



سرسره سر : MGPL-I/PD/2019/14

د جنت

[illegible]

وَأَمَّا الْفُلُ فَأُرْسِلَتْ بِرَحْمَةٍ مِنَّا لِيُبَيِّنَ مَا بَيْنَ أَيْمَانِهِ سِرًّا

- ۱۰.۰۰۰.۰۰ ریال به مبلغ قرارداد در تاریخ ۱۳۹۸/۰۵/۲۷
- ۵٪ از مبلغ قرارداد در تاریخ ۱۳۹۸/۰۶/۲۷

[illegible]

|                |       |       |
|----------------|-------|-------|
| 05 سبتمبر 2019 | 10:00 | 10:00 |
| 09 سبتمبر 2019 | 14:00 | 14:00 |

سرفہ:

- [illegible]

29 دسمبر 2019ء





بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

މާލިބު ގާސް ޕްރައިވެޓް ލިމިޓެޑް  
MALDIVE GAS PVT LTD



އި.ސ.ޖ. ގާސް ޕްރައިވެޓް ލިމިޓެޑް، # 02-21 (2 ވަނަ ވަނަ ވަނަ)

މާލެ

މާލެ

މާލެ، ދިވެހިރާއްޖޭގެ ޖުމްހޫރިއްޔާ

ފޯން: 3335614

**MALDIVE GAS PVT LTD**  
#02-21 S.T.O TRADE CENTER,  
ORCHID MAGU  
MALE' REPUBLIC OF MALDIVES  
TEL: (960) 3328338  
FAX: (960) 3323798  
EMAIL: info@maldivegas.com  
www.maldivegas.com

**MALE' SALES**  
BODUTHAKURUFAANU MAGU  
MALE' REPUBLIC OF MALDIVES  
TEL: (960) 3325473  
(960) 3328118  
(960) 3328338  
FAX: (960) 3314797

**HULHUMALE' SALES**  
MAIN ROAD  
HULHUMALE' REPUBLIC OF MALDIVES  
TEL: (960) 3356565  
FAX: (960) 3356789

**VILLIMALE' SALES**  
VESHI MAGU  
VILLIMALE' REPUBLIC OF MALDIVES  
TEL: (960) 3325428  
FAX: (960) 3314797

**PRODUCTION & ENGINEERING**  
K. THILAFUSHI  
MALE' REPUBLIC OF MALDIVES  
TEL: (960) 7935614  
FAX: (960) 6640115

A Subsidiary of



## REQUEST FOR PROPOSAL/TERMS OF REFERENCE

|                                |                                                                          |                                    |
|--------------------------------|--------------------------------------------------------------------------|------------------------------------|
| <b>Project Name</b>            | <b>CONSTRUCTION OF GH. THINADHOO SPHERICAL TANK<br/>FOUNDATION WORKS</b> |                                    |
| <b>Reference</b>               | MGPL-I/PD/2019/14                                                        | Date: 29 <sup>th</sup> August 2019 |
| <b>Bid Information Session</b> | 05 <sup>th</sup> September 2019                                          | Time: 10:00 AM                     |
| <b>Bid Submission</b>          | 09 <sup>th</sup> September 2019                                          | Time: 02:00 PM                     |

### Disclaimer

The information contained in this Request for Proposals document (the “RFP”) or subsequently provided to Bidder(s), whether verbally or in documentary or any other form by or on behalf of the Maldiv Gas Pvt Ltd or any of its employees or advisors, is provided to Bidder(s) on the terms and conditions set out in this RFP and such other terms and conditions subject to which such information is provided.

Information provided in this RFP to the Bidder(s) is on a wide range of matters, some of which may depend upon the interpretation of the law. Maldiv Gas Pvt Ltd accepts no responsibility for the accuracy or otherwise for any interpretation or opinion on law expressed herein.

Maldiv Gas Pvt Ltd, its employees and advisors make no representation or warranty and shall have no liability to any person, including any Applicant or Bidder under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this RFP or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the RFP and any assessment, assumption, statement or information contained therein or deemed to form part of this RFP or arising in any way for participation in this Bid Stage.

Maldiv Gas Pvt Ltd also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from a reliance of any Bidder upon the statements contained in this RFP. Maldiv Gas Pvt Ltd may in its absolute discretion, but without being under any obligation to do so, update, amend or supplement the information, assessment or assumptions contained in this RFP.

The Bidder shall bear all its costs associated with or relating to the preparation and submission of its Bid including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by Maldiv Gas Pvt Ltd or any other costs incurred in connection with or relating to its Bid. All such costs and expenses will remain with the Bidder and Maldiv Gas Pvt Ltd shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by a Bidder in preparation or submission of the Bid, regardless of the conduct or outcome of the Bidding Process

## 1 - BACKGROUND

Maldivian Gas Private Limited (MGPL), a subsidiary of State Trading Organization (STO), is in the natural gas distribution market since 1999, catering to a customer base of over 40,000. Over the years we have emerged as the market leader in providing Liquefied Petroleum Gas (cooking gas) throughout the Maldives. In addition to LPG, we also provide a wide range of related appliances and industrial gases such as Acetylene, Argon, Nitrogen, and Helium. We are also the sole producer and supplier of medical oxygen catering to more than 95% of hospitals throughout the country.

## 2 – DEFINITIONS

For the purpose of this Request for Proposal (RFP), the following words and expressions shall have the meaning hereby assigned to them except where the context otherwise requires: -

2.1 'Client' means the Maldivian Gas Pvt Ltd, which expression shall unless excluded by or repugnant to the context include the Client's representative.

2.2 'Client's Representative' means the staffs or any person authorized by who would be in charge of work and would sign the documents on behalf of the Client.

2.3 'Contractor' means the word "Contractor" referred in this document shall be a person/firm/company or organization engaged in rendering professional services & shall include all his associates.

2.4 'Bid Due Date' means 09th September 2019, 1400hrs or date extended according to the process stated herein.

2.5 'Bid Stage' means the period between the date of this RFP and Bid Due Date.

2.6 'LOA' means the Letter of Award notification.

2.7 'Member or Associate' means shareholder/s of the Bidder or a partner in business.

2.8 'Subsequent Agreements' means one or more agreements, deed, instruments executed between Maldivian Gas Pvt Ltd and Selected Bidder pursuant to the Project.

## 3. SCHEDULE OF BIDDING PROCESS

Maldivian Gas Pvt Ltd shall endeavor to adhere to the following schedule:

| <b><u>Event Description</u></b>             | <b><u>Date</u></b>                        |
|---------------------------------------------|-------------------------------------------|
| 3.1 Bid Information                         | 05 <sup>th</sup> September 2019, 1000hrs  |
| 3.2 Last date for receiving queries         | 07 <sup>th</sup> September 2019, 1200hrs  |
| 3.3 Authority response to queries latest by | 08 <sup>th</sup> August 21, 2019, 1200hrs |
| 3.3 Bid Submission                          | 09 <sup>th</sup> September 2019, 1400hrs  |
| 3.4 Validity of Bids                        | 60 days of bid due date                   |

## 5 – SCOPE OF WORK

To carry out Construction work at GDh. Thinadhoo Spherical Tank foundation works as per attached the drawings (Annexure 1), technical specification (Annexure 2) and BOQ ((Annexure 3)

### 5.1 Additional Service

Additional Services – Additional services will include the redesign of previously approved work where necessary, major revisions, which the Client and Contractor had agreed upon, to program and expansion of the scope of work beyond the itemized in the service agreement. Payment terms and time period of additional services shall be negotiated between the Client and the Contractor

## 6. INSTRUCTIONS TO BIDDERS

- 6.1 Unless the context otherwise required or expressed, the terms not defined in this RFP shall have the meaning assigned thereto in this RFP.
- 6.2 Bidders shall be responsible for the careful examination of all Bid Documents. All the information necessary for the Bid shall be obtained at Bidders' responsibility and expense. Misrepresentation or misinformation does not justify bidder in any alteration of the submitted offer.
- 6.3 **A bid Security of 10,000.00 MVR from a financial institute/insurance company shall be submitted along with the bid.**
- 6.4 Bid currency should be in Maldivian Rufiyaa (MVR)
- 6.5 Each Bidder must submit only one proposal by itself. A Bidder who submits or participates in more than one proposal will be disqualified. If Client discovers or has a reason to believe that collusion exists among any/all Bidders, any/all such proposals will be rejected, and all participants in such collusion will be excluded from consideration for future proposals for the same work.
- 6.6 The proposal price must be written without erasures, both in figures and in words. In case of discrepancy between figures and words, the words shall prevail.
- 6.7 At any time prior to the Bid Due Date, Client may, for any reason, whether at its own initiative or in response to clarifications requested by a Bidder, modify the RFP by the issuance of Addenda. In order to afford the Bidders a reasonable time for taking an Addendum into account, or for any other reason, Client may, in its sole discretion, extend the Bid Due Date.
- 6.8 Agreement shall be drawn with the selected bidder and this document with all terms and conditions shall form part of the Subsequent Agreement.
- 6.9 Notwithstanding anything to the contrary contained in this RFP, the detailed terms specified in the Subsequent Agreement shall have overriding effect; provided, however, that any conditions or obligations imposed on the Bidder hereunder shall continue to have effect in addition to its obligations under the Agreement.
- 6.10 Deadline for submission of Proposal may be extended at the discretion of Client.
- 6.11 Proposal submitted after the deadline shall be rejected.

- 6.12 Bids received by Client after the specified time on the Bid Due Date shall not be eligible for consideration and shall be summarily rejected.
- 6.13 Any condition or qualification or any other stipulation contained in the bid shall render the Bid liable to rejection as a non- responsive Bid
- 6.14 Proposal will be opened at the presence of the bidders
- 6.15 The Letter of Award Notification (LOA) shall be sent to the Selected Bidder within the validity date of the Bidding process.
- 6.16 Client will review each bid and perform a detailed evaluation based on the evaluation criteria described in this RFP document.
- 6.17 Client reserves the right to accept or reject any bid and to annul the bidding process and reject all Bids at any time prior to contract award, without thereby incurring any liability to Bidder.
- 6.18 In the event where the prices received are above the prices anticipated or where the Submitted Proposals are not representatives of the prices in the general market, Client reserves the right to negotiate.
- 6.19 The delay damages for the project is 1% (One percent) per day
- 6.20 The maximum amount of delay damages for the whole of the works is 15% (fifteen percent) of the final contract value.
- 6.21 Client reserves the right to verify all statements, information, and documents submitted by the Bidder in response to the [the RFP and/or the Bidding Documents
- 6.22 The Bidder shall furnish, an Advance Payment Guarantee in the form of Bank Guarantee issued by a Maldivian Bank, 1st class international bank, or a Financial Institute – Maximum of 15% advance payment shall be paid
- 6.23 Withholding tax of 10% will be deducted from the gross amount of invoice value if a payment is made for any technical service rendered by the Bidders not registered in the Maldives.
- 6.24 The bidder shall be responsible for all of the costs associated with the preparation in the Bidding Process. The client will not be responsible or in any way liable for such costs, regardless of the conduct or outcome of the Bidding Process. This includes the cost of transportation, duty, import, shipping, etc.
- 6.25 The bidder should take responsibility for all-expense related tax registration/company registration in the Maldives for international companies.
- 6.26 Within 10 days of receipt of the Letter of Award Notification from Client, the successful

bidder must furnish a Performance Security in the form of a Bank/Financial Institute guarantee with an amount of 5% (five percent) of the Contract Price.

- 6.27 Failure of the successful bidder to comply with the requirements of clause 6.26 shall constitute annulment of the Award and the Client may resort to Awarding the contract to the next ranked Bidder.
- 6.28 The percentage of retention shall be five percent (5%) of the contract value. The payment of retention money will be made after 01 (one) year of issuing of the certificate of completion. All necessary repairs will have been done to the satisfaction of Client before this payment is made.

## 7. REQUIRED DOCUMENTS.

Documents or Information listed in this section is mandatory for the proposal to be valid. The client may choose to accept a proposal which does not contain one or more of the documents listed in this section on the ground that information provided in another document or elsewhere in the proposal does satisfy the purpose for which the document is requested.

### 7.1. REQUIRED DOCUMENTS

- 7.1.1. Copy of Company/ Sole Proprietorship Registration Certificate
- 7.1.2. Copy of Company GST/VAT registration certificate
- 7.1.5. A Cover Letter including the proposed price and project schedule (**timeline**).
- 7.1.7. Project Experience Summary list (as per the format provided in Annexure 4
- 7.1.8. Project Team (Annexure 5)

## 8. EVALUATION CRITERIA AS FOLLOWS.

| Criteria                                   | Marks    |
|--------------------------------------------|----------|
| Price                                      | 55 Marks |
| Duration (Work Schedule must be submitted) | 35 Marks |
| Profile and Experience                     | 10 Marks |

## 9. EVALUATION GUIDELINES

- 9.1 Client will subsequently examine and evaluate the Bids in accordance with the provisions set out in this RFP.
- 9.2 Prior to evaluation of Bids, Client shall determine whether each Bid is responsive to the Requirements of this RFP.
- 9.3 Marks shall be distributed on pro-rata basis.

**9.4 Proposed Price (55 marks)**

Lowest price offered would achieve the highest. Higher Proposal will receive lesser marks in proportion to the lowest quoted. The client has the right to reject unrealistically low or high price, unrealistically low or higher price will be determined by estimated cost and budget predefined by client

**9.5 Proposed Duration (35 marks)**

Lowest duration offered would achieve the highest. Higher Proposal will receive lesser marks in proportion to the lowest quoted. Bidder should submit a detailed work schedule along with the bid. The duration shall not exceed 3 months.

**9.6 Profile and Experience of the bidder (10marks)**

Experience of the bidder will be validated only by reference letters issued to the bidder by the respective client.

- a) The profile should include the Company registration certificate, GST Certificate and an overview of the company
- b) Reference letter/Completion letter received ONLY in the name of the project owner (companies'/ government entities/institutions/commissions etc.) (any legal or government entity) will be considered as experience of the bidder.

**14. QUERIES & FEEDBACK**

All questions relating to the terms of condition shall be directed by email or in writing to:

Hussain Azim  
Manager Procurement  
Maldives Gas Pvt Ltd,  
#02-21 S.T.O Trade Centre, Orchid Magu, Male', 20188  
Republic of Maldives,

Email: [procurement@maldivegas.com](mailto:procurement@maldivegas.com)

*Disclaimer:*

*Notwithstanding anything contained in this RFP, **Client** reserves the right to reject any bid and to annul the Process and reject all Bids at any time without any liability or any obligation for such acceptance, rejection or annulment, and without assigning any reasons therefor. In the event that **Client** rejects or annuls all the Bids, it may, in its discretion, invite all eligible Parties to submit fresh Bids hereunder*

**15 – OTHER INFORMATION**

- a) Proposals are to be submitted on **Monday, 09<sup>th</sup> September 1400hrs** to the address below:

**Maldiv Gas Private Limited  
#2-21 S.T.O Trade Center, Orchid Magu  
Male', Republic of Maldives**

## GENERAL NOTES

A. IN THE INTERPRETATION OF THESE DRAWINGS, INDICATED DIMENSIONS SHALL GOVERN AND DISTANCES OR SIZES SHALL NOT BE SCALED FOR CONSTRUCTION PURPOSES.

B. THE CONTRACTOR SHALL COORDINATE WITH THE AR, SE, EE AND OTHER UTILITY AND EQUIPMENT PLANS FOR FOOTING AND COLUMN.ALL THE MATERIALS NEED TO APROVED BY CONSULTANT.

C. ALL REINFORCED CONCRETE WORK SHALL BE DONE IN ACCORDANCE WITH THE BRITISH STANDARDS.

D. ALL STRUCTURAL STEEL WORK SHALL BE DONE IN ACCORDANCE WITH THE BRITISH STANDARDS AND AISC ASD 1989 IN SO FAR AS THEY DO NOT CONFLICT WITH THE LOCAL BUILDING CODE REQUIREMENTS.

E. ALL SLABS, BEAMS AND OTHER STRUCTURAL ELEMENTS WHICH ARE NOT INDICATED, DETAILED, DESIGNATED OR INADVERTENTLY OMITTED BUT ARE NECESSARY TO BE COORDINATED WITH ARCHITECTURAL AND OTHER ALLIED ENGINEERING PLANS AS WELL AS TO COMPLETE THE STRUCTURAL WORKS IN ACCORDANCE WITH THE INTENT OF THE PLANS AND SPECIFICATIONS SHALL BE BROUGHT UP DURING PRE-BIDS/MEETINGS/NEGOTIATIONS. IT IS UNDERSTOOD THAT THE CONTRACTOR HAS PROVIDED AND INCLUDED ALL THESE ITEMS IN HIS BID.

F. SLAB ON FILL MUST NOT BE PLACED UNLESS FILL HAS BEEN PROPERLY COMPACTED. UNLESS DETAILED OTHERWISE, ALL SLABS ON FILL SHALL BE PROVIDED WITH DAMP PROOF MEMBRANE. BACK FILLING OF ALL EXCAVATED AREAS AND PREPARATION OF LEAN CONCRETE SHALL BE WELL COMPACTED TO AT LEAST 95% OF THE MODIFIED PROCTOR DENSITY BEFORE LAYING 75mm LEAN CONCRETE.

## NOTES ON CONCRETE MIXES AND PLACING

A. UNLESS OTHERWISE INDICATED IN PLANS OR NOTED IN THE SPECIFICATIONS THE MINIMUM 28-DAY CUBE COMPRESSIVE STRENGTH OF CONCRETE, fcu, SHALL BE AS FOLLOWS:

|                              |       |
|------------------------------|-------|
| 1.) FOOTING AND COLUMN STUMP | 30MPa |
| 2.) LEAN CONCRETE            | 15MPa |

B. 1.) CONCRETE SHALL BE DEPOSITED IN ITS FINAL POSITION WITHOUT SEGREGATION, RE-HANDLING OR FLOWING. PLACING SHALL BE DONE PREFERABLY WITH BUGGIES, BUCKETS OR WHEEL BARROWS. NO CHUTES WILL BE ALLOWED EXCEPT TO TRANSFER CONCRETE FROM HOPPERS TO BUGGIES, WHEEL BARROWS OR BUCKETS, IN WHICH CASE, THEY SHALL NOT EXCEED SIX (6) METERS IN AVERAGE LENGTH.

2.) NO DEPOSITING OF CONCRETE SHALL BE ALLOWED WITHOUT THE USE OF VIBRATORS UNLESS AUTHORIZED IN WRITING BY THE DESIGNERS AND ONLY FOR UNUSUAL CONDITIONS WHERE VIBRATION IS EXTREMELY DIFFICULT TO ACCOMPLISH.

C. EACH BATCH OF CONCRETE MIX TIME SHOULD NOT BE <3 MINS.

D. POURING HEIGHT OF CONCRETE SHALL NOT BE MORE THAN 1.5M.

E. CONCRETE SHALL BE CURED FOR NOT LESS 7 DAYS.

F. FOR COLD JOINTS, SIKA LATEX OR EQUIVALENT BONDING AGENT SHOULD BE APPLIED 10 MINS. BEFORE POURING CONCRETE.

G. EXPOSED & EXTERNAL CONCRETE MEMBERS SHOULD BE CASTED WITH SIKA PLASTOCRETE PLUS OR EQUIVALENT WATER PROOFING CHEMICAL.

## GENERAL NOTES

## NOTES ON REINFORCING STEEL BARS

A. ALL REINFORCING STEEL BARS SHALL BE NEW BILLET, HOT ROLLED, DEFORMED BARS CONFORMING TO THE SPECIFICATIONS OF PNS 49: 1995 (ASTM 615) GRADE 460.

B. ALL CONCRETE REINFORCEMENT SHALL BE DETAILED, FABRICATED, LABELED, SUPPORTED AND SPACED IN FORMS, SECURED IN THE REQUIRED LOCATION IN ACCORDANCE WITH THE PROCEDURES AND REQUIREMENTS OUTLINED IN THE LATEST EDITION OF THE BUILDING CODE AND THE MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES, AS PER BRITISH STANDARDS.

C. ALL REINFORCING BARS SHALL BE CLEANED THOROUGHLY OF ALL LOOSE RUST, SOIL OR OTHER MATERIAL IMMEDIATELY PRIOR TO PLACING CONCRETE.

D. REINFORCING BARS SHALL NOT BE WELDED WITHOUT THE STRUCTURAL ENGINEER'S WRITTEN PERMISSION. WELDING OF STIRRUPS, TIES, INSERTS OR OTHER SIMILAR ELEMENTS TO LONGITUDINAL REINFORCEMENT SHALL NOT BE ALLOWED.

E. SEE TABLE "A" FOR SCHEDULE OF LAP SPLICES, GIRDERS.

TABLE A

| BAR DIAMETER | LAP SPLICES LENGTH (mm) |
|--------------|-------------------------|
| 16           | 750                     |
| 20           | 900                     |

## NOTES ON FOUNDATION

A. FOOTINGS WERE DESIGNED WITH AN ASSUMED ALLOWABLE SOIL BEARING PRESSURE OF 100 KPa. CONTRACTOR SHALL REPORT IN WRITING TO THE STRUCTURAL ENGINEER ACTUAL SOIL CONDITION UNCOVERED AND CONFIRM ACTUAL BEARING CAPACITY OF SOIL BEFORE DEPOSITING CONCRETE.

B. NO FOOTING SHALL REST ON UNCOMPACTED FILL.

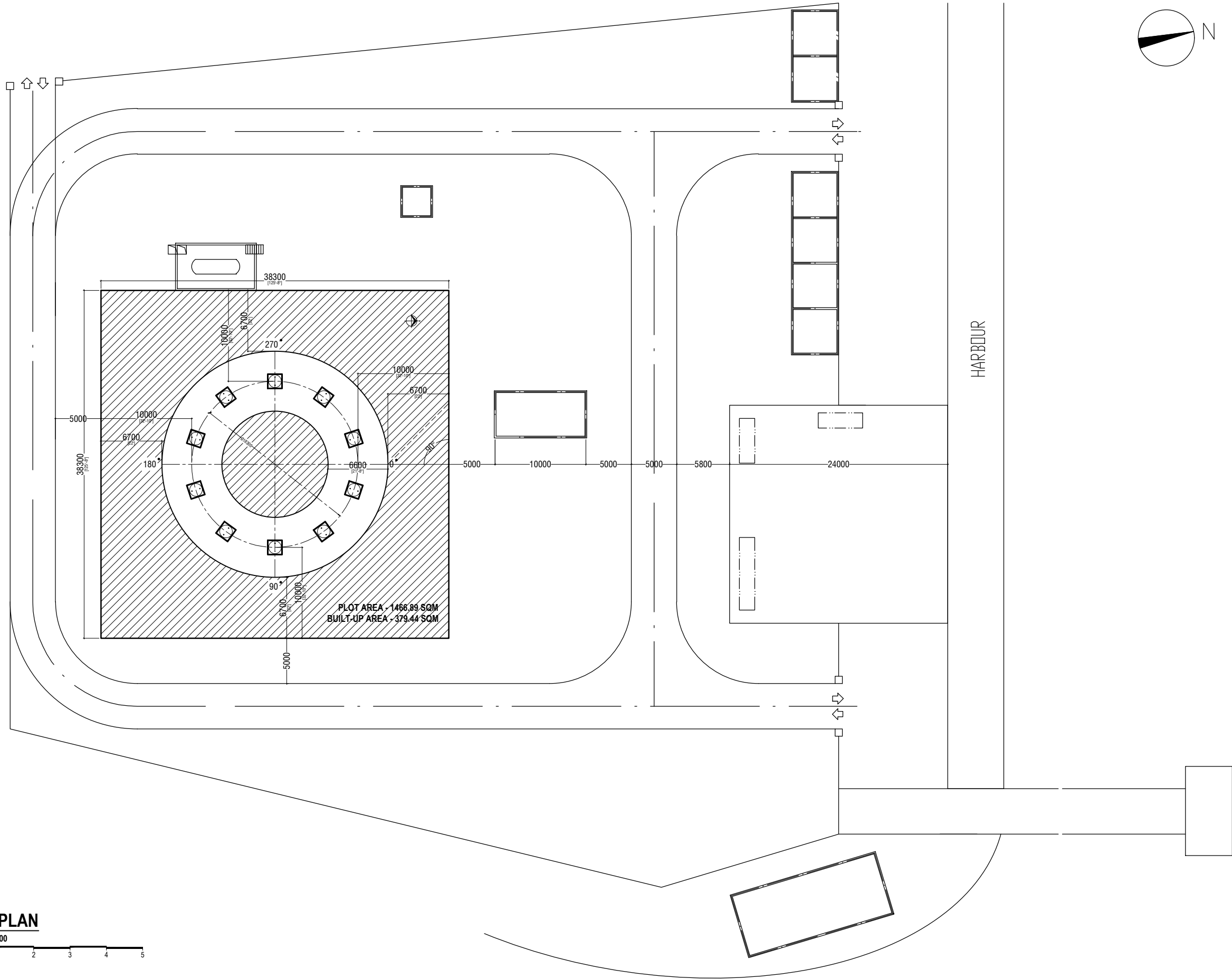
C. PROVIDE TEMPORARY REMOVAL OF WATER FROM ANY SOURCE DURING CONSTRUCTION. DEWATERING SHALL BE CAREFULLY AND PROPERLY PERFORMED TO AVOID DISTURBING THE FOUNDATIONS AND SLAB BEARING SURFACES.

D. CONTRACTOR SHALL DESIGN, INSTALL AND MONITOR ALL EXCAVATION RETENTION SYSTEMS AS REQUIRED FOR PROTECTION OF ADJACENT PROPERTIES AND PROVIDE ALL MEASURES AND PRECAUTIONS NECESSARY TO MINIMIZE SETTLEMENT AND PREVENT DAMAGE TO ADJACENT EXISTING OR NEW CONSTRUCTION.

E. IN CASES WHERE REQUIRED FOOTING LEVELS SHOW A HONEYCOMBED STRUCTURE CONTAINING LOOSE MATERIALS, REMOVE LOOSE MATERIALS AND FILL ALL VOIDS WITH A CONCRETE REPAIR MOTAR.

**SITE PLAN**

SCALE 1:100



RYAN PRIVATE LIMITED

t : +9603315049 f : +9603310776  
e : info@ryan.com.mv  
w : www.ryan.com.mv  
3rd floor, H. Azum, Ameremmagu, Male'

Title: Footing Reinforcement  
Distribution Layout

Page: S-01

Foundation Design of Spherical Tank at Gh. Thinhadho

Client: STO

Project Number: RI/2019/007

Date: June 2019

Architect : Mohamed Yasbin Ismail

Engineer : Ahmed Zuhair Zaem

Drawn by : Zainal Abidheen Ali Rasheed

Services : -

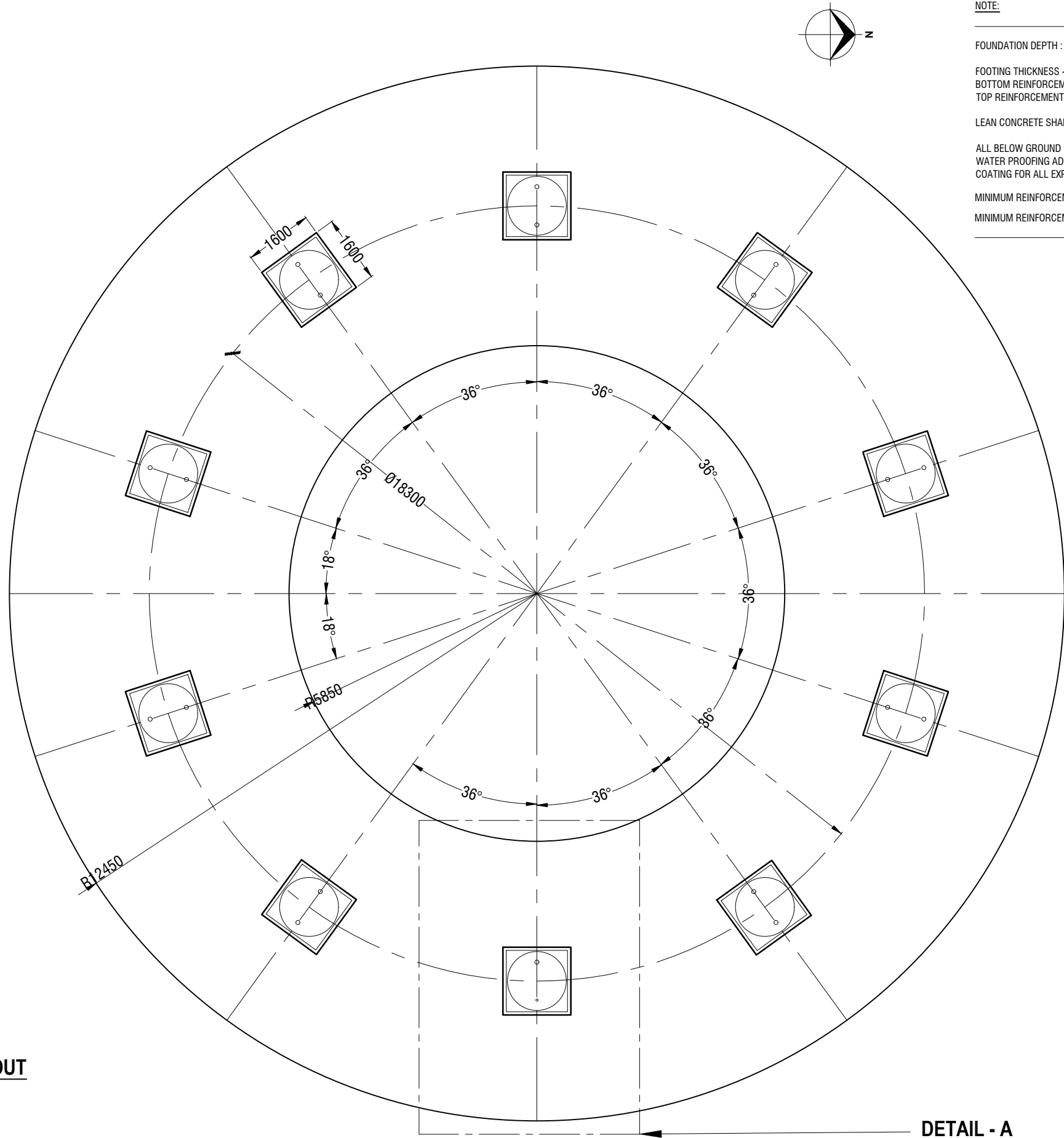
Interior : -

Rev no

Date

The contents of these drawings remain as a property of RYAN Private Limited. Any use other than those expressly stated is a violation of this copyright

**PILLAR DISTRIBUTION LAYOUT**  
SCALE 1:100



**NOTE:**

FOUNDATION DEPTH : 1800mm BELOW GROUND LEVEL

FOOTING THICKNESS - 600mm  
BOTTOM REINFORCEMENT - T16@100C/C B/W (NOT SHOWN)  
TOP REINFORCEMENT - T16@100C/C B/W (NOT SHOWN)

LEAN CONCRETE SHALL BE 75mm THICK

ALL BELOW GROUND CASTINGS SHALL BE DONE USING  
WATER PROOFING ADMIXTURE AND PROVIDE BITUMINOUS  
COATING FOR ALL EXPOSED SURFACES

MINIMUM REINFORCEMENT FOOTING COVER : 75mm  
MINIMUM REINFORCEMENT STUMP COVER : 50mm



RIYAN PRIVATE LIMITED

t : +9603315049 f : +9603310776  
e : info@riyan.com.mv  
w : www.riyan.com.mv  
3rd floor, H. Azum, Ameremmagu, Male'

Title: Pillars Distribution Layout

NOTE:

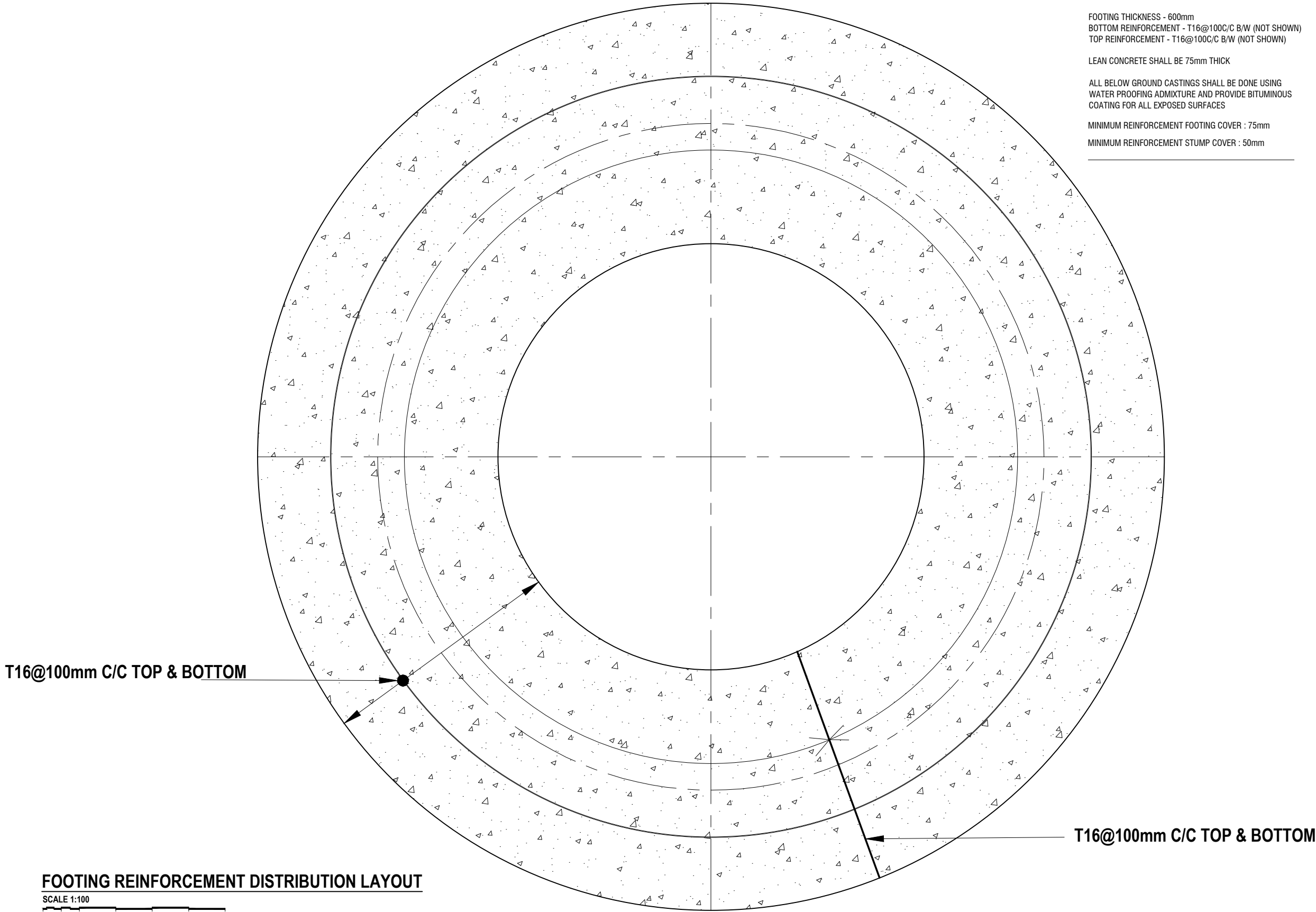
FOUNDATION DEPTH : 1800mm BELOW GROUND LEVEL

FOOTING THICKNESS - 600mm  
BOTTOM REINFORCEMENT - T16@100C/C B/W (NOT SHOWN)  
TOP REINFORCEMENT - T16@100C/C B/W (NOT SHOWN)

LEAN CONCRETE SHALL BE 75mm THICK

ALL BELOW GROUND CASTINGS SHALL BE DONE USING  
WATER PROOFING ADMIXTURE AND PROVIDE BITUMINOUS  
COATING FOR ALL EXPOSED SURFACES

MINIMUM REINFORCEMENT FOOTING COVER : 75mm  
MINIMUM REINFORCEMENT STUMP COVER : 50mm





## **GENERAL ARRANGEMENT OF THE SPECIFICATIONS**

### **1 SECTION C – GROUND WORKS / SITE WORKS**

PART 1 – GENERAL DEMOLITION WORKS

PART 2 – EXCAVATION AND FILLING

### **2 SECTION D – INSITU CONCRETE**

PART 1 – GENERAL

PART 2 – AGGREGATES

PART 3 – CEMENT

PART 4 – WATER & ADMIXTURE

PART 5 – CONCRETE MIXES

PART 6 – CASTING & CURING

PART 7 – FORMWORK REINFORCEMENT & JOINTS

PART 8 – PROTECTION & WATERPROOFING OF CONCRETE

### **3 SECTION E – MASONRY**

PART 1 – MASONRY WORKS

END OF SECTION

## **1 PART 1 – GENERAL**

### **1.1. GENERAL**

This Part specifies procedures and requirements for demolition and removal of buildings, structures and related service utilities.

### **1.2. GENERAL REQUIREMENTS**

1. Unless otherwise indicated in the Project Documentation or directed by the Engineer, the Contractor is to complete the demolition and removal of buildings and structures together with all foundations and retaining walls, piers, partitions and columns, and associated service utilities.
2. Demolition work in alterations are to be undertaken with the maximum consideration for the surrounding structure and are to be limited to the minimum required in order to carry out the work. The manner and order of the work, including the design and provision of any supports and other safety precautions, will be the Contractor's responsibility and shall be fully detailed in the method statement.
3. The design of any shoring and supports necessary to maintain the stability of any structure retained after the demolition of adjoining property are to be submitted to the Engineer for approval. The responsibility for the sufficiency of the design is to rest with the Contractor, notwithstanding the approval of the Engineer.
4. The demolition is to be carried out in a planned and safe sequence, generally in reverse order of erection, reducing the shell of the building in small lifts.
5. The Contractor is responsible for the removal and disposal of all debris resulting from demolition work.
6. Upon hand over of the Site to the Contractor, the Contractor is to take over all responsibility of the buildings to be demolished.
7. The Contractor is to inspect each building he is to remove and determine for himself the work involved and the equipment and the materials required for the specified demolition

### **1.3. METHOD STATEMENT**

1. The Contractor is to prepare a method statement which shall detail all aspects proposed demolition work and associated procedures before commencing any demolition work. The method statement shall be approved by the Engineer before any demolition work commences.
2. The Contractor shall establish whether any stressed components are present in the structure. The Contractor shall include a complete statement of his proposed method of demolition of the such components in his method statement.
3. The Contractor shall establish whether any of the walls of the structure to be demolished are load bearing and shall establish whether cross walls are bonded into the abutting walls. The Contractor shall identify such walls in his method statement.

### **1.4. EXECUTION**

1. The Contractor shall demolish and remove buildings and structures, as indicated in the project documentation
2. Debris, including brick, concrete, stone, metals and similar materials are to become the property of contractor and be disposed of by him, off the Site. Concrete slabs below grade that do not require removal from the site are to be broken up into pieces not exceeding 60 cm<sup>2</sup>.
3. The Contractor is to conduct his operations in such a manner as to avoid danger to persons and property. Once demolition work has started on any building, the work on that building is to be continued to completion, promptly and expeditiously.
4. The Contractor is responsible for removing any additional small “out” buildings or miscellaneous structures that have not been indicated in the Project Documentation unless otherwise instructed by the Engineer.
5. Operations necessary for the removal of an existing structure or obstruction, which may damage new construction, are to be completed prior to placing the new work unless otherwise specified in the Project Documentation.
6. Where trees have been designated to remain, but are a hindrance to demolition work, the Contractor is to, at his own expense, temporarily relocate such trees and provide all maintenance as necessary until such time as replanting is feasible.

### **1.5. UTILITY & SERVICE**

1. The Contractor is to arrange for the disconnection of all utilities that serve buildings in accordance with the respective requirements and regulations.
2. The Contractor is to disconnect and properly seal, in a manner approved by the relevant authority and the Engineer, all sewer outlets that serve buildings to be demolished. The Contractor will keep the Engineer informed of his plans for the performance of any

work in connection with the sealing off of such outlets in order that proper inspection may be provided at the time the work is performed.

#### **1.6. SPECIAL PRECAUTIONS**

1. The Contractor is to follow and implement all procedures defined or required by related environmental or public safety authorities. These precautions will be taken at all times during the removal or confinement of hazardous materials, whether known or suspected.
2. The Contractor is to have present at the Site, a representative of the related approval authority during removal or confinement work, if it is a requirement the approval authority.
3. The Contractor is to be responsible for processing and approval of any documentation relating to procedures required by governmental or agencies related to procedures for removal or containment of hazardous materials.

END OF SECTION

---

## **2. EXCAVATION AND FILLING**

### **1.0. GENERALLY**

0. **SITE INVESTIGATION:** No site investigation has been carried out and the Contractor shall be responsible for establishing the sub-ground conditions. All foundations have been designed for a safe ground bearing pressure of  $100 \text{ KN/m}^2$  at 0.8m below ground level and the Contractor shall be responsible for establishing the adequacy of this strata by means of all necessary site and laboratory testing, if required to do so. The Contractor shall provide a written report on his site investigation. The foregoing work shall be carried out immediately upon the award of the Contract and the Contractor shall make allowance in his programme for time to re-design the foundations in the event of the safe ground bearing pressure being less than  $100 \text{ KN/m}^2$ .
0. The Contractor shall consult local knowledge for information on ground water. He shall take into account that the site may contain reclaimed land formed from crushed coral and is therefore porous. This means that ground water level will be dependant upon adjoining sea levels and any tidal fluctuations.
0. A substantial part of the excavation is under seawater. When excavating under the seabed, the contractor must ensure that all environmental and statutory requirements are adhered and if required must use silt screen to protect the fragile corals. A detailed method statement must be submitted prior to the execution of any excavation work.

### **1.0. EXCAVATING FOR STRUCTURES**

#### **Excavation Support System**

0. Prior to Commencing any structural excavation work which is 1.5 m or greater in depth, the Contractor shall design an excavation support system.
0. Details of the excavation support system shall be submitted to the Engineer for review and approval before any excavation work commences.
0. Details of the excavation support system shall be complete with, but not limited to, the following:
  - Drawings of the structural support members showing materials, sizes and spacing,
  - Calculations showing the maximum theoretical deflection of the support member.
0. The system is to be designed so that no members extend through surfaces exposed in the finished construction, and no shoring or bracing is placed under permanent structures.

---

Site Clearance

0. Before commencing any excavation or fill, the area shall be cleared of all trees, stumps, roots, bushes, vegetation, debris, materials or other obstructions.
0. Before removal of any trees or shrubs the Contractor shall obtain written consent from the Supervising Engineer in advance of the planned removal.
0. All bushes, undergrowth, etc. to be removed shall be grubbed up and disposed of in a manner as agreed with the Supervising Engineer. Holes left by stumps or roots shall be filled with suitable material, compacted to the Supervising Engineer's satisfaction in accordance requirements of this Section.
0. MATERIALS ARISING from the excavations and surplus to requirements for filling are to remain the property of the Client unless the Contractor:
  - Is instructed to remove them from the site, or
  - Purchases them at a price to be agreed.
0. BENCHING: Surfaces of excavations with a gradient greater than 1 in 5 which are to receive filling must have horizontal benches cut to match the depths of compacted layers of filling.
0. ACCURACY - Permissible deviations from formation levels:
  - Beneath mass concrete foundations: +/-25mm
  - Beneath ground bearing slabs and R.C. foundations: +/-15 mm
0. Make advance arrangements with the Supervising Engineer for inspection of formations for the following:
  - Foundations and ground slabs,
0. Remove the last 150 mm of excavations just before inspection. Trim excavations to required profiles and levels, and remove all loose material.
0. Unless otherwise instructed seal formations within 4 hours of inspection with concrete or other specified fill.
0. FOUNDATIONS GENERALLY: Obtain instructions if:
  - The formation contains soft or hard spots or highly variable material.
0. EXCESS EXCAVATION: Backfill any excavations taken:
  - Wider than required or deeper than required with well graded granular material or mass concrete, all as instructed by the Supervising Engineer.

**1.0. DISPOSAL OF MATERIALS**

0. SURPLUS SUBSOIL - Remove from site, surplus excavated material, which is not required to be spread, levelled or stockpiled.
0. WATER: Keep all excavations free from water.

**1.1 FILLING**

0. HAZARDOUS, AGGRESSIVE OR UNSTABLE MATERIALS:

Do not import or use fill materials which would, either in themselves or in combination with other materials or ground water, give rise to a health hazard, damage to building structures or instability in the filling.

1. Ensure that excavations and areas to be filled are free from loose soil, rubbish and standing water.
1. Take all necessary precautions to ensure stability of adjacent structures. Place and compact fill against structures, membranes or buried services in a sequence and a manner that will ensure stability and avoid damage.
1. Plant employed for transporting, laying and compacting must be suited to the type of material.
1. Lay differing materials separately so that only one type of material occurs in each layer.

Benching In Fill:

1. Where, during the progress of the work, the difference in level between adjacent areas of filling exceeds 600 mm, cut into edge of higher filling to form benches having a minimum width of 600 mm and a height equivalent to the depth of a layer of compacted filling. Spread and compact new filling to ensure maximum continuity with the previous filling.

**1.1 HARDWARE UNDER CONCRETE GROUND BEARING SLABS, INFILL WITHIN FOUNDATIONS, AND UPFILL**

1. Fill to be compacted by a suitable plate type vibrator, pedestrian operated vibrator roller, small tandem roller or other approved compaction plant.
1. The material is to be placed in layers within the effective range of compaction of the plant, however the maximum unconsolidated thickness of each layer will not exceed 250 mm irrespective of plant type.
1. The material is to be watered and mixed as necessary to ensure that prior to compaction the moisture content of the whole layer is  $\pm 3\%$  of the optimum moisture content.
1. Compaction of each layer is to continue until a density of at least 95% of the maximum dry density has been achieved.
1. The dry density/moisture content relationship will be determined by the heavy compaction test (4.5% rammer method) of BS 1377.

Defective Compaction

1. As soon as possible after any part of the work is known or suspected to be defective, submit proposals for testing, inspection or replacement and obtain instructions.

END OF SECTION

## **1 PART 1 – GENERAL**

### **1.1. GENERAL**

1. This Section includes the requirements for concrete work for structures, water retaining structures, foundations and bases for structures and equipment
2. This Part includes relevant standards, definitions, abbreviations, and requirements for testing facilities, rejected materials, and record keeping.

### **1.2. REFERENCES**

The following standard is referred to in this Part:  
BS 6100: Building and civil engineering terms.

### **1.3. DEFINITIONS**

Definitions used in this Section follow the requirements of BS 6100.  
The following are terms and abbreviations used:

|          |                                               |
|----------|-----------------------------------------------|
| °C       | degree Celsius                                |
| cal      | calorie                                       |
| cm       | centimetre                                    |
| d        | day                                           |
| $f_{cu}$ | characteristic cube strength of concrete      |
| GGBFS    | ground granulated blast furnace slag          |
| GUTS     | guaranteed ultimate tensile strength          |
| h        | hour                                          |
| kg       | kilogram                                      |
| kJ       | kilojoule                                     |
| kN       | kilonewton                                    |
| l        | litre                                         |
| m        | metre                                         |
| $m^2$    | square metre                                  |
| $m^3$    | cubic metre                                   |
| mg       | milligram                                     |
| min      | minute                                        |
| mm       | millimetre                                    |
| $mm^2$   | square millimetre                             |
| months   | months                                        |
| MPa      | mega pascal                                   |
| MSRPC    | moderately sulphate resisting Portland cement |
| OPC      | ordinary Portland cement                      |
| PFA      | pulverised fuel ash                           |
| PVC      | polyvinylchloride                             |
| s        | second                                        |
| SRPC     | sulphate resisting Portland cement            |
| ton      | 1000 kg                                       |

#### **1.4. IMPLEMENTATION**

1. The Contractor shall carry out the test procedures required by this Section and any other tests and test procedures as directed by the Supervising Engineer from time to time. The test procedures shall be carried out using the facilities of an approved independent testing laboratory.
2. The Supervising Engineer may also require the Contractor to take samples of materials and deliver them to a Materials Laboratory for additional tests to be carried out by the Employer. Sampling procedures and sample sizes shall conform to the requirements shown in Table 1.1.
3. All equipment required for testing on Site shall be maintained on Site at all times during concreting operations together with the necessary scoops, buckets, sample containers, and other items required for sampling.

#### **1.5. REJECTED MATERIALS**

Any material rejected by the Supervising Engineer, in particular cement which has deteriorated or aggregates which have segregated or become contaminated, shall be immediately removed from the Site.

#### **1.6. RECORDS**

1. The Contractor shall maintain on the Site full records of all work carried out accurately related to the location of the work on site, which shall include:
  - (a) the time and date when all concrete was poured, formwork removed and when formwork props were fully removed
  - (b) all cubes and other tests
  - (c) daily maximum and minimum temperatures.
2. One copy of all test results shall be sent to the Supervising Engineer immediately upon completion of the tests.

Table 1.1  
Sampling Procedure and  
Minimum Sample Sizes for Central Materials Laboratory

| MATERIAL      | TEST                                                                                                                                                               | SAMPLE SIZE                                          |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Cement        | Full range of tests                                                                                                                                                | Composite sample of 7 kg taken from at least 12 bags |
| Aggregate     | Full range of tests                                                                                                                                                | 200 kg                                               |
|               | Sieve analysis<br>Chemical analysis<br>Soundness test<br>Specific gravity<br>Water absorption<br>Bulk density<br>Flakiness index<br>Dust content<br>Abrasion value | 50 kg                                                |
|               | Aggregate crushing value                                                                                                                                           | 25kg                                                 |
|               | Ten percent fines                                                                                                                                                  | 25kg                                                 |
|               | Immersed rotational test                                                                                                                                           | 100kg                                                |
| Reinforcement | Tensile test<br>Bend test                                                                                                                                          | 500mm<br>300mm                                       |
| Water         | Full range of tests                                                                                                                                                | 1 litre                                              |

END OF SECTION

---

## **2 PART 2 - AGGREGATES**

### **2.1 GENERAL**

1. This part covers the requirements of aggregates for use in structural concrete.

### **2.2 REFERENCES**

The following standard is referred to in this Part:

BS 812, Testing aggregates

BS 882, Specification for aggregates from natural sources

### **2.3 SOURCE APPROVAL**

The Contractor shall submit to the Supervising Engineer for approval full details of the proposed sources of aggregate. These sources of aggregate supply shall be regularly and thoroughly investigated to ensure that the quality of the material supply is satisfactory and that it does not deteriorate during the performance of the project.

### **2.4 SAMPLING**

1. Contractor shall provide samples of both fine and course aggregate to the Supervising Engineer, in accordance with the requirements of BS 812 Part 101, Guide to Sampling and Testing Aggregates, for testing at least two weeks before beginning deliveries to the Site.
2. All samples shall be taken in the presence of the Supervising Engineer.

### **2.5 QUALITY AND TESTING**

1. Aggregates shall consist of tough, hard, durable and uncoated particles containing no harmful material in quantities sufficient to adversely affect the concrete or reinforcing steel, and shall contain no materials likely to cause staining or otherwise disfigure the concrete surface.
2. Aggregates which shall be obtained from a source approved by the Engineer, shall comply with the requirements of BS 882 except as modified here under. If required by the Supervising Engineer, and in order to comply with these requirements the aggregates shall be washed clean with potable water. The Contractor shall provide all data as specified in Appendix A of BS 882.
3. Contractor shall satisfy the Supervising Engineer that aggregates to be supplied will not give rise to alkali aggregate reaction with the cement.
4. Fine aggregates shall be natural sand or manufactured crushed rock sand. Crushed rock sand shall be the direct product of a manufacturing process, not the by-product of coarse aggregate production.

5. Beach sand shall not be permitted for use in concrete mixes. Aggregates shall meet the requirements of Table 2.1 Frequency of routine testing shall meet the requirements of Table 2.2. Samples of aggregates shall be tested in accordance with the requirements of Table 2.2.
6. No aggregate deliveries shall be made to the Site until the Supervising Engineer has approved the samples as complying with this specification.

## 2.6 STORAGE

1. The Contractor shall provide a means of storing aggregate at each point where concrete is made such that;
  - each nominal size of coarse aggregate and the fine aggregate shall be kept separated at all times
  - contamination of the aggregates by the ground or other foreign matter shall be effectively prevented at all times
  - each heap of aggregate shall be capable of draining freely
  - storage shall be such as to prevent segregation
  - stock piles shall be protected from direct sunlight
2. The preparation, location and size of any stockpiles, and the methods of segregation shall be to the approval of the Supervising Engineer

Table 2.1  
Limits for physical, chemical and  
Mechanical properties of Aggregates for Concrete

| NO: | REQUIREMENT                         | TEST METHOD    |           | PERMISSIBLE LIMITS                          |           |
|-----|-------------------------------------|----------------|-----------|---------------------------------------------|-----------|
|     |                                     | BS 812         | ASTM      | COARSE                                      | FINE      |
| 1.  | Grading                             | Part 103 (dry) |           | Standard                                    | Standard  |
| 2.  | Clay lumps & friable particles      |                | C142      | Max 3%                                      | Max 2%    |
| 3.  | Lightweight pieces                  |                | C123      | Max 0.5%                                    | Max 0.5%  |
| 4.  | Organic impurities                  |                | C40       | Colour standard not darker than Plate No. 3 |           |
| 5.  | Water absorption                    | Part 2         | C128/C127 | Max 2.3%                                    | Max 2%    |
| 6.  | Specific gravity                    | Part 2         | C128/C127 | Min 2.6                                     | Min 2.6   |
| 7.  | Acid soluble chlorides              | Part 117       |           | Max 0.6%                                    | Max 0.3%  |
|     | Reinforced Concrete & Mass concrete |                |           |                                             |           |
| 8.  | Acid soluble Sulphates              | Part 118       |           | Max 0.3%                                    | Max 0.3%  |
| 9.  | Drying shrinkage                    | Part 120       |           |                                             | Max 0.05% |
| 10. | Moisture content                    | Part 109       |           |                                             |           |

Table 2.1  
Limits for physical, chemical and  
Mechanical properties of Aggregates for Concrete

| ITEM NO: | REQUIREMENT                    | TEST METHOD      | TEST FREQUENCY                                |
|----------|--------------------------------|------------------|-----------------------------------------------|
| 1.       | Grading                        | BS8102: Part 103 | Daily                                         |
| 2.       | Clay lumps & friable particles | ASTM C142        | Daily                                         |
| 3.       | Organic impurities             | ASTM C40         | Greater of : per month or per 200 cubic meter |
| 4.       | Water absorption               | ASTM C128/C127   | Weekly                                        |
| 5.       | Specific gravity               | ASTM C128/C127   | Weekly                                        |
| 6.       | Acid soluble chlorides         | BS 812: part 117 | Twice weekly                                  |
| 7.       | Acid soluble Sulphates         | BS 812: part 118 | Twice Weekly                                  |
| 8.       | Drying shrinkage               | BS 812: part 120 | Start of project or change of source          |
| 10.      | Moisture content               |                  | Twice daily                                   |

## 2.7 FINE AGGREGATE FOR CONCRETE AND MORTAR

1. The gradation of fine aggregate for concrete and mortar shall be in accordance with the gradation designations shown in Table 2.3
2. Each batch of aggregate delivered to the Site shall be kept separate from previous batches, and shall be stored for at least three working days before use to allow for inspection and tests to be carried out.
3. The aggregate used shall be clean, sharp, natural or crushed sand or a uniform mixture of both.
4. The Contractor shall mechanically wash the aggregate to remove salts and other impurities in order to meet the specified requirements.

END OF SECTION

---

### **3 PART 3 - CEMENT**

#### **3.1 GENERAL**

This Part covers the requirements for the testing and use of cement in structural concrete.

#### **3.2 REFERENCES**

The following standard is referred to in this Part:

BS 12, Portland cement  
BS 146, Portland-blast furnace cement  
BS 4027, Sulphate-resisting Portland cement  
BS 4550, Methods of testing cement

#### **3.3 SOURCE APPROVAL**

1. The Contractor shall submit to the Supervising Engineer for approval full details of the proposed sources of cement. These sources of cement supply shall be regularly and thoroughly investigated to ensure that the quality of the material supply is satisfactory and that it does not deteriorate during the performance of the project.
2. The Contractor shall supply the Supervising Engineer with the manufacturer's test sheets for each consignment of cement, certifying that the cement is in compliance with the relevant standards.
3. The Contractor shall submit to the Supervising Engineer the date of manufacture and proof that the specifications have been complied with, certified by an independent agency in the country of origin.

#### **3.4 SAMPLING**

1. The methods of obtaining samples of cement for testing shall be carried out as described in BS 4550 Part 1.
2. The Contractor shall provide samples from each consignment of cement delivered to the Site, or as required by the Supervising Engineer. Seven days shall be allowed for the Supervising Engineer's review of these samples.

#### **3.5 QUALITY AND TESTING**

1. Ordinary Portland cement shall meet the requirements of BS 12.
2. Sulphate resisting Portland cement shall conform to the requirements of BS 4027.
3. The testing of cement shall be carried out in accordance with the provisions of BS 4550 Parts 2 and 3.

### **3.6 STORAGE**

1. Cement shall be delivered to the Site in sealed and branded bags, or in the manufacturer's containers, bearing the manufacturer's name, cement type and date of manufacture, in batches not exceeding 100 tons.
2. Immediately upon arrival at the Site the Contractor shall store the cement in
  - silos designed for the purpose, or
  - dry, weather tight and properly ventilated structures with floors raised a minimum of 450 mm above the ground with adequate provision to prevent absorption of moisture.
3. Each consignment of cement shall be kept separately, and the Contractor shall use the consignments in the order in which they are received. Different types of cement shall be kept in clearly marked separate storage facilities.
4. During transport and storage the cement shall be fully protected from all weather elements.
5. Any consignment of cement not used within six months from the date of manufacture or cement which in the opinion of the Supervising Engineer is of doubtful quality shall not be used in the Works until it has been retested and test result sheets showing that it complies in all respects with the specification and relevant standards have been delivered to the Supervising Engineer.

END OF SECTION

---

## **4 PART 4 - WATER & ADMIXTURE**

### **4.1 GENERAL**

This Part includes the use of water and admixture for concrete mixes, washing of equipment, wetting of surfaces or ponding during curing or for wetting formwork and washing reinforcement.

### **4.2 REFERENCES**

The following standard is referred to in this Part:

BS 12, Portland cement  
BS 1377, Methods of test for soils for civil engineering purposes.  
BS 3148, Water for making concrete (incl. notes on the suitability of the water)  
BS 2690, Methods of testing water used in industry  
BS 4550, Test for setting timer  
BS 5075, Concrete admixtures  
ASTM C494, Standard Specification for Chemical Admixtures for Concrete

### **4.3 QUALITY OF WATER & TESTING**

1. Water shall be potable water and shall comply with the requirements of BS 3148 except as modified below.
2. The pH of water used in concrete works shall be between 7 – 9 when tested in accordance with BS 2690: Part 5
3. The concentration of chloride and sulphates shall not exceed 500mg/l and 1000mg/l respectively when tested in accordance with BS 1377 part 3.
4. The concentration of alkali carbonates and bicarbonates shall not exceed 500mg/l when tested in accordance with BS 2690 part 109.
5. The total dissolved ions including 3 and 4 above shall not exceed 2000mg/l when tested in accordance with BS 1377 part 3.
6. Temperature of water for concrete shall not be less than 5 °C and not more than 25 °C
7. Water may be cooled to not less than 5 °C by the gradual addition of chilled water or ice as follows:
  - no ice particles shall be present in the mix
  - alternatively, flaked ice may be used
  - ice to be used shall be crushed and shall be a product of frozen water which complies with the acceptance criteria of above.
8. Water for curing concrete shall not contain impurities in amounts to cause discoloration of the concrete.

9. Whenever required to do so by the Supervising Engineer the Contractor shall take samples of the water being used, or which it is proposed to use, for mixing concrete and test them for quality.
10. Samples of water of not less than 5l shall be taken, sealed and sent for testing at an approved independent laboratory, prior to the approval of any water source, and whenever the sources of water is changed periodically during the continuance of its use.

#### **4.4 USE OF ADMIXTURE**

1. Admixtures shall mean materials added to the concrete materials during mixing for the purpose of altering the properties of the mix.
2. Where approved and or directed by the Engineer, admixtures shall be used as a means of:
  - enhancing concrete durability
  - increasing workability of the concrete without increasing the water:cement ratio
  - controlling and limiting retardation and setting.
3. The methods of use and the quantities of admixture used shall be in accordance with the manufacturer's instruction and subject to the Supervising Engineer's approval after evaluation in trial mixes and shall in no way limit the Contractor's obligations under the Contract to produce concrete with the specified strength, workability and durability.
4. The effects of accidental overdose, of the admixture and measures to be taken, if an overdose occurs, shall be provided by the Contractor to the Supervising Engineer.
5. No admixtures containing chlorides shall be used. In particular, the use of acceleration admixtures containing calcium chloride shall not be used.
6. The use of the admixtures shall be controlled; i.e., strict quality control to ensure correct dosages as prescribed by the manufacturer and justified by trial mixes to be used. A calibrated dispenser or flow meter shall be used to for the addition of the admixture.

#### **4.5 ORGANIC CORROSION INHIBITORS**

1. Where the concrete is deemed to be in a contact with salt water the Contractor must use an organic corrosion inhibiting admixture. The admixture shall be based on an aqueous emulsion of amines and esters and shall be capable of inhibiting chloride penetration through the capillary pores in addition to forming a protective corrosion resistant film around the steel reinforcement.
2. The admixture shall have no effect on either the slump or temperature development of the concrete in its plastic state.
3. In its hardened state the admixture shall not affect strength development or concrete-steel bond strengths in any way.

4. The corrosion inhibitor shall be capable of effecting protection to the steel where concrete has cracked and allows access to the elements responsible for corrosion.
5. The corrosion inhibitor is to be added at a rate of five litres per cubic metre at the time of mixing or as recommended by the manufacturer.

#### **4.6 ANTI WASHOUT / UNDERWATER CONCRETE ADMIXTURE**

1. All insitu concreting in or under water must use an anti washout /underwater concrete admixture. The admixture shall ensure that there is minimal loss of cement in the mix and there is no segregation of the particles.
2. The admixture shall have no effect on either the slump or temperature development of the concrete in its plastic state.
3. In its hardened state the admixture shall not affect strength development or concrete-steel bond strengths in any way.

#### **4.7 QUALITY ASSURANCES**

1. Manufacturer: Concrete admixtures shall be manufactured by a firm with a minimum of ten years experience in the production of admixtures for concrete. Manufacturers proposed for use shall submit evidence of their ability to meet all the requirements specified, and include a list of projects of similar design and complexity.
2. The manufacturer or distributor shall provide product certification, as required as to the products quality and source of manufacture. A representative of the distributor shall be present for project startup during initial concrete placement. This requirement may be waived if the Contractor provides sufficient evidence that the producer and finisher have adequate experience with admixtures.

END OF SECTION

## 5 PART 5 - CONCRETE MIXES

### 5.1 GENERAL

This Part includes Grades 15, 20, 25 and 30 of concrete to be used in the Works, and the requirements for workability, permeability, and drying shrinkage.

### 5.2 REFERENCES

The following standard is referred to in this Part:

BS 8007, Design of concrete structures for retaining aqueous liquids  
BS 8110, Structural use of concrete  
BS 1881, Methods of testing concrete  
BS 812, Testing aggregates  
BS 882, Aggregates from natural sources for concrete  
BS 5328 Part 3,  
BS 7542, Method of test for curing compounds for concrete.

### 5.3 GRADES OF CONCRETE

1. Grades of concrete to be used in the Works shall in general be as shown table below. Where different grades of concrete are required the design of the mix shall follow the requirements of this specification.

| Concrete grade | Max Agg. size | Min Cement content (kg/m <sup>3</sup> ) | Water to cement ratio | Trial mix test (MPa) | Works test (MPa) |
|----------------|---------------|-----------------------------------------|-----------------------|----------------------|------------------|
| 30             | 20            | 330                                     | 0.40 – 0.45           | 40                   | 30               |
| 25             | 20            | 320                                     | 0.45 - .50            | 35                   | 25               |
| 20             | 20            | 310                                     | 0.55                  | 30                   | 20               |
| 15             | 20            | 280                                     | 0.55                  | 25                   | 15               |

2. Where adequate workability is difficult to obtain at the maximum water:cement ratio allowed, the use of plasticisers or water reducing admixtures may be considered.
3. Cement contents in excess of 400 kg/m<sup>3</sup> shall not be used unless special consideration has been given to reduce thermal stress in the concrete, and approval has been obtained from the Supervising Engineer.
4. At the start of the construction period, the Contractor shall design a mix for each grade of concrete listed above Table that is required to be built into the Works.
5. Each mix design shall be such that:
  - the aggregate shall comprise fine aggregate and coarse aggregate no greater than the maximum size specified in above Table.
  - the combined aggregate grading shall be continuous
  - the aggregate quantity shall be calculated by weight

- the mixes shall be designed to produce a concrete cube strength at twenty-eight days after manufacture of not less than the cube strength specified in above Table.

#### **5.4 CONCRETE MIXES**

All concrete mixes shall be designed to the relevant clauses of BS 5328: Parts 2, 3 and 4

1. NORMAL DESIGNED MIX FOR BLINDING CONCRETE  
Grade: C15  
Cement: Sulphate Resisting Portland Cement
2. NORMAL DESIGNED MIX FOR MASS CONCRETE UPFILL  
Grade: C20  
Cement: Sulphate Resisting Portland Cement
3. NORMAL DESIGNED MIX FOR ALL STRUCTURAL CONCRETE IN LAND:  
Grade: C30  
Cement: Sulphate Resisting Portland Cement (for below ground)  
Cement: Ordinary Portland Cement (for above ground)
4. NORMAL DESIGNED MIX FOR ALL STRUCTURAL CONCRETE IN/OVER WATER:  
Grade: C35  
Cement: Sulphate Resisting Portland Cement (all areas in direct contact with seawater)  
Cement: Ordinary Portland Cement (for all other areas)

#### **5.5 TRIAL MIXES, TESTS AND SAMPLING**

1. In order to ensure that the quality of materials and mix proportions are maintained throughout concreting operations, sampling and testing shall be carried out using the relevant procedures set out in BS 812, BS 882 and BS 1881 and all other relevant codes quoted in this specification in accordance with a routine testing program that shall be agreed with the Supervising Engineer before the start of concrete work.
2. The concrete mix shall have at least the required minimum cement content and mean strength greater than the required characteristic strength.
3. Test cubes shall be taken as specified from fresh mixed concrete which is being used in the Works and which has been prepared in the normal way.
4. Samples for works cubes tests shall be taken at the average rate one test per 10 m<sup>3</sup> of concrete of a particular grade placed, with a minimum of one sample taken every day that the mix is used. A sample consists of six cubes, three to be tested at 7 d, three at 28 days.
5. If the average strength of the three works test cubes at 7 d indicate that the required strength at 28 d will not be achieved the Contractor shall immediately:
  - stop all concreting until checks are made on material and equipment

- rectify any defect which has become apparent as the result of checking.

At Contractor's option, defective concrete may be removed and replaced without awaiting the 28 d test results.

6. Slump tests shall be carried out at the rate of one test per 5 m<sup>3</sup> of concrete produced. The maximum slump, measured at the point of placing the concrete shall not be less than 75 ±25 mm for general concrete work.
7. The workability of fresh concrete shall be suitable for the conditions of handling and placing so that after compaction concrete surrounds all the reinforcement, ducts and completely fills the formwork without voids or honeycombing. The design slump range of the concrete shall be the minimum necessary to ensure the correct placement and compaction of the mix.
8. All concrete shall be designed to be dense, durable and have a high impermeability to water.

END OF SECTION

## **6 PART 6 - CASTING & CURING**

### **6.1 GENERAL**

1. This part deals with the transportation, placing, compaction and the requirement for curing of concrete.

### **6.2 REFERENCES**

The following standard is referred to in this Part:

BS 8110, Structural use of concrete  
BS 1881, Methods of testing concrete  
BS 5328 Part 3,  
BS 7542, Method of test for curing compounds for concrete.

### **6.3 SUBMITTALS**

1. Should the Contractor propose to use concrete pumps for the transportation and placing of concrete, he shall submit details of the equipment and operating techniques he proposes to use for the approval of the Supervising Engineer.
2. A method statement shall be submitted for approval for major concrete placements, which shall address;
  - the planned rate of placing
  - number of batching plants
  - number and positioning of pumps (if any)
  - pour sequence quality control measures
  - any other factors that might affect the placing of concrete
3. The Contractor shall submit to the Engineer the proposed method of curing for approval.

### **6.4 TRANSPORTING, PLACING AND COMPACTION**

#### **6.4.1 Transporting**

1. Concrete shall be conveyed from the mixer to its place in the Works as rapidly as possible by methods which will prevent segregation or drying out and ensure that the concrete is of the required workability at the point and time of placing. Should segregation occur in the concrete then the materials shall be remixed to the satisfaction of the Supervising Engineer or discarded.
2. The Contractor shall ensure that the time between placing of different lifts or layers of concrete is short enough to prevent the formation of cold joints. Concrete shall be handled from the place of mixing to its place in the Works within 30 min unless retarders have been incorporated in the mix that have satisfactorily demonstrated that

workability and other properties can be retained, and that approval is obtained from the Supervising Engineer.

3. The Contractor shall obtain the approval of the Supervising Engineer to his proposed arrangements before beginning concreting.
4. All placing and compacting of concrete shall be carried out under the direct supervision of a competent member of the Contractor's staff with a minimum of five years of experience in concreting works, and in a manner to produce a watertight concrete of maximum density and strength.
5. For night concreting operations, the Contractor shall arrange adequate suitable lighting. The Contractor shall provide safe secure access for all personnel on concreting operations.
6. Where the thickness of the concrete section exceeds 600 mm the Contractor shall adopt special precautions, to be approved by the Engineer, to avoid thermal cracking due to external and core temperature differentials.
7. Concrete shall not be placed in adverse weather conditions such as heavy rain.
8. No concrete shall be placed until the Supervising Engineer has inspected and approved in writing the surfaces upon which the concrete is to be placed, the formwork, and reinforcing steel. The Contractor shall give the Engineer at least 24 hours notice to enable this inspection to be carried out.

#### **6.4.2 Placing**

1. Concrete shall be placed in its final position before initial set has commenced and shall not be subsequently disturbed. All concrete shall be placed within 15 min of mixing unless carried in purpose made agitators.
2. Concrete shall be carefully placed in horizontal layers which shall be kept at an even height throughout the work. The depth of layers and time between placement of layers shall be such that each layer can be properly merged into the preceding layer before initial set takes place, the depth of layer shall be determined from the type of plant the Contractor proposes to use.
3. Concrete shall be allowed to slide or flow down sloping surfaces directly into its final position from skips, down pipes or other placing machines or devices or, if this is not practical, it should be shovelled into position, care being taken to avoid separation of the constituent materials.
4. Concrete placed in horizontal slabs from barrows or other tipping vehicles shall be tipped into the face of the previously placed concrete.
5. Concrete dropped into place shall be dropped vertically. It shall not strike the formwork between the point of its discharge and its final place in the Work, and except by approval of the Supervising Engineer it shall not be dropped freely through a height

greater than 1.5 m. Chutes and conveyor belts shall be also designed so that there is no segregation or loss of mortar and shall be provided with a vertical tapered down pipe, or other device, to ensure that concrete is discharged vertically into place.

6. Concrete shall not be placed in standing water in the formwork.

#### **6.4.3 Compaction**

1. Concrete shall be thoroughly compacted by vibration during the operation of placing and thoroughly worked around the reinforcement, around embedded fixtures and into corners or the formwork to form a solid mass free from voids.
2. When vibrators are used to compact the concrete, vibration shall be applied continuously during the placing of each batch of concrete until the expulsion of air has practically ceased and in a manner that does not promote segregation of the constituents of the concrete.
3. Immersion type vibrators shall be capable of producing not less than 10 000 cycles per minute, and external vibrators not less than 3000 cycles per minute.
4. A sufficient number of vibrators in serviceable condition shall be on site to ensure that spare equipment is always available in the event of breakdown.
5. Immersion type vibrators shall be inserted into the uncompacted concrete vertically and at regular intervals. Where the uncompacted concrete is in a layer above freshly compacted concrete the vibrator shall penetrate vertically for about 100 mm into the previous layer.
6. Vibrators shall not come into contact with the reinforcement or the formwork. They shall be drawn back slowly from the mass concrete so as to leave no voids. Internal type vibrators shall not be placed in the concrete in a random or haphazard manner nor shall concrete be moved from one part of the work to another by means of the vibrators.
7. Operators shall be trained in the use of vibrators. Foremen shall have a minimum of five years of experience in the supervision of placing concrete.
8. Vibration of the concrete shall not be applied by way of the reinforcement.
9. Compaction shall commence as soon as there is sufficient concrete to immerse the vibrator and continue during the placing operations so that at no time shall there be a large volume of uncompacted concrete in the formwork.
10. The duration of vibration shall be limited to that required to produce satisfactory compaction without causing segregation. Vibration shall on no account be continued after water or excess grout has appeared on the surface.
11. During the placing of all reinforced concrete, a competent steel fixer and a competent carpenter shall be in attendance on each concreting gang. They shall ensure the reinforcement embedded fittings and forms are kept in position as work proceeds.

---

## **6.5 CURING**

### **6.5.1 General**

1. The Contractor shall ensure that curing is provided for 24 hours per day including holidays and that all related necessary plant and labour resources are also available.
2. Special attention shall be given to the curing of vertical and overhanging surfaces to ensure satisfactory curing.
3. The Contractor shall adopt curing measures that preclude the possibility of thermal shock to the concrete during curing. This may be achieved by ensuring that the temperature of the water used for curing does not differ from that of the concrete by more than 15 °C.
4. Water used for any curing purposes shall conform to the requirements of this specification.
5. All concrete shall be cured for a period of time required to obtain the full specified strength, but not less than seven consecutive days. The method of curing shall be by water for the first seven days and by water or membrane until the concrete has reached the full specified strength.
6. Exposed surfaces shall be protected from air blown contamination until 28 d after the concrete is placed.
7. The method of curing shall ensure that sufficient moisture is present to complete the hydration of the cement, and shall be to the approval of the Supervising Engineer the method of curing shall not :
  - disfigure permanently exposed surfaces
  - affect bonding of subsequent coatings
  - increase the temperature of the concrete.

### **6.5.2 Moisture Curing**

8. Moisture curing shall be performed by :
  - a) covering the surface of the concrete with water and keeping it continuously wet
  - b) continuous use of fine fog water sprays
  - c) covering the surface with a saturated absorptive cover and keeping it continuously wet.

Where method (a) is employed, the bunds used shall not be made from fill from excavations or any other areas where there is the possibility of chloride contamination.

END OF SECTION

---

## **7 PART 7 - FORMWORK, REINFORCEMENT & JOINTS**

### **7.1 GENERAL**

1. This Part includes permanent forms, temporary formwork, and falsework for structural and architectural cast-in-place concrete including form liners, coatings, and accessories.
2. This Part includes tension, compression, and temperature reinforcing steel. The work includes furnishing, fabrication, and placement of reinforcement for cast-in-place concrete, including bars, welded wire fabric, ties, and supports.
3. This part deals with movement and construction joints, slip bearings, waterstops and associated sealants and filler materials.

### **7.2 REFERENCES**

The following standard is referred to in this Part:

BS 5328, Concrete  
BS 5975, Code of practice for falsework  
BS 8110, The structural use of concrete  
BS 4449, Carbon steel bars for the reinforcement of concrete  
BS 4466, Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete  
BS 2571, General purpose flexible PVC compounds for moulding and extrusion  
BS 2782, Methods of testing plastics  
BS 6093, Design of joints in building construction

### **7.3 SUBMITTALS**

1. Shop drawings for formwork shall be produced, giving the following minimum information for each level:
  - (a) details of formwork for columns, beams, parapets, slab and kickers
  - (b) details of construction joints and movement joints
  - (c) details of retaining walls showing the position and size of ties, joints, soldiers and sheeting, together with detailed information on erection and casting sequences and construction joints
  - (d) general assembly details
  - (e) proposals at all penetrations through the concrete
  - (f) proposed sequence of shoring and re-shoring beams and slabs for different spans and floor heights and number of floors shored, and the stripping time for supported and
  - (g) suspended structural elements, clearly identifying the supported element and suspended element.
2. Product data including the manufacturer's specification and installation instructions for proprietary materials and reinforcement accessories shall be provided.

3. The Contractor shall submit for approval by the Supervising Engineer as soon as practicable and not less than three weeks before commencement of concreting, drawings showing his proposals for the position of construction joints having due regard to any that may or may not be shown on the Contract Drawings.
4. The Contractor shall prepare shop drawings that show the layout of the waterstops, specials and joints.

#### **7.4 INSPECTION OF FORMWORK AND REINFORCEMENT**

1. Inspection of formwork, reinforcing steel and the installation thereof will be conducted by the Supervising Engineer.
2. The Contractor shall give 24 hour notice to the Supervising Engineer before closing forms or placing concrete.
3. The Supervising Engineer may instruct the Contractor to break out and remove completely all sections of the work already constructed under any of the following circumstances:
  - reinforcing steel sample under test fails to meet the specification requirements at any time
  - the Supervising Engineer considers that samples which were presented to him for test were not truly representative
  - it becomes apparent that reinforcing steel which has not been approved has been used on the Works.

#### **7.5 FORMWORK MATERIALS AND EXECUTION**

##### **7.5.1 Materials**

1. Formwork for exposed concrete surface finish shall be lined with as large panels as possible of non-staining material with a smooth unblemished surface such as sanded plywood or hard compressed fibre board, arranged in a uniform approved pattern and fixed to back formwork by oval nails.
  - the same type of lining shall be used throughout any one structure
  - unfaced wrought boarding or standard steel panels shall not be permitted.
2. Formwork for external concrete below ground shall be constructed of timber, or of any suitable material which will prevent loss of grout when the concrete is vibrated.

##### **7.5.2 Execution**

1. The erection of formwork and associated falsework shall be executed and supervised by fully qualified personnel having a minimum of five years experience. The erected formwork shall be watertight from the ingress of external liquids and the egress of internal liquids.

2. Adjustable steel supports and shores shall allow form boards and framework to be accurately adjusted to line and level. The Contractor shall ensure that adequate ground support for falsework is available, and if not shall take measures to make them suitable.
3. Formwork shall be designed to be sufficiently rigid to maintain the correct position, shape and profile so that the final concrete structure is within the dimensional tolerances specified.
4. Formwork shall be designed to be demountable without causing shock, disturbance or damage to the concrete.
5. Soffit formwork, properly supported on shores only, shall be capable of being retained in position during the concrete maturing period.
6. The design shall allow free movement and accessibility under the formwork.
7. The forms shall be designed to incorporate 20 mm chamfers on exposed corners of columns, walls and beams.
8. Conduits or pipes shall be located so as not to reduce the strength of the construction. In no case shall pipes other than conduits be placed in a slab 125 mm or less in thickness.
9. Conduits may be embedded in walls provided they are not larger in outside diameter than one-third the thickness of the wall, are not spaced closer than three diameters on centre, and do not impair the strength of the structure.
10. Embedded pipes and conduits shall be supported independently from reinforcing steel in a manner to prevent metallic contact and thereby prevent electrolytic deterioration.
11. Pipes and conduits where embedded shall be placed as nearly as possible to the centre line of the concrete section. Conduits, piping, and other wall penetrations or reinforcements shall be subject to the Supervising Engineer's review and approval.
12. The following minimum periods (in days) for retaining formwork in position before striking apply to sulphate-resisting or ordinary Portland cement concrete with no cement replacement materials or admixtures:

| Type of formwork                           | Days |
|--------------------------------------------|------|
| Vertical to Columns, walls, beams          | 0.5  |
| Soffits to slabs, beams and props to slabs | 7    |
| Props to beams                             | 14   |

## 7.6 REINFORCEMENT MATERIALS, CUTTING & FIXING

### 7.6.1 Materials

1. Reinforcing steel shall conform to the requirements of BS 4449 and shall meet the following requirements for minimum yield stress

|                          | Bars Yield Stress     | Symbol |
|--------------------------|-----------------------|--------|
| Plain round mild steel   | 250 N/mm <sup>2</sup> | R      |
| Deformed High Yield bars | 410 N/mm <sup>2</sup> | T      |
2. If in the opinion of the Engineer the steel has excessive surface rust, dust or other deleterious material then the steel shall be sand blasted. Sand for blasting shall not contain materials deleterious to the durability of the reinforcement or concrete.
3. All reinforcement shall be pressure washed with fresh water after erection and immediately before placing concrete.
4. Tie wire shall conform to the requirements of BS 4482. 1.6 mm. annealed steel wire shall be used for tie wire. No wires smaller than size D-4 shall be used.

### 7.6.2 Cutting And Bending

1. Cutting and bending of reinforcement shall be in accordance with BS 4466 and shall be done without the application of heat. Bends shall have a substantially constant curvature.
2. Reinforcement shall not be straightened or re-bent without the approval of the Supervising Engineer. If permission is given to bend projecting reinforcement care shall be taken not to damage the concrete and to ensure that the radius is not less than the minimum specified in BS 4466.

### 7.6.3 Fixing of Reinforcement

1. All reinforcement shall be securely and accurately fixed in positions shown on the Drawings to ensure that the reinforcement steel framework as a whole shall retain its shape. The framework shall be so temporarily supported as to retain its correct position in the forms during the process of placing and consolidating the concrete.
2. The ends of all tying wires shall be turned into the main body of the concrete and not allowed to project towards the surface.
3. No part of the reinforcement shall be used to support access ways, working platform or for the conducting of an electric current.
4. The Contractor's specific attention is drawn to the following general requirements:
  - lapped joints shall be as indicated on the Drawings and/or in accordance with the requirements of BS 8110
  - hooks shall be semicircular with a straight length of at least:

- i. four bar diameters for mild steel
- ii. six bar diameters for high yield steel

5. Welding shall not be used unless authorised by the Engineer and recommended by the reinforcement manufacturer.

## **7.7 CONSTRUCTION JOINTS**

### **7.7.1 General**

1. Where construction joints are required in slabs or beams these shall be made at the quarter point of the span and at right angles to the member except where otherwise approved by the Supervising Engineer. Where slabs are supported by beams then both beams and slabs shall be constructed in one operation.
2. In all cases vertical stop boards of a form to be approved by the Supervising Engineer shall be provided by at the end of each section of work which is to be concreted in one operation and the concrete shall be thoroughly compacted against these stop boards.
3. Where slabs, beams and walls incorporate construction joints, panels shall generally be constructed consecutively. Where this is not possible a gap not exceeding one metre shall be formed between adjacent panels. This gap shall not be concreted until a minimum interval of 7 d has expired since the casting of the most recent panel.
4. The size of bays for reinforced floors, walls and roofs shall be as shown on the drawings but in no event shall they exceed 7.5 m in either direction and 6 m when unreinforced or with nominal reinforcement.
5. Horizontal construction joints in walls will only be permitted when the wall is continuous with the floor slab. Walls shall be keyed on cast kickers 150 mm high or on the tops of walls meeting the soffits of suspended members.
6. Construction joints in monolithic structures shall be aligned with each other whenever practicable.
7. Before placing new concrete against concrete, which has already set the latter shall be treated to expose the aggregate over the full section and leave a sound irregular surface. This shall be done while the concrete is still fresh by means of water spray and light brushing or other means approved by the Supervising Engineer.
8. Immediately before the new concrete is placed all foreign matter shall be cleaned away and the surface moistened.
9. If during the course of the Contract it should become apparent that the Contractor's methods of forming construction joints are not proving effective the Supervising Engineer may order the Contractor to execute at the Contractor's expense such preventative measures as the Supervising Engineer may consider necessary to ensure the water tightness of the construction joints in further work.

### **Construction Joints in Water Retaining Structures**

10. Waterstops shall be incorporated into construction joints in water retaining structures. The Contractor shall ensure that all such construction joints are watertight and any joints which may leak or weep shall be rectified by the Contractor to the Supervising Engineer's satisfaction.
11. The waterstops shall be a high performance system forming a continuous network. Site jointing is to be limited to butt joints and shall be performed strictly in accordance with the manufacturer's instructions.
12. Centrally placed waterstops shall employ centre bulbs/shutter stop with ribs on the web sections.
13. Externally placed waterstops shall have ribs on either side of the centre of the waterstops.
14. The water bar used at the location of expansion joints shall have a bulb in the centre to accommodate the movements.
15. Waterstops shall have a minimum thickness of 5 mm.
16. The minimum test performance data for PVC waterstops shall be as follows:
  - Tensile strength >12 MPa
  - Elongation at break 300 %
  - Hardness Shore 'A' 80 to 90
17. The materials shall tested in accordance with BS 2571 or BS 2782.

END OF SECTION

---

## **8 PART 8 – PROTECTION & WATER PROOFING FOR CONCRETE**

### **8.1 GENERAL**

This Part covers the materials and application requirements for the subgrade protection of concrete by waterproofing applications, epoxy coatings for concrete surfaces in harsh environments and waterproofing of concrete in immersed conditions.

### **8.2 REFERENCES**

The following standard is referred to in this Part:

BS 1881, Testing of Concrete

### **8.3 SUBMITTALS**

1. The Contractor shall submit manufacturers' specifications, installation instructions and other data to show compliance with the requirements of this part of the specification and the Contract Documents.
2. The Contractor shall submit samples of all materials to be used in the works before delivery of material to Site. Samples of membrane waterproofing shall be 300 mm square. Samples of liquid components shall be a minimum of one litre.
3. The Contractor shall submit comprehensive test results for the all coating and protection system as per the tests in the specification which shall clearly indicate whether the values are mean values measured in current production or minimum values which the property does not fall below.
4. If the Contractor wishes to propose alternative systems for protections or waterproofing to those specified here, a technical submission shall be made which shall include a comprehensive justification giving an explanation of why the proposed systems is equivalent or superior to the one designated.

### **8.4 QUALITY ASSURANCE**

1. The protective coating system shall be supplied by a manufacturer who is certified to the ISO 9000 series of quality standards.
2. The works shall be executed by an approved specialist subcontractor having a minimum of 5 years successful experience in the installation of the specified material. Only tradesmen experienced with the installation of the materials specified shall be used.

---

## 8.5 EPOXY COATING

### General

1. To be applied on all exposed concrete surfaces over water, the coating shall be a decorative flexible high solids, epoxy polyurethane coating applied in two coats to a dry film thickness of 400 microns minimum.

### Surface Preparation

2. The surface of the concrete shall be free from oil, grease, loose particles, decayed matter, moss or algae growth and general curing compounds. All surface contamination and surface laitance shall be removed by high pressure water jetting or sweep blasting.
3. Blow holes and areas of substantial pitting shall then be filled with a solvent free thixotropic epoxy resin fairing coat. The mixing and application of the this coat shall be in accordance with the product manufacturer's recommendations.
4. Where surface cracking is apparent these cracks shall be chased, by an approved mechanical means, to the depth of the crack. A thixotropic epoxy resin shall be applied using a trowel, scraper or filling knife ensuring that full compaction is achieved into the chased section and providing a flush finish with the concrete surface. A minimum period of 24 h shall be allowed before applying any subsequent protective coating systems.

### Materials

5. External above ground coating materials shall provide protection against chlorides and carbonation, and be UV and abrasion resistant.
6. The above ground coating shall be applied over the below ground coating and shall continue for a minimum of 150 mm above the ground level.
7. The epoxy coating shall be UV stable.
8. The finished coating shall be pinhole free and have a total minimum dry film thickness of 400 mm.
9. The materials used in the coating system shall comply with the following requirements:
  - Solids Content > 85 %
  - Service temperature -20 oC to 70 oC
  - Tensile strength (DIN 53504) 4 MPa
  - Extensibility (DIN 53504) greater than 110 %
  - Resistance against crack (DIN 53515) 6 MPa
  - Adhesion to concrete (ASTM D 4541) greater than 3.5 MPa

## **Application**

10. The coating shall be applied by spray, roller or brush to achieve a finish acceptable to the Supervising Engineer.

## **8.6 BITUMINOUS BASED WATERPROOFING**

### **General**

1. To be applied on all subgrade concrete surfaces in contact with earth. The material shall be a liquid applied single component elastomeric coating applied to a dry film thickness of 500 microns minimum.

### **Materials**

2. Membrane performance as follows;
  - Typical Moisture Vapour Transmission Rate  $9.9 \text{ g/m}^2/24 \text{ hours}$  (ASTM E96)
  - Primer: As per manufacturer recommendations.
  - Recommended Application Temperature:  $-10^{\circ}\text{C}$  to  $35^{\circ}\text{C}$ .

### **Workmanship**

3. Apply materials carefully in accordance with manufacturer's recommendations to provide a continuous membrane.
4. Ensure that surfaces to be covered are clean, dry and free from standing water, voids and sharp protrusions.
5. Protect finished areas as recommended by the manufacturer to prevent puncturing damage or deterioration during following work.
6. Cover finished areas with permanent overlying construction as soon as possible, or as recommended by manufacturer.
7. Immediately prior to covering check for damage and repair as necessary.

### **Inspection**

8. Inform the Supervising Engineer a reasonable length of time before covering any finished areas with overlying construction, to allow inspection.

## **8.7 CEMENT BASED WATERPROOFING**

1. To be applied on all concrete surfaces immersed or in full contact with water. The material shall be a cement based, flexible 2 part waterproofing and sealing membrane appraised by an international accreditation organisation.
2. The workmanship and inspection of the finished surfaces shall be as per clause 8.6 items 3 to 8.

END OF SECTION

## **1. PART 1 - MASONRY**

### **1.1 GENERAL**

1. Work shall be complied with this specification or drawings unless otherwise stated. Any work not specified shall be discussed and as directed by the Supervising Engineer
2. Work is to be performed by experienced workers under the direction of a qualified supervisor who is fully aware of the requirements.
3. Stake-board shall be provided at each 5m in length and shall be inspected by the Supervising Engineer for the accuracy, firmness and secure ness. However, a suitable ruler, plumb bob and leveler may be provided for minor performance of cement block and bricks.

### **1.2 MATERIALS**

1. Blocks: solid concrete blocks with all accessories
  - Minimum average compressive strength: 3.5N/mm<sup>2</sup>
  - Work size(s): 600/450 x 200 x 150/125
2. Mortar: 1:1:6 cement: lime: sand
3. Bond: Stretcher

### **1.3 MANUFACTURER OF CONCRETE MASONRY BLOCKS**

1. Blocks are to be made with ordinary Portland cement unless used below ground floor at natural slab level in which case sulphate resisting cement should be used.
2. All blocks are to be manufactured, supplied and tested in accordance with BS 6073, Part 1.
3. The minimum compressive strength of the average of 10 blocks shall be as given in clause C1.4
4. Each block manufactured from sulphate resisting cement is to be colour coded with an identifying mark.
5. Blocks are to be manufactured in a vibrated/pressure block making machine using cement and aggregate in the proportions required to produce the minimum strengths given in C1.4
6. The materials to be mixed in a mechanical mixer and placed in the block-making machine in layers not exceeding 100 mm, each layer being thoroughly vibrated and compacted before the addition of the next.
7. Immediately after manufacture the blocks are to be stacked on clean, level, non-absorbent pallets in honeycomb fashion. The pallets are to be marked with the date of production and stored in a level curing and stacking area in such a manner that one day's production is separated from the next.

8. Blocks manufactured from mobile machines are to be cast on to a clean concrete hardstanding. Each day's production shall be easily identifiable and kept separate from the next.
9. All blocks, however manufactured, are to be immediately protected from the effects of the sun and wind by suitable moisture retaining coverings.
10. Care shall be taken for damage during transportation of materials and any defect of natural finished blocks shall be rejected.
11. Different size of material shall be stored separately and protected from dirt and other impurities.

#### 1.4 SETTING OUT OF BLOCKWORK

1. All blockwork is to be fully set out before laying commences to ensure:
  - Correct bonding over all lengths of wall particularly at openings and piers
  - Minimum cutting
  - Compliance with Permissible deviation given below;

| Dimension | Permissible deviation (mm) |
|-----------|----------------------------|
|-----------|----------------------------|

|                                                                                                                      |       |
|----------------------------------------------------------------------------------------------------------------------|-------|
| Position in plan of any point or specified fair face in relation to the nearest building grid line at the same level | +/-10 |
| <hr/>                                                                                                                |       |
| Length (unless otherwise defined by adjacent construction):                                                          |       |
| Up to 5 m                                                                                                            | +/-15 |
| 5 to 10 m                                                                                                            | +/-20 |
| <hr/>                                                                                                                |       |
| Height:                                                                                                              |       |
| Up to 3 m                                                                                                            | +/-15 |
| 3 to 6 m                                                                                                             | +/-20 |
| <hr/>                                                                                                                |       |
| Level of bed joints:                                                                                                 |       |
| Up to 5 m long                                                                                                       | +/-10 |
| 5 to 10 m long                                                                                                       | +/-15 |
| <hr/>                                                                                                                |       |
| Straightness in any 5 m length                                                                                       | +/-10 |
| <hr/>                                                                                                                |       |
| Vertically:                                                                                                          |       |
| In any 3 m height                                                                                                    | +/-10 |
| In o/a height of building exceeding 6 m                                                                              | +/-20 |
| <hr/>                                                                                                                |       |
| Thickness:                                                                                                           |       |
| Overall thickness of walls or width of piers (subject to the following)                                              | +/-15 |
| Difference in thickness of a wall or width of a pier at any two points 3 m apart                                     | +/-10 |

2. The average thickness of both vertical and horizontal mortar joints is to be 10 mm exclusive of any key in the joint surfaces of the unit.

### **1.5 PLACING CONCRETE MASONRY BLOCKS**

1. Do not wet concrete blocks before laying: use an approved water retaining admixture in the mortar to counteract suction.
2. Bonding mortar shall be used immediately after mix, and mixed mortar left for more than one hour shall be rejected.
3. Vertical and horizontal joint of blocks shall be filled completely and suitable with mortar on line shall not be moved or rearranged. Joint and surface of block of exposed finished block wall shall be cleaned immediately after joint is filled.
4. Mortar for joint shall be touched with steel trowel before hardened and exposed joint shall be finished with uniform width and planned without roughness or cavity.
5. Height for placing block per day shall be maximum 1.5 m unless otherwise specified.
6. Partitions shall be 100 mm thick unless otherwise noted. Partitions having lavatories or other plumbing fixtures secured to them back-to-back (or approximately so) are to be a minimum of 150 mm thick. Solid concrete masonry units shall be built in where full units cannot be used or where needed for the fixing of accessories. Bells or hubs of pipes must be completely enclosed.
7. Reinforced masonry partitions are to fully extend to the underside of slabs.
8. When pipes or conduits or both occur in plastered partitions, at least one web of the hollow masonry units must be retained.

### **1.6 JOINT REINFORCEMENT**

1. Expanded steel mesh joint reinforcement, fabricated from 0.5 mm nominal thickness light coat galvanized steel to BS 2989, Z2 grade, coating type C or stainless steel to BS 1449, should be embedded in the horizontal mortar joints not closer than 20 mm from the external face of the wall and, except at movement joints, is to be continuous and lapped at least 75 mm at all passing. Full lap joints are to be provided at angles.

### **1.7 CONNECTIONS BETWEEN WALLS OR PARTITIONS, COLUMNS AND SOFFITS**

1. Blockwork shall be anchored to concrete columns, beams and walls, to steel stud construction and to masonry backup with ties and anchors in accordance with the relevant provisions of BS 5628.
2. All connections between blockwork walls or partitions and concrete or steel columns shall be reinforced at maximum 400 mm centres by means of stainless steel or zinc coated expanded metal as directed by the Supervising Engineer or approved proprietary ties shot fired to the column and built into and fully embedded in the mortar joints of the block walls or partitions.

## **1.8 MOVEMENT JOINTS**

1. Movement joints to be 12 mm wide and formed where indicated or where continuous runs of block walling exceed 6 meters in length.
2. The joints are to be straight and vertically formed with uncut faces of the blocks to each side and filled with an approved compressible material manufactured specifically for building into movement joints.
3. External joints are to be sealed with mastic compatible with the joint filling material when the block walling is thoroughly dry and the joint surfaces have been cleaned with a wire brush or mechanical tool.
4. A primer is to be applied to the joint surface if specified by the manufacturer of the mastic.
5. Mastic sealing to unfilled movement joints to be on an approved foam backing strip placed to ensure the correct depth of sealant.

END OF SECTION

**THINADHOO TANK**  
Male', Republic of Maldives

**BILL OF QUANTITIES**

| ITEM          | DESCRIPTION                                                                                                                                                                                                                                 | UNIT | QTY  | RATE | AMOUNT |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|--------|
| <b>1.0.00</b> | <b>Bill No: 01 - PRELIMINARIES</b>                                                                                                                                                                                                          |      |      |      |        |
| <b>1.1.00</b> | <b><u>GENERAL NOTES</u></b><br>Abbreviations<br>m - metre<br>nr - numbers<br>m3 - cubic metres<br>m2 - square metres<br>m - linear metre<br>t - tons<br>inc. - including<br>mm - millimetre<br>SS - stainless steel<br>GI - galvanized iron |      |      |      |        |
| <b>1.2.00</b> | <b><u>SITE MANAGEMENT COSTS</u></b><br>Allow for all on and off site management cost including costs of foreman and assistants, temporary services, telephone, fax, hoardings & similar.                                                    | item | 1.00 |      | -      |
| <b>1.3.00</b> | <b><u>SIGN BOARD</u></b><br>Allow for sign board.                                                                                                                                                                                           | nr   | 1.00 |      |        |
| <b>1.4.00</b> | <b><u>CLEAN-UP</u></b><br>Allow for clean-up upon completion of works.                                                                                                                                                                      | item | 1.00 |      | -      |
| <b>1.5.00</b> | <b><u>INSURANCE, BONDS, GUARANTEES AND WARRANTIES</u></b><br>Insurance as stated in the general conditions.                                                                                                                                 | item | 1.00 |      |        |
| <b>1.6.00</b> | <b>TOTAL OF BILL No: 01 - Carried Over To Summary</b>                                                                                                                                                                                       |      |      |      | -      |

| ITEM   | DESCRIPTION                                                                                                                                                                                                                           | UNIT           | QTY    | RATE | AMOUNT |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------|------|--------|
| 2.0.00 | Bill №: 02 - EXCAVATION AND FILLING                                                                                                                                                                                                   |                |        |      |        |
| 2.1.00 | <b><u>GENERAL</u></b><br>(a) Rates shall include for: leveling, grading, trimming, compacting to faces of excavation, keep sides plumb, backfilling, consolidating, and disposing surplus soil.                                       |                |        |      |        |
| 2.2.00 | <b><u>SITE CLEARING</u></b>                                                                                                                                                                                                           |                |        |      |        |
| 2.2.01 | Clear the area of site from rubbish and vegetable matters, stumps, roots.<br>Rates shall include for removal of trees and tree stumps                                                                                                 | m <sup>2</sup> | 486.95 |      | -      |
| 2.3.00 | <b><u>EXCAVATION</u></b>                                                                                                                                                                                                              |                |        |      |        |
| 2.3.01 | Excavation quantities are measured to the faces of concrete members.<br>Rates shall include for all the additional excavation required to place the formwork. Rates shall include for backfilling.<br>Excavation for Foundation strip | m <sup>3</sup> | 711.45 |      | -      |
| 2.4.00 | <b><u>FILLING</u></b>                                                                                                                                                                                                                 |                |        |      |        |
| 2.4.01 | Rate shall include for: levelling, grading, trimming, compacting and similar<br>Compacted earth filling                                                                                                                               | m <sup>2</sup> | 379.44 |      | -      |
| 2.5.00 | <b><u>DAMP-PROOF MEMBRANE</u></b>                                                                                                                                                                                                     |                |        |      |        |
| 2.5.01 | Rate shall include for: dressing around and sealing to all penetrations.<br>Bituminous waterproofing membrane                                                                                                                         | m <sup>2</sup> | 379.44 |      | -      |
| 2.6.00 | <b><u>DE-WATERING</u></b>                                                                                                                                                                                                             |                |        |      |        |
| 2.6.01 | De-watering the excavation until completion of concrete work as required                                                                                                                                                              | item           | 1.00   |      | -      |
| 2.7.00 | TOTAL OF BILL №: 02 - Carried Over To Summary                                                                                                                                                                                         |                |        |      | -      |

| ITEM   | DESCRIPTION                                                                                                                                                                                                                                 | UNIT           | QTY      | RATE | AMOUNT |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|------|--------|
| 3.0.00 | Bill №: 03 - INSITU CONCRETE WORKS                                                                                                                                                                                                          |                |          |      |        |
| 3.1.00 | <b>GENERAL</b>                                                                                                                                                                                                                              |                |          |      |        |
|        | (a) Rates shall include for: placing in position, making good after removal of formwork, mortar touch up to all concrete and casting in all required items; additional concrete required to conform to structural and excavated tolerances  |                |          |      |        |
|        | (b) Mix ratio for reinforced concrete shall be 1:2:3 and lean concrete shall be 1:2:6.                                                                                                                                                      |                |          |      |        |
|        | (c) All structural concrete shall be GRADE C30 and lean concrete shall be GRADE C15                                                                                                                                                         |                |          |      |        |
|        | (d) Rates shall include for: concrete, formwork, reinforcement, cleaning, fabrication, placing, the provision for all necessary temporary fixings and supports including tie wires and chair supports, laps, distribution bars and wastage. |                |          |      |        |
|        | (e) Rates shall include for: all necessary boarding, supports, erecting, framing, temporary cambering, cutting, perforations for reinforcing bars, bolts, straps, ties, hangers, pipes and removal of formwork.                             |                |          |      |        |
|        | (f) Rates shall include for: cleaning, fabrication, placing the provision for all necessary temporary fixings and supports including tie wires and chair supports, laps, distribution bars and wastage.                                     |                |          |      |        |
|        | (g) All reinforcing bars shall be high strength bars.                                                                                                                                                                                       |                |          |      |        |
|        | (h) Slab soffits to be finished fairfaced, use plasteciser and formwork with reducing agent.                                                                                                                                                |                |          |      |        |
|        | (i) Waterproofing shall be added to all areas specified.                                                                                                                                                                                    |                |          |      |        |
| 3.1.01 | Allow for Concrete Testing.                                                                                                                                                                                                                 | item           | 1.00     |      | -      |
| 3.2.00 | <b>MASS CONCRETE</b>                                                                                                                                                                                                                        |                |          |      |        |
|        | Quantity is measured to the edges of concrete foundation members. Rates shall be inclusive for any additional concrete required to place the formwork.                                                                                      |                |          |      |        |
| 3.2.01 | 75 mm Lean Concrete (Foundations)                                                                                                                                                                                                           | m <sup>3</sup> | 28.46    |      | -      |
|        | cement                                                                                                                                                                                                                                      | bags           | 227.38   |      | -      |
|        | sand                                                                                                                                                                                                                                        | bags           | 454.76   |      | -      |
|        | aggregate                                                                                                                                                                                                                                   | bags           | 1,364.28 |      | -      |
| 3.3.00 | <b>REINFORCED INSITU CONCRETE</b>                                                                                                                                                                                                           |                |          |      |        |
|        | <b>SUB-STRUCTURE</b>                                                                                                                                                                                                                        |                |          |      |        |
|        | <b>INSITU-CONCRETE</b>                                                                                                                                                                                                                      |                |          |      |        |
|        | <b>FOUNDATION STRIP</b>                                                                                                                                                                                                                     |                |          |      |        |
| 3.3.01 | 600mm thk Circular Foundation Strip                                                                                                                                                                                                         | m <sup>3</sup> | 252.11   |      | -      |
|        | cement                                                                                                                                                                                                                                      | bags           | 2,014.36 |      | -      |
|        | sand                                                                                                                                                                                                                                        | bags           | 4,028.72 |      | -      |
|        | aggregate                                                                                                                                                                                                                                   | bags           | 6,043.08 |      | -      |
|        | <b>COLUMNS</b>                                                                                                                                                                                                                              |                |          |      |        |
| 3.3.02 | 1600 x 1600 x 1630mm Concrete columns stump                                                                                                                                                                                                 | m <sup>3</sup> | 41.73    |      | -      |
|        | cement                                                                                                                                                                                                                                      | nr             | 333.42   |      | -      |
|        | sand                                                                                                                                                                                                                                        | nr             | 666.85   |      | -      |
|        | aggregate                                                                                                                                                                                                                                   | nr             | 1,000.27 |      | -      |
| 3.4.00 | <b>REINFORCEMENT</b>                                                                                                                                                                                                                        |                |          |      |        |
|        | <b>FOUNDATION STRIP</b>                                                                                                                                                                                                                     |                |          |      |        |
| 3.4.01 | 600mm thk Circular Foundation Strip                                                                                                                                                                                                         |                |          |      |        |
|        | T16 Steel bars                                                                                                                                                                                                                              | t              | 24.23    |      | -      |
|        | T16 Steel bars - 6m                                                                                                                                                                                                                         | nr             | 2,557.00 |      | -      |
|        | <b>COLUMN STUMP</b>                                                                                                                                                                                                                         |                |          |      |        |
| 3.4.02 | T16 steel bars                                                                                                                                                                                                                              | t              | 2.80     |      | -      |
|        | T16 steel bars-6m                                                                                                                                                                                                                           | nr             | 296.00   |      | -      |
| 3.4.03 | R6 Steel bars                                                                                                                                                                                                                               | t              | 0.13     |      | -      |
|        | R6 Steel bars-6m                                                                                                                                                                                                                            | nr             | 101.00   |      | -      |
| 3.5.00 | <b>FORMWORK</b>                                                                                                                                                                                                                             |                |          |      |        |
|        | <b>COLUMN STUMP</b>                                                                                                                                                                                                                         |                |          |      |        |
| 3.5.01 | 12mm Plywood                                                                                                                                                                                                                                | nr             | 35.04    |      | -      |
| 3.5.02 | 50x38mm timber                                                                                                                                                                                                                              | m <sup>3</sup> | 1.04     |      | -      |

| ITEM   | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | UNIT                                   | QTY                                  | RATE | AMOUNT |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------------|------|--------|
|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                        |                                      |      |        |
| 3.6.00 | TOTAL OF BILL №: 03 - Carried Over To Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                        |                                      |      | -      |
| 4.0.00 | Bill №: 04 - MASONRY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                        |                                      |      |        |
| 4.1.00 | <u>GENERAL</u><br>(a) Rates shall include for: cleaning out cavities, forming rebated reveals and pointing and cleaning down to reveals where necessary; fractional size blocks, all necessary machine cutting, cutting or forming chases or edges of floor slabs, cutting or leavingholes and openings as recesses for and building in pipes, conduits, sleeves and similar as required for all trades; leaving surfaces rough or raking out joints for plastering and flashing, bedding frames or plates, building in joists, bearers or similar, temporary supports to openings, templates, reinforcement in walls and for all necessary making good. |                                        |                                      |      |        |
| 4.2.00 | <u>BLOCK WORK</u><br>Cement block Masonry wall (British bond) with 14mm plastering and Damp proof membrane on inner side of foundation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                        |                                      |      |        |
| 4.2.01 | 150 mm thk 600mm Height<br>UNDER GROUND LEVEL<br><div>150mm solid block</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <div>m<sup>2</sup></div> <div>nr</div> | <div>68.99</div> <div>2,694.91</div> |      | -      |
| 4.3.00 | TOTAL OF BILL №: 04 - Carried Over To Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                        |                                      |      | -      |

| ITEM   | DESCRIPTION                                   | UNIT | QTY | RATE | AMOUNT |
|--------|-----------------------------------------------|------|-----|------|--------|
| 5.0.00 | Bill №: 05- ADDITIONS AND OMMISIONS           |      |     |      |        |
| 5.1.00 | <u>ADDITIONS</u>                              |      |     |      |        |
| 5.1.01 | Bill №: 01 - PRELIMINARIES                    |      |     |      |        |
| 5.1.02 | Bill №: 02 - EXCAVATION AND FILLING           |      |     |      |        |
| 5.1.03 | Bill №: 03 - INSITU CONCRETE WORKS            |      |     |      |        |
| 5.1.04 | Bill №: 04 - MASONRY                          |      |     |      |        |
| 5.1.05 | Bill №: 05- ADDITIONS AND OMMISIONS           |      |     |      |        |
|        | <u>TOTAL</u>                                  |      |     |      |        |
| 5.2.00 | <u>OMISSIONS</u>                              |      |     |      |        |
| 5.2.01 | Bill №: 01 - PRELIMINARIES                    |      |     |      |        |
| 5.2.02 | Bill №: 02 - EXCAVATION AND FILLING           |      |     |      |        |
| 5.2.03 | Bill №: 03 - INSITU CONCRETE WORKS            |      |     |      |        |
| 5.2.04 | Bill №: 04 - MASONRY                          |      |     |      |        |
| 5.2.05 | Bill №: 05- ADDITIONS AND OMMISIONS           |      |     |      |        |
|        | <u>TOTAL</u>                                  |      |     |      |        |
| 5.3.00 | TOTAL OF BILL №: 05 - Carried Over To Summary |      |     |      |        |

***G.Dh.Thinadhoo Spherical Tank Foundation Work - Annexure 4- PROJECT EXPERIENCE***

| <b>No</b> | <b>Client</b> | <b>Project Descriptions</b> | <b>Contract Value (MVR)</b> | <b>Start Date</b> | <b>Completed date</b> | <b>Contact number and person from client side</b> | <b>Remarks</b> |
|-----------|---------------|-----------------------------|-----------------------------|-------------------|-----------------------|---------------------------------------------------|----------------|
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |
|           |               |                             |                             |                   |                       |                                                   |                |

I certify that the information listed above is true and that, I understand that false information or the provision of a false statement (including false declaration) will automatically lead to disqualification or exclusion from further participation in contracting, procurement, no matter what stage in the process has been reached when the error, omission or misrepresentation is discovered.

Sign Name:

Designation:

Dat

*G.Dh. Thinadhoo Spherical Tank Foundation Work – Annexure 5 – Project Team*

|    |                                               |
|----|-----------------------------------------------|
| 1. | Title of position: Project Manager            |
|    | Name:                                         |
|    | Highest Qualification:                        |
|    | Experience (# of years):                      |
| 2. | Title of position: Project Engineer           |
|    | Name:                                         |
|    | Highest Qualification:                        |
|    | Experience (# of years):                      |
| 3. | Title of position: Site Engineer / Supervisor |
|    | Name:                                         |
|    | Highest Qualification:                        |
|    | Experience (# of years):                      |

**\*The bidder shall provide CVs of the proposed personnel and reference**