gabion retaining wall is one of the important structures in road construction. This report will explain these two types of retaining wall based on on-site observation during practical terms. This report covers a study on the importance of retaining wall, purpose of retaining wall inspection works and construction methods of both structures. All the data in this report had been gathered during 5 months of practical training with Cypark Resouces Berhad doing project of upgrading Kajang Silk highway from UNITEN Interchange to UPM Interchange. The main objective of this report is to understand more on the overall construction method of retaining wall with the specification given by JKR (Jabatan Kerja Raya). This report also explained on the preparation of slope to ensure the retaining wall can support the slope and also need to calculation involved for the structure. Overall, this report will concentrates on construction method statements and the purpose of retaining wall from the very beginning. Every single work will be explained in sequence the way the workers did on site.

TABLE OF CONTENTS **PAGE NO**

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

LIST OF APPENDIX

LIST OF ABBREVIATION

C.O.W	Clerk of Work
PVC	Polyvinyl Chloride
REBAR	Reinforcement Bar
UPM	Universiti Putra Malaysia
UNITEN	Universiti Tenaga Nasional
JKR	Jabatan Kerja Raya
LHS	Left Hand Side
RHS	Right Hand Side

CHAPTER 1

PREFACE

1.1 Introduction

In the construction industry, there are many types of construction which is landscape, building, road construction, underwater construction and others. This report will be focusing on the road construction which is needed for the high quality of construction to make people using the road safe from the accidents. In road construction, retaining wall is one of the important that will help to prevent the landslide from the slope.

Retaining wall function is to protect the slope from landslide during raining to the road and also to prevent from accidents happen to the user of the road. Retaining wall may look like simple stacked stone, block or timber, but, in fact retaining wall is actually a carefully engineered system that wage an ongoing battle with the gravity. It also restrains tons of saturated soil that would otherwise slump and slide away from a foundation or damage the surrounding landscape.

There are many processes need to be careful to create a proper retaining wall. One of the reason failure of retaining wall because of the poor system of drainage. This can make the existing retaining wall will crack, bulging or leaning after a few years.

1.2 Objective

For my practical training report, it will focus on the construction related to slope protection and other associated works at the Sistem Lingkaran Lebuhraya Kajang (SILK) Highway widening project, which is the construction of retaining wall. The objectives of this report are to provide and outline the details related to the followings:

i) To study the sequence inspection works and the importance of the inspection works for reinforced concrete and gabion retaining wall construction.

ii) To study the method of construction of reinforced concrete retaining walls, gabion walls and other associated works based on my practical training.

1.3 Scope of Study

The internship program took place at the project to upgrade the existing SILK Highway from UNITEN interchange to UPM interchange within the existing Right of Way (ROW) from two (2) lanes dual carriageway to three (3) lanes dual carriageway with the provisional tender sum of RM 34 million and with the completion period of 18 months. The total length of the highway to be upgraded is 1.2km with the construction of additional lanes of 2.4km. Within the length of the highway construction, there are few numbers of retaining wall construction required.

Generally, the major scopes of works observed in this highway project are as the followings:

i) Embankment widening along main line
ii) Realign Ramp A geometry
iii) **Ground treatment works and retaining structures**
iv) Underpass structure extension at Lebuh Silikon
v) Upgrade/reconstruct drainage system
vi) Milling and overlaying pavement
vii) Traffic management work Road Marking & furniture
viii) Upgrading of existing Street light
ix) Installation of traffic light
x) Installation of two CCTV
xi) Protect /relocate the existing utilities
xii) Installation of new traffic and directional signage
xiii) Installation of new road furniture including guardrails conforming to Test Level 3
xiv) New road marking

However, this report will only focus mainly on the above no iii) scope of works which is ground treatment works and retaining structures, which consist from preparing the base for the retaining wall such as removing and cart away unsuitable soil before replace with the imported good earth, excavation for the foundation, reinforcement bars, formworks, concreting, construction of drains, construction of gabion walls as additional slope protection, backfilling behind the completed retaining and trimming the existing slopes. The retaining wall construction for reinforced concrete observed located at zone 3 (RHS), zone 4 (LHS), and zone 5 (LHS) while the gabion retaining wall construction located at zone 5 (RHS) and zone 5&6 (RHS).

1.4 Method of Study

Method of study is the way to gathered all the data in this report. Below shows all the methods applied to gain the data required:

i) Observation

With the assistance from Project Engineer and C.O.W, observation at the site was done during execution of the works. During observation, project engineer and C.O.W has also explained on the process and the control required to ensure that the constriction are done based on the approved method of statement. Visiting the laboratory to test the materials used and also part of the activities. The activities at the site were recorded either as notes or captured as photos and were used to prepare this report.

ii) Interview

Explanation by the project engineer and COW on construction activities during interview in the office as well as at the site is another methodology in gathering information for preparing this report.

iii) Project Documents

Referring to the documents prepared and submitted by the contractor to Supervising Engineer such as Method of Statement, plans, site instructions from Resident Engineer, method of statement from the supplier or installer is another methodology used for preparing this report.

CHAPTER 2

COMPANY BACKGROUND

Photo 2.1: Company Logo of Cypark Resources Berhad

(Source: Cypark Resources Berhad, 2015)

2.1 Introduction of Company

Cypark Group entered the market as a landscape specialist via Cypark Sdn. Bhd in 1999 which is wholly owned by Cypark Resources. Cypark Sdn. Bhd was incorporated in Malaysia on the 27th of February 1999. Cypark Resources Berhad was incorporated in Malaysia on the 19th February 2004. Cypark later expanded its activities to environmental management in 2004 and Renewable Energy in 2010. Cypark Group today is an integrated landscape and environmental engineering solutions provider and Renewable Energy developer with major projects located mainly in Malaysia, Qatar and U.A.E.

Cypark Resources Berhad is an integrated environmental engineering and technology provider. Infrastructure works, transforming dump sites, and environmental bane to an economic and environmental boon is the raison the entire of our business. The critical goal of landfill remediation is to protect human health and the environment by eliminating airborne vectors, contamination of land and water, air pollution and a host of other problems caused by open dumping. The ultimate aim is

to return land back to the community in a form that will benefit the environment and the community.

At Cypark, they recognize that a balanced enduring approach is needed to ensure sustainability in economic activity, environmental responsibility and social progress. Their commitment to sustainable development is evidenced by what they do. They help to preserve our environment, preventing further degradation to land, water and air with a strong aspiration to help create a sustainable, healthy and economically stable environment for our children and future generations.

Leveraging the synergy from restoring landfills to the creation of renewal energy has placed Cypark at the forefront of sustainable development and green energy generation. One of the achievements Cypark is Pajam Solar Park has been awarded by the Malaysian Book of Records as the largest solar park in Malaysia.

As an environmental technology and engineering specialist, Cypark combines technologies and engineering proficiency, with high-end research and development, to develop systems specifically for restoring brownfields like the Contaminated Land Assessment Remediation and Information System (COLARIS), Sustainable Environmental Restoration (SER) and Groundwater Assessment Remediation and Information System (GARIS).

(Source: Cypark Resources Berhad, 2015)

2.2 Company Profile

Cypark Resources Berhad has been created on January 1, 2004. Table below shows company profile of Cypark Resources Berhad.

Table 2.2: Cypark Resources Berhad company profile

Title	Description
Name of company	Cypark Resources Berhad
Business Address	Unit 13A-09, Block A, Philleo Damansara II, No. 15 Jalan 16/11, 46350 Petaling Jaya, Selangor Darul Ehsan, Malaysia
CEO	Dato' Daud Bin Ahmad
Registered Address	Level 7, Menara Milenium, Jalan Damanlela, Pusat Bandar Damansara, Damansara Height, 50490 Kuala Lumpur.
Legal Form	Public Limited Company
Incorporation Date	January 1, 2004
Status	Listed
Authorised Capital	RM 100,000,000
Paid-up Capital	RM 89,172,325
Website	http://www.crbenv.com
Tel	
Fax	603-7660 6169
Email	Info@crbenv.com
Financial Auditors	Ernst & Young
Company Number	642994-H

(Source: Cypark Resources Berhad, 2015)

2.3 Company Structure

One of the Cypark Resources Berhad is Cypark Suria which is located at Bukit Palong, Pajam, and Kuala Sawah. Table below will shows about corporate structure of Cypark Resources Berhad.

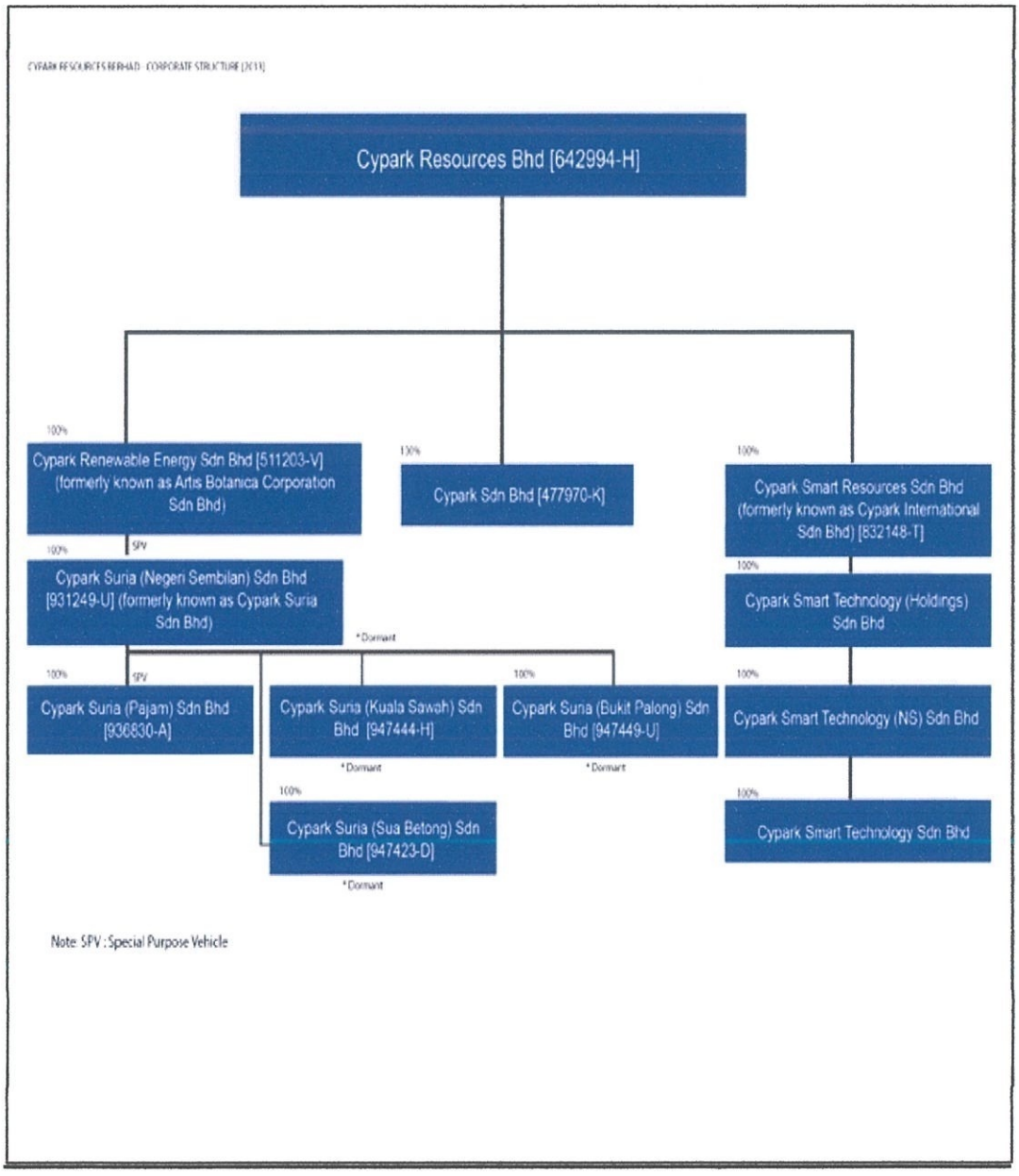


Figure 2.3: Cypark Resources Berhad Company Structure

(Source: Cypark Resources Berhad, 2015)

2.4 Organization Chart

Senior project manager of this project is Mr. Sasidharan and project manager is Mr. Faisa Ngah. Below shows the rest site team of this project:

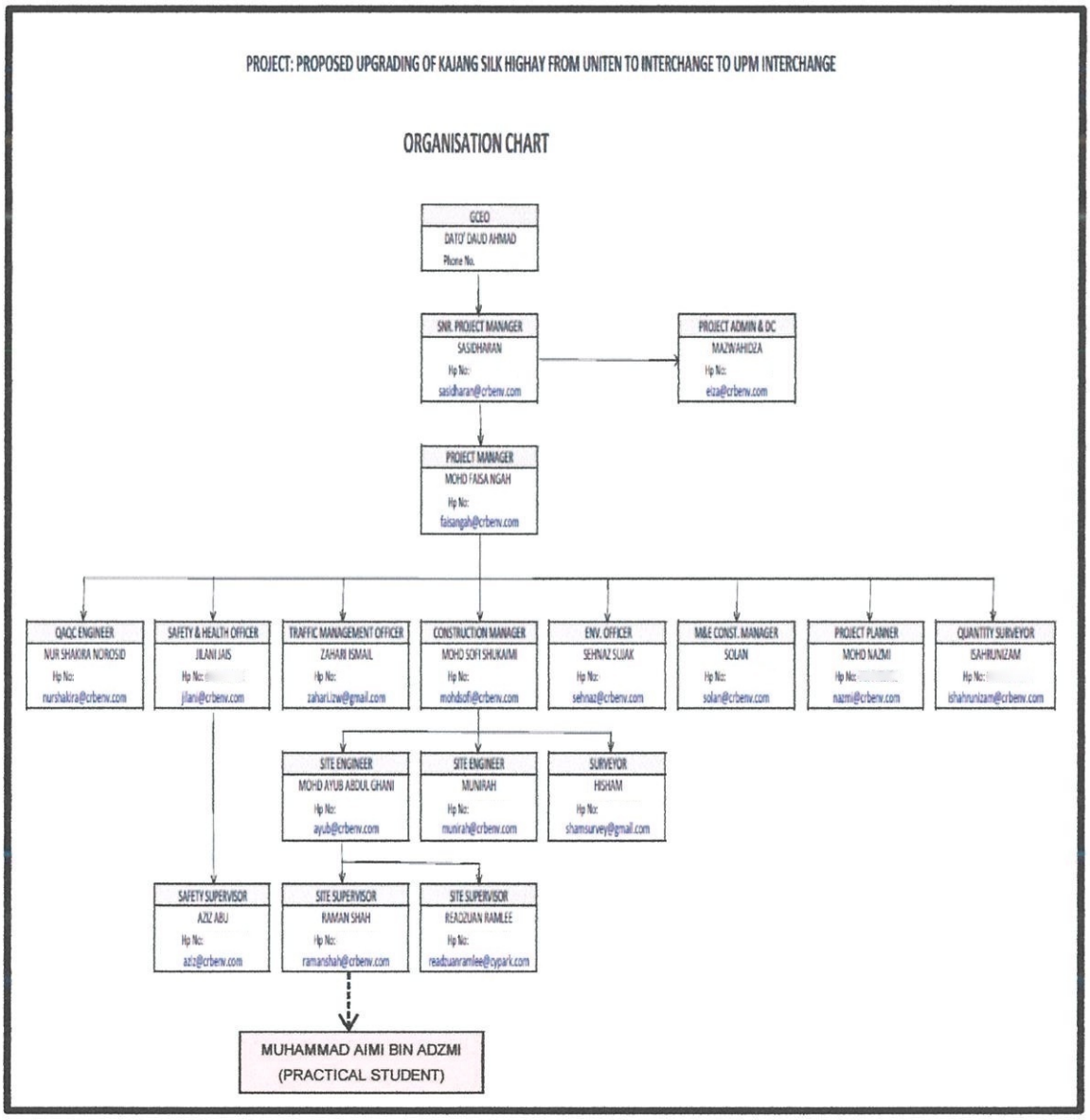


Figure 2.4: Cypark Resources Berhad Organization Chart

(Source: Cypark Resources Berhad, 2015)

2.5 List of Projects by Cypark Resource Berhad

Through my investigation, Cypark Resources Berhad has been completed many types of projects which is terrace house, infrastructure, landscape, landfill, treatment plant, building, and also renewable solar energy.

2.5.1 Completed Projects

Table below shows the completed project list by Cypark Resources Berhad. Most of the project had been done by Cypark Resources Berhad is landfill.

Table 2.5.1: Completed projects under Cypark Resources Berhad

No	Title	Location	Type
1.	 **Figure 2.5.1(i):** Resort Villas at Langkawi. Source: Cypark Resources Berhad (2015)	Four Seasons Hotel, Langkawi, Malaysia.	Landscape Works.
2.	 **Figure 2.5.1(ii):** National Landfill Restoration. (16 Landfill) Source: Cypark Resources Berhad	Batu Empat, Jalan Kluang, Kota Tinggi, Johor.	Landfill Works.

	(2015)		
3.	 **Figure 2.5.1(iii):** National Landfill Restoration. (16 Landfill) Source: Cypark Resources Berhad (2015)	Ladang Cep 1, Simpang Renggam, Johor.	Landfill Works.
4.	 **Figure 2.5.1(iv):** Double Storey Terrace Houses Source: Cypark Resources Berhad (2015)	Laman Kiara, Taman Air Biru, Pasir Gudang, Johor.	Double Storey Terrace House.
5.	 **Figure 2.5.1(v):** Bridge Project at Putrajaya Source: Cypark Resources Berhad (2015)	Putrajaya, Malaysia.	Infrastructure works.

6.	 **Figure 2.5.1(vi):** Leachate Treatment Plant Source: Cypark Resources Berhad (2015)	Taman Beringin, Kepong, Kuala Lumpur.	Treatment Plant.
7.	 **Figure 2.5.1(vii):** Taman Metropolitan Kepong Source: Cypark Resources Berhad (2015)	Kepong Urban Park, Kuala Lumpur.	Landscape Works.

2.5.2 Project in Progress

Table belows shows the current project list by Cypark Resources Berhad. Most of the current projects by Cypark Resources Berhad is renewable solar energy.

Table 2.5.2: Current projects under Cypark Resources Berhad

No	Title	Location	Type
1.	Proposed Construction and Completion of The Rectification and Desilting Works for Main Drains Lines.	Precinct 5, Precinct 18, Putrajaya.	Drainage works.
2.	8 MW Solar, 1 MW Biogas.	Pajam, Negeri Sembilan.	Renewable Energy.
3.	Proposed Construction and Completion of The Remaining Infrastructure Works. - Sub-Contractor	Precinct 11, Putrajaya.	Softscape and Walkways Works.
4.	2+1 MW Solar Farm (Phase 1), 2 MW Solar Farm (Phase 2)	Kuala Sawah, Negeri Sembilan.	Renewable Energy.
5.	Kuala Lumpur Convention Centre Soft and Hard Landscape works.	Kuala Lumpur, Wilayah Persekutuan.	Landscape Works.
6.	Construction of 116 Units of Terrace Houses Type Idaman Dahlia 2 & 3.	Taman Bukit Dahlia, Pasir Gudang, Johor.	Double Storey Terrace House.
7.	Construction of 61 Units of Terrace Houses.	Laman Kiara, Taman Air Biru, Pasir Gudang, Johor.	Terrace House.
8.	Construction of 64 Units of Terrace Houses Type Begonia	Neighbourhood 15, Bandar Dato'	Terrace House.

CHAPTER 3

CASE STUDY: CONSTRUCTION OF REINFORCED CONCRETE AND GABION RETAINING WALL FOR A PROPOSED OF UPGRADING KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

3.1 Introduction

Sistem Lingkaran Lebuhraya Kajang Sdn Bhd (SILK) being the concessionaires company and the owner of the highway had advertised in all main stream newspapers inviting qualify contractors having the CIDB license of G7 that is unlimited tender capacity to submit the details such as experiences, capacity, availability of recourses for tender pre-qualification exercise. Cypark Recourses Bhd (CYPARK) being the contractor having all the pre-requisite qualifications had submitted the tender pre-qualification documents to SILK for the pre-qualification and was selected as one of the contractors to be invited and participate in the tender.

Cypark had participate in the tender and after a series of interview, negotiations was successfully selected and appointed as the main contractor to execute the proposal for upgrading of SILK highway. The awarded provisional tender sum is 34 million with 18 months completion period. Inspection is the most crucial part before concreting work for installation of reinforced concrete retaining wall for engineer to determine and approve the structure is equivalent to engineering details. Thus, before digging knowledge further on the method of construction, initially, this report will explain in brief the inspection works carry out during the construction of both types of retaining wall.

3.2 Inspection Works for Retaining Wall Construction

Inspection works of reinforced concrete retaining wall and gabion wall can be classified into 3 categories:

3.2.1 Pre-Construction Consideration

Pre-construction of both reinforced concrete retaining wall and gabion retaining wall are very important to ensure that all the site preparation and materials to be used in the construction comply with the standard as specified in the tender specification, standard drawing and standard engineering practice as per JKR Arahan Teknik and Lembaga Lebuhraya Malaysia Guidelines. For both retaining wall and gabion wall, the followings are the items that need stringent inspection and approval:

i. The setting out for level and the alignment.

ii. The material used eg: reinforcement (size and type), material for formwork, size of the steel cage for gabion, rock or stone to be used to fill in the gabion cage, PVC pipe for weep holes, geotextile netting as the filter behind the weep holes.

iii. The base is well compacted and there is no loose material.

3.2.2 Inspection During Construction

Close supervision and inspection during construction is very important to ensure that both retaining wall and gabion wall are constructed according to the required specifications and standard. The followings are the inspection required:

i. The arrangement of the steel reinforcement bars is as per the detail design approved by the designer.

ii. The formworks are properly installed and there is no gap between the formworks.

iii. To check the docket or delivery order of the concrete to ensure that the concrete grade is as per the designer requirements.

iv. To do the slump test for the concrete.

v. To prepare the concrete cube for testing the strength of the concrete (crush test) after 7 days and 14 days.

vi. To make sure that the concrete is being poured into the formwork at reasonable height to avoid segregation of the aggregate and to make sure the concrete is properly compacted by using the vibrator.

vii. To check the interlocking between gabion cage.

viii. To ensure that any backfilling behind these walls are only to be done after 7 days i.e. after the concrete properly cure.

3.2.3 Inspection at Post Construction

Post construction inspection is the activity to ensure that the completed retaining walls and gabion walls are well constructed without any defects.

i. To check the surface of the retaining walls free from honeycomb. Honeycomb was formed due to concrete was not well compacted or segregation take place during concreting process or the concrete already harden when pour into the formwork. If this occurs then the Resident Engineer shall inspect and if he is in the opinion that the wall was not constructed properly then the Resident Engineer may instruct the contractor to do the non-destructive test to check on the strength of the wall. The wall needs to be demolished and reconstruct if the non-destructive test proof that the strength of the wall was not as per designer requirement.

ii. For the gabion wall, the inspection is more to check to ensure that the stone or rock that has been placed inside the gabion cage did not cause the cage bulging.

3.4 Background of Case Study Project

SILK is required to upgrade part of existing SILK Highway. The upgrading works from UNITEN interchange to UPM interchange from two (2) lanes dual carriageway to three (3) lanes dual carriageway is the requirement of the concessionaire company after achieving seven years operation anniversary or when the level of service (LOS) had reach LOS C or the Average Daily traffic more than 50,000, whichever to achieve first. The total length of the highway required to be upgrade is 1.2 km. The completion period is 18 months.

The appointed design and supervising consultant is ARSEA Consulting Engineers Sdn Bhd. As the project is Private Partnership Project (PPP), the authority overseeing the overall implementation is Malaysia Highway Authority (MHA).

3.4.1 Project Location

Cypark Resources Berhad doing project of Upgrading of Silk Highway from UNITEN Interchange to UPM Interchange. The following Figure shows the location of the project:

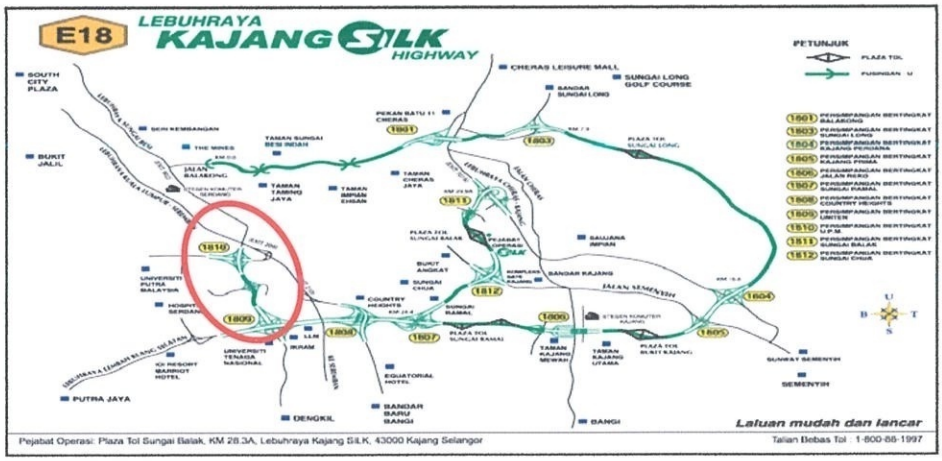


Figure 3.4.1: Cypark Resources Berhad Project Location

(Source: Cypark Resources Berhad, 2015)

3.4.2 Works Breakdown by Section

Cypark Resources Berhad have break down the works into two (2) major sections. Works in these 2 major sections will run concurrently. One separate team concentrating in each of two sections as shown below:

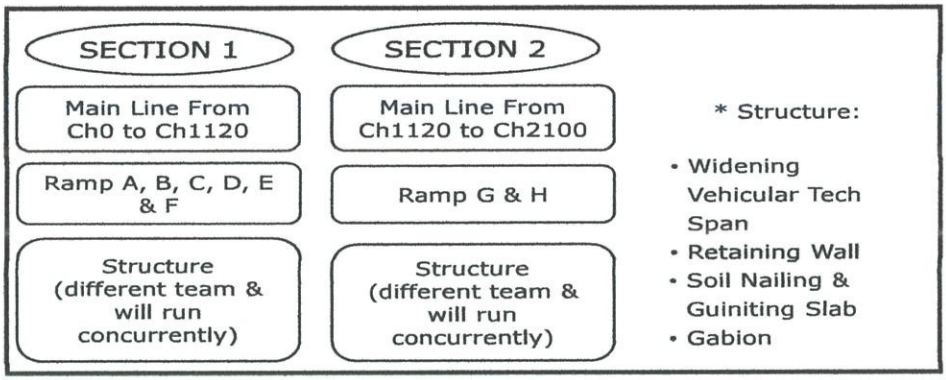


Figure 3.4.2: Cypark Resources Berhad Work Breakdown by Section

(Source: Cypark Resources Berhad, 2015)

3.4.3 Sequence of Work

Below is the work sequence by Cypark Resources Berhad for project Upgrading of Kajang Silk Highway from UNITEN to UPM interchange:

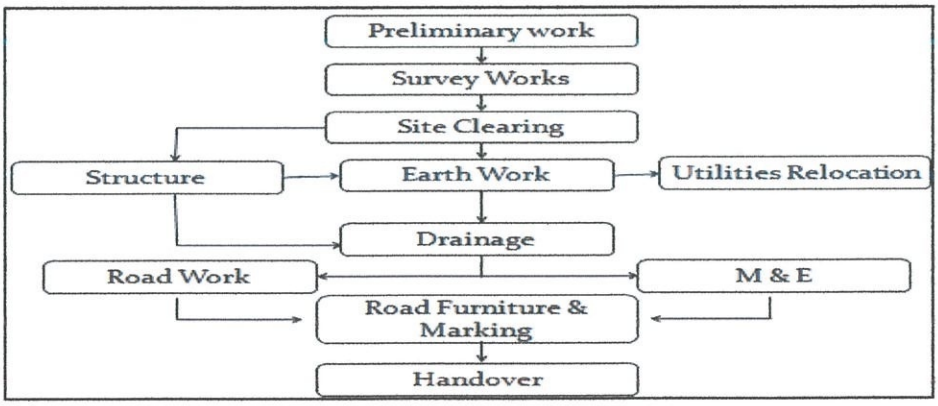


Figure 3.4.3: Cypark Resources Berhad Sequence of Work

(Source: Cypark Resources Berhad, 2015)

3.4.4 Typical Section of the Highway

Below is the typical section by Cypark Resources Berhad for cutting slope:

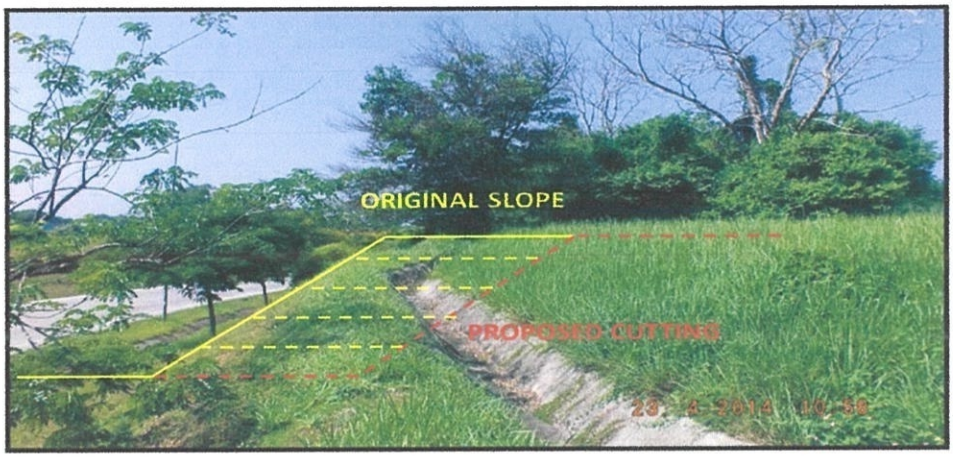


Figure 3.4.4: Cypark Resources Berhad Typical Section of The Highway

(Source: Cypark Resources Berhad, 2015)

3.5 Methods of Construction For Reinforced Concrete And Gabion Walls In The Upgrading Project Of Kajang Silk Highway From UNITEN Interchange To UPM Interchange

During my practical training, I will focus on 2 scopes of work at site which is the construction of reinforced concrete retaining wall and gabion retaining wall.

3.5.1 Reinforced Concrete Retaining Wall

Reinforced concrete retaining walls are structures that are constructed to support almost vertical (steeper than 70 degrees) or vertical slopes of earth masses. All reinforced concrete retaining walls over 5 feet in height shall be professionally design by qualified engineer using the standard and acceptable engineering practice. Reinforced concrete retaining walls are often used near the toe of cut or fill slopes, so that the flatter slopes can be constructed to prevent and to minimize slope erosion or failure due to slip circle. They can be also used to keep a toe of the slope from encroaching into a wetland or into a stream and prevent undercutting of the toe by water.

In general, the main purpose for these walls is to maintain a difference in elevation of the ground surface on each side of the wall by providing provide lateral support for a mass of earth or other material that is at a higher elevation behind the wall than the earth or other material in front of the wall.

Reinforced concrete and reinforced masonry walls on spread foundations are gravity structures in which the stability against overturning is provided by the weight of the wall and reinforcement bars in the wall. The following are the main types of wall:

i) Concrete Cantilever retaining wall

A cantilever retaining wall is one that consists of a wall which is connected to foundation. A cantilever wall holds back a significant amount of soil, so it must be well engineered. They are the most common type used as retaining walls. Cantilever wall rest on a slab foundation. This slab foundation is also loaded by back-fill and

thus the weight of the back-fill and surcharge also stabilizes the wall against overturning and sliding.

ii) Counter-fort / Buttressed retaining wall

Counterfort walls are cantilever walls strengthened with counter forts monolithic with the back of the wall slab and base slab. The counter-forts act as tension stiffeners and connect the wall slab and the base to reduce the bending and shearing stresses. To reduce the bending moments in vertical walls of great height, counterforts are used, spaced at distances from each other equal to or slightly larger than one-half of the height Counter forts are used for high walls with heights greater than 8 to 12 m. (http://www.aboutcivil.org/retaining-wall)

3.5.2 Gabion Retaining Wall

Gabion walls are single or multiple celled rectangular wire mesh baskets that are fill with rocks and wired together to form retaining structure. Gabions can be used as retaining walls to mechanically stabilize slopes and area particularly used when the seepage is anticipated.

Similar to the reinforced concrete retaining wall, the main purpose for these walls is also to maintain a difference in elevation of the ground surface on each side of the wall by providing provide lateral support for a mass of earth or other material that is at a higher elevation behind the wall than the earth or other material in front of the wall. Gabions have the advantage that they can be constructed in various height, size and shapes. The design procedure for gabion walls is similar to that for gravity walls. During their design, as a rule of thumb (Datta, 1986), the bottom width of a gabion wall is kept equal to $2/3^{rd}$ height of the wall, which tapers off upward. Under the no surcharge condition, though the width of the wall is reduced stepwise, the top width is recommended to be kept more than 1m and when there is a surcharge condition, then a top width of at least 2m be provided. Under no circumstances, the bottom and top widths be kept less tan 1m, otherwise it would jeopardize the safety of the structure. It is also recommend that the bottom width be kept in multiples onf 1m, so as to make x use of the standard box sizes. Sometimes, the walls are also provided with stair steps, up to $1/3^{rd}$ the box width for each metre of height of the wall.

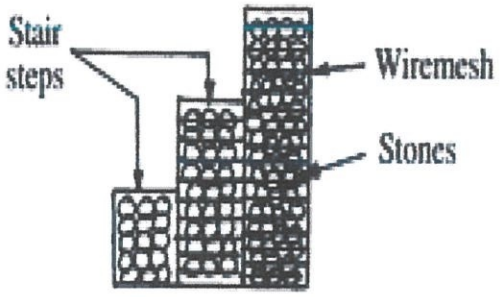


Figure 3.5.2: Gabion Retaining Wall with Stair Steps

(DAS, 2011)

3.6 Method Statement

Method statement is a detail document which elaborates the construction work from start until completed. Below shows the method statement of two types of retaining wall which is reinforced concrete retaining wall and gabion retaining wall:

3.6.1 Reinforced Concrete Retaining Wall

Table 3.6.1: Method Statement of Reinforced Concrete Retaining Wall

No	Operation	Method	Labor	Machineries	Duration
1.	Setting out	- Peg the alignment of the reinforced concrete retaining wall. - Peg the level of base reinforced concrete retaining wall. - Probe Mackintosh Test needs to do to know the type of soil and also to ensure whether the soil can carry the load or not.	- 1 Surveyor with 2 chairman	- Total station - Tripod - Prism - Mini prism - Pole	1 days operation

2.	Open excavation  **Photo 3.6.1 (i):** Excavation Work for Base Reinforced Concrete Retaining Wall.	- The level of excavation for base reinforced concrete retaining wall shall be monitored constantly during this process. - Depth for base of reinforced concrete retaining wall is 500mm. - Rain water or surface run off shall be pumped out from excavated area to avoid ponding. - Photo 3.6.1(i) shows excavation work at zone 4 (LHS).		- 1 Hydraulic excavator	1 days operation (30-40m) per day
3.	Inspection by Consultant	- Site Supervisor or Engineer must fill in the form Request For Inspection (RFI) before Consultant doing Inspection at site. - Resident Engineer or Clerk of Work will check the level at site. - To check the level of base reinforced concrete retaining wall.	- Resident Engineer - Clerk of Work		

4.	Laying Crusher Run  **Photo 3.6.1 (ii):** Laying Crusher Run for Base	- After consultant approve the level, laying the crusher run on the base of reinforced concrete retaining wall based on the alignment and level given by surveyor. - 150mm thick - Normally 20m per day - Photo 3.6.1 (ii) shows laying crusher run for base reinforced concrete retaining wall at zone 4 (LHS)		- 1 Backhoe - 1 Compactor (24 tonne)	1 days operation (20m-30m) per day

5.	Lean Concrete  **Photo 3.6.1 (iii):** Laying Lean Concrete	- Lean concrete the base of reinforced concrete retaining wall based on the alignment and level given by surveyor. - 50 mm thick - Grade 15 - Normally 20m per day - Photo 3.6.1 (iii) shows laying lean concrete for base at Zone 4 (LHS)	- 7-8 Labor	- 1 Backhoe	1 days operation (20-30m) per day
6.	Installation of Rebar  **Photo 3.6.1 (iv):** Installation of	- Installation of rebar for base - Using T10 and T16 - Insert spacer block (50mm) below the rebar to make sure the rebar in place and become the permanent part of structure after concreting work. -Thickness of the base is 300mm - Length of base is 2300mm - Photo 3.6.1 (iv) shows the	- 7-8 Labor		1 days operation (20m-30m) per day

	Rebar for Base.  **Photo 3.6.1 (v):** Insert Spacer Block for Rebar.  **Photo 3.6.1 (vi):** Insert U Spacer at Rebar.	installation of rebar at zone 4 (LHS). - Photo 3.6.1 (v) shows the location of spacer block during installation of rebar. - For type of joint rebar and size of rebar used, refer appendix D. - For detail drawing installation of rebar, refer to appendix B. - Photo 3.6.1 (vi) shows works of insert U spacer at rebar. This is to maintain rebar in position from move when concreting work.			

7.	Installation of Formwork  **Photo 3.6.1 (vii):** Installation of Formwork for Concreting Work.	- Formwork function is to make the concrete stay in the shape after concreting work done. - Using thyroid to fix the formwork with the rebar. - Photo 3.6.1 (vii) shows installation of formwork for concreting work for base. Function formwork is to make sure the concrete follow	- 7-8 Labor		1 days operation (20m-30m) per day
8.	Inspection by Consultant	- Resident Engineer or Clerk of Work will check the installation of rebar and also the formwork before start the concreting work for base reinforced concrete retaining wall.			
9.	Concreting Work	- Concrete of base slab of reinforced concrete retaining wall. - Before concreting work, there are 2 test to know whether the concrete can use or not in site which is Cube	- 8-10 Labor	- 1 Vibrating Poker - 1 Backhoe - Cement Lorry	1 days operation (20m-30m) per day

	 **Photo 3.6.1 (viii):** Concreting Work for Base.	test and Slump test. - For specification of Slump test and Cube test by JKR, refer to appendix F and G. - Grade 30 - Normally 20m3 of concrete ordered by Site Engineer. - For every concreting work must have vibrating poker to ensure that a pour is even and free of air bubbles so that the concrete remain strong and have smoo0th finish even after the formwork is removed. - Photo 3.6.1 (viii) shows concreting work for base reinforced concrete retaining wall.			

10.	Setting Out	- Setting out for center line wall of reinforced concrete retaining wall.	- 1 Surveyor with 2 chairman	- Total station - Tripod - Prism - Mini prism - Pole	1 days operation
11.	Installation of Rebar  **Photo 3.6.1 (ix):** Installation of Rebar for Wall.	- Installation of rebar for wall of reinforced concrete retaining wall. - Using T16 and T10 -Using T12 for front wall of reinforced concrete retaining wall extend. - Insert spacer block (50mm) below the rebar to make sure the rebar in place and become the permanent part of structure after concreting work - Height of wall of reinforced concrete retaining used in this site is 2200mm and the maximum of height	- 7-8 Labor		1 days operation (20m-30m) per day

		is 2500mm. - Thickness of the wall is 250mm - Insert Hirip to joint another 20m wall. - Photo 3.6.1 (ix) shows the installation of rebar for wall reinforced concrete retaining wall. - For detail installation of wall, refer to appendix B.			
12.	Installation of PVC pipe  **Photo 3.6.1 (x):** Installation of PVC Pipe.	- Size of pipe 2 inch. - To flow out the water from top level. - Photo 3.6.1 (x) shows the installation of PVC pipe at wall of reinforced concrete retaining wall. - For detail installation of PVC pipe, refer to appendix B.	- 7-8 Labor		1 days operation (20m-30m) per day

13.	Installation of Formwork  **Photo 3.6.1 (xi):** Installation of Formwork.	- Formwork function is to make the concrete stay in the shape after concreting work done. - Using thyroid to make the formwork stick with the rebar. - Photo 3.6.1 (xi) shows the installation of formwork for wall of reinforced concrete retaining wall.	- 7-8 Labor		1 days operation (20m-30m) per day

14.	Inspection by Consultant  **Photo 3.6.1 (xii):** Inspection by Consultant	- Resident Engineer or Clerk of Work will check the installation of rebar and also the formwork before start the concreting work for base reinforced concrete retaining wall. - Photo 3.6.1 (xii) shows inspection by consultant which is involved site engineer, site engineer, clerk of work, and resident engineer. - For example of request for inspection form, refer to appendix E.	- Resident Engineer - Clerk of Work		
15.	Concreting Work for Wall	- Concrete wall of reinforced concrete retaining wall. - Before concreting work, there are 2 test to know whether the concrete can use or not in site which is Cube test and Slump test. - For specification of Slump test and	- 8-10 Labor	- 1 Vibrating Poker - 1 Mobile Crane - Cement Lorry	1 days operation (20m-30m) per day

	 **Photo 3.6.1 (xiii):** Concreting Work for Wall.	Cube test by JKR, refer to appendix F and G. -Grade 30. - Normally 20m3 of concrete ordered by Site Engineer - For every concreting work must have vibrating poker to ensure that a pour is even and free of air bubbles so that the concrete remain strong and have smoo0th finish even after the formwork is removed. - Photo 3.6.1 (xiii) shows concreting work for wall using crane bucket at zone $ (LHS).			

3.4.2 Gabion Retaining Wall

Table 3.4.2: Method Statement of Gabion Retaining Wall

No	Operation	Method	Labor	Machineries	Duration
1.	Setting out	- Peg for level base of gabion retaining wall. - Peg for alignment base of gabion retaining wall. - Probe Mackintosh Test also need to do to know the type of soil and also to ensure whether the soil can carry the load or not.	- 1 Surveyor with 2 chairman	- Total Station - Tripod - Prism - Mini Prism - Pole	1 days operation
2.	Inspection by Consultant	- Resident Engineer or Clerk of Work will go to site to check the alignment and level of base gabion which is can stop the slope from landslide.	- Resident Engineer - Clerk of Work		1 days operation

3.	Excavation Works  **Photo 3.6.2 (i):** Excavation Works.	- After consultant give the permission, excavation work can start. - The level base of gabion retaining wall needs to stable before installation of gabion. - Depth of the gabion retaining wall is 3m. - The gradient for base gabion retaining wall is 1:6 - Photo 3.6.2 (i) shows excavation works for base of gabion retaining wall. - For detail of base gabion retaining wall, refer appendix C.	- 1 Backhoe	- 2 Labor	1 days operation (30m-40m)

4.	Compaction Work  **Photo 3.6.2 (ii):** Compaction Work	- Compact the base of gabion retaining wall after excavation because the base of gabion retaining wall must be stable to stop the slope from landslide. - Photo 3.6.2 (ii) shows compaction work for base gabion retaining wall.	- 2 Labor	- 1 Baby Roller (1tonne) - 1 Backhoe	1 days operation (20m-30m) per day
5.	Laying Geotextile  **Photo 3.6.2 (iii):** Laying Geotextile	- Type of geotextile used in this site is Non-woven. - Size of geotextile is 6m x 9m. - Photo 3.6.2 (iii) shows laying geotextile works for base of gabion retaining wall. - For detail of geotextile and how installation of geotextile, refer to appendix C.	- 4-5 Labor		1 days operation (20m-30m) per day

6.	Installation of Gabion Cage  **Photo 3.6.2 (iv):** Installation of Gabion Cage.  **Photo 3.6.2 (v):** Position of Gabion Cage.	- Size of the gabion cage on the top is different with the base which is for top 1m x 1m x 1m and base is 1m x 1m x 0.5m - The gabion cage comes in pallet and the workers need to install the cage one by one. - The workers must make sure that the alignment of the gabion cage straight depends on the slope. - Photo 3.6.2 (iv) shows the installation of gabion cage at site. The gabion cage come in pallets from supplier. - Photo 3.6.2 (v) shows position of gabion cage. - For size of gabion cage, refer to appendix C.	- 5-6 Labor		1 days operation (20m-30m) per day

7.	Rock fill Works  **Photo 3.6.2 (vi):** Shifting Rock  **Photo 3.6.2 (vii):** Rock Fill Works	- Transferring rock using backhoe. - For base gabion retaining wall, the workers need to choose the same size of rocks to make the base stable and strong to support from landslide. - Photo 3.6.2 (vi) shows shifting rock to place of gabion retaining wall using backhoe. - Photo 3.6.2 (vii) shows rock fill works for gabion retaining wall at zone 5 (RHS). - For size and position of rock in gabion cage, refer appendix C.	- 6-7 Labor	- 1 Backhoe	1 days operation (20m-30m) per day

8.	Laying Geotextile  **Photo 3.6.2 (viii):** Laying Geotextile	- After rock fill works done, laying geotextile again on gabion retaining wall cage to protect from unsuitable material that can make landslide happen. - Photos 3.6.2 (viii) shows laying geotextile works to cover the top of gabion retaining wall from the top soil.	- 4-5 Labor		1 days operation

CHAPTER 4

CONCLUSION

In conclusion, proper designing, construction and close supervision of reinforced concrete retaining walls and gabion walls are very important in the highway construction. Cutting corner or not paying attention to details, specifications is to be avoided as normally slope failure cause by failure of retaining walls or gabion walls resulted catastrophic risk to safety of highway user and the vehicles using the highway.

Corrective maintenance or repairing works whenever there is slope failure normally required high cost and affecting the comfort and safety of the highway user. In some cases, the highway needs to either partially close or total closure during repairing the slope failure. When this problem occurs it will affects the highway connectivity and indirectly affecting transportation system. These domino effects will not only affecting the highway operator but also getting worst if affecting the safety of nearest public. Inspection is very crucial and important on every structure before casting processed.

4.1 RECOMMENDATION

Based on the above rationale and explanation, it is recommended that all COW involves in this construction activity to be properly trained and certify. Certificate or card similar CIDB Green card to be issue by government agencies or any training agencies or higher institution approved by government as evidence that COW are competent and train. Enforcement by government agencies such as CIDB, JKR and relevant institutions such as Institute of Engineers Association which was given the authority is to be done more regularly. Any breach of this requirement by the companies or contractors, hefty fine to be imposed and for repeated offender the construction license is to be suspended or revoke.

To ensure consistency, authorized agencies such as JKR, CIDB or IEM have to prepare a standard checklist and to be used by all COW during inspection and supervision of all projects or works which involve construction of reinforced walls. These forms will be treated as the quality record and to keep by the client until the design life of the structure expire. These forms will be used during investigation in the event that the slope or embankment strengthening with either reinforced concrete retaining walls or gabion walls has failed. If based on the investigation, it is proven that the supervision was not done according to the required SOP then action can be taken against the COW. By having this procedure or requirement in place, all COW involving in construction of these walls will perform their duty and responsibility diligently without cutting corner. This will minimize disaster that will potentially lead to loss of live, damaged to the asset.

REFERENCES

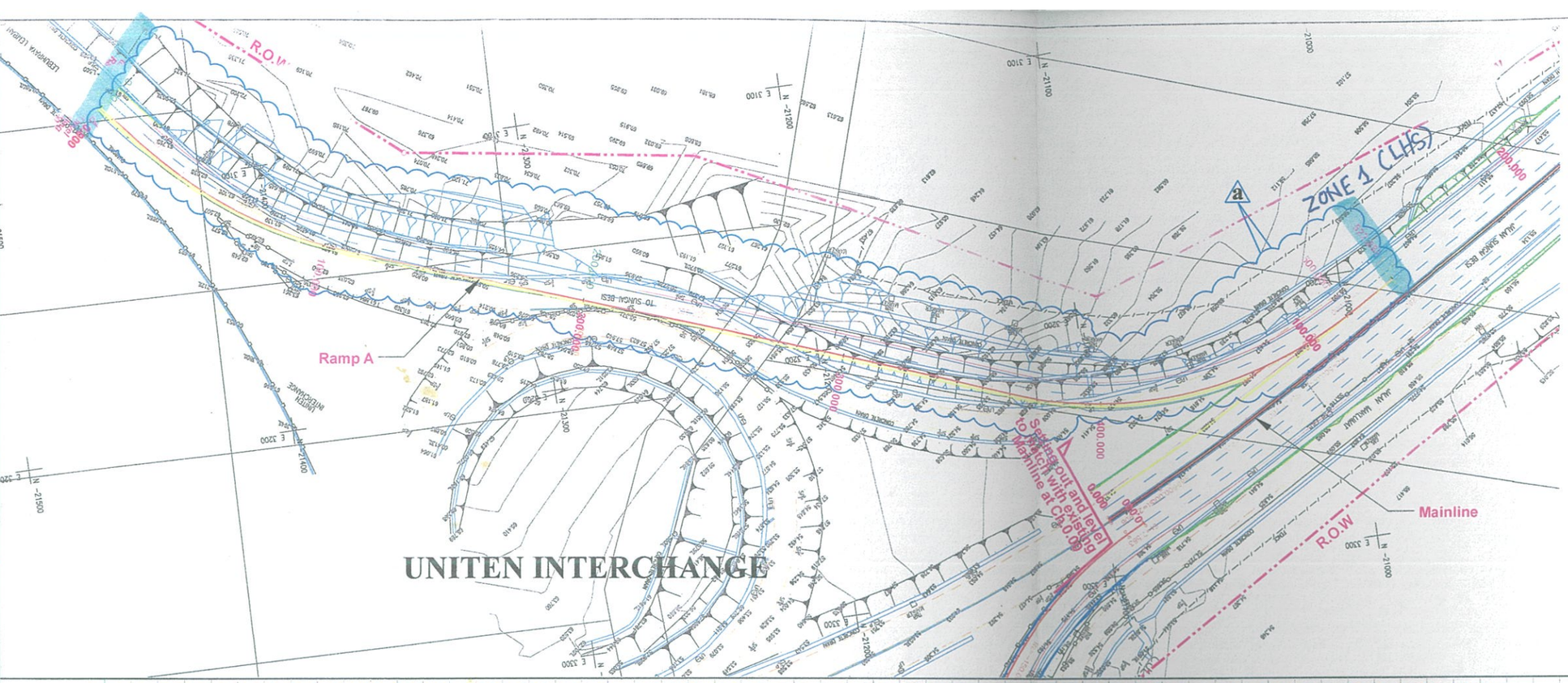
DAS, G. (2009). Hydrology and Soil Conservation Engineering: Including Watershed Management. New Delhi: Asoke K. Ghosh.

Concrete Slump Test. (2014). Available from: http://www.aboutcivil.org.

Tests Conducted To Check Quality Of Concrete. (2015). Available from: http://www.engineeringcivil.com.

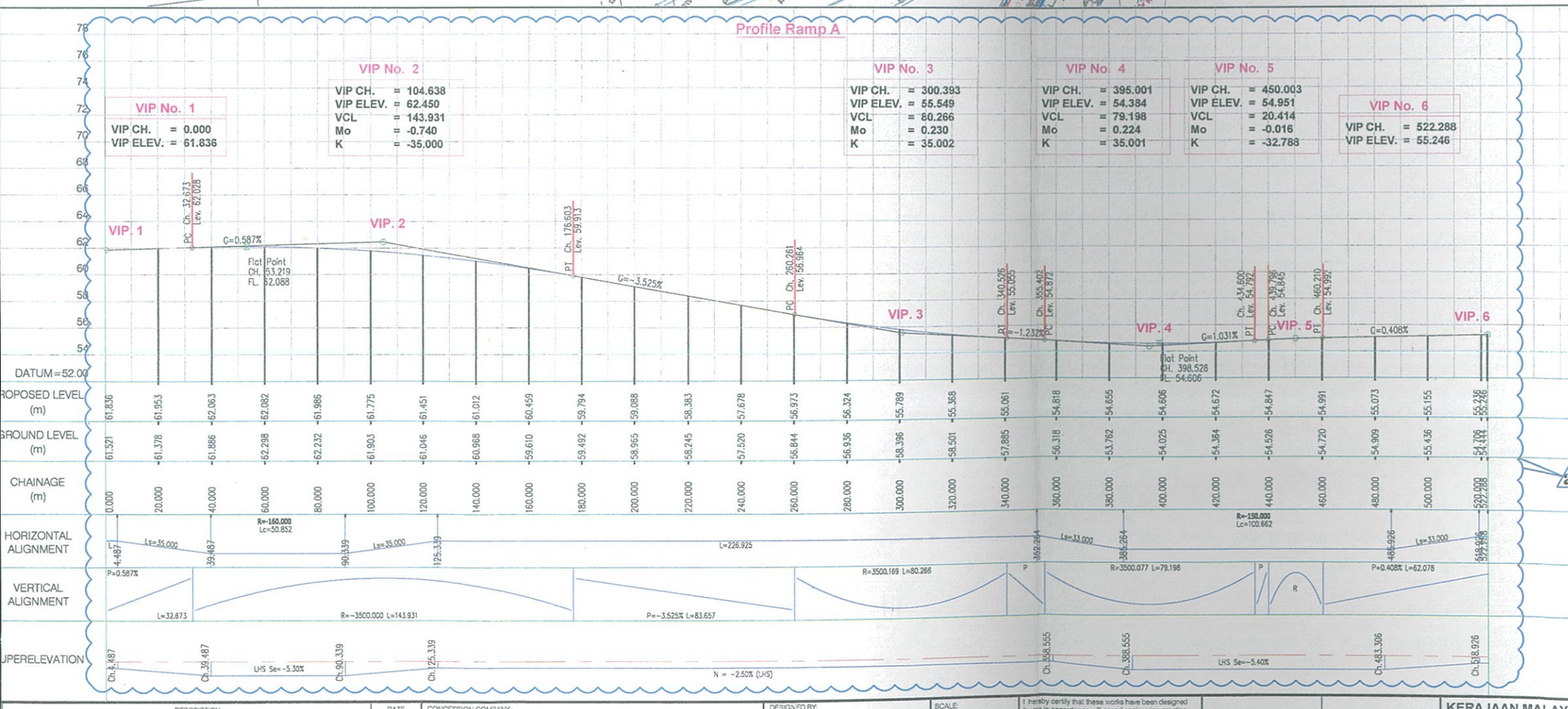
Company Profile. (2015). Available from: http://www.crbenv.com

APPENDIX A



NOTE :

1. Coordinates in Cassini.
2. IP coordinates for Easting and Northing values have been added with 100000
3. Limit of Works for Access Road is up to the R.O.W



DESCRIPTION	DATE
Omission of IOI ramp as per instructed by SILK in April 2014.	22-04-2014
Length of spiral revised from 30m to 33m as required by road safety auditor in RSA Stage 3. Ch. 360.000 to end chainage revised.	27-05-2014

CONCESSION COMPANY:
SILK
SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD. (371228-H)
Plaza Tol Sungai Balok, KM 28.3A, Lebuhraya Kajang SILK, 43000 Kajang, Selangor Darul Ehsan. Tel: 03-8921 0000 Fax: 03 - 8921 0001

PROJECT CONSULTANT:
ARSEA CONSULTING ENGINEERS SDN. BHD. (333114-U)
No.40, 1st-3rd. Floor, Jln. Wangsa Satria 3, Wangsa Melawati, 53300 K. Lumpur, M'SIA
Tel: 03-4143 4923 Fax: 03-4143 4922
URL : www.arseagroup.com

DESIGNED BY: NIK MOHD ADID
DRAWN BY: SAADIAH
CHECKED BY: DZULKIFLE SULONG
APPROVED BY: Ir. JAFLUS ABDUL JALIL

SCALE: H = 1:1000 V = 1:200
DATE: December 2013

I hereby certify that these works have been designed by me in accordance will sound engineering practice and that I take full responsibility for the design and proper performance of the same.

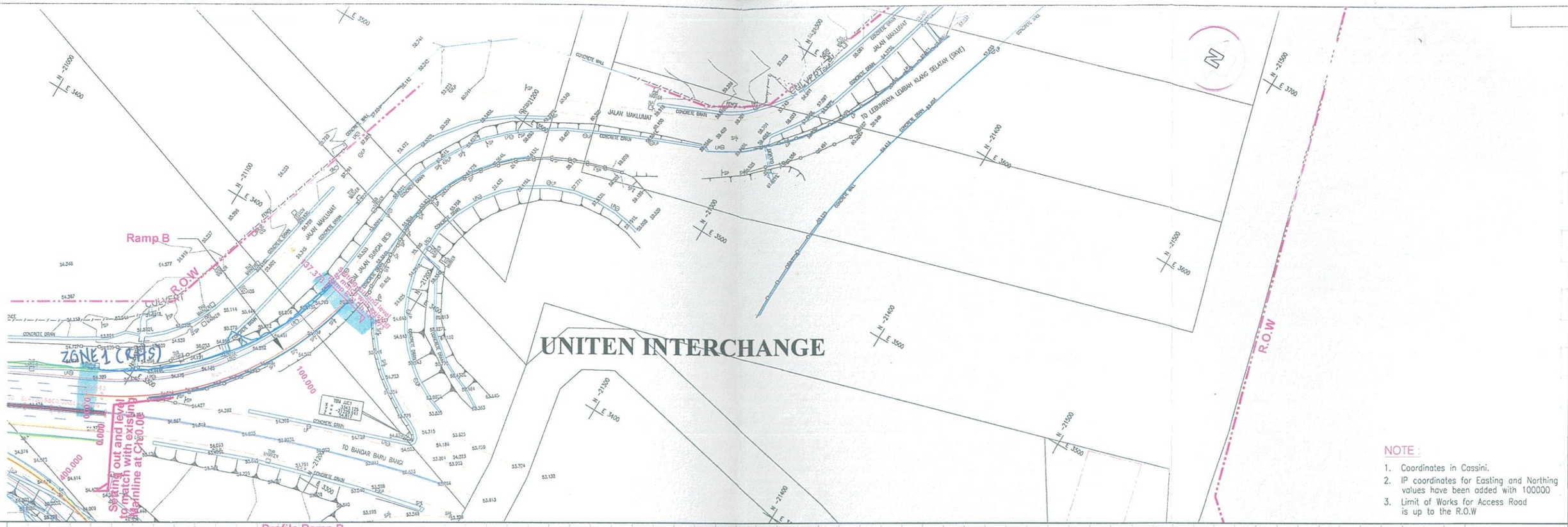
(ARSEA CONSULTING ENGINEERS SDN. BHD) | (SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD.) | (KETUA PENGARAH LEMBAGA LEBUHRAYA MALAYSIA)

KERAJAAN MALAYSIA
LEMBAGA LEBUHRAYA MALAYSIA

UPGRADING OF KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

DRAWING TITLE:
PLAN AND PROFILE RAMP A - FROM CH. 0.00 TO CH. 515.906

DRAWING NO: C/SILK/CW/EX/PP/04
REV: a

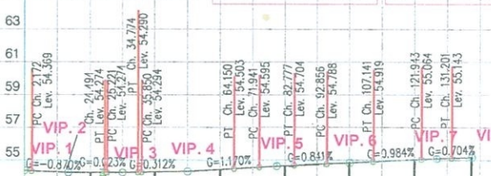


NOTE :

1. Coordinates in Cassini.
2. IP coordinates for Easting and Northing values have been added with 100000
3. Limit of Works for Access Road is up to the R.O.W

Profile Ramp B

VIP No. 1	VIP No. 2	VIP No. 3	VIP No. 4	VIP No. 5	VIP No. 6	VIP No. 7	VIP No. 8
VIP CH. = 0.000	VIP CH. = 13.333	VIP CH. = 29.998	VIP CH. = 50.000	VIP CH. = 77.359	VIP CH. = 99.998	VIP CH. = 126.572	VIP CH. = 137.373
VIP ELEV. = 54.388	VIP ELEV. = 54.272	VIP ELEV. = 54.276	VIP ELEV. = 54.338	VIP ELEV. = 54.658	VIP ELEV. = 54.848	VIP ELEV. = 55.110	VIP ELEV. = 55.186
	VCL = 22.322	VCL = 9.553	VCL = 28.299	VCL = 10.836	VCL = 14.286	VCL = 9.258	
	Mo = 0.025	Mo = 0.003	Mo = 0.030	Mo = -0.004	Mo = 0.003	Mo = -0.003	
	K = 25.000	K = 32.999	K = 33.000	K = -33.000	K = 100.000	K = -33.000	



DATUM=53.00								
PROPOSED LEVEL (m)	54.388	54.277	54.309	54.458	54.679	54.851	55.045	55.186
GROUND LEVEL (m)	54.430	54.311	54.481	54.552	48.374	54.854	54.973	55.186
CHAINAGE (m)	0.000	20.000	40.000	60.000	80.000	100.000	120.000	137.373
HORIZONTAL ALIGNMENT	0.000	7.563	R=150.000 Lc=129.454				137.017	137.373
VERTICAL ALIGNMENT	P	R=2499.997 L=22.322	R P	R=3300.025 L=28.299	P R P	R P	R P	R P
SUPERELEVATION	Ch.0.000	Ch.7.563	LHS Se=-5.30%				Ch.137.017	Ch.137.373

DESCRIPTION	DATE

CONCESSION COMPANY:
SILK
SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD. (913218-V)
Plaza Tol Sungai Balak, KM 28.3A, Lebuhraya Kajang SILK, 43000 Kajang, Selangor Darul Ehsan.
Tel: Fax: 03 - 8921 0001

PROJECT CONSULTANT:
ARSEA CONSULTING
ARSEA CONSULTING ENGINEERS SDN. BHD. (333114-U)
No.40, 1st-3rd. Floor, Jln. Wangsa Satia 5, Wangsa Melawati, 53300 K. Lumpur, M'SIA
Tel: Fax: 03-4143 4922
URL : www.arseagroup.com

DESIGNED BY: NIK MOHD ADID
DRAWN BY: SAADIAH
CHECKED BY: DZULKIFLE SULONG
APPROVED BY: Ir. JAFLUS ABDUL JALIL

SCALE: H = 1:1000 V = 1:200
DATE: December 2013

I hereby certify that these works have been designed by me in accordance will sound engineering practice and that I take full responsibility for the design and proper performance of the same.

(ARSEA CONSULTING ENGINEERS SDN. BHD.)

(SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD.)

(KETUA PENGARAH LEMBAGA LEBUHRAYA MALAYSIA)

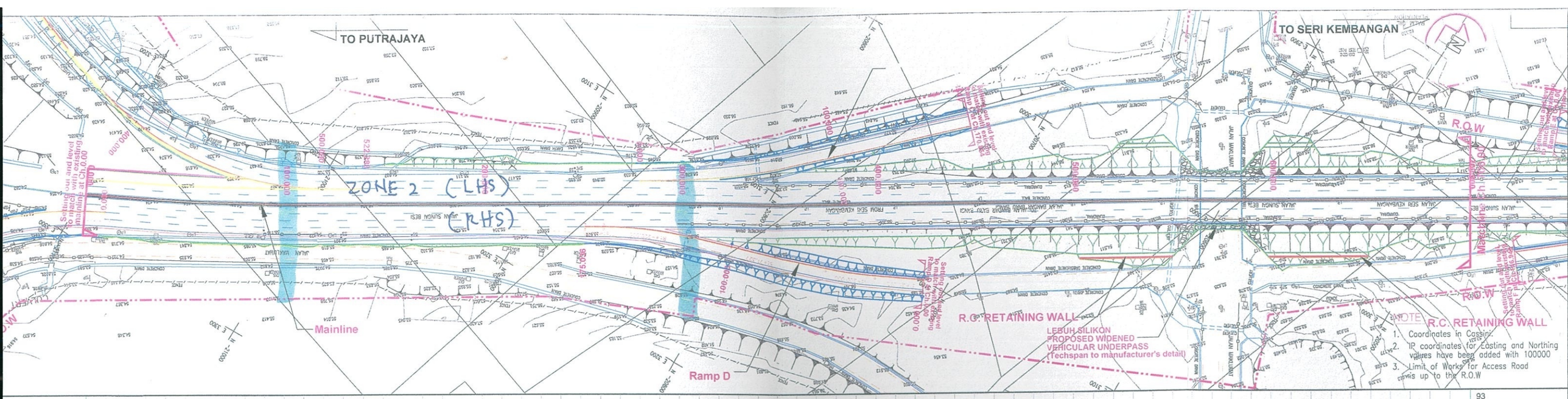
KERAJAAN MALAYSIA
LEMBAGA LEBUHRAYA MALAYSIA

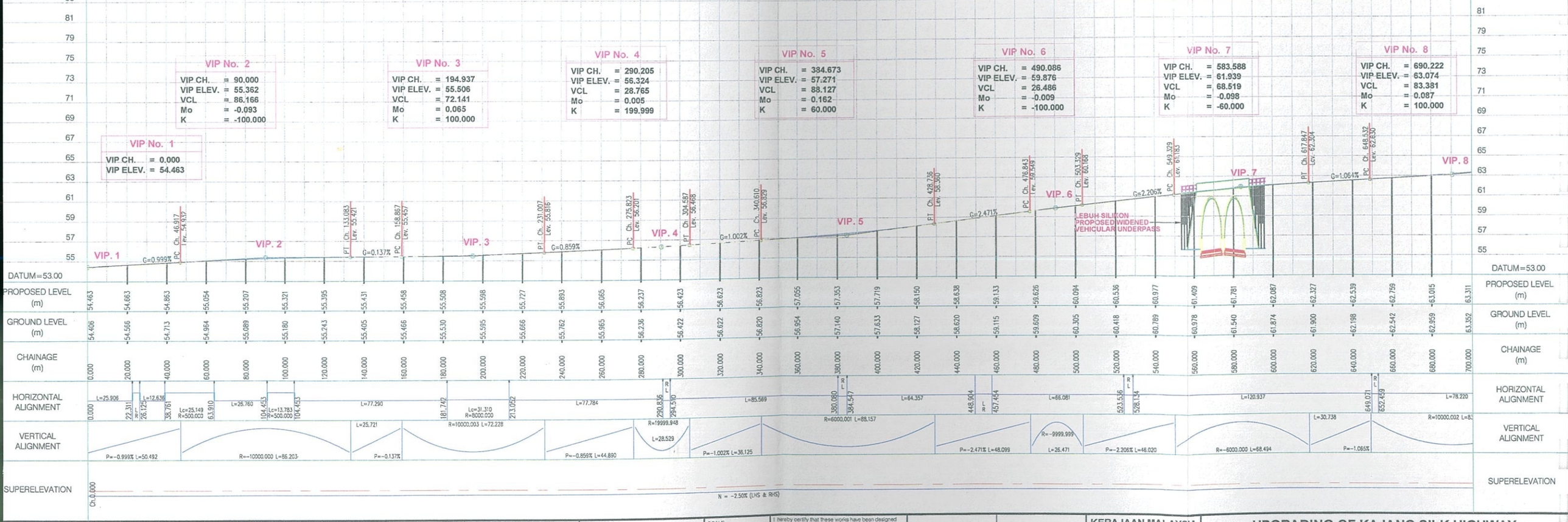
UPGRADING OF KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

DRAWING TITLE:
PLAN AND PROFILE RAMP B - FROM CH.0.00 TO CH.137.373

DRAWING NO: C/SILK/CW/EX/PP/05

REV:





DESCRIPTION	DATE

CONCESSION COMPANY:
SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD. (372128-K)
Plaza Tol Sungai Bekok, KM 28.3A, Lebuhraya Kajang SILK, 43000 Kajang, Selangor Darul Ehsan
Tel: Fax: 03 – 8921 0001

PROJECT CONSULTANT:
ARSEA CONSULTING ENGINEERS SDN. BHD. (333114-U)
No.40, 1st-3rd. Floor, Jln. Wangsa Satu 3, Wangsa Melawati, 53300 K. Lumpur, M'SIA.
Tel: Fax: 03-4143 4922
URL : www.arseagroup.com

DESIGNED BY: NIK MOHD ADID
DRAWN BY: SAADIAH
CHECKED BY: DZULKIFLE SULONG
APPROVED BY: Ir. JAFLUS ABDUL JAUL

SCALE: H = 1:1000, V = 1:200
DATE: December 2013

I hereby certify that these works have been designed by me in accordance will sound engineering practice and that I take full responsibility for the design and proper performance of the same.

(ARSEA CONSULTING ENGINEERS SDN. BHD)

(SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD.)

(KETUA PENGARAH LEMBAGA LEBUHRAYA MALAYSIA)

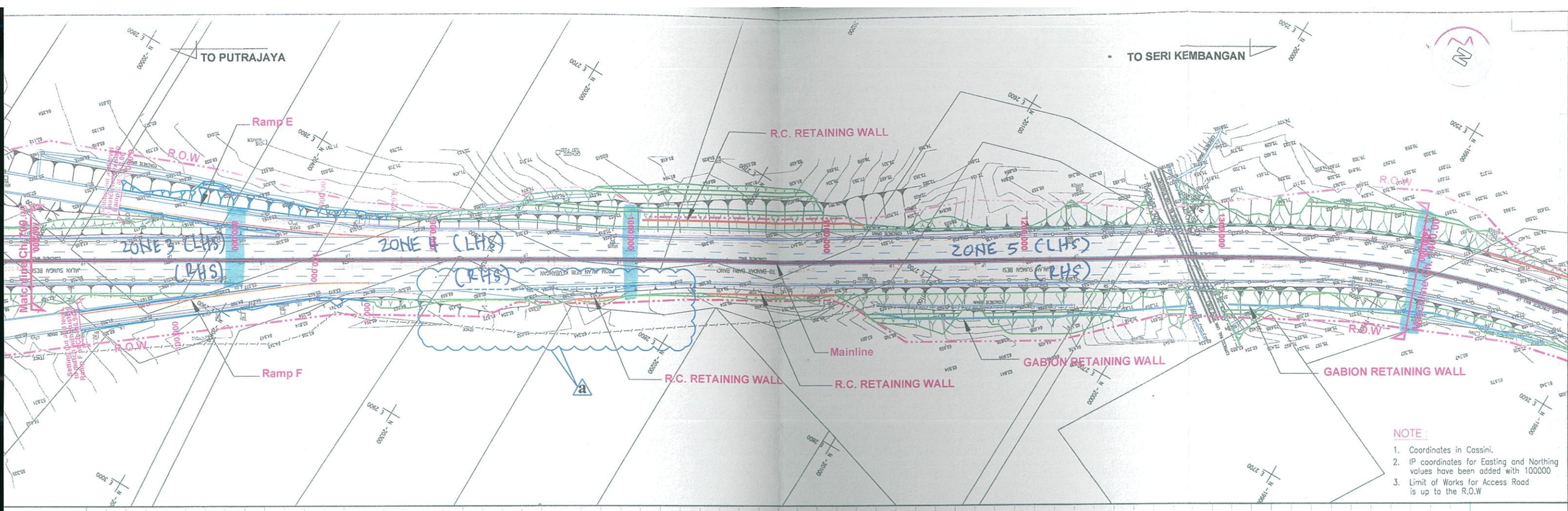
KERAJAAN MALAYSIA
LEMBAGA LEBUHRAYA MALAYSIA

UPGRADING OF KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

DRAWING TITLE:
PLAN AND PROFILE MAINLINE - FROM CH. 0.00 TO CH. 700.00

DRAWING NO: C/SILK/CW/EX/PP/01

REV: *



NOTE :

1. Coordinates in Cassini.
2. IP coordinates for Easting and Northing values have been added with 100000
3. Limit of Works for Access Road is up to the R.O.W

VIP No. 9
VIP CH. = 790.001
VIP ELEV. = 64.968
VCL = 43.608
Mo = 0.010
K = 325.000

VIP No. 10
VIP CH. = 890.081
VIP ELEV. = 67.022
VCL = 58.686
Mo = -0.025
K = -170.000

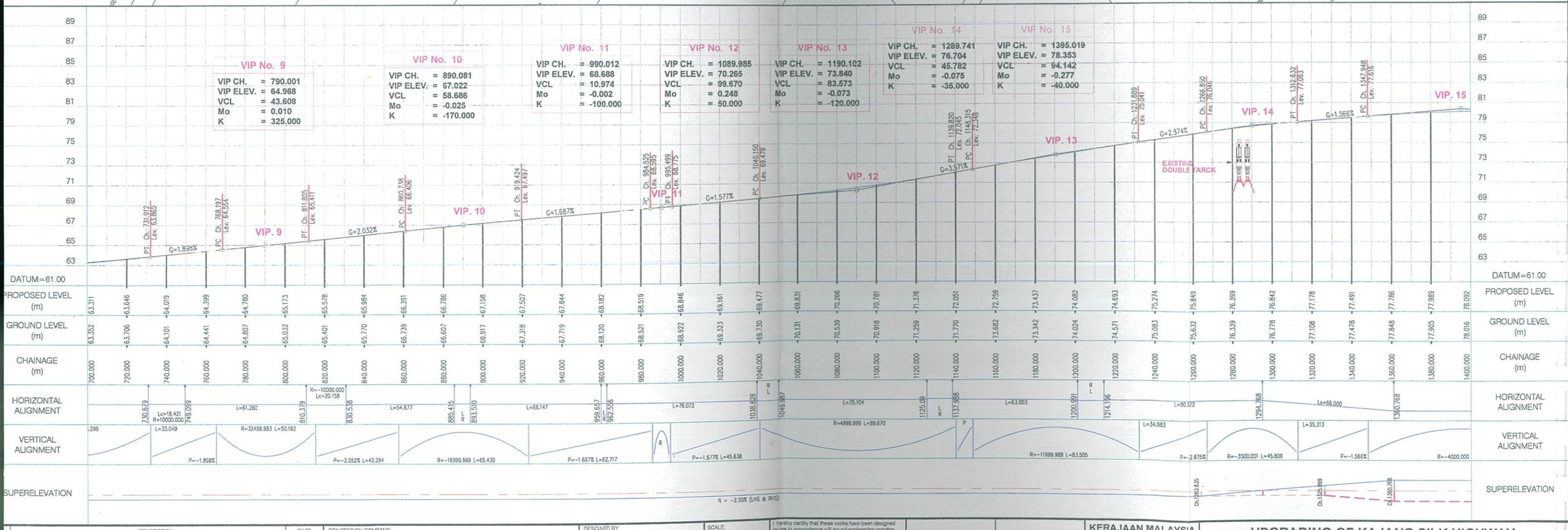
VIP No. 11
VIP CH. = 990.012
VIP ELEV. = 68.688
VCL = 10.974
Mo = -0.002
K = -100.000

VIP No. 12
VIP CH. = 1089.985
VIP ELEV. = 70.265
VCL = 99.670
Mo = 0.248
K = 50.000

VIP No. 13
VIP CH. = 1190.102
VIP ELEV. = 73.840
VCL = 83.573
Mo = -0.073
K = -120.000

VIP No. 14
VIP CH. = 1289.741
VIP ELEV. = 76.704
VCL = 45.782
Mo = -0.075
K = -35.000

VIP No. 15
VIP CH. = 1395.019
VIP ELEV. = 78.353
VCL = 94.142
Mo = -0.277
K = -40.000



DESCRIPTION	DATE
Additional of emengency lay byes at Ch. 960 (Rhs) and at Ch.1625 (Lhs).	26-05-2014

CONCESSION COMPANY :
SILK
SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD. (371231-K)
Plaza Tol Sungai Besi, KM 28.3A,
Lebuhraya Kajang SILK,
43000 Kajang, Selangor Darul Ehsan.
Tel: [redacted] Fax: 03 - 8921 0021

PROJECT CONSULTANT :
ARSEA CONSULTING ENGINEERS SDN. BHD. (333114-U)
No.40, 1st-3rd. Floor, Jln. Wangsa Setia 3
Wangsa Melawati, 53300 K. Lumpur, M'SIA.
Tel: Fax: 03-4143 4922
URL : www.arseagroup.com

DESIGNED BY: NIK MOHD ADID
DRAWN BY: SAADIAH
CHECKED BY: DZULKIFLE SULONG
APPROVED BY: Ir. JAFLUS ABDUL JAUL

SCALE: H = 1:1000 V = 1:200
DATE: December 2013

I hereby certify that these works have been designed by me in accordance will sound engineering practice and that I take full responsibility for the design and proper performance of the same

(ARSEA CONSULTING ENGINEERS SDN. BHD)

SISTEM LINGKARAN LEBUHRAYA KAJANG SDN. BHD

KETUA PENGARAH LEMBAGA LEBUHRAYA MALAYSIA

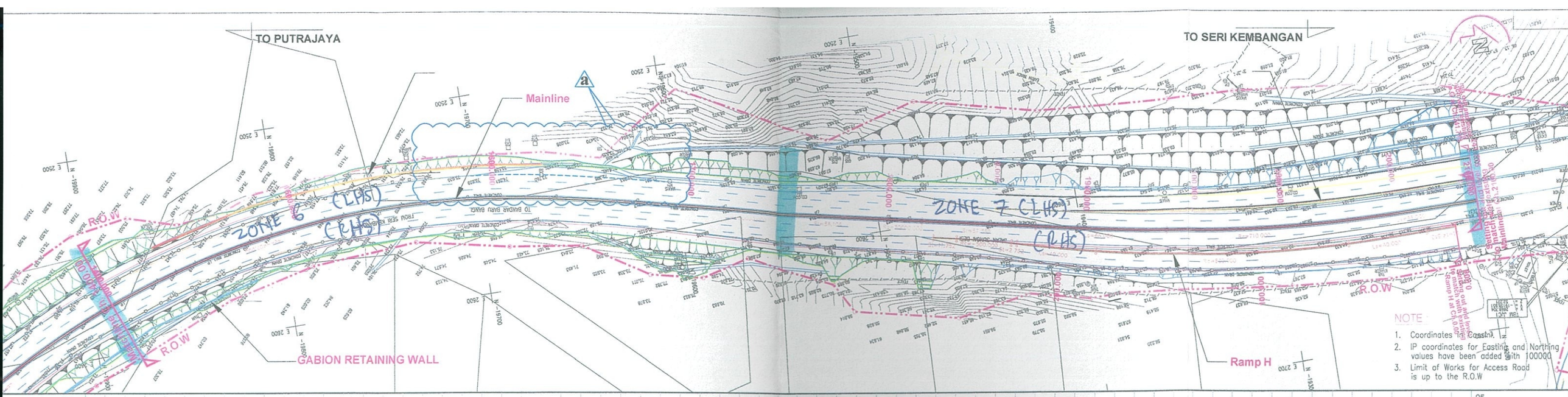
KERAJAAN MALAYSIA
LEMBAGA LEBUHRAYA MALAYSIA

UPGRADING OF KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

DRAWING TITLE:
PLAN AND PROFILE MAINLINE - FROM CH. 700.00 TO CH. 1400.00

DRAWING NO: C/SILK/CW/EX/PP/02

REV: a



TOWARDS ERL | TOWARDS UPM TOLL PLAZA

CH. 1744.680

VIP No. 16
VIP CH. = 1494.990
VIP ELEV. = 77.566
VCL = 71.849
Mo = -0.161
K = -40.000

VIP No. 17
VIP CH. = 1595.050
VIP ELEV. = 74.981
VCL = 90.543
Mo = -0.205
K = -50.000

VIP No. 18
VIP CH. = 1695.001
VIP ELEV. = 70.589
VCL = 37.907
Mo = 0.003
K = 700.000

VIP No. 19
VIP CH. = 1795.001
VIP ELEV. = 66.249
VCL = 36.583
Mo = 0.008
K = 200.000

VIP No. 20
VIP CH. = 1894.999
VIP ELEV. = 62.092
VCL = 81.666
Mo = 0.208
K = 40.000

VIP No. 21
VIP CH. = 1995.026
VIP ELEV. = 59.976
VCL = 46.220
Mo = 0.045
K = 60.000

VIP No. 22
VIP CH. = 2100.000
VIP ELEV. = 58.564

Plot Point CH. 1410.601 FL. 76.106

PT Ch. 1442.090 Lev. 77.982 | PC Ch. 1459.066 Lev. 77.849 | G=-0.787% | VIP. 16
PT Ch. 1530.914 Lev. 76.638 | PC Ch. 1549.782 Lev. 76.150 | G=-2.584% | VIP. 17
PT Ch. 1640.318 Lev. 72.992 | PC Ch. 1676.047 Lev. 71.422 | G=-4.394% | VIP. 18
PT Ch. 1713.955 Lev. 69.766 | PC Ch. 1776.709 Lev. 67.043 | G=-4.340% | VIP. 19
PT Ch. 1813.293 Lev. 65.489 | PC Ch. 1854.165 Lev. 63.789 | G=-4.157% | VIP. 20
PT Ch. 1935.832 Lev. 61.226 | PC Ch. 1971.916 Lev. 60.465 | G=-2.115% | VIP. 21
PT Ch. 2018.136 Lev. 59.665 | G=-1.345%

DATUM=57.00

PROPOSED LEVEL (m)	78.092 78.095 77.998 77.841 77.629 77.317 76.905 76.403 75.876 75.278 74.601 73.843 73.006 72.127 71.248 70.373 69.504 68.636 67.768 66.900 66.046 65.210 64.378 63.551 62.799 62.147 61.594 61.140 60.717 60.299 59.937 59.640 59.371 59.102 58.833 58.564
GROUND LEVEL (m)	78.016 77.975 77.854 77.684 77.487 77.352 76.815 76.425 75.818 75.250 74.610 73.927 73.010 72.076 71.144 70.228 69.303 68.378 67.453 66.549 66.149 65.440 64.575 63.727 62.928 62.125 61.358 60.841 60.421 60.215 59.876 59.634 59.434 59.223 57.019 58.457
CHAINAGE (m)	1400.000 1420.000 1440.000 1460.000 1480.000 1500.000 1520.000 1540.000 1560.000 1580.000 1600.000 1620.000 1640.000 1660.000 1680.000 1700.000 1720.000 1740.000 1760.000 1780.000 1800.000 1820.000 1840.000 1860.000 1880.000 1900.000 1920.000 1940.000 1960.000 1980.000 2000.000 2020.000 2040.000 2060.000 2080.000 2100.000
HORIZONTAL ALIGNMENT	R=-407.000 Lc=240.601 · 1601.369 · Ls=65.000 · 1667.369 · L=47.527 · 1714.896 · R=-20000.000 Lc=28.825 · 1743.721 · L=58.105 · 1801.825 · Lc=17.052 R=30000.000 · 1818.878 · L=57.369 · 1876.247 · Ls=65.000 · 1942.247 · Lc=91.469 R=710.000 · 2033.716 · Ls=65.000 · 2100.000
VERTICAL ALIGNMENT	L=94.121 · P=-0.787% · L=16.979 · R=-4000.001 L=71.853 · P=2.584% · L=18.858 · R=-5000.000 L=90.543 · P=4.394% L=35.643 · R=59999.999 L=38.072 · P=4.340% L=62.653 · R=20000.008 L=36.621 · P=4.157% L=40.863 · R=4000.000 L=81.648 · P=2.116% L=36.082 · R=6000.001 L=45.244 · P=1.345% L=81.852
SUPERELEVATION	LHS Se=+5.30% RHS Se=-5.30% · Ch.1601.369 · Ch.1636.736 · Ch.1688.494 · N = -2.50% (LHS & RHS) · Ch.1834.996 · Ch.1917.697 · Ch.1892.697 · RHS Se=+4.00% LHS Se=-4.00% · Ch.2033.716 · Ch.2058.465 · 2091.819 2100.000

DESCRIPTION	DATE
Additional of emengency lay byes at Ch. 960 (Rhs) and at Ch.1625 (Lhs).	26-05-2014

CONCESSION COMPANY:
SILK
SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD. (372218-K)
Plaza Tol Sungai Balak, KM 28.3A, Lebuhraya Kajang SILK, 43000 Kajang, Selangor Darul Ehsan
Tel: Faks: 03 - 8921 0001

PROJECT CONSULTANT:
ORSEA CONSULTING ENGINEERS SDN. BHD. (333114-U)
No.40, 1st-3rd. Floor, Jln. Wangsa Setia 3, Wangsa Melawati, 53300 K. Lumpur, W.P.
Tel: Fax: 03-4143 4922
URL : www.orseagroup.com

DESIGNED BY: NIK MOHD ADID
DRAWN BY: SAADIAH
CHECKED BY: DZULKIFLE SULONG
APPROVED BY: Ir. JAFLUS ABDUL JAUL

SCALE: H = 1:1000 V = 1:200
DATE: December 2013

I hereby certify that these works have been designed by me in accordance will sound engineering practice and that I take full responsibility for the design and proper performance of the same.

(ARSEA CONSULTING ENGINEERS SDN. BHD) | SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD | KETUA PENGARAH LEMBAGA LEBUHRAYA MALAYSIA

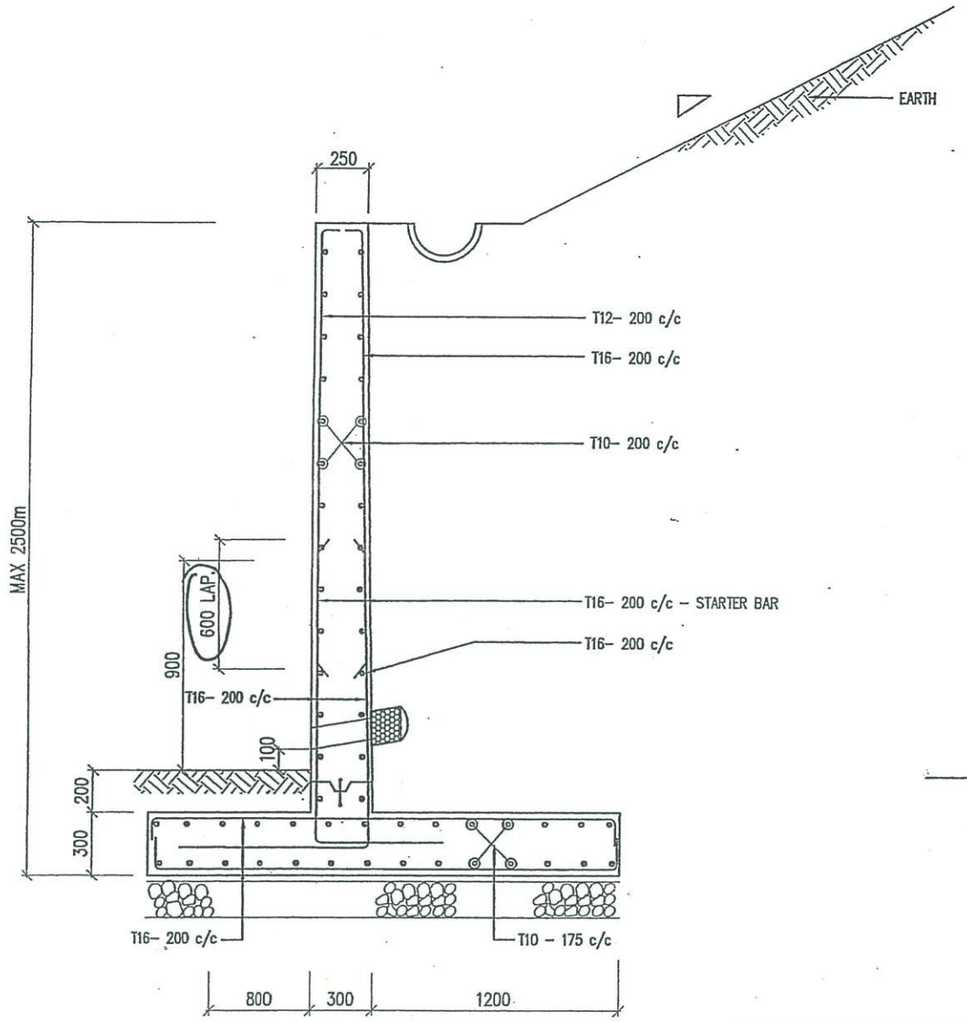
KERAJAAN MALAYSIA
LEMBAGA LEBUHRAYA MALAYSIA

UPGRADING OF KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

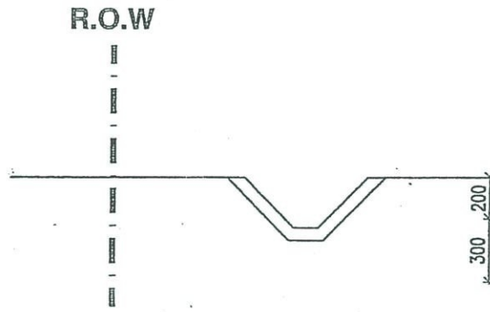
DRAWING TITLE:
PLAN AND PROFILE MAINLINE - FROM CH. 1400.00 TO CH. 2100.000

DRAWING NO: C/SILK/CW/EX/PP/03
REV: a

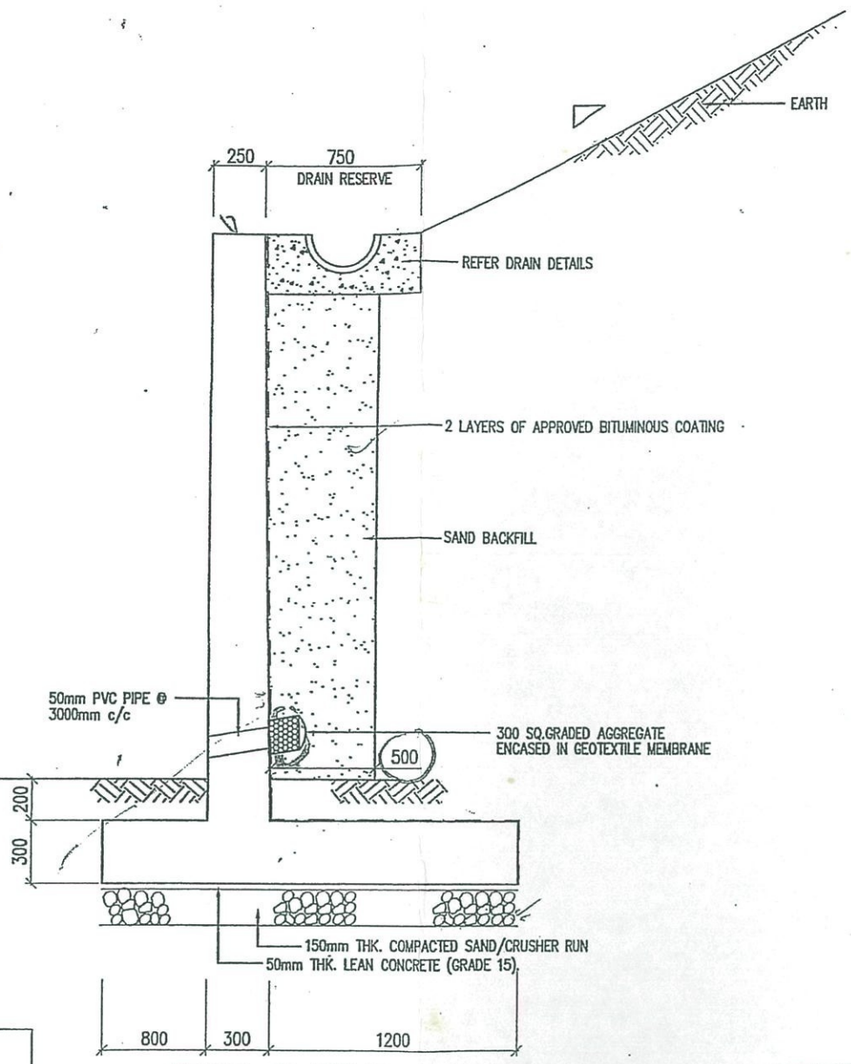
APPENDIX B



RC RETAINING WALL
REINFORCEMENT DETAIL



CHAINAGE		LENGTH (m)	LOCATION	TREATMENT
FROM	TO			
500.00	540.00	40	RHS	RC RETAINING WALL
600.00	650.00	50	RHS	RC RETAINING WALL
960.00	1000.00	40	RHS	RC RETAINING WALL
1030.00	1110.00	80	RHS	RC RETAINING WALL
1005.00	1125.00	120	LHS	RC RETAINING WALL
1430.00	1620.00	190	LHS	RC RETAINING WALL



TYPICAL RC RETAINING WALL

CONSTRUCTION DRAWING

NOTES :

1. CONCRETE FOR RC WALL SHALL BE GRADE 30.
2. MINIMUM COVER TO REINFORCEMENT FOR BOTTOM BARS IS 50mm AND TOP BARS IS 40mm.
3. 'T' DENOTES HIGH YIELD DEFORMED BARS WITH MINIMUM YIELD STRENGTH OF 460N/mm.
4. MINIMUM LAP LENGTH FOR REINFORCEMENT SHALL BE 40 TIMES DIAMETER.
5. MINIMUM SOIL BEARING CAPACITY = 100KN/m² TO BE CHECKED ON SITE BY PROPER TESTING AS APPROVED BY ENGINEER.
6. REMOVE AND REPLACE FOR SOIL WITH JP <40.00 LOWS / 0.3m WITH GRANULAR MATERIAL.
7. THE BACK BETTER FOR CUT SLOPE IS 1:1.5 AND FILL SLOPE IS 1:2.

JURUTERA PROFESIONAL
AWAM
7825
MALAYSIA

REV.	DESCRIPTION	DATE

CONCESSION COMPANY :
SILK
SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD.
Plaza Tol Sungai Dekah, Km 28.3A,
Lebuhraya Kajang SILK,
43000 Kajang, Selangor Darul Ehsan.
Tel: Fax: 03 – 8921 0001

PROJECT CONSULTANT :
GNSCG
GNSCG CONSULTING ENGINEERS SDN. BHD. (333114-U)
No.40, 1st-3rd. Floor, Jln. Wangsa Satu 3
Wangsa Maju, 53300 K. Lumpur, MSIA
Tel:

DESIGNED BY: Dr. AMJED H NAIEF
DRAWN BY: SHAHRUL
CHECKED BY: Ir. HARUN B. ABD HARUN
APPROVED BY
DATE: Aug. 2013
SCALE:

SISTEM LINGKARAN - LEBUHRAYA KAJANG SDN. BHD.

KETUA PENGARAH
LEMBAGA LEBUHRAYA MALAYSIA

KERAJAAN MALAYSIA
LEMBAGA LEBUHRAYA MALAYSIA

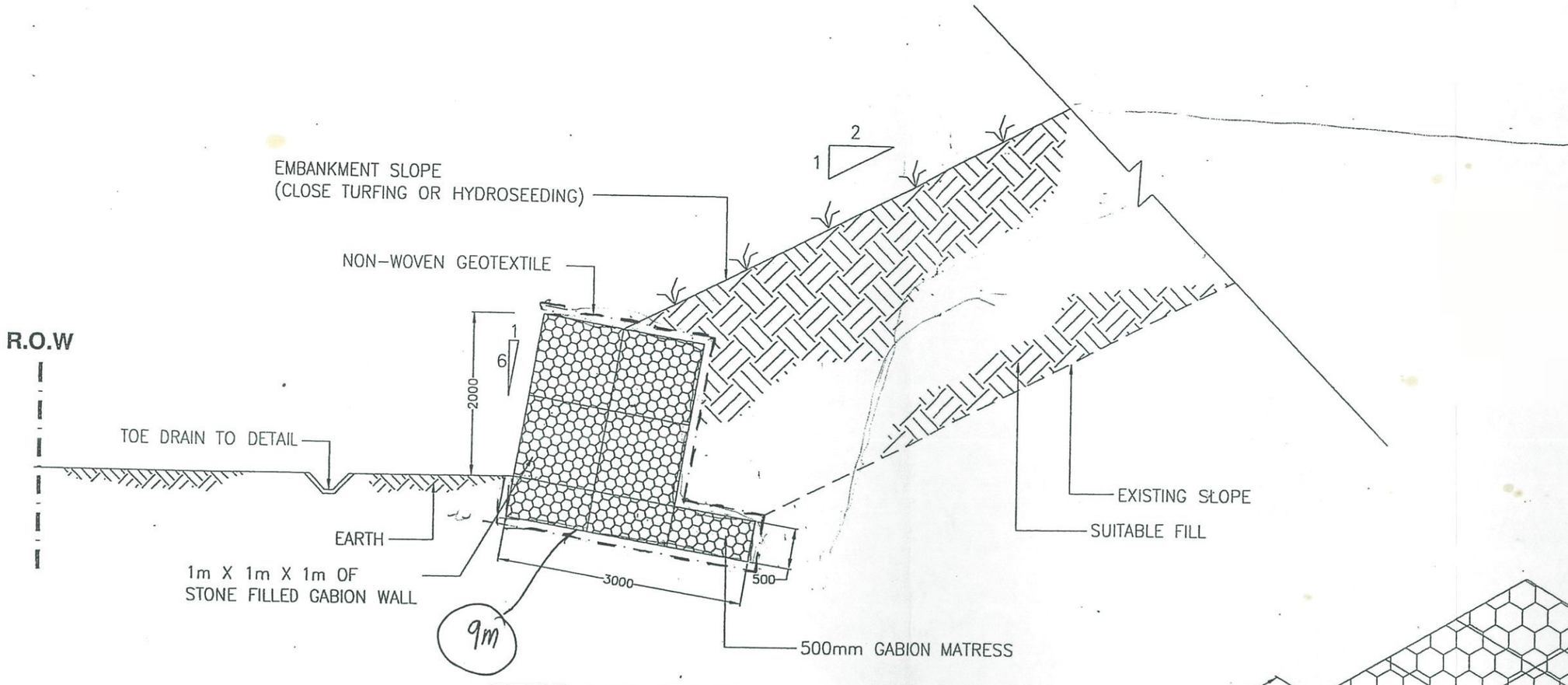
UPGRADING OF KAJANG SILK HIGHWAY
FROM UNITEN INTERCHANGE TO UPM INTERCHANG

DRAWING TITLE:
TYPICAL RC RETAINING WALL

DRAWING NO: T/SILK/CW/EX/ SD/GEO/04

REV

APPENDIX C

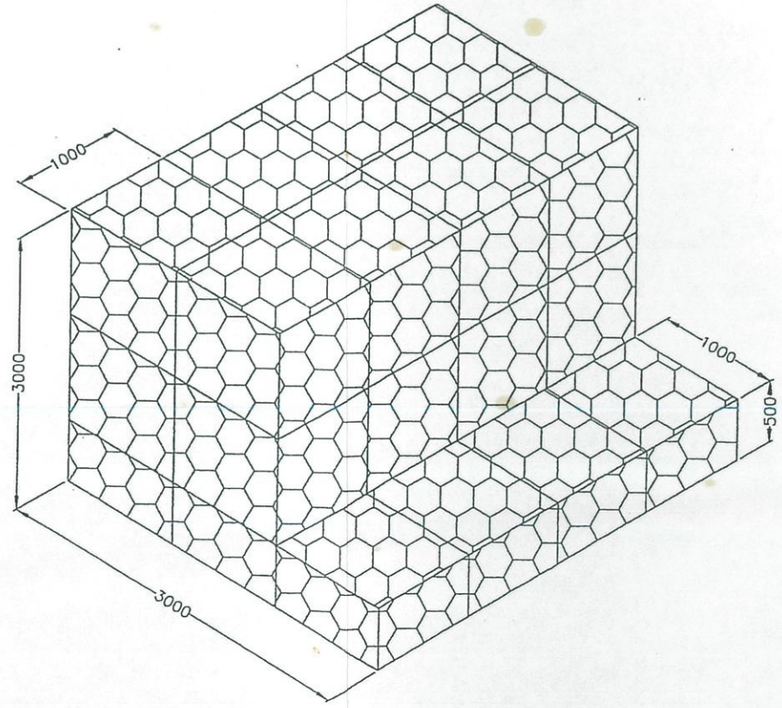


TYPICAL CROSS SECTION
STONE FILLED GABION WALL
SCALE 1:1

CHAINAGE		LENGTH (m)	LOCATION	TREATMENT
FROM	TO			
1130.00	1280.00	150.00	RHS	GABION RETAINING WALL
1300.00	1480.00	180.00	RHS	GABION RETAINING WALL

NOTE :

1. OTHER CONFIGURATIONS OF STONE FILLED GABION WALL MAY BE PROPOSED TO SUIT TO SITE/GEOTECHNICAL CONDITIONS SUBJECT TO APPROVAL OF THE ENGINEER.
2. THE GABION CAGE SHALL BE OF APPROVED TYPE.
3. FOUNDING LAYER SHALL HAS JP >40 BLOWS/0.3m.
4. NON–WOVEN SHALL BE LAID AS PER SPECIFICATION.
5. THE ROCK USE IN GABION SHALL BE OF HARD AND INERT TYPES.



GABION WALL (ISOMETRIC VIEW)
SCALE N.T.S

REV.	DESCRIPTION	DATE

CONCESSION COMPANY: SILK — SISTEM LINGKARAN LEBUHRAYA KAJANG SDN. BHD.
Pkt 7a Sungai Balak, KM 28.3A, Lebuhraya Kajang SILK, 43000 Kajang, Selangor Darul Ehsan. Tel: Fax: 03 – 8921 0001

PROJECT CONSULTANT: AIDA VOTRUBUNG ENGINEERS SDN. BHD. (333116-U) No.40, 1st–3rd. Floor, Jln. Wangsa Setia 1, Wangsa Melawati, 53300 K. Lumpur, M'SIA. Tel: URL : www.aiscogroup.com

DESIGNED BY: Dr. AMJED HAMEED
DRAWN BY: SHAHRUL
CHECKED BY: Ir. HARUN B ABD GHANI
APPROVED BY: Ir. JAFFUS ABDUL HAMID
SCALE: N.T.S
DATE: December 2013

I hereby certify that these works have been designed by me in accordance with sound engineering practice and that I take full responsibility for the design and proper performance of the same.

AIDA VOTRUBUNG ENGINEERS SDN. BHD.

SISTEM LINGKARAN LEBUHRAYA KAJANG SDN. BHD.

LEMBAGA LEBUHRAYA MALAYSIA

KERAJAAN MALAYSIA
LEMBAGA LEBUHRAYA MALAYSIA

UPGRADING OF KAJANG SILK HIGHWAY
FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

DRAWING TITLE:
TYPICAL DETAIL OF GABION RETAINING WALL
FOR RIVER PROTECTION AND TERRAMESH STRUCTURE

DRAWING NO: T/SILK/CW/SD/GEO/02
REV:

APPENDIX D

ARSEA CONSULTANT ENGINEERS SDN BHD

SITE JOINT MEASUREMENT SHEET

Project : Proposed Upgrading of Kajang Silk Highway From UPM to Uniten Interchange

Structure: Typical RC Retaining Wall

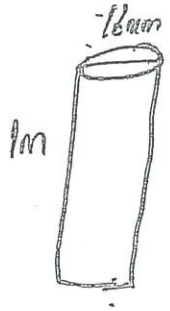
Prepared By :Danion Lewis

BAR BENDING SCHEDULE

Type	Dia	Mark	No of Member	No in Member	Total No.	Length (m)	Total Length (m)	Sketch
T	16	01	1	650	650	2.600	1690.000	2200 200
T	16	02	1	650	650	2.600	1690.000	2200 200
T	16	03	1	650	650	2.400	1560.000	1400 1000
T	16	03	1	650	650	2.400	1560.000	1400 1000
T	10	05	2	14	28	136.600	3824.800	12000 130/12m =11 lap = 6.6m
T	16	Chair	1	260	260	1.500	390.000	200 500 300
	T10	T16	T?	T16	T20	T?	T32	
	0.616	0.616	0.363	1.579	2.466	5.994	6.313	
Unit	0.000	3824.304	0.000	6990.000	0.000	0.000	0.000	
Total	0.000	2.355	0.000	10,473	0.000	0.000	0.000	

* $0.00616 \times 2 \text{ bar dia} \times 2 \text{ bar dia} \times 1m = \sim \ldots$

$0.00616 \times 16 \times 16 \times 1m = 1.577\#$



$\pi j^2 t = 3.142 \times 0.008 \times 0.008 \times 1$

$= 0.000201088 \times (7850\ kg)$

$= 1.579\#$

APPENDIX E

CRB Cypark Resources Berhad

UPGRADING OF KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

REQUEST FOR INSPECTION AND TESTING (RFI)

)NTRACT NO : SILK/PR/UNI-UPM/TD/(12/13)/0001

RFI NO: CRB/SILK/RFI/ 026

) : ARSEA CONSULTING ENGINEER

TN : EN YUS ARHANUM

e following works/test are ready for inspection/will be conducted at 9.00 am (time) on 20/3/2015 (date)

ork is intended to commemce at ..... (time) on ..... (date)

scription of Work:

cation: Mainline ch 1100 - 1130 LHS.

pe of Work: Concreting base RC Wall - Gr 30.

spection Checklist / Method Statement / Material / Product Approval Status : Approved / Not Approved

bmitted By Contractor

me:

ne: MUHAMMAD RAUZAN B. RAHMAT
PROJECT ENGINEER
CYPARK RESOURCES BERHAD

te:

nature:

Received By Client's Consultant (COW/RE/RA/Rep)

Name: MOHD ZAIRI BIN MOHD JASMIN
CLERK OF WORK
ARSEA CONSULTING ENGINEERS SDN. BHD

Time:

Date:

Signature:

SAMPLE

spection Response

Client's Consultant

Inspection Passed. The Contractor is allowed to proceed with the works ☒

Remedial works listed below to be completed and re-ispection is required afterward ☐

Works not ready for inspection. New Inspection Form (RFI) to be submitted ☐

mment :

ent's Consultant Proceed with work.

rtified By Client Consultant
OW/RE/RA/Rep)

me: MOHD ZAIRI BIN MOHD JASMIN
CLERK OF WORK
ARSEA CONSULTING ENGINEERS SDN. BHD

te:

nature:

ER's / ERA's Approval Status : (A/B/C)

Name:

Time:

Date:

Signature:

Received By Contractor

Name: MUHAMMAD RAUZAN B. RAHMAT
PROJECT ENGINEER
CYPARK RESOURCES BERHAD

Time:

Date:

Signature:

for Contractor

Cypark Resources Berhad

UPGRADING OF KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

CONCRETEPOUR CHECKLIST

PROJECT : KAJANG SILK. SUB CON :
LOCATION : mainline Ch 1100-1130 LHS DATE :
DRAWING : refer attachment

REF :
GRADE : 30 Normal

D.O NO	TIME ARRIVE		TIME DISCHARGE		TIME FINISH		SLUMP	VOLUME OF CONCRETE	NO. OF CUBE	REMARKS

Remark :

Inspected by: Cypark

Verified by: Clients Consultant

Acknowledge by: ER's/ERA's

Signature :
Name :
Date :

Signature :
Name :
Date :

Signature :
Name :
Date :

CRB Cypark Resources Berhad

UPGRADING OF KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

POST-CONCRETING INSPECTION

Description :	concreting base RC wall	Date of Inspection :	20/3/2015
Section :	Ch 1100-1130 LHS.	Block No :	-
Zone :	4 LHS	Level :	-
Element :	-	Drawing Ref No. :	refer attachment

Concrete Pour Record Ref		Concrete Grade	30
Date/Time of Pour		Concrete Curing Ref	
Date/Time of Pour Completed		Concrete Curing Method	
Date of Formwork Removal			

	Subcontractor		Cypark		Consultant	
	OK	NOT OK	OK	NOT OK	OK	NOT OK
INSPECTIONS						
Concrete Lines						
Concrete Level						
Pour Dimension						
Insert Location						
Box Out Location						
Water Bar Position						
Concrete Surface Finishes						
OTHERS (To be filled up)						

Comments

Checked By Main Contractor	Approved By Client's Consultants	Acknowledged By ER/ERA
Signature :	Signature :	Signature : .....
Name :	Name :	Name : .....
Position :	Position :	Position : .....
Company :	Company :	Company : .....
Date :	Date :	Date : .....

CRB Cypark Resources Berhad

UPGRADING OF KAJANG SILK HIGHWAY FROM UNITEN INTERCHANGE TO UPM INTERCHANGE

RECORD OF CONCRETE TEST

Revision :
Issied :

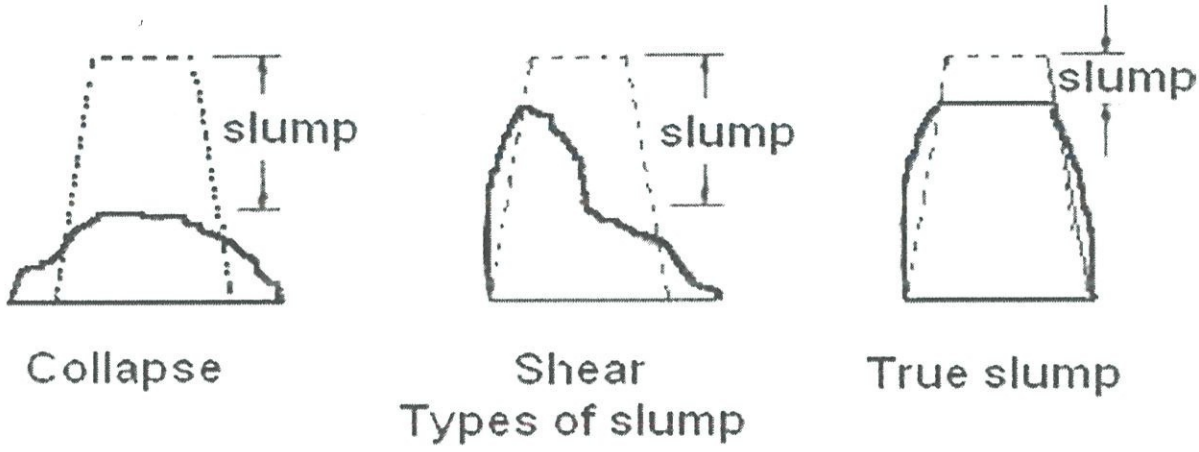
Note:
1. For Ready Mix, the delivery notes must be retained as record. Mix of more than 2 hours of age to be rejected, unless otherwise instructed by RE.
2. Minimum of 6 cubes per set to be taken as testing 3 each for 7 and 28 days.
3. The testing period is subject to change base on C&S Consultant approvals.

No	Date	Time	Location of work	DO Number	Concrete Mix/Grade	Ready Mix Company	Slump (mm)	Cube Ref.	Cube Test Schedule on		Remarks	Status
									7 days	28 days		
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

Note :
1. For Ready Mix, the delivery notes must be retained as record. Mix of more than 2 hours of age to be rejected, unless otherwise instructed by RE.
2. The testing period is subject to change base on C&S Consultant approvals.

APPENDIX F

16. If the repeated test still does not show an acceptable slump, record this fact in the report, or reject that load of concrete.



Types of slump

Collapse Slump

In a collapse slump the concrete collapses completely. A collapse slump will generally mean that the mix is too wet or that it is a high workability mix, for which slump test is not appropriate.

Shear Slump

In a shear slump the top portion of the concrete shears off and slips sideways. OR

If one-half of the cone slides down an inclined plane, the slump is said to be a shear slump.

1. If a shear or collapse slump is achieved, a fresh sample should be taken and the test is repeated.
2. If the shear slump persists, as may the case with harsh mixes, this is an indication of lack of cohesion of the mix.

True Slump

In a true slump the concrete simply subsides, keeping more or less to shape

1. This is the only slump which is used in various tests.
2. Mixes of stiff consistence have a Zero slump, so that in the rather dry range no variation can be detected between mixes of different workiability.

However , in a lean mix with a tendency to harshness, a true slump can easily change to the shear slump type or even to collapse, and widely different values of slump can be obtained in different samples from the same mix; thus, the slump test is unreliable for lean mixes.

Applications of Slump Test

1. The slump test is used to ensure uniformity for different batches of similar concrete under field conditions and to ascertain the effects of plasticizers on their introduction.
2. This test is very useful on site as a check on the day-to-day or hour- to-hour variation in the materials being fed into the mixer. An increase in slump may mean, for instance, that the moisture content of aggregate has unexpectedly increases.
3. Other cause would be a change in the grading of the aggregate, such as a deficiency of sand.
4. Too high or too low a slump gives immediate warning and enables the mixer operator to remedy the situation.
5. This application of slump test as well as its simplicity, is responsible for its widespread use.

Degree of workability	Slump		Compacting Factor	Use for which concrete is suitable
	mm	in		
Very low	0-25	0-1	0.78	Very dry mixes; used in road making. Roads vibrated by power operated machines.
Low	25-50	1-2	0.85	Low workability mixes; used for foundations with light reinforcement. Roads vibrated by hand operated Machines.
Medium	50-100	2-4	0.92	Medium workability mixes; manually compacted flat slabs using crushed aggregates. Normal reinforced concrete manually compacted and heavily reinforced sections with vibrations.
High	100-175	4-7	0.95	High workability concrete; for sections with congested reinforcement. Not normally suitable for vibration

Slump Test

This is a site test to determine the workability of the ready mixed concrete just before its placing to final position inside the formwork, and is always conducted by the supervisor on site. However in mid of concreting process , should the site supervisor visually finds that the green concrete becomes dry or the placement of concrete has been interrupted , a re-test on the remaining concrete should be conducted in particular of the pour for congested reinforcement area . The procedure of test in brief is as follows: –

1. Ensure the standard Slump Cone and associated equipment are clean before test and free from hardened concrete.

2. Wet the Slump Cone and drain away the superfluous water.

3. Request the mixer or concrete truck to well mix the concrete for additional 5 minutes.

4. Place the Slump Cone on one side (i.e. not in middle) of the base plate on leveled ground and stand with feet on the foot-pieces of cone .

5. Using a scoop and fill the cone with sampled concrete in 3 equal layers, each of about 100mm thick.

6. Compact each layer of concrete in turn exactly 25 times with a Slump Rod, allowing the rod just passes into the underlying layer.

7. While tamping the top layer, top up the cone with a slight surcharge of concrete after the tamping operation.

8. Level the top by a "sawing and rolling" motion of the Slump Rod across the cone.

9. With feet are still firmly on the foot-pieces, wipe the cone and base plate clean and remove any leaked concrete from bottom edge of the Slump Cone.

10. Leave the foot-pieces and lift the cone carefully in a vertical up motion in a few seconds time.

11. Invert the cone on other side and next to the mound of concrete.

12. Lay the Slump Rod across the inverted cone such that it passes above the slumped concrete at its highest point.

13. Measure the distance between the underside of rod and the highest point of concrete to the nearest 5mm.

14. This reading is the amount that the sampled concrete has slumped.

15. If the concrete does not show an acceptable slump, repeat the test with another sample.

APPENDIX G

Concrete Compressive Strength Tests & Compliance

Rate of Sampling for Testing of Concrete Cubes

All sampling, curing and testing of concrete, fresh or hardened shall be carried out in accordance with Malaysian Standards, MS 26 and relevant Parts of British Standards, BS 1881.

The rate of sampling shall be as specified as follows:

For critical structures such as pre stressed concrete, pile caps, retaining wall etc; One (1) sample per 10.0 m^3 or every group of 10 batches shall be taken, with a minimum of two samples on each concreting day.

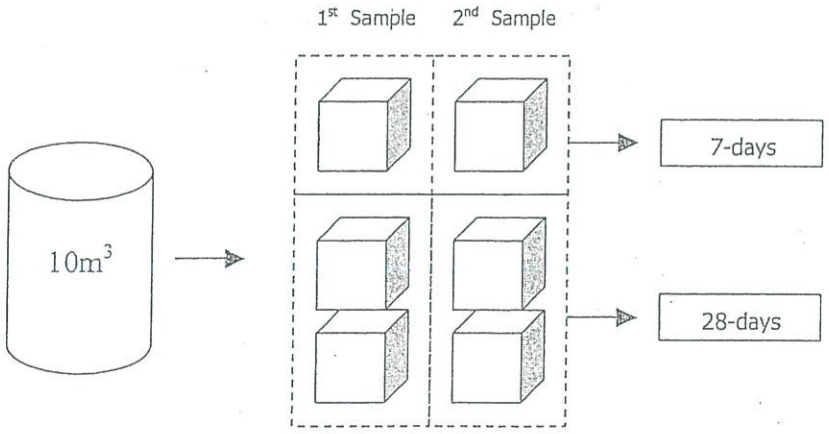
For each sampling, three cubes shall be made from a single sample taken from a randomly selected batch of concrete.

Where One (1) cube from each sample batch shall be tested for the 7-day compressive strength, and the remaining two (2) cubes for 28-day compressive strength.

Additional cubes, if required for various purposes, shall be made and tested in accordance with MS25, but the methods of sampling and the conditions under which the cubes are stored shall be varied according to the purpose required. The extra cubes shall be identified at the time of marking and shall not be used for normal quality control or compliance procedures.

Examples:

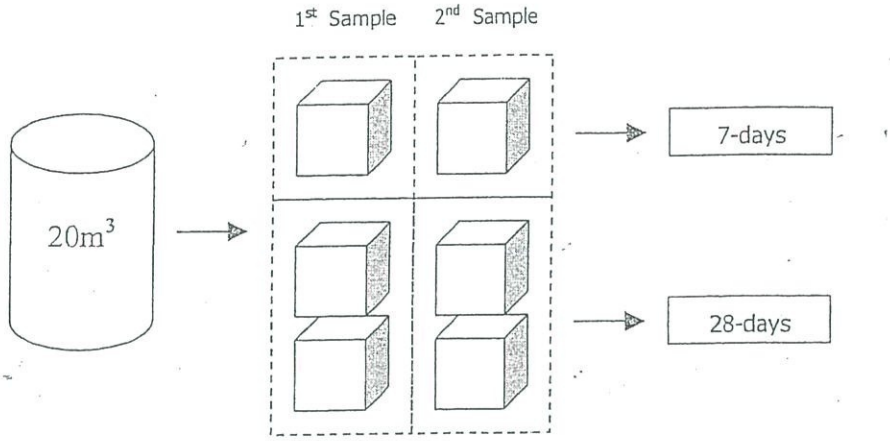
1. *Critical structures of less or equal to* ***10.0m^3***



A minimum of two samples, three (3) cubes each, six (6) cubes in total.

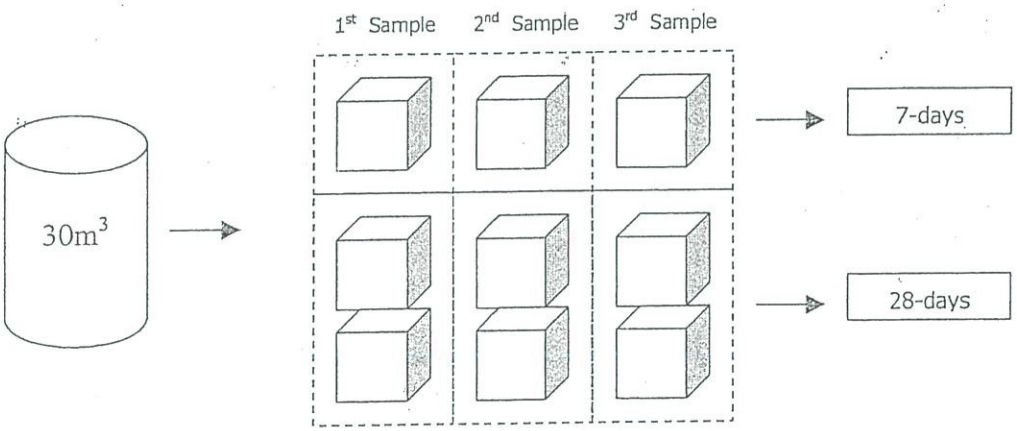
---

2. Critical structures of less or equal to **20.0m³**, but more than 10.0m³



A minimum of two samples, three (3) cubes each, six (6) cubes in total.

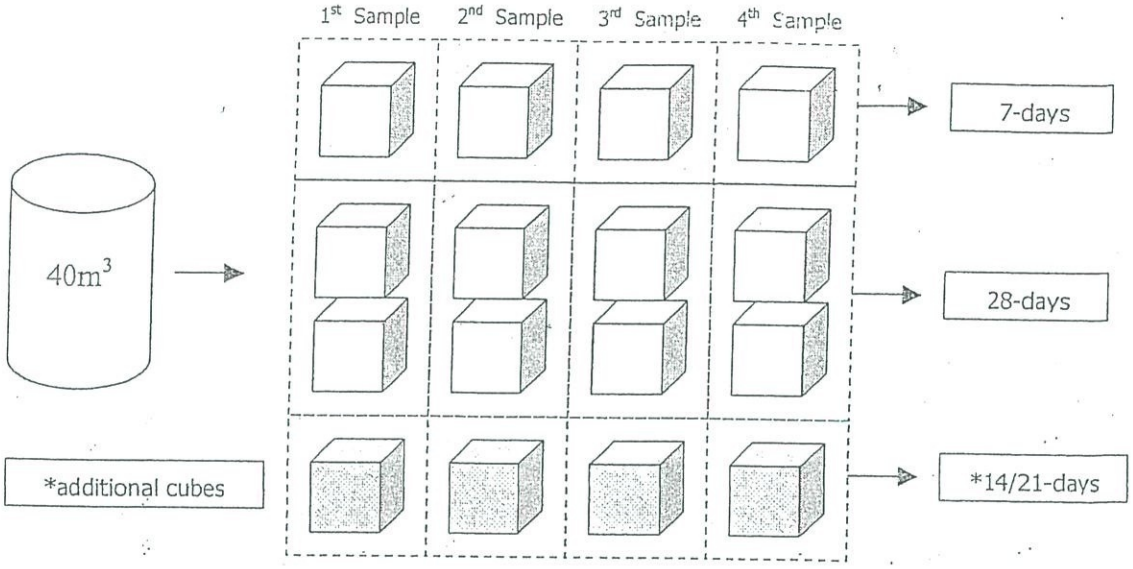
3. Critical structures of less or equal to **30.0m³**, but more than 20.0m³



A minimum of three (3) samples, three (3) cubes each, nine (9) cubes in total.

1st Sample 2nd Sample 3rd Sample

4. Critical structures of less or equal to **40.0m^3**, but more than 30.0m^3



A minimum of four (4) samples, three (3) cubes each, with four (4) additional cubes per sample, if required. sixteen (16) cubes in total.

*For additional cubes, one (1) cube per sample shall be made.