CONTENTS

SECTION 01000

INTRODUCTION

A. This Division of the Specifications contains General Requirements relating to the Works as a whole and where the requirements contained herein conflict with the particular requirements contained in further Divisions of the Particular Specifications, the latter shall take precedence.

B. In examining the requirements of any section of the Specifications the Contractor shall examine all other sections of the Specifications and the other Documents and the Drawings which affect the work of that section.

References which are made in any of these Documents to certain Sections of the Specifications or certain Drawings do not rule out the need to study and follow all other relevant technical documents which are part of the Contract.

C. All documents related to this project shall be treated as CONFIDENTIAL. Distribution of these documents is strictly prohibited and the documents are property of the Government of Maldives.

D. The construction works are to comply with the relevant regulations applicable for the harbor works, restoration and the environmental aspects associated with the same.

E. The current British Standard Specifications and Codes of Practice apply to all construction works and materials.

END OF SECTION

SECTION 01110
SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description.
B. Contract.
C. Inspection and Investigation of Site.
D. Contractor Use of Site and Premises.
E. Existing Services.
F. Protection of Existing Service and Utilities.
G. Damage to Existing Utilities and Properties.

1.02 DESCRIPTION

A. A tsunami struck the Maldives at 09:20 local time on 26 December 2004, devastating the lives and livelihoods of one third of the population, about 100,000 people living on 69 of the 198 inhabited islands. The disaster impacted the entire country with damage to infrastructure and the two main economic sectors, tourism and fisheries. About 20,500 people lost their homes and many people suffered from the trauma of seeing a major part of their lives swept away. The vital tourist sector was hit with damage to 19 of the 87 resorts and a serious drop in hotel occupancy in the months following the tsunami. Many of the country's public service utilities were damaged or destroyed.

B. The Islamic Development Bank(IDB) together with the Government of Maldives (GOM) selected Islands of N. Maafaru, N. Maalhendhoo, HDh. Nolhivaramfaru and HDh. Nolhivaramu for harbour reconstruction works This project is financed by a loan from IDB with the Executing Agency being Ministry of Finance and Treasury (MoFT) and the implementing agency being Ministry of Housing, and Infrastructure(MHI).

C. The Contract comprises restoration of existing harbor, construction of new quay walls and related works, breakwater and necessary dredging/reclamation, completion, commissioning, handover and maintenance of RE*CONSTRUCTION OF HARBORS PHASE 2 in the Islands of* N. Maafaru, N. Maalhendhoo, HDh. Nolhivaramfaru and HDh. Nolhivaramu at Republic of Maldives for Ministry of Housing and Infrastructure, together with all ancillary items except insofar as the Contract otherwise provides including the provision of all labour, materials, constructional plant, temporary works and everything whether of a temporary or permanent nature, required in and for such construction, completion, commissioning and maintenance insofar as the necessity for providing the same is specified in or can reasonably be inferred from the Contract

D. Breaking of existing Quay walls and Breakwaters as indicated, Construction of new Quay walls and Breakwaters, Dredging to the levels, Navigational Aids and other related works.

E. Construct all functional requirements as follows.
- Fish Landing Facility
- Loading/unloading of cargo space
- Passenger Ferry/Boat facilities
- Mooring of mainly locally registered vessels

1.03 CONTRACT

A. The object of this contract is to Construct, handover and maintain the rehabilitation and restoration of the two Island Harbour described above and as specified in the Specification and other Contract Documents.

B. The Particular Specifications shall be read in conjunction with the other Contract Documents. Specifications given in one Division shall apply to other Divisions unless otherwise stated.

C. Notwithstanding anything contained herein the Contractor shall be responsible for complying in all respects with such Bylaws and Regulations as may be enforce at the time of execution of the Works.

D. The Contractor shall provide and do everything necessary for the proper execution of the Works according to the intent and meaning of the Tender and Contract Documents and Drawings, whether the same may or may not be particularly shown on the Drawings or included in the Documents provided that the same is reasonably to be inferred there from.

E. The Works shall be completed in strict accordance with the Documents and Drawings and any further drawings or instructions issued or approved by the Engineer during the execution of the Works.

F. The work to be performed under this Contract includes, but is not necessarily limited to, the furnishing of all supervision, labor, materials, temporary works, false-work, plant, machinery, equipment, parts, tools, supplies, transportation, utilities, construction facilities, incidentals and logistic support necessary for the performance and maintenance of the Works, accomplishing the same in a workmanlike manner.

G. Scope covers for temporary works like maintained furnished office and accommodation for Contractors and Engineers staff, storage, equipments and stationary, internal travels, supervision and management staff, mobilization and demobilization, tools and equipments, insurance and bonds and the like

H. The work comprises of all necessary civil, structural, electrical and mechanical items.

I. All work shall be executed by skilled tradesman who shall be thoroughly acquainted with all aspects of their trade including any special local customs and modes of operation.

J. The Contractor shall be deemed to have based his tender on the information in respect of hydrological, physical and climatic conditions of the site and have inspected the site and its surroundings and satisfied himself before submitting his tender. The Engineer and any person authorized by him shall at all times have access to the works and to the site and to all workshops and places where work is being obtained for the works.

1.04 INSPECTION AND INVESTIGATION OF SITE

A. The Contractor shall inspect and examine the site and its surroundings and shall satisfy himself before submitting his Tender as to the nature of the ground and sub-soil, the quantities and nature of the Works and materials, tools and equipment necessary for the Completion of the Works.

C. The Contractor shall note that it may prove necessary to carry out excavation support and ground dewatering in order to construct the Works.

D. The information and details given on the Drawings are not guaranteed to be accurate or correct and are given for guidance in compiling the Tender. The Contractor shall make his own investigations and enquiries of the various Government Ministries and other Authorities to ascertain the exact positions, sizes, numbers and details of all obstacles to be encountered.

E. The rates given in the Bills of Quantities and the Schedule of Rates shall include for all costs involved in the negotiating obstacles and no claim will be considered for additional expenses the Contractor may incur on account of any unforeseen obstacle of whatever nature, over and above those which would have been incurred had the existence of the obstacle been known at the time of preparing the construction drawings.

F. Any excavations needed to determine the exact location and levels of obstacles shall be done by the Contractor, and shall be deemed to be included as part of the rates for general trenching work in the Bills of Quantities.

G. The Contractor shall take full responsibility of the co-ordination to fit his work with other constructions and utilities on the same site. The Contractor shall make and submit to the Engineer for approval his design on the connections details and adjustments to existing utilities in accordance with Contractor's inspection on the Site. The elevations and co-ordinates of such connections may not be accurate on the Drawings and are to be checked by the Contractor.

H. The elevations and co-ordinates used in the Drawings are related to Mean Sea Level, however the Contractor may check before proceeding.

I. The Contractor shall obtain all further information required as to the risks, contingencies and other circumstances, which may influence or affect the execution of the Works and include the costs thereof in his Tender.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Access to the Site shall be agreed with the Engineer prior to commencement and maintained by the Contractor. Also the Contractor shall be responsible for all damage resulting from the use of this access.

B. All construction operations and site establishment facilities shall be confined to within the Site Boundaries, unless otherwise agreed with the Engineer.

C. The Contractor shall be responsible for safeguarding all structures and the like in the vicinity of the Site. Also he shall ascertain from the public utility authorities positions of all existing underground services; maintain and protect or divert as required.

D. The Contractor shall have full possession of the Site at the location of the works only, and be responsible for arranging his own working space, the storage of materials, setting of all temporary accommodation, etc.; locations are to be agreed with the Engineer. No claim whatsoever will be entertained for any reason regarding the setting or allocation of any working space regardless of the distance.

1.06 EXISTING SERVICES

A. The Contractor shall notify the Ministries, Establishments, and Departments which have certain services at the Site of Works, at least two weeks before he desires to carry out

any work, near, above or under the services of these Ministries and Establishments and he shall submit a detailed programme of each area on which the work shall be commenced and the anticipated date of commencement in addition to a report, signed by the Engineer, the Engineer of the Ministry to whom the services belong and the Contractor's representative, confirming this Notice of Intent.

B. It should be noted that the Contractor shall not be allowed to work in any area where services are still covered and the Engineer shall have the right to stop the work in any part of the Works where the Contractor fails to take the necessary measures to uncover these services and the Contractor shall not claim for compensation in time or money.

C. The Contractor shall refer to and comply the current Regulations and Specifications of Public Utilities Authorities before commencing any works adjacent to equipment, plant, cables, etc. The above requirement will not relieve the Contractor of any responsibility for taking every precaution to avoid damage to equipment, plant, cables, etc. and he will be held responsible for the cost or repair of all damage in accordance with the Conditions of Contract and Specifications. Payment for complying with the above requirements will be deemed to have been included in the rate for Works included in Bills of Quantities.

1.07 PROTECTION OF EXISTING UTILITIES AND SERVICES

A. During construction the Contractor shall provide all protection for existing utilities and services as may be required for his construction operations, including protection for the construction of detours and diversions, as directed by the Engineer and as required by the Regulations.

B. Protection during construction includes, but not by way of limitation, all labor, materials, equipment and accessories which shall be furnished and installed by the Contractor and such protection shall be considered as a subsidiary obligation under the items in the Bills of Quantities.

C. In addition to the requirements as specified in the other Contract Documents, the Contractor shall conform with the following requirements.

a) Use of all necessary precautionary and protective measures required to maintain existing utilities, services and appurtenances. In particular, the Contractor shall take adequate measures to prevent undermining of utilities and services whether they are presently in service or not.

b) Protect existing or new utilities and services when considering necessary and directed by the Engineer. The Contractor shall be responsible for bracing and supporting utilities and services to prevent settlement, displacement or damage to the same. The protection of utilities and services as specified herein, will not paid for separately but shall be considered as a subsidiary obligation to the work under this Contract unless otherwise specified in the Contract Documents.

c) The Contractor shall recover, remove or abandon redundant utility and service lines as required by the Contract Documents and/or directed by the Engineer.

d) The Contractor shall not remove any utility or service line, conduit or structure until he has received written permission from the Engineer.

e) The Contractor shall, at all times during the progress of the Works, afford facilities to properly accredited agents of any Authority for access to all or any of their apparatus situated in or under the Site, as may be necessary for inspecting,

reporting, maintaining, removing, renewing or altering such apparatus in connection with the construction of the Works or for any other purpose whatsoever.

Prior to commencing construction and subsequent to the Contractor's determination of the location of the existing utility and service lines and the condition of the adjacent areas, the Contractor shall prepare and submit to the Engineer for his review shop drawings complete with the description of procedure and materials and related data of the Contractor's proposed method of protection for the said lines. Review, comments and approval by the Engineer shall in no way relieve the Contractor of the full responsibility for all protection and precaution required during the Works.

1.08 DAMAGE TO EXISTING UTILITIES AND PROPERTIES

A. In the event of any damage to utilities or properties as a result of work carried out by the Contractor, his agents, employees, or by the sub-contractors or their agents, employees, the Contractor shall be responsible for indemnification against such damages.

B. The Employer shall have the right, upon receiving any claims from the party concerned in respect for such damages, to deduct the actual costs charged to the Employer from monies due or becoming due to the Contractor without it being necessary to serve a notice or warning or to take any legal action and the Contractor shall not be entitled to object, refrain from or suspend the work on account of such deduction.

C. In the event of any damage whatsoever to any existing or relocated utility and/or service lines, the Contractor shall immediately notify the Employer, the Engineer and the relevant utility or Service Ministries, Authorities or Companies. The Contractor shall co-operate with the Employer and the Client of such utility or service and take whatever steps necessary to repair and restore such utility or service all in accordance with the requirements of the Contract Documents. The decision of the Employer regarding responsibility for any damage or interruption of any utility or service shall be final.

END OF SECTION

SECTION 01200
PAYMENT, PROGRAM & MEASUREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES; the following minimum items

A. Measurement and payment criteria applicable.

B. Defect assessment and non-payment for rejected work.

C. Program Development and Adjustments

D. Cost Loading

1.02 RELATED SECTIONS; This schedule is intended to be used as a helpful indication of the related sections within the Project specifications. It is not necessarily comprehensive or complete and it is the Contractors responsibility to ascertain all applicable sections required to understand the full Scope of Works intended.

A. Document - General Conditions: Progress Payments and final Payment.

B. Section 01320 Project Coordination.

C. Section 01330 Submittal: Submittal Procedures.

D. Section 01770 Contract Close-out: Final Payment.

1.03 AUTHORITY

A. Measurement methods delineated in the Principles of Measurement within the Bills of Quantities apply to all work requiring measurement for payment.

B. Take all measurements and compute quantities for the purpose of interim payments. The Engineer will verify measurements and quantities. Assist by providing necessary equipment and survey personnel as required to enable the Engineer to verify measurements and quantities.

1.04 UNIT QUANTITIES

A. Measurements of work in place and required by the Contract, supplied by the Contractor and verified by the Engineer, shall determine payment for interim purposes.

1.05 DEFECT ASSESSMENT

A. Replace work not conforming to specified requirements.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the work, the Engineer will direct one of the following remedies:

1. The defective work may remain, but the unit sum/price will be adjusted to a new sum/price at the discretion of the Engineer.

2. The defective work will be partially repaired to the instructions of the Engineer, and the unit sum/price will be adjusted to a new sum/price at the discretion of the Engineer.

C. The authority of the Engineer to assess the defect and identify payment adjustment is final.

1.06 NON-PAYMENT FOR REJECTED PRODUCTS

A. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required work.
5. Products remaining on hand after completion of the work.
6. Loading, hauling and disposing of rejected products.

1.07 CONTRACT PROGRAMME - GENERAL

A. CONTRACTOR SHALL BE RESPONSIBLE; for submitting adequate planning data and acceptable cost distribution information for the development and maintenance of the Contractor's Cost Loaded Construction Programme (hereinafter referred to as the Construction Programme) all to the approval of the Engineer as detailed hereinafter.

B. PROGRAMMING AND REPORTING PROCEDURES; required to be carried out by the Contractor are included in this clause. The Contractor shall develop the Construction Programme by cost loading the activities and sub-activities as shown in his Construction Programme.

C. CONSTRUCTION PROGRAMME; shall be updated at the request of the Engineer showing actual progress of activities compared with planned progress.

D. FAILURE OF THE CONTRACTOR; to comply with the requirements of this Clause shall be grounds for recommendation by the Engineer that no further progress payments shall be made until the Contractor is in compliance.

E. CONSTRUCTION PROGRAMME SUBMITTALS; shall be signed by the duly Authorized representative of the Contractor and these documents, upon approval by the Engineer shall thereupon become incorporated into the Contract Documents for the Project.

1.08 PROGRAMME OF WORKS

A. MASTER SCHEDULE; In bar chart format indicating the Contractors proposed work programme shall be submitted to the Engineer within (7) days after approval of the Contractor’s scheduler or program Consultant, the Contractor shall submit a master schedule in bar chart format indicating the Contractor’s proposed work program. The schedule shall be of adequate detail to indicate all elements of constructions as well as shop drawings submittals, permits, material deliveries and other procurement work items.

The approved master schedule shall be used to monitor progress until the detailed Contractor's C.P.M. schedule is approved.

B. C.P.M. CONSTRUCTION DETAILED SCHEDULE; shall be submitted by the Contractor within 14 days of submitting the Master schedule to show the sequence and interdependence of activities required for complete performance of all items of work under the contract and meeting milestone dates as required. In preparing the Contractor's C.P.M. Construction Schedule the contractor shall comply with the formatting requirements of the Engineer and exercise care to produce a clear legible and accurate logic, activities related to specific physical areas of the project shall be grouped. The logic shall show the following for each work activity.

1) Concise description of the Work.
2) Performance responsibility codes
3) Performance location and / or area code
4) Performance trade / division code
5) Duration in calendar days.
6) Manpower assignment to activity of works (Resource Loading).
7) Cash Flow Charts

C. SUPPORTING DATA; Contractor shall submit the under mentioned supporting data with the submittal of his C.P.M. detailed construction schedule, any changes in this information shall be submitted with successive updates and revisions:-

- The holidays and non-working days observed during the contract period (by date).
- The planned number of shifts per day.
- The planned usage of major construction equipment on the site, on a monthly basis.
- The planned procurement and delivery of local and imported materials.
- The average weekly manpower usage for each trade of the works.

D. ACTIVITY DETAILS; The contractor shall provide as a minimum the following schedule information for each activity.

- Activity identifier(s)
- Activity description
- Different used codes.
- Original duration
- Early and late start and finish dates
- Total float time.

E. REPORTS; Contractor shall provide the following schedule reports:

- Total schedule by activity identification
- Total schedule sorted by total float
- Total schedule sorted by early start dates
- Schedule report by areas of work
- Schedule report by responsibility
- Summary schedule in form of bar chart sorted and summarized by trade from the detailed schedule.
- Logic diagrams grouped by work type.

F. SUBMITTAL REQUIREMENTS; as follows

- Three copies of all reports
- Three copies of supporting data
- One back-up soft copy

G. SCHEDULE OF VALUES AND COST LOADED CONSTRUCTION SCHEDULES;

- Within (10) days after obtaining approval of his construction schedule, the contractor shall submit for the Engineer's approval a cost loaded schedule i.e. the construction schedule after entering the amount of each activity, based upon the bill of quantities along with detailed schedule of values.

- The Contractor's cost loaded schedule shall be the basis for calculating interim payments pro-rata to the work performed. The cost load construction schedule and the calculation for the interim payment shall employ computerized C.P.M. techniques.

- The contractor shall submit back-up CD's along with his submittal of cost loaded schedule.

H. FAILURE OF CONTRACTOR TO PRODUCE AND SUBMIT THE DETAILED C.P.M. CONSTRUCTION SCHEDULE; within (45) days from date of signing the contract shall result in applying a penalty of USD250/- for each day after the mentioned date till he submit the detailed schedule.

I. FAILURE OF CONTRACTOR TO OBTAIN THE ENGINEER'S APPROVAL TO THE DETAILED CONSTRUCTION SCHEDULE; within (60) days from date of signing the contract, shall result in applying a penalty of USD500/- for each day till approval.

J. DELAY IN SUBMISSION IN DETAILED C.P.M. SCHEDULE; more than 45 days from signing the Contract but succeeded to submit and obtain approval to the detailed C.P.M. schedule within 60 days after signing the contract, then any amounts deducted as penalties related to his delay in submitting the detailed scheduled shall be returned to the Contractor.

K. SCHEDULING SYSTEM; The Contractor shall utilize the latest version of "M S Project" scheduling software. An original version of the software shall be made available for the exclusive use of Engineer at site.

L. UPDATES; The Contractor shall update the detailed approved construction schedule for review in every site meetings or when requested by the engineer, the reports shall include the following information:

- Actual start and finish dates of completed activities.
- Remaining duration and percentage of completion for all activities not completed.
- Logic, time and cost data for variation order and approved site work instructions.
- Interim payment due to the Contractor, based on percentage completion of activities in the approved cost loaded schedule.
- Contractor's measures to rectify the delays from the planned dates.

M. ADJUSTMENTS AND REVISIONS; The Contractor shall incorporate into the approved C.P.M. Schedule all approved variations orders and site work instructions as separate activities in their logic sequence of work. No adjustment or revisions to the Contract time shall be shown in the C.P.M schedule until such adjustment or revisions have been approved by the engineer.

N. DELAY IN SUBMITTING UPDATED OR REVISED SCHEDULE; within 15 days from the date of requesting the same by the engineer, will automatically empower the engineer to recommend the Owner to employ any professional office to do the same on the account of the Contractor.

1.09 VARIATION ORDERS/SITE WORKS INSTRUCTIONS

A. The Contractor shall incorporate into the Programmes all work related to Variation Orders and Site Instructions. They shall be incorporated as separate activity(s) in their logical sequence of work. Any requests for an extension of time and/or change in milestone date resulting from a Variation Order and/or Site Instructions shall be based on the effect that the variation has on the critical activities in the approved Programme. No change to the Contract Time or to specified Milestone Dates shall be shown on the Programme unless the change has been approved or instructed by the Engineer.

END OF SECTION

SECTION 01310

PROJECT COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project coordination administrator.
B. Program and Service Co-ordination.
C. Construction mobilization.
D. Coordination of the Site Work.
E. Arrangements for Site Meetings.
F. Schedules.
G. Submittals.
H. Coordination drawings.
I. Closeout procedures.

1.02 RELATED SECTIONS; This schedule is intended to be used as a helpful indication of the related sections within the Project specifications. It is not necessarily comprehensive or complete and it is the Contractors responsibility to ascertain all applicable sections required to understand the full Scope of Works intended.

A. Section 01110 - Summary of Work.
B. Section 01200 - Program, Payment and Measurements.
C. Section 01330 - Submittals
D. Section 01320 – Progress Schedules
E. Section 01770 - Contract Closeout. Contract Closeout Procedures.

1.03 PROJECT COORDINATION

A. Project Coordination Administrator - The Engineer or his representative.

B. The Contractor shall be entirely responsible for the co-ordination and proper execution and completion of the works and this responsibility shall in no way be reduced by the employment of sub-contractors whether approved, nominated or otherwise. The Contractor shall co-ordinate the work of each trade with that of all other trades and shall ensure that all trades co-operate to assure the required and steady progress of all work under the Contract.

C. The Contractor shall also co-ordinate his work with that of any other contractors, authorities or organizations performing works under separate contracts to ensure no delay, disruption or interference is caused to such other contracts. Unless otherwise agreed by the Engineer, the Contractor shall not be permitted to work in the vicinity of works being executed by any Ministry or its contractor. Where the Contractor delays the co-ordination of the works, he shall hold the Engineer harmless for any consequential claims resulting from such delays.

1.04 PROGRAMME AND SERVICES CO-ORDINATION

A. The Contractor shall, prior to commencement of the project, prepare a time programme to be approved by the Engineers in which he shall elucidate procedures and measures

to be followed and the date of completion of stages of work. The programme shall not be altered without the approval of the Employer.

B. The Contractor shall notify other Ministries and Authorities whose services might be affected by the Works regarding this programme. He shall also submit fortnightly details of the works contemplated for execution in order to enable the Service Authorities to carry out inspections and/or to indicate their services on the site, and/or to take measures deemed necessary. The Employer shall assist the Contractor to liaise with other Ministries and Authorities with a view to expedite the obtaining of the required details.

C. The Contractor must also ensure that he obtains any work or excavation permits from the Services Authorities or Companies necessary to allow him to carry out construction works in the vicinity of existing services.

D. The Contractor shall, prior to carrying out covering up or backfilling, notify the said Authorities with a view to inspecting the site of work and ascertaining the safety of those services and supervising the covering up and backfilling works. Such supervision shall not relieve the Contractor of any responsibility, if it is established that his work had affected the public services.

1.05 PRE-CONSTRUCTION CONFERENCE

A. A Pre-Construction Meeting will be held at least 15 days prior to the commencement of the Works, to be attended by the Contractor and his major sub-contractors.

B. The agenda for the Pre-Construction meeting will be provided to the Contractor by the Engineer a minimum of 3 days prior to the meeting. The agenda will include but not limited to:

1. Contractor's organization agreements.

2. Channels and procedures for communication.

3. Construction Schedule, including sequence of critical work.

4. Contract Documents, including distribution of required copies.

5. Processing of shop drawings and other data to be submitted to the Engineer for review.

6. Processing of Site decision and variation/change orders.

7. Rules and regulations governing performance of the work.

8. Procedures for safety and first aid, security, quality control, house keeping, etc.

9. Procedures for reporting and monitoring progress, cost, materials, labour and equipment.

1.06 CONSTRUCTION MOBILIZATION

A. Cooperate with the Administrator in allocation of mobilization areas of site, for field offices and sheds, for access, traffic, and parking facilities.

B. During construction, co-ordinate use of site and facilities through the Administrator.

C. Comply with Administrator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

D. Comply with instructions of the Administrator for use of temporary utilities and construction facilities.

E. Coordinate field engineering and layout work under instructions of the Administrator.

1.07 PROGRESS MEETINGS

A. Contractor shall attend regular site meetings as necessary for the proper management and co-operation of the contract. Subcontractors as suppliers are to be informed, when their presence is required.

The scheduling and co-ordination meeting shall be as directed by the Engineer.

B. Two days before each site meeting submit the following information to the Engineer:

a) A list of completed activities.

b) A list of current activities, with an estimate of time required for completion.

c) A list of any variation in starting dates and durations of outstanding activities from planned dates and times.

d) Percentage of completion in every activity.

e) The concrete volume cast during the last period and the present total sum of the cast concrete volume.

f) Activities the Contractor plans to start during the following period should be indicated.

g) Other information required by the Engineer.

1.08 JOB SITE ADMINISTRATION

A. Do not use the Site for any purpose other than carrying out the Works.

B. Do not display or permit advertisements to be displayed on site without consent of the Engineer.

1.09 ADJOINING PROPERTY

A. Take all reasonable precautions to prevent damage to adjoining properties.

B. Obtain permission as necessary from Client of adjoining property if requiring to erect scaffolding or otherwise use adjoining property, and pay all charges. Clear away and made good on completion or when directed.

1.10 STRUCTURAL FABRIC

A. Provide and maintain during the execution of the Works all shoring, strutting, needling and other supports as may be necessary to preserve the stability of the buildings, whether new or existing, on the Site or adjoining, than may be endangered or affected by the Works.

1.11 ROADS AND FOOTPATHS

A Ensure that no damage beyond fair wear and tear is caused by site traffic to roads and footpaths outside the site boundaries. Adequately maintain approaches to the site and keep clear of mud, sand and debris. Each contractor will be required to repair damage directly attributable to his work, such as excavation and trenches access the site access road.

1.12 LABOUR RECORD

A. Provide a daily record to the Engineer in a format to be approved by the Engineer, showing the number and description of craftsmen, laborers and other persons employed on or in connection with the works, including those employed by sub-contractors.

1.13 PLANT RECORD

A. Provide a monthly record to the Engineer in a format to be approved by the Engineer, showing the type, model and capacity of all mechanical and power operated plant employed on the works. The contractor will not be permitted to remove any plant or material unless written approval is obtained from the Engineer plant record to be submitted daily.

1.14 VISITORS RECORD

A. Maintain a record of visitors to the Site, and submit at monthly intervals to the Engineer.

1.15 NON-COMPLIANCE

A. Work which fails to meet the specified levels of accuracy must not be rectified without approval.

B. Submit proposals for such rectification and meet all costs arising, including effects on other work.

C. Allow for the possibility that approval will not be given, necessitating removal and replacement of the work.

1.16 DEFECTIVE WORKS

A. As soon as possible after any part of the work is known or suspended to be defective, submit proposals to the Engineer for further testing, opening up, inspection, making good or removal and re-execution and obtain instructions.

B. Whenever inspection or testing shows that the work is not in accordance with the Contract and measures (e.g. testing, opening up, experimental making good) are taken to establish the acceptability of the work, such measures:

1. Will be at the expense of the Contractor, and
2. Will be not considered as grounds for extension of time.

1.17 SCHEDULES

A. Submit preliminary progress schedule in accordance with Section 01320 coordinated with project construction schedule.

B. After review, revise and resubmit schedule to comply with revised Project schedule.

C. During progress of work revise and resubmit as directed.

1.18 SUBMITTALS

A. Submit preliminary shop drawings, product data, samples, etc. in accordance with Section 01330 for review and compliance with Contract Documents, for filed dimensions and clearances, for relation to available space, and for relation to work of separate contracts. Revise and resubmit as required.

B. Submit requests for interpretation of Contract Documents, and obtain instructions through Administrator.

C. Process requests for substitutions, and change orders, through Administrator.

E. Deliver closeout submittals for review and preliminary inspection reports, for transmittal to Engineer.

1.19 COORDINATION DRAWINGS

A. Provide information required by Administrator for preparation of coordination drawings.

B. Review drawings prior to submission to Engineer.

1.20 CLOSEOUT PROCEDURES

A. Notify Administrator when Work is considered ready for Substantial Completion. Accompany Administrator on preliminary inspection to determine items to be listed for completion or correction in Contractor's notice of Substantial Completion.

B. Comply with Administrator's instructions to correct items of work listed in executed Certificates of Substantial Completion.

C. Notify Administrator when Work is considered finally complete. Accompany Administrator on preliminary final inspection.

D. Comply with Administrator's instructions for completion of items of Work determined by Engineer's final inspection.

END OF SECTION

SECTION 01320

PROGRESS SCHEDULES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Format.
B. Content.
C. Revisions to schedules.
D. Submittals.

1.02 RELATIONS SECTIONS

A. Section 01110 - Summary of Work.
B. Section 01330 - Submittals: Shop drawings, product data, and samples.

1.03 FORMAT

A. Prepare Schedules as a horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week.

B. Sequence of Listings: The chronological order of the start of each item of Work.

C. Scale and Spacing: To provide space for notations and revisions.

D. Sheet Size: Multiples of A4-size.

1.04 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by Specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire Schedules.

E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

F. Provide separate schedules of submittal dates for shop drawings, product data, and samples, and dates reviewed submittals will be required from Engineer. Indicate decision data for selection of finishes.

1.05 REVISIONS TO SCHEDULES

A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including the effect of changes on schedules of separate contractors.

1.06 SUBMITTALS

A. Submit initial Schedules within 10 days after date of Client-Contractor Agreement. After review, resubmit required revised data within ten days.

B. Submit revised Progress Schedules Progress Schedules with each Application for Payment.

C. Submit the number of copies which Contractor requires, plus 4 copies which will be retained by Engineer.

1.07 DISTRIBUTION

A. Distribute copies of reviewed Schedules to project site file, Subcontractors, suppliers, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicates in Schedules.

END OF SECTION

SECTION 01330
SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals procedures.
B. Construction progress schedules.
C. Proposed Products list.
D. Shop drawings.
E. Product data.
F. Samples.
G. Manufacturer's instructions and Certificates.
H. Construction photographs.

1.02 RELATED SECTIONS

A. Section 01450 - Quality Control: Manufacturer's field services and reports.
B. Section 01770 - Closeout: Contract closeout submittals.

1.03 SUBMITTAL PROCEDURES

A. Transmit each submittal with Engineer accepted form.

B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix

C. Identify Project, Contractor, Subcontractor or supplier, pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.

D. Schedule submittals to expedite the Project, and deliver to Engineer.

E. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

F. Revise and resubmit submittals as required, identify all changes made since previous submittal.

G. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.04 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule in 4 copies within 10 days after date of Client-Contractor Agreement for Engineer review.

B. Revise and resubmit as required.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version.

D. Submit a chart with separate line for each major section of Work or operation, identifying first work day of each week.

E. Submit the following Progress Reports described hereinafter in a form required by the Engineer in 4 copies.

a) Daily report: The Contractor shall submit this report on a daily basis. The report shall describe the labor force and its allocation, material, equipment to the utilize and describe the work to be carried out during the day.

b) Monthly report: The Contractor shall submit a detailed report reflecting his monthly progress and status of work. This report shall include a description of problem areas, current and anticipated causes of delay and their estimated impact on progress, together with a description of corrective measures taken or proposed, in addition to staffing and plant levels and materials procurement.

c) Weather Records
Keep and accurate record of:

1) Daily maximum and minimum air temperature, rainfall and humidity (including overnight).

2) Number of hours per day in which work is prevented by inclement weather. Provide maximum and minimum thermometers at locations relevant to the nature and stage of the work as approved by the Engineer.

1.05 PROPOSED PRODUCTS LIST

A. Within 30 days of contract award, the contractor must submit to the Engineer in a format approved by the Engineer 4 copies of a complete schedule of all submittals required under this contract and a shop drawing schedule, manufacturer's test certificate, testing, operation and maintenance, etc. Also within 30 days of contract award the contractor must submit to the Engineer a procurement schedule in an approved format providing information on all material that the contractor must purchase under this contract.

B. For products specified only by reference standards, give manufacturer trade name, model or catalogue designation, and reference standards.

1.06 SHOP DRAWINGS

A. The drawings issued with these Tender and Contract Documents are issued solely to show the basic principles on which tenders are to be prepared. The drawings are not to be taken as working drawings. Shop, or working, drawings and, where specified, design drawings are to be prepared and submitted by the Contractor in accordance with other sections of the Contract Documents.

B. Do not scale from Drawings. Obtain from the Engineer any dimensions required but not given in figures on the Drawings nor calculable from figures on the Drawings.

C. Provide design, coordination, installation, shop and builder's work drawing and other information as appropriate, collectively referred to as 'Shop Drawings'. Allow for completion of all such drawings, etc., checking, inspection by the Engineer and any subsequent amendment(s) re-submission(s) and re-inspection(s) when preparing the master programme for the works.

D. Produce all drawings, etc. in time to meet the programme. Thoroughly check all drawings, etc. to ensure that the various works, installations and services do not conflict

with each other or with the building structure, fabric or finishes, either during construction or in the finished building. Note any such discrepancies or divergences on one copy drawings, etc., date and sign to show that they have been checked then submit to the Engineer with the required number of additional unmarked copies.

E. The Engineer will note any comments on one copy of the drawings, etc., date and sign to show that they have been inspected, then return to the Contractor. Inspection of drawings, etc. and any comments made by the Engineer will not relieve the contractor, Sub-contractor and/or suppliers or responsibility for compliance with the Contract requirements, design, documentation and checking as appropriate.

F. Ensure that any necessary amendments to drawings, etc., are made in accordance with any comments of the Engineer and without delay. Unless and until the Engineer confirm that re-submission is not required, obtain copies of amended drawings, etc., check, re-submit to the Engineer ensure incorporation of necessary further amendments all as before.

G. Produce final version of all drawings, etc., submit the required number of copies to the sub-contractors and suppliers, and keep at least one copy out in accordance with the final drawings, etc.

H. Metric measurements shall be used in all documents and drawings. If imperial or other units are shown, equivalent metric measurements shall be shown in addition.

I. Submit 3 sets of full-size paper copies of all shop drawings, including detailed fabrication and erection drawings, setting out drawings, diagrammatic drawings and materials schedules, together with relevant samples. Submit shop drawings and product data for equipment in a given system at the same time, with each set bound in a separate brochure. If submitted drawings, etc., differ from requirements of the Contract Documents, each such difference must be the subject of a request for substitution of variation, supported by all relevant information.

J. Should any amendment to drawings, etc., required by the Engineer or any discrepancy or divergence that he may find be considered to involve or be a variation, notify the Engineer without delay and in any case within 7 days, and do not proceed with ordering, fabrication, erection or installation until subsequently instructed. Claims for the extra cost of such work, if made after it has been carried out, may not be allowed.

K. Each shop drawings shall identify the Project, Contractor, sub-contractor, fabricator or manufacture and give the date of drawing. They shall be numbered sequentially and each sheet shall indicate the total number of sheets in the set.

L. Each shop drawing shall be clearly marked to indicate which product or item is being submitted for consideration and each product or item shall be marked for identification with the applicable page and clause number of the Specification and/or the detail and sheet number of the Contract Drawings.

M. Shop drawings shall include types, gauges and finishes of materials and show the brand name and manufacturer's type identification number where a shop coat of paint is required.

N. Each set of shop drawings shall include sufficient data to permit a detailed study of the product or system submitted Submit manufacturer's or fabricators pre-printed product literature and data sheets, normally transmitted in booklet or brochure form, in bound and indexed brochures. If brochures contain sheets longer than A4, they shall be bound to

allow them to be unfolded for reading without being removed form the binding. Submit 5 copies of shop drawings brochures, 1 of which will be retained by the Engineer.

1.07 PRODUCT DATA

A. Submit 3 copies.

B. Mark each copy to identify applicable products, model, options, and other data. Supplement manufacturer's standard data to provide information unique to this Project.

C. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 01770 - Contract Closeout.

1.08 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate samples submittals for interfacing work.

B. Submit samples of finishes from the full range of manufacturer's standard colours, textures, and pattern for Engineer's selection.

C. Include identification on each sample, with full Project information.

D. Within 30 days of contract award, submit to the Engineer a complete schedule indicating all the samples the contractor must be required to produce, including the scheduled time of the sample submittals.

1.09 MANUFACTURER'S INSTRUCTIONS & CERTIFICATES

A. When specified in individual specification, Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturer's instructions and Contract Documents.

C. Indicate materials or Product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

END OF SECTION

SECTION 01450
QUALITY CONTROL

PART 1 GENERAL

1.01 SECTIONS INCLUDES

A. Quality assurance and control of installation.
B. References.
C. Field samples.
E. Inspection and testing laboratory services.
G. Quality control of on-site construction.
I. Schedule of quality control plan.
J. Reports.
K. Latest Documents.
L. Testing and Inspection Devices.
M. Test methods.
N. Supervisory staff.

1.02 RELATED SECTIONS

A. Section 01330 - Submittals: Submission of Manufacturer's Instructions and Certificates.

B. Section 01600 - Materials and Equipment: Requirements for materials and product quality.

C. General Conditions of Contract Clause 36.4 – Cost of Tests not provided for

1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturer's instructions, including each step in sequence.

C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standard or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.04 REFERENCES

A. Conform to reference standard by date of issue current on date for receiving bids.

B. Obtain copies of standards when required by Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification for Engineer before proceeding.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 FIELD SAMPLES

A. Install field samples at the site as required by Engineer for review.

B. Acceptable samples represent a quality level for the Work.

1.06 QUALITY CONTROL OF ON-SITE CONSTRUCTION

The Contractor shall provide a control system for the following phases of inspection:

PREPARATORY INSPECTION

This inspection shall be performed prior to beginning work on any particular element of the works and shall include a review of the Contract requirement. The Contractor shall check that materials, products and equipment have been tested, submitted and approved, check that provisions have been made for required control testing, examine the work area to ascertain that preliminary work has been completed, examine materials and equipment to ensure that they conform to shop drawings and data and check that the materials and equipment are in hand.

FOLLOW-UP INSPECTIONS

The Contractor shall perform further inspection as each section, trade or part of the work commence and on a regular basis thereafter to ensure continuing compliance with Contract requirements.

DOCUMENTATION OF QC PROGRAM

The Contractor shall identify the inspections hereinbefore specified and document then in the QC report with a brief description of the subject matter covered and the personnel involved.

1.07 SCHEDULE OF QUALITY CONTROL PLAN

The Contractor shall furnish a schedule outlining the procedures, instructions and reports to be used as follows:

1) Quality control organization.
2) Qualifications of personnel.
3) Authority and responsibility of personnel.
4) Schedule of inspections and tests with personnel assigned to each task and duration of each task.
5) Test methods.
6) Methods or performing and documenting control operations

1.08 REPORTS

Inspection shall be recorded in triplicate and submitted by the Contractor as required by the Engineers approved forms certifying items correctly installed and items found to be defective, for the latter a statement on corrective measures taken shall be duly recorded and submitted.

The Contractor shall also maintain in a format approved by the Engineer a log of all test performed which shall include date of test, type of test and results.

1.09 TESTING AND INSPECTION DEVICES

All measuring and testing devices shall be calibrated periodically against certified standard equipment.

1.10 SUPERVISORY STAFF

A. The minimum qualifications of contractors supervisory site staff shall be as specified and shall be approved by the Engineer prior to assignment of subject staff to the project. The Engineer has the authority to ask the contractor to remove unsatisfactory staff by providing the contractor with written notice of this effect. The replacement of such staff shall take place within 2 weeks of the Engineer notice. The minimum Contractor's staff shall be as required in Section III (Evaluation and Qualification Criteria) Clause 3.5 of the Tender Document.

B. No staff shall be changed without the Engineer written consent. The contractor's and sub-contractor's senior site staff shall be fluent in technical English.

END OF SECTION

SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Electricity, ventilation, telephone service, water, and sanitary facilities.

B. Temporary Controls: Barriers, enclosures and fencing and protection of work.

C. Construction Facilities: Access roads, parking, progress cleaning, and temporary buildings.

1.02 TEMPORARY ELECTRICITY

A. Provide and pay for power service.

1.03 TEMPORARY LIGHTING

A. Provide and maintain lighting for construction operations.

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

C. Maintain lighting and provide routine repairs.

1.04 TEMPORARY VENTILATION AND AIR CONDITIONING

A. Ventilate and/or air condition the offices and accommodation of Engineers and Contractors staff

1.05 TELEPHONE SERVICE

A. Provide, maintain and pay for telephone service to field office and Engineer's field office at time of project mobilization.

1.06 TEMPORARY WATER SERVICE

A. Provide, maintain and pay for suitable quality water service required.

1.07 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide protection for plant life designated to remain. Replace damaged plant life.

C. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.08 SECURITY AND SAFETY

A. Provide security and facilities to protect Work and existing facilities from unauthorized entry, vandalism, or theft.

B. Accident Prevention Responsibility: Safety Meetings shall be held at least once a week at the jobsite. The meetings will be convened and conducted by the Safety Co-coordinator. All supervisors and foremen are expected to be in attendance. Each subcontractor will have a responsible representative present to follow through on information and resolutions discussed and adopted at these meetings. The Contracting Officer's Representative, or his designated agent, is encouraged to attend these meetings.

The Agenda for the Safety Meetings will generally include inter alia.

1. Development of timely topics for discussions and dissemination of Safety Bulletins, Signs and Notices.

2. A review of the Safety Co-coordinator’s inspections.

3. Identification of potential safety hazards in the coming month and discussion and implementation of steps to be taken to avoid the same.

4. Appointment of Safety Representatives for subcontractors.

C. All supervisors and foremen are responsible to plan and accomplish their work with due regard for the safety of all individuals on the jobsite. They will be expected to eliminate all possible accident hazards when planning the work under their control. It is expected the subcontractors will observe and correct any accident producing practices before injury occurs. If an accident does occur, they will investigate to determine the cause and take the required corrective action to prevent a recurrence. All accidents shall immediately be reported to the Project Superintendent and to the Engineer.

D. First Aid and Medical Facilities: First Aid facilities will be provided at the project site as required. A vicinity map indicating routing to emergency facilities will be posted in the first aid station and on the Project Bulletin Board.

C. In the event of any employee being sent to a doctor for treatment, a release will be obtained from the doctor stating whether (1) the employee is not fit for duty; (2) the employee is fit for light duty; or (3) the employee is fit for duty. A copy of this release will accompany the accident report.

D. Safety Check List:

1. Prepare Safety Programme.

2. Post Safety programme on Job Bulletin Board. Prepare and post Fire Prevention Programme.

3. Analyze job for potential hazards and hazardous procedures.

4. Establish plan for location of material storage, personal facilities and traffic flow.
5. Arrange for debris removal.

6. Establish procedure to obtain Subcontractor Safety Programmes.

7. Obtain claims forms.

8. Contract Loss Prevention Department of Insurance Carrier.

9. Obtain a report form for reporting accidents and injuries.

10. Establish adequate first aid kit and stretcher facilities.

11. Post chart to signify weekly checks of first aid kits.

12. Conduct a preconstruction survey of surrounding property existing condition, if appropriate.

13. Arrange for watchman service, if required.

14. Verify insurance on subcontractors starting work on site prior to final execution of subcontractors.

15. Obtain safety equipment appropriate to operations:

    a. Hard hats
    b. Safety belts
    c. Goggles
    d. Ear protection
    e. Carbon monoxide tester.

16. Arrange for and post, safety posters and warning signs.

17. Establish weekly tool box safety talks.

18. Establish weekly safety meetings.

19. Appoint a safety supervisor and set date for the first safety meeting.

E. Worker Indoctrination

1. Minimum Protective Clothing

    a) Hard hats are required at all times.

    b) Protective eye covering will be worn when welding, hammering metal, stone, or concrete, grinding or cutting metal units.

2. Minimum Safety Observances

    a) Work areas and access ways are to be free of trash, materials, and all tripping hazards.

    b) Temporary electrical wiring will be protected from damage, be in good condition and protected by ground fault circuit interrupters.

    c) All accidents are to be reported directly to supervisors, and the Engineer.

    d) All equipment must meet the Safety Standards, described in these specifications.

1.09 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site form puddling or running water.

1.10 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification Section.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.

1.11 ACCESS ROADS

A. Extend and relocate roads as Work progress requires. Provide detours necessary for unimpeded traffic flow.

1.12 PROJECT NAME BOARDS

A. The Contractor shall erect and maintain Project name board one at each island and shall display the names of project, Client, Consultant, Contractor, Executing Institution, Funding agency, Project cost, Project start/ end dates etc and any other information as per the directions from the Engineer. The language shall be both in Dhivehi and English. The size of board shall be minimum 6 ft x 6 ft and shall be in a format approved by the Engineer. The Project name board shall be erected within 14 days of effective project commencement date.

1.13 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove waste materials, debris, and rubbish from site weekly and dispose off-site.

1.14 FIELD OFFICES AND ACCOMODATION

A. Contractor shall provide Office with stationary and equipments for Engineer, his supervision and management staff. The minimum floor area of the office facility shall be 50 m^2. The Contractor shall submit his proposed details, layouts for the office and laboratory buildings to the Engineer for approval before leasing the properties.

The individual office rooms shall have all required furniture's, computers, printers, photocopier, telephone, internet, fax machine, digital camera and shall be maintained throughout the construction period including air conditioning with sufficient consumables separately for Engineer and Contractors staff.

The Contractor shall provide all services and infrastructure. He shall light, clean and maintain the building and shall provide water, sanitary system and arrangements for refuse disposal. The Contractor shall provide an electricity supply of sufficient power for general use, including air conditioning

The office and all furniture, fixings, equipment, services etc, all as detailed above, shall be provided complete within 30 days from the date of the Engineer's order to provide the

same. The Contractor shall provide alternative accommodation to the satisfaction of the Engineer if he fails to provide as appropriate the properties within the above stated time.

B. Furnished Accommodation at site exclusively and separately for Engineer and Contractors staff shall be provided by the Contractor and maintained throughout the construction period. Contractors provided accommodation for Engineer and his own staff shall have separately two bedrooms, one dining/living room, one Kitchen and one toilet with all furniture's, equipments and shall be secured and maintained at all times. The minimum floor area of the Building shall be 50 m^2. The accommodations shall have adequate electrical, water, sanitation and air conditioning and shall be maintained by the Contractor throughout the construction period

1.15 TELEPHONE/ INTERNET

A. The Contractor shall arrange for the installation, commissioning and maintenance in use of one telephone line to serve the Engineer's office from the public exchange. The Contractor shall ensure that this line has the facility for local telephone calls only and shall have facility to make calls worth USD 50.00 per month. Handsets, Extensions and fax machine shall be provided. On completion of the Works the telephone line rental agreement shall be terminated.

B. The Contractor shall arrange for provision of internet to serve Engineer's office throughout the construction period. Contractor shall ensure that this internet facility shall be through 3G modem or wireless internet connection with best available data speed with minimum data of 2GB per month. On completion of the works, the internet rental agreement shall be terminated.

1.16 TRAVELS

A. All internal travels from the island to the Ministry or Male' once a month for the Engineer shall also be provided by the Contractor.

B. The Contractor shall arrange transports for field visits within the island at any time as required by the Engineer.

1.17 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Products.
B. Source of materials.
C. Transportation and handling.
D. Storage and protection.
E. Substitutions.

1.02 RELATED SECTIONS

A. Section 01450 - Quality Control: Product quality monitoring.

1.03 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

C. Provide interchangeable components of the same manufacturer, for similar components.

1.04 SOURCE OF MATERIALS

A. The Contractor shall use local materials and products whenever possible providing they comply with the specifications.

B. The Contractor shall submit within fourteen (14) days of the Date of Enterprise a complete and detailed list of materials and articles proposed for use in the Works together with the names and addresses of manufacturers and suppliers.

C. Copies of the orders for imported materials together with the supplier's confirmation of such orders shall be deposited with the Engineer as soon as they are available.

D. Where the source of a particular material is not stated, samples of the materials specified shall be submitted to the Engineer for approval before the placing of bulk orders.

E. The Contractor will be held responsible to ensure that all proprietary articles and materials incorporated in the Works are fixed and used in strict compliance with the particular manufacturer's instructions.

F. The Contractor must ensure that all materials purchased will be from a reliable source which will ensure continuity of supply in case of extras and if any damage occurs at all

times throughout the periods of the Contract to ensure regular supply and progress of the Works.

1.05 TRANSPORTATION AND HANDLING

A. Transport and handle Products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to assure that Products comply with requirements, quantities are correct, and Products are undamaged.

C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.06 STORAGE AND PROTECTION

A. Store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible.

B. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

C. Arrange storage of Products to permit access for inspection. Periodically inspect to assure Products are undamaged and are maintained under specified conditions.

1.07 SUBSTITUTIONS

A. Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor.

B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

C. A request constitutes a representation that the Contractor:

1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Project.

2. Will provide the same warranty for the Substitution as for the specified Product.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Client.

4. Waives claims for additional costs or time extension which may subsequently become apparent.

END OF SECTION

SECTION 01720

FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality control.
B. Survey.
C. Setting Out.
D. Non-Compliance.

1.02 QUALITY CONTROL

A. Employ a Land Surveyor at site throughout the construction works acceptable to Engineer.

B. Maintain a complete and accurate log of control and survey work as it progresses.

C. Submit Record Documents under provisions of Section 01770.

D. Verify locations of survey control points prior to starting work.

E. Promptly notify Engineer of any discrepancies discovered.

1.03 SURVEY

A. Contractor to locate and protect survey control and reference points.

B. The Contractor shall verify all measurements and be responsible for their correctness. No extra charge or compensation will be allowed on account of difference between actual measurements and the dimensions given in the Contract Documents. Any differences which may be found shall be submitted to the Engineer in writing for consideration and directives before proceeding with the works.

C. Site Bench Marks shall be accurately and safely established, maintained and cleared away upon completion of the Works all to the satisfaction of the Engineer. The datum will be that established by Client. The Engineer will indicate the position and value of Bench Marks near the works.

D. The Contractor shall prepare a plan detailing the location of the Bench Marks and keep up to date throughout the period of the Contract Reproducible copies of the plan so prepared shall be supplied to the Engineer as and when he may require.

E. The Engineer reserves the right to order levels to be taken at any time considered necessary for the full and proper supervision and measurement of the works.

F. Before the works or any part thereof are commenced, the Contractor and the Engineer shall together survey and take levels of the Site of the works and agree all particulars upon which setting out of the works shall be based, including existing pipes and services.

G. Such levels shall be related to the Bench Marks as aforesaid and plotted by the Contractor and, after agreement of the Drawings, shall be signed by the Engineer and the Contractor, and shall form basis of setting out of the works.

H. Failing such surveys and agreements being prepared and/or signed by the Contractor, the surveys of the Engineer shall be final and binding upon both parties.

I. The Contractor shall plot these levels and after they have been signed by both the Engineer and the Contractor, the original with three (3) copies will be submitted to the Engineer.

J. Promptly report to Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

1.04 SETTING OUT

A. After the Contractor is handed the Contract Drawings and after taking over all the existing Permanent Bench Marks, he shall carry out at his own responsibility and expense the setting out of the work, definitions of levels and setting out lines, axes and slopes, all in accordance with the Drawings.

B. The Contractor shall be responsible for the true and proper setting out of the work in relation to original points, lines and levels of references given in the Drawings and for the accuracy of the positions, levels, dimensions and alignment of all parts of the work, and for any delay or loss resulting from errors made in completing the setting out of the work. The contractor shall protect, preserve and be responsible for all existing bench marks, pegs and boundary marks and shall keep them in place or replace them when necessary or as directed by the Engineer either in their original positions or in some other approved positions.

C. Setting out shall be approved by the Engineer before commencing the works, but such approval shall in no way relieve the Contractor of his responsibility for the correct execution of the work.

1.05 NON-COMPLIANCE

A. Work which fails to meet the specified levels of accuracy must not be rectified without approval.

B. Submit proposals for such rectification and meet all costs arising, including effects on other work. Allow for the possibility that approval will not be given necessitating removal and replacement of the work.

C. Provide instruments and assistance for checking the setting out and levels.

END OF SECTION

SECTION 01770

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Closeout Procedures.
B. Final Cleaning.
C. Adjusting.
D. Project Record Documents.
E. Operation and Maintenance Data.
F. Warranties.
G. Space Parts and Maintenance Materials.

1.02 RELATED SECTIONS

A. Section 01500 - Construction Facilities and Temporary Control.
B. Section 01780 - Operation and Maintenance

1.03 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.

B. Submit final application for payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

C. Substantial Completion

1. When Contractor considers work is substantially complete, submit written notice with list of items to be completed or corrected.

2. Should Engineer inspection find work is not substantially complete, he will promptly notify Contractor in writing, listing observed deficiencies.

3. Contractor shall remedy all deficiencies and send a second written notice of substantial completion.

4. When Engineer finds work is substantially complete he will prepare a Certificate of Substantial Completion in accordance with provisions of General Conditions.

D. Final Completion

a. When Contractor considers work is complete, submit written certification:

1. Contract Documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents, and deficiencies listed with Certificate of Substantial Completion have been corrected.

4. Equipment and system have been tested, and balanced, and are fully operational.

5. Operational of systems has been demonstrated to Client's personnel.

6. Work is complete and ready for final inspection.

b. Should Engineer inspection find work incomplete, he will promptly notify Contractor in writing listing observed deficiencies.

c. Contractor shall remedy deficiencies and send a second certification of final completion.

d. When Engineer finds work is complete, he will consider closeout submittals.

1.04 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.05 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.06 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Revised Shop Drawings, Product Data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Client.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and Modifications.

F. Contractor shall prepare Record Drawings for the Works. These Record Drawings shall show all works constructed or installed in the Contract together with all existing detail to form a complete pictorial record of the finished work. The details to be shown on the Drawings, the drawing format and standard sheet and drawing block layout shall be agreed with the Engineer before production of the Record Drawings commences.

The Drawings shall be to a high standard of draughting and finish and a sample drawing shall be submitted to the Engineer for approval before draughting of the Record Drawings commences. Once approved the sample will be used as a reference standard for overall quality of draughting and finish of the Record Drawings.

With the approval of the Engineer top quality copies of certain of the Contract or Construction Drawings may be used, with the necessary updating, as Record Drawings. The copies shall be produced by the Contractor and shall be subject to the approval of the Engineer. Should the Engineer decide that any of the copies produced are unsatisfactory for use as the base for a Record Drawing, and then the Contractor shall not use such copies for the Record Drawings but will produce new drawings in accordance with these specifications.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance documents in accordance with 01730.

1.08 WARRANTIES

A. Provide duplicate notarized copies.

B. Execute and assemble transferable warranty documents from Subcontractors, Supplier, and Manufacturers.

C. Submit prior to final Application for Payment.

END OF SECTION

SECTION 02200

SITE CLEARING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Removal of sum, foreshore and sea bed debris.

B. Removal of paving, curbs and foundations.

C. Removal, tree planting and removal of trees, shrubs, and other plant life.

D. Topsoil excavation,

E. Removal of vegetation.

1.02 RELATED SECTIONS

A. Section 01110 - Summary of work

B. Section 02315 - Excavating

C. Section 02316 – Backfilling & Reclamation

1.03 REGULATORY REQUIREMENTS

A. Conform to EPA and all applicable code for environmental requirements, and use of herbicides.

B. Coordinate clearing work with utility companies.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that existing plant life designated to-remain is tagged or identified and recorded on drawings.

B. Liaise with relevant authorities with regard to specific requirements for careful removal of trees, shrubs and plant life for replanting off site.

C. Identify a waste area for placing removed materials.

3.02 PROTECTION

A. Locate, identify, and protect utilities that remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping.

C. Protect beach marks, survey control points, and existing structures from damage or displacement.

3.03 CLEARING

A. Clear areas required for access to site and execution of work.

B. Remove trees and shrubs indicated to a location off site agreed by the Engineer and the relevant authority.

C. Clear debris along the entire length of the existing shoreline.

3.04 REMOVAL

A. Remove debris, rock and extracted plant life from site to authorized dump approved by the Engineer.

3.05 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site as agreed with the Engineer to depth not exceeding 2.5m and protect from erosion.

D. Remove from site to authorized dump approved by the Engineer excess topsoil not intended for reuse.

END OF SECTION

SECTION 02315

EXCAVATING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavating for site structures.

B. Excavation for scour protection.

C. Excavation for rubble layer foundations.

1.02 RELATED SECTIONS

A. Section 01200 - Measurement and Payment:

B. Section 01450 - Quality Control:

C. Section 01500 - Construction Facilities and Temporary Controls:

D Section 02200 – Site Clearing.

E Section 02316 -Backfilling and reclamation

1.03 FIELD MEASUREMENTS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

PART 2 - PRODUCTS

(Not Used.)

PART 3 - EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify and protect utilities that remain from damage.

C. Notify utility company to remove and relocate utilities.

D. Protect plain life, lawns and other features remaining as a portion of final landscaping.

E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

3.02 EXCAVATING

A. Underpin adjacent structures, which may be damaged by excavating work.

B. Excavate subsoil to accommodate building foundation and construction operations.

C. Compact disturbed load-bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 02223

D. Slope banks with machine to angles of repose or less until shored unless otherwise directed on the drawings.

E. Do not interfere with 45 degree hearing splay of foundations of existing structures or newly installed structures.

F Grade top perimeter of excavating to prevent surface water from draining into excavation.

G. Mechanical excavation to take place where possible. Hand excavation only where required. Remove unwanted materials from site as directed by the Engineer.

H Notify the Engineer of unexpected subsurface conditions and discontinue affected Work in area mind notified to resume work within a reasonable period of lime, not to affect the overall time schedule.

I. Correct areas over excavated in accordance with Section 02223.

J. Remove excavated material from site.

3.03 FIELD QUALITY CONTROL

A. Section 01400 -Quality Assurance: Field inspection and testing.

B. Provide for visual inspection of bearing surfaces.

3.04 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 02316

BACKFILLING AND RECLAMATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Site reclamation and backfilling.

B. Consolidation and compaction as scheduled.

C. Placing of bedding lacer foundation material for the walls.

D. Placing of Geotextile.

1.02 RELATED SECTIONS

A. Section 01200 - Measurement and Payment: Requirements applicable to unit prices for the work of this section.

B. Section 01450-Quality Control: Compaction testing.

C. Section 02200 – Site Clearing

D. Section 02315 - Excavating.

E. Section 02390 - Slope Protection

F. Section 03300-Cast-in-Place Concrete:

1.03 REFERENCES

A. ASTM D 1556-Test Method for Density of Soil in Place by the Sand Cone Method.

B. ASTM D2922 - Test Methods for Density, of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

C. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

D. US 1377 Methods of tests for soil for Civil Engineering purposes,

E. BS 6349 Code of Practice for Maritime Structures.

1.04 SUBMITTALS FOR REVIEW

A. Prior to the commencement of filling operations, the Contractor shall provide details of the post construction settlement characteristics of the completed reclamation based on his proposed construction methods and sequencing, fill grading and seabed conditions. The details shall include full justification of the suitability of the completed reclamation for purposes of the construction to be founded on the filled areas including removal or displacement of materials on seabed

PART 2 - PRODUCTS

Dredged Material

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify sub-drainage, damp-proofing, or waterproofing installation has been inspected.

B. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

C. Verify structural ability of unsupported walls to support imposed loads by the fill.

D. Verify that the sea bed is excavated to the required profile and free from debris.

E. Verify that concrete blocks have been correctly placed within the specified tolerances before backfilling.

3.02 METHOD STATEMENT

A. Within 14 days after the acceptance of his tender, the Contractor shall submit a detailed method statement for undertaking the reclamation work to the Engineer for his approval. The method statement shall confirm and expand upon the information previously provided with the Contractor's tender and shall include the following as appropriate to the Contractors proposed method of working.

a) Sequencing and programming of fill works.
b) Details of the Contractor's predicted post construction settlement characteristics of the filled areas,
c) Types and capacities of construction equipment.
d) Details of fill material to be used for reclamation including sources of fill, test results, grading, and methods of transportation, placing and compaction.
e) Details of proposals for removing or displacing existing fine deposits on the seabed to eliminate post construction settlement,
f) Details of proposals for treating the fill during and after placement in order to achieve the specified compaction of the fill and for trimming and grading finished surfaces
g) Details of proposals for ensuring that silt pockets are not formed within reclamation areas.
h) Details of sequencing of filling with construction of retaining structures such as retainment bunds so that stability of retaining structures is maintained and loss of fine material into suspension is minimal.
i) Details of means of reducing turbidity and released fine material into suspension to minimize adverse environmental impacts.
j) Compaction methods adjacent to new and existing retaining structures to avoid damage or movements of structures
k) Details of fill grading to localized areas to enable pile installation.
l) Details for preventing dust nuisance arising from the works and keeping roads clean.
m) And other details required by the Engineer.

B. The Contractor shall submit to the Engineer for approval his proposals for the compaction of each type of material to be used, including those in relation to the type of plain, the number of passes and the loose depth of layer. The Contractor shall carry out compaction trials, supplemented by any necessary field and laboratory investigations, as required by the Engineer using the procedure proposed by the Contractor for the earthworks and shall satisfy the Engineer that all the specified

requirements regarding compaction can be achieved. The Contractor may not commence placing fill until compaction trials with the main types of materials likely to encounter have been completed and results accepted by the Engineer.

3.03 FILLING WORKS GENERAL

A. All filling and reclamation works shall be carried out in accordance with the principles contained in BS 6349 Part 5 1991, except as amended herein.

B. The Contractor shall complete all reclamation works to the dimensions, lines, levels, and profiles shown on the Drawings or as directed by the Engineer.

C. The Contractor's method of transporting and placing fill shall ensure that environmental impacts are minimized.

D. He shall also ensure that the drainage of water from reclamation placed above sea water shall be such as to minimize suspended sediment in the vicinity.

E. Following completion of filling works within the reclamation area as defined on Drawing, it is envisage that above surface construction will commence immediately. The Contractor therefore shall be inquired to develop his filling methods such that formation areas provided within this Contract are stable with minimal residual settlement and require no additional work prior to construction of services and surfacing thereon by others.

F. The formation of silt pockets in the filled area will not be permitted and any significant soft areas which, in the opinion of the Engineer, would cause differential settlement of the fill shall be removed at the Contractors expense and disposed off site.

G. All finished surfaces shall be trimmed and graded to the levels shown on the Drawings or otherwise ordered by the Engineer and formation surfaces of roads, paving and sometimes shall be further rolled by an approved weight and type of roller. All settlement shall be made good and re-rolled, this being repeated as necessary.

H. Completed sections of reclamation shall be protected from damage by wave action or other causes as soon as possible after placement. Material eroded by wave action or other causes shall be made good by removal and replacing to the approval of the Engineer.

I. Remove surplus backfill materials from site.

J. Leave fill material stockpile areas free of excess fill materials.

3.04 COMPACTION TRIALS

A. Prior to placing any fill in reclamation areas the Contractor shall establish trial(s) to demonstrate the adequacy of the proposed method and sequence of operation.

B. The trial(s) shall take place at a location to be agreed with the Engineer and each trial shall be carried out over an area not less than 20 meters x 20 meters and constructed on land

C. Trials shall comprise filling the area to a depth not less than 2 meters using the plant, method and sequence of construction proposed by the Contractor. Following placing and compaction determination of the degree of compaction will be made by the Engineer in accordance with the sand replacement method of BS 1377: Pan 9; 1990. The results obtained from the trial will be used as a standard of acceptability for the

permanent works.

D. If in the opinion of the Engineer the material for filling is significantly altered during the progress of the Works additional Trials will be required following completion of the trial the material used in the trial shall be removed and incorporated in the Works.

E. The Contractor shall allow in his rates for undertaking all trials and removal on completion.

3.05 CONTROL OF WATER

A. The Contractor shall continually monitor the concentration levels of suspended materials in the vicinity to demonstrate that no increase in concentration levels results from his operations and he shall submit his proposals to the Engineer for approval.

B. Where material is placed hydraulically, the Contractor shall be responsible for all the binding necessary to contain the reclamation within the limits shown on the drawings and shall ensure that return waste water causes no damage and shall easy out, at his own cost, the Engineer's instructions to re-route return waste water channels if necessary.

C. The Contractor shall submit, for approval to the Engineer, his proposed mutes for onshore pipelines. The Contractor shall ensure that all lands adjacent to the onshore pipelines are protected as necessary from flooding, should the pipelines burst or break.

3.06 DRAINAGE OF THE WORKS

A. Except where works are permitted to be constructed "in the wet" the Contractor shall provide, construct maintain and operate sufficient pumps and piping, wells, boreholes sumps and the like to keep the Works free from all water from whatsoever source arising for as long a period as shall be ordered by the Engineer. Such period will not be extended unreasonably and will be determined solely by engineering conditions relative to the affected work or site.

B. Springs, drains and watercourses shall be included in the scope of this clause and these shall be diverted temporarily or permanently clear of the works in progress; on no account shall they be stopped or blocked up without the written percussion of the Engineer's Representative. Where temporary diversions are not subsequently removed, they shall, after restoring the flow to its original course, be filled with concrete of appropriate Class, or pressure grouted with Treat cement grout according to size and accessibility.

3.07 PLACING OF QUAY WALL BEDDING LAYER MATERIALS

A. Bedding layer material shall be dumped onto the prepared excavated sea bed by land or marine based plant. It shall be installed by means of a grab from a land or marine based crane.

B. Bedding layer material shall be leveled to the required tolerances.

3.08 PLACING OF GEOTEXTILE MEMBRANES

A. Before laying the Geotextile any stones, or other objects which may damage the Geotextile, within the formation shall be removed and disposed of The Geotextile shall be laid and installed in the positions and to the line and levels described on the drawings and laid in accordance with the manufactures recommendations.

B. The method of installation shall not impose stresses or strains likely to cause damage

to the Geotextile; the method of installation shall ensure that the Geotextile is in continuous contact with the surface on which it is placed without stretching or bridging over humps or hollows.

C. The Geotextile shall be laid with overlaps of not less than 0.6m. Damaged Geotextile shall be repaired by overlaying with additional membrane tile to achieve a minimum lap of 1.0m beyond the damaged section in all directions.

D. The Geotextile shall be protected at all times against physical or chemical damage. Vehicular traffic shall not be permitted to rum on the uncovered Geotextile membrane.

E. Earthworks materials shall be placed onto the uncovered Geotextile membrane and not directly tipped from a lorry.

3.09 TOLERANCES

A. Reclamation slopes shall be surveyed at 10m intervals from a setting out line 10.0m back from the reclamation crest, to the sea bed with levels taken at 2.0m intervals and significant changes in slope along the surveyed line. Leveling above water level shall be by means of staff and level and below water level by means of hand soundings. Underwater reclamation slopes shall also be inspected by divers to assess the uniformity of the slope.

B. The finished level on reclamation areas shall be surveyed on a 10.0m grid.

C. The level tolerance on the top surface of backfilled / reclaimed areas shall be +100mm and - 50mm with respect to the required levels as shown on the drawings.

D. The level tolerance on reclamation slopes shall be 100mm taken vertically with respect to the required levels as indicated on the drawings.

E. The finish surface level of areas to be paved by others shall not be less than the level indicated on the Drawings and shall not exceed the stated level by more than 100mm

F. Settlement of all filled areas shall be monitored. Concrete settlement pads 300mm x 300mm x 300mm shall be installed throughout the site on a 150m grid for the monitoring of settlement, Settlement pads shall be adequately protected from damage or movement. Settlement measurements shall be made on a monthly basis for the first three months and on a quarterly basis thereafter. Monitoring shall cease when the total of three consecutive readings is less than 25

G. The minimum bearing capacity at formation level shall be equivalent to 5% CBR when tested in accordance with BS 1377:Part9:1990. Under no circumstances shall earth moving equipment be accepted as compaction equipment.

3.10 FIELD QUALITY CONTROL

A. Section 01400 - Quality Assurance: Field inspection and testing.

B. Compaction testing will be performed in accordance with BS812.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest

D. Frequency of Tests: As directed by Engineer

E. Proof roll compacted fill surfaces.

F. Subsequent layers shall rot he placed until the material and profile of the previous

laver has been approved.

3.11 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500.

B. Reshape and re compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 02325

DREDGING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Dredging of existing seabed

1.02 SUBMITTALS

A. Before any dredging plain is brought to Site the Contractor shall agree with the Engineer his method and detailed programme for carving out dredging work which shall take full account of the requirements of shipping movements in the vicinity of the Site, including full particulars of all dredging and other plant, craft and equipment which he purposes to use. The method and sequence of dredging shall be such as to ensure that no damage is caused to existing marine structures and that the tolerances given herein can be achieved.

B. Details of the survey of the adjacent structure and the interface arrangement shall be agreed with the Engineer before any dredging equipment is brought to site.

C. Not less than 14 days before commencement of any dredging work the Contractor shall provide a full and detailed Method Statement for dredging works to the Engineer for his approval. The Method Statement shall cover all aspects of dredging works including the following:
Type and capacity of dredgers and barges.

- Methods of anchorage and positioning of dredger.
- Sequence and programming of dredging
- Method of position control, surveys and soundings to be used.
- Methods of dredging adjacent to existing or new structures.
- Measures to be adopted to avoid interference with navigation.
- Measures to be taken to control dispersion and deposition of silt and to absolutely minimize adverse environmental effects.
- Methods of disposal of dredged material.

Methods of control and placement of dredged material placed as fill (if any).

PART 2 - PRODUCT

NOT USED

PART 3 - EXECUTION

3.01 DREDGING METHOD

A. All dredging works shall be carried out in accordance with the principles contained in BS 6349 Part 5 1991, except as amended herein.

B. Dredging shall be undertaken to the lines and levels shown on the Drawings. No part of the finished dredging work shall, on completion be higher than the specified dredged level or profiles. The Contractor shall undertake a final bar sweep of the dredged area under the supervision of the Engineer- to ensure the minimum dredged level is achieved.

C. The Contractor shall ensure that the method and extent of any over dredge is not detrimental to the stability of any existing structures or adjacent properties or new structures installed as part of the works. Where approved by the Engineer, materials arising from dredging operations may be used for reclamation works, subject to the requirements of this specification

D. The Contactor shall undertake a pre-dredge survey immediately before commencing dredging and shall undertake interim surveys as directed by the Engineer to monitor dredging progress. The area of the pre-dredge survey shall be the site area indicated on drawing.
The dredged quantity shall be measured in accordance with the measurement lines shown on the drawings defined as the extent of dredging at the given dredged levels and measured vertically from the existing seabed level excluding side slopes

F. The Contractor shall provide and maintain in good working order all plant and equipment required for the successful completion of the works.

G. The Contractor shall establish for the duration of the Contract an automatic recording tide gauge of approved panel at agreed location. The gauge shall be accurately leveled and related to MSL Datum and periodically checked for level.

H. Side slopes shall be formed to profiles designed by the Contractor. The Contractor shall demonstrate to the satisfaction of the Engineer that the slopes to be provided in the various material types shall be stable.

I No portion of the finished works shall be higher than the approved lines and levels unless directed by the Engineer.

J. The Contractor shall ensure that his dredging operations do act in anyway interfere with or endanger shipping or navigation and shall at all times take full account of all relevant requirements of this specification

K. The Contractor shall dredge at his own cost any material which, during the periods between the dates of conic extent and completion of all dredging operations, accumulates above the specified dredged levels within the areas to be dredged as defined in the Drawings.

L. The Contractor shall take every precaution to minimize the possible negative effects on the environment due to the dispersion and deposition of silt in the waters in and around the area of his dredging operations. He shall submit his proposals for achieving this and monitoring the effectiveness of his proposed method of working for approval by the Engineer.

M. Agitation dredging, being the attempted removal of material by the use of natural water currents or artificially induced water currents, will not be permitted

N. Dredging shall be carried out in any type of material which may be encountered, which shall include natural bed materials.

O. The Contractor shall be responsible for the clearance and disposal off Site of manufactured or fabricated items that are encountered in the dredging areas.

P. Where major items of wreckage are encountered, before the required dredged profile has been achieved, the Contractor shall immediately inform the Engineer and await his instructions before proceeding with removal of the same.

3.02 DREDGING PLANT

A. The Contractor shall provide and maintain in good order all plant and equipment required for the successful execution of the works.

B. Dredging shall be carried out using suitable floating or shore-based plant, or a combination thereof. Due regard shall be paid to the required tolerances for dredging. Details of the types and outputs of dredging plant to be employed shall be provided for the Engineer which shall confirm and expand upon information supplied with the Contractor's tender.

3.03 POSITION CONTROLS

A. The methods by which the horizontal dredging limits are to be established shall be to the approval of the Engineer.

B. The Contractor shall provide and maintain on board all dredging plant position fixing systems giving the position of plant to an accuracy of +/- 0.5 meter in the horizontal plane, together with competent operators to ensure that the position of dredging plant can be accurately located whilst dredging is being undertaken.

3.04 SURVEYS AND SOUNDINGS

A. Before commencement of dredging the Contractor shall carry out a pre-dredge survey to establish existing seabed levels to provide a basis for determination of final dredging quantities for payment purposes.

B. During the course of dredging, the Contractor shall carry out interim surveys as the Engineer may require for the purpose of checking the dredged depths, which have been achieved as the work progresses to provide a basis for evaluating interim payments.

C. The minimum extent of surveys shall cover the area shown in Drawing.

D. The Engineer may require the Contractor to extend the surveys to cover other areas in order to determine whether material is being deposited within these areas as a result of the dredging or filling operations or for any other purpose in connection with the Works.

E. When the dredging has been completed the dredged areas shall be surveyed by the Contractor jointly with the Engineers Representative to ensure that the dredging has been carried out to the required levels and profiles.

F For the purpose of earning out pre-drudge, interim and post-dredge level surveys, the Contractor shall provide a motor boat, fully manned with experienced staff and equipped with echo sounding apparatus, available for use at any time throughout the duration of the Contract.

G. All pre-dredge, interim and post-dredged surveys shall be based upon lines of soundings at intervals of 10 m or other such spacing as the Engineer shall direct the levels of the seabed shall be recorded by beams of echo sounding equipment with an accuracy of not less than 0.l m which shall record output onto a paper tape. The paper printout shall have a minimum scale of 1 in 100 from which the water depths can be scaled. Equipment used for determining the locations of the sounding positions shall be capable of fixing positions to an accuracy required by the Engineer in plan.

H. The soundings indicated on the paper tape shall be calibrated by undertaking bar check measurements before commencement and on completion of survey work each day. Bar check measurements shall be carried out at every meter of depth in the range of depths to be surveyed.

I Post dredge surveys over rack areas should be carried out at line interests which give complete coverage of the area, with overlapping lines as necessary.

J. The Contractor shall notify the Engineer of his intention to carry out interim surveys at least 24 hr prior to commencement of the survey and shall provide facilities for the Engineer to witness the survey when required.

K. All surveys shall be witnessed by the Engineers Representative or his assistant.

The Contractor shall prepare record drawings of the pre-dredge and post-dredged surveys carried out for agreement with the Engineer and shall provide three hard copies and one digital copy (in Autocad format) of each agreed drawing to the Engineer.

3.05 DREDGING TOLERANCES

A. Dredging shall be carried out to the required levels and profiles or such modified levels and profiles as shown on the Drawings or such levels and profiles as may be notified by the Engineer to the Contractor in writing. No part of the finished dredging work shall- on completion, be higher than the specified dredged level or profiles.

B. Within 20m of any existing structure or proposed new structure the maximum permitted over dredge, below the specified dredged levels as shown on the Drawings, shall be 300mm.

C. If required by the Engineer, the Contender shall make good, at his own cost any over excavated areas with such material and in such a manner as the Engineer shall direct

3.06 SIDE SLOPES

A. The Contractor shall demonstrate to the Satisfaction of the Engineer that the slopes to be formed in the different material types will be stable.

3.07 DISPOSAL OF DREDGED MATERIAL

A. Where approved by the Engineer, materials from dredging operations may be used for construction of other key elements of the harbour, backfilling, reclamation works, subject to the requirements of this Specification.

B. Dredged material surplus to requirements or not approved for filling shall not become the property of the Contractor who shall make his own arrangements for the disposal of surplus or unsuitable material off site as directed by the Engineer. If he elects to dump surplus material at sea, he shall be responsible for all liaisons and for obtaining any appropriate approvals/licenses from the relevant authorities, copies of which shall be provided for the Engineer prior to the commencement of dredging.
Dredged material shall not be disposed of within the proposed works or adjacent areas. Where surveys show that dredged material has been placed or has accumulated within areas where the seabed level was previously lower, the Contractor will be required to remove such material at his own cost as directed by the Engineer.

3.05 SILTATION

A. The Contractor shall dredge and dispose at his own cost any material which, during the period between the Works Commencement Date and issue of the Certificate of Completion for all dredging operations accumulates above the specified dredged levels within the area to be dredged as defined on the Drawings.

B. The Engineer may require the Contractor to extend the interim surveys referred to above to cover areas of adjacent navigable areas. If as a result of these surveys it is found that material is being deposited within these berths as a result of the Contractor's dredging, filling or other operations, the Contractor will be required to clean such areas at his own cost.

C. The Contractor shall not be required to maintain the dredging works after the Engineer has issued a Certificate of Completion for the Whole of the Works.

3.09 SWEEPING

A. On completion of the dredging the Contractor shall undertake a physical sweep of all dredged areas to ensure that the seabed is level and free from projections above the respective specified minimum levels. The Contractor shall remove any such projections and sweep the area again to check that their removal is complete. The sweeping method and equipment shall be to the approval of the Engineer

3.10 OVERSPILLING

A. No over spilling of hopper barges or hopper dredgers will be allowed. The Contractor shall submit to the Engineer for approval his proposals to confirm overspill will not occur.

3.11 DEMURRAGE

A. No demurrage will be paid for any delays arising due to weather, breakdown or damage to Contractor's plant.

3.12 DAILY RECORDS

The Contractor shall keep daily records of the dredging work and shall submit two signed copies of these records to the Engineer's Representative not later than the following day. The records shall include the following information:

a) Type and location of material(s) dredged.
b) Areas of materials dredged.
c) Estimated volume of materials dredged.
d) Weather and sea conditions.
e) Tide plot.
t) Times, duration and causes of all stoppages.

The form of the daily records shall be agreed with the Engineer's Representative.

END OF SECTION

SECTION 02390

SLOPE PROTECTION AND BREAKWATERS

PART I - GENERAL

1.01 SECTION INCLUDES

A. Armour Rock

B. Under layer

C Scour Protection.

D. Geotextile membrane on slopes

1.02 RELATED SECTIONS

A. Section 02315 -Excavating.

B. Section 02316 –Backfilling & Reclamation.

1.03 REFERENCES

A. BS 6349 Code of practice for maritime structures.

B. CIRIA Special Publication 83 - Manual on the use of rock in coastal and shore line engineering.

C BS 812 Testing aggregates.

D ASTM C-131.

E. ISRM 1986.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with BS6349 and CIRIA Special Publication 83.

B. Maintain one copy of each document on site.

C. At least one month before starting work on slope protection and breakwaters, a detailed rock boulder placing programme, including particulars of handling equipment and other plant including marine craft which the contractor proposes to use, shall be submitted to the Engineer.

PART 2 - PRODUCTS

2.01 SLOPE PROTECTION GENERAL

All amour rock and under layer works shall be carried out in accordance with the principles contained in BS 6349 Part 1 (1984), Part 7 (1991) and CIRIA SP83 (1991) except as amended herein.

A. All armour rock shall be sourced from countries approved by MCPI.

B. The Contractor shall be responsible for finding and proving the quality of material for

rock armour.

C. Separate faces within a quarry shall constitute separate Rock faces.

D. The Contractor shall be deemed to have satisfied himself that his proposed rock source is capable of supplying rock of the sizes, quality and quantity required for the Contract and he shall be responsible for obtaining the licenses, permissions and the like for the rock and delivering it to the site.

E. The slope protection shall comprise rock armour, under layer and Geotextile membrane placed over trimmed reclamation fill material.

The rock amour, under layer and Geotextile membrane shall meet the requirements for gradation specified herein

The Contractor shall ensure that the fill material onto which the slope protection is constructed shall be graded to ensure that the fine material within the reclamation fill does not migrate through the under layer and amour layers under the influence of tidal and wave action or other effects in accordance with the criteria set out in Clause 4.4.5 of BS 6349: Part 7.

2.02 ROCK

A. Rock, including the main armour, under layers and scour protection layers, shall be hard and durable stock. It should be free from laminations, cracks, scams and weak cleavage planes and must not disintegrate or erode from the action of the air, water, wetting and drying, freezing and thawing and impact due to wave action. It shall not contain earth, clay or other soft or decomposed material. It should be capable of being handled and placed without undue fracture or damage.

Rock shall be sound fresh material with the following physical and chemical and durability properties; in accordance with BS 812 (except where otherwise shown). When tested Rock shall satisfy

i)	Relative Density (oven dried) (BS 812: Pan 2)	/2.65
ii)	Aggregate Impact Value (BS 812: Part 112)	<27%
iii)	Water Absorption (BS 812: Part 2)	< 2.0%
iv)	10%Fines (BS 812: Part 111)	/120kN
v)	Magnesium Sulphate Soundness (BS 812: Part 121)	112%
vi)	Los Angeles Abrasion (ASTM C-131)	< 35%
vii)	Unconfined compressive strength (ASTM D2938)	> 20N/mm
viii)	Deleterious secondary minerals.	<0.7g/100g

ix)	Methylene Blue absorption (CIRIA SP83)	In. < 5%
x)	Block Integrity drop test (CHUA SP83 Appendix 2, Section A2 11)	
xi)	Point Load Index (ISRM 1986)	> 4.SMPA
xii)	Shape index (L/d > 3.0) (CIRIA SP 83 Appendix 2)	< 5.0%

B. Rocks shall consist of fragments of approximate cubical shape with angular corners and the maximum dimension should not exceed twice the overall minimum dimension.

C. All sources of rock supply shall be approved by the Engineer. Prior to rock supply, the Contractor shall submit test results from each proposed source of rock to demonstrate compliance with the relevant grading and durability requirements specified herein.

2.03 GEOTEXTILE CLOTH

A. Materials: The brand and type of geotextile proposed by the contractor for the work shall become subject to the Engineer's representative's acceptance before bringing it to site.

The geotextile shall be polypropylene filter fabric and shall be resistant to air, water and chemical and bacteriological attacks. The geotextile shall fulfill International classification (ASTM) Class 4. The fabric shall be manufactured with and preserve the following mechanical properties according to DIN 54307.

1) Weight of fabric : 500 g/m2 (minimum)
2) Thickness of fabric : Minimum of 4.5 mm under a load of 2 kN/m2
3) Tensile strength
    a. Longitudinal : 15.0 kN/m (minimum)
    b. Transverse : 25.0 kN/m (minimum)
4) Elongation at break : Minimum of 50.0 % in both longitudinal & transverse directions.
5) Durability : The material shall be resistant to naturally occurring soil, alkalis, acids and bacteria. Further the material shall be resistant to the effect of sunlight if exposed for less than 12 weeks.
6) Dimensions of rolls
    a. Minimum width of 4.5 m
    b. Maximum width of 6.0 m
7) Soil retention and Permeability : Data on water permeability and effective opening size and test methods used to obtain such data shall be submitted together with a test sample.

8) Test sample : Before shipment of the geotextile the contractor shall supply at test sample of 2.0 m x 2.0 m to the Engineer's representative for testing.

2.04 GEOTEXTILE SAND CONTAINERS

A. Type of Material: Material of the sand container is multi layered composite mechanically bounded (Needle punching) non- woven geo textile made of Polypropylene / Polyester filter sheets.

B. Thickness of the Material: minimum thickness of material under a load of 2 kN/sqm should not be less than 6.0 mm

C. Unit Weight: Minimum unit weight (Composite) should not be less than 1,200g/sqm

D. Tensile Strength: Minimum tensile strength along the longitudinal and transverse direction are as follows:

Minimum longitudinal tensile strength = 30 kN/m

Minimum transverse tensile strength = 60 kN/m

E. Elongation: Minimum elongation without breaking for both directions of longitudinal and transverse should be 50%

F. Loaded capacity of the container (Sand filled bag): Loaded capacity of the sand container should be within the limit of 0.4 to 0.6 ton and alternative cost effective design and sizes are accepted.

G. Fill Material: Fill material has to be in the range; Very fine sand (62.5-125 µm) to Medium Gravel/Medium Coral (8-16 mm). Silt and Clay as fill material is NOT allowed.

H. Durability and UV Resistance: UV degradation is the most significant factor in terms of long term survivability of the sand container. Container structures used on coastal foreshore areas are exposed to UV for long periods of time, hence it is essential that the Geotextile used to manufacture the containers has the highest possible UV resistance. In addition, the material shall be resistance to natural occurring soil and acid.

Determination of durability – Resistance to degradation by light and heat : Percentage of minimum acceptable limit of the strength retention shall be 80% on expose of 12 weeks natural sunlight or equivalent.

I. Damage Resistance: There are two main courses of damage which are incidental damages and vandalism. In case of vandalism, a composite vandal deterrent Geotextile has been developed and this product has significantly improved the resilience and durability of the individual containers. Hence material should be with anti-vandalism protection layer.

Minimum allowable limit of the puncher resistance shall be 6,000 N (ISO 12236 test method)

J. Abrasion Resistance: The containers will be exposed to constant abrasion due to water born sands and gravels carries by current and waves, this abrasion can be extreme in areas where sand, coral and shell fragments are present. The Geotextile must have the highest possible abrasion resistance.

K. Fines Retention: The containers will be exposed to wave action and tidal flow conditions over extended periods of time, these extreme dynamic flow conditions will restrict the soils ability to form a natural filter. As size and mass of the container determines the stability of a container structure it is critical the Geotextile selected retain sufficient fill material to ensure the container does not deflate and remains stable. Performance testing is recommended to determine the actual fines retention capacity of a Geotextile.

Maximum mean pore size at the 90% confidence level shall be 100 microns.

L. Permeability: The containers are likely to be exposed to cyclic wetting and drying due to tidal variation, the Geotextile through flow will control the period for which the sand fill remains saturated after being submerged, and stability of the structure is dependant of the water release capacity of the Geotextile.

Minimum mean water flow permeability of the material shall be 10 l/sqm/s
Permeability normal to the plain is 50mm head (ISO11058)

M. Seam Strength: Containers will be subjected to extreme pressure during the filling and placement operation and as such high strength seams are a requirement for all containers. Container should have single, double or triple stitching depending on the size, method of installation and risk of damage to the container.

The yarn used for the stitching mush be high strength, abrasion resistant and UV stabilized. The container should have minimum seam strength of 80% of the virgin material.

2.05 QUALITY CONTROL OF ROCK

A. Provision shall be made by the Contractor for all sources of rock supply to be inspected by the Engineer at source. Prior to rock supply, the Connector shall submit for inspection by the Engineer trial loads from each proposed source of rock, which shall be fully tested to prove compliance with the relevant grading aid durability requirements specified. When, the source of rock includes more than one face from a quarry, a trial load shall be provided from each quarry face. The source of each trial load shall be separately identified the numbers and sizes of trial loads shall be as directed by the Engineer. Inspection by the Engineer of trial loads or rock sources shall not relieve the Contractor of his obligations under the Contract.

B. Test certificates showing the results of tests of all physical properties shall be submitted to the Engineer. Separate sets of certificates shall be submitted for each trial load.

C. The trial loads shall be set aside in an area approved by the Engineer for the duration of the Contract and used as directed by the Engineer.

D. Rock delivered to the Site for incorporation in the Works will be monitored by the Engineer. This will include periodic inspections of the quarry face and check measurements on samples delivered to Site.

E. The Contractor shall notify the Engineer in advance of any changes in the rock production method or of any relocation of the blast face within the quarry. Adequate

provision shall be made by the Contractor in this even to permit the Engineer to inspect the rock at source. The Contractor shall, if so required by the Engineer and at no additional cost to the Employer, submit trial loads for testing from the relocated face or as a result of the change in production method.

F. The Contractor shall, prior to the delivery of the rock, provide the Engineer with a Method Statement outlining how the required rack grading shall be achieved. His proposals regarding rock handling and stooge shall be outlined, together with his proposal for dealing with any contaminated rock supplies.

G. To check compliance with the specified grading requirement, analyses of the recorded weights of rock shall be carried our by the Contractor. The method of analyzing the weights recorded shall be agreed with the Engineer.

H. For the purposes of this Clause, analyses shall be carried out on the recorded weights of batches of 500 tones or more intended for use or used in the Works. The numbers and sizes of batches analyzed shall be as required by the Engineer.

I. Each stone shall be weighed at the quarry. Individual rock weights shall he pained onto the rocks using waterproof pairs in figures not less than 150mm in height. The Engineer may require stones to be weighed at the location of final placement. The Contractor shall allow for sufficient equipment to be available to enable the measurements to be carried out without disarmin$_g$ quarry production or other construction activities. The Contractor shall allow for the return of any rejected rocks from the Site to the quarry.

J. The Contractor shall perform stringent checks at all stages during the period of the Contract to ensure that no explosive wires, detonator charges or similar are left within the rock units. The Contractor shall ensure that all personnel involved in the supply, delivery, bundling and placing of rock are made aware of the need for such devices to be detected and dealt with by authorized and competent authorities.

K. Consistent rock color shall be maintained for all visible rock.

2.06 TESTING OF SLOPE PROTECTION & SCOUR PROTECTION MATERIALS

A. Sampling of rocks, under layer and scour protection rock shall be carried out in accordance with the procedures in appendix 1 of CIRIA Special Publication 83

B. All samples shall be tested for compliance with all of the specified criteria.
Samples shall be taken from material stockpiles (not at source) prior to use in the permanent works shall be tested for grading shape and rock quality at the frequency of 2 in every lot

Grading
The sample shall consist of a minimum of 100 stones. Each shall be made up of four sub samples

Shape
The sample shall consist of a minimum of 50 stones.

Rock Quality
One sample shall be taken at the frequency shown in the above table for the full range of rock quality testing.

PART 3 - EXECUTION

3.01 EXAMINATION

A Verify that the profile, thickness and density of the previous construction layer has been approved priority placing further slope protection material

B. Verify material stockpiles have been approved poor to placing in the permanent works.

3.02 PLACEMENT OF ARMOUR ROCK

A. Place armour rock layers to levels, gradients and thickness shown on the drawings.

B. Place rock evenly and carefully to minimize disturbance, or displacement of the underlying construction.

C. Armour rocks shall be individually placed by grab or equivalent method so as not to detrimentally' affect any of the properties specified above.

D. Rocks shall not be dropped from a height greater than 1.5m and rock in the primary layer shall be placed to ensure a minimum of three points of contact. Rocks in the armour layers shall not be tipped from vehicles, bulldozed or dumped from rock trays into position

E. The Contractor shall remove immediately from the structure any rocks found to fracture following placing.

F Interstices between adjacent armour rocks within the amour layer shall remain free of small rock particles. The Contractor shall at his own expense remove and reconstruct the entire armour layer in areas where the interstices become filled.

G. The placing of armour layers on both the landward and seaward sides of the breakwaters shall follow not more than 50m behind the core.

H. The Contractor shall ensure that armour layers interlock with the underlying armour or core layer and shall avoid any disturbance to previously placed layers or to the core fill when placing overlying layers.

I. The Contractor shall include in his Method Statement detailed proposals for protecting partially completed work from adverse sea or weather conditions and for making good any damage caused to partially completed work from such conditions.

J. Unsuitable material shall be removed from the Site to an approved disposal area.

K. Uncompleted sections of armour rock shall be protected from damage by wave action or causes as soon as possible after placement. Material eroded by wave action or other causes shall be made good by removal and replacing to the approval of the Engineer.

L. The thickness of the armour rock layer shall not be less than 80% of the layer thickness shown on the drawings along any one measurement profile. The layer thickness shall not be less than 90% of that shown on the drawings on two consecutive measurement profiles.

M. The minimum bulk density of completed sections of armour rock shall not be less then 1.7 T/m^3

3.03 PLACEMENT OF UNDERLAYER ROCK

A. Under layer rock will be placed to the thickness specified in the drawings. The thickness of the under layer shall not be less than 80% of the layer thickness shown on the drawings. The layer thickness shall not be less than 90% of that shown on the

drawings on two consecutive measurement profiles.

B. Completed sections of under layer rock shall be protected from damage by wave action or other causes as soon as possible after placement. Material eroded by wave action or other causes shall be made good by removal and replacing to the approval of the Engineer.

C. Place rock evenly and carefully to minimize disturbance or displacement of the underlying construction or Geotextile membrane Use of rock traps for construction below water is permitted.

D. For placing above Mean Low Low Water (MLLW) tide level- the rock shall be placed to grade to ensure that the larger rock fragments are uniformly distributed and the smaller rock fragments serve to fill the space between the larger rock fragments in such a manner as will result in the resulting stone being well-keyed, densely packed and of the specified dimensions.

E. For placing below MLLW tide level, handling and placing methods shall be approved by the Engineer to minimize segregation of the stone grading and to ensure the specified dimensions are achieved.

3.04 PLACEMENT OF SCOUR PROTECTION ROCK

A. Scour protection material shall be placed manually by means of a crane mounted grab or similar method to the approval of the engineer.

B. Care shall be taken to minimize damage to adjacent structures during the placement of scour protection reek.

3.05 PLACEMENT OF GEOTEXTILE MEMBRANE

A. Until the time of installation of a geotextile in the permanent work, it shall be stored so that it is not exposed to direct sunlight. During installation temporary exposure to sunlight shall preferable, which is not exceeding 4.0 hours. Total exposure to direct sunlight in excess of 2 days of a piece of geotextile will lead to rejection of the exposed geotextile. Shall be protected at all times against physical or chemical damage.

B. Before installation of the geotextile the surface of placing shall be trimmed and cleared for obstructions, which may damage the geotextile. The method of installation shall not impose stresses or strains likely to cause damage to the Geotextile. The method of installation shall ensure that the Geotextile is in continuous contact with the surface on which it is placed without stretching or bridging over humps or hollows.

C. The geotextile lengths shall be placed perpendicular to the longitudinal direction of the rubble mound structure with an overlap of at least 0.5 m. The geotextile shall be in one piece from the bottom to the top of the structure. The Geotextile shall be laid and installed in the positions and to the line and levels described on the drawings and laid in accordance with the manufacturers recommendations. Damaged Geotextile shall be repaired by overlaying with additional Geotextile to achieve a minimum lap of l.0m beyond the damaged section in any direction.

D. When correctly placed on slopes, the geotextile shall be smooth and kept in position by weights (e.g. stones or iron bars), preventing the sheet from floating. No rock or fill material shall be placed on geotextile sheet before its placing has been accepted by the Engineer's Representative. Placing of subsequent layers shall take place in a manner, which will not damage the geotextile.

E. Rounded gravel materials shall be used under and over geotextiles whenever

required for protection of the fabric. Any damage caused to geotextiles shall result in replacement of the damaged section by the contractor at no additional cost.

3.06 TOLERANCES

A. Survey profiles of all slope protection and scour protection construction layers shall be taken at 10m intervals along the revetment with readings at 2.0m intervals from the slope setting out line to the seabed.

B. Leveling above water level shall be by means of staff and level. Leveling below water level shall be by means of band soundings using a probe with a spherical end of diameter equal to 0.5 Dn50 of the particular rock size.

C. Underwater slope protection and scour protection slopes shall be inspected by divers to assess the uniformity and stability of the slope.

D. Survey lines for each layer of construction shall be set out directly above the survey lines of previous construction layers such that the layer profiles and thickness can be directly compared.

E. The placing tolerance on armour rock taken vertically on the lines and levels shown on the drawings shall be as follows:

Position	Tolerance
Above 0.0 MSL	± 0.3 Dn50
Below 0.0 MSL	± 0.5 Dn50

Where Dn50 is the size of the cube with equivalent volume to the rock with median mass.

F. Notes

1. Tolerances apply even if grading being placed has not been selected from the standard grading.

2. All tolerances refer to the design profile to actual mean profile unless stated otherwise.

G. Notwithstanding the tolerances in the above table the following shall apply:

1. The tolerances on two consecutive mean actual profiles shall not be negative.

2. Notwithstanding any accumulation of positive tolerances on underlying layers, the thickness of the layer shall not be less than 80% of the nominal thickness when calculated using mean actual profiles.

The tolerance for horizontal alignment shall be 0.5m in either direction.

Where the profile is found to be below the specified tolerances, additional amour shall be placed to achieve the required profile.

3.07 TRIAL SECTION

A. The Contractor shall initially construct a leg panel or section of each type of structure which upon acceptance by the Engineer shall become the model for further placement and shall remain pan of the finished works. The length of the section shall be not less than 10 meters and shall extend over the full height of the structure. The

tolerances and survey methods shall be as described in the relevant clauses of this Specification

B. The objective of the trial section is to verify the average layer thickness in the Drawings and the tonnage per meter cubed.

C. Within the test panel each rock shall be weighted individually and placed into a two layer section using a mix of block weights representative of the specified concrete and size requirements.

D. Profiles shall be established by the survey' techniques set out in Specification Clause 3.06 above, except that cross sections shall be at five meters intervals. Values of Yb, and Yb>z shall be determined and shall not differ by more than 0.2t/m,
where Yb, - Measured weight of armour in sample Total volume of amrour in sample
and Yb_z= Calculated weight of armour in sample Total volume of armour in sample where calculated weight equals the product of the number of blocks and the rock density and the cube of D„,

E. The trial panel shall be re-built if necessary until the values of Yb, and Ybz differ by not more than 0.2t/m'.
Upon acceptance of the trial section, the section shall be incorporated in the Works and not disturbed. In the event of the source of armour rock being changed, the trial section procedure described above shall be repeated for the new source.

G. No placing of armour rack other than for the trial section shall be carried out until the trial section has been accepted by the Engineer.

3.08 SURVEY TECHNIQUES

A. Measurements shall be carried out using a probe with a spherical end of diameter $0.5D_{50}$. The Contractor shall submit his proposals for carrying out the survey to the Engineer for approval. For a land-based survey the sphere may be connected to a staff or EDM target; for an underwater survey it may be a weighed ball on the end of a sounding chant.

B. A permanent survey point shall be established at the crown of each profile to be measured. The form and location of each survey point shall be for the approval of the Engineer and shall permit access for purposes of measurement of the profile during and after completion of constriction of the whole breakwaters.

C. Profiles shall be measured at intervals of 20m, along the length of the breakwaters. Crass sections shall be prepared by the Contractor and approved by the Engineer. Each cross section shall be prepared from a series of reduced levels taken across and on the slope surface, spaced at intervals of one meter.

D. Such surveys shall be ongoing during the course of the Contract and will be carried out after each main breakwater element e.g. toe, under layer and armour has been constructed.

E The full length of all underwater amour shall be subject to a diver inspection before acceptance.

3.09 CRUSHED STONE BEDDING LAYER TO QUAY WALLS

A. The crushed stone bedding layer for the placing of precast block and wall units shall be placed to the following tolerances: +/- 75mm in level and no deviation exceeding +l- 50mm under any 5m straight edge. Not withstanding the above, the preparation of the bedding layer must be compatible with achieving the tolerances given for the

precast concrete blocks m this Specification. Whilst also ensuring a uniform contact between the blocks and the bedding layer.

3.10 METHOD STATEMENT

A. The Method Statement shall provide the Engineer with a full and detailed Method Statement for the rock armouring work including the following items:

i) Programming of armouring works and sequencing with other activities

ii) Details of plant and personnel to be used.

iii) Details of proposed sources of rock materials with grading, test results and other supporting data,

iv) Methods of sequencing and of protecting partially completed work to avoid wave or other damage during construction.

v) Method of working to ensure the toes of the breakwater structures are founded on a suitable bearing stratum.

vi) Methods of controlling and monitoring the quality of grading of materials at the quarry source.

vii) Methods of controlling and monitoring the placing of armour to ensure specified tolerances are achieved.

viii) Methods of installing the filter membrane,

ix) Methods of surveying the profile of the placed material

B. ROCK FOR BREAKWATER CORE, ETC.

All rock for the breakwater shall be hard, dense, non-friable stone from sources approved by the Engineer. The rock shall be free from cracks, seams and similar defects and shall not fracture when dropped through 1.5 metes on to a steel plate. Rocks shall be of all sizes within the limits specified and shall be angular in shape being neither unduly elongated nor flat, nor unduly rounded. The greatest dimension shall be less than twice the least dimension. Rocks, which do not comply with these requirements, will not be accepted in the permanent works.

Rock for use in the breakwater shall have the following properties

- Density (oven dried)	not less than 2600 kg/m^3
- Aggregate Impact value	not more than 25%
- MgSO4 soundness loss	not more than 12%
- Water absorption	not more than 2.0%
- Franklin Point load strength	not more than 4MN/m^2

C. SUPPLY OF ROCK

The Contractor may obtain the rock or stone required for the Works from any source or sources approved by the Engineer.

Notwithstanding any approval given by the Engineer, it shall be the responsibility of the Contractor to satisfy himself that the source is capable of supplying rock of the sizes, quality and quantity required. The Contractor shall be responsible for obtaining

all licenses, way leaves permissions, etc, necessary for extracting rock, and shall take all necessary precautions to avoid causing any nuisance by the extraction of stone or its transport to the site.

D. SIZES OF ROCKS FOR BREAKWATER

The rock sizes used in the breakwater armour layer should satisfy the following guidelines:

W400

Upto 10 percent (by mass) may be below the nominal lower limit NLL of 300kg, and up to 30 per cent may be above the nominal upper limit NUL of 500 kg. Upto 5 percent (by mass) may be below the extreme lower limt ELL of 200kg, and up to 3 percent may be above the extreme upper limt of 600kg.

W500

Upto 10 percent (by mass) may be below the nominal lower limit NLL of 400kg, and up to 30 per cent may be above the nominal upper limit NUL of 600 kg. Upto 5 percent (by mass) may be below the extreme lower limt ELL of 300kg, and up to 3 percent may be above the extreme upper limt of 750kg.

W600

Upto 10 percent (by mass) may be below the nominal lower limit NLL of 500kg, and up to 30 per cent may be above the nominal upper limit NUL of 750 kg. Upto 5 percent (by mass) may be below the extreme lower limt ELL of 400kg, and up to 3 percent may be above the extreme upper limt of 1000kg.

W800

Upto 10 percent (by mass) may be below the nominal lower limit NLL of 700kg, and up to 30 per cent may be above the nominal upper limit NUL of 1000 kg. Upto 5 percent (by mass) may be below the extreme lower limt ELL of 600kg, and up to 3 percent may be above the extreme upper limt of 1200kg.

W1200

Upto 10 percent (by mass) may be below the nominal lower limit NLL of 1000kg, and up to 30 per cent may be above the nominal upper limit NUL of 1500 kg. Upto 5 percent (by mass) may be below the extreme lower limt ELL of 750kg, and up to 3 percent may be above the extreme upper limt of 2000kg.

4-6T (W4000-W6000)

Upto 10 percent (by mass) may be below the nominal lower limit NLL of 4000kg, and up to 30 per cent may be above the nominal upper limit NUL of 6000kg. Upto 5 percent (by mass) may be below the extreme lower limt ELL of 2500kg, and up to 3 percent may be above the extreme upper limt of 7500kg.

E. ROCK TO BE CLEAN

The Contractor shall take proper measures to separate rocks into the appropriate categories in the quarry. Neither rocks of smaller sizes than those specified or indicated on the drawings nor earthly sand, clay or quarry waste shall be placed in the breakwaters or revetments and all such material shall be removed by the Contractor at his own expense if found to be present in the Permanent Works.

F. PLACING ROCK TO UNDERLAYERS AND BERMS

All rocks in the outer faces of the breakwaters, that is in the under layers and berms shall be placed individually or by grab .Tipping and dumping will not be permitted.

Rocks having one axis predominantly longer than the others shall be placed such that the long axis is perpendicular to the face of the slope.

The method of placing stone must provide a finished slope that is regular enough in profile and in grading to permit the amour units to be bedded firmly upon in. No large voids beneath the units will be acceptable and in general every effort must be made to provide support to as much as possible of the bearing surface of each unit as much as possible.

G. PLACING OF RIP-RAP

Rip-rap to the revetments to facilitate other constructions shall be placed back in a manner as approved by the Engineer.

H. TOLERANCE IN PLACING ARMOUR

No unit in the armoring layer shall project beyond the required line by more than 35% of its average dimension. Any unit placed outside this tolerance shall be removed and replaced to the satisfaction of the Engineer.

I. MEASUREMENT OF ROCK

All rock placed to the breakwater shall be measured as the theoretical volume and shall be from agreed sections of the bottom profile, where appropriate, applied to designed levels and side slopes as shown on the Drawings and without allowance for settlement. The measurement of area shall be the area of the outer surface of the item being measured calculated from the levels and slopes shown on the Drawings.

J. COST OF ROCKS IN BREAKWATER

All costs and charges whatsoever in connection with the construction of the breakwater in accordance with the provisions of the Contract Documents, including, but not by way of limitation, procuring and transporting rock, sorting into different sizes required, grading, stockpiling, handling , loading and unloading and including all quarrying and placing and surveying as specified, shall be deemed as being included in and covered by the rates in the Bill of Quantities.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED SECTIONS

A. Section 03200 - Steel Reinforcement.

B. Section 03300 - Cast-in-Place Concrete.

1.03 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI 347 - Recommended Practice for Concrete Formwork.

D. ANSI/ASME A17.1- Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks

E. PS 1 - Construction and Industrial Plywood.

1.04 DESIGN REQUIREMENTS

A. Design and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.05 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

C. Product Data: Provide data on installation requirements.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347, 301, 318.

B. Maintain two copies of each document on site.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable ACI 347 code for design, fabrication, erection and removal of formwork.

1.08 FIELD SAMPLES

A. Provide under provisions of Section 01400 and Coordinate with requirements stated in Section 03100 and 03300.

1.09 COORDINATION

A. Coordinate work under provisions of Section 01039 Coordination and meetings.

B. Coordinate this Section with other Sections of work which require attachment of components to formwork.

C. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

PART 2PRODUCTS

2.01 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Engineer.

2.02 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, cone type, with waterproofing washer, free of defects that could leave holes larger than 25 mm in concrete surface.

B. Form Release Agent: Colourless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or colour characteristics of coating intended for use on concrete.

C. Corners: Fillet or Chamfer, rigid plastic wood strip of suitable size.

D. Flashing Reglets: Galvanized steel or rigid PVC, 0.8 mm thick, longest possible lengths, with alignment splines for joints, release tape sealed slots, anchors for securing to concrete formwork.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

E. Water Stops: - Polyvinyl choride water stops in accordance with B.S. 2571 and U.S. Corps of Engineers CRD - C 572 - 74 to the required width with maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

PART 3 WORKMANSHIP

3.01 EXAMINATION

A. Verify lines, levels and centres before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301 ACI 347.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.07 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, are secure.

3.08 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 03200

STEEL REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.02 RELATED SECTIONS

A. Section 03100 - Concrete Formwork.

B. Section 03300 - Cast-in-Place Concrete.

1.03 REFERENCES

(1) Applicable standards referred to in this section.

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

D. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

E. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

F. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.

G. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.

H. CRSI - Placing Reinforcing Bars.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300 submittals.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI - Manual of Standard Practice ACI 301, ACI 318-89.

B. Maintain one copy of each document on site for the use of Engineer.

1.06 COORDINATION

A. Coordinate work under provisions of Section 01039.
B. Coordinate with placement of formwork, formed openings and other Work.

PART 2PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: Minimum Compressive strength of 460N/mm2 yield grade deformed billet steel bars, unfinished.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gauge annealed type or 18 gauge stainless wires.
B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapour barrier puncture.
C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel or Stainless steel type; size and shape as required.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice ACI 318 ANSI/ASTM A184.

B. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Engineer.

PART 3WORKMANSHIP

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapour barrier.

C. Accommodate placement of formed openings.

D. Maintain 40mm concrete cover around reinforcing

E. Conform to applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01400 quality control.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete.

1.02 RELATED SECTIONS

A. Section 03100 - Concrete Formwork: Formwork and accessories.

B. Section 03200 - Steel Reinforcement.

1.03 REFERENCES

(1) Comply with the following codes, specifications and standards, except where more stringent standards are required by this specification, or as shown on the Drawings.

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 302 - Guide for Concrete Floor and Slab Construction.

C. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

D. ACI 308 - Standard Practice for Curing Concrete.

E. ACI 318 - Building Code Requirements for Reinforced Concrete.

F. ASTM C33 - Concrete Aggregates.

G. ASTM C150 - Portland Cement.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300 submittals.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700 Project closeout.

B. Accurately record actual locations of embedded utilities and components which are concealed from view.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301, ACI 318 building code requirements or for reinforcement concrete.

1.07 COORDINATION

A. Coordinate work under provisions of Section 01039 co-ordination and meeting.

B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement Generally:-

(1) Sulphate resisting cement to ASTM C 150, type V for all Structural Works

B. Aggregates Generally:-

- Use aggregates from natural sources to ASTM C 33 for all concrete .Do not use aggregate that contain more than 1% of free mica by volume of fine or coarse aggregates, or other deleterious materials in such form or in sufficient quantity to adversely affect the strength, at any age, or the durability of the concrete. Such materials include clay, particularly as an adherent coating, flaky or elongated particles, and shale or other laminated material, coal or other organic impurities, iron pyrites and soluble sulphate salts such as those of calcium, magnesium and sodium.

- Maximum size of aggregates shall be 20 mm.

C. Coarse aggregate:-

- Shall be crushed natural gravel or crushed rock of suitable shape and grading having hard, strong, durable pieces free from an adherent coating. Coarse aggregates shall be washed thoroughly to remove clay, silt, bark, sticks, alkali, organic matter or other deleterious matter. Coarse Aggregate Particle Gradation is as follows.

Sieve Size	Percent Passing
# 4	100%
3/8 inch square	80% - 100%
1/2 inch square	10% - 40%
3/4 inch square	0% - 4%

D. Fine aggregate:-

- Shall be natural sand or crushed gravel sand complying with ASTM C 33 having hard, strong, durable particles free from an adherent coating. Fine aggregates shall be washed thoroughly to remove clay, loam, alkali, organic matter or other deleterious matter. Fine Aggregate Particle Gradation is as follows.

Sieve Size	Percent Passing
# 4	95% - 100%
# 8	85% - 95%
# 16	45% - 85%
# 30	40% - 60%
# 50	10% - 30%
# 100	2% - 10%
# 200(wet)	0% - 2.5%

ALL AGGREGATES; shall be screened and washed and shall have less than the following maximum salt contents as acid soluble chlorides and sulphates. The table also shows the maximum salt contents allowed in the mixed concrete.

	Chlorides	Sulphate
Percent by weight of fine aggregate	0.06	0.4
Percent by weight of coarse aggregate	0.03	0.4
Total in concrete as percent by weight of cement.	0.05	2.4*

* Exclusive of Sulphate Content of cement

E. Water:-

(1) Water for mixing:
Obtain water for mixing concrete and other cement products from potable supply system. DO NOT use well water.

(2) Water for curing:-
Water from the potable supply system, do not use sea water.

2.02 ADMIXTURES

1. Super plasticisers to ASTM C 494, type "A".

2. Concrete retarding to ASTM C 494 type "B" or "D" select the suitable admixtures which may used in concrete mixtures for "Special Structural Concrete" with prior acceptance of the Engineer.

3. The Engineer shall be advised in advance of the following data:-

a) The typical dosage and detrimental effects of under-dosage and over-dosage.

b) Chemical name(s) of the main active ingredient(s) in the admixture.

c) Whether or not the admixture contains chlorides, and if so, the chloride of the admixture expressed as a percentage of equivalent anhydrous calcium chloride by weight of admixture.

d) Whether or not the admixture leads to the entertainment of air when used at manufacturer's recommended dosage.

Admixtures required in the works shall be obtained from reliable manufacturers whose products he proposes to use for the acceptance of the Engineer and these must be used strictly in accordance with the manufacturer's instructions.

2.03 ACCESSORIES

A. Vapour Barrier: Polyethylene sheeting minimum 0.15 mm thick of approved manufacturer, test in accordance with ASTM E 96 and E 154, and shall be laid below grade application.

2.05 CONCRETE MIX

A. Design Mix

All concrete used shall have a minimum of following compressive strength at 28 days. The cement shall be Sulphate resistant for all structural concrete works. A cover of 50mm shall be provided for below grade concreting and 40mm cover for above grade.

1 Concrete Compressive Strength for all Structural Works(cast in place) — 35 N/mm2

2 Blinding concrete — 10 N/mm2

B. Concrete used for all works, which has 35 N/mm2 of compressive strength at 28 days shall have following qualities.

Minimum Cement Content: - 420 kg/m3
Water Content: - 199liters/m3
Water cement ratio: - 0.45
Nominal maximum size of aggregate: - 3/4 inch
Coarse Aggregates Content: - 1120 kg/m3
Fine Aggregates Content: - 685 kg/m3
Air Content: - 5 to 8%
Slump at time and point of discharge: - 160 to 230mm
Chemical admixtures: - According to ASTM C 494

C. The Contractor shall furnish to the Engineer for approval before commencing any concrete work on Site the design of the mix he proposes to use.

2.06 BONDING AGENTS AND ADHESIVES

A. Bonding Agents as required

B. Primer and Sealers: As recommended by the adhesive and bonding agent manufacturers.

2.07 CONTROL AND EXPANSION JOINTS

A. Joint Filler: Pre-formed, non-extruding asphalt impregnated resilient material; ASTM D 1752, Type 1, 3/8 inch wide by depth required to bring top surface within 1/2 inch of slab surface.

B. Joint Sealer: Self-levelling Polyurethane, ASTM C920, Type M, Grade SL, Class 25. Colour: gray.

C. Expansion Joint Cap: Removable, high impact extruded polystyrene, placed on joint filler during concrete placement.

2.08 WATER STOPS

A. PVC water stop materials shall be an elastomeric plastic compound, the basic resin of which shall be polyvinyl chloride, and containing any additional resins, plasticizers or other materials needed for the material to comply with the requirements specified.

B. PVC water stop materials shall meet the following physical requirements:

Physical Property Value	ASTM Std.
Tensile Strength – min. MPa14.0	D412, Die C
Ultimate Elongation – min. (%)300	D412, Die C
Low Temp. BrittlenessPass	D746
Stiffness in Flexure – min. MPa8.3	D747
Specific Gravity - max104	D792
Accelerated ExtractionPass	CRD C572*
Effect of AlkaliesPass	CRD C572*
Water Adsorption – max. (%)0.5	D570

C. Water stops shall be 210mm x 9mm thick multi – rib type with Canter bulb for construction, Control and expansion joints.

D. Water stops for all joints shall be continuous around the corners and intersection, either in horizontal or vertical direction, as indicated on the Drawings. Field splices and joints shall be made in accordance with the water stop manufacturer's instruction, using a thermostatically controlled heating iron.

PART 3 WORKMANSHIP

3.01 EXAMINATION

A. Verify site conditions under provisions of Section 01039 coordination and meetings.

B. Verify requirements for concrete cover over reinforcement.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and/or construction joint device are not disturbed during concrete placement.

D. Install vapour barrier under concrete on grade. Lap joints minimum 150 mm and seal watertight by sealant applied between overlapping edges and ends taping edges and ends.

E. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

F. Place concrete continuously between predetermined expansion, control, and construction joints.

G. Do not interrupt successive placement; do not permit cold joints to occur.

3.04 CONSTRUCTION JOINTS

A. Form all joints perpendicular to main reinforcement. Continue reinforcing across joints, unless otherwise indicated; provide longitudinal keys at least 1-1/2 inch deep at all joints in walls between walls and slabs or footings. Remove key forming wood inserts and thoroughly clean surface of concrete at all joints before placing next lift.

B. Roughen surface of concrete at joints and remove laitance to obtain bond before placing next lift; if use of keys is impractical due to congestion or inaccessibility or if it is inadvisable to disturb surface before it has hardened, use only wet sandblast method for preparing surface.

C. Dampen hardened concrete of joints between footings and walls, joints in unexposed walls, and all others not specifically mentioned here in after and roughen by air water cutting.

D. Dampen hardened concrete joints in exposed work and roughens by air/water cutting. Thoroughly cover joint surfaces with neat cement mortar of similar proportions to mortar in concrete; apply mortar as thick as practicable on vertical surfaces and a minimum of 1/2 inch thick on horizontal surfaces; places next lift before mortar has reached its initial set.

E. For bonding new concrete to existing concrete use bonding agent. For grouting dowels and reinforcing bars use specified adhesives in accordance with manufacturer's instructions.

F. Provide key forming wood inserts strips in walls; pour concrete to 1/2 inch above lower edge or strip.

3.04 CONTROL AND EXPANSION JOINTS

A. Provide control joints at maximum of 5m each way, unless otherwise noted, in interior slabs on grade. Where saw cut joints are permitted, start cutting as soon as concrete has hardened sufficiently to prevent dislodgement of aggregates. Saw a continuous slot to a depth of one – forth the thickness of the slab but not less than 1 1/4 inch. Complete saw cutting within 12 hours after placement.

3.05 CURING AND PROTECTION

A. Careful attention shall be given to the proper curing and protection of all new concrete. This work shall be protected from the elements, fast flowing water and from defacement. Concrete shall be cured for a period not less than that given in the following table by methods that shall ensure that cracking, distortion and efflorescence are minimized:

Type of Structure	**Curing Time (Days)**
Vertical Walls and Roof Slabs	14
Bedding Concrete	3
Supporting for Existing Concrete	14
Other Minor Structure	7

B. Components which are intended to have a similar exposed surface finish shall receive the same treatment.

C. Care shall be taken not to disturb the concrete by direct or indirect loading, striking of forms or otherwise, until it has hardened sufficiently.

D. Construction loads shall not be allowed on beams, decks or slabs until the concrete has attained its designed strength, nor shall the Contractor impose loading exceeding the design loading.

Water Curing

E. Concrete shall be moist cured by maintaining all surfaces wet continuously (not periodically) for the duration of the entire curing period or until covered with fresh concrete. Wooden forms shall be wetted immediately after concrete has been poured and shall be kept wet with water until removed. Water for curing shall be free from any elements which will cause staining or discoloration of the concrete.

Curing With Moist Earth

F. The surface shall be covered with moist earth minimum 0.15 meter thick, for not less than four (4) hours and not more than twenty four (24) hours after the concrete are placed.

3.06 CONCRETE FINISHING

A. FAIRFACE CONCRETE: White cement exposed aggregate finish to match precast concrete unless otherwise described in the Contract, all formwork joints for exposed surface of concrete finish shall form a regular pattern with horizontal or vertical lines continuous through each structure and all construction joints where permitted shall coincide with these horizontal or vertical lines.

B. INTERIOR EXPOSED CONCRETE SURFACES OF WALLS

1. Unless otherwise shown, leave with a smooth finish, even textured and free of blemishes. Repair of replace defective areas, as directed. As soon as the face forms are removed, remove all fins and other projections carefully, level offsets and grind where necessary. Repairing, replacing and pointing and filling voids shall be done to the Engineers satisfaction. Patch as specified under paragraph "Patching".

2. Do not sprinkler dry cement or mixture of dry cement and sand on the surface to absorb moisture. Remove excess moisture by either a patented absorption process or vacuum processes.

3. Thoroughly compact the topping by using motor-driven floats of metal discs or by roller weighing not less than 10 lbs per linear inch. Finish by troweling, and broom to produce a non skid surface.

4. Start curing as soon as practicable and maintain for at least 7 days.

5. DUSTPROOFER

Apply two coats of dust proofer in accordance with the approved manufacturer's printed instructions.

C. EPOXY PAINTS FOR CONCRETE TANKS

1. Primer Epoxy Coating for Concrete Tanks: Material must have a high viscosity self-priming paint that is highly resistant to rust, corrosion, fumes, chemical attacks and excellent resistance to oils, solvents, alkalis and most dilute acids. It must be water impermeable that penetrates on concrete substrates when applied while leaving a tough film on the surface.

Concrete must be cured 28 days 24C and 50% relative humidity or equivalent. Prepare surfaces in accordance with ASTM D4258 Surface Cleaning of Concrete and ASTM. Dry film thickness shall be-4-5 mils per coat. Material shall have a pot life of 1-2 hours @ 25C.

2. Top Coat Epoxy Coating for Concrete Tanks; Paint material must be highly resistant to rust, corrosion, UV exposure, fumes and chemical attacks.

Epoxy coating material shall be fixable, with minimum impact resistance of 16 kgs. It shall have a minimum dry to coat of 3 hours at 29°C at a spreading rate of 24 sq.m. per gallon at dry film thickness of 3 mils.

3.07 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section quality control.

B. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

C. Two concrete test cylinders will be taken for every 25 cu m of each class of concrete placed.

D. One slump test will be taken for each concreting.

3.08 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections in accordance with ACI 301.

3.09 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION

SECTION 03411

STRUCTURAL PRECAST CONCRETE

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Concrete quay wall units.

1.02 RELATED SECTIONS

A. Section 03300- Cast- in -Place Concrete: Concrete topping and reinforcement.

B. Section03100-Concrete formwork.

C. Section 03200 - Concrete reinforcement.

1.03 REFERENCES

A. PCI MNL-116 - Manual for Quality Control for Plants and Production of Precast and Pre stressed Concrete Products.

B. PCIMNL120-Design Handbook –Precast and Pre stressed Concrete.

C. BS 8110- Structural of concrete.

1.04 SUBMITTALS FOR REVIEW

A. Section 01300 - Submittals: Procedures for submittals.

B. Shop Drawings: Indicate layout, unit locations, fabrication details, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials, and sealed by a Professional Structural Engineer.

C. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.

D. Samples/trials: The Contractor shall cast three test samples of both the revetment crest wall element and the quay wall units. These shall be cast, compacted and cured in the manner intended for the rest of the units and monitored to assess:

heat of hydration
surface finish and color
extent of shrinkage cracks

After 28 days cores shall be taken from the units at positions to be agreed with the Engineer and permeability- strength and water absorption tests shall be undertaken. Once approved these units shall be kept on view

1.05 SUBMITTALS FOR INFORMATION

A. Section 01300 - Submittals: Procedures for submittals.

1.06 QUALITY ASSURANCE

A. The supply and delivery of precast concrete shall comply with the recommendations of

BS8110. Ordinary Portland cement shall comply with BS 12.

1.07 REGULATORY REQUIREMENTS

A. Conform to ACI 318 and BS81IO for design

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Section 01600 -Material and Equipment: Transport, handle, store, and protect products.

B. Handle precast members in position consistent with their shape and design. The units shall only be lifted by the support points detailed by the Contractor the Contractor shall note that the precast units on the project are plain concrete elements and he shall plan his lifting points/method accordingly.

C. Provide and use lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation and erection.

D. Protect members to prevent staining, chipping, or spading of concrete.

E. Mark each member with a unique reference number, incorporating date of production

F. Keep record for inspection by the Engineer of the date of casting, date of striking, date and location of installation and an, other information requested.

G. Precast units shall not be stacked unless arrangements are made to the satisfaction of the Engineer and in any case, not until the 28 day strength has been achieved.

PART 2 - PRODUCTS

2.01 MATERIALS

A. See section 03300 for concrete mix design, concrete batching, concrete mixing transporting concrete, placing of concrete, testing requirements, finishes and joints.

B. All Precast concrete has to be grade C40

C. All Plain cement concrete (PCC) shall be C25.

2.02 FABRICATION

A. Fabrication procedure to conform to PCI MNL-I 16.

B. Maintain plant records and quality control program during production of precast members. Make records available upon request

C. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on Drawings.

D. All concrete quay walls, crest wall units and slipway slabs and kerb units shall not be moved until the concrete has achieved strength.

2.03 FINISHES

A. Ensure exposed-to-view finish surfaces of precast concrete members are uniform in color and appearance.

B. Cure members under identical conditions m develop required concrete quality, and minimize appearance blemishes such as Non-uniformity, staining, or surface cracking.

C. Rubbed Finish. Surface holes or bubbles over 6 mm filled with matching cementitious paste, fins or protrusions removed and surface ground smooth, stiff ice then rubbed with neat cementitious paste to smooth and even color and texture.

2.04 FABRICATION TOLERANCES

The Dimensions of blocks and units shown on the drawings are theoretical and the layout of the blocks indicative of architectural requirements. The Contractor shall produce shop drawings showing actual block dimensions to suit programme and placement progression and dimensions of blocks at which tolerance is to be adjusted to suit actual conditions

A. Maximum Variation From Nominal Dimension: 10 mm

B. Maximum Variation from Intended Camber: 10 mm.

C. Maximum Out of Square: 3mm per 3m length non-cumulative.

D. Maximum Misalignment of Inserts, Openings 3mm.

E. Maximum Bowing of Members: Length of Bow divided by 360.

F. The dimensions and location of shear keys show indicative requirements. The Contractor shall determine and check exact requirements in his detail of precast blocks. The agreed dimensions of blocks shall not be varied during fabrication. The top and bottom surfaces shall not be convex.

2.05 SOURCE QUALITY CONTROL AND TESTS

A. Section 01400 -Quality Control: Provide mix design for concrete.

B. Provide shop inspection and testing for crest wall units.

C. Test samples in accordance with applicable ASTM standard.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that site conditions and reads to receive work and field measurements are as Drawings.

B. Verify that concrete wall rubble layer has been placed, leveled to within the required tolerances and is free from silt and debris.

C Verify that units have achieved the specked strength before lifting.

3.02 PREPARATION

A. Not less than 28 days prior to the programmed commencement of placing precast concrete blocks and crest wall units, the contractor shall submit to the Engineer for approval a detailed method statement. Thus shall include but not be hunted to the following information:

a) Programme of works
b) Method of lifting units and transporting including any relevant structural calculations regarding lifting hooks.
c) Method of placing the units to the required tolerances.
d) Plant to be used
e) For blocks to be placed at the base of the vertical wall this shall include details of achieving the correct line and level of the toe.

B. Prepare support equipment for the erection procedure, temporary bracing, and induced loads during erection. Prepare revetment surface by leveling the fill material and placing minimum 75 mm blinding to receive crest units,

3.03 PRECAST BLOCKS-GENERAL

A. The manufacture of precast concrete components shall be in accordance with the recommendations contained in BS 0110.

B. Three trial units for each type of precast unit shall be cast and erred in the same manner as intended for the remaining units. These units shall demonstrate consistency, achievement of the requirements of the specifications and shall form the benchmark for other units. The Engineer may instruct such tests on these units as he considers necessary. Trial units may be incorporated into the works as the last units to be placed at the Engineer's discretion.

C. Precast units that fail to reach the agreed standard may be rejected by the Engineer, in which case they shall be removed from site and disposed of at the Contractor's expense. Patch repairs to units that fad to reach required standards will not be acceptable.

D. The moulds of all precast concrete works shall be to the accurate dimensions and shapes us shown on the Drawings and shall be of sound construction. Moulds shall be thoroughly cleaned before each casting. Exposed faces shall be trowelled smooth. All edges of the precast units shall be formed with a chamfer as shown on the Drawing.

E. Moulds for blocks shall be of robust steel construction, close jointed and fixed tree and square on the beds. The moulds shall permit blocks to be accurately cast to achieve the tolerances in placing without the need for in situ grinding. Bulging, distortion and spreading shall be prevented when the concrete is poured Moulds shall be demountable without causing damage to the blocks.

F. An excellent surface finish is required on visible surfaces and moulds and casting orientation shall be developed in order that the best surface finish can be achieved.

G. The standard of workmanship and the quality of materials used in the manufacture of all precast components shall comply with the relevant clauses of this specification.

H. Detailed records of mixes, cubes, curing methods, dates of manufacture, etc., shall be kept and submitted to the Engineer within 7 days of manufacture.

I. All precast members shall be marked with a unique reference.

J. The Contractor shall be fully responsible for supplying adequate lifting points and equipments as necessary to ensure the safe handling, transport and erection of the precast members.

K. Holes left in the precast units to facilitate lifting shall be neatly pointed with an approved expanding grout as soon as the units are finally positioned

L. Stacking of precast units shall be properly carried out after curing in a separate area set aside for that purpose and so arranged that the units may be removed and used in the order in which they were cast.

M. Where in situ concrete is placed against precast concrete the precast elements shall be prevented from movement during the placing of the in situ concrete. Where construction joints are required between pre-cast and in-situ elements the joint shall be treated in acceptable manner

N. Generally the external faces of precast units which will be visible after their inclusion in the Works shall be finished with a fair face as described in the relevant section of this Specification.

O. Leveling devices shall only be released or removed with the Engineer's approval.

P. At all stages of construction, the Contractor shall adequately protect installed precast concrete units and other concrete associated therewith to prevent damage to permanently e. posed concrete surfaces.

Q. Damaged concrete elements shall not be dispatched to the Site and elements which sustain damage during transportation shall be removed from the Site and replaced at the Contractor's expense. The same prevision shall apply to precast elements damaged prior to or during erection into the Works or thereafter Only minor repairs as approved by the Engineer will be permitted to be carried out to precast elements at the Site.

R. Generally the external faces of precast units, which will be visible after their inclusion in the Works, shall be finished with a fair face as described in the relevant section of this Specification. If necessary to prevent the formation of blowholes a controlled permeability formwork liner should be used.

3.04 PLACING

A. Blocks shall only be placed on underlying materials which comply with the specified tolerances for line and level. No block shall be placed until the underlying material has been approved by the Engineer as ready to accept the block. Such approval shall not relieve the Contractor of his responsibilities under the Contract.

B. The Contractor shall excavate disturbed material from foundation trenches and shall clean out all loose and soft material and the trench prepared in minimum lengths for inspection by divers.

The divers shall inspect the trench for clean mess and will sample the material of the trench bottom. On receipt of approval from the Engineer; the Contractor shall immediately proceed to place the foundation

The contractor shall remove loose material encountered below the block work wall. In this context `loose' shall be considered as material with SPT<l7. This shall be determined by probing the excavated trench at a maximum of 5m centers.

C. Precast units shall be placed to the lines and levels stated on the drawings within the tolerances stated herein.

D. Units shall be placed without damage to structural capacity, shape or finish. Replace or repair damaged members.

E. Align and maintain uniform horizontal and vertical joints, as erection progresses.

F. Concrete block units shall be placed in accordance with the overlap / reverse overlap pattern shown on the drawings. The nominal overlap dimension shall be 0.5m

G. Maintain temporary bracing in place until final support is provided. Protect members from staining.

H. Provide temporary lateral support to prevent bowing, twisting, or warping of members.

I. Adjust differential camber between precast members to tolerance before final attachment.

J Place fill material and armour stones against crest units maintaining line, level and integrity of units.

K. Surfaces of joints shall be clean and free of loose material before blocks are placed.

3.05 ERECTION TOLERANCES

A. Section 01400 -Quality Control: Tolerances.

B. Erect members level and plumb within allowable tolerances.

C. Each block shall be placed hard up against the adjacent block. Joints or parts of a joint shall not be open in excess of 10 mm.

D. The dimensions of precast concrete blocks as shown on the drawings are theoretical and an allowance of 10mm has to be made for joints. The tolerance to be allowed in the manufacture of the blocks shall be agreed on site taking into consideration the local conditions of manufacture and placing

E. Blocks shall be placed to the following tolerances: Alignment:

a) Adjacent blocks <10mm

b) Level: <25mm

F. Final Tolerance:
The cope line of the capping block shall comply with the following tolerances

Alignment <10mm

Level <10mm

The variation from the main line shall not exceed 5mrn over a 5m length.

3.06 CLEANING

A. Clean weld marks, din, or blemishes from surface.

END OF SECTION