



Petra Development & Tourism Region Authority

سلطة إقليم البترا التنموي السياحي

تنفيذ شارع خدمات الطوارئ

Specifications
Volume II

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Road Works Specifications

0. SPECIAL SPECIFICATIONS

0.1 General:

The Special Specifications shall be read in conjunction with the "Standard Specifications for Highway and Bridge Construction" of Ministry of Public Works and Housing of the Hashemite Kingdom of Jordan, 1991.

The MPWH "Standard Design for Reinforced Concrete Culverts No. 1-72" shall be implemented in the construction of culverts, which are required but are not shown on the tender detailed drawings.

The Special Specifications shall amend, supplement, delete or modify the Standard Specifications and unless otherwise indicated, the provisions of these Special Specifications shall prevail over those of the Standard Specifications.

Section numbers in the Special Specifications refer to corresponding sections in the Standard Specifications and the sub-sections, clauses, and items contained in these sections constitute additions, modifications and revisions to corresponding clauses in the Standard Specifications.

The Special and Standard Specifications shall be read together in conjunction with the Bills of Quantities, Drawings and other Contract Documents, which shall be considered as mutually explanatory.

0.2 Drawings:

0.2.1 The Contract Drawings consist of General Drawings which show general features and such details as are necessary to give a comprehensive idea of the construction contemplated. Roadway alignment, profile grade, typical sections and pavement, locations and size of drainage structures, dimensions of all structural elements, reinforcement details, protection works and other ancillary items are all shown on the Drawings.

0.2.2 The Contractor shall be responsible for preparing, thoroughly checking and submitting to the Engineer, for his approval, sufficiently in advance, such working drawings as may be required or directed to show in detail all parts of the permanent works including detailed shop drawings, bar bending schedules, foundations of structures and other drawings if required.

The Contractor shall prepare working drawings and details for, but not limited to, the following:

1. All drainage provisions including culverts, ditches, spillways, gullies, channels, dikes, inlets, outlets, etc. according to site conditions.
2. All structures.
3. Cut and fill slope geometry according to the natural ground cross-sections to be taken by the Contractor, materials used, ground conditions and the results of testing and geotechnical investigations performed by the Contractor where required.
4. Protection and stabilization measures for cut and fill slopes.
5. Walls and protection measures.
6. Traffic control devices and barriers.
7. Facilities for the supervision staff.
8. Relocation and diversion of existing utilities.

These working drawings shall be based on the Contract Drawings, field surveys, investigations and testing as may be required or directed, and shall be coordinated with the Contract Documents including compliance with the Standard and Special Specifications.

The Contractor shall also prepare such working drawings as may be necessary to shown in detail the temporary works and methods of construction he proposes to use including formwork.

No separate payment shall be made in respect of the preparation of the working drawings whose cost shall be considered subsidiary to the relevant pay items in the Bill of Quantities.

0.2.3 The Contractor shall be responsible for preparing and submitting to the Engineer a CD, one reproducible set of A1 size and two sets of A3 size of As-Built Drawings and cross-sections as may be required to show in detail all parts of the permanent works as-built. No separate payment shall be made in respect of the preparation of the As-Built drawings, whose cost shall be considered subsidiary to the relevant pay items in the Bill of Quantities

0.3 Test Sampling:

The basis of taking samples and their repetitions for various construction items of the road project are shown in the following tables:

Minimum Tests Required

Reference: The Specification for Road and Bridges, 1991

1. Earthworks

Work Item	A Tests at Source of Material	Frequency for all tests mentioned under (A)	(B) Tests at Road site	Frequency for all tests mentioned under (B)
1-1 Embankment	1- Soil Classification (AASHTO) 2- Any other tests as required in the Specifications and Drawings 3- C.B.R	- Test for each borrow pit - Test for each cut area having suit- able material - When materials quality Change	1- Maximum Dry Density (Mod. Proctor) 2- Soil Classification (AASHTO)	- Test for each 500 L.m. and for each layer. - When materials quality change
			3- Field Density 4- Any other test as required by the Specs. and Drawings	- Test for each 1500 m2 or 100 L. M whichever be less, and for each layer
1-2 Structural Backfill (at culverts)			1- Maximum Dry Density (Mod. Proctor) 2- Granular Gradation 3- Plasticity Index	- Test for each structure. - When materials quality change. - As requested
			4- Field Density 5- Any other test as required by the Specs. and Drawings	- 50% of the layers or to the sat- isfaction of the Engineer
1-3 Structural Backfill at Bridges (piers)			1- Modified proctor 2- Granular gradation 3- Plasticity Index	- Test at each pier. - When materials quality Changes. - As required
			4- Field Density 5- Any other tests as required by specs and drawings	- 50% of the layers for each pier and to the satisfaction of the Engineer.

Work Item	A Tests at Source of Material	Frequency for all tests mentioned under (A)	(B) Tests at Road site	Frequency for all tests mentioned under (B)
1-4 Structural Backfill at Bridges (abutments)			(same as above)	(same as above)
1-5 Subgrade and shoulders	1- Granular Gradation 2- Plasticity Index 3- C.B.R. 4- Any other tests or required in specs and drawings.	- Test for each borrow pit - Test for each cut area having suit- able material - Test for each 4000 m3 - When materials quality Change	1- Modified proctor 2- Granular gradation 3- Plasticity Index 4- Soil Classification (AASHTO) 5- C.B.R	- Test for each 1000 L.m and for each layer. - When materials quality Changes
			6- Field Design 7- Any other tests as required by technical specs and drawings	- Test for each 1500 m2 or 100 L.m for each layer
1-5 Subgrade and shoulders	1- Granular Gradation 2- Plasticity Index 3- C.B.R. 4- Any other tests or required in specs and drawings.	- Test for each borrow pit - Test for each cut area having suit- able material - Test for each 4000 m3 - When materials quality Change	1- Modified proctor 2- Granular gradation 3- Plasticity Index 4- Soil Classification (AASHTO) 5- C.B.R	- Test for each 1000 L.m and for each layer. When materials quality Changes
			6- Field Design 7- Any other tests as required by technical specs and drawings	- Test for each 1500 m2 or 100 L.m for each layer

Work Item	A Tests at Source of Material	Frequency for all tests mentioned under (A)	(B) Tests at Road site	Frequency for all tests mentioned under (B)
1-6 Selected subgrade	1- Granular Gradation 2- Plasticity Index 3- C.B.R. 4- Any other tests or required in specs and drawings. 4- Any other tests or required in specs and drawings	- Test for each source - When materials quality Change	1- Modified proctor 2- Granular gradation 3- Plasticity Index 4- C.B.R	- Test for each 500 L.m and for each layer. - When materials quality Changes
			5- Field Density 6- Layer thickness 7- Any other tests as required by technical specs and drawings	- Test for each 1500 m2 or 100 L.m for each layer.
2-1 Base & Subbase	1- Granular Gradation 2- Plasticity Index 3- Abrasion 4- C.B.R. 5- Sand equivalent 6- Fractured faces (for bases) 7- Any other tests or required in technical specs and drawings	- Test for each source - Test for each 2000 m3 - When materials quality Change	1- Modified proctor 2- Granular gradation 3- Plasticity Index 4- C.B.R. 5- Abrasion 8- 6- Sand equivalent	- Test for each 500 L.m and for each layer. - When materials quality Change
3-1 Fine aggregate for concrete	1- Granular Gradation 2- Plasticity Index 3- Abrasion 4- C.B.R. 5- Sand equivalent 6- Fractured faces (for bases) 7- Any other tests or required in technical specs and drawings	- Test for each source - Test for each 2000 m3 - When materials quality Change	1- Gradation and fineness modu- lus 2- Specific gravity and water ab- sorption. 3- sand equivalent 4- Organic and harmful material. 5- Any other tests and requested in the specs. And drawings 6- Sulfates & chlorides 7- Soundness test	- Test for each source - Test for each 300 m3 - When materials quality Changes.

Work Item	A Tests at Source of Material	Frequency for all tests mentioned under (A)	(B) Tests at Road site	Frequency for all tests mentioned under (B)
3-2 Coarse aggregate for concrete	1- Gradation 2- Specific gravity and water absorption. 3- Abrasion 4- Organic and harmful materials 5- Clay lumps and friable materials. Elongated and flaky particles Index. 6- Any other tests as required in specs and drawings	- Test for each source - Test for each 2000 m3 - When materials quality Changes	(Same tests mentioned under A) in addition to: 1- Abrasion test 2- Percentage of clay lumps and friable particles 3- Flakiness index & Elongation index.	- Test for each source - Test for each 300 m3 - When materials quality Changes.
3-3 Combined aggregates for concrete	1- Must satisfy fine and coarse aggregate requirements. 2- Gradation.	- Test for each source - Test for each 4000 m3 - Test at change of material	- Must satisfy fine and coarse aggregate requirements - Gradation	- Test for each source - Test for each 500 m3 - Test at change of material.
3-4 Water for concrete	1- PH. 2- Sulfates & chlorides 3- Water effect in concrete strength and properties 4- Grease and oil.	- Test for each source - When source changes	Same tests mentioned under (A)	- Test for each source - When source change.
3-5 Concrete admixtures	1- Manufacturer's Certificate	- One for each type or manufacturer	- Trail mixes to check suitability and percentages to be used based on site conditions, materials and manufacturer's recommendations. - Any other tests as requested in the spec and drawing.	- One for each type or manufacture.

Work Item	A Tests at Source of Material	Frequency for all tests mentioned under (A)	(B) Tests at Road site	Frequency for all tests mentioned under (B)							
3-6 Concrete (fresh) 3-6-1 Trail Mix Design			1- Slump test 2- Cubes or cylinders for crushing strength as specified. 3- Workability	- Test for each class of concrete. - Test for change in any material.							
3-6-2 Ready Mix	1- The concrete and all its constituents shall satisfy all concrete and materials requirements as specified. 2- Workability 3- Any other tests as required in technical specs and drawings	- For each source - When any material changes	1- Slump test	- For each transit mixer.							
			2- Compression Tests (Take cubes) 3- Any other tests as required in specs and drawings	<table border="1"> <thead> <tr> <th>No. of Transit Mixers</th> <th>No. of sample</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>6</td> </tr> <tr> <td>2-5</td> <td>12</td> </tr> <tr> <td>6-10</td> <td>18</td> </tr> <tr> <td>11-20</td> <td>24</td> </tr> </tbody> </table> <p>- For each 10 additional transit mixes take 6 additional samples (Test half the samples after week and the next half after 28 days).</p>	No. of Transit Mixers	No. of sample	1	6	2-5	12	6-10
No. of Transit Mixers	No. of sample										
1	6										
2-5	12										
6-10	18										
11-20	24										
3-6-3 Concrete Tests			1- Compression tests	- 6 specimens for every less or equal 80 m3.							
			2- Workability 3- Slump	- 6 specimens for each casting day. - Test for each transit mixer at casting location							

Work Item	A Tests at Source of Material	Frequency for all tests mentioned under (A)	(B) Tests at Road site	Frequency for all tests mentioned under (B)
3-7 Hardened Concrete			1- Core samples 2- any other tests as required in the technical specs and drawing	- 3 cores for each part of a structure that did not satisfy the compression test after 28 days. - If samples are not taken during casting. - 3 cores for each part of a structure.
4-1 Materials in Asphalt mix. (At Batching Plant)	1- Specific gravity and water absorption. 2- Abrasion test 3- Chert content 4- Clay lumps and friable particles. 5- Flaky and elongated particles 6- Soundness	- Test for each source - When material quality changes - As required		
4-2 Materials used in Asphalt mix (from hot pins)	1- Gradation 2- Specific gravity & water absorption. 3- Plasticity index 4- Sand Equivalent 5- Stripping with asphalt	- Test for each source When materials quality change As required.		
4-3 Asphalt mix design each layer (At Batching Plant)	1- Complete mix design in accordance with the American Asphalt Institute (MS2) 2- Loss of stability	- For each project - When materials quality changes. - When results are not consistent with the mix design results. - As required.		

Work Item	A Tests at Source of Material	Frequency for all tests mentioned under (A)	(B) Tests at Road site	Frequency for all tests mentioned under (B)												
4-4 Asphalt mix for each layer	<u>At Batching Plant</u> 1- Stability 2- Flow 3- Extraction (binder content and gradation) 4- Air voids 5- Voids in mineral aggregates. 6- Daily Marshall Density	- Test each 3 working days - Test for each batching plant - As requested	<u>Behind spreader</u> 1- Stability 2- Flow 3- Extraction (binder content and gradation) 4- Air voids 5- Voids in mineral aggregates. 6- Daily Marshall Density 7- Loss of Stability	- Test each working days - Test for each batching - As requested												
	7- Loss of Stability	- As requested - Once per week	8- Road density and thickness (after final compaction)	- Test each 200 L.m. per lane and for each layer. - As requested.												
5-1 Concrete pipes (Plain/ reinforced plant)	1- Abrasion 2- Proof & Ultimate loads 3- Materials used in pipes shall satisfy each individual material requirements as specified 4- Any other tests as required in the specs and drawings.	- Specimen for each pipe diameter	1- Absorption 2- Proof & Ultimate loads 3- Any other tests as required in the specs and drawings.	<table border="1"> <thead> <tr> <th>Pipes Diameter In (mm)</th> <th>No. of specimens</th> </tr> </thead> <tbody> <tr> <td>100 – 500</td> <td>2-3</td> </tr> <tr> <td>501 – 1000</td> <td>3-6</td> </tr> <tr> <td>1001 – 1500</td> <td>6-9</td> </tr> </tbody> </table>	Pipes Diameter In (mm)	No. of specimens	100 – 500	2-3	501 – 1000	3-6	1001 – 1500	6-9				
Pipes Diameter In (mm)	No. of specimens															
100 – 500	2-3															
501 – 1000	3-6															
1001 – 1500	6-9															
5-2 Reinforcing steel	1- Tensile strength 2- Yield point 3- Elongation 4- Bending 5- Dimensions 6- Any other tests as required in the specs and drawings	- For each source 3 specimens for each diameter (Specimens to be taken from different bars)	1- Tensile strength 2- Yield point 3- Elongation 4- Bending 5- Dimensions 6- Any other tests as required in the specs and drawings	<table border="1"> <thead> <tr> <th>Shipment Load (Tons)</th> <th>No. of Specimens</th> </tr> </thead> <tbody> <tr> <td>< 10</td> <td>1</td> </tr> <tr> <td>10-50</td> <td>2</td> </tr> <tr> <td>51-100</td> <td>3</td> </tr> <tr> <td>101-500</td> <td>4</td> </tr> <tr> <td>501-1000</td> <td>6</td> </tr> </tbody> </table> Over 1000 tons – divide shipment into the above mentioned ranges in accordance with the Jordanian specifications.	Shipment Load (Tons)	No. of Specimens	< 10	1	10-50	2	51-100	3	101-500	4	501-1000	6
Shipment Load (Tons)	No. of Specimens															
< 10	1															
10-50	2															
51-100	3															
101-500	4															
501-1000	6															

PART 1 General Provisions

The following sections, subsections, clauses, items of the Special Specifications shall amend, supplement, modify or delete the pertinent sections, subsections, clauses, and items etc., of the Standard Specifications.

SECTION 1.03 Scope and Control of work

SUB-SECTION 1.03.4 WATER SUPPLY

Add the following clause at the end of sub-section:

The Contractor shall provide at his expense water for the works, temporary works, and for the Employer's Personnel facilities. Where mains supply is not available, the Contractor shall provide suitable water supply and storage facilities as agreed with the Engineer.

SUB-SECTION 1.03.5 ELECTRICITY SUPPLY

Add the following clause at the end of this sub-section:

3. The Contractor shall also provide at his expense electricity supply for the Employer's Personnel facilities.

SUB-SECTION 1.03.6 EXISTING UTILITIES AND OTHER OBSTRUCTIONS

Clause No. 2 Existing Utilities

Delete Item No. 2.3 and replace by:

2.3 At the commencement of the Contract, the Contractor shall examine the Site and identify / verify all utilities within the right-of-way above or below ground, and shall record all such Information on suitable Site Drawings, which shall be submitted to the Engineer within one Month of commencement of the Works. Also the Contractor shall for this purpose excavate trial Pits on site or take any other measures needed as may be necessary for identification and Verification of existing utilities.

The Employer/Engineer takes no responsibility as to the correctness, accuracy; completeness or validity of information obtained from the Drawings obtained from Employer/Engineer, and the Contractor shall be fully responsible for his own interpretation and shall execute whatever additional investigations are necessary to obtain the needed information at the Contractor's own expense.

The costs of all related Works concerning verification and identification of existing utilities including detection means, mapping and detailing of drawings, and co-ordination with respective Authorities, shall be fully borne by the Contractor.

The necessary utility diversions may be specified or directed to be carried out by the Contractor. Alternatively, the Employer may make arrangements for such works to be executed by other parties.

The Contractor shall:

- Take into account that the diversion works shall be carried out to the requirements and approval of the Utility Owners and/or under their supervision, and also where required by the Utility Owners, specialist diversion works shall be carried out by accredited specialist Contractors. The utility owners have the right to direct the relocation process themselves through nominating their own subcontractor who works under the Contractor.
- Verify and identify the existing utilities. Coordinate with the relevant Authorities, map these utilities, and prepare detailed and accurate existing utilities drawings identifying the utilities that are in service and those that are dead or abandoned. Submit these existing utilities Drawings, which are accurate and detailed giving location of utilities in plan and section with all pertinent data of the respective utility, to the Engineer and to the Utility Owners.
- Work out and develop, in coordination with the Utility Owners and the Engineer, the approved utilities diversion schemes that will be required to enable the execution of the Works and also maintain continued utilities services in the Area, and to the users.
- Provide superintendence for the execution of the utility diversions whether they are carried out by the Contractor directly or by other parties employed by the Contractor.
- Provide accurate As-Built Drawings of all permanent utility diversions that are executed under the Contract.

Test Pits

The test pits executed by the Contractor to locate the existing utilities shall be fully borne by the Contractor.

SUB-SECTION 1.03.17 MEASUREMENT

Delete Clause 3 and replace by:

3. All works prescribed in this section shall not be measured for direct payment, but shall be considered as subsidiary work, the costs of which will be deemed to be included in the Contract prices for pay items unless otherwise mentioned in BoQs.

	Pay Items	Unit of Measurements
1.03.6(1) 2.02	Provisional sum for removal of any Obstructions above and below ground which are required to be dismantled, demolished or excavated, and removed to approved location, realignment and replacement of Utilities according to the Utility's Owner requirements and Specifications.	PS
1.03.6(2)	Overhead and Profit, Percentage of Pay Item 1.01 above	10%
	Provisional sum for geotechnical investigation, studies, testing, and reports at GRS walls and steep cuts and where required and directed by the Engineer.	PS
	Overhead and Profit, Percentage of Pay Item 1.03 above	10%
8.05	Provisional sum to protect the slope side of cuts by proper method where needed (such as nailing system , shot crete sytem, gabion,...etc) in accordance with the recommendation of geotechnical investigation in the item 1.03 above.	PS
	Overhead and Profit, Percentage of Pay Item 1.05 above	10%
	Provisional sum from which electrical company (EDCO) shall be paid against official invoice for the providing and supplying electricity to feeder pillar, price including all electrical works such as overhead electrical poles and all related civil works, also price include needed testing, according to EDCO Specifications and requirements. (provisional sum cost is estimated, the exact cost will decided after EDCO review).	PS
	5% of the previous real amount paid to EDCO shall be paid to the Contractor for overhead & profits for coordination and follow up with EDCO.	5%

SECTION 1.07 Field Control Laboratories

1.07.1 SCOPE

Delete Clause 1 and replace by:

1. The Contractor shall provide, deliver and maintain for the use of both the Contractor and the Engineer and for the duration of the Contract in addition to any extension of time at an agreed location on the work site an approved mobile trailer or building with services, furniture, equipment, apparatus, fittings, materials and supplies as a field control laboratory. The Engineer and his staff will have the right to use the laboratory at any time, and as required, during the life of the project.

Delete Clause 2 and replace by:

2. The Contractor shall provide control mobile laboratory in good condition and approved by the Engineer, it shall have a net floor area of not less than 50 m², it shall be constructed of strong durable and weather proof materials, with walls, ceiling and floor and adequately insulated against heat and cold, fly proofed and suitable painted inside and out, and it shall be provided with doors, windows, electric light, power, fans and air conditioning as necessary.

1.07.2 MATERIALS

Add the following at the end of item 2.11:

British Standard and other relevant standards, materials manuals and codes of practice referred to in this Contract.

1.07.3 Delivery and Completion

Delete Clause 1 from the specifications and replace by the following:

“The Contractor shall deliver the laboratory ready and complete for use of the Engineer and to his satisfaction within 10 days from the date of commencements and before any work requiring material control and laboratory testing is started. If the laboratory is not ready and complete, then the Contractor, at his expense, shall carry out all tests required by the Engineer at a material testing office approved by the Engineer.”

SECTION 1.08 Maintenance of Buildings and Utility Services

1.08.1 SCOPE

Delete and substitute by the following:

The Works to be done under this section consist of maintaining of the Supervision Staff Site Offices and facilities as well as maintaining the operation of the internal and external utility system and providing all necessary services, including periodic cleaning of septic tank and shall be as per the headings of the Specifications and the following:

1. Water, electricity, Wastewater, and solid disposal systems shall be provided for the compound of the Supervision Staff.

The water supplied to the compound for whatever use shall be sweet, drinkable type of water fit for human consumption.

One septic tank of suitable size located at least sixty (60) meters away from the compound.

2. Service and maintain office machines and equipment and provide all associated consumables, stationery, ink and paper supplies for printers, plotters, and photocopying machines as and when requested.

3. The Contractor shall maintain for the duration of the Contract Period the Site Offices as per the requirements and satisfaction of the Engineer.
4. One adequate generator shall be provided by the Contractor for continuous provision of electricity to the Offices and the compound. The maximum time for the shutdown of the power shall not be more than one hour per 24 hours.
5. The Contractor shall carry out customary maintenance and janitorial services including the supply of coffee, tea, and sugar for the offices for the Supervision. The contractor shall provide on a continuing basis all supplies and utility services, which shall include, but not limited to, electricity supply, drinkable water supply, gas supply, office supplies, sewerage and waste disposal, all at the satisfaction of the engineer.
6. The services provided shall include the provision of cleaning materials and other necessary supplies. The contractor shall also responsible for the safety and security of the Supervision Staff Offices on site, including provision of watchmen and external lighting at night.

1.08.2 MEASUREMENT

All works prescribed in this Section shall not be measured for direct payment, but shall be considered as subsidiary work, the costs of which will be deemed included in the Contract prices for pay items unless otherwise indicated.

SECTION 1.09 Provision of Workmen to Assist the Engineer's Representative

1.09.1 Scope

Delete Clause 2 and substitute by the following:

The Contractor shall provide the Engineer with (1) semi-skilled workman (office boy) for cleaning and servicing the Supervision Staff Site Offices.

1.09.2 MEASUREMENT AND PAYMENT

All works prescribed in this Section shall not be measured for direct payment, but shall be considered as subsidiary work, the costs of which will be deemed included in the Contract prices for pay items unless otherwise indicated.

SECTION 1.10 Provision of Vehicles for Use by Client

1.10.1 Scope

Delete Clause 1 and substitute by the following:

These works shall consist of the purchase and delivery to the site of motor vehicles of the types and in the number as specified hereunder, including payment of all clearance charges and fees, registration, comprehensively insured for the duration of the contract and any extension of time, and handed over in good condition and fully operational in all respects, Upon completion of the Works or at the Employer's request.

Three 4x4 Wheel Drive, Double Cabin Pick-Ups 2021 model or up to date model at the commencement date of the following characteristics:

1. Best Quality, Full Options Diesel engine capacity not less than 2500cc,
2. Automatic Transmission,
3. Power Steering,
4. Power/brakes-heavy duty,

5. Heavy-duty shock and suspension systems,
6. Air-Conditioning,
7. Heating,
8. Heavy duty cooling system,
9. Heavy duty Battery,
10. Heavy duty off-road tires,
11. Spare tire, fire extinguisher, and Standard tools (Jack, pliers, set of spanners etc.).
12. GPS tracking system

The cost of supplying these Pick-Ups shall be deemed included in the Contract unit rates. The Contractor, at his own expense, shall also pay **comprehensive** insurance for all Pick-Ups and provide all daily use of fuel (**including weekend transportation**), fees, and cost of maintenance required for the operation of these Pick-Ups.

The Pick-Ups shall be maintained in a safe and serviceable condition to the satisfaction of the Engineer.

The Contractor bears all expenses for operation and maintenance of the vehicles.

The Contractor shall provide acceptable suitable alternative transportation during each Pick-Up's maintenance. In the event of a breakdown or accident, the Contractor must provide New vehicle with the same class or higher within maximum 24 hours.

In the event of failure to provide Pick-Ups for the Engineer within the time as specified, the Engineer reserves the right to provide such vehicles as necessary until such time as the specified Pick-Ups are made available. Cost incurred for provision and maintenance of these vehicles will be deducted from monies due or become due to the Contractor.

The Contractor shall furnish, supply and provide as may be necessary, all fuel coupons, lubricants, tires and other supplies, all maintenance repairs and running costs at all times and yearly renewal of both license and comprehensive insurance in the name of the Contractor.

All costs and expenses resulting from or in relation to the operation and maintenance shall be borne by the Contractor and shall be deemed to be included in the Contract unit rates.

The vehicles shall be delivered to the Engineer within 14 days from the date of receiving notice to proceed of the Contract. The Contractor shall provide temporarily rented vehicles (of similar type and capacity) to the Engineer until such time vehicles are delivered.

1.10.3 Measurement and Payment

All works prescribed in this section shall not be measured for direct payment, but shall be considered as subsidiary work, the costs of which will be deemed to be included in the Contract prices for pay items.

SECTION 1.14 Topographic Survey

1.14.1 Scope

Immediately following the Notice to Commence, the Contractor shall carry out a topographic survey (by cross-sections) of the project road along the proposed centerline, check all the reference points benchmarks and jointly with Employer and/or Engineer's Representative take cross sections, to serve as the basis of earthwork volume measurements and envisaged revision of road profile.

The topographic survey shall be done in presence of the Engineer and the Employer.

The survey shall also cover side and service roads, as shown on the Drawings or directed.

1.14.2 General Requirements

1. The topographical survey shall be carried out by taking cross-sections along the proposed road centerline at a maximum interval of 20m. The cross-sections shall cover an area of at least 50 m each side of the mainline centerline. However, where required or directed, the Contractor shall increase the width of the area covered by the survey sufficiently to show the full extent of the proposed earthworks (cut and fill) and any other works to be executed under this Contract, and/or to establish the stability of the proposed earthwork slopes.

Each cross-section shall include the related topographic details, for the existing and proposed sections, but not limited to the following:

- Street furniture (electricity poles, lighting columns, traffic signals, road signs, gullies, manhole covers, etc.).
- Boundary features (fences, gates, walls, hedges, etc.).
- Survey data (National Grid survey points and PRMs).
- Slopes and earthworks (cuttings and embankments, quarries, refuse tips, cliffs, etc.).
- Water and drainage features (watercourses, wadis, wells, reservoirs, ditches, channels, etc.).
- All natural and manmade features.
- Buildings (outline threshold elevation).
- Structures (bridges, culverts, retaining walls, sign and signal gantries, etc.).
- Roads, tracks, footpaths (curb line or edge of surfacing to carriageways, steps, traffic islands, parking or amenity areas).
- Industrial features (tanks, electricity overhead lines and substations, etc.).

2. Each section shall be identified by its change, and coordinates (X, Y, Z) in the National Grid system and description shall be given for all the surveyed points.

3. The road shall be plotted in plan at an approved scale and the elevations of all the surveyed points shall be shown.

4. Cross-sections shall be plotted at an approved scale and delivered in AutoCAD (Version 2011 or later) files.

5. Computer diskettes shall be delivered containing the above mentioned drawings together with the files containing the listing of the surveyed points (point number easting, northing, elevation and description) in an approved format suitable for input into AutoCAD and SOFTDESK.

All the survey works shall be done by a Total Station.

1.14.3 Measurement and Payment

No separate payment shall be made in respect of the required topographic survey and production of maps and cross-section in hard reproducible copy or computer files. The cost of this work shall be considered subsidiary to the pay items related to earthworks.

SECTION 1.15 General and Management Obligations

1.15.1 Statutory and Other Obligations

1. Noise, pollution, and nuisance: The Contractor shall ascertain and comply with any regulations concerning noise, pollution and other nuisance in addition to the obligations imposed by the Conditions of Contract and by law.
2. Noise: Compressors, percussion tools and vehicles are to have effective silencers of a type recommended by the manufactures of the equipment. Pneumatic drills and other noisy appliances shall not be used during days of rest or after normal working hours without the consent of the Engineer's Representative.
3. Nuisance: The Contractor shall take necessary precautions to prevent nuisance from smoke, dust, rubbish, water, polluted effluent and other causes.

1.15.2 Protection of Property

1. Roads and Footpaths: The Contractor shall protect public and private roads, footpaths and the like from damage by site traffic or other causes arising from the execution of the Works and shall repair any damage to the satisfaction of the relevant public authority or private owner.
2. Existing Features: The Contractor shall prevent damage to existing buildings, fences, gates, walls, roads, paved areas and other features on the Site or adjacent thereto which are to remain in position during the execution of the Works.
3. Adjoining property: The Contractor shall:
 - (a) Take all reasonable precautions to prevent damage to adjoining property and, if any damage is caused as a result of the execution of the Works, make good to the satisfaction of the owner.
 - (b) Preserve trees, planted fields, fences and the like in areas adjoining the Site and shall replace or re-plant as necessary the trees, crops etc. which are damaged or removed, and shall re-erect or replace fences, etc. in their original condition.
 - (c) Advise owners of adjoining property of the dates on which work will be done which may affect them and obtain their consent for erection of scaffold or other temporary works on their land.
4. Water: The Contractor shall ensure that his operations do not cause damage to adjoining land by flooding; he shall provide temporary drains and ditches and shall pump away excess water if necessary.
5. Existing condition of roads, paths, fences and other features shall be recorded by photographs or surveys if necessary before work is carried out adjacent to them.

1.15.4 Site Administration

1. Engineer's Site Meetings: The Engineer's Representative will hold site meeting as frequently as deemed necessary for the efficient management of the Works and he will distribute minutes. The Contractor shall attend all such meetings and secure the attendance of subcontractors and others if requested by the Engineer's Representative.

2. The Contractor shall attend all such meetings and secure the attendance of subcontractors and others if requested by the Engineer's Representative.
3. The Contractor shall provide all drawings, dimensions and other information required for the proper execution of subcontract works and of associated builder's work, and shall accept responsibility for the accuracy and fitness of subcontract works.

1.15.5 Records and Reports

1. Labour Record: provide each week a record showing the number and description of workmen employed each day on the works including those employed by subcontractors.
2. Materials and plant record: Provide each week a record showing the quantity and description of all materials and plant delivered to the site complete with copies of delivery notes.
3. Equipment Record: provide each day a record showing the number, type and capacity of all Contractor's equipment, excluding hand tools daily employed on the Works.
4. Daily work record: provide each day a record showing activities performed and locations in which work has been carried out and any other matter requested by the Engineer's Representative.
5. Monthly Report: provide monthly report, which summarize the daily and weekly reports and deliver to the Engineer's Representative not later than one week following the end of each month.
6. Climatic Conditions: Measure and keep an accurate daily record of and submit to the Engineer's Representative at the end of each week:

Air temperature : maximum and minimum

Humidity : maximum and minimum

Rainfall : total in mm and hours

1.15.6 Program

1. The Contractor shall provide a computer based programme in critical path network form using "Primavera Enterprise P3E" latest edition software or a software of similar capabilities, showing at least the following information:
 - (a) Contract milestones (Engineer's order to commence, Commencement date, date for completion of sections of the Works, date for completion of the whole of the Works etc.).
 - (b) Durations and earliest / latest start and completion dates for each construction activity.
 - (c) Free and total float time for each activity.
 - (d) Number of working days per week.
 - (e) Number of working shifts per day for each construction activity.
 - (f) Construction activities are to be scheduled so as not to exceed twenty-five (25) working days without the approval of the Engineer.
 - (g) Dates and times for procurement of materials and plants.
 - (h) Dates and times for performance of work by Subcontractors.
 - (i) Dates for supply by the Engineer of drawings and other information.
 - (j) Dates for submission by the Contractor of shop drawings, samples and the like and dates for approval by the Engineer.
 - (k) Dates and times for work to be performed by other contractors.
 - (l) Dates and times for testing and commissioning plant and installations.
 - (m) Bar chart showing earliest dates and total float of activities.

Monitoring: The Contractor shall monitor progress of the Works and shall revise the program, as required by Conditions of Contract. Copies of revised programs etc. and notices of actual and forecast delays and short-falls shall be regularly given to the Engineer.

Computer Programme: The Contractor shall provide the Engineer with a copy of the computer disk for the original and revised programs, schedules and estimates.

The Contractor shall provide original licensed copy of software for the use of the Engineer with a valid maintenance agreement for the duration of the project. Cost of which are deemed to be borne by the Contractor

1.15.7 Drawing to Be Provided By the Contractor

General: The Engineer will supplement the Contract Drawings with further drawings issued in accordance with the Conditions of Contract, as he deems necessary. The Contractor shall prepare all other drawings required for Temporary Works and for fabrication and coordination of trades and prepare all shop drawings and other drawings and documents required under the contract.

Shop Drawings: The Contractor shall prepare and submit for approval, all Contractor Shop Drawings together with calculations, technical specifications, product information and other supporting data, etc., as required by the Specifications or instructed by the Engineer, in good time to meet the programme requirements, including an allowance of 48 hour for Engineer's approval and extra time for resubmission in the case of rejection and, in any case, a minimum of 48 hour before the work is to be commenced or order placed, as applicable. Drawings shall be carefully checked before submission to ensure that no conflict exists with other parts of the Works.

Unless otherwise approved or instructed by the Engineer the Contractor shall submit for Engineer's approval Shop Drawings for all the permanent works specified under the Contract. These shall incorporate the setting out and survey data carried out by the Contractor as well as any modification necessitated by site conditions. The Contractor shall reflect such modification on the Shop Drawings or any other drawings that are deemed necessary to fulfill such task.

The Shop Drawings shall be submitted in such details in order to encompass all the elements of such permanent works and/or as specified in the Contract documents and/or as instructed by the Engineer. The Contractor shall include the scheduled submittals in the Program of Works and shall describe in detail such intended submissions in the Method Statement at the Commencement of the Works. Approval of the Method Statement and Program of Works shall not relieve the Contractor from its obligation under the Contract.

The Contractor is not relieved from submitting additional shop drawings as deemed necessary for the execution of the Works, or as instructed by the Engineer or as required for the execution of variations.

The Contractor shall not execute any of the permanent works without the prior approval by the Engineer of the relevant Shop Drawings for such works.

Supporting data, such as manufacturers' standard details etc., shall be in English or accompanied by a translation, and are to be properly referenced to the Drawings and Specifications.

Produce for submission and approval:

1. The Contractor shall submit three copies of drawings and other documents for approval to the Engineer.
2. Within 48 hours of receipt at the Engineer's office, the Engineer will return one copy of the drawings stamped as:
 - a. approved, or
 - b. approved subject to amendments shown on the returned copy or in an accompanying letter, or
 - c. rejected, with recommendations for resubmission.
3. In the case of approval, work may be commenced or orders placed.
4. In the case of approval with amendments, work may be commenced or orders placed, at the Contractor's risk; providing the qualifications are implemented. The Contractor shall submit revised drawings for approval.
5. In the case of rejection, the Contractor shall resubmit until approval is obtained.
6. The Contractor shall provide four copies, and reproducible copy if required, of all approved material.

1.15.8 Measurement and Payment

No separate payment will be made for the General and Management Obligations described in this section. The cost shall be considered as subsidiary to other items in the Bill of Quantities.

PART 2 EARTHWORKS

SECTION 2.02 REMOVAL OF OBSTRUCTIONS AND UTILITIES

2.02.3 MEASUREMENT

Replace this Sub-Section by:

1. Removal and disposal of large rocks and boulders which exceed the requirement of Sub-Section 2.01.2 Clause 2 (Page2-1) shall be measured by cu.m. of "Unclassified Highway Excavation" as prescribed in Section 2.03 - "Highway Excavation".
2. Removal and disposal of walls, fence, foundations, tin roof buildings,, trees, plastic green houses, abandoned pipes and culverts, ducts, wells, ditches, sidewalks, curbs, light poles, abandoned telephone and electrical poles, traffic and advertising signs, advertising billboards, poles and signs foundation, road furniture and any other obstructions shall not be measured for direct payment, but shall be considered as subsidiary Works the costs of which will be deemed to be included in the Contract prices for Pay Items unless otherwise mentioned in the BOQ.
3. Survey works, investigation works and mapping of existing utilities and obstructions, coordination costs, and fees requested by Utility Owners shall not be measured for direct payment, but shall be considered as subsidiary Works the costs of which will be deemed to be included in the Contract prices for Pay Items.

SECTION 2.03 HIGHWAY EXCAVATION

2.03.1 Scope

Replace Clause No (1) by:

1. These works shall consist of excavating material in the cut sections of the highway, including channels, grading for bridges, watercourses, ditches and wadi relocations (but excluding borrow pits and structural excavation) all as and where shown on the Drawings, and hauling the excavated material either to locations for highway embankments or to stockpiles or to waste.

2.03.2 Construction

Replace Item No (1.1) by:

- 1.1 All suitable soils, rock, boulders, existing pavement layers, and other materials complying with Tables 2.1 and 2.2 shall be excavated in such a manner that they can be utilized, if intended to be used, as embankment fill or in subgrade, shoulder or elsewhere as appropriate.

Replace Item No. (1) of Table 2.1 by:

- 2.1 1- Maximum dry density not less than 1.9 (T-180)

Replace Item No. (4) of Table 2.1 by:

- 2.1 4- Maximum size not more than 1/3 of the loose layer thickness.

Replace Items No. (3) and No. (4) of Table 2.2 by:

- 2.2 3- Bulk specific gravity not less than 2.25 t/m³ (ASTM-C127).
- 2.2 4- Water absorption not more than 6% (ASTM-C127).

Replace Item No. (1.3) by:

- 1.3 Materials such as existing concrete, bituminous, granular or other surfaces or other materials shall, if shown on the Drawings or directed, be stockpiled for a specific purpose or for future use. Such

materials shall be excavated and handled in a manner that will exclude foreign or undesirable material. Stockpiles shall be neatly formed and maintained in an approved manner.

Replace Item No (6.6) by:

- 1.6 The subgrade in cut, where the soil is unsuitable for retention as the subgrade layer, shall be excavated to a depth of 250mm below top of subgrade to allow for subsequent placing and compaction of the subgrade layer (topping). If the material of the subgrade is suitable for retention as subgrade layer, then scarify to the required depth, water and compact.

2.03.3 Measurement

Replace this Sub-Section by:

1. All excavated material (**to the top of subgrade**) of whatever type (except for unauthorized undercut below top of subgrade) shall be measured as "unclassified" which shall be deemed to include all materials encountered of any nature, including silts, clays, sand, gravel and granular materials, fractured, jointed and solid rock, unsuitable material, and existing pavements.
2. Highway Excavation (including roadside ditches and unsuitable materials) shall be measured by cu.m. of material excavated, hauled away and either wasted, stockpiled, or deposited on or in vicinity of highway embankment areas, completed and accepted. Measurements shall be of volumes computed from the cross sections shown on the Drawings and the original ground elevations taken jointly by the Consultant and the Contractor before clearing and grubbing operations.
3. Ditch Excavation shall not be measured for direct payment but shall be considered as a part of unclassified excavation.
4. Subgrade layer or layers in approved in situ material shall be scarified to a minimum depth of 200 mm including removal of undesirable matter compacted, completed, and accepted. This work shall not be measured for direct payment but shall be considered as subsidiary Works the cost of which shall be deemed to be included in item No. 2.02" Unclassified Highway Excavation. "
5. Excavation Quantities that needed to remove of unsuitable soil **below top of subgrade** shall be considered as subsidiary Works the costs of which will be deemed to be included in **item 2.03 "Topping layer"** as illustrated on Bill of Quantities.
6. Excavation of Unstable Material (from areas outside the ROW) where indicated or directed shall be measured as Unclassified Highway Excavation. Measurements shall be of volumes computed from surveyed cross sections of original and final ground elevations. When cross sectioning is impractical in the opinion of the Engineer, approval may be given to measure volumes in the vehicles removing such excavated material, adjusted to reflect in situ volumes.
7. Rock blasting, backfilling of over breakage, the trimming and grading of cut slopes, ditches and of other below-subgrade surfaces, drainage of excavation areas, obliteration of disused roadways, and other ancillary excavation Works shall not be measured for direct payment, but shall be considered as subsidiary Works the costs of which will be deemed to be included in the Contract prices for Pay Items.
8. Excavation for benching slopes in fill/embankment sections shall be measured in cubic meters and shall be considered as unclassified Highway Excavation.

Delete The Pay Items and replace by:

	<u>Pay Items</u>	<u>Unit of Measurements</u>
2.03	Unclassified Highway Excavation	Cubic Meter

SECTION 2.06 EMBANKMENT CONSTRUCTION

2.06.03 Construction

In Clause 1 General, Replace sub-clause 1.5 by:

- 1.5 Rock fill can be used in the top 20 cm of the embankment (below the topping). Water must be added as required, and with approval of the Engineer, to achieve maximum compaction.

Add Sub Clause 1.15 to Clause 1 General, as follows:

- 1.15 The elevations of embankments layers can be checked out using a Total Station of 1-2 second standard deviation, instead of using the Level.

In Clause 3 Foundation Preparation, Replace sub-clause 3.2 by :

- 3.2 Clearing and grubbing, and removal of trees stumps, shall be undertaken. The top 150 mm of the surface on which the embankment, of less than 1.5 m height is to be placed shall be scarified, brought to uniform moisture content within the specified range, and compacted to Engineer satisfaction, no compaction test is required.

In Clause 3 Foundation Preparation, Replace sub-clause 3.5 by:

- 3.5 All surfaces to receive rock fill are to be cleared and all vegetation removed off site before filling is placed. All unsuitable soil shall be removed to a depth as required by the Engineer. Soil surfaces are to be scarified and compacted to Engineer Satisfaction, no compaction test is required. Compaction is to be to a depth of at least 200 mm below ground surface. Hard or smooth surfaces are to be roughened before filling is placed existing road surfaces and the like are to be broken up and removed.

2.06.5 Measurement

Delete only the word "less" in Clause 2 line 4 and substitute by the word "excluding"

Add clause 8 as follows:

8. Embankment for benching as required in section 2.06 item 3.3 shall be paid for as Embankment Construction. The compacted fill for Diversion Dykes will also be paid for as Embankment Construction.

Delete The Pay Items and replace by:-

	<u>Pay Items</u>	<u>Unit of Measurements</u>
2.06	Embankment Construction	Cubic Meter

SECTION 2.07 SUBGRADE CONSTRUCTION AND TOPPING

2.07.2 Materials

Amend Clause No. (1) to read:

1. Topping shall consist of selected borrow material having a 4-day soaked CBR of not less than 25% when tested in accordance with AASHTO T193, when compacted at 100% modified proctor (AASHTO T-180) and having P.I. not exceeding 12% when tested according to AASHTO T89 and T99 and when the sample is prepared according to AASHTO T146. Topping gradation shall be reasonably smooth without gap grading. All topping material shall pass 75mm sieve and not more than 18% + 2% shall pass 0.075mm No. (200) sieve. A tolerance of 2% is allowed in upper limit for percentage of material passing No. 200 sieve if tested after compaction.

2.07.3 Construction

Add point (3.4 and 3.5) to Clause 3 as follows:

3.4 The elevations of Topping layer can be checked out using a Total Station of 1-2 second standard deviation, instead of using the Level.

3.5 Where the subgrade is located on existing road surfaces, unsuitable materials should be removed and replaced, whereas suitable surfaces should be scarified and compacted, all as directed by the Engineer.

2.07.4 Measurement

Delete Clause No. (2), and replace by:

2. Subgrade layer or layers in approved in situ material shall be scarified to a minimum depth of 200 mm including removal of undesirable matter compacted, completed, and accepted. This work shall not be measured for direct payment but shall be considered as subsidiary Works the cost of which shall be deemed to be included in item No. 2.01 " Unclassified Highway Excavation. " as illustrated in bill of quantities

Delete The Pay Items and replace by:

	<u>Pay Items</u>	<u>Unit of Measurements</u>
2.07	Topping	Cubic Meter

PART 3 SUBBASE AND BASE COURSES

SECTION 3.01 MATERIALS

3.01.3 Granular Material for Subbase

Add the following at the end of Clause No. 4:

In The specified sand equivalent value corresponds to the value obtained in accordance with AASHTO T. 176 (Dry method), for the material in dry condition.

Replace the Clause 5 as follows:

5. The loss in weight of granular material shall not exceed 40% after 500 revolutions, when tested in accordance with AASHTO T96 (Los Angeles Abrasion Test).

Abrasion after 100 Rev

The ratio of wear loss = -----

Abrasion after 500 Rev

Should not be more than 0.25

Add the following new clause:

10. The fractions of material passing the No. 200 mesh sieve shall not be greater than 67% of the fractions passing the No. 40 mesh sieve.

3.01.4 Aggregate for Base Courses

Delete Table 3.2: Gradation of Base Course Aggregate by Class and replace by:

Table 3.2: Gradation of Base Course Aggregate by Class

Sieve Designation (Square openings)	Percent by weight passing Class A*	Class B*
50 mm (2 in.)	100	100
37.5 mm (1-1/2 in.)	100	70-100
25 mm (1 in.)	84 - 94	55- 85
19.0 mm (3/4 in.)	71- 84	50- 80
12.5 mm (1/2 in.)	59 - 75	---
9.5 mm (3/8 in.)	---	40- 70
4.75 mm (No. 4)	36 - 53	30- 60
2.00 mm (No. 10)	23- 40	20- 50
0.425 mm (No. 40)	11 - 24	10- 30
0.075 mm (No. 200)	4 - 12	5- 12

* Class A is intended for use in the main carriageway, whereas Class B is intended for temporary roads and detours.

Add the following at the end of Clause No.5:

The specified sand equivalent value corresponds to the value obtained in accordance with AASHTO T. 176 (Dry method). If the test is carried out in accordance with AASHTO T 176 (Wet Method), the Contractor shall establish a correlation between the two tests.

In Clause (6), amend the following:

- a. In the first line, delete "45%" and replace by "40%"
- b. Delete the third and fourth lines and replace by the following:

Abrasion after 100 Rev.

The ratio of wear loss = -----

Abrasion after 500 Rev.

Should not be more than 0.25.

Replace the first sentence in Clause (9) by:

9. The portion of aggregate, including any blend material, passing the 0.425mm (No. 40) mesh sieve shall have a liquid limit (L.L) of not more than 25 and plasticity index (P.I) of not more than 6 when tested in accordance with AASHTO T90.

Add the following new clause: -

11. The fractions of material passing the No. 200 mesh sieve shall not be greater than 67% of the fractions passing the No. 40 mesh sieve.

SECTION 3.02 GRANULAR SUB BASE COURSES

3.02.6 Construction

Add item 4.6 to read as follows:

- 1.6 The elevations of sub base layer shall be checked out using a level instrument of 1 mm double run accuracy.

Pay Items

Unit of Measurements

- | | | |
|------|--|-------------|
| 3.02 | Granular Sub-Base Course C.B.R > 40% at 100% MDD, compacted thickness. | Cubic Meter |
|------|--|-------------|

SECTION 3.03 AGGREGATE BASE COURSES

3.03.6 Construction

Revise the first sentence to read: "All components of base course material shall be mixed thoroughly and uniformly with water in a pug mill mixing plant or other method approved by the Engineer and permit complete mixing of all the material

Add the following paragraphs to the end of Clause 2.1;

Aggregate base course material shall be collected in a stockpile with suitable heights that will not cause any segregation. The base course material shall be transferred from the stockpile by a shovel

to a stationary plant which consists of the following or similar approved plant:

A cold bin with revolving blades to mix base course material before transferring it by a conveyor (BEH) to a pug mill (with or without rotary blades), adding water by a water sprayer to achieve a uniform moisture content with +2.0% of the optimum moisture content.

Or a cold bin without revolving blades that can transfer the mixed material to a pug mill mixing plant with revolving blades or rotary drum or a continuous mixing type.

The rate of feed shall not exceed that which will permit complete mixing of all the material.

After mixing, the material shall be transferred to the trucks which will transfer the material to a self-propelled finisher, equipped with mechanical vibrator with rotary blades that will mix the base course material again to prevent any segregation and spread the material to the required width.

Revise Clause 2.4 to read:

“The base course material shall be placed to the required width using a self-propelled spreader (finisher), and shall be delivered such that it is ready for compaction without further shaping.

The finisher shall be equipped with a sensor that runs on a string line or a 6.0m skid to spread the base course evenly to the required elevation. Immediately upon completion of spreading to the required shape and elevation, the mix shall be compacted using approved rollers to achieve the required compaction density. Rolling should start immediately after spreading to avoid moisture loss.

The elevation of the sensor wire shall be established based on site trials that will be made to measure the difference between the loose thickness and compacted thickness in order to define the elevation of the sensor wire accordingly.”

For transverse joints during construction, the end of constructed lane should be prepared and cleaned to form a vertical face to the required compacted thickness; the finisher screed should be placed on it but at the required thickness of the loose new materials to achieve continuity of surface elevation.

Replace Items No 4.2 and 4.4 by:

4.2 The elevations of the finished base course shall be checked by the Contractor in the presence of the Engineer at intervals of 10 m and its intermediate points as directed.

4.4 When the finished surface is tested with a 4m long straightedge, placed parallel to, or at right to the centerline, the maximum deviation of the surface from the testing edge between any 2 contact points shall not exceed 10 mm

Pay Items

Unit of Measurements

3.03	Aggregate Base Course, including watering and spreading with finisher and compaction to CBR > 80% at 100 MDD, compacted thickness.	Cubic Meter
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PART 4 BITUMINOUS CONSTRUCTION

SECTION 4.01 MATERIALS

4.01.3 Aggregates for Bituminous Paving Mixes

- Amend Clause 1 to read as follows:
- Aggregate for use in bituminous base course, binder course, levelling course, wearing course and cold mix courses, shall consist of crushed stone.

The coarse fraction of aggregate for use in bituminous **binder course shall consist of high quality lime crushed stone**. Vesicular particles shall not exceed 5.0% by weight.

The coarse fraction of aggregate for use in bituminous **wearing course shall consist of high quality Basalt crushed stone**. Vesicular particles shall not exceed 5.0% by weight.

Replace Clause 7 by

6. Aggregate particles shall be clean, hard, durable and sound. Crushing shall result in a product such that for particles retained on 4.75 mm (No. 4) sieve, at least 90% by weight shall have 2 or more newly fractured faces.

Replace Clause 11 by

11. Combined coarse and fine aggregates for bituminous mixes, including mineral filler, when tested in accordance with AASHTO T 27 and T11, shall conform to the gradations shown in Table 4.1.

Table 4.1 Gradation of Aggregates for Bituminous Mixes

Sieve Designation	Heavy Traffic*		Light Traffic**	
	Binder Course	Wearing Course	Binder Course	Wearing Course
1 1/2"	-	-	-	-
1" (25.0mm)	100	100	100	100
3/4" (19.0mm)	70-100	90-100	70-100	90-100
1/2" (12.5mm)	53-90	71-90	53-90	71-90
3/8" (9.5mm)	40-80	56-80	40-80	56-80
No.4 (4.75mm)	30-56	35-56	30-56	35-65
No.8 (2.36mm)	23-38	23-38	23-49	23-49
No.20 (1.18mm)	13-27	13-27	14-34	14-34
No.50 (0.300mm)	5-17	5-17	5-19	5-19
No.80 (0.150mm)	4-14	4-14	4-15	4-15
No.200 (0.075mm)	2-8	2-8	2-8	2-8

* To be used for the main roads and parking areas.

** To be used for temporary roads and detours

Amend Clause No. 12 to read as follows: -

12. The loss in weight of aggregate after 500 revolutions, when tested in accordance with AASHTO T 96, shall not exceed 25% for bituminous wearing course layer and 35% for bituminous binder course layer.

Abrasion after 100 Rev.

Ratio of wear loss = $\frac{\text{Abrasion after 100 Rev.}}{\text{Abrasion after 500 Rev.}}$

Less than or equal 0.25

Add the following new Clauses

16. Polish Stone Value of coarse aggregate used in wearing course mix, when tested in accordance with BS 812, shall be at least 60%
17. The water absorption of the coarse lime stone and basalt aggregate material shall not exceed 2%.
18. The aggregate material shall have chloride content of less than 0.8 percent and sulphate content of less than 0.30 percent when tested in accordance with BS-812.

SECTION 4.02 BITUMEN PRIME AND TACK COATS

4.02.2 Materials

Clause 2 "Rapid – Curing (RC) Cutback Bitumen", replace 2.1 to the following:

- 2.1 RC cutback bitumen (for tack coat) shall be grade RC250 and as specified in section 4.01 "Material".

	<u>Pay Items</u>	<u>Unit of Measurements</u>
4.02 (1)	Bituminous Prime coat MC-70 , Application rate from 0.75 to 2.00 kg/m ²	Ton
4.02(2)	Bituminous Tack coat RC-250 , Application rate from 0.3 to 0.6 kg/m ²	Ton

SECTION 4.03 BITUMINOUS COURSES

4.03.5 Construction of Trial Sections

Add Clause 6 as follows:

6. The trial section shall commence immediately after the completion of the design mix stage at least one month before actual production. If the initial trial section should prove to be unacceptable, the necessary adjustments to the Job Mix Formula, plant operation, placing procedures, and/or rolling procedures shall be made. A second trial section shall then be placed. Additional trial sections, as required, shall be constructed and evaluated for conformance to the specifications. Full production shall not begin until an acceptable section has been constructed and accepted.

SECTION 4.05 BITUMINOUS BINDER AND WEARING COURSE

4.5.2 Materials

- Add Clauses 4 and 5 as follows:
- 4. The bitumen for bituminous wearing course layer shall meet the requirements for performance graded bitumen Grade 60-70.

4.5.3 Job Mix and Project Mix

- Replace Clauses 2 to 4 and Table 4.15 by the below Clauses:
- 2. The job mix shall be composed of a mixture of aggregate, filler and bituminous material.
- 3. The several aggregate fractions shall be combined in such proportions that the resulting mixture meets the grading requirements of the Job Mix Formula (JMF)
- 4. Job Mix Formula:
 - 4.1 No asphalt mixture for pavements shall be produced until a job mix formula has been approved by the Engineer. Details of JMF shall be submitted at least 15 days prior to first trials.
 - 4.2 The Job Mix Formula shall be determined based on volumetric mix design according to the Asphalt Institute's Manual (MS-2).
 - 4.3 The field laboratory to be used shall be capable of performing all the tests required by this Section.
 - 4.4 The gradation given in Table 4.1 and 4.1A of Section 4.01 represents the limits that shall determine the suitability of aggregates for use in the course of supply.
 - 4.5 Marshall design criteria:

Table 4.15 Marshall Design Criteria

Criterion	Requirement for Bituminous Binder Course Layer	Requirement for Bituminous-Wearing Course Layer
Number of Blows at each end of the specimen	75	75
Stability, in Newton	>10,000	> 12,000
Flow, in mm	2 – 4	2 – 4
Air Voids, percent	4 – 7	3 – 6
Loss of Marshall Stability* in accordance with AASHTO T165	Max. 25%	Max. 25%
Marshall Quotient, /mm (- Stability / Flow)	4900	4900 min.
Percent Voids in Mineral Aggregate (VMA)	Min 13	Min 14
Filler/Bitumen Ratio, by weight	0.6 – 1.2	0.6 – 1.2
Air Voids at Refusal**, percent	2 minimum	2 minimum

* The loss of Stability shall not be more than 25 percent determined as follows:

Submerge samples in water at 60 deg. C for 30 minutes and determine Marshall Stability – result (a).

Submerge samples in water at 60 deg. C for 24 hours – result (b). Loss of Stability is $(a - b)/a \times 100$ percent.

** The refusal condition shall be achieved by compacting samples with increasing number of blows in the Marshall procedure until no further densification occurs. The sequence of blows recommended to determine the refusal condition is 75 blows, 200 blows, 300 blows, 400 blows, and 600 blows.

Add the following Clauses to subsection 4.05.3:

5. Bitumen content shall be calculated by weight of total mixture excluding absorption.

The range of bitumen content by weight of total mix to be added to the mix is indicated below:

<u>Pavement Course</u>	<u>Bitumen Content</u> (percentage by weight of total mixture)
Binder	3.5 to 5.0
Wearing	3.5 to 5.0

These values are guidelines only. The minimum binder content shall be selected consistent with achieving the void content, durability and mechanical property requirements.

6. When tested for resistance to water damage in accordance with AASHTO T 283 “Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage”, the bituminous wearing course mixture shall have a retained tensile strength greater than or at least equal to 80%. In case the anti-stripping agents are not successful in providing the specified Tensile Strength Ratio, then the Contractor shall consider alternative means, such as the use of hydrated lime to achieve this purpose.
7. Surface texture: An average surface texture depth in the asphalt course of 0.9mm shall be achieved when tested according to the sand patch test to ASTM E 965, with no values below the minimum limit of 0.72mm. Mix proportions shall be performed by the Contractor to optimize the asphalt wearing course mix design taking into consideration the surface texture requirements.

4.5.9 SAMPLING AND TESTING

1. Sampling and testing shall conform to the relevant requirements of section 1.05 “Control of Materials and Standards for sampling and Testing”.

Table 4.13 Tests for Bituminous Pavements Minimum Tests Required:

Table 4.13 should be replaced by Table 4 in Clause 0.5 of these particular specifications.

4.5.10 SURFACE TOLERANCES

Amend Clause 2 to read as follows:-

2. The Tolerances on elevations of the final bituminous wearing and binder course surfaces shall not be greater than 10mm.

Amend Clause 3 to read as follows:-

3. When the finished wearing and binder course surfaces are tested with a 3 m long straight-edge, placed parallel to, or at right angles to the centerline, the maximum deviation of the surface from the testing edge between any 2 contact points shall not exceed 3 mm and 4 mm, respectively.

Add the following new clause:

4.05.12 Measurement

Bituminous Binder course and bituminous wearing course shall be measured by sq.m of mix furnished, Spread, Compacted, completed and accepted Measurements shall be of the areas and thickness as shown on the Drawings and BOQs.

Add the following Pay Item:

	<u>Pay Items</u>	<u>Unit of Measurements</u>
4.05(1)	7cm Bituminous Binder Course consist of high quality lime crushed stone, compacted thickness.	Square Meter
4.05(2)	5cm Bituminous Wearing Course consist of high quality basalt crushed stone, compacted Thickness.	Square Meter

PART 5 CONCRETE, STEEL AND STRUCTURES

SECTION 5.01 CONCRETE AND CONCRETE MIXES AND TESTING

5.01.2 Material

Item 4.2.5, Correct this item to read as follows: -

4.2.5 Aggregate abrasion value by the Los Angeles test in accordance with AASHTO T96-83, ASTM C131-81, and ASTM C535-81.

Item 5.4, Correct this item to read as follows: -

5.4 Fine aggregate shall meet the requirements specified under this item of the Standard Specifications.

Item 6.3, Correct this item to read as follows: -

6.3 Coarse aggregates shall meet the requirements specified under this item of the Standard Specifications.

Item 6.4, Delete and replace by:

6.4 The grading of coarse aggregates shall comply with Table 1 of JSS/96/1987 or to AASHTO M43 or as per the Engineer's directions.

1. CONSTRUCTION REQUIREMENTS

1.1 Preparation of Foundation Bed

The foundation bed shall be excavated to the lines and grades as shown in the plans as directed by the Engineer, and shall be thoroughly compacted in accordance with Item 104.3.3.

1.2 Formwork Construction

Formwork shall be constructed so as to withstand the stresses imposed.

Formwork used shall be constructed with sufficient strength, rigidity and shape as to leave the finished works true to the dimensions shown on the Plans and with the surface finished as specified.

The inside surface of forms shall be cleaned of all dirt, water and foreign materials. Forms shall be thoroughly coated with form oil prior to use. The form oil shall be commercial quality form oil or other approved coating which will permit the ready release of forms and will not discolor the concrete.

1.3 Placing

One layer of concrete class "20" shall be placed at the prepared bed prior to placing of stones. Clearance between stones shall not be more than 10 cm.

Concrete Class "20" shall be placed after each layer of stone and shall be thoroughly consolidated by means of a vibrator inserted in each layer of concrete. In no case shall the vibrator be operated longer than 10 seconds in any location.

After removal of forms, any cavities, voids and honeycomb spots shall be filled up with mortar composed of one-part cement and two parts sand.

All debris and refuse resulting from work shall be removed and the site left in a neat and presentable condition.

2. Method of Measurement

The quantity to be paid for shall be the number of cubic meters of rubble concrete complete in place and accepted. In computing the quantity for payment, the dimension used shall be those shown on the plans or ordered in writing by the Engineer. No reduction shall be made for weep holes.

3. Basis of Payment

The quantity of rubble concrete shall be paid for at the contract unit price per cubic meter, which price and payment shall be full compensation for preparation of the bed, furnishing, necessary excavations, false work, and for all labor, equipment, tools and incidentals necessary to complete the Item.

5.01.8 Measurement

Delete Items 2.3 and 2.4 and substitute by the following:

2.2 Measurement and payment shall be based upon different classes of concrete as stated in the BOQ irrespective of type of form and/or false work and irrespective of class of surface finish.

Renumber Items 2.5 and 2.6 as 2.4 and 2.5 respectively.

4. Inclusion in the Rates

Add the following:

4.1.16 Backfill drains, shear key, and any other items shown in the drawings.

4.1.17 Inspection holes with service pipes, deflection and contraction joints used for concrete parapets, all types of joints (except the joints stated in 5.18.5), shear bars, threaded inserts sleeves, expanded polystyrene fillings, joint filler, tar paper, voids formers and its fixing ancillaries, sealants, epoxy (mortar, resin, or adhesive paint), utility dusks, weep holes, voids vents, base course and polyethylene under approach slab.

Add the following new clause:

5. Payment

The Payment Items for the Bill of Quantities under which the works in this section and other related sections of the Specifications shall be paid for, are as listed hereinafter. Measurement for payment shall be made according to the units of measurement stated in the Bill of Quantities.

Prices and payment for the Pay Items shall be deemed to include all that is required to complete the work according to this section and other sections of the Specifications, including all incidentals and subsidiary work which have no separate items for payment in the Bill of Quantities.

All concrete works shall be measured in cubic meter Unless it is explicitly specified in the specification or the drawings and a separate Item is included in the BOQ, prices shall be according to concrete classes and type of works all as shown in the bill of quantities, the rate for any concrete class shall deemed to include the following:

1. All exposed surface Fair Face finish
2. Formwork,
3. Provision and installation of joint filler,

4. Weep holes for abutment, wing walls and retaining walls,
5. Permeable materials behind abutments and retaining walls,
6. UPVC conduits,
7. Drainage of Structures,
8. Expansion joints for retaining walls
9. Water stop if not itemized in BoQs.
10. All other miscellaneous details shown on structural Drawings.

Cylinder Strength		Cube Strength	
MPa	Psi	MPa	Psi
12	1740	15	2175
25	3625	30	4350
30	4350	37	5365
35	5075	45	6525
40	5801	50	7251

Delete the Pay Items and replace by: -

	Pay Items	Unit of Measurements
5.01	Concrete of all classes	Cu.m

SECTION 5.02 CONCRETE HANDLING, PLACING AND CURING

5.02.6 Hot Weather Concrete

Clause 2, Delete item 2.2 and substitute by the following:

- 2.2 In the absence of an alternative procedure proposed by the Contractor and approved by the Engineer in order to control the concrete mix temperature, no concreting shall commence when the air temperature is 32° C and rising. However, the Contractor may schedule his operations to commence pouring concrete during the hours that the air temperature is 34°C maximum but dropping at late hours of the day.

5.01.2 Materials

12 Admixtures:

Add the following sentence to the admixtures:

- 12.6 Silica fume additive shall be added to the concrete class 70 ($f_c'=55$)
- 12.7 super plasticizer additives shall be added to all concrete grades.

SECTION 5.03: STEEL REINFORCEMENT AND FIXING

5.03.2 Materials

Delete item 1.1 and substitute by the following: -

1. Hot rolled steel bars shall conform to JSS/441/1994 or to AASHTO M31M (ASTM A615M) or to B.S. 4449.

	<u>Pay Items</u>	<u>Unit of Measurements</u>
5.03	High tensile steel	Ton

SECTION 5.13 PIPE CULVERTS, STORM DRAINS, AND UTILITY DUCTS

5.13.4 Measurement

Delete Clauses 1,2 and 3, and replace by:

1. Pipe Culverts, shall be measured by linear meter of each pipe size and type furnished, installed, or constructed, backfilled, completed, and accepted.

Storm Drains and Utility Ducts shall be measured by linear meter of each size and type furnished, installed or constructed, backfilled, completed, and accepted.

2. Measurement of pipes for pipe culvert shall be made as per B.O.Q items. The length measured shall extend from end to end of pipe in the absence of headwall or end walls, or shall extend between inside (Highway) faces of headwall and end wall.

3. Reinforced Concrete class (30) for head walls and apron, and class 15 concrete for blinding shall be measured and paid for as prescribed in section 5.01.8 and as shown in drawings.

Add the following new clause:

12. The quantities, measured as provided above, shall be paid for at the contract price per unit of measurement, for the pay items listed below which price and payment shall be full compensation for furnishing and placing all materials including all labor, tools, equipment and incidentals necessary to complete the work described in this section.

Delete the Culverts Pay Items and replace by:-

	<u>Pay Items</u>	<u>Unit of Measurements</u>
5.13	Pipe Culvert	Linear Meter

PART 8 INCIDENTAL CONSTRUCTION

8.01.2 Materials and Precast Manufacturer

Add the following to sub-Clause 4.7:

The Precast concrete curbs shall be tested in accordance to Jordan Standard Specification (JSS) No. 479/94.

Clause 8 – Bedding, replace item 8.1 by the following:

Bedding Material shall conform with the relevant requirements of Section 2.07 “Sub-grade construction and topping, Section 3.02 “Granular Sub-base Courses” and Section 3.03 “Aggregate Base Courses”, and as shown on Drawings.

SECTION 8.05 Slope Protection and Stabilization

8.05.2 Materials

Clause 1: Stone for Riprap

○ Amend Item No. 1.1 to read as follows:

- 1.1 Stone for loose and grouted riprap shall consist of fieldstones furnished in broad flat shapes to the maximum extent practicable. All stone shall be hard, sound, durable, and highly resistant to weathering and shall be suitable as protection material for the intended purpose. The foundation surface of the slope shall be furnished with 7.5 cm layer of mortar or concrete Class (20). No direct payment shall be made for the material used in the foundation and the cost shall be included in the price of this item.

Amend Item 1.4 to make the table of riprap classes read as follows:

Weight of Stones (Kg)				% of Total Weight Smaller than size shown
Class (A)	Class (B)	Class (C)	Class (D)	
50	200	1000	5000	95 – 100
20	100	500	2000	50 – 100
5	20	100	500	0 – 50
1	5	20	100	0 – 10

8.05.3 Construction

Clause 3: Mortared Stone Riprap

Delete this clause and replace by:

3. Grouted Riprap

- 1.1 The surfaces (formation) upon which grouted riprap is to be placed shall be excavated, formed, and compacted to the required lines, grades, and sections as shown on the drawings or as directed.

- 1.2 Excavation and preparing for paved ditches shall be performed in a manner so as to anchor the structure into the sides of the ditches and protect the slopes to prevent seepage and scour. Unless otherwise specified, each anchor shall extend about 60 cm into the natural ground and shall be backfilled and tamped after completion. Surplus excavation shall be disposed.
- 1.3 Stones shall be class B as specified in sub section – “8.05.2 Materials”, and shall be cleaned of all adhering dirt and clay before being placed. Stones shall first be laid into a layer of soft moist concrete composition of class “20”. Unless otherwise indicated, the concrete layer thickness shall not be less than 75 mm.
- 1.4 The successive layers of stone masonry shall be laid in cement mortar. Stone shall be placed by hand, laid with close, broken joints, and the stones so selected that they are firmly bedded against adjoining stones.
- 1.5 The larger stone shall be placed in the lower courses. Interstices between stones may be chinked with spalls or selected small stones firmly rammed into place, but voids between large and small stones or spalls shall be filled with mortar as the work progress. The mortar shall be vibrated, spaded, and rodded into place until the voids are completely filled. Excess material and spillage shall be cleaned from the front face of the riprap before hardening. The finished work shall present uniform tight surfaces.
- 1.6 The exposed mortar shall immediately after completion of each section of riprap, be cured using clear compound in accordance with the relevant requirements of section 5.02 – “Concrete Handling, Placing and Curing”. Alternatively, if approved, the mortared riprap shall be protected from the sun and kept moist for at least 3 days after completion of mortar placement.

Delete this subsection and replace by:

	<i>Pay Items</i>	<i>Unit of Measurements</i>
8.05(1)	Grouted Stone Riprap Protection	Cu.m

SECTION 8.07 GRS STRUCTURE (MSE WALL)

The work shall consist of constructing retaining walls using a proprietary reinforced soil wall system, constructed in accordance with the proprietor’s drawings and specifications and in conformity with the alignment, grades and dimensions shown on the Tender Documents or as established by the Engineer. The Contractor shall provide complete set of drawings issued for construction and complete specifications of the proposed **MSE wall** system for the approval of the Engineer, any particular requirements of approved detailed specifications for the approved proprietary system shall override any conflicting or incomplete requirement contained within this section.

Considering the site limitations, wall geometry, estimated subsoil conditions and seismicity of the site, the recommended wall is Geogrid reinforced soil (GRS) structure; the proposed system shall consist of Geogrid reinforced soil wall with **Terramesh**.

Specialized Proprietor of the wall system

- The design must be performed by locally established and experienced Proprietor of the wall system, who shall be fully responsible for the design, provision of materials installation and construction supervision services as identified in this specification.

- All components of the GRS structure with Terramesh system shall be supplied or constructed under the full supervision of the Proprietor of the wall system.
- The design department of the Proprietor of the wall system shall include the following as a minimum requirement:
 - A. Design Manager having at least 20 years of experience in similar projects and successfully designed at least 20 constructed projects in the last 5 years of similar heights in the ME area with no reported problems.
 - B. Design Team Leader having at least 12 years of experience and have completed the design of at least 10 constructed structures of similar wall heights in the ME area with no reported problems.
 - C. Site QC inspector Engineer having a minimum experience of 10 years including relevant experience in at least 5 similar projects.
- The design shall be prepared and stamped by the design manager and the design team leader who should be available to technical backup at site upon request
- The Proprietor of the wall system shall furnish the CVs of the above staff for review and approval of the Client.
- The Proprietor of the wall system shall provide the following:
 - A. A copy of the current Geogrid BBA certificate for the Geogrid reinforcement.
 - B. Detailed design calculations for the proposed walls in compliance with FHWA Publication No. FHWA-NHI-10-024 Design and Construction of MSE Walls and Reinforced Slopes –Vol.1” and FHWA-NHI-10-025 Design and Construction of MSE Walls and Reinforced Slopes –Vol.2”.
 - C. Soil specifications and information of the proposed reinforced soil fill.
 - D. Method statement for construction for such heights with all safety precautions and hand railing during installation.
 - E. Verified experience and supervision of similar wall at a height not less than 30.0m in one lift.
 - F. Experience in similar scope of work with similar wall heights and design approach in Middle East and Jordan.
 - G. Established presence in Jordan with experienced local engineers for design and supervision and QC supervision Engineer with relevant experience not less than 15 years.
 - H. **Proprietor of the wall system** shall provide proven clear track record of maintaining a Design, Service & Installation by **Professional Indemnity Insurance with a limit of Indemnity of 160,000 JD for each claim for the past five years.**

Specifications for Geogrid Reinforced Soil Wall System with Terramesh

The design shall address the climatic and soil conditions existing in the site area and provide a minimum design life of 10 years.

The design shall consider continuous geosynthetic reinforcement material in the areas where reinforcement is placed. The specifications as presented to the Engineer shall state any requirements for the limitations on backfill used in the structure to ensure the design life.

Any changes in section depending on the alignment, dimensions and profile of the project maintaining the right of way, slopes and tiers should follow the **Proprietor of the wall system** recommendation and design the **Proprietor of the wall system** shall undertake the changes at his own cost keeping the same facing area subjected to the Engineer’s approval.

The following materials specifications shall follow the **Proprietor of the wall system** recommendation subjected to Engineer’s approval.

a. Reinforcement Geogrid

- The Geogrid shall be flexible reinforcing geogrid or similar in accordance with the design calculations provided by the Proprietor of the wall system. The geogrid has to be approved by the Engineer and the installation has to follow the manufacturer's instructions.
- The flexible geogrid shall be manufactured from Polyvinyl Alcohol PVA in the main reinforcement direction yarns with low creep and an environmentally inert coating, resistant to UV light and all micro organisms and chemicals naturally present in the soil and temperature resistance up to 40° C (no deviations in mechanical properties of more than 5 %).
- The Strain at nominal strength in longitudinal direction shall not exceed a maximum of 6% when tested in accordance with EN DIN ISO 10319.
- The total post construction strain for the design life of the structure at the allowable design load shall not exceed 1% (in accordance with BS 8006).
- The pH resistance of the Grid shall be >2 and <13.
- The allowable design load under working conditions for a design life of 10 years shall be justified by partial (material) reduction factors on creep, mechanical damage, chemical and environmental effects, and an overall factor of safety for extrapolation of data, design assumptions and calculations for 120 years. All reduction factors applied have to be certified and based on independent product-specific research by authorised research or testing institutes.
- The mesh size shall not exceed 30 x 30 mm.
- The mechanical properties of the grid should be verified by both internal quality assurance and external quality control and assurance by accredited laboratories (DIN EN ISO 17025:2000).
- Frictional connection to be proven by third party test and certification.
- The production of the geogrid shall be EN ISO 9001:2000 certified.
- Each roll should have at least one identification label with roll number and product type in accordance to DIN EN 30320.

b. Reinforced Soil fill

This item covers the requirements for all operations in connection with the excavation (cut) areas, hauling and unloading of the excavated material to fill location where they are to be deposited, level to grades, watering, mixing and compacting to required density.

The reinforced soil material should be well graded crushed and granular not sub-rounded, and should conform to the following:

- The reinforced fill shall be composed of embankment fill (rock fill or rock soil) with the requirements as described according to listed in Table 2.1 of section 2.03 of the 2008 Jordanian Specifications for Highways and Bridge Construction.
- Inorganic with no plastic material content.
- Angle of friction of the reinforced fill soil not less than 36 degrees.
- The maximum boulder size shall be equivalent to two thirds (2/3) the lift thickness.
- In-situ tests based on the reinforced soil/backfill type and parameters shall be as the Proprietor's requirements and specifications.
- Acceptability of other soils will be up to the Proprietor of wall system.

c. Non woven filter geotextile

- Shall consist of high strength woven made of Polypropylene (PP).

- The geotextile shall have the minimum following properties:

Mass per unit area (g/m²) in accordance to DIN EN 9864: ≈ 160 g/m²

Thickness under 2 kPa load in accordance to DIN 9863-1: ≥ 1.1mm

Ultimate Tensile strength (acc. to DIN ISO 10319)

long. ≥ 12 kN/m

trans. ≥ 12 kN/m

Strain at Ultimate Tensile Strength (acc. to DIN ISO 10319)

long. ≤ 45 %

trans. ≤ 50 %

CBR puncture resistance (DIN EN ISO 12236) ≥ 1700 N

Cone drop resistance (EN ISO 13433) ≤ 25mm

Effective opening size O90 in accordance to EN ISO 12956: ≤ 0.09mm

Water permeability index normal to the plane (DIN EN ISO 11058 VI H50)

min. ≥ 100 l/m²s

- The mechanical properties shall be verified in accordance to DIN 18200 quality assurance by an accredited laboratory (DIN EN ISO 17025:2000).
- Each roll should have at least one identification label with roll number and product type in accordance to DIN EN 10320.
- The manufacturer shall have Product Liability Insurance for bodily injury & property damage with a limit of liability of 20,000,000 JD for each occurrence and 40,000,000 JD in aggregate; and the insurance shall be valid 5 years after delivery of Materials.

d. Back drainage and barrier geocomposite

- The virtually impermeable continuous core shall have 100mm flat selvages on both edges which allow joining of the adjacent sheets by wedge welding. Any other alternative means of joining the adjacent panels will not be allowed, due to the importance of the continuity of the drainage and barrier layer.
- The producer of the drainage layer will be accredited to ISO 9001. The drainage and barrier layer will have CE mark accreditation to EN 13252.
- The drainage and barrier layer will consist of a single-cusped HDPE (high density polyethylene) core with excellent High pressure OIT performance. Geonet products will not be permitted. Drainage cores permeable on both sides shall not be permitted. Polymer HIPS core will not be permitted. Drainage products consisting of multiple drainage cores will not be permitted.
- The below minimum requirement shall be satisfied:

Properties	Required Value*	Test Method	
Type	Single cusped		
Material (Core)	HDPE		
In plane water flow (MD & CMD) @ H.G. 1.0 & 500kPa with SOFT platens	0.82 l/m/s	MIN	EN ISO 12958
@ H.G. 0.1 & 500kPa with SOFT platens	0.19 l/m/s	MIN	EN ISO 12958
E Long term design creep at actual site pressure, 100 years*	2500 kPa	MIN	ASTM D7361
High Pressure OIT	1000 minutes	MIN	ASTM D5885
Thickness at 2kPa	8.1 mm	MIN	EN ISO 9863-1
Static Puncture Resistance CBR	4 200 N	MIN	EN ISO 12236
Resistance to Weathering	Excellent		EN 12224

- The drainage and barrier layer shall be installed in accordance with the producer's written instructions.
- The drainage and barrier layer shall be installed with the primary gradient aligned with the roll length.
- The drainage and barrier layer shall be installed with the flat side facing downwards.
- The drainage and barrier layer shall be covered with soil within 24 hour of installation.
- The cover soil has to be permeable to allow the liquid to get to the drainage geocomposite.

Terramesh:

- Terramesh units consist of double twisted hexagonal wire mesh of soft annealed, hot dip coating according to en10223-3 & en 10218-1.
- Mesh type for terramesh units shall be 8x10.
- Paralink bonded grids shall be unidirectional strip

Design Standard and Methodology

The Contractor shall be responsible for design of GRS to the line and levels shown on the drawings.

The **Proprietor of the wall system** shall provide a complete set of drawings issued for construction and complete specifications of the proposed wall system for the approval of the Engineer.

GRS structure shall be designed in accordance with the load combinations and load factors in AASHTO and as per FHWA Publications No. FHWA-NHI-10-024 Design and construction of MSE walls and Reinforced Slopes – Vol.1” and FHWA-NHI-10-025 Design and construction of MSE Walls and Reinforced slopes –Vol.2 “ The GRS structural design shall include specific checks for strength and service limit states.

a. Design Check

The design of reinforced earth walls shall check and verify the following cases:

- Internal stability of the system, including rupture, pull-out and connection stability.
- External stability: bearing capacity, sliding, overturning and global (deep-seated) stability.
- Compound stability: stability of the system utilizing the combined reinforcement actions and forces.

b. Design Standards

- AASHTO – 2002 / NHI-043 (ASD).
- FHWA-NHI-10-024 –Vol.1
- FHWA-NHI-10-025 –Vol.2

c. Design Criteria

- Foundation/Supporting soil data to be verified by lab tests and soil reports to verify all required design parameters including soil condition, water table effect and site seismicity.
- The Proprietor of the wall system shall do his own judgment based on his experience with similar projects within the area.
- Full responsibility for the internal design and global stability of the reinforced soil wall and facing based on the site condition and tender documents and drawings.
- Replacement of the existing soils with a compacted backfill to meet the requirements of the wall system if required.
- The adopted factor of safety for GRS structure shall be in accordance with the design codes and standards stated above.
- The embedment and extent of the GRS structure shall be designed to meet the stability requirements and in accordance with minimum requirements of the design codes listed above.
- Dead loads and live loads shall be in accordance with the design codes and standards including applied dead loads, live loads and seismic loads in accordance with the loads, load combinations and load factors in "AASHTO Standard Specifications for Highway Bridges.
- Wall Batter shall be in accordance to the tender documents and drawings.
- Geogrid reinforcement Long Term Design Strength (LTDS) for 120 years. Such standard requires that the geogrid reinforcement be reduced by factors to accommodate for possible installation damage, creep behaviour of geogrids and durability of geogrids.

Pay Items as follows: -

	<u>Pay Item</u>	<u>Unit of Measurement</u>
8.07	<p>Design, Supply materials and install Geogrid Reinforced Soil (GRS) wall with terramesh Units. The works shall include the geogrid reinforcement, reinforced soil fill, non-woven Geotextile filter, back drainage composite, filter gravel drainage and terramesh Units with the required excavation and backfilling in accordance with design requirements as per Specifications & Drawings.</p> <p>The Contractor shall take into consideration the culverts inlets & outlets through GEO Grid wall system design.</p> <p>The Contractor shall comply with MPWH circular No. 63/1/27624 dated 30/6/2019.</p>	
a	Supply and install reinforced soil fill	Cu.m
b	<p>Terramesh facing units including all works mentioned in the item description above except sub-item 8.03.a.</p> <p>Measurement shall be of the front face area of Geo-Grid wall.</p>	Sq.m

SECTION 8.11 HIGHWAY SIGNING

8.11.2 Materials

Amend Item 8 (Reflective sheeting), Para 8.1 to read that Reflective Sheeting shall be of the "High Intensity Grade".

8.11.4 Measurement

Delete Sub-Section 8.11.4 and substitute by the following:

- Signs shall be measured per number for each type and size of signs installed in place and accepted.
- Payment shall be made according to the different classes of signs per number at the Contract unit rate including, but be not limited to, erection, excavation, backfilling, compaction, concrete, reinforcement steel, materials, painting, frames, posts, and all other items necessary for the proper completion of the work.

	Pay Items	Unit of Measurements
8.11(1)	Triangular Shape, Circular shape signs, and Rectangular shape signs.	No.

8.12 Pavement Markings for Traffic

8.12.1 Scope

Add the following items to be used in the project:

- 1.3 Sprayed Thermoplastic ReflectORIZED Paint (TRP) for painted markings and paint lines.
- 1.4 Reflective cat eyes type studs located and spaced as shown on drawings should be used for raised pavement markers.

8.12.3 Application and Installation

Delete item 5.4 and substitute by the following:

- 5.4 The completed lines shall be a continuous and uniform cross section, and shall have clean, sharp dimensions. The width of paint line specified shall be applied in one application. The lines shall be laid to the following thickness unless otherwise agreed between the Engineer and the Supplier:

Sprayed Lines: 2.0 mm minimum

8.12.5 Measurement

Delete this Sub-Section and substitute by the following:

1. Painted Pavement Lines and Painted Pavement Markings shall be measured net by linear meters and square meters or numbers respectively as itemized in the Bill of Quantities of completed and accepted work.
2. Payment shall be made for the amount of completed and accepted work as measured by linear meters, square meters and number at the relevant Contract unit price, which shall be full compensation for furnishing all materials, for all labor, equipment and tools, supplies and all other items necessary for the proper completion of the work.
3. Pavement studs shall be measured by the number, furnished, installed, completed and accepted.

	Pay Items	Unit of Measurements
8.12(1)	Thermoplastic ReflectORIZED Paint (TRP) for Pavement Lines, white and yellow (gaps not Measured)	Square Meter
8.12(4)	Reflective pavement markers (Aluminum cat eyes 15x15) with flat reflective strip.	No.

SECTION 8.16 STEEL GUARDRAIL AND CONCRETE SAFETY BARRIER

8.16.2 Materials

Item 8. Concrete, amend Item 8.3 to read that:

8.3. "Concrete for New Jersey concrete Barriers (NJCB) and terminal section shall be of Class 25".

Also add that NJCB shall be pre-cast using 2.5 meter units or straight and curved sections

8.16.5 Measurement

Amend the second sentence of Clause No. 1 to read as follows:

Measurements shall be based on the dimensions as shown on Drawings or as directed, and shall include terminal sections and transition sections which shall be measured by the linear meter furnished, Installed, completed and accepted and paid for at the relevant rate for Guardrail and New Jersey Concrete Barrier, as appropriate.

Delete Clause No. (2)

Renumber Clauses 3 and 4 as (2) and (3).

Delete Pay Items (3), (4), (5), (6), (7) and (8).

	Pay Items	Unit of Measurements
8.16	Steel guard rail with reflectors	L.M

Add New Section:

8.17 STONE MASONRY

8.17.1 Description

The work shall consist of construction of walls using natural stones set in cement mortar in the type of masonry specified.

The stone work shall be carried out and executed in accordance with the "recommended practices for uses of natural stones in building construction as set under section 5, volume 1 STONE WORK, of Ministry of Public works. General Technical Specifications for Buildings. Housing.

8.17.2 Materials

Stones: Stones used shall be from local area **Wadi Mousa** of good quality of hard and durable type without weak seams or cracks and of regular shape. The Los Angeles Value shall not exceed 40. The apparent specific gravity shall not be less than 2.4 and water absorption when tested in accordance with AASHTO T85 shall not exceed 6 percent.

Mortar: Mortar shall be made of a mixture of cement and sand in the proportion of one cement to three sand. Cement shall be Portland Cement conforming to AASHTO M85, Type II. Sand shall be

crushed stone or natural sand or a combination thereof conforming to AASHTO M45. Water added shall be just adequate for making a workable mix and shall be subject to approval of the Engineer.

8.17.3 Construction Requirements

A - Stone Masonry

Stone masonry shall be used for walls of different types above the ground level. The stones shall be of regular shape with length of any stone not exceeding 3 times its height, with the breadth on the bed not less than 150mm nor greater than three quarters of the thickness of the wall. Unless otherwise directed, stones shall have thickness not less than 15 cm.

- B - All stone possessing bedding planes shall be laid with its natural bed as nearly as possible at right angles to the direction of load, and in the case of arch rings, the natural bed shall be radial.
- C - Each course shall present a uniform horizontal line and more or less equal height. Vertical joints shall be sufficiently thick to prevent stone to stone contact and shall be completely filled with mortar. On the exposed face no part of the masonry shall deviate from the general line of the wall by more than 20mm.
- D - Walls of stone masonry shall be provided with weep holes as shown on the Drawings or directed by the Engineer. In continuous long structures, expansion joints shall be formed as shown on the Drawings subject to a minimum spacing of 10m
- E - All face joints shall be finished almost flush with the surface of the work without covering the stones. The top surface of all walls shall be provided with 2 cm thick cement mortar coping with a crossfall for shedding rainwater.
- F - Newly laid masonry shall be protected against the harmful effects of weather and cured for a minimum period of 4 days. All visible surfaces of the masonry shall be clean and free from mortar stains and other blemished.
- G - Backfill behind the stone masonry walls shall be placed only after the masonry work has been in place for at least 14 days, or as directed by the Engineer.

8.17.5 Measurement and Payment

A - Stone Masonry

The quantity to be paid will be measured square meter of stone masonry complete in place and accepted. In computing the area for payment, the dimensions used will be limited to those determined by the dimensions shown on the drawings or ordered in writing by the Engineer. No deductions will be made for weep holes, drain pipe or other openings of less than 0.2m in area.

- D - The amount of completed and accepted work as measured will be paid for at the unit prices per square meters for "Stone Masonry" as the case may be as shown in the Bill of Quantities. These prices shall be in full compensation for furnishing and placing all materials including 7 cm of plain concrete, 5 cm natural stone and for all labour, equipment, tools, and incidentals necessary for completion of the work to the specifications.

Electrical Works Specifications

Electrical specifications

SECTION 01- GENERAL REQUIREMENTS

1.1 Scope of Work

The contractor shall submit a lighting study to achieve the required level of illumination on the bridge, tunnel and roadway using universal software such as (DiaLux) for instance with the use of an LED luminaire, and poles with suitable heights as specified in the tender specifications to satisfy the lighting level of illumination as required in the tender.

Eave ≥ 15 Lux, Lave ≥ 1.0 cd/ sq. m, U0 ≥ 0.4 , U1 ≥ 0.70 , TI < 10.0 , SR ≥ 0.5

1. These Works shall consist of Designing, furnishing, installing, testing, and putting into service, commissioning and fully integrating with the works all required lighting, and other electrical installations, including their associated civil works.
2. These Works shall also include preparation and submission by the Contractor of all necessary "working" drawings and 'as built' drawings and all calculations required by the Specifications and submission of all documentation and samples relevant to the proposed Works. All drawings and documents submitted by the Contractor shall be in the English language.
3. Materials supplied shall include all necessary items required for complete installations which will operate in a satisfactory manner. Materials listed in the Specifications are therefore indicative only. All Works shall be carried out, so as to be readily accessible for operation, maintenance and repair and shall ensure that the true meaning and intent of the Specifications are fulfilled.
4. Specifications and Drawings shall be deemed to be documents enabling selection of materials having the general and specific character is lies detailed.

1.2 Regulations and Standards

- A. The Works shall conform to all relevant Government Regulations, to the requirements of the Electricity Supply Authority and to the following:
 1. Relevant Standards and Specifications issued by the appropriate Authorities.
 2. I.E.C. recommendations.
 3. Regulations of Electrical installations (UK) as published by the institution of Electrical Engineers.
 4. National electric Code (USA) as published by the National Fire Protection Association (NFPA).
 5. Electricity Distribution Company (EDCO), and the public guidelines and regulations must be observed.
- B. All equipment and materials supplied shall be manufactured in conformity with the latest relevant recommendations of the IEC, NEMA, BS or DIN, hereinafter referred to as Standards. Lighting calculations and luminaries lighting characteristics shall conform to the relevant requirements of the international Commission of Illumination (CIE).
- C. Acceptance tests shall conform to the above mentioned Regulations and Standards.

1.3 INTERPRETATION Of Drawings

It is intent of the specifications and drawings to describe a complete Project to be constructed in accordance with the contract documents.

If the Contractor finds a conflict, error or discrepancy in the contract documents, he shall call it to the Engineer's attention in writing at once and before proceeding with the work affected thereby; however, he shall

not be liable to Client or Engineer for his failure to discover any conflict, error or discrepancy in the Specification or drawings. Any work that may be reasonably inferior from the Specifications or Drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for. Work, materials or equipment described in works, which so applied, have a well-known technical or trade meaning shall be deemed to refer to such recognized standard.

1.4 CONTRACT Documents

The Contractor is not permitted to change the original tender documents. If the contractor wishes to suggest the use of items that are different from the description in the tender documents, these must be submitted as separate alternative offers.

Alternative offers will be considered only if the specified products and performances are exactly described with detailed documentation, sufficient to allow the Engineer to verify beyond doubt that above requirements are fulfilled.

The Client reserves the right to omit positions partly or as a whole for the order, without giving the Contractor any claim for compensation or lost profit. All payments will be based on the actual installed quantities.

1.5 Commissioning

Following successful site testing of all items of equipment, the Contractor shall be responsible for the commissioning of the equipment within the project.

The commissioning period shall consist of a start-up and a running period. During the start-up period individual units shall be put into service and any initial operating faults rectified. The start-up period will end when all items of the plant are operating satisfactory, at which point the running period will commence. The running period shall be a period of not less than 20 days satisfactory fault-free running of the plant at the conclusion of which the Contractor shall give to the Engineer seven days' notice that he is ready to carry out the final test of the above works.

The Contractor shall, as the final test of the whole works, demonstrate in the presence of the Engineer that all electrical equipment is functioning as an integrated whole according to the requirements of the specification and are capable of being operated satisfactorily.

The final test will be in a form to be agreed between the Engineer and the Contractor but it is envisaged that it will take the form of a systematic check on the functioning of each individual operation that the plant is capable of performing, by all items of the plant, separately and in conjunction with one another.

The Contractor shall be responsible for the operation of the project equipment during the commissioning and testing period.

The Contractor shall guarantee that all parts of the plant delivered by himself or his subcontractors meet all expectations concerning faultless operation, technical characteristics, material, workmanlike execution, adequate construction, quality and arrangement, that meet the requirements of the specifications, the offer, the standards and regulations and the current state of technology.

In case of ambiguity or disagreement concerning the quality of the Contractor's deliveries and performances, the Employer may consult an approved and independent expert to get a clarifying judgment. If the Contractor's deliveries and performances turn out to be not meeting the requirements, he has to pay the costs of this judgment, including necessary measures, materials, auxiliary and operational materials and energy as required.

The faults must be corrected by the Contractor immediately. If the Contractor does not correct damages for faults within a reasonable period, after being informed of and requested to do so, the Employer may do that by himself or by another firm at the Contractor's expense. This does not affect the Contractor's duty of warranty.

If a plant or a part of it must be upgraded within the period of warranty, the new warranty begins at the time after the improvement is done. This also applies to spare parts.

In case of faults, the Contractor shall pay all costs for replacement, i.e. delivery, installation and start-up. If it should be necessary for the Contractor to change the technical solution, any costs will be to his account, including any increase in costs for electricity, maintenance and consumption of spare parts for the following two years.

1.6 Lighting Design Criteria

a. Street Lighting

1. The installation shown on the Drawings has been designed on the basis of distribution curves of the luminaries, to achieve the required levels as follows :
Eave \geq 15 Lux, Lave \geq 1.0 cd/ sq. m, U0 \geq 0.4, U1 \geq 0.70, TI $<$ 10.0, SR \geq 0.5
2. Surfaces on which lighting levels shall be measured shall include the full width of all traffic lanes and full face of highway signs.
3. For computer calculation purposes, the highway surface characteristic shall be taken as type R3 CIE. Classification with Q0 = 0.07 unless otherwise indicated.

b. Design Basis

Contractor shall submit computer aided lighting design calculations to substantiate lighting results:

1. An Overall Maintenance factor of 0.67 to take into account pollution Level, Line Voltage Drop Maximum of 6%, product Tolerances etc.
2. Lumen output for basis of calculation should be the lumen at 230 V to take into account available supply voltage during peak evening hours, which is 85% of the declared lumen output by manufactured at nominal voltage.
3. Detailed designing for individual sections shall be done by the contractor depending on site situations. However, pole heights, brackets, tilt angles shall be strictly adhered to, so that the overall harmony is maintained on the road. Lighting levels and other technical parameters need to be complied to.

1.7 DESCRIPTION of the Electrical supply

Power system of the street lighting should be supplied with electricity with a high level of reliability. Electric Company (EDCO) through providing power to the feeder pillars which will feed power to the service roads lighting poles, bridge lighting and the tunnel lighting.

The contractor shall ensure that all equipment and material shall be suitable for use on the appropriate voltage.

The contractor shall obtain from the local electrical authority all relevant Information and data pertaining to his part of the work. He shall allow for a suitable cable termination for the incoming supply cables on the distribution panel.

SECTION 2 - OVERALL ELECTRICAL REQUIREMENTS

2.1 BASIC DESIGN FIGURES

- Nominal Voltage 400/230 VAC, 50 Hz, three phase and neutral earthed system
- Control voltage 230 VAC, 50Hz single phase

SECTION 3 - PARTICULAR ELECTRICAL REQUIREMENTS

3.1 DISTRIBUTION PANEL

3.1.1 Street Lighting Feeder Pillar (FP)

The street lighting feeder pillar (FP) should be 3 phase, 400 volts, 5 wires panel board type in accordance with the drawings and the following characteristics:

1. Cabinet
The panel should have an enclosure with 2mm thickness galvanized sheet metal and two doors; the inner one which will hold the measuring devices such as voltmeter & ammeters, selector switches, bush buttons etc...

The outer door should be used to protect & secure the panel and should have two latches and lock.

The panel should have two metal enclosures

The enclosures should be painted inside and outside with 2 primer coats and 2 finish coats, grey, the distribution board should be classified to IP 65.
2. Circuit Breakers
Circuit breakers shall be thermal-magnetic, bolt-in, individually front replaceable, and shall indicate "ON", "OFF" and "Tripped". Breakers indicated as multiple poles shall be common trip. Breakers shall have interrupting ratings not less than 10 KA.
3. Buses
The panel should have 5 buses, 3 phases, neutral and earth bus. Buses shall be copper with ampere rating and main lugs or breakers as indicated. The earthing bus shall be similar to a neutral bus and shall have a good earth connection to the cabinet, a removable bond to the neutral bus, clamp type lugs for the earth cable in each supply conduit, and connections for a earth cable in each load conduit.
4. Timer and Contactor
The feeder pillar should have astronomical timer and contactors for the lighting circuits in order to control the operation of lighting fixtures. The timer should have built in battery & charger.
5. The feeder pillar should be provided by fixture operated through a dedicated door limit switch.
6. The feeder pillar should be provided by a 13 amp, 3 pins of phase socket outlet.
7. Each lighting circuits inside the feeder pillar should have the following:
 - Molded Case Circuit Breaker(MCCB).
 - Contactor (minimum 15A) with 2 auxiliary contacts (1 NO + 1 NC).
 - 3-position selector switch on the panel over with indications for these positions as follows:
 - M – Manual operation.
 - O – OFF.
 - A – Automatic operation.

- A red indicating lamp to light when the power is ON.
- A green indicating lamp to light when the system is OFF.
- 3 copies of the internal control and power diagram with the external lighting units (numbered) should be put inside the distribution board.

All wires and components inside and outside the distribution board should be numbered and labeled. Labels should be plastic with the name engraved on them and should be fixed by screws

8. Contractor should submit an empty separate compartment for the utility's (KWH) meter inside the feeder pillars, however, copper bus bars extensions to facilitate the connection of the incoming cables from the respective power supply shall be installed. The KWH-meter compartment shall have the provision for tamper proof locking.

9. Safety of Personnel and Operation

Even if the doors of the panel are open, the safety of personnel against accidental touching of live parts will be insured through the insulation of live parts and the installation of insulated barriers of insulated material.

The electrical layout, the protection scheme of the system shall ensure safety operation for man and material.

10. The feeder pillar shall carry a designation plate (title) on its outside surface, identifying the description of the panel.
11. If not specifically defined, instruments are to be supplied with moving iron measuring element for alternating current and voltage and with moving coil for direct current and voltage. All instruments are to have a black frame and a non-reflecting front glass. The degree of protection is to be IP 65, the accuracy class at least 1.5. All instruments are to have the basic dimensions of (10x10) cm. Each normal position of used has to be applicable for the location in which it is installed and the replaceable quadrant scale is to be appropriate for the item measured. The instruments shall not allow the possibility of an operator touching live electrical parts.
12. The following dimensions shall be used for the feeder pillars:
Height: Not less than 1200mm

Width: 1000-1200 mm Depth:

Not less than 350 mm
13. Doors, covers and sides are to be made from galvanized sheet metal at least 2 mm thick, painted with two primary coats and two finishing coats of gray oil paint. Doors should be provided with locks for double bit keys and central locking system. To avoid earthing problems, internal parts may not be varnished.
14. Surge Arrestor
At the main incoming of the feeder pillar, surge arrestor protected by suitable HRC fuses for over voltage protection at the main incomings shall be installed.
15. Current Transformers
Current transformers are to be supplied insulated in resin with either a wound core or a pushing bar with one or two cores, with performances and precision classing provided.

Current transformers with a secondary connection of 5 A shall be provided for current measurements of various consumer stations.

In general, current transformers shall be designed as plug-on transformers through which both busbars and wires can be routed. The power rating shall be established in accordance with the instruments and

devices to be connected, the minimum power rating being 10 VA. The precision class shall be determined to be 1.

16. Panel concrete base

The street feeder pillar should be installed on fair face reinforced concrete base with the following characteristics:

- a) The concrete base shall be reinforced by steel bars with diameter 10mm.
- b) The steel strength shall be grade 60.
- c) The concrete strength shall be grade 25 KN.
- d) The concrete base shall be cured with water for three days twice per day (morning and evening).
- e) The shuttering shall not be removed before 48 hours.
- f) The dimensions of the concrete base as shown in drawing
 - Height 200 mm
 - Length: 1200 mm or as needed
 - Depth: 350 mm

The base shall be equipped with UPVC pipes for interring and outgoing of power cables.

3.1.2 Molded Case Circuit Breakers (MCCBs)

Main distribution board and control panels circuit breakers, shall have short circuit ratings as shown on Drawings, totally enclosed, molded case, constructed from high quality, high temperature resistant, molded insulating materials, for normal operation at 70°C within enclosures, and provided with single toggle type handle mechanism for manual operation of main contacts in addition to automatic operation under over-current conditions. Multi-pole breakers are to have common integral trip bar for simultaneous operation of all poles. Ampere rating is to be clearly visible, all terminals are to be box lug or clamp type with setscrews. Circuit breakers up to and including 600/630 A frame size, are to be adjustable thermal-magnetic type, having bimetallic inverse time delay over-current element for small overloads and instantaneous magnetic over-current trip element for operation under short-circuit conditions on each pole.

Feeder circuit breakers shall have thermal and instantaneous trip elements. These breakers shall be manually operated with quick-make, quick-break, trip-free toggle mechanism. Bimetallic thermal elements shall withstand sustained overloads and short-circuit current without injury and without affecting calibration. Thermal elements shall have inverse time characteristic and shall trip the breaker at 225 percent of trip rating current. Instantaneous elements of 225 ampere frame and larger breakers shall be adjustable and shall be set at 800 percent of trip rating.

Each breaker shall have suitable arc quenching devices. Main current carrying contacts shall be silver-plated. The manual-operating handle shall indicate automatic tripping.

Where a compartment contains a breaker only, the access door of the compartment shall be interlocked with the circuit breaker so the door cannot be opened with the breaker in closed position. Where two breakers are located in a common compartment, and interlock override shall permit door opening with one breaker closed.

3.1.3 Miniature Circuit Breakers (MCBs)

Thermal magnetic non-adjustable type, tested in accordance with the BSEN 60898 Standard.

Minimum Short-Circuit breaking capacities for 20-32 A MCB should be 10 KA at 240/415 V A.C.

MCBs are to be tropical zed for operation at ambient temperatures up to 70°C within panel board enclosure and humidity up to 95%, and are to be constructed from high quality, high temperature, molded insulating materials. Guaranteed duties and characteristics are to be submitted for temperatures above 40°C. MCBs and combinational devices are to be modular, of unified profile and mounted to a standards DIN rail.

Under overload conditions, thermal tripping is to provide close protection on insulated conductors.

Under short-circuit conditions; magnetic trip is to operate at 7-10 times normal rated current. Magnetic operation is to be in the current limiting region and opening time is not to exceed 5 milliseconds.

3.1.4 Instruments

A. Ammeter (for 400 V, 3 Phase Boards)

The ammeter shall be moving iron type, flush pattern with dust and moisture proof enclosure. The ammeter shall comply with BS 89 and the dial size shall be 10 * 10 cm approximately. The range of ammeter shall be according to the rating of the incoming switch. An OL separate current transformer should be provided for the ammeter.

B. Voltmeter (for 400 V, 3 Phase Boards)

The voltmeter shall be moving iron type, flush pattern with dust and moisture proof enclosure and the range shall be 0 – 500 Volts unless otherwise specified.

The size of dial shall be 10 * 10 cm approximately and the meters shall comply with BS 90. The Voltmeter selector switch shall read line-to-line voltages and line to neutral voltages.

C. Indicating Lights

Indicating lights shall be heavy – duty, 18 mm, oil tight type, which utilizes a low voltage lamp and built – in transformer. Legends shall be engraved on the lens or on a legend faceplate. Lamps shall be easily replaceable from the front of the indicating light. Indicating lights shall be the Push – to- Test type.

3.2 CABLES

3.2.1 Power Cables

Cables shall be manufactured in conformity with BS 5467:1989 and IEC 502:1983 as follows:

- Conductor: shall be of annealed Aluminium.
- Insulation: the insulation material must be an extruded layer of cross-linked polyethylene (XLPE) and be sheathed with one sheath as per BS 5467 and BS 6469.
- Armour: of one layer of galvanized round steel wires.
- Over sheath: of extruded layer of PVC compound, as per BS 6746.

The working voltage for cables shall be 600/1000 volts at 50 Hz, and the test voltage shall not be less than 2500 volts for one minute.

The cable must be physically resistant to shock, friction and bending.

Cable Length and packing: There are no specific requirements for any one piece of cable. Individual lengths of cable are to be wrapped on wooden drums and in order to prevent moisture penetration, both ends of the cable must be sealed during storage and transportation. Cable jointing will not be allowed.

All details such as the size, weight, length, specifications standards, manufacturer, etc. must be indelibly marked on the drum.

3.2.2 Cabling Method

Each cable shall be installed in accordance with the relevant codes of practice and shall be neatly run in all situations.

Where cables are surface run on the external faces of structures or above ground level, suitable protection from the radiation of the sun shall be provided by means of covers or canopies.

When a cable is cut from a length on a drum, the drum length shall be immediately sealed. All cables once cut and laid shall be terminated in their final position or effectively sealed.

The general routing of cables shall be as generally indicated on the contract drawings but the final routes shall be those agreed with the Engineer before any cable installation work is carried out. All cables shall be installed strictly in accordance with the requirements of this specification.

The laying of all cables shall satisfy the following requirements:

- Cable depths shall be assessed from the finished ground level unless otherwise directed by the Engineer.
- Cables shall be laid at a depth of 0.7 meters, less bedding.
- A layer of soft sand, 10 cm thick shall be laid under and over the cable.
- A 10 cm thickness of solid blocks and warning tape shall be placed above the sand along the cable trench.

3.3 EARTHING AND BONDING

3.3.1 General

This section covers furnishing and installing earthing cable, earthing rods, and earthing materials as indicated on the Drawings and as specified herein for the electrical system and equipment grounding.

3.3.2 Earthing System

Earthing system shall be installed as indicated in the Jordanian General Technical Specifications for Buildings "Chapter 4" in accordance with the "Regulations for Electrical Installations" issued by the Institute of Electrical Engineers, London, Sixteenth Edition Parts 4 and 5 and subsequent revisions.

Main earthing conductors shall consist of tin copper bar of hard drawn, high conductivity copper strip (or equivalent tinned or lead coated bare copper, hard drawn wire).

Earthing conductors shall be adequately sized for maximum fault current.

3.3.3 Earthing Rods

Earth rods shall be of 16 mm in diameter by 1.5 meters long power driven vertically into the ground apart with heads located at a depth to suit the position of the disconnecting chamber.

Earth rods shall be copper plated steel cored with a metallic bonded outer surface, rods shall be provided with special hardened tips and caps, to avoid distortion when driven into the ground. Approved non-ferrous clamps for connecting the rod to the copper strip (or the bare wire), between rod and final earth lead test link shall be provided.

The head of each rod shall be brought to a concrete chamber to enable each electrode to be disconnected for testing purposes.

Concrete disconnecting chambers with removable cover and disconnecting link, for location and test purposes, shall be provided over each rod. The top of the chamber shall be at finished ground level.

Where armoured cables are installed above ground level for the purpose of running sub-main or final distribution circuits, then the armouring may be used as the earth conductor provided that the following requirements of the next paragraph are complied with.

Where armoured cables are installed directly in the ground then the armouring must be bonded to earth using suitable glands. The armouring must not be used as the sole earthing conductor. Additional earthing shall be provided by means of a separate needed rods for both distribution panels or lighting poles.

The test link shall be of tinned copper and not be less than the connecting cables cross sectional areas and have a generous contact area.

Disconnecting bolts, nuts, locknuts and washers shall be made from phosphor bronze.

The copper PVC insulated wires connecting the earth rods to the test link shall be exothermically welded at the test link and sweated to the top of the earth rod.

Particular care shall be taken to ensure earth continuity across items of equipment situated within a cable run, and should the design of such equipment not give adequate and lasting continuity through its structural body then additional earthing clamps and conductors shall be provided to bond the cable sheaths together independently.

Earth electrodes shall be of high carbon steel with a copper bonded finish installed below concrete inspection covers marked "EARTH".

3.3.4 Earthing System Resistance

The earthing resistance shall not exceed 2.0 ohms at each structure. All earthing resistance measurements shall be made with a three terminal "Merger" type earthing tester which applies alternating current to the electrodes and which gives a reading in direct current ohms. Two reference earth probes shall be used, and all tests shall be made in accordance with the instrument manufacturer's instructions for ground resistance testing.

The earthing resistance measurement data may indicate that additional earthing rods are required. The Contractor shall install and connect additional earthing rods to achieve the required ohms needed.

3.4 LIGHTING FIXTURES

3.4.1 LED LUMINARIES

The LED street lighting luminaries shall be manufactured and tested to comply fully with the requirements of IEC/BS EN 60598-1 & 2-3 and shall be CE or UL certified, or comply with equivalent international standards with all certification made available. The luminaries shall have class-1 insulation in accordance with above IEC/BS EN with provision of earthing.

- a) Luminaries shall be with a minimum protection degree of IP66, and it shall have a minimum mechanical strength of (IK08 rating or higher).
- b) Optical compartment or unit shall be protected by a clear, toughened, heat resistant UV stabilized glass with 5mm thickness.
- c) The luminaries shall include 10KV surge arrester and 1-2m extended power cable... The luminaires shall have protection against electric shock and provision shall be made for connection of a protective earth conductor to which all non conductive accessible metal parts shall be connected.
- d) Luminaries shall be made of non-corrosive high pressure die-cast aluminum and shall be of minimum thickness 2.0mm.
- e) The luminaire system efficacy shall be greater than 140 lumens/watt at ambient temperature -40°C to +50°C and (10-90) % relative humidity.
- f) The luminaries must have a serial numbers
- g) Luminaires shall be firmly fixed at the top of the column to minimize the possibility of wind rotation, or falling if the column is subject to impact.
- h) The luminaries shall be manufactured in accordance with IEC 192.

Luminaire Light Source:

- a) The light source shall be high power SMD white light emitting Diodes (LEDs) shall provide color temperature 4000K with color rendering index of not less than 70.
- b) The LEDs shall be removable/replaceable on site by modular means without any possible risk to maintaining laminar photometry and without the need to demount the fixtures for sake of future upgrading /maintenance requirements.
- c) Lens shall be made of polycarbonate or toughened glass.

The LED light source and the driver shall be compliant with the)d

Restriction of Hazardous Substances Directive (RoHS) No. 2002 as adopted by the European Union and the luminaire shall be designed for ease of component replacement and end-of-life disassembly

- i) Luminaire should pass the photo Biological Safety Test and the manufacturer shall submit the Report for the fixture as per IEC-EN 62471
- j) Useful Life requirements: The useful life of the luminaire in terms of lumen output must be specified by a minimum of 50000 Hr before reaching L70 Lumen output degradation point with no catastrophic failure, LM-80-08 and TM-21 calculation shall be submitted.
- k) Thermal Management: Substantial heavy duty heat sinks shall be provided for mounting the LED modules to ensure excellent heat dissipation the thermal

3.4.2 LED Drivers:

The driver unit shall be highly reliable on driver compartment conditions. The Mean Time Between Failures (MTBF) shall be of 1.5 million hours calculated as per Reliability Prediction Procedure for Electronic Equipment" Document No. SR332 (Telcordia SR332). The LED drivers shall be an integral part of the LED luminaires and shall meet the following requirements:

- a) Drivers shall be IP 66 encapsulated type
- b) Drivers shall be 1-10v dimmable and have a minimum efficiency of 85%.
- c) Case (Tco °C) Temperature rating -40 C to minimum +50 C and at (10- 95) % Relative Humidity (RH).
- d) The Driver and driver output current must be shown to be fully tested and compatible with the exact LED chips/engine of the luminaire.
- e) Input voltage: 230V ± 10%, single phase, 50 Hz.
- f) Surge protection: Must be tested for 10 KV in accordance to the requirements of IEEE Recommendation C62.41.2-2002, Scenario I Location Category C or International equivalent.
- g) Drivers shall have a Power Factor (PF) ≥ 0.90.
- h) Drivers shall comply with BS EN 55015 and IEC/BS EN 61000-3-2, 3-3 with regard to the RFI and EMC compliances.
- i) Drivers shall also be RoHS Compliant.
- j) Drivers shall have a total individual luminaries Harmonic Distortion (THD) of: ≤ 20% in accordance with IEC/BS EN 61000-3-2 or ANSI C82.77 (2002). The Contractor shall measure the harmonic at the supply point (LV side of the distribution substation) after the installation of all the LED fixtures and adopt harmonic compensation methods to limit the total harmonics distortion in the supply voltage to maximum 5% as per IEEE 519 Regulations

3.4.3 Data to be submitted (before installation for at least two weeks)

a. Luminaries :

1. Manufacturer
2. Type, with manufacturer's catalog and descriptive leaflets.
3. Details of construction with specification of materials used.
4. Total electrical load luminaries.
5. Lighting characteristics of luminaries:
 - 5.a Total luminaries output as % of output.
 - 5.b Iscandela diagrams in all azimuths.
 - 5.c Isolux Curves on a horizontal surface.
 - 5.d Coefficient of utilization
 - 5.e Photometric files (phillum ,IES,.....etc) to be used with standard lighting design software.
6. Weight of luminaire.
7. Luminaire dirt depreciation curves.

b. LED DRIVER:

- i. Manufacturer.
- ii. Topic with manufacturer's catalog and descriptive leaflets.
- iii. Variations of lumen output with voltage
- iv. Power factor.
- v. Wiring diagram and characteristics of each component

In addition to the above, the supplier must submit the test report and test certificates for the following:

- CB test for the unit according to IEC 60598-1 and IEC 60598-2-3.
- CB or UL certificate for the unit.
- CB certificate for the driver according to IEC 61347-2-13
- ENEC,EMC certificates from accredited laboratory .
- LM-79-08 test report for the unit from NVLAP approved laboratory
- LM-80-08 and TM-21-11 test report from accredited laboratory for the unit expected life .
- LM-82-12 test report on lumen dissipation for the complete fixture
- ISTMT test for the luminaire
- Manufacturer photometric characteristics.
- IK8 test report according to EN 62262
- RoHS certificate for the luminaire.

All test report should be recent and issued from internationally accredited laboratory

Certificates shall be verified and approved by Jordan Standards and Metrology Organization (JSMO).

Warranty:

7 years warranty shall be given for whole system including but not limited to LED modules,Driver,wiring connections ,Housing ,glass cover ,hardwares ,painting ,corrosion...etc.

3 years warranty shall be given for lighting decay do not exceeded 10%.

3.5 STREET LIGHTING POLES

The street lighting poles should have the following characteristics:

- Street lighting poles shall be hot dip galvanized octagonal and made of sheet steel with a minimum rupturing resistance of 510 MN/sq.m and minimum yield strength of 355 MN/sq.m, 4 mm thickness steel. The interior and exterior of the poles shall be cleaned of picking or plastic and shall be free of any trace of grease.
- The galvanized thickness should not be less than 65 microns and must be tested by third party (Royal Scientific Society) in the presence of client representative.
- Street lighting poles shall be equipped with opening door of (135x600) mm, located 600 mm above the base as per specifications and drawings with cut in galvanized steel box.
- The pole box should have 10 A MCBs to control the operation of the lighting fixtures in addition to neutral link and connector for in-out cable.
- Street lighting poles height shall be as shown on the drawings. Poles tops shall be designed to receive the required arms and luminaires.
- The pole, once installed and fully equipped, shall be able to withstand a wind speed of 160 km/hr blowing in the most unfavourable direction, at the height of the luminaires above ground level, taking into account the effect of the luminaires head, which shall be assumed to have a resistance of not less than 25 kg/luminaires, plus any special bracketing. Appropriate reinforcement shall be provided if needed to increase the strength.
- For anti-corrosion purposes the pole shall have prime paint, enamel paint, plastic coated and finally hot-dip galvanization.
- Bracket arms and all steel accessories should be hot-dip galvanized.
- Anchor bolts should be hot-dip galvanized.
- Foundation bolts should be equipped with appropriate nuts and washer.

- The steel wire armoured of the cables should be bonded to the pole by means of suitable clamps.
- The foundation of the pole shall be completed with UPVC pipes, and 4 threaded bolts that will pass through the pole mounting steel plate according to the drawings.
- The poles lighting fixtures shall be controlled by an astronomical timer, photocell and 3-phase contactors. An override switch shall be provided for manual operation. Contactors and override switch shall be located inside feeder pillars, with indication lamps and push buttons.
- Testing: The Contractor before delivering the street lighting poles to the site; shall choose one pole in the presence of the Employer and the Engineer to be tested by third party Royal Scientific Society (RSS).

Note:

For the above lighting pole types, the following conditions must be considered as Per specifications:

- Base dimensions should be 40x40cm and distance between screws' opening's centers is 30cm, equipped with a welded hook for loading, unloading and installing the bases.
- The part of the arm that is inside the pole for all types should be no less than 50 cm long.
- The screw in the middle of the cover of the pole should be fixed to the cover in a special way so it won't fall when opening the cover.
- Each pole should contain a metallic fuse box fixed safely inside the pole, thermally painted to be rust-resistant, or equivalent. Provided with (10A) electromagnetic breakers, and BJC fittings to join two wires of 50 mm cross section together. And the fuse box should contain two openings at the bottom with PVC glands, each is enough to fit a (4x6mm²) cable, and two rubber glands at the top, each enough to fit a flexible (3x1.5mm) cable. The contractor shall provide a sample with the offer to be checked and approved.
- The contractor should submit with the offer a full study to prove that the poles will withstand a wind with speed up to 160km/hour, and the committee has the right to reject any offers that don't include this study.
- An original detailed diagram of the pole including all dimensions and materials should be submitted by the contractor.
- All materials used in the pole (metal) and its galvanizing, screws for fixing the arms, welding and base screws and their galvanizing should be manufactured according to (DIN, BS) standards, with submitting explanation to each specification with the submittal.

3.6 APPROVAL OF EQUIPMENT

- A. Equipment shall not be ordered until approved in writing by the Engineer. All documentation submitted in respect of equipment shall be in the English language.
- B. Promptly upon signing the Contract, the Contractor shall submit to the Engineer 3 copies of the detailed characteristics of all equipment proposed for the installation, including catalogues (originals not copies) with identification reference. Particulars shall be given of any manufacturer's deviations from the Specifications. The Contractor shall also confirm that the equipment proposed will provide lighting levels and uniformities at least equal to those specified.
- C. Luminaries shall have the light distribution characterizes require to achieve the threshold increment levels and specified criteria. Luminaries shall be of pleasing aesthetic appearance with high quality finish and shall conform to IEC 598 PT1 and PT2 and BS 4533 or equivalent. Luminaries shall also conform to IEC 529 with enclosures as specified.
- D. The Contractor shall, at his own expense, present a sample to the Engineer of the luminaries to be used, complete with auxiliary equipment. Such sample will be required only after approval of their technical characteristics. Approval of proposed luminaries will be conditional upon acceptance of detailed calculations and information to be provided by the Contractor.

- E. Approval of proposed poles will be conditional upon the Engineer of detailed calculations and information to be provided by the Contractor.
- f. The Engineer may verify the performance and quality of any samples by arranging for such tests, as he deemed appropriate to be carried out at the contractor's expense.
- g. Approval of samples by the Engineer shall not relieve the contractor of his obligations in respect of the suitability of equipment or its final performance once installed, and coordination of elements into a fully operational installation. The Contractor shall not be entitled to any compensation in respect of rejection of any sample by the Engineer and shall be held responsible for any delay resulting from such rejection.

3.7 WORKING DRAWINGS AND "AS BUILT DRAWINGS:

- A. The Drawings are outlining design drawings, showing the installations deemed necessary to achieve the required performance.
- B. The Contractor shall submit for approval 3 sets of fully detailed Working drawings before commencing the works. These drawings shall conform with the requirements of the Drawings and shall show the physical layout of all requirement, exact locations of poles, construction and installation and details and wiring diagrams. Work shall not be commenced on site until all working drawings have been approved.
- C. Upon completion of the Works the contractor shall submit to the Engineer one transparency and 3 prints of each of the working drawings which shall have been fully updated and corrected to represent 'as built' drawings. The Contractor shall also submit all other relevant information and documentation concerning operation of the equipment.

3.8 TECHNICAL DATA FOR PROPOSE EQUIPMENT

3.8.1 General

- A. Schedules containing full details of all principal items of the electrical installation shall be submitted by the contractor together with his Tender. The Contractor shall ensure conformity of the equipment with the requirements of the specifications. Additional information required by the Engineer shall be provided promptly by the Contractor.
- B. A summary of Equipment Manufacture, drawn up as follows, shall be included in the Contractor's submission:

Bills of		Country	Catalogue
Quantity	Description	Manufacturer of	Reference
Item No.		Origin	

- C. The Contractor shall supply equipment from the manufacturers' lists with the characteristics indicated in his Tender unless otherwise agreed.
- D. Products of manufacturers having good repute and standing will be considered by the Engineer on an equal basis. In this respect, the Engineer decision shall be final.
- E. Approval of a manufacturer does not necessarily constitute approval of his product as equal to that specified.

- F. The contractor shall ascertain that the approved manufacturers capable of supplying the required materials and/or equipment and shall ensure conformity with the Specifications in all respects.
- G. The LED luminaires supplier must be a manufacturer of the LED Street Lights or authorized dealer of a manufacturing firm. In case of a dealer, authorization letter from the manufacturing firm shall be submitted with tender document as a proof.

3.8.2 Data to be Submitted

A. Lighting Poles

1. Manufacturer.
2. Type, with manufacturer's catalogue and descriptive leaflets.
3. Details to construction with specification of materials used for column and holding down bolts.
4. Calculations showing details of stresses under maximum wind loading.
5. Calculations and sizes for concrete support bases.

B. Cables

1. Manufacturer.
2. Specification.
3. Standard to which it conforms.
4. Rated voltage.
5. Manufacturer's catalogue reference, with indication of cables proposed.
6. Drop voltage calculation on cable.

C. LV switchboards:

1. Manufacturer.
2. Specification, with manufacturer's catalogue.
3. Construction drawings'
4. Characteristics of each component
5. Foundation details.
6. General arrangement.

D. other equipment

1. Manufacturer.
2. Type.
3. Catalogue, with indication of equipment proposed.
4. Detailed specification.
5. Construction drawings and wiring diagram.

3.9 WARRANTY AND MAINTENANCE

Warranty and Maintenance of the defect shall be 2 years' period after the primary handover.

END OF SECTION