CIDB MALAYSIA

TECHNICAL OPINION

SUBMITTED TO CIDB MALAYSIA | JANUARY 2012

TECHNICAL OPINION REPORT

PRODUCT
GeoCrete®

APPLICANT
Geo Crete Specialist Sdn. Bhd.

CIDB MALAYSIA

CONSTRUCTION INDUSTRY DEVELOPMENT BOARD
7th Floor, CIDB Headquarters,
Grand Seasons Avenue,
No. 72, Jalan Pahang, 53000 Kuala Lumpur

CREAM
Construction Research Institute of Malaysia

CONSTRUCTION RESEARCH INSTITUTE OF MALAYSIA
Makmal Kerja Raya Maysia (MKRM),
IBS Centre, 1st Floor, Block E, Lot 8,
Jalan Chan Sow Lin, 55200 Kuala Lumpur

FOREWORD

Construction Industry Development Board (CIDB Malaysia) is a statutory body enacted under the Act 520 in 1994. Its mission is to develop Malaysian Construction Industry towards global competitiveness. To support that mission, a number of functions were formulated and one of them is to encourage the improvement of construction techniques and materials. Under that function, CIDB is to carry out assessment and appraisal of innovations of any kind of product and technology related to construction and to publish its finding, in the form of Technical Opinion.

This Technical Opinion will provide a reference to the relevant/interested parties in the construction industry. CIDB assess innovation based on application and evaluation by its Technical Opinion. Applicants may use it as a supporting document for regulatory and approving authorities, architects, engineers and others in dealing with the new products and technologies.

This Technical Opinion was prepared on behalf of CIDB by The Technical Expert Panel on construction products, construction material and technology in Construction Industry. The Technical Expert Panel was set-up by CIDB and its members were drawn from experts that represent relevant sector in the construction industry.

This Technical Opinion has been modelled based on international recommended practice.

CIDB Technical Expert Panel Committee for GeoCrete

Technical Expert Panel

Ir. Dr Zuhairi Abd. Hamid	(Chairman)	Construction Research Institute of (CREAM)
Prof. Dr. Mohd. Raihan Taha	(Committee member)	Universiti Kebangsaan Malaysia (UKM)
Ir. Dr. Che Ariffin Hassan	(Committee member)	EDP Consulting Group Sdn Bhd
Dr. Aishah Abu Bakar	(Committee member)	Universiti Malaya (UM)

Secretariat

Ahmad Hazim Abdul Rahim	CREAM
Muhammed Asraff Abdul Rahman	CREAM
Rohani Mokhtar	CREAM
Wan Norhasiah Wan Bidin	CREAM

GENERAL PROVISIONS

The purpose of this report is to assist parties comprising that is, both applicant and granting approval authority, with respect to specification and use of the proposed subject. This report shall not be considered as approval.

Special note should be taken on the provisions and limitations set out and the period of validity of the Technical Opinion.

Technical Opinion is initially given a term of validity of three years from the date of issue in the expectation that, after this period, the subject will no longer be an innovation. It can be reviewed within the first twelve months and when necessary during the life of the products or system described in the document. The limitation on the validity of these opinions should not be interpreted as if it is implying like the life expectancy of the products or system described in the Technical Opinion. However, if experience shows poor overall standard of quality or performance, the Technical Opinion will be withdrawn.

The legitimacy and validity of the Technical Opinion can be verified at office of CIDB Head Office.

CIDB, the Technical Expert Panel shall accept no responsibility for the quality and performance of the products.

Disclaimer

While every effort is made to ensure accuracy of the information presented in this report, neither the Technical Expert Panel nor its Secretariats or CIDB can accept responsibility for any loss or damage incurred in connection with the use of the contents.

Definition

Technical Opinion Programme	: A programme initiated by CIDB with the aim to evaluate products, materials, components or system with regard to, but not limited to IBS. It normally covers wide range of innovative products to be used in local construction industry
Technical Expert Panel	: Individual selected based on their expertise in road work.
GeoCrete/InfraCrete	: GeoCrete/InfraCrete is a whitish powder consisting of alkaline and alkaline earth elements or complex compounds.

Abbreviation

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
BS EN	European Standard adopted as a British Standard
BS	British Standard
CIDB	Construction Industry Development Board
CREAM	Construction Research Institute of Malaysia
EN	European Standard
ESAL	Equivalent Single Axle Load
FWD	Falling Weight Deflectometer
GCSSB	Geo Crete Specialist Sdn. Bhd.
IBS	Industrialised Building System
JKR	Jabatan Kerja Raya
JPS	Jabatan Pengairan dan Saliran
KKLW	Kementerian Kemajuan Luar Bandar dan Wilayah
MARA	Majlis Amanah Rakyat
MSZ	Hungarian Standard
OPC	Ordinary Portland Cement
UCS	Unconfined Compressive Strength
ZTVE-STB 94	German Standard

Symbols

%	percent
^{0}C	Degree Celsius
cm	centimetre
g	gram
kg	kilogram
kg/m^3	kilogram per cubic metre
kN	kilo Newton
M	Mega
m	metre
mg	milligram
mg/m^3	milligram per cubic metre
mm	millimetre
MN/m^2	Meganewton per square metre
MPa	Megapascals
N	Newton
N/mm^2	Newton per square millimetre

List of Figures

List of Tables

Contents *Page*

1.0 IDENTIFICATION

1.1 Name of Product

GeoCrete/InfraCrete - Stabilising agent for soil construction application

Note: GeoCrete and InfraCrete refer to the same product. GeoCrete is a local trade name and InfraCrete is the term used at country of origin.

1.2 Dates of Evaluation

15th April 2011, 26th May 2011, 14th December 2011

1.3 Application of Product

For use as capping layers, sub-base and bases in road construction.

1.4 Applicant & Address

Geo Crete Specialist Sdn. Bhd.
Lot 2990, 2nd Floor,
Wisma Keretapi, Blok 10, KCLP,
Jalan Tun Ahmad Zaidi Adruce,
93150 Kuching, Sarawak.
Contact :
Telephone : 082 – 241232 / 242232
Website : www.geocretespecialist.com
E-mail : geocrete@gmail.com

2.0 DESCRIPTIONS

2.1 General Descriptions of Product

GeoCrete is a whitish powder consisting of alkaline and alkaline earth elements or complex compounds. It promotes cement hydration process and inhibits the action of fulvic acids and carbonic acids. The structural changes and the formation of minerals occurring during cement hydration greatly increase the compressive strength, the static and dynamic elasticity modulus, the bending tensile strength and the frost resistance of the soil, and also stabilise humus-rich soils. Apart from heightening the above mentioned parameters, GeoCrete also promotes the immobilisation of pollutant that causes injury to the environment.

2.2 Element of Product

The natural soil material/in-situ soil used in cement GeoCrete stabilisation can exist in any combination of clay, silt, sand, gravel, or crushed stone.

2.3 Origin of the Product

GeoCrete is a product originated from Soil Tech GmbH, Germany (Appendix A). The manufacturer has given the exclusive contract to Geo Crete Specialist Sdn. Bhd. (GCSSB) to use and market the product in Malaysia.

Address of Parent Company in Germany:

Soil Tech GmbH
Am Sportplatz 15
D-35641 Schoffengrund, Germany

Website: www.soiltech.de

2.4 Product Range/Application

Due to its versatility, GeoCrete is widely used as stabilisation of any types of soils, recycling failed pavements and foundation. For foundation or base of any type of infrastructure works, it can be either a low-cost pavement subgrade or base material for many infrastructure applications, including:

In Malaysia

i. Road (Jabatan Kerja Raya (JKR), Kementerian Kemajuan Luar Bandar dan Wilayah (KKLW), Majlis Amanah Rakyat (MARA), Tabung Haji Plantations Berhad, Jabatan Pengairan dan Saliran (JPS))
ii. Canal (Jabatan Pengairan dan Saliran (JPS))

Other Countries

i. Highways
ii. Airport runaways
iii. Building pads
iv. Container ports
v. Warehouses
vi. Rail and truck terminals
vii. Parking areas
viii. Truck docks
ix. Material handling and storage areas
x. General foundations
xi. Footpath
xii. Slope reinforcement

2.5 Technology and Skill Required for Application/Installation

The application/installation process can be carried out by the use of stabilising machine. GCSSB will provide training for installation process.

2.6 Machinery/Equipment Required

Type of machinery or equipment used for installation process comprise of the following:

i. SBF 2k Soil Stabiliser
ii. Sterhr SBS 10 Pull Type Binding - Agent Spreader
iii. Renault 260 tractor or equivalent
iv. Motor grader
v. Compact Roller

2.7 Handling and Storage of GeoCrete

Similar to ordinary cement, GeoCrete should be stored under room temperature and protected from water and damp weather condition.

3.0 BASIS OF APPRAISAL

3.1 Document for Appraisal

The following documents were received from GCSSB to confirm the appraisal and performance of the products:

i. Catalogue of Product
ii. Material Quality Control Document
iii. Test Report on Qualification Test
iv. Test Report on Road Testing

3.2 Inspection of Appraisal

Site visit to Sibu, Sarawak

Site visits by CIDB officials on two road projects that used GeoCrete product were made on 2nd to 4th November 2010 at Ladang Raja Udang and Sebalak, Sibu, Sarawak. The purpose of these visits was to confirm the actual installation process of GeoCrete in road work projects is in accordance with the specification. Photos taken during the site visits are attached in Appendix B.

4.0 PRODUCT: MATERIAL SPECIFICATIONS, CRITERIA AND CHARACTERISTICS AND PERFORMANCE TESTS

4.1 Material Specifications

The detail of GeoCrete specification is given in Material Quality Control Document as attached in Appendix C.

4.2 Material Criteria and Characteristics

i. Durability

In order to ensure that irreversible stabilisation reaction occurs, the amount of stabiliser added shall not be less than the required amount after being determined in the Qualification Test. The Qualification Test has been done by a third party. The details of the Qualification Test are provided in Appendix I. The typical GeoCrete road work process is shown in Figure 4.1.

ii. Material Requirements

Other tests requirements on the material after stabilisation are given below:

Table 4.1: Requirements on the material properties after stabilisation (*Source: From applicant*)

After Stabililisation : Post Construction		
a)	Compactness according to Proctor	97 % of maximum dry density
b)	Minimum Unconfined Compressive Strength after 28 days site sample (N/mm^2)	➢ 1.5 for farm roads ➢ 2.0 for JKR R1-R6 normal roads ➢ 2.5 for highways
c)	Plate Bearing Test after 28 days (MN/m^2)	> 2.5
d)	Deflection Modulus (MPa) by Falling Weight Deflectometer Test	> 25

4.3 Type of Tests

As reported by applicant, several types of test have been performed in order to ensure the results meet the criteria of design requirement. The types of tests for every road work are summarised in Figure 4.1. Detail of test reports of selected road project by the applicant are attached in Appendix I.

FLOW CHART OF INFRACRETE/GEORGETE PAVEMENT TECHNOLOGY APPLICATION

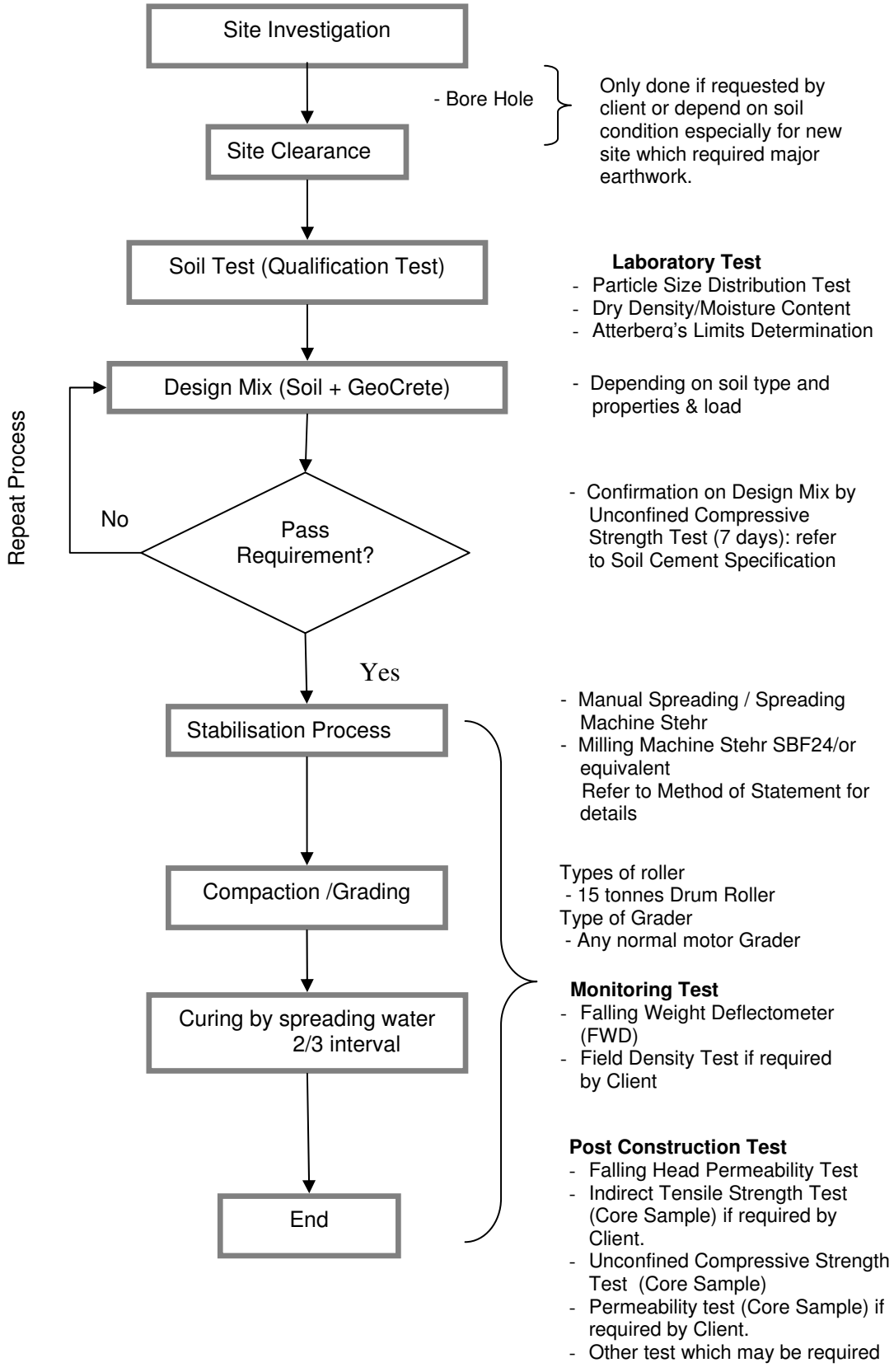


Figure 4.1: Typical GeoCrete road work process *(Reference provided by applicant)*

4.4 Additional Tests Required

The applicant is to notify to CIDB on any additional test required (if any) during the validation period.

4.5 Completed Road Projects by GCSSB in Malaysia

Table 4.2 shows several of completed projects that have used GeoCrete as stabiliser.

Table 4.2: Completed road project by GCSSB based on JKR road category

No	Project	Client	Soil Type	Mix Design	Type of Road
1.	Perlaksanaan Naiktaraf Jalan Ladang/Jalan pertanian MPOB, LKM, LGM & MPB Peruntukan KKLW Tahun 2011 Negeri Sarawak- FB Teknik/ Kementerian Kemajuan Luar Bandar dan Wilayah (KKLW)	FB Teknik / KKLW	Existing Soil	160-200kg/m^3	T1
2.	Projek MRSM Sabak Bernam, Selangor	MARA	Sand	175 kg/m^3	T1
3.	Upgrading Work for Existing Earth Bund at Skuduk Chupak Irrigation Scheme, Sarawak	Jabatan Pengairan dan Saliran	Greyish Brown Sandy Clay	180 kg/m^3	T1
4.	Cadangan Pilot Projek bagi Perlaksanaan Pembinaan Projek Jalan Kampung (PJK) di Jalan Buluh Telur, Kuala Kubu Bharu Daerah Hulu Selangor, Selangor Darul Ehsan	KKLW/JKR Kementerian Kemajuan Luar Bandar dan Wilayah (KKLW)	Sand	175 kg/m^3	T1
5.	Proposed Sg Sebalak Padi Scheme, Betong Division, Sarawak- Drainage and Irrigation System & Flood Mitigation	Jabatan Pengairan dan Saliran	Clay	190 kg/m^3	T1
6.	Proposed Application of GeoCrete Pavement at MR5, Raja Udang Estate, Pusa Sarawak.	Tabung Haji Plantations Berhad	Clay,Silt	190 kg/m^3	T1
7.	Projek Membina dan Menyiapkan Jalan Menalun Sg Poi, Kanowit, Bahagian Sibu Sarawak.	Jabatan Pengairan dan Saliran	Clay, Silt	190 kg/m^3	T2
8.	Projek Membina dan Menyiapkan Jalan Kp Debak/Kg Babu/Kg Bungai/kg Lallang, Bahagian Betong, Sarawak.	Jabatan Pengairan dan Saliran	Clay, Silt	190 kg/m^3	T2
9.	Projek Membina Dan Menyiapkan Jalan Simpang Sibu/Bintulu Ke Sk Sg .Anak, Selangau, Bahagian Sibu, Sarawak.	Jabatan Pengairan dan Saliran	Clay, Silt	190 kg/m^3	T2
10.	Cold in Place Recycling at Existing Road to Mukah from Sibu/Bintulu Junction to Matadeng Junction, Sarawak	JKR	Existing Gravel	170 kg/m^3	T 3

No	**Project**	**Client**	**Soil Type**	**Mix Design**	**Type of Road**
11.	Cadangan Membaikpulih Jalan Menggunakan kaedah Cold in Place (CIPR Simen-GeoCrete di Laluan Ft03 Seksyen 614, Kuala Terengganu - Kota Bharu, Setiu, Terengganu-Roadcare/JKR	Roadcare-JKR	Existing Gravel	165 kg/m^3	T3
12.	Cold In Place Recycling at Jalan Mak Langam, Kemaman, Terengganu	Roadcare-JKR	Existing Gravel	163 kg/m^3	T3
13.	JKR Research Fundamental Characteristic of Stabilisation Full Depth Reclaimed (FDR) Pavement Layer at Felda Pekoti Timur, Rompin, Pahang	JKR	Gravel, Sandy Clay	180 kg/m^3	T3
Farm Road					
14.	Jalan Samarahan/Ensengei/Lubok Bunting, Kota Samarahan Division, Sarawak		Dark Brown Sand	180 kg/m^3	R3

Note:

1) *Mix Design: Bulk density of Ordinary Portland Cement (OPC) and Soil Type (refer Appendix D for details)*
2) *T1, T2, T3 : Design Traffic based on Equivalent Standard Axle Load (ESAL)*

5.0 DESIGN PROCEDURES

The design procedures and methods of statement for road work using GeoCrete are based on the recommendations of Soil-Cement Agent Mixture Specification as given in Table 7.2 of section 7.0. The design take into consideration the result of Qualification Test conducted during laboratory test earlier. The aims of the design procedure are to determine the weight of cement and GeoCrete:

i. Relation between design mix with soil matrix (depending of soil types)
ii. Relation between design mix with ESAL (subjected to traffic category)

The design sheets for item i and ii are provided in Appendix D for reference. However, the final mix design (percentage of Cement:GeoCrete) will be subjected to Qualification Test. For further details on other design calculations can be referred directly to GCSSB. The recommendation and summary given in this Technical Opinion Report are based on the design and documents submitted by GCSSB as mentioned in Appendix E.

Summary of road category and application used recommended by applicant is shown in Appendix F.

6.0 METHOD OF STATEMENT, MAINTENANCE AND LIMITATION

6.1 Method of Statement for Road Work Construction

There are two methods of statement for construction using GeoCrete product as given by applicant:

i. Method of statement for GeoCrete application for roadwork.
ii. Method of statement for GeoCrete hydraulically-bound mixture

The details and photos for construction of road work are highlighted in Appendix G.

6.2 Maintenance

Issue

Since this material is relatively new in Malaysia, there is no maintenance experience and report available yet. However, the method of statement for rectification work on existing road i.e. patching of pothole is given by the applicant as explained in Appendix H.

6.3 Limitations

i. Construction

a. No stabilisation shall be done when weather conditions in the opinion of the Engineer may adversely affect the stabilising operations.

b. Excessive drying out or rain falling on the working area during the process of stabilisation may be sufficient cause for the Engineer to order any affected areas to be reconstructed at the Contractors' own cost.

c. Freshly spread stabilising areas should be out of bound for all traffic, except those required for construction purpose. Only equipment required for curing or priming may be allowed over the treated layers during the specified curing period. Where water spraying equipment causes damage to the layer, the Contractor shall carry out watering by side spraying tankers travelling off the stabilised layer or alternative methods shall be employed to the satisfaction of the Engineer.

ii. Limitation of use

As claimed by applicant, GeoCrete product was also found to be suitable on peat soil condition i.e. at Jalan Raja Udang, Pusa Sarawak. However, for soils which have more than 20% peat content by weight, modification by importing some other material need to be done. This is to ensure the new stabilised material would have adequate density and strength to sustain the load.

The recommended design steps proposed by applicant for peat-soil conditions are as follows:

a. Conduct basic soil geotechnical test
b. If peat content is found to be more than 20% of the soil weight then; perform qualification test to determine the strength of stabilised material under certain amount of import material and the different ratio between cement and GeoCrete
c. Optimum mixture between existing soil: import material: cement: GeoCrete is then finalised.

7.0 COMPLIANCE TO MALAYSIAN AND INTERNATIONAL STANDARD

7.1 Quality Control Tests

GCSSB has provided a list of standards and quality control test to be used on road projects as shown in Table 7.1:

Table 7.1: Standards used for each type of tests

Type of tests	**Standard** *(Reference provided by GCSSB)*
Site Investigation	
- Mackintosh Probe Test	Using Mackintosh Probe to Probe to a maximum depth of 12 m or until maximum resistance of 400 blows per 300 mm penetration depth whichever is achieved earlier (JKR Specification)
- Bore Logs	BS 5390:1990 Hand Auger Boring
BEFORE MIXING	
Qualification Tests (Laboratory Tests)	
- Particle Size Distribution	BS 1377:Part 2:1990
- Atterberg's Limits Determination	BS 1377:Part 2:1990
- Moisture Content	BS 1377:Part 2:1990
- Laboratory Compaction Test/Proctor Test	BS 1377:Part 4:1990

AFTER MIXING	
Field Trial test	
- Unconfined Compressive Strength (UCS)	BS 1881:Part 120:1983
- Falling Weight Deflectometer Test (FWD)	
- Unbound and Hydraulically Bound Mixtures	EN 13286-1:2003
- Unbound and Hydraulically Bound Mixtures	EN 13286-2:2010
- Bearing Capacity Test on Pavement Structures.	MSZ 2509-3
- Falling Head Permeability Test	BS 1377:Part 6:1990, Method 6
- Indirect Tensile Strength (ITS)	AASHTO T-198

7.2 Standards Used for Work Procedure

The standards used for work procedure for GeoCrete is based on Soil Cement Agent Mixture Specification. The specifications referred to by the applicant are adopted from the standards as listed below:

Table 7.2: Standard and procedure used for road work

Standard	Description
BS 12:1978	Standard for Portland Cements
BS 812 :Part 101:1984	Methods for Sampling and Testing Aggregates – Unconfined Compressive Strength of Compacted Materials
BS 434 : Part 1 : 1984	Laboratory Method for a Remoulded Specimen
BS EN 14227 – 10 : 2006	Hydraulically-Bound Mixture Soil Treated by Cement
BS EN 13286 – 48 : 2005	Unbound and Hydraulically-Bound Mixture

ASTM D4695-03	Standard Guide for General Pavement Deflection Measurements
BS 1377 Part 4:1990	Construction Control Test (Rapid Method)
BS 1377 Part 2:1990	Compaction Control Test - Dry Density Ratio, Moisture Variation and Moisture Ratio
ZTVE-STB 94	Supplementary Technical Terms and Conditions of Contract and Guidelines for Earthworks in Road Construction

8.0 VALIDITY OF OPINION

8.1 Condition

The Technical Opinion given in this report was based on the British Standard, European Standard, American Society for Testing and Materials and American Association of State Highway and Transportation Officials, Hungarian Standard, and German Standard (BS 5390:1990, BS 1377:Part 2:1990, BS 1377:Part 4:1990, BS 1881:Part 120:1983, EN 13286-1:2003, EN 13286-2, MSZ 2509-3, BS 1377:Part 6:1990, BS 12:1978, BS 812 :Part 101:1984, BS 434 : Part 1 : 1984, BS EN 14227 – 10 : 2006, BS EN 13286 – 48 : 2005, ASTM D4695-03, AASHTO T-198, ZTVE-STB 94). The recommendations by Technical Opinion Expert Panels are also based upon and limited to available information provided by the applicant.

Critical test results and test report were issued by Accredited Laboratory in Malaysia i.e Buildtest Laboratory Sdn. Bhd.

8.2 Withdrawal

In the event of non-compliance to the Malaysian or equivalent International accepted standards will lead to withdrawal of this Technical Opinion Report.

8.3 Term of Validity

The recommendation is valid for three (3) years from the date of issuance of this Technical Opinion Report. The date of issuance of this Technical Opinion Report is on January 2012.

9.0 RELEVANT DOCUMENTS

9.1 Project Quality Plan For Main Road

This document is important to ensure quality in production and it shall be observed at all time during the process of road construction at site.

10.0 TECHNICAL OPINION SUMMARY

GeoCrete product manufactured or marketed by GCSSB was found to meet the Specification of British Standard, European Standard, American Society for Testing and Materials and American Association of State Highway and Transportation Officials, Hungarian standard and Germany Standard as mentioned earlier in Table 7.1 and 7.2. The following tests as listed below were done at Buildtest Laboratory Sdn. Bhd. which is an accredited laboratory and met the requirement for use as road stabiliser:

i. Mackintosh Probe Test
ii. Hand Auger Boring
iii. Natural Moisture Content
iv. Particle Size Distribution
v. Atterberg's Limits
vi. Unconfined Compressive Strength

The Technical Expert Panels are in the opinion that this GeoCrete product is suitable to be used in Malaysia provided that it complies with the terms and conditions mentioned in this report. Additional requirement proposed by Technical Expert Panels are as follows:

i. A competent and professional design engineer has to be engaged to undertake all design and supervision of the road work.
ii. Trial runs shall be carried out to determine the suitability and effectiveness of the product.
iii. Exercise good engineering practice, recommended procedures and methodology.

Ir. Dr Zuhairi Abdul Hamid
Chairman
Technical Opinion Committee

Prof. Dr. Mohd Raihan Taha
Technical Opinion Committee

Ir. Dr. Che Ariffin Hassan
Technical Opinion Committee

Dr. Aishah Abu Bakar
Technical Opinion Committee
On sabbatical leave

January 2012

11.0 BIBLIOGRAPHY

GCSSB. (2010 a). Cadangan Membaikpulih FT 2686 Jalan Mak Langgam, Kemaman Terengganu (Section 2.000-3.000) CIPR with Cement & GeoCrete.

GCSSB. (2010 b). Cadangan Membaikpulih Jalan Menggunakan Kaedah Cold in Place (CIPR) Simen-GeoCrete di Laluan FT03, Seksyen 614, Kuala Terengganu-Kota Bharu, Setiu, Terengganu.

GCSSB. (2010 c). Catalogue: Soil stabilization/solidification: New Foundation Technology

GCSSB. (2010 d). Fundamental Characteristic of Stabilisation Full Depth Reclaimed (FDR) Pavement Layer-Cold in Place Recycling (CIPR) at Jalan Felda Pekoti Timur, Rompin, Pahang.

GCSSB. (2010 e). Geotechnical Solution for Pavement Structure.

GCSSB. (2010 f). JKR Research – Fundamental Characteristics of Stabilisation Full Depth Reclaimed. (FDR) Pavement Layer.

GCSSB. (2010 g). Pilot Project bagi Pelaksanaan Pembinaan Project Jalan Menggunakan GeoCrete Pavement Technology bagi Tabung Haji Plantations Berhad, di Jalan Ladang MR5 Ladang Raja Udang, Pusa, Sarawak.

GCSSB. (2010 h). Pilot Project Jalan Kampung for KKLW Jalan Buluh for KKLW Jalan Buluh Telur, Kuala Kubu Baru, Selangor.

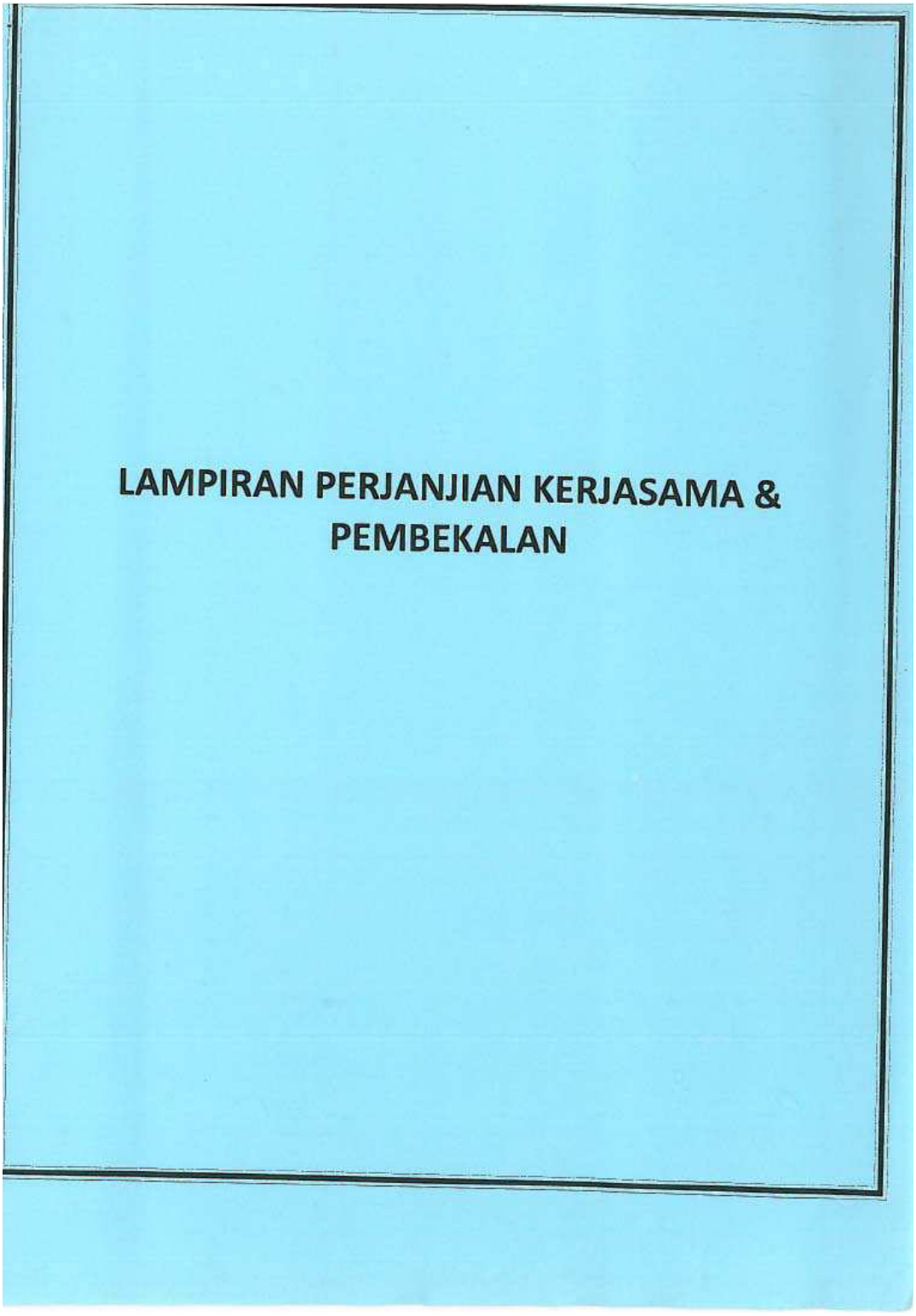
GCSSB. (2010 i). Proposed Sungai Sebalak Padi Irrigation Scheme, Betong Division, Sarawak.

GCSSB. (2010 j). Proposed Upgrading Work of Existing Earth Bund at Skuduk Chupak Irrigation Scheme – Finale Report.

GCSSB. (2010 k). Stabilisation Full Depth Reclaimed (FDR) Pavement Layer using Cement – GeoCrete Mixture at Jalan Samarahan.

12.0 APPENDICES

APPENDIX A



Cooperation and Supply Agreement

between: SoilTech Gmbh, Am Sportplatz 7, D-35641 Schöffengrund, Germany

represented by Mr. Andreas Korytowski

hereafter: SoilTech

and: GeoCrete Specialist Sdn Bhd, Jalan Tun Ahmad Zaidi Adruce, 93150 Kuching, Sarawak, Malaysia

represented by Mr. Zoran Djumic

hereafter: GEO

SoilTech, producer of GeoCrete®/InfraCrete® has many years of experience in the stabilization of several soils for road construction and foundation work using its unique GeoCrete®/InfraCrete® system and has effect numerous projects in road construction and foundation work as well as complete immobilization of pollutants in combination with stabilization.

GEO as excellent contacts to local authorities, construction companies, contractors and beyond it the equipment to execute required work at the site.

General Subject of the Agreement

The aim of the cooperation between the parties is to offer a complete service for application fields of GeoCrete®/InfraCrete® on the market of the agreed territory in accordance with the client requirement.

SoilTech shall be responsible to ensure the supply availability of GeoCrete®/InfraCrete® for the entire duration of the agreement. The use of GeoCrete®/InfraCrete® requires that a geologist determines the amount of additional material per area with regard to the individual soil conditions on the basis of soil surveys. In this respect, SoilTech provides the application know-how.

GEO shall purchase GeoCrete®/InfraCrete® from SoilTech as a reseller and /or produce a binding material (cement and GeoCrete®/InfraCrete®) by a third party as subcontractor; if a suitable device is available, GEO shall be entitled to produce the binding material on its own. GEO will then use the binding material for construction measures or to supply the binding material to possible subcontractors according to the specifications individually agreed with each subcontractor. The adjustment of the amount of binding material for each construction measure on the basis of soil surveys and the provision of technical support for this construction measure with regard to the use of GeoCrete®/InfraCrete® requires the cooperation with geologists. Basically, these services, beyond creation of test field, are under responsibility of GEO. SoilTech provides its application know-how.

Contract territory, Exclusivity

For construction measures within Malaysia SoilTech gives GEO exclusivity, means SoilTech will not supply third parties with GeoCrete®/InfraCrete® into the exclusive contract territory and SoilTech must refer orders to and perform these orders in cooperation only with GEO.

Deviating from the preceding provision, SoilTech can assign third parties to perform the individual construction measures and supply them with GeoCrete®/InfraCrete®, if GEO has agreed in individual cases, or denied the performance of the respective construction measure. Such agreements or denials shall not affect the agreed exclusivity with refer to other construction measures.

GEO shall not process a binding material or binding material compound supposed to have the same features like GeoCrete®/InfraCrete® within the exclusive contract territory.

Liability, Warranty

Due to the legal conception of the cooperation, GEO shall assume liability and warranty for all their services in respect to the relevant clients of construction measures.

SoilTech shall particularly be responsible to ensure that the supplied GeoCrete®/InfraCrete® complies with the required specifications.

Price, Payment

The price of GeoCrete®/InfraCrete® is currently EUR 4,00 / kg CIF main port, Malaysia, delivered in big bags of 1 ton per container (max. payload 20 tons, min. quantity per container 10 tons). The price can be adjusted at years end if costs of raw material increase.

The payment has to be guaranteed by LC payable after 60 days or 100 % cash before shipment.

Duration, Termination

This agreement shall come into force after GEO buys the first 50 tons and remains for a period of 5 (five) years, unless terminated earlier by either party upon 120 days written notice with certificate of receipt to the other party. GEO must buy the minimum of 50 tons of GeoCrete®/InfraCrete® of an amount of EUR 205.000,00 (two hundred five thousand euro) within the first six month of 2010, and 50 tons within the second half of 2010. The contract can be terminated without any notice if GEO has shown no performance and has not bought the minimum quantity of 100 tons per year.

A notice of termination must be supplied to the respective other party in writing. If one party withdraws from the agreement, the entire contract shall be terminated with effect for and towards all contracting parties.

After a 5 year successful cooperation between the parties the contract should be prolonged for another long term agreement.

Cooperation

The parties shall ensure mutual loyalty and compliance with the principle of good faith when completing this agreement. Each contracting party shall be informed in due time about upcoming construction measures and/or offers so that the collaboration, capacity planning and the completion of the obligations set under this agreement are possible.

The parties shall not disclose any knowledge and information on technical, financial or business operations and facts acquired within the duration of the agreement in confidence to other parties. This obligation remains also valid after termination of this agreement.

Court of jurisdiction: Wetzlar, Germany

If a provision of this agreement is or should become invalid, the validity of the remaining provisions shall not affect. In this case, the parties will replace the invalid provision by such valid provision which is most closely to the economic purpose of the eliminated provision.

SoilTech GmbH

Andreas Korytowski

02.05.2010

GeoCrete Specialist Sdn BhD

Zoran Djumic

APPENDIX B

SITE VISIT PHOTOS

Date of Visit : 2nd to 4th November 2010

Venue : Sibu, Sarawak

Figure 1 : Technical visit by CIDB representatives at Sibu, Sarawak

Figure 2 : Briefing by GCSSB about project site.

Figure 3 : GeoCrete in 25 kg bag packaging

Figure 4 : Sterhr, one of the machinery used in road construction work

Figure 5 : Spreading cement and GeoCrete mixture along the road to be constructed (manual spreading)

Figure 6 : Mixing process using soil stabiliser machine

Figure 7 : Spreading water over the road surface.

Figure 8 : Manual compaction at site.

Figure 9 : Vibratory roller for compaction

Figure 10 : Falling Weight Deflection Test (FWD) is done in order to determine the quality of product.

Figure 11 : CIDB representatives with GCSSB personnel.

APPENDIX C

MATERIAL QUALITY CONTROL DOCUMENT

Material Quality Control : Product GeoCrete ST

GeoCrete

Data Summary

Trade Name	GoeCrete	
Description	GeoCrete is mixture of different inorganic alcaline and alkaline earth elements	
Usage	GeoCrete is cement additive for soil stabilization and immobilization of pollutant	
Chemical Valuation		
	CHLORIDES (Natural)	25 - 35 %
	OXIDE (Natural)	35 - 45 %
	SULFATE (Natural)	10 - 20 %
	SILICATE (Natural)	10 - 25 %
Physical Valuation	Form	Powder/Granulat
	Colure	white, greyish
	Spec. Weight	1,000 kg/m³ at 20° C
	Melting Point	> 1,000° C
	Freezing Point	No
	Ph value in dest. H_2O	9

GEOCRETE B.V.
Postbus 230
3100 AE SCHIEDAM
+31 10 409 09 40

1

Part 1: Composition

Chemical Composition	Percentage	CAS Number	Classification	LD 50	LS 50
Chlorides (Natural)	25—35 %	N/A	N/A	N/A	N/A
Oxide (Natural)	35—45 %	N/A	N/A	N/A	N/A
Sulfate (Natural)	10—20 %	N/A	N/A	N/A	N/A
Silicate (Natural)	10—20 %	N/A	N/A	N/A	N/A

Part 2: Product Information

Product Label: GeoCrete ST			
Manufacturer: Van Mannekus & CO. B. V.		Plant GeoCrete B. V.	
Street Nieuwe Waterrwegstraat 45		Street Nieuwe Waterrwegstraat 45	
City: 3115 HE Schiedam	Country: Nederland	City: 3115 HE Schiedam	Country: Nederland
Tel.: 00 31 - (0)10 - 409 15 00 Fax.: 00 31 - (0)10 - 473 08 80		Tel.: 00 31 - (0)10 - 4090940 Fax.: 00 31 - (0)10 - 4090949	
Usage: Cement additive; Use for immobilization of pollutant for heavy metals			

Part 3: Physical and Chemical Characteristics

Form: Powder/Granulat	Smell and Colure: Odorless, white, greyish	Smell Adversity: N/A
Specific Weight: 1,000 kg/m³ at 20° C	Ph value in dest. H2O 9	Steam Pressure: N/A
Melting Point: ≥ 1,000° C	Freezing Point: N/A	Gas Density (Air=1) N/A

Inflammable: No	Self inflammable: No
Explosive: No	Dengerous side-effect: No

Part 4: Stability and Reactivity

Stability: Thermal stabile
Incompatible materials: Unknown
Dangerous decomposition products Unknown

Part 5: Indication on Toxicity

Exposition way:	
Skin contact:	to avoid
Receive trough skin:	N/A
Eye contact:	to avoid
Inhalation:	to avoid
Swallowing:	to avoid

Effect trough actual exposition: In case inhaling or swallowing of the material, as soon as possible material have to be remove and wash over with a sufficient quantity of water. In case of eye contact immediately have to wash over with a sufficient quantity of water.
Effect trough longer time exposition: Unknown

Exposition limit: Unknown	Irritations: Unknown	Interactions: Unknown

Cancer, sterility, gene mutation, narcotic effects? Unknown

Par 6: Ecology

Mobility: No (inorganic, mineral)	Absorption: Binder for heavy metal
Desorption: No	Degradability: No (inorganic, mineral)
Accumulation: No bio accumulation	Pollution: No

Part 7: Safety

Personal protection equipment: Protective glasses, protective shoes, dust protection (protect eyes, skin, respiratory tract)

Gloves: Working gloves	Breath protection: Dust concentration >TWAEV 10 mg / m³

	Overalls
Eye protection: Protective glasses with dust release Usage of contact lens is not recommended	Shoe quality: Closed shoe, boots, to avoid skin contact
Fuher security equipment: No	
Usage in close space: Work is recommended in a dust concentracio of > 10 mg / m³ TWAEV (Timed weighted average exposure limit)	
Dry cleaning methods; minimize dust winding; avoid inhaling	
Disposal: No special requests; disposal according local authority instructions	
Handling: Mitigate dust development	
Storage: Dry storage; recommendations to the durability	
Special instruction for shipments: Unrestricteder risk looses during shipment	

Part 8: First Aid Measures

Inhalation: Wash over with water and ask for help	
Swallowing: Small quantity can neutralize with drinking a water, other ask for help. Do not drink warm water.	
Eye contact: Wash with sufficient amount of water	
Skin contact: Avoid skin contact	
Futher informations: No	
Manufacturer: Van Mannekus & Co.B.V. Nieuwe Waterwegstraat 45 3115 HE Schisdam Van Mannekus & Co B.V. Postbus 230 3100 AE SCHIEDAM Tel.: 010-4091500 GEOCRETE B.V. Postbus 230 3100 AE SCHIEDAM +31 10 409 09 40 Schieam, at 10.08.2005 Signature:	

APPENDIX D

DESIGN MIX OF GEOCRETE

A. Relation between Design Mix with ESAL (subjected to traffic loading)

GEOCRETE PAVEMENT TECHNOLOGY

RELATION OF GEOCRETE PAVEMENT DESIGN ON ESAL VALUE.

Traffic Category	Design Traffic (ESAL X 10^6)	Depth Stabilization Recommended	Design Mix Recommended
.T1	≤ 1.0	200mm	Refer to Relation of Design Mix and Soil Classification.
.T2	1.1 to 2.0	250mm	
.T3	2.1 to 10.0	275mm	
.T4	10.1 to 30.0	300mm	
.T5	› 30.0	≥300mm	

Note:

Traffic Category is based on Table 3 New JKR Manual on Pavement Design ; Arahan Teknik Jalan 5/85 Manual on Pavement Design.

Actual Mix Design (Percentage of Cement:Geocrete) will be subject to Qualification Test as per Soil Cement Specification.

Min Maximum Dry Density assume to be 1100kg/m2 , Import material shall be apply as modifcation method to increase the stabilized material min Maximum Dry Density.

B. Relation between Design Mix with Soil Matrix (depending of soil types)

GEOCRETE PAVEMENT TECHNOLOGY

RELATION ON MIX DESIGN AND SOIL CLASSIFICATION

SOIL MATRIX

	Soil Class		Initial Water Content	Normal Amount of OPC+Geocrete (Q)
Non Binding	GW	Well Graded gravels and gravel-sand mixtures,little or no fine	From 0 to 15/20%	From 140kg/m3 to 180 kg/m3
	SW	Well Graded sand and gravelly sand ,little or no fine		
	GP	Poorly gradedgravels and gravel-sand mixtures,little or no fine		
	GM	Silty gravels, gravel-sand-silt mixtures		
	GC	Clayey gravels, gravel-sand-clay mixtures		
	SW	Well graded sand and gravelly sands,little or no fines		
Mixed Grains	SP	Poorly graded sand and gravelly sands, little or no fines	From 0 to 30/35%	From 160 kg/m3 to 190 kg/m3
	SM	Silty sands, sand-silt mixtures		
	SC	Clayey sands, sand-clay mixture		
Binding	ML	In organic silts,very fine sands, rocks,silty or clayey fine sands	From 0 to 15/30%	From 170 kg/m3 to 220 kg/m3
	CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/ lean clays		
	OL	Organic silts and organic silty clays of low plasticity		
	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts		
	CH	Inorganic clays or high plasticity, fat clays		
	OH	Organic clays of medium to high plasticity		
Organic	Pt	Peat, muck and opther highly organic soils	Import material recommended to be installed before Stabilization.	

Note: **Formula to determine Weight of Cement and Geocrete**

Value of Q (180 -220kg/m3)is derived from the Above Schedule which final value will be confirmed based on Qualification Test.
This is due to possibility of soil sample having more than 1 of Soil Calssification.

P% (Percentage of OPC+ Geocrete in Per m3 of Soil) = $\frac{Q}{\text{MDD of Soil (kg/m3)}} \times 100\%$

W (Weight of Dry Soil per m2 of Roadbase)= $\frac{\text{MDD x Proposed thickness of Roadbase in mm}}{1000}$

X (weight of OPC + Geocrete)=W x P%

Y (Weight of OPC)=99% x X
Z (Weight of Geocrete)= 1-2% x Y

The above formula will be use as aguide in preparing the Soil Sample for Qualification Test.
The Design Mix will be confirmed once Qualification Test meet all the design criteria.

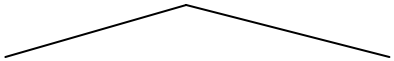
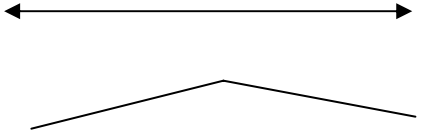
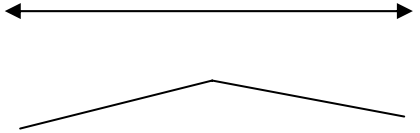
APPENDIX E

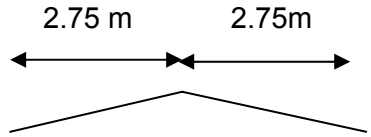
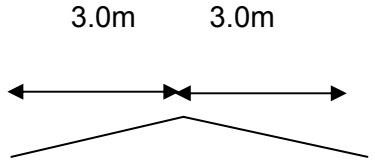
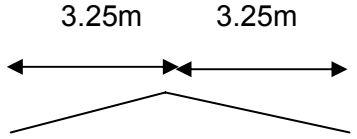
RELATION BETWEEN TYPE OF SOIL, GEOCRETE DESIGN MIXTURE AND STRENGTH

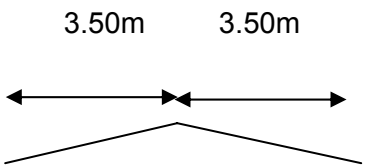
No.	Location	Gravel	Sand	Clay	Silt	Fine	Soil Classification	Dry Density Mg/m3	Moisture	OMC	Plastic	Cement	Geocrete	UCS 7 days N/mm2	UCS 28 days N/mm2
1	Mak Langgam						Existing Gravel Road Material	2.12	5.29%	5.60%		8% 8%	1.50% 2%	8.31 9.30	
3	Kuala Kubu	25%	67%			8%	Brown Sand with some gravel	1.86	5.99%	9.30%	-	8%	1.50%	5.92 8.18	
4	Long Semado	5%	38%	21%	36%		Light Brown Clay with some sand and gravel CL.	1.9	9.90%	10.00%	15.0 m	9% 9%	2% 1%	2 1.66	3.64 2.89
5	Long Lopeng	7%	30%	23%	40%		Light grey CLAY with some sand gravel.CL	1.88	8.53%	10.50%	17.1 m	9%	1% 2%	1.12 1.3	2.46 2.6
6	Bakalalan	5%	38%	21%	36%		Brown Clay with some sand and gravel.CL	1.8	8.6	15%	21.1m	9.80%	2%	1.73	2.33
7	Bario		15%	23%	62%		Light brown Clay with some sand. Cl	1.599	27%	18%	27.1m	11% 11%	1% 2%	0.88 0.84	0.68 2.25
8	Brooke Dockyard	28%	52%	5%			Dark Brown Sandy Silt with some gravel.	2.38	11.6	5.50%	-	7.50%	1%	11.04	12.17

APPENDIX F

Summary of Road Category and Application Used Recommended by Applicant

No.	Road Category	ESAL Value	Depth (mm)	ρ kg/m^3 (range of design mix)	Application	Standard used	Typical drawing
1a		Not Applicable	150-200	140 – 200 (depend on type of soil/existing material and special requirement)	Farm Road	Refer to the Note below	Varies from 1 -5 m width 
1	T1*	≤ 1.0	200-250	180-200 (depend on type of soil/existing material and special requirement)	R1A/U1A	Refer to the Note below.	4.5m 
2	T1* T2*	≤ 1.0 1.1 to 2.0	250	180-220 (depend on type of soil/existing material and special requirement)	R1/U1	Refer to the Note below.	5.00m 

3	T1* T2* T3*	≤ 1.0 1.1 to 2.0 2.1 to 10	200 250 275	200-220 (depend on type of soil/existing material and special requirement)	R2/U2	Refer to the Note below.	
4	T1* T2* T3* T4*	≤ 1.0 1.2 to 2.0 2.1 to 10 10.1 to 30	200 250 275 300	200-220 (depend on type of soil/existing material and special requirement)	R3/U3	Refer to the Note below	
5	T1* T2* T3* T4* T5*	≤ 1.0 1.3 to 2.0 2.1 to 10 10.1 to 30 ›30	200 250 275 300 ≥300	200-220 (depend on type of soil/existing material and special requirement)	R4/U4	Refer to the Note below	

6	T1* T2* T3* T4* T5*	≤ 1.0 1.4 to 2.0 2.1 to 10 10.1 to 30 ›30	200 250 275 300 ≥300	200-220 (depend on type of soil/existing material and special requirement)	R5/U5 And R6/U6	Refer to the Note below	

*Note** : Structurally type of Road (T1 to T5) based on load will determined by ESAL VALUE and does not really reflect to the Geometrical type of Road (R1A/U1A to R6/U6). The above mentioned geometrically type of road is based on relativity whereby for heavier load normally required wider width (not been mentioned in any JKR Specification to related this two item).

Structurally type of road can be referred to Arahan Teknik Jalan JKR 5/85 Manual on Pavement Design
Geometrical type of road can be referred to Arahan Teknik Jalan 8/86 A Guide of Geometric Design of Roads. Refer to this for the shoulder width.

All the specification for GeoCrete Application is the same regardless for Farm Road to the T5 of road as per listed below list of specification:

APPENDIX G

A. METHOD OF STATEMENT FOR GEOCRETE APPLICATION FOR ROADWORK.

- **Application of GeoCrete Pavement Technology as following:**

1. **Qualification Test-** to determine the right **Design Mix,** first the '**Soil Property** and **Engineering Characteristic**' of the soil need to be tested in the laboratory. This Qualification test will determine the rate of Cement and GeoCrete to be applied per m3 of Soil Stabilisation.(**Refer to Soil Stabiliser Specification)**

2. **Site Preparation-** Once the proposed **Design Mix** meet the criteria of the Qualification Test, site need to be prepare to receive the Stabilising material**. Grading and trimming of the earth Roadbase shall be carried out. (Refer to JKR Standard Specification for Roadworks Section 2)**

3. **1st Milling Process-** By applying the **Design Mix, Ordinary Portland Cement and GeoCrete Powder will be spread equally per unit area either by manual spreading or by Spreading Machine Sther.**

   Stabilisation or Milling process then start by special milling machine Stehr SBF24 to ensure a uniform blend of Stabilisation material and the Soil which the depth of milling will depend on the Design Criteria.

4. An extra of **2% from Optimum Moisture Content (OMC from Qualification Test)** of water will be spread uniformly into the Mixed Soil- Cement GeoCrete material to ensure the moisture is efficient to start the Chemical Reaction between Cement and GeoCrete and to promote the optimum Cement Hydration.

5. **2nd Milling will be carried out as per 3 step.-** this to ensure the added water will be uniformly blend with the Mixed Soil-Cement GeoCrete.

6. **Initial Compaction-** Compaction will be carried out with 15 tonnes Drum Roller with the initial compaction pattern is in Rolling mode without vibration.

7. **Trimming dan Grading –** To ensure the Stabilize GeoCrete Cement Roadbase surface is following the acceptable gradient as per design criteria, trimming and grading will be carried out by Motor grader**. The Stabilize Surface will be the final surface if** '**Asphalt Wearing Course** 'is not required**.**

8. **Final Compaction-** after trimming and grading had been done, final compaction will be carried out by 3 passes of vibration roller. Speed shall not be more 3km/hr. Another round of grading shall be carried out if necessary. (Refer to Rekabentuk Jalan JKR Standard Specification Ror Roadworks Section2)

9. **Curing Process- This is a process whereby the stabilize surface will be spray by water to control the Hydration process to avoid premature cracking**. Spraying of water will be done at 2 or 3 hrs interval in 2 days time depending on weather condition.

10. **Laying ACW 20 Wearing Course-** This is '**Optional**' if required by Client or design.

B. METHOD OF STATEMENT FOR GEOCRETE HYDRAULICALLY BOUND MIXTURE

PRIMARY CANAL

a. Site Preparation

Primary Canal Bed

1. Setting out the Primary Canal centre and the Bed Level of the Primary Canal
2. Excavation work of 300mm thick of the Primary Canal Bed to receive GeoCrete Hydraulically Bound Mixture.

Primary Canal Wall

1. Setting out the Primary Canal Wall inner Pag.
2. Excavation work of 1000mm width of the Primary Canal Wall to receive GeoCrete Hydraulically Bound Mixture

b. Mixing and Placing of Stabilizing Material

1. Mixing shall be done outside the canal area to avoid damage on the embankment.
2. The cement and the stabilizing agent shall be spread uniformly over the full area of the prepared layer at the prescribed rate of application by means of an approved type of mechanical spreader in an continuous process, or it may spread by other methods such as motor grader or by hand. Any equipment and method to be used shall be approved by the Engineer.
3. After the cement and stabilizing agent has been spread, it shall be mixed for the dull required depth of the treatment. Care shall be taken not to disturb the compacted layer underneath, nor to mix the stabilizing agent in below the desired depth. Mixing shall be continued for as long as soil and stabilizing agent over the full area and depth of the material to be treated and until the resulting mixture is homogeneous and uniform appearance throughout.
4. Mixing Rate shall be 8% of Ordinary Portland Cement and 2% GeoCrete by milling machine.
   (+/- 1%).
5. To place the stabilize Hydraulically Bound Mixture in the excavated trench of Primary Canal Bed/ Wall by using excavator bucket.

6. Placing shall be control to ensure uniform blend of material is spread properly on in the excavated Primary Canal Bed trench. Thickness of uncompacted material shall be not less than 400mm.

7. For Primary Canal Wall, placing of Stabilize material shall be carried out in layers of uncompacted 400mm thick and shall be carried layer by layer till the Bund Top Level is reach.

c. Trimming and Compaction

1. After mixing the layer shall be trimmed and compacted in accordance with the Specification for FLEXIBLE PAVEMENTS to produce a tight dense surface parallel with the finished wearing surface so that the levels do not vary from the design levels beyond the tolerance for primary trimming.

2. Compaction of stabilised pavements shall be carried out with a combination of roller types to provide initial compaction and a vibrating smooth drum roller to complete the compaction. Both roller types shall comprise an appropriate configuration and mass to achieve the specified degree of compaction for the projects. To level the Hydraulically Bound Mixture material manually before Compaction by roller proceeds.

3. All trimmed material having been cut to waste shall be used as fill or spoiled as directed by the Superintendent.

4. To check the final level of the Primary Canal Bed to ensure the required level is achieved.

5. To ensure the trimming of the Primary Canal Wall is carried layer by layer and following the Gradient required of 1:2.

d. Curing

1. For dry weather, curing need to be carried out by spraying a water to the stabilized area immediately in every 2 to 3 hrs at daytime for a period of 48 hrs.

2. The stabilised work shall be protected against rapid drying out by keeping it continuously wet or damp during the period prior to the provision of a subsequent layer or the application of a seal coat.

3. Water curing shall consist of frequent light uniform spraying that will not produce significant run off or flooding on sections of the area. Slurring of the surface or leaching of the stabilising agent shall be avoided.

Photos for method of statement

STEP 1	STEP 2
	
Preparation of surfaces • Secure trafficability for construction equipment • Reduce water content of soil, if required • Exchange soil, if required. • Pre¯leveling/pre¯compaction of rough grade level - Obstruction¯free trafficability of the area • Marking/pegging of stabilization area Safeguarding of	**Spreading of cement** • Qualification test for specification of cement/ additive mixture • Production of cement • Preparation and use of suitable spreading vehicle • Construction site logistics for on-schedule delivery of spreading vehicle • Supervision of spreading procedure
STEP 3	**STEP 4**
	
Mixing of cement • Mixing of cement/additive mixture in required strength using soil stabilizer in the soil • In the case of milling depths required > 50 cm, the soil is dug away, stored intermediary, mixed with cement and reused.	**Watering the surface** • Irrigating the base layer (evaporation protection) using an irrigation unit • Continual adding of water without interrupting the milling work • Filling procedure using vacuum tanker

STEP 5	STEP 6
	
Compaction of the Surface • On site creation of precise grade level • Dynamic and/or static compaction on average 100% DPR using suitable equipment • Post-profiling with grader (laser controlled) if necessary • Compaction of precise grade level using smooth drum roller on average 100% DPR with suitable equipment	**Quality Assurance** • Geotechnical support using static plate test according to standards and using dynamic plate test as well as falling weight equipment • Removal of drilling cores • Compression strength test, etc

APPENDIX H

Rectification Work

POTHOLE METHOD OF STATEMENT FOR GEOCRETE

1. Good Traffic Management during Pothole repairing work for safety reason.
2. Marking the Cutting Pothole area in square shape (size between 0.5m x 0.5m minimum and 1.3m x 1.3m maximum) and at least 150mm from the pothole edge.
3. To Cut the Asphalt using Pavement Cutter in square shape with vertical edge as per marking.
4. To excavate properly the existing roadbase material (**250mmthk minimum**) using breaker, shovel or backhoe . Excavation area need to have a flat ground and vertical edge.
5. To recycle this excavated material (3/4 inch crushed stone) with cement and **Geocrete** by mixing this mix in a **Portable Drum Mixer** with adequate water (additional of water equivalent of 42kg or 40 litre of water per m3 of recycle mix).
   (ratio of mixing is by weight; 160kg/m3 of cement from weight of excavated roadbase material and 3kg of Infracrete)
6. Filling this recycle material to the excavated pothole area in 2 layer and thoroughly tamp each layer with **Vibratory Plate Compacter** to 90-95% of compaction degree.
   (Vibratory Plate compacter of min 12KN Centrifugal Force).*
7. Clean the area from any loose material and ensure it dry to receive **Tack Coat**.
8. Tack coat grade RS-1K have to be spray at 0.25 to 0.55 liter/m all over the area and the cutting edge and to be wait for 30 minutes for setting before proceed with Asphalt patching.
9. To apply Premix on the surface (hot mix or cold mix) but need to comply with Jadual 4.10 JKR/SPJ/1988 till the existing wearing course level
10. Compaction density is between 90-100%
11. To seal the edge of the cutting area with **' sand seal'** or **'chip seal'** to restraint water to penetrate in through the joint.
12. Sprinkle the top of the patch with wet sand to prevent the roller and the traffic from picking up the mix while it hardening.

*Note: If Premix does not apply at the same day, care should be taken to spray water at interval times of 2 to 3 hrs.(for the first 24hrs)

The stated quantity of cement and Infracrete is based on Dry Density of DCR 0f 2000kg/m3, Design is 8% of Cement and 2% of Geocrete from the cement content

APPENDIX I

Project at Kuala Kubu Baru, Selangor.

BUILDTEST LABORATORY SDN. BHD.
(Company Reg. No. 413340-D)

NO.12, JALAN PS 8/1, PRIMA SELAYANG, 68100 BATU CAVES, SELAYANG, SELANGOR DARUL EHSAN.
TEL : 03-6120 5835 FAX : 03-6120 5836

MACKINTOSH PROBE TEST

Doc. No.	Lab Ref.
BTL-FT-Soil-4	: 7824
Tested By	**Date Test**
: AM / KEN / SA	: 28-10-2010

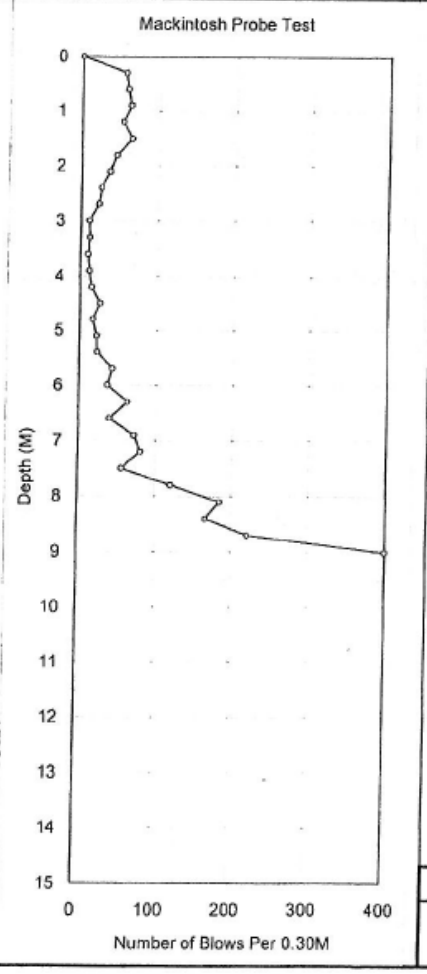
Tested For : KARISMA MSC SDN. BHD.

Project / Location : PILOT PROJEK BAGI PELAKSANNAAN PEMBINAAN PROJEK JLN KAMPUNG(PJK) MENGUNAKAN TEKNOLOGI KAEDAH BARU,JLN BULUH TELUR,KKB.

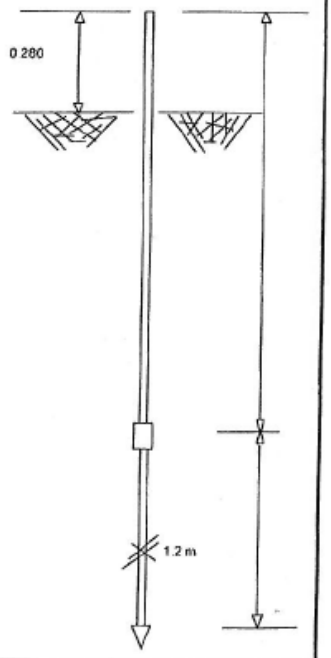
Test Location	Chainage
: As indicated by client	: N/A
Ground Surface Condition	**Ground Level**
: DRY	: ORIGINAL GRD LEVEL

Test No. : MP 1

Penetration Depth (m)	Number Of Blows	
0.00 - 0.30	56	
0.30 - 0.60	59	
0.60 - 0.90	63	
0.90 - 1.20	53	
1.20 - 1.50	65	
1.50 - 1.80	45	
1.80 - 2.10	37	
2.10 - 2.40	26	
2.40 - 2.70	23	
2.70 - 3.00	11	
3.00 - 3.30	12	
3.30 - 3.60	10	
3.60 - 3.90	12	
3.90 - 4.20	15	
4.20 - 4.50	20	
4.50 - 4.80	17	
4.80 - 5.10	22	
5.10 - 5.40	23	
5.40 - 5.70	43	
5.70 - 6.00	37	
6.00 - 6.30	63	
6.30 - 6.60	40	
6.60 - 6.90	72	
6.90 - 7.20	80	
7.20 - 7.50	58	
7.50 - 7.80	120	
7.80 - 8.10	184	
8.10 - 8.40	166	
8.40 - 8.70	221	
8.70 - 9.00	400	(P)
9.00 - 9.30		
9.30 - 9.60		
9.60 - 9.90		
9.90 - 10.20		
10.20 - 10.50		
10.50 - 10.80		
10.80 - 11.10		
11.10 - 11.40		
11.40 - 11.70		
11.70 - 12.00		
12.00 - 12.30		
12.30 - 12.60		
12.60 - 12.90		
12.90 - 13.20		
13.20 - 13.50		
13.50 - 13.80		
13.80 - 14.10		
14.10 - 14.40		
14.40 - 14.70		
14.70 - 15.00		
Water Level	NIL	



Sounding Equipment			
Cone diameter (mm)	25	Ht of fall (cm)	30
Cone angle	30o	Dia of rod (mm)	13
Wt of hammer (kg)	4 5	Dia of coupling (mm)	24
Final Depth Check			
Total tubes on site (nos)	13	Tubes in use (nos.)	8
Tubes not in use (nos)	5		



Final Depth	8.720 m
Reason Terminated	Probe achived 400 blows per 300 mm penetration

Remarks : (P) - 0.3m / P 0.020

TEST METHOD	USING MACKINTOSH PROBE TO PROBE TO A MAXIMUM DEPTH OF 12 METERS OR UNTIL MAXIMUM RESISTANCE OF 400 BLOWS PER 300 mm PENETRATION DEPTH WHICHEVER IS ACHIEVED EARLIER.	CHECKED BY :

BUILDTEST	**BUILDTEST LABORATORY SDN BHD** (CO.REG.NO.413340-D)	NO 12,JALAN PS8/1,PRIMA SELAYANG, 68100 BATU CAVES,SELAYANG SELANGOR DARUL EHSAN TEL : 03-61205835 FAX : 03-61205836

BORE LOG

	Doc NO : BTL-FT-SOIL-6	Lab Ref : 7824
	Tested By : AM / KEN / SA	Date of Test : 28-10-2010

TESTED FOR	: KARISMA MSC SDN. BHD.
PROJECT	: PILOT PROJEK BAGI PELAKSANNAAN PEMBINAAN
	PROJEK JLN KAMPUNG(PJK) MENGUNAKAN TEKNOLOGI
	KAEDAH BARU,JLN BULUH TELUR,KKB.
BOREHOLE NO	: HA / 1
BOREHOLE LOCATION	: LOCATION 1
REDUCED LEVEL	: N/A
TYPE OF BORING	: 100 mm Diameter Hand Auger Boring
DATE OF BORING	: 28-10-2010
WATER LEVEL	: N/A
LOGGED BY	: DT

DEPTH m	DEPTH mm FROM - TO	THICKNESS mm	SOIL DESCRIPTION	SAMPLE NO	DEPTH m
0.00	0-1000	1000	Medium Brown Silty SAND.	HA1-S1	0.00-1.00
1.00	1000-2000	1000	Sandy Material	HA1-S2	1.00-2.00
2.00	2000-2500	500	Medium Brown Silty SAND with traces of Gravels.	HA1-S3	2.00-2.50
2.60			Hard Layer		
3.00					
4.00					
4.80	Borehole terminated at 2.5 m				
5.00					

TEST METHOD	BS 5930 : 1999 CODE OF PRACTICE FOR SOIL INVESTIGATION	**CHECKED BY**	

Log not drawn to scale

BUILDTEST LABORATORY (413340-D) SDN BHD

BUILDTEST	BUILDTEST LABORATORY SDN. BHD. (CO.REG.NO.413340-D)	NO. 12 JALAN PS 8/1, PRIMA SELAYANG, 68100 BATU CAVES, SELANGOR DARUL EHSAN. TEL : 03-6120 5835 FAX : 03-6120 5836	
DETERMINATION OF MOISTURE CONTENT		**Doc. No.** BTL-LT-Soil-5	**Lab Ref.** : 7824
		Tested By : LDA	**Date Test** : 29-10-2010

TESTED FOR : KARISMA MSC SDN. BHD.

PROJECT / LOCATION : PILOT PROJEK BAGI PELAKSANNAAN PEMBINAAN PROJEK JLN KAMPUNG(PJK) MENGUNAKAN TEKNOLOGI KAEDAH BARU,JLN BULUH TELUR,KKB.

SOURCE			LOCATION 1	LOCATION 1
SAMPLE NO.			HA1-S1	HA1-S3
DEPTH	m		0.00 - 1.0	2.0 - 2.5
CONTAINER NO.			B27	BTL4
WEIGHT OF WET SAMPLE + CONTAINER	gm	(A)	137.4	142.4
WEIGHT OF DRY SAMPLE + CONTAINER	gm	(B)	133.4	138.1
WEIGHT OF CONTAINER	gm	(C)	36.6	38.5
WEIGHT OF DRY SAMPLE	gm	D = (B - C)	96.8	99.6
WEIGHT OF WATER	gm	E = (A - B)	4	4.3
MOISTURE CONTENT	%	(E / D) X 100	**4.1%**	**4.3%**

SOURCE			LOCATION 2	
SAMPLE NO.			HA2-S5	
DEPTH	m		4.0 - 5.0	
CONTAINER NO.			CT33	
WEIGHT OF WET SAMPLE + CONTAINER	gm	(A)	141.3	
WEIGHT OF DRY SAMPLE + CONTAINER	gm	(B)	135.3	
WEIGHT OF CONTAINER	gm	(C)	35.5	
WEIGHT OF DRY SAMPLE	gm	D = (B - C)	99.8	
WEIGHT OF WATER	gm	E = (A - B)	6	
MOISTURE CONTENT	%	(E / D) X 100	**6.0%**	

Remarks : The above samples were submitted by the Client to our Laboratory therefore BUILDTEST LABORATORY SDN BHD shall not be held responsible for the correctness of the sampling.

TEST METHOD	OVEN DRIED METHOD	CHECKED BY :

BUILDTEST	**BUILDTEST LABORATORY SDN. BHD.** (CO.REG.NO.413340-D)	NO.12, JALAN PS 8/1, PRIMA SELAYANG, 68100 BATU CAVES, SELAYANG, SELANGOR DARUL EHSAN TEL. : 03-6120 5835 FAX : 03-6120 5836	
DETERMINATION OF GRADING OF SAND		Doc. No. BTL-LT-Soil-1	Lab Ref. : 7824
		Tested By : SA	Date Test : 09-11-2010

TESTED FOR : KARISMA MSC SDN. BHD.

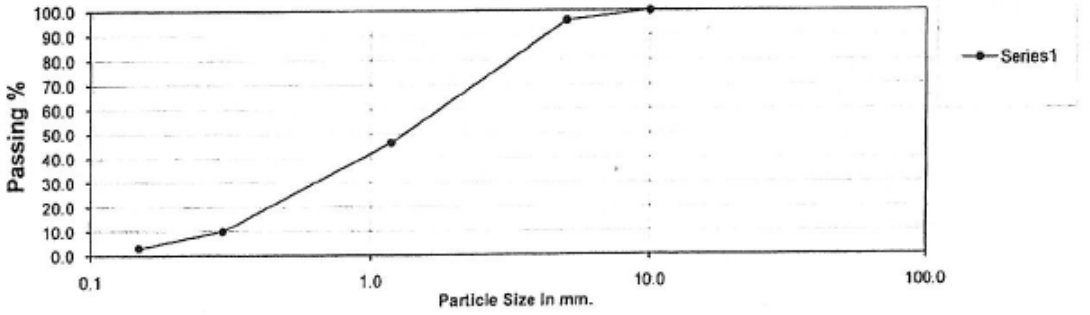
PROJECT & LOCATION : PILOT PROJEK BAGI PELAKSANNAAN PEMBINAAN PROJEK JLN KAMPUNG(PJK) MENGUNAKAN TEKNOLOGI KAEDAH BARU,JLN BULUH TELUR,KKB.

TEST MATERIAL : Medium Brown Silty SAND.
SAMPLE REF. : HA1-S1
SOURCE : LOCATION 1 (0.0 - 1.0m Depth)

BS Sieve Size mm	Wt. Of Retained gm.	Retained %	Passing %
			100
10	0.0	0.0	100.0
5.0	11.0	3.9	96.1
1.18	141.6	49.9	46.3
0.30	102.9	36.2	10.0
0.15	19.6	6.9	3.1
Pan	8.9	3.1	0.0
Total Wt.	284.0		

BS.Sieve Size (mm)	TEST SAMPLE
10	100
5.0	96
1.18	46
0.30	10
0.15	3
Pan	0

PARTICLE SIZE DISTRIBUTION



Series 1-- Test Sample

Remarks :

TEST METHOD	BS 1377 : Part 2 : 1990 JKR/SPJ/1988 Table 3.1	CHECKED BY :	BUILDTEST LABORATORY SDN. BHD. (413340-D)

BUILDTEST	**BUILDTEST LABORATORY SDN. BHD.** (CO.REG.NO.413340-D)	NO.12, JALAN PS 8/1, PRIMA SELAYANG, 68100 BATU CAVES, SELAYANG, SELANGOR DARUL EHSAN. TEL : 03-6120 5835 FAX : 03-6120 5836	
DETERMINATION OF ATTERBERG LIMITS (LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX)		**Doc. No.** BTL-LT-Soil-2	**Lab Ref.** : 7758
		Tested By : LDA	**Date Test** : 01-11-2010

TESTED FOR : KARISMA MSC SDN. BHD.

PROJECT / LOCATION : PILOT PROJEK BAGI PELAKSANNAAN PEMBINAAN PROJEK JLN KAMPUNG(PJK) MENGUNAKAN TEKNOLOGI KAEDAH BARU,JLN BULUH TELUR,KKB.

Sample No.	: HA1-S1
Source	: LOCATION 1 (0.0 - 1.0m Depth)
Soil Description	: Medium Brown Silty SAND.

	LIQUID LIMIT				NMC	PLASTIC LIMIT	
DETERMINATION NUMBER							
CONTAINER NUMBER					B27		
NUMBER OF BLOWS							
WT. OF CONTAINER & WET SOIL (gms)					137.4		
WT. OF CONTAINER & DRY SOIL (gms)					133.4		
WT. OF WATER (gms)					4		
WT. OF CONTAINER (gms)					36.6		
WT. OF DRY SOIL (gms)					96.8		
MOISTURE CONTENT (%)					4.1		

NON PLASTIC

LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%	N. MOISTURE CONTENT (%)	CLASSIFICATION
0	0	0	4	NP

REMARKS : NP - NON PLASTIC

TEST METHOD	BS 1377 : Part 2 : 1990 Test 4.5 Casagrande Apparatus Method.	CHECKED BY :	BUILDTEST LABORATORY (413340-D) SDN. BHD.

SOILS & MATERIALS LABORATORY (M) SDN. BHD. (75025-M)

MODIFIED / STANDARD COMPACTION TEST
(BS 1377: PART 4: 1990)

CLIENT : :Karisma MSC Sdn. Bhd.

REF. NO. : **GT/ 9712**

PROJECT:Pilot Project Jalan Kampung KKLW at Kuala Kubu Bharu Selangor Darul Ehsan

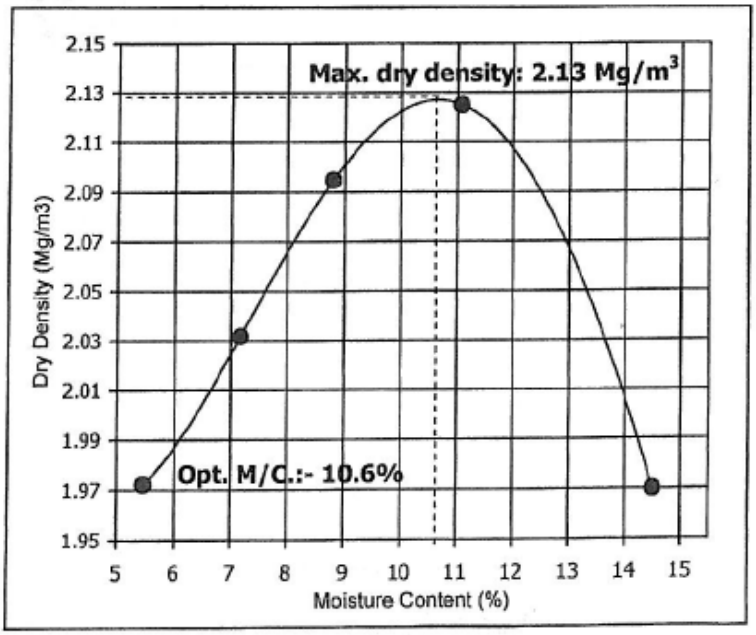
DATE : 08.10.2010

SAMPLE MARKING :**RP/SO/KKB/OCT 06**

Source :Jalan Buluh Telur,Kuala Kubu Bharu,Selangor

SOIL DESCRIPTION : Brown silty sand with some gravels

Test No.		1	2	3	4	5
Wt. of Mould + Wet Soil	g	6794	6889	6988	7067	6963
Wt. of Mould	g	4768	4768	4768	4768	4768
Wt. Wet Soil	g	2026	2121	2220	2299	2195
Vol. Of Mould	cm^3	974	974	974	974	974
Wet Density (A)	Mg/m^3	2.08	2.18	2.28	2.36	2.25
Container No.		KK	A 3	A 15	A 2	A 8
Wt. Wet Soil + Cont.	g	223.6	217.8	242.2	258.5	382.1
Wt. Dry Soil + Cont.	g	213.6	205.4	225.4	236.2	337.4
Wt. Container	g	30.2	32.5	34.5	34.8	29.4
Wt. Water	g	10.0	12.4	16.8	22.3	44.7
Wt. Dry Soil	g	183.1	172.9	190.9	201.4	308.3
Moisture Content (B)	%	5.5	7.2	8.8	11.1	14.5
Dry Density	Mg/m^3	1.97	2.03	2.09	2.13	1.97



Max dry density : **2.13** Mg/m^3
Opt. M/C : 10.6 (%)
Specific gravity:
Nat. M/C :

Vol. Of Mould : 974 (cm^3)
Rammer Weight : **4.5 Kg**
Blows/layer : 27
No. of layers :5Layers
Method of test : Modified Compaction

Tested by: Kamal

Checked by : Marzuki
Date : 08.10.2010

BUILDTEST	**BUILDTEST LABORATORY SDN. BHD.** (CO.REG.NO.413340-D)	NO.12, JALAN PS 8/1, PRIMA SELAYANG, 68100 BATU CAVES, SELAYANG, SELANGOR DARUL EHSAN. TEL : 03-6120 5835 FAX : 03-6120 5836		
UNCONFINED COMPRESSIVE STRENGTH TEST (AFTER 7 DAYS)		**Drilled By** : AM / KEN	**Doc. No.** : BTL-LT-Con-2	**Lab Ref.** : 7971
		Tested By : LDA	**Date of Drilling** : 02-12-2010	**Date of Testing** : 10-12-2010

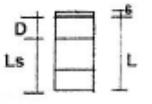
TESTED FOR : KARISMA MSC SDN. BHD.
CLIENT : KEMENTERIAN KEMAJUAN LUAR BANDAR DAN WILAYAH
Project / Location : PILOT PROJEK BAGI PERLAKSANAAN PEMBINAAN PROJEK JLN KAMPUNG(PJK) MENGUNAKAN TEKNOLOGI KAEDAH BARU.JLN BULUH TELUR,KKB.
Structure : ROAD (SOIL-CEMENT-GEOCRETE ROAD BASE)
Concrete Grade : N/A

Description of sample

Core Reference		C1	C2	
Client's Marking		1	2	
Location		**LHS CH 050**	**RHS CH 200**	
Date of casting		22-11-2010	22-11-2010	
Age of concrete	( ) days	18	18	
Drilling direction		VERTICAL	VERTICAL	
Specimen before capping (Measurement)				
Max. Length as received	(mm) (L)	160	172	
Weight in air	(g)	1612	1626	
Weight in water	(g)	862	874	
As-received Density	(kg/m^3)	2149	2162	
Length after sawing	(mm) (Ls)	99	100	
Core diameter	(mm)	100	100	
Specimen after capping (Method of end preparation : BS 1881 : Part 120 : 1983 : Clause 5.3 a)				
Length after capping	(mm)	106	106	
Length / Diameter ratio		1.06	1.06	
Cross sectional area	(mm^2)	7855	7855	
Diameter of Re-bar	(mm)	NIL	NIL	
Distance from Nearest End	(mm)	NIL	NIL	
Compressive Strength				
Loading Rate	($N/mm^2/s$)	0.2 - 0.4 $N/mm^2/S$		
Max. Load at Failure	(kN)	123.7	66.7	
Compressive Strength	(N/mm^2)	15.7	8.5	
Estimated In-Situ Cube Strength	**(N/mm^2)**	**15.0**	**8.0**	
Type of Failure		Satisfactory Fracture	Satisfactory Fracture	
Visual Inspection On Core Specimen				
Excess Voidage	(%)	0.5	0.5	
Honeycombing		NIL	NIL	
Presence of cracks		NIL	NIL	
Sketch of specimen after compressive testing				

STEEL BAR

Remarks : 1. Capping Material used is High Strength Cement.
2. Mix Supplier : SITEMIX



TEST METHOD	**BS 1881 : Part 120 : 1983**	**CHECKED BY :**	BUILDTEST LABORATORY SDN. BHD. (413340-D)
TEST WITNESSED BY :			

TIMUR TESTING

Timur Testing Sdn. Bhd. (340401-X)

Soils & Materials Testing

ORIGINAL

TEST REPORT

SO No.: GEO/SO/KUALA KUBU/001-0411
Lab. Ref.: TT/2011-03/ML8911
Date: 20-Apr-2011

Indirect Tensile Strength Test of Bound Materials

Client: Geo Crete Specialist Sdn. Bhd.
Project: Kuala Kubu, Ulu Selangor

Material: Brownish SAND with some gravel.
Cement: 8%
Geocrete: 1.5% of cement content
Compaction: Standard Proctor
Date of test: Wednesday, 20 April, 2011
Age: 7 days

Test Results

Sample No.	Diameter mm	Height mm	Max Force kN	ITS MPa	Weight g	Moisture Content %	Bulk Density Mg/m³	Dry Density Mg/m³
A	105.2	115.5	22.5	1.18	2184	8.14	2.18	2.01
B	105.4	115.6	21.42	1.12	2173	8.19	2.15	1.99

TIMUR TESTING SDN. BHD. KUCHING

.....
Loke Chin Sang
for Timur Testing Sdn. Bhd.

Note: The above result is obtained from the test done on the sample received from Geo Crete Specialist Sdn. Bhd. 25-Mar-2011. We are not liable for the authenticity of the sample received.

Lot 525, (Ground Floor), Section 62, Off Jalan Padungan, 93100 Kuching, Sarawak.
Tel : 082-429257 & 237788 Fax : 082-246023 & 428210

TIMUR TESTING SDN. BHD.
Soils & Materials Testing

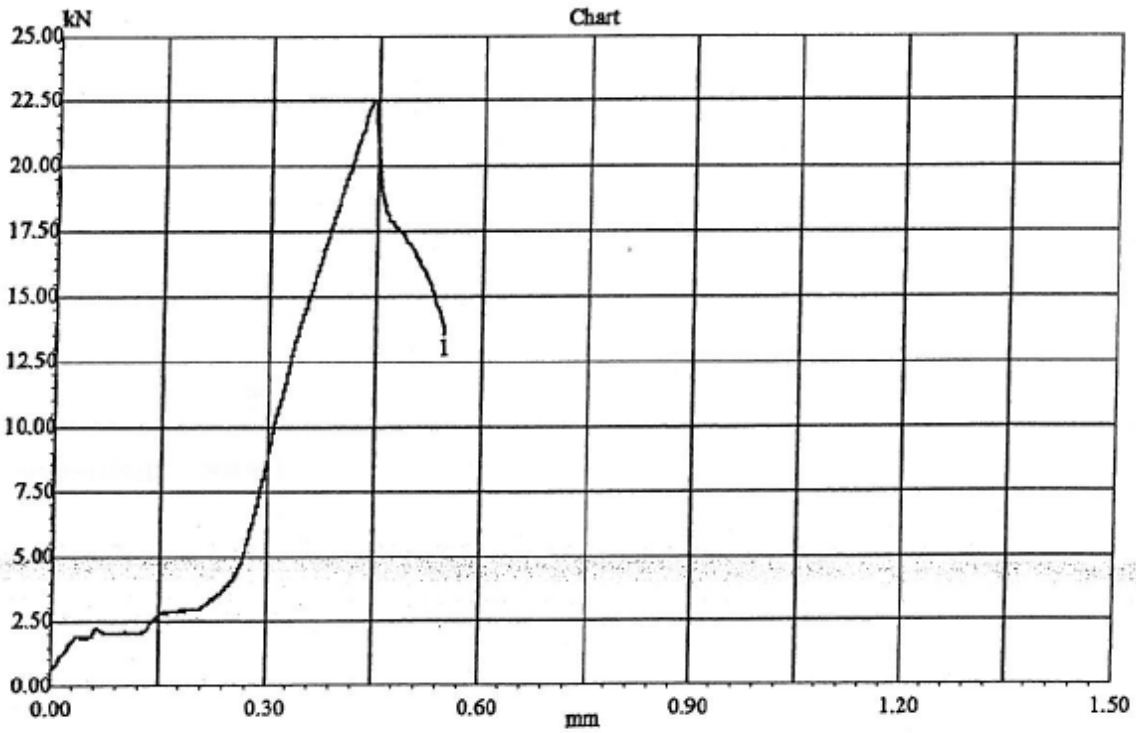
INDIRECT TENSILE TEST

Date : 20th April 2011

Lab Ref. : TT/2011-03/ML8911

Project : Kuala Kubu, Ulu Selangor.

Sample Name	Diameter	Height	Max. Load
	mm	mm	kN
A	105.18	115.49	22.50
—	—	—	—
—	—	—	—
—	—	—	—



Project at Skuduk Chupak Irrigation Scheme

Asphalt Pavement

Test sheet - statistics

Determination of the dynamic deflection modulus
Instrument: Light Drop Weight Tester ZFG-2000,
Manufacturer: ZORN, Stendal, Germany
TP BF - StB, Teil B 8.3, 2003, TP BF-StB, Teil E1, 1993

Client: Syarikat Dorban

Project: Proposed Upgrading Work of Existing Earth Ban at Skuduk Chupak Irrigation Scheme

Test depth: 200mm — Date: 8/1/09

Layer: Asphalt Pavement Road 2.0km — Card number: #050109075352

Remarks: Test no.2 — Device number: #4672

Weather/Temperature: Fine — Device type: 300 mm/10 kg

Operator: Mustaza/Ansol

Required minimum quantile: 25 MN/m²

Test points:

No	Date	Time	Deflection [mm] single values s1	s2	s3	mean s	Evd [MN/m²]	remarks
1	7/1/2009	3:59	1.663	0.664	0.697	1.008	22.3	
2	8/1/2009	7:22	1.034	0.767	0.748	0.850	26.5	

Arithmetic average of spot-check Xm(Evd): 24.40 MN/m²
Standard deviation s(Evd): 2.93 MN/m²
Variation coeffizient: V(Evd): 12.0%

Quality number: Q(Evd) = -0.21

The test (Q>0.88) **has failed.**

Kuching 15/6/2010

GeoCrete Pavement

Test sheet

Determination of the dynamic deflection modulus
Instrument: Light Drop Weight Tester ZFG-2000,
Manufacturer: ZORN, Stendal, Germany
TP BF - StB, Teil B 8.3, 2003

Client: Syarikat Dorban

Project: Proposed Upgrading work of Existing Earth Bun At Skuduk Chupak Irrigation Shceme

Date: 7/1/09 3:48

Test depth: 200mm

Number of the test: 6

Layer: Geocrete Pavement Road Base 1.7km

Card number: #050109075352

Remarks: Test no.1

Device number: #4672

Weather/Temperature: Fine

Device type: 300 mm/10 kg

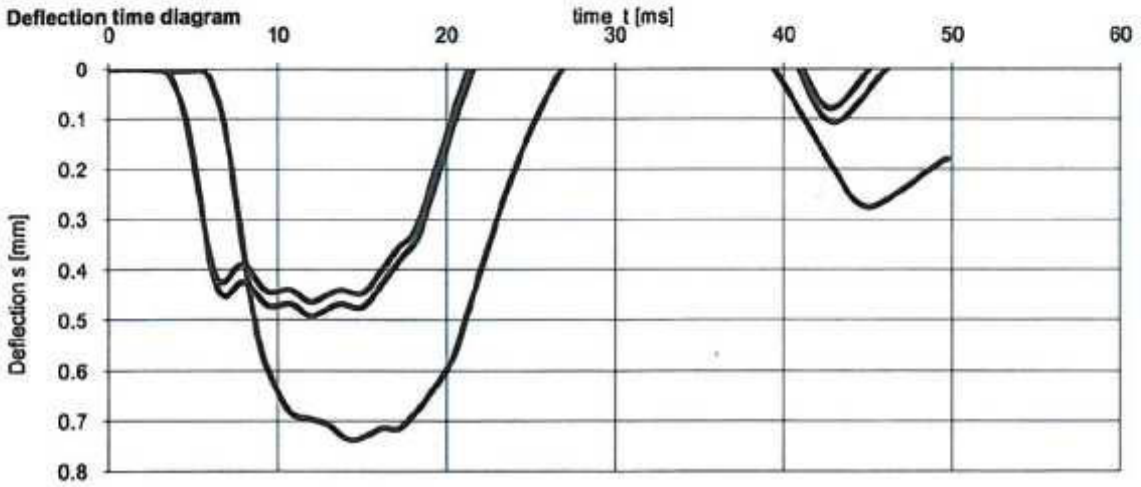
Operator: Mustaza/Ansol

Result:

No.	Velocity v [mm/s]	Defelction s [mm]
1	7.1	0.742
2	220.9	0.495
3	215.4	0.465
Ø	147.8	0.567

s/v= 3.836 ms

Evd: 39.7 MN/m²



TIMUR TESTING

Timur Testing Sdn. Bhd. (340401-X)

Soils & Materials Testing

TEST REPORT

SO Number: GEO/SO/ROBAN/001-0111
Lab. Ref.: TT/2011-01/ML8867

Falling Head Permeability Test
on core-drilled sample

Client: Geo Crete Specialist Sdn. Bhd.
Location: Roban
Chainage: -

Temperature of water bath: 28°C
Date tested: 10-Feb-2011

Specimen diameter, D	mm	91.84	91.84
Specimen length, L	mm	114.47	114.47
Specimen area, A	mm^2	6625	6625
Volume of specimen, V	cm^3	758	758
Mass of sample	g	1386	1386
Bulk density of specimen	Mg/m^3	1.83	1.83
Manometer no.		1	1
Manometer area	mm^2	12.49	12.49
Height above outlet, h1	mm	1225	836
Height above outlet, h3	mm	836	570
	h1/h3	1.47	1.47
	$\log_{10}$(h1/h3)	0.166	0.166
Time taken	min	9.5	9.3
Permeability	m/sec	1.45E-07	1.48E-07
Average permeability	m/sec	1.5E-07	
Permeability (at 20°C)	m/sec	1.2E-07	

TIMUR TESTING SDN. BHD. KUCHING

for Timur Testing Sdn. Bhd.
(Loke Chin Sang)

RECEIVED 10 FEB 2011

Lot 525, (Ground Floor), Section 62, Off Jalan Padungan, 93100 Kuching, Sarawak.
Tel : 082-429257 & 237788 Fax : 082-246023 & 428210

BUILDTEST	**BUILDTEST LABORATORY SDN. BHD.** (CO.REG.NO.413340-D)	NO.12, JALAN PS 8/1, PRIMA SELAYANG, 68100 BATU CAVES, SELAYANG, SELANGOR DARUL EHSAN. TEL : 03-6120 5835 FAX : 03-6120 5836		
COMPRESSIVE STRENGTH TEST ON CEMENT GEOCRETE TREATED BASE		**Drilled By** : AM / KEN	**Doc. No.** : BTL-LT-Con-2	**Lab Ref.** : 8411
		Tested By : LDA	**Date of Drilling** : 22-03-2011	**Date of Testing** : 29-03-2011

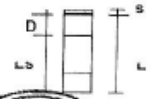
Tested For : GEO CRETE SPECIALIST SDN. BHD.
Client : KEMENTERIAN KEMAJUAN LUAR BANDAR DAN WILAYAH
Project / : PILOT PROJEK BAGI PELAKSANNAAN PEMBINAAN
Location PROJEK JLN KAMPUNG(PJK) MENGUNAKAN TEKNOLOGI KAEDAH BARU,JLN BULUH TELUR,KKB.
Structure : ROAD (CEMENT GEOCRETE TREATED BASE)
Concrete Grade : N/A

Description of sample

Core Reference			C1	C2	C3	C4
Client's Marking			1	2	3	4
Location			CH 050	CH 050	CH 200	CH 200
Date of casting			August 2010	August 2010	August 2010	August 2010
Age of concrete	( ) days		8 Months	8 Months	8 Months	8 Months
Drilling direction			VERTICAL	VERTICAL	VERTICAL	VERTICAL
Specimen before capping (Measurement)						
Max. Length as received	(mm)	(L)	195	250	214	195
Weight in air	(g)		1578	1625	1583	1652
Weight in water	(g)		827	867	823	870
As-received Density	(kg/m^3)		2101	2144	2082	2111
Length after sawing	(mm)	(Ls)	100	100	99	101
Core diameter	(mm)		100	100	100	100
Specimen after capping (Method of end preparation : BS 1881 : Part 120 : 1983 : Clause 5.3 a)						
Length after capping	(mm)		109	109	109	109
Length / Diameter ratio			1.09	1.09	1.09	1.09
Cross sectional area	(mm^2)		7854	7854	7854	7854
Diameter of Re-bar	(mm)		NIL	NIL	NIL	NIL
Distance from Nearest End	(mm)		NIL	NIL	NIL	NIL
Compressive Strength						
Loading Rate	($N/mm^2/s$)		0.2 - 0.4 $N/mm^2/S$			
Max. Load at Failure	(kN)		94.7	135.5	109.1	108.3
Compressive Strength	(N/mm^2)		12.1	17.3	13.9	13.8
Estimated In-Situ Cube Strength	**(N/mm^2)**		**11.5**	**16.5**	**13.5**	**13.5**
Type of Failure			Satisfactory Fracture	Satisfactory Fracture	Satisfactory Fracture	Satisfactory Fracture
Visual Inspection On Core Specimen						
Excess Voidage	(%)		0.0	0.0	0.5	0.0
Honeycombing			NIL	NIL	NIL	NIL
Presence of cracks			NIL	NIL	NIL	NIL
Sketch of specimen after compressive testing						

STEEL BAR

Remarks : 1. Capping Material used is High Strength Cement.
2. Mix Supplier : Site Mix



TEST METHOD	BS 1881 : Part 120 : 1983	CHECKED BY :	BUILDTEST LABORATORY (413340-D) SDN. BHD.
TEST WITNESSED BY :			