

**REPUBLIC OF INDONESIA**  
**MINISTRY OF COMMUNICATIONS**  
**DIRECTORATE GENERAL OF LAND TRANSPORT**  
**AND INLAND WATERWAYS**

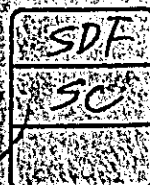
**TENDER DOCUMENTS**  
**FOR**  
**NEW RAILWAY LINE FOR CENGKARENG AIRPORT**  
**CONSTRUCTION PROJECT**

**PACKAGE I CIVIL AND ARCHITECTURAL WORK**

- PART A INSTRUCTIONS TO BIDDERS
- B CONDITIONS OF CONTRACT
- C GENERAL SPECIFICATIONS
- D TECHNICAL SPECIFICATIONS
- E BILL OF QUANTITIES

AUGUST 1984

**JAPAN INTERNATIONAL COOPERATION AGENCY**  
**(JICA)**



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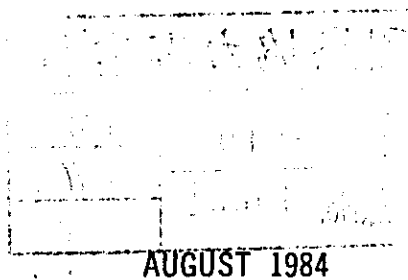
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**JAPAN INTERNATIONAL COOPERATION AGENCY  
(JICA)**

国際協力事業団	
受入 月日 '84.11.19	108
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	SDF

マイクロ  
フィッシュ作成



PART A

INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

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## INSTRUCTIONS TO BIDDERS

### Package 1 : Civil and Architectural Works

#### 1. OUTLINE OF THE WORK

A new airport is being constructed in Cengkareng apart approximately 15 km from Jakarta City towards north-western district. The Government of Indonesia has planned to construct a single track railway line of a total length of about 20km to link Jakarta City as a most suitable access means to the proposed air terminal.

The Works under this Contract include earthwork, drainage, retaining walls, culverts, bridges, viaducts, two stations including platforms and buildings with utilities, ventilation, air-conditioning and furnishings, two signal cabins including furnishings and utilities, station plazas, approach roads and relocation of tracks in the existing station yard.

Apart from the Works under this Contract, track laying work of this new railway line will be carried out as Package 2 and electrification of the railway, signaling, telecommunications and substations will be provided under Package 3 Contract.

#### 2. COMPOSITION OF BID DOCUMENTS

The Bid Documents shall comprise the following:

- (1) Invitation to Bid
- (2) Instructions to Bidders
- (3) Form of Bid
- (4) Form of Bid Bond
- (5) Conditions of Contract
- (6) General Specifications
- (7) Technical Specifications
- (8) Drawings
- (9) Form of Priced Bill of Quantities
- (10) Further information or notices and conditions contained in Addenda which may be issued to Bidders prior to stipulated delivery date of Bids.

#### 3. GENERAL PROVISIONS

##### 3.1 General Rules

The Bidder shall carefully examine all the documents, drawings, information and data comprising the Bid Documents referred to in Article 2 above, and inform himself fully with respect to any and all conditions which may in any way affect the amount or nature of his Bid, or the performance of this work in the event that he is awarded the Contract.

Failure of the Bidder to so examine and inform himself shall be at his sole risk and no relief for error or omission will be given.

### 3.2 Clarification of Bid Documents

Should there be any doubt or obscurity as to the meaning of any of the Bid Documents or as to anything to be done or not to be done by the awarded Contractor or as to any other matter or thing relating to the Bid, the Bidder must submit his queries in writing to the employer not later than 20 (twenty) days before the date by which Bids must be delivered. The answer to these and any other outstanding questions will be issued to all Bidders to whom Bid Documents have been issued. Each recipient shall acknowledge receipt of any such Addenda.

The Employer shall not be bound by and the Bidder shall not rely on any oral interpretation or clarification of the Bid Documents or answer given orally to any queries raised by him.

### 3.3 Inspection of Project Site

The Bidder is urged and expected to inspect the Project site and its surroundings and to satisfy himself as to all general and local conditions that may in any way affect the amount and nature his Bid.

### 3.4 Partnership or Joint Venture

If the Bidder is a partnership or joint venture, a Power of Attorney signed by each party to the partnership or joint venture appointing and designating one of them as Principal Partner and authorizing him to submit and sign the Bid and to act for and binding the Bidder in all matters relating thereto, shall be provided with his Bid. The Power of Attorney shall be certified by the Competent authorities.

If the Bidder intends to form a partnership or joint venture, he shall in addition to the Power of Attorney referred to above, submit with his Bid an authenticated copy of the agreement of the parties to partnership or joint venture, or an affidavit signed by the parties declaring their intention to form a partnership or joint venture.

The Bidder shall not be entitled to modify the composition of the partnership or joint venture as presented with his Bid, except by written authorization from the Employer.

### 3.5 Language and Unit

All documents shall be drawn up in English, using the decimal unit, metric and kilogram-ton. All correspondence during the period of bidding shall be in English.

3.6 Reimbursement to Bid Preparation

The Employer will not be responsible for nor pay for any compensation, or any expenses or loss which may be incurred by any Bidder in the preparation of his Bid.

4. PREPARATION AND SUBMISSION OF BID

4.1 Entries on Documents

The Bid Documents referred to in Article 2 shall be completed as required in indelible ink, using the Documents provided or true copy thereof and no alteration or erasure shall be made in any of the Documents. Any comments which the Bidder wishes to make shall not be placed on any of the Documents but must take the form of a separate statement, cross referenced to items, clauses and pages of the Documents.

4.2 Bid Price

Bids are to be priced in Indonesian Rupiah and US Dollars. the Bidder shall convert the US Dollars' element of his Bid to Indonesian Rupiah for the purposes of comparison of Bids. The exchange rate to be used shall be the T/T selling rate of the US Dollars quoted by the Bank Indonesia at close of business on the 30th day prior to the due date for delivery of Bids. Payment under the Contract will be made both in Indonesian Rupiah and US Dollars.

4.3 Sufficiency of Offer

The Bidder shall be responsible for the correctness and sufficiency of his offer for the Works and of the Rates, costs and prices stated in his Bid which shall cover all his responsibilities and obligations under the Contract and all matters and things necessary for the proper execution and completion of the Works.

4.4 Documents Accompanying Bid

The following is a summary of the documents which must be submitted with the Bid and which are described or referred to the following sections.

- (1) Power of Attorney for Partnership )
- (2) Power of Attorney for Joint Venture ) Where
- (3) Declaration of Partnership or Joint ) Applicable  
Venture Agreement )
- (4) List of Constructional Plant
- (5) Price List of Materials Required for the Works
- (6) Wage Rates for Labor
- (7) Detail Price Analysis
- (8) Detail Progress Schedule
- (9) List of Contractor's Staff

(10) Curriculum Vitae of Contractor's Senior Staff

Bids which are not accompanied by all the above documents are liable to be rejected.

4.5 List of Constructional Plant

The Bidder shall submit with his Bid a list of constructional plant which he intends to use for the execution of the Works under the Contract using the form attached to these Instructions, indicating separately equipment he owns, equipment he intends to purchase and equipment he intends to lease.

4.6 Price List of Materials Required for the Works and Wage Rates for Labor

Price List of materials Required for the Works and Wage Rates for Labor shall accompany the Bid, using the form attached to these Instructions to Bidders.

4.7 Detail Price Analysis

The Bidder shall submit with his Bid detail price analysis showing the price component of each pay item listed in the Bill of Quantities using the form attached to these Instructions as a guide. The unit price shall be broken down into various cost elements such as labor, fuel and lubricants, materials, equipment, overhead and profit, and other necessary costs.

4.8 Detail Progress Schedule and List of Contractor's Staff

Detail progress schedule and the list of the Contractor's staff who would be employed for the execution of the Works and who would be actually be present on Site shall accompany the Bid, using the form attached to these Instructions.

4.9 Bid Bond

The Bid must be accompanied by a Bid Bond in the sum of at least 3 (three) percent of the total bid price. The Bid Bond shall consist of a bank guarantee provided by a bank acceptable to the Government of Indonesia in the form attached to these Instructions. The Bid Bond shall remain valid up to 90 (ninety) days after the date when the Bids are opened and will be returned to an unsuccessful Bidder after expiry of the Bond validity period or as soon as possible after a successful Bidder has been awarded the Contract.

#### 4.10 Signatures

The Bid shall be signed by the legal representative of the Bidders. The Bid Documents shall be endorsed on the front page with the words "READ AND ACCEPTED AND GOOD FOR AGREEMENT" and signed and each page initiated by the person signing the Bid. All documents accompanying the Bid, referred in article 4.4, shall be dated and signed by the person signing the Bid.

#### 4.11 Submission of Bid

The Bid Documents and documents accompanying the Bid referred to in Articles 2 and 4.4 shall be divided into groups "A" and "B". Each group of documents shall be enclosed in a sealed envelope separately and marked "A" and "B".

Group "B" shall comprise the Bid, priced Bill of Quantities, List of Constructional Plant, Price List of Materials Required for the Works, Wage Rates for Labor and Detail Price Analysis, all of which must be duly filled in and signed by the Bidder. Group "A" shall comprise all other documents referred to in Articles 2 and 4.4.

The Bid shall be delivered by registered mail or personally by hand against a dated receipt not later than \_\_\_\_\_ local time on the date stated in the letter of invitation to bid to:

Departmen Perhubungan  
Direktorat Jenderal Perhubungan Darat  
Jl. Jenderal Sudirman No. P.59-60  
Jakarta, Indonesia

Any Bid, or any modification or withdrawal of a Bid which is received after the due date for delivery of Bids will be rejected.

#### 4.12 Modification or Withdrawal of Bid

The Bidder may modify or withdraw his Bid at any time prior to the due date and time for delivery of Bids provided the employer has received a written signed notification of modification or withdrawal before such date and time.

#### 4.13 Alternative Bids

If more than one Bid is submitted by an individual, contractor, partnership or joint venture under the same or different names, these Bids may be rejected.



5. OPENING OF BIDS

The Bids will be opened at the time, date and place advised in the letter of invitation to bid.

Envelope "A" will first be opened and examined by the duly authorized Evaluation Committee of Bids. If the contents of Envelope "A" are not considered satisfactory to the Evaluation Committee the Bid will be rejected immediately and envelope "B" will be returned unopened to the Bidder. Subject to the acceptance of Envelope "A", the Evaluation Committee will then proceed to open Envelop "B".

The Bidder or his authorized representative may attend the opening of the Bids, if he so desires. The amounts of each Bid will be read aloud and recorded.

6. EVALUATION OF BIDS

The Bids will be examined to ascertain that each pay item is moneyed out correctly at the unit price quoted. Should the Employer require any explanations of a Bid, the Bidder shall comply promptly with any notification by the Employer and provide such explanations as may be required.

The Employer does not bind himself to accept the lowest or any Bids, and reserves the right to accept any Bid, to stop the bidding process or to call for new Bids. No reasons will be given for rejecting Bids.

7. VALIDITY OF BID

Bids shall remain valid and binding Bidders for 90 (ninety) days from the date for opening Bids.

If any Bidder withdraws his Bid before the said period expires, without written authorization from the Employer, the amount of the Bid Bond will be forfeited.

8. AWARD OF CONTRACT

8.1 Letter of Intent

A Letter of Intent shall be sent by the Employer to a successful Bidder fixing the date of negotiation determining the unit prices quoted in his Bid, and other contractual matters.

8.2 Determination of Unit Prices

The unit price of each pay item stated in the priced Bill of Quantities shall be determined after adjustment and mutual agreement between the Employer and the successful Bidder.

8.3 Letter of Acceptance

Notification by the Employer to the successful Bidder of the acceptance of his Bid subject to the determination of the unit prices shall be made by a Letter of Acceptance to enter into an agreement awarding the Contract to him.

The Successful Bidder shall be expected within 15 (fifteen) days from the date of such notification to execute the Form of Contract with the Employer. The successful Bidder shall furnish a Performance Bond as specified in the Conditions of Contract. If he does not do so, the Employer shall have the right to cancel the Bid.

8.4 Failure to Sign the Contract by the Successful Bidder

If the successful Bidder refuses or fails to sign the Contract, the Employer may award the Contract the second Bidder. If the second Bidder refuses or fails to sign the Contract, the Employer may award the Contract the third Bidder. In such event the Bidders may be requested to extend the validity of the Bids for such further period as may be agreed upon in writing between the Employer and the Bidders concerned.

In the case of the second or third Bidder, the signing of the Contract shall also take place with 15 (fifteen) days from the date that Bidder has been notified of the award made to him.

8.5 Forfeiture of Bid Bond

If any Bidder refuses or fails to sign the Contract within 15 (fifteen) days after receiving the letter of Acceptance from the Employer and thereby declines the Award of Contract or if he fails to furnish a Performance Bond in accordance with the requirements of Clause 10 of the Conditions of Contract, then the amount of the Bid Bond will be forfeited in conformity with the terms and conditions stated in the Bid Bond.

NEW RAILWAY LINE FOR CENGKARENG AIRPORT  
CONSTRUCTION PROJECT

## FORM OF BID

Director General  
Departmen Perhubungan  
Direktorat Jenderal Perhubungan Darat  
Jakarta  
Indonesia

1. We, the Undersigned, duly authorized representative of \_\_\_\_\_ after having carefully examined the Instructions to Bidders and all the Bid Documents pertaining to Package 1 of New Railway Line for Cengkareng Airport Construction and having duly studied the site, the nature of the works to be carried out, and all local conditions, offer to execute, complete and maintain the whole of the said Works in conformity with the said Documents and provisions as stipulated therein for the sum of \_\_\_\_\_ ( ) or such other sums as may be ascertained in accordance with the said Documents.
2. We Undertake if our Bid is accepted to commence the Works within 30 (thirty) days of receipt of the Engineer's order to commence, and to complete the whole Works comprised in the Contract \_\_\_\_\_ days calculated from the last day of the aforesaid period in which the Works are to be commenced.
3. If our Bid is accepted we will obtain the guarantee of an Insurance Company or Bank (to be approved by you) to be jointly or severally bound up with us in a sum equivalent to 3 (three) percent of the above named sum for the due performance of the Contract under the terms of a Bond to be approved by you.
4. We are to abide by this Bid for the period of 90 (ninety) days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
5. Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding Contract between us.

6. We understand that you are not bound to accept the lowest or any Bid you may receive.

Date \_\_\_\_\_

Name of Bidder \_\_\_\_\_

Signature of the Bidder

Position of the Bidder

Address

Witness \_\_\_\_\_



PRICE LIST OF MATERIALS REQUIRED FOR THE WORKS

PAY ITEM NO. .... Unit Price: Rp. ....

Description : Cost of Material on Site .....

Item	Unit	Price		
		Foreign	Local	Total
1. CIF Cost at Port ... ..... from .....				
2. Handling				
3. Transport to Site Km .....				
4. Unloading, Storage, etc.				
Grand Total				

Exchange Rate: US\$ 1 = Rp. ....

WAGE RATES FOR LABOR

(Unit: Rupiah)

Class of Labor	Normal Working Day Hourly Rate	
	Local	Foreign

DETAIL PRICE ANALYSIS

PAY ITEM NO. .... Unit Price: Rp. ....

Description: .....

Item	Unit	Price		
		Foreign	Local	Total
A. Equipment				
Sub-total A				
B. Labor				
Sub-total B				
C. Materials				
Sub-total C				
D. Other Expenses				
Temporary roads for Works				
Temporary office and accomodations for Works				
Sub-total D				
E. Site Expenses				
Sub-total E				
F. Overhead and Profit (..... %)				
Grand Total				

Exchange Rate : US\$ 1 = Rp. ....



DETAIL PROGRESS SCHEDULE

Works	Comple- tion Time Month	Progress Schedule (Month)											
		1	2	3	4	5	6	7	8	9	10	11	12
1. Mobilization													
2. Installation of Right-of-way Post													
3. Earthwork													
4. Retaining Wall													
5. Box Culvert													
6. Transfer Underpass													
7. Pit Excavation													
8. Prestressed Concrete Pile													
9. Reinforced Concrete Pile													
10. Abutment & Pier													
11. Viaduct													
12. Prestressed Concrete Beam													
13. Manufacture & Shipping of Through Girder													
14. Erection of Through Girder													
15. Asphalt Pavement													
16. Station Main Building													
17. Interior Finish Work													

Works	Comple- tion Time Month	Progress Schedule (Month)											
		1	2	3	4	5	6	7	8	9	10	11	12
18. Air-condition- ing, furnishing, etc.													
19. Platform Shed													
20. Signal Cabin													
21. Gate Keeper's Box													
22. Landscaping & Vegetation													
23. Relocation of Track													
24. Demobilization													

LIST OF CONTRACTOR'S STAFF

Post to be held	Name	Nationality	Age	Years of Experience

CURRICULUM VITAE OF CONTRACTOR'S SENIOR STAFF

1. Full Name
2. Nationality
3. Date of Birth
4. Education
5. Full Details of Qualification
  
6. Full Details of Past Experience with Particular Reference to Railway Construction

FORM OF BID BOND

Date: \_\_\_\_\_

..... (Name of Bank) ..... Situated at .....  
..... (Address) .....  
agree to make a Bid Bond to the Departmen Perhubungan Direktorat  
Jenderal Perhubungan Darat of the Republic of Indonesia  
(hereinafter called the "Government") on the following terms:

1. That the Bid of ..... (Name and Address of Bidder) .....  
.....  
is made in agreement with the Bid Documents issued from the  
Government for the construction of the new Railway Line for  
Cengkareng Airport.
2. In submitting the Bid, the Bidder agrees to furnish a Bid  
Bond through the above named Bank in the sum of .....  
.....
3. The Bank hereto agrees to be a guarantor for the Bid Bond  
for the above sum in the name of the Government.
4. When ..... (Name of Bidder) ..... who has submitted the  
Bid does not abide by the terms and conditions stipulated  
in the bid Documents, the Bank agrees to pay the sum of ...  
.....  
to the Government within 7 (seven) days after notification  
to the Bank by the Government of the default of the Bidder.
5. This Bid Bond becomes effective from ..... (Date) .....  
to ..... (Date) .....  
(The Bond shall be effective from the date of submission of  
the Bid until 90 (ninety) days after the Opening of the  
Bid.)

IN WITNESS WHEREOF the authorized representative of the Bank has hereto signed.

Guarantor .....

Witness .....

PART B

CONDITIONS OF CONTRACT

## CONDITIONS OF CONTRACT

### DEFINITIONS AND INTERPRETATION

#### Definitions.

1. (1) In the Contract, as hereinafter defined, the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires:

- (a) "Employer" shall be Departmen Perhubungan, Direktorat Jenderal Perhubungan Darat, Republic of Indonesia.
- (b) "Contractor" means the person or persons, firm or company whose tender has been accepted by the Employer and includes the Contractor's personal representatives.
- (c) "Engineer" means the Engineer designated as the Engineer by the Employer, or other the Engineer appointed from time to time by the Employer and notified in writing to the Contractor in place of the Engineer so designated.
- (d) "Engineer's Representative" means any resident engineer or assistant of the Engineer, or any clerk of works appointed from time to time by the Employer or the Engineer to perform the duties set forth in Clause 2 hereof, whose authority shall be notified in writing to the Contractor by the Engineer.
- (e) "Works" shall include both Permanent Works and Temporary Works.
- (f) "Contract" means the Conditions of Contract, Specification, Drawings, priced Bill of Quantities, Bid, Letter of Acceptance and the Contract Agreement.
- (g) "Contract Price" means the sum named in the Letter of Acceptance, subject to such additions thereto or deductions therefrom as may be made under the provisions hereinafter contained.
- (h) "Constructional Plant" means all appliances or things of whatsoever nature required in or about the execution or maintenance of the Works but does not include materials or other things intended to form or forming part of the Permanent Works.
- (i) "Temporary Works" means all temporary works of every kind required in or about the execution or maintenance of the Works.
- (j) "Permanent Works" means the permanent works to be executed and maintained in accordance with the Contract.
- (k) "Specification" means the specification referred to in the Bid and any modification thereof or addition thereto as may from time to time be furnished or approved in writing by the Engineer.
- (l) "Drawings" means the drawings referred to in the Specification and any modification of such drawings approved in writing by the Engineer and such other drawings as may from time to time be furnished or approved in writing by the Engineer.



- (m) "Site" means the land and other places on, under, in or through which the Permanent Works or Temporary Works are to be executed and any other lands and places provided by the Employer for working space or any other purpose as may be specifically designated in the Contract as forming part of the Site.
- (n) "Right-of-Way" means land on which the Permanent Works are to be executed.
- (o) "Approved" means approved in writing, including subsequent written confirmation of previous verbal approval and "approval" means approval in writing, including as aforesaid.

Singular and Plural.

(2) Words importing the singular only also include the plural and vice versa where the context requires.

Headings or Notes.

(3) The headings and marginal notes in these Conditions of Contract shall not be deemed to be part thereof or be taken into consideration in the interpretation or construction thereof or of the Contract.

Cost.

(4) The word "cost" shall be deemed to include overhead costs whether on or off the Site.

#### ENGINEER AND ENGINEER'S REPRESENTATIVE

Duties and Powers of Engineer and Engineer's Representative.

2. (1) The Engineer shall carry out such duties in issuing decisions, certificates and orders as are specified in the Contract.

(2) The Engineer's Representative shall be responsible to the Engineer and his duties are to watch and supervise the Works and to test and examine any materials to be used or workmanship employed in connection with the Works. He shall have no authority to relieve the Contractor of any of his duties or obligations under the Contract nor, except as expressly provided hereunder or elsewhere in the Contract, to order any work involving delay or any extra payment by the Employer, nor to make any variation of or in the Works.

The Engineer may from time to time in writing delegate to the Engineer's Representative any of the powers and authorities vested in the Engineer and shall furnish to the Contractor and to the Employer a copy of all such written delegations of powers and authorities. Any written instruction or approval given by the Engineer's Representative to the Contractor within the terms of such delegation, but not otherwise, shall bind the Contractor and the Employer as though it had been given by the Engineer. Provided always as follows:

- (a) Failure of the Engineer's Representative to disapprove any work or materials shall not prejudice the power of the Engineer thereafter to disapprove such work or materials and to order the pulling down, removal or breaking up thereof.
- (b) If the Contractor shall be dissatisfied by reason of any decision of the Engineer's Representative he shall be entitled to refer the matter to the Engineer, who shall thereupon confirm, reverse or vary such decision.
- (3) Notwithstanding the provisions of sub-clause (1) and (2) of this Clause, if, in the opinion of the Engineer or the Engineer's Representative, an emergency occurs affecting the safety of life or of the Works or of adjoining property, they may

direct the Contractor to carry out all such work or to do all such things as may be necessary in the opinion of the Engineer or the Engineer's Representative to abate or reduce the risk. The Contractor shall forthwith comply without appeal with any such direction of the Engineer or the Engineer's Representative.

#### ASSIGNMENT AND SUB-LETTING

**Assignment.** 3. The Contractor shall not assign the Contract or any part thereof, or any benefit or interest therein or thereunder, otherwise than by a charge in favor of the Contractor's bankers of any monies due or to become due under this Contract, without the prior written consent of the Employer.

**Sub-letting.** 4. The Contractor shall not sub-let the whole of the Works. Except where otherwise provided by the Contract, the Contractor shall not sub-let any part of the Works without the prior written consent of the Engineer, which shall not be unreasonably withheld, and such consent, if given, shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any sub-contractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents, servants or workmen. Provided always that the provision of labor on a piece work basis shall not be deemed to be a sub-letting under this Clause. It shall be the duty of the Contractor, if so required by the Engineer, to furnish to the Engineer all particulars as to any sub-contractor employed or to be employed on the Works.

#### CONTRACT DOCUMENTS

**Language.** 5. (1) The English language shall be the ruling language of the Contract and shall be used in all correspondence and matters relating to the Contract.

**Weights and Measures.** (2) The metric system of weights and measures shall be used, except as may otherwise be approved in writing by the Engineer.

**Law.** (3) The Contract is subject to and shall be construed in accordance with the laws of the Republic of Indonesia.

**Extent of Contract.** (4) The Contract comprises the construction, completion and warranty of the Works and the provision of all labor, materials, Constructional Plant, Temporary Works and everything else, whether of a temporary or permanent nature, required in and for such construction, completion and warranty so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

**Documents Mutually Explanatory.** (5) Except if and to the extent otherwise provided by the Contract, the provisions of the Conditions of Contract shall prevail over those of any other document forming part of the Contract. Subject to the foregoing, the several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer who shall thereupon issue to the Contractor instructions thereon. Provided always that if, in the opinion of the Engineer, compliance with any such instructions shall involve the Contractor in any cost, which by reason of any such ambiguity or discrepancy could not reasonably have been foreseen by the Contractor, the Engineer shall certify and the Employer shall pay such additional sum as may be reasonable to cover such costs.

- Custody of Drawings. 6. (1) The Drawings shall remain the sole custody of the Engineer, but two copies thereof shall be furnished to the Contractor free of charge. The Contractor shall provide and make at his own expense any further copies required by him. At the completion of the Contract the Contractor shall return to the Engineer all Drawings provided under the Contract.
- One Copy of Drawings to be Kept on Site. (2) One copy of the Drawings, furnished to the Contractor as aforesaid, shall be kept by the Contractor on the Site and the same shall at all reasonable times be available for inspection and use by the Engineer and the Engineer's Representative and by any other person authorized by the Engineer in writing.
- Disruption of Progress. (3) The Contractor shall give written notice to the Engineer whenever planning or progress of the Works is likely to be delayed or disrupted unless any further drawing or order, including a direction, instruction or approval, is issued by the Engineer within a reasonable time. The notice shall include details of the drawing or order required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.
- Delays and Cost of Delay of Drawings. (4) If, by reason of any failure or inability of the Engineer to issue within a time reasonable in all the circumstances any drawing or order requested by the Contractor in accordance with sub-clause (3) of this Clause, the Contractor suffers delay and/or incurs costs then the Engineer shall take such delay into account in determining any extension of time to which the Contractor is entitled under Clause 44 hereof and the Contractor shall be paid the amount of such cost as shall be reasonable.
- Further Drawings and Instructions. 7. (1) The Engineer shall have full power and authority to supply to the Contractor from time to time, during the progress of the Works, such further drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and maintenance of the Works. The Contractor shall carry out and be bound by the same.
- Working Drawings. (2) The Contractor shall submit in duplicate to the Engineer for approval all Working Drawings which may be required in connection with the Contract, and any change or modification therein which the Engineer shall consider desirable shall be made and the work executed accordingly without entailing extra payment to the Contractor therefor. Three sets of copies of such approved Drawings shall be furnished to the Engineer at an early date after approval if required by the Engineer.
- Temporary Work Drawings. (3) The Contractor shall submit for approval and supply copies of drawings of the Temporary Works as required by the Engineer or by the Engineer's Representative.
- As-Built Drawings. (4) When the Works are completed, the Contractor shall prepare the As-Built Drawings from the Drawings used for executing the Works in accordance with the instructions of the Engineer and submit the original of the As-built Drawings and two copies thereof to the Engineer.
- Alteration After Approval. (5) Should it be found, at any time after approval has been given by the Engineer to any Drawings submitted by the Contractor, that the said Drawings do not comply with the terms and conditions of the Contract or that the details do not agree with any Drawings submitted previously such alterations and additions as may be deemed necessary by the Engineer shall be made therein by the Contractor and the work carried out accordingly without entailing extra payment to the Contractor therefor.

## GENERAL OBLIGATIONS

**Contractor's General Responsibilities.** 8. (1) The Contractor shall, subject to the provisions of the Contract, and with due care and diligence, execute and maintain the Works and provide all labor, including the supervision thereof, materials, Constructional Plant and all other things, whether of a temporary or permanent nature, required in and for such execution and maintenance, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

(2) The Contractor shall take full responsibility for the adequacy stability and safety of all site operations and methods of construction, provided that the Contractor shall not be responsible, except as may be expressly provided in the Contract, for the design or specification of the Permanent Works, or for the design or specification of any Temporary Works prepared by the Engineer.

**Contract Agreement.** 9. The Contractor shall when called upon so to do enter into and execute a Contract Agreement, to be prepared and completed at the cost of the Employer, in the form annexed with such modification as may be necessary.

**Performance Bond.** 10. The Contractor shall before the signing of the Contract Agreement submit Performance Bond in a sum equal to ten percent of the Contract Price for the due performance of the Contract. The Performance Bond shall consist of a bank guarantee to be made through a bank acceptable to the Government of Indonesia. The terms of the Bond shall be as the form attached hereto and shall be in form and substance and in all other respects satisfactory to the Employer. The obtaining of such guarantee and the cost of the Bond to be so entered into shall be at the expense in all respects of the Contractor. The Bond shall be returned to the Contractor with the Maintenance Certificate to be issued in accordance with Clause 62 hereof.

The Contractor may, in lieu of the specified bank guarantee substitute one hundred percent Performance Bond in conformity with the Guide Form shown in the Invitation to Bid and issued by a bonding company or companies or other sureties recognized by and acceptable to the Government of Indonesia.

**Inspection of Site.** 11. The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself, so far as is practicable, before submitting his Bid, as to the form and nature thereof, including the sub-surface conditions, the hydrological and climatic conditions, the extent and nature of work and materials necessary for the completion of the Works, the means of access to the Site and the accommodation he may require and, in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Bid.

**Sufficiency of Bid.** 12. The Contractor shall be deemed to have satisfied himself before bidding as to the correctness and sufficiency of his Bid for the Works and of prices stated in the priced Bill of Quantities which Bid prices shall, except insofar as it is otherwise provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper execution and maintenance of the Works.

**Adverse Physical Conditions and Artificial Obstructions.** If, however, during the execution of the Works the Contractor shall encounter physical conditions could, in his opinion, not have been reasonably foreseen by an experienced contractor, the Contractor shall forthwith give written notice thereof to the Engineer's Representative and if, in the opinion of the Engineer, such conditions or artificial obstructions could not have been reasonably foreseen by an experienced

contractor, then the Engineer shall certify and the Employer shall pay the additional cost to which the Contractor shall have been put by reason of such conditions, including the proper and reasonable cost

- (a) of complying with any instruction which the Engineer may issue to the Contractor in connection therewith, and
- (b) of any proper and reasonable measures approved by the Engineer which the Contractor may take in the absence of specific instructions from the Engineer,

as a result of such conditions obstructions being encountered.

**Work to be to the Satisfaction of Engineer.** 13. Save insofar as it is legally or physically impossible, the Contractor shall execute and maintain the Works in strict accordance with the Contract to the satisfaction of the Engineer and shall comply with and adhere strictly to the Engineer's instructions and directions on any matter whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions and directions only from the Engineer or, subject to the limitations referred to in Clause 2 hereof, from the Engineer's Representative.

**Program to be Furnished.** 14. (1) The Contractor shall, within fifteen days after the signing of the Contract Agreement, submit to the Engineer for his approval a program showing the order of procedure by CPM-Network in which he proposes to carry out the Works. The Contractor shall whenever required by the Engineer or Engineer's Representative, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works.

(2) If at any time it should appear to the Engineer that the actual progress of the Works does not conform to the approved program referred to in sub-clause (1) of this Clause, the Contractor shall produce, at the request of the Engineer, a revised program showing the modifications to the approved program necessary to ensure completion of the Works within the time for completion as defined in Clause 43 hereof.

(3) The submission to and approval by the Engineer or Engineer's Representative of such programs or the furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

**Contractor's Superintendence.** 15. The Contractor shall give or provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor, or a competent and authorized agent or representative approved of in writing by the Engineer, which approval may at any time be withdrawn, is to be constantly on the Works and shall give his whole time to the superintendence of the same. If such approval shall be withdrawn by the Engineer, the Contractor shall, as soon as is practicable, having regard to the requirement of replacing him as hereinafter mentioned, after receiving written notice of such withdrawal, remove the agent from the Works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another agent approved by the Engineer. Such authorized agent or representative shall receive, on behalf of the Contractor, directions and instructions from the Engineer or subject to the limitations of Clause 2 hereof, the Engineer's Representative.

**Contractor's Employees.** 16. (1) The Contractor shall provide and employ on the Site in connection with the execution and maintenance of the Works

(a) only such technical assistant as are skilled and experienced in their respective callings and such sub-agents, foremen and leading hands as are competent to give proper supervision to the work they are required to supervise, and

(b) such skilled, semi-skilled and unskilled labor as is necessary for the proper and timely execution and maintenance of the Works.

(2) The Engineer shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person employed by the Contractor in or about the execution or maintenance of the Works who, in the opinion of the Engineer, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose employment is otherwise considered by the Engineer to be undesirable and such person shall not be again employed upon the Works without the written permission of the Engineer. Any person so removed from the Works shall be replaced as soon as possible by a competent substitute approved by the Engineer.

**Setting-out.**

17. The Contractor shall be responsible for the true and proper setting-out of the Works in relation to control point, bench marks, route and profile instructed by the Engineer in writing and for the correctness, subject as above mentioned, of the position, levels, dimensions and alignment of all parts of the Works and for the provision of all necessary instruments, appliances and labor in connection therewith. If, at any time during the progress of the Works, any error shall appear or arise in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required so to do by the Engineer or the Engineer's Representative, shall, at his own cost, rectify such error to the satisfaction of the Engineer or the Engineer's Representative, unless such error is based on incorrect data supplied in writing by the Engineer or the Engineer's Representative, in which case the expense of rectifying the same shall be borne by the Employer. The checking of any setting-out or of any line or level by the Engineer or the Engineer's Representative shall not in any way relieve the Contractor of his responsibility for the correctness thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things used in setting-out the Works.

**Boreholes and  
Exploratory  
Excavation.**

18. If, at any time during the execution of the Works, the Engineer shall require the Contractor to make boreholes or to carry out exploratory excavation, such requirement shall be ordered in writing and shall be deemed to be an addition ordered under the provisions of Clause 51 hereof, unless a provisional sum in respect of such anticipated work shall have been included in the Bill of Quantities.

**Watching and  
Lighting.**

19. The Contractor shall in connection with the Works provide and maintain at his own cost all lights, guards, fencing and watching when and where necessary or required by the Engineer or the Engineer's Representative, or by any duly constituted authority, for the protection of the works, or for the safety and convenience of the public or others.

**Care of Works.**

20. (1) From the commencement of the Works until the date stated in the Certificate of Completion for the whole of the Works pursuant to Clause 48 hereof the Contractor shall take full responsibility for the care thereof. Provided that if the Engineer shall issue a Certificate of Completion in respect of any part of the Permanent Works the Contractor shall cease to be liable for the care of that part of the Permanent Works from the date stated in the Certificate of Completion in respect of that part and the responsibility for the care of any outstanding work which he shall have undertaken to finish during the Period of Maintenance until such outstanding work is completed. In case any damage, loss or injury shall happen to the Works. or to any part thereof, from any cause whatsoever, save and except the excepted risks as

pridefined in sub-clause (2) of this Clause, while the Contractor shall be responsible for the care thereof the Contractor shall, at his own cost, repair and make good the same, so that at completion the Permanent Works shall be in good order and condition and in conformity in every respect with the requirements of the Contract and the Engineer's instructions. In the event of any such damage, loss or injury happening from any of the excepted risks, the Contractor shall, if and to the extent required by the Engineer and subject always to the provisions of Clause 65 hereof, repair and make good the same as aforesaid at the cost of the Employer. The Contractor shall also be liable for any damage to the Works occasioned by him in the course of any operations carried out by him for the purpose of completing any outstanding work or complying with his obligations under Clauses 49 or 50 hereof.

**Excepted Risks.** (2) The "excepted risks" are war, hostilities (whether war be declared or not), invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, or unless solely restricted to employees of the Contractor or of his sub-contractors and arising from the conduct of the Works, riot, commotion or disorder, or use or occupation by the Employer of any part of the Permanent Works, or a cause solely due to the Engineer's design of the Works, or ionizing radiations or contamination by radio-activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive, or other hazardous properties of any explosive, nuclear assembly or nuclear component thereof, pressure waves caused by aircraft or other aerial devices traveling at sonic or supersonic speeds, or any such operation of the forces of nature as an experienced contractor could not foresee, or reasonably make provision for or insure against all of which are herein collectively referred to as "the excepted risks".

**Insurance of Works, etc.** 21. Without limiting his obligations and responsibilities under Clause 20 hereof, the Contractor shall insure in the joint names of the Employer and the Contractor against all loss or damage from whatever cause arising, other than the excepted risks, for which he is responsible under the terms of the Contract and in such manner that the Employer and Contractor are covered for the period stipulated in Clause 20(1) hereof and are also covered during the Period of Maintenance for loss or damage arising from a cause, occurring prior to the commencement of the Period of Maintenance, and for any loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations under Clause 49 and 50 hereof:

- (a) The Works for the time being executed to the estimated current contract value thereof, together with the materials for incorporation in the Works at their replacement value.
- (b) The Constructional Plant and other things brought on to the Site by the Contractor to the replacement value of such Constructional Plant and other things.

Such insurance shall be effected with an insurer and in terms approved by the Employer, which approval shall not be unreasonably withheld, and the Contractor shall, whenever required, produce to the Engineer or the Engineer's Representative the policy or policies of insurance and the receipts for payment of the current premiums.

**Damage to Persons and Property.** 22. (1) The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the Employer against all losses and claims in respect of injuries or damage to any person or material or physical damage to any property whatsoever which may arise out of or in consequence of the execution and maintenance

of the Works and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto except any compensation or damages for or with respect to:

- (a) The permanent use or occupation of land by the Works or any part thereof.
- (b) The right of the Employer to execute the Works or any part thereof on, over, under, in or through any land.
- (c) Injuries or damage to persons or property which are the unavoidable result of the execution or maintenance of the Works in accordance with the Contract.
- (d) Injuries or damage to persons or property resulting from any act or neglect of the Employer, his agents, servants or other contractors, not being employed by the Contractor, or for or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or where the injury or damage was contributed to by the Contractor, his servants or agents such part of the compensation as may be just and equitable having regard to the extent of the responsibility of the Employer, his servants or agents or other contractors for the damage or injury.

**Indemnity  
by Employer.**

(2) The Employer shall indemnify the Contractor against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the proviso to sub-clause (1) of this Clause.

**Third Party  
Insurance.**

23. (1) Before commencing the execution of the Works the Contractor, but without limiting his obligations and responsibilities under Clause 22 hereof, shall insure against his liability for any material or physical damage, loss or injury which may occur to any property, including that of the Employer, or to any person, including any employee of the Employer, by or arising out of the execution of the Works or in the carrying out of the Contract, otherwise than due to the matters referred to in the proviso to Clause 22 (1) hereof.

**Minimum  
Amount of  
Third Party  
Insurance.**

(2) Such insurance shall be effected with an insurer and in terms approved by the Employer, which approval shall not be unreasonably withheld, and for at least the amount approved by the Employer. The Contractor shall, whenever required, produce to the Engineer or the Engineer's Representative the policy or policies of insurance and the receipts for payment of the current premiums.

**Provision to  
Indemnify  
Employer.**

(3) The terms shall include a provision whereby, in the event of any claim in respect of which the Contractor would be entitled to receive indemnity under the policy being brought or made against the Employer, the insurer will indemnify the Employer against such claims and any costs, charges and expenses in respect thereof.

**Accident or  
Injury to  
Workmen.**

24. (1) The Employer shall not be liable for or in respect of any damages or compensation payable at law in respect of or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or any sub-contractor, save and except an accident or injury resulting from any act or default of the Employer, his agents, or servants. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation, save and except as aforesaid, and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.



Insurance against  
Accident, etc.,  
to Workmen.

(2) The Contractor shall insure against such liability with an insurer approved by the Employer, which approval shall not be unreasonably withheld, and shall continue such insurance during the whole of the time that any persons are employed by him on the Works and shall, when required, produce to the Engineer or the Engineer's Representative such policy of insurance and the receipt for payment of the current premium. Provided always that, in respect of any persons employed by any sub-contractor, the Contractor's obligation to insure as aforesaid under this sub-clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such sub-contractor to produce to the Engineer or the Engineer's Representative, when required, such policy of insurance and the receipt for the payment of the current premium.

Remedy on  
Contractor's  
Failure to  
Insure.

25. If the Contractor shall fail to effect and keep in force the insurances referred to in Clauses 21, 23 and 24 hereof, or any other insurance which he may be required to effect under the terms of the Contract, then and in any such case the Employer may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the Employer as aforesaid from any monies due or which may become due to the Contractor, or recover the same as a debt due from the Contractor.

Giving of  
Notices and  
Payment of  
Fees.

26. (1) Except for the right-of-way acquisition which will be furnished and paid by the Employer, the Contractor shall give all notices and pay all fees required to be given or paid by any National or State Statute, Ordinance, or other Law, or any regulation, or bye-law of any local or other duly constituted authority in relation to the execution of the Works and by the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works.

Compliance  
with Statutes,  
Regulations,  
etc.

(2) The Contractor shall conform in all respects with the provisions of any such Statute, Ordinance or Law as aforesaid and the regulations or bye-laws of any local or other duly constituted authority which may be applicable to the Works and with such rules and regulations of public bodies and companies as aforesaid and shall keep the Employer indemnified against all penalties and liability of every kind for breach of any such Statute, Ordinance or Law, regulation or bye-law.

(3) The Employer will repay or allow to the Contractor all such sums as the Engineer shall certify to have been properly payable and paid by the Contractor in respect of such fees.

Fossils, etc.

27. All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the site of the Works shall as between the Employer and the Contractor be deemed to be the absolute property of the Employer. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such article or thing and shall immediately upon discovery thereof and, before removal, acquaint the Engineer's Representative of such discovery and carry out, at the expense of the Employer, the Engineer's Representative's orders as to the disposal of the same.

Patent Rights  
and Royalties.

28. The Contractor shall save harmless and indemnify the Employer from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name or other protected rights in respect of any Constructional Plant, machine work, or material used for or in connection with the Works or any of them and from and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. Except where

otherwise specified, the Contractor shall pay all tonnage and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the Works or any of them.

**Interference  
With Traffic  
and Adjoining  
Properties.**

29. All operations necessary for the execution of the Works shall, so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with the convenience of the public, or the access to, use and occupation of public or private roads and footpaths to or of properties whether in the possession of the Employer or of any other person. The Contractor shall conduct his operations so as to offer the least possible obstruction to maintaining flow in irrigation canals, channels and water-courses which must be maintained without interruption. The Contractor shall observe all rules and regulations of appropriate authorities regarding the interruption and maintenance of flow in irrigation canals, channels and water-courses. The Contractor shall conduct his operations, make necessary arrangements, take suitable precaution and perform all required work incidental to the protection of and avoidance of interference with power transmission and other utilities within the areas of his operations in connection with this Contract and the cost therefore shall be borne by the Contractor. The Contractor shall save harmless and indemnify the Employer in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of, or in relation to, any such matters in so far as the Contractor is responsible therefor.

**Extraordinary  
Traffic.**

30. (1) The Contractor shall use very reasonable means to prevent any of the highways or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of his sub-contractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic as will inevitably arise from the moving of plant and material from and to the Site shall be limited, as far as reasonably possible, and so that no unnecessary damage or injury may be occasioned to such highways and bridges.

**Special Loads.**

(2) Should it be found necessary for the Contractor to move one or more loads of Constructional Plant, machinery or pre-constructed units or parts of units of work over part of a highway or bridge, the moving whereof is likely to damage any highway or bridge unless special protection or strengthening is carried out, then the Contractor shall before moving the load on to such highway or bridge give notice to the Engineer or Engineer's Representative of the weight and other particulars of the load to be moved and his proposals for protecting or strengthening the said highway or bridge. Unless within fourteen days of the receipt of such notice the Engineer shall by counter-notice direct that such protection or strengthening is unnecessary, then the Contractor will carry out such proposals or any modification thereof that the Engineer shall require and, unless there is an item or are items in the Bill of Quantities for pricing by the Contractor of the necessary works for the protection or strengthening aforesaid, the costs thereof shall be paid by the Employer to the Contractor.

**Settlement of  
Extraordinary  
Traffic Claims.**

(3) If during the execution of the Works or at any time thereafter the Contractor shall receive any claim arising out of the execution of the Works in respect of damage or injury to highways or bridges he shall immediately report the same to the Engineer and thereafter the Employer shall negotiate the settlement of and pay all sums due in respect of such claim and shall indemnify the Contractor in respect thereof and in respect of all claims, proceedings, damages, costs, charges and expenses in relation thereto. Provided always that if and so far as any such claims or part thereof shall in the opinion of the Engineer be due to any failure on

the part of the Contractor to observe and perform his obligations under sub-clause (1) and (2) of this Clause, then the amount certified by the Engineer to be due to such failure shall be paid by the Contractor to the Employer.

Opportunities  
for other  
Contractors.

31. The Contractor shall, in accordance with the requirements of the Engineer, afford all reasonable opportunities for carrying out their work to any other contractors employed by the Employer and their workmen and to the workmen of the Employer and of any other duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any contract which the Employer may enter into in connection with or ancillary to the Works. If, however, the Contractor shall, on the written request of the Engineer or the Engineer's Representative, make available to any such other contractor, or to the Employer or any such authority, any roads or ways for the maintenance of which the Contractor is responsible, or permit the use by any such of the Contractor's scaffolding or other plant on the Site, or provide any other service of whatsoever nature for any such, the Employer shall pay to the Contractor in respect of such use or service such sum or sums as shall, in the opinion of the Engineer, be reasonable.

Contractor  
to Keep  
Site Clear.

32. During the progress of the Works the Contractor shall keep the Site reasonably free from all unnecessary obstruction and shall store or dispose of any Constructional Plant and surplus materials and clear away and remove from the Site any wreckage, rubbish or Temporary works no longer required.

Clearance of  
Site on  
Completion.

33. On the completion of the Works the Contractor shall clear away and remove from the Site all Constructional Plant, surplus materials, rubbish and Temporary Works of every kind, and leave the whole of the Site and Works clean and in a workmanlike condition to the satisfaction of the Engineer.

#### LABOR

Engagement of  
Labor.

34. (1) The Contractor shall make his own arrangements for the engagement of all labor, and, according to "Manpower Regulations in Indonesia Guidance for Foreign Investors" (Labor Legislation, Republic of Indonesia - by Juridical Bureau Department of Manpower), for the transport, housing, payment and all other allowance thereof.

Supply of  
Water.

(2) The Contractor shall, so far as is reasonably practicable, having regard to local conditions, provide on the Site, to the satisfaction of the Engineer's Representative, an adequate supply of drinking and other water for the use of the Contractor's staff and work people.

Alcoholic Liquor  
or Drugs.

(3) The Contractor shall not, otherwise than in accordance with the Statutes, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor, or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his sub-contractors, agents or employees.

Arms and  
Ammunition.

(4) The Contractor shall not give, barter or otherwise dispose of to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

Festivals and  
Religious  
Customs.

(5) The Contractor shall in all dealings with labors in his employment have due regard to all recognized festivals, days of rest and religious or other customs.

**Epidemics.**

(6) In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities for the purpose of dealing with and overcoming the same.

**Disorderly Conduct, etc.**

(7) The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his employees and for the preservation of peace and protection of persons and property in the neighbourhood of the Works against the same.

**Observance by Sub-Contractors.**

(8) The Contractor shall be responsible for observance by his sub-contractors of the foregoing provisions.

**Other Conditions Affecting Labor and Wages.**

(9) The Contractor shall also take steps to acquaint himself and conform with all the other labor regulations as may be issued from time to time by the Department of Manpower or other authorities concerned.

**Returns of Labor, etc.**

35. The Contractor shall, if required by the Engineer, deliver to the Engineer's Representative, or at his office, a return in detail in such form and at such intervals as the Engineer may prescribe showing the supervisory staff and the numbers of the several classes of labor from time to time employed by the Contractor on the Site and such information respecting Constructional Plant as the Engineer's Representative may require.

**MATERIALS AND WORKMANSHIP**

**Quality of Materials and Workmanship and Tests.**

36. (1) All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Engineer's instructions and shall be subjected from time to time to such tests as the Engineer may direct at the place of manufacture or fabrication, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places. The Contractor shall provide such assistance, instruments, machines, labor and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples of materials before incorporation in the Works for testing as may be selected and required by the Engineer.

**Cost of Samples.**

(2) All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Contract, but if not, then at the cost of the Employer.

**Cost of Tests.**

(3) The cost of making any test shall be borne by the Contractor if such test is clearly intended by or provided for in the Contract and, in the cases only of a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfill, is particularized in the Contract in sufficient detail to enable the Contractor to price or allow for the same in his Bid.

**Cost of Tests not Provided for, etc.**

(4) If any test is ordered by the Engineer which is either

(a) not so intended by or provided for, or

(b) (in the cases above mentioned) is not so particularized, or

(c) though so intended or provided for is ordered by the Engineer to be carried out by an independent person at any place other than the Site or the place of manufacture or fabrication of the materials tested,

then the cost of such test shall be borne by the Contractor, if the test shows the workmanship or materials not to be in accordance with the provisions of the Contract or the Engineer's instructions, but otherwise by the Employer.

**Inspection of Operations.**

37. The Engineer and any person authorized by him shall at all times have access to the Works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery are being obtained for the Works and the Contractor shall afford every facility for and every assistance in or in obtaining the right to such access.

**Examination of Work before Covering up.**

38. (1) No work shall be covered up or put out of view without the approval of the Engineer or the Engineer's Representative and the Contractor shall afford full opportunity for the Engineer or the Engineer's Representative to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. The Contractor shall give due notice to the Engineer's Representative whenever any such work or foundations is or are ready or about to be ready for examination and the Engineer's Representative shall, without unreasonably delay, unless he considers it unnecessary and advise the Contractor accordingly, attend for the purpose of examining and measuring such work or of examining such foundations.

**Uncovering and Making Openings.**

(2) The Contractor shall uncover any part or parts of the Works or make openings in or through the same as the Engineer may from time to time direct and shall reinstate and make good such part or parts to the satisfaction of the Engineer. If any such part or parts have been covered up or put out of view after compliance with the requirement of sub-clause (1) of this Clause and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating and making good the same shall be borne by the Employer, but in any other case all costs shall be borne by the Contractor.

**Removal of Improper Work and Materials.**

39. (1) The Engineer shall during the progress of the Works have power to order in writing from time to time

(a) the removal from the Site, within such time or times as may be specified in the order, of any materials which, in the opinion of the Engineer, are not in accordance with the Contract.

(b) the substitution of proper and suitable materials and

(c) the removal and proper re-execution, notwithstanding any previous test thereof or interim payment therefor, of any work which in respect of materials or workmanship is not, in the opinion of the Engineer, in accordance with the Contract.

**Default of Contractor in Compliance.**

(2) In case of default on the part of the Contractor in carrying out such order, the Employer shall be entitled to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the Employer, or may be deducted by the Employer from any monies due or which may become due to the Contractor.

**Suspension  
of Work.**

40. (1) The Contractor shall, on the written order of the Engineer, suspend the progress of the Works or any part thereof for such time or times and in such manner as the Engineer may consider necessary and shall during such suspension properly protect and secure the work, so far as is necessary in the opinion of the Engineer. The extra cost incurred by the Contractor in giving effect to the Engineer's instructions under this Clause shall be borne and paid by the Employer unless such suspension is

- (a) otherwise provided for in the Contract, or
- (b) necessary by reason of some default on the part of the Contractor, or
- (c) necessary by reason of climatic conditions on the Site, or
- (d) necessary for the proper execution of the Works or for the safety of the Works or any part thereof insofar as such necessity does not arise from any act or default by the Engineer or the Employer or from any of the excepted risks defined in Clause 20 hereof.

Provided that the Contractor shall not be entitled to recover any such extra cost unless he gives written notice of his intention to claim to the Engineer within twenty-eight days of the Engineer's order. The Engineer shall settle and determine such extra payment and/or extension of time under Clause 44 hereof to be made to the Contractor in respect of such claim as shall, in the opinion of the Engineer, be fair and reasonable.

**Suspension  
Lasting more  
Than 90 days.**

(2) If the progress of the Works or any part thereof is suspended on the written order of the Engineer and if permission to resume work is not given by the Engineer within a period of ninety days from the date of suspension then, unless such suspension is within paragraph (a), (b), (c) or (d) of sub-clause (1) of this Clause, the Contractor may serve a written notice on the Engineer requiring permission within twenty-eight days from the receipt thereof to proceed with the Works, or that part thereof in regard to which progress is suspended and, if such permission is not granted within that time, the Contractor by a further written notice so served may, but is not bound to, elect or treat the suspension where it affects part only of the Works as an omission of such part under Clause 51 hereof, or where it affects the whole Works, as an abandonment of the Contract by the Employer.

**COMMENCEMENT TIME AND DELAYS**

**Commencement  
of Works.**

41. The Contractor shall commence the Works on Site within the period named in the Letter of Acceptance after the receipt by him of a written order to this effect from the Engineer and shall proceed with the same with due expedition and without delay, except as may be expressly sanctioned or ordered by the Engineer, or be wholly beyond the Contractor's control.

**Possession  
of Site.**

42. (1) Save insofar as the Contract may prescribe, the extent of portions of the Site of which the Contractor is to be given possession from time to time and the order in which such portions shall be made available to him and, subject to any requirement in the Contract as to the order in which the Works shall be executed, the Employer will, with the Engineer's written order to commence the Works, give to the Contractor possession of so much of the Site as may be required to enable the Contractor to commence and proceed with the execution of the Works in accordance with the program referred to in Clause 14 hereof, and otherwise in accordance with such reasonable proposals of the Contractor as he shall, by written notice to the

Engineer, make and will, from time to time as the Works proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with the said program or proposals, as the case may be. If the Contractor suffers delay or incurs cost from failure on the part of the Employer to give possession in accordance with the terms of this Clause, the Engineer shall grant an extension of time for the completion of the Works and certify such sum as, in his opinion, shall be fair to cover the cost incurred, which sum shall be paid by the Employer.

**Wayleaves, etc.** (2) The Contractor shall bear all costs and charges for special or temporary wayleaves required by him in connection with access to the Site. The Contractor shall also provide at his own cost any additional accommodation outside the Site required by him for the purpose of the Works.

**Furnishing of Right-of-Way and Removal of Obstruction.** (3) The Employer will be responsible for obtaining at his own expense all necessary Right-of-Way in advance of construction. Except if and to the extent otherwise provided by the Contract, the Employer will clear away and remove from the Right-of-Way all such unnecessary obstruction as buildings, houses, towers of power transmission lines, telephone and electric poles, lines and cables, gas, water supply and drainage pipes and other utility cables which interfere with the proper execution of the Works prior to giving to the Contractor possession thereof.

If, during the execution of the Works, the Contractor discovers inside the Right-of-Way any such obstruction which shall, in his opinion, be removed and replaced, the Contractor shall forthwith give written notice thereof to the Engineer's Representative and if, in the opinion of the Engineer, such obstruction shall be removed and replaced, then the Engineer shall direct the Contractor or other persons to remove and replace the same at the expense of the Employer.

**Times for Completion.** 43. Subject to any requirement in the Contract as to completion of any section of the Works before completion of the whole, the whole of the Works shall be completed, in accordance with the provisions of Clause 48 hereof, within the time stated in the Contract calculated from the last day of the period named in the Letter of Acceptance as that within which the Works are to be commenced, or such extended time as may be allowed under Clause 44 hereof.

**Extension of Time for Completion.** 44. Should the amount of extra or additional work of any kind or any cause of delay referred to in these Conditions, or exceptional adverse climatic conditions, or other special circumstances of any kind whatsoever which may occur, other than through a default of the Contractor, be such as fairly to entitle the Contractor to an extension of time for the completion of the Works, the Engineer shall determine the amount of such extension and shall notify the Employer and the Contractor accordingly. Provided that the Engineer is not bound to take into account any extra or additional work or other special circumstances unless the Contractor has within twenty-eight days after such work has been commenced, or such circumstances have arisen, or as soon thereafter as is practicable, submitted to the Engineer's Representative full and detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

**No Night or Sunday Work.** 45. Subject to any provision to the contrary contained in the Contract, none of the Permanent Works shall, save as hereinafter provided, be carried on during the night or on Sundays, if locally recognized as days of rest, or their locally recognized equivalent without the permission in writing of the Engineer's Representative, except when the work is unavoidable or absolutely necessary for the saving of life or

property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer's Representative. Provided always that the provisions of this Clause shall not be applicable in the case of any work which it is customary to carry out by rotary or double shifts.

The Engineer will not withhold permission for night, Sunday or official holiday work provided that he is satisfied with the Contractor's arrangements for compliance with Clauses 19 and 29 of the Conditions of Contract. All work at night shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify the Employer from and against any liability for damages on account of noise or other disturbance created while or in carrying out the work and from and against all claims, demands, proceedings, costs, charges and expenses whatsoever in regard or in relation to such liability.

**Rate of Progress.**

46. If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any section is at any time, in the opinion of the Engineer, too slow to ensure completion by the prescribed time or extended time for completion, the Engineer shall so notify the Contractor in writing and the Contractor shall thereupon take such steps as are necessary and the Engineer may approve to expedite progress so as to complete the Works or such section by the prescribed time or extended time. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the Contractor shall seek the Engineer's permission to do any work at night or on Sundays, if locally recognized as days of rest, or their locally recognized equivalent, such permission shall not be unreasonably refused.

**Liquidated Damages for Delay.**

47. (1) If the Contractor shall fail to achieve completion of the Works within the time prescribed by Clause 43 hereof, then the Contractor shall pay to the Employer the sum equivalent to zero point zero three percent of the original Contract Price up to maximum five percent of the same as liquidated damages for such default and not as a penalty for every day or part of a day which shall elapse between the time prescribed by Clause 43 hereof and the date of certified completion of the Works. The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any monies in his hands, due or which may become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.

**Reduction of Liquidated Damages.**

(2) If, before the completion of the whole of the Works any part or section of the works has been certified by the Engineer as completed, pursuant to Clause 48 hereof, and occupied or used by the Employer, the liquidated damages for delay shall, for any period of delay after such certificate and in the absence of alternative provisions in the Contract be reduced in the proportion which the value of the part or section so certified bears to the value of the whole of the Works.

**Certification of Completion of Works.**

48. (1) When the whole of the Works have been substantially completed and have satisfactorily passed any final test that may be prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer or to the Engineer's Representative accompanied by an undertaking to finish any outstanding work during the Period of Maintenance. Such notice and undertaking shall be in writing and shall be deemed to be a request by the Contractor for the Engineer to issue a Certificate of Completion in respect of the Works. The Engineer shall, within twenty-one days of the date of delivery of such notice either issue to the Contractor, with a copy to the Employer, a Certificate of Completion stating the date on which, in his opinion, the Works were substantially completed in accordance with the Contract or give instructions in writing to the Contractor specifying all the work which, in the



Engineer's opinion, requires to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the works specified therein. The Contractor shall be entitled to receive such Certificate of Completion within twenty-one days of completion to the satisfaction of the Engineer of the works so specified and making good any defects so notified.

**Certification  
of Completion  
by Stages.**

(2) Similarly, in accordance with the procedure set out in sub-clause (1) of this Clause, the Contractor may request and the Engineer shall issue a Certificate of Completion in respect of:

- (a) any section of the Permanent Works in respect of which a separate time for completion is provided in the Contract and
- (b) any substantial part of the Permanent Works which has been both completed to the satisfaction of the Engineer and occupied or used by the Employer.

(3) If any part of the Permanent Works shall have been substantially completed and shall have satisfactorily passed any final test that may be prescribed by the Contract, the Engineer may issue a Certificate of Completion in respect of that part of the Permanent Works before completion of the whole of the Works and, upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete any outstanding work in that part of the Works during the Period of Maintenance.

(4) Provided always that a Certificate of Completion given in respect of any section or part of the Permanent Works before completion of the whole shall not be deemed to certify completion of any ground or surfaces requiring reinstatement, unless such Certificate shall expressly so state.

**MAINTENANCE AND DEFECTS**

**Definition of  
'Period of  
Maintenance'.**

49. (1) In these Conditions the expression "Period of Maintenance" shall mean the period of maintenance for one year, calculated from the date of completion of the Works, certified by the Engineer in accordance with Clause 48 hereof, or in the event of more than one certificate having been issued by the Engineer under the said Clause, from the respective dates so certified and in relation to the Period of Maintenance the expression "the Works" shall be construed accordingly.

**Execution of  
Work of  
Repair, etc.**

(2) To the intent that the Works shall at or as soon as practicable after the expiration of the Period of Maintenance be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall finish the work, if any, outstanding at the date of completion, as certified under Clause 48 hereof, as soon as practicable and making good defects, imperfections, shrinkages or other faults as may be required of the Contractor in writing by the Engineer during the Period of Maintenance, or within fourteen days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration.

**Cost of  
Execution of  
Repair, etc.**

(3) All such work shall be carried out by the Contractor at his own expense if the necessity thereof shall, in the opinion of the Engineer, be due to the use of materials or workmanship not in accordance with the Contract, or to neglect or failure on the part of the Contractor to comply with any obligation, expressed or

implied, on the Contractor's part under the Contract. If, in the opinion of the Engineer, such necessity shall be due to any other cause, the value of such work shall be ascertained and paid for as if it were additional work.

Remedy on  
Contractor's  
Failure to  
carry out  
Work Required.

(4) If the Contractor shall fail to do any such work as aforesaid required by the Engineer, the Employer shall be entitled to employ and pay other persons to carry out the same and if such work is work which, in the opinion of the Engineer, the Contractor was liable to do at his own expense under the Contract, then all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the Employer, or may be deducted by the Employer from any monies due or which may become due to the Contractor.

Contractor  
to Search.

50. The Contractor shall, if required by the Engineer in writing, search under the directions of the Engineer for the cause of any defect, imperfection or fault appearing during the progress of the Works or in the Period of Maintenance. Unless such defect, imperfection or fault shall be one for which the Contractor is liable under the Contract, the cost of the work carried out by the Contractor in searching as aforesaid shall be borne by the Employer. If such defect, imperfection or fault shall be one for which the Contractor is liable as aforesaid, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case repair, rectify and make good such defects, imperfection or fault at his own expense in accordance with the provision of Clause 49 hereof.

#### ALTERATIONS, ADDITIONS AND OMISSIONS

Variations.

51. (1) The Engineer shall make any variation of the form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion be desirable, he shall have power to order the Contractor to do and the Contractor shall do any of the following:

- (a) increase or decrease the quantity of any work included in the Contract,
- (b) omit any such work,
- (c) change the character or quality or kind of any such work,
- (d) change the levels, lines, position and dimensions of any part of the works, and
- (e) execute additional work of any kind necessary for the completion of the Works

and no such variation shall in any way vitiate or invalidate the Contract, but the value, if any, of all such variations shall be taken into account in ascertaining the amount of the Contract Price.

Orders for  
Variations to  
be in Writing.

(2) No such variations shall be made by the Contractor without an order in writing of the Engineer. Provided that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an order given under this Clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities. Provided also that if for any reason the Engineer shall consider it desirable to give any such order verbally, the Contractor shall comply with such order and any confirmation in writing of such verbal order given by the Engineer, whether before or

after the carrying out of the order, shall be deemed to be an order in writing within the meaning of this Clause. Provided further that if the Contractor shall within seven days confirm in writing to the Engineer and such confirmation shall not be contradicted in writing within fourteen days by the Engineer, it shall be deemed to be an order in writing by the Engineer.

**Valuation of Variations.**

52. (1) All extra or additional work done or work omitted by order of the Engineer shall be valued at the prices set out in the Contract if, in the opinion of the Engineer, the same shall be applicable. If the Contract does not contain any prices applicable to the extra or additional work, then suitable prices shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such prices as shall, in his opinion, be reasonable and proper.

**Power of Engineer to Fix Rates.**

(2) Provided that if the nature or amount of any omission or addition relative to the nature or amount of the whole of the Works or to any part thereof shall be such that, in the opinion of the Engineer, the price contained in the Contract for any item of the Works is, by reason of such omission or addition, rendered unreasonable or inapplicable, then a suitable prices shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such other price as shall, in his opinion, be reasonable and proper having regard to the circumstances.

Provided also that no increase or decrease under sub-clause (1) of this Clause or variation of price under sub-clause (2) of this Clause shall be made unless, as soon after the date of the order as is practicable and, in the case of extra or additional work, before the commencement of the work or as soon thereafter as is practicable, notice shall have been given in writing:

- (a) by the Contractor to the Engineer of his intention to claim extra payment or a varied price, or
- (b) by the Engineer to the Contractor of his intention to vary a price.

**Variations Exceeding 10 per cent**

(3) If, on certified completion of the whole of the Works it shall be found that a reduction or increase greater than ten per cent of the sum named in the Letter of Acceptance, excluding all fixed sums, and allowance for dayworks, if any, results from:

- (a) the aggregate effect of all Variation Orders, and
- (b) all adjustments upon measurement of the estimated quantities set out in the Bill of Quantities, excluding all provisional sums, dayworks and adjustments of price made under Clause 70(1) hereof,

but not from any other cause, the amount of the Contract Price shall be adjusted by such sum as may be agreed between the Contractor and the Engineer or, failing agreement, fixed by the Engineer having regard to all material and relevant factors, including the Contractor's site and general overhead costs of the Contract.

**Daywork.**

(4) The Engineer may, if, in his opinion it is necessary or desirable, order in writing that any additional or substituted work shall be executed on a daywork basis. The Contractor shall then be paid for such work at the prices agreed upon between the Engineer and the Contractor.

The Contractor shall furnish to the Engineer such receipts or other vouchers as may be necessary to prove the amounts paid and, before ordering materials, shall submit to the Engineer quotations for the same for his approval.

In respect of all work executed on a daywork basis, the Contractor shall, during the continuance of such work, deliver each day to the Engineer's Representative an exact list in duplicate of the names, occupation and time of all workmen employed on such work and a statement, also in duplicate, showing the description and quantity of all materials and plant used thereon or therefor. One copy of each list and statement will, if correct, or when agreed, be signed by the Engineer's Representative and returned to the Contractor.

At the end of each month the Contractor shall deliver to the Engineer's Representative a priced statement of the labor, material and plant used and the Contractor shall not be entitled to any payment unless such lists and statements have been fully and punctually rendered. Provided always that if the Engineer shall consider that for any reason the sending of such lists or statements by the Contractor, in accordance with the foregoing provision, was impracticable he shall nevertheless be entitled to authorize payment for such work, either as daywork, on being satisfied as to the time employed and plant and materials used on such work, or at such value therefor as shall, in his opinion, be fair and reasonable.

**Claims.**

(5) The Contractor shall send to the Engineer's Representative once in every month an account giving particulars, as full and detailed as possible, of all claims for any additional payment to which the Contractor may consider himself entitled and of all extra or additional work ordered by the Engineer which he has executed during the preceding month.

No final or interim claim for payment for any such work or expense will be considered which has not been included in such particulars. Provided always that the Engineer shall be entitled to authorize payment to be made for any such work or expense, notwithstanding the Contractor's failure to comply with this condition, if the Contractor has, at the earliest practicable opportunity, notified the Engineer in writing that he intends to make a claim for such work.

**PLANT, TEMPORARY WORKS AND MATERIALS**

**Plant, etc.,  
Exclusive Use  
for the Works.**

53. (1) All Constructional Plant, Temporary Works and materials provided by the Contractor shall, when brought on to the site, be deemed to be exclusively intended for the execution of the Works and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent, in writing, of the Engineer, which shall not be unreasonably withheld.

**Removal of  
Plant, etc.**

(2) Upon completion of the Works the Contractor shall remove from the Site all the said Constructional Plant and Temporary Works remaining thereon and any unused materials provided by the Contractor.

**Employer not  
Liable for  
Damage to Plant,  
etc.**

(3) The Employer shall not at any time be liable for the loss of or damage to any of the said Constructional Plant, Temporary Works or materials save as mentioned in Clauses 20 and 65 hereof.

Re-export of Plant. (4) In respect of any Constructional Plant which the Contractor shall have imported for the purposes of the Works, the Employer will assist the Contractor, where required, in procuring any necessary Government consent to the re-export of such Constructional Plant by the Contractor upon the removal thereof as aforesaid.

Customs Clearance. (5) The Employer will assist the Contractor, where required, in obtaining clearance through the Customs of Constructional Plant, materials and other things required for the Works.

Approval of Materials, etc., not implied. 54. The operation of Clause 53 hereof shall not be deemed to imply any approval by the Engineer of the materials or other matters referred to therein nor shall it prevent the rejection of any such materials at any time by the Engineer.

#### MEASUREMENT

Quantities. 55. The quantities set out in the Bill of Quantities are the estimated quantities of the work, but they are not to be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfilment of his obligations under the Contract.

Works to be Measured. 56. All works acceptably completed shall be measured by the Contractor and the measurements shall be checked and approved by the Engineer. The Engineer shall be present and supervise such measurement. The Contractor shall prepare records and drawings of the measurements of the Permanent Work which shall be submitted to the Engineer for approval. If after examination of such records and drawings the Engineer withholds his approval of them, the Engineer and the Contractor shall retake the measurements using the Contractor's equipment and personnel. In the event of further disagreement concerning the measurement the decision of the Engineer shall be final.

Method of Measurement. 57. The measurement of the Works shall be performed on the basis of the Specification. If they exceed the measurements indicated in the Specification and Drawings including the Working Drawings, such excess shall be on the personal account of the Contractor and he shall not be entitled to any compensation therefore. But if they are less than the measurements indicated in the Specification and Drawings including the Working Drawings, then the Works actually executed shall be measured, provided they are technically acceptable and there is no provision to the contrary in any other part of the Contract Documents.

#### PROVISIONAL SUMS

Definition of "Provisional Sums." 58. (1) "Provisional Sum" means a sum included in the Contract and so designated in the Bill of Quantities for the execution of work or the supply of goods, materials, or services, or for contingencies, which sum may be used, in whole or in part, or not at all, at the direction and discretion of the Engineer. The Contract Price shall include only such amounts in respect of the work, supply or services to which such Provisional Sums relate as the Engineer shall approve or determine in accordance with this Clause.

- Use of Provisional Sums. (2) In respect of every Provisional Sum the Engineer shall have power to order:
- (a) Work to be executed, including goods, materials or services to be supplied by the Contractor. The Contract Price shall include the value of such work executed or such goods, materials or services supplied determined in accordance with Clause 52 hereof
  - (b) Work to be executed or goods, materials or services to be supplied by a nominated Sub-Contractor as hereinafter defined. The sum to be paid to the Contractor therefor shall be determined and paid in accordance with Clause 59 (4) hereof.
  - (c) Goods and materials to be purchased by the Contractor. The sum to be paid to the Contractor therefor shall be determined and paid in accordance with Clause 59(4) hereof.
- Production of Vouchers, etc. (3) The Contractor shall, when required by the Engineer, produce all quotations, invoices, vouchers and accounts or receipts in connection with expenditure in respect of Provisional Sums.

#### NOMINATED SUB-CONTRACTORS

Definition of "Nominated Sub-Contractors." 59. (1) All specialists, merchants, tradesmen and others executing any work or supplying any goods, materials or services for which Provisional Sums are included in the Contract, who may have been or be nominated or selected or approved by the Employer or the Engineer, and all persons to whom by virtue of the provisions of the Contract the Contractor is required to sub-let any work shall, in the execution of such work or the supply of such goods, materials or services, be deemed to be sub-contractors employed by the Contractor and are referred to in this Contract as "nominated Sub-Contractors".

Nominated Sub-Contractors; Objection to Nomination. (2) The Contractor shall not be required by the Employer or the Engineer or be deemed to be under any obligation to employ any nominated Sub-Contractor against whom the Contractor may raise reasonable objection, or who shall decline to enter into a sub-contract with the Contractor containing provisions:

- (a) that in respect of the work, goods, materials or services the subject of the sub-contract, the nominated Sub-Contractor will undertake towards the Contractor the like obligations and liabilities as are imposed on the Contractor towards the Employer by the terms of the Contract and will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection therewith, or arising out of or in connection with any failure to perform such obligations or to fulfill such liabilities, and
- (b) that the nominated Sub-Contractor will save harmless and indemnify the Contractor from and against any negligence by the nominated Sub-Contractor, his agents, workmen and servants and from and against any misuse by him or them of any Constructional Plant or Temporary Works provided by the Contractor for the purposes of the Contract and from all claims as aforesaid.

**Design Requirements to be Expressly Stated.** (3) If in connection with any Provisional Sum the services to be provided include any matter of design or specification of any part of the Permanent Works or of any equipment or plant to be incorporated therein, such requirement shall be expressly stated in the Contract and shall be included in any nominated Sub-Contract. The nominated Sub-Contract shall specify that the nominated Sub-Contractor providing such services will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection with any failure to perform such obligations or to fulfill such liabilities.

**Payments to Nominated Sub-Contractors.** (4) For all work executed or goods, materials, or service supplied by any nominated Sub-Contractor, there shall be included in the Contract Price:

- (a) the actual price paid or due to be paid by the Contractor, on the direction of the Engineer, and in accordance with the Sub-Contract;
- (b) the sum, if any, entered in the Bill of Quantities for labor supplied by the Contractor in connection therewith, or if ordered by the Engineer pursuant to Clause 58 (2) (b) hereof, as may be determined in accordance with Clause 52 hereof;
- (c) in respect of all other charges and profit, a sum being a percentage rate of the actual price paid or due to be paid calculated, where provision has been made in the Bill of Quantities for a rate to be set against the relevant Provisional Sum, at the rate inserted by the Contractor against that item or, where no such provision has been made, at the rate inserted by the Contractor in the Appendix to the Bid and repeated where provision for such is made in a special item provided in the Bill of Quantities for such purpose.

**Certification of Payments to Nominated Sub-Contractors.** (5) Before issuing, under Clause 60 hereof, any certificate, which includes any payment in respect of work done or goods, materials or services supplied by any nominated Sub-Contractor, the Engineer shall be entitled to demand from the Contractor reasonable proof that all payments, less retentions, included in previous certificates in respect of the work or goods, materials or services of such nominated Sub-Contractor have been paid or discharged by the Contractor, in default whereof unless the Contractor shall

- (a) inform the Engineer in writing that he has reasonable cause for withholding or refusing to make such payments and
- (b) produce to the Engineer reasonable proof that he has so informed such nominated Sub-Contractor in writing,

the Employer shall be entitled to pay to such nominated Sub-Contractor direct, upon the certificate of the Engineer, all payments, less retentions, provided for in the Sub-Contract, which the Contractor has failed to make to such nominated Sub-Contractor and to deduct by way of set-off the amount so paid by the Employer from any sums due or which may become due from the Employer to the Contractor.

Provided always that, where the Engineer has certified and the Employer has paid direct as aforesaid, the Engineer shall in issuing any further certificate in favor of the Contractor deduct from the amount thereof the amount so paid, direct as aforesaid, but shall not withhold or delay the issue of the certificate itself when due to be issued under the terms of the Contract.

**Assignment of Nominated Sub-Contractors' Obligations.**

(6) In the event of a nominated Sub-Contractor, as hereinbefore defined, having undertaken towards the Contractor in respect of the work executed, or the goods, materials or services supplied by such nominated Sub-Contractor, any continuing obligation extending for a period exceeding that of the Period of Maintenance under the Contract, the Contractor shall at any time, after the expiration of the Period of Maintenance, assign to the Employer, at the Employer's request and cost, the benefit of such obligation for the unexpired duration thereof.

**CERTIFICATES AND PAYMENT**

**Monthly Payment.**

60. (1) The Employer shall pay to the Contractor the Contract Price named in the Letter of Acceptance at monthly intervals, subject to additions or deductions in accordance with the Contract.

**Monthly Certificate and Payment.**

(2) Based on the approved records and drawings of measurements set forth in Clause 56 hereof, the Engineer shall, at the end of each month, prepare a Monthly Certificate of work completed. The Monthly Certificate which is signed by the Engineer and the Contractor shall be submitted to the Employer for approval within the tenth day of the following month. The employer shall review the Certificate and if the same is found accurate and in compliance with the Contract, then the Employer shall pay to the Contractor ninety-five percent of the approved certificate amount less any amount which the Employer is entitled to deduct therefrom in terms of Contract including taxes and charges pursuant to the laws and regulations of the Republic of Indonesia. Such payment shall be made within sixty days after receipt of the Certificate by the Employer.

**Overdue Interest.**

(3) In the event of failure by the Employer to pay to the Contractor the amount due in accordance with the terms of Contract, the Contractor may, from the date after the same shall have become due, charge the Employer interest at the rate of banking interest of the Bank Indonesia.

**Final Payment.**

(4) Upon issuance by the Engineer of the Certificate of Completion, the Engineer and the Contractor shall together take measurements and make preparation of the Final Certificate of the Works completed. The Final Certificate which is signed by the Engineer and the Contractor shall be submitted to the Employer for approval. The Employer shall, within sixty days of receipt of such Certificate, pay to the Contractor all approved amount remaining due including the aggregate of all amounts retained by the Employer from previous progress payments.

**Payment Currencies and Percentage of Foreign Currency.**

(5) All payments to the Contractor shall be made in the Rupiah currency of Indonesia and US dollars in compliance with the Conditions of Contract.

Percentage of the US dollars shall be fixed at the time of Contract, provided that such percentage shall not exceed seventy percent of the Contract Price.

**Advance Payment.**

(6) As an advance payment of a portion of the Contract Price, the Employer shall pay to the Contractor the amount of twenty percent of the original Contract Price against a bank guarantee through a bank acceptable to the Government of Indonesia. Such payment shall be made within ninety days of issuance of the written order to commence the Works.

The advance payment shall be repaid to the Employer by the Contractor by deducting from each Monthly Certificate twenty five per cent of the net amount otherwise due and payable under the Monthly Certificate, starting from the third Monthly Certificate until the entire amount of the advance has been repaid. Any



outstanding amount of advance payment not repaid prior to completion of the Works shall be deducted from the final payment. The Contractor may reduce from time to time his bank guarantee to an amount equal to or exceeding the amount of the advance payment still outstanding as of the last Monthly Certificate paid by the Employer. The advance shall be exempted from the payment of interest.

Approval only  
by Maintenance  
Certificate.

61. No certificate other than the Maintenance Certificate referred to in Clause 62 hereof shall be deemed to constitute approval of the Works.

Maintenance  
Certificate.

62. (1) The Contract shall not be considered as completed until a Maintenance Certificate shall have been signed by the Engineer and delivered to the Employer stating that the Works have been completed and maintained to his satisfaction. The Maintenance Certificate shall be given by the Engineer within twenty-eight days after the expiration of the Period of Maintenance, or, if different periods of maintenance shall become applicable to different section or parts of the Works, the expiration of the latest such period, or as soon thereafter as any works ordered during such period, pursuant to Clauses 49 and 50 hereof, shall have been completed to the satisfaction of the Engineer and full effect shall be given to this Clause, notwithstanding any previous entry on the Works or the taking possession, working or using thereof or any part thereof by the Employer.

Cessation of  
Employer's  
Liability.

(2) The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or the execution of the Works, unless the Contractor shall have made a claim in writing in respect thereof before the giving of the Maintenance Certificate under this Clause.

Unfulfilled  
Obligations.

(3) Notwithstanding the issue of the Maintenance Certificate the Contractor and, subject to sub-clause (2) of this Clause, the Employer shall remain liable for the fulfilment of any obligation incurred under the provisions of the Contract prior to the issue of the Maintenance Certificate which remains unperformed at the time such Certificate is issued and, for the purposes of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties hereto.

#### REMEDIES AND POWERS

Default of  
Contractor.

63. (1) If the Contractor shall become bankrupt, or have a receiving order made against him, or shall present his petition in bankruptcy, or shall make an arrangement with or assignment in favor of his creditors, or shall agree to carry out the Contract under a committee of inspection of his creditors or, being a corporation, shall go into liquidation (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or if the Contractor shall assign the Contract, without the consent in writing of the Employer first obtained, or shall have an execution levied on his goods, or if the Engineer shall certify in writing to the Employer that in his opinion the Contractor:

(a) has abandoned the Contract, or

(b) without reasonable excuse has failed to commence the Works or has suspended the progress of the Works for twenty-eight days after receiving from the Engineer written notice to proceed, or

- (c) has failed to remove materials from the Site or to pull down and replace work for twenty-eight days after receiving from the Engineer written notice that the said materials or work had been condemned and rejected by the Engineer under these conditions, or
- (d) despite previous warnings by the Engineer, in writing, is not executing the Works in accordance with the Contract, or is persistently or flagrantly neglecting to carry out his obligations under the Contract, or
- (e) has, to the detriment of good workmanship, or in defiance of the Engineer's instructions to the contrary, sub-let any part of the Contract

then the Employer may, after giving fourteen days' notice in writing to the Contractor, enter upon the Site and the Works and expel the Contractor therefrom without thereby voiding the Contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the Employer or the Engineer by the Contract, and may himself complete the Works or may employ any other contractor to complete the Works. The Employer or such other contractor may use for such completion so much of the Constructional Plant, Temporary Works and materials, which have been deemed to be reserved exclusively for the execution of the Works, under the provisions of the Contract, as he or they may think proper, and the Employer may, at any time, sell any of the said Constructional Plant, Temporary Works and unused materials and apply the proceeds of sale in or towards the satisfaction of any sums due or which may become due to him from the Contractor under the Contract.

**Valuation at Date of Forfeiture.**

(2) The Engineer shall, as soon as may be practicable after any such entry and expulsion by the Employer, fix and determine ex parte, or by or after reference to the parties, or after such investigation or enquiries as he may think fit to make or institute, and shall certify what amount, if any, had at the time of such entry and expulsion been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract and the value of any of the said unused or partially used materials, any Constructional Plant and any Temporary Works.

**Payment after Forfeiture.**

(3) If the Employer shall enter and expel the Contractor under this Clause, he shall not be liable to pay to the Contractor any money on account of the Contract until the expiration of the Period of Maintenance and thereafter until the costs of execution and maintenance, damages for delay in completion, if any, and all other expenses incurred by the employer have been ascertained and the amount thereof certified by the Engineer. The Contractor shall then be entitled to receive only such sum or sums, if any, as the Engineer may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.

**Urgent Repairs.**

64. If, by reason of any accident, or failure, or other event occurring to in or in connection with the Works, or any part thereof, either during the execution of the Works, or during the Period of Maintenance, any remedial or other work or repair shall, in the opinion of the Engineer or the Engineer's Representative, be urgently necessary for the safety of the Works and the Contractor is unable or unwilling at once to do such work or repair, the Employer may employ and pay other persons to carry out such work or repair as the Engineer or the Engineer's Representative may consider necessary. If the work or repair so done by the Employer is work which, in

the opinion of the Engineer, the Contractor was liable to do at his own expense under the Contract, all expenses properly incurred by the Employer in so doing shall be recoverable from the Contractor by the Employer, or may be deducted by the Employer from any monies due or which may become due to the Contractor. Provided always that the Engineer or the Engineer's Representative, as the case may be, shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof in writing.

#### SPECIAL RISKS

65. Notwithstanding anything in the Contract contained:

No Liability  
for War, etc.,  
Risks.

(1) The Contractor shall be under no liability whatsoever whether by way of indemnity or otherwise for or in respect of destruction of or damage to the Works, save to work condemned under the provisions of Clause 39 hereof prior to the occurrence of any special risk hereinafter mentioned, or to property whether of the Employer or third parties, or for or in respect of injury or loss of life which is the consequence of any special risk as hereinafter defined. The Employer shall indemnify and save harmless the Contractor against and from the same and against and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising thereout or in connection therewith.

Damage to  
Works, etc., by  
Special Risks.

(2) If the Works or any materials on or near or in transit to the Site, or any other property of the Contractor used or intended to be used for the purposes of the Works, shall sustain destruction or damage by reason of any of the said special risks the Contractor shall be entitled to payment for:

- (a) any permanent work and for any materials so destroyed or damaged, and, so far as may be required by the Engineer, or as may be necessary for the completion of the Works, on the basis of cost plus such profit as the Engineer may certify to be reasonable;
- (b) replacing or making good any such destruction or damage to the Works;
- (c) replacing or making good such materials or other property of the Contractor used or intended to be used for the purposes of the Works.

Projectile,  
Missile, etc.

(3) Destruction, damage, injury or loss of life caused by the explosion or impact whenever and wherever occurring of any mine, bomb, shell, grenade, or other projectile, missile, munition, or explosive of war, shall be deemed to be a consequence of the said special risks.

Increased Costs  
arising from  
Special Risks.

(4) The Employer shall repay to the Contractor any increased cost of or incidental to the execution of the Works, other than such as may be attributable to the cost of reconstructing work condemned under the provisions of Clause 39 hereof, prior to the occurrence of any special risk, which is howsoever attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this Clause hereinafter contained in regard to outbreak of war, but the Contractor shall as soon as any such increase of cost shall come to his knowledge forthwith notify the Engineer thereof in writing.

Special Risks.

(5) The special risks are war, hostilities (whether war be declared or not), invasion, act of foreign enemies, the nuclear and pressurewaves risk described in Clause 20 (2) hereof, or insofar as it relates to the country in which the Works are being or are to be executed or maintained, rebellion, revolution, insurrection,

military or usurped power, civil war, or, unless solely restricted to the employees of the Contractor or of his Sub-Contractors and arising from the conduct of the Works, riot, commotion or disorder.

**Outbreak of War.**

(6) If, during the currency of the Contract, there shall be an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the Works, the Contractor shall, unless and until the Contract is terminated under the provisions of this Clause, continue to use his best endeavours to complete the execution of the Works. Provided always that the Employer shall be entitled at any time after such outbreak of war to terminate the Contract by giving written notice to the Contractor and, upon such notice being given, this Contract shall, except as to the rights of the parties under this Clause and to the operation of Clause 67 hereof, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

**Removal of Plant on Termination.**

(7) If the Contract shall be terminated under the provisions of the last preceding sub-clause, the Contractor shall, with all reasonable dispatch, remove from the Site all Constructional Plant and shall give similar facilities to his Sub-Contractors to do so.

**Payment if Contract Terminated.**

(8) If the Contract shall be terminated as aforesaid, the Contractor shall be paid by the Employer, insofar as such amounts or items shall not have already been covered by payments on account made to the Contractor, for all work executed prior to the date of termination at the prices provided in the Contract and in addition:

- (a) The amounts payable in respect of any preliminary items, so far as the work or service comprised therein has been carried out or performed, and a proper proportion as certified by the Engineer of any such items, the work or service comprised in which has been partially carried out or performed.
- (b) The cost of materials or goods reasonably ordered for the Works which shall have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery, such materials or goods becoming the property of the Employer upon such payments being made by him.
- (c) A sum to be certified by the Engineer, being the amount of any expenditure reasonably incurred by the Contractor in the expectation of completing the whole of the Works insofar as such expenditure shall not have been covered by the payments in this sub-clause before mentioned.
- (d) Any additional sum payable under the provisions of sub-clauses (1), (2) and (4) of this Clause.
- (e) The reasonable cost of removal of Constructional Plant under sub-clause (7) of this Clause and, if required by the Contractor, return thereof to the Contractor's main plant yard in his country of registration or to other destination, at no greater cost.
- (f) The reasonable cost of repatriation of all the Contractor's staff and workmen employed on or in connection with the Works at the time of such termination.

Provided always that against any payments due from the Employer under this sub-clause, the Employer shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of Constructional Plant and materials and any other sums which at the date of termination were recoverable by the Employer from the Contractor under terms of the Contract.

#### FRUSTRATION

Payment in  
Event of  
Frustration.

66. If a war, or other circumstances outside the control of both parties, arises after the Contract is made so that either party is prevented from fulfilling his contractual obligations, or under the law governing the Contract, the parties are released from further performance, then the sum payable by the Employer to the Contractor in respect of the work executed shall be the same as that which would have been payable under Clause 65 hereof if the Contract had been terminated under the provisions of Clause 65 hereof.

#### SETTLEMENT OF DISPUTES

Settlement of  
Disputes—  
Arbitration.

67. If any dispute or difference of any kind whatsoever shall arise between the Employer and the Contractor or the Engineer and the Contractor in connection with, or arising out of the Contract, or the execution of the Works, whether during the progress of the Works or after their completion and whether before or after the termination, abandonment or breach of the Contract, it shall, in the first place, be referred to and settled by the Engineer who shall, within a period of ninety days after being requested by either party to do so, give written notice of his decision to the Employer and the Contractor. Subject to arbitration, as hereinafter provided, such decision in respect of every matter so referred shall be final and binding upon the Employer and the Contractor and shall forthwith be given effect to by the Employer and by the Contractor, who shall proceed with the execution of the Works with all due diligence whether he or the Employer requires arbitration, as hereinafter provided, or not. If the Engineer has given written notice of his decision to the Employer and the Contractor and no claim to arbitration has been communicated to him by either the Employer or the Contractor within a period of ninety days from receipt of such notice, the said decision shall remain final and binding upon the Employer and the Contractor. If the Engineer shall fail to give notice of his decision, as aforesaid, within a period of ninety days after being requested as aforesaid, or if either the Employer or the Contractor be dissatisfied with any such decision, then and in any such case either the Employer or the Contractor may within ninety days after receiving notice of such decision, or within ninety days after the expiration of the first-named period of ninety days, as the case may be, require that the matter or matters in dispute be referred to arbitration as hereinafter provided. All disputes or differences in respect of which the decision, if any, of the Engineer has not become final and binding as aforesaid shall be finally settled under the Rules of Conciliation and Arbitration of the International Chamber of Commerce by one or more arbitrators appointed under such Rules. The said arbitrator/s shall have full power to open up, revise and review any decision, opinion, direction, certificate or valuation of the Engineer. Neither party shall be limited in the proceedings before such arbitrator/s to the evidence or argument put before the Engineer for the purpose of obtaining his said decision. No decision given by the Engineer in accordance with the foregoing provisions shall disqualify him from being called as a witness and giving evidence before the arbitrator/s on any matter whatsoever relevant to the dispute or difference referred to the arbitrator/s as aforesaid. The reference to arbitration may proceed notwithstanding that the works shall not then be or be alleged to be complete,

provided always that the obligations of the Employer, the Engineer and the Contractor shall not be altered by reason of the arbitration being conducted during the progress of the Works.

#### NOTICES

##### Service of Notices on Contractor.

68. (1) All certificates, notices or written orders to be given by the Employer or by the Engineer to the Contractor under the terms of the Contract shall be served by sending by post to or delivering the same to the Contractor's principal place of business, or such other address as the Contractor shall nominate for this purpose.

Address of the Contractor's Site Office:

##### Service of Notices on Employer or Engineer.

(2) All notices to be given to the Employer or to the Engineer under the terms of the Contract shall be served by sending by post or delivering the same to the respective address nominated for that purpose hereunder.

(a) To the Employer;

Departmen Perhubungan  
Direktorat Jenderal Perhubungan Darat  
Jl. Jenderal Sudirman No. P.59-60  
Jakarta  
Indonesia

(b) To the Engineer;

(Name)  
(Address)

##### Change of Address.

(3) Either party may change a nominated address to another address in the country where the Works are being executed by prior written notice to the other party and the Engineer may do so by prior written notice to both parties.

#### DEFAULT OF EMPLOYER

##### Default of Employer.

69. (1) In the event of the Employer:

- (a) failing to pay to the Contractor the amount due under any certificate of the Engineer within thirty days after the same shall have become due under the terms of the Contract, subject to any deduction that the Employer is entitled to make under the Contract, or
- (b) interfering with or obstructing or refusing any required approval to the issue of any such certificate, or
- (c) giving formal notice to the Contractor that for unforeseen reasons, due to economic dislocation, it is impossible for him to continue to meet his contractual obligations

the Contractor shall be entitled to terminate his employment under the Contract after giving fourteen days' prior written notice to the Employer, with a copy to the Engineer.

(2) Upon the expiry of the fourteen days' notice referred to in sub-clause (1) of this Clause, the Contractor shall, notwithstanding the provisions of Clause 53 (1) hereof, with all reasonable dispatch, remove from the Site all Constructional Plant brought by him thereon.

(3) In the event of such termination the Employer shall be under the same obligations to the Contractor in regard to payment as if the Contract had been terminated under the provisions of Clause 65 hereof, but, in addition to the payments specified in Clause 65 (8) hereof, the Employer shall pay to the Contractor the amount of any loss or damage to the Contractor arising out of or in connection with or by consequence of such termination.

#### CHANGES IN COSTS AND LEGISLATION

Changes in  
Costs.

70. (1) Adjustments to the unit price for unfinished works as of the end of the month preceding the month for which the adjustment is applied shall be made in respect of the work item for which the execution cost rises or falls significantly due to changes in the costs of labor, materials, fuel or equipment during the execution of the Works. The work items to be adjusted shall be only those specified hereunder.

Formulas to  
Compute  
Adjustment  
Coefficients.

(2) The adjustment shall be made in accordance with the following formulas, rounding the figure to two decimal places for the computation of adjustment coefficients:

$$\text{New Unit Price} = K (\text{Adjustment Coefficient}) \times \text{Initial Contract Unit Price}$$

Adjustment coefficients shall be calculated by the following formulas:

Formula 1

$$K_a = 0.26 + 0.02 (L_1/L_0) + 0.55 (M_1/M_0) + 0.02 (F_1/F_0) + 0.15 (E_1/E_0)$$

Formula 2

$$K_b = 0.26 + 0.09 (L_1/L_0) + 0.19 (M_1/M_0) + 0.20 (MF_1/MF_0) + 0.01 (F_1/F_0) + 0.25 (E_1/E_0)$$

formula 3

$$K_c = 0.26 + 0.08 (L_1/L_0) + 0.40 (M_1/M_0) + 0.16 (MF_1/MF_0) + 0.01 (F_1/F_0) + 0.09 (E_1/E_0)$$

Formula 4

$$K_d = 0.26 + 0.10 (L_1/L_0) + 0.06 (F_1/F_0) + 0.58 (E_1/E_0)$$

Formula 5

$$K_e = 0.26 + 0.18 (L_1/L_0) + 0.05 (M_1/M_0) + 0.24 (MF_1/MF_0) + 0.03 (F_1/F_0) + 0.24 (E_1/E_0)$$

Formula 6

$$Kf = 0.26 + 0.19 (L1/L0) + 0.19 (M1/M0) + 0.36 (MF1/MF0)$$

Where Ka, Kb, Kc, Kd, Ke, and Kf are the adjustment coefficients which will be applied to the corresponding unit prices.

L0, F0, M0, MF0 and E0 are the indices corresponding to the costs of labor (L0), fuel and lubricants (F0), local material (M0), imported material (MF0) and equipment (E0) respectively, on the date one hundred eighty days after the date of opening the Bids.

L1, F1, M1, MF1 and E1 are the indices corresponding to the costs of labor (L1), fuel and lubricants (F1), local material (M1), imported material (MF1) and equipment (E1) respectively, as of the date of occurrence of cost.

**Sources of Indices.**

(3) The values of the indices shown in the formulas 1 through 6 are applicable as follows:

L = consumer price index for Jakarta, subsector general, published in the Indikator Ekonomi.

F = index of cost for high speed diesel fuel as established by the state owned Pertamina Oil Company for the Capital of Province where the largest part of the Works is performed.

E = wholesale price index for imported commodities for the group "fabricated metal products, machinery and equipment" as published in Indikator Ekonomi.

M = wholesale price index for construction materials in Indonesia, using the group most applicable to the item under consideration, as published in Indikator Ekonomi.

Groups to be used for the adjustment of material price are:

Ma = wholesale price index of construction materials (Asphalt)

Mc = wholesale price index of construction materials (Cement)

Mq = wholesale price index of construction materials (Quarrying)

Ms = wholesale price index of construction materials (Iron and Steel Basic Industries)

MF = wholesale price index for imported commodities for the group "Iron & Steel Basic Industries and Others" as published in Indikator Ekonomi.

The "Indikator Ekonomi" is the basic source for all indices except for fuel. This monthly statistical bulletin is published by the Biro Pusat Statistik, Jakarta, Indonesia.



If the method of establishing the indices, or if the basket of materials or items change, the Employer shall, in consultation with the Biro Pusat Statistik, Pertamina or other neutral bodies, establish, select or adjust the new indices to make them compatible with the initial indices.

If indices are not officially published on a daily basis, the indices to be used shall be those available which are closest to the relevant day.

The Employer shall collect all the necessary documents relative to the initial indices and the relevant changes and submit them to a Committee appointed by the Employer.

**Application of Adjustment Coefficient and Material Component.**

(4) The applicable adjustment coefficient and material component to be applied to the unit price which are subject to price adjustment are as follows:

<u>Adjustment Coefficient</u>	<u>Material Component</u>	<u>Pay Items subject to Price Adjustment</u>
Ka	Ma	5.02 a, b, c, d
Ka	Mc	3.11; 4.04
Ka	Mq	3.01; 3.02; 3.03; 5.01
Ka	Ms	3.17; 4.03 a, b, c, d; 4.06
Kb	Mc, MFs	4.07 a, b, c, d, e, f, g, h, i, j
Kc	Mc, MFs	3.12 a; 3.13 a, b, d; 4.05 a, b, c, d, e, f, g
Kd	-	3.05; 4.01 a
Ke	Ms, MFs	3.06 b, c, d; 4.01 b, c, d
Kf	Ms, MFs	6.01 b; 6.02 b; 6.03 b; 6.04 b; 6.05 b

**Price Adjustment of Variations.**

(5) The formulas set forth for the revision of unit prices due to changes in costs shall not subject to any variation under the provisions of Clause 51 and Clause 52 hereof. When appropriate prices during construction are agreed upon, between the Engineer and the Contractor in accordance with Clause 52, the adjustment of unit prices may also be applicable to the new prices if the Engineer decides that this is necessary.

**Price Adjustment of Daywork.**

(6) Daywork shall be subject to price adjustment in accordance with the procedures as stipulated in this Clause, except that as there shall be no separate adjustment for fuel this shall be considered to be included in the adjustment for equipment.

**Price Adjustment for Delay of Works.**

(7) If major differences, in the opinion of the Engineer, occur during the Contract Period between the Contractor's work program approved by the Engineer and the real progress of the Works, the Employer reserves the right to use the adjustment coefficients which would have been applied in an on-schedule execution.

If the Contractor shall fail to achieve completion of the Works within the time prescribed in Clause 43 hereof, the value of the revised prices relative to the works to be executed after such time shall not be greater than those adopted at the time of the completion date named in this Contract. Provided always that if the delay of the works is due to default on the part of the Employer the works executed during this period will continue to be subject to price adjustment in accordance with this Clause and the revised unit prices to be applied to the works executed during such period shall not be lower than those at the time of completion date prescribed in the Contract.

**Preparation of  
Payment Revision  
Certificate.**

(8) At the end of each month, using the data provided by the Employer and the Contractor, the Engineer shall prepare, together with the Monthly Certificate mentioned in Clause 60 hereof, a separate Payment Revision Certificate covering exclusively the price adjustments due to the application of the revised unit prices under the supervision by the Committee appointed by the Employer. The preparation of the Payment Revision Certificate, and the manner and payment thereof, shall be the same as that of the Monthly Certificate.

The "date of occurrence of cost" means the month in which the Contractor is entitled to put the quantities in the Payment Revision Certificate. The Payment Revision Certificate will be considered provisional and the Final Payment Revision Certificate shall be prepared upon issuance by the Engineer of the Certificate of Completion.

The Payment Revision Certificate will be prepared at monthly intervals, however with a maximum delay of six months after occurrence of cost since relevant indices may not be available earlier.

**Subsequent  
Legislation.**

(9) If, after the date thirty days prior to the latest date for submission of bids for the Works there occur in the Republic of Indonesia changes to any National or State Statute, Ordinance, Decree or other Law or any regulation or by-law of any local or other duly constituted authority, or the introduction of any such Statute, Ordinance, Decree, Law, regulation or by-law which causes additional or reduced cost to the Contractor, other than under sub-clause (1) of this Clause, in the execution of the Works, such additional or reduced cost shall be certified by the Engineer and shall be paid by or credited to the Employer and the Contract Price adjusted accordingly.

**CURRENCY AND RATES OF EXCHANGE**

**Currency  
Restrictions.**

71. If, after the date thirty days prior to the latest date for submission of bids for the Works the Government or authorized agency of the Government of Indonesia imposes currency restrictions and/or transfer of currency restrictions in relation to the currency or currencies in which the Contract Price is to be paid, the Employer shall reimburse any loss or damage to the Contractor arising therefrom, without prejudice to the right of the Contractor to exercise any other rights or remedies to which he is entitled in such event.

**Rate of  
Exchange.**

72. (1) Any payment of the Contract Price to be made to the Contractor in US dollars in accordance with the provisions of the Contract shall not be subject to variations in the rate of exchange between the said currency and the Rupiah currency of Indonesia.

(2) The exchange rate applicable for calculating the payment in US dollars shall be the T/T selling rate of the Bank Indonesia on the date thirty days prior to the latest date for submission of bids for the Works as provided for in the Bid Documents.

(3) The proportions or amounts to be paid in US dollars in respect of Provisional Sum items shall be determined in accordance with the principles set forth in sub-clause (1) and (2) of this Clause as and when these sums are utilized in whole or in part in accordance with the provisions of Clauses 58 and 59 hereof.

Income Tax,  
etc.

73. The Contractor and his personnel shall be liable for income tax and such other taxes, duties, contributions and other charges levied on all payments made to them under this Contract in accordance with the laws and regulations of the Republic of Indonesia.

The taxes and other duties and charges as aforesaid for which the Contractor and his personnel shall be liable will be stipulated in the Invitation to Bid or in a separate Addenda and Supplements of the Contract.

A P P E N D I X

FORM OF CONTRACT AGREEMENT

THIS AGREEMENT made the ..... day of ..... 19...  
between .....  
..... (hereinafter called "the Employer") of the one part and  
..... (hereinafter called "the Contractor")  
of the other part

WHEREAS the Employer is desirous that certain Works should be  
executed, viz .....  
..... and has accepted a Bid  
by the Contractor for the execution, completion and maintenance  
of such Works NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings and are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:
  - (a) Bid
  - (b) Conditions of Contract
  - (c) General Specifications
  - (d) Technical Specifications
  - (e) Drawings
  - (f) Priced Bill of Quantities
  - (g) Addenda and Supplements
  - (h) Letter of Acceptance
3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned the Contractor hereby covenants with the Employer to execute complete and maintain the Works in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution, completion and maintenance of the Works the Contract Price at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have affixed their signatures and seals as of the date aforesaid.

CONTRACTOR

GOVERNMENT OF THE REPUBLIC  
OF INDONESIA

---

Name of Contractor

---

Director General  
Departmen Perhubungan  
Direktorat Jenderal  
Perhubungan Darat

---

Address of Contractor

---

Witness:

---

Witness:

FORM OF PERFORMANCE BOND

1. WHEREAS the Departmen Perhubungan, Direktorat Jenderal Perhubungan Darat, Republic of Indonesia (hereinafter called the "Government" has awarded a contract for the New Railway Line for Cengkareng Airport Construction Project, Package 3 to ..... (name and address of Contractor) ..... (hereinafter called the "Contractor").
2. WHEREAS the Contractor is bound by the said Contract to submit to the Government a Performance Bond for a total amount of .....
3. NOW We, the Undersigned, responsible and representative of the ..... (name of Bank) ..... in ..... (address) ..... (hereinafter called the "Bank") and fully authorized to sign and to incur obligation in the name of the Bank, hereby declare that the Bank will guarantee the Government the full amount of ..... as stated above.
4. After the Contractor has signed the aforementioned contract with the Government the Bank is engaged to pay the aforementioned full amount upon written order from the Government to indemnify the Government for any liability of the Contractor.
5. The Bond is valid for a period of ..... calendar months after the date of signature of the Contract.

IN WITNESS WHEREOF the authorized representative of the Bank has hereunto signed.

Guarantor: .....

Witness: .....

PART C

GENERAL SPECIFICATIONS



GENERAL SPECIFICATION

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## GENERAL SPECIFICATION

### 1.0 PROJECT INFORMATION AND DATA

#### 1.01 GENERAL

Information is contained herein on the subjects of environmental considerations and requirements, and safety requirements.

#### 1.02 ENVIRONMENTAL CONSIDERATIONS

The Contractor shall construct the facility, such that none of its work has a detrimental impact upon the environment. This applies to the effect upon the residential community, adjacent industrial facilities and upon the area outside the Engineer Boundary.

Considerations shall be made to the following but not limited to:

- a. Use of clean fuels to minimize air polluting emissions.
- b. Control of sulphur dioxide and other air pollutions.
- c. Segregation of industrial and municipal wastewater.
- d. Reclamation of wastewater.
- e. Recovery and recycling of suitable materials.
- f. Control of vehicle noise.
- g. Control of noise form industrial and commercial facilities.
- h. Limitation of vibrations.
- i. Preservation of natural land to the extent possible.
- j. Preservation of archaeological sites.

#### 1.03 INDUSTRIAL SAFETY

The Contractor shall incorporate in its construction work, the Indonesian requirements for industrial safety, where applicable.

Area of interest to Indonesian Departments having jurisdiction include but are not limited to:

- a. Fire resistance of building materials.
- b. Spacing and isolation of high-risk facilities.
- c. Fire fighting systems.
- d. Stand-by fire water systems.
- e. Fire exists from structures.
- f. Electrical wiring and color coding.
- g. Dikes and drainage systems for flammable liquid.
- h. Fire alarm systems within facilities.
- i. Lightning protection system.
- j. Earthquake design criteria.
- k. Industrial safety.
- l. Operating manuals for safety-related systems.
- m. Communication system.
- n. Emergency power system.
- o. Security systems.

#### 1.04 SIGNS

The primary language for Cengkareng Project is Indonesian, while the second language is English. Where both languages are required on a sign, label, instruction, name or other use, it shall be written so that the Indonesian text is above or to the right of the English text. All lettering shall be done in a correct and artistic form.

Both Indonesian and English shall be used for all signs where it is necessary to inform, warn or instruct the public. In addition, both languages shall be used to provide instruction for the operation of equipment necessary for the health, safety or welfare of the population.

Examples of informative bilingual signs are street signs, names of camps, or signs on tanks showing contents.

Examples of warning bilingual signs are signs showing high voltage, inflammable liquids, or warning of dangerous or hazardous driving conditions.

Examples of instructive signs are not marking signs, instructions for operation of fire-fighting equipment, or instructions for making emergency telephone calls.

## 2.0 REFERENCE CODES AND STANDARDS

### GENERAL

Where the abbreviations listed below are used, the abbreviation shall make reference to the code, standard or publication listed herein, or published by the following organizations.

<u>Abbreviation</u>	<u>Code, Standard or Publication</u>
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Corporation
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
AREA	American Railway Engineers Association
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BS	British Standards
IEC	International Electrotechnical Commission
JIS	Japanese Industrial Standards
JEC	Japanese Electrotechnical Committee
JEM	Japanese Electrical Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturer
NFPA	National Fire Protection Association
SII	Standar Industri Indonesia

SPLN	Standar Perum Listrik Negara
UBC	Uniform Building Code
UIC	International Union of Railways (Union Internationale Des Chemin De Fer)
UL	Underwriter's Laboratories, Inc.

### 3.0 INDONESIAN PRODUCTS

Where applicable, the use of Indonesian products shall be made to the maximum extent provided that they meet basic standards of quality as established by the Engineer. If the Contractor judges the use of the products would be detrimental to the work, he shall report to the Authorized Representative, supported by a complete justification of this judgement, and await further instruction.

### 4.0 DRAWINGS AND DOCUMENTS

#### 4.01 DRAWINGS

All drawings prepared by the Contractor shall be in compliance with the requirements of the Project.

Construction Contract Package drawings shall be submitted on A-1 size sheets only, unless otherwise expressly approved by the Engineer.

Drawings and specifications prepared by the Contractor shall include complete construction details. The drawings shall include, but not be limited to the following information or details as applicable: construction joints, bar bending details, details for unusual or special items for formwork, special trenching, structural steel detailing, architectural drawings for doors, window, hardware and schedules, piping isometrics and spool sheets, electrical connection schedule and wiring diagrams and bill of materials on drawings. All drawings submitted by Contractor shall be in the metric system.

Generally, the intent shall be that drawings shall be in such detail as to not require additional architecture/engineering to be performed.

Alphabetical revisions (A thru Z) shall be used for drawings until issued for construction. The first issue of a drawing for construction shall be designated as Revision 0 (Zero) and all subsequent revisions shall be designated in numerical order, 1, 2, 3, etc. Specific changes shall be clearly designated on the drawing with the revision number/letter shown in an adjacent triangle.

Review of Contractor's submitted drawings or documents by the Engineer shall not relieve the Contractor of any of its obligations to meet all the requirements of the Contractors nor relieve the Contractor of the responsibility for the correctness of such drawings and documents. The Contractor shall, at its expense, make any changes which are necessary to make the Work conform to the provisions and intent of the Contract.

#### **4.02 FABRICATION AND INSTALLATION DRAWINGS**

Where drawings are required for fabrication of the Contractor furnished equipment, or installing the Contractor furnished material or equipment, or planning and performance of the work under the Contract, such drawings shall be provided by the Contractor and submitted to the Engineer for review.

These drawings shall include, but not be limited to shop fabrication detail drawings including details of welding match-marks, erection drawing and other details of such as field connections for proper installation, erection of the equipment and performance of the work. Approval of manufacturers detailed specification and catalogs shall be required for all equipment prior to shipment. The drawings of a specific piece of equipment shall identify components with the manufacturer's part number or reference drawing number clearly indicated. If reference drawings are used, the approval data of such drawings shall be included. The drawings shall indicate dimensions, maximum and minimum allowable operating tolerances on all major wear fits, i.e., rotating, reciprocating or intermittent sliding fits between shafts or submission of all drawings shall be such that all information is available for checking each drawing when it is received.

The Contractor shall furnish layout drawings verifying clearances with all piping and structures, prior to concrete placement or structure construction on all the Contractor furnished equipment.

The Contractor shall furnish rebar schedules.

#### **4.03 AS-BUILT DRAWINGS**

The Contractor shall supply the Engineer with an accurate set of As-Built Drawings. A set shall consist of two good quality vellum reproducibles and one print of each Drawing. Upon completion of each work, As-Built Drawings shall be prepared on reproducibles and one print each supplied to the Engineer.

As-Built Drawings shall be the Contract Drawings to which has been added actual information from field measurement to accurately represent the final and actual as-built condition of the Work.

The type of information required includes, but is not restricted to the following:

- Property line and centerlines by coordinates or dimensions from baseline.
- Pole numbers on layout drawings.
- Schematics with equipment/device numbers, wire and cable numbers, terminal numbers, special sequencing of logic descriptions.
- Cable routing with box and equipment numbers and location. Connections with trunk identification and assignment.

#### 4.04 OPERATION AND MAINTENANCE MANUALS

The Contractor shall provide operation and maintenance manuals for all equipment and systems supplied or installed by the Contractor. The manuals shall cover the following subjects as applicable:

- a. Technical description of the equipment.
- b. Operation instructions including recommended clearances and tolerances, and sequence of application and type of lubricants.
- c. Step-by-step procedures for dismantling, cleaning, servicing, replacing parts and reassembling.
- d. Parts list with part identification numbers and sources of replacement parts.
- e. Simplified facility drawings for a complete system, to show all components of the system.
- f. Schematic diagrams for each system.

#### 4.05 CERTIFICATE

Where certificates are required, four (4) copies of each such certificates shall be submitted by and at the expense of the Contractor. Such submittal shall be made not less than thirty (30) calendar days prior to the time that the materials represented by such certificates are needed for incorporation into any work. Certificates shall be subject to review and material represented by



such certificates shall not be manufactured, delivered to the site nor incorporated into any work without any such review.

Certificates shall clearly identify the material being certified and shall include but not be limited to providing the following information; item, manufacturer's name and reference to the appropriate drawings, technical specification section and paragraph number, all as applicable.

#### **4.06 CALCULATIONS**

Where calculations are required, four (4) copies of each such calculations under manufacturer's letterhead shall be submitted by and at the expense of the Contractor. Such submittal shall be made not less than thirty (30) calendar days prior to the time that the materials represented by such calculations are needed for incorporation into any work. Calculations shall be subject to review and material dependent upon such calculations shall not be manufactured, delivered to the site nor incorporated into any work without any such review.

Calculations shall clearly identify the subject of the calculations and shall include but not be limited to providing the following information; Contractor's name, project name, Contract number, name of the item, manufacturer's name and reference to the appropriate drawing, technical specification section and paragraph number, control register reference all as applicable.

#### **4.07 CATALOG CUTS AND DATA SHEETS**

Where catalog cuts are required, four (4) copies of each sub catalog cut shall be submitted by and at the expense of the Contractor. Such submittal shall be made not less than thirty (30) calendar days prior to the time that the materials represented by such catalog cuts are needed for incorporation into any work. Catalog cuts shall be subject to review.

#### **4.08 SUBMITTALS**

All drawings and documents shall be submitted for the Engineer review by and at the expense of the Contractor, accompanied by approved transmittal form or letter.

Submittals shall be transmitted to:

Perusahaan Jawatan Kereta Api  
(Indonesian State Railways)  
Bandung, Indonesia

Attn: :  
Telephone Number :  
Telex Number :  
Cable :

#### 5.0 THE ENGINEER SURVEY MONUMENTS

The Contractor shall, in the course of the work, and three weeks prior to the necessary disturbance of any existing survey monuments, notify the Engineer who will arrange suitable repositioning.

The Contractor shall make all reasonable efforts to avoid damage to the Engineer survey monuments. If monuments are accidentally damaged, the Contractor shall immediately notify the Engineer who will arrange replacement as soon as practicable. New coordinate and level values will be given to the Contractor when checked and verified.

#### 6.0 CONSTRUCTION WATER REQUIREMENTS

Water which is from domestic or public supply sources or of equivalent quality and purity may be used for all construction purposes.

Water from each source of supply shall be tested prior to use and the quality of each source identified by way of written analysis reports submitted to the Engineer by the Contractor.

Water supply sources and distribution facilities, including storage tanks, etc. as may be utilized, shall be initially, and thereafter maintained, free from unnecessary or unwanted contamination.

Construction water at points of Contractor's source shall be routinely rechecked at reasonable frequency to assure that the required quality is being maintained.

Raw water may be used for construction of embankments or other work which involves soil materials only, but shall not be used in or over topsoils or other soils which are required to or are being planned to support erosion control plantings or other landscaping under this or other contracts.

#### 7.0 CONSTRUCTION REQUIREMENTS

When construction water is obtained from a domestic or public use source, any piping systems connected thereto shall be equipped with suitable devices which will positively prevent any backflow into the source system.

When construction water is obtained from a source other than domestic or public use, all hydrants, faucets or other points or the Contractor's facilities, including mobile equipment, from which such water is obtainable or accessible shall be clearly identified by securely affixed signs, lettered in Indonesian and English, to the effect that such water is prohibited for purposes of drinking or preparation of foods.

Regardless of other means of supply or distribution facilities provided for the work, at least one self-propelled, pneumatic tired water tank truck or truck and trailer combination, of not less than 4,000 gallon or 16 cubic meter capacity, shall be maintained ready for use at the project premises at all times. This equipment shall be provided with both spray bar and hose connections, each with suitable pressure control for regulating discharge flow.

All outlets for watering equipment or facilities shall be equipped with means of positive shut-off; and all watering equipment and facilities shall be maintained free from leaks. Water shall not be unnecessarily or carelessly wasted. Water for compacting embankment material, subbase, base and surfacing material, and for dust control shall be applied by means of pressure type distributors equipped with a spray system with nozzles that will insure a uniform application of water.

#### 8.0 DUST CONTROL

The Contractor shall be responsible for the control of dust which results from the Contractor's performance of the work and whenever the work in progress is in the vicinity of work camps, rest areas, habitable structures or public roads or other places which are used or occupied by persons other than the contractor's work crews.

The provisions in this subsection 8.0 will not prevent the Contractor from applying water or other approved means of dust control for his own convenience.

The Contractor shall be responsible for determining and providing the means and materials and at the times necessary for control of dust throughout the areas within which work is to be executed under the Contract, including that which may arise from equipment operation or otherwise, and also when conveying dust laden material from place to place.

Water shall comply with requirements specified under section 6.0 CONSTRUCTION WATER REQUIREMENTS.

Other types of material proposed for dust control shall not be corrosive, toxic or poisonous nor otherwise environmentally unsafe; and shall be only as approved in advance by the Engineer.

#### 9.0 CONTROL OF WATER

The Contractor shall be responsible for the control of water as may be used, developed or otherwise occurring within the work areas from time to time; and whether such water is classified as seepage, underground, rain or storm water, or otherwise.

Control shall mean to include providing pumps or other devices, lines, ditches, dikes, shaping of surfaces or other construction or operations as necessary for the collection and disposal of water; and such as is necessary for the proper execution of the work and protection of all facilities and improvements within or near the work areas.

Water disposal shall not damage any terrain, plants, trees, construction or structures, and shall not lead onto nor across established roads, parking areas, planting areas, or adjacent properties, unless otherwise specifically approved for each case.

The Contractor shall, during the course of the work, maintain the work site free of standing water except at approved decanting ponds. The Contractor shall clean, trim and maintain all drainage ditches from time to time during the work to permit a free flow of water at all times. Damage to the work attributable to wetting through failure to provide such adequate drainage shall be repaired by the Contractor at no cost to the Engineer.

The Contractor shall construct and maintain such temporary dikes, weirs and ditches and until the work requiring such temporary structures is accepted by the Engineer. All such temporary construction structures as are required for construction shall be removed prior to final acceptance of the finished and completed work.

Disposal of surface disposal shall be in such manner as not to damage or inconvenience work or facilities of other Authorities or Contractors, and should be to the approval of the Engineer.

#### 10.0 RIGHT-OF-WAY AND PERMITS

Any agreements or permits required by DKI, Police or local authorities for moving materials and equipment shall be obtained by the Contractor. The Contractor shall make investigations to determine conditions,

restrictions, and difficulties which may be encountered in the transportation of material and equipment to the work site.

For each part of the work, the Contractor shall determine in the field and from drawings the availability of routes for hauling materials, and for routes for disposing of unsuitable material. This shall be coordinated with the Engineer into a Plan of Operation for each phase of work. Plans of Operation must be approved by the Engineer prior to commencement of work.

#### 11.0 ENVIRONMENTAL PROTECTION

The Contractor must be aware of the environmental protection practices and procedures as stipulated by the relevant authorities.

Silts and mud which are classified as waste (unsuitable) material must not be disposed of directly to the nearshore waters. This material will be disposed of on approved landfill sites, and water clarified as stated above.

No separate payment shall be made for environmental protection but all costs thereof shall be included in the contract prices of the payable items.

#### 12.0 REMOVAL AND RESTORATION OF EXISTING PAVEMENT

Any and all existing or newly placed concrete and asphalt concrete pavements shall not be cut into or through; other than at test points as specified, and at certain specific locations as particularly approved in advance by the Engineer.

Prior to any other removal work, the existing pavement shall be accurately and neatly cut to straight lines and regular areas using power equipment which is designed for the purpose and is of adequate capacity for the work required.

All equipment, vehicles and manner and means utilized for the removal and restoration work shall be such as to preclude unnecessary damage to pavements not required or not intended to be removed.

The extent of cutting and removal of existing pavement shall be limited to only that necessary for the work to be installed within such areas. The depth of the initial power cutting shall be such that the pavement to be removed can be readily cut free and removed without unnecessarily damaging the adjacent pavement areas which are to remain in place.

Removal of existing pavement and its underlying substructure shall be carried out such as to preclude damage to the remaining adjacent pavement and substructures. Means shall be provided as necessary to adequately protect the surfaces and edges of the remaining pavement, and the trenching or excavation cuts.

Existing pavement and substructure materials which are removed shall not be temporarily or otherwise placed, stockpiled or permitted to accumulate on the surfaces of the adjacent pavements.

Existing pavement materials shall be removed and disposed of outside the limits of the project, and shall not be incorporated or otherwise reused in the restoration work.

Existing substructure materials may be reused in the restoration work provided that each type of such material complies with the respective requirements of the technical specifications; otherwise, such materials shall be removed and disposed of the same as provided for disposal of surplus material.

When the duct, culvert or other work to be installed is complete, the substructure and pavement shall be completely restored to an acceptable condition.

Restoration shall include replacement of substructures, pavement, seal coat when applicable, pavement marking, roadway markers or other items; and to the appropriate lines, grades, slopes, and extent; all as necessary to make the restored work consistent with the conditions as they existed prior to start of the removal work.

Unless otherwise indicated, specified or approved, restoration materials shall be new, and all work and materials involved in the restoration work shall conform to the respective technical specifications.

When the areas of pavement removal and replacement are of a limited size or extent, such as for small pipes, ducts, culvert, etc., which precludes access for replacement work using normal roadway construction methods and equipment, the pavement substructure shall be reconstructed using Class E concrete in lieu of backfilling using soil materials.

Prior to installation of any replacement paving, the edges of the paving remaining in place shall be cleaned free from dust, dirt, loose particles, etc. Asphalt surfacing edges shall be primed with a coat of hot asphalt just prior to placing the new asphalt concrete. Concrete pavement edges shall be in a thoroughly dampened condition when the new concrete is placed.

The finish surfaces of the pavement shall be flush and free from offsets across the joints between the existing and newly placed pavement.

When complete, all pavement in and about the areas involved in or utilized for the work shall be left in a clean and orderly condition in accordance with Tech. Spec. entitled FINISHING OF THE WORK.

### 13.0 MANUFACTURER'S INFORMATION

When commercially produced material or equipment are to be utilized for or incorporated into the work, the installation or application instructions of the manufacture of the product shall be submitted for review the same as provided above for drawings and samples.

Maintenance recommendations and/or operating instructions shall also be included to the extent as is applicable to the specific products involved.

Wiring diagrams shall be included for any electrically powered or operated equipment or devices.

### 14.0 WORK PROGRAM REQUIREMENTS

As soon as practical following award of the Contract, and before commencement of the work, the Contractor shall submit to the Engineer for review comprehensive Contract Work Program which shall:

- outline the procedures proposed to be used for execution of the work.
- identify the number, type, capacity, etc. of all equipment intended to be utilized for carrying out the work.
- identify the name and qualifications of the Contractor's or other key personnel who have prime responsibility for overseeing this work.

### 15.0 PRODUCT IDENTIFICATION

Pumps, motors, panelboards, assemblies in cabinets and other such equipment shall be identified with a permanently fixed metal product label indicating the manufacturer or trade mark, item name, type number, serial number, rating, capacity, and electrical and performance characteristics - as applicable.

Packaged mass or bulk materials shall be identified with well secured product labels indicating the manufacturer or trade mark, product name and type, production lot or batch numbers, expiration dates or shelf life

limitations, and like standard information; and with precautions and emergency instructions for hazardous or toxic products - as applicable.

Lamps, fuses, lenses or other such accessory items shall be identified with indelible or embossed markings indicating the manufacturer or trade mark, item name, type or part number, rating and like standard information - as applicable.

Crated products shall be delivered to the site as factory crated, and with each crate clearly identifying the contents, use, weight, end destination, and like standard shipping information - as applicable.

Packaged materials shall be delivered to the site in unopened containers as factory packaged, labeled and sealed.

#### 16.0 PRODUCT PROTECTION

Products shall be factory prepared, tropicalized, packaged, crated or otherwise such as to preclude damage during shipping and handling, including and transshipment, or as may result while in transit or storage over an extended period of time.

While in transit or in intermediate storage, electrical equipment and materials shall be maintained in suitable warehouses or otherwise as is appropriate for the items involved. Sensitive materials and electrical devices shall be maintained within the extremes of temperature and humidity as recommended by the respective manufacturers such as to preclude any deterioration or damage due to any adverse ambient conditions.

Packages, wrappings, or other medium shall be water-resistant, and sealed watertight when applied over the products or the products placed therein. Wrappings and containers shall be non-reactive to the products being enclosed.

#### 17.0 PROTECTIVE FINISH

Equipment or assembly enclosures which are to remain exposed to the weather, and are steel or galvanized steel, shall be factory cleaned and finished with a durable high gloss abrasion and corrosion resistant finish system consisting of at least a prime coat and two finish coats for a total dry film thickness of not less than 0.13 mm; or may be a manufacturer's standard system provided that an equivalent degree of protection is achieved. All such finishes shall be subject to approval in advance of the work.



## 18.0 PROTECTION OF ADJACENT WORK

When any given work operation is to proceed or is in progress, all adjacent existing and newly placed work or improvements shall be suitably protected against damage. Protective materials shall be provided, placed and secured, and work operations shall be carried out, as necessary and appropriate for the various conditions encountered.

Damaged adjacent work shall be replaced or repaired to an acceptable condition and which is equal to the original work in quality and appearance.

## 19.0 CONSTRUCTION AREAS

Building sites and work areas shall be maintained in a reasonably orderly manner and free from encumbrance as practical to provide best conditions possible for various operations and installations required.

Regularly remove construction waste and debris from the work area, and periodically remove same from the premises and dispose of in a legal manner.

Periodically broom clean slabs, floors, decks and other areas and leave clean and free from dust, shavings, litter, etc., upon completion of each phase of work.

## 20.0 SPECIAL CLEANING AND PROTECTION

Rooms or spaces in which sensitive signal, electrical or electronic equipment is to be installed, whether under this Contract or separate contracts, shall be positively dust and dirt free when turned over for such installation work.

As Minimum Requirements: Upon completion of all other cleaning required within respective spaces, provide additional vacuuming, additional replacement of filters for respective air conditioning or ventilating systems, temporary seals or dust barriers around or at doors or other openings where dust might enter, and/or other safeguards as may be necessary to maintain said spaces in dust free condition until completion of equipment installations.

In addition, respective air conditioning and/or ventilating systems shall be operated throughout each of not less than 3 work days prior to start of equipment installations, after new replacement filters have been provided as specified.

## 21.0 WATERTIGHT INTEGRITY

Buildings and exterior equipment enclosures shall be constructed, installed and otherwise treated or equipped such as to preclude entry of water into any interior space or internal surface.

When buildings and exterior enclosures are essentially complete, they shall be tested for leaks by hosing down with generous applications of fresh water, and thereafter the work shall be thoroughly inspected.

Any conditions revealing water leaks shall be corrected as required and retested.

## 22.0 ABBREVIATIONS

As used under technical specifications, reference abbreviations shall mean as follows:

- TECH. SPEC. : Technical Specification(s).
- SPEC. : Specifications(s).

## 23.0 WORK SITE TRANSPORTATION

The Contractor shall provide suitable transportation for its employees between camps where its employees reside and the Work Site. The Contractor's equipment used in the performance of the Work shall not be considered suitable for this purpose. The Contractor shall also provide adequate parking areas at the Work Site for all of its construction equipment used in the performance of the Work and for all vehicles used in transporting its personnel and the coverage of its security program.

## 24.0 PROJECT SIGN BOARDS

The Contractor shall, at its expense, furnish, erect and maintain two (2) project signs in accordance with the Standard Format for Project Signs at each main work area. On completion of such work at a general work area, the Contractor shall, at its expense, remove the signs.

**25.0 EMPLOYER FURNISHED MATERIALS FOR TRACK SHIFTING WORK**

The Employer will furnish the Contractor with the used track materials at the storage area on the Work Site listed below as required for laying or shifting work of the existing tracks at the locations as specified. Such items will be furnished without cost to the Contractor; provided that the Contractor shall, at his expense, accept delivery thereof promptly unload at points of storage or use, and care for such items until final disposition thereof.

Material	Unit	Quantity	Location
R14A Rails	m	710	Kota Station Yard
		2,020	Gudang Freight Yard
Fish-plates	no.	90	Kota Station Yard
		260	Gudang Freight Yard
Fish-bolts & nuts	no.	180	Kota Station Yard
		520	Gudang Freight Yard
Track Spikes	no.	2,390	Kota Station Yard
		6,790	Gudang Freight Yard

Upon completion of the work, the Contractor shall return, at his expense, all used track materials listed below as derived from the Work Site where removal of the existing track was carried out.

Material	Unit	Quantity	Location
R14A Rails	m	670	Kota Station Yard
		1,840	Gudang Freight Yard
Fish-plates	no.	95	Kota Station Yard
		210	Gudang Freight Yard
Fish-bolts & nuts	no.	190	Kota Station Yard
		420	Gudang Freight Yard
Track Spikes	no.	2,080	Kota Station Yard
		5,660	Gudang Freight Yard
Wood Sleepers	no.	520	Kota Station Yard
		140	Gudang Station Yard

\*END OF GENERAL SPECIFICATION\*

PART D

TECHNICAL SPECIFICATIONS

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001 - MOBILIZATION AND DEMOBILIZATION

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## 001 - MOBILIZATION AND DEMOBILIZATION

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This work shall consist of providing preliminary activities in preparation for construction work under the Contract; and of carrying out final close-out activities in preparation for completion of construction work under the Contract

This work shall include the furnishing of all services, labor, materials, tools, equipment and incidentals, and for providing or performing all of the work involved in mobilization and demobilization work as specified.

#### 1.02 MOBILIZATION

Mobilization shall consist of preparatory work and operations, including but not be necessarily limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site.

Mobilization will be considered as complete when the Contractor can satisfactorily demonstrate to the Engineer. Compliance with the respective requirements under the Contract.

#### 1.03 DEMOBILIZATION

Demobilization will be considered as complete when all of the Contractor's equipment, materials, personnel, construction plant or otherwise belonging to the Contractor have been removed from the project site, and the requirements specified under Tech. Spec. entitled FINISHING OF THE WORK have been satisfied.

Demobilization shall include providing required submittals prior to close-out of the work.

END OF SECTION

002 - CLEARING AND GRUBBING

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## 002 - CLEARING & GRUBBING

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the construction requirements for clearing and grubbing. The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

This work shall consist of removing all objectionable material from within the limits of work, including bridge construction areas, road crossings or approaches, material sites, areas through which ditches and channels are to be excavated, and such other areas as may be shown or specified; and includes removal and disposal of cleared and grubbed materials, and protection of property against damage resulting from these operations; all in accordance with these specifications.

It shall also include the removal and disposal of structures that obstruct, encroach upon, or otherwise obstruct the work, except when otherwise provided for on the plans or in the special provisions.

#### 1.02 REFERENCE

Related Work in Other Section:

Section 003 GENERAL EXCAVATION

#### 1.03 CONSTRUCTION REQUIREMENTS

Clearing and grubbing shall be performed in advance of grading operations and in accordance with the requirements specified in these specifications.

Unless otherwise specified or shown on the drawings, the entire length of the work to the widths specified below shall be cleared and grubbed.

The area above the natural ground surface shall be cleared of all vegetable growth, such as trees, logs, upturned stumps, roots of downed trees, brush, grass, weeds, and all other objectionable materials, including concrete or masonry, within the following limits:

- Railway construction areas, including structures, frontage areas, ditches and channels having a bottom width of 4.0 meters or more, and all other accessory areas that are to be constructed. Such areas shall extend to a width of 2.0 meters outside of structures

- and excavation and embankment slope lines, except that where slopes are to be rounded, the areas shall extend to the outside limits of slope rounding.
- Ditches and channels having a bottom width of less than 4.0 meters. Such areas shall extend to a width of 1.0 meter outside the slope lines.
  - Material sites within the limits of work.
  - Material sites outside of the limits of work which are to be utilized for disposal of surplus materials which are reserved for work under other contracts and when such off-site disposal is shown or specified.

Within the limits of clearing, the areas below the natural ground surface, except in embankment areas where the grading plans is 1.0 meters or more above the natural ground shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material. Such objectionable material shall not be left in or under embankment or dikes.

All existing trees, stumps and roots within embankment areas where the grading plane is 1.0 meter or more above the natural ground shall be cut off not more than 0.3 meters above the natural ground at any point; or shall be completely removed where a structure is to be constructed, piles are to be placed or driven, subdrainage trenches are to be excavated, unsuitable material is to be removed, or where the slopes of original hillsides, old or new fill, are cut into in accordance with the specifications.

Where the construction is to be performed through cultivated areas, all orchard trees, vines and other vegetable growth shall be removed from the entire right-of-way area, unless shown or specified to remain.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted in accordance with the specifications.

The railway and adjacent areas shall be left with a neat and finished appearance. No accumulation of flammable material shall remain on or adjacent to the limits of work.

#### 1.04 REMOVAL AND DISPOSAL

All manner, means and locations for disposal of cleared and grubbed materials shall be only as approved in advance by the Engineer.

If perishable material is burned, it shall be burned under the constant care of competent watchmen at such times and in such a manner that anything designated to remain within the

limits of work or other adjacent property will not be jeopardized. Burning shall be done in accordance with applicable laws and ordinances.

Materials and debris which cannot be burned and perishable materials shall be removed from within the limits of work and disposed of. The Contractor shall make all necessary arrangements with property owners for obtaining or utilizing suitable disposal locations.

END OF SECTION

003 - GENERAL EXCAVATION

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## 003 - GENERAL EXCAVATION

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the material and construction requirements for general excavation to be provided at the locations indicated on the drawings. The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

This work shall consist of providing all excavation operations involved in the grading and construction of areas within the limits of work; and outside the limits of work when so designated; except any shall exclude other type of excavation which may be separately designated or specified to be classified as a different or separate type or item of work.

General excavation shall mean the removal from the locations specified above of all materials regardless of whether such materials are classified as unsuitable or surplus materials or otherwise, and regardless of how or where such materials are to be used or disposed of.

The work shall include the subsidiary work as follows:

- Clearing and grubbing.
- Subgrade preparation.
- Construction of embankment utilizing general excavation materials.
- Disposal of surplus general excavation materials not utilized for the work, including unsuitable materials.
- Carrying out field surveys at excavation areas, and preparation and submittal of drawings thereof.
- Slope shaping and rounding, providing related details indicated, and complying with all associated requirements.

#### 1.02 REFERENCES

Related Work in Other Sections:

Section	002	CLEARING & GRUBBING
Section	007	FILLING, GRADING AND EMBANKMENT CONSTRUCTION
Section	011	SUBGRADE PREPARATION

1.03 SUBMITTALS

A. GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents.

B. BEFORE COMMENCING WORK:

Work Program - comprising an outline of equipment to be employed in carrying out this work, including field testing.

PART 2: PRODUCTS

2.01 SUITABLE MATERIAL

Suitable material shall be any soil material derived from the excavation work which, shall generally conform to AASHTO M 57; and which is capable of meeting the compaction requirements for the location where the material is to be used.

Compaction requirements shall be in accordance with the reference specifications, unless otherwise more particularly shown or specified.

PART 3: EXECUTION

3.01 GENERAL REQUIREMENTS

Excavation of ditches or channels shall be to the lines, grades and extent shown on the drawings; and shall comply with all requirements specified for general excavation, unless otherwise shown or specified. Bottoms forming a flow line shall be uniformly sloped between the elevations shown.

Classification or identification of soil materials, when required or applicable, shall be as designated on the drawings or in the technical specifications.

Excavation in excess of the lines and grades or the extent indicated shall be replaced using suitable material placed and compacted to a density at least equal to the density of the surrounding earth.

3.02 UNSUITABLE MATERIAL

Material below the natural ground surface in embankment areas, and basement material below the grading place in excavation areas, that is unsuitable for the planned use, shall be excavated and disposed of.

Disposal areas outside the limits of the project shall be the Contractors responsibility to arrange for and provide.

When such unsuitable material is removed, the resulting space below the ground level or grading plane shall be filled with material suitable for the planned use. Such suitable material shall be placed and compacted in layers conforming to Tech. Spec. entitled STRUCTURE EXCAVATION AND BACKFILL Article entitled STRUCTURE BACKFILL.

### 3.03 SLIDES AND SLIPOUTS

Material outside the planned excavation slopes which is unstable and constitutes potential slides, or material from slides which has come into the railway or ditch, or material which has slipped out of new or old embankments, shall be excavated and removed. The material shall be excavated to designated lines or slopes by benching. Such material shall be used in the construction of the embankments or disposed of as specified for surplus material.

### 3.04 SLOPES

Excavation slopes shall be finished in conformance with the required lines and grades. All debris and loose material shall be removed. When completed, the average plane of the slopes shall conform to the slopes indicated on the drawings and no point on the completed slopes shall vary from the designated slopes by more than 10 cm measured at right angles to the slope.

In no case shall any portion of the slope encroach on any railbed or roadbed.

The tops of excavation slopes and the ends of excavations shall be rounded or shaped as shown on the drawings.

### 3.05 SURPLUS MATERIAL

Surplus material shall mean suitable earth material which has been excavated from within the limits of work and which is not otherwise needed to completed the work as required under the Contract.

### 3.06 SURPLUS MATERIAL DISPOSAL REQUIREMENTS

Surplus disposal shall include the hauling, placing and shaping of earth materials at designated locations as shown or specified. Compaction is not included.

Surplus disposal sites or areas not previously made ready under this or other contracts shall be prepared as specified under Tech. Spec. entitled CLEARING & GRUBBING.

Surplus material shall be disposed of in banks or strips, and which shall be neatly constructed by dumping and shaping the loose material into a stabilized condition but without compaction.

Top surfaces of all disposal construction shall be sloped transversely to drain free from standing water and toward adjacent land areas which will most readily drain away the run-off water; and all completed surfaces shall be reasonable well levelled and smoothed off and left in a condition that will preclude heavy concentrations of run-off water that could cause severe erosion.

Different types of surplus material shall be disposed of separately.

### 3.07 DEFICIENT MATERIAL

When, from within the limits of work or other areas designated for this Contract, the quantity of suitable material from excavation is not sufficient to complete the work required under the Contract, the deficient quantity of material needed shall be borrow material obtained as follows:

- In accordance with the provisions of Tech. Spec. entitled FILLING, GRADING AND EMBANKMENT CONSTRUCTION, when applicable to the Contract and included as part of these technical specifications.
- Otherwise, in the manner and from locations within the limits of the project as approved in advance by the Engineer.

### 3.08 GRADE TOLERANCES

At the time any covering layer of material is placed, the finished subgrade of railway excavation shall:

- Comply with requirements specified under Tech. Spec. entitled SUBGRADE PREPARATION.
- Not vary more than plus or minus 25 mm from the lines and grades shown.

For ditches elsewhere, the finish subgrade or finish grade shall not vary more than plus or minus 25 mm from the lines and grades shown.

### 3.09 MAINTENANCE OF THE WORK

The Contractor shall be responsible for maintaining the work free from slides and slipouts, erosion caused by

action of the elements, and any other damage however caused for the duration of the Contract; and any such damage shall be repaired or restored by the Contractor.

END OF SECTION

004 - STRUCTURE EXCAVATION & BACKFILL

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## 004 - STRUCTURE EXCAVATION & BACKFILL

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the material and construction requirements for structure excavation and backfill for structures to be provided as specified and at the locations indicated on the drawings. The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

This work shall consist of performing all operations necessary to excavate all materials, regardless of the character or subsurface condition, required to be removed for the construction of structures, culverts, rods, deadman, cutoff walls, and other facilities; to carry out other excavation designated on the drawings or in these specifications as structure excavation; to place backfill for structures, culverts and other facilities; and to provide or carry out all related work or operations necessary to complete work; or shall consist of only performing backfill and all related work necessary within the limits of embankment construction area.

This work shall also include: control and removal of surface or subsurface water, regardless of the character or source, in and around the areas of structure excavation and backfill; the construction of cofferdams or other temporary facilities necessary to accomplish construction of the work required under the Contract; and the subsequent removal of cofferdams or other temporary water control facilities, unless such facilities or portions thereof are permitted to remain in place when and if particularly indicated, specified or approved.

This work shall also include excavation and disposal of unsuitable material as specified; and excavation of recesses in excavation or embankment slopes at culvert inlets to the shapes and dimensions indicated, and the disposal of the resulting material in embankments or otherwise as specified.

#### 1.02 REFERENCES

Related Work in Other Sections:

Section	003	GENERAL EXCAVATION
Section	005	TRENCHING, BEDDING, BACKFILLING AND COMPACTING
Section	007	FILLING, GRADING AND EMBANKMENT CONSTRUCTION
Section	011	SUBGRADE PREPARATION

### 1.03 SUBMITTALS

#### A. GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents.

#### B. BEFORE COMMENCING WORK::

Work Program - comprising:

- Outlines to fully identify and detail and contractor's manner and means proposed for any required shoring, sheeting and bracing; and required cofferdams; and the manner and means proposed for dewatering and maintaining dry structure excavations.

### PART 2: PRODUCTS

#### 2.01 BACKFILL MATERIAL

Structure backfill material shall be suitable material which shall generally conform to AASHTO M 57; and which is capable of meeting the compaction requirements for the location where the material is to be used.

When structure backfill required within the limits of the railway embankment area, backfill material shall be equal to the embankment material.

### PART 3: EXECUTION

#### 3.01 GENERAL REQUIREMENTS

Structure excavation outside of the net structures as shown, shall be the responsibility of the Contractor to arrange for and provide as part of the work under the Contract; and whether such is necessary for placing formwork, or shoring, bracing, or other work or operations, or reasons of safety or integrity of the work, or otherwise.

Structure excavations shall be sloped, or shored or sheeted and braced, as necessary to assure that work areas and spaces are safe at all times, and provided as the work progresses downward.

Shoring, sheeting and bracing shall be structurally designed and constructed and sufficient for the loads and forces involved; and excavation slopes shall be sufficient to preclude slides, slipouts or other failures and as warranted by the conditions and materials involved.



The Contractor shall submit to the Engineer for review drawings showing his proposed methods and designs for shoring and bracing or other temporary construction and other details left open to his choice or not fully shown on the drawings.

The Contractor shall be responsible for the control of water as may be used, developed or otherwise occurring within the work areas from time to time; and whether such water is classified as seepage, underground, rain or storm water, or otherwise.

Control shall mean to include providing pumps or other devices, lines, ditches, dikes, shaping of surfaces or other construction or operations as necessary for the collection and disposal of water; and such as is necessary for the proper execution of the work and protection of all facilities and improvements within or near the work areas.

Water disposal shall not damage and terrain, plants, trees, construction or structures, and shall not lead onto nor across established roads, parking areas, planting areas, or adjacent properties, unless otherwise specifically approved for each case.

The Contractor shall, during the course of the work maintain the work site free of standing water except at approved decanting ponds. The Contractor shall clean, trim and maintain all drainage ditches from time to time during the work to permit a free flow of water at all times. Damage to the work attributable to wetting through failure to provide such adequate drainage shall be repaired by the Contractor at no cost to the Engineer.

The Contractor shall construct and maintain such temporary dikes, weirs and ditches and until the work requiring such temporary structures is accepted by the Engineer. All such temporary construction structures as are required for construction shall be removed prior to final acceptance of the finished and completed work.

Disposal of surface and dredge disposal shall be in such manner as not to damage or inconvenience work or facilities of other Authorities or Contractors, and should be to the approval of the Engineer.

Shoring, sheeting and bracing shall be removed when the work is completed.

Structure excavation work shall be such that they remain open and exposed for the shortest time practical.

Unsuitable material encountered in the structure excavation work shall be removed and disposed of outside the limits of the project, and as provided for under Tech. Spec. entitled GENERAL EXCAVATION Article entitled UNSUITABLE MATERIAL,

regardless of the location from which such material is removed.

When any unsuitable material is encountered at or below the lower limits of the excavation required for structures or other facilities, the Contractor shall immediately give notice to the Engineer as to the location and observed extent and apparent condition of such circumstance.

### 3.02 RELATED REQUIREMENTS

To the extent applicable to structure excavation and in accordance with the conditions encountered in the work, the following Articles under Tech. Spec. entitled GENERAL EXCAVATION shall apply to work under these specifications:

- SLIDES AND SLIPOUTS.
- SURPLUS MATERIAL DISPOSAL REQUIREMENTS.
- DEFICIENT MATERIAL.
- GRADE TOLERANCE.
- MAINTENANCE OF THE WORK.

When applicable to work under these specifications, the above respective items of work shall be considered as structure excavation and not as general excavation.

### 3.03 COFFERDAMS

The Contractor shall be responsible for determining the need for cofferdams; and, if required, shall be arranged for and provided as part of the work under the Contract. The designs, methods, means, and drawings and submittals for any cofferdam work shall comply with requirements the same as specified for shoring, sheeting and bracing under Article herein entitled GENERAL REQUIREMENTS in subsection 3.01.

If so determined and used by the Contractor, the requirements herein shall apply.

Cofferdams for construction purposes shall be carried well below the bottom of the footing and shall be well braced and as watertight as practical.

Cofferdams which are tilted or moved out of position by any cause during the process of construction shall be righted and/or strengthened as required.

Cofferdam walls shall be vented at low water elevation to insure equal hydrostatic head both inside and outside of the cofferdam during the period of placing and setting of seals.

No shoring will be permitted in cofferdams which will induce stress, shock, or vibration in the permanent structure.

Cross struts or bracing may extend through foundation concrete, and such struts or bracing shall not be permitted to remain in place, unless otherwise approved by the Engineer. Struts or bracing above low water shall be removed and the resulting space filled with concrete of the same mix as that specified for the surrounding concrete.

After completion of the substructure, the cofferdams with all sheeting and bracing shall be removed by the Contractor, and such removal shall be performed in a manner that will not disturb or mar the finished concrete.

### 3.04 FOUNDATION TREATMENT FOR STRUCTURES

When no piles are used and footing concrete, culverts or other structures are to rest on an excavated surface other than rock, care shall be taken to protect the surface from water and not disturb the bottom of the excavation. If suitable material in the bottom of the excavation is disturbed or removed and replaced for the Contractor's convenience, the foundation shall be restored by the Contractor to a condition at least equal to the undisturbed foundation.

When a firm foundation is not encountered, due to soft, spongy or other unsuitable material, the Contractor shall carry out such work as necessary to assure adequate support of the structure and as reviewed in advance by the Engineer.

When footing concrete is to rest upon rock, the rock shall be fully uncovered and the surface thereof shall be thoroughly prepared to properly support the loads to be imposed by the structure. Any seams in the rock shall be especially treated to preclude development of unstable foundations at some future time.

When excavating for culverts, and solid rock or other unyielding material is encountered, the material shall be removed below the bottom of the culvert. The resulting trench below the bottom of the culvert shall be backfilled with structure backfill material in accordance with Article entitled STRUCTURE BACKFILL.

When swell or subsidence results for driving piles, the Contractor shall excavate, or backfill with suitable material, the footing area to the grade of the bottom of the footing. If material under footings is such that it would mix into the concrete during footing placement or would not support the weight of the fluid concrete, the Contractor shall provide a suitable platform on which to cast the footing.

### 3.05 NOTIFICATION

The Contractor shall notify the Engineer whenever any structure excavation is substantially completed to the lower limits required for the work.

### 3.06 STRUCTURE BACKFILL

When the filling work required at the location of railway, roadway and station plaza area embankments, filling work shall perform in accordance with Tech. Spec. entitled FILLING, GRADING & EMBANKMENT CONSTRUCTION.

Locations other than those as specified above, filling work shall be performed conforming to manners as follows:

Prior to commencement of filling work, the contractor shall determine the optimum density of filling material, obtained from structure excavation, to be equal to the surrounding earth density when that compacted.

When the filling material is containing the moisture, exceeding optimum moisture content limit, shall be dried until surplus moisture evaporate.

Backfill material shall be placed in uniform layers and shall be brought up uniformly on all sides of the structure or facility.

Compaction equipment or methods which may cause excessive displacement, or may damage structures, shall not be used.

No backfill material shall be deposited against the back of concrete abutments, concrete retaining walls, or cast-in-place concrete structures until the concrete has developed a strength of not less than 170 kg/cm<sup>2</sup> in compressive strength, or until the concrete has been in place for 28 days, whichever occurs first.

Backfill at the inside of bridge wingwalls and abutments shall be placed before curbs or sidewalks are constructed over the backfill and before railings on the wingwalls are constructed.

Material shall be compacted in accordance with the requirement as specified herein.

Structure backfill placed at bridge piers in waterways and water channels, not beneath any embankment, pavement or slope protection shall consist of aggregate as specified in Tech. Spec. entitled AGGREGATE SUBBASE Article 2.04 shall be placed by spreading into a reasonably stable condition.

Where structure excavation is performed and materials is removed outside the limits designated for structure excavation, as shown or specified, all backfill material

placed in said excavation areas shall be compacted to a relative compaction of not less than that required for the adjacent structure backfill.

Compaction of the lower levels of structure backfill by ponding and jetting will not be permitted unless specifically approved in advance by the Engineer. If proposed for use in the work, the Contractor shall submit for approval the locations, materials, methods and means for such work.

Special material for structure backfill, or special methods or procedures, shall be provided using the materials or means and at the locations when and if particularly indicated as such on the drawings; and such work shall be carried out in accordance with the requirements of these specifications, except as may be otherwise indicated on the drawings.

Material for structure backfill shall be furnished by the Contractor, except that the Contractor may use material found in excavation when it is suitable for the purposes and locations where it is to be used.

### 3.07 SURPLUS MATERIAL

Surplus structure excavation materials not utilized for the work shall be removed and disposed of outside the limits of the work, unless otherwise approved in advance.

END OF SECTION

005 - TRENCHING, BEDDING, BACKFILLING AND COMPACTING

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005 - TRENCHING, BEDDING , BACKFILLING AND COMPACTING

PART 1: GENERAL

1.01 DESCRIPTION

Work Included: This section covers the furnishing of all materials, equipment, and labor for trenching, bedding, backfilling and compacting for utility systems. "Utility Systems" shall include all underground piping and appurtenances for liquids, and buried cables and conduits for electrical and communication lines. Whenever existing surface finishes are damaged, as a result of placing the "Utility System", the surface finish shall be restored as part of the Work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section	004	STRUCTURE EXCAVATION AND BACKFILL
Section	007	FILLING, GRADING AND EMBANKMENT CONSTRUCTION
Section	014	ASPHALT CONCRETE CONSTRUCTION

1.03 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standard provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

AASHTO American Association of State Highway and  
Transportation Officials:

M 57 Materials for embankments and subgrades.

ASTM American Society for Testing and Materials.

D 1557 Moisture-Density Relations of Soils, Using  
10 lb. (4.5 kg) Rammer and 18 in. (457 mm)  
Drop, Tests for,

D 2049 Relative Density of Cohesionless Soils,  
Tests for.

1.04 SUBMITTALS

A. The Contractor shall submit to the Engineer items for information and/or approval. Such submittals shall include but not be limited the following:

1. Method of Construction plan. The Contractor shall submit a "Method Statement" for how each item of Work will be performed, including:

- a. Excavation Plan
- b. Alternative Methods
- c. Alternative Materials
- d. Equipment to be used

2. Quality Inspection Plan. The Contractor shall be responsible for the quality of all fill material and as such shall develop and submit a Quality Inspection Plan for review. The plan shall indicate source or sources to be used and once approved shall not be changed without prior written approval from the Engineer.

## PART 2: PRODUCTS

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

### 2.01 MATERIALS

- A. Suitable Fill Material shall be comprised of suitable excavated materials or borrow materials. Such materials shall generally conform to AASHTO M 57 for excavated materials conforming to the requirements specified in Tech. Spec. entitled FILLING, GRADING AND EMBANKMENT CONSTRUCTION for borrow materials, and shall be free from perishable and organic materials, scrap and rubbish, and shall not have particle sizes greater than 50 mm and/or a total salts content in excess of one (1) percent.
- B. Bedding material shall conform to the requirements under Tech. Spec. entitled AGGREGATE SUBBALLAST Article entitled TYPE ASB-3 AGGREGATE SUBBALLAST.

## PART 3: EXECUTION

### 3.01 TRENCHING

- A. Excavations for trenches, shall be to the lines and grades indicated on the Contract Drawings. Trenches shall be made as narrow as practicable or to the minimum widths specified on the Contract Drawings but shall nevertheless provide sufficient room for the laying, jointing and testing of pipework and utilities. In no case shall the earth be scraped or dug by machinery so near to the bottom of the bedding formation level as to result in the disturbance of the material below. Remove the last of the material at the bedding level carefully by using hand tools, however, do not remove before the placing of the pipe, utility or bedding is imminent. If the bottom of the trench is excavated beyond the limits indicated on the Drawings or specification, the resulting void shall be backfilled with suitable fill material, conforming to para. 2.01 A. herein, and compacted to a density at least equal to the density of the surrounding earth.



- B. Sheeting, bracing and shoring shall be used to provide for the safety of all personnel and also to assure that the stability of previously constructed structures and facilities are not impaired or endangered by excavation work. Previously constructed structures and facilities include both structures and/or facilities existing when this Contract began and structures and facilities already provided under these specification. The lateral distance to the edge of the excavation from the adjacent structure(s) foundation shall be at least equal to the depth of that part of the trench which is lower than the bottom of the adjacent foundations, unless otherwise approved by the Engineer. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or possible surcharge loads from equipment used in the Work. Contractor may slope the sides of the trench at the angle of repose of the excavated material.
- C. Dewatering equipment shall be provided and maintained to remove and dispose of all surface and or ground water entering excavations and other parts of the Work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the construction to be provided therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result. Any excavation work shall not be commenced until permission is given by the Engineer.

### 3.02 BEDDING

Bedding shall be carried out in accordance with the requirements in the types and sizes as shown on the drawings. Subgrade to receive bedding shall be cleared in accordance with the requirements as specified in Tech. Spec. entitled SUBGRADE PREPARATION.

### 3.03 BACKFILLING AND COMPACTING

Prior to commencement of filling work, the contractor shall determine the optimum density of filling material, obtained from structure excavation, to be equal to the surrounding earth density when that compacted.

When the filling material is containing the moisture, exceeding optimum moisture content limit, shall be dried until surplus moisture evaporate.

Backfilling shall be carried out at all trenches in such a manner that the work will not damage and disturb the utility system.

Backfill material shall be placed in uniform layers and shall not be placed until dewatering work is completed and also shall be deposited in 150 mm maximum layers on the properly bedded utility systems and carefully tamped until the utility systems has a cover of 300 mm.

Unless otherwise specified or indicated, trenches in non-paved areas shall have the remainder of the backfill to subgrade elevation in 300 mm layers to be compacted to the density as specified in this specification.

In areas such as roadways, and station plaza areas, the trenches shall be backfilled to subgrade elevation in 150 mm layers and each layer shall be compacted in such a manner as specified Tech. Spec. entitled FILLING, GRADING AND EMBANKMENT CONSTRUCTION.

Subbase, base course and pavement required to complete the backfilling shall meet the requirements specified in Tech. Spec. entitled ASPHALT CONCRETE CONSTRUCTION.

Material which is not suitable for backfilling shall be disposed of in such a manner as specified in Tech. Spec. entitled GENERAL EXCAVATION Article entitled SURPLUS MATERIAL DISPOSAL REQUIREMENTS.

Trenches improperly backfilled and not in conformance to these specifications shall be reworked until such time that the work will be satisfactorily at Contractor's expense.

END OF SECTION

006 - SLOPE PROTECTION

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## 006 - SLOPE PROTECTION

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers material and installation requirements for slope protection in the types as indicated to be provided at the locations; and extent and depths indicated on the drawings and as specified. The Contractor shall furnish all labor, materials, tools and equipment required to complete the work.

#### 1.02 REFERENCES

Related Work under Other Sections:

Section	012	SUBGRADE PREPARATION
Section	021	PORTLAND CEMENT CONCRETE
Section	022	CAST-IN-PLACE CONCRETE

#### 1.03 SUBMITTALS

Samples of sodding materials shall be submitted for inspection and acceptance upon the Engineer's request.

### PART 2: MATERIALS

#### 2.01 SODDING MATERIAL

Sodding materials required under these specifications shall be where available, "Rumput Embun" procured from a local supplier. Proposed materials are subject to approval by the Engineer in advance.

Sodding materials shall be nursery-grown unless specifically authorized to be collected. Sodding materials shall be hardy under climatic conditions similar to those in the locality of the project. Sodding material shall be typical of their species or variety and shall have a normal habit of growth.

Sodding material shall be sound, healthy, vigorous, and shall be free of disease, insect pests, eggs or larvae; and shall have healthy, well-developed root system.

#### 2.02 MIXTURE SOIL FOR SODDING

Mixture soil shall be natural, fertile, typical of cultivated topsoils of the locality and shall be free from stones, clods, sticks, roots or other and shall contain no toxic materials.

## 2.03 CONCRETE, AGGREGATES AND WATER

Concrete, aggregates and water shall be in accordance with Section 021, PORTLAND CEMENT CONCRETE.

Slump of concrete shall be subject to approval by the Engineer at site.

## PART 3: EXECUTION

### 3.01 PLANTING OPERATIONS

Planting shall be done by experienced workmen familiar with planting procedures under the supervision of a qualified foreman.

Planting time shall be according to local practice.

Planting pits shall be dug to a depth of approx. 15 cm and be separated approx. 30 cm transversely and approx. 20 cm longitudinally from each other over the entire surface area of the slope as shown on the drawings.

All planting pits shall be excavated with vertical sides. When planting material are set, soil shall be compacted around bases to fill all voids. Soil around roots shall be thoroughly compacted and watered.

### 3.02 PROTECTION

Roots of sodding material shall be adequately protected at all times from sun and from drying winds.

### 3.03 MAINTENANCE

Maintenance shall begin immediately after each portion of planting and shall continue in accordance with the following requirements until final acceptance. The Contractor shall be held responsible for maintenance of planting material, including watering, weeding and re-planting as much longer as is necessary to establish a uniform stand of the specified grasses and until "Acceptance". After the grass has started, all areas and parts of areas which fail to show a uniform stand of grass, for any reason whatsoever, shall be replanted repeatedly until all areas are covered with a satisfactory growth of grasses. At time of cutting, maintain grass at a maximum height of 50 mm.

Spraying: During the maintenance period and up to the Final Acceptance, the Contractor shall do all seasonal spraying as required to keep them in a healthy state.

**Protection:** Planting areas and grasses shall be protected against trespassing and damage of any kind. If any grasses become damaged or injuries occur, they shall be treated or replaced as directed.

**Damage:** Damage resulting from erosion, washouts, or other causes shall be repaired by filling with topsoil, tamping, refertilizing by the Contractor at his expense if damage occurs prior to acceptance of the Contract.

**Guarantee:** Sodding materials (grass) shall be guaranteed for one (1) full year after Initial Acceptance of planting and shall be alive and in satisfactory growth at the end of the guarantee period, except for damage resulting from causes beyond the responsibility of the Contractor.

Upon completion of planting and prior to provisional acceptance, remove from the site, excess soil and debris, and repair all damage resulting from planting operations.

**Watering:** Sodding shall be watered continuously with spraying of water in a satisfactory manner during and immediately after planting, until provisional acceptance.

Until grass growth is established, provide supplementary watering not less than twice per day to nourish root system.

### 3.04 PLACING OF CONCRETE

Placing shall comply with Section 022, CAST-IN-PLACE CONCRETE unless otherwise specified herein.

Prior to placing of concrete, finished grade of the slope shall be sufficiently smooth and flat and concrete shall be tamped manually such that concrete will be in close contact with the surface of the slope.

Construction joints shall be provided at intervals of 5 meters.

Upon placing, reasonable time gap shall be provided between each step of placing operations to prevent the placed concrete from slippage and successive placing of concrete shall be made after the previous placed concrete has been sufficiently hardened.

Construction of concrete foundation for the slope protection shall conform to Section 022, CAST-IN-PLACE CONCRETE, and size and dimensions shall be as shown on the drawing and concrete shall be Class E.

3.05 FINAL INSPECTION AND FINAL ACCEPTANCE

At the end of the guarantee period, inspection will be made by the Engineer upon written request submitted at least ten (10) days before the anticipated date. After all necessary corrective work has been completed the Engineer will certify in writing the final acceptance of the planting.

END OF SECTION

1.02 REFERENCES

Related Work in Other Sections:

Section	003	GENERAL EXCAVATION
Section	004	STRUCTURE EXCAVATION & BACKFILL
Section	011	SUBGRADE PREPARATION

1.03 SUBMITTALS

A. GENERAL:

The Contractor shall submit to the Engineer, for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents. When not otherwith indicated.

B. BEFORE COMMENCING WORK:

1. Work program comprising an outline of equipment to be employed in carrying out this work.
2. Grade Drawings to clearly indicate the areas intended to be constructed utilizing borrow excavation, and together with a summary of estimated quantities at such areas.
3. An outline, details and grade drawing to clearly indicate the borrow excavation intended to be carried out. A summary of estimated quantities shall also be submitted. Excavation within these areas then shall be limited to the lines, grades and extent indicated on such drawings as approved.

PART 2: PRODUCTS

2.01 FILL MATERIAL

Fill material for embankment shall be suitable borrow material as specified hereunder, unless otherwise specified or indicated. Suitable material shall be any soil material derived from borrow pit as designated by the Engineer which, when used in the work, is capable of meeting the requirement tabulated in these specifications.

Embankment fill material shall be free from appreciable amounts of organic matter; shall be free from rocks, broken concrete or other solid material which are 10 centimeter or larger in greatest dimension.

Gradation of borrow material, when tested in accordance with AASHTO T 27, shall be within the limits as follows:



<u>Seive Size</u>		<u>Percent Passing, by Weight</u>
<u>(Inch)</u>	<u>(mm)</u>	<u>Individual Test Result</u>
3	75	100
1 3/4	0.45	40 maximum
No. 200	0.075	2-20

The portion of borrow material passing the 0.425 mm (No. 40) seive shall conform to the requirements as follows:

<u>Characteristics</u>	<u>AASHTO Test</u>	<u>Requirement</u>
Liquid Limit	T 89	35 maximum
Plasticity Index	T 90	Less than 9

Uniformity coefficient of borrow material shall not be less than 6.

## 2.02 SAND MAT

Material for the sand mat shall be of natural sand, manufactured sand or combination of the two, and shall be free from any organic matter or deleterious substances, and in such condition that it can be readily compacted under watering and rolling to form a firm, stable base.

## PART 3: EXECUTION

### 3.01 PLACING

Transporting and conveying of fill materials shall be controlled and supervised by the Contractor for convenience of completion of the work.

Prior to placing any fill, the Contractor shall satisfactorily demonstrate that the compaction method or methods, and the equipment which he proposes to use, will provide the degrees of compaction hereinafter specified.

The Contractor shall place fill materials in horizontal loose layers and spread, mix and place in such manner as to product a uniform thickness of material. Placement shall start in the deepest area and progress approximately parallel to the finished grade.

No fill material shall be placed on areas where free water may be standing. Clods or hard lumps shall be broken up before compacting the material in embankment.

When the location of advance construction of embankment would cut off water-ways, severely restrict draining of run-off water, or otherwise result in blockage or damming of water, temporary cross channels shall be cut through the embankment as are needed to effect drainage; and which shall be maintained for as long as necessary until drainage facilities are completed and usable.

### 3.02 TEST EMBANKMENT

This work shall only apply to the railway embankment construction. Prior to commencement of permanent embankment construction, the Contractor shall construct trial test embankments in such a manner, at the locations, length and width of the embankment, all as directed by the Engineer for review the optimum moisture content of material and equipment that are most appropriate for the work, and also for determination of the thickness of fill material at each layer, intervals between successive filling works and testing method.

### 3.03 COMPACTING

#### A. GENERAL:

Compaction work shall conform to the requirements as specified hereunder.

The placing and compacting of suitable material where unsuitable material has been removed, and the filling of holes, pits and other depressions within the limits of work shall conform to all of the requirements herein.

Trenches, holes, piers and other depressions outside of areas where embankments are to be constructed but are within the limits of work shall be graded to provide a presentable and well-drained area.

Where embankments are to be constructed across low swampy ground or ponds, which base shall be drained and dried prior to the permanent construction.

Pits, holes or other depressions below adjacent ground levels shall be filled with suitable material and compacted.

Construction work shall not be permitted when the weather is rainy and material which contains excessive moisture shall not be compacted until the material is dry enough to obtain the required compaction.

At locations where it would be impracticable to use mobile power compacting equipment, embankment layers shall be compacted to the specified requirements by any method that will obtain the specified compaction.

Embankments shall be constructed in layers of uniform thickness and each layer shall be tested in accordance with AASHTO T 221 using 30 cm in diameter steel bearing plate.

B. TESTING AND COMPACTING:

1. Application for railway embankment

Embankment for these areas shall be compacted and tested in accordance with the requirements as specified in GENERAL of this Chapter as well as the requirements specified hereunder.

Test shall be carried out at the locations 100 meter apart from each other over the embankment area; and for each 90 cm thickness in respective layers and top surface of embankment.

The test shall include a group of testing which consists of three (3) individual tests to be performed at the location of center and 1.0 meter inside from the both sides of embankment shoulder along the perpendicular to the center line of the railway.

When tested in accordance with AASHTO T 221 specified in GENERAL of this Chapter, the result of the test shall not be less than 7 kg/cm<sup>3</sup> at the layer and locations specified above.

When the construction lot is limited less than 100 m by the structure(s) across the embankment, construction lot shall be assumed as such limited area.

Thickness of each spreading layer shall conform to the result which is obtained from the test embankment work as specified in this specification Chapter 3.02, but shall be not greater than 30 cm in thickness.

Slope of embankment shall be graded, rounded and shaped as indicated simultaneously with embankment construction work, and shall be compacted thoroughly as specified immediately after embankment construction has been completed, and also shall be temporarily protected from erosion by rainfall by the use of suitable manner directed by the Engineer until such time that Slope Protection has been completed.

Embankment shall be constructed so that each layer shall have a cross-fall not to exceed 0.3 meter in 10 meters.

2. Application for roadway embankment

Embankment for these areas shall be compacted and tested in accordance with the requirements as specified in GENERAL of this Chapter as well as the requirements specified hereunder.

Each test results shall be not less than 7 kg/cm<sup>3</sup> when tested at random locations on the finished surface as directed by the Engineer.

3. Application for the station plaza area embankment

Embankment for these area shall be compacted and tested in accordance with the requirements as specified in GENERAL of this Chapter as well as the requirements specified hereunder.

Each test results shall be not less than 5 kg/cm<sup>3</sup> when tested at random locations on the finished surface as directed by the Engineer.

3.04 SAND MAT

Prior to commencement of permanent construction, the Contractor shall construct trial test strips for each type of material to be used, to the lengths and width as approved by the Engineer, for the purpose of the review of the material and equipment operations that are most appropriate for the work.

Test strip material shall be the same type as that to be used in the work and the compaction equipment shall be the same as detailed in the Contractor's work program as approved.

Test strips which do not indicate acceptable results shall be removed and reconstructed for as many times as necessary until satisfactory results can be demonstrated.

Immediately prior to commencement of placing sand mat, the subgrade to receive sand mat shall be cleared of all vegetable growth, such as trees, logs, upturned stumps, roots of downed trees, brush, grass, weeds, and all other objectionable material, including concrete or masonry or debris, and shall be also free from irregularities.

Each layer shall be filled until obtained the thickness as specified in advance of compaction work, and shall be compacted by three wheel power rollers or pneumatic-tired rollers or other compaction equipments. Finished thickness of each layer shall be not more than 25 cm.

Test and grade tolerance shall conform to the requirements as specified in Tech. Spec. entitled AGGREGATE SUBBALLAST.

3.05 MAINTENANCE OF THE WORK

Embankment shall be maintained in accordance with the requirements specified under Tech. Spec. entitled GENERAL EXCAVATION Article entitled MAINTENANCE OF THE WORK.

END OF SECTION

008 - PRESTRESSED CONCRETE PILES

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## 008 - PRESTRESSED CONCRETE PILES

### PART 1: GENERAL

#### 1.01 DESCRIPTION

- A. This work shall consist of providing prestressed concrete piles at the locations and to the lines and grades, shown on the drawings, and in accordance with these specifications.
- B. Furnishing and installing pile caps, grade beams, girders or other structures supported by the piling shall be as provided for elsewhere in the technical specifications.
- C. This work shall include formulation and submittal of a complete pile installation and testing program, providing key supervisory personnel and boring investigations, all as specified.
- D. Alternate pile heads, pile tips, splices, build-ups or other alternates shall be used only if specified or authorized by the Engineer.

Where specific methods are indicated for achieving a result, other methods which will insure equal results may be considered for approval by the Engineer.

- E. This work shall include the furnishing of all services, labor, materials, tools, equipment, and incidentals, and for providing or performing all of the work involved in the piling work as shown or specified.

#### 1.02 RELATED WORK IN OTHER SECTIONS

Not applicable.

#### 1.03 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

ASTM - American Society for Testing and Materials

D 1586-67 Penetration Test and Split-barrel Sampling  
of Soils

AASHTO - American Association of State Highway and  
Transportation Officials

T 22-74 Compressive Strength of Cylindrical  
Concrete Specimens

T 24-68 Obtaining and Testing Drilled Cores and  
Sawed Beams of Concrete

ACI - American Concrete Institute

AWS - American Welding Society

1.04 SUBMITTALS

- A. As a prerequisite, a summarized outline of the piling work program as proposed shall be included and submitted as part of any tender proposal offered by any prospective contractor.
- B. Before commencement of the work, the Contractor shall submit to the Engineer for review a complete and comprehensive Piling Work Program which shall provide all data and information specified herein after, and shall account for any modifications or adjustment reflecting results of any negotiations or other considerations which may have affect upon the piling work. The program shall be submitted in sufficient time such that the program can be reviewed by the Engineer.
- C. The program for this piling and testing work shall be based upon the drawings and these specifications, and such that the piling work will satisfy all conditions shown or specified and comply with all performance requirements shown or specified.
- D. The piling program shall be outlined and set forth in sufficient detail such that all aspects can be clearly identified and readily evaluated; including: type(s) of pile proposed, and material, structural and performance characteristics thereof; method(s) proposed for installation and testing; and equipment and facilities proposed to be utilized for production, installation and testing for both test and permanent pile work.
- E. The program shall include all necessary coordination such that execution and completion of the test and permanent pile work will not result in delay in completion of all Contract work as required by the Construction Schedule approved for this Contract.
- F. Following completion of the initial test pile work and before commencement of any permanent pile work, the Contractor shall submit to the Engineer for review the final

complete piling program, together with and modifications or adjustments made by the Contractor as may result from the test pile work or otherwise.

PART 2: PRODUCTS

2.01 CONCRETE

- A. Prestressed piles shall have a minimum compressive cylinder strength of 500 kg/cm<sup>2</sup> at 28 days.
- B. Air entrained concrete is recommended for use in piles which will be subjected to cycles of wetting and drying.

2.02 PRESTRESSING REINFORCEMENT

Prestressing tendons shall conform to the general requirements of ASTM Designation A 722, and may be either regular or high strength, in accordance with tendon manufacturer's published tables. Subject to the approval of the Engineer, prestressing may be increased as required for handling or driving by increasing the number or size for tendons.

PART 3: EXECUTION

3.01 GENERAL REQUIREMENTS

The permanent pile work shall be carried out in accordance with the piling program as approved from time to time by the Engineer and piles shall be built up with driving.

The initial permanent pile of each structure shall be driven until such time that bearing capacity can be ascertained. Type of driving equipment may be option of the Contractor, unless otherwise specifically required by the Engineer however driving of the piles shall be carried out in accordance with calculation method as designated by individual piling equipment and as approved by the Engineer.

Should it become necessary due to unforeseen events to leave open any hole or casing longer than the above period, the top opening shall be effectively covered to preclude the falling in of any person, object or extraneous material, and substantially weighted to preclude blowing off or easy removal.

3.02 SUPERVISION

The Contractor shall be responsible for providing such key personnel as are necessary for continuously overseeing the various phases and steps of the piling work such as to assure compliance with the piling program and these specifications.



Personnel for such supervisory work shall be sufficiently well qualified by training and experience. Personnel for testing and installation may be one and the same provided that they are sufficiently qualified in both such phases of work.

The Contractor shall require that the supervisory personnel be responsible for utilizing and recording the conformation records or check sheets. Such records shall be maintained in an orderly manner; and, as the respective parts or portions of the work are completed from time to time, such records shall be delivered to the Engineer for information.

The assigned and approved supervisory personnel shall not be changed unless duly qualified personnel are provided in lieu thereof and are approved in advance by the Engineer.

### 3.03 PILE DRIVING

- A. Pile heads shall be protected from direct impact of the hammer by cushion blocks consisting of several piles of soft compressible wood or other approved material.
- B. Jetting will be permitted and/or required when necessary to obtain the required penetration. Internal jets may be installed provided they are securely anchored to the pile and are imbedded in the concrete. The last two meters should be driven without water injection.
- C. The driving head (helmet) shall be sufficiently large and shallow so as not to bind the head of the pile if it twists slightly during driving.

### 3.04 SPLICES

Where necessary, two prestressed pile sections may be spliced by the use of welding method in compliance with applicable provisions of A.W.S. and the throat thickness for welded section shall conform to the requirement as shown on the drawings.

### 3.05 BORING INVESTIGATIONS

The Contractor shall provide and maintain at the work for the duration necessary the equipment and personnel required to properly carry out these requirements.

Boring investigations shall be provided and at the locations as approved by the Engineer, and the number of quantity of tests to be carried out shall be as indicated elsewhere under the Contract Documents.

Total depth of each borehole shall be as required subject to soil conditions of each location; and ASTM D 1586 standard penetration tests shall be performed at every one meter of depth as the work progresses downward.

The borehole test locations shall be sequentially numbered for ready identification and the location of each noted on a suitable diagram. Material conditions and characteristics and the results of each test carried out shall be accurately and clearly recorded, and all such records shall be submitted to the Engineer for information as soon as the series of tests for each location have been completed.

Boreholes shall be backfilled to a stable condition, but not sooner than as approved by the Engineer after completion of each hole.

### 3.06 TOLERANCES

- A. Pile ends shall be plane surfaces and perpendicular to axis of pile with a maximum tolerance of 11 mm per meter transversely.
- B. The maximum sweep (deviation from straightness measured along two perpendicular faces of the pile, while not subject to bending forces) shall not exceed 3.0 mm in any 3 m of its length.
- C. The elevation of the top of the concrete for the pile shall not vary more than plus or minus 10mm from the elevation indicated.

### 3.07 NONCOMPLIANT OR DAMAGED PILE

- A. Pile not conforming to all quality, performance and tolerance requirements, or pile which is damaged during the course of this or subsequent work operations, shall be either: repaired to acceptable condition; or abandoned and replaced by the addition of one or more extra piles.
- B. The Contractor shall be responsible for determining and proposing to the Engineer for review in advance of the work the means or methods for repairs and/or replacement.
- C. The Contractor shall be responsible for design engineering made necessary as a result of any permanent pile not being in compliance with these specifications.

### 3.08 ABANDONED PILES

Any test or permanent pile which is abandoned for any reason shall be cut off and removed to not less than 3.0 meters below the lowest finished ground level at the pile location.

END OF SECTION

009 - PROTECTIVE FENCE

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## 009 - PROTECTIVE FENCE

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This work shall consist of furnishing and installation of protective fence and assemblies of the size and type as indicated with the details as shown on the drawing and the requirements of these specifications.

As used herein, the term protective fence shall mean fencing with barbed wired of the type as shown on the drawing and as specified.

The work shall include any preliminary clearing and leveling off of the ground area along the lines of fencing as may be needed in advance of the fencing work; shall include all surveying and measuring necessary to layout the work; and shall include the determining and providing of the quantities of material required to complete the work.

The work shall cover and include excavation, backfilling, compaction, and disposal of surplus material; concrete for post bases; all assembly components as shown or specified.

The Contractor shall furnish all labor, materials, tools and equipment required to complete the work.

#### 1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

ASTM            American Society for Testing and Materials

A 121           Barbed Wires

JIS             Japanese Industrial Standards

G 3528          Barbed Wires

#### 1.03 PROTECTION AND STORAGE

Material shall be stored out of mud and dirt and proper drainage of the storage area shall be provided. Protect from damage or soiling by adjacent construction operations.

Storage of steel materials at the job site shall be the responsibility of the Contractor. Store material at the job site in a manner to prevent excessive deflection, corrosion or deterioration.

## PART 2: PRODUCTS

### 2.01 GENERAL

All goods and products as required for the work shall be, when available, procured from a local manufacturer or supplier. The proposed products and materials shall be subject to approval by the Engineer in advance of the work.

### 2.02 MATERIALS

Angle materials shall be of good commercial quality, structural steel.

Fastenings and miscellaneous materials shall be galvanized.

Zinc-coating shall be smooth and relatively free of lumps, globs, or points. Excessive roughness, blisters, salt-ammoniac spots, bruises or flocking will be a basis for rejection.

Concrete for post bases shall be Class F in accordance with Tech. Spec. Section "PORTLAND CEMENT CONCRETE".

Barbed wire shall be in accordance with ASTM A 121, Class 1, made from two strands of galvanized, twisted, 2.5 mm (12-1/2 US gauge) carbon steel wire, with 4 points barbs spaced not over 75 mm apart; and shall be vinyl coated; or be in accordance with JIS 3528 Barbed wires. Paint material shall be in accordance with Section "PAINTING" unless otherwise specifically directed by the Engineer.

## PART 3: EXECUTION

### 3.01 ERECTION

Line posts shall be accurately laid out and set to uniform spacing throughout each run and to not exceed the maximum typical spacing indicated, and gate posts shall be set to not exceed the spacing dimensions indicated.

Fence runs shall be in straight alignments between dimension points indicated, or uniformly arced to the required radius when required to be curved.

Posts shall be erected plumb and true to line and level; and shall be firmly set into concrete bases of the size or sizes not less than as shown, and anchored into the ground and free from movement when tested by moderate hand pressure applied horizontally at the top of the post and in any direction.

Any soft, spongy or other unstable ground at a post location shall be removed and replaced with suitable material well compacted into place, and to the extent necessary to meet the above requirements.

Unstable or unsuitable soil material removed shall be disposed of outside the limits of the project; and suitable surplus excavated material shall be disposed of outside the limits of the work and the areas assigned for such use by the Engineer in advance of the work.

Excavated holes for post bases shall be neat and free from loose materials when the concrete is placed.

When placed, concrete shall be thoroughly mixed to a uniform condition. concrete not used within one hour after start of mixing shall not be used in the work and disposed of outside the limits of the project.

As it is being placed, concrete shall be well consolidated to a dense condition and to completely fill all voids in the hole and around the post. The exposed top surfaces shall be slightly sloped away from the post and trowel finished smooth and with outer edges eased by rounding.

Concrete shall be moist cured for not less than 4 days.

#### BRACING:

Terminal panels of fencing formed by the last 2 posts shall be braced as shown, or by some comparable means proposed by the Contractor and approved by the Engineer, which will effectively stiffen the fence assembly against away in the longitudinal direction.

At corners where the line of a fence run turns by 30 degrees or more, the end panels each side of the corner shall be similarly braced; and the terminal panels on each side of each gate opening shall be similarly braced.

When a run of fence is 300 meters or more between any other braced panels, additional braced panels shall be provided at uniformly spaced intervals not exceeding 300 meters.

Fastenings shall be set tight and full bearing on the items they secure into place. Fastenings with stripped threads or otherwise damaged shall be replaced.

#### PAINTING:

Painting work shall be in accordance with Section 123 "PAINTING".

3.02 COMPLETION OF WORK

The ground areas around and adjacent to the fencing shall be left in a neat, clean, smooth, level and in a stable condition.

Exposed edges, ends and holes of all metal elements shall be free from torn metal, burrs and sharp edges or other protrusions.

Fencing assemblies shall be free from laps, splices or joints not shown, specified or approved; and free from bends, twists or other deformations not required by the lines or shapes as shown.

The completed fencing work shall be free from damage, and any waste or surplus materials shall be removed from and around the work areas.

END OF SECTION

010 - GUARD RAILING

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010 - GUARD RAILING

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing, delivery and installation of metal beam guard railings, support posts and all required accessories at the locations and to the details shown on the Contract Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.

B. Related Work Specified Elsewhere:

Section	004	STRUCTURE EXCAVATION AND BACKFILL
Section	021	PORTLAND CEMENT CONCRETE

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. AASHTO American Association of State Highway and Transportation Officials:

- M 111 Zinc (Hot-galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
- M 180 Corrugated Sheet Steel Beams for Highway Guardrail.
- M 183 Structural Steel.
- M 232 Zinc Coating (Hot-dip) on Iron and Steel Hardware.
- T 65 Weight of Coating on Zinc-coated (Galvanized) Iron or Steel Articles.

B. ASTM American Society for Testing and Materials: ,

- A 501 Hot-formed Welded and Seamless Carbon Steel Structural Tubing.

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Copies of manufacturer's specifications for all materials.
  - B. Certification that all materials meet the requirements of this Section.
  - C. Shop drawing for all required work.
- 1.04 PRODUCT HANDLING
- A. Materials shall be handled and shipped so as not to bend the rail units or scratch the galvanized.
  - B. All material shall be stored above ground.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured must be approved by the Engineer.

2.02 GUARD RAILING ASSEMBLIES

- A. Guard railing assemblies shall consist of standard components of the types and sizes as shown on the Contract Drawings, and shall be as produced by a manufacturer regularly providing materials of the kinds required. Components of like kind shall be uniform throughout the work and readily interchangeable without modification.
- B. The assemblies shall be capable of rapid field erection and without need of field welding, unless otherwise indicated for special connections.
- C. Rail elements, back up or splice plates, terminal or return sections, bolts, nuts and other fitting shall comply with requirements of AASHTO M 180, unless otherwise shown on the Contract Drawings.
- D. Metal beam elements shall be galvanized steel, either AASHTO Class A or B, and Type 1 or 2.
- E. Metal posts and post anchor plates shall be fabricated from structural steel conforming to AASHTO M 183. Steel blocks shall be fabricated from steel conforming to AASHTO M 183 or steel tube conforming to ASTM A501. Each metal post shall be fabricated from a single length piece of stock.
- F. Bolts, nuts and steel items other than railing elements formed from pre-galvanized steel sheet, shall be hot-dip galvanized after fabrication in accordance with AASHTO M 111 or M 232 as applicable to the items involved.

- G. Galvanized coating weights for all steel items shall be not less than as specified in the standards referenced above when tested in accordance with AASHTO T 65.
- H. Damaged galvanizing shall be repaired by re-galvanizing or an approved metalizing process or other method approved in advance by the Engineer.
- I. Any applied identification other than die stamping shall not appear on the public side of any of the assembly elements.

2.03 OTHER MATERIALS

- A. Concrete for post bases indicated shall be Class E as specified in Section 021, PORTLAND CEMENT CONCRETE.
- B. When placed, concrete shall be thoroughly mixed to a uniform condition. Concrete not used within one hour after start of mixing shall not be used in the work and shall be disposed of outside the limits of the project.

PART 3: EXECUTION

3.01 EXECUTION

A. Posts and Bases:

1. Posts shall be erected plumb, uniformly spaced, and true to line and level. Post shapes shall all face in the same direction as shown on the Contract Drawings.
2. Where indicated on the Contract Drawings, post shall be set into concrete bases of the sizes shown.
3. Posts shall be firmly anchored and free from movement when tested by moderate hand pressure applied horizontally at the top of the post and in any direction.
4. Any soft, spongy or other unstable ground at a post location shall be removed and replaced with suitable material well compacted into place, and to the extent necessary to meet the above requirements.
5. Unstable material and surplus material shall be disposed of as specified under Section 003, GENERAL EXCAVATION.
6. Excavated holes for concrete post bases shall be neat and free from loose materials when the concrete is placed.
7. When placed, the concrete shall be well consolidated to completely fill all voids in the hole and around the post. The exposed top surfaces shall be slightly

sloped away from the post and finished off smooth and with outer edges eased by rounding.

8. Concrete shall be moist cured for not less than seven days.

#### Railings

1. Railing elements shall be erected true to line and grade, and with all beam slides facing in the same direction as shown on the Contract Drawings.
2. All elements shall be firmly interconnected and securely anchored to and with full bearing on the posts.
3. When the radius of curvature of the railing layout is shown to be less than 50 meters, the running beam elements shall be uniformly pre-shaped to the radius required, and identified with such radius indicated on the back surface by stencil and paint.
4. Bolts shall be tightened for full bearing, but shall not be overly tightened so as to restrict thermal expansion/contraction of the running beam elements.
5. Edges and holes of all metal elements shall be free from torn metal, burrs and sharp edges or other protrusions.
6. Beam assemblies shall be free from laps, splices or joints not shown on the Contract Drawings or approved; and free from bends, twists or other deformations not required by the shapes as shown.
7. The completed work shall be free from damage, and any waste or surplus materials shall be removed and the work areas left in a neat condition.

#### 3.02 MAINTENANCE OF THE WORK

The Contractor shall be responsible for maintaining guard railing until initial acceptance of the Work.

END OF SECTION

011 - SUBGRADE PREPARATION

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011 - SUBGRADE PREPARATION

PART 1: GENERAL

1.01 DESCRIPTION

This section sets forth provisions applicable to preparation of subgrades prior to placement of covering materials required under this Contract; and related requirements.

Subgrade preparation shall mean preparing a subgrade surface to a condition meeting the requirements specified for the particular material involved and immediately prior to placement of any covering material; achieved by whatever means and as may be necessary.

Subgrade, for purposes under these specifications, shall mean the plane of exposed surface of substrate material in place and upon which a subsequent material of like or different kind is next to be placed.

Finish subgrade shall mean subgrade when complete and ready for installation of subsequent materials and in accordance with requirements under the specifications.

1.02 REFERENCES

Related work in Other Section:

Section	003	GENERAL EXCAVATION
Section	006	SLOPE PROTECTION
Section	007	FILLING GRADING AND EMBANKMENT CONSTRUCTION
Section	012	AGGREGATE SUBBASE
Section	014	ASPHALT CONCRETE CONSTRUCTION
Section	017	AGGREGATE SUBBALLAST

PART 2: (Not Applicable)

PART 3: EXECUTION

3.01 GENERAL REQUIREMENTS

Subgrade preparation shall be provided as required at various stages and phases as work progresses to assure that each step of work as well as completed work is in full accord with requirements under these Contract Documents.

As excavation are carried downward and approach lowest required levels which will become finish subgrades, soil conditions shall be closely observed for indications of soils or conditions which might adversely affect providing proper foundation or basement subgrade; and where subgrade contain unsuitable soil or materials, such as peat and

other highly organic swamp soils, organic clays of high plasticity, organic matter, cinder, trash, debris, etc., additional excavation will be authorized to remove such unsuitable soil or materials. All additional excavation shall be replaced with acceptable suitable fill material and compacted in accordance with requirements under Tech. Spec. entitled STRUCTURE EXCAVATION AND BACKFILL Article entitled STRUCTURE BACKFILL.

Subgrades of lowest portions of excavations, and intervening and highest levels of fills, shall be maintained free from unnecessary run-off or excessive water where avoidable by providing temporary diversionary ditches or berms and maintaining subgrade surfaces sloped to assure adequate drainage.

Once completed, subgrades shall remain intact and undisturbed, other than by work necessarily to follow as required under the Contract.

When any work occurs within areas of subgrades which have been previously prepared in accord with these requirements, any and all resulting damage to said subgrades shall be repaired to meet the required Subgrade Preparation as specified herein.

Any subgrade area which becomes excessively or extensively damaged, the entire area thereof shall be treated as specified for Recompact Original Ground, or otherwise restored to the required conditions.

Vehicular trafficking over finished grade shall be avoided where at all possible by providing routes of travel outside of finished subgrade areas. When not otherwise avoidable, traffic over subgrade shall not be in a single track. Any ruts formed or other damage caused by traffic shall be repaired to the required condition prior to covering subgrade with other materials.

Performing unnecessary work or stockpiling materials on finished subgrade shall not be permitted.

Finished subgrades shall be within the tolerances specified for the various levels or layers of material involved.

Any suspect conditions encountered in the subgrade, shall be tested for compliance in accordance with the requirements specified for the particular material involved.

### 3.02 RECOMPACTING ORIGINAL GROUND

Requirements herein apply to original or native ground of soil areas upon which embankment or any pavement structure is to be constructed, regardless of type or location.

Recompacting original ground shall comprise scarify the upper layers of soil to a thoroughly broken up condition; by tothing, discing or other means necessary; moisture conditioning; and compacting to required density.

Scarifying shall be not less than 15 cm deep; or greater as and where necessary to meet other requirements under these technical specifications.

Recompacting original ground shall also include general leveling or trueing up of areas; such as filling or leveling off of localized low or high spots; and removal and refilling of any localized zones of unsuitable materials remaining after the general excavation operations have been completed.

END OF SECTION



012 - AGGREGATE SUBBASES

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## 012 - AGGREGATE SUBBASES

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the material and construction requirements for aggregate subbases to be provided at the locations and in the types and depths indicated on the drawings. The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

Aggregate subbases are designated as Types ASB-1, ASB-2 and ASB-3; and each type required at the time of deposit in place shall conform to these specifications.

Aggregate subbase work shall cover and include obtaining, loading, hauling, preparing, mixing, depositing, spreading, watering and compacting the material complete in place, and finishing the subgrade at the grading plane as specified.

#### 1.02 REFERENCES

Related Work in Other Sections:

Section        011        SUBGRADE PREPARATION

#### 1.03 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

AASHTO        American Association of State Highway and  
                  Transportation Officials:

- |          |                                                                                               |
|----------|-----------------------------------------------------------------------------------------------|
| T 27-74  | Sieve Analysis of Fine and Coarse Aggregate.                                                  |
| T 90-70  | Determining the Plastic Limit and Plasticity Index of Soils.                                  |
| T 180-74 | Moisture Density Relations of Soils Using a 10lb. (4.5 kg) Rammer and an 18in. (457 mm) Drop. |
| T193-72  | The California Bearing Ratio.                                                                 |

1.04 SUBMITTALS

A. GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents.

B. BEFORE COMMENCING WORK:

1. Work Program - comprising:

- List of specific products proposed and precise standards covering each item.
- Outline of means for safe and secure handling and storage of products.
- Outline of equipment to be employed in carrying out this work.

2. Samples of material proposed - submitted in the manner and quantity as requested by the Engineer.

3. Test reports establishing characteristics and properties of material proposed.

C. DURING PROGRESS OF WORK:

1. Reports of field trials and tests made in advance of permanent work operations.

2. Reports of tests performed during work and upon completion of work.

1.05 PRODUCT HANDLING

Products shall be at all times transported, protected, stored and handled such as to preclude damaged. Items found damaged or not in proper condition shall be removed from the site and replaced with compliant products.

PART 2: PRODUCTS

2.01 GENERAL

Products required under these specifications shall be, where available, procured from a local manufacturer or supplier. Products proposed for this work shall be determined by the Contractor to be in compliance with these specifications, and substantiated by way of his submittals. Proposed manufacturers and suppliers and proposed products are subject to approval by the Engineer.

2.02 TYPE ASB-1 AGGREGATE SUBBASE

**MATERIAL REQUIREMENTS:**

Aggregate for Type ASB-1 aggregate subbase shall be clean and free from organic matter and other deleterious substances, and shall be in such condition that it can be readily compacted under watering and rolling to form a firm, stable base.

CBR value, when tested in accordance with AASHTO T 193, shall be not less than 80.

Materials with a CBR value less than stated herein will be used only with the written approval of the Engineer.

Gradation of the material, when tested in accordance with AASHTO T 27, shall be within the limits as follows:

<u>Sieve</u> <u>(Inch)</u>	<u>Size</u> <u>mm</u>	<u>Percent Passing, by Weight</u> <u>Individual Test Result</u>
1 1/2	37.5	95 - 100
3/4	19.0	60 - 100
No. 8	2.36	20 - 50
No. 200	0.075	2 - 10

The portion of the material passing the 0.425 mm (No. 40) sieve shall conform to requirements as follows:

<u>Characteristics</u>	<u>AASHTO Test</u>	<u>Requirement</u>
Plasticity Index	T 90	Less than 4

2.03 TYPE ASB-2 AGGREGATE SUBBASE

Aggregate for Type ASB-2 aggregate subbase shall be clean and free from organic matter and other deleterious substances, and shall be in such condition that it can be readily compacted under watering and rolling to form a firm, stable base.

CBR value, when tested in accordance with AASHTO T 193, shall be not less than 20.

Materials with a CBR value less than stated herein will be used only with the written approval of the Engineer.

Diameter of the material shall be not more than 50 mm and the portion of the material passing the 0.425 (No. 40) sieve shall conform the requirement as follows:

<u>Characteristics</u>	<u>AASHTO Test</u>	<u>Requirement</u>
Plasticity Index:	T 90	Less than 6

2.04 TYPE ASB-3 AGGREGATE SUBBASE

Aggregate for Type ASB-3 Aggregate subbase shall conform to AASHTO M 43 or ASTM D 448 size number 56, or other materials as approved by the Engineer may be used.

PART 3: EXECUTION

3.01 TEST STRIPS

Prior to commencement of permanent construction, the Contractor shall construct trial test trips for each type of material to be used, to the lengths and width as approved by the Engineer, for the purpose of review of the moisture content and equipment operations that are most appropriate for the material involved.

Test strip material shall be the same type as that to be used in the work and the compaction equipment shall be the same as detailed in the Contractor's work program as approved.

Test strips which do not indicate acceptable results shall be removed and reconstructed for as many times as necessary until satisfactory results can be demonstrated.

3.02 SUBGRADE

The subgrade to receive aggregate subbase, immediately prior to spreading, shall conform to the compaction and elevation tolerance specified for the material involved, shall be free of loose or extraneous material, and shall comply with requirements specified under Tech. Spec. entitled SUBGRADE PREPARATION.

3.03 PLACING

A. APPLICATION FOR TYPE ASB-1 AND TYPE ASB-2

Aggregate for subbases shall be delivered to the work as a uniform mixture and shall be deposited on the subgrade at a uniform quantity per linear meter and at a rate which will provide the required compacted thickness within the grade tolerances specified under Article herein entitled COMPACTING AND GRADE TOLERANCE.

The base material shall be spread, and compacted in layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed 20 centimeters, unless otherwise approved by the Engineer. Each layer shall be spread and compacted in a similar manner.

When the subgrade for aggregate subbases consists of cohesionless material, and when approved in advance by the Engineer, a portion of the aggregate subbase may be dumped in piles upon the subgrade and spread ahead in sufficient quantity to stabilize the subgrade.

When placed in 2 or more layers, the layer placed first shall be permitted to dry just sufficient for stability during placing of the subsequent layer.

B. APPLICATION FOR TYPE ASB-1, TYPE ASB-2 AND TYPE ASB-3

Segregation shall be avoided, and the subbase shall be free from pockets or concentrations of coarse or fine materials, and from material not uniform in mixture.

At locations where the aggregate subbase is to be placed over areas inaccessible to the spreading equipment, the aggregate subbase may be spread and compacted by any means necessary to obtain the specified results.

Subbase which does not conform to the requirements of these specifications shall be reworked, watered and where necessary, thoroughly recompactd to conform with the specified requirements. Reworking shall include the full depth of the layer involved. Additions of thin layers to make up insufficient thickness will not be permitted.

When placing the subbase or during any other operations, the subbase material shall not be mixed with other material. Subbase aggregate which has become contaminated with other materials shall be removed and replaced.

3.04 WATERING

Aggregate subbase Type ASB-1 and Type ASB-2 shall be watered as provided for under Tech. Spec. entitled ENGINEERING INFORMATION & REQUIREMENTS.

3.05 COMPACTING AND GRADE TOLERANCE

A. APPLICATION FOR TYPE ASB-1 AND TYPE ASB-2

The field density, when tested in accordance with AASHTO T 180, method D, of each layer of compacted subbase material shall not be less than 95 percent for any individual test result.

Tests shall be provided at a rate of not less than one test for each 300 cubic meters of material and in each compacted layer.

B. APPLICATION FOR TYPE ASB-1, TYPE ASB-2 AND TYPE ASB-3

The surface of the finished subbase at any point shall not vary more than plus zero or minus 25 mm from the grades shown on the drawings.

After completion and at the time the subbase is covered with other materials, the subbase shall comply with the requirements specified herein and under Tech. Spec. entitled SUBGRADE PREPARATION.

Subbase which does not conform to the above requirements shall be reshaped or reworked, watered and where necessary thoroughly recompact to conform to the specified requirements.

END OF SECTION

013 - ASPHALT REQUIREMENTS

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## 013 - ASPHALT REQUIREMENTS

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section sets forth provisions pertaining to various type of asphalt materials an their use and application.

Asphalt shall be an oil asphalt, or a mixture of refined liquid asphalt and refined solid asphalt, prepared from crude asphaltic petroleum; shall be free from admixture with any residues obtained by the artificial distillation of coal, coal tar, or paraffin oil, shall be homogeneous and free from water, and shall not foam when heated to 180 degree C.

Asphalt cements, liquid asphalts and primer asphalt shall be in the grades as shown or specified and shall comply with these specifications.

#### 1.02 REFERENCES

Related Work in other Sections:

Section        014        ASPHALT CONCRETE CONSTRUCTION

#### 1.03 APPLICABLE CODES AND STANDARDS

The following codes and standard are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

AASHTO        American Association of State Highway and  
Transportation officials:

T 44-70	Solubilty of Bituminous Materials in Organic Solvents.
T 48-74	Flash and Fire Points by Cleveland Open Cup.
T 49-68	Penetration of Bituminous Materials.
T 51-74	Ductility of Bituminous Materials.
T 72-74	Saybolt Viscosity.

- T 78-74 Distillation of Cutback Asphaltic Products.
- T 79-74 Flash Point with Tag Opencup apparatus.
- T 102-74 Spot Test of Asphaltic Materials.
- T 179-74 Effect of Heat and Air on Asphalt Materials (Thinfilm Over Test.)

ASTM American Society for Testing and Materials:

- E 102-62 Saybolt Furol Viscosity of Bituminous (1973) Materials at High Temperature, Test.

1.04 SUBMITTALS

A. GENERAL:

The Contractor shall submit to the engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents.

B. BEFORE COMMENCING WORK:

1. Work Program - comprising:

- List of specific products proposed and precise standards covering each item.
- Outline of means for safe and secure handling and storage of products.
- Outline of equipment to be employed in carrying out this work.

2. Samples of material proposed-submitted in the manner and quantity as requested by the Engineer.

3. Test reports establishing characteristics and properties of material proposed.

4. Certificates of Compliance from manufacturer indicating that products are in accordance with the applicable specifications, accompanied by substantiating test reports indicating standards for and results of each test. Required for each production lot of materials delivered to the site.

5. Regardless of the type of kind involved, asphalt furnished without a Certificate of Compliance shall not be used in the work until the required tests have been made by the Contractor and test reports therefore have been reviewed by the Engineer.

1.05 PRODUCT HANDLING

Products shall be at all times transported, protected, stored and handled such as to preclude damage. Items found damaged or not in proper condition shall be removed from the site and replaced with compliant products.

PART 2: PRODUCTS

2.01 GENERAL

Products required under these specifications shall be, where available, procured from a local manufacturer or supplier. Products proposed for this work shall be determined by the Contractor to be in compliance with these specifications, and substantiated by way of his submittals. Proposed manufacturers and suppliers and proposed products are subject to approval by the Engineer.

2.02 ASPHALT CEMENTS

<u>Characteristics</u>	<u>AASHTO TEST METHOD</u>	<u>Grade 60-70</u>
Flash Point (Cleveland Open 232.2 cup), Degrees C:	T 48	260
Penetration, 100 grams, 5 seconds, 25 degrees C:	T 49	60-70
Penetration Ratio, percent, minimum:	Note 1	25
Furol Viscosity, at 135 degrees C, seconds:	(ASTM E 102)	100+
Thin Film Oven Test:		
Loss in weight, percent, Maximum:	T 179	0.80
Retention in Penetration, percent, minimum:	T 49	52+
Ductility, at 25 Degrees C:	T 51	100+
Spot Test, Heptane Xylene: solvent, 35 percent Xylene:	Note 2	Negative
Solubility:	T 44	99.5
Temperature for Mixing, degrees C:		135-163

<u>Characteristics</u>	<u>AASHTO TEST METHOD</u>	<u>Grade 60-70</u>
Maximum Temperature of Aggregate for Plant Mixing, degrees C:		163

Note 1:

Penetration ratio

$$\frac{\text{Penetration at 4 degrees C., 200 grams, 60 seconds}}{\text{Penetration at 25 degrees C., 100 grams, 5 seconds}} \times 10$$

Note 2:

Test Method AASHTO T 102, except that the test at twenty four (24) hours and the test on the glass plate shall be eliminated from the method.

2.03 RAPID CURING (RC) LIQUID ASPHALTS

<u>Characteristics</u>	<u>AASHTO TEST METHOD</u>	<u>RC250</u>
Flash Point (Open Tag), Degrees:	T 79	27+
Furol Viscosity at 25 degrees C, seconds:		-
Furol Viscosity at 50 degrees C, seconds:		-
Furol Viscosity at 60 degrees C, seconds:	T 72	250-500
Furol Viscosity at 82.2 degrees C, seconds:		-
Distillation:		
Distillate (percent of total distillate to 360 degrees C)		
To 190 degrees C:		-
To 225 degrees C:		25+
To 260 degrees C:	T 78	55+
To 315.6 degrees C:		83+

<u>Characteristics</u>	<u>AASHTO TEST METHOD</u>	<u>RC250</u>
Residue from distillation to 360 degrees C, volume percent by difference:		
Test on Residue from Distillation		
Penetration, 25 degrees C, 100 grams, 5 seconds:	T 49	80-120
Ductility, 25 degrees C, centimeters:	T 51	100+
Solubility in Carbon Tetrachloride, percent:	T 44	99.5+
Temperature for Application by spraying, in degrees C:		65-95

2.04 MEDIUM CURING (MC) LIQUID ASPHALT

<u>Characteristics</u>	<u>AASHTO TEST METHOD</u>	<u>MC70</u>
Flash point (Open tag), degrees C:	T 79	40+
Furol Viscosity at 25 degrees C, seconds:		-
Furol Viscosity at 50 degrees C, seconds:	T72	75-150
Furol Viscosity at 60 degrees C, seconds:		-
Furol Viscosity at 82.2 degrees C, seconds:		-
Distillation:		
Distillate (percent of total distillate to 360 degrees C)		
To 190 degrees C:		20-
To 225 degrees C:		25-65
To 315.6 degrees C:		70-90

<u>Characteristics</u>	<u>AASHTO TEST METHOD</u>	<u>MC70</u>
Residue from distillation to 360 degrees C, volume percent by difference:		60+
Tests on Residue from Distillation		
Penetration, 25 degrees C, 100 grams, 5 seconds:	T 49	120-300
Ductility, 25 degrees C centimeters (See Note 1):	T 51	100+
Solubility in Carbon Tetrachloride, percent:	T 44	99.5
Temperature for Application by Spraying, in degrees C:		50-80

**Note 1:**

If penetration of residue is more than two hundred (200) and its ductility at 25 degrees C is less than one hundred (100) the material will be acceptable if its ductility at 15.6 degrees C is one hundred plus (100+).

**PART 3: EXECUTION**

**3.01 ASPHALTS**

Asphalt shall not be heated during the process of its manufacture or during construction so as to cause injury as evidenced by the formation of carbonized particles.

During the progress of the work no change affecting the uniformity of the asphalt shall be made in either the source of crude stock or the method of manufacture without giving notice to and obtaining approval in advance from the Engineer.

Unless otherwise provided in these specifications, paving asphalt shall be applied at a temperature of not less than 120 degree C nor more than 190 degree C, the exact temperature to be determined by the Contractor as best for the particular type or grade of material involved.

**3.02 LIQUID ASPHALTS**

Liquid asphalt shall be prevented from spraying upon adjacent pavements, that portion of the traveled way being used by traffic, structures, railings and barriers,

markers, trees and shrubbery that are not be removed, adjacent property and improvements, and other highway improvements or facilities not mentioned herein.

Unless otherwise specified in these specifications, the various grades of liquid asphalt shall be applied at temperatures within the limits specified in the tables specified hereinbefore.

No grade of rapid curing liquid asphalt shall be plantmixed with heated aggregate.

Liquid asphalt shall be heated by a retort or by steam coils in such a manner that steam will not be introduced directly into the liquid asphalt during heating. The Contractor shall furnish and keep on the work at all times, an accurate thermometer suitable for determining the temperature of the liquid asphalt being applied.

Distributor trucks shall be of the pressure type with insulated tanks. The use of gravity distributors will not be permitted, Spray bars shall have a minimum length of 3 meters and shall be of the full circulating type. The spray bar shall be adjustable to permit positioning at various heights above the surface to be treated. The valves shall be operated by levers so that one or all valves may be quickly opened or closed in one operation.

Spreading by means of cab controlled valves will be permitted in the application of seals. The valves which control the flow from nozzles shall be of a positive action design so as to provide a uniform unbroken spread of bituminous material on the surface. The distributor shall be equipped with devices and charts to provide for accurate and rapid determination and control of the amount of bituminous material being applied and with a tachometer of the auxiliary wheel type reading spread in meters per minute. The spreading equipment shall be so designed and articulated that uniform application of bituminous material, in controlled amounts, may be made ranging from 0.10 to 5.0 liters per square meters of surface and with a range of pressure from 1.5 to 5.5 kg/cm<sup>2</sup>. If a spray bar extension is used to cover a greater width, it shall be of the full circulating type. The distributor shall be equipped with a hose and nozzle attachment to be used for spotting areas inaccessible to the distributor. The distributor shall also be equipped with pressure gages and an accurate thermometer for determination of temperatures of the bituminous material. Distributor and booster tanks shall be so maintained at all times as to prevent dripping of bituminous material from any part of the equipment.

In order to secure uniform distribution at the junction of 2 applications, the distribution shall be promptly stopped when the uniform flow decreases, indicating the tank is about empty.

The Engineer reserves the right to order the use of any equipment discontinued which, in the opinion of the Engineer, fails to produce a satisfactory distribution of asphalt in accordance with the specifications.

Spreading liquid asphalt will not be permitted when the surface to be treated is appreciable damp, or when weather conditions are unsuitable.

Discharging unused liquid asphalt within the limits of work will not be permitted. When spreading asphalt, distributors shall stop while traffic is passing.

Liquid asphalt delivered to the work shall not be used for any purpose other than that provided for under the technical specifications.

The Contractor shall provide some method satisfactory to the Engineer of accurately measuring the volume of liquid asphalt in his storage tanks and in each spreading unit at any time.

END OF SECTION



014 - ASPHALT CONCRETE CONSTRUCTION

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014 - ASPHALT CONCRETE CONSTRUCTION

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## 014 - ASPHALT CONCRETE CONSTRUCTION

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the material and construction requirements for asphalt concrete surface course and binder course; asphalt stabilized base; and prime and tack coats; to be provided at the locations and in the types and depths indicated on the drawings. The contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

Asphalt concrete surface course is designated as Type AC, asphalt concrete base course is designated as Type ACB, asphalt stabilized base is designated as Type ACSB; and each type required at the time of deposit in place shall conform to these specifications.

Asphalt concrete work shall cover and include obtaining, loading, hauling, preparing, depositing, spreading and compacting the material complete in place, and finishing the work to the grading plane and within the tolerances as specified.

#### 1.02 REFERENCES

##### A. Related Requirements Specified Elsewhere:

GENERAL SPECIFICATION

##### B. Related Work in Other Sections:

Section	011	SUBGRADE PREPARATION
Section	012	AGGREGATE SUBBASE
Section	013	ASPHALT REQUIREMENTS

#### 1.03 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for material and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

AASHTO            American Association of State Highway and  
                         Transportation Officials:

M 17-70	Mineral Filler for Bituminous Paving Mixtures.
T 11-74	Amount of Material Finer Than 0.075 mm (No. 200 Sieve).
T 27-74	Sieve Analysis of Fine and Coarse Aggregate.
T 37-70	Sieve Analysis of Mineral Filler.
T 84-74	Specific Gravity and Absorption of Fine Aggregate.
T 85-74	Specific Gravity and Absorption of Coarse Aggregate.
T 90-70	Determining the Plastic Limit and Plasticity Index Soils.
T 96-74	Abrasion of Coarse Aggregate by Use of the Los Angeles Machine.
T 104-74	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
T 112-74	Clay Lumps and Friable Particles in Aggregate.
T 166-74	Specific Gravity of Compacted Bituminous Mixtures.
T 168-55	Sampling Bituminous Paving Mixtures.
T 230-68	Determining Degree of Pavement Compaction of Bituminous-Aggregate Mixtures.
T 245-74	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

1.04 SUBMITTALS

A. GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents.

B. BEFORE COMMENCING WORK:

1. Quality Control Program.

2. Work Program - comprising:
  - List of specific products proposed and precise standards covering each item.
  - Outline of equipment to be employed in carrying out this work.
3. Certificates of Compliance from manufacturer, indicating that products are in accordance with the applicable specifications, accompanied by substantiating test reports test reports indicating standards for and results of each test. Required for each production lot of mass materials delivered to the site.

C. DURING PROGRESS OF WORK:

1. Reports of field trials and tests made in advance of permanent work operations.
2. Reports of test performed during work and upon completion of work.

1.05 PRODUCT HANDLING

Products shall be at all times transported, protected, stored and handled such as to preclude damage. Items found damaged or not in proper condition shall be removed from the site and replaced with compliance products.

1.06 DELIVERY CERTIFICATES

Each delivery of asphalt concrete to the site shall be accompanied by a certificate which records information not less than as follows

- Project and specific job or contract name and number.
- Names of Contractor and source plant.
- Ticket (certificate) serial number.
- Identification of truck making delivery.
- Date and time loaded.
- Mix identification.
- Volume of mix loaded and temperature at time of loading.

- Location where placed in the work.

The form and content of the certificates shall be acceptable to the Engineer. Certificates for all deliveries made to the site shall be maintained complete on file and delivered to the Engineer for reference upon completion of the work.

## PART 2: PRODUCTS

### 2.01 GENERAL

Products required under these specifications shall be, where available, procured from a local manufacturer or supplier. Products proposed for this work shall be determined by the Contractor to be in compliance with these specifications, and substantiated by way of his submittals. Proposed manufacturers and suppliers and proposed products are subject to approval by the Engineer.

### 2.02 ASPHALT

Asphalt cement for each type of asphalt concrete, prime and tack coats, shall be Grade 60-7-, and shall conform to the applicable requirements under Tech. Spec. entitled ASPHALT REQUIREMENTS.

### 2.03 AGGREGATES-GENERAL

Aggregates for asphalt concrete construction work shall consist of coarse aggregate, fine aggregate, and filler material, if required, all complying with requirements specified herein.

Coarse aggregate is material retained on the 2.36 mm (No. 8) sieve; fine aggregate is material passing the 2.36 mm (No. 8) sieve; and filler is added fine material passing the 0.60 mm (No. 30) sieve, including dust from dust collectors.

Aggregate material shall be crushed rock or crushed gravel or combination thereof; and clean and free from decomposed material, organic matter, clay and other deleterious substances.

### 2.04 COARSE AGGREGATE

Coarse aggregate shall be crushed gravel and the amount of crushing of gravel shall be regulated and retained on a 2.36 mm (No. 8) sieve shall consist of pieces with at least one (1) mechanically fractured face, and when tested for stability of bituminous mix shows satisfactory stability.

2.05 FINE AGGREGATE

Fine aggregate may be crushed or natural sand and shall be passing the 2.36 mm (No. 8) sieve and retained on the 0.074 mm (No. 200) sieve shall consist of pieces having at least one (1) mechanical fractured face.

2.06 FILLER MATERIAL

Filler shall be homogenous material, mill processed by crushing and filler material gradation, when tested in accordance with AASHTO T 37, shall be as follows:

<u>Sieve Size</u>		<u>Percent passing, by Weight</u>	
<u>mm</u>	<u>(inch)</u>		
0.60	(No. 30)	100	
0.30	(No. 50)	95	100
0.075	(No. 200)	70	100

Filler material may be an approved Portland cement or lime.

2.07 COMBINED AGGREGATES-QUALITY

Combined aggregates for all types of asphalt concrete construction shall conform to the requirements as follows:

<u>Characteristic</u>	<u>AASHTO Test Method</u>	<u>Requirement, Percent, Max.</u>
Abrasion Loss:	T 96	35
Friable Particles:	T 112	0.25

2.08 COMBINED AGGREGATES-GRADATION

When tested in accordance with AASHTO T 11 and T 27, the combined aggregates for each type of asphalt concrete surfacing shall conform to the requirements tabulated herein.

Type AC

<u>Sieve Size</u>		<u>Percent Passing, by Weight</u>
<u>mm</u>	<u>(inch)</u>	<u>Individual Test</u>
19.0	(3/4)	100
12.5	(1/2)	80 - 95
9.5	(3/8)	- -
4.75	(No. 4)	48 - 62
2.0	(No. 10)	32 - 45
0.425	(No. 40)	16 - 26
0.180	(No. 80)	8 - 18
0.075	(No. 200)	4 - 8

Type ACB

<u>mm</u>	<u>Sieve Size</u> <u>(inch)</u>	<u>Individual Test</u>
37.5	(1-1/2)	100
25.0	(1)	100
19.0	(3/4)	80 - 100
9.5	(3/8)	60 - 80
4.75	(No. 4)	45 - 65
2.0	(No. 10)	30 - 50
0.425	(No. 40)	15 - 32
0.075	(No. 200)	3 - 10

Type ACSB

<u>mm</u>	<u>Sieve Size</u> <u>(inch)</u>	<u>Individual Test</u>
50	(2)	100
37.5	(1-1/2)	95 - 100
19.0	(3/4)	50 - 100
2.0	(No. 10)	20 - 60
0.075	(No. 200)	0 - 10

2.09 ASPHALT CONCRETE

Proportion of components and properties shall meet the requirements as follows:

<u>Type</u>	<u>AC</u>	<u>ACB</u>	<u>ACSB</u>
Total Aggregates	96 - 93	96 - 93	96 - 94
Asphalt Cement	5 - 7	4 - 6	4 - 6
<u>Property</u>	<u>AC</u>	<u>ACB</u>	<u>ACSB</u>
Stability, kg, min.	700	500	350
Flow, mm:	2.4 - 4.0	2.4 - 5.0	10 - 40
Total Voids, percent:	3.5 - 5.0	3.0 - 7.0	3 - 12
Voids Filled with Asphalt, percent	70 - 80	60 - 75	Less than 75

Asphalt concrete which has taken an initial set, or which contains any type or quantity of foreign or other material not intended to be included, shall not be used in the work.



Immediately prior to placement in the spreading and finishing machine, the temperature of the mixture shall be not less than the lower limit specified for the respective type of mix being used, and when found otherwise shall not be used in the work.

## 2.10 EQUIPMENT

Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds which have been thinly coated with a suitable material to prevent the mixture from adhering to the beds; and each vehicle shall be quipped with a canvas cover or other suitable material of such size as to protect the mixture from the weather.

Rolling equipment for compaction shall be selfpropelled. The wheels on the rollers shall be equipped with adjustable scrapers and the rollers shall have water tanks and sprinkling apparatus for use to prevent asphalt material from sticking.

Rollers for initial compaction shall be not less than 8 tons.

Rollers shall be in good mechanical condition, capable of reversing without backlash, and shall be operable at speeds slow enough to avoid displacement of the bituminous mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Equipment used shall not cause excessive crushing of the aggregate.

All spreading and finishing machines shall have a screed assembly arranged to be controlled as to elevation of strike-off directly by a side form, or by self-contained mechanical devices. All finishing machines shall be self-powered. Blade grades shall not be used.

The spreading and finishing machines shall be capable of spreading the bituminous mixture without tearing the surface and shall strike a finish that is smooth, true to cross section, uniform in density and texture, and free from hollows, transverse corrugations and other irregularities.

Prime and tack coat materials shall be applied using approved pressure type distributors, with spray nozzles and spray bar properly adjusted at all times for uniform distribution.

Servicing or cleaning of equipment shall not occur within any pavement area.

2.11 PREPARATION OF MATERIALS

Asphalt Cement:

All mixed material shall be delivered to the work site and transferred to the spreading and finishing machines at a temperature not less than 120 degrees C.

Mixtures at temperatures lower than the above shall not be used for the work.

Liquid Asphalt

The liquid asphalt for the prime and tack coat shall be Grade MC 70 and RC 250, and shall conform to the applicable requirements under Tech. Spec. entitled ASPHALT REQUIREMENTS.

Any method of agitation or heating that introduces free steam or moisture into the bituminous material shall not be used.

Bituminous prime and tack coat shall be applied at temperature within the ranges specified under Tech. Spec. entitled ASPHALT REQUIREMENTS.

PART 3: EXECUTION

3.01 TEST STRIPS

Prior to commencement of permanent construction, the Contractor shall construct trial test strips for each type of base and surfacing course material to be used, to the lengths and width as approved by the Engineer, for the purposes of review of the material and equipment operations that are most appropriate for the work.

Test strip material shall be the same type as that to be used in the work and the equipment shall be the same as detailed in the Contractor's work program as approved.

Test strips which do not indicate acceptable results shall be removed and reconstructed for as many times as necessary until satisfactory results can be demonstrated.

3.02 SUBGRADE TOLERANCE AND CONDITION

The subgrade to receive any layer of asphalt concrete immediately prior to applying the prime coat, if required, shall conform to the compaction and elevation tolerance specified for the material involved, and shall comply with the requirements under Tech. Spec. entitled SUBGRADE PREPARATION.

When the asphalt concrete is to be placed on an aggregate base course or on a nonbituminous base surface, all loose or extraneous materials shall be removed from the surface and the surface shall be cleaned by means of mechanical sweepers or blowers and/or hand brooms, until it is as free from dirt as is deemed practicable. Traffic other than for paving operations shall not be permitted on the surface after it has been prepared to receive any bituminous material.

When asphalt concrete is constructed on an existing bituminous surface, the surface shall be cleaned of all foreign material and broomed free of dust. In addition, any loose, broken, or shattered bituminous material along the edges of the existing surface shall be removed, and the exposed subgrade and a sufficient width of the shoulder adjacent to the edge of the existing surface to receive the new bituminous mixture shall be shaped, bladed, and broomed to provide a uniform firm subgrade for the new surface course.

When an existing bituminous surface to be covered is broken, shattered or otherwise in an unstable condition, such surfaces shall be removed from within lines neatly cut around such areas and replaced with asphalt concrete well compacted into place. Any existing subgrade not in a stable condition shall be repaired and/or recompacted as necessary. All replacement work shall comply with these specifications.

### 3.03 PROTECTION

When bituminous materials are being applied, the surfaces of all structures, wheel guards, guard rail, curbs and gutters, and other appurtenances shall be protected in a manner to prevent them from being splattered with bituminous material or marred by equipment operation. In the event that any appurtenances become splattered or marred, the Contractor shall remove all traces of bituminous materials, and repair all damage and leave the appurtenances in an approved condition.

The Contractor shall provide detours for the traveling public and for operational use in areas where priming or other operations are in progress. Where no convenient detour can be made available the operations shall be confined to one half (1/2) of the roadway at a time, and the Contractor shall provide traffic control as needed.

The Contractor shall provide flagmen, reflectorized warning and speed limit signs, and barricades, all as may be necessary for the conditions that exist at the time.

3.04 PRELIMINARY SURVEYS & REFERENCE LINES

The Contractor shall make the surveys required for the reference lines and grades, and provide erected and/or mobile type string lines or other suitable means such that the layers of work conform to the grades required. The work shall include providing a sufficient number of intermittent control point grades.

3.05 LIQUID ASPHALT

General:

The prime and tack coats shall be applied to approved surfaces, and pavements as soon as practicable after they have been prepared and are sufficiently dry.

All loose material shall be removed immediately before applying prime and tack coat. The removal of loose material shall be accomplished by the use of hand brooms or other acceptable means without using water. This cleaning operation shall not displace or damage surface.

Prime Coat

The cutback asphalt prime coat shall be applied uniformly at designated temperature distributed evenly at a rate of 0.65 to 1.75 liter/m<sup>2</sup> on prepared surfaces and as determined by field trials, appropriate application rate in accordance with ASTM D 2995 and results shall be submitted of such trials to the Engineer for review. Sufficient material shall be applied to penetrate and seal but not flood the surface. Allowance shall be made to cure and volatilize as long as required to attain required penetration and in no case less than 24 hours. Excess asphalt shall be blotted with just enough sand to prevent pick-up under traffic if required. Loose sand shall be removed before paving.

Tack Coat:

The cutback asphalt tack coat shall be applied uniformly at designated temperature distributed at a rate within 0.40 and 0.80 liter/m<sup>2</sup> on prepared surface of the asphalt concrete binder course. The appropriate application rate in accordance with ASTM D 2995 shall be determined by field trials and results shall be submitted for such trials, to the Engineer for review. Tack coat shall be applied by brush to contact surfaces of curbs, gutters, manholes and other structures projecting into the abutting asphalt concrete pavement. Surface shall be allowed to volatilize until tack coat is at condition of tackiness to receive over laying course.

The rate of spread of emulsified asphalt shall be determined by trial and as recommended by the Contractor and approved by the Engineer.

All permanently exposed curb surfaces shall be protected to prevent contamination by prime and tack coats during application.

### 3.06 BASE AND SURFACING COURSES

All mixed material shall be delivered to the site in time to permit completion of spreading, finishing and compaction of the mixture during daylight hours.

The longitudinal joints in successive layers shall be offset not less than fifteen (15) centimeters nor more than thirty (30) centimeters. The width of surface of top course placements shall conform to traffic lane edges as shown on the drawings.

Breakdown rolling shall commence the lower edge and shall progress towards the center. On the return coverage, the edge strip shall be compacted by the breakdown roller such as to prevent rollover and displacement of the edge strip.

Where successive layers are to be placed, the surface of the previously placed layer shall be swept clean with a power broom or by other approved means. The nominal compacted depth of any layer of any course shall not exceed 7.50 cm.

Bituminous mixtures shall be spread in a placement thickness such that after rolling the nominal thickness of the compacted bituminous material will not exceed that which will produce the work in compliance with these specifications.

Hot asphaltic mixtures shall be placed only when the air temperature is four (4) degrees C or above, and when the weather is not foggy or rainy and when the existing surface is free from moisture.

When complete, the finished surfaces shall be true to line, grade and profile, and not exceeding the tolerance limits specified.

### 3.07 LEVELING COURSES

A leveling course, consisting of a layer of bituminous material of variable thickness may be used to eliminate irregularities in existing surfaces or bases and to vary existing cross section elements of roadway.

Unless otherwise shown or specified the material and procedures for the leveling course shall be the same as that specified for the subsequent course of asphalt concrete.

In areas where leveling courses are to be provided, the Contractor shall make a survey study of the existing surface or base, and which shall be submitted to the Engineer for review. The precise locations and thicknesses proposed shall be included.

### 3.08 COMPACTION

Compaction shall be thorough and uniform, and sufficient to effect the density required but without leaving evident of cracking due to prolonged rolling.

Initial or breakdown rolling shall be done by means of either a tandem power steel roller or a three (3) wheel power steel roller. Rolling shall begin as soon as the mixture will bear the roller without undue displacement. Rolling shall be longitudinally, beginning at the low side of the spread of material and proceeding toward the high side, overlapping on successive trips by at least one-half (1/2) the width of the rear wheels. alternate trips of the roller shall be of slightly different lengths.

The motion of the roller shall at all times be slow enough to avoid displacement of the mixture. To prevent adhesion of the mixture to the rollers, the wheels of the rollers shall be kept properly moistened with water, but an excess of water shall not be permitted.

The initial or breakdown rolling shall be followed by rolling with pneumatic tired roller. Final compaction and finish rolling shall be done by means of a tandem power steel roller unless otherwise approved. When the specified density is not obtained, changes in the size and/or number of rollers shall be made as corrective measures to satisfy the density requirement.

Rollers shall be operated by competent and experienced personnel and shall be kept in operation continuously if necessary so that all parts of the pavement will receive substantially equal compaction at the time desired. The Contractor shall order the suppliers to cease operation at any time proper rolling is not being performed.

Any mixture that becomes loose, broken, mixed with foreign material, or which is in any way defective in finish or density, or which does not comply in all other respects with the requirements of the specifications shall be removed, replaced with suitable material, compacted and finished in accordance with the specifications.

The compaction density of the completed work shall be not less than the specified compaction tolerance.

### 3.09 DETAIL REQUIREMENTS

#### Contact Surfaces:

Contact surfaces of curbing, gutters, manholes, and similar structures shall be painted with a thin uniform coating of suitable liquid asphalt material. The bituminous mixture shall be placed uniformly high near the contact surfaces so that after compaction it will be seven (7) millimeters above end edge of such structures.

#### Joints:

Joints between old and new pavements or between successive day work shall be made so as to insure thorough and continuous bond between the old and new mixtures. Transverse construction joints in previously laid material shall be constructed by cutting the material back vertically for its full depth so as to expose a fresh surface.

Before placing the fresh mixture against a cut joint or against old pavement, the contact surface shall be sprayed or painted with a thin uniform coat of RC 250 asphalt. Where a finishing machine is used, the longitudinal joint shall be made by overlapping the screed on the previously laid material for a width of at least three (3) centimeters and depositing a sufficient amount of mixture so that the joint formed will be smooth and tight.

#### Protection of Fresh Mixture:

The Contractor shall protect all sections of newly compacted mixture from traffic until they have hardened properly.

### 3.10 TESTS

Completed works shall be tested in accordance with the following instructions unless otherwise indicated by the Engineer. When test result(s) exceeding the specified tolerance shall be corrected by removing the defective work and replacing it with new material and in compliance with these specifications. Each test shall be performed at each construction lot and shall not exceed 500 square meters.

#### Surface Tolerance:

When the finish surface of the completed work is tested at each completed work lot using a four (4) meter straight edge, the variation of the surface from the testing edge of the straightedge between any two (2) contact with the surface shall at no point exceed four (4) millimeters when

placed on or parallel to the centerline or three (3) millimeters when placed perpendicular to the centerline of the roadway.

Grade Tolerance:

When the finish surface of the completed work is tested by survey at random location, the finish grade at any point shall not vary more than plus or minus 6 mm from the grades shown on the drawings.

Thickness Tolerance:

When tested using sawn or cored samples from the completed work at random locations, the measured thickness of the sample shall not be less than ten (10) percent to the thickness shown on the drawings for the respective location.

Compaction tolerance:

At least three (3) sawn or cored samples, each of which having approximately 30 square centimeters, shall be taken at random from the locations of each completed work lot and tested in accordance with AASHTO T 166 and T 230, the density of the sample shall not be less than ninety six percent (96%) of the design density determined in accordance with AASHTO T 245.

3.11 SAMPLING FOR TESTS

Samples for testing shall be obtained in accordance with AASHTO T 166, T 168 or T 230, as applicable.

Unless otherwise approved in advance by the Engineer, samples extracted for thickness measurements shall not be used for density determination, and density samples shall not be used for thickness measurements.

3.12 TESTING AND SAMPLING LOCATIONS

Initial test locations within each lane shall not be closer than 100 meters from another test location, otherwise locations for initial tests shall be selected at random within each lane of roadway.

Second and third tests for purposes of averaging for compliance shall be located in a vicinity near to and each side of the initial test location.



Asphalt concrete surfacing locations from which samples are removed shall be neatly trimmed, cleaned free from loose materials; and repaired using fresh materials of the type originally used, well compacted into place, and finished off smooth, level, flush, and in an appearance closely matching the adjacent surfaces.

END OF SECTION

015 - SAFETY MARKINGS

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## 015 - SAFETY MARKINGS

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the material and construction requirements for painted safety markings on curbs, guard railing, or other structures; to be provided at the locations and in the color types and configurations indicated on the drawings. The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

When required, safety markings shall be applied to structures, in addition to any other painting required for such structures, and shall not be applied until completion of such other painting.

The work shall include the determining and providing the quantities of each type and color of paint and associated materials as are needed to complete the work required based upon the configurations and extent indicated on the drawings by typical layouts and the requirements of these specifications.

The Contractor shall be responsible for coordinating the painting work with other marking work such that the entire work conforms to the requirements indicated by the typical layouts.

The Contractor shall be responsible for obtaining and following the manufacturer's precautionary data and instructions respective to the storage, handling and use of any material which is considered as flammable, toxic, or otherwise hazardous.

Any coats of paint applied in addition to those required by these specifications, whether for protection or otherwise, shall be considered as for the Contractor's own convenience, and shall not be considered as a replacement or substitute for any of the number of coats of paint as specified.

Painting work shall cover and include preparation of surfaces, primer and/or pretreatment, and furnishing and applying paints and/or reflectorizing material, and all incidental items and work.



- Applicable material and test standards.
- Installation instructions, including requirements for both products and substrates; with maintenance and repair recommendations.
- Recommendations for safe and secure product transport, storage and handling.
- Precautions against fire, injury to health, or other hazards, with emergency first-aid instructions.
- Samples of finish colors available for selection. Colors used shall match those approved by the Engineer.
- Samples of warranties offered covering products or systems.
- List of representative projects where products have been used and proven successful, adequate and durable under environmental conditions similar to those for this project.

Samples of material proposed - submitted in the manner and quantity as requested by the Engineer.

Certificates of Compliance from manufacturer indicating that products are in accordance with the applicable specifications, accompanied by substantiating test reports indicating standards for and results of each test. Required for each equipment item and each production lot of mass materials delivered to the site.

#### 1.05 PRODUCT HANDLING

Products shall be at all times transported, protected, stored and handled such as to preclude damage. Items found damaged or not in proper condition shall be removed from the site and replaced with compliant products.

### PART 2: PRODUCTS

#### 2.01 GENERAL

Products required under these specifications shall be, where available, procured from a local manufacturer or supplier. Products proposed for this work shall be determined by the Contractor to be in compliance with these specifications, and substantiated by way of his submittals. Proposed manufacturers and suppliers and proposed products are subject to approval by the Engineer.

2.02 MATERIAL

A. GENERAL:

The Contractor shall be responsible for determining and proposing the specific grades of paint most appropriate for the kinds and conditions of work involved, and as based upon these specifications. Paints not approved shall not be used for the work.

Paints shall be of the generic types as specified, unless otherwise approved; and each type shall consist of only first quality ingredient materials, shall be factory pre-mixed ready for application, shall be the product of a manufacturer regularly providing materials of the kinds required, and shall have a successful history proven by actual use for similar installations.

Tints or colorants for adjusting paint colors, thinners, primers or other subsidiary materials as may be needed shall be only as produced or recommended by the respective paint manufacturer for use with the specific type of paint being used.

Materials not produced under, or not in compliance with, approved standards shall not be used in the work; and materials which have become contaminated or have exceeded the manufacturer's indicated package or shelf life shall not be used.

Final coats of paint colors shall match the color samples as approved, and any intermediate coats of the same type or color of paint shall be tinted or varied such that the coat being applied is readily distinguishable from the preceding coat being covered.

B. PAINTS FOR SAFETY MARKINGS:

Paints for safety markings shall be an alkyd type.

White paint shall conform to the respective requirements under AASHTO M248, and the resin type or types shall be as determined by the Contractor as most suitable for the work required and for the installation and ambient conditions at the site of the work.

C. GLASS BEADS:

Glass beads for surface application shall conform to the requirements of AASHTO M 247, or equivalent standard as approved, except as modified as follows:

Glass beads for surface application shall be supplied and delivered to the project in unopened containers as factory sealed and labeled. The containers and labeling shall be essentially the same as specified above.

PART 3: EXECUTION

3.01 EQUIPMENT

Paint and reflectorizing materials shall be applied using equipment as recommended by the manufacturer of the respective material, and operated such that the material is applied in accordance with the manufacturer's instructions as approved and these specifications.

3.02 WEATHER CONDITIONS

Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather. Painting shall not be permitted when the relative humidity exceeds the limit specified by the manufacturer of the respective paint at the site of the work, or when freshly painted surfaces may become damaged by rain, fog, and condensation.

Paint shall not be applied when the substrate temperature or other ambient conditions exceed the limits specified by the manufacturer of the respective paint being used.

Fresh paint damaged by the elements shall be repaired or replaced such as to provide work in compliance with these specifications.

3.03 PROTECTION

The Contractor shall be responsible for carrying out the painting operations, and for determining and providing such ways, means or facilities for protection, all such that any other workmen, pedestrians, vehicles or other surfaces or areas in the vicinity of the work are at all times safeguarded against damage resulting from the painting work; and for maintaining or otherwise cleaning any such other surfaces or areas of the work free from any spills, splatters, smears or other paint materials not required to be applied.

Paint materials, equipment, rags, etc. shall be maintained, handled and used at all times under safe conditions and by prudent procedures such as to preclude fire, explosion or other damage.

When the work is complete, any spaces or areas of the permanent work which may have been used for storage, preparation or other subsidiary painting operations shall be entirely free from any paint materials or other damage resulting from such operations or work.

3.04 LAYOUTS AND TOLERANCE

The Contractor shall provide the work necessary to layout the safety marking work in conformance with the layouts and

details shown and within the specified tolerances; and templates, masking, chalk lines or other means necessary shall be provided such that the work meets the specified quality of workmanship.

Safety markings shall be located within plus or minus 2.0 cm of the locations required as shown.

Horizontal lines shall be water level, vertical lines plumb, and 45 degree slope lines shall be accurate, all within one half percent of the length of each such line.

The edges of painted markings, and the edges between different paint colors, shall be neatly and accurately formed, straight or uniformly curved when required, and free from overlaps, raggedness or other uneven conditions; and all corners shall be neatly and accurately cut off square or true to the angle required.

### 3.05 SUBSTRATE PREPARATION

#### A. GENERAL:

The Contractor shall be responsible for determining, proposing and providing any and all procedures, manner or means of preparation of all surfaces required to be painted such that the applied paint will develop full and complete adhesion to the substrate, and such that the coatings are durable and fully effective as intended under these specifications.

The Contractor shall be responsible for obtaining and following the surface preparation recommendations of the manufacturer of the paint to be used, and as are specifically applicable to each of the various substrate materials involved.

At the time of application of paints, the substrates shall be clean and free from moisture, sand, dust, dirt, laitance, grease, oil or other conditions inhibitive to proper application or adhesion of the paint or would otherwise in anyway adversely affect the material or the durability of the work.

Dust, grit or any other such residue resulting from the cleaning operations shall be completely removed before the painting is started.

Oil, grease or like substances on surfaces required to be painted, before any other cleaning or preparation is started, shall be removed by washing with a suitable solvent and then wiped off to remove any excess solvent.

All substrate surfaces shall be in a thoroughly dry condition before the painting is started.



B. UNCOATED STEEL SURFACES:

Bare steel surfaces to be painted shall be cleaned free from rust, loose mill scale and other foreign substances.

Unless otherwise specified for a particular type or location of work, cleaning shall be carried out by hand cleaning, blast cleaning or flame cleaning as necessary to achieve the intended results.

Unless cleaning is done by blast cleaning, before the cleaning is started, all weld areas shall be neutralized using a suitable chemical and then thoroughly rinsed with clean water.

C. GALVANIZED SURFACES:

Galvanized surfaces required to be painted shall be cleaned as specified and pretreated to pre-condition and etch the surfaces before any paint is applied.

For the purpose of conditioning the galvanized surfaces for improved adhesion of the paint, the pretreatment and painting work shall be deferred such that the surfaces may be exposed and permitted to weather for as long a period of time as possible.

the pretreatment material shall be either a proprietary type specifically formulated for this purpose, and as proposed and approved.

3.06 APPLICATION

A. GENERAL:

When applied, paint shall be in a thoroughly mixed and uniform condition, and each can or batch of paint being used shall be maintained well mixed. Paints such as zinc rich types when required shall be continuously agitated throughout the application period.

Other than as particularly specified by the paint manufacturer, addition of thinner or other ingredients to ready-mixed paint shall not be permitted; and the intermixing of different generic types or brands of paint shall not be permitted.

Other than as specified, paints, including pretreatments and primers when required, shall be applied in one or two coats and for the total dry film thicknesses not less than as specified by the respective paint manufacturer.

When painting adjoins any type of surface not required to be painted, or is required to be painted differently, the painting shall be brought up to and neatly and accurately cut off at the edges of such surfaces.

Painting shall be done in a neat and workmanlike manner, and paint shall be applied in a uniform film free from skips, thin spots, holidays, runs, sags or other irregularities; and the finished surfaces shall be reasonable free from brush marks or stipple-like textures as may be caused by insufficient effort or experience or by the use of overlay stiff brushes or coarse rollers.

When multiple coats are to be provided, the time lapse between coats shall be not less than as specified by the respective paint manufacturer. Should more than 7 days elapse between coats, the previously applied coat shall be washed or cleaned prior to application of the next coat and in accordance with the paint manufacturer's instructions.

When complete, the applied paint shall be uniform in color, level and smoothness, and free from inclusions of sand or other deleterious substances, stains, discoloration or other irregularities.

Each color required shall be uniform in hue, sheen and reflectance throughout the work.

After completion of the painting and of any other work that would cause dust, grease or other foreign materials to be deposited upon the painted surfaces, the painted surfaces shall be cleaned and by such methods as will not damage the paint.

Painted surfaces that are damaged or marred as a result of the Contractor's operations, or which otherwise are defective, shall be repaired or refinished with materials and to a condition equal to the requirements or these specifications, and carried out in accordance with the paint manufacturer's instructions.

#### B. PAINTS WITH GLASS BEADS:

Paint which is to receive surface applied glass beads shall be applied in one coat and for a wet film thickness of not less than 0.38 mm.

Surface applied glass beads shall be applied under pressure and as part of the paint application operations such that the required quantity of glass beads remains fully adhering to the paint when it is dry. The residual quantity of glass beads adhering to the paint shall be not less than 400 grams per square meter of paint surface.

Glass bead rebound shall be swept up and removed from the work.

END OF SECTION

016 - REINFORCED CONCRETE PIPE

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016 - REINFORCED CONCRETE PIPE

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the material and construction requirements for reinforced concrete pipes for non-pressure service, to be provided at the locations and in types and sizes indicated on the drawings. The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

As used herein or on the drawings, the term R.C.P. shall mean reinforced concrete pipe of the type required herein.

Manholes, or other structures into which R.C.P. penetrate shall be as provided for under other technical specifications, when required.

Bedding for R.C.P. shall be of the type designated on the drawings, and shall be in accordance with the referenced specifications.

R.C.P. shall be encased in concrete of the class designated on the drawings or as specified, when required.

The work shall include the determining and providing the quantities of materials and other items as are needed to complete the work required; and for providing the work necessary to lay out the work in the filled; all as based upon the configurations and extent indicated on the drawings by typical layouts and in accordance with these specifications.

Surplus excavation shall be disposed of in accordance with the reference specifications.

1.02 REFERENCES

B. Related Work in Other Sections:

Section	003	GENERAL EXCAVATION
Section	005	TRENCHING, BEDDING, BACKFILLING AND COMPACTING
Section	007	FILLING, GRADING AND EMBANKMENT CONSTRUCTION
Section	014	ASPHALT CONCRETE CONSTRUCTION
Section	021	PORTLAND CEMENT CONCRETE

1.03 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards

provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

AASHTO American Association of State Highway and Transportation officials

M 170-78 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

T 22-74 Compressive Strength of Cylindrical Concrete Specimens.

T 33-72 Culvert Pipe, Sewer Pipe and Drain Tile.

JIS A 5302 Reinforced Concrete Pipes.

1.04 SUBMITTALS:

A. GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents.

B. BEFORE COMMENCING WORK:

1. Work Program - comprising:

- List of specific products proposed and precise standards covering each item.
- Outline of means for safe and secure handling and storage of products and equipment.
- Outline of equipment to be employed in carrying out this work.

2. Manufacturer's Product Information - comprising an orderly compilation of:

- Current published catalogs or manuals containing complete product specifications, technical/performance data, details and illustrations - clearly demarked to readily identify the specific items involved.
- Applicable material and test standards.
- Installation instructions, with maintenance and repair recommendations.
- Recommendations for safe and secure product transport, storage and handling.

3. Samples of material proposed - submitted in the manner and quantity as requested by the Engineer
4. Shop or working drawings indicating material, layouts, installation details, location marks, and relationship and connections to adjacent work.
5. Certificates of Compliance from manufacturer indicating that products are in accordance with the applicable specifications, accompanied by substantiating test reports indicating standards for and results of each test. Required for each production lot of R.C.P. materials delivered to the site.

C. DURING PROGRESS OF WORK:

1. Reports of tests performed during work and upon completion of work.

1.05 PRODUCT HANDLING

Products shall be at all times transported, protected, stored and handled such as to preclude damage. Items found damaged or not in proper condition shall be removed from the site and replaced with compliant products; or, where repairable, shall be made to meet the specifications before use in the work.

Repair methods and condition of completed repairs shall be subject to review and approval by the Engineer in advance of the use of any repaired R.C.P. in the work.

1.06 PROTECTION

Pipe joint materials shall be factory prepared, tropicalized, packaged, crated or otherwise such as to preclude damage during shipping and handling, including any transshipment, or as may result while in transit or storage over an extended period of time.

PART 2: PRODUCTS

2.01 GENERAL

Products required under these specifications shall be, where available, procured from a local manufacturer or supplier. Products proposed for this work shall be determined by the Contractor to be in compliance with these specifications, and substantiated by way of his submittals. Proposed manufacturers and suppliers and proposed products are subject to approval by the Engineer.

2.02 REINFORCED CONCRETE PIPE (R.C.P.)

R.C.P. shall be in standard patterns and sizes of circular reinforced concrete pipe conforming to requirements of AASHTO M 170, Class V, or JIS A 5302 unless otherwise designated; and shall be as locally produced by a manufacturer regularly providing materials of the kinds required.

Joints for R.C.P. may be either tongue and groove or other type standard with the R.C.P. manufacturer, but shall be capable of being made watertight and capable of being made up such that there are no gaps or offsets at the interior surfaces of the pipe when completed.

Jointing materials shall be suitable for the type of joints to be used and as supplied or recommended by the R.C.P. manufacturer.

R.C.P. shall indicate compliance when tested in accordance with AASHTO T 22, T 33 or JIS A 5302.

2.03 RELATED WORK REQUIREMENTS

Work and materials required to complete the installations under these specifications, unless otherwise shown or specified, shall conform to the applicable requirements of the reference technical specifications.

Concrete for saddles, cradles or other subsidiary items shown as concrete shall be the class as indicated on the drawings.

PART 3: EXECUTION

3.01 GENERAL REQUIREMENTS

The Contractor shall notify the Engineer when excavations are ready to receive the pipes.

Pipes shall be free from defects or damage when installed, and the surfaces of pipe shall be in such condition that they can be properly sealed.

Pipe joining and joint sealing shall be in accordance with the respective manufacturer's recommendations and/or instructions as approved by the Engineer.

Pipes shall be sloped uniformly between the grade points indicated, established or approved.

PIPE LAYING

Before and after laying any pipe, if any cause for rejection is discovered in a pipe, it shall be removed, and corrective or replacement work shall be provided by the Contractor.

When connections are to be made to any existing pipe or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate for, and expose, the existing improvement. The Contractor shall notify the Engineer before any pipe is laid and any connection is made. The Contractor shall make any adjustments in line of grade which may be necessary to accomplish the intent of the drawings.

Where cutting is necessary, cuts shall be neat and true to line and profile.

When laid, pipe shall be true to line and grade, with inverts uniformly sloped between elevations indicated, and with uniform bearing under the full length of the barrel of the pipe. The bell or collar or other fittings shall not bear on the subgrade or bedding. Any pipe which is not in true alignment or shows any undue settlement after laying shall be taken up, and adverse soil condition corrected, and the pipe relaid.

Pipe sections shall have been joined in such manner that any offset of the inside of the pipe at any joint is at a minimum at the invert. The maximum offset at the invert of pipe shall be one percent (1%) of the inside diameter of the pipe.

Pipe layouts and lengths shall be such that there are a minimum of joints in the work.

When complete, annular spaces at joints for concrete pipe shall be completely filled with sealing materials and flush across the inner surfaces of the pipe.

After joining, any pipe that is disturbed in any way shall be taken up and replaced, and using new materials where necessary.

END OF SECTION



017 - AGGREGATE SUBBALLAST

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017 - AGGREGATE SUBBALLAST

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the material and construction requirements for aggregate subballast to be provided at the locations and in the types and depths indicated on the drawings. The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

The work shall cover and include obtaining, loading, hauling, preparing, mixing, depositing, spreading, and compacting the material complete in place, and finishing the subgrade at the grading plane as shown and specified.

1.02 REFERENCES

Related Work in Other Sections:

Section 011 SUBGRADE PREPARATION

1.03 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

ASTM American Society for Testing and Materials:

- C 136-76 Sieve or Screen Analysis of Fine and Coarse Aggregates, Test.
- C 142-71 Clay Lumps and Friable particles in Aggregates, Test.
- C 235-68 Scratch Hardness of Coarse Aggregate Particles, Test
- D 423-66 Liquid Limit of Soils, Test.  
(1972)
- D 424-59 Plastic Limit and Plasticity Index of  
(1971) Soils, Test.

#### 1.04 SUBMITTALS

##### A. GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents. When not otherwise indicated, each submittals item shall be in duplicate copies or sets.

##### B. BEFORE COMMENCING WORK:

###### 1. Work Program - comprising:

- List of specific products proposed and precise standards covering each item.
- Outline of means for safe and secure handling and storage of products.
- Outline of equipment to be employed in carrying out this work.

2. Samples of material proposed - submitted in the manner and quantity as requested by the Engineer.

3. Test reports establishing characteristics and properties of material proposed.

##### C. DURING PROGRESS OF WORK:

1. Reports of field trials and tests made in advance of permanent work operations.

2. Reports of tests performed during work and upon completion of work

#### 1.05 PRODUCT HANDLING

Products shall be at all times transported, protected, stored and handled such as to preclude damage. Items found damaged or not in proper condition shall be removed from the site and replaced with compliant products.

### PART 2: PRODUCTS

#### 2.01 GENERAL

Products required under these specifications shall be, where available, procured from a local manufacturer or supplier. Products proposed for this work shall be determined by the Contractor to be in compliance with these specifications, and substantiated by way of his submittals. Proposed manufacturers and suppliers and proposed products are subject to approval by the Engineer.

2.02 MATERIAL SOURCE AND SELECTION

When required, the source location for subballast material shall be as directed and approved by the Engineer. The obtaining of subballast material from the source indicated may require selective excavation in the pit. The Contractor shall be responsible for selecting proper materials in the pit and shall not use material not approved by the Engineer for subballast.

2.03 MATERIAL REQUIREMENTS

Subballast material shall be crushed stone composed of hard, strong and durable particles, clean and be free from organic matter and injurious amounts of deleterious substances and conforming to the requirements of this specifications.

Deleterious substances shall not be present in subballast material in excess of the following amounts:

<u>Deleterious Substances</u>	<u>ASTM Method of Test</u>	<u>Amount</u>
Soft and friable pieces:	C 235	5.0%
Clay Lumps:	C 142	0.5%

The grading of subballast material, when tested in accordance with ASTM C 136, shall conform to the following requirements:

<u>Sieve No.</u>	<u>Square Opening Size</u>	<u>Percent passing, by Weight Individual Test Result</u>
1"	25.4 mm	100
3/8"	9.52 mm	50 - 85
No. 4	4.76 mm	35 - 65
No. 10	2.00 mm	25 - 50
No. 40	0.42 mm	15 - 30
No. 200	0.074 mm	8 - 15

The portion of the material passing the No. 40 (0.42 mm) Sieve shall conform to requirements as follows:

<u>Characteristics</u>	<u>ASTM Method of Test</u>	<u>Requirement</u>
Liquid Limit:	D 423	Less than 35
Plasticity Index:	D 424	Less than 9

PART 3: EXECUTION

3.01 TEST STRIPS

Prior to commencement of permanent construction, the Contractor shall construct trial test strips for each type of material to be used, to the lengths and width as approved by the Engineer, for the purposes of review of the material and equipment operations that are most appropriate for the work.

Test strip material shall be the same type as that to be used in the work and the compaction equipment shall be the same as detailed in the Contractor's work program as approved.

Test strips which do not indicate acceptable results shall be removed and reconstructed for as many times as necessary until satisfactory results can be demonstrated.

3.02 SUBGRADE

The subgrade to receive subballast, immediately prior to spreading, shall conform to the compaction and elevation tolerance specified for the material involved, shall be free of loose or extraneous material, and shall comply with requirements specified under Tech. Spec. entitled SUBGRADE PREPARATION.

Subballast material shall be hauled and placed by trucks or earthmoving equipment in such a way that rutting or disturbance of the completed subgrade is completely avoided. Disturbed or rutted subgrade materials shall be removed from the fill, disposed of in an approved manner, and replaced.

3.03 PLACING AND COMPACTING

Subballast construction work shall be commenced when the embankment construction is completed, and as approved by the Engineer.

Subballast material shall be delivered to the work as a uniform mixture and shall be deposited on the subgrade at a uniform quantity per linear meter and at a rate which will provide the required compacted thickness within the grade tolerance specified under the Article 3.04 herein.

Segregation shall be avoided; and the subballast shall be free from pockets or concentrations of coarse or fine material, and from material not uniform in mixture.

Subballast material shall be spread and compacted in layers of approximately equal thickness, the maximum thickness of any one layer shall not exceed 10 centimeters in compacted thickness, unless otherwise approved the Engineer.

Initial compaction shall be thorough and uniform by means of suitable rollers, defined by the trial test, and finally compacted to conform to the specified requirement. During compaction work, materials shall be kept their optimum moisture content directed by the Engineer.

Subballast material shall be compacted within the same day of spreading.

Embankment shoulder or inaccessible area that can not be spread or compacted by normal operations shall be spread or compacted by other means as required.

When the subgrade for subballast consists of cohesionless material, and when approved in advance by the Engineer, a portion of the subballast may be dumped in piles upon the subgrade and spread ahead in sufficient quantity to stabilize the subgrade.

Subballast which does not conform to the requirements of these specifications shall be reworked and thoroughly recompacted to conform with the specified requirements. Reworking shall include the full depth of the layer involved. Additions of thin layers to make up insufficient thickness will not be permitted.

When placing the subballast or during any other operations, the subballast material shall not be mixed with other material. Subballast material which has become contaminated with other materials shall be removed and repalced.

### 3.04 TEST AND GRADE TOLERANCE

Subballast shall be tested in accordance with AASHTO T 221, using a steel bearing plate, 30 cm in diameter, and the result of test shall be not less than 11 kg/cm<sup>3</sup> at the top surface of subballast. The test as specified shall be performed by at least one (1) group of test for each 100 meter long construction lot.

One group of test shall consist of three (3) individual tests to be provided at the location of the center and the locations 2.0 meters apart toward both sides of embankment shoulder along the perpendicular to the centerline of the railway.

When the construction lot is limited to less than 100 m in length, obstructed by the structure(s) across the embankment, construction lot will assumed as such a limited area.

The surface of the finished subballast at any point shall be not less than 25 mm from the grades shown on the drawing.

Subballast which does not conform to the above requirements shall be reshaped or reworked and thoroughly recompactd to conform to the specified requirements.

END OF SECTION

018 - MISCELLANEOUS BRIDGEWORK ITEMS

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## 018 - MISCELLANEOUS BRIDGEWORK ITEMS

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the material and construction requirements for miscellaneous bridgework items to be provided at the locations and in the types and sizes indicated on the drawings. The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

Miscellaneous bridgework items as shown or detailed on the drawings and to be included or classified as miscellaneous item work, and the specific item requirements therefore, shall be as specified in these specifications.

Miscellaneous bridgework item shall cover and include materials, fabrication, assembly, finishing, delivery, and installation.

#### 1.02 REFERENCES

Related Work in other Sections:

Section	019	CONCRETE REINFORCEMENT
Section	020	CONSTRUCTION JOINT TREATMENT
Section	021	PORTLAND CEMENT CONCRETE
Section	022	CAST-IN-PLACE CONCRETE

#### 1.03 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

AASHTO American Association of State Highway and Transportation Officials:

ASTM American Society for Testing and Materials:

#### 1.04 SUBMITTALS

##### A. GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein, and as are appropriate for the various types of miscellaneous items required. Submittals shall meet the requirements and be in quantities specified in the reference documents.

B. BEFORE COMMENCING WORK:

1. Work Program - comprising:

- List of specific products proposed and precise standards covering each item.
- Outline of means for safe and secure handling and storage of products.
- Outline of equipment to be employed in carrying out this work.

2. Manufacturer's Product Information - comprising an orderly compilation of:

- Current published catalogs or manuals containing complete product specifications, technical/performance data, details and illustrations - clearly demarked to readily identify the specific items involved.
- Applicable material and test standards.
- Installation instructions, including requirements for both products and substrates; with maintenance and repair recommendations.
- Recommendations for safe and secure product transport, storage and handling.

3. Samples of material proposed - submitted in the manner and quantity as requested by the Engineer.

4. Shop or working drawings indicating materials, layouts, fabrication and installation details, and location marks.

5. Certificates of compliance from manufacturer indicating that products are in accordance with the applicable specifications, accompanied by substantiating test reports indicating standards for and results of each test. Required for each production lot of mass materials delivered to the site.

C. DURING PROGRESS OF WORK:

1. Reports of tests performed during work and upon completion of work.

1.05 PRODUCT HANDLING

Products shall be at all times transported, protected, stored and handled such as to preclude damage. Items found damaged or not in proper condition shall be removed from the site and replaced with compliant products.

PART 2: PRODUCTS

2.01 GENERAL

Products required under these specifications shall be, where available, procured from a local manufacturer or supplier. Products proposed for this work shall be determined by the Contractor to be in compliance with these specifications, and substantiated by way of his submittals.

Proposed manufacturers and suppliers and proposed products are subject to approval by the Engineer.

2.02 MATERIALS FOR BRIDGE EXPANSION JOINT

A. STEEL PLATE, ANCHOR BOLTS AND NUTS:

Steel plate shall be corrosion-resistant low-alloy type of steel conforming to ASTM A 242, in cross section size as shown, and fabricated to meet requirements specified herein.

Steel plate anchor bolts and nuts shall be stainless steel conforming to ASTM F 593 and F 594, respectively, and in sizes as shown.

B. JOINT SEALANT:

Joint sealant as indicated shall conform to ASTM D 3406 or equivalent standards as approved.

2.03 MATERIALS FOR BRIDGE DECK DRAIN

A. DRAIN PIPE AND CAP:

Bridge deck drain shall consist of an assembly of drain pipe and cap, and shall be cast iron conforming to ASTM A 518, and in the size and type shown on the drawings.

B. SUPPORT:

Supports shall be fabricated from commercial quality steel sheet, hot-dip galvanized after fabrication; or may be type 302 or 304 stainless steel.

Support fastenings shall be type 302 or 304 stainless steel.

2.04 BRIDGE DECK PADS

Bridge deck pads shall be pure virgin rubber units of the thickness and sizes as shown on the drawings. Bearing deck pads shall be accurately fabricated to neatly fit around and center on the anchor bars or other items where indicated on the drawings as penetrating the pads.

2.05 SHOE FOUNDATION MORTAR

Shoe foundation mortar shall be either Portland cement with special additives or a pre-mixed type material, either of which is especially formulated to produce a compressive strength of 400 kg/cm<sup>2</sup> at 28 days, shrink-free mortar.

The materials shall be as determined and proposed by the Contractor for review by the Engineer in advance of the work; but shall not be a material containing ferrous elements or otherwise which would cause any staining over any length of time.

2.06 ELASTOMERIC BEARING PADS

- A. Elastomeric bearings shall be units designed for the purposes indicated, as produced by a manufacturer regularly providing units of the types required; and all units utilized for the work shall be new.
- B. Elastomeric bearing shall be laminated layer type units comprising alternative layers of elastomer and metal plates, in the overall sizes and laminate layer thicknesses as shown on the drawings, or may be used encapsulated type such that all perimeter edges of the metal plate layers are protected by a covering of elastomer not less than 3.2 mm in thickness.
- C. Metal plate layers shall be rolled steel conforming to AASHTO M 183 or ASTM A 36, Grade C or D; and each plate shall be in a single piece free from any joints or seams.

D. Elastomer materials shall be 100 percent virgin chloroprene (neoprene), and when tested by the standards listed, shall meet the requirements as follows:

<u>Property</u>	<u>ASTM</u>	<u>Requirement</u>
Hardness, Durometer, Type A:	D2240	60+5
Tensile Strength, Kg/cm <sup>2</sup> , min.:	D 412	180
Ultimate Elongation, percent, min.:		350
Heat Resistance -		
- Change in Durometer Hardness max. points:		+15
- 70 hours at 100C -	D 573	
a) Change in Tensile Strength percent, max.:		-15
b) Change in Ultimate Strength, percent, max.:		-40
Compressive Set, 22 hours at 100C percent, max.:	D 395; Method B	35
100 ppm Ozone in Air, by volume 20 percent strain 38C +1, 100 hours, mounting procedure ASTM D 518, Proc. A:	D 1149	No Cracks.
Bond Made During Vulcanization, Kg/m:	D 429	720
Brittleness at Minus 40C:	D 746 Proc. B	No failure

E. When full size elastomeric bearing units are tested under laboratory conditions, the units shall meet the requirements as follows:

- Compressive strain of any layer shall not exceed 7 percent at 57 kg/cm<sup>2</sup> average unit pressure, or at the design dead load plus live load when so indicated on the Contract Drawings.
- Shear resistance of the bearing shall not exceed 5 kg/cm<sup>2</sup> at 25 percent strain of the total effective elastomer thickness after an extended 4 day ambient temperature of minus 29C.

F. Dimensions of the bearing units shall not vary from the dimensions indicated on the Contract Drawings in excess of the tolerances as follows:

	<u>mm</u>
- Vertical Dimensions, with average total thickness of:	
30 mm or less:	-0, +3.0
Over 30 mm:	-0, +6.0
- Horizontal Dimensions:	
900 mm and less:	-0, +6.0
Over 900 mm:	-0, +13.0
- Thickness in Elastomer Layers	+3.0
- Variations from a Plane Parallel to the Theoretical Surface, as determined by measurements at the edges of the bearings:	
Top:	3.0
Sides:	6.0
Individual metal Layers:	3.0
- Position of Exposed Connection Members:	3.0
- Edge Cover over Metal Layers:	-0, +3.0

2.07 ANCHORING

Anchoring shall consist of sleeve pipe and steel bar. All anchoring materials shall meet the requirement of ASTM A 6 or 36 and A 53 or equivalent standards as approved.

PART 3: EXECUTION

3.01 GENERAL REQUIREMENT

Miscellaneous bridgework items shall be fabricated, assembled or otherwise treated and installed in accordance with requirements under this article as are applicable to the items of work involved, and in addition to any other specific item requirements as specified hereinafter.

When complete, miscellaneous bridgework items shall be straight, true to line, smooth, securely anchored and free from twists and bends, nicks, scars or other irregularities, as applicable to the work required.

Miscellaneous bridgework items not in compliance shall be repaired or replaced as required to meet the requirements of these specifications.

### 3.02 BRIDGE EXPANSION JOINT ASSEMBLY

#### A. STEEL PLATE AND BOLTS:

Steel plate may be in multiple pieces to make the length required for the joint but any one piece shall not be shorter than can be secured by 3 bolts at the spacing indicated, and joints shall be centered between 2 adjacent bolts.

Plate ends shall be cut square, and all edges shall be reasonably free from burrs, shear deformations or other conditions which would prevent full continuous bearing on the supporting concrete.

Holes for bolts shall be drilled and/or reamed only and edges made free from burrs, and shall be sufficiently oversized to facilitate easy setting without force.

Intermediate and end joints shall be gapped by 2 to 3 mm.

Bolts shall be installed utilizing the steel plate or comparable template such as to facilitate easy placement and any later removal if needed.

Bolts shall be set to a depth that permits full grip by the nuts and without excessive projection of the shank end above the nut.

When installed nuts shall be tightened for full and complete bearing but without overstress that could result in failure or damage.

#### B. SEALANT WORK:

Sealant shall be installed in accordance with requirements under Tech. Spec. entitled CONSTRUCTION JOINT TREATMENTS.

Joint surfaces shall be clean, dry and thoroughly cured at the time of application.

### 3.03 BRIDGE DECK DRAIN ASSEMBLY

Deck drains shall be positioned within reasonably close tolerance at the locations shown; shall be set plumb, and with the pipe rim accurately aligned with the deck surface as indicated.

### 3.04 BRIDGE DECK PADS

Bridge deck pads shall be installed at the locations and in accordance with details as shown on the drawings.

3.05 SHOE FOUNDATION MORTAR

The material shall be mixed, cured, or otherwise handled in accordance with the manufacturer's instructions; shall be placed to the dimensions required, and uniformly and accurately formed and finished off smooth at the elevations indicated on the drawings; and all exposed edges shall be uniformly struck off smooth, straight and bevelled. The completed mortar work shall be free from any air pockets, voids, pits or other irregularities.

3.06 ELASTOMERIC BEARING PADS

Bearing pads shall be accurately set at the locations and positions required as indicated on the drawings, and for 100 percent contact with the surface of the supporting concrete and the concrete which the units are intended to support. The contact surfaces of the concrete shall be finished and/or ground or otherwise treated such as to meet these requirements.

3.07 ANCHORING

Anchor bars and sleeves shall be carefully installed by use of templates to permit true position as shown on the drawings and shall be accurately remained at the installed position until placement of concrete.

Sleeves shall be completely filled with the grout in advance of placing concrete. The grout shall be mixed and placed as per manufacturer's instruction.

END OF SECTION



019 - CONCRETE REINFORCEMENT

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019 - CONCRETE REINFORCEMENT

(REINFORCING STEEL)

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the material and construction requirements for concrete reinforcing steel to be provided at the locations and in the grades, types and sizes indicated on the drawings. The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

Reinforcing steel work shall cover and include furnishing, fabricating, transporting, assembly, erecting and placing of reinforcing bars including welding thereof when required, as shown or specified.

1.02 REFERENCES

Related Work in Other Sections:

Section	008	PRESTRESSED CONCRETE PILES
Section	022	CAST-IN-PLACE CONCRETE
Section	023	PRESTRESSED CONCRETE STRUCTURES

1.03 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

ASTM	American Society for Testing and Materials
A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
JIS	Japanese Industrial Standard
G 3112	Steel Bars for Concrete Reinforcement

1.04 SUBMITTALS

A. GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents.

B. BEFORE COMMENCING WORK:

1. Work Program - Comprising:

- List of specific products proposed and precise standards covering each item.
  - Outline of means for safe and secure handling and storage of products.
  - Outline of equipment to be employed in carrying out this work.
2. Working or shop drawings indicating reinforcing layouts, bar types and sizes, location marks and schedules, and bending and splicing.
3. The mill test report for each lot of billet steel reinforcement bars proposed for use. The mill test report shall be sworn to the manufacturer of the steel, by a person having legal authority of bind the manufacturer, and shall show the following information:
- The process or processes used in the manufacture of the steel from which the bars were rolled.
  - Identification of each heat of open-hearth, basic oxygen or electric furnace and/or each lot of acid Bessemer steel from which the bars are rolled.
  - Chemical and physical properties of the heat from which the bars were rolled.
4. The fabricator shall furnish the certification which shows the heat number or numbers from which each size of bar in the shipment was fabricated.

1.05 PRODUCT HANDLING

Product shall be at all times transported, protected, stored and handled such as to preclude damage. Items found damaged or not in proper condition shall be removed from the site and replaced with compliant products.

Reinforcing steel shall be stored above the ground on platforms, skids, or other supports; and shall be stored in such a manner and adequately marked to facilitate inspection and checking.

When placed in the work, the reinforcing steel shall be free from dirt, detrimental scale, paint, oil or other foreign substance as specified.

PART 2: PRODUCTS

2.01 GENERAL

Products required under these specifications shall be, where available, procured from a local manufacturer or supplier. Products proposed for this work shall be determined by the Contractor to be in compliance with these specifications, and substantiated by way of his submittals. Proposed manufacturers and suppliers and proposed products are subject to approval by the Engineer.

2.02 REINFORCING BARS

A. GENERAL:

All reinforcing bars shall be of a deformed type SD 30 in accordance with JIS G 3112 or Grade 60 in ASTM A 615 except that plain bars may be used where specifically indicated on the drawings.

All steel reinforcement shall conform to the requirements of ASTM A 615 Grade 60 or JIS G 3112, unless otherwise shown or specified.

All reinforcement bars shall be free from detrimental dirt, mill scale, rust, paint, grease, oil or other foreign substance, fins or tears. Slight rusting which discolors the metal may exist, but all loose mill scale and scaley rust shall be removed. Brushing to clean blue metal will not be required. There shall be no evidence of piping or visual flow in the test specimen or on the sheared ends of the bars. Various types and sizes of reinforcing bars shall be as follows:

## TYPES OF REINFORCING BARS

### (SD30) Deformed Bars

D	Unit Weight kg/m	Cross Sectional Area cm <sup>2</sup>
D10	0.560	0.7133
D13	0.995	1.267
D16	1.56	1.986
D19	2.25	2.865
D22	3.04	3.871
D25	3.98	5.067
D29	5.04	6.424
D32	6.23	7.942
D35	7.51	9.566

### (SR24) Round Bars

$\phi$	Unit Weight kg/m	Cross Sectional Area cm <sup>2</sup>
$\phi 6$	0.222	2.2827
$\phi 9$	0.449	0.6362
$\phi 12$	0.888	1.131
$\phi 13$	1.04	1.327
$\phi 16$	1.58	2.011
$\phi 19$	2.23	2.835
$\phi 22$	2.98	3.801
$\phi 25$	3.85	4.909
$\phi 28$	4.83	6.158
$\phi 32$	6.31	8.042

B. IDENTIFICATION:

The bars in each lot shall be legibly tagged by the manufacturer and/or fabricator before being offered for inspection. The tag shall show the manufacturer's test number and lot number or other designation that will identify the material with the certificate issued for that lot of steel.

C. INSPECTION AND SAMPLING:

The sampling and testing of reinforcement bars may be made at the source of supply when the quantity to be shipped or other conditions warrant such inspection. Bars not tested before shipment shall be tested after arrival on the work. Test samples obtained at the destination of the steel shall be duplicate bars not less than one (1) meter in length and bars from which such samples are taken shall be replaced at the Contractor's expense.

The Engineer reserves the right to require the Contractor to reassemble and retest all reinforcement steel upon its arrival at the work site if the steel appears to be other than as previously tested or certified.

2.03 SUPPORTS

Supports for reinforcing bars shall be prefabricated mortar blocks, and designed and fabricated for this purpose. Special supports shall be provided when shown on the drawings.

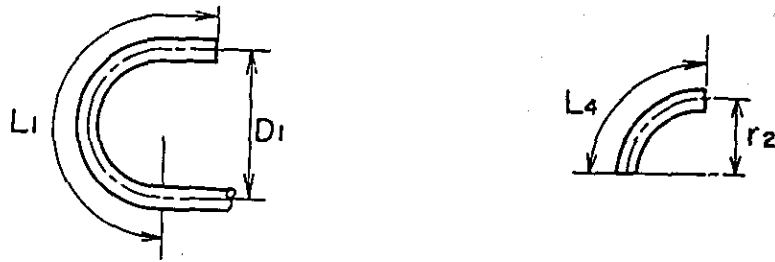
PART 3: EXECUTION

3.01 CUTTING AND BENDING

All cutting and bending of reinforcement bars shall be done by competent workmen and with suitable mechanical equipment. All reinforcement bars shall be cut and bent in facilities approved in advance by the Engineer.

Bent bar reinforcement shall be cold bent to the shapes shown on the drawings, and unless otherwise shown, bends shall conform to the requirements as shown in the following Table:

BENDING OF REINFORCING BARS



(SD30) Deformed Bars

$\varnothing$	D1	L1	2L1	r2	L4
D10	60	160	320	110	173
D13	83	200	400	140	220
D16	96	230	460	170	267
D19	119	270	540	200	314
D22	132	300	600	240	377
D25	155	350	700	270	424
D29	179	400	800	310	487
D32	192	430	860	340	534
D35	210	470	940	370	581

(SR24) Round Bars

$\varnothing$	D1	L1	2L1	r2	L4
$\varnothing 6$	36	120	240	70	110
$\varnothing 9$	49	140	260	100	157
$\varnothing 12$	62	160	320	130	204
$\varnothing 13$	73	180	360	140	220
$\varnothing 16$	86	210	420	170	267
$\varnothing 19$	99	240	480	200	314
$\varnothing 22$	112	270	540	240	377
$\varnothing 25$	125	300	600	270	424
$\varnothing 23$	143	350	700	300	471
$\varnothing 32$	162	390	780	340	534

3.02

PLACING, SUPPORTING, AND FASTENING

All reinforcing steel shall be accurately placed and, during the placing of concrete, firmly held by approved supports in the position shown on the drawings.

Reinforcing bars shall be securely fastened together. Reinforcement placed in any member shall be inspected for completeness and accuracy before any concrete is placed.

Laying or driving bars into the concrete after placement shall not be permitted. All horizontal reinforcement shall be supported on mortar blocks or spaces as specified. The use of small stones or wood blocks for supporting reinforcement will not be permitted.

Reinforcement shall be held securely in place at the proper position and spacing as indicated by the use of adequate and sufficient wire ties at bar intersections and tying to the supports and spacers, all such that displacement will not occur during concrete placing operations. Plastic or nylon blocks, clips, spacers, tools, etc. shall be used as required.

Reinforcing steel shall be inspected and rechecked by the Contractor before any concrete is deposited to assure that all reinforcement is in the required positions.

3.03

SPLICING

Wherever it is necessary to splice reinforcement at points other than those shown on the drawings, because of the lengths of steel delivered to the site, drawings showing the location of each splice shall be submitted by the Contractor to the Engineer for approval before the reinforcing steels placed.

Splices shall be avoided at points of maximum stress; shall where possible, be staggered; and shall be designed to develop the strength of the bar without exceeding the allowable unit bond stress.

If different bar sizes are to be lapped, lap lengths shall be thirty (30) diameters of the largest bar at the splice.



3.04

CONCRETE PROTECTION FOR REINFORCEMENT

Unless shown otherwise on the Contract Drawings, the following minimum concrete cover shall be provided for reinforcement:

Type of Structures and Sections		Minimum Cover, mm
RC AND PC GIRDERS	Slabs	25
	Beams	30
RIGID FRAME VIADUCTS	Slabs	25
	Beams	30
	Columns	35
ABUTMENTS, RETAINING WALLS BOX CULVERTS	Exposed to weather:	30
	Exposed to earth:	50
PIERS	Exposed to weather or water:	50
FOOTINGS	Top	50
	Side	50
	Bottom	75

For Bottom of Footing where PC Piles used minimum concrete cover shall be 150 mm (from core of rebar to surface of concrete).

END OF SECTION

020 - CONSTRUCTION JOINT TREATMENT

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T 187-60 Concrete Joint Sealers.

ANSI American National Standards Institute:

All6.1- Two-component Elastomeric Sealing  
1967 Compounds for the Building Trade.

ASTM American Society for Testing and Materials:

A 525-76 Steel Sheet, Zinc-coated (Galvanized) by the  
Hot-dip Process, General Requirements.

B 32-76 Solder Metal.

D 140-70 Bituminous Materials, Sampling.  
(1976)

D 1751-73 (Same as For M 213)

D 1752-67 (Same as for M 153)  
(1973)

D 1851-67 Concrete Joint Sealers, Cold Application  
(1972) Type, Testing.

U.S. Federal Specifications:

TT-S-227B(1) Sealer Compound; Rubber  
24 June 1965 Base, Two Component.

JIS Japanese Industrial Standards

A 5758 Sealing Compounds for Sealing and Glazing  
in Buildings

#### 1.04 SUBMITTALS

##### A. GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents.

##### B. BEFORE COMMENCING WORK:

###### 1. Work Program - comprising:

- List of specific products proposed and precise standards covering each item.
- Outline of means for safe and secure handling and storage of products.

- Outline of equipment to be employed in carrying out this work
2. Manufacturer's Product Information - comprising an orderly compilation of:
- Current published catalogs or manuals containing complete product specifications, technical /performance data, details and illustrations - clearly demarked to readily identify the specific items involved.
  - Applicable material and test standards.
  - Installation instructions, including requirements for both products and substrates; with maintenance and repair recommendations.
  - Recommendations for safe and secure product transport, storage and handling.
  - Precautions against fire, injury to health, or other hazards, with emergency first-aid instructions.
  - Samples of finish colors available for selection. Colors used shall match those approved by the Engineer.
  - Samples of warranties offered covering products.
  - List of representative projects where preformed and sealant products have been used and proven successful, adequate and durable under environmental conditions similar to those for this project.
3. Samples of material proposed - submitted in the manner and quantity as requested by the Engineer. Samples of joints proposed for waterstops shall be submitted as specified.
4. Shop or working drawings indicating materials, details, and location marks for the various types of joints required.
5. Certificates of Compliance from manufacturer indicating that products are in accordance with the applicable specifications, accompanied by substantiating test reports indicating standards for and results of each test. Required for each production lot of materials delivered to the site.

1.05 PRODUCT HANDLING

Products shall be at all times transported, protected, stored and handled such as to preclude damage. Items found damaged or not in proper condition shall be removed from the site and replaced with compliant products. Any such damage shall be reported to the Engineer within 48 hours of the occurrence.

Sealant materials shall be at all times protected from exposure to direct sunshine until installed and have taken an initial set.

While in transit or in intermediate storage, materials shall be maintained in suitable warehouses or otherwise as is appropriate for the items involved, and shall be maintained within the extremes of temperature and humidity as recommended by the respective manufactures such as to preclude any deterioration or damage due to any adverse ambient conditions.

1.06 ENVIRONMENTAL CONDITIONS

No sealant work shall be done when the air temperature is below 4 degree C or above 32 degree C without the written concurrence of the sealant manufacturer.

No exterior sealant work shall be done during conditions of blowing sand, or rain.

The Contractor shall provide adequate ventilation when using sealants indoors which contain toxic ingredients.

PART 2: PRODUCTS

2.01 GENERAL

Products required under these specifications shall be, where available, procured from a local manufacturer or supplier. Products proposed for this work shall be determined by the Contractor to be in compliance with these specifications, and substantiated by way of his submittals. Proposed manufacturers and suppliers and proposed products are subject to approval by the Engineer.

2.02 HOT TYPE JOINT SEALING COMPOUND

This type shall be a mixture of virgin synthetic rubber or reclaimed rubber, or a combination of the two, with asphalt plasticisers and polymerized.

The compound, after heating and application, shall form a resilient and adhesive compound capable of effectively sealing joints in concrete against the infiltration of moisture and foreign material through repeated cycles of expansion and contraction; shall be capable of being

brought, by heating, to a uniform, smooth pouring consistency, free from lumps, and suitable for completely filling the joints and without damage to the material; and shall not flow from the joints or be picked up and tracked by vehicle tires at summer temperatures.

2.03 COLD TYPE JOINT SEALING COMPOUND

This type shall be homogeneous material of such consistency that it can be applied by means of a pressure pump through suitable nozzles to completely fill the joints. The compound may be blended with a suitable solvent or solvents by the manufacturer to provide better workability during installation in the joints. The volatility of these solvents must be such that they will evaporate within a short time after installation leaving a material that is adhesive and resilient.

2.04 PREFORMED EXPANSION JOINT FILLER

This type of filler shall be a nonextruding and resilient bituminous type and shall have relatively little extrusion and a moderate to high amount of recovery after release from compression.

Prefomed joint filler shall be nonextruding and resilient types of expansion joint filler conforming to the requirements of AASHTO M 213, ASTM D 1751, or equivalent standards as approved.

2.05 ASPHALT SEALED JOINTS

Joints indicated to be sealed with hot asphalt shall receive a coating of liquid asphalt applied over the entire joint surface and for full coverage in a thickness of not less than 2.0 mm, unless otherwise shown.

Liquid asphalt shall be any type suitable for the work and conforming to the requirements under Tech. Spec. entitled ASPHALT REQUIREMENTS, or as proposed and approved.

2.06 WATERSTOPS

Waterstops shall be provided in the type and at the locations indicated and installed as specified. Sizes shall be not less than as specified, unless otherwise shown.

Flexible waterstops shall be of a manufacturer's standard type meeting the testing requirements of the applicable JIS and/or ASTM standards, or equivalent standards as approved.

Materials and procedures for forming joints for flexible waterstops shall be as supplied and/or recommended by the manufacturer and as approved.

PART 3: EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. SEALANT AND COMPOUND MATERIALS:

The preparation of each type of material and the substrates receiving the material, and the handling and installation of the material shall be in strict accordance with the manufacturer's specifications and instructions as approved.

Materials shall be delivered to the work sites as factory sealed, labeled and dated. Materials older than the manufacturer's stated "shelf life" shall not be used in the work.

Subsidiary material, such as backing fillers, primers and/or thinners, shall be provided and used when they are recommended by the manufacturer for the conditions and/or substrates applicable to the work under the Contract.

Installation equipment and tools shall be provided and used as and when recommended by the material manufacturer.

Materials of different types or manufacture shall not be intermixed other than as specifically recommended by the manufacturer of the material involved.

When the material is job-mixed, when approved, but is not installed complete in place within the manufacturer's recommended "pot life" or working time after mixing, the material shall not be used for the work.

When a premixed material is opened but is not installed complete in place within the manufacturer's recommended exposure or working time after opening or exposure to the air, the material shall not be used for the work.

Material installations shall be performed by or under the charge of personnel who are well experienced in work of the kinds required under these specifications.

When other asphaltic, painting or coating work is involved under the Contract, and are in adjacent locations, elastomeric type joint sealing materials shall be installed in advance of such other work.

Materials shall not be installed by techniques nor at times when the ambient temperatures or weather conditions would preclude achieving the results intended by these specifications.



When complete, exposed surfaces of sealants and compounds shall be neat and regular in appearance; and exposed surfaces of adjacent construction shall be free from smears, stains or other evidence of any joint sealing materials.

When joints with sealant or compound are to be concealed in the completed work, the material shall be installed to finish flush with the surface of the concrete. Elsewhere, the material shall be installed to finish slightly recessed.

Unless otherwise indicated or specified, the depth of sealant shall be not less than equal to the width of the joint for joints up to a width of 15 mm; and for joints wider than 15 mm, the sealant depth shall be not less than equal to 75 percent of the joint width;.

B. PREFORMED FILLERS AND WATERSTOPS - GENERAL:

Preformed joint and waterstop materials shall be provided and installed in the longest single length units permitted by available stocks such as to avoid or minimize intermediate jointing. When the runs required for the work exceed the available lengths of material, the material shall be used and arranged such as to minimize the number of intermediate joints needed, and such as to provide the joints in reasonably uniform and symmetrical layouts.

Pieces of preformed material which are shorter than one-half of the available stock length of the respective material shall not be permitted, except that the individual piece lengths may be shorter when provided as part of approved factory or shop prefabricated corner units.

All pieces used in the work shall be reasonably straight and flat, and free from excessive twisting, cupping or winding, and free from holes, gouges, dents, cracks or other damage or defects.

Preformed materials shall be set, supported or otherwise maintained such that they are in reasonably straight lines and levels in the completed work.

C. FILLERS PER ARTICLES 2.04:

All pieces of filler material shall be preformed or cut such that all edges and ends are in straight lines, are square and normal to the flat running faces, and are reasonably neat and free from excessive fraying or gouges.

Intermediate joints shall be formed by fitting the adjacent pieces together such that the adjoining ends are in close and intimate contact, and free from offsets from the required straight alignment.

Corner joints, unless otherwise indicated, shall be the overlap type, formed by extending one piece for a distance equal to the material thickness beyond the corner return, and abutting the end of the adjacent piece to the face of the extended piece.

Where exposed in the completed work, the outer running edges of all pieces shall be set recessed below the finished surface of the concrete to a reasonably uniform depth of 4 or 5 mm.

When the preformed pieces are to be covered by a sealant or filler compound, the depth of the edge shall be not less than equal to the thickness of the preformed material involved, or to a greater depth when so indicated or specified.

D. Waterstops - General:

Unless otherwise indicated or specified, waterstops shall be set centered on the transverse width of the joint, except at keyed type joints waterstops shall be set centered on the bottom width of the keyway; and all waterstops shall be set with the longitudinal centerline at the joint centerline.

Representative samples of the various types of joints required for waterstops shall be submitted for review by the Engineer, and with each type formed using the materials and procedures proposed and approved for the work.

E. FLEXIBLE WATERSTOPS:

All joints for flexible waterstops shall be formed, sealed or welded or otherwise treated in accordance with the manufacturer's instructions as approved; and all joints shall be structurally sound and positively watertight when used in the work.

Unless otherwise approved, intermediate joints shall be square butt type, and corner joints shall be 45 degree mitered butt type.

F. CONCRETE CONSTRUCTION JOINTS:

Construction joints which are formed by an intimate contact between two separate placements of concrete shall be provided and formed only as and where shown or approved, and treated as specified under Tech. Spec. entitled CAST-IN-PLACE CONCRETE. Waterstops or other materials shall be provided in addition to said treatment in the types and at the locations indicated on the drawings and as specified.

END OF SECTION

021 - PORTLAND CEMENT CONCRETE

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021 - PORTLAND CEMENT CONCRETE

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing of portland cement concrete, including materials, delivering and testing.

Portland cement concrete shall be composed of portland cement, fine aggregate, coarse aggregate, with or without admixtures as approved.

- B. Related Work Specified Elsewhere:

Section	019	CONCRETE REINFORCEMENT
Section	022	CAST-IN-PLACE CONCRETE
Section	023	PRESTRESSED CONCRETE STRUCTURES

1.02 APPLICABLE CODES AND STANDARDS

The codes and standards generally applicable to the work of this section are listed hereinafter.

Peraturan Beton Berturang Indonesia, 1971

AASHTO	American Society for Testing and Materials
ACI	American Concrete Institute
JIS	Japanese Industrial Standards

1.03 CLASSES OF CONCRETE

Classes of concrete are denoted by the Engineer designation which consists of the letters from A through F indicating the 28-day compressive strength in kg/cm<sup>2</sup> as shown in APPENDIX 1.

1.04 DESIGN CRITERIA

- A. The design mixes for each class of concrete shall be as determined by the Contractor through an approved design laboratory and accepted by the Engineer to produce the results as specified herein.

- B. For each class of concrete there shall be as many mix designs as there are different combinations of ingredients, anticipated to cover the requirements of the Work. Mix design may vary to meet field conditions particularly for hot weather concreting, but after acceptance by the Engineer no change shall be made without notice to and acceptance by the Engineer based on the Contractor's report and recommendation.

- C. Unless otherwise specified, design strength shall be based on 28 day tests.
- D. Sampling and Testing: Prior to use, all concrete ingredients shall be sampled

1.05 SUBMITTALS

- A. Materials Report: Prior to start of concrete delivery the following shall be submitted by the Contractor to the Engineer for review:
  - 1. Recommended Suppliers and/or Sources of all ingredients for making concrete, including cement, water, fine and coarse aggregates and additives. (Item 1 APPENDIX 2)
  - 2. A Supplier Quality Inspection Plan to ensure continuing quality control of ingredients by periodic sampling, testing and reporting to the Engineer on the quality of materials being supplied. (Item 2 APPENDIX 2)
  - 3. All design mixes, using the "Standard Mix Design Presentation", APPENDIX 3, for each class of concrete, indicating that the concrete ingredients and proportions will result in a concrete mix meeting requirements specified. (Item 3 APPENDIX 2)
  - 4. The name and location of the test laboratory to be used by the Contractor's Concrete Supplier, as well as the proposed program, methods and details of plant, equipment and personnel to be used in testing ingredients, mix design and concrete samples. (Item 4 APPENDIX 2)

The Contractor shall present the mix design as a report with its recommendation to gain the Engineer approval prior to commencement of concreting work. This report shall compare the proposed mix design with specified requirements and shall be summarized on a form similar to that shown in APPENDIX 3.

- B. Hot Weather Concreting: A report shall be submitted for proposed methods for compliance with hot weather mixing and delivery requirements (Item 6 APPENDIX 2).
- C. Certificates:
  - 1. Submit with each mix design, laboratory test reports and mill or manufacturer's certificates attesting to conformance of compressive strength as required.

2. A certificate shall be submitted stating that each admixture used is identical in composition to the sample used for acceptance testing, and is compatible with all other material in the design mix. (Item 8 APPENDIX 2).

D. Delivery Tickets:

1. A delivery ticket from the Concrete Supplier for each load delivered to the job-site shall be submitted setting forth the following information:

- Contract Number
  - Date
  - Name of Purchaser
  - Registration Number of Delivery Truck
  - Driver's Name or Number
  - Class of Concrete
  - Slump Ordered
  - Air Content
  - Amount of Concrete in Truckload in Cubic Meters
  - Cement in Truckload in Kilograms (including additives)
  - Total Water in Batch in Liters (indicate also % of ice)
  - Admixture Type and Dosage
  - Type and Cement Used
  - Time Concrete Mixing Started (if Dry, Time Cement Added to Aggregates)
  - Temperature Specified (Maximum) and Temperature when leaving the plant (Actual)
  - \* - Temperature of Concrete (when Discharged for Placement)
  - \* - Time of Arrival at Job-Site
  - \* - Amount of Extra Water Added in liters (Extra water to be added at Job-Site only upon recommendation of the Contractor and with approval of the Engineer.)
  - \* - Time of Discharge at Job-Site
- \* To be completed by Contractor at Job Site.

2. Delivery tickets shall be retained by the Contractor for inspection at any time by the Engineer.

E. Test Reports: The Contractor shall obtain from its Concrete Supplier copies of the results of all tests which shall become part of the Contractor's Weekly Quality Control Report to the Engineer.

F. Summary of Submittals: APPENDIX 2 is the complete list and frequency of reports which the Contractor shall obtain from its Concrete Supplier.

1.06 HANDLING

Temperature Control: The Concrete supplier shall provide procedures and facilities to control or reduce the temperature of all materials used in the concrete mix during "hot weather" as defined by air temperature over 30 degree C.

PART 2: PRODUCTS

2.01 MATERIALS

- A. All goods and products covered by these specifications shall be procured, when available, from a local manufacturer or supplier. Procurement of all goods and products manufactured must be approved by the Engineer.
- B. Portland Cement: Portland Cement shall conform to ASTM C150, Type V cement or JIS R5210 unless otherwise indicated on the drawings.
- C. Admixtures and additives: Chemical admixtures are not to be used until the Supplier has verified their use in accordance with ASTM C494.
- D. Water: Water to be used for cooling and/or washing aggregates and for mixing and curing concrete shall be clean and free from injurious amounts of oil, acid, salt, alkali, organic matter or other deleterious substances.
- E. Fine Aggregate: Fine aggregate shall consist of natural sand, manufactured sand or a combination of the two, and shall be composed of clean, hard, durable spherical or cubical particles.
- F. Coarse Aggregate: Coarse aggregate shall consist of crushed or uncrushed gravel, crushed stone or a combination of the two, and shall be composed of clean, hard, uncoated particles.

The maximum size of coarse aggregate shall be limited to 25 mm. The Contractor shall be responsible for supervision of the supplier upon mixing of fine and coarse aggregate such that mixing work shall be carried out to meet requirements of compressive strength as specified in this specification.

PART 3: EXECUTION

Acceptance of Concrete:

The slump of delivered concrete shall be determined on site, and shall not exceed the working limit as directed by the Contractor's Quality Control Supervisor. The Contractor is to assess slump at job-site for acceptable.

workability. Where the slump is deemed inappropriate for acceptable workability, the Contractor's Quality Control Supervisor can authorize adding additional water to the mix to obtain acceptable workability.

Upon arrival of concrete at the place of deposition, the Contractor shall receive from the driver, prior to acceptance, a delivery ticket for the concrete. Reference 1.05D., herein for a listing of requirements. The Contractor shall verify if concrete, as received, meets the requirements of the specification. The Contractor shall complete the delivery ticket and fill in those items for which he is responsible.

APPENDIX 1

Class	Minimum Compressive Strength $\sigma_{ck}$ (kg/cm <sup>2</sup> )	Description
A	400 (480)	Cast-in-place concrete for prestressed concrete
B	300 (360)	Cast-in-place concrete for diaphragms
C	240 (290)	Cast-in-place concrete for R.C. girder, box culvert and viaduct (reinforced concrete)
D	210 (250)	Cast-in-place concrete for pier, abutment and retaining wall (reinforced concrete)
E	180 (220)	Cast-in-place concrete (plain concrete)
F	140 (170)	Leveling concrete

Note:  $\sigma_{ck}$  = Ultimate compressive strength of concrete as determined on a 15 cm diameters cylinder at the age of 28 days (as determined on a 15 cm cube).



APPENDIX 2

Reports Contractor is to obtain from concrete supplier and submit to the Engineer.

No.	TITLE	REPORT SUBMITTED	FREQUENCY OF REPORT
1	Sources of Materials	a) 31 days prior to delivery of concrete b) On apparent change	a) One time b) As required
2	Supplier Quality Inspection Plan	a) 31 days prior to delivery of concrete	a) One time
3	Mix Design for all Classes of Concrete (Reference APPENDIX 3)	a) 31 days prior to delivery of concrete b) When mix is re-designed for any purpose	a) One time b) As required
4	Name, Location, Equipment & Personnel of Test Laboratory to be used by Supplier (including Own Laboratory)	a) 31 days prior to delivery of concrete b) If changed	a) One time b) As required
5	Program, Methods and Details of Batching Plant & Equipment	a) 31 days prior to delivery of concrete	a) One time
6	Proposed Methods of Complying with Hot Weather Mixing and Delivery	a) 31 days prior to delivery of concrete	a) As required
7	Certificate for Cement from Manufacturer	a) 31 days prior to delivery of Concrete b) For each new delivery from Manufacturer	a) One time b) As required
8	Certificates for Admixtures from Manufacturer	a) 31 days prior to delivery of concrete b) If any change occurs	a) One time b) As required

No.	TITLE	REPORT SUBMITTED	FREQUENCY OF REPORT
9	Report on Plant Trial Mixes with 7 day & 28 day Test Results for all Classes of Concrete Required for the Work	a) 31 days prior to delivery of concrete b) If changed	a) One time b) As required
10	Report of the Following Tests on Fine and Aggregate:  1) Los Angeles Abrasion at 100 & 500 revolutions 2) Sieve Analysis 3) Clay, Silt & Dust (passing 75 micron) 4) Clay Lumps & Friable Particles 5) Water Absorption 6) Percentage of Sulphates(SO3) Chlorides (NaCl)	a) 31 days prior to delivery of concrete  b) During production of concrete	a) One time  b) Monthly (with independent check report bi-monthly)
11	Reports of the Following Tests on Water for Mixing Concrete, Washing and/or Cooling Aggregates and Curing:  1) Sulphates (as SO3) 2) Chlorides (as NaCl)	a) 31 day prior to delivery of concrete  b) During production of concrete	a) One time  b) Monthly (with independent check report bi-monthly)
12	Delivery Ticket	a) With delivery of each load of concrete	a) Each delivery
13	Calibration Tests, and adjustments made to Concrete Plant Equipment with Statement of accuracy of all measuring devices - for weekly	a) Submitted to contractor who shall also provide for inspection on request by the Engineer	a) Quarterly

CONCRETE

STANDARD MIX DESIGN PRESENTATION

Supplier and Class of Concrete :  
 Cement (Additive) Content and Type : (kg/m<sup>3</sup>)  
 Water - Cement Ratio :  
 Free Water : (litres/m<sup>3</sup>) or (kg/m<sup>3</sup>)  
 Specified Strength @ 28 days : (kg/cm<sup>2</sup>)  
 Current Mean Strength : (kg/cm<sup>2</sup>)  
 Current Standard Deviation : (kg/cm<sup>2</sup>)  
 Admixture Type :  
 Admixture Dosage : (litres/m<sup>3</sup>) or (kg/m<sup>3</sup>)  
 Slump @ 30 minutes/Slump @60 : (mm)/(mm)  
 minutes (in laboratory)  
 Air Content : (%)  
 Chlorides (as NaCl)\* : (%)  
 Sulphates (as SO<sub>3</sub>)\* : (%)  
 Method of Placement \*\* : Pump/Other  
 Combined Aggregate Grading :

Sieve						75
Size as applicable						Micron
% passing						
by washing						

Los Angeles Abration @ 500 revs/100 revs : (%)/(%)  
 Clay and Friable Particles : (%)  
 Valid Hot Weather Trial Mix Report : Yes/No  
 Attached \*\*

\* total in mix, expressed as a percentage by weight of cement.  
 \*\* encircle as appropriate.

END OF SECTION

022 - CAST-IN-PLACE CONCRETE

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## 022 - CAST-IN-PLACE CONCRETE

### PART 1: GENERAL

#### 1.01 DESCRIPTION

A. **Work Included:** This section covers the requirements for receiving, forming, placing, compacting, finishing, jointing, curing and all other work as required for cast-in-place concrete.

B. **Related Work Specified Elsewhere:**

Section	019	CONCRETE REINFORCEMENT
Section	021	PORTLAND CEMENT CONCRETE
Section	023	PRESTRESSED CONCRETE STRUCTURES

#### 1.02 APPLICABLE CODES AND STANDARDS

The Codes and Standards generally applicable to the Work of this Section are listed hereinafter.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
JIS	Japanese Industrial Standards
ASTM	American Society for Testing and Materials

#### 1.03 DESIGN CRITERIA

##### A. PORTLAND CEMENT CONCRETE MIXTURES:

1. Portland Cement Concrete shall be as specified in Section 021 PORTLAND CEMENT CONCRETE.
2. All concrete shall be made with ASTM C 150, Type V Cement or JIS A 5308 Ready-Mixed Concrete, unless shown otherwise on the drawings.
3. Concrete classes shall be identified by PJKA designation as shown in "PORTLAND CEMENT CONCRETE, APPENDIX 1, and the Class to be used shall be that shown in the specifications and on the drawings.

##### B. FORMWORK

1. Formwork shall be designed for the loads and lateral pressures as outlined in ACI 347, and for other loads as indicated on the drawings.
2. Maximum deflection of facing materials which reflect in concrete surfaces exposed to view shall be not greater 1/240 of the span between structural supports.

3. Forms shall be designed to have sufficient strength to carry the hydrostatic head of the concrete as a liquid without deflection tolerances exceeding those stated in ACI 347.
4. Where necessary to maintain the tolerances indicated, the formwork shall be cambered to compensate for anticipated deflections due to the weight and pressure of the fresh concrete, and also due to any other construction loads.
5. The surface of forms is to be designed to provide the correct finish, as specified in subsection 3.08 herein.

1.04 SUBMITTALS

- A. Materials Report: All submittals shall be made in accordance with "PORTLAND CEMENT CONCRETE" - Section 021.
- B. Hot Weather Concreting: A report shall be submitted for proposed methods for compliance with hot weather concreting including delivery, placement, curing and protection requirements. (See item 2 APPENDIX 3).
- C. Delivery Tickets:

1. A delivery ticket from the Concrete Supplier for each load delivered to the job-site shall be submitted setting forth the following information:

- Contract Number
- Date
- Name of Purchaser
- Registration Number of Delivery Truck
- Driver's Name or Number
- Class of Concrete
- Slump Ordered
- Air Content
- Amount of Concrete in Truckload in Cubic Meters
- Cement in Truckload in Kilograms (including additives)
- Total Water in Batch in Liters (indicate also % of ice when applicable)
- Admixture Type and Dosage
- Type of Cement Used
- Time Concrete Mixing Started (if Dry, Time Cement Added to Aggregates)
- Temperature Specified (Maximum) and Temperature when leaving the Plant (Actual)
- \* - Temperature of Concrete (when Discharged for Placement)
- \* - Time of Arrival at Job-Site
- \* - Time of Discharge at Job-Site

\* - Amount of Extra Water Added in Liters (Extra Water to be added at Job-Site only upon recommendation of the Contractor and with approval of PJKA.)

\* To be completed by Contractor at Job-Site.

2. Delivery tickets shall be retained by the Contractor for inspection at any time by the Engineer.

D. Reports for Inspection and Testing: During concreting operations the Contractor shall conduct inspection and testing, as described in Subsection 1.05 herein, and all Reports thereon shall become part of the Contractor's Weekly Quality Control Report in summary form.

E. Summary of Submittals:

1. APPENDIX 2 "PORTLAND CEMENT CONCRETE" - Section 021 is the complete list and frequency of Reports which the Contractor shall obtain from its Concrete supplier for submission to the the Engineer.

2. APPENDIX 3 is the listing and frequency of Reports which the Contractor shall submit during the course of the Work.

F. Working Drawings: The Contractor shall prepare working drawings for the following, and when requested, shall submit same to the Engineer.

1. Details of formwork system;
2. Method of form construction and erection;
3. Falsework and computations; and
4. Locations of form joints, form-ties and construction joints.

G. Schedules: The Contractor shall prepare working schedules for the following, and when requested, shall submit same to the Engineer.

1. Scheduled dates and rate of placing concrete for each item of work

1.05 QUALITY CONTROL

A. Quality Control Supervisor:

1. The Contractor shall have full responsibility for inspection. To carry on this function, the Contractor shall at all times have a quality Control Supervisor and one or more inspectors on-site who are charged with the specific responsibility of quality control.



2. During the placing of Concrete the Quality Control Supervisor shall provide the continuous inspection of delivered concrete.
3. The Quality Control Supervisor shall provide the following Testing:
  - a. At the point of placement provide for consistency measurements, such as slump, air content, temperature and, as required, cement content; all to be conducted in accordance with the Contractor's Quality Control Program.
  - b. One set of six test specimens from each 100 cubic meters, or fraction thereof, shall be provided for each class of concrete placed. Provide at least one set of test specimens for each class of concrete placed in each eight hour shift. Samples shall be secured in accordance with ASTM C 172. Extra sets of cylinders shall be taken by the Contractor as required.
  - c. The test specimens shall be cured in accordance with ASTM C 31, and tested in accordance with ASTM C 39.
  - d. The standard age of concrete for test is 28 days, but seven day tests may be used to predict probable 28 day strength, provided:
    - The relation between seven day and 28 day test strength is established, and
    - The 28 day test is subsequently performed for confirmation.

A failure rate of not more than 1 in 10 consecutive results in the field shall be considered acceptable, except that no concrete represented by a result which falls below 85% of the required 28 day strength shall be accepted unless in the opinion of the Engineer this is directly attributable to non-standard sampling or testing.
  - e. All concrete control tests shall be performed and certified by an authorized laboratory, the Contractor's choice of which shall have prior approval by the Engineer, based on the Contractor's report and recommendation.
4. The Quality Control Supervisor shall execute necessary provisions of the Contractor's Quality Control program, perform inspection procedures therein and

maintain reports and records for necessary inspection and testing including but not limited to those items listed herein below:

- a. Inspection, and approval of the concrete materials.
- b. Inspection and approval of excavation, formwork, reinforcing steel, shoring, falsework, bracing, supports, embedded item, joints, water-stop, etc.
- c. Inspection and approval of placement, consolidation and finishing operations.
- d. Inspection and approval of form removal operation.
- e. Inspection and approval of curing facilities.
- f. Inspection and approval of testing facilities.

Daily inspection reports and pour cards (as per APPENDIX 1) on all of the above shall be maintained by the Quality Control Supervisor.

5. The Quality Control Supervisor or his designate shall be authorized to:
  - a. Postpone concreting operations until outstanding requirements are corrected.
  - b. Reject materials or workmanship which do not conform to this Specification.
  - c. Prevent the use of equipment which could cause improper construction relative to this specification.
  - d. Stop any work which is not being done in accordance with this Specification.
  - e. Report within 24 hours and provide records to and as required by the Engineer upon discovery of non compliance.
6. Any concrete which is ultimately deemed by the Engineer not to comply with this specification shall be broken out and replaced.

B. Formwork Tolerances:

All formwork shall be constructed so that concrete surfaces comply with ACI 301, CHAPTER 4, and ACI 347, CHAPTER 2.

PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be procured, when available, from a local manufacturer or supplier. Procurement of all goods and products manufactured must be approved by the Engineer.
- B. Proprietary products considered by the Contractor to meet this specification shall be approved by the Engineer, based on the Contractor's report and recommendation before use in the permanent works.

2.02 MATERIALS (BASIC)

- A. Portland Cement: Cement to be used shall be in accordance with "PORTLAND CEMENT CONCRETE" - Section 021.
- B. Aggregates: Aggregates shall be in accordance with "PORTLAND CEMENT CONCRETE" - Section 021.
- C. Water: Water shall be in accordance with "PORTLAND CEMENT CONCRETE" - Section 021.
- D. Admixtures: Admixtures shall be in accordance with "PORTLAND CEMENT CONCRETE" - Section 021.
- E. Grout:
  - Premixed, Non-shrink, Non-metallic Grout: As shown on the Contract drawings.
  - Expansive Grout: As shown on the Contract drawings.

2.03 FORM MATERIALS

- A. The selection of materials suitable for formwork shall be made by the Contractor based on maximum quality consistent with the specified finishes and safety. ACI 347, CHAPTER 4 shall be used as a guideline, however, the tabulated information therein should not be interpreted to exclude the use of any other materials which can meet quality and safety requirements established for the finished Work.
- B. The use of proprietary forming systems is encouraged by the Engineer and should be used where possible.

2.04 CURING MATERIALS

- A. Impervious Sheeting: ASTM C 171
- B. Burlap: Cloth made of jute or kenaf conforming to AASHTO M 182 and weighing a minimum 0.29 kg/m<sup>2</sup>.

- C. Membrane Curing Compound: ASTM C 309, Type 1
- D. Any materials other than those above as deemed suitable by the Engineer at site.
- E. Water: As 2.02.C. above.

2.05 JOINT MATERIALS

- A. Joint Fillers: As shown on the Contract drawings.
- B. Joint Sealants: As shown on the Contract drawings.

2.06 MISCELLANEOUS MATERIALS

- A. Vapor Barrier: Polyethylene sheeting shall conform with ASTM E 154 and 200 micron thick as a minimum. Other similar material having a vapor permeability rating not exceeding 0.5 permeability as determined by ASTM E 96, Procedure E may be used.
- B. Chamfer Strips: Wood, polyvinyl chloride or neoprene.
- C. Anchoring Inserts: As shown on the Contract drawings.
- D. Form Release: Non-staining, non-reactive rust preventive, guaranteed to be compatible with subsequent surface applications to concrete.

PART 3: EXECUTION

3.01 FORMWORK

- A. Forms shall be used wherever necessary to confine the concrete during vibration and to shape it to the required lines. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall be maintained rigidly in position. The strength and rigidity of the forms shall be such that formed surfaces will conform to specification requirements relating to surface irregularities and tolerances for concrete construction. Forms shall be tight enough to prevent loss of mortar from the concrete.
- B. Chamfer Strips shall be placed in the corners of forms for exposed exterior corners so as to produce 20 mm beveled edges except where otherwise shown on the drawings.
- C. Forms for wall openings shall be constructed so as to facilitate loosening and removal.
- D. Uniformity of forming Material: Forms for F2 and F3 finishes shall be constructed so as to produce a uniform and consistent texture and pattern on the face of the concrete. Patches on forms for these surfaces will not be permitted. The form sheathing shall be placed so that all

horizontal form marks are continuous across the entire surface. If forms are constructed of lumber and are not paneled, the sheathing shall be staggered and then only at studs. The Contractor shall use one type of material for all F2 surfaces and one type of material for all F3 surfaces.

- E. Form Ties: Embedded ties for holding forms shall remain embedded and, except where F1 finish is permitted, shall terminate within the concrete approximately two diameters or twice the minimum dimension of the tie from the formed faces of the concrete. Ties shall be placed in a symmetrical pattern.
- F. Cleaning and Oiling of Forms: At the time the concrete is placed in the forms, the surfaces of the forms in contact with the concrete shall be free from encrustations of mortar, grout, or other foreign material. The surfaces of the forms to be in contact with the concrete shall be coated with an approved coating that will effectively prevent sticking and will not stain the concrete surfaces. The coating for wood forms shall consist of straight, refined, pale, paraffin mineral oil, or other approved coating; the coating for steel forms shall consist of refined mineral oil suitably compounded for the purpose; except that, forms for surfaces which are to be painted shall be coated with a material which is compatible with the paint system. Lubricating (machine) oils shall not be used.
- G. Forms for Sloped Surfaces: Forms for sloped surfaces shall be built so that the sheathing can be placed board-by-board immediately ahead of concrete placement so as to enable ready access for placement, vibration, inspection, and repair of the concrete. The sheathing shall also be built so that the boards can be removed, one by one from the bottom up, as soon as the concrete has attained sufficient stiffness to prevent sagging. Surfaces of construction joints and finished surfaces with slopes steeper than 5 (horizontal) to 1 (vertical) shall be formed as required herein.
- H. Forms for Curved Surfaces: The Contractor shall interpolate intermediate sections as necessary and shall construct the forms so that the curvature will be continuous between sections. Where necessary to meet requirements for curvature, the form lumber shall be built up of laminated splines cut to make tight, smooth form surfaces.

After the forms have been constructed, all surface imperfections shall be corrected, and all surface irregularities at matching faces of form material shall be dressed to the specified curvature.

3.02 PREPARATION FOR PLACING

- A. General: No concrete shall be placed until all formwork, embedded parts, steel reinforcement, foundation surfaces and joints involved in the placing have been approved, and until acceptable facilities have been provided and made ready for accomplishment of the work as specified. Record of this approval (Concrete Pour Card - See APPENDIX 1) shall be submitted to the Engineer by the Contractor before concreting commences.
- B. Concrete shall not be placed in water unless the method of depositing such concrete has been proposed and recommended by the Contractor and approved by the Engineer. Concrete shall not be placed in running water and shall not be subjected to the action of running water until after the concrete has hardened.
- C. All surfaces of embedded materials that have become encrusted with dried mortar and other debris shall be cleaned of all such debris before the surrounding concrete is placed.

Form Cleanout: Immediately before placing concrete, all surfaces upon or against which concrete is to be placed shall be clean and free from water, mud, debris, sand, wire, cigarette ends, etc.

- E. Rock surfaces, in addition to the foregoing requirements, shall be free from oil, coatings, and loose, or unsound rock fragments. Surfaces shall be cleaned by brooming, high velocity water jets, or other approved means as appropriate for the surface being prepared.

3.03 ACCEPTANCE OF CONCRETE

- A. Upon arrival of concrete at the place of deposition, the Contractor shall receive from the driver, prior to acceptance, a delivery ticket for the concrete. Reference 1.04 C., herein for a listing of requirements. The Contractor shall verify if concrete, as received, meets the requirements of this Specification. The Contractor shall complete the ticket and fill in those items for which he is responsible.
- B. The concrete shall be compacted in its final position within two (2) hours from the time of introduction of the cement into the aggregates, but in all cases at least ninety (90) minutes less than the certified initial set time of the cement.
- C. Temperature of concrete materials leaving the mixing plant should be such that at the time of actual placement the maximum temperature of the concrete does not exceed that specified for its placement.

- D. Extra water shall not be added without the Quality Control Supervisor's explicit permission and as permitted by the Contractor's approved Quality Control Program.

3.04 PLACING CONCRETE

Concrete generally shall be placed in accordance with ACI 301 and ACI 304 CHAPTER 5 and 6, unless shown otherwise in the Contract documents, or below, herein.

- A. Concrete shall not be placed until formwork, reinforcing and other embedded items have been inspected and found satisfactory, and when applicable, that hot weather precautions are taken.
- B. Water, debris, oil and all foreign materials shall be removed from the excavations and forms before concrete is deposited, except as provided for in Subsection 3.02 B.
- C. Where concrete is placed by pumping, the requirements of Table 3.04 C. shall apply;

Table 3.04 C.

Maximum Size Aggregate	Minimum I.D. of Pumphline
80 mm	180 mm
40 mm	150 mm
20 mm	100 mm

- D. Do not use any aluminum pipe or other conveying equipment containing aluminum that will be in contact with fresh concrete when conveying to point of placement.
- E. Pour card shall be signed by the Contractor's Quality Control Supervisor and delivered to the Engineer for signature prior to starting the pour (See APPENDIX 1).
- F. Concrete shall not be dropped through dense reinforcing steel which could cause segregation of the coarse aggregate. Employ spouts, or flexible drop chutes to avoid "nesting" of coarse aggregate.
- G. Concrete shall be placed and consolidated in horizontal layers which shall not exceed 400 mm in thickness. Concrete shall not be allowed to flow laterally a distance greater than 1.0 meters from point of deposit. All concrete shall be revibrated as long as the running internal vibrator will sink of its own weight.

H. Vibrating:

1. Concrete shall be consolidated by the use of vibrators in such number and power as to properly consolidate the concrete as shown in Table 3.04 H. 1. or as otherwise approved by the Engineer based on the Contractor's report and recommendation.

Table 3.04 H.

Maximum Size of Aggregate	Minimum O.D. Vibrator Head
80 mm	100 mm
40 mm	75 mm
20 mm	50 mm

2. Internal vibrators shall be capable of producing not less than 7,000 vibrations per minute.
3. Vibrators shall not be used to move or spread concrete horizontally.
4. Vibrators shall be operated in a near vertical position and allowing the vibrating head to penetrate the upper Layer under its own weight and to enter and vibrate the concrete in the upper portion of the underlying layer.
5. Standby vibrators and power sources shall be available during all concrete placement Work.

J. Special Considerations:

Placing in Hot Weather: Placement of concrete in hot weather shall be in accordance with recommended practice of ACI 305, unless otherwise specified herein. The temperature of concrete at the point of placement shall at all times be less than 30 degree.

- Any concrete which has reached a temperature greater than that specified herein shall not be used.
- Temperature of concrete shall be measured 50 mm below the surface immediately prior to placement in the forms.
- Reinforcing steel and forms shall be protected from direct sun rays. Reinforcing steel and forms shall be cooled off with fog misting immediately before concrete placing unless provision is made for night-time concreting.



- Concrete shall not be placed when the Work will be affected by wind-blown sand conditions.

### 3.05 SLAB ON GRADE

- A. Slab to be placed directly upon approved compacted sub-grade, where shown on the drawings. Vapor barriers shall not be used unless shown on the Contract drawings. When so specified place 75 mm below the elevation of the bottom of the slab and cover with 75 mm of damp sand (Sand to be as specified as fine aggregate in "PORTLAND CEMENT CONCRETE" - Section 021 ) and densely compacted.
- B. Place reinforcing steel and proceed in compliance to the following requirements:
  - 1. Concrete shall be placed continuously so that each unit of operation will be monolithic in construction.
  - 2. Construction Joints: Where shown on the Contract drawings and required.
  - 3. Expansion and Contraction Joints: As shown on the Contract drawings.
  - 4. Sealing: Concrete joints shall be filled with joint sealant except where floor covering is required.

### 3.06 CONCRETE JOINTS

- A. Construction Joints are hardened concrete surfaces to which fresh concrete is to adhere, and which have become so rigid that such fresh concrete cannot be made monolithic with the existing concrete by vibration. Construction joints shall be clean and damp, but not wet, before adjoining with fresh concrete. The joint cross-section area shall be kept to a minimum. Cleaning shall consist of the removal of all laitance, loose or defective concrete, coatings, sand, sealing compound, and/or other foreign material. Joints shall be wet-process sandblasted and washed thoroughly with air-water jets immediately before fresh concrete is placed.
- B. Expansion Joints shall be provided at the locations and in accordance with the details shown on the drawings. Formed surfaces for these joints shall be cleaned thoroughly of lumps of concrete or other foreign material by scraping, chipping, or other effective means.
- C. Watertight Joints shall be provided at the locations shown on the drawings. Unless shown otherwise, a polyvinyl-chloride type of a practical width for the application intended, shall be used. Install per manufacturers approved recommendations.

3.07 MISCELLANEOUS WORKS

- A. The setting of steel base plates to be as shown on the Contract drawings.
- B. When Miscellaneous bridge works such as shoe foundation mortar and anchoring are required on the top surface of piers, abutments and viaducts, hollows and pits shall be formed simultaneously with concrete placing work.

3.08 CONCRETE FINISHES

- A. General: The types of finishes and the requirements for finishing of concrete surfaces shall be as herein specified unless indicated otherwise on the drawings. Finishing of concrete surfaces shall be performed only by skilled workmen. Concrete surfaces will be inspected by the Contractor's Quality Control Supervisor when necessary to determine whether surface irregularities are within the limit hereinafter specified.

Surface irregularities are classified as "abrupt" or "gradual". Offsets caused by displaced or misplaced form sheathing or lining, form section, loose knots in forms or otherwise defective form lumber will be considered as abrupt irregularities, and will be tested by use of a template consisting of a straight-edge or the equivalent thereof for curved surfaces. The length of the template will be 1.5 meter for testing of formed surfaces, and 3 meters for testing of unformed surfaces.

B. Formed Finishes for Concrete:

- 1. Type F1. This finish is for surfaces against which backfill or further concrete will be placed. Formwork shall consist of sawn boards, sheet metal or any other suitable material which will prevent the loss of grout when the concrete is vibrated.
- 2. Type F2. This finish is for surfaces which are permanently exposed to view, but where the highest standard of finish is not required. Forms for providing a Type F2 finish shall be faced with wrought or finished boards with square edges arranged in a uniform pattern. Alternatively, plywood or metal panels may be used if they are free from defects likely to detract from the general appearance of the finished surface. Joints between the boards and panels shall be horizontal or vertical unless otherwise directed. This finish shall be such as to require no general filling of surface pitting; however fins, surface discolouration, or other minor defects shall be remedied by approved methods.

3. Type F3. This finish is for surfaces prominently exposed to view where good appearance and alignment are of special architectural importance.

To achieve this finish, which shall be free of board marks, the formwork shall be faced with plywood or equivalent material in large sheets. The sheets shall be arranged in an approved uniform pattern. Wherever possible, joints between sheets shall be arranged to coincide with architectural features, sills, window heads or changes in direction of the surface. All joints between panels shall be vertical or horizontal, unless otherwise directed. Suitable joints shall be provided between sheets. The joints shall be arranged and fitted so that no blemish or mark is imparted to the finished surfaces. Unfaced wrought boarding or standard steel panels will not be permitted for Type F3 finish. The use of internal metal ties shall not be allowed.

### 3.09 REMOVAL OF FORMS AND SHORING

- A. Removal of Forms. Forms shall be removed carefully so as to prevent damage to the concrete. Wooden wedges only shall be used between the concrete surface and the form where force is necessary to separate the form from the concrete. Metal wedges, bars, or tools shall not be used for this purpose. Any concrete damaged in the process of removing the forms shall be repaired in accordance with the provisions of this Specification.
- B. All non-supporting forms shall be loosened and removed during regular working hours, and as soon as the concrete has hardened sufficiently to prevent damage from form removal. All falsework and forms supporting concrete beams and slabs, or other members subject to direct bending stress, shall not be removed or released until job-cured test cylinders are tested to show a strength of not less than 80% of the current mean 28 day strength. Any required repairs or required finish treatment shall be performed as soon as the forms have been removed, and shall then be followed immediately by the specified curing.
- C. In no case shall forms be stripped in less than the following minimum periods.
- |                                                            |         |
|------------------------------------------------------------|---------|
| 1. Walls                                                   | 12 hr   |
| 2. Columns                                                 | 12 hr   |
| 3. Sides of beams and girders                              | 12 hr   |
| 4. Pan joist forms:                                        |         |
| - 750 mm wide or less                                      | 3 days  |
| - over 750 mm wide                                         | 4 days  |
| 5. Arch centers                                            | 14 days |
| 6. Joist, beam or girder soffits:                          |         |
| - Under 3 meters clear span<br>between structural supports | 7 days  |

- 3 meters to 6 meters clear span  
between structural supports 14 days
- 7. One-way slabs:
  - Under 3 meters clear span  
between structural supports 4 days
  - 3 meters to 6 meters clear span  
between structural supports 7 days
  - Over 6 meters clear span  
between structural supports 10 days

D. No construction loads exceeding the combination of super-imposed dead load plus specified live load shall be supported on an unshored portion of the structure under construction, unless analysis indicates adequate strength to support such additional loads.

E. Forms shall be removed in such manner so as not to impair safety and serviceability of the structure. All concrete to be exposed by form removal shall have sufficient strength so as not to be damaged thereby.

### 3.10 REPAIR OF CONCRETE

A. Concrete shall not be repaired if in the opinion of the Engineer it has insufficient integrity to meet specified requirements, however, if deemed repairable repairs of imperfections in formed concrete shall be started not more than 24 hours after removal of forms and shall be completed without delay. Fins shall be neatly removed from exposed surfaces. Concrete that is damaged or honeycombed shall be removed down to sound concrete by chipping. In areas where wall and columns are prominently exposed to view, an initial cut of 25 mm in depth shall be made by a diamond or carborundum saw around the honeycombed area. The inside of this area shall be chipped to sound concrete and replaced with concrete. Concrete replacement shall be used where any reinforcing bar is exposed. Concrete shall be removed to a depth of 40 mm behind the exposed reinforcing bar. The area shall then be cleaned, dampened prior to forming and placing. Application shall be in accordance with the manufacturer's written instructions. All fillings shall be bonded tightly to the surface of the holes, shall be sound and free from shrinkage cracks and hollow sounding areas, and shall match the adjacent concrete in color and texture after the fillings have been cured and dried.

Concrete Replacement: Concrete replacement shall be made with 25 mm maximum size aggregate concrete, with the same mix design and 28 day strength as the original concrete. Immediately prior to replacement, the concrete repair mix shall be remixed to reduce subsequent shrinkage.

### 3.11 CURING

- A. All concrete shall be cured with concrete mix quality water in accordance with recommendations of ACI 308 and ACI 305, and as specified herein, immediately after finishing flatwork or removal of formwork. One of the following methods shall be used to retain and supply water to curing concrete.
1. Ponding (or immersion): Ponding shall comprise of at least 40 mm depth of water contained over the entire surface of the concrete for a period of at least 7 days. The water shall be replenished when less than 50 mm depth to assure the 40 mm minimum required.
  2. Wet Burlap Curing: Wet Burlap Curing shall comprise of at least two layers of damp burlap laid tight against the pre-soaked concrete surface for a period of at least 7 days. The burlap shall be kept uniformly damp, so that lighter patches of drier burlap are not evident, by a clock-valve controlled soil soaker hose supplied with water at adequate pressure.
  3. Membrane Curing: Membrane curing shall be preceded by saturation of concrete with sprayed water. This water shall be sealed against the concrete by application of a white (reflective) curing membrane in strict accordance with manufacturer's instructions.
- B. Any alternative methods of curing shall be previously approved by the Engineer before use, and shall be based on the Contractors' report and recommendation.
- C. The choice of methods employed shall be combined as required to provide adequate thermal protection.
- D. The curing methods for hot weather shall be part of the hot weather concrete report (see Subsection 1.04 B.) where due consideration shall be given for an extended curing period and for an increase of thermal protection.

<b>CONCRETE POUR CARD</b> (on Contractors Headed Paper)		POUR CARD NUMBER																				
CONTRACTOR																						
A	LOCATION OF POUR	DESCRIPTION OF POUR																				
	TYPE AND SOURCE OF CONCRETE	AMOUNT OF CONCRETE																				
B	CHECKLIST	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: center;">CONTRACTOR INSPECTION APPROVALS</th> </tr> <tr> <th style="width: 80%;">INSPECTED AND APPROVED</th> <th style="width: 20%;">DATE</th> </tr> <tr> <td style="padding: 2px;">LINE AND GRADE</td> <td></td> </tr> <tr> <td style="padding: 2px;">FORMWORK AND WATERSTOP</td> <td></td> </tr> <tr> <td style="padding: 2px;">REINFORCEMENT</td> <td></td> </tr> <tr> <td style="padding: 2px;">EMBEDDED METAL</td> <td></td> </tr> <tr> <td style="padding: 2px;">EMBEDDED PIPE</td> <td></td> </tr> <tr> <td style="padding: 2px;">EMBEDDED CONDUIT</td> <td></td> </tr> <tr> <td style="padding: 2px;">PREPARATION OF ABUTTING CONCRETE</td> <td></td> </tr> <tr> <td style="padding: 2px;">WATERPROOFING</td> <td></td> </tr> </table>	CONTRACTOR INSPECTION APPROVALS		INSPECTED AND APPROVED	DATE	LINE AND GRADE		FORMWORK AND WATERSTOP		REINFORCEMENT		EMBEDDED METAL		EMBEDDED PIPE		EMBEDDED CONDUIT		PREPARATION OF ABUTTING CONCRETE		WATERPROOFING	
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EMBEDDED PIPE																						
EMBEDDED CONDUIT																						
PREPARATION OF ABUTTING CONCRETE																						
WATERPROOFING																						
PROPOSE AND RECOMMENDED:      WORK MAY PROCEED:																						
_____ CONTRACTOR SIGNATURE/DATA/TIME		_____ P J K A /DATE/TIME																				

REMARKS:

CONCRETESTANDARD MIX DESIGN PRESENTATION

Supplier and Class of Concrete :  
 Cement (Additive) Content and Type : (kg/m3)  
 Water - Cement Ratio :  
 Free Water : (liters/m3) or (kg/m3)  
 Specified Strength @ 28 days : (kg/cm2)  
 Current Mean Strength : (kg/cm2)  
 Current Standard Deviation : (kg/cm2)  
 Admixture Type :  
 Admixture Dosage : (liters/m3) or (kg/m3)  
 Slump @ 30 minutes/Slump @60 : (mm)/(mm)  
 minutes (in laboratory)  
 Air Content : (%)  
 Chlorides (as NaCl)\* : (%)  
 Sulphates (as SO3)\* : (%)  
 Method of Placement \*\* : Pump/Other  
 Combined Aggregate Grading :

Sieve						75
Size as applicable						Micron
% passing						
by washing						

Los Angeles Abrasion @ 500 revs/100 revs : (%)/(%)  
 Clay and Friable Particles : (%)  
 Valid Hot Weather Trial Mix Report : Yes/No  
 Attached

- 
- \* total in mix, expressed as a percentage by weight of cement.  
 \*\* encircle as appropriate.

END OF SECTION

023 - PRESTRESSED CONCRETE STRUCTURES

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## 023 - PRESTRESSED CONCRETE STRUCTURES

### PART 1: GENERAL

#### 1.01 DESCRIPTION

Work Included: This work shall consist of construction of cast-in-place prestressed concrete members and structures, and the prestressed portions of concrete structures indicated of a composite type, including incidental construction and appurtenant items as indicated or specified; all constructed at the locations and to the lines, grades, sizes, details, designs and extent indicated on the drawings, or as approved, and in accordance with these specifications.

Prestressed concrete structures may comprise prestressed concrete members in various different types and/or configurations; and the work shall include only such member types as are indicated on the drawings for this Contract.

Prestressed concrete structures may comprise composite type construction consisting of both prestressed and non-prestressed elements. When such is required, the portions of the work not to be prestressed shall be in accordance with the requirements provided for elsewhere under these technical specifications; such as standard reinforcing steel and concrete, and other incidental items such as miscellaneous bridgework; as may be shown on the drawings for this Contract.

Piles, abutments or other structures as may be indicated adjacent to or for the support of prestressed concrete members shall be as provided for elsewhere under these technical specifications.

This work shall also include the determining and providing the quantities of materials, equipment and other items as are needed to complete the work required; and for providing the work necessary to lay out the work in the field; all as based upon the configurations and extent indicated on the drawings by typical layouts and in accordance with these specifications.

This work shall also include formulation and submittal of a complete prestress construction program, in both outline and comprehensive forms; and providing qualified key supervisory personnel; all as specified.

Cast-in-place prestressed concrete work shall cover and include supplying and delivering concrete in accordance with the requirements of Tech. Spec. entitled PORTLAND CEMENT CONCRETE together with compliance with all provisions specified herein; and shall cover and include prestressing strand and/or wire, joint sealing and filler, metal frames and gratings, metal or concrete covers and other accessories or detail work as shown or specified.

This work shall include the furnishing of all services, labor, materials, tools, equipment, and incidentals, and for providing or performing all of the work involved in prestressed concrete structures work as shown or specified.

#### Prestressing Work:

The prestressing work shall include providing all tensioning tendons and related items necessary for the particular prestressing systems indicated, specified or approved to be utilized for the work, including but not necessarily limited to grouting of ducts, and all tensioning equipment and operations. Prestressing tendons may be in various different types or sizes. The work shall include only such types or sizes as are indicated on the drawings, or as otherwise in accordance with these specifications, and the prestressing program as approved.

This work shall also include the determining and providing the methods and means for carrying out the prestressing work, based upon the work as indicated, and in accordance with these specifications and the prestressing program as proposed by the Contractor and approved by the Engineer.

#### Terms and Definitions:

As used under these specifications or on the drawings, the term member shall mean:

- For cast-in-place prestressed concrete, the concrete placed in the work which is to be prestressed in situ.
- Prestressed member shall mean to include or cover the above as the case or context may require.

As used on the drawings or herein, the term tendon shall mean the wires, strands or bars of the types required, or as approved, to be utilized for the particular prestressing work involved.

Unless specifically stated otherwise, the term prestress(ed)(ing) shall mean to be post-tensioning, as the case or context may require.

1.02 PREREQUISITE QUALIFICATIONS

Production, transport and erection of prestressed concrete members shall only be performed by a company or organization specializing in such services; that is regularly providing items of work of the types required under this Contract; who can demonstrate as having sufficient and adequate plant, equipment, personnel and experience; and who can present evidence of having previously and successfully completed similar or comparable types of work.

These requirements shall not preclude the Contractor from performing all or any portion of the prestressed concrete work provided that the Contractor can demonstrate as having at least equal qualifications for the work he proposes to carry out.

1.03 REFERENCES

Related work in Other Sections:

Section	019	CONCRETE REINFORCEMENT
Section	022	CAST-IN-PLACE CONCRETE

1.04 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

AASHTO          American Association of State Highway and  
Transportation Officials

ASTM            American Society of Testing and Materials

JIS             Japanese Industrial Standards

1.05 SUBMITTALS

GENERAL:

The Contractor shall submit to the Engineer for review the items listed herein. Submittals shall meet the requirements and be in quantities specified in the reference documents. When not otherwise indicated, each submittal item shall be in duplicate copies or sets.

BEFORE COMMENCING WORK:

1. Work Program as specified elsewhere herein.
2. Submittals respective to reinforcing steel and concrete shall be in accordance with the requirements of the referenced specifications.

1.06 WORK PROGRAM

The Contractor shall be responsible for carrying out this work such as to meet all requirements of the Contract Documents. The equipment and procedures intended for the execution of this work shall be included as part of the Contractor's Work Program as required under Tech. Spec. entitled GENERAL SPECIFICATION, subsection entitled WORK PROGRAM REQUIREMENTS.

The program shall be submitted in sufficient time such that the program can be reviewed not later than following the date of award of the Contract.

The program for this work shall be based upon the drawings and these specifications, and such that the work will satisfy all conditions and requirements shown or specified.

The prestress construction program shall be outlined and set forth in sufficient detail such that all aspects can be clearly identified and readily evaluated, including but not necessarily limited to:

- Types of prestressed members or construction involved.
- Prestressing systems proposed to be utilized for each type of prestressed member or construction.
- Methods, equipment and facilities proposed to be utilized for the production, transport, erection, prestressing, and grouting for each type of prestressed work.

Material specifications for each type, kind or size of prestressing tendons, anchoring devices, ducts, grout and associated materials and accessory items.

The prestress system program for each type of work shall include, in part:

- Descriptive, pictorial and/or other data pertaining to the particular prestress system proposed, including identification of equipment involved.
- Complete working drawings of the respective systems and uses or locations, and all layouts and details therefor.
- Substantiation calculation; prepared and signed by a duly qualified professional engineer.
- Sequence of stressing, working stresses, and anchoring stresses.
- Any proposed additions or rearrangement of prestress or reinforcing steel, and any proposed modification of any item sizes or concrete dimensions different from those indicated.

The program outline shall identify the on-site and off-site areas proposed to be utilized for the production, stocking and storage of the prestressed concrete members until placed in the work.

The program shall include all necessary coordination such that execution and completion of the prestress construction work will not result in delay in completion of all Contract work as required by the Construction Schedule approved for this Contract.

The program shall also identify the Contractor's key fabrication and installation personnel intended to be assigned for overseeing the respective phases of the work, together with experience records for each; and, similarly shall set forth the name of any subcontractor intended to be employed respective to the prestress work, together with a company experience outline and identification of key personnel involved and their individual experience.

The program shall further include a proposed confirmation or check sheet system whereby the various phases and steps during the fabrication and prestressing work can be controlled and verified in an orderly written and recorded form as the work proceeded.

1.07 SUPERVISION

The Contractor shall be responsible for providing such key personnel as are necessary for continuously overseeing the prestress construction work such as to assure compliance with the program and these specifications.

Personnel for such supervisory work shall be sufficiently well qualified by training and experience. Personnel for overseeing fabrication, prestressing and installation work may be one and the same provided that they are sufficiently qualified in each such phase of work.

The Contractor shall require that the supervisory personnel be responsible for utilizing and recording the confirmation records or check sheets, and test records. Such records shall be maintained in an orderly manner; and, as the respective parts or portions of the work are completed from time to time, copies of such records shall be delivered to the Engineer for information.

The assigned and approved supervisory personnel shall not be changed unless duly qualified personnel are provided in lieu thereof and are approved in advance by the Engineer.

PART 2: PRODUCTS

2.01 PORTLAND CEMENT CONCRETE

Concrete for prestressed concrete work shall be in accordance with the designations and requirements specified under Tech. Spec. entitled PORTLAND CEMENT CONCRETE. Each class required for the work shall be used for the locations indicated on the drawings, as specified herein.

With respect to the above referenced specification, under Appendix 1 - CONCRETE MIX DESIGN STANDARD PARAMETERS, Concrete - Classification shall meet the following requirements:

<u>Class</u>	<u>ck (kg/cm<sup>2</sup>)</u>	<u>Description</u>
A	400 (480)	Girder
B	300 (360)	Diaphragms

Items indicated to be concrete but otherwise not designated shall be of the class of concrete the same as required for similar items or locations, unless otherwise approved.

The Contractor shall be responsible for determination of compliance with material requirements, design of mix formulations, and controlling the manufacture and delivery all such that the concrete used in the work meets the requirements of these specifications.

## 2.02 PRESTRESSING STEEL AND ACCESSORIES

### General:

Prestressing steel shall be in the types, sizes, and locations as indicated on the drawings; and each type shall conform to the applicable requirements specified herein and the following or equivalent standards as approved:

- High-tensile Seven-wire Strand: JIS G3536 or ASTM A 416.
- High-tensile Wire: AASHTO M 204 or ASTM A 421 or JIS G 3536.
- High-tensile Steel Bars: ASTM A 722 or JIS G 3109.

All prestressing reinforcement in each individual prestressed concrete member shall be of the same grade, unless otherwise indicated or approved.

All prestressing reinforcement shall be free from detrimental dirt, mill scale, rust, paint, grease, oil or other foreign substance, fins or tears. Slight rusting which discolors the metal may exist, but all loose mill scale and scaley rust shall be removed. Brushing to clean blue metal will not be required. There shall be no evident of piping or visual flaw in the test specimen or on the sheared ends of the bars.

### Post-tensioning Bars:

Bars for pos-tensioning work shall be manufactured from high-tensile steel bars, and shall be plain (not deformed).

Bars shall be cold stretched to not less than 80 percent of the minimum ultimate strength, and stress relieved after cold stretching; after which, based upon the nominal bar cross section area, the physical properties shall conform to the requirements as follows:

<u>Characteristic</u>	<u>Requirement</u>
- Minimum Ultimate Tensile Strength	10,500 kg/cm <sup>2</sup>
- Minimum Yield Strength at 0.2% Offset:	9,000 kg/cm <sup>2</sup>
- Minimum Elongation after Rupture in 20 Diameters:	4 percent
- Minimum Reduction of Area After Rupture	20 percent

The physical characteristics of bars shall not exceed the tolerances as follows:

- Out of Round: 0.029 cm (0.0115 inch)
- Diameter: Plus 0.076 cm, minus 0.025 cm (Plus 0.030 inch, minus 0.010 inch)
- Straightness: 0.60 cm in any 150 cm (0.25 inch in any 60 inches of bar length)

#### Prestressing Wires:

Wires shall be straightened when necessary to produce equal stress in all wires or wire groups or parallel lay cables that are to be stressed simultaneously or when necessary to insure proper positioning in the duct enclosures.

#### Anchoring Devices:

All post tensioned prestressing steel shall be secured at the ends by means of anchoring devices as indicated, or if not shown as proposed and approved. Anchoring devices of materials or designs not approved shall not be used for the work.

Anchoring device shall mean to be a unit or assembly of components which both secures the ends of the prestressing steel and distributes the prestress loads or stresses into the supporting concrete.



Anchoring devices shall be a permanent type, of a type designed and regularly produced for the purposes intended, and shall have a successful history proven by actual use for work of the type required under this Contract.

Anchoring devices shall have a material tensile strength at least equal to that of the prestressing steel to be secured, and shall be capable of holding the prestressing steel at a load of not less than 95 percent of the specified ultimate tensile strength of the prestressing steel.

The load from the anchoring device shall be distributed by such means that will effectively distribute the load to the concrete. Such devices shall conform to the following requirements:

- The final unit compressive stress on the concrete directly underneath the plate or assemblies shall not exceed 290 kg/cm<sup>2</sup>.
- Bending stresses in the plates or assemblies induced by the pull of the prestressing steel shall not exceed the yield point of the material or cause visible distortion in the anchorage plate when 100 percent of the specified ultimate tensile strength of the tendons is applied.

Should the Contractor elect to furnish an anchoring device of a type which is sufficiently large and which is used in conjunction with a steel grillage embedded in the concrete that effectively distributes the compressive stresses to the concrete, the steel distribution plates or assemblies may be omitted, except shall be only as approved in advance of use for the work.

### PART 3: EXECUTION

#### 3.01 GENERAL REQUIREMENTS

##### Production and Storage:

The Contractor shall be responsible for determining, providing and/or developing such land areas and relevant facilities as are necessary for the proper production and adequate stocking and storage of the prestressed concrete members until placed in the work. Locations within the limits of work or limits of the project may be utilized for such purpose when assigned or approved by the Engineer.

Areas or locations not approved shall not be utilized for this work.

Pursuant to the above, whether on-site or off-site, the Contractor shall be responsible for providing and carrying out all clearing and grubbing, grading, leveling, stabilizing, compacting, temporary surface courses or otherwise as necessary to properly, efficiently and safely produce and care for the members involved.

Temporary construction, supports, bracing or otherwise shall be provided and utilized such that all prestressed concrete members are safe and secure against physical damage during any storage period.

Upon completion of the work, unless otherwise permitted or approved, all temporary work, surfacing, debris, or otherwise shall be removed and disposed of outside the limits of the project, and the areas so utilized shall be restored to essentially the same condition as they existed prior to commencement of the work.

#### Handling and Erection:

The Contractor shall be responsible for determining, providing and utilizing all necessary handling, transport and erection equipment and facilities such that all prestressed concrete members are safe and secure against physical damage during any such handling, transport or erection periods.

The Contractor shall be responsible for determining and utilizing all such ways, means, manner and methods of handling, moving, storing, transporting, erecting, placing and securing all prestressed concrete members such as to preclude any damage resulting from such operations or otherwise would render the members in a condition not in compliance with these specifications.

#### Maintenance of Traffic:

When this work is required to be constructed or erected above or in the vicinity of roadways over which traffic is required to be maintained, the work shall be arranged such that said traffic can be maintained and permitted to pass in a safe manner at all times. When by necessity the work operations require interruption of said traffic flow, the work and schedule therefore shall be set forth in advance and submitted for review by the Engineer; and when such work is undertaken, the Contractor shall provide all such means as are necessary for traffic control and traffic safety, and all in accordance with the requirements specified elsewhere under the Contract Documents.

#### Falsework and Formwork:

The Contractor shall be responsible for determining and providing all falsework and formwork necessary for the production, construction, erection, and subsequent removal thereof, and/or otherwise as required to complete the work under this Contract in accordance with the drawings and these specifications.

Unless otherwise shown, specified or approved, the requirements for falsework, formwork and formwork removal respective to this work shall be essentially the same as specified under Tech. Spec. entitled CAST-IN-PLACE CONCRETE.

Falsework and formwork shall be designed and arranged such that the prestress construction work can be carried out as required, and otherwise such that it will not unnecessarily interfere with the various work operations.

Falsework and formwork shall be provided such that the prestress construction work is adequately and safely supported at all times; such that the members can lift free from the falsework and formwork when the required tensioning is carried out and such that after the tensioning the falsework and formwork will remain in a stable and safe condition until deliberately and completely dismantled.

#### Embedded Items:

This work shall include installation of items as indicated or required to be embedded in prestressed concrete work but which are otherwise specified elsewhere under the technical specifications.

Similarly, the Contractor shall be responsible for determining, proposing, providing and installing such embedded devices or items as are necessary for carrying out the prestress construction work but which are not otherwise indicated or specified.

#### Miscellaneous Work:

The Contractor shall be responsible for furnishing and installing or otherwise providing or incorporating all miscellaneous items and details necessary to fully carry out and complete the work as required.

### Installation Conditions:

The Contractor shall be responsible for determining and verifying the condition and accuracy of all bearing surfaces, inserts, anchorage or other items pertaining to this work; and shall be responsible for the correction of any deficiencies or defects thereof; all such that the entire work is constructed as intended under this Contract.

3.02

### PROTECTION OF PRESTRESS REINFORCING STEEL

Except as specified otherwise herein, reinforcing steel shall be protected in accordance with the requirements under Tech. Spec. entitled CONCRETE REINFORCEMENT Article entitled PRODUCT HANDLING.

All steel used for prestressed concrete construction shall be protected against damage - from the time of manufacture to the time of encasement in concrete or grout - in accordance with the requirements under the above referenced specification and as specified herein.

Damage shall mean physical or mechanical damage or that due to rust, corrosion or otherwise, excepting only the slight rusting permitted as specified for post-tensioning bars.

Prestressing steel which is damaged shall not be used in the work.

All prestressing system materials and component parts shall be factory prepared, tropicalized, packaged, crated or otherwise such as to preclude damage during shipping and handling, including any transshipment, or as may result while in transit or storage over an extended period of time.

Any corrosion inhibitors used in shipping containers or on the prestressing steel which results in any damage to the steel or concrete, or which reduces the bond strength of the steel to the concrete, shall not be permitted.

Shipping containers shall be clearly marked with a statement that the package contains high-strength prestressing steel, and the type of corrosion inhibitor used, including the date packaged.

Prestressing steel for post-tensioning which is installed in members prior to placing and curing of the concrete, shall be continuously protected against rust or other corrosion, until grouted, by means of a corrosion inhibitor placed in the ducts or applied to the steel in the duct.

All water used for flushing ducts shall not oxidize the tendons and ducts.

All compressed air used to blow out ducts shall be oil free.

### 3.03 DUCTS FOR PRESTRESSING STEEL

#### Materials and Accessories:

Ducts for enclosing prestressing steel shall be rigid galvanized ferrous metal, or other type regularly used for the purpose and as proposed and approved. Ducts not approved shall not be used for the work.

Ducts, including all related accessories, shall have sufficient strength to maintain their shape and alignment through out the various work operations after they are placed into position; shall be free from unintended holes and otherwise in an undamaged condition when the work is carried out; and shall be clean and free from grease, oil, paint, dirt, excessive rust or otherwise in any condition which would be detrimental to the work.

Ducts shall be in single length units where available material lengths permit such as to eliminate intermediate joints where possible, otherwise in a combination of lengths and arrangement such as to minimize the number of joints needed for any one duct run.

Metallic duct may have either welded or interlocked seams, and such seams need not be galvanized, or ducts may be seamless type. Regardless of material type, duct seams shall be such as to preclude passage of water or cement matrix into the duct when they are encased in concrete.

Joints between sections of duct shall be positive metallic connections of a type which precludes any angular changes at the joint. Joints shall be of a type which precludes passage of water or cement matrix, or otherwise wrapped using a suitable waterproof, pressure-sensitive tape such as to achieve the same results.

Transition couplings from ducts to anchoring devices shall be metallic, and need not be galvanized.

For tendons consisting of two or more wires, bars, or strands, the duct area shall be at least twice the net area of the prestressing steel.

For tendons consisting of a single wire, bar or strand, the duct diameter shall be at least 6.4 mm larger than the nominal diameter of the wire, bar or strand.

All ducts or anchoring devices shall be provided with pipes or other suitable means necessary for the proper injection of the grout and venting of air, and shall be in arrangements and provided with connections, valves, caps or otherwise such that the grouting can be carried out in accordance with the requirements of these specifications. For continuous type structures, vents shall be provided at all intermediate support locations.

Pipes for vents and drains shall be not less than nominal 12.5 mm diameter size, and may be either metallic or plastic.

Connections to ducts shall be metallic, unless otherwise approved.

Any plastic components shall be non-reactive with the Concrete and grout, and shall not promote or enhance any corrosion of the prestressing steel; and shall be free from water soluble chlorides.

#### Installation:

Ducts for enclosing prestressing steel shall be accurately shaped and placed to conform with the details and locations indicated on the drawings, or otherwise as approved.

Ducts shall be shaped free from crimping, flattening or other deformations not intended to be incorporated. All ducts and related accessories shall be set and secured into position such as to preclude displacement or movement during subsequent work operations; and all ducts shall be supported and secured by such means and at such intervals as to preclude floatation when the encasing concrete is placed.

All connections for or to the ducts shall be structurally and mechanically sound and tight against leakage, and wrapped with tape as required.

After installation, all duct and other openings shall be maintained closed or covered such as to preclude intrusion of water, dirt or other foreign matter or debris.

When the prestressing steel is to be installed after the encasing concrete is placed, the Contractor shall carry out such tests and by such approved means as are necessary to satisfactorily demonstrate that all ducts are positively

free from any obstructions or other adverse conditions that would preclude providing the work as required; and all immediately prior to the time the enclosing concrete is placed.

Immediately following completion of concrete placement for each prestressed concrete member, all tendon ducts therein shall be cleaned out using oil free air applied under sufficient pressure to break up and remove any cement matrix or water which may have entered the ducts.

### 3.04 CONCRETE WORK

#### General:

Unless otherwise specified or approved, concrete for this work shall be furnished, handled, placed and consolidated in accordance with the applicable requirements specified under Tech. Spec. entitled PORTLAND CEMENT CONCRETE, and CAST-IN-PLACE CONCRETE.

When placed for the work, concrete shall be within the temperature limits of 30 degrees C.

Consolidation of concrete shall be carried out such as to preclude movement or disturbance of any tendons, reinforcement of other embedded items.

#### Construction Joints:

Unless otherwise specified or approved, construction joints shall be treated in accordance with the requirements under Tech. Spec. entitled CONSTRUCTION JOINT TREATMENTS of CAST-IN-PLACE CONCRETE, as applicable.

Unless otherwise indicated, the Contractor shall be responsible for determining and proposing the locations, types and details for construction joints. Joints not shown or approved shall not be permitted.

Construction Joints between precast members and cast-in-place concrete need not be roughened and mortar treated as required under the Article referenced above, but such adjoining surfaces shall be clean and free from laitance, dirt or loose particles before they are joined.

#### Curing - General:

The Contractor shall be responsible for determining and proposing the means and methods necessary to properly cure the concrete. Curing procedures not approved shall not be utilized for the work.

3.05 REINFORCING WORK

Standard Reinforcement:

Reinforcing steelwork and materials not otherwise required to be tensioned shall conform to the requirements specified under the referenced Tech. Spec. entitled CONCRETE REINFORCEMENT.

Verification:

The Contractor shall be responsible for establishing and utilizing an inspection, verification and check list procedure to be carried out immediately prior to any concrete placements at the respective locations; all such as to ensure that all reinforcement is provided as required when the work is complete.

This procedure shall be determined and proposed by the Contractor, and an outline thereof submitted as part of the prestress construction program.

3.06 TENSIONING WORK

Tensioning of prestressing steel shall not commence until tests of the specimen concrete cylinders indicate a compressive strength not less than as follows:

- Main Members, Class A Concrete: 350 kg/cm<sup>2</sup>
- Secondary Members, Class B Concrete: 260 kg/cm<sup>2</sup>

Specimen cylinders shall be prepared using the same concrete and cured by the same procedure as that utilized for the production of the respective concrete member.

Tensioning stress transfer and related operations shall be carried out by the means, procedures and sequences in accordance with the prestress construction program as approved.

Cast-in-place concrete shall not be post-tensioned until the compressive strength of said place concrete has reached the above specified strength at the time of tensioning.

All side forms for girders shall be removed before post-tensioning. The falsework supporting the superstructure shall not be removed nor released until a minimum of 48 hours have elapsed after grouting of the post-tension tendons nor until all other conditions of the specifications have been met.



Prior to post-tensioning any member, the Contractor shall demonstrate and verify by such means as are necessary to ensure that the prestressing steel is free and unbonded in the duct; or, if the prestressing steel has not yet been placed, that all ducts are unobstructed.

Unless otherwise specified or shown on the drawings, the average working stress in the prestressing steel shall not exceed 55 percent of the specified minimum ultimate tensile strength of the prestressing steel. The maximum temporary tensile stress (jacking stress) in prestressing steel shall not exceed 80 percent of the specified minimum ultimate tensile strength of the prestressing steel. The prestressing steel shall be anchored at stressed (initial stress) that will result in the ultimate retention of working forces, but in no case shall the initial stress exceed 70 percent of the specified minimum ultimate tensile strength of the prestressing steel.

Working force and working stress shall be considered as the force and stress remaining in the prestressing steel after all losses, including creep and shrinkage of concrete, elastic compression of concrete, creep of steel, losses in post-tensioned prestressing steel due to sequence of stressing, friction and take up of anchorages, and all other losses peculiar to the method or system of prestressing have taken place or have been provided for.

Losses of prestress shall be determined in accordance with the requirements specified under AASHTO Standard Specifications for Highway Bridges, Article 1.6.7.

Prestressing tendons in main beam of simple span post-tensioned members shall be tensioned by jacking at both ends simultaneously.

The tensioning process as applied to post-tensioned members shall be so conducted that tension being applied and the elongation of the prestressing steel may be measured at all times. A record shall be prepared and maintained of gauge pressures and elongations for all tensioning work, and copies thereof shall be submitted to the Engineer for information, and from time to time as the work progresses.

3.07

## PRESTRESSED CONCRETE MEMBERS

### General:

Unless otherwise indicated or specified, all cast-in-place and precast prestressed concrete members constructed or placed in the work shall comply with the applicable requirements specified under the Tech. Spec. entitled CAST-IN-PLACE CONCRETE.

Minor or superficial damage or surface irregularities resulting from construction of other work operations shall be repaired in accordance with the requirements referenced above, except that the Contractor shall be responsible for determining and proposing in advance the specific materials and procedures intended to be utilized for such work. Means or manner of carrying out repairs which are not approved shall not be utilized for the work.

Prestressed concrete members shall be free from construction joints, or seams not shown or approved or otherwise in any condition whereby the concrete is not monolithic and continuous throughout the member.

Upon completion of the work, prestressed concrete members shall be shown complete, structurally sound, and free from chips, cracks, stains, discoloration or other irregularities, defects or damage; or otherwise shall be repaired to an acceptable condition as approved, or shall replace with like members which are in compliance with these specifications.

### Fabrication tolerances:

Prestressed concrete members, and the constituent parts and components specified or indicated, shall be constructed and completed within the fabrication tolerances - plus or minus, unless otherwise indicated - as follows:

- Member Length of Width: 5.0 mm.
- Depth of Member: Plus 3.0 mm, minus zero.
- Position of Void Forms: 5.0 mm
- Position of Tendons -
  - a) For Section 200 mm or Less in Thickness: 3.0 mm
  - b) Elsewhere: 5.0 mm.

### Erection tolerances:

Prestressed concrete members shall be constructed or erected within the erection tolerances as follows:

- Differential Elevation of Top Surfaces of Adjacent Members: 12.0 mm, maximum.
- Gap Between Adjacent Members: 10.0 mm, maximum.

### 3.08 GROUT AND GROUTING

#### General:

The requirements herein shall apply to all prestressed concrete work, unless a method is otherwise indicated or proposed and approved which does not require the work to be grouted.

After the tendons for each member have been stressed and anchored, the space occupied by the tendons shall be completely filled with grout to meet the requirements of these specifications, and in accordance with the prestress program as approved.

Grouting shall be by such means and materials that will provide permanent protection of the prestressing steel and will develop full and complete bond between the steel and concrete.

#### Grout:

Grout shall be a non-shrink or moderately expansive type. Any grout which exhibits any shrinkage characteristics shall not be used in the work.

Grout shall be a suitable mixture of Portland Cement and water, and any specific admixture(s) as may be proposed and approved. Constituent materials shall conform to the applicable requirements under the referenced Tech. Spec. entitled PORTLAND CEMENT CONCRETE and as specified herein.

Admixtures for grout shall be at the option of the Contractor to determine and propose. Admixtures shall not contain any chemical or substance that may have harmful effect on the prestressing steel or cement. Admixtures shall only be used in accordance with the manufacturer's instructions as approved.

Grout used in the work shall be in the proportions determined and proposed by the Contractor, based upon the characteristic and property requirements as follows:

- Compressive Strength, 28 Days: 200 kg/cm<sup>2</sup> minimum.

The Contractor shall provide and carry out such trial grout mixes and testing thereof as necessary to supply grout for the work which complies with the requirement of these specifications. Grout mixes not approved shall not be used for the work.

Unless otherwise approved, grout shall be prepared by the standard procedure of introducing water first into the mixer, followed by cement and admixture.

When used in the work, grout shall be in a thoroughly blended and uniform condition, free from loss of expansive properties of the admixture, and within a temperature not exceeding 30 degrees C; all such that the grout will properly hydrate and produce the results in the completed work as intended under these specifications.

Grout not in compliance with these specifications, or otherwise than as approved, or which is not placed in the work within 45 minutes after the time of initial blending of water and cement, shall not be used and shall be removed and disposed of outside the limits of the project.

Addition as of water or other materials not in accordance with the approved grout mix proportions shall not be permitted.

#### Equipment

Grout shall be mixed and pumped using equipment particularly designed and produced for these specific purposes. Equipment not approved shall not be utilized for the work.

All equipment shall be motor powered, and designed and equipped with seals and other devices such as to preclude intrusion of grease, oil, water or other substances not intended to be mixed into the grout.

The entire mixing and delivery system shall be of sufficient size and capacity such that, under normal conditions, the largest tendon duct in the work can be completely grouted in not more than 20 minutes.

Mixing equipment shall be capable of continuously mixing and agitating the grout until passed on to the grout pump, and shall be provided with suitable devices such that both solid and liquid ingredient materials can be accurately measured in accordance with the approved grout proportions.

The equipment shall include a standby flushing system capable of developing a pumping pressure of not less than 17.5 kg/cm<sup>2</sup> and of sufficient capacity to flush out any partially grouted ducts.

The equipment shall be arranged and operated such as to preclude intrusion of air bubbles or pockets not intended to be included, and at all times up to and including the time when the grout is injected into the duct.

The equipment shall be equipped and so arranged that the grout passed through a screening device just prior to its entry into the pump. The screen shall have clear openings not larger than 2.0 mm, and shall be readily accessible for inspection and cleaning.

The grout pump shall be a positive displacement type, unless otherwise approved; and shall be capable of grouting at a pressure of at least 7.0 kg/cm<sup>2</sup>.

The grout conveying system shall be provided with a pressure gauge having a full-scale reading of not more than 21.0 kg/cm<sup>2</sup>, and located at a suitable point between the pump outlet and duct inlet.

Grout injection pipes shall be fitted with positive mechanical shutoff valves. Vent and ejection pipes shall be fitted with valves, caps, or other devices capable of withstanding the pumping pressures. Valves and caps shall not be removed or opened until the grout has set.

Leakage of grout through the tendon anchorage assemblies shall be prevented by positive mechanical means.

#### Ambient Temperature Conditions:

When hot or windy weather conditions would contribute to rapid stiffening of the grout, the grout shall be cooled by approved methods or otherwise maintained cool and as necessary to preclude the development of any blockages during the pumping operations as may result from the premature stiffening of the grout.

#### Grouting:

All ducts shall be clean and free of water and deleterious materials that would impair bonding of the grout or interfere with grouting procedures.

All ducts shall be flushed with flushing water as specified, and the water shall be blown out using oil-free air just before starting the grouting; and all grout

injection and high point vent openings shall be open when the grouting is started; all such that there is no restriction in the outflow of air or inflow of grout.

Grout shall be injected continuously under pressure and from the low point of the duct and injection system, and the grout shall be allowed to flow out from the first vent after the inlet pipe until residual flushing water or entrapped air has been removed, at which time the vent shall be capped or otherwise closed. Remaining vents shall be closed in sequence in the same manner.

The pumping pressure at the tendon duct inlet shall not exceed 17 kg/cm<sup>2</sup>.

When the one-way flow of grout cannot be maintained under pressure less than above, the grouting work shall be stopped, and the injected grout shall be flushed out of the duct with water until it is essentially free from grout residue.

At the completion of the grouting, and when all other vents or openings are closed, the grouting pressure at the injection point shall be raised to not less than 7.0 kg/cm<sup>2</sup> and maintained for at least 10 seconds, after which the injection port shall be immediately closed while maintaining this pressure.

All injection and vent ports shall be maintained closed and undisturbed until the grout has set.

### 3.09 TESTING GROUT FLOWABILITY

The flowability of each batch of grout to be used in the work for filling prestressing ducts shall be determined to meet the specified requirements for efflux or flow by the method specified herein; except shall not be applicable when using grout which contains a thixotropic additive, if permitted.

A comparable method or methods may be proposed for determining grout flowability provided that like results are attained and is approved in advance by the Engineer.

The tests shall be carried out with sufficient care and expertise such that the test readings are accurate and reliable.

One set of two separate tests are required for each separate batch of grout to be used for the work, and shall be carried out before the respective grout is actually used in the work.

### Apparatus and Test Samples!

Apparatus for testing grout flowability shall consist of the following:

- Flow Cone: Per Figure 1, herein, entitled CROSS SECTION OF GROUT TEST FLOW CONE.
- Stop Watch: With a least reading of not more than two-tenths (0.2) of a second.
- Water for Calibrating Flow Cone: 1,725 ml, plus or minus one ml; measured using a standard calibrated laboratory type beaker.
- Grout Samples: Two separate portions, each in a quantity sufficient to fill the flow cone as specified, and each obtained from the same batch but just prior to the time each test is actually to be made.

The flow cone shall be firmly mounted or supported and located such that the grout level line is water level and free from vibration during calibration and testing, and shall be maintained clean and washed free from grout residue immediately following each individual efflux test.

The flow cone shall be calibrated by closing the discharge tube by placing the finger over the lower end, filling the cone with the gaging water, and setting the point of the point gage precisely at the water surface level.

#### Test Procedure:

One minute before testing the grout, moisten the flow cone interior by filling with fresh water similar to the calibration procedure, then allow the water to drain from the cone.

When all free running water has drained from the cone, close the discharge tube by placing the finger over the lower end, and introduce the grout until the top surface is level and just touching the point gage point. Set the stop watch at zero. Start the stop watch and remove the finger simultaneously. Stop the watch at the first break in the continuous flow of grout from the discharge tube.

The indicated stop watch time shall be the efflux of the grout sample.

When the flow cone free from grout residue, and repeat this entire procedure for the second portion of grout to be tested.

Records and Evaluation:

Appropriate records of flowability tests shall be maintained to record the information as specified, and copies thereof shall be furnished the same as specified under Article herein entitled SUPERVISION.

Record information shall include grout batch identification and mix composition, location and time of placement, grout mix and local ambient temperatures, efflux time for each test and average of tests for each grout batch, and other information or comments regarding the physical characteristics or the samples used.

Efflux and average times shall be given to the nearest two tenths (0.2) second.

The average time of the first set of two tests for each batch of grout shall not be less than 11.0 seconds; otherwise, the batch shall be considered as not in compliance, and shall be immediately rejected and not used in the work.

Retempering with water or addition of any other material to the batch to force compliance or otherwise shall not be permitted.

END OF SECTION



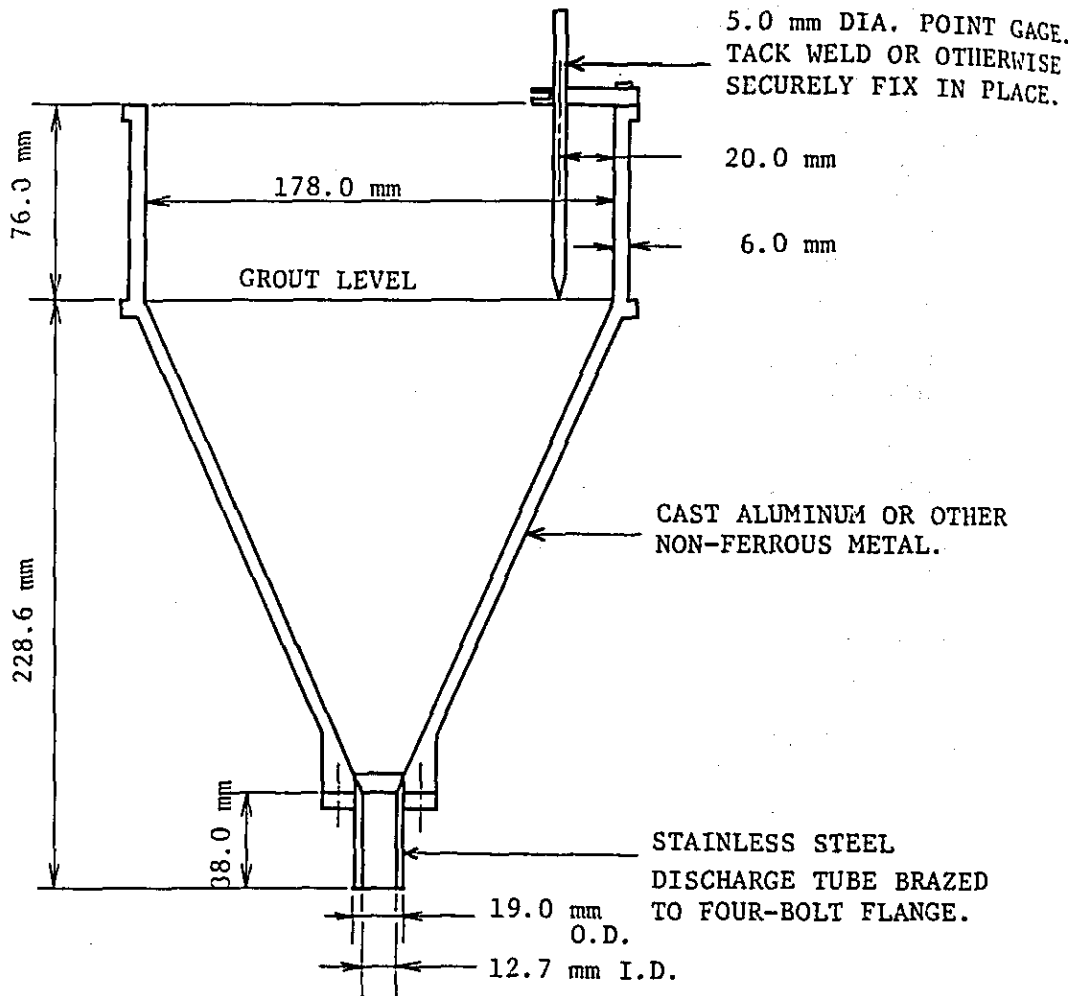


Figure 1.  
CROSS SECTION OF GROUT TEST FLOW CONE  
Scale: 1/3 (Approximately)

024 - FINISHING OF THE WORK

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## 024 - FINISHING OF THE WORK

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section sets forth provisions pertaining to:

- Cleanup after construction.
- Cleanliness of the Work upon completion.
- Condition of workmanship upon completion.
- Conditions prerequisite to completion inspections.

The Contractor shall furnish all labor, materials, tools, and equipment required to complete the work.

Procedures relevant to operating demonstrations, completion inspections and like matters shall be as established in cooperation with the Engineer, and as are otherwise provided for under the Contract Documents.

#### 1.02 GENERAL CIVIL WORK AREAS

All areas within the limits of the work shall be trimmed and shaped to the finished cross section to produce smooth surfaces and slopes, and uniform cross sections. In the case of a graded area without surfacing or pavement, the entire area shall be trimmed and shaped to uniform cross sections and slopes.

Stockpiling of material on finished pavements and drifting of material across pavements will not be permitted. The finished pavement shall be cleaned free from all dirt and foreign material.

Slopes of embankments, excavations, road approaches, or crossings, ditches, channel changes, and material sites within or adjacent to the limits of work shall be trimmed and finished to the lines, grades and tolerances shown or specified. Ditches and channels within or adjacent to the limits of work shall be cleared of debris and obstructions. Slopes of gutters shall be trimmed to the required grade and cross section. All sewers, culverts and other drainage facilities, and pipes and conduits, and their appurtenant structures constructed under the Contract shall be cleaned out. Excess earth, debris, or other waste material adjacent to culvert headwalls and endwalls, bridge ends, poles, posts, and trimmed and left in a neat and orderly condition. All stones, roots and other waste material exposed on slopes, which are liable to become loosened, shall be removed and disposed of. All materials and debris resulting from clearing and grubbing operations not

previously removed shall be disposed of. All loose rock larger than 6cm in maximum dimension shall be removed from the finished grades and disposed of.

All weeds and other objectionable growths shall be removed and disposed of from areas which were previously cleared and grubbed by the Contractor.

All materials resulting from the above specified operations shall be disposed of outside the limits of work and at locations the same as provided for disposal of clearing and grubbing materials.

The entire area within the limits of work shall be left in a neat and presentable condition.

1.03 FINAL CLEANING OF BUILDING SITES

Thoroughly clean up entire building site areas and put into neat, acceptable condition.

Remove all construction waste and unused materials, dunnage, loose rock and stones, weeds, roots, and all debris of any description resulting from the work.

Hose down and scrub where necessary all new pavement and walks, and adjacent existing pavement and walks as necessary.

1.04 FINAL CLEANING OF BUILDINGS

Contractor shall retain established janitorial service, or provide other like or equivalent services, for final cleaning and polishing of finish hardware, bright and anodized metal finishes, glass, mirrors, plumbing fixtures, equipment, cabinets and other items or facilities.

Include and provide all sweeping, brushing, dusting, vacuuming, dry and wet mopping, polishing, buffing and other operations, including supplies and equipment required, necessary to leave all work in immaculate condition ready for immediate occupancy and use.

Include all exposed surfaces, sills, recesses, corners, cabinet interior and like areas exposed or accessible.

Remove protective tapes, wrappings, labels and other temporary coverings not required to remain.

Wash and buff resilient flooring. Do not wax unless specified.

Cleanup roofs and decks as necessary.

1.05 CLEANING EQUIPMENT AND MATERIALS

Cleaning equipment, solutions, agents, solvents, waxes or other materials shall be only as approved by manufacturers or suppliers of materials installed, where so provided; otherwise per methods proposed and approved in advance of the work.

1.06 CONDITION OF WORKMANSHIP

The criteria given herein in general and shall be supportive of and to, not in lieu of, any other or more restrictive tolerances, limitations or requirements under the various sections of the technical specifications.

Planes of straight surfaces shall be flat and true to established lines, grades or levels; floors, ceilings, and soffits level; walls, corners and vertical returns plumb; sloping surfaces uniformly pitched or battered; corner intersections true to straightedge lines.

Repeating members shall be uniformly, accurately spaced. Solid, tubular or like running members shall be straight, level or plumb as required; free from twists and winds; and with axes true to established planes or lines.

Frames and unit assemblies shall be square, level, plumb, true to established planes or lines; all joints accurately formed, securely joined and neatly fit.

Layouts for brick, block tile, and like unit materials shall be symmetrical about floor, wall or ceiling centerlines, or as shown; positioned such that necessary cut units at perimeter edges are not less than one-half natural unit width, except as particularly shown or specified otherwise.

Fixed parts or members shall be secured tight in place, free from distortions, squeaks, rattles.

Finishes shall be free from bubbles, streaks, peeling, pits or other irregularities, except where rough materials are required.

Finish surfaces shall be free from dirt, grease, mastics, finger prints, scratches, dents, cracks, stains, chips or other damage or undesirable effects or conditions.

1.07 QUIETNESS OF OPERATION

Equipment and devices shall operate smoothly, quietly and free from vibration. Properly adjust, repair, and balance as necessary, or replace where producing objectionable noise or vibration. Provide additional brackets, bracing,

etc., to prevent objectionable noise or vibration. All systems shall operate free from unnecessary hum, surge or rapid cycling.

Doors, panels, operable hardware and various operative devices shall be installed, adjusted and serviced as necessary for operating free from bind, squeak, vibration and other objectionable conditions.

1.08 CONDITIONS PREREQUISITE TO COMPLETION INSPECTIONS

Cleanup and cleaning operations complete.

Temporary facilities and utilities properly disconnected and removed.

Systems, equipment and devices properly adjusted, serviced, tested and fully operable.

Equipment instructions and identification labeling complete.

Materials and finishes neat, clean and undamaged; accessory parts and items securely attached.

Broken or damaged work repaired or replaced as required.

Spare parts delivered and stored as required.

Test reports and other required documentation assembled and delivered to the Engineer.

Operation and Maintenance Manuals, and Warrantees, assembled and delivered to the Engineer.

Written notice of readiness for completion inspection filed with the Engineer.

Written notice submitted by the Contractor requesting any total or partial completion Inspection shall mean that the Contractor has:

- Inspected and checked all work installed;
- Compared all work with the drawings, specifications, and submittals as approved;
- And, conformed that all conditions, provisions and requirements of Contract Documents have been fulfilled, other than any maintenance and incidental procedures necessarily to follow.

END OF SECTION

025 - SIGNALLING CHANGE-OVER WORK

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## 025 - SIGNALING CHANGE-OVER WORK

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the general requirements for change-over work consisting of modification, fabrication, installation, replacing and removal of the existing signaling system provided at the Jakarta Kota Station and adjacent Jayakarta Signal Station to be newly constructed on the Central Line of Indonesian State Railways. The Contractor shall furnish all labor, materials, equipment and tools to complete the work.

#### 1.02 DETAIL TECHNICAL REQUIREMENT

The Contractor shall be responsible for close coordination with relevant Divisions or Section of PJKA organization specifically in regard to train operations such that change-over work will not impair the train operations, otherwise interference to the train operations shall be limited to the minimum.

The Contractor shall prepare necessary information and data in an orderly compilation of construction schedule, outline of the work, limited operation time of signaling system involved, preparatory arrangement for the work, proper assignment of the workers, communication methods during the work and whatever nature as may be required and submit to the Engineer for review.

Prior to commencement of the work, the Contractor shall be responsible for instruction of information and data as specified to all the workmen for strict compliance such that the work can be satisfactorily completed.

The care shall be exercised by the Contractor to preclude damage to the existing facilities, equipment and materials during the work for the purpose of re-use of the equipment as stated.

### PART 2: PRODUCTS

#### 2.01 GENERAL

Products as required under the work shall be, where available, procured from a local manufacturer or supplier.

Proposed products and materials shall be subject to approval by the Engineer.



## 2.02 SIGNAL WIRES AND SUPPORTING STRUCTURE

Characteristics and ratings of signal wires and supporting structures as may additionally be required under this work shall be in compliance with the products and materials as used in the existing signaling system.

## 2.03 CONCRETE FOUNDATIONS

Concrete for foundations of the signal wires and supporting structures shall be in accordance with Section 021 Portland Cement Concrete, Class E.

## PART 3: EXECUTION

### 3.01 GENERAL

The work shall be limited to change-over of the existing signal equipment to the locations as directed by the Engineer.

The work shall be carried out in the following manner after the approval has been obtained from the Engineer.

- a. Prior to preparatory work for construction of piers of viaducts over the tracks of the Western Line, a semaphore signal, the distant signal "Om", and signal wires including supporting structures thereof shall be relocated to the locations so as not to interfere the civil work and area out of the construction clearance.

Installation of concrete foundation of the signal and supporting structures of the signal wires shall conform to Section 022, Cast-in-Place Concrete.

- b. Semaphore signals, the home signal "L" for the Tanjung Priok Line and "M" for the Eastern Line, and signal wires thereof shall be relocated to adequate locations where sufficient visibility can be secured for the train drivers to identify the signals as indicated.

Installation of concrete foundation as required shall conform to Section 022, Cast-in-Place Concrete.

- c. The semaphore signal "Hm", the distant signal for the Central Line, and signal wires and their supporting structures including concrete foundations shall be removed following the installation of a color light signal at Jayakarta Signal Station.

### 3.02 FINISHING OF THE WORK

Finishing of the work shall be in accordance with Section 024, Finishing of the Work.

END OF SECTION

026 - TRACK REMOVAL WORK

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## 026 - TRACK REMOVAL WORK

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the general requirement for removal work of the existing tracks installed at the location as shown on the drawings.

The Contractor shall furnish all labor, materials, equipment and tools required to complete the work.

#### 1.02 DETAIL TECHNICAL REQUIREMENT

The Contractor shall be responsible for close coordination with relevant Divisions or Section of PJKA organization, specifically in regard to train operations such that the train operations will not be impaired by the performance of the work, otherwise interference to the train operations shall be limited to the minimum.

The Contractor shall prepare and submit to the Engineer for review and approval the necessary information and data in an orderly compilation of work schedule, outline of the work, preparatory arrangement for the work, proper assignment of the workers, communication methods during the performance of the work and other means whatever nature as may be required.

The materials derived from the removal work shall be collected and sorted at the location directed by the Engineer for the purpose of re-use of the materials.

### PART 2: PRODUCTS

(Not Applicable)

### PART 3: EXECUTION

#### 3.01 GENERAL

The work shall be limited to removal of the existing tracks at the locations as directed by the Engineer.

The work shall be carried out in the following manner after the approval has been obtained from the Engineer.

- a. Prior to commencement of the work, any type of barriers such as movable fences or other means whatever nature suitable for the work shall be provided in order to secure the sufficient space for the work along the tracks to be removed.

- b. The work shall be orderly and safely executed in such a manner by assigning an adequate number of watchers at the site, keeping close observation for the passage of trains and warning the workers so as not to be endangered by accident.
- c. When the work is required during the night, the Contractor shall obtain the approval from the Engineer prior to commencement of the work.

3.02 FINISHING OF THE WORK

- a. The remaining ballast materials at the site after completion of removal of track materials shall be leveled and trimmed to the lines and grades as required.
- b. Finishing of the other work shall be in accordance with Section 024, FINISHING OF THE WORK.

END OF SECTION

027 - TRACK SHIFTING WORK

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## 027 - TRACK SHIFTING WORK

### PART 1: GENERAL

#### 1.01 DESCRIPTION

This section covers the general requirement for shifting work of the existing tracks at the location as shown on the drawings. The work shall consist of clearing and grading of the ground, spreading and compacting ballast materials, shifting the track panels and re-alignment of the track.

The Contractor shall furnish all labor, materials, equipment and tools required to complete the work.

#### 1.02 REFERENCE

Related Work in Other Section

Section	208	BALLAST
Section	209	TRACK LAYING WORK

#### 1.03 DETAIL TECHNICAL REQUIREMENTS

The Contractor shall be responsible for close coordination with relevant Divisions or Sections or PJKA organization, specifically in regard to train operations such that the train operations will not be impaired by the performance of the work, otherwise interference to the train operations shall be limited to the minimum.

The Contractor shall prepare and submit to the Engineer for review and approval the necessary information and data in an orderly compilation of work schedule, outline of the work, preparatory arrangement for the work, proper assignment of the workers, communication methods during the performance of the work and other means whatever nature as may be required.

### PART 2: PRODUCTS

#### 2.01 GENERAL

Products required under the work shall be, in principle, furnished by the Owner as specified in GENERAL SPECIFICATION, Section, Owner furnished Materials.

#### 2.02 BALLAST

Ballast materials required for the work shall be in accordance with Section 208 BALLAST.

PART 3: EXECUTION

3.01 GENERAL

The work shall be limited to shifting of the existing tracks at the locations as directed by the Engineer.

The work shall be carried out in the following manner after the approval has been obtained from the Engineer.

- a. Shifting of tracks shall be limited to the extent within 2.0 m from the original location.
- b. Lower ballast shall be formed in accordance with Section 209, TRACK LAYING WORK.
- c. Upper ballast shall be formed in accordance with Section 209, TRACK LAYING WORK.
- d. Re-alignment of the track after completion of shifting shall be performed in accordance with Section 209, TRACK LAYING WORK.

The care shall specifically be exercised for track gauge, level, surface and lines to maintain ordinary train operation.

- e. Rail joint work with newly installed track shall be in accordance with Section 209, TRACK LAYING WORK.
- f. The Contractor shall exercise the care to preclude damage to the existing equipment and track materials during performance of the work.

3.02 FINISHING OF THE WORK

Finishing of the work shall be in accordance with Section 024, FINISHING OF THE WORK.

END OF SECTION

101 - LANDSCAPING

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101 - LANDSCAPING

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## 101 - LANDSCAPING

### PART 1: GENERAL

#### 1.01 DESCRIPTION

- A. Work Included: This work shall include the installation of plant material in planting pits and beds, placing of crushed stone under drainage and rock mulch in locations as shown on the drawings and as specified.
- B. Provide all labor, materials, equipment, services and transportation required to complete all planting work.
- C. Related Work Under Other Sections:  

Section	007	FILLING, GRADING AND EMBANKMENT CONSTRUCTION
---------	-----	-------------------------------------------------
- D. Conditions of the Contract as indexed, apply to this Section.
- E. Examine all other sections of the specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- F. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.
- G. See drawings for locations and details.

#### 1.02 SUBMITTALS

- A. Samples of all materials shall be submitted for inspection and acceptance upon the Engineer's request.
- B. Provide samples for testing as required by the Engineer.

#### 1.03 GUARANTEE PERIOD

- A. All plants shall be guaranteed for not less than two (2) full years from time of provisional acceptance.
- B. At the end of this period, any plant that is missing, dead, not true to name or size as specified, or not in satisfactory growth, as determined by the Engineer, shall be replaced. In case of any question regarding the condition and satisfactory establishment of a rejected plant, the Engineer may allow such a plant to remain through another complete planting season at which time the rejected plant, if found to be dead, in an unhealthy or badly impaired condition, shall be replaced at once. Replacement of a plant will not be required more than once.

- C. All replacements shall be plants of the same kind and size as specified in the plant list. They shall be furnished and planted as specified herein. The cost of replacement shall be done at no additional expense to the Engineers except where it can be definitely shown that loss resulted from the Engineer's failure to maintain planting and irrigation as instructed.

1.04 FINAL INSPECTION AND FINAL ACCEPTANCE

- A. At the end of the guarantee period, inspection will be made by the Engineer upon written request submitted at least ten (10) days before the anticipated date.
- B. After all necessary corrective work has been completed the Engineer will certify in writing the final acceptance of the planting.

PART 2: PRODUCTS

2.01 MATERIALS

A. TOPSOIL:

1. Topsoil used for planting at grade and for other soil mixtures shall be natural, fertile, non-alkaline sand mix, typical of cultivated topsoils of the locality. Topsoil shall be taken from a well-drained arable site, shall be reasonably free of stones, clods, sticks, roots or other objectionable extraneous matter or debris and shall contain no toxic materials.
2. Prior to placing topsoil or mixing topsoil into other soil mixtures, topsoil shall be treated with an organic amendment (manure). Spread topsoil to a depth of 30 cm and mix in manure at rate of 0.5 cubic meter manure to nine (9) square meters topsoil. No topsoil shall be delivered in a muddy condition.

B. FERTILIZER:

1. Fertilizer shall be a complete fertilizer, part of the elements of which are derived from organic sources.
2. Percentages of nitrogen, phosphorus and potash shall be based on laboratory test recommendations as approved by the Engineer.
3. Fertilizer shall be delivered, mixed as specified, in standard size bags showing weight, analysis and name of manufacturer. Store in a weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.

C. SOIL MATERIALS:

1. Manure: Shall be screened steer manure from corral-fed cattle. It shall be aged a minimum of six months and be free from noxious weeds, straw and other objectionable materials and chemicals.
2. Peat Moss: shall be coarse brown sphagnum peat, free of woody materials and of mineral matter such as sulphur and iron and shall have a pH value between 4 and 5. Deliver air dry. Substitution for local peat may be used, provided it is approved by the Engineer.
3. Perlite: Shall be chemically inert, sterile horticultural, premium quality perlite, as approved by the Engineer.

2.02 SOIL MIXTURE FOR PLANTS

A. PLANTING SOIL:

1. Planting soil will be 'sweet' sand, non alkaline with low saline content and coarse intextur as defined by the USDA Soil Classification. The planting soil mixture will be as follows with percentages expressed as percent by volume:

75% MIN - - 85% MAX	Coarse Sand
5% MIN - - 10% MAX	Peat Moss
5% MIN - - 10% MAX	Organic Material
5% MIN - - 10% MAX	Perlite

2. The coarse sand will have a pH range of 6.0 to 7.5. The EC (Electrical Conductivity) will not exceed 3.0 milliohm per centimeter at 25 degree centigrade. The SAR (Sodium Absorption Ratio) will not exceed 6.0.
3. Samples of the soil proposed for use as planting soil will be analyzed by an approved Laboratory. The Laboratory report will be submitted by the Contractor and approved, before any soil is brought to the job-site. The report will recommend amendments to rectify any deficiencies. These recommendations will be followed by the Contractor at no additional expense to the Engineer. The Irish peat moss will have a pH range from 3.7 to 5.5. The peat moss is helpful in bringing the pH of the soil mixture down. The organic material may be a combination of various organic materials. Organic manure will be fermented; Sewage sludge will be processed; saw dust, wood chips, bark or other wood by-products will be nitrogen stabilized; other plant by-products and garbage will be composted. Commercial organic material may be used. Other expanded soil conditioners such as vermiculite, expanded mica and organic resin foam may be substituted for perlite.

4. Slow release agricultural fertilized tablets shall be placed in the plant pits at the time of planting.
5. Planting pits shall be two and one-half times greater in diameter than the rootball, and one and one-half times deeper than rootball depth.
6. After settlement, plant crowns shall be flush with soil grade. Gravel mulch shall be applied.
7. All trees, except palms, shall be double-staked. Large palms shall be stabilized with guy wire as required.

2.03 ACCESSORY MATERIALS

1. Stakes: For supporting trees shall be of sound wood uniform in size, reasonably free of knots, and capable of standing in the ground at least two (2) years. Stakes for supporting small trees, under 3 m tall, shall be 5 cm<sup>2</sup> and not less than 2.5 m in length.
2. Wire: For tree bracing and guying shall be pliable 12 to 14 gauge (2.8 mm to 2.0 mm) galvanized soft steel wire.
3. Ground Anchors: Sizes shall be in accordance with use required.
4. Hose: Shall be two-ply fibre-bearing garden hose, not less than 1.0 cm inside diameter.
5. Wrapping material: Shall be first quality, heavy water-proof crepe paper manufactured for this purpose, or first quality burlap not less than 15 cm nor more than 25 cm wide of suitable strength and manufactured for this purpose.
6. Soil Separators: Shall be water permeable glass fiber mat 6 mm to 12 mm thick, 48 kgs per cubic meter uniform density. Fibers shall be 100 % textile glass fibers, 8 to 12 microns in diameter, bonded and phenol formaldehyde resin.
7. Rock mulch: For covering base areas in planting beds shall be natural stones 3 cm to 5 cm in diameter. Source shall be as approved by the Engineer.
8. Insulation: For exterior planters shall be 5 cm thick rigid polystyrene.
9. Crushed Stone: For drainage shall be clean, sound crushed gravel or stone free from silt, clay, organic matter and unsuitable material or other deleterious

substances, and shall be in such condition that it can be readily compacted under watering and rolling to form a firm and stable base. material shall be graded as follows:

100% passing 32 mm screen

45% - 75% passing 19mm screen

25% - 45% passing 13 mm screen

0 - 10% passing 6.5 mm screen

0 - 2% passing no. 10 seive (2mm)

10. antidessicant: Shall be applied to all plants before being dug and transported to the final site for planting.

#### 2.04 PLANT MATERIALS

- A. Furnish and plant all plants shown on drawings, as specified. All plants shall be nursery-grown unless specifically authorized to be collected.
- B. All plants shall be hardy under climatic conditions similar to those in the locality of the project.
- C. All plants shall be freshly dug. No heeled-in plants or plants from cold storage shall be used. All plants shall be typical of their species or variety and shall have a normal habit of growth. Plants shall be sound, healthy, and vigorous, well-branched and densely foliated when in leaf, shall be free of disease, insect pests, eggs or larvae, and shall have healthy, well-developed root systems.
- D. Provision will be made for plants to be acclimatized on-site before planting.
- E. Container-Grown Stock: Shall have been grown in a container large enough for the root system to have developed sufficiently to hold its soil together, firm and whole. No plants shall be loose in the container.
- F. Substitutions: When plants of kinds or sizes specified are not available within a reasonable distance, substitutions may be made upon request by the Contractor, if approved by the Engineer.

#### 2.05 PLANT SIZES

- A. Sizes and quality of trees, palms and shrubs shall conform to specifications in the current edition of the American Nurserymen's Association Standards (metric equivalents).

- B. All plants shall conform to the measurements specified in the plant list.
- C. Plants larger than those specified in the plant list maybe used if approved by the Engineer, but use of such plants shall not increase the Contract Price. If the use of larger plants is approved, the spread of roots or ball of earth shall be increased commensurate with the size of the plant.
- D. Up to ten (10) percent of undersize plants in any one variety or grade may be used, provided that there are sufficient plants above size to make the average equal to or above specified size and provided that undersize plants are larger than the average size of the next smaller grade.
- E. Size changes may be made upon request by the Contractor if approved by the Engineer.

## 2.06 INSPECTION

- A. Plants shall be subject to inspection and approval at the place of growth and upon delivery for conformity to specification requirements as to quality, size and variety. Such approval shall not impair the right of inspection and rejection upon delivery at the site or during the progress of the work.
- B. Plants shall be accompanied by Nursery Inspection Certificate.
- C. Inspection of plants before digging shall be at the option of the Engineer. The Contractor or his representative shall be present if requested by the Engineer for inspection of plants at Nursery.

## PART 3: EXECUTION

### 3.01 DIGGING, HANDLING AND PROTECTION OF PLANTS

- A. Bare-rooted (B-R) plants shall be dug with adequate fibrous roots. Roots of these plants shall be covered with a uniformly thick coating of mud by being puddled immediately after they are dug, or packed in moist straw.
- B. Balled and burlapped (B & B) plants shall be dug with firm natural balls of earth, of sufficient diameter and depth to include most of the fibrous roots and as required by American Nurserymen's Association Standards which is binding under the work of this Contract. No plant moved with a ball shall be accepted if the ball is cracked or broken before or during planting operations except upon approval of the Engineer.
- C. Roots or balls of all plants shall be adequately protected at all times from sun and from drying winds.

- D. Balled and burlapped plants which cannot be planted immediately upon delivery shall be set on the ground and shall be well protected with soil, wet straw, or other acceptable material. Bare-rooted plants which cannot be planted immediately shall be planted or heeled-in in trenches immediately upon delivery.
- E. Bundles of plants shall be opened and the plants separated before the roots are covered. Care shall be taken to prevent air pockets among the roots. During planting operations, bare roots shall be covered with canvas, hay or other suitable materials. No plant shall be bound with wire or rope at any time. Prevent damage to bark and breaking of branches.
- F. Palms shall have their fronds tied back to avoid damage in handling and planting as well as digging.

### 3.02 TIME OF PLANTING

- A. Planting time shall be according to local practice.
- B. It is recommended that no planting be done during the months of May, June, July, August and September.

### 3.03 PLANTING OPERATIONS

- A. Planting: Shall be done by experienced workmen familiar with planting procedures under the supervision of a qualified foreman. Planting shall not begin until irrigation system is operational. Existing plants within the limits of work shall be relocated on the site as directed by the Engineer.
- B. Stake out locations of all plants and secure the Engineer's approval before excavating plant pits or beds.
- C. All plant pits shall be excavated with vertical sides.
- D. Tree and Large Palm Pits: Shall be 60 cm greater in diameter than the ball of earth or spread of roots of the tree and sufficiently deep to allow for a 15cm thick layer of topsoil and manure mixed 2 to 1 beneath the ball or roots.
- E. Shrub and Small Palm Pits: Shall be 30cm greater in diameter than the spread of roots and for palms sufficiently deep to allow a minimum of 10cm of topsoil and manure mixed 2 to 1 under balls or roots of all plants.
- F. Ground Cover Beds: Shall be prepared to a depth of 35cm below final grade. Incorporate peat moss with the topsoil in the ratio of one part peat moss to two parts topsoil.



- G. Plant Pits: Shall not be backfilled until they have been approved by the Engineer. If pits are prepared and backfilled to grade prior to planting, their location shall be marked and recorded on the plans so that when planting proceeds they can readily be found.
- H. Soil mixture for on-grade or raised grade lawns and plants shall have fertilizer incorporated with it in accordance with laboratory test recommendations as directed by the Engineer.
- I. Plants: Shall be set in center of pits plumb and straight and at such a level that after settlement, the crown of the plant will be at the surrounding finished grade.
- J. When balled and burlapped plants are set, soil shall be compacted around bases of balls to fill all voids. All burlap, ropes or wires shall be removed from the tops of balls.
- K. Roots of bare-root plants shall be properly spread out and soil carefully worked in among them. Broken or frayed roots shall be cut off cleanly.
- L. Soil around roots or balls shall be thoroughly compacted and watered. After planting, cultivate the soil in the shrub beds between shrub pits, rake smooth and outline neatly.
- M. Prior to seeding on prepared surface a dressing of compound fertilizer shall be applied dry and watered-in one day before planting operation.

3.04 WRAPPING, GUYING AND STAKING

- A. Trees and palms shall be inspected for injury to trunks, evidence of insect infestation and improper pruning before wrapping.
- B. Wrap trunks of all trees spirally from bottom to top securely with material specified. The wrapping shall overlap and entirely cover the trunk from the ground to the height of the second branches and shall be neat and snug. Overlap shall be approximately 5cm.
- C. Tree and palms guying and staking shall be as detailed.
- D. Fronds shall be tied back as required for handling and planting.

3.05 PRUNING AND MULCHING

- A. Each tree, palm and shrub shall be pruned to preserve the natural character of the plant and as directed by the Engineer.

- B. Pruning shall be done with clean, sharp tools.
- C. Cuts over 2cm in diameter on trees and shrubs shall be painted with a tree paint. paint shall cover all exposed cambium as well as other exposed living tissue.
- D. Immediately after planting operations are completed, all trees, palm and shrub pits and planting beds shall be covered with an 8cm layer of the specified mulch.

### 3.06 OBSTRUCTIONS AT PLANTING PITS

- A. In the event that obstructions are encountered in any plant pit, the obstruction shall be removed to a depth not less than 1m below grade and no less than 15cm below bottom of ball or roots when plant is properly set at the required grade.

### 3.07 MAINTENANCE

- A. Maintenance shall begin immediately after each portion of lawn and each plant is planted and shall continue in accordance with the following requirements until final Acceptance.

1. **Lawns:** The Contractor shall be held responsible for maintenance of lawns, including watering, weeding, sowing and replanting as necessary for at least thirty (30) days after sowing and as much longer as is necessary to establish a uniform stand of the specified grasses and until "Acceptance". Scattered bare spots, none of which are larger than four hundred sixty-five (465) square centimeters will be allowed to a maximum of two (2) percent of any lawn area. After the grass has started, all areas and parts of areas which fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded repeatedly until all areas are covered with a satisfactory growth of grass. At time of cutting, maintain grass at a maximum height of 50mm.

2. **New Planting** shall be protected and maintained until the end of the lawn maintenance period or, if installed after the lawn maintenance period, until installation of planting is complete. Maintenance shall include watering, mulching, tightening and repairing of guys, replacement of sick or dead plants, resetting plants to proper grades or upright position and restoration of the planting saucer, and all other care needed for proper growth of the plants. if planting is done after lawn preparation, proper protection to lawn areas shall be provided and any damage resulting from planting operations repaired promptly.

3. **Spraying and Dusting:** During the maintenance period and up to the Final Acceptance, the Contractor shall do all seasonal spraying and/or dusting of trees, shrubs, vines and ground cover as required to keep them in a healthy state.
4. **Protection:** Planting areas and plants shall be protected against trespassing and damage of any kind. If any plants become damaged or injuries occur, they shall be treated or replaced as directed. No work shall be done within or over planting areas or adjacent to plants without proper safeguards and protection.
5. **Damage resulting from erosion, gulleys, washouts, or other causes shall be repaired by filling with topsoil, tamping, refertilizing, and reseeding by the Contractor at his expense if damage occurs prior to acceptance of the Contract.**
6. **The Contractor's responsibility for maintenance shall cease at the time of acceptance or of acceptance with reservations. In the latter case, the Contractor will be held responsible for making replacements, but no maintenance will be required.**
7. **Replacement:** At the end of the guarantee period, inspection will be made by the Owner and the Architect upon written notice requesting such inspection submitted by the Contractor at least ten (10) days before the anticipated date. Any plant required under this contract that is dead or not in satisfactory growth, as determined by the Architect, shall be removed from the site; these and any plants missing due to the Contractor's negligence, shall be replaced as soon as conditions permit, but during the normal planting season. in case of any question regarding the condition and satisfactory establishment of a rejected plant, the Contractor may elect to allow such a plant to remain through another complete growing season at which time the rejected plant, if found to be dead, in an unhealthy or badly impaired condition, shall be replaced.
  - a. All replacements shall be plants of the same kind and size specified in the plant list. They shall be furnished and planted as specified under 2.04 PLANT MATERIALS and 3.01 DIGGING, HANDLING AND PROTECTION OF PLANTS. The cost shall be borne by the Contractor, except for possible replacements resulting from removal, loss or damage due to occupancy of the Project in any part, vandalism or acts of neglect on the part of others, physical damage by animals, vehicles, etc., and losses due to curtailment of water by Owners.

b. **Guarantee:** Lawns and planting shall be guaranteed for one (1) full year after Initial Acceptance of planting and shall be alive and in satisfactory growth at the end of the guarantee period, except for damage resulting from causes beyond the responsibility of the contractor.

8. Upon completion of planting and prior to provisional acceptance, remove from the site excess soil and debris, and repair all damage resulting from planting operations.

3.08 WATERING

- A. Plantings shall be watered continuously with drip irrigation in a satisfactory manner during and immediately after planting, until provisional acceptance. All initial settings and adjustments required by the irrigation system for correct water application shall be performed by the Contractor during the planting guarantee period.
- B. Until plant growth is established, provide supplementary watering not less than twice per day to nourish root system.

3.09 INSPECTION AND PROVISIONAL ACCEPTANCE

- A. The Engineer will inspect all work for provisional acceptance upon the written request of the Contractor received at least ten (10) days before the anticipated date of inspection.
- B. After all necessary corrective work has been completed, the Engineer will certify in writing the provisional acceptance of the planting.

3.10 FINAL INSPECTION AND FINAL ACCEPTANCE

- A. At the end of the guarantee period, inspection will be made by the Engineer upon written request submitted at least ten (10) days before the anticipated date.
- B. After all necessary corrective work has been completed, the Engineer will certify in writing the final acceptance of the planting.

END OF SECTION

102 - MASONRY WORK - GENERAL REQUIREMENTS

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102 - MASONRY WORK - GENERAL REQUIREMENTS

PART 1: GENERAL

1.01 DESCRIPTION

This specification covers all design, labor, materials, equipment, tools and supervision for supplying, detailing, fabricating, delivering and installing all masonry work as specified herein and as is evidently necessary to complete the work.

1.02 APPLICABLE CODE AND STANDARDS

Within this Section of the Specification, wherever reference is made either directly or indirectly to United States (U.S.) Codes and Standards, corresponding Indonesian and Japanese Codes and Standards may be used subject to acceptance by the Engineer.

- A. ANSI - American National Standards Institute
  - 1. A41.1 Building Code Requirements for Masonry
- B. ASTM - American Society for Testing and Materials
  - C109 Test for Compressive Strength of Hydraulic Cement Mortars
  - C144 Specification for Aggregate for Masonry Mortar
  - C145 Specification for Solid Load Bearing Concrete Masonry Units
  - C150 Specification for Portland Cement
  - C207 Specification for Hydrated Lime for Masonry Purposes
  - C270 Specification for Mortar for Unit Masonry
  - C827 Test for Early Volume Change of Cementitious Mixtures
- C. JIS - Japanese Industrial Standards
  - R-1250 Common Bricks
  - R-5210 Portland Cement

- A-5005 Crushed Stone for Concrete
- A-5406 Hollow Concrete Blocks

1.03 RELATED WORK

The following items related to masonry work shall be as specified in other sections of these specifications:

- |    |         |     |                     |
|----|---------|-----|---------------------|
| 1. | Section | 129 | CAULKING            |
| 2. | Section | 110 | BUILDING INSULATION |
| 3. | Section | 112 | WOOD DOORS          |

1.04 Relation With Work of Others. - The Contractor shall be responsible for the correct locations, size and proper construction of all openings and special accommodations for his own work and for the work of others as necessary. He shall consult other contractors in advance and make proper provisions for the installation of their work. In the absence of special drawings or information, he shall obtain all necessary information from the proper sources before proceeding with any work which may be affected thereby.

1.05 SUBMITTALS

Samples and Sample Panels. - Before any material is ordered for the work, samples of each type of masonry unit to be used in the work shall be submitted to the Engineer for approval. Samples shall be sufficient in number to show the full range of color, texture and size of the units to actually be used in the work. In addition, a 1.25-m x 1.25-m (4 ft by 4 ft) sample panel of the wall construction shall be built using the chosen specified materials. The sample panel shall show complete color range of units, color of mortar, bonding, size of joint and wall reinforcing. The sample panel, as finally accepted by the Engineer shall be kept on the site as a guide for masonry workmanship, and shall be removed by the Contractor only when no longer needed for the work.

1.06 PRODUCT HANDLING

All masonry units used in the work shall be new and equal in all respects to the approved samples. Masonry units shall be handled in such a manner as to prevent chipping of edges, cracking and breaking.

1.07 STORAGE OF MATERIALS

All materials shall be stored off the ground, and protected from soil, staining and damage. Mortar materials shall be stored in dry condition. Any material which is damaged or deteriorates in storage shall be removed from the jobsite and not used in the work.



PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. A Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

B. Mortar Materials

- 1. Portland Cement. - ASTM Designation C-150.
- 2. Lime. - Hydrated lime, ASTM Designation C-207, Type 'S'.
- 3. Masonry Cement. - Conforming to ASTM Specification C-91, Type II, with the approval of the Engineer may be used in place of cement and lime mortar.
- 4. Sand. - Sand shall be clean, hard, siliceous, in accordance with ASTM Specification C-144, free from loam, silt or other impurities, composed of grains of varying sizes within the following limits:

<u>Sieve Size</u>	<u>Percent Passing Natural Sand</u>	<u>Percent Passing Manufactured Sand</u>
No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 - 100	95 - 100
No. 16 (1.18 mm)	70 - 100	70 - 100
No. 30 (600 microns)	40 - 75	40 - 75
No. 50 (300 microns)	10 - 35	20 - 40
No. 100 (150 microns)	2 - 15	10 - 25
No. 200 ( 75 microns)		0 - 10

Mortar specimens made with sand shall have compressive strength at 28 days of not less than 90 percent of the compressive strength of specimens made with Ottawa sand.

- 5. Water. - Fresh, clean and potable.
- 6. Admixtures. - Water repellents and other admixtures shall be used only where specified or otherwise acceptable to the Engineer. When used, they shall be the product of a manufacturer who can demonstrate successful usage of his product for a period of not

less than 3 years prior to being offered for the work and shall be used in strict accordance with the printed directions of the manufacturer.

c. Mortar Mixing and Use

1. Mixing. - Mortar materials shall be measured by weight or by volume and the methods of measurement shall be such that the proportions can be controlled with an error not over 2 percent. One bag of Portland cement weighing not less than 42.6 kg (94 lbs.) shall be considered as 0.028 m<sup>3</sup> (1 ft<sup>3</sup>). Mortar shall be mixed in a mechanical batch mixer, not less than 3 minutes after all the materials are in the mixer. Hand mixing will be permitted for small batches provided the quantities of materials and water are accurately controlled and that the method of mixing is approved by the Engineer. Hand mixing for small batches shall be continued until the mortar is completely and uniformly mixed. Mortar shall be used within 30 minutes after it leaves the mixer and no retempering of mortar in which the cement has begun to set will be allowed.

2. Mortar Composition

Unless otherwise specified or required by building codes mortar shall conform to ASTM C-270 Type 'N', composed by volume of one part Portland cement, 1/2 to 1-1/4 part hydrated lime, and with sand not less than 2-1/4 nor more than 3 times the sum of volumes of cement and lime used. Alternate - 1 part approved masonry cement, and 2-1/4 to 3 parts sand.

Where specifically shown or noted, or where required by building codes for the indicated construction, mortar shall conform to ASTM C-270 Type 'S', composed by volume of one part Portland cement, 1/4 to 1/2 part hydrated lime, and with sand not less than 2-1/4 nor more than 3 times the sum of the volumes of cement and lime used.

Alternate - 1/2 part Portland cement, one part masonry cement, and 3-1/2 to 4-1/2 parts sand.

3. Fire Wall Mortar. - Mortar for fire walls shall be 3 parts sand, one part Portland cement, and 15 percent lime by cement volume, conforming to Underwriters Laboratories, Inc. requirements or approved equal.

4. Tuck Pointing Mortar. - Prehydrated mortar of same composition as the laying mortar used. Mix dry materials thoroughly, then remix adding only enough water to produce a damp workable mix which will retain shape when pressed into a ball. After one to two hours add water as required for proper pointing consistency.

## 2.03 MISCELLANEOUS MATERIALS

### A. Dovetail Anchors and Slots:

Anchors shall be 12-gauge hot-dip galvanized, corrugated steel, sized as required for the particular installation. Slots shall be heavy-gauge, hot-dip galvanized steel, sized to receive the anchor sizes required. Sizes of anchors and slots shall be as shown on final construction drawings.

### B. Membrane Flashing:

Membrane flashing shall be non-reinforced, homogeneous, waterproof, impermeable sheeting compound of elastomeric substances which have been reduced to a thermoplastic state, and extruded into a continuous sheet thickness as noted on final construction drawings, but not less than 1.66-mm (1/16-in) thickness. The sheeting shall not be physically deformed when stretched at room temperature and shall be suitably stabilized to resist exposure without physical deterioration when subjected to weatherometer testing in accordance with ASTM Standards D-822 for a period of not less than 400 hours. The material shall show no signs of cracking or flaking when, at temperatures of -29 degrees C (-20 degrees F), it is bent through 180 degrees over a 0.8-mm (1/32-in) mandrel, and over the same size mandrel in the opposite direction through 360 degrees. The product shall carry the manufacturer's or brand name at frequent intervals.

### C. Membrane Flashing Cement:

Shall be a cold setting cement compatible with the flashing material, as recommended by the membrane flashing manufacturer and used in accordance with the manufacturer's instructions.

### D. Caulking Compounds:

As specified in Section.

### E. Wall-to-Column, Wall-to-Concrete, and Wall-to-Beam Anchors and Shelf Angles:

As shown on the final construction drawings, and hot dip galvanized steel if not otherwise noted or specified.

### F. Preformed Control Joint Gasket:

Shall be preformed, factory-extruded, solid rubber sections of either the regular or wide flange type as shown on final construction drawings. Material for regular type shall conform to ASTM D2000 2AA-805, with a durometer hardness of approximately 80 when tested in accordance with ASTM D2240.

Material for wide flange type shall be similar to the regular type except the edge shall be a compressible neoprene compound edge conforming to ASTM D2000 2BC-310C12 with a durometer hardness of 30. The shear strength of the material shall have the following minimum requirements.

	<u>Average Load Per 203 mm (8 in) of Joint</u>	<u>Shear Strength</u>
	kg (lbs)	kg/cm <sup>2</sup> (psi)
Regular Type	1230 (2706)	38 (541)
Wide Flange Type	1068 (2350)	33 (470)

G. Coating for Embedded or Abutting Steel:

Bituminous paint conforming to ASTM D-1187, Type A, similar to (for quality control only) Flintkote asphalt base clay emulsion coating C-13-E as manufactured.

H. Masonry Reinforcement:

Preformed truss-type masonry reinforcement, galvanized per ASTM A153, Class B-2, complete with preformed corner and intersection units.

PART 3: EXECUTION

3.01 GENERAL

All masonry shall be built plumb, square and true to dimensions and lines, with full mortar joints. Horizontal joints shall be level and true. For bed joints a thick bed of mortar shall be spread and only slightly furrowed, so that the joint will be filled completely with mortar. The ends of the units shall be buttered with an ample quantity of mortar and the unit shoved into place, so that the end joint is filled completely with mortar. In making closures, ample quantity of mortar shall be spread in the closure space, the closure units buttered on both ends and rocked into place, so that both end joints and the bed joint are filled completely with mortar. Over-plumbing and pounding of corners and jambs to fit units after being set in position shall be avoided. Where an adjustment must be made after the mortar has lost its plasticity, the unit and mortar shall be removed and fresh mortar shall be used to reset the work.

3.02 SCAFFOLDING AND EQUIPMENT

Contractor shall furnish, erect, maintain as long as necessary, and remove when no longer needed, safe and adequate scaffolding and other equipment required for the proper execution of the work. All equipment for the

mixing, transportation and handling of mortar shall be kept clean and free from set mortar, dirt or other foreign matter.

### 3.03 WEATHERTIGHT EXTERIOR WALLS

The Contractor shall be entirely responsible for weathertightness of the exterior masonry walls. The workmanship shall be such, that no leaks to the interior shall occur in the exterior walls because of defective workmanship or materials, from failure to fill completely all joints or to properly install all flashings and weep holes as detailed and/or specified.

### 3.04 JOINTS

All brickwork shall be laid with joints of uniform thickness of 10 mm (3/8 in). Joints shall be not less than 6.4 mm (1/4 in) nor more than 12.7 mm (1/2 in). End joints in exposed brick work shall be not wider than the bed joints. Holes left in exposed joints by the removal of nails, line pins and putlog irons shall be filled immediately with fresh tuck-pointing mortar.

### 3.05 POINTING AND TOOLING

All joints in masonry shall be filled with mortar and all exposed joints shall be tooled. When the joint mortar has become thumb-print hard, all exposed joints shall be tooled with a rounded stainless steel, ceramic or other non-staining jointer, compressing and sealing the joint mortar and forcing a continuous and complete contact between the mortar and the masonry units. Joints not exposed to view or weather or joints in surfaces to be covered with other materials may be cut.

### 3.06 WEATHER CONDITIONS

No masonry work shall be performed when the ambient temperature is below 5 degrees C (40 degrees F) or above 40 degrees C (104 degrees F), or is likely to fall below the minimum or rise above the maximum during the 24 hours period after laying, unless the approval of the Engineer is received and adequate protection is provided. At temperatures below 5 degrees C, (40 degrees F) adequate equipment shall be provided for heating the materials and completed masonry. Temperature of air on both sides of the wall shall be maintained at 5 degrees C (40 degrees F) minimum. Temperatures of the separate materials, including mixing water, when placed in the mixer shall not exceed 60 degrees C (140 degrees F). When the mortar is being used, it shall have a temperature above 10 degrees C (50 degrees F) and the mortar shall be maintained at this temperature until it has been placed in the masonry. No masonry units having a film of water on their surfaces shall be laid in the work.

3.07 PROTECTION OF WORK

Top of new work shall be covered with suitable waterproof covering, turned down at the edges and held in place by plank or other suitable means when work is stopped. The staging plank next to the walls shall be turned back from the face of the masonry work when work is stopped, to prevent spattering and staining of masonry in the event of rain. The Contractor shall protect all sills and projecting members with suitable and sufficient boxing as a protection against mortar dropping and damage. Bases of walls shall be protected from soil staining by covering adjacent soil.

3.08 CONNECTION OF NEW WORK

When starting masonry work after work has been stopped for the night or other reasons, the exposed bearing surface of the masonry shall be cleaned with a wire brush, all loose mortar removed to obtain the best possible bond between new work and the previously installed work.

3.09 BUILT-IN ITEMS

All items of the various trades to be built into the masonry work shall be installed as the work progresses. Other trades shall be consulted in advance and provisions made for the installation of their work to avoid unnecessary cutting and patching. All sleeves for pipes, anchors, plates and supports shall be built in. Plates and lintels shall be solidly bedded in mortar, true and level with the bedding joints not less than 9.5 mm (3/8 in) thick. Columns shall have a premolded filler. Mason shall assist in setting all window, door and louver frames occurring in masonry work, fill in the joint in exterior work between masonry and frames with mortar to within 12.7 mm (1/2 in) of face of frame and rake out the joint to provide space for caulking not less than 19 mm (3/4 in) deep. Hollow metal door frames shall be filled solid with mortar.

3.10 CUTTING AND PATCHING

The Contractor shall leave out or cut all chases and openings shown or as required for the installation of the work of other trades, and make tight around same if required.

Cutting and patching of masonry shall be performed only by masons.

Masons shall build in or cut out all reglets for flashing as shown or evidently required. Cutting and raking shall be avoided as far as possible by cooperation with the trades involved.

### 3.11 EMBEDDED AND ABUTTING METALS

All steel and aluminum surfaces which are to be built against or embedded in masonry shall be cleaned and given two coats of bituminous paint conforming to the requirements of ASTM D-1187, Type A, or approved. The coating shall be of uniform thickness without voids. Metal surfaces not embedded or in contact with the masonry shall be protected against soiling by the bituminous paint.

### 3.12 CAULKING

#### A. General:

All joints of exterior masonry at the perimeter of door, window and louver frames shall be not less than 9.5 mm (3/8 in) nor more than 12.7 mm (1/2 in) wide, shall be raked out and cleaned to a minimum uniform depth of 19 mm (3/4 in), and shall be filled with caulking compound forced into place with a pressure gun and the face of joint neatly finished.

#### B. Caulking Compounds

Shall be as specified in the caulking section of the specification, Section.

### 3.13 INSTALLATION OF MEMBRANE FLASHING

Membrane materials shall be elastomeric sheeting. The membrane shall be bedded in cold setting cement and a coat of cement shall be mopped over the membrane after it is installed in place. Joints shall be lapped not less than 76 mm (3 in) and thoroughly cemented in place. Membrane flashings shall be installed under sills, over lintels and spandrel sections, and elsewhere as required. Membrane shall be continuous and shall extend uninterrupted through all wythes of single and composite walls and through both wythes and cavity of cavity walls. All membrane flashing intended to perform the function of pan flashing or through-wall flashing shall be turned up a minimum of 102 mm (4 in) on the interior wall surface and continuously cemented in place with an approved adhesive.

### 3.14 WEEP HOLES

Shall be provided over thru-wall flashings in wall, at bottom of wall and elsewhere as required for proper drainage. Weep holes shall be spaced 610 mm (24 in) on center, and shall be formed with plastic tubing extending into the cavity and left in place.