



TENDER DOCUMENT

FOR

CONSTRUCTION OF DRIVE THRU CASHIER STATIONS

Prepared by:
Belize Electricity Limited
Facilities Department
2 ½ Miles Phillip Goldson Highway
Belize City, Belize
May 2024

The Belize Electricity Limited (BEL) has available funds to undertake the financing of the **2024 Capital Project**. BEL intends to apply part of the funds to cover eligible payments under the contract for the Construction of Drive Thru Cashier Stations at the BEL Corporate Headquarters Compound.

Bidders will be required to submit a fixed price quotation via the price schedule linked [here](#) and provide all equipment and materials. Please see attached drawing [here](#) for you to reference to and submit your quotation. Proposals will be accepted by email only and should be submitted to bidsubmittal@bel.com.bz by **Friday, June 21, 2024, no later than 3:00 p.m.** local time and labeled:

BID #2024-2378 Construction of Drive Thru Cashier Stations

IMPORTANT DATES

- Mandatory Site Visit at the BEL Corporate Headquarters Compound: 10:00 a.m. local time on Monday, June 3, 2024
- Questions or queries can be emailed to bidboxrequest@bel.com.bz and will be addressed on or before Friday, June 7, 2024.
- Bid Due Date: 3:00 p.m. local time on **Friday, June 21, 2024**

BEL shall not be bound to give any reason for not accepting any tender and shall not defray costs incurred by the Bidders.

TERMS OF BIDDING AND EVALUATION CRITERIA

1. Scope of Bid

- 1.2 The Employer, as defined in the Service Contract, invites bids for construction of Drive Thru Cashier Stations at Belize Electricity Limited (BEL) Headquarters Compound. The work is inclusive of all site preparation, construction, mechanical, electrical and finishing. The required works are detailed below under 'Contract Services'. A draft contract is shown in Appendix 1.
- 1.3 The successful Bidder will be expected to complete the works by the intended completion date as specified in the contract (see Appendix 1). Queries and clarifications relating to this tender will be addressed during the mandatory site visit and via email to bidboxrequest@bel.com.bz on or before **3:00 p.m. on Friday, June 7, 2024.**

2. Site Visit

- 2.1 The Bidder, at their own responsibility and risk, is encouraged to visit and examine the 'Site of Works' and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for all related works. A one-time **mandatory site visit** will be scheduled for **10:00 a.m. local on Monday, June 3, 2024.** The costs of visiting the site shall be at the Bidder's own expense.

Site Location:

Belize Electricity Limited
BEL Corporate Headquarters Compound
2.5 Mile Philip Goldson Highway.
Belize City, Belize.

3. Contract Services

The Bidder shall, in consultation with the Employer:

- 3.1 Provide all necessary equipment/materials and labor for the site preparation, construction and finishing Drive Thru and associated accessories. This will also include removal and installation of fence and installation of gate as identified. Securing work area with temporary fencing clearly demarcating the construction zone and appropriate signage.
- 3.2 Provide all equipment/material and labor for all electrical works inclusive of but not limited to; the supply and installation of power supply to cashier station and Drive Thru Canopy, all power supply & network cable to be placed in cable trays. This will encompass wiring from the distribution panel to the Drive Thru Cashier stations, motorized gate and pneumatic vacuum system, inclusive of trench works and placement of markers as identified by BEL personnel.
- 3.3 Provide all equipment/material and labor for the commissioning of civil, electrical and mechanical systems upon completion of all works. This is to be done in conjunction with all relevant BEL personnel.
- 3.4 Provide all necessary equipment and labor to clean the Drive Thru Cashier Station and surrounding area at the end of construction works.

- 3.5 Ensure that employees are using their Personal Protective Equipment (PPE) such as hardhat, working gloves, goggles, proper footwear, and safety harness whenever necessary when engaged in works on BEL's compound.
- 3.6 Provide safety barriers when working in active areas such as caution tapes, cones and warning signs.
- 3.7 Provide all equipment's/material & labor for the construction of hot mixed access road for the drive Thru with all road markers and reflectors.

4. SCHEDULE OF PRICES

Fill out all worksheets in the excel file linked [here](#) and submit only this file as your quotation to bidsubmittal@bel.com.bz on or before the deadline.

BID# 2024-2378 – Construction of Drive Thru Cashier Stations

5. Administrative Information

Type of contract: Lump sum contract

Payment schedule

The payment for Construction works shall be made as follows:

- Mobilization payment: 10%
- Interim payments: 80%
- Final payment: 10%

Evaluation Criteria

Bids will be evaluated using the criteria below:

- i. Pricing (70%)
- ii. Project Duration (30%)

APPENDIX 1

DRAFT CONTRACT

BELIZE ELECTRICITY LIMITED

SERVICES CONTRACT FORM

Contract No: _____
Service Type: _____
Service Zone: _____
Contract Period: _____
Support No: _____
PO or ReqNo: _____
Insurance: _____

AN AGREEMENT made the __ day of _____ Two Thousand and Twenty Four BETWEEN **BELIZE ELECTRICITY LIMITED** a company incorporated under the laws of Belize with its registered office situated at Mile 2½ Philip Goldson Highway, Belize City, Belize (hereinafter called “the Company” of the one part) and _____ situated at _____ hereinafter called “The Contractor” of the other part).

WHEREBY IT IS AGREED as follows:

1. The Company hereby engages and the Contractor hereby agrees to carry out the work set out in the schedule to this Agreement.

2. The Term of this Agreement shall be agreed on by the Company and the Contractor and shall be stated in a **WORK SCHEDULE CONTRACT** signed by both parties and attached to this Agreement as Schedule 2; provided that in the event of non-completion of the work by the Contractor within this period the Company may in its sole discretion extend the time for completion. Such extension of time shall not constitute a renewal of this agreement and no further consideration shall be payable to the Contractor during the period of such an extension. Provided, also that in the event of death, disability or other incapacity resulting in the inability of the Contractor to perform the work herein agreed this Agreement may be terminated and all compensation due hereunder shall cease as of the date of death, disability or other incapacity.

3. The Contract price shall be \$ XXXX and shall be payable as follows:

i. \$ _____ To be paid on the signing of this agreement.

\$ _____ To be paid as approved by a Company agent or representative and as follows:

a. \$ _____ After the works are half complete

b. \$ _____ Weekly

ii. \$ _____ Bi-weekly

iii. \$ _____ to be paid upon completion to the satisfaction of the Company as certified by a Company agent or representative.

4. Any money paid to the Contractor prior to the completion of the work herein agreed will be deducted from the sum of \$ _____ and in any event the sum of \$ _____ will be retained to be paid after completion.

5. It is expressly agreed that the Contractor is acting as an independent contractor in performing the work herein agreed. The Company shall not make any contributions to Social Security or withhold any taxes nor provide any other contributions or benefits, which might be expected in an employer-employee relationship.

6. The Contractor agrees to provide all the materials and labor necessary for the carrying out and completion of the work herein agreed and to perform his obligations under this Agreement in a professional and workman like manner.
7. The Contractor agrees that, in accordance with his status as an independent contractor, he will be solely responsible for his employees including all monies that may become due and payable to or on behalf of said employees under any law or agreement and all obligations imposed by any law or agreement and that he shall abide by all laws existing and applicable in an employer-employee relationship.
8. For the purpose of monitoring and assessing the progress and quality of the work herein agreed, the Company shall have access to the Contractor's accounting records, personnel, job sites, offices, and other sites and information relating to the conduct and completion of the work; provided that the Company shall give the Contractor reasonable notice of the intention to enter into any premises belonging to the Contractor or to question any of the Contractor's employees or review any documents.
9. The Contractor agrees to indemnify, defend and hold harmless the Company from and against all or any claims, demands, expenses, costs damages and liabilities, including legal fees that the Company shall incur or suffer which arise out of or result from or in any way relate to any breaches of this agreement on the part of the Contractor. The Contractor shall, at its own expenses, maintain suitable insurance in relation hereto.
10. The Contractor shall indemnify the Company against all claims for injuries, damages, or losses occurring on the Company's premises and arising out of the Contractor's or its agents' negligence, incompetence or misconduct. The Contractor shall maintain suitable insurance to cover claims under this clause and the Company shall be entitled to assess the suitability of the Contractor's insurance. Provided that if it is impractical for whatever reason for the Contractor to obtain insurance coverage as required under this clause, the Contractor shall provide evidence of impracticality to the Company and the Company may, in its sole discretion, waive the requirement for insurance.

11. The Company may, at its own option by giving thirty days' notice of its intention, terminate this Agreement, if:
 - a. Through negligence or any other fault, the Contractor fails to perform the services in a satisfactory manner or ceases or fails to perform any condition or stipulation of this Agreement, or
 - b. If the Contractor voluntarily or otherwise enters into a process of dissolution, or
 - c. If the Contractor becomes liable to have his goods seized under a writ of fieri facias or is the subject of any bankruptcy proceedings.

12. The Contractor shall not assign any of the rights or obligations derived from this Agreement in whole or in part and shall not sub-contract the work itself without the prior written consent of the Company.

13. In the case of an authorized sub-contract, the Contractor will remain liable to fulfill all its obligations and conditions hereunder and any such sub-contract will in no way be a release of the Contractor from its obligations and liabilities hereunder.

AS WITNESS the hand of the parties the day and year first above written

SIGNED BY

For and behalf of Belize Electricity Limited

Procurement Manager

Signature

SIGNED BY

Contractor Name

Contractor Signature

Witnessed by

Witness Name

Witness Signature

SCHEDULE 1

SCHEDULE 2

WORKS SCHEDULE CONTRACT

Payment Date request: _____

Date Of Contract: _____

Start Date of Works: _____

Completion Date: _____

Contract No: _____

Details of work completed:

Certified by:

(Contractor)

Signature: _____

Date: _____

Verified by:

(BEL Rep. Supervising Project)

Signature: _____

Date: _____

Approved by:

(BEL Project Manager)

Signature: _____

Date: _____

PAYMENT CERTIFICATE

(Payment Upon Signing)

This is to certify that _____
(Contractor) has satisfactorily completed _____% the works related to Contract
No. _____ which commenced on _____ (Date) and that the
works meet the specifications laid out in the Contract.

In accordance with the conditions and terms laid out in the contract, payment of _____
_____ (Net of 3% Gross Contract Payment Withholding Tax) is now due.

Project and Cost Category to be charged: _____

Prepared by:

_____ Signature: _____ Date: _____

(Works Supervisor)

Approved by:

_____ Signature: _____ Date: _____

(Name)

(Position)

Note: Original copy to be presented for payment.

Any contract exceeding \$3,000.00 is subject to GCPW tax.

PAYMENT CERTIFICATE

(No. _____ Interim Payment)

This is to certify that _____
(Contractor) has satisfactorily completed _____% the works related to Contract
No. _____ which commenced on _____ (Date) and that the
works meet the specifications laid out in the Contract.

In accordance with the conditions and terms laid out in the contract, payment of _____
_____ (Net of 3% Gross Contract Payment Withholding Tax) is now due.

Project and Cost Category to be charged: _____

Prepared by:

_____ Signature: _____ Date: _____

(Works Supervisor)

Approved by:

_____ Signature: _____ Date: _____

(Name)

(Position)

Note: Original copy to be presented for payment.

Any contract exceeding \$3,000.00 is subject to GCPW tax.

COMPLETION CERTIFICATE

Completion Date: _____

Project No. & Cost Category: _____

Contract No: _____

Works completed as per Schedule 1:

Site inspected by:

Signature: _____

Date: _____

(BEL Representative)

Date works/services inspected: _____

Certified by:

Signature: _____

Date: _____

(Contractor)

Verified by:

Signature: _____

Date: _____

(BEL Representative)

(Position)

Approved by:

Signature: _____

Date: _____

(Name)

(Position)

Signature: _____

(Contractor)

Date: _____

Signature: _____

(BEL Rep. supervising project)

Date: _____

SECTION V

SPECIFICATIONS

SECTION V: TECHNICAL SPECIFICATIONS

A.O GENERAL

- A. Coordination & Cooperation with other Contractors
- B. Alternatives
- C. Submittals
- D. Miscellaneous Design and Detailing
- E. Signage
- F. Hoarding

A. EARTHWORKS & EXCAVATION

B. CONCRETE WORK

C. WALLING

D. WOODWORK

E. DOORS & WINDOWS

F. FINISHINGS

G. ELECTRICAL

H. PLUMBING

SECTION A.0: TECHNICAL SPECIFICATIONS

SECTION A.0

TECHNICAL SPECIFICATIONS

A.0 GENERAL

A. Coordination & Cooperation with Other Contractors

The Contractor is responsible to coordinate and cooperate with all other listed Contractors on the project. The Contractor's Project Manager shall have regular coordination meetings with all

subcontractors and other contractors to ensure the smooth execution of the works. All conflicts and unresolved disputes shall be reported to the Engineer immediately in writing.

B. Alternatives

In cases where the Contractor proposes to utilize a product, which differs from the specifications in brand name, detail or other, then the Contractor shall submit in writing to the Engineer a proposal for change, which shall include the details of the specified product as well as the proposed product. The Engineer shall accept or reject the same in writing at his own discretion.

C. Submittals

In general, cut sheets and details of all products shall be provided to the Engineer for review before the ordering or purchase of the same. The Engineer shall offer objection or no-objection or approval of the same, but no-objection shall not relieve the Contractor of his responsibilities as it relates to the quality, defects and performance of the product.

D. Miscellaneous Design and Detailing

The drawings and specifications are intended to provide the general intent of the Clients requirements and as a result, the Contractor is responsible to detail and construct all miscellaneous items not expressly shown in the drawings or described in the specifications to provide a totally complete product. These include items such as certain connections details, fixings, bracings backing, etc. Submittals for all such details must be provided to the Engineer for no-objection prior to execution of such works. All proposals shall be of a high quality, appropriate for the intended use and conditions, and shall conform to prevalent industry standards.

SECTION A.0 (Contd.)

TECHNICAL SPECIFICATIONS (Contd.)

A.0 GENERAL (Contd.)

E. Signage

The Contractor shall erect, maintain and remove on completion signages as noted and required.

A. 1 No. 8' x 16' screen printed billboard project signs depicting

details of the project as directed.

B. Painted warning and convenience signs as required.

F. Hoarding

The Contractor shall allow to protect the site with suitable hoarding in the form of plywood, chain link, metal sheeting or other acceptable means that restricts access to the building area.

SECTION A: EARTHWORKS AND EXCAVATION

SECTION A

EARTHWORK AND EXCAVATION

A1 Survey

Before the work commences on the site, the Contractor shall agree the existing ground levels with the Engineer. In the event of the Contractor failing to do this, the levels assessed by the Engineer shall be taken as accepted by the Contractor.

A2 Site Clearance

The site shall be cleared of organic or unsuitable material and obstructions to the extent required or approved by the Engineer.

Where underground obstructions coincide with pile caps they shall be completely removed, and the excavation refilled with compacted suitable material. At other locations underground obstructions shall be cleared where they are within one meter of the final level, and backfilled similarly.

A3 Unsuitable Material

Where in the opinion of the Engineer, existing materials are unsuitable; the Contractor shall remove such unsuitable materials and replace it with fill material approved by the Engineer.

A4

Excavations

The Contractor shall carry out all excavations required for the Permanent Works in whatever material may be met including rock. All excavations shall be carried out to lengths, widths, depths and profiles necessary for the construction of the Works or to such other dimensions as may be approved in writing by the Engineer.

Where excavation is untimbered open cut, the Contractor shall be entirely responsible for ensuring that the side slopes are suitable for stability. The sides of excavation in trenches are to be made secure by means of adequate supports, timbering, close sheeting, timber and steel sheet piling as required for the work and the means adopted are to be to the satisfaction of the Engineer.

The excavation shall be carried out by the Contractor in such a way as to avoid disturbance to the surrounding ground. Particular care shall be taken to maintain stability when excavating in close proximity to existing works.

A5

Keeping Excavation Free from Water

The Contractor shall be responsible for keeping all excavations free from water from whatever cause arising and shall provide such pumping capacity as may be necessary for this purpose.

The Contractor shall make good at his own expense any damage that may result from the Contractor's failure to keep the excavation free from

water.

A6 Approval of Excavation

When the excavation, whether in open or in trench, have been accurately taken out to profiles or dimensions required for the work, due notice is to be given by the Contractor to the Engineer and the same is to be inspected by or on behalf of the Engineer.

A7 Excavation Beyond True Line and Level

If from any cause whatsoever excavations other than for concrete work are carried out beyond their true line and level other than at the direction of the Engineer, the Contractor shall at his own cost make good to the required line and level with concrete or other approved material and in such a manner as the Engineer, the Contractor shall, when directed by the Engineer, and at his own cost fill in the required line and level with concrete.

A8 Disposal of Spoil

The Contractor shall remove spoil from excavations and shall place it at the dumping point designated (or approved) by the Engineer for future use for filling and other circumstances.

All surplus spoil is to be loaded and carted away to a tip to be provided by the Contractor and agreed by the Engineer immediately prior to the completion of the Works.

A9 Materials for Filling

A9.1 Approved Filling Material

Fill shall be non-expansive of consistent type and quality and shall be subjected to the approval of the Engineer prior to use. A representative sample of any proposed material other than fill already on site shall be delivered to the Engineer's office at least 7 days before approval is required.

The Contractor shall carry out chemical tests on the fill materials to establish that it will not have an adverse effect on the concrete.

All fill materials shall be free from organic and other unsatisfactory material. Any lumps or rock exceeding 4" in greatest dimension shall, without extra payment, be either broken down to less than 4" or removed or used as directed by the Engineer.

A9.2 Approved Hardcore

Hardcore shall comprise natural material obtained from a source approved by the Engineer, well graded down to 1" the largest passing a 6" ring but may contain up to 5% by weight or sand and dust.

Hardcore shall be placed in layers not exceeding 8" thick, each layer being well compacted before the next layer is placed. Compaction shall be by hand-tamping using a heavy tamper and the hardcore shall be well watered

during tamping.

The hardcore base shall be blinded by sweeping sand into the interstices of the finally compacted hardcore and lightly tamped.

A10 Placing Fill Material

When the moisture content of fill material is below that considered necessary to achieve the specified degree of compaction, water shall be added and thoroughly mixed into the fill.

Similarly, when the moisture content is too high it shall be air drifted by scarifying, harrowing or other aeration process. The moisture content shall also be kept low enough to provide a stable working surface for hauling and compacting plant.

A10 Placing Fill Material Cont'd

Where the fill material is to be placed against previous filling where the slope is steeper than four horizontal to one vertical, the Contractor shall prepare the fill sub-grade by cutting horizontal benches at vertical intervals of not more than 4 feet.

A11 Filling Around Structures and Services

The Contractor is to take particular care in placing and compacting fill material around pipes, cables, structures and the like and is to take such

steps as may be necessary to prevent damage thereto.

When fill material is filled up to or over any structure, the filling shall be brought up equally on each side so that no unequal pressures likely to cause damage to the structure are applied.

A12 Compacting Fill Material

After each layer of fill material has been placed, spread evenly and brought to the proper moisture content, it shall be compacted to at least 95% relative compaction.

Compaction shall be accomplished with approved special purpose compaction equipment. The equipment shall make sufficient passes to ensure that the required density has been obtained everywhere. The Contractor shall complete the Schedule giving the Proposed Method of Compaction and this method shall be approved by the Engineer.

A13 Defects

The Contractor shall make good any damage or defects to the Work caused by settlement, slips or falls, or any other causes and shall carry out all the necessary work to prevent or remedy the same in accordance with the Conditions of Contract.

A14 Polythene Sheeting

Polythene sheeting shall be 1200-gauge polythene sheeting obtained from a manufacturer approved by the Engineer, supplied in rolls and laid by rolling over the prepared base at the levels and in the areas shown on the drawings. Where a joint is necessary at the side or end of a sheet, this shall be carried out in strict accordance with the manufacturer's printed instructions.

The Contractor shall protect the sheets from damage during laying and subsequent operations and shall replace all damaged sheets to the satisfaction of the Engineer.

SECTION B: CONCRETE WORK

CONCRETE WORK

B1 Cement Work

The cement to be used throughout the Works shall be Portland Cement obtained from manufacturers approved in writing and shall be as described under one of the following headings:

(a) Ordinary Portland Cement (OPC)

Cement complying with BS 12 but containing not less than 4% and not more than 13% proportion by weight of tri-calcium aluminate.

(b) Moderate Sulphate Resisting Portland Cement (MSRPC)

Cement complying with BS 12 but containing less than 4% and not more than 8% proportion by weight of tri-calcium aluminate, or cement complying with ASTM C150 type II. In either case the cement shall not contain more than 2.7% proportion by weight of Sulphur trioxide.

(c) Sulphate Resisting Portland Cement (SRPC)

Cement complying with either BS 4027 or ASTM C150 type V. Cement shall comply with the following requirements:

- (a) The acid-soluble alkali level measured as $(NA_{20} + 0.658 K_{20})$ shall not exceed 0.6% by weight.
- (b) The heat of hydration shall not exceed 75 calories per gram at 7 days when tested in accordance with ASTM C 186.
- (c) The specific surface shall not be greater than 325 sq. m/kg and not less than 225 sq.m/kg when tested as described in BS 4550 Part 3 Section 3.3.
- (d) The temperature of the cement shall not exceed 50 C at the time of incorporation into a concrete mix.

B2 Cement Testing

Cement shall be certified by the manufacturer as complying with the requirements of the appropriate specification. Before ordering cement, the Contractor shall submit details of the proposed supplier and information on the proposed methods of transport, storage and certification for approval and show that the quantity and quality required can be attained and maintained throughout the construction period.

Representative samples of the proposed cement may be required to be taken and forwarded to an independent laboratory for analysis before the

source is approved.

B3 Aggregate Generally

The Contractor shall obtain approval of proposed aggregate sources, and shall select suitable aggregate and samples of sand and stone for specified testing before obtaining aggregate. Laboratory tests shall be made at regular intervals to confirm the suitability of aggregate.

B3.1 Quality Testing

Aggregate shall be free from earth, clay, loam and soft, clayey, shaley or decomposed stone, organic matter and other impurities and shall be hard and dense. The percentage of hallow shells shall be limited and is unlikely to exceed

3% by weight retained on a BS 2.36 mm sieve if approved concrete is to be

produced. Aggregate to be used in the construction of structures from retaining aqueous liquids shall comply with Clause 21.2.3 of BS 5337. Aggregate shall conform in all respects with BS 882 and 1201.

The following shall apply when tested in accordance with

BS 812: Aggregate crushing value shall not exceed	20%
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Water absorption shall not exceed	2%
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B3.1 Quality Testing Cont'd

The following criteria shall be ascertained by testing to assess the suitability of aggregate:

- (a) Grading
- (b) Specific gravity and water absorption
- (c) Clay, silt and dust content
- (d) Organic impurities
- (e) Elongation and flakiness
- (f) Moisture content

The frequency of tests (a) to (f) shall be in accordance with the following tables:

<u>Frequency Once Per Period of Days</u>		
<u>Test Reference</u>	<u>Aggregate</u>	<u>Beach Sand</u>
(a)	5	5
(b)	10	10
(c)	5	5
(d)	30	30
(e)	10	10
(f)	5(morning)	5(morning)

The tests shall be carried out in accordance with British and ASTM standards and the results shall comply with the limits given therein, or as otherwise stated here in.

Grading test shall be carried out daily or per 100 m whichever is the more frequent when concrete is being produced on a regular basis or beforehand when production is irregular.

The combined grading of aggregate shall be constant. The percentage passing any sieve size as determined by approved trial mixes shall be the target grading for all concrete of that type. The combined grading of the works concrete shall not vary more than 4% from that target. If the estimated or measured combined grading of the permanent works concrete does not meet this requirement, then a new trial mix shall be prepared for approval.

B3.2 Fine Aggregate

Fine Aggregate shall be capable of passing through a 5mm BS test sieve and shall be graded so that when mixed the course aggregate and cement a concrete of maximum density is produced. It shall not contain appreciable amounts of flaky

or elongated particles.

Crushed value sand may be added to natural sand in approved proportions in order to achieve the required grading.

Crushed sand alone may not be used without approval. The amount of material passing a 75 micron BS 410 fine test sieve when tested in accordance with BS

812 (wet-sieving method) shall not exceed 5% by weight.

B3.3 Coarse Aggregate

Coarse aggregate shall be totally retained on a 5.00 mm BS test sieve; the grading shall be within the limits prescribed in BS 882 Table 1 so that when mixed with approved fine aggregate and cement a workable concrete of maximum density is produced. The densities of the classes of concrete shall be approved after tests have been carried out on the Site.

The amount of materials passing a 75 micron BS 410 fine test sieve when tested in accordance with BS 812 (wet-sieving method) shall not exceed 1% by weight.

The flakiness and elongation indices of the predominant size fractions in each single-sized coarse aggregate, determined in accordance with BS 812, shall not exceed 20% and 35% by weight respectively.

B4 Reinforcement

B4.1 Steel for Reinforcement

Reinforcement for use in reinforced concrete shall comply where appropriate

4 with BS 449, 4461, 4482, 4483 and BS 8110.

High yield deformed bars shall be typed 2 classification as defined in BS 4449 and 4461.

B4.2 Testing

The Contractor shall provide copies of the manufacturer's certificates of test results relating to the steel reinforcement to be supplied, and shall additionally provide independent test results obtained from an approved laboratory.

B5 Water

B5.1 Generally

The Contractor shall make his own arrangements and obtain approval for the provision of fresh water for the manufacture and curing of concrete.

B5.2 Water Quality

Water to be used for mixing and curing concrete and mortar shall be fresh and free from sediment and dissolved or suspended matter which may be harmful and shall comply with the requirements of BS 3148. Water samples from the intended source of supply shall be taken for analysis before any concrete work is commenced, and at intervals throughout the duration of the Contract.

If the samples are unaccepted, the Contractor shall either change to a new

supply or take steps to improve the existing source, as approved.

B6 Admixtures

B6.1 Generally

Admixtures shall be used in concrete without approval. Admixtures containing chlorides or other corrosive agent shall not be used.

B6.2 Quality

If admixtures are permitted they shall be used in the correct quantities. Approved equipment and methods shall be used for dispensing and incorporating the admixtures in the concrete; the dispensing unit shall be designed so that the discharge of the admixture is visible.

B6.2 Quality (Contd)

The concrete tests described herein shall be conducted with the admixture incorporated to establish that specified strengths are achieved, and that densities are not reduced. If air-entraining agents are used the density shall not be reduced by more than 5%.

Set-retarding and water-reducing admixtures shall consist of ligno-sulphonate. Air-entraining agents shall consist of neutralize vinsol resin.

B7 Delivery and Storage

B7.1 Cement

Cement shall be delivered in bulk or in sealed and marked bags and shall be protected from the weather by enclosed systems or other approved coverings.

The Contractor shall provide approved silos to store sufficient bulk cement for continuity of work, and the cement shall be placed therein upon delivery. Approved precautions shall be taken to prevent cement dust causing nuisance.

Alternatively, the Contractor shall provide ventilated sheds with raised floors for the storage of sufficient bagged cement for continuity of work. Each consignment shall be stacked separately for inspection, testing and approval before use. The cement shall be placed in the sheds upon delivery and shall be in the order in which it was delivered.

B7.2 Aggregate

Aggregate shall be stored in concrete-based bins or on stages to prevent intermixing and the inclusion of dirt and foreign materials. Each size of aggregate shall be stored separately. Storage bins shall be emptied & cleaned regularly.

B7.3 Reinforcement

Steel reinforcement shall be stored in an approved manner above ground,

on a concrete slab; under cover and racked as necessary for protection from aggressive elements.

B8 Concrete Grade

B8.1 Mixes - General

Concrete shall be shown on the drawings and detailed in the Table of Mixes. The number of mixes may be required to be increased.

The criteria given in the Table are designed to produce concrete of the required strength and durability.

B8.2 Table of Mixes

Concrete Grade	Type of	Maximum Size	Minimum Quantity	Maximum Free	Characteristic Cube
Strength					
Cement	Aggregate	of Cement	Water/	<u>CCS</u>	
		Cement	7 day 28 day		
	inch	lbs/ft	Ratio	(lbf/sq. in)	

C15/20	OPC	3/4"	12.5	0.60	1450	2175
C35/20 (P)	OPC	3/4"	25	0.50	2390	3500
(Piling)						
C25/10	OPC	3/8"	19	0.55	2170	3000
C35/20	OPC	3/4"	20.5	0.50	2390	3500
(Superstructure)						

The CCSs are for concrete which has been cured at a temperature of 20⁰ C +/- 1⁰

C and are the values below which no more than 5% of the test results fall. The 7

day strengths shall be used only as a guide.

Air entrainment is not required for this

project. B8.3 Quality Testing

Concrete shall comply with BS 8110 except where BS5337 or this specification differs. Sampling for test purposes shall comply with BS 1881 Part 1. The making and curing of specimens shall comply with BS 1881 Part 3.

B8.3 Quality Testing (Contd)

If air entrainment is specified the average air content at the time of placing measured in accordance with BS 1881 shall be:

Concrete containing 12" maximum size aggregate 4% +/-
1% Concrete containing 3/4" maximum size aggregate 5%
+/- 1%

B9 Trial Mixes

B9.1 Laboratory Trial Mixes

Preliminary laboratory tests shall be carried out to determine the mixes to satisfy the specification with the available materials.

Trial mixes should be tested to determine the following properties of mixes for initial field tests:

- (a) Bleeding in accordance with ASTM C232
- (b) Drying shrinkage in accordance with BS 1881
- (c) Air Content if applicable
- (d) Free water/cement ratio
- (e) Workability
- (f) Wet and dry density

If the values obtained are unacceptable, the mixes shall be redesigned.

B9.2 Initial Field Tests

Trial mixes shall be prepared under full-scale site conditions and

tested in accordance with BS 1881.

Samples of concrete incorporating the reinforcing details to be used shall be cast in the presence of the Engineer-s Representative.

Trial mixes shall be made on each of three days; the workability shall equate to the designed target value. Six cubes from each mix shall be taken, three for test at 28 days.

B9.2 Initial Field Tests (Contd)

Further trial mixes shall be made if the range (the maximum minus the minimum of the three cube results in any batch) exceeds 15% of the average of that batch, or if the range of the three batch averages exceeds 20% of the overall average of the batches.

The mixes shall be tested to determine the following properties: (a) Bleeding in accordance with ASTM C232

- (b) Air content if applicable
- (c) Free water/cement ratio
- (d) Indirect tensile strength in accordance with BS 1881 including cylinder- splitting and beam tests.

The average 28 day CCS of the three trial mixes shall not be less than the designed mean strength, and the results of the above tests shall be acceptable before the mix is approved. Otherwise the mix shall be re-designed.

B10 Quality Control

B10.1 Test Cubes

Cubes shall be manufactured in an on-site laboratory, specially equipped for the purpose, in controlled conditions. They shall be made, cured, stored, transported and tested to BS 1881. The method of compacting cubes shall be as approved. The cube testing machine shall be housed in a laboratory and calibrated to BS

1610 when delivered; the calibration shall be verified at 3 monthly minimum intervals in accordance with The Cement and Concrete Association publication

The Comparative Cube Test[®] by P.Foote, 1974.

B10.2 Sampling Cubes

A sample of concrete shall be taken at random on eight separate occasions during each of the first days of using a mix. The standard deviation shall be calculated from at least 25 individual cube results each representing separate batches of similar concrete produced by the same plant under the same supervision.

The current margin for the plant shall be thus established as 1.64 times the standard deviation.

B10.2 Sampling Cubes (Cont)

Thereafter one sample shall be taken at random for each class of concrete from every group of 25 batches made by each batching plant, and at least one sample shall be taken each day that concrete of a particular grade is made.

Samples shall also be taken and two cylinders cast to determine the indirect tensile strength of the concrete at 7 days and 28 days, as specified in BS 1881. These samples shall be taken from every 100 batches, but at least one week

during concreting operations, and shall coincide with samples taken for test cubes.

The frequency of sampling may be required to be varied.

In addition to the above requirements, at least one sample shall be taken from each individual structural unit, or part of unit, when the latter is the product of a single pour.

From each sample two cubes shall be made for testing at 28 days and one for testing at 7 days for control purposes. The 28 day CCS shall be the mean of the two cubes.

The procedures shall be repeated when materials or design mixes are changed. B10.3 Cube Strength Results

The results will be unacceptable if:

- (1) The average strength determined from any four consecutive test cubes does not exceed the CCS by 0.5 times the current margin.

- (2) One value is less than 95% CCS

- (3) Three or more values in twenty-five are less than CCS or

- (4) The range of values exceeds the mean by 20% or more and any of the following actions may be instructed:
 - (a) Changing the mix
 - (b) Improving quality control
 - (c) Cutting and testing cores from placed concrete
 - (d) Load-testing relevant structural units
 - (e) Non-destructive testing of placed concrete
 - (f) Cutting out and replacing of defective concrete

B10.3 Cube Strength Results Cont'd

If range of individual cube strength made from the same sample exceeds 15% of the mean strength then the method of making, curing and testing cubes shall be checked.

In the event of (c) the Contractor shall cut cores from locations selected by the

Engineer. These shall be tested in accordance with BS 1881.

The diameter of the cores shall be 6" and the length to diameter ratio of the prepared specimen shall be between 1.0 and 1.2, except where otherwise directed by the Engineer.

An age correction factor shall be interpolated from the following table:

<u>Age in Weeks</u>	<u>Factor</u>
4	1.00
8	1.10
12	1.15
26	1.20
52 or more	1.24

If the equivalent estimated cube strength of the cores, when corrected by dividing by the appropriate age factor is less than 75% of the specified characteristic cube strength then the concrete shall be cut out unless the Engineer considers it to be appropriate.

B11 Batching

B11.1 Machinery

Batching shall be by weight-batching machines equipped with accuracy checks for the weight mechanism. The machines shall be cleaned, checked and adjusted regularly as approved.

The water supply to the concrete mixers shall have a metering system to control and record the amount.

B11.2 Accuracy of Batching

Batched materials shall be measured out within the following tolerances and discharged into the mixer without loss:

B11.2 Accuracy of Batching (Cont'd)

Cement	+/- 2% of the weight of the cement in the batch
Aggregate	+/- 2% of the weight of each aggregate in the batch
Water	+/- 2% of the weight of water added to the batch
Admixture	+/- 5% of the amount to be added to the batch

B11.3 Calibration of Measuring Equipment

Measuring equipment shall be checked and calibrated at the start of the preliminary concrete tests and at weekly intervals. The necessary test weights and the like shall be kept available on site.

Scales shall be checked over their complete range by a specialist every three months. A calibrated container shall be used to check the accuracy of admixture dispensers one each month. The results of these checks shall be notified.

B11.4 Mixing

Concrete shall be mixed in batches in machines which comply with BS 1305. The constituents shall be thoroughly mixed before discharge. The machines shall be capable of discharging while running.

B11.5 Ready-Mixed Concrete

Ready-mixed concrete shall not be used unless approved and shall comply with the requirements specified herein and those of BS 1926 and the British Ready- Mixed Concrete Association Specification, May 1975. Ready-mixed concrete plants and mixers shall comply with the requirements of BS 4251.

B11.6 Records

Daily returns shall be provided showing the quantities of cement and the total volume batched of each class of concrete for each section of the works and temporary works.

B12 Placing

B12.1 Placing - General

Concrete shall be placed in the position and sequence indicated on the drawings, or as directed. Placing shall not be commenced until the fixing and condition of reinforcement and items to be embedded and the

condition of the containing surfaces or formwork has been approved. Twenty-four hours notification shall be given of the intention to place concrete.

Concrete shall be transported by means which prevent contamination (by dust, rain, etc.) segregation or loss of ingredients, and shall be transported and placed without delay.

B12.1 Placing - General

Concrete shall be placed directly in its final position without segregation or displacement of the reinforcement, embedded items and formwork. Concrete shall not be placed in water, except as specified.

B12.2 Extent of Pours

The limit of individual pours and the height of lifts shall be as approved.

For walls, the length of panel placed at one time shall not exceed 20'-0 and adjacent panels shall not be placed within 7 days; this period may be required to be extended in special circumstances. Subsequent vertical lifts shall not be poured within 2 days.

Floors, roofs and ground slabs shall be placed in an approved sequence of panels. Adjacent panels shall not be placed 7 days of each other. Panels shall not exceed

300 sq. ft.

If the use of slip-form or paving trains is permitted these limits will be revised. The sequence of pours shall be arranged to minimize thermal

and shrinkage strains.

B12.3 Placing Equipment

Concrete shall generally be placed without segregation by pumping or bottom - opening skips. If chutes are used their slopes shall not cause segregation and spout or baffles shall be provided.

B12.4 Time for Placing

Concrete and mortar must be placed and compacted within 30 minutes of water being added to the mix or otherwise included via damp aggregates, unless admixtures are in use. Partially-set concrete shall not be used in the Works.

B12.5 Compaction

Concrete shall be compacted during placing by approved internal vibrators. The Vibrators shall operate at a frequency of not less than 10,000 cycles per minute, and shall be designed for continuous operation. The performance of vibrators shall suit the working conditions, and they shall generally not be less than 3" diameter. The radius of influence shall ensure that the mass under treatment is compacted at a speed commensurate with the rate of supply of concrete.

B12.6 Vibrators

Vibrators shall penetrate the full depth of the layer of concrete placed and just into the layer below, and be withdrawn slowly to avoid the formation of voids.

Vibration shall not be applied directly or immediately to concrete after the initial set has taken place, nor shall it be used to make concrete flow in formwork.

B12.7 Continuity of Placing

Placing in each section of work shall be continuous between construction joints. The Contractor shall make provision for standby equipment. If the placing of concrete is delayed due to breakdown the Contractor shall erect vertical stop-ends and form a construction joint or remove the concrete already placed and restart after repair of the breakdown, as directed.

B12.8 Placing in Inclement Weather

Placing shall not take place in the open during storms or heavy rains. If such conditions are likely to occur the Contractor shall provide protection for the material, plant and formwork so that work may proceed. If strong winds are prevalent protection from driving rain and dust shall be provided.

B12.9 Placing in High Temperatures

The temperature of concrete shall not exceed 32⁰ C at the time of placing.

Recommendation for Hot Weather Concreting: in the 1972 edition of ACI 305 shall be complied with. The following measures inter-alia may be required to control the placing temperature:

B12.9 Placing in High Temperatures (Contd.)

(1) Shade aggregate, cement silos, water tanks and concrete plant

(2) Paint concrete plant white

(3) Use chillers to cool the mixing water

(4) Place concrete at night

The Contractor shall supply suitable maximum/minimum thermometers and record the shade and sun temperatures at locations where concrete is being placed.

B12.10 Placing at Night

If approval has been given for placing at night or in dark adequate lighting shall be provided where mixing transportation and placing are in progress.

B12.11 Placing Under Water

Underwater concrete shall be placed with minimum disturbance of the water. Running water and wave wash shall be controlled. The specified concrete grade shall be used and the mix design shall provide for good flowing ability.

Tremie pipes, bottom-dump skips or other approved placing equipment shall be used. Segregation shall be avoided.

B12.11 Placing Under Water (Cont'd)

Placing shall be commenced in approved sections and continued to completion.

The tremie pipe shall be buried in the concrete and the pipe must not be emptied until the pour is completed. If a bottom-dump skip is used, the contents shall be covered by canvas or similar before lowering into the water. The door shall be opened when the skip is resting on the bottom with no tension in the support cable, and the skip shall be lifted gradually so that the concrete flows out steadily.

B12.12 Preparation Before Placing

Before placing concrete for reinforced work on the ground, the formation shall be compacted as specified and a screed of blinding concrete shall be applied to form a surface for construction.

Before placing concrete on or against rock, masonry, brickwork or old concrete, loose material shall be removed and the surface washed down; water seepage shall be stopped or channelled away from the work.

For mass concrete placed against masonry or brickwork the following shall apply: (1) The mortar joints in the facework shall have fully hardened.

(2) The water-cement ration of the concrete shall be increased to compensate for the absorption of moisture by the existing work.

(3) The surface shall be soaked prior to placing.

(4) The concrete shall be worked around ties and bond stones and into open joints.

B13 Formwork

B13.1 Formwork - General

The Contractor shall obtain approval of the methods and materials proposed. Details of formwork for special finishes shall be approved before materials are ordered. Formwork shall provide concrete of the shape, lines and dimensions shown on the drawings.

B13.1 Formwork - General (Cont'd)

Formwork shall be constructed from materials of sufficient strength, supported to provide rigidity during placing and compacting concrete without visible deflection and removable ties shall be located so that the specified cover to reinforcement is maintained to all surfaces including that of the tie-holes. If ties are left in, the cover shall be specified for the reinforcement or as approved. Tie cavities shall be filled with approved concrete or mortar.

Formwork panels shall have true edge for accurate alignment and shall be fixed with either vertical or horizontal joints. If chamfers are required, the fillets shall be cut to provide an even line. Joints shall not permit leakage of grout, nor steps and edges in exposed surfaces.

B13.2 Rough Formwork

Rough formwork shall be butt-jointed, seasoned, sawn timber.

B13.3 Wrought Formwork

Wrought formwork shall be steel or seasoned plywood to produce a surface free from visible defects.

B13.4 Preparation of Formwork for Concreting

Formwork and supports shall be cleaned; temporary opening shall be provided for the removal of rubbish. The formwork shall be coated with an approved release agent and the excess removed. Release agent shall not be allowed to come into contact with concrete already placed or with reinforcement.

Not less than 24 hours notice shall be given for the inspection and approval of the formwork and reinforcement, prior to which concrete shall not be placed.

B13.5 Removal of Formwork

Formwork shall be removed without damage to the concrete, but not until the concrete has sufficient strength to support itself. Centers and props may be removed when the member has sufficient strength to carry itself and any loading with a reasonable factor to safety. External loading shall not be applied until the concrete has reached the 28 day CCS.

B13.5 Removal of Formwork (Cont'd)

The following is a guide to the minimum periods between placing and the removal of formwork:

Vertical sides of beams, walls, columns) but see

- lift not exceeding 5'-0" - 12 hours) Curing and

- lift exceeding 5'-0" - 36 hours) Protection Clause

Soffits of main slabs and beams

props left under - 5 days

Beam and main slabs removal

of props - 18 days

After removal remedial work shall be undertaken until the concrete has been inspected and approved.

B14 Reinforcement

B14.1 Reinforcement - General

Steel rod reinforcement shall be cut and bent to BS 4466 and fixed in accordance with Section 7 of BS 8110. Cold bending shall be used which does not damage the material. Bending hot at a cherry-red heat not exceeding 840⁰ C may be approved except for bars dependent on cold-working for strength. Bars shall not be cooled by quenching.

B14.2 Cutting and Bending

Cutting and bending of reinforcement shall be carried out in Belize. Facilities for cutting and bending bars up to 3/4" diameter shall be provided by the Contractor on site. The maximum length of bars required by the drawings will be 40'-0", except for reinforcement in piles.

A bar shall be bent in accordance with the dimensions shown in the bending schedule. Where an overall or an internal dimension of a bent bar is specified, the tolerance unless otherwise stated, shall be as follows:

B14.2 Cutting and Bending (Cont'd)

Dimensions of bent bars		Tolerance	
Over inch	Up to and including inch	Plus inch	Minus inch
80	-	1/4"	1"
Dimension of straight bars - all lengths		1"	1"

B14.3 Fixing

The number, size and position of pieces of reinforcement shall be as shown on the drawings. They shall be held in position in the form work during the placing of concrete by use of distance pieces and spacer bars.

Links shall be taut so that bars are braced and the inside of their curved

parts shall be in contact with the bars being connected. Tying wire shall be black annealed mild steel approximately 0.06" diameter twisted with pliers; the free ends shall be bent inwards.

Reinforcement shall be grit-blasted before use to remove rust, oil, grease, salt and other deleterious matter, and where pitting has occurred and the causes and products thereof. Repeated blasting may be required when the reinforcement is in position, or partially cast in. Partially-set concrete adhering to exposed bars during concreting operations shall be removed.

B14.3 Fixing

Reinforcement temporarily projecting from the concrete at joints shall not bend out of position without approval, in which event the reinforcement shall be bent over a suitably sized former to prevent any damage or over-stressing.

B14.4 Schedules

The Contractor will be supplied with drawings and bending schedules in accordance with BS 4466. Schedules shall be checked by the Contractor before bending and cutting of reinforcement. Any amendments to the laps or details resulting from the Contractor's proposed construction method shall be submitted to the Engineer for approval. Any corrections which the Contractor considers necessary shall be noted to the Engineer for confirmation. The responsibility for the accuracy of schedules shall be borne by the Contractor.

B14.5 Welding

Electric arc welding may be used, if approved, for joining bars. Covered-alloy or shielded-arc electrodes shall conform to BS 639. Workmanship shall be to the

BS 5135. Joints shall be butt-welded with standard double-V or double-U welds.

B14.6 Cover to Reinforcement

The thickness of concrete cover to reinforcement shall be shown on the drawings. Only approved concrete or plastic spacer shall be used.

If concrete spacers are used they shall be of similar concrete grade to the main concrete and shall have non-metallic ties. For concrete with a CCS of 3500 PSI or more, the spacers shall comply with the requirements of this Specification for water absorption.

B15 Joints

B15.1 Construction Joints

Construction joints shall be located and the sequence of placing arranged as approved, or as shown on the drawings to minimize shrinkage and thermal strains in the concrete.

Concrete placing shall not be interrupted except where joints occur, and shall continue after normal hours if necessary to achieve this.

Joints shall be formed square to the work with keyways included. Horizontal joints shall be generally at least 20" above ground level.

B15.1 Construction Joints (Cont'd)

Upon removal of the formwork the joints face shall be inspected and if the soundness of the concrete is not approved the Contractor shall investigate and remedy defects.

Before placing is resumed at a joint the set surface shall be roughened to remove laitence and expose the aggregate; the aggregate shall not be damaged. If damaging materials have come into contact with surfaces of joint, the concrete shall be cut back and the roughened surface cleaned by compressed air or water jets and brushed and watered immediately before placing. If required the surface shall be coated with a layer of stiff cement grout prior to placing the new concrete.

Chemical surface-retarders shall not be used.

Construction joints shall be sealed with an approved sealant at external and liquid- contact faces. Construction joints in water-retaining structures shall incorporate and approved water bar.

B15.2 Design Joints

Expansion and contraction joints shall be as shown on the drawings.

A contraction joint in a non-water retaining structure shall form a plane of discontinuity in the member. The concrete face first cast shall be painted with two

coats of approved rubberised bitumen paint before the adjacent concrete is placed.

The adjacent concrete shall include a groove against the joint for sealant. The exposed edges shall be sealed with an approved compound.

If a contraction joint is likely to be contaminated, the joint shall be sealed immediately with Multibond or similar approved as soon as the formwork has been removed.

An expansion joint in a non-water retaining structure shall be formed as for a contraction joint, but resin-bonded cork filler board shall be included so that the adjacent concrete members can expand.

A design joint in a water-retaining structure shall include a continuous water stop strip of copper, rubber, rubber and steel or PVC fixed across the joint as shown on the drawings. The concrete shall be free from honey combing and worked against the embedded part of the strip. Projecting portions of the strip shall be protected from damage during operations and, in the case of rubber and plastic, from light

B15.2 Design Joints (Cont'd)

and heat. Bituminous paint shall be applied to the lips of the loop of copper water stop and the loop filed with bituminous compound before embedding in the concrete.

The method of jointing water stops shall be in accordance with the manufacturer's instructions.

B16 Curing and Protection

B16.1 Curing and Protection - General

Concrete shall be protected from sunshine and drying winds by approved shading and wind-breaks, and from cold, rain or running water, for a period of 7 days after placing. During this period the following measures shall be taken to prevent the loss of moisture and to minimize thermal stress caused by the difference in temperature between the surface of the concrete and the core of the concrete mass:

(a) Horizontal Surfaces:

(1) Polythene sheeting shall be placed immediately after finishing. (2) After final set has taken place, the polythene shall be replaced by

wet hessian covered with polythene; the hessian shall be kept

permanently damp.

(3) After 7 days the hessian and polythene shall be removed and an approved aluminized or white resin-based curing

compound applied. The rate of application shall be recommended by the manufacturer.

- (4) Alternative methods of curing must be approved before use where special finishes are required.

(b) Vertical
Surfaces:

- (1) Polythene over wet hessian shall be secured to the surfaces immediately after removal of the formwork. The hessian shall be kept permanently damp.

B16.1 Curing and Protection - General (Contd.)

(b) Vertical Surfaces (Cont'd):

- (2) After 7 days the hessian and polythene shall be removed and an approved aluminized or white resin-based curing compound applied. Alternatively, the hessian and polythene shall remain for a further 7 days.

Water used during curing operation shall be fresh water. Curing membranes shall be compatible with waterproofing or other materials that may subsequently be applied to the surface of the concrete.

B16.2 Contamination

Concrete shall be protected from contamination by sea or brackish water, oil, fuel and other deleterious materials for a minimum period of 30 days after placing.

B16.3 Insulation Formwork

Insulation formwork shall be left in place for 72 hours after placing or until the temperature peak of the concrete is reached. The initial curing period in (b) (2) above may then be reduced in proportion.

B16.4 Protection of Joints

Rebates formed to receive sealant and the surfaces of construction joint shall be protected from curing compound by wet hessian to ensure proper curing of the joint surface and adjacent concrete. The protection shall remain in place until the joint surface is sealed.

B17 Finishes

B17.1 Exposed Surface

The finish faces of concrete shall be sound, even-colored, even-textured and free from defects. Arrises shall have a 1" x 1" chamfer. Concrete faces shall not be

rendered and defective concrete shall be cut out and replaced or made good as directed.

B17.2 Fine Finish

Fine finish shall be produced by the use of lines and formwork with flush joints; lining shall be clear-lacquered extra-hardboard. The face of the concrete shall be rubbed smooth by carborundum stone; small holes shall be stopped with approved mortar for the same final colour as adjacent concrete.

B17.3 Concrete Surfaces

Concrete surfaces which do not require formwork or special finish, the finish shall be produced by proper placing and compacting operations alone.

For a fair finish, screeding shall be used, carried out by sliding and tamping a screed board running on the top edges of the formwork, or on screeding guides, to give a dense concrete surface.

B17.3 Concrete Surfaces

For a fine finish, screeding shall be used as described, then left until the concrete has stiffened and the film of moisture has disappeared. A steel or wooden float shall then be used for a glossy or sandpaper surface as

required. Working shall be the minimum compatible with a good finish. The surface shall be protected from water drops.

B17.4 Wire-Brush Finish

After removal of the formwork, the surface of the concrete shall be abraded by stiff wire brushes and water to remove the cement laitence and expose the aggregate.

B17.5 Bush-Hammered Finish

The surface shall be abraded by carborundum stones to remove irregularities. Within 3 weeks, the surface shall be bush-hammered to remove cement laitence and expose the aggregate. Approved abush hammers shall be worked to within

1/2" of corners and arrisses, the remaining 1/2" shall be hand-chiseled to match.

Bush hammers shall be operated perpendicularly to the surface, and the remaining exposed aggregates shall not be loose or fractured. The treated surface shall be washed with water and stiffly brushed. The exposed aggregate shall be clean and free from film.

B17.6 Chemical Retarders

Chemical surface retarders, if approved, may be used to produce an exposed aggregate finish, and the Contractor shall demonstrate that the durability of the concrete surface is not reduced.

B17.7 Specimen Panels of Concrete

If required, the Contractor shall produce specimen panels of finished concrete for approval.

B18 Special Concrete

B18.1 Pre-Cast Concrete

The Contractor shall submit details of arrangements for casting, handling and placing pre-cast units for approval.

Pre-cast concrete units shall be cast on manufactured beds. The beds shall not be liable to settlement and shall have smooth, hard and level surfaces. Each unit shall be marked with a serial number and date of casting. Steel bars shall not be embedded in the concrete for lifting.

B18.2 No-Fine Concrete

The aggregate for no-fine concrete shall be coarse graded from 1/2" to 3/4". A small percentage of fines from 1/2" to 1/4" may be used to improve the strength if approved. Cement shall be mined with the aggregate in the proportion of 1 to 8 by volume. Segregation of the cement grout shall be prevented.

B18.3 Granolithic Concrete

Granolithic concrete shall consist of one part by weight cement to three parts of combined coarse and fine aggregate. The combined aggregate grading shall be as follows:

B18.3 Granolithic Concrete (Cont'd)

<u>BS Sieve</u>	<u>Percentage Passing</u>
14 mm	100
10 mm	95 - 100
5 mm	30 - 45
2.36 mm	30 - 35
1.18 mm	15 - 25
0.60 mm	10 - 20
0.30 mm	5 - 10
0.15 mm	0 - 5

Granolithic concrete shall be laid on top of the onset base concrete, and compacted and worked to the correct levels. The surface shall be floated with a steel float after hardening until water sheen has disappeared. Cement or cement- sand shall not be sprinkled onto the surface. The layer shall be 1/2" to 3/4" thick.

If Granolithic layer is required to be placed on set concrete, the latter shall be scabbled and cleaned to expose the aggregate and an approved bonding agent applied. The layer shall not be less than 2" thick.

Granolithic concrete paving shall be panels not exceeding 10'-0" square. Approved contraction joints shall be provided around the perimeter of each panel.

B18.4 Cement Mortar, Grout and Rendering

Cement-mortar shall consist of one part cement and four part fine sand by volume with just enough water to achieve workability.

Grout shall consist of cement mixed with water in approved proportions. Fine sand may be included in approved qualities.

Rendering shall consist of three part fine, sharp sand to one part cement applied in two 1/2" coats and one 1/4" finishing coat. The color of the finishing coat shall be as approved.

Acid-resistance epoxy mortar shall be obtained from an approved manufacturer and applied in accordance with manufacturer's instructions.

Mortar, render and grout shall be used freshly mixed.

B19 Protective Coatings

B19.1 External Protection (Membrane)

External protection to concrete sub-structure where required shall be Visqueen

1200 with taped laps in accordance with the manufacturer's instructions.

B20 Tolerances

B20.1 Tolerances of Concrete Surfaces

The tolerances of concrete surfaces shall be in accordance with the following:

Exposed concrete -BS 5605 Table 2

Pre-cast concrete members -BS 8110 Selection 6

and as follows:

B20.1 Tolerances of Concrete Surfaces (Contd.)

Maximum permissible deviations in building using in-situ concrete.

Space between elements:

Columns and walls at floor +/- 3/4"

Size and shape of elements and components:

of any face up to 1m

heights - up to 10'-0" +/- 3/4"

B20.1 Tolerances of Concrete Surfaces (Contd.)

Beams depth - up to 24" +/-
5/8"

- over 24" +/- 3/4"

Slabs depth +/-2"
Suspended floor before level: variation from

Laying of screed target plane of any
point

on the surface +/- 3/4"

Structural soffit level: variation
from target
plane of any

point

on the surface

+/- 3/4"

Over
all
size:

Building
12"

length or width

+/-

95% of measurements for tolerances checks shall be within two thirds of the maximum permissible deviations and 67% of measurements shall be within one third of the maximum permissible deviations.

B20.2 Tolerances of Reinforcement Position

The cover shall be as specified on the drawings with a tolerance of +/-1/4". Cover is measured to the link bar nearest to the surface. Main reinforcement beams shall generally be located in the corners of the links and shall touch the inside of the link.

SECTION C: WALLING

WALLING

C1.1 Cement

Cement shall be Ordinary Portland Cement complying with BS 12 or Sulphate

Resisting Cement complying with BS 4027 and shall be as described in Section B

Concrete Work.

C1.2 Aggregate

Aggregate shall be natural aggregate complying with BS 882, and as

described in
Section B Concrete Work.

C1.3 Sand

Sand for mortar shall comply with BS 1200 Building Sands for Natural Sources
and as described in Section B Concrete Work.

C1.4 Lime

Lime for mortar shall be hydrated semi-hydraulic lime complying with BS 890
Part 2 Building Limes.

C1.5 Water

Water for mortar shall be described in Section B Concrete
Work. C1.6 Damp-Proof Courses

Felt for damp-proof shall be bituminous 3-ply felt to BS 743 Materials for Damp- Proof Courses Type A.

C1.7 Reinforcement

Block work walls are to be reinforced every third course with one layer of

Brick force as manufactured by BRC West Indies Ltd., Cane Garden, St. Thomas, Barbados or other equal and approved.

C1.8 Movement Joints

The filler material and sealant for movement joint shall be as described in Section

B Concrete Work and as shown on the drawings.

C1.9 Pre-Cast Concrete Blocks

All pre-cast concrete blocks in walls are to be made to comply with BS 6073 Pre- cast Concrete Blocks and to the approval of the Engineer and manufactured in an approved machine.

The blocks shall have a density of between 94 lbs/ft and 135 lbs/ft. Eight inches (8") thick hollow Block work shall have a maximum laid density of 17.5 lbs/sq.ft and six inches (6") thick hollow Block work a maximum laid density of 13 lbs/sq.ft.

Every block be clearly and permanently marked indicating its use and date of manufacture.

For solid Block work the standard block shall be 8" deep overall with a minimum compressive strength of 508 lbs./sq.in and made from Ordinary Portland Cement.

For hollow Block work, the standard block shall be 8" deep overall, with voids running vertically. The minimum thickness of the outside skin shall be 1/2" and of the diaphragms 1". The maximum longitudinal dimension of any one void shall be 4". The blocks shall have a minimum compressive strength of 1015 lbs/sq. in. measured on the net plan area of the blocks, and shall be made from Ordinary Portland Cement.

C1.10 Testing of Blocks

The Contractor shall supply certificates of tests carried out on samples of each batch of blocks manufactured.

6073. C1.11 Samples

The general procedure of sampling and tests shall be as laid down in BS

Separate samples of each type of block taken at random shall be deposited and be approved by the Engineer. The Engineer will reject any block or blocks below the required strengths, uncured, under or over the required size, damaged or having any other defect which he may consider detrimental to the work concerned.

C1.12 Special Blocks

Special shaped blocks required to form proper bonding which cannot be made in standard block making machines may be made in approved wooden moulds. When specifically required blocks shall be solid.

C1.13 Mortar Mixes

Mortar for all Block work below damp-proof courses level and in contact with the soled shall be a mix measured by volume of one part of Ordinary Portland Cement and three parts sand.

Mortar for all Block work above damp-proof course level shall be mixed measured by volume of one part of Ordinary Portland Cement, one part of lime and six parts of sand.

A plasticizer may be used instead of lime with the approval of the Engineer. The plasticizer shall be added strictly in accordance with the manufacturer's instructions.

C1.14 Mortar Generally

Mortar shall be mixed dry and then with water added until the correct consistency is obtained. All mortar shall be properly mixed upon a clean platform and shall be used as a mix. Mortar shall be used within two hours of the addition of water. No mortar which has been allowed to set prior to use shall be remixed or used in the work.

C1.15 Concrete Infill to Hollow Blocks, etc.

The concrete mix for filling to hollow blocks and for lintels shall be 6000 psi as described in Section B Concrete Work.

C1.16 Solid Concrete Blocks DPC

All solid concrete Block work below DPC level shall have a minimum compressive strength of 1015 lbs/sq.in.

C2 Workmanship

C2.1 General

The Block work workmanship shall comply in general with the recommendation of BS 5628 Pars 1, 2 and 3.

Before any fair face block walls for building purposes are commenced, the Contractor shall provide a specimen panel of fair faced Block work for approval by the Engineer. Thereafter all fair faced Block work shall conform to this approved standard. Should any fair faced Block work fail to conform to the approval standard the Contractor shall render the Block work at his own expense to the approval of the Engineer if so instructed by the Engineer.

C2.2 Laying of Pre-Cast Concrete Blocks

All pre-cast concrete Block work shall be laid in stretcher bond solidly bedded, jointed and flushed up in mortar.

Blocks shall not be soaked before laying. Blocks shall be well buttered with mortar before being laid and joints shall be thoroughly flushed up from the top as the work proceeds and not faced afterwards. Block work shall be carried up in a uniform manner, no one portion being raised more than 1 meter above another at one time. All perpend, quoins and the like shall be kept strictly true and square and the whole properly bonded together and leveled.

Where wall faces are to be plastered or rendered or tiles the faces shall be hacked and the joints shall be raked out to form a 3/8" deep key.

No block shall be set in place within 28 days of manufacture and completed panels of walling shall be protected from the sun and cured for not less than 10 days.

C2.3 Loadbearing Walls

In the load bearing walls the void of hollow blocks shall be filled with concrete for the full height of each void where shown on the drawings. Where the drawings show vertical reinforcement the end bars shall be 5'-0 long and lapped by at least 16".

C2.3 Load bearing Walls (Cont'd)

If it is found that a horizontal or vertical joint is not solidly filled or that the Contractor used blocks other than the blocks specified, the whole panel of wall will be considered suspect and will have to be removed and rebuilt.

C2.4 Non-Load bearing Walls

Non-load bearing walls shall not be constructed at the same time as the load bearing walls but built at least two days after the concrete slab form work is struck. Tothing in to load bearing walls will not be permitted.

Between non-load bearing walls and load bearing walls there shall be

straight vertical joints with wire ties at 10" centers.

Non-load bearing walls shall be separated from the slabs above a layer of compressible filler material not less than 3/8" thick. Where rendering or plastering is applied over a joint to control cracking.

C2.5 Cavity Walls

Where indicated on the drawings, walls are to be constructed in cavity with an 8" internal load bearing leaf and a 4" outer non-load bearing leaf separated by a 2" cavity and tied together with galvanized butterfly ties every two courses vertically and every 32" horizontally.

All mortar droppings are to be cleaned out of the cavity as work proceeds and the Contractor shall take care to ensure that the cavity is not bridged at any point above the damp-proof course.

The two leaves of the cavity wall are to be constructed together but the final courses of the non-load bearing leaf are to be left until after the concrete slab form work is struck.

Where cavities of cavity walls are formed between Block work and concrete the Block work skin shall be tied at every course to the concrete by means of galvanized steel cranked brick anchors to approve manufacture cast into the concrete work.

C2.6 Protection of Cavities

The Contractor shall submit to the Engineer for his approval a method for protecting the cavities of hollow blocks and cavities of cavity walls against concrete falling into these cavities while casting floor and roof slab.

C2.7 Laying Damp-Proof Courses

Bituminous felt damp-proof courses shall be laid in block walling where shown on the drawings or as directed by the Engineer. Felt shall be laid on an even bed of mortar in accordance with BS 743 and shall be lapped 6" at all joints.

C2.8 Jointing

All Block work walls which are not rendered are to be fair faced and are to have the vertical and horizontal joints keyed as the work proceeds.

The above mentioned method of jointing is to be included in the trial wall built for the Engineer's approval.

C2.9 Bedding Lintels and Sills

Wherever required ends of sills and lintels are to be built in or cut and pine in cement mortar.

C2.10 Raked Out Joints

Where required joints for flashing, asphalt, etc. are to be raked out and pointed in mortar.

C2.11 Joint Fillers

Expand foam obtainable from Expandite Limited or other equal and approved, shall be used where specified on the drawings or requested by the Engineer.

Filler shall be cut to the exact widths and shall have all edges neatly trimmed. Fixing of filler shall be strictly in accordance with the manufacturers printed

instructions.

C2.12 Anchorage to Concrete

Where block walls abut concrete columns or walls, dovetail masonry slots and anchors shall be used as anchorage, one anchor to every three courses of Block work or as otherwise specified.

SECTION D: WOODWORK

WOODWORK

D1 Materials

D1.1 Hardwood shall be a locally selected hardwood complying with BS 1186, Part 1 and BS 5450, and shall satisfy the requirements for strength of Class 5 of BS 5286

Part 2.

Planned representative samples of each hardwood species shall be submitted to the Engineer for approval before the manufacture of any joinery work.

D1.2 Quality _____ of Timber

Timber shall be free of the following defects:

1. Unsound knots, dead knots, loose knots and knot holes.
2. Sapwood on any external hardwood or any surfaces to receive clear finish.
3. Splits extending through the piece from one surface to another and ring shakes.
4. Decay and insect

attack.

Except in the case of members to receive clear finish, defects arising from manufacture and knots may be cut or bored out and replaced with a plug or insert of the same species, well glued in. The plug shall be the full depth of the hole and the grain shall be in the direction of the grain of the piece into which it is inserted. The width of any plug or insert shall not be more than 6 mm greater than the maximum limit of the knot size.

D1.3 Moisture Content

All timber shall be kept in store, properly stacked, to ensure conditioning to a maximum moisture content of 12% at the time of delivery to the Site.

Particular care shall be taken to ensure that all carpentry and joinery timbers, plywood, block board or loose form, are delivered and maintained at the required maximum moisture content stated.

D1.4 Preservative Treatment of Timber

All softwood for permanent incorporation in the Works shall be treated with preservative to provide protection against damage from insect larvae, termites and fungal decay.

D1.4 Preservative Treatment of Timber (Contd.)

The preservative treatment shall be applied by pressure impregnation or the double vacuum process. Dipping, deluging, spraying, brushing or other methods which only provide shallow protection are not permitted.

The treatment shall be carried out under factory conditions at the source of supply of the timber and the Contractor shall provide Certificate of Impregnation when required by the Engineer. Treatment is to be carried out after all cutting and shaping has been completed. If subsequent cutting of the timber is unavoidable all freshly exposed surfaces shall receive a liberal application of the preservative recommended in the relevant treatment specification.

D1.5 Plywood

Plywood generally shall comply with BS 1455 and be manufactured from tropical hardwoods.

D1.6 Marine Plywood

Marine plywood shall comply with BS 1088 and be manufactured from selected tropical hardwoods.

D2 Workmanship

D2.1 Carpentry - Generally

Timber for carpentry work shall be finished sawn to the sizes shown

on the drawings. A tolerance of +/- 1/8" to 1/32" is permissible.

D2.2 Non-Structural Framing

Timber section in stud partitions, bulkheads, etc., shall be accurately cut so that they fit together tightly but without distortion. Each joint shall be fixed with at least two nails.

The timber sections shall be fixed plumb, level and square to ensure that the lining material can be positioned accurately and securely to give flat surfaces, free from undulations.

WOODWORK (Contd.)

D2.2 Non-Structural Framing

The spacing of members shall not exceed the permissible span of the lining material as recommended by the manufacturer. All edges of the lining material shall be supported except where other methods of supporting the edges are provided, e.g., tongued and grooved joints.

Holes for services shall pass through the center of timber sections and the diameter of the hole shall not exceed one third the width or thickness of the timber.

Additional supports shall be provided for appliances and

fixtures.

Framing, grounds and bearer shall be fixed to the substrate at maximum 18" centers using masonry nails unless described as plugged and screwed or bolted.

D2.3 Joinery - Generally

Timber used for joinery work shall be finished to the sizes indicated on the drawings.

The joinery shall be constructed exactly as shown on the drawings. Where types of joints are not specifically indicated they shall be recognized forms of joints for each position and shall be made so as to comply with BS 1186.

All joints shall be glued and screwed or dowelled.

Exposed and semi-concealed joinery shall be planned and sanded to remove all machinery and other surfaces defects so that after application of the specified finish imperfection in manufacture will not be apparent.

Exposed edges and corners shall be sanded off to form a pencil rounded arris. Architraves, cover fillets, skirtings and the like shall be accurately shaped to fit

the contour of any irregular surface against which they are required to form a

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n.

Where possible joinery for painting shall be primed before delivery to site, and where this has not been carried out, shall be primed as soon as possible after delivery and inspection by the Engineer.

D2.4 Fixing Laminated Plastics

Laminated plastics shall be fixed to the backing material with adhesive recommended by the manufacturer.

Unless otherwise specified a balancing laminate of similar material and the same thickness shall be fixed to all back faces.

The laminate shall be cut and trimmed neatly using the tools recommended by the manufacturer and all external angles shall be neatly chamfered.

D2.5 Fastening

Fastenings in external areas shall be sheradised, galvanized or non-ferrous.

Nails shall not be less than 1" long or 2.5 times the thickness of the member through which the nails are being driven, whichever is the greater.

Screws shall not be less than 2" long or twice the thickness of the member through which the screws are being driven, whichever is the greater.

Regardless of the specified minimum lengths, nails and screws shall not be longer than the total thickness of the members being joined, less 1/4".

Nail heads shall be punched, and screw heads not required to be pelleted shall be countersunk, not less than 1/8" below surfaces which will be visible in the finished work, the holes filled with putty or proprietary filler and sanded smooth and flush.

Plugs for screw fastenings into block work or concrete shall be of proprietary manufacture sized to suit screw. Wooden plug shall not be permitted.

D2.6 Pellating

Screw heads which are to be pelleted shall be countersunk 1/4" below the timber surface. Pellets shall be cut from matching timber not less than 1/4" thick, glued in, the grain matched, planned and sanded off flush with the face.

Screw heads shall be pelleted where the timber surface is to receive a clear finish.

SECTION E: DOORS AND WINDOWS

E1 General Woodwork

E1.1 Storage of Materials

Joinery shall be stacked on bearers on level, dry floors. Components shall be staggered or separated with spacers as necessary to prevent damage by and to protect ironmongery, beads, etc.

Components which cannot be immediately unloaded into conditions of storage recommended by the manufacturer or approved by the Engineer shall not be delivered to Site.

During transit and while stored on Site, doors shall be stacked horizontally in piles, each pile on not fewer than three cross bearers laid level and true.

E1.2 Definition of Terms

Concealed surfaces: Surfaces which after installation in the building will be concealed by the surrounding work, not merely by declaration.

Semi-concealed surfaces: Surfaces such as the internal parts of cupboards or fittings which are not visible when the fittings are closed.

Class 1 finish: Refers to the exposed surfaces of joinery which are selected for clear finish.

Class 2 finish: Refers to the exposed surfaces of joinery which are selected for painting.

E2 Materials - Woodwork

E2.1 Hardwood

Timber described as hardwood shall be Mahogany to BS 1186, Part I unless otherwise specified.

Planned representative samples of each hardwood species specified shall be submitted to the Engineer before the manufacture of any joinery work.

E2.2 Quality of Timber

Timber shall be free of the following defects:

1. Unsound knots, dead knots, loose knots and knots holes.

E2.2 Quality of Timber (Contd.)

2. Sapwood on any external hardwood or Class 1 finish

surface.

3. Splits extending through the piece from one surface to another and ring shakes.
4. Decay and insect attack.

Except in Class 1 finish work, defects arising from manufacture and knots may be cut or bored out and replaced with a plug or insert of the same species, well glued in. The plug shall be the full depth of the hole and the grain shall be in the direction of the grain of the piece into which it is inserted. The width of any plug or insert shall not be more than 1/4" greater than the maximum limit of the knot size.

In jointed panels each piece shall be of the same species and in Class 1 finish work all the exposed surfaces of each piece shall have the same character of grain and shall be matched.

E2.3 Moisture Content

All timber shall be kept in store, properly stacked to ensure conditioning to a maximum moisture content of 12% at the time of delivery to the Site.

Particular care shall be taken to ensure that all carpentry and joinery timbers, plywood, block board and other timber-based composite board, whether in pre-fabricated or loose form, are delivered and maintained at the required maximum moisture content stated.

E2.4 Preservative Treatment of Timber

All softwood for permanent incorporation in the Works shall be treated with preservatives to provide protection against damage from insect larvae, termites and fungal decay. Organic solvent type preservatives shall contain a water repellent.

Treatment is to be carried out after all cutting and shaping has been completed. If subsequent cutting of the timber is unavoidable freshly exposed surface shall receive a liberal application of the preservative recommended in the relevant treatment specification.

E2.5 Ironmongery

Unless otherwise specified all locks shall differ and be supplied by one manufacturer. Each lock shall be supplied with two servant keys.

E2.5 Ironmongery (Contd.)

Ironmongery shall be supplied complete with fastening matching the specified finish.

E3 Workmanship - Woodwork

E3.1 Joinery - Generally

Timber used for joinery work shall be finished to the sizes indicated

on the drawings.

The joinery shall be constructed exactly as shown on the drawings. Where types of joints are not specifically indicated they shall be recognized forms of joints for each position and shall be made so as to comply with BS 1186, Part 2.

All joints shall be glued and screwed or dowelled.

Exposed edges and corners shall be sanded off to form a pencil rounded arris. Architraves cover fillets, skirting and the like shall be accurately shaped to fit the

contour of any irregular surface against which they are required to form a close connection.

Where possible joinery for painting shall be primed before delivery to Site, and where this has not been carried out, shall be primed as soon as possible after delivery and inspection by the Engineer.

E3.2 Hanging Timber Doors

The maximum clearance between frame and door when hung shall be 1/8".

The maximum clearance between an internal door and finished floor level shall be

1/4" and between an external door and threshold or finished floor level shall be

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External doors and doors exceeding 45 lbs in weight shall be hung on three 4" hinges as a minimum.

E3.3 Door and Window Frames, Sub-Frames and Linings

Frames shall be fixed plumb, level and securely to prevent deflection or movement.

Frames built-in as the surrounding structure is constructed shall be fixed with cramps at maximum 2'-0" centers. One cramp shall be located 8" from the bottom of the frame and one 8" from the top or at the nearest adjacent bed joint. All cramps shall be secured to the frame by two screws.

Frames which are to be built-in shall be temporarily braced sufficiently to prevent distortion.

Frame to previously prepared openings shall be fixed with screw fastenings at maximum 18" centers. One fastening shall be located only where the fastenings tighten against the reveal.

Screw fastenings shall extend into the structural reveal by at least 1 3/4" or the thickness of the frame excluding any stop, whichever is the

greater.

Door frames shall not extend below the finish level of any floor which may be cleaned by washing.

E3.4 Architraves, Quadrants, Beads

Architraves, quadrants, beads and the like shall be in unjointed lengths between angles or ends of runs. Angle joints shall be mitred.

Architraves and quadrants shall not be installed until after the wall coverings have been formed or constructed.

E3.5 Fastenings

Fastenings in external areas shall be sheradised, galvanized or non-ferrous.

Nails shall not be less than 1" long or 2.5 times the thickness of the member through which the nails are being driven, whichever is the greater.

Screws shall not be less than 1/2" long or twice the thickness of the member through which the screws are being driven, whichever is the greater.

Regardless of the specified minimum lengths, nails and screws shall not be longer than the total thickness of the members being joined, less than

3/16".

E3.5 Fastenings (Contd)

Nail heads shall be punched, and screw heads not required to be pelleted shall be countersunk, not less than 1/8" below the surface which will be visible in the finish work, the holes filled with putty or proprietary filler and sanded smooth and flush.

Plugs for screw fastenings into block work or concrete shall be of proprietary manufacture sized to suit the screw. Wooden plugs shall not be permitted.

E3.6 Pelleting

Screw heads which are to be pelleted shall be countersunk 1/4" below the timber surface. Pellets shall be cut from matching timber not less than 1/4" thick, glued in the grain, matched, planned and sanded off flush with the face.

finish. E3.7 Fixing Ironmongery

Hinges shall be fitted in a standard position 10" from the top or bottom edge of the door to the centre of the hinge. When a third hinge is fitted it shall be located centrally between the top and bottom hinges. Where four hinges is required, they shall be spaced evenly between top and bottom hinges.

Locks shall be fitted so that the centre of the handle is at a height of 40" from the bottom of the door.

On Practical Completion all keys shall be handed to the Engineer together with a typed schedule relating name of lock manufacturer, key number, door reference, master key zone, etc.

Each key shall be fitted with a proprietary key ring and tag, and the tag marked with the appropriate door reference.

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Provide two (2) sets of each door hardware type as spares to the Employer.

Keying

- A. Provide the following keys:
- 3 Keys per Cylinder
 - 4 copies of the Master keys for the building.

E4. Application of Sealants

Sealants and primers shall be applied in the exact manner specified by the manufacturer and shall not be used when the shelf life shown on the tin or cartridges has expired.

The minimum width and depth of the sealant shall be 1/4" and for wider joints the depth shall not be less than half the width of the joint.

The surfaces of the joint shall be free from laitence, grease, loose particles, etc., and the temporary protective coatings shall be removed from metal components. All surfaces shall be cleaned as necessary to ensure they are suitable for adhesion of the sealant and shall be dry.

Unless the sealant manufacturer recommends otherwise:

1. The joint surfaces shall be primed.
2. Joint backing shall be used to control the depth of the sealant.
3. Where the joint design will not permit the use of joint backing, and adhesive back polythene bond breaker tape shall be installed to prevent three sided adhesion.

Adjacent surfaces to the joint shall be masked with tape to prevent staining by the primer or sealant. The tape shall be removed as soon as the joint

has been sealed by drawing it across, and not away from the joint.

The sealant shall be applied with sufficient pressure to completely fill the joint, so as to exclude all air pockets and to ensure adhesion of the material to the joint bond surface equally on opposite sides. The surface of the sealant shall be tooled smooth and flush with the adjacent surfaces unless detailed otherwise.

E5 Workmanship - Glazing

E5.1 Glazing - Generally

Glazing shall comply with the requirements of BSCP 6262.

Prime rebates when recommended by mastic/sealant manufacturer using material recommended by him.

E5.1 Glazing - Generally (Contd)

Clean glazing channels, or other framing members to receive glass, immediately before glazing. Remove and replace coatings which are not firmly bonded to substrate. Remove protective lacquer from metal surfaces wherever elastomeric sealants are used.

Clean glass edges and faces that are to be in contact with sealant or glazing compound with solvent to remove all traces of cutting oils

or other contaminations.

Each installation must withstand normal temperature changes, wind loadings and applicable, impact loading (for the operation of sash and doors) without failure of any kind including: loss or breakage of glass, failure of sealants or gaskets to remain water tight and air tight, deterioration of glazing materials and other defects in the work.

Glazing channel dimensions, where not shown, are to provide for necessary minimum bite on glass, minimum edge clearance and adequate sealant thickness, with reasonable tolerances. The Contractor is responsible for correct glass size being used for each opening.

Comply with recommendations of glass manufacturer and manufacturer of sealants, gaskets and other materials used in glazing, except where manufacturer directs otherwise.

Inspect each piece of glass immediately before installation, and discard any which has edge damage or face imperfections.

Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other piece.

Ensure that glazing, and placement of framed or unframed glass is done in such a fashion that glass will not develop any damaging thermal stresses from solar radiation.

Clean and trim excess glazing materials from glass and stop or frame promptly after installation, and eliminate stains and discolorations.

Gasket glazing is to be carried out in accordance with glass manufacturer's recommendations.

SECTION F: FINISHINGS

F1 General

F1.1 Storage of Materials

Wallboards shall be stored flat in dry conditions and shall always be carried on edge.

Roll of sheet material shall be stored standing
on end. F1.2 Sample Panels and Control Samples

Sample panels minimum size 24" x 24" shall be prepared for all textured coatings to be used in the Works.

If Engineer so requires a control sample/s of a finish material/s shall be prepared in an agreed location within the Works (e.g. the floor tiling to a complete room). The area to be used as control shall be completed and approval to the standard of workmanship and appearance obtained before the application of the material is proceeded with elsewhere in the Works.

F1.3 Uniformity

To ensure consistency of appearance all flexible sheet or tiles of the same type, color and pattern which will be visible together when laid shall be from one batch.

F1.4 Recess Ducts Covers and the Like

Floor finishes shall be fitted into recessed duct covers to finish flush with the surrounding floor. Tiled finishes shall be located so as to continue the joint pattern of the surrounding floor.

F1.5 Changes in Finishes at Doorways

Changes in color or type of finish in doorways shall be situated under the center line of the door leaf.

F1.6 Protection of Floor

During floor laying operations, the areas being treated shall only be assessable to the floor layers.

Completed tiled floors shall not be subject to traffic until the bedding has stiffened and sufficient bond has developed between the bedding and the finish to ensure that the tiles will not be disturbed.

Light pedestrian traffic shall not be allowed over a finished floor until 4 days after completion of the laying; traffic heavier than pedestrian shall be excluded for 14 days after laying.

F1.7 Marking of Paint Containers

Materials shall be delivered in sealed containers clearly labelled with the following information:

1. Manufacturers name, initials or recognized trade mark.
2. Title and specification number.
3. Whether primer, undercoat or finish coat
4. Whether for internal or external use, where appropriate.
5. Method of application

6. Batch number and date of manufacture of re-test.

No paint shall be used more than 18 months after manufacture or re-test. Coating material other than spray paints, bituminous paints and fine texture

masonry paints shall be in containers not exceeding 5 litres capacity.

F1.8 Samples of Decorations

Sample panels minimum 4 ft. in area shall be prepared for each type and color of coating material to be used in the Works for the approval of the Engineer.

SECTION F (Contd.)

FINISHES (Contd.)

F2 Materials

F2.1 Cement

Cement shall be Ordinary Portland Cement complying with BS 12 and shall be as described in Section B Concrete Work.

F2.2 Pigment for Cement

Any pigments used to color the cement or cement products shall meet the requirements of BS 1014.

F2.3 Aggregate

Aggregate shall be natural aggregate complying with BS 882 and as described in

Section B Concrete Work.

F2.4 Lime

Lime shall be hydrated semi-hydraulic lime complying with BS 890, Part 2 Building Limes.

F2.5 Water

Water shall be as described in Section B Concrete Work.

F2.6 Welded - Fabric for Block Reinforcement (BRICKFORCE)

Reinforcement for blocks shall be galvanized or plain finish manufactured from using Hard Drawn Steel Wire to BS 4482, 1985; Galvanized wire finish BS 443.

F2.7 Nails, Screws and Washers

Nails, screws and washers shall be galvanized or of stainless steel. Pins for shot- firing shall be of steel with a tight coating of cadmium or zinc to comply with BS

1706.

Clout nails shall be galvanized steel and comply with BS 1201, Part 1. Staples shall be galvanized steel and shall comply with BS 1494, Part 2.

F2.8 Adhesives

Adhesives used for fixing ceramic tiles shall comply with BS 5980, Class A.

Adhesives used for fixing flexible PVC, rubber or similar material in sheet or tile form shall be recommended for the purpose by the flooring manufacturer.

F2.9 Dry Linings

Gypsum wallboard shall consist of either 1/2" or 5/8" thick gypsum plasterboard complying with BS 1230, having one face finished for direct decoration.

The edge profiles of wallboard shall be:

1. "Tapered" for smooth seamless jointing

2. ⁶⁶ Beveled” for V-jointing

3. ⁶⁶ Square” for stippled texture coatings, corner strip jointing or plaster.

F2.10 Painting and Decorating Generally

Paint removers, abrasive papers and blocks, cleaning agents, etching solutions, stopping, knotting, fillers and other commodities shall be of the types recommended by the manufacturer of the coating to be supplied.

Stopping and filler for woodwork shall be approved proprietary leafless, oil-based type recommended for internal or external work as appropriate. Stopping for woodwork to receive a clear finish shall be tinted to match with surrounding woodwork.

Filler for plaster and rendering shall be an approved proprietary type.

All brands of primers, paints and coatings shall be approved and shall comply with the relevant BS where one exists.

F2.10 Painting and Decorating Generally (Contd.)

Primers for plaster and rendering shall be alkali resistant. Primers for other surfaces shall be those recommended by the manufacturer of the

coating to be applied.

Undercoats on wood and metal surfaces shall be of the drying-oil/resin binder type pigmented with titanium dioxide and/or coloured pigments providing a matt or low-sheen finish suitable for subsequent application of a drying-oil type finish.

Water thinned priming paints and undercoats shall only be used with the specific approval of the Engineer.

Finish coats on wood and metals shall be of the drying-oil/alkyd resin binder type pigmented with titanium dioxide and/or light, fast coloured pigments.

Temperatures, moisture content of the surfaces, PH value, lighting and ventilation shall conform to the following or as recommended by the paint manufacturer:

1. Gypsum Wallboard / gypsum Plaster / Cement Plaster:
Maximum moisture content 12%.
 - (i) Concrete/Concrete Block: Maximum moisture content 12% for solvent type paint, 18% for water base paint.
 - (ii) Masonry surfaces shall be tested for alkalinity and shall be painted upon after the PH Value as recommended by the paint supplier is achieved, unless otherwise approved.

(iii) Wood: Maximum moisture content 15%.

(iv) Provide minimum of 323 lx lighting on surfaces to be painted.

Provide adequate continuous ventilation.

2. Paint gloss is defined as the sheen rating of applied paint, in accordance with the following values:

(i) Flat or matte: 0-5 units @ 60 degrees to a maximum of 10 units @

85 degrees.

(ii) Eggshell, velvet or low luster: 5-25 units @ 60 degrees to a maximum of ten (10) units at 85 degrees.

(iii) Satin: 20-35 units @ 60 degrees.

F2.10 Painting and Decorating Generally (Contd.)

(iv) Semi-gloss: 35-65 units @ 60 degrees. (v) Gloss: 65 units and greater.

F3 Workmanship

F3.1 Preparation of Background to be Rendered

Surface to be rendered shall be thoroughly cleaned of all mould, oil, dust and loose particles.

If dubbing out is required it shall be done well in advance of the undercoat, using a mix at least as strong as the undercoat but no stronger than the background. If the thickness needed is greater than 3/4" it shall be built-up in two coats; no coat shall exceed 1/2" thick.

Concrete surfaces shall receive one of the following treatments before the application of the undercoat:

1. Hacking by hand or mechanical means to remove all laitence and to roughen the whole of the surface to depth of at least 1/8" to expose the aggregate.
2. A spatter dash treatment of one part cement and three parts of coarse sand, mixed with sufficient water to give a consistency of a thick slurry shall be dashed on to the dampened background with either a trowel or a scoop to give a thin coating with a roughcast uneven appearance. To prevent rapid loss of moisture the spatter dash shall be dampened periodically and then be permitted to dry out slowly and hardened before the application of the rendering.

Block work surfaces shall have joints raked out during construction. Where the joints have not been raked out or where in the opinion of the Engineer high strength concrete clocks with smooth surfaces will provide insufficient key, a spatter dash treatment shall be applied as described above.

F3.2 Preparation of Mixes or Rendering

Cement, lime and sand for each batch shall be accurately measured by volume using properly constructed gauge boxes or wherever possible, whole bags of cement or hydrated lime.

F3.2 Preparation of Mixes or Rendering (Contd.)

Mixing shall preferably be by machine. Where, however, small quantities are required, mixing may be carried out on a board or platform which shall be cleaned after each batch has been removed.

The hydrated lime shall first be thoroughly mixed with the sand and the cement then added and mixed continued until the material is uniform in appearance. Water shall then be added while continuing mixing until the materials are workable and of a uniform colour and consistency.

To improve workability of the mix the hydrated lime, sand and water may first be mixed in the required proportions and then allowed to stand undisturbed for at least 16 hours before mixing with the cement. If allowed to stand for a longer period it must be protected from drying out.

mixed. F3.3 Application of the Various Render Coats

The work shall not start until the background has been properly prepared in accordance with Clause G3.1.

The render shall generally be applied in two coats except where the

background is metal lathing where three coats shall be applied.

Before applying any coat, the background or preceding coat shall be brushed down to remove any loose particles and shall be dampened sufficiently to ensure uniform absorption.

The undercoat shall be applied either by laying on with or throwing from a trowel or float. It shall be as uniformly thick as possible, and less than 3/8" or more than

1/2" thick in any part.

The undercoat shall be left rough and open from the edge of the trowel, and after it has been left long enough to set firm, it shall be combed with evenly spaced wavy horizontal lines. The lines shall be approximately 3/4" apart and 3/16" deep (less in the case of a first coat on metal lathing).

The finishing coat shall not be less than 3/16" or more than 1/2" thick and shall be laid on with a trowel and finished with a wood float, care being taken not to overwork the surface.

F3.3 Application of the Various Render Coats (Contd.)

All coats shall be prevented from drying out too quickly.

The surface of the finish coat shall be smooth, true and free from waviness, irregularities or blemishes with straight, level or plumb angles. External angles shall be pencil rounded.

Care shall be taken when rendering up to plaster beads or stops to avoid excessive polishing at the arris.

F3.4 Cement and Sand Floor Screeds

The surface of the concrete base must be clean, firm and rough to ensure a good bond. This shall be achieved by hacking thoroughly to remove all laitence and to expose the aggregate over the whole area, followed by sweeping clean and hosing down to remove all dust.

The base shall be soaked with water for at least 12 hours and any surplus water removed before laying commences.

To obtain the required thickness of screed leveling battens shall be used, carefully fixed to line and level and fully bedded. There shall be a minimum thickness of screed 34" over the top of any conduit or duct.

The screed shall be laid in alternate bays maximum 200 sq. ft. with plain butt joints and the length of the bay shall not exceed 1.5 times the width. Movement and construction joints in the base shall be carried through the screed.

Immediately prior to laying the screed a thick brush coat of wet cement grout

shall be applied to the damp surface of the base concrete & shall be well scrubbed in. The brush coat must not be applied more than 10 minutes before it is covered with screed.

Screeds to receive thin flexible finishes (i.e. of vinyl and rubber sheet or tile) shall consist of one part of cement to three parts of sand by weight and screeds to receive strong rigid coverings (e.g. quarry and ceramic tile) shall consist of one part of cement to four parts of sand by weight.

F3.4 Cement and Sand Floor Screeds (Contd.)

The mix only contains sufficient water that will allow full compaction and shall be evenly spread to a thickness approximately 3/8" greater than that required.

The screed shall then be thoroughly compacted by tamping and drawing off to the

required level with a screed board.

If a smooth surface is required the final workings up shall be done with a wood float, steel trowel, power float or other finish as specified elsewhere. Care shall be taken to avoid excessive trowelling which may cause crazing.

Screed to receive thin flexible finishes or screeds which are finished as paving shall be laid to the tolerance such that localized variations do not exceed +/- 1/8" under a 10'- 0" straight edge and +/- 3/8" over large areas, measured from datum.

As soon as each bay is completed and has hardened sufficiently to prevent damage to its surface, it shall be covered with polythene or similar sheets which shall be adequately lapped and held down. The screed shall not be allowed to dry out for a minimum period of 7 days and no traffic shall be permitted on the surface during this time.

F3.5 Laying Ceramic Marble or Porcelain Tiles

The areas of concrete substrate to be tiled shall be brushed clean and dampened until absorption ceases and the finish floor level shall be established by means of dots and rules.

The mortar for bedding the tiles shall consist of one part of cement to four parts of sand by volume, mixed in a mechanical mixer to a stiff plastic consistency so that when tamped and fully compacted into place free water does not bleed to the surface.

The bedding mortar shall be laid on the concrete substrated $5/8"$ - $1"$ thick, except where tiles $3/8"$ or less are used when the bedding shall not exceed $5/8"$, & shall be leveled and tamped with a straight edge board.

The tiles shall be soaked in clean water for 15-30 minutes before fixing and allowed to drain for 10 minutes to remove all surplus water. Fully vitrified tiles do not require soaking.

F3.5 Laying Ceramic Marble or Porcelain Tiles (Contd.)

The bedding mortar shall be lightly dusted with dry cement sprinkled from

a floor sieve and lightly trowelled level until the surface becomes damp. The tiles shall then be laid on the bed and beaten firmly into position with a wooden beater to ensure a true surface and that contact between the tiles and the bedding is complete.

The tiles must be correctly positioned at the time they are placed and joints of about 1/8".

Grouting of joints shall be carried out within a period of 4 hours of the completion of the laying of the tiles so that the grout will attach itself firmly to the bedding. Care shall be taken to avoid disturbing the tiles and walking boards shall be used during the grouting operations.

The grouting mix shall either consist of one part cement to one part fine, dry sand by volume, or a suitable proprietary grout may be used.

The tiles shall be neatly and accurately cut to a close fit where necessary at abutments and around outlets, pipes and the like.

Tiles shall be laid level or to 1% falls in wet areas, as may be required. Localized variations in level for a nominally flat floor shall be a maximum of +/-

1/8" under a 10'-0" straight edge. Particular care shall be taken in wet areas to prevent low spots and the pooling of water.

Skirting of the same tile size as the floor shall be fixed in such a manner that their vertical joints coincide with the horizontal joints of the floor tiles.

F3.6 Movement Joints in Tiled Floors

Unless otherwise stated a 3/8" movement joint shall be formed at the perimeter of all tiled floors & where the tiling meets structural features such as columns, machine bases, etc.

In clay floor tiling, additional intermediate movement joints shall be provided where the flooring exceeds 10'-0" and in other tiled floor finishes 37'-0", in any direction.

F3.6 Movement Joints in Tiled Floors (Cont'd.)

Where a structural movement is provided in the base, a movement joint of the same width in the bedded finish shall be positioned immediately above.

The movement joint cavities shall extend through the combined thickness of the finish and the bedding mortar or compound and shall be completely filled and sealed after grouting of the normal joints takes place.

F3.7 Laying Flexible Sheet and Tile Flooring

Floor screeds shall be laid in accordance with Clause G3.4 except that the requirement for laying in bays shall not apply.

The sub-floor shall be smooth, hard, clean and dry before laying

commences. All minor irregularities, cracks and hollows shall receive a skim coat of proprietary leveling compound as necessary to give a fine, true surface suitable to receive the following.

The Engineer may require all of the sub-floor to be treated with leveling compound if, in his opinion, the quality of the surface is unsuitable.

The flooring shall be laid strictly in accordance with the manufacturer's printed instructions. Trowel ridges and high spots caused particles on the sub-floor will not be accepted.

Tiles shall be laid with tight joints and with sides parallel to the room axis. Joints in sheet flooring shall be seamed welded.

F3.8 Fixing Ceramic Wall Tiles - Internally

Ceramic wall tiles shall be fixed strictly in accordance with the manufacturer's printed instructions.

Where the tiling is to be bedded in a thin-bed adhesive the trueness of the rendering shall be such that when tested with 9'-0" straight edge no gap exceed

1/8".

Where the gap exceeds 1/8" but is less than 1/4" or if the walls are out of plumb

by not more than 1/4" the Engineer may permit a thick-bed adhesive to be used or may direct that the defective areas are cut back and made good.

F3.8 Fixing Ceramic Wall Tiles – Internally (Contd.)

Deviations from true and plumb in the surfaces of the rendering exceeding 1/4" shall be made good.

Thin-bed adhesive shall not be for fixing tiles with backs incorporating deep keys or frogs; for these thick-bed adhesives must be used.

The tiles shall be set out before the work commences so that:

1. Cut tiles are kept to a minimum and where they do occur, are as large as possible.
2. Joints are horizontal and vertical, with horizontal joints aligning in walls that adjoin or adjacent.

The tiles shall be neatly and accurately cut to a close fit where necessary at abutments or are adjacent.

The adhesive shall be prepared and applied with a trowel to dry rendering in the manner recommended by the manufacturer. The tiles shall be pressed firmly into the adhesive with twisting/sliding action, tapped firmly into position and cleaned as soon as the bedding is complete.

The finish surface of the tiles shall be plumb and true such that when checked with 9'- 0" straight edge no gap exceeds 1/8".

The joints shall be even, approximately 3/32" wide and where titles without spacer lugs are used spacer pegs of suitable and even thickness shall be inserted between the titles as the work proceeds.

The joints shall be grouted after the adhesive has set and not less than 48 hours after fixing. The grout shall be well worked into the joints so that they are completely filled, and finished flush. Surplus grout shall be cleaned off as the work proceeds using a damp cloth and the joints tooled smooth.

F3.9 Fixing Wallboard to Framed Backgrounds

The boards shall be fixed to walls with the paper covered edges vertical and to ceiling with the paper covered edges at right angles to the main supporting members/joints.

F3.9 Fixing Wallboard to Framed Backgrounds (Contd.)

The board shall be fixed to the background at maximum 6" center and not nearer than 1/2" from the edges using 40 x 1/16" galvanized clout nails.

The nails shall be driven home straight (i.e. not skewed) and firmly so

that the heads are slightly below the surface without fracturing it.

Boards to receive direct decoration shall be fixed so that:

1. The paper covered edges are slightly butted together.
2. Cut edges occur at internal angles.
3. Cut edges occurring at external angles are masked by paper covered edges.
4. Cut edges meeting in the same plane have a 1/8" gap between.

F3.10 Jointing Dry Lining for Direct Decoration

The joints of square edge boards which are to receive a stippled textured coating shall be finished with a paper faced cotton joint tape fixed with a suitable adhesive.

The joint of beveled edge boards shall have the base of the V joint completely filled with joint filler and the surplus removed.

The joints of tapered edge boards shall either be finished by the manual methods described in the following paragraphs or except for joints at external angles, by approved mechanical methods recommended by the manufacturer of the board.

Joints in straight runs of tapered edge boards shall be finished as follows:

1. A continuous, thin band of joint filler shall be applied to the trough of the tapered edge joints; using an applicator and making sure areas are not left uncovered. The required length of 2 1/2" joint tape shall then be pressed into the band of filler using a taping knife. The tape shall be firmly bedded and free from all bubbles, with sufficient filler under the tape to ensure good adhesion.

F3.10 Jointing Dry Lining for Direct Decoration (Cont'd.)

Joints in straight runs of tapered edge boards shall be finished as follows:

2. Immediately after the tape has been fixed a new layer of filler shall be applied over it. This should be brought flush with the surface of the board. Before the filler begins to stiffen, a jointing sponge should be moistened and surplus material wiped from the edges of the joint, taking care not to disturb with the main joint filling.

3. The sponge should be rinsed occasionally to prevent any filler setting in it.

Once the filler has set any slight depressions in the surface shall be filled

with another coat of the filler and any projection cut back taping knife.

4. When the filler has set a thick layer of joint finish shall be applied

to a broad band 8" wide using the applicator. The edges of this band shall be immediately feathered out with a slightly damp jointing sponge. When this band of jointing finish has dried, another application shall be made and feathered out as before. The first coat of finish must dry before the final finish coat is applied.

Joints at internal angles of tapered edge boards shall be finished as follows:

1. After any gaps have been filled, a thin layer of joint finish shall be applied with a paint brush to both sides of the angle. The jointing tape shall be folded and pressed firmly into the angle using a brush or applicator to make sure any air bubbles are removed and the tape is firmly bedded. A thin layer of joint finish 6" wide centered on the joint shall be applied immediately and the edges feathered out with the jointing sponge.
2. Surplus materials shall be removed from the extreme edges.
3. When this coat has dried, another coat of joint finish 8"-10" wide shall be applied and the edges feathered out with the jointing sponge.

Joints at external angles of tapered edge board shall be finished as follows:

1. The edges of the board shall be treated as recommended by the dry lining manufacturer with the insulation cut back and using a bond and tapered edge so as to mask the cut edge of the dry lining.

Jointing Dry Lining for Direct Decoration (Cont'd.)

2. The angle shall be reinforced with a 1/2" wide corner taped consisting of strong paper tape with bonded parallel steel reinforcement strips. The tape shall be cut to the required length and creased firmly at the angles to allow the steel strips to lie close to the board surfaces. A 2" wide bank of joint filler shall be applied to each side of the angles and the tape shall be pressed firmly into the corner with a taping knife, making sure that the arris of the folded tape is straight.
3. Immediately after bedding the tape, a 5" band of joint filler shall be applied to both sides of the angle with an applicator and the edges feathered out with the jointing sponge.
4. After the filler coat has set, a thin layer of joint finish shall be applied and the edges again feathered out with the jointing sponge.
5. When the first filler coat is dry, the process shall be repeated with a further application of joint finish.

Nail and screw indentation shall be filled with joint filler and finished flush. When the filler has set a thin layer of joint finish shall be applied and the edges feathered out with a jointing sponge.

When all jointing and filling has been completed and the last application of joint finish has dried, a slurry coat of joint finish shall be applied over the entire surface of the boards to give an even sponged texture.

F3.11 Painting and Decorating Generally

Before painting commences all floors shall be washed over and every possible precaution taken to keep down dust. No paint shall be applied to surfaces structurally or superficially damp and all surfaces must be ascertained to be free from condensation, efflorescence, etc., before the application of each coat.

No primed or undercoated woodwork and metal work shall be left in an exposed or unsuitable situation for any undue time prior to completion of the painting process. No exterior or exposed painting shall be carried out under adverse weather conditions, such as rain, extreme humidity, dust storms, etc.

All items not required to be painted (e.g. ironmongery) shall first be fitted and then be removed before any painting preparation commences. The fittings shall be refixed in position when all painting is completed.

F3.11 Painting and Decorating Generally (Cont'd.)

Brushes, pails, kettles, etc., used in carrying out the work shall be clean and free from foreign matter. They shall be thoroughly cleaned before being used for different types or classes of material.

All materials shall be used strictly in accordance with the manufacturer's instructions and paints of different brands shall not be mixed or used in

the same coating system. No dilution of painting materials shall be allowed except strictly as detailed by the manufacturer and as approved by the Engineer.

F3.12 Preparation of Plastered and Rendered Surfaces for Painting

The surface shall first be scraped to remove mortar splashes, etc., and then made good, cutting out all defective work and repairing with plaster or render of the same type as previously used.

The surface shall then be rubbed down with fine glass paper to remove loose particles and to smooth irregularities before the application of the filler coat which shall be spread evenly with a scraper over all surfaces and allowed to dry.

The first application of filler coat shall be rubbed down and a second application of filler coat shall be made as before.

The surface shall then be sanded using progressively finer grades of paper until perfectly smooth and approved by the Engineer.

All rendered surfaces shall receive one full coat of alkali resistant primer before the application of oil based paints.

F3.13 Preparation of Wood Surfaces for Painting

All large, loose or resinous knots shall be cut out and the holes plugged with sound wood. Nails shall be punched well below surfaces, especially externally.

All surfaces shall be rubbed down with fine glass paper in the direction of the grain to give a smooth, even finish with arrises rounded or eased.

After dusting off all oily woods such as teak and afromosia shall be washed with white spirit.

F3.13 Preparation of Wood Surfaces for Painting (Cont'd.)

Two thin coats of knotting shall be applied to all knots and any other resinous parts of softwood.

A full coat of primer shall be vigorously brushed, in particular, care being taken to fill end grain. Backs of members shall receive two coats of primer.

After priming all nails, screw holes and similar depressions shall be filled with stopping, pressed well in and finished off flush with the surface. Screw heads shall be countersunk sufficiently to hold the stopping.

After priming and stopping is completed, pore and grain irregularities shall be treated with a coat of brush or knife applied filler and the surface rubbed down smooth and even.

F3.14 Preparation of Metal Surfaces for Painting

Iron and steel surfaces shall be wire brushed to remove rust, loose scale, welding slag and spatter, and cleaned with white spirit to remove oil, grease and dirt.

Iron and steel surfaces shall receive two coats of primer.

On pre-primed surfaces care shall be taken to ensure that defective primer, rust and loose scale are removed back to bare metal and patch primed to match existing.

Priming shall follow manual preparation as quickly as possible and not later than on the same day. With blast cleaned surfaces priming should follow within one hour and under no circumstances later than after three hours.

F3.15 Paint Application

Coatings shall be applied in accordance with the manufacturer's printed instructions to clean, dry surfaces, in dust free and dry atmospheric conditions and after any previous coats have hardened.

Priming coats shall be applied by brush unless other methods are approved taking care to work the primer into the surface, joints, angles and end grain.

Any primed surfaces which have deteriorated on site or in transit shall be touched up.

F3.15 Paint Application (Cont'd.)

All surfaces of joinery which have not been primed in the workshop shall be primed immediately on arrival at site and before fixing.

Care shall be taken to ensure that finish coats applied over calcium plumbate primer are compatible with the primer.

Undercoats shall be applied as an even film over all exposed surfaces avoiding an uneven thickness at edges and angles.

All priming and undercoats shall be rubbed down to a smooth surface with fine abrasive paper and cleaned of all dust before the application of the next coat.

Finishing coats shall be applied as an even film over all exposed surfaces, avoiding brush marks, sags, runs and other defects. Where two gloss finishes coats are specified the second coat shall be applied within 48 hours of the first.

The application of the paint system for iron and steel shall result in a minimum total film thickness of 125 microns internally or externally notwithstanding the number of coats specified.

SECTION G: ELECTRICAL

ELECTRICAL

G1 Drawings and Specifications

- (a) The drawings and specifications are complementary each to the other and what is called for by one shall be binding as if called for

by both.

- (b) Should any discrepancy appear between the drawings and specifications, which leave the Contractor in doubt as to the true intent and meaning of the plans and specifications, a ruling shall be obtained from the Engineer.

G2 Codes, Permits and Inspections

- (a) The installation shall comply with the requirements of the current edition

of the Canadian Electrical Code (latest edition) and the Electrical By-Laws

of the local electrical authority.
- (b) The Contractor shall obtain all permits required and after completion of the work, shall furnish to the Engineer a Certificate of Final Inspection and Approval from the Inspection Department. The Contractor shall take out all permits at the beginning of work.

G3 Compliance of Equipment with Specifications

- (a) The Contractor shall be completely responsible for ascertaining that every item of equipment complies in all respects with the

specifications and drawings in each case.

G4 Alterations

- (a) Alterations entailing additional work or deletions shall be carried out only upon written request of the Engineer.

- (b) The Engineer reserves the right to change location of outlets, switches, etc., to within 5'-0" of points indicated on the plans, before installation is made, without additional charge.

- (c) The number of wires per conduit and size of conduit shall not be changed except with the approval of the Engineer. The actual route of the conduit may be altered to avoid beams, columns and other obstructions.

G5 Identification of Equipment

- (a) Power panels, lighting panels, circuit breakers, motor starters, and all major electrical apparatus shall be clearly identified using name plates.

- (b) A typewritten list of proposed nameplate designations shall be submitted to the Engineer in triplicate for approval prior to engraving.

G6 Identification of Equipment (Cont'd.)

- (c) A typewritten identification list shall be attached to the inside of the lighting and power panel doors, listing the use of every circuit.

G7 Finishes of Equipment

- (a) All supports, hanger rods, pull boxes, channel frames, conduit racks, outlet boxes, brackets, clamps, etc., shall have galvanized or approved painted finish.
- (b) All switchboards, panel boards, distribution centers, shall be factory finished with air dry lacquer. All panels, distribution centers or similar factory finished units that are scratched or marked during installation, shall be touched up with matching lacquer or, if required by the Engineer shall be completely repainted.

G8 Cutting and Patching

- (a) The Contractor shall ensure that, where practical, all holes, roof,

walls, or floors for conduits shall be located before the roof, walls or floor are built.

G9 Temporary Trail Usage

(a) It will be understood and agreed that the Owner shall have the privilege of temporary and trial usage of any electrical device equipment and materials as soon as the Contractor shall claim said work complete and in

accordance with plans and specifications, for such length of time, as deemed necessary by the Owner, sufficient for complete testing. No claim will be made by this Contractor for damage caused by defective material

or workmanship.

G10 Guarantee

The Contractor shall agree:

That all work executed under this Contract will be free from defects of workmanship and materials for the period of six months from the date of final acceptance of this work.

That he will, at his own expense, repair and replace all such defective work and other work damaged thereby which fails or becomes defective during the term of the Guarantee provided that such failure is not due to improper usage.

G11 Wire & Cable - 600V & Below

- (a) All building wire shall be AWG/MCM gauge, 98% conductivity copper with 600 volts insulation and shall bear C.S.A. approval label.
- (b) All wiring installations shall be made with stranded wire unless specified otherwise. All stranded wiring termination at devices that do not have box type terminals shall be terminated using self-insulating fork type compression terminals.
- (c) No wire smaller than #12 shall be used for lighting, receptacles, power or motor circuits. Control wiring to be #14 or #12 stranded as specified on the drawings.
- (d) Branch circuit home runs exceeding 75 feet in length shall be #10 gauge wire

G11 Wire & Cable - 600V & Below (Cont'd.)

- (e) Only commercially prepared wire pulling compounds approved by cable manufacturers will be used. The use of soaps, soap flakes, detergents or similar preparations will not be used.
- (f) Wire runs shall be continuous wherever possible. Splices, taps, and terminations shall be made in accessible approved junction boxes. All splices shall be made with Ideal Supernut connectors and taped using Scotch #33 electrical tape.
- (g) Each wire entering a box shall be left with at least 7" of wire clear of the box after splicing to facilitate future alterations. Through wires in a box shall be 6" between the box and bottom of loop.
- (h) Communication and signal circuits shall not be installed in the same conduit with power and lighting circuits.

G12 Conduit

- (a) All conduits where they penetrate outside concrete walls or manholes shall be sealed using an approved vapor sealing compound. In addition the conduit entrance shall be made water tight, and the area around the

conduit repaired to match remainder of wall. Drains shall be provided where necessary.

Where conduit is exposed it shall be neat in appearance and

installed in straight runs following lines of the building.

- (b) All conduits shall be securely screwed together and where necessary unions used. No running thread or Erickson couplings will be permitted.
- (c) All threads shall be treated with UNI-TITE thread sealer.
- (d) Bends shall not be made over sharp objects. Improperly formed bends will not be accepted. All stub-ups from concrete into walls shall be adequately braced and capped before concrete is poured. Where stub-ups miss the partitions the concrete shall be chiseled out and the conduit bent properly into place to come up within the wall.

G12 Conduit (Cont'd.)

- (e) Conduits shall be laid out to avoid interference with other work and to avoid pockets in which water can collect.
- (f) As soon as conduits are installed the ends are to be capped to prevent the entrance of dirt or moisture. No wire to be pulled into conduits until rough building operations has been completed. The Contractor shall be responsible for all conduit moved with or without his knowledge.

G13 Fixtures

- (a) Supply and install all fixtures complete with lamps, hangers, ballasts, globes and everything needed to leave the fixture complete in position and operating.

G14 Grounding

- (a) All buried ground wire to be a minimum 24" below finished grade.

- (b) All ground wire to be pulled through 3/4" conduit when leaving floor slab or ground level. Conduit to extend within 6" of connection point.

- (c) Ground rods shall be 3/4" 5'-0 hot dipped galvanized steel.

G15 Testing

electrical system.

G16

Fire Fighting System

- A. Provide and install fire extinguishers in locations as shown on the drawings. Fire extinguishers shall be twenty (20) pounds dry chemical extinguishers with the Underwriters Laboratories Inc. rating of 10A:

80B:C. The unit shall be fitted with a discharge hose and have a minimum operating pressure of 195 psi.

SECTION VII

BILL OF QUANTITIES

SECTION VII: BILL OF QUANTITIES

PRICING NOTES

1 GENERAL

- 1.1 No works shall be executed, or materials ordered without a written notice to proceed is given by the Engineer.

- 1.2 All the requirements of the contract documents and associated works explicitly and implicitly noted, implied or necessary for the proper execution and completion of the works, unless otherwise specifically noted, shall be deemed to have been included in the rates and prices contained in the Bill of Quantities. Where specific details are required to be done for the completion of the project but the method, or particulars to achieve this is not clearly defined, then the Contractor is allowed some flexibility shall allow to complete the same to a reasonably high standard consistent with the other aspects of the works and to the satisfaction of the Engineer. Details of such works shall be submitted to the

Engineer for approval prior to execution.

- 1.3 Any item contained in the Bill of Quantities that is not priced by the bidder shall be deemed to have been included elsewhere.
- 1.4 The Contractor shall allow to provide the Engineer with samples and copies of cut sheets of all pre-manufactured products, indication requirements as specified. Any alternative proposals must be submitted for consideration and must include relevant cut sheets and samples of both the originally specified and proposed products.
- 1.5 Items noted to be optional shall be priced on the basis that such items may be removed from the contract without affecting any other rate or costs.
- 1.6 Items noted as alternatives may be included in place of the main items.
- 1.7 Refer to the specification for details on alternatives.

2. ADDITIONAL WORKS

- 2.1 This contract shall be fixed price subject to variation orders, which shall be priced based on pre-approved rates and profit margin. Additional costs for additional works or changes shall not exceed rates set forth in the schedule of rates.

2. ADDITIONAL WORKS (Contd.)

- 2.2 From time to time, the Engineer may request quotations from the Contractor for works of a nature not covered in the Bill of Quantities or Schedule of Rates. Such estimates shall be provided within a period not to exceed one (1) week after the request is made, unless otherwise determined by the Engineer.
- 2.3 Unless specifically provided for in writing via a written change order issued by the Engineer, the Engineer shall prepare certificates and payment shall be made be based on the value of works done and as indicated in the Bill of Quantities only. Works in addition to those included in the contract, or as detailed in the Bill of Quantities, or those included in Change Orders or under written instructions, shall be done at the Contractors cost and risk.
- 2.4 The cost to the Employer for additional works shall be strictly based on rates provided in the Schedule of Rates for similar items. Non-similar works shall be priced based on the direct cost plus the pre-agreed rate for administration, profit and overhead costs.

2.5 The Contractor shall allow to drive and set piles down to a depth of no more than 35 feet below the original unfilled grade. Additional payment shall be made to the Contractor for every foot of pile installed below this level to achieve the required set, based solely on the rates noted in the Schedule of Rates.