

GENERAL AUTHORITY
FOR ROADS, BRIDGES AND LAND TRANSPORT
MINISTRY OF TRANSPORT AND COMMUNICATIONS
THE GOVERNMENT OF THE ARAB REPUBLIC OF EGYPT

THE PROJECT FOR CONSTRUCTION OF
THE SUEZ CANAL BRIDGE
IN EGYPT

TECHNICAL SPECIFICATIONS

with

SPECIAL SPECIFICATIONS

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January 1997

PREPARED BY
PACIFIC CONSULTANTS INTERNATIONAL
CHODAI CO., LTD.

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CONTENTS OF TECHNICAL SPECIFICATIONS

Special Specifications

Technical Specifications

- 1.0 General
- 2.0 Earthworks
- 3.0 Concrete Mixtures and Concrete Structures
- 4.0 Foundations
- 5.0 Incidental Concrete Work
- 6.0 Structural Steel Works
- 7.0 Incidental Bridge Works.
- 8.0 Road Pavement
- 9.0 Safety Facilities
- 10.0 Electric and Telephone Works
- 11.0 Supplementary Works

SPECIAL SPECIFICATION S

S.1	The Project -----	1
S.2	Works Included in Contracts-----	2
S.2.1	The East Bank Contract-----	2
S.2.2	The West Bank Contract-----	3
S.2.3	The Central Section Contract-----	3
S.3	Weather Conditions -----	4
S.3.1	Weather -----	4
S.3.2	Visibility -----	5
S.3.3	Wind -----	5
S.4	Earthquakes -----	5
S.5	Work in the Vicinity of Railways-----	6
S.6	Provisions and Supplies for the Engineer -----	9
S.6.1	Facilities for the Engineer-----	10
S.6.2	Offices, Equipment for the Engineer -----	11
S.6.3	Vehicles for the Supervisory Team-----	14
S.6.4	Survey Instruments for the Engineer's Staff-----	15
S.6.5	Telephone for the Engineer-----	16
S.6.6	Protective Clothing for the Engineer's Staff -----	16
S.6.7	Basis of Payment -----	17

S.1 THE PROJECT

1. The Suez Canal Bridge Project for the Road crossing of the Suez Canal at Qantara comprises the first major fixed connection between the Northern part of the Sinai peninsula and the rest of Egypt.
2. The crossing consists of a central cable-stayed 4 lane steel box girder bridge spanning across the Canal, of 730 m total length and with a 70m clearance above the canal. The Central Section connects to the East and West Side approach viaducts of 1440m and 1743m lengths respectively, which in turn are linked via embankments to the New Central Highway in Sinai and the main Ismailiya-Port Said Highway on the West Bank.
3. The Project is being jointly financed by a grant from the Japanese Government for the Central section and funding from the Egyptian Ministry of Transport and Communications for East and West Bank Sections. The construction phase is planned to commence in mid-1997 and be completed as shown below.

Contract Number	Project for Construction of the Suez Canal Bridge	Times Envisaged for Start and Finish
	- Central Section	Oct. 1997 - Mar. 2001
	- East Bank Section	May 1997 - June 2000
	- West Bank Section	May 1997 - Nov. 2000

4. In preparing the Construction Programme the Contractor shall at all times take full account of and coordinate with the programming of work on the other two contracts, and the Contractor of West Bank shall take into account the need to provide free access through the Works for the Contractor on the Central Bridge Contract from the end of October 2000.
5. The Central Section incorporating some of the approach structures and totaling 1850m in length is to be constructed by a Japanese Contractor, whilst the two approach structures of 880m and 1180m respectively plus the embankments will be constructed by Egyptian Contractors.
6. The sites for works to be constructed on or beneath the surface are on the West Bank generally cultivated, but on the East Bank generally desert and low lying salt

marshes are either owned by the Employer or privately owned lands. The Employer has obtained authority for the Contractor to use all sites for Permanent Works and for long term Working Sites as listed below and shown on the Drawings.

7. It is to be noted that this Project is of great National and International importance and must be constructed to the highest possible standards and quality.

S.2 WORKS INCLUDED IN CONTRACTS

S.2.1 The East Bank Contract

1. This Contract forms part of the Project and comprises the junction with the New Central Highway at grade to the interface at +49.5m above datum level of the approach bridge with the Japanese Central Section Contract.
2. The contractor will be required to establish a Working Site and Camp in the desert/salt marshes on the East Bank and make all service connections in the area.
3. The main Works included in the Contract are for the construction of:
 - 3745m of 4 lane road on formed embankments upto 20m max. height, and max. gradient of 3.3% with benched slopes at 2:1 (H:V.).
 - 880m of elevated prestressed cast in situ concrete box section approach bridge with 40m spans supported on concrete piers.
 - A total of 21 reinforced concrete twin piers ranging from about 20m to over 45m in height
 - A total of approx. 400 No., 1.5 m.dia. cast in place bored r.c.piles
 - Pitched stone slope protection to the embankment
 - Miscellaneous drainage works
 - Road parking, marking, kerbs, barriers and other miscellaneous works.
 - Road Lighting and associated electrical works.

S.2.2 The West Bank Contract

1. This Contract forms part of the Project and comprises a junction with the existing Port Said - Ismailiya highway at grade to the interface at +49.5m above datum level at the approach bridge with the Japanese Central Section Contract.
2. The Contractor will be required to establish a Working Site and Camp in the agricultural lands on the West Bank and make all service connections in the area.
3. The main Works included in the Contract are for the construction of:
 - 1562m of 4 lane road on a formed circular embankment (radius = 450m) up to 10m height and max. gradient of 3.3% with benched slopes at 2:1 (H:V).
 - A short span R.C. bridge crossing the Al Abassah Irrigation Canal.
 - 1180m of elevated prestressed-cast in-situ concrete box section approach bridge with spans between 30 and 40m, supported on concrete piers.
 - A total of 30 reinforced concrete twin piers ranging from about 10m to over 45m in height.
 - A total of approx. 600 No., 1.5m dia. cast-in-place bored r.c. piles.
 - Pitched stone slope protection to the embankment.
 - Miscellaneous drainage works
 - Road paving, marking, kerbs, barriers and other miscellaneous works.
 - Road lighting and associated electrical works.

S.2.3 The Central Section Contract

1. This Contract forms a part of the Project and comprises the main cable-stayed bridge main and side spans, plus lengths of approach bridges on both the East and West sides of the Canal which interface with the Egyptian Contracts at +49.5 above datum level.
2. The Contractor will be required to establish Working Sites on both sides of the Canal with the principal work facilities contained on the East Bank.
3. The Camp location for his personnel may be established on either or both sides to suit the work plan.

4. Main service supplies for electricity and water will be provided by the Employer to the Contractor's main distribution points, and the Contractor will be responsible for all ensuing connections and services within the sites.
5. The main Works included in the Contract are for the construction of:
 - A 4-lane cable-stayed steel box girder bridge with a main span of 404m plus two side spans of 163m each = 730m long bridge.
 - Two 153m high reinforced concrete 'H' shaped main pylons - one on each side of the Canal
 - Diaphragm Wall foundation to both pylons
 - From pairs of twin reinforced concrete piers approx. 65m high founded on groups of 9 No. bored R.C. piles of 1.5m dia
 - 1120m of elevated prestressed cast-in-situ concrete box section approach bridge with 40m spans supported on concrete piers. (560m on each Bank)
 - A total of 32 reinforced concrete twin piers ranging from about 45m to 65m in height.
 - A total of approx. 380 No. bored r.c piles of 1.5m dia.
 - Road paving, marking, kerbs, barriers, drainage and other miscellaneous works.
 - Road lighting, navigation lights.
 - Radar station

S.3 WEATHER CONDITIONS

S.3.1 Weather

The climate in Egypt is generally arid and hot in the summer (April to October) but there is occasional rainfall in the winter months (November to March).

The number of rainy days is greater from January to March at Ismailiya, but the total number of rainy days is less than 20 days per annum and the rainfall is very low, typically 30 mm per annum.

Temperature at Ismailiya is highest in the summer months between April and October and a maximum temperature of 39.6°C has been recorded in October. The winter months are cooler with more moderate temperatures generally, and a

minimum of 4.0°C has been recorded in January. In recent times, however, the air temperatures have been less extreme with a maximum of 35.9°C and a minimum of 7.8°C being recorded in the last decade at El-Ement Station.

Qantara experiences a typical North African desert climate. During the winter months of November to March the Egyptian weather is comparatively cool and dry with an average day temperature of about 18 degrees Centigrade. From April to October the average day temperature is 32 degrees Centigrade with spells of intense heat. A hot and dusty wind (Khamsin) sometimes blows from the desert normally during March, April and May. Rainfall in Qantara average only 30 millimeters a year. Very heavy rainfall nevertheless sometimes occurs for short periods.

S.3.2 Visibility

The frequency of poor visibility conditions at Ismailiya of under one kilometer, increases from December to February. The poor visibility occurs due to fog and sandstorms, and the frequency of poor visibility occurring is higher at Ismailiya compared to other areas bordering the Suez Canal. However, statistically the frequency of these occurrences per month is relatively low.

The duration of poor visibility conditions due to fog, when there is relatively little wind, is shorter than 6 hours, but during sandstorms when the wind is stronger, it can frequently exceed 10 hours.

S.3.3 Wind

Wind velocity of 1 to 3 knots (1.5 m/sec.) occurs frequently throughout the year but strong winds in excess of 20 knots (10 m/sec.) rarely occur at Ismailiya. A wind velocity of 28 to 33 knots (14 - 17 m/sec.) has been recorded during January to March, but is an infrequent occurrence.

S.4 Earthquakes

There is no recent detailed data for major earthquakes in Egypt. However, some previous records of earthquakes in Egypt were preserved, and these records indicate that the area along the Suez Canal experiences some seismic activity with occasional low to medium strength earthquakes). However, in recent times there have been more frequent tremors in Egypt, notably the strong earthquake in 1992

and the medium one experienced in November 1995.

Therefore, detailed study for the seismic analysis was carried out for the bridge design using seismic data from the Red Sea and other relevant areas.

S.5 Work in the Vicinity of Railways

S.5.1 The Contractor shall be responsible for ensuring that the whole of the work covered by this Contract, whether undertaken by himself or by Sub-Contractors, is carried out in such a way as to comply with following Requirements:

S.5.1.1 The Contractor shall supply sufficient high visibility clothing of a shade of orange color approved by the Engineer for all his employees who may work on or about the track and shall use his best endeavors to ensure that they wear this clothing.

S.5.1.2 Demolition, excavation, piling and Temporary or Permanent Works or any other works in the vicinity of the track which in the opinion of the Engineer require speed restrictions or track occupations shall be carried out on dates and at times agreed in writing by the Engineer.

S.5.1.3 All operations on or affecting the Egyptian National Railway land shall be carried out in a such manner as not to endanger or interfere in any way with the railway or other properties of the Railway Company or the traffic thereon excepting such interference as may be agreed in writing in advance of the operations.

Protective arrangements necessary to ensure the safety of persons, property or traffic on the Companies' land shall have been previously approved in writing by the Engineer.

Excavation near any railway line or structure shall not commence until the agreed measures required to maintain the stability of the track and/or structures have been carried out and have been inspected and approved by the Engineer.

The Contractor shall ensure, during all operations on the Works, that no material of any description can fall on to the railway or foul the traffic and special precautions to the satisfaction of the Engineer shall be taken to guard against this eventuality.

The contractor's employees shall not be allowed to cross or convey material across the tracks except under such special conditions as the Engineer may previously approve in writing.

S.5.1.4 After the method of carrying out the Works has been agreed with the Engineer, the Contractor shall in all cases submit written notice and programme of the work to the Engineer at least ten weeks in advance (or considerably more in some cases) of the proposed date for the commencement of the Works affecting the railway. The programme shall be in accordance with any preliminary arrangements made for speed restrictions and occupations.

The Engineer reserves the right to cancel or alter the dates and times of the agreed speed restrictions or occupations at short notice if this proves necessary because of any emergency affecting the safe or uninterrupted running of rail traffic, but in such an event will endeavor to make an alternative period available.

S.5.1.5 Before commencing any work in the vicinity of the tracks the Engineer will ascertain whether the Railway Company considers it necessary to appoint handsignalmen for the control of trains, lookoutmen for the protection of employees at the site and/or railway supervisors for inspecting the work and ensuring the safety of their traffic and property. The Contractor shall only proceed with the work or allow their employees to approach and remain close to the tracks when such handsignalmen, lookoutmen and/or railway supervisors have been provided and are in position and whilst they are acting as such.

The Contractor shall ensure that wherever work is in progress in the vicinity of the railway the person at site in charge of the Works knows the best method of stopping the rail traffic in the event of a mishap that could affect their safety.

S.5.1.6 The Contractor shall not interfere with the electric cables, signals, and telegraph wires and cables or any apparatus affecting the working of the railway without the written approval of the Engineer.

The Contractor shall, when necessary and to the complete satisfaction of the Engineer, locate, divert or support pipes and services cables etc. in order to permit construction of the Works.

S.5.1.7 Plant and material shall not be used or handled in such a manner that even in the event of mishandling or failure such plant or materials could possibly move or fall

foul of rail traffic, that is within 2 metres of a vertical plane from the nearest rail on which traffic may run.

The use and handling of mechanical plant and bulky or heavy materials in the vicinity of the track shall be carried out only under such restrictions as the Engineer may impose for the protection of rail traffic.

Unless foolproof guard rails, locking devices or other safety measures can be provided to the satisfaction of the Engineer, these restrictions are likely to be that such work can only be carried out during occupation of the tracks involved or, alternatively (if in the opinion of the Engineer the circumstances are suitable) work must cease immediately on receipt of instructions from the lookoutman and shall not restart until permitted to do so by him. The Engineer may require the submission of drawings showing the proposed method of using and handling such plant and materials in the vicinity of the tracks.

The Contractor shall be responsible for taking every precaution to avoid risk, injury or damage to the traffic, passengers, employees, plant or equipment of the Railway Companies.

- S. 5.1.8 The Contractor shall stack and place all materials, plant and appliances in such a manner as to prevent their causing injury or damage to persons or property and at safe distance from railway tracks normally not less than 2 metres.
- S. 5.1.9 All lights provided by the Contractor shall be so placed or screened so as not to interfere with any signal lights on the railway and any Temporary or Permanent Works which may interfere with the sighting of signals shall not be erected without the consent of the Engineer.
- S. 5.2 The Contractor shall submit to the Engineer all necessary information in sufficient time for the Employer to comply with the above Requirements concerning the giving of information or notice to, and the obtaining of consent or approval from the Railway Company, except where these measures have already been taken by the Employer prior to the placing of the Contract.
- S. 5.3 The Contractor shall only assume that the Employer has given such information or notice or obtained such consent or approval if this is stated elsewhere in the Specification.

S.6. Provisions and Supplies for the Engineer

1. In spite of Article 3.13 and Article 3.14 of General Conditions, the Contractor shall provide and supply facilities, office equipment, vehicles, survey equipment, telephones, protective clothing and services related to the works for the use of the Engineer (and Employer) staying at the site as stated hereinafter.
2. The Contractor shall supply adequate food for the Egyptian Supervisory staff during working hours.

Before providing any of above 1 and 2 things the Contractor shall submit detailed proposals including drawings and specifications for the approval of the Engineer.

3. Ownership of above buildings, furniture, vehicles and equipment except consumable items provided by the Contractor shall revert to the Contractor at the issuance of the Defects Liability Certificate, unless stated to the contrary in the Bill of Quantities or unless paid for by the Employer on a cost reimbursable basis when in either case such items shall remain the property of the Employer.
4. The above items at the Working Site shall be provided within 60 days of the official starting date of the Contract and shall be maintained until the end of the Defects Liability Period.
5. The Contractor shall provide necessary attendance during working hours such as for continuous securities and the daily cleaning of the offices, toilets, site office etc..
6. In the event of the Contractor's failure to provide or maintain any of the items specified herein within a reasonable time of being required to do so under the Contract, or instructed to do so by the Engineer, the Engineer shall be entitled to make his own arrangements for providing or maintaining such items and to deduct the cost of so doing from any moneys owing to the Contractor.

S.6.1 Facilities for the Engineer

1. The Contractor shall provide the following offices:

	ITEM	CENTRAL SECTION	EAST BANK SECTION	WEST BANK SECTION
1	SINGLE BUILDING OF PLAN AREA APPROX. 210 SQ. M	1	1	1
2	COVERED CAR PORTS FOR 5 VEHICLES	1	1	1
3				

2. The Contractor shall provide, erect, furnish, equip, clean, maintain, and subsequently remove temporary buildings.
3. The site for the office shall be such that surface water rapidly disperses from it without inconvenience, and shall be kept free from surplus or unsuitable material and debris at all times.
4. The office, together with all car parking etc., shall be sited in a location where it can be enclosed within a 2.4 m minimum height security fence with one pair of lockable gates. The gates shall have 4.0 m clear opening.
5. Adequate fire prevention equipment shall be provided. The site shall also be provided with adequate lighting to all footpaths and car parking areas.
6. The offices including all necessary linking corridors, entrance halls, lobbies, etc. shall be of approved prefabricated, weatherproof, and dustproof construction suitable for the climatic conditions of the Qantara District. They shall be erected on adequate foundations, and the floors shall be raised a minimum of 300 mm above ground level and protected against rising damp. Walls and roof shall be of double skin construction containing adequate insulation against sound transmission and thermal effects. Interior finishes shall be of good quality and designed for ease of keeping clean and durability. The offices shall be protected against surface water flooding and vehicular access shall be maintained at all times.

7. Each room shall be provided with adequate windows which shall be fitted with flyscreens and adjustable sun blinds or curtains. External doors shall also be fitted with flyscreens.
8. A constant and adequate supply of electricity will be provided to the offices. Each room shall be fitted with electric lighting, 2-pin outlet sockets, and heating and air conditioning suitable for maintaining an equable internal environment, and the operation of all computers and related items.
9. A constant and adequate supply of good quality water shall be maintained to the offices. All necessary plumbing including hot and cold water supply, waste pipes, soil drainage, vent pipes to all sanitary fittings, and filters for potable water shall be provided. A septic tank or other approved method of disposal of sewer drainage and wastewater shall be provided with all necessary pipe work and fittings.
10. The facilities shall be air conditioned, fully furnished, and serviced continuously with power, water, sewerage, lighting, waste disposal and telephone or radio communication.

S.6.2 Offices, Equipment for the Engineer

1. The Contractor shall supply all necessary office supplies, stationery and consumables including requirements of bottled gas cleaning materials, etc. for the duration of the contract for the requirements of the Engineer.
2. The following offices equipment, furnishings and fittings, all as specified, are required for the Contract.

Suez Canal Bridge 1997

	Items	Specified Central Section	Number East Section	West Section
1	desk (minimum 2000 mm x 900 mm) with six lockable drawers and swivel armchair to suit.	1	1	1
2	desks (minimum 1800 mm x 900 mm) with six lockable drawers and swivel armchairs to suit.	5	5	5
3	desks (minimum 1500 mm x 750 mm) with three lockable drawers and chairs to suit.	8	9	9
4	desks (minimum 1200 mm x 750 mm) with four lockable drawers and chairs to suit.	4	4	4
5	typists desks with three lockable drawers and caster wheeled chairs to suit.	2	2	2
6	typists desks with chairs to suit.	2	2	2
7	conference table (minimum 2000 mm x 2000 mm)	2	2	2
9	drawing tables (2000 mm x 1000 mm) with stools to suit.	2	2	2
10	Formica face tables (2000 mm x 1000 mm)	2	2	2
11	fully adjustable A0 size parallel motion drawing boards with fixed lighting and adjustable stools to suit.	2	2	2
12	upholstered upright chairs to suit conference table.	16	14	12
13	padded chairs to match swivel armchairs.	4	3	3
14	padded chairs to match those provided with desks.	30	26	22
15	kitchen chairs to suit kitchen table.	4	3	3
16	chairs.	8	7	6
17	2000 mm x 540 mm bench seats.	3	2	2
18	plan chests with six drawers to suit A0 size drawings.	4	3	3
19	dustproof lockable cupboards (1800 mm x 900 mm x 540 mm) with four shelves.	6	5	4
20	melamine faced floor standing cupboard (2000 mm x 600 mm x 900 mm high) with Formica worktop.	1	1	1
21	melamine faced wall mounted cupboard (2000 mm x 450 mm x 600 mm high).	1	1	1
22	lockable filing cabinets each with four drawers.	7	6	5

	Items	Specified Central Section	Number East Section	West Section
23	- drawing filing chests (hanging) to suit A0 size drawings.	2	2	2
24	- bookcases (1200 mm x 450 mm x 900 mm high) with sliding glass doors.	4	3	3
25	- bookcases (1000 mm x 450 mm x 750 mm high).	6	5	4
26	- shelving, 300 mm depth, 1 m wide, 1.5 m height	10	8	7
27	- Pinboards (10 sqm)	4	5	4
28	- waste-baskets Adequate toilet facilities, in two separate bathrooms including:	15	13	11
29	- European type W.C.s.	3	2	2
30	- urinals.	2	2	2
31	- hand basins.	3	3	3
32	- shower unit complete with shower tray, mixing taps and curtain.	1	1	1
33	- mirrors wall mounted (1500 mm x 1000 mm).	3	3	3
34	- sanitary disposal unit.	1	1	1
35	- toweling facilities. Partitions and small fixings as required in bathrooms. Adequate kitchen facilities, including:	6	5	4
36	- four burner gas stove with oven, complete with two, 25-kg gas bottles.	1	1	1
37	- single bowl sink with draining board.	1	1	1
38	- 340 litter capacity (12 cu. ft.) refrigerator.	1	1	1
39	- drinking water fountain. Crockery and cutlery (24 pieces each, minimum), cooking and utensils	1	1	1
40	- dylne printing machine equivalent to Harper and Tunstall model type 720 A, complete on stand.	1	1	1
41	- plain paper photocopying machine equivalent to Xerox type 3107, complete on stand.	0	0	0
42	- electronic desktop IBM computer (Pentium 160, RAM 32 MB, HD 1 GB) or Equivalent with laser printer	2	2	2

S.6.3 Vehicles for the Supervisory Team

1. The Contractor shall provide vehicles of the following types and numbers to be kept available at all times for the sole use of the Supervisory Team. The Contractor shall submit for approval details of the make and model of the vehicles he proposes to provide.

	Central Section	East Bank Section	West Bank section
1 --Five-door saloon cars with engine capacities not less than 1600 cc.	0	2	2
2 --Four-door, four-wheel drive vehicles with high ground clearance designed for use on non-metalled roads and with engine displacement not less than 2500 cc.	0	4	4

2. New, unused vehicles shall be provided. They shall be specified suitable for the Egyptian climate and for locally available fuel and shall be of types for which spare parts are normally stocked in Egypt. They shall be equipped with seat belts for the front seats and air conditioning. Where a site radio telephone system is provided, these vehicles shall be equipped with receiver/transmitter sets. The vehicles shall be provided with all standard spares, tools and handbooks normally provided by the manufacturer with a new car.
3. The vehicles shall be comprehensively insured for use anywhere in Egypt whether for use associated with the Contract or otherwise.
4. The Contractor shall be solely responsible for the running and maintenance of the vehicles in good, safe and legal operating condition including taxes, insurance, licenses, fuel, oils, lubricants, and repairs.
5. In the event of a breakdown or accident the Contractor shall provide a replacement vehicle within 24 hours.
6. The Contractor shall provide competent drivers for the Engineer's Representative and his staff. Any driver unsatisfactory to the Engineer shall be replaced.

S.6.4 Survey Instruments for the Engineer's Staff

1. In spite of Article 3.13 of General Conditions, the Contractor shall provide for the use of the Engineer all survey and other instruments necessary for checking the Contractor's work as listed in the table below, such instruments to be maintained in good order by the Contractor.

Instruments List

Item	Central Section	East Section	West Section
1 – microptic theodolites (Wild T2 equipped to take E.D.M. or equivalent) measuring to one second of arc complete with tripods and close-focus lens attachment.	0	2	2
2 – electronic distance measurer (Wild or equivalent complete with 4 No. tripods and 4 No. targets/reflectors.	0	1	1
– automatic levels (Wild NA2 or equivalent) complete with tripods.	0	3	3
– 5m extending leveling staves, with detachable staff bubbles, and footplates.	0	2	2
– 5m extending leveling staves, with detachable staff bubbles, and footplates.	0	2	2
– 100m steel band, with thermometer and spring balance.	0	1	1
– 30m steel tapes.	0	3	3
– 30m linen tapes.	0	3	3
– 3m. steel tapes.	0	20	20
– 2m wooden ranging rods.	0	20	20

S.6.5 Telephone for the Engineer

1. The Contractor shall arrange for the installation of four external telephone lines for the sole use of Engineer and his staff as follows:

	Item	Central Section	East Section	West Section
1	Telephone instrument line	2	2	2
2	Facsimile line	1	1	1
3	Modemline	1	1	1

2. The lines shall be suitable for making calls both within Egypt and Internationally and shall include a telephone extension in each room (except toilets, kitchens and store rooms) of each office. The Contractor shall arrange for and pay for the installation and rental of such equipment and for local calls made by the Engineer's Representative and his staff.
3. In the event of the Contractor being unable to provide a telephone, he shall arrange, install and maintain a private radio telephone system for use by the Engineer and his staff and to his requirements.

S.6.6 Protective Clothing for the Engineer's Staff

1. The Contractor shall provide to the Supervisory Team such waterproof and other protective clothing, safety helmets and other safety equipment, rubber boots, torches and the like as may reasonably be required by them.
2. All such articles shall be new when issued and shall be repaired or replaced by the Contractor as necessary.

S.6.7 Basis of Payment

- 1 The costs relative to Clause above are to be included in the costs for Mobilization and Demobilization as a Lump Sum.
- 2 All these costs are to be include for Supply . Maintenance , Cleaning , repair and consumables , including replacement of items (not already insured) damaged or rendered inoperable during the course of the Contract.

1.0 General

1.0.1	Scope-----	1
1.0.2	Unit of Measurement-----	1
1.0.3	Drawings -----	1
1.1	Standards-----	1
1.1.1	Reference Standards-----	1
1.1.2	Abbreviations for Reference Standards -----	2
1.2	Data & Drawings -----	3
1.2.1	Non-disclosure of Information-----	3
1.2.2	Data for Setting Out the Works -----	3
1.2.3	Geotechnical Information-----	4
1.2.4	Design Drawings -----	5
1.2.5	Submissions by the Contractor -----	5
1.2.6	Drawing Standards -----	6
1.2.7	Additional Drawings -----	6
1.2.8	Temporary Works Designs-----	7
1.2.9	Revisions to Typical Detail Drawings-----	7
1.2.10	Fabrication and Installation Drawings-----	7
1.2.11	Contractor's As-Built Drawings -----	8
1.2.12	Operation and Maintenance Manuals -----	9
1.2.13	Implementation Programme -----	9
1.2.14	Monthly Report -----	12
1.3	Mobilization and Temporary Works-----	13
1.3.1	The Site -----	13
1.3.2	Offices and Accommodation -----	14
1.3.3	Temporary Works, Plant and Appliances-----	15
1.3.4	Temporary Hoardings, Fences and Barriers -----	15
1.3.5	Water Supplies-----	16
1.3.6	Electricity Supplies -----	16
1.3.7	Safety - General-----	17
1.3.8	Claims for Damage to Persons or Property-----	18
1.3.9	Prevention of Noise and Disturbance -----	18
1.3.10	Fire Prevention-----	19

1.3.11	Lighting and Electric Power-----	19
1.3.12	Sanitation-----	20
1.3.13	Works to be Kept Clear of Water-----	20
1.3.14	Disposal of Water-----	21
1.3.15	Disposal of Surplus Excavated Material -----	21
1.3.16	Public Streets and Site to be Kept Clean-----	21
1.3.17	Advertising and Publicity-----	22
1.3.18	Cooperation on Site -----	22
1.3.19	Protection and Diversion of Existing Services ----	23
1.3.20	Traffic Arrangements-----	24
1.3.21	Amenities to be Preserved -----	25
1.3.22	Protection of Antiquities -----	25
1.3.23	Fossils, etc. Found in Excavations-----	26
1.3.24	Protection of Finishes-----	26
1.3.25	Reinstatement of Working Sites -----	26
1.3.26	Taking Over Certificates -----	27
1.3.27	Commemorative Plaque and Opening Ceremony--	27
1.4	Quality Control Procedures-----	27
1.4.1	Responsibilities and Procedures-----	27
1.4.2	Quality Control Plan-----	27
1.4.3	Samples, Materials and Equipment for Testing ----	29
1.4.4	Inspections and Tests -----	29
1.4.5	Site Records and Test Certificates -----	30
1.4.6	Reports-----	31
1.4.7	Inventories-----	31
1.5	Reimbursement of Measurement-----	31
1.5.1	Methods of Measurement-----	31
1.5.2	Basis of Payment -----	32
1.5.3	Items in the Bill of Quantities -----	32

1.0 GENERAL

1.0.1 Scope

1. This Part of the Technical Specifications covers certain duties of the Contractor in connection with the administration of the Contract; it includes also some of the general responsibilities of the Contractor in carrying out work under the Contract.

1.0.2 Unit of Measurement

2. All units of measure used in this Specifications and the Drawings are according to standard metric system or SI systems. All documents or data submitted by the Contractor shall use the English language and Metric system.

1.0.3 Drawings

3. Drawings are composed of Design Drawings, Shop drawings and As-built drawings. Design Drawings mean the Drawings provided as a Tender Document and the Drawing means this Design Drawing if there are no definitions provided. The Contractor shall prepare and submit the Shop drawings and As-built drawings as described in Clause 1.2.5 of this Specification.

1.1 STANDARDS

1.1.1 Reference Standards

1. The Work shall be carried out in accordance with the relevant quality standards, test procedures or Codes of Practice, collectively referred to as Reference Standards, listed in the relevant Part of the Technical Specification. The Contractor shall familiarize himself fully with the requirements of such standards.
2. The issue of any Reference Standard current at the time of tender shall be used unless otherwise stated in the Technical Specification.
3. The Contractor may propose to the Engineer, if no standard is indicated or he deems to be necessary, the use of any alternative relevant authoritative internationally recognized Reference Standard which shall be no less exacting in the opinion of the Engineer than the corresponding standard quoted in this Technical Specification. The Contractor shall demonstrate to the Engineer that

the alternative standard is suitable and equivalent to the specified standard, as well as providing proof of previous successful use. The Engineer will decide and advise the Contractor whether or not such alternative will be allowed as a Reference Standard.

1.1.2 Abbreviations for Reference Standards

4. The following abbreviations where used in this Technical Specification refer to Standards, Codes of Practice and other publications published by the organizations listed:

AASHTO	American Association of State Highway & Transportation Organization
ACI	American Concrete Institute
ANSI	American National Standards Institute
API	American Petroleum Institute
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BS	British Standards Institution
CP	British Standards Institution (Code of Practice)
DIN	German Industrial Standards
DOE	Department of the Environment, U.K.
ES	Egyptian Standards
FIP	Federation International de Precontrainte
HMSO	Her Majesty's Stationery Office, U.K.
ICE	Institution of Civil Engineers, U.K.
IEC	International Electrical Commission
IEE	Institution of Electrical Engineers, U.K.
I.Mech.E	Institution of Mechanical Engineers, U.K.
IOS	International Organization for Standardization
JIS	Japanese Industrial Standards
SI	International System of Units

SIS Swedish Standards Commission
SSPC Steel Structures Painting Council U.S.

5. The Standard of JIS indicated in the Drawing will be allowed to use the alternative Standard of BS or equivalent with the Approval of the Engineer.

1.2 DATA & DRAWINGS

1.2.1 Non-disclosure of Information

1. The Contractor shall not, without the consent in writing of the Employer disclose particulars of the Contract to any person or furnish or publish or permit to be furnished or published any information with regard to the Employer's business to any person save in so far as may be necessary for the due performance of the Contract and shall preserve strict confidence with regard to any information of a confidential or secret nature received from the Employer or the Engineer.

1.2.2 Data for Setting Out the Works

2. The Contractor shall agree and record with the Engineer, prior to his first entry thereon, the surface topography and ground conditions of the Working Site(s) and the immediate surrounding area to the extent considered necessary by either the Engineer or the Contractor. The agreed record is to include photographs and spot levels as necessary and written descriptions of the site conditions.
3. All levels are related to bench marks **as shown in the Drawings**.
4. A traverse has been carried out of the **Site** and a series of drawings prepared to show the location of the survey stations. A list of the coordinates of survey stations which define the coordinate system to be used for the contract are shown on the **Drawings**.
5. The Contractor shall carry out all survey and leveling work to establish reference points in order to fulfill his obligations. The Contractor shall provide all survey and measuring instruments of every kind necessary for his own use in the execution of the Works.

6. The Works are shown on the Drawings but the precise positions lines and directions of the Works will be determined by the Engineer as the Contract proceeds.
7. Before commencing setting out the Contractor shall check by level survey that all bench marks he proposes to use conform with **at least 4 other bench marks** listed, and check by traverse the relative coordinates of the survey stations. The Contractor shall inform the Engineer in writing of the result of these survey checks and whether such bench marks and survey stations are in agreement or not. Should the bench marks or survey stations coordinates not be in agreement the Engineer will direct the Contractor to undertake further survey checks and what bench marks values and survey station coordinates to adopt.
8. The Contractor shall use the above datum and coordinate system in constructing the Works and preparing **As-Built Drawings**.
9. In order to ensure compatability with the survey and leveling work of other contractors the Contractor shall coordinate his survey and leveling points with those of other Contractors. He shall keep the Engineer informed of this coordination and shall take such steps as are required by the Engineer to adjust the values of his survey and leveling points should adjustments be required to make them compatible with those of others.
10. The Contractor shall provide chainmen and every other assistance to the Engineer's Representative and his staff in carrying out their duties and shall provide pegs, poles, paint, lines, spirit levels, and other materials and small tools as needed by the Engineer's Representative for checking and setting out and for the measurement of work.

1.2.3 Geotechnical Information

11. Site investigations have been carried out by the Employer in connection with the Project. The original Site Investigation reports together with other information considered by the Engineer during design are available for inspection in the Engineer's office after starting the Project.

1.2.4 Design Drawings

12. The Drawings prepared by the Engineer are listed in the Drawing Schedules. They may be modified or added to during the course of the Contract.

1.2.5 Submissions by the Contractor

13. The Contractor shall provide the following numbers of copies to the Engineer unless otherwise instructed: (Note : Contractors Drawings prepared in Item 1, 2, 3 and 4 shall be called as Shop Drawings hereinafter.)

Name of Drawings and Data	numbers of copies
1: Additional drawings (for use by Contractor's employees)	2 copies
2: Temporary Works designs	2 copies
3: Fabrication/installation drawings	2 copies
4: Revisions to typical details	2 copies
5: Contractor's As-Built Drawings for approval	2 copies
6: Contractor's As-Built Drawings - final negatives	1 copy
7: Operation and maintenance manuals	6 copies
8: Manufacturer's test certificates	2 copies
9: Implementation & Payment Programs	3 copies
10: Revised Method Statements , if necessary	3 copies
11: Reference Standards as specified	1 copy
12: Monthly Report	3 copies
13: Other Submissions as may be specified	as advised by the Engineer

14. Subject to any specific requirements in the Contract, all submissions shall be made sufficiently early to allow the Engineer time for review and approval, and for the Contractor to provide and submit revisions or alternatives, or carry out further tests if, in the opinion of the Engineer, the initial submissions do not meet the requirements of the Contract.

15. Unless otherwise specified or agreed before submission, the Contractor shall allow not less than **30 days** for review by the Engineer of designs, documents

and samples which are required to be approved before manufacture or construction commences as part of the Permanent Works.

16. Unless other arrangements are agreed to by the Engineer all submissions shall be made by the Contractor whether on his own behalf or that of his Sub-Contractors.
17. The Engineer's consent to any or all of the drawings submitted by the Contractor and/or sub-contractor shall not relieve the Contractor of his responsibilities in connection with the carrying out of the Works.

1.2.6 Drawing Standards

18. All drawings submitted by the Contractor shall be clearly printed with black lines on white paper, and shall be resistant to fading on exposure to light.
19. Sheet sizes shall be in accordance with A series to ISO 216, 1975, and shall not be larger than A1 size unless otherwise agreed by the Engineer.
20. All drawings submitted by the Contractor shall use the English language and Metric units.
21. All drawings shall be clearly and fully cross referenced to the Technical Specification and the Design Drawings as relevant.
22. Where drawings are revised, the revision letter or number shall be incorporated in the title block and the revision shall be clearly indicated on the drawing with the revision letter or number shown in an adjacent triangle.
23. As-Built Drawings shall be prepared in a similar style and presentation to the Design Drawings. CAD Files of them are required also.
24. All drawings and revisions submitted by the Contractor shall be dated, certified and signed by the Contractor to be correct.

1.2.7 Additional Drawings

- 25 Any additional drawings which the Contractor requires to interpret the Drawings for the use of his employees shall be prepared by the Contractor with two copies to the Engineer for information.

1.2.8 Temporary Works Designs

26. The Contractor shall, as soon as practicable after the **Notice to Proceed**, submit to the Engineer for his approval two copies of fully-figured detail drawings, calculations and diagrammatic or written method statements of all Temporary Works, constructional plant and methods of construction he proposes to adopt in connection with the Works.
27. In formulating his proposal the Contractor shall take full account of the need to avoid infringing any right of support to the ground or buildings or other structures or services whether above or below the surface of the land. The Contractor shall not be absolved from any liability imposed upon him under the Contract by reasons of the Engineer having examined the Contractor's drawings of the Temporary Works and arrangements or by any consent given by the Engineer thereto, either with or without modifications.

1.2.9 Revisions to Typical Detail Drawings

28. Where Drawings provided by the Employer show typical details for the positions, dimensions or levels of foundations, supports, holes or openings through walls or slabs for items of equipment or plant to be provided by the Contractor as part of the Works, the Contractor shall satisfy himself before construction that such positions, levels or dimensions are correct for the actual items being supplied by him.
29. In the event that such Drawings require to be changed to suit the items being supplied by him the Contractor shall prepare drawings of such changes and submit them for approval. In the event that such Drawings require to be changed to suit the items supplied by another contractor, the Engineer will provide revisions of such Drawings as become necessary to the Contractor.

1.2.10 Fabrication and Installation Drawings

30. Where drawings are required for fabrication or installation of items of plant or equipment provided by the Contractor or his sub-contractors, such drawings shall be provided by the Contractor and submitted to the Engineer for approval.
31. These drawings shall include, but not be limited to, **shop** fabrication detail drawings including details of welding, match-marks, erection diagrams, and

other details such as connections, all as necessary for proper installation and erection of the equipment and performance of the work.

32. 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 date of such drawings shall be included. The drawings shall indicate dimensions and allowable tolerances.

1.2.11 Contractor's As-Built Drawings

33. On the completion of the Work the Contractor shall provide a complete and accurate set of all drawings to detail parts of the Permanent Works, regardless of whether such details were originally prepared by the Engineer or by the Contractor, his sub-contractors, or suppliers. This set of drawings is referred to as "**Contractor's As-Built Drawings.**"
34. During manufacture, installation, or construction, the original drawings shall be progressively marked up to show any changes which may become necessary, and to show correct dimensions, sizes, equipment details and the like so as to provide a complete and accurate record of the part of the Permanent Works covered by such drawings.
35. The Contractor's As-Built Drawings shall be completed and submitted to the Engineer **within 1 month** of the time that the work detailed on them is completed. Each drawing shall be certified by the Contractor as being a complete and accurate record of the work detailed on it. A copy of the current drawings shall be kept on Site, at all times available for inspection by the Engineer. After approval of the Contractor's As-Built Drawings by the Engineer, the Contractor shall provide one reproducible on plastic film of each drawing and appropriate CAD file.
36. The **Taking-Over Certificate** (or Substantial Completion Certificate) shall not be issued until the Contractor has submitted a complete set of approved As-Built Drawings on plastic film and CAD files.

1.2.12 Operation and Maintenance Manuals

37. The Contractor shall provide Operation and Maintenance Manuals for all mechanical, electrical and special equipment and systems supplied by the Contractor. The Manuals shall cover the following subjects as applicable:

- (a) Technical description of the equipment.
- (b) Detailed operational instructions and sequence of operations for all equipment and systems.
- (c) Simplified facility drawings for a complete system, to show all components of the system.
- (d) Schematic diagrams for each system.
- (e) Schedule of equipment supplied giving manufacturer's name and appropriate Model No./Cat. No. and technical description.
- (f) Sectional arrangement drawings of plant items together with step-by-step procedures for dismantling, cleaning, servicing, replacing parts and reassembling, including recommended clearances and tolerances.
- (g) Parts list with part identification numbers and sources replacement parts.
- (h) Test certificates, performance curves and calibration data for both works and site tests for transformers/electrical installation and other items, where appropriate.
- (i) Permanent plant layout drawings, if any, showing the 'as erected' installation.
- (j) General arrangement and schematic diagrams of the 'as installed' control panels.
- (k) 'As wired' diagrams of all electrical connections, between the control panel and installed loads.

38. The Contractor of Central Section shall provide Maintenance Manuals of the Cable Stayed Bridge before end of construction of the bridge. The Manuals shall cover the following subjects as applicable:
- (a) Interval for painting, lubricating with oil, changing parts, etc. for different parts of the bridge.
 - (b) name and address of manufacturer of special parts shall be given.
 - (c) detailed procedures for changing of special parts , for example
 - (c-1) Exterior sheathing of cable stay
 - (c-2) Bearing shoes at deck to Pylon connection in the Cable Stayed Bridge.
 - (c-3) Wind shoe at Pylon to deck connection
 - (c-4) Pendel at auxiliary piers and end piers
 - (c-5) Changing of cable-stay
 - (c-6) All other important parts of the Bridge.
 - (d) detailed procedures for regular maintenance of the expansion joint to avoid from clogging by sand due to the severe sand storms in the area around the bridge.
38. The Manuals shall be prepared in both the English and Arabic languages. Pages shall be of approximately A4 size or folded to that size, and placed in a loose-leaf hard cover binder, using not more than 70 percent of the binder capacity.
39. The title page shall bear, in an approved form, sufficient information to identify the Employer, the Project, the Contract, and the subject of the Manual. A table of contents shall follow the title page and list each item with the number of pages included. The manual pages need not be numbered, but index tab pages shall be provided to permit quick access. Each item of equipment shall be cross referenced to the applicable Technical Specification Clause.

40. All pages shall be clear, legible and permanent. Offset printing is preferable, but photocopies will be acceptable if clear. Relevant catalogue cuts may be incorporated if non-applicable parts are deleted.
41. The Contractor shall furnish **2 copies** of each Manual for approval not less than **30 days** before initial start-up of the item.
42. After approval by the Engineer the 2 initial copies shall be revised to incorporate any required amendments and a further 4 copies shall be provided, making a total of 6 copies in all. The **Taking-Over Certificate** (or Substantial Completion Certificate) shall not be issued until the Contractor has submitted such revised manuals.
43. If any further revisions are required as a result of operational experience during the Defects Liability Period, all 6 copies shall be revised by the Contractor by the provision of replacement or additional pages within a period of **30 days** of the need for the revisions becoming apparent.

1.2.13 Implementation Programme

44. The Implementation Programme shall itemize each major operation for the construction of the civil works. Where the Contract includes the provision of mechanical or electrical equipment, the Programme shall include the preparation of shop drawings, manufacture, delivery, installation, testing and commissioning of each item of equipment and the preparation of Operation and Maintenance manuals.
45. The Programme shall show the arrival and departure of major construction plant to and from the Site and shall show the monthly requirement of major materials on Site.
46. The Programme shall be accompanied by a Payment Programme indicating the estimated level of payment throughout the Contract.
47. The unit of time to be used in all programming and planning shall be the week **beginning on Saturday.**
48. All work shall subsequently be correlated to the Project Calendar provided by the Engineer.

49. The form of the Programme shall be to the approval of the Engineer.
50. In preparing the programme the Contractor shall also take account of certain basic requirements given below:
 - a) The Contractor shall be responsible for all utility diversions required either for the Permanent Works or for the setting up of Working Sites, as well as for temporary or permanent traffic, diversions.
 - b) The Contractor may be required to be responsible for the care and safekeeping of the works for the period between the date of substantial completion and the opening of the Bridge Crossing.
 - c) The Working Site may be occupied by the Contractor throughout the period of the Contract up to the completion.
51. The contractor shall similarly revise his **Method Statement** submitted with his tender, and in a form to the approval of the Engineer, as becomes necessary during the course of the Contract and shall obtain approval to such revisions from the Engineer.
52. The submission, approval or acceptance of an updated Programme shall in no way relieve the Contractor from his responsibility to complete the Works within the Contract Period, subject to any extensions of time granted by the Engineer.

1.2.14 Monthly Report

53. The Contractor shall provide Monthly Report with his Programme and Payment Programme covering all aspects of the Works. The updated Programs shall clearly show the actual progress to date, the expected future progress, and the dependencies between one operation and another.
54. The Contractor shall provide the Engineer with records of labour and plant used each month including labour and plant used by his sub-contractors. Such information shall be provided promptly at the end of each month in a form acceptable to the Engineer.
55. The Contractor shall arrange for photographs to be taken at monthly intervals and additionally as ordered by the Engineer and shall provide from each negative 6

color prints of a size not less than 165 mm x 215 mm. 2 sets of 6 prints shall be mounted and captioned in hard back albums.

56. Each print shall be identified on the back with the date and place of taking and such other information as may be relevant. The Contractor may also take record photographs for his own purposes, but shall ensure that no use is made of any negative or print for purposes not directly related to the Contract without permission from the Employer. The Contractor shall also ensure that no unauthorized photography is allowed on the Site.
57. All photographs shall be clear, in focus and properly exposed and printed. The film size shall be not smaller than 35 mm.

1.3 MOBILIZATION AND TEMPORARY WORKS

1.3.1 The Site

1. Working Sites shall be used solely for the construction of the Works.
2. Apart from transport to and from these areas the Contractor shall confine his local operations under the Contract to these areas.
3. Before entering the Working Sites the Contractor shall give 30 (thirty) days notice to the Engineer in writing.
4. In addition, before entering any additional working sites the Contractor shall obtain and forward to the Engineer a copy of the written consent of the owner and occupier or authority having charge of the land stating the purposes for which such land is to be used by the Contractor, and defining the extent and periods of his occupation for which such consent is granted. Notwithstanding the requirements of such consent additional working sites shall be protected by fences or barriers or other works as required by the Engineer. Wherever practicable a passage shall be maintained for vehicles and pedestrians along public roads and to all adjacent properties.
5. The Contractor's access to the Working Sites shall be restricted to that shown on the Drawings unless no access is indicated or unless alternative access is requested by the Engineer.

6. Upon occupation of the Working Site the Contractor shall demolish and remove all debris, street furniture, etc. enclosed within the site boundary as directed by the Engineer. The Contractor shall provide adequate access to, within and around outside the site. The Contractor shall be responsible for the diversion of all utilities, those necessary and the eventual reinstatement of all such diversions as directed by the Engineer. The Contractor shall preserve all existing utilities situated in or adjacent to the Working Sites. The Contractor shall locate his plant, equipment, offices, etc. to avoid existing utilities, and to allow access for the repair and maintenance of such utilities.

1.3.2 Offices and Accommodation

7. For the use of his own staff and work force the Contractor shall provide, maintain, and subsequently remove all “**temporary offices**”, sanitary arrangements, stores, workshops, *compounds*, parking areas, and the like necessary for the completion of the Works and maintenance of the Permanent Works and the siting and layout of these shall be to the general approval of the Engineer.
8. The Contractor shall also provide, maintain and subsequently remove all “**temporary accommodation**”, living facilities and appurtenant services where required including all necessary services for water supply, drainage, lighting, heating, roads, paths, parking places and refuse disposal for his staff, other employees and for the employees of his sub-contractors. Such accommodation must meet the sanitation requirements of the **Medical Officer of Health** appointed by the Employer. The Contractor shall provide medical facilities as required by the Medical Officer of Health. Details and layout of such buildings and services shall be to the general approval of the **Engineer** and the Contractor shall also obtain any necessary approval from any local or other authorities concerned.
9. The Contractor shall provide, erect, furnish, equip, clean, maintain, heat and cool, light, and subsequently remove temporary buildings for the use of the Engineer’s and Employer’s staff as specified in the Special Specifications. The required quantities of the Tables in the Special Specifications show the number for the three separated Contract Sections, and the Contractor shall provide and maintain the defined number of items of his Section only.

1.3.3 Temporary Works, Plant and Appliances

10. The Contractor shall be held solely and entirely responsible for the safety, security, and maintenance of all "Temporary Works, plant, and appliances" which may be erected or provided for the purpose of or in connection with the Works.
11. The Contractor shall take all precautions to ensure that the whole of the "Temporary Works, plant and appliances" are fully secured and made safe for as long as may be necessary against all risk of damage thereto by water or wind action or from any causes whatsoever.
12. The Contractor shall remove all "Temporary Works, plant and appliances" in such a manner as to prevent damage to the Permanent Works.
13. The permission of the Engineer for removal from the Site for everything provided by the Contractor as a part of the "Temporary Works or of the construction plant" (whether it is owned by or is on hire to the Contractor) may be withheld until the issue of the Defects Liability Certificate.

1.3.4 Temporary Hoardings, Fences and Barriers

14. The Contractor shall provide, erect and maintain in good condition to the satisfaction of the Engineer **hoarded enclosures** in positions shown on the Drawings or where directed by the Engineer. Except where otherwise specified, hoardings at surface level shall be close hoarded, **2.4 m high**, and constructed so as to be unclimbable and provided with lockable gates at each site entrance. **Paint** of an approved color shall be applied to the external face of the hoardings.
15. Where shown on the Drawings, or if so instructed by the Engineer, the Contractor shall dismantle **hoardings** and re-erect them in new positions.
16. The Contractor shall erect such **hoardings** before commencing other works at the Working Site.
17. The perimeter of the Working Site is to be clearly defined by posts and wire strand type fencing or similar.

18. The Contractor shall remove all **hoardings and fencing** on completion of the Works, except for such hoardings, or parts thereof, as the Engineer may direct to be left in place and in good condition for the Employer's use.

1.3.5 Water Supplies

19. The Contractor shall make his own arrangements for the provision of an **adequate water supply** for the purposes of the Contract.
20. The Contractor shall also ensure an adequate **potable water supply** for the use of his employees and the Engineer's staff.

1.3.6 Electricity Supplies

22. The Contractor shall install, operate, maintain, and subsequently remove equipment to provide sufficient supplies of electricity for the heating, lighting, and air conditioning of all offices, stores, laboratories, and other temporary buildings used by the Contractor and by the Engineer in addition to any supplies he may require in connection with the construction of the Works.
23. In addition to his main source of power supply, the Contractor shall where necessary provide and maintain temporary power supplies adequate to ensure the safety of the Works in the event of failure in the main supply irrespective of the timing or duration of such failure.
25. All site electrical installations shall be carried out in accordance with the current edition of the Regulations for the Electrical Equipment of Buildings published by the Institution of Electrical Engineers in the U.K. or the Egyptian equivalent.
26. Should the Contractor elect to use **Ismailiya Electricity Distribution Co.** as the source of his main electrical power, he is advised to determine his requirements and commence early negotiations with the Company such that supplies, from this source can be made available as required by the Contractor's construction programme. The detailed requirements of the Contractor shall be mentioned in the Implementation Programme, and the result of negotiation shall be mentioned in the Monthly report.
27. Any permanent fencing or other safeguards required to be erected around electrical equipment shall be completed as far as practicable before connection is made to the

electricity supply. In so far as this is not practicable the Engineer may permit the use of temporary fencing or other safeguards.

28. Where work has to be carried out in proximity to operational, mechanical, and electrical equipment other than the Contractor's own plant, the Contractor shall establish a Restricted Area to the approval of the Engineer.

1.3.7 Safety - General

29. The Contractor shall execute the Works in a manner complying with the best international standards regarding safety.
30. This shall generally be interpreted as complying with the safety requirements as practiced under the Egyptian Civil Code.
31. Should the Engineer consider the Contractor's method of working unsafe or that there are insufficient or inadequate safety barriers or other devices or that there is insufficient safety or rescue equipment the Contractor shall change his method of working or install or strengthen safety and rescue equipment as so instructed. Such instructions shall not relieve the Contractor of any of his responsibilities under the Contract.
32. The Contractor shall notify the Engineer immediately if any accident occurs whether on Site or off Site in which the Contractor is directly involved which results in any injury to any person whether directly concerned with the Site or a third party. Such initial notification may be verbal and shall be followed by a comprehensive written report within 24 hours of the accident.
33. Transportation of any material by the Contractor shall be in suitable vehicles which, when loaded, do not cause spillage; all loads shall be suitably secured. Any vehicle which does not comply with this requirement or any of the local traffic regulations and laws shall be removed from the Site.
34. The Contractor shall make all necessary arrangements with the appropriate authority before entering in or working on existing sewers and associated works, and shall strictly observe all safety regulations.

1.3.8 Claims for Damage to Persons or Property

35. Any claim received by the Employer in respect of matters in which the Contractor is required under the Contract to indemnify the Employer will be passed to the Contractor who shall likewise inform the Employer of any such claim which is submitted directly to him by a claimant. The Contractor shall do everything necessary, including notifying the insurers of claims received, to ensure that all claims are settled properly and expeditiously and shall keep the Employer informed as to the progress made towards settlement.
36. If the Contractor receives a claim which he considers to be in respect of matters for which he is to be indemnified by the Employer under the Contractor he shall immediately pass such claim to the Employer. All information as aforesaid shall be given in writing and shall be copied to the Engineer.

1.3.9 Prevention of Noise and Disturbance

37. Noise and disturbance shall be kept to the reasonable minimum. The Contractor's attention is drawn to the close proximity of some Working Sites to building in continuous use. All plant and tools used at such sites above or near ground level shall be silenced or of a silent type.
38. The Contractor shall take all necessary steps to ensure that his workmen carry out their duties in a quiet manner particularly when working at night and shall display notices in prominent positions at the Working Sites, stressing the need for quietness.
39. The Contractor shall obtain the Engineer's consent to the details and arrangements of all plant before installation. All plant shall be kept in good repair and safe working order. Operation of any particular item of plant shall be stopped whenever, in the opinion of the Engineer, it is causing unreasonable noise or disturbance. The Contractor shall immediately take steps to eliminate such noise or disturbance or replace the plant.
40. Where compressors or generators are to be used in the built up area suitable baffles or other provisions to reduce noise emission shall be provided to the approval of the Engineer. External doors and ventilation openings shall be

provided with suitable acoustic baffles to reduce the emission of noise. Acoustic screening for outside plant shall be provided to the satisfaction of the Engineer.

41. The Contractor shall take noise intensity readings as required by the Engineer and shall submit the results to the Engineer. The Contractor shall comply with any additional measures required by the Engineer to keep noise and disturbance to the minimum.

1.3.10 Fire Prevention

42. During the performance of the Contract, the Contractor shall make arrangements to the satisfaction of the Engineer for the protection of the Works and any Temporary Works and any adjacent property from fire and shall give the Fire Authority access to all facilities periodically to inspect the fire prevention arrangements.
43. Particular care must be exercised in connection with the operation of electric-arc welding equipment, oxy-acetylene cutting equipment and other processes involving the use of naked lights. Special arrangements will be necessary for the storage of highly flammable liquids on the Site.
44. The Contractor shall remove all rubbish and surplus material of a flammable nature and take such other steps as the Engineer may require but this shall not relieve the Contractor of any of his obligations under the Contract.
45. The Contractor shall contact with Local Fire Service Stations immediately after receiving the Notice to Proceed.

1.3.11 Lighting and Electric Power

46. The Contractor shall provide and maintain efficient temporary lighting and power supplies for all parts of the Works as may be necessary and shall, in connection with such supplies, adopt precautions to ensure the safety of all personnel.
47. The Contractor shall provide adequate lighting for the proper execution and inspection of the Works. If the Engineer considers the intensity of lighting to be inadequate for the proper execution and inspection of the work being undertaken the Contractor shall install such additional lighting as the Engineer may require.

48. Such lighting shall be maintained throughout the Contract until the date of the Engineer's Taking Over Certificate or such earlier date as the Engineer may agree for certain sections of the Works.

1.3.12 Sanitation

49. The Contractor shall clean as necessary and maintain the Site in a hygienic condition and shall comply with the requirements of the Medical Officer of Health appointed by the Employer and any instructions of the Engineer.
50. The Contractor shall provide, maintain and remove at the end of the Contract or when directed by the Engineer, adequate toilet facilities including flushing W.C.'s, hot water and showers for the use of his own staff and that of the Engineer adjacent to or part of their site offices and additional suitable facilities in various parts of the Site as necessary for the use of his workmen.

1.3.13 Works to be Kept Clear of Water

51. The Contractor's attention is drawn to the generally high groundwater levels.
52. The Contractor shall ensure that so far as is practicable all work is carried out in the dry and shall keep all excavations free from water and wastewater whether caused by floods, storms, pipe leakage, groundwater infiltration or otherwise. Construction in water shall only be carried out with the specific written permission of the Engineer.
53. The Contractor shall, before commencing any excavation, obtain the Engineer's approval to his proposals for dealing with water encountered in the works. He shall construct, operate and maintain all Temporary Works and dewatering plant necessary to exclude water from the Works while construction (including installation work by other contractors) is in progress. Such Temporary Works and Plant shall not be removed without the approval of the Engineer.
54. Any approval by the Engineer to the Contractor's arrangements for dealing with water shall be not relieve the Contractor of his responsibilities under the Contract.

1.3.14 Disposal of Water

55. Water removed from excavations must not be allowed to cause nuisance or damage to traffic or any public or private property or service.
56. The Contractor shall make his own arrangements for disposing of water collected in the excavations. Notwithstanding any requirement of the owners of watercourses or sewers into which drainage water is discharged, the Contractor shall provide and maintain to the satisfaction of the Engineer an efficient settling basin or sand trap through which such drainage waters shall pass before discharge. The Contractor shall furthermore take all necessary precautions to prevent the discharge of toxic materials.
57. The Contractor shall be held responsible for any damage which may occur as a result of such discharges into watercourses or sewers, notwithstanding any approval which may have been given.

1.3.15 Disposal of Surplus Excavated Material

58. Surplus excavated material and debris arising from the Works shall be disposed of at places approved by the Engineer. In order to avoid unauthorized disposal, the Contractor shall arrange that each cartage contractor and lorry driver employed for the disposal of such materials is given written instructions as to the approved place where each load is to be tipped.
59. The Contractor shall retain in his office copies of such instructions, together with a list of approved places to be used, for inspection at any time by the Engineer.
60. The Contractor shall indemnify the Employer against any claims arising from unauthorized disposal of such materials.

1.3.16 Public Streets and Site to be Kept Clean

61. The Contractor shall take great care and all reasonable precautions to ensure that public streets and thoroughfares used by him either for the construction of the Works or for the transport of plant, labour and materials are not made dirty as a result of such construction or transport and in the event of their becoming thus dirtied in the opinion of the Engineer the Contractor shall take all necessary and immediate steps to clean them.

62. Vehicles shall be thoroughly cleaned down before leaving the sites and shall be so loaded that spillage therefrom is prevented. Particular care shall be observed when disposing of slurry type material in a highly fluid condition which may additionally be contaminated with bentonite.
63. Each individual site must be kept clean during the work and must be thoroughly cleaned up on completion.

1.3.17 Advertising and Publicity

64. Advertising will not be allowed on any boarding whether temporary or permanent, or on any other part of the Works, except such as the Employer may require for his own purposes.
65. The Contractor shall obtain the permission of the Employer before publishing any article describing the Works. The Engineer's permission shall be obtained before any member of the public is allowed to inspect the Works. All visitors will be required to sign a form of indemnity.
66. The Contractor shall provide notice boards as required by the Engineer advertising the Project.

1.3.18 Cooperation on Site

67. The Contractor shall use his best endeavors at all times to facilitate the operations of the Employer's other Contractors to ensure the successful completion of the Project.
68. The presence of the Employer or his other Contractors on the Site shall not in itself be deemed to constitute any handing over of the Works or to warrant the issue of a Completion Certificate.
69. All work shall be carried out in such a way as to allow reasonable access and afford all reasonable facilities for any other Contractor and his workmen, for the Engineer and staff and any other person who may be employed in the execution and/or operation at or near the Site of any work in connection with the Contract or otherwise. In this connection the Contractor shall also make available and maintain in a safe condition at all times, ladders, landings, walkways and the like which he has provided for his own use.

70. The Contractor shall clean and clear up all sections of the Works as they are completed, and prior to the entry of the contractors, save only for the maintenance of such access services and plant as are essential to continue and complete other sections of work.

1.3.19 Protection and Diversion of Existing Services

71. The approximate locations of all existing utilities known to the Engineer are indicated on the Drawings. The Engineer does not warrant the accuracy of the information set out on such Drawings and the Contractor is required by his own inquiries and actions to satisfy himself as to the sufficiency and accuracy of the information set out thereon.
72. The Contractor shall be responsible for notifying the utility service authorities of his intention to expose utilities and where so required by the utility service authority shall not commence operations until the utility service authority is represented on Site.
73. The Contractor shall carry out exploratory excavations by hand, in a manner so as not to damage the utilities, to expose all utilities in advance of his general excavation. Such exploratory excavations shall either be protected until the general excavation meets this excavation or be re-filled after recording the nature and position of the service according to the Engineer's instructions.
74. As soon as a utility is encountered in the excavation whether previously located or discovered during the course of excavation for the Permanent Works the Contractor shall forthwith call the attention of the Engineer and the appropriate utility service authority thereto.
75. The Contractor shall be responsible for maintaining all such utilities encountered by him in the construction of the Works and shall make good and damage caused directly or indirectly by his activities. He shall temporarily support or divert and subsequently reinstate all such utilities to the satisfaction of the Engineer and appropriate utility service authority.
76. Existing utilities shall not be removed or cut into without the written agreement of the appropriate utility service authority, a copy of which agreement shall be handed to the Engineer prior to the commencement of the work. Such agreement

shall state the minimum safety and protective measures required to be undertaken in carrying out the work.

77. Where permanent diversion or support of utilities is necessary to enable construction of the Permanent Works to proceed, and the appropriate utility service authority elects to carry out the work, the Contractor shall provide all necessary attendance and facilities. If the Contractor is directed to carry out the work it shall be carried out to the instructions and approval of the appropriate utility service authority and the Engineer. Notwithstanding the protective measures being to the requirements of the authorities the Contractor shall be responsible for making good any damage caused either directly or indirectly by his activities or negligence.

1.3.20 Traffic Arrangements

78. The Contractor shall seek information on and comply with all requirements and recommendations of the local police regarding traffic safety measures.
79. Plans for re-routing traffic along public streets during occupation of the Working Sites have been arranged with the appropriate Governorate Authorities which include the Traffic Police.
80. The Contractor shall provide all barriers and traffic signs indicated on the Drawings or as otherwise required by the Authorities or instructed by the Engineer. All signs must comply with standard international practice or as otherwise required by the traffic authorities. All written notices on signs shall be in both Arabic and English. The Contractor shall erect such signs and traffic control equipment immediately before his occupation of the Working Sites, maintain them during his occupation and remove them immediately after the termination of his occupation. When alternate one-way working of traffic is required, the Contractor shall also provide, operate and maintain manually operated 'Stop-Go' signals.
81. Where normal access to properties cannot be maintained the Contractor shall arrange with the owners and occupiers of such properties alternative temporary access and shall submit details of such agreed temporary access arrangements to the Engineer in writing before occupying the Working Sites.

82. The Contractors attention is drawn to the risk of discovering unexploded bombs, shells and similar military ordnance, particularly on the East Bank of the Suez Canal.
83. Prior to any clearing leveling or entry works commencing arrangements are to be made with the Engineer to enlist the services of the Egyptian Army Bomb Disposal Branch. The area will be swept to locate any such ordnance and rendered harmless or removed by the army as appropriate.
84. Non hazardous debris so identified shall be removed to an appropriate dump site by the Contractor. In the event that the Contractor discovers unexploded or hazardous ordnance he shall secure the area with warning bunting or similar, cease all work at the location, prevent entry by personnel and inform the Engineer, immediately.
85. The appropriate action required will then be advised to the Contractor.

1.3.2.1 Amenities to be Preserved

86. The Contractor shall cause the least possible interference with existing amenities, whether natural or man-made. No trees shall be trimmed or felled except as authorized by the Engineer.
87. All lights provided by the Contractor shall be so placed or screened as not to interfere with the use of adjacent buildings, road users, traffic or signal lights or other equipment of the Employer or other authority.
88. The contractor shall store and place all materials, plant and appliances in such a manner as to prevent them causing injury or damage to persons or property and at a safe distance from roads, tracks and footpaths.

1.3.2.2 Protection of Antiquities

89. The authorities responsible for public utility services and antiquities in the Project Area and their appointed agents are informed by the Employer soon after the issuance of Notice to Proceed.
90. In connection with the discovery of antiquities the Contractor's attention is drawn to Sub-Clause 27.1 of the Conditions of Contract.

1.3.23 Fossils, etc. Found in Excavations

91. No requirement of the Technical Specification regarding the disposal of material arising from Site clearance or excavation shall override any provision in the Conditions of Contract Sub-Clause 27.1 as to the discovery, or ownership, of fossils, coins, articles of value or antiquity or anything of geological or archaeological interest found on the Site.

1.3.24 Protection of Finishes

92. The Contractor shall take every care to prevent damage to the Works and shall ensure that adequate protection is given to all works from the activities of following trades and any third party. Vulnerable parts of the Works particularly liable to damage shall be protected as may be reasonably required by the Engineer and shall be deemed to be insured against damage in accordance with the Conditions of Contract.

1.3.25 Reinstatement of Working Sites

93. The Contractor shall reinstate all properties affected by the Works, Temporary Works, constructional plant, labour, materials, or transport to a condition at least equal to that existing before his first entry on to them or otherwise as specified in the Contract or as agreed in writing with the landowner or tenant.
94. If in the opinion of the Engineer the Contractor shall have failed to take reasonable and prompt action to discharge his obligations in the matter of reinstatements the Engineer will inform the Contractor in writing of his opinion in which circumstances the Employer reserves the right to carry out the reinstatement himself or to arrange for it to be carried out by others or to make payments to the owners and occupiers in respect of such matters for which the Contractor is responsible. All such costs incurred and payments made will be deducted from any moneys due or which shall become due from the Employer to the Contractor.
95. Temporary reinstatement shall be carried out as soon as is practical after completion of the Permanent Works. Temporary reinstatement shall be maintained by making good any subsidence shrinkage defect, imperfection, or fault for a period as directed by the Engineer, but of not more than **half year**

following which the permanent reinstatement shall be carried out. Permanent reinstatement shall be to the requirements of the Engineer.

1.3.26 Taking Over Certificates

96. No Taking Over Certificate (or Substantial Completion Certificate) shall relieve the Contractor of any of his obligations in connection with the other contractors whose work might be carried out subsequent to the issue of such a Certificate.

1.3.27 Commemorative Plaque and Opening Ceremony

- 97 The Contractor shall take into consideration the cost of the Commemorative Plaque and Opening Ceremony in his tender price. The payment items are not included in the Bill of quantities, but shall be included in the mobilization and demobilization cost.

1.4 QUALITY CONTROL PROCEDURES

1.4.1 Responsibilities and Procedures

1. In addition to any specific obligations for sampling and testing the Contractor shall be responsible for routine inspection sampling and testing of all materials, workmanship, plant, and measuring devices in order to control the quality of work and to ensure compliance with the Technical Specification and with approved samples.
2. The Contractor shall be responsible for establishing and maintaining procedures for quality control which will ensure that all aspects of the Works comply with the requirements of the Contract.
3. The Contractor shall appoint a suitably qualified member of his staff to be responsible for all aspects of quality control and to maintain effective liaison with the Engineer.

1.4.2 Quality Control Plan

4. Within 90 days of receipt of the Notice of Award, the Contractor shall submit for the Engineer's review a detailed description of his proposed Quality Control Plan.
5. The Plan shall include the quality control of all aspects of on-site construction.

6. The Contractor shall be responsible for the quality of all his purchased items and as such, shall develop and submit a supplier quality inspection plan for review. The inspection plan shall cover those items intended for inspection at the supplier's works and the procedures for carrying out same.
7. The Plan shall contain, as a minimum, the following items and shall be supplemented with additional information from time to time required by the Engineer:
 - (a) Organization chart for quality control.
 - (b) List of the Contractor's staff to be engaged in quality control and materials testing together with details of their relevant experience.
 - (c) Location and layout of Site materials testing laboratory.
 - (d) List of major laboratory equipment and a description of the laboratory's testing capability relevant to the Contract.
 - (e) Arrangements for carrying out any tests that may prove necessary beyond the capability of the Contractor's laboratory.
 - (f) List of purchased items and materials, obtained by the Contractor for the Works, which require inspection at the suppliers' premises, and the proposed procedures for ensuring quality control is carried out.
 - (g) List of materials and operations to be inspected by the Contractor at the various stages of construction work on Site, together with inspection procedures, test types and frequencies.
 - (h) List of proposed "hold points", defined as points at which specified inspection and documentation shall be performed by the Contractor and reviewed by the Engineer prior to proceeding (for example, soil testing, concrete placement, backfilling, commencement of pre-stressing, and the like).
8. The adoption of the Contractor's Quality Control Plan shall be to the approval of the Engineer. Should the Engineer be dissatisfied with the Contractor's Plan at any time the Contractor shall alter his Plan as the Engineer requires. The Quality

Control Plan approved by the Engineer shall be followed throughout the performance of the Contract, unless specific approvals or instructions to the contrary are received from the Engineer. Any approval by or on behalf of the Engineer of the Contractor's Plan shall not relieve the Contractor of his obligation to ensure that the Works comply with the requirements of the Contract.

9. The Contractor shall at all times have one or more persons on the Site charged with specific responsibility for quality control and no other responsibility. Such person or persons shall be vested with the authority to reject work already carried out when such work does not meet the specified standards. The Contractor's quality control personnel shall maintain close liaison with the Engineer at all times.
10. The Contractor shall establish an efficient, comprehensive records facility and library. Books, drawings, publications and manuals shall be indexed and their distribution controlled.

1.4.3 Samples, Materials and Equipment for Testing

11. The Contractor shall provide all samples for testing together with the necessary storage, packing, and transport required in connection with quality control. The Contractor shall provide all consumable materials used in testing procedures and all test equipment, and laboratory facilities.
12. Samples shall be submitted by and at the expense of the Contractor not less than thirty days prior to the time that the materials represented by such samples are needed for incorporation into any work. Samples shall be subject to approval by the Engineer, and material represented by such samples shall not be manufactured, delivered to the Site nor incorporated into any work without such prior approval.
13. Where samples, including samples of materials and workmanship constructed on the Site, are submitted as a reference for materials and workmanship to be provided as part of the Permanent Works, they shall, after approval by the Engineer, be carefully preserved for this purpose by the Contractor until permission is given by the Engineer for their disposal.

1.4.4 Inspections and Tests

14. The Contractor shall be responsible for ensuring that all inspections and tests in connection with quality control or otherwise are properly carried out whether on

the Site or elsewhere, and that where necessary the appropriate remedial measures are taken. If welding is proposed, the Contractor shall deliver an X-ray or cobalt ray testing machine and he must employ a material Engineer for this Laboratory.

15. The Engineer may require to inspect work being prepared and to witness tests at suppliers' premises. The Contractor shall give the Engineer adequate notice of the programs of work and testing at suppliers' premises to enable the Engineer to arrange such inspections.
16. Manufactured items and materials delivered to the Site shall be inspected by the Contractor on arrival. Any defects shall be notified to the Engineer. Minor defects to surface finishes and the like in manufactured items shall be made good in an approved manner to the satisfaction of the Engineer. Items with more serious defects shall be returned to the suppliers for correction or replacement as appropriate.
17. Inspections or tests carried out by or on behalf of the Engineer shall not relieve the Contractor of his responsibilities in connection with quality control.

1.4.5 Site Records and Test Certificates

18. Quality Control records, test certificates, reports and daily records of on site testing and inspection shall be kept on forms approved by the Engineer.
19. Test results shall be certified by the appropriate responsible member of the Contractor's staff. All test certificates and inspection records (including any form suppliers or other outside testing agencies) shall be clearly identified with the appropriate part of the Works to which they refer, and shall include information required by the relevant Reference Standard or Technical Specification clause, and they shall be submitted to the Engineer.
20. The timing for submission of certificates shall be as follows:
 - (a) Manufacturer's and supplier's test certificates shall be submitted as soon as the tests have been completed and in any case not less than seven days prior to the time that the materials represented by such certificates are needed for incorporation into the Permanent Works.

- (b) Certificates of tests carried out during the construction or on completion of parts of the Permanent Works shall be submitted within seven days of the completion of the test.

1.4.6 Reports

21. Once each week, or at such longer intervals as the Engineer may allow, the Contractor shall submit in an approved form a Report including information on all quality control inspections and tests performed at Site and elsewhere in the intervening period.
22. The Report shall include all work performed by the Contractor, tests performed with applicable sample numbers, and inspection reports for both the supplier's shops and the Permanent Works. All test data shall be summarized in tabular and/or graphical form in a manner which best illustrates the trends, specific results and Technical Specification requirements. Where tests do not meet Technical Specification requirements, full explanations shall be provided to show what action was taken (i.e. rejection of the work, retest, etc.)
23. Each report shall also contain a forecast of quality control work likely to be carried out during the period to be covered by the succeeding report.

1.4.7 Inventories

24. The Contractor shall keep detailed and up-to-date inventories in an approved form of goods and materials subject to quality control which are on order, delivered, found faulty, lost during the work or found to be surplus to requirements. The Engineer shall have access to these records at all times. Summary inventory records shall be submitted to the Engineer once a month with Monthly Report.

1.5 REIMBURSEMENT OF MEASUREMENT

1.5.1 Methods of Measurement

- 1 All items contained within the General Section and General or Supplementary Conditions of Contract which result in cost the Contractor will not be subject to separate measurement.

1.5.2 Basis of Payment

2. Costs for all the items referred to in the above unless paid for under stated items elsewhere in the Bill of Quantities be included in the Costs for Mobilization and Demobilization as a Lump Sum .
3. These costs are to include for all supply of items , maintenance , cleaning, consumables and replacement of items (not already insured) damaged or rendered inoperable during the cause of the Contract.

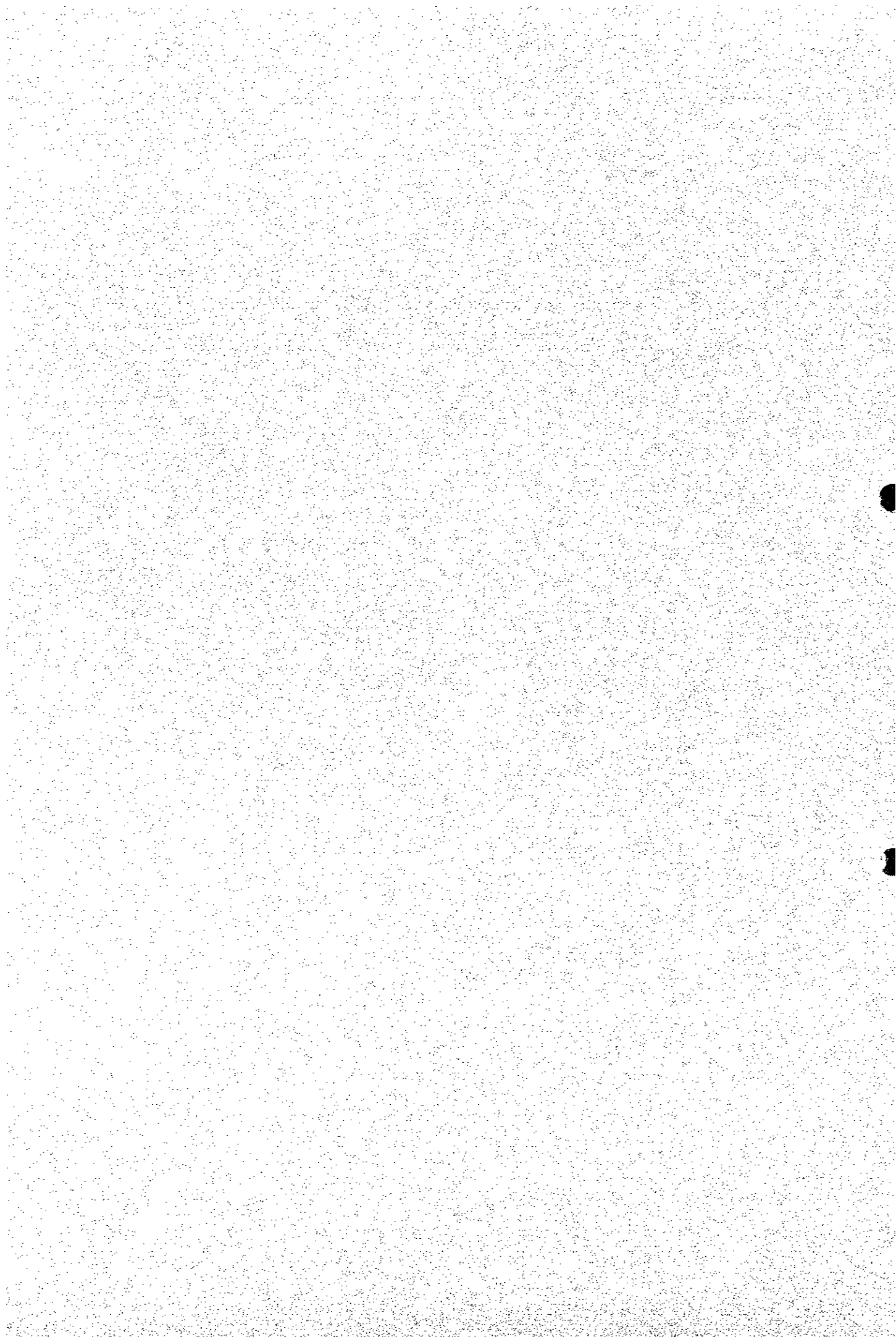
1.5.3 Items in the Bill of Quantities

Item No. 0.1 **Mobilization and Demobilization**

2.0 EARTHWORKS

2.1	Clearing and Grubbing-----	1
2.2	Removal of Structures and Obstructions-----	2
2.3	Earthworks Excavation-----	4
2.4	Embankments -----	9
2.5	Excavation and Backfilling to Structures-----	12
2.6	Stone Pitching-----	18

10/10/07



2.1 Clearing and Grubbing

2.1.1 Description

1. This work shall consist of clearing, grubbing, removing and disposing of all vegetation and loose debris within the limits of the Right-of-Way, and from borrow pits. Objects that are designated to remain or are to be removed in accordance with other Sections of the Specification are excluded. This work shall also include the preservation from damage or defacement of all material designated to remain or to be delivered.

2.1.2 Construction Requirements

2. The Contractor shall establish the construction limits and the Engineer will designate trees, shrubs, plants and other objects to remain. Trees to be removed and delivered elsewhere (for re-planting) shall be carefully and appropriately handled, and their works saturated and sealed in plastic sheeting or similar.
3. Surface objects and trees, tree stumps, roots and protruding obstructions not designated to remain shall be dug-out or otherwise removed. Non-perishable solid objects which will be a minimum of 2 m below the subgrade of the finished ground level may be left undisturbed at the Engineer's discretion.
4. Except in areas to be excavated on the construction site, stump holes and other holes from which obstructions have been removed shall be backfilled with suitable material and compacted in accordance with Clause Embankment. Elsewhere backfilling will only be required in the interests of safety, where appropriate.
5. Material arising from the clearing and grubbing operations shall become the property of the Contractor, apart from that to be delivered elsewhere. It shall be disposed of either off Site at designated dump sites, or on Site at locations approved by the Engineer.

2.1.3 Method of Measurement

6. The work described in this Clause, with the exception of removing and delivery of trees having trunk diameters not more than 300 mm, **will not be measured for directly** but will be considered incidental work.
7. Trees with a trunk diameter 300 mm or more when measured 750 mm above existing ground level shall be measured by the number removed and delivered to the Employer.

2.1.4 Basis of Payment

8. Clearing and grubbing shall be paid at a lump sum price.

2.1.5 Items in the Bill of Quantities

Item No. 2.1 Clearing and grubbing

2.2 Removal of Structures and Obstructions

2.2.1 Description

1. This work shall consist of the removal, wholly or in part, and the disposal of all buildings, fences, and other obstructions which are not designated or permitted to remain. It excludes obstructions to be removed and disposed of under other *Sections* of the Specification. It shall include salvaging designated materials and backfilling the resulting excavations.

2.2.2 Construction Requirements

General

2. The Contractor shall demolish, remove and dispose of buildings, foundations, fences and other obstructions any portions of which are within the Construction Limits. Basements or cavities left shall be filled and compacted to the level of the surrounding ground as specified in Clause 2.5.3.
3. Salvaged items to be re-used shall be securely stored in suitable compounds on the Site as approved by the Engineer and shall remain the property of the Employer.
4. Steel bridges, wooden bridges, telegraph poles and electricity power pylons designated on the Drawings to be removed, shall be carefully dismantled without unnecessary damage. Steel members shall be match marked, bundled and suitably protected for storage, pending re-use.
5. Blasting and other destructive operations, necessary for removal of existing structures or obstructions, which may damage new construction, shall be completed prior to commencing the new work.

Bridge and Culverts

6. Bridges, culverts and other drainage structures carrying public traffic shall not be removed until satisfactory approved alternative structures have been put in place.
7. Substructures shall be removed down to the natural stream bottom and those parts outside the stream bed shall be removed to 300 mm below the natural ground surface. Where existing structures lie partly within the limit for a new structure, they shall be removed only as necessary to accommodate the new construction.

Walls, Boulders, and Stones

8. Masonry and concrete walls, boulders and accumulated stones of size greater than 0.25 m³ which lie within the construction limits as shown on the Drawings, shall be removed and disposed of as instructed by the Engineer.
9. When walls or fences enclosing cultivated or agricultural areas are to be removed, the Contractor shall notify the property owner sufficiently in advance to give reasonable time to construct temporary fences or make other arrangements.

Wells

10. Existing wells, abandoned or active, which lie within the construction limits as shown on the Drawings, shall be abandoned, backfilled or filled with concrete. No abandon or backfilling of a well shall be done by the Contractor without the prior approval of the Engineer.

Buildings

11. Existing buildings which have been condemned or abandoned within the construction limits with more than 10 sq metre shall be dismantled and totally removed as directed by the Engineer

2.2.3 Method of Measurement and Basis of Payment

12. Removal of Structures and Obstructions shall be paid at a lump sum price.
13. The cost for 'Removal of Structures and Obstructions' shall be payment in full for the removal, storage, protection and disposal of the existing structures, as instructed, including items necessary for the proper completion of the Work.

2.2.4 Items in the Bill of Quantities

Item No. 2.2 Removal of Structures (type)

2.3 Earthworks Excavation

2.3.1 Description

1. This work shall consist of excavating material from the Cut Sections of the roadway, from borrow pits, ditches and other excavations, (but excluding 'Structural Excavation'), transporting the excavated materials to Embankment Sections and disposal of surplus material to waste.

Classification of Excavation Materials

2. Excavated roadway materials will be classified either as 'Suitable' or 'Unsuitable' or 'Borrow'. 'Suitable' material shall be any material that is suitable for use in the Works. 'Unsuitable' material shall be material designated as not suitable for use in the Works by the Engineer. 'Borrow' material is Suitable material excavated from locations beyond the Earthworks outer boundary.
3. When Excavation is itemized in the Bill of Quantities it shall comprise complete excavation in any material encountered, including solid rock.
4. Borrow excavation shall include all material taken from locations outside the construction limits of the contract.

2.3.2 Construction Requirements

5. Excavated material from sources other than Borrow Pits shall be used as Embankment fill before making use of imported material, unless this material is declared Unsuitable by the Engineer.
6. Should the Contractor choose to run Suitable Excavated Materials to Waste and then replace them with Borrow Excavation for Embankment, no extra payment shall be made. Suitable material shall not be caused, or allowed, to become Unsuitable by the

methods or actions employed. Nor shall the Contractor dispose of Suitable material without the prior approval of the Engineer. When the location of Unsuitable materials known to be beneath the future structure, their removal, replacement, or improvement by stabilization, shall be as shown on the Drawings.

7. During construction the Engineer may designate as Unsuitable those materials that cannot be satisfactorily compacted in the Embankments. This material shall be disposed of in locations approved by the Engineer. The Contractor shall obtain the consent of landowners and tenants, where appropriate and agree to suitable rates for using the areas for disposal of material.
8. The Drawings may show certain existing materials, such as selected excavation, rock, concrete, bitumen or other surfacing materials, that are to be removed and stockpiled for specific future use. Such materials shall be carefully excavated and handled in a manner that will prevent contamination. They shall be neatly stockpiled in an approved location.
9. Where the Contractor is required to excavate Unsuitable material from below original ground level not indicated on the drawings, in Embankment areas, (other than that required for Clearing and Grubbing), the depth to which these materials are to be removed will be determined by the Engineer.
10. Rock materials declared Unsuitable as a sub-grade in cuttings shall be excavated to the widths and depth indicated on the Drawings or as otherwise instructed. Overbreak will not be paid for. Backfill of overbreak shall be at the expense of the Contractor and to details approved by the Engineer.
11. The earthworks shall be maintained at all times in a well-drained condition, to avoid damage and erosion by run-off waters from rainfall or other sources. The Contractor shall provide all necessary means to achieve this in the form of flow checks, drawing paths or similar. Drainage paths shall be kept clear during the work to permit free water flow at all times. Damage to the Works attributable to failure to provide adequate protection measures shall be immediately repaired by the Contractor at his expense.

Excavation with Explosives

12. Drilling and blasting shall be done with the prior approval of the Engineer to complete the excavation as close as possible to required slopes and grade lines with least practicable disturbance of material to be left in place. Blasting shall be performed as the sole responsibility of the Contractor and appropriate safety precautions shall be taken. The Contractor shall avoid injury to persons, properties or to finished work. The handling and use of explosives shall be restricted to, or under the direct control of, one competent and qualified person.
13. Excessive blasting shall not be used. No payment for overbreak will be made. Material outside the designated excavation section limits which may be shattered or loosened by blasting shall be removed and replaced by the Contractor at his expense if so instructed by the Engineer.
14. Where instructed by the Engineer the Contractor shall provide heavy mesh blasting mats. Blasting shall be restricted to the hours stipulated by the local Authorities. If in the opinion of the Authorities or the Engineer, blasting would be dangerous to persons or adjacent structures or is being carried out in a dangerous manner, the Engineer may order the rock to be excavated by other means. If it is necessary for safety reasons to suspend traffic movements as public roads during blasting operations, the Contractor shall obtain the Engineer's prior approval.

Borrow Pits

16. No borrow pit shall be located with its nearest edge closer than 30 m to the toe of the embankment or crest of the cutting.
17. If the Contractor locates a borrow pit on privately-owned land he shall secure the consent of the Owner and arrange the necessary permits and payments.
18. Approval to use borrow material in the Permanent Works, shall be obtained from the Engineer before execution of the work. The Contractor shall submit a request with test results at least three working days before taking material from the borrow area. Borrow material shall not be taken from any area within 200 m downstream of a drainage structure.
19. Upon abandonment of a borrow pit or quarry area the Contractor shall, at his own expense, clean and trim the excavated area, the access and any adjoining land which

was occupied during execution of the work, whether Government or privately-owned, to the satisfaction of the Engineer.

20. Removal of old roadways shall include filling of all ditches and rough grading of the roadway to restore to the approximate original contour of the ground, or to produce a pleasing appearance by forming natural rounded slopes.

2.3.3 Method of Measurement

21. Excavation quantity calculations shall be based on the final cross sections developed in accordance with the dimensions on the Drawings. All required and accepted earthwork excavation including excavation of unsuitable soil shall be measured for payment in its original position and the volume determined in cubic metres by the average end area method as computed from the original and final geometric cross sections of required and completed work, as shown on the Drawings or directed by the Engineer. Preparation and compaction of excavated areas shall not be measured and paid for separately but shall be incidental to the excavation work.
22. When unsuitable material is encountered in cut sections, the volume of this material shall be measured separately as 'Unsuitable Material in Cut'. When unsuitable material is encountered under Embankment areas, the volume of embankment shall be the original volume of embankment plus the volume of 'Unsuitable Material Below Embankment' removed, as agreed by the Engineer.
23. The pay quantity for 'Suitable Excavated Material to Embankment' shall be the 'Original Volume of Excavation' less the volume of 'Unsuitable Material in Cut'.
24. The pay quantity for 'Unsuitable Excavated Material to Waste' shall be the volume of 'Unsuitable Material in Cut' plus the volume of 'Unsuitable Material Below Embankment'.
25. The pay quantity for 'Borrow Excavation to Embankment' shall be the 'Volume of Embankment' less the volume of 'Suitable Excavated Material to Embankment'.
26. When ground water is encountered in excavations, other than those defined as 'Borrow Excavation', the volume of material excavated below standing water level shall be the original volume measured in cubic metres for payment under 'Extra Cost for Excavation Under Water'. In tidal water conditions the water level shall be taken as the highest tide level recorded during the construction.

2.3.4 Basis of Payment

27. The amount of completed and accepted work, measured as provided for above, will be paid for at the unit rate per cubic metre in the Bill of Quantities for 'Suitable Excavated Material to Embankment', 'Unsuitable Excavated Material to Waste' and 'Borrow Excavation to Embankment'.
28. The rate shall include for all excavation, drilling, blasting, formation of embankments, trimming of slopes, disposal of surplus, preparation and completion of roadway, subgrade and shoulders including labour, materials and equipment for excavating, hauling any distance, watering, compacting, shaping and other items necessary for the proper completion of the work.

2.3.5 Items in the Bill of Quantities

Item No. 2.3.1	Suitable excavated material to embankment
Item No. 2.3.2	Unsuitable excavated material to waste
Item No. 2.3.3	Borrow excavation to embankment

2.4 Embankments

2.4.1 Description

1. This work shall consist of raising and forming road Embankments, including preparation of the ground upon which they are to be built, and placing and compacting Suitable material within roadway areas.

2.4.2 Construction Requirements

General

2. Top soil containing organic matter shall be stripped from the ground surface upon which the embankment is to be built and the cleared surface shall be broken up by ploughing or scarifying to a minimum depth of 200 mm, or as otherwise instructed by the Engineer. This layer of material which will form the foundation to the embankment shall then be compacted as specified.

3. When an embankment is to be constructed over an area previously occupied by a building basement, irrigation canal, well, a previous excavation or other construction that will not permit use of normal embankment compaction methods, construction shall conform to backfilling requirements specified in Clause of Subgrade Preparation until normal compaction procedures can be used.
4. Throughout construction the Contractor shall remain responsible for the stability of the embankments and shall replace any section which becomes damaged or displaced and the formation shall be kept shaped and well drained at all times.
5. No material shall be placed in an embankment fill that is not classified in accordance with Clause of Earth Work Excavation as 'Suitable'. If rock fill and soil fill layers are combined in any embankment, the coarser material shall be used for the lower layers.
6. The top 300 mm of all embankments shall be restricted to AASHTO Class A1 (0) and A2.4 (0) soils (as defined in AASHTO M145) or their equivalent as approved by the Engineer. Material of particle size greater than 75 mm shall not be used. This restriction shall also apply to areas subject either to flash flood or prolonged inundation, such as at bridge sites or wadi crossings.
7. Embankments shall be neatly formed to the lines, levels and profiles shown on the Drawings. Batter slopes shall not be steeper than shown, except where temporarily necessary to permit adequate edge compaction before trimming to the final shape. Where fill is to be placed against a natural slope or sloping earthworks face, the existing slope shall first be benched as shown on the Drawings or as instructed.
8. Embankments shall be raised to subgrade level evenly across their full width from edge to edge. Excess width will not be permitted other than is needed for proper edge compaction and to allow trimming back to the required profile and finishing as shown on the Drawings. Side slope protection shall be as shown on Drawings or instructed by the Engineer.
9. Soil fill shall be placed and spread evenly to a loose-layer thickness not more than 250 mm before compaction. No fresh layer shall be placed or spread until the preceding layer or surface has been compacted as specified and approved.
10. Water shall be added as necessary to maintain the optimum moisture content of the fill material. Compaction plant shall be operated so as to give a uniform soil density in

each layer. All plant, vehicles and equipment shall be routed evenly over the surface of each layer.

Rockfill

11. Material consisting predominantly of rock fragments of such a size that it cannot be placed in layers of the thickness allowed without crushing, or further breaking down, may be placed in the embankment in layers not exceeding twice the average size of the larger fragments. However, no layer of rockfill shall exceed 800 mm loose thickness.
12. Rockfill shall be placed and spread so that the largest boulders and fragments are evenly distributed, with the voids between completely filled with smaller fragments, sand or gravel, watered in if necessary. Each layer shall be bladed and leveled by a track-laying bulldozer.

Compaction shall be carried out by a vibratory roller with the minimum mass shown in Table 2.1. Quality control tests will not normally be performed on this material but each layer must be approved by the Engineer before the next is placed.

Table 2.1: Compaction of Rockfill

Mass per metre width of vibrating roll (kg/m)	Depth of fill layer (mm)	Number of passes of the roller on each layer
2300 - 2900	400	5
2900 - 3600	500	5
3600 - 4300	600	5
4300 - 5000	700	5
>5000	800	5

13. Embankment layers which consist of material that contains rock but also has sufficient compactable finer material other than rock shall be placed and compacted as for soil embankments. Quality control tests will be made wherever the Engineer determines.

Compaction Quality Control

14. Testing shall be carried out using AASHTO T180 (Method D).
15. The moisture content of each fill layer at the time of compaction shall be within ± 1.5 % of the optimum moisture content.

16. Layers placed more than 300 mm below embankment subgrade level shall be compacted to 90 % of the maximum dry density. For all fill soils containing more than 10 % oversize material retained on a 19 mm sieve, the maximum dry density obtained shall be adjusted for the oversize material by a procedure approved by the Engineer.
17. Layers placed in the top 300 mm of the embankment shall be compacted to 95 % of maximum dry density.
18. The frequency of Quality Control density testing of each embankment layer shall be 1 per 150 m³ of compacted soil, or as instructed by the Engineer.
19. Where embankments are placed adjacent to structures, or at locations where it is not practicable to use normal plant, each layer shall be compacted by use of pedestrian rollers, mechanical rammers or other suitable equipment. Each layer shall be compacted to the specified density and shall not be greater than 200 mm (loose measurement) in thickness.

Compaction Trials

20. If necessary and as instructed by the Engineer, the Contractor shall construct trial embankment sections. The fill soils used in the trials shall be those intended for the permanent works and the compaction equipment used shall be that listed in the programme of work intended for use in the embankment construction. The trials shall show the relationship between the number of compaction plant passes and fill layer density attained, and shall be continued until a satisfactory procedure is established.

2.4.4 Measurement and Payment

21. No direct measurement or payment shall be made for embankment construction. All payment is deemed to be included in the Bill items for 'Suitable Excavated Material to Embankment' or 'Borrow Excavation to Embankment'.

2.5 Excavation and Backfilling to Structures

2.5.1 Description

1. This work shall consist of excavation for bridge works, trenches, pipelines, ducts, culverts, headwalls, catch basins, manholes, inlets and retaining walls, and shall include drainage, pumping, ground support and the installation and removal of cofferdams if necessary, as well as disposal of material arising from the excavation, and backfilling to the level of the original ground. It shall include removal of any part of an existing structure below ground which is required for construction of the new structure.

2.5.2 Materials

2. Classification of excavated materials shall be in accordance with *Clause* of Earthwork Excavation.
3. Rocks or boulders of an individual size greater than 1 m³ and other hard strata which are not possible to excavate without drilling and blasting shall be classified as 'Rock Excavation'. Removing and disposing of concrete pavement, cement stabilized base course or asphalt pavement of thickness more than 100 mm shall also be classified as 'Rock Excavation'.
4. In any individual structural excavation where more than 50 % of rock or concrete content of the total volume removed is classified as Rock, all the excavated material shall be designated as Rock for payment purposes.

2.5.3 Construction Requirements

General

5. Foundation excavations shall be made in accordance with the dimensions of the foundations shown on the Drawings and shall permit placing of the full width and lengths of concrete shown.

6. Excavation shall be taken to the level shown on the Drawings. No foundation or blinding concrete shall be placed prior to approval of the excavation bottom by the Engineer. Any overbreak beyond the dimensions shown on the Drawings shall be backfilled with the same class of concrete as for the foundation and shall be poured with the foundation.
7. Where rock is exposed at foundation level the excavation shall be prepared by trimming and removal of loose rock fragments before blinding with concrete.
8. Drilling and blasting required in any foundation excavation shall be completed prior to placing foundation concrete.
9. When Unsuitable material is encountered at foundation level, the Contractor shall over-excavate and replace it with Suitable backfill material, concrete or as instructed by the Engineer. The necessary depth of over-excavation and the suitability of the proposed backfill material shall be approved by the Engineer prior to commencement of the work.
10. Where piled foundations are to be used, excavation for the pile cap shall be completed before the piles are installed. After piling is completed, loose and displaced material shall be removed, leaving a smooth solid bed to receive concrete.
11. Cofferdams shall be used whenever water-bearing ground is encountered above the level of the bottom of excavation. They shall be sufficiently large to give easy access to all parts of the excavation and shall be of dimensions not less than those for which payment for excavation is made.

Excavation and Backfilling for Pipe Culverts, Storm Sewers and Ducts

12. Precast concrete and steel pipe culverts and pipe ducts shall be installed in trenches cut into previously constructed and compacted embankment either from the subgrade or from an embankment height at least twice the nominal diameter of the pipe. Unless otherwise noted on the Drawings, trenches shall be no wider than the external diameter of the pipe plus 300 mm on each side. If trenches are dug too wide, the pipe culvert shall be bedded in a concrete cradle, as described in Clause of Pipe Culvert, at the expense of the Contractor.
13. Pipe bedding shall be either graded aggregate 13 mm nominal size to Table 1 of **BS 882**, or concrete Class 135 kg/cm² as shown on the Drawings. Exposed concrete bedding shall be cured for a minimum of 3 days.

14. Pipe shall be laid so that the lower portion of each pipe is supported for its entire length to a depth at least equal to 1/4 the external diameter. They shall be fitted and matched so that when laid in the trench the pipe invert follows a smooth and uniform fall as defined on the Drawings.
15. Granular material for pipe bedding shall be compacted to the minimum bed thickness given in Table 2.2. 50 mm less bedding may be provided under the sockets of spigot and socket pipes.

Table 2.2: Sewer Pipe Bedding Thickness

Pipe Diameter (mm)	Minimum Bedding (mm)
<300	150
300 to 500	200
>500	250

16. Pipe surround shall consist of Granular bedding material placed and compacted in uniform layers on both sides simultaneously to 50 mm above the top of the pipes. Selected excavated material or approved granular fill shall then be placed and compacted above the pipe for the full trench width to not less than 300 mm finished depth.
17. Where rock, or similar unyielding material is encountered in the excavation bottom, it shall be removed for a depth of 150 mm. The extra excavation shall be backfilled with a properly compacted granular material complying with the above.
18. In-situ concrete Pipe Culverts shall be cast in trenches cut into previously constructed and compacted embankment from the subgrade or from an embankment height at least twice the nominal diameter of pipe. The trench width shall be no greater than the external diameter of the pipe plus 300 mm each side when the Contractor elects to use external forms, or plus 80 mm each side when he elects not to use external forms.
19. If the Contractor uses forms and excavates a trench wider than specified, backfill to the height of the external haunch of pipe shall consist of bedding concrete class 12. Concrete backfill shall be at the Contractor's expense. If forms are not used and the trench is excavated wider than specified, the side walls of the pipe shall be increased to fill the channel width. Overdepth excavation shall be compensated for by increasing the thickness of concrete base or as otherwise instructed by the Engineer. Additional concrete required shall be at the Contractor's expense.

Scheduling Excavation for Structures

20. The Contractor shall schedule the Works so that no excavation is left in an exposed condition for a period greater than 30 days.
21. If the Earthworks progress is not integrated with the drainage structural work to the point where the road embankment dams the natural drainage, the Engineer may order the Contractor to provide an adequate temporary water course through the roadway at locations where the drainage structures are to be installed. Damage to the roadway caused by water passing through these openings shall be repaired at the Contractor's expense.

Backfill for Structures

22. Only selected granular materials that will produce a stable, dense, backfill shall be used for structures. In addition, backfill for metal pipe culverts shall contain less than 1.5 % of combined chlorides and sulphates.
23. Selected backfill, which shall be subject to the prior approval of the Engineer, shall consist of well graded natural sands and gravels, crushed gravel and crushed rock (but excluding argillaceous rock types) with the properties shown in Table 2.3.

Table 2.3: Selected Backfill Properties

Particle size	75 mm maximum
Material passing 75 μ m sieve	15 % maximum
Uniformity coefficient	10 minimum
10 % Fines value	100 kN minimum

24. No cast-in-place concrete structures shall be subjected to pressures from backfilling until 3 days after expiration of the period designated for removal of forms in Clause of Concrete Structures. Backfill placed around culverts, abutments and piers shall be placed concurrently on both sides to approximately the same elevation. Care shall be taken to prevent any wedging action against the structure. Slopes bounding the excavation shall be stepped to prevent such wedge action.
25. Materials shall be placed in layers and compacted by means of rollers, vibrating plates or mechanical rammers. Each layer shall be compacted to 95 % of the maximum dry density measured according to AASHTO T180 (method D). In no case shall any layer

be greater than 150 mm (loose measurement) in depth. The moisture content of the soil used for backfill shall be uniform and within the optimum moisture range.

26. At box culverts the Contractor shall completely backfill the excavation to the level of the original ground or as shown the Drawings.. If the top of the culvert extends above the original ground level, the Contractor shall continue the backfill to the top of the culvert and for a width of 3 m on each side of the culvert and to the full width of the roadway embankment, to a level to be agreed by the Engineer.
27. At pipe culverts and storm sewers (including metal pipe and metal arch culverts) the Contractor shall complete backfill around the culvert as specified to the level of the original ground line and to the full width of the excavation area. If the top of the culvert extends above the original ground level, the Contractor shall continue the backfill to the top of the culvert for a width of 1.5 times the maximum external width of the culvert and on each side of the centerline of the culvert to the full width of the roadway embankment, to a level to be agreed by the Engineer.
28. At bridges the Contractor shall complete the backfill to piers and abutments to the level of the original ground or to the top elevation of any adjacent embankment, if appropriate.
29. Backfill around retaining walls shall be compacted to the finished level shown on the Drawings.
30. Catch basins, manholes, inlets and miscellaneous structures shall be backfilled in accordance with the methods specified in the preceding Sub-Clauses.

2.5.4 Method of Measurement

31. Measurement of Excavation for Structures shall be measured in cubic metres and will be limited to excavation for foundations for bridges, retaining walls, box culverts of cross sectional area exceeding 1.0 m², box culvert wing walls, headwalls, tow walls and aprons, manholes, pump houses and sub-stations.

Backfilling and disposal of surplus material shall not be paid separately but shall be included in the rate for excavation.

32. Box culverts 1.0 m² or less, pipe culverts, storm sewers and ducts, excavated in rock will be measured.

33. The pay volume of excavations for structures shall be that within a plane prism bounded by a lower horizontal plane, vertical planes and an upper horizontal plane. Unless otherwise shown on the Drawings, the limits shall be as defined as follows:

(i) **Bridge Foundations.** The lower level shall be the underside of the blinding concrete, and the sides 500 mm outside the foundation width. The upper level shall be the existing mean ground level above the foundation at the time the Contractor is given full possession of the site, or the finished mean level of the ground above the foundation. This shall apply whether or not the Contractor has carried out the general excavation of the area by the time the foundation excavation is carried out.

(ii) **Box culverts.** The lower level shall be the underside of the blinding concrete and the sides 500 mm outside the full base slab width. The upper level shall be the mean of the existing ground level over the plan area of the culvert floor slab, including apron slabs and toe walls. Where there is a significant change in ground level over the culvert length, the volume of excavation shall be calculated by dividing the culvert into several smaller lengths. Where the culvert is located in an embankment, the upper level shall be as described above, irrespective of whether or not the embankment has been constructed in advance of the culvert. Excavations for toe-walls below the general level of the base slab, shall be measured as the actual original volume of material excavated.

(iii) **Miscellaneous Structures.** Excavation measurement for retaining walls, wing walls, headwalls, toe-walls and other miscellaneous minor structures shall be as described for box culverts.

34. When ground or tidal water is encountered during structural excavation, only the original volume of material excavated below water level shall be measured by the cubic metre for payment under 'Extra Cost for Excavation for Structures Under Water'.

2.5.5 Basis of Payment

35. Excavation, bedding, backfilling for pipe culverts and ducts, and box culverts of cross sectional area 1 m² or less (regardless of type) will not be paid directly but will be considered as ancillary work to other related items in the Bill of Quantities, except for excavation in rock.

36. The amount of completed and accepted work, measured as provided for above will be paid for at the unit rate per cubic metre for 'Structural Excavation in Soils' and 'Structural Excavation in Rock' in the Bill of Quantities, which rate shall compensation for excavation, clearing, side support, removal of any portion of existing structures below ground as required, trimming, cleaning, backfilling, compaction, disposal of surplus materials and supplying equipment, tools, labour, and other items necessary for proper completion of the Works.
38. In a mixed soil and rock strata excavation, when the soil layers are less than 50 % of the total excavated thickness, the entire volume excavated shall be paid for as 'Excavation for Structures in Rock'. Where the percentage of the strata classified as 'Excavation for Structures in Soil' is greater than 50 % of the total depth below the stripped overburden, the soil and rock layers shall be measured separately. Overburden shall be paid for as 'Excavation for Structures in Soil'.

2.5.6 Items in the Bill of Quantities

- | | |
|----------------|--------------------------------|
| Item No. 2.5.1 | Structural Excavation in soils |
| Item No. 2.5.2 | Structural Excavation in rock |

2.6 STONE PITCHING

2.6.1. Description.

The work covered by this specification consists of furnishing all plant, labour, equipment, and materials, and performing all operations in connection with the construction of hand-placed stone pitching on the slopes of embankments..

2.6.2. Materials

- 1) General.

All stone for the stone pitching work shall be durable stone as approved by the Engineer. The sources from which the Contractor proposes to obtain the material shall be selected well in advance of the time when the material will be required in the work. Suitable samples of stone pitching material shall be submitted to the Engineer for approval prior to delivery of any such material to the site of work. Unless otherwise specified, all test samples shall be obtained by the Contractor and delivered to a point designated by the Engineer at least 60 days in advance of the time when the placing of the stone pitching is expected to begin.

2) Quality.

Suitable tests and service records will be used to determine the acceptability of the stone pitching materials. In the event that suitable test reports and a service record, that are satisfactory to the Engineer are not available, as in the case of newly operated sources, the material shall be subjected to such tests as are necessary to determine its acceptability for use in the work. Tests to which the materials may be subjected include petrographic analysis, specific gravity, abrasion, absorption, wetting and drying, and such other tests as may be considered necessary to demonstrate to the satisfaction of the Engineer that the materials are acceptable for use in the work.

3) Sand for Grouting.

Sand for grouting shall conform to the requirements of Section 500, Concrete, relative to fine aggregate for concrete.

4) Bedding Material.

Bedding material shall consist of sand, gravel, or crushed stone, well graded between the prescribed limits as specified in 2.6.3, Foundation Preparation. The material shall be composed of tough, durable particles, shall be reasonable, free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered unacceptable by the Engineer.

5) Stone.

Stone for pitching shall be durable and of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used. It shall be free from cracks, seams, and other defects that would tend to increase unduly its deterioration from natural causes. The inclusion of unacceptable quantities of dirt, sand, clay, and rock fines will not be permitted. The nominal thickness of the stone shall be **40 cm**.

6) Grout.

Grout shall be composed of cement, water, sand and 10 mm stones mixed in the proportions of 300 kg of Portland cement to 1 cubic meter of mortar and sufficient water to produce a workable mixture. The grout shall be mixed in a concrete mixture except that the time of mixing shall be increased to that necessary to produce a mixture having a consistency such as to permit gravity flow into the interstices of the pitched stone with the help of limited spading and brooming. The grout shall be used within a period of **2 hours** after mixing. Retempering of grout will not be permitted.

2.6.3. Construction Requirement.

Foundation Preparation

Areas on which bedding materials are to be placed shall be trimmed and dressed to conform to cross sections shown on the drawings with an allowable tolerance of plus or minus **5 mm** from the theoretical slope lines and grades. Where such areas are below allowable tolerance limit they shall be brought to grade by filling with soil similar to the adjacent material and well compacted and no additional payment will be made for any material thus required. Immediately prior to placing the gravel bedding, the prepared base will be inspected by the engineer and no material shall be placed thereon until that area has been approved.

Bedding Layers.

1) General.

Bedding layers, composed of a 75 mm thickness of bedding material shall be placed within the limits shown on the drawings or as staked in the field, to form a backing. The bedding material shall be reasonably well graded within the following limits:

Sieve Size	Percent by Weight Passing
12.5 mm	100 %
0.075	0-9 %

2) Placement.

Bedding material shall be spread uniformly on the prepared base, in a satisfactory manner, to the slope lines and grades indicated on the drawings or as directed. Placing of material by methods which will tend to segregate particle sizes within the bedding will not be permitted. Any damage to the surface of the bedding base during placing of the bedding shall be repaired before proceeding with the work. Compaction of the bedding layers will not be required but it shall be finished to a regular and even profile.

Pitching of Slopes.

The stones shall be placed upon slopes of the prepared embankments and benches. At least 50 % of the stone shall consist of broad flat stones with minimum lateral dimension of 30 cm, laid with the flat surface uppermost and parallel to the slope.

The spaces between these large stones shall be filled with stones of suitable size, leaving the smooth surface upper most and parallel to the slope, and conforming to the contour required.

Gaps between all placed stone should not , in general , exceed 75 mm , and upon completion of laying a section of 10 square meter or more these gaps are to be fully filled with mortar grout.

The grout is to be fully compacted around all the placed stones ensuring that each stone is carefully and firmly bedded laterally.

After work has been completed as described above, all excess mortar forced up shall be spread uniformly to completely fill all surface voids. All surface joints then shall be roughly pointed up either with flush joints or with shallow, smooth raked joints.

After completion of any strip as specified, no workman nor any load shall be permitted on the grouted surface for a period of at least 24 hours. The grouted surface shall be protected from rain, flowing water, and mechanical injury. The surface of all grouted

stone pitching shall be cured by keeping the surface continuously wet for a period of not less than 7 days.

2.6.4 Method of Measurement.

Grouted hand-placed stone pitching will be measured for payment on the basis of the number of square meters of grouted stone pitching of the specified thickness acceptably placed as computed from the slope lines and grades indicated on the drawings or as staked in the field.

2.6.5. Basis of Payment.

Payment for furnishing and placing the grouted stone pitching, complete as specified, will be made at the contract price per square meters, which price shall include all costs for labour, materials, and equipment required to complete the specified work.

2.6.6. Items in the Bill of Quantities.

Item No. 2.6 Stone Pitching