Kenya National Highways Authority

Quality Highways, Better Connections

HORN OF AFRICA GATEWAY DEVELOPMENT PROJECT (HoAGDP),
PROJECT ID: P161305

PKG. 2: UPGRADING OF WAJIR - KOTULO (A13) ROAD
ICB NO : KE-KENHA-299749-CW-RFB

LOT 1: TENDER NO. KeNHA/2506/2022: WAJIR – TARBAJ ROAD AND TARBAJ SPUR ROAD

BIDDING DOCUMENT

VOLUME 4 OF 7 – TECHNICAL SPECIFICATIONS

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Section VII - Works' Requirements

TECHNICAL SPECIFICATIONS

The Standard Specifications referred to in this document is the *Standard Specifications for Road and Bridge Construction, 1986 Edition* published by the Ministry of Transport and Communications. This document shall form part of the Contract

Work shall be carried out in accordance with the Standard Specification except as supplemented or revised in the Special Specifications.

Special Specifications

Special Specifications

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SECTION 1 – GENERAL

The Special Specifications are supplementary to the Standard Specification and the two must be read in conjunction. In any case, where there appears to be conflict between the two then the Special Specifications will take precedence.

101 LOCATION AND EXTENT OF SITE

The project road Wajir – Kotulo (A13) road is located in Wajir County of the North Eastern region of Kenya extending to the Mandera County border. .

The road forms part of the national trunk route from Isiolo to Modogashe to Wajir to Rhamu and ends at Mandera town at the Kenya/Somali border.

The project road under contract Lot 1 Wajir– Tarbaj road km 0+000 to km 55+000 and Tarbaj Spur Road 1.8km, making a total of 56.8km.

The site of the works shall be within the road reserve of the existing Wajir-Tarbaj road and any other places as may be designated in the Contract. The road reserve width is 60m.

102 EXTENT OF CONTRACT

The Works to be executed under the Contracts comprise the construction of single carriageway road 7.0m wide with 2.0m shoulders, two-lane bitumen standard road between Wajir town and Tarbaj market. The major items of Works to be executed under the Contract include the following:-

Lot 1: Wajir km 0+000 – Tarbaj km 55+000 and Tarbaj loop (1.8km)

1) Provision of offices, laboratory for the Engineer and his staff; housing accommodation and provision of vehicles for the Engineer and his staff and for security personnel.
2) Site clearance and top soil stripping, setting out and taking cross sections.
3) Construction of earthworks, including removal and replacement of expansive clays.
4) Operations in quarries and borrow areas.
5) Maintenance of existing road during the construction period, construction of diversions, management and control of traffic passing through or around the works.
6) Construction of 5 no. box culverts, 66 no. pipe cross culverts lines, plus access culverts and erosion soil erosion protection works
7) Construction of pavement layers generally comprising 175 mm thick cement improved gravel subbase; 150 mm cement stabilised gravel base layer; 75mm asphalt concrete wearing course and 14/20mm surface dressing on carriageway; and 50mm asphalt concrete and 6/10mm surface dressing to shoulders.
8) Provision of road furniture including road signs, road markings, edge marker posts, guardrails and other miscellaneous works.
9) Rectification of defects affecting the completed road.

The Works detailed above are only indicative of the scope of works associated with this contract and the Engineer may, where necessary, substitute some of the works with others within the project areas without substantially altering the overall scope of the works. Work shall be measured and paid using the relevant rates and prices in the Bill of Quantities.

The works will also include for any operations necessary for the safe and convenient passage of traffic at all times.

Compliance with Specification: All material, plant, labour and workmanship in and connected with the execution of the works shall be the best of their respective kinds without regard to any trade terms and the Contractor shall comply with these and all other respects with the relevant Clauses in the Specification and shall carry out the Contract in a proper and workmanship like manner and in strict accordance with Specifications, Working Drawings and Instructions of the Engineer.

103 DRAWINGS

The Drawings referred to in the General Conditions of Contract have been reduced to size A3 and bound in a book of drawings accompanying these Bid Documents as a separate volume. The successful Bidder will be supplied with two sets of size A1 drawings. Additional copies of these drawings that may be required by the Contractor can be obtained from the Engineer at the Contractor's expense.

The Drawings are subject to modification and addition as described in the General Conditions of Contract and the Engineer may from time to time, in order to enable satisfactory completion of the Works, revise, amend, or supersede any of these Drawings. It shall be the Contractor's responsibility to construct the Works in conformity with the latest revision or amendment to the drawings, provided that the Engineer has given to the Contractor in writing such reasonable prior notices of intention to revise, amend or supersede as the nature of the intended change requires, and the relevant drawings have been issued to the Contractor.

The Contractor may be required to demolish, alter and correctly rebuild any part of the works not in conformity with the Drawings currently forming a part of the Contract at the time of construction of such Works at his own expense, provided always that such current Drawings had been previously given to him.

The contractor shall be responsible for the preparation and production of working drawings for all pipe and box culvert concrete works.

104 PROGRAMME OF EXECUTION OF THE WORKS

The Time for Completion for the Works for each lot as defined in clause 8.2 of the Conditions of Contract is 42 months. The defects notification period is 12 months.

The Contractor shall submit to the Engineer a programme for execution of the works, required under clause 8.3 of the Conditions of Contract, within twenty-eight (28) days of receipt of the Engineer's order to commence.

The Contractor's work programme shall include a printout and electronic copy of a chart with critical path analyses using Microsoft Office Project or similar approved management planning software. The programme shall be resourced and coordinated with climatic and other conditions to provide for the completion of the works in the order and by the time specified.

The Contractor's work programme shall include a Quality Management System conforming to international standards, including the Work Method Statement and Quality Audit for major items of work.

The programme shall also include a detailed Traffic Control Plan for managing public traffic through the works which must be approved by the Engineer before the Contractor commences work.

The Contractor shall carry out the contract in accordance with the programme agreed with the Engineer, but he shall in no manner be relieved by the Engineer's approval of the

programme, of his obligation to complete the works in the prescribed order and by the prescribed completion date and he shall from time to time review his progress and make such amendments to his rate of execution of the works as may be necessary to fulfil his obligations.

107 CERTIFICATE OF COMPLETION

The minimum length of the road for which a taking over certificate will be issued shall be 20 km of continuous road, when it is substantially completed and open to public traffic.

108 METHOD OF CONSTRUCTION

The Engineer's Representatives' normal working hours shall be 8 hours from Monday to Friday and 5 hours on Saturday, with Sunday set aside for rest.

If the Contractor wishes to execute permanent works outside these hours, he shall seek the Engineer’s approval after giving two days’ notice in writing, and shall meet any extra costs for supervision arising thereof.

109 NOTICE OF OPERATIONS

Notification Terms: It shall be the Contractor’s responsibility to notify the Engineer when any items of works scheduled are completed and ready for approval, and the contractor shall give sufficient notice to allow control test to be performed.

Explosives and Blasting: The requirements of the Laws of Kenya governing explosives and other authorities shall be complied with. No explosives of any kind shall be used without prior written consent of the Commissioner of Mines and Geology, and the Engineer. The Contractor shall be solely responsible for the provision, handling, and storage and transporting of all explosives, ancillary materials and all other items of related kind whatsoever required for blasting.

115 CONSTRUCTION GENERALLY

Security Camps; The Contractor will establish four project Security Camps at designated locations to be notified by the Engineer in consultation with the Kenya Police Service. Within these project Security Camps the Contractor will erect the Engineer’s Office, Laboratory and Staff housing as well as Contractor’s main camp and the housing accommodation for security officers attached to the project.

The typical general arrangement of the project Security Camps is depicted below.

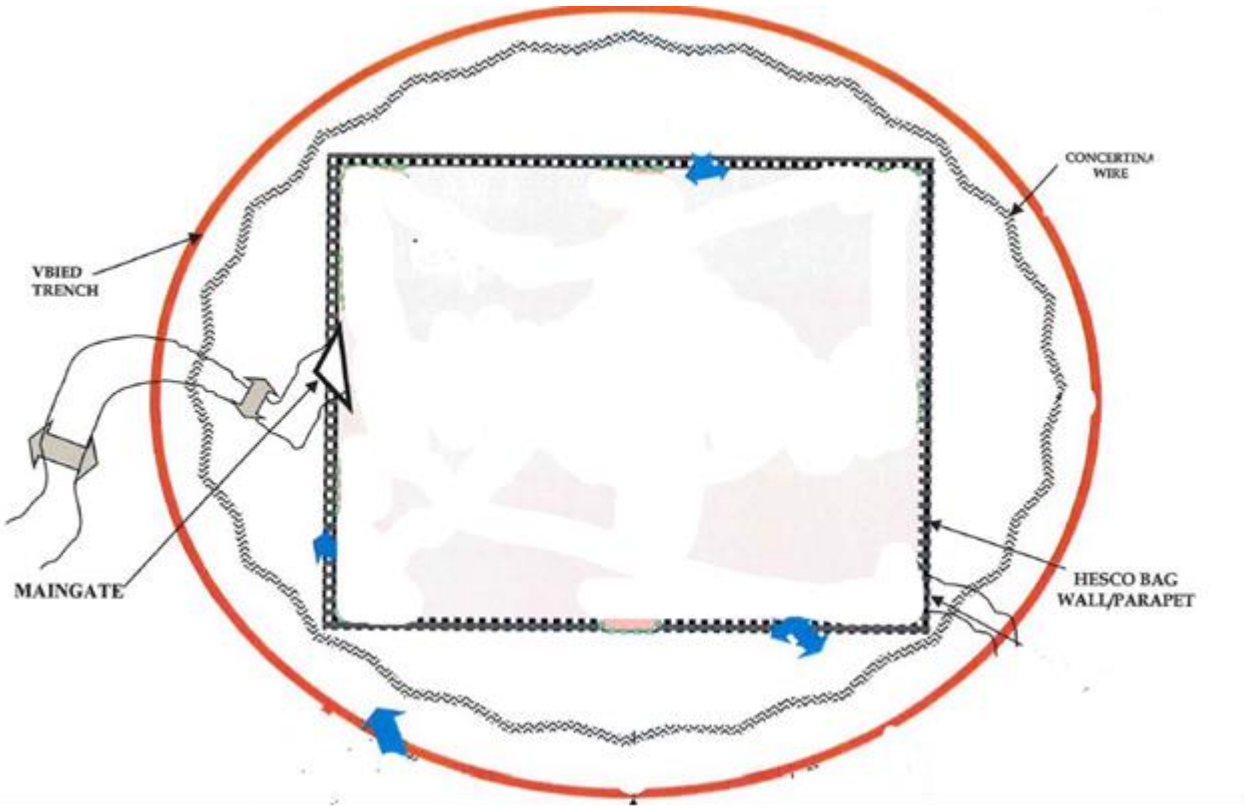

Figure 1: Typical Project Security Camp Site Plan

The following basic minimum arrangements and features are to be provided at each camp;-

1. Construction site to be sited away from built-up area
2. Construction site to be located on a higher ground to provide good observation
3. The site to be located on hard surface ground
4. Sufficient space for parking, accommodation and offices with clear night visibility.
5. One defined approach route for vehicles and workers.
6. Avoid long straight approaches towards main gate (zig zag)
7. Vehicle barriers and speed bumps while approaching the main gate coupled with reinforced concrete barriers.
8. Perimeter fence around the facility with razor wire to the outer and inner side of the fence
9. Anti-Vehicle Borne Improvised Explosive Device (VBIED) trench to be constructed around the site.
10. Proper illumination around the facility and within the sites, flash lights recommended.
11. Security patrols enhanced by 24 hours manned watchtowers and CCTV cameras with a central security control centre
12. Each site should have at least three entry and exit point
13. Each site should have an emergency gate securely locked and periodically checked by the Security officers
14. Sentry box at the main gate well covered with sandbags.
15. An established radio (walkie-talkie) communication network within the site and with other friendly forces.
16. Each site should have a standby generator
17. Clear zone on the inner and outer side of the perimeter fence

18. Zoning of the inner part of the site through signage; Visitors areas, Employees only and restricted area.
19. Clearance of bushes around the camp at least 50m
20. Building structures to be at least 100 feet from the outer perimeter fence

117 HEALTH, SAFETY AND ACCIDENTS

The Contractor shall prepare a specific Occupational Health and Safety Management Plan for the project, which shall be submitted to the Engineer not later than 4 weeks after the notice to commence the Works. This Management Plan shall incorporate but not be limited to, the requirements of Clause 117, and identify the risks and mitigation measures, and specify monitoring indicators and reporting requirements. The contractor shall set up, on site, a dispensary with qualified staff.

As part of the occupational health and safety program the Contractor shall provide training for all employees on how to ensure their own personal safety, and on ways to reduce the accident risk on site. The Safety Officer shall provide training in safe work practices and general awareness of potential danger situations to avoid injuries. In addition, all employees handling dangerous/toxic materials shall be trained on how to handle such substances.

All the Contractor's personnel shall, before commencing work, have an induction course on safety and health at the site. The information and training shall be on site and have duration of at least two (2) hours. It shall be conducted in a language which is appropriate for the personnel, to ensure that all personnel can understand the information and instruction. Follow-up training sessions shall be carried out during the course of the project.

The Contractor shall, also be required to submit its code of conduct for Gender Based Violence and sexual exploitation and abuse *(*GBV/SEA) prevention and management, to the Engineer not later than 4 weeks after the notice to commence the Works in accordance with the work requirements in this contract.

There is no separate payment for these requirements and the costs should be included in the Contractor's rates and prices generally

120 PROTECTION OF EXISTING WORKS AND SERVICES

The Contractor shall acquaint himself with the location of all existing services such as telephone poles and underground cables, underground optic fibre cables, electricity poles, water pipes, sewers etc., before execution of any works that may affect the services.

He is required to appoint a competent licensed land surveyor who will liaise with the Engineer on matters related to the demarcation of the existing road reserve, site measurements, removal and reinstatement of existing services.

The cost of determining the location of the existing services together with making good or repairing of any damage caused all to the satisfaction of the Engineer shall be deemed to be included in the tender rates. No other payment shall be made for the costs of such operations or for the making good of damage caused thereby to the existing services.

The Contractor shall be held responsible for injury to existing structures, works or services and shall indemnify and keep indemnified the Employer against any claims in this respect (including consequential damages).

121 DIVERSION OF SERVICES

Subject to the agreement with the relevant Authorities and the Engineer, the Contractor shall be responsible for removal of alteration and relocation of existing services where necessitated by the Works and shall pay any charges arising from the moving of the services or alteration to services such as power lines, telephone lines, water pipes and the like. A Provisional Sum has been included in the Bill of Quantities for this work.

124 PROVISION OF LAND

The Employer will only provide land for the permanent works including the road reserve and land for roadside amenities and the Security Camps. The Contractor's attention is drawn to the fact that additional land for widening of the existing road reserve may not have been secured at the time of commencement of the works and shall only be made available once the land acquisition formalities by the Employer are complete. The Contractor should take this into account in his programme of execution of works submitted in accordance with clause 8.3 of the Conditions of Contract.

Notwithstanding Clause 124 of the Standard Specification all requirements of land for deviations, quarries, stockpile areas and spoil areas and borrow pits as well and land for temporary works, camps and construction purposes shall not be made available by the Contracting Authority. The Contractor will make all necessary arrangements with the property owners concerned and pay all charges arising therefrom. On or before completion of the Contract, the Contractor shall remove all temporary works and shall restore all such land to the condition in which it was immediately prior to the occupation thereof as far as is reasonable and practicable. No separate payment will be made to the Contractor on account of these items and the Contractor must make due allowance for them in his rates.

127 INFORMATION FROM EXPLORATORY BORINGS AND PITS

The Factual Materials Report for this Contract does not form part of the Contract Documents. The Report has been provided for the Contractor's information only, and any conclusions on issues such as suitability of materials, location of borrow pits, material quantities etc., made by the Contractor on the basis of the Factual Materials Report, will be at his own risk.

130 PROGRESS PHOTOGRAPHS AND VIDEO RECORDING

The Contractor shall as directed by the Engineer's Representative, take digital progress photographs and video recordings of physical progress and activities for submission to the Engineer's Representative as part of the contractor’s monthly progress reporting within 5 days after the end of each month.

The digital photographs two shall be submitted in two copies of editable CD properly indexed with details of location, date and activity description. The video recording shall be submitted on two copies of Digital Video Disk (DVD) or similar format complete with voice track, text and subtitles of works.

Measurement and payment per set of digital progress photographs and video recording per month as specified shall be made under the relevant item in the bills of quantities.

131 SIGNBOARDS

The Contractor shall provide and erect two (2) publicity signboards on the site as directed. The minimum dimensions of the boards shall be as shown in the Drawings and as directed by the Engineer. The boards shall be prepared primed and painted cream and lettered in black. The boards shall be of stout construction, resistant to the effects of weather and insects. The rates and prices inserted for this item shall include for regular cleaning and periodic re-painting of the publicity signboards as necessary and repair of any damaged or vandalized panels.

132 A HOUSING, OFFICE, LABORATORY AND EQUIPMENT FOR THE ENGINEER

(a) Housing Accommodation for the Engineer's Staff

The Contractor shall be instructed by the Engineer to provide accommodation and maintain houses (3 for Type I, 11 for Type II) for the Engineer's senior staff and 15 for Type III, 11 for Type IV for the Engineer's junior staff.

In addition, the contractor will provide Dormitory-style Guest house (Type V) with a capacity of 20 people, with common lounge, dining area and kitchen; all as shown in the drawings or as instructed by the engineer. The rate for the construction of the guest house shall include furnishing with beds, tables, chairs, a television set for the dining area etc. as instructed by the Engineer.

The Contractor shall construct, and maintain for the duration of the Contract, houses of floor size equivalent to, or greater than the respective house type designs detailed in the drawings, all subject to the approval of the Engineer. The Engineer's senior staff houses shall be located within one of the designated Security Camp Sites for the contract.

The design and construction of the houses shall be approved by the Engineer. The walls shall be constructed with stone masonry, concrete blocks, prefabricated timber, or other approved weatherproof construction, and suitably insulated against heat and cold. The ceilings of houses and verandas shall be lined with ceiling board. All doors are to be fitted with mortise locks, which must be heavy duty on external doors. All windows shall be fitted with burglar bars and mosquito proof gauze. The houses shall be provided with mains electricity supply and water supply.

All houses shall be provided with a piped supply of drinkable water, mains electricity, and waterborne sanitation and disposal systems. The Contractor shall pay for all water, electricity, and gas consumed, and for garbage disposal services and the statutory charges associated therewith. The outer perimeter of the compound on which the Engineer's housing accommodation is located shall be securely fenced with electrified barbed wire and provided with a secure lockable metal gate.

The Contractor shall provide new basic furniture, equipment and fittings as listed herein below. The Contractor shall obtain approval of the Engineer for the type and quality of the furniture, fittings and equipment before ordering.23

ITEM DESCRIPTION	QUANTITY PER HOUSE TYPE

	T1	T II	T III	TIV	TV
FURNITURE					
Double Bed (5'x6') with inner spring mattress + 2no. Pairs of same size of blankets and bed sheets for each bed	3	5	0	0	20
Single Bed (3.5' x6') with inner spring mattress + 2no. Pairs of same size bed sheets for each bed	3	6	1	1	0
Pillow and Pillow case (same colour with bed sheets)	8	11	15	11	40
Dressing table with mirror and stool	2	1	1	0	0
Chest of 5No. drawers with mirror	2	2	2	1	0
Wardrobe (movable)	3	3	2	1	0
Resident table	5	4	3	1	20
Bedroom chair	4	3	2	1	0
600mm x 450mm high medicine cabinet with mirror	1	1	1	0	0
Bathroom stool	1	1	1	0	0
Towel Rail	1	1	1	1	20
Dining Table (2m x 1m approx.)	1	1	1	1	0
Dining Chairs	6	6	5	4	0
Dining Chairs with arms	2	2	1	1	0
Side Board	1	1	1	1	0
3-piece lounge chairs	1	1	1	0	0
Armchair with cushions	4	3	2	1	0
Coffee table 40 x 45cm high	1	1	1	1	0
Occasional tables, 70 x 70 x 45cm high	3	2	1	0	0
Book case (2m long with 3 shelves)	1	1	1	1	0
Writing Desk with chair	1	1	1	1	20
Kitchen shelves (per sq. m)	2	2	1	1	0
Kitchen table (2m x 0.8m approx.)	1	1	1	0	0
Kitchen chair	5	4	3	1	0
Floor rags	6	4	4	3	0

ITEM DESCRIPTION	QUANTITY PER HOUSE TYPE				
	T1	T II	T III	TIV	TV
EQUIPMENT					
Refrigerator (at least 19 cu. ft.) including a freeze Compartment of about 3 cubic feet capacity	1	1	0	0	1
Refrigerator (at least 7 cu. ft.) including a freezer compartment	0	0	1	1	1

ITEM DESCRIPTION	QUANTITY PER HOUSE TYPE				
	T1	T II	T III	TIV	TV
Cold water storage tank of at least 400L capacity	1	1	1	1	1
Water filter (hot and cold dispenser) at least 15L capacity	2	2	1	1	1
Table lamps	5	4	2	1	20
Electric fan	2	2	1	1	20
Gas or Electric hot water unit for kitchen	1	1	1	0	1
Gas or Electric hot water unit for bathroom	1	1	1	0	1
Electric and Gas cooker with 4 element/ burners, a grill and an oven	1	1	0	0	1
Electric and gas cooker 2 elements and 1 burner	0	0	1	1	0
Gas or Electric Rechargeable lamp	3	2	2	2	20
Dustbin with lid (outdoor type)	1	1	1	1	1
Waste paper basket	4	4	2	1	20
Fire extinguisher at least 9L capacity	1	1	1	1	2
Air conditioner unit (3.5kwh or 12000 BTU/hr)	5	4	3	2	20
2m x 1.5m high curtain with lining	9	9	4	0	0
1m x 1.5m high curtain with lining	3	3	6	3	20
Set of 8-piece crockery, cutlery, glass wear	1	1	1	1	3
Vacuum cleaner	1	1	1	0	1
Door mats	2	2	2	2	2
Set of kitchen utensils	1	1	1	1	1
Set of cooking pots and pans etc.	1	1	1	1	1
Mixer electric (portable)	1	1	1	1	1

(b) Main Office and Main Laboratory

The Contractor shall construct and maintain for the duration of the Contract, an office of plan area not smaller than 155 metre square and a laboratory of plan area not smaller than 120 metre square for the Resident Engineer to the design and dimensions shown in the drawings or of equivalent size and layout approved by the Engineer.

The office and laboratory shall be located to the Engineer's approval within compound of one of the Security Camp Sites to be designated for the contract.

The compound for the office and laboratory shall be securely fenced with chain-link fencing with electrified wire and provided with a secure lockable metal gate. The Contractor shall also provide 24 hours a day security (day and night watchmen and security lights, and panic button alarm system). Parking for at least 8 vehicles shall be provided.

The Contractor shall be responsible for paying all charges and fees related to the installation and use of the telephone and fax line, water and electricity consumed, security and for any statutory charges associated which shall be deemed to have been included in the rates for the office and the laboratory respectively.

The office and laboratory shall be of stone masonry, concrete blocks, prefabricated timber, or other approved weatherproof construction; shall be fitted with mosquito proof and burglar proof windows and lockable doors and suitably insulated against heat and cold; and provided with mains electricity supply and water supply. Separate toilet facilities for male and female shall be provided, with a drinkable water supply and waterborne sewage disposal.

The laboratory shall comprise a Main Laboratory Room with floor area of not less than 55m^2 and a total window area of not less than 7m^2 and a double door external entrance; an internal Office of floor area of not less than 14 square meters and a total window area of not less than 2 square meters; and a Store Room, of at least 18m^2 floor area and with shelves along one wall. Soaking tanks for CBR specimen and Concrete cube curing tanks of adequate size shall be provided at floor level in the main laboratory room, with built-in drainage pipes. Concrete plinths suitable for mounting the cube crusher and CBR load frame shall also be provided.

The permanent fixtures in the laboratory shall include three double draining stainless steel sinks, piped potable water supply to each and waste water outlets. The room shall be fitted with three rigidly constructed work benches 0.9m high by 1.0m wide by approximately 15m length and with a steel float finished concrete top (at least 75mm thick and suitably reinforced). Wall shelves 450mm wide and having a surface area of at least 6m^2 shall be provided and securely fitted.

A concrete slab, 150mm thick with a total area of not less than 14m^2, shall be provided adjacent to main laboratory building in a position to be indicated by the Engineer. The slab shall have a smooth finish all to the satisfaction of the Engineer

(c) Equipment and furniture for Office

The Contractor, when instructed, shall provide and install at the Engineer's office the equipment and computer software and office furniture specified below:

Computers and Design Software and printers

(i) 4 no. Laptop computers
Laptop computers ,Intel Core i3 processor, 2.4GHz 4GB RAM 450GB HD, DVD writer; 15.6" screen, Windows 10 operating System; Loaded with Microsoft Office, Microsoft MS Project, Internet Security anti-virus. Provide laptop bag; wireless mouse and mouse pad

(ii) 6 no. Desktop Personal computers
Desktop computers, Intel Core i3 processor, 3.3GHz 4GB RAM 500GB HD, DVD writer; 18.5" TFT flat screen monitor, Windows 10 Operating System. Loaded with Microsoft Office, MS Project and Internet Security anti-virus. Dust covers, mouse and mouse pad.

(iii) Design Software
AutoCAD Civil 3D version 2019 or later: 4 no. CD and multi-user licenses

(iv) 1 no. Colour Printer

HP Colour LaserJet CP5225 or similar wireless all-in-one A4/A3 network colour printer, two-sided printing, colour print speed 20 copies per min. Processor speed 540 MHz; Memory 192 MB random-access memory (RAM).

(v) 1 no. Multifunction Network Printer/Photocopying Machine
HP MFP 779dn or equivalent multifunction network laser printer/scanner/photocopier; min 40 copies per minute A4 Colour printing; two sided printing, paper size A4 - A3. Print speed min. 36 pages/minute colour A4. Processor speed min. 1.2 GHz

Payment for provision of the above equipment, software and furniture shall be made against the relevant item of the Bills of Quantities. The rate inserted for computers and printers shall include for purchase, delivery, installation, and dealer service support contract and insurance cover for the duration of the contract. Ownership of the above items shall revert to the Contractor at the end of the Project.

Survey Equipment

The Contractor may be instructed by the Engineer to provide survey equipment listed below and in the Bills of Quantities.

All equipment shall be new and of approved manufacture, and shall be made available to the Engineer, not later than six (6) weeks after the Engineer's order to supply.

Any delays in supervision and approval of Works caused by the Engineer being unable to perform survey work, due to the contractor's failure to supply the said equipment shall be deemed to have been caused entirely by the Contractor's own actions, and any consequences of such delays shall be interpreted as such.

The payment to comply with this requirement is provided in the Bill of Quantities and ownership of all equipment shall revert to the Contractor after the completion of the Works.

(i) Total station Leica T1205 or similar approved with on-board software with Windows operating system, DXF data format, ancillary equipment such as alpha-numeric keyboard, batteries, rapid charger, data transfer cable,
(ii) Tribrach with optical plummet for total station, Leica GST/20 or equivalent
(iii) Standard reflector with circular prism and metal holder, Leica GPR121 or similar complete with telescopic reflector pole GLS 11 or similar extendable to 2m height.
(iv) Heavy duty tripod for total station, Leica GST/20 or equivalent
(v) Engineer's automatic level Wild NAK2 or similar including tripod (2 no. each)
(vi) Levelling staff 5m with levelling bubble (Wild iNLe 3 or similar)

Furniture

List of Furniture for Engineer's Office: -

Item	Description	No.
1	Executive office desk	2
2	Executive office chair	2
3	Conference table with 12 seats	1 set
4	Typist desk and chair	1 set
5	Standard office desk 2.2 x 0.9m with lockable drawers	10
6	Standard office chairs	8
7	Steel filing cabinets 6 drawers	8

(d) Equipment and furniture for Laboratory

The Contractor may be instructed by the Engineer to provide, install such laboratory equipment and furniture as are listed in the Bills of Quantities for the duration of the contract.

All equipment shall be new and of approved manufacture, and shall be made available to the Engineer, complete, calibrated and ready to perform the tests, not later than six (6) weeks after the Engineer's order to supply.

Any delays in supervision and approval of Works caused by the Engineer being unable to perform field or laboratory tests due to the contractor's failure to supply the said equipment shall be deemed to have been caused entirely by the Contractor's own actions, and any consequences of such delays shall be interpreted as such.

The payment to comply with this requirement is provided in the Bill of Quantities and ownership of all equipment shall revert to the Contractor after the completion of the Works.

(e) Wireless communication for the Engineer

Internet Connection

The Contractor shall install and maintain for the duration of the contract an approved internet Wi-Fi connection for the Engineer's main office and Laboratory with extension cabling to all offices. No separate payment shall be made for internet connection and the Contractor will be deemed to have included for this cost in his rates for office and laboratory.

132 B HOUSING, FURNITURE AND EQUIPMENT FOR THE SECURITY OFFICERS

(a) Housing Accommodation for the Security Officers

The Contractor shall, if so instructed, provide, erect, and maintain for the duration of the Contract, 10no. prefabricated dormitory buildings with furniture, equipment and fittings for the Kenya Police Service Officers attached to the project.

The buildings will be erected on four Security Camp Sites designated for Wajir- Tarbaj contract Lot 1 whose location will be notified by the Engineer in consultation with the Kenya Police Service commander. The perimeter of each Security Camp Site shall be securely fenced with concertina wire external fencing and encircled with a vehicle-borne improvised explosive device VBIED trench and HESCO bag inner wall as shown in the drawings and as instructed.

The prefabricated buildings shall be of a design specification to be issued upon commencement of the contract and shall be provided with a piped supply of drinkable water, electricity, and waterborne sanitation and disposal systems. The Contractor shall pay for all water, electricity, and gas consumed, and for garbage disposal services and the statutory charges associated therewith.

Reimbursement for prefabricated buildings and installations, furniture, equipment and fittings and fencing shall be on a Provisional Sum basis plus a percentage for Contractor's overheads and profit.

Ownership of the buildings and installations shall revert to the Kenya Police Service on completion of the Contract.

(b) Wireless communication equipment for the Security Officers

The Contractor shall, if so instructed provide, install, maintain a HF and VHF radio communications network for exclusive use of Kenya Police Service attached to the project for the duration of the Contract. The Contractor shall also supply new satellite phones, pocket phones, mobile phones and airtime for the duration of the contract.

The model and make of the radio communication system shall be approved by the Engineer in consultation with the Kenya Police Service commander.

The Contractor shall be responsible for obtaining all necessary permits and licenses needed for the operation of the radio call services.

Reimbursement for provision of VHF radio communication equipment with permits and licenses, satellite phones, pocket phones, mobile phones and airtime shall be on the rates in the Bill of Quantities for the appropriate items .

Ownership of the radio equipment, satellite phones, pocket phones, mobile phones shall revert to the Kenya Police Service on completion of the Contract.

(c) Surveillance equipment for the Security Officers

The Contractor shall, when instructed by the Engineer, provide and maintain, for the duration of the Contract, unmanned aerial vehicles as surveillance equipment (Unmanned Aerial Vehicle) for use in the project.

The Contractor shall offer training and maintenance support as shall be instructed by the Engineer.

The Contractor shall insure comprehensively the surveillance equipment and shall provide competent operators during normal working hours and whenever required by the Engineer.

The export, reexport, or transfer (in-country) of the surveillance equipment shall be authorized by license granted the United States Department of Commerce Bureau of Industry and Security

The equipment shall revert to the Employer on completion of the Contract.

Payments shall be inclusive of all fuels, lubricants, servicing, insurance, maintenance, operators and repairs.

(d) Allowances for the Security Officers

The Contractor shall, when instructed, provide allowances for Kenya Police Service and Kenya Defense Forces officers attached to the project for the duration of the Contract.

Reimbursement for payment of allowances for Kenya Police Service and Kenya Defense Forces officers shall be on a Provisional Sum basis plus a percentage for Contractor's overheads and profit.

(e) Office Equipment for the Security Camps

The Contractor shall, when instructed, provide, install and maintain office equipment for security camps in accordance with the list below.

ITEM DESCRIPTION	QUANTITY
(a) Computer and Accessories: Desktop computer, Intel Core i3 processor, 3.3GHz 4GB RAM 500GB HD, DVD writer; 18.5" TFT flat screen monitor, Windows 10 Operating System. Loaded with Microsoft Office and Internet Security anti-virus. Including dust covers, mouse and mouse pad and 650vA UPS.	4
(b) Printer: HP OfficeJet Pro 8720 or similar A4 colour printer, two-sided printing, colour print speed 20 copies per min. 256 MB Printer memory.	4

(c) Scanner /Photocopier : Monochrome A4 LaserJet Printer/copier/scanner Kyocera FS-1025 or similar, 25 copies per min	4
(d) Computer maintenance: Annual maintenance service contract for 4 no. each computers, printers and scanner/photocopiers exclusive of supply of consumables	2
(e) Paper Shredder: Atlas CC 1540 or similar paper shredder, capacity 15 sheets capable of shredding CDs	2

Payment shall be made upon delivery and installation of equipment as instructed against the relevant item in the bills of quantities. Payment for computer service maintenance shall be annual.

133 TIME FOR PROVISION OF OFFICE AND LABORATORY AND SECURITY CAMP

The main office and main laboratory shall be made available for the Engineer's exclusive use not later than eight (8) weeks after the Engineer's order to commence. Should the Contractor fail to hand over the office and laboratory within the period specified, the Engineer will make such alternative arrangements as he considers necessary and the Contractor will be responsible for all costs arising therefrom.

The security camps shall be completed including site works, external fencing and VBIED trench and HESCO bag inner wall and the prefabricated buildings with furniture and installations within six (6) weeks after the Engineer's order to commence.

134 INSURANCE AND OWNERSHIP OF THE ENGINEER'S STAFF HOUSES, OFFICES, LABORATORIES, FURNITURE AND EQUIPMENT

All buildings, furniture and equipment provided by the Contractor for the Resident Engineer's staff houses, offices and laboratory shall be comprehensively insured by the Contractor against any loss or damage by accident, fire and theft for the duration of the Contract. Theft and fire accident insurance shall also cover personal effects of the Engineer and his staff.

135 MAINTENANCE OF ENGINEER'S STAFF HOUSES, OFFICES, LABORATORIES, FURNITURE AND EQUIPMENT

The Contractor shall provide day and night guards for the housing camp and offices, the cost of which shall be included in the rates for the buildings.

The Contractor shall be responsible at his own cost for the calibration and recalibration at required intervals or as instructed by the Engineer, all equipment on site required for quality control of the works.

Maintenance and calibration of equipment shall only be carried out by persons and organisations approved by the Engineer.

137 ATTENDANCE UPON THE ENGINEER AND HIS STAFF

The Contractor shall provide all assistance as may be required by the Engineer and his staff for setting out, measuring, sampling, testing and checking the works. In particular, the Contractor

shall recruit, pay wages and overtime and provide housing for all attendant junior staff listed below for the duration of the contract;-

(i) Survey Assistants (2 no.): Minimum level of education - Ordinary National Diploma (civil engineering) from a recognized Technical College or Polytechnic
(ii) Laboratory Technician (2no.): Minimum level of education - Ordinary National Diploma (civil engineering) from a recognized Technical College or Polytechnic
(iii) Office attendant (1 no.): Minimum level of education - KCPE

The above staff must be individually approved by the Resident Engineer and in the event that the Resident Engineer demands the removal of any of the staff the Contractor must comply forthwith and provide a suitable and acceptable replacement.

The Contractor shall provide continuous supply of tea, coffee, milk and sugar and bottled drinking water for the dispensers provided. The Contractor shall also provide a continuous supply of soap, towels and toilet paper and shall keep the office and laboratory in a well maintained, clean and habitable condition. The Contractor shall also provide high visibility vests and protective clothing for the Engineer and his Staff and all basic tools, wooden pegs, iron pins and pickets and water, cement and aggregate for concreting survey beacons and construction safety

The Contractor shall provide adequate security by day and by night for the Engineers offices, laboratory, vehicles and houses, and for the Engineer's staff. This shall include, but not be limited to, provision of suitable gates and electrified fencing of the compounds and the full-time attendance of permanent watchmen.

No separate measurement and payment shall be made in respect of attendance to the Engineer and his staff in compliance with this clause, and the Contractor will be deemed to have included for this cost in his rates for office and laboratory.

138 A PROVISION OF VEHICLES TO THE ENGINEER

The Contractor shall when instructed provide and maintain in good working condition throughout the contract the following vehicles for the exclusive use of the Engineer and his staff;-

(i) Three (3 no.) new diesel 4WD hardtop 5-door 9 seater station wagon vehicle of minimum engine capacity 4,000 cc fitted with driver and front passenger airbags, Anti-lock braking system (ABS), air-conditioner and power steering, electric windows, alloy wheel rims, an approved immobilizer and anti-theft security system, a satellite tracking system, and 2-way radio. Two spare wheels provided for the vehicle. One (1No.) will be used during the defects liability period (DLP). At the end of the contract, the vehicle shall revert to the Contractor.

(ii) Three (3 no.) new turbo-diesel 4WD station wagon vehicle of minimum engine capacity 3,000 cc fitted with driver and front passenger airbags, Anti-lock braking system (ABS), air-conditioner and power steering, electric windows, alloy wheel rims, an approved immobilizer and anti-theft security system, a satellite tracking system, and 2-way radio. Two spare wheels provided for the vehicle.

The vehicle shall be for the use of Engineer's staff based at the headquarters during the contract and during the defects liability period (DLP). At the end of the defects liability period of contract, the vehicle shall revert to the Contractor.

(iii) Nine (9) new turbo-diesel four wheel drive Double-cabin pickups of minimum engine capacity 2,400cc fitted with driver and front passenger airbags, Anti-lock braking system (ABS), air-conditioner and power steering, a lockable fiberglass rear compartment, an approved immobilizer and anti-theft security system, a satellite tracking system, and 2-way radio. Two spare wheels provided for each vehicle. Three (3) vehicles will be used during the defects liability period (DLP). At the end of the contract, all vehicles shall revert to the Contractor

(iv) Seven (7) new turbo-diesel four wheel drive single-cabin pickups of minimum engine capacity 2,400cc fitted with driver and front passenger airbags, Anti-lock braking system (ABS), air-conditioner and power steering, a lockable fiberglass rear compartment, an approved immobilizer and anti-theft security system, a satellite tracking system, and 2-way radio. Two spare wheels provided for each vehicle. Both vehicles will be used during the defects liability period (DLP). At the end of the contract, all vehicles shall revert to the Contractor

The Contractor shall insure comprehensively the vehicles and shall provide competent drivers during normal working hours and whenever required by the Engineer.

Payment for km travelled per month shall be made under the relevant items of the Bills of Quantities at a rate per kilometre. These payments shall be inclusive of all fuels, lubricants, servicing, insurance, maintenance, drivers and repairs and any overtime the drivers might be due or any other allowances in addition to the normal working hours.

Should the Contractor delay in initially supplying any of the new vehicles beyond six (6) weeks of being instructed to do so, or should a new vehicle supplied become un-roadworthy, then the Contractor may provide a used vehicle of equivalent type as a temporary replacement, but payment shall be reduced to 50% of the applicable rates in the bills of quantities.

The vehicles provided under this clause shall revert to the Contractor at the end of the contract.

138 B PROVISION OF VEHICLES TO THE SECURITY TEAM

The Contractor shall when instructed provide and maintain in good working condition the following vehicles for the exclusive use of the Kenya Police Service security team attached to the Wajir – Kotulo Lot 1 contract throughout the contract;-

(i) Five (5no.) new – 4 Wheel Drive twin cab pick-up with engine capacity of 2500 - 3000 cc and turbo charged diesel engine, Anti-lock braking system (ABS), air-conditioner and power steering, electric windows, an approved immobilizer and anti-theft security system, a satellite tracking system, and 2-way radio. Two spare wheels provided for the vehicle.

(ii) Eight (8) new 4 Wheel Drive single cab pick-up Land cruiser with engine capacity of 4000 - 4200 cc and turbo charged diesel engine fitted with driver and front passenger airbags, power steering, an approved immobilizer and anti-theft security system, a satellite tracking system, and 2-way radio. Two spare wheels provided for each vehicle.

(iv) One (1) new diesel 4WD hardtop Ambulance vehicle of minimum engine capacity 4,000 cc fitted with power steering, air conditioner, driver and front passenger airbag, an approved immobilizer and anti-theft security system, a satellite tracking system, and 2-way radio. Two spare wheels provided for each vehicle. Standard equipment to include main stretcher and attendant seat, first aid box / kit, flexible type patient lamp, cabinet with water tank and basin, electric sucker infusion bottle holder, oxygen cylinder, oxygen inhaler, and oxygen resuscitator.

(v) Three (3) new 4x2 trucks of 10 ton GVW and minimum engine capacity 8,000 cc fitted with power steering, an approved immobilizer and anti-theft security system, a satellite tracking system, and 2-way radio and canvas read canopy. Two spare wheels provided for the vehicle.

(vi) Four (10) new motor cycle off-road trial bike type of 175cc engine capacity.

The Contractor shall insure comprehensively the vehicles and motorcycles. The Contractor will not be required to provide drivers, and the Kenya Police Service will provide drivers.

Payment for km travelled per month shall be made under the relevant items of the Bills of Quantities at a rate per kilometre. These payments shall be inclusive of all fuels, lubricants, servicing, insurance, maintenance, drivers and repairs.

Should the Contractor delay in initially supplying any of the new vehicles beyond six (6) weeks of being instructed to do so, or should a new vehicle supplied become un-roadworthy, then the Contractor may provide a used vehicle of equivalent type as a temporary replacement, but payment shall be reduced to 50% of the applicable rates in the bills of quantities.

The vehicles and motor cycles provided under this clause shall revert to the Contractor at the end of the contract.

140 PAYMENT OF OVERTIME FOR ENGINEER'S JUNIOR STAFF

If the Contractor wishes to execute permanent work outside the Engineer's normal working hours, as stated in Clause 108 of the Special Specification then the payment for the overtime for the Engineer's Junior Staff engaged in supervising such extra work shall be reimbursed in full, by the Contractor at his own costs to the Engineer's Representative.

If the Contractor wishes to execute works on the regular basis outside the Engineer's normal working hours (Clause 108) over a prolonged period, the Engineer may, if he deems necessary, employ additional supervisory staff for which the required salaries including accommodation allowance and the percentage for administrative overheads shall be reimbursed in full by the Contractor at his own costs to the Engineer's Representative.

142 ENVIRONMENTAL PROTECTION

(a) Environmental Management Plan

The Contractor shall comply with the Statutory Regulations in force in Kenya regarding environmental protection and waste disposal, and shall liaise with the National Environmental Management Agency (NEMA).

Within four (4) weeks of the order to commence work, the Contractor shall prepare and submit a specific Environmental Management Plan for the project and his operations, relating to the approved Environmental Impact Assessment. The Environmental Management Plan shall outline potential environmental hazards and risks, and provide an action plan to deal with the hazards, minimize the risks, and mitigate adverse environmental impacts, and include a general

decommissioning plan covering all relevant aspects of the project. The Environmental Management Plan shall identify monitoring indicators and reporting requirements.

The Contractor shall be required to submit environmental progress reports to the Engineer every three (3) months.

The Contractor shall ensure so far as is reasonably practicable and to the satisfaction of the Engineer; that the impact of the construction on the environment shall be kept to a minimum and that appropriate measures are taken to mitigate any adverse effects during the construction.

i) The Contractor shall exercise care to preserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent works, all trees, native shrubbery, and vegetation shall be preserved and shall be protected from damage by the Contractor's construction operations and equipment. All unnecessary destruction, scarring, damage or defacing resulting from the Contractor's operations shall be repaired, replanted, reseeded or otherwise corrected as directed by the Engineer, and at the Contractor's expense.

ii) The Contractor shall ensure that measures are in place to control soil erosion and water pollution, by use of berms, dykes, silt fences, brush barriers, dams, sediment basins, filter mats, netting, gravel, mulches, grasses, slope drains, contour banks, and other erosion control devices and methods. Temporary erosion control provisions shall be coordinated with permanent erosion control features to assure economical, effective and continuous measures throughout the period of the works. The Contractor's attention is drawn to the requirements of Clause 502, in that works need to be progressively finished so that permanent vegetation can establish quickly to mitigate soil erosion and erosion of drains.

iii) The Contractor shall provide all the labour, equipment, materials, and means required and shall carry out proper and efficient measures wherever and as often as necessary to minimize the dust nuisance.

iv) The Contractor shall comply with all applicable Kenyan laws, orders and regulations concerning the prevention, control and abatement of excessive noise. Blasting, use of jackhammers, pile driving, rock crushing, or any other activities producing high-intensity impact noise may be performed at night only upon approval of the Engineer.

v) Immediately after extraction of materials, all borrows pits shall be backfilled to the satisfaction of the Engineer. In particular borrow pits near the project road shall be backfilled in such a way that no water collects in them.

vi) Spilling of bitumen fuels oils and other pollutants shall be cleared up.

The Contractor's attention is drawn to the requirements of the Standard Specification in regard to the environment and in particular to the following clauses:

Clause 115:	Construction Generally
Clause 116:	Protection from Water
Clause 136:	Removal of Camps
Clause 605:	Safety and Public Health Requirements Clause
Clause 607:	Site Clearance and Removal of Topsoil and Overburden

No separate measurement and payment shall be made in respect of the Contractor's compliance with Clause 142 and the Contractor shall be deemed to have allowed for all costs involved elsewhere in his rates and prices.

(b) Off Road Environmental Measures

In addition to the provisions of Clause 142(a) above and all other requirements of the Conditions of Contract, Standard and Special Specifications, the Employer and the National

Environmental Management Agency (NEMA), may order certain environmental measures to be carried out which are off the road and not specifically covered under these provisions. The Contractor shall carry out such works against the provisional sum provided in the bills of quantities with equipment, labour and plant at the dayworks bill rates.

(c) Environmental Monitoring

The Contractor will, subject to the Engineer's approval, subcontract the Environmental Monitoring activities to a registered organisation with proven experience in environmental monitoring of infrastructure projects.

The sub-contractor will be required to design and implement a monitoring programme for environmental parameters, including but not limited to noise/vibration, dust/particulate matter, and water pollution throughout the construction period. The sub-contractor will prepare and submit monthly monitoring reports with recommendations for action to improve operational matters on the construction site.

Measurement and payment shall be made against the relavant Provisional Sum bill item plus percentage for Contractor's overhead and profit.

(d) Stakeholder Engagement

The Contractor will be required to formulate and impliment a Stakeholders Engagement Plan (SEP) during construction period through an approved specialist sub-contractor. The terms of rerefemce of the SEP will however be prepared by the supervising consultant.

Measurement and payment shall be made against a Provisional Sum item provided in the bills of quantities plus percentage for Contractor's overhead and profit.

143 GREIVANCE REDRESS

The Contractor shall in compliance with World Bank Grievance Redress Service (GRS) procedures, receive and forward to the Resident Engineer particulars of complaints received from project affected persons on any aspect of the construction contract site based on the World Bank Grievance Redress Service (GRS) Complaint Form. Such details shall include reporting date and nature of complaints, details of complainant. The Contractor will also submit a report on accidents and or incidents/occurrences that may occur either on site or off-site if affecting the contractor's site personnel or equipment and vehicles. The Resident Engineer who will be responsible for maintaining a project-level complaints register shall carry out necessary investigations and issue instructions for appropriate follow-up actions and necessary responses.

A Provisional Sum has been included in the bills of quantities for reimbursement of any authorised expenses associated with the resolution of grievances.

SECTION 2 – MATERIALS AND TESTING OF MATERIALS

202 TESTING BY THE CONTRACTOR

The Contractor shall together with his Programme for Execution of Works submitted within 28 days after the order to commence works, a Quality Management System conforming to international standards, including the Work Method Statement and Quality Audit for major items of work.

The provision of the Engineer's laboratory and testing equipment, as outlined in section 1 of this Special Specification, does not relieve the Contractor of his obligation to provide laboratory and testing equipment and execute his own testing, in conformity with the

specified requirements in the Standard Specification and Special Specifications.

The onus rests with the Contractor to produce work which confirms in quality and accuracy of detail to the requirements of the Specifications and drawings, and the Contractor must, at his own expense institute a quality control system to ensure adequate supervision and positive control of the Works at all times, and the Contractor must provide chainmen and labourers for the Engineer to carry out checks on the Works.

The Contractor shall make his laboratory accessible to the Engineer's Representative for cross checking the test results and inspection during material testing in the laboratory.

204 SIEVES

A standard set of sieves for general use shall consist of the following sieve sizes mm: 100-63-50-37.5-28-20-14-10-6.3-5-4-2-1-0.6-0.5-0.425-0.300-0.150-0.075 mm. The sieves from 0.425 to 0.075 mm shall be suited for wet sieving.

207 CEMENT

All cement to be used shall comply with Kenya Standard KS 1725 2001 CEM 1 42.5

224 TRIALS TO CONFIRM COMPLIANCE WITH SPECIFICATIONS

(b) Site Trials

The Contractor shall allow in his programme of works described in Clause 104 of these specifications, for constructing trial sections and carrying out tests upon them as directed by the Engineer. Trials would normally be required at the start of each pavement layer and if changes of materials, method, or equipment deem it necessary, as directed by the Engineer. The time for completion of the Contract shall not be extended because of the time needed to construct trial sections and evaluate the tests on them.

At least fourteen days before the work of laying any pavement layer is commenced, the contractor shall construct trial sections of at least 100 m in length and to the full construction width and the specified pavement layer thickness. For each trial section, the Contractor shall use the materials, mix proportions, mixing, laying, compaction equipment and construction procedure that he proposes to use for the main work. The main work of laying the pavement layer shall not be commenced until this trial has been tested and approved by the Engineer.

No variation in the construction procedure, mix proportions, size, grading or source of any of the constituents shall be made without the agreement of the Engineer who may first require new trial sections to be carried out.

Trial sections, if found satisfactory, will be paid for under the rates in the Bill of Quantities for the appropriate items, as if the trial sections were part of the normal work. No separate payment will be made for trial sections and testing.

The Contractor shall make good, at his own expense; any trial sections that fail to meet the specified standards. The standards shall include, but not be limited to, material quality, layer thickness, levels and compaction.

SECTION 3 – SETTING OUT AND TOLERANCES

301 SETTING OUT

(a) General

The basic survey provided by the Engineer to the Contractor shall include a traverse line which is referenced by steel pins in concrete located alongside the works, and a computer printout of the geometric centreline which will enable the Contractor to set out these lines.

Any abortive setting out resulting from survey errors on the part of the Contractor, and any construction work carried out on the basis of such abortive setting out shall be rectified entirely at the Contractor's expense.

If the traverse points to be used for the setting out are close to the existing carriageway and interfere with construction works then the Contractor will have to relocate them to a location where they will not be disturbed. The coordinates and heights of all traverse points so located shall be listed and provided to the Engineer for checking and/or approval.

The Contractor shall also monument the new centreline every 200m along straight and all salient points along curves by a pin in concrete beacon before commencement of any work.

The reference points to define the road reserve shall have 12mm diameter steel pins embedded in concrete, 200mm long with 25mm exposed to the air, sticking out from its top surface. This pin shall be coordinated and heighted and the result of the same shall be provided to the Engineer for approval.

Commencement of the works shall not be permitted until this basic survey data has been provided and approved by the Engineer for at least 5km of the road.

(b) Detailed Setting Out

Reference pegs shall be 50mm x 50mm in section, 600mm long, driven 400mm firmly into the ground and painted white above ground. The offset from the centreline shall be indicated by a small nail, 20mm to 25mm long, with its head driven flush with the top of the peg. Chainage, offset and reference elevation shall be clearly indicated on the side(s) of the peg to the satisfaction of the Engineer.

302 TOLERANCES

(j) Pavement Widths

The edges of the wearing course, base and sub-base shall nowhere lie closer to the carriageway centreline than the dimensions shown on or calculated from the design data given on the drawings or as amended by the Engineer in writing to the Contractor, and the half widths of wearing course, base and sub-base measured at any point along the road shall not exceed the nominal width by more than 50mm for wearing course, base and sub-base.

(k) Drainage

The maximum deviation from the specified line of a pipe or pipe culvert shall be 20mm in 3m for horizontal line, and 30mm in 10m for vertical line.

The Contractor shall correct any excess deviation before proceeding with the work.

The invert level of drainage ditches both lined and unlined shall be within +0mm to -50mm

of that specified by the Engineer and trimmed such that water does not pond. In the event of the Contractor over-excavating any lined or unlined drainage ditches or channels outside the specified tolerances, the Contractor will be held responsible for any additional work ordered by the Engineer as being, in his opinion, necessary to maintain acceptable invert grades. Such remedial work shall be carried out entirely at the Contractor's expense. Replacement of the over-excavated material within the ditches and channels will not be permitted, unless such material is compacted and that part of the channel is lined, all to the satisfaction of the Engineer. The Contractor should be aware that the most likely form of remedial work to be ordered by the Engineer for unlined ditches would be the deepening of the remainder of the ditch or channel downstream of the over-excavated section for such length as the Engineer deems necessary to avoid ponding, and, in his opinion, sufficient to adequately cope with the design flows.

SECTION 4 – SITE CLEARANCE AND TOP SOIL STRIPPING

401 SITE CLEARANCE

Site Clearance shall be carried out as directed by the Engineer, the extent shall generally be for the full width of road reserve (60m). However, where instructed, the Contractor may be required to increase the width of corridor to be cleared up to 100m for security purposes. The existing road and cleared drains shall not be measured within the width to be cleared.

402 REMOVAL OF TOPSOIL

Topsoil shall be removed only in areas instructed by the Engineer for an average depth of 200mm including grass, crops, weeds, and other vegetation material encountered in existing drainage channels.

403 REMOVAL OF STRUCTURES, FENCES AND OBSTRUCTIONS

Where instructed by the Engineer, the Contractor shall take down and dismantle structures including pipe culverts, buildings, fences, walls, gates, advertisement boards and drainage structures, and remove them from the site of the works.

Measurement and payment for removal of structures shall be made on daywork basis, against the relevant provisional sum provided in Bill No. 4 of the Bill of Quantities.

SECTION 5 – EARTHWORKS

504 PREPARATION PRIOR TO FORMING EMBANKMENT

Where benching is required for existing pavement to accommodate earthworks for widening the road, the rate for compaction of existing ground shall be deemed to cover this activity.

Excavation in the pavement of the existing road shall be kept dry. In the event of water penetrating the underlying layer, construction of the subsequent layers shall be postponed until the underlying layers are dry enough to accommodate the construction plant without deforming or otherwise showing distress.

Step construction shall be carried out per layer at the joint where excavating both vertically and perpendicular to the direction of the travel. Bench widths shall be minimum 750mm measured perpendicular to the direction of the travel and the depth of each step shall be maximum 150mm vertical when compacted unless otherwise instructed by the Engineer.

Special care shall be taken when compacting the new material at the joint ensuring that specified density is achieved.

505 CONSTRUCTION OF EMBANKMENTS

Only material approved by the Engineer shall be used for fill in embankments. Material with high swelling characteristics or high organic matter content and low bearing capacity shall not be used.

Material suitable for use as fill shall meet the following characteristics;-

(i) CBR of minimum 8% after 4-day soak and compaction to a dry density of 100% MDD (AASHTO T99)

(ii) Swell less than 1%

(iii) Plasticity Index less than 50%

(iv) Contain not more than 5% by weight of organic matter

Any in-situ material below formation level in cutting that does not meet the above requirements shall be removed to a depth of 300mm or such other larger depth as shall be instructed by the Engineer, and replaced with material from cuttings or borrow pits which complies.

Subgrade shall mean upper 300mm of earthworks either insitu or in fill and subgrade shall be provided for as part of earthworks operation and payment shall be made as “fill”. The material for subgrade shall have a CBR of not less than 8% measured after a 4 day soak in a laboratory mix compacted to a dry density of 100% MDD (AASHTO T99) and a swell of less than 1%.

Improved Sub-grade

Where instructed, the Contractor will provide, lay and compact Improved subgrade material obtained from borrow pits which meets the following specifications:-

Improved subgrade material shall have a CBR of min. 22.5% after 4-day soak and compaction to a dry density of 100% MDD (AASHTO T99).

The material shall be deposited in layers not exceeding 150mm compacted thickness and compacted in place to 100% MDD (AASHTO T99) at 75-105% of OMC. Each layer shall extend to the full width of embankment and shall be compacted in accordance with clause 508.

Measurement and payment shall be made per cubic metre of improved subgrade as specified including all hauls.

508 COMPACTION OF EARTHWORKS

All fill above ground level around the pipe culverts shall be compacted to density of 100% MDD (AASHTO T.99) up to the level of the top of the surround, and for a width equal to the surround.

All fill around box culverts upto the formation level underside of the subgrade shall be compacted to density of 100% MDD (AASHTO T.99) for the full width of the fill and for a length bounded by the vertical plane passing through the ends of the wingwalls.

Where improved sub-grade material shall be required, this shall be compacted and finished to the same standards and tolerances as those required for normal subgrade and clauses in the specifications applying to normal subgrade shall also apply.

509 MASS HAUL DIAGRAM

A mass haul diagram has not been provided with the Drawings. The Contractor shall optimize his earthworks operations and locate suitable materials for constructing earthworks along the alignment to reduce haulage requirements.

511 BORROW PITS

Fill material which is required in addition to that provided by excavation shall be obtained from borrow pits to be located and provided by the Contractor but to the approval of the Engineer.

It shall be the Contractor's responsibility to obtain all rights of access to these borrow pits. Payment for any item in connection with prospecting, access roads, royalties etc., shall be included in the Contractor's unit rates for supply of borrow pit materials. These shall incorporate the cost of the following:

i) Opening up the borrow area, site clearance, removal of topsoil and overburden, fencing, drainage, landscaping and topsoiling upon completion and leaving neat and tidy;

ii) Constructing and maintaining access roads, complying with conditions of access, traffic control, safety and public health requirements, fencing, drainage and making good on completion and leaving neat and tidy;

iii) Excavation and selection of material, removing and spoiling of oversize material, screening, stockpiling, providing and mixing water or drying out the material, mixing, processing, spreading and compacting;

iv) Spreading, providing and admixing of fines if necessary, rolling, making good defective areas and maintenance of the surface;

v) Loading, hauling a free haul distance of 1.0 km measured from the centre of volume of the source of material and dumping the material, and

vi) Complying with the requirements of NEMA in respect of treatment of borrow pits.

514 TOPSOILING AND GRASSING

Where directed by the Engineer, the Contractor shall provide topsoil and grassing for erosion protection to embankment slopes, cut faces, side drains and verges.

Topsoil material shall be obtained from stockpiles formed during top soil stripping operation or from other suitable location. Topsoil shall be spread and lightly compacted in locations instructed to 75mm thickness.

Grassing shall entail planting sprigs of an approved runner type grass at 150mm centres. The contractor shall care for and water and regularly weed the grass until it is firmly established.

517 MEASUREMENT AND PAYMENT

(a) Item: Fill in Soft Material

Unit: m^3

The rate for compaction of fill in soft material shall allow for the requirements of clause 508 of the special specification and no extra payment shall be made for compaction around pipe culverts to 100% MDD AASHTO T.99.

(e) Item: Overhaul.

There shall be no separate payment for overhaul on earthworks, and the Contractor is deemed to have allowed elsewhere in his rates for all hauls required to construct the earthworks as specified.

(l) Item: Topsoiling.

Unit: m^3

Topsoiling shall be measured by the cubic metre calculated as the net area coverage as instructed multiplied by the compacted thickness.

SECTION 6 – QUARRIES, BORROW PITS, STOCKPILES AND SPOIL AREAS

603 PROVISION OF LAND

The Employer shall not make available to the Contractor any land for hardstone quarries, borrow pits, stockpiles and spoil areas. The information in the Factual Materials Report regarding identified material sites is provided for the general guidance of tenderers and the information contained therein is neither guaranteed nor warranted. The Contractor is expected to conduct his own investigation and to identify sites for extraction of natural materials to be used in the works, subject to approval by the Engineer.

The Contractor will be entirely responsible for locating suitable sources of materials complying with the Specifications, and for negotiating and leasing land, procurement, winning, haulage to site of these materials and all costs involved therein. Similarly the Contractor will be responsible for the provision and costs involved in providing suitable areas for stockpiling materials and spoil dumps. No spoil dumps or stockpiles shall be permitted within any road reserve forming the site of the works.

No separate payment will be made to the Contractor to cover costs arising from the requirements of this Clause and the Contractor must include for these costs in the rates inserted against the respective items of the Bills of Quantities.

SECTION 7 –EXCAVATION AND FILLING FOR STRUCTURES

703 EXCAVATION OF FOUNDATIONS FOR STRUCTURES

All excavated surfaces in material other than hard material, on which foundations for structures shall be placed, shall be compacted to 100% MDD (AASHTO T.99) to a depth of 300mm immediately before structures are constructed.

707 BACKFILLING FOR STRUCTURES

Unless otherwise instructed by the Engineer, all backfilling material shall be compacted to a minimum of 100% MDD (AASHTO T.99).

710 STONE PITCHING

Stone pitching to drains, inlets and outlets of culverts to embankments and around structure shall consist of sound un-weathered rock approved by the Engineer. The stone may be hammer dressed to ensure a roughly cubical shape with least dimension of any stone being minimum 200mm and volume not less than 0.01 m^3 for normal thickness of stone pitching.

The surface to receive the pitching shall be compacted and trimmed to slope and the stone laid, interlocked and rammed into the material to give an even finished surface.

711 GABIONS

Where instructed by the Engineer, the Contractor will install gabions as protection works to drainage outfall areas or culvert or drift end structures, or embankment support. Gabions shall be constructed in accordance with Clause 711 of the Standard Specification.

In locations with existing gabions these shall be removed and the site excavated to the correct levels and grades as directed by the Engineer, and in accordance with Clause 711 of the Standard Specifications and replaced with new gabions and rockfill. The old gabions shall be recovered and transported to the Kenya National Highways Authority regional office in Wajir.

712 RIP-RAP PROTECTION WORK

Quarry waste or similar approved material shall be used to backfill scoured and eroded side, outfall and cut-off drains. The material shall be compacted to form a flat or curved surface preparatory to stone pitching of drainage channels, existing and new scour checks as directed by the Engineer.

The surface to receive the pitching shall be compacted and trimmed to slope and the stone hand laid, interlocked and rammed into the material to give an even finished surface. The interstices of the pitching shall be rammed with insitu material. The insitu material immediately behind the pitching shall be compacted to minimum density of 100% MDD compaction (AASHTO T.99)

713 MEASUREMENT AND PAYMENT

(g) Item: Stone Pitching

Unit: m^2

The rates inserted for stone pitching shall include for the cost of excavating, trimming to line and level, providing and laying the stone, and grouting with 1:3 mix of cement/sand mortar all in compliance with clause 710 of the standard specification.

SECTION 8 – CULVERTS AND DRAINAGE WORKS

801 SCOPE OF SECTION

The operations specified in this section apply to the installation of drainage works and reinstatement and improvement of the same. This Section covers construction of concrete pipe cross culverts and access culverts, and concrete lined drains in urban areas.

804 EXCAVATION FOR CULVERTS AND DRAINAGE WORKS

The final excavated surface in soft material on which culverts are to be constructed shall be compacted to a dry density of at least 100% MDD (AASHTO T99) to a depth of 150mm.

Where instructed by the Engineer, the Contractor shall excavate and remove existing cross and access culvert pipes and drifts, including concrete surround, bedding, and inlet and outlet structures. The void left after removal of culvert pipes shall if so instructed be carefully preserved in order to accommodate replacement pipe culverts. Measurement and payment for removal and demolition of drainage structures shall be on daywork basis, under a Provisional Sum provided in Bill No 4 in the Bill of Quantities.

805 EXCAVATION IN HARD MATERIAL

(a) For concrete pipe culverts

Where both hard and soft material are encountered in trenches for concrete pipe culverts either the soft material shall be removed to a depth of 300mm or if directed the hard material shall be removed to a depth of 300mm and backfilled with soft material compacted to 100% MDD (AASHTO T.99).

807 CONCRETE PIPE CULVERTS

(b) Inflatable Balloon pipe culverts

The Contractor shall use an approved inflatable balloon form for culvert construction to the dimensions shown on the drawings, Measurement and payment shall be per metre run of pipe constructed as specified inclusive of all reinforcement and formwork. The Contractor inner concrete barrel surface immediately in contact with the inflated balloon form during placing shall achieve Class F3 finish.

The culverts will be constructed to the overall dimensions shown in the drawings in concrete class 30/20 placed on a blinding layer of concrete class 25/20. All reinforcement shown in the drawings will be provided.

The materials for concrete, the concreting operations and quality control shall be in accordance with section 17 of these specifications.

The balloon forms used shall be in good condition, free of air leakage and fitted with appropriate pressure gauges. The air pressure on the balloon must be monitored and kept uniform during the culvert construction and thereafter until the concrete has set.

The Contractor shall submit a detailed method statement for the construction of the culverts using inflatable balloon forms and obtain the Engineer's approval before commencing these works.

The inflatable rubber balloon for casting concrete culverts shall be manufactured from two layer natural rubber and an inner layer of high strength synthetic polymer fabric capable of

withstanding the force from concrete and air pressure. The outer layer shall be vulcanized rubber.

The balloon shall comply with the following technical specifications;-

- Wall thickness min. 3.2mm±0.2mm
- Hardness: min. 65 ± shore A
- Adhesive tension of rubber and fabric: ≥8 N/25mm
- Tensile strength min 12 mPa
- Elongation at break min 350%
- No cracks, bubbles or surface imperfections

The balloons shall be inflated using suitable air compressors equipped with air hoses, pressure gauges and valves to the following minimum working pressure.

- 600mm dia –0.03 mPa
- 900mm dia – 0.025 mPa
- 1200mm dia – 0.02mPa

812 BACKFILL

All backfill whether from excavated material or borrow pits shall have a CBR of at least 8 measured after 4 day soak on laboratory mix compacted to 100% MDD (AASHTO T99), a plasticity index of less than 35%, maximum particle size of 20mm and shall be compacted to a dry density of 95% MDD (AASHTO T99).

814 SUBSOIL DRAINS

In the event of excavation for repairs exposing local seepage, springs or high water table, the Engineer may instruct the provision of French drains.

These drains shall consist of a trench excavated to the line, width, depth and gradient instructed by the Engineer, and backfilled with approved compacted clean hard crushed rock material as specified in clause 814 of the standard specification. Where these drains lie within the carriageway the pavement layers shall be constructed over them as instructed by the Engineer.

SECTION 9 – PASSAGE OF TRAFFIC

901 SCOPE OF THE SECTION

The existing road refers to the section of Wajir km 0+000 – Tarbaj km 55+000 road including Tarbaj town loop.

The Contractor shall take over the responsibility of maintaining the existing road in good motorable condition for the duration of the contract. The Contractor shall grade the road regularly and carry out spot improvements as instructed by the Engineer. No separate measurement or payment shall be made in respect of maintaining the existing road and the Contractor is deemed to have included for all costs elsewhere in his rates and prices.

904 CONSTRUCTION OF DEVIATIONS

The Contractor shall program his works in such a way that traffic shall not be required to pass over more than 5 km continuous length of deviation at any one time, unless otherwise approved by the Engineer.

The work consists of construction and maintenance of a two-way temporary deviation road. The carriageway shall be 8.0 m wide.

Where instructed, the Contractor shall provide, lay and compact a layer of natural gravel wearing course on the constructed deviations to 150mm compacted thickness in compliance with clause 1007 of the Specification. The gravel material shall meet the grading requirements of clause 1002 for class 2 gravel wearing course and have a minimum CBR of 20 at 95% MDD (AASHTO T180) and 4-day soak and a minimum Plasticity Index 10/maximum 30, a minimum Plasticity Modulus 200 / maximum 1,200.

905 MAINTENANCE OF DEVIATIONS

All diversions constructed under clause 904 a shall be maintained by the Contractor in a safe all-weather motorable condition from the date of opening of the deviation to traffic until the adjacent section of road is completed.

Maintenance shall include regular grading, reshaping, watering and compaction to restore a smooth riding surface and clearing of side drains and culverts to free-flowing condition, bush clearing and cutting grass, and rendering assistance to the public traffic.

Grading, reshaping, watering and compaction shall be executed at 2 monthly intervals along the entire length of existing road and /or deviation in use at the time by public traffic.

The Contractor shall ensure that deviations through trading centres and/ or built up areas shall be watered at least twice a day to suppress dust.

No separate payment shall be made for maintenance of deviations, and the Contractor shall be deemed to have provided for this in his rates for maintenance of passage of traffic through the works.

906 PASSAGE OF TRAFFIC THROUGH THE WORKS

The Contractor shall maintain passage of public traffic through or across the works through

specified activities including maintenance of constructed deviations and existing roads, erection and operation of signs, barriers, stop-go boards and traffic control.

The Contractor shall ensure that the workforce and site supervisory staff at all times wear high visibility garments when work is carried out on or adjacent to a section of the road open to traffic. The Contractor shall provide a full time traffic safety officer to co-ordinate aspects of road safety for the whole site.

No separate payment shall be made in respect of maintaining the passage of traffic in compliance with the requirements of this clause ad the Contractor shall be deemed to have included for all cost elsewhere in his rates and prices.

SECTION 12 – NATURAL MATERIAL FOR SUB-BASE AND BASE

1203 MATERIALS REQUIREMENT

Natural gravel material for cement-improved sub-base pavement layer shall have a minimum CBR of 20% at 95% MDD (AASHTO T180) and 4-day soak, plasticity index maximum 30% and plasticity modulus max 2,500 and shall meet all other requirements given in clause 1203 (c) of the Standard Specification.

Natural gravel material for cement stabilized base pavement layer shall have a minimum CBR of 30% at 95% MDD (AASHTO T180) and 4-day soak, plasticity index maximum 25% and plasticity modulus max 1,500 and shall meet all other requirements given in clause 1203 (e) of the Standard Specification.

1209 MEASUREMENT AND PAYMET

(a) Item: Natural material for sub-base and base:
Unit: m^3
Measurement and payment shall be by Method A as described in the Standard Specification and subject to the provisions of clause 603 of these specifications.

(b) Item: Overhaul:
There shall be no overhaul on natural material for sub-base and base.

SECTION 14 – CEMENT TREATED MATERIALS

1403 MATERIAL REQUIREMENTS

(b) Cement

(i) Cement for stabilisation will be Ordinary Portland cement complying with **Kenya Standard "KS 1725 2001 CEM 1 42.5"** Specifications.

1404 AMOUNT OF STABILIZER TO BE ADDED

The cement content of the stabilised material shall be as instructed by the Engineer folowing site trials but will norminally be about 3% for cement improved subgrade layers and 4% for cement stabilised gravel base layers. The Engineer shall exercise his discretion to any variation in the rate of application of the cement, which he may see fit to order from time to time.

1405 MIX-IN-PLACE METHOD OF CONSTRUCTION

The mix-in-place method shall be used for the addition and mixing in of the stabiliser to sub-base gravel layer.

(a) Mixing equipment

The equipment to be used for pulverising the material and mixing in stabilizer shall be an approved self-proelled pulvimixer equipment equipped with a device for controlling the depth of processing and the mixing blades shall be maintained or reset periodically so that the correct depth of mixing is obtained at all times.

(d) Mixing and watering

The moisture content of the layer after spreading and mixing in the stabilizer shall be adjusted as directed by the Engineer to within the range of 95% to 100% of the Optimum Moisture Content (AASHTO T180) before commmencxement of compaction. Compaction and finishing to be completed within 2 hours of spreading the stabilizer.

SECTION 15 – BITUMINOUS SURFACE TREATMENTS

1501A GENERAL

PART B – PRIME COAT

1502B MATERIALS FOR PRIME COAT AND TACK COAT

The surface of base layer shall be primed with a prime coat binder shall be a medium-curing cutback MC 30 unless otherwise directed by the Engineer.

The tack coat to be applied prior to laying bituminous mixes shall consist of bitumen emulsion KI-70 unless otherwise directed by the Engineer.

1504B SPRAYING OF PRIME COAT AND TACK COAT

The rate of spray of bituminous prime coat refers to the gross volume of the cut-back bitumen, that is to say the volume of the bitumen sprayed per m^2. It will generally be between 0.8-1.2 litres/square metre.

The rate of spray of the tack coat binder shall be as instructed by the Engineer and shall generally be within the range 0.3-0.8 litres/square metre.

1502C MATERIALS FOR SURFACE DRESSING

(a) Binder

The bituminous binder shall be 80/100 penetration grade bitumen cut back with between 3% and 10% of kerosene fuel as shall be instructed following site trial paving.

(b) Chippings

(i) Hardness, soundness, shape and cleanliness

The Contractor's attention is drawn to the requirements of Clause 1502C of the Standard Specification with regard to cleanliness and the dust content of chippings for surface dressing. Should it prove necessary in the Engineer's opinion to wash chippings, no extra payment will be made to the contractor for this operation.

Chippings shall meet the requirements of Class 4 specification.

(iii) Grading

The carriageway shall be sealed with single surface dressing of 10/14 mm nominal size chippings.

The shoulders shall be sealed with single surface dressing of 6/10 mm nominal size chippings.

1503C SPRAY AND SPREAD RATES OF BITUMEN AND CHIPPINGS

Directions on the spray rates for bitumen and the spread rates for chippings will be instructed by the Engineer following satisfactory paving trials on site but generally within the following range.

Bitumen Spray Rates: 1.2 – 1.4 l/m^2 for the seal to carriageway

Bitumen Spray Rates: 10.9– 1.2 l/m^2 for the seal to shoulders

Chippings spread rate on carriageway: 10/14mm size pre-coated chippings at 80-100 m^2/m^3.
Chippings spread rate on shoulders: 6/10mm size pre-coated chippings at 100 - 120 m^2/m^3

After submission of samples and completion of laboratory tests on chippings and binder, the Contractor shall in the presence of the Engineer lay trial sections of seal at various rates of spray and spread as directed by the Engineer and in accordance with clause 1503C of the Standard Specification.

Should any change occur in nature of source of chippings or bitumen, the Contractor shall advice the Engineer accordingly who will then decide if any revisions are required to the spray and spread rates in which case the Contractor shall carry out further trials as instructed by the Engineer.

Payment for binder and chippings will be based on the instructed spray and spread rates used which may not necessarily be those specified. The Engineer will specify the spray rates of bitumen as residual bitumen per square meter. Actual spray rates used by the Contractor must be adjusted to compensate for any cutter added.

1505C PRECOATED CHIPPINGS

Chippings utilized for surface dressing works under this contract shall be pre-coated in accordance with clause 1505C of the Standard Specification. The binder used for pre-coating chippings shall be MC 30 cut-back bitumen.

The amount of bituminous binder used to pre-coat chippings will be as instructed by the Engineer and will normally be between 0.4% and 1.0% residual bitumen as percentage of the total dry weight.

Prior to laying any pre-coated chippings the Contractor shall prepare trial mixes of bitumen and chippings in the presence of the Engineer. After completion of trial mixes the Engineer shall issue written instructions to the Contractor indicating the amount of binder to be added in pre-coated chippings. The Contractor shall maintain this proportion unless the surface or nature of the chippings changes when the Contractor shall repeat the trials and the Engineer will issue revised instruction.

1511C MEASUREMENT AND PAYMENT

(a) Item: Seal Coat
Unit: m^3 of each nominal size
The 80/100 pen bitumen shall be measured by the litre for each seal coat at the instructed rate of application. The rate shall include for the cost of preparation of the surface to receive the binder, providing, heating and cutting back with kerosene fuel at the instructed rate, hauling and spraying and complying with Parts A and C of Section 15 of the Specifications.

(b) Item: Chippings
Unit: m^3 of each nominal size
The rate for chippings shall include for the cost of providing, precoating in accordance with clause 1505C hauling, spreading and rolling the chippings at the instructed rate and all hauls necessary and complying with Parts A and C of Section 15 of the Specifications.

(c) Item: Precoated Chippings
No separate payment will be made in respect of precoating and the Contractor is deemed to have included for such costs in his rate for chippings in compliance with clause 1505C of these specifications.

SECTION 16 – BITUMINOUS MIX BASES, BINDER COURSE AND WEARING COURSES

PART A – GENERAL

1603A CONSTRUCTION PLANT

(d) <u>Compaction Plant</u>

The Contractor shall provide sufficient rollers of adequate size and weight to achieve the specified compaction. Prior to commencing the laying of bituminous mixes in the permanent Works the Contractor shall carry out site trials in accordance with clause 1606A and Section 2 of the Standard Specification to demonstrate the adequacy of his plant and to determine the optimum method of use and sequence of operation of the rollers.

It is important to achieve as high a density as possible at the time of construction and it is essential that thorough pre-construction trials are carried out to ensure that:-

(a) The roller is set up to have the optimum amplitude and frequency of vibration for the particular material being laid
(b) That the roller does not cause breakdown of the aggregate particles.
(c) That the optimum compaction temperatures are established which allow compaction without causing ripple effects or other distortions of the surfacing.

1604A PREPARATION OF SURFACE

A tack coat shall be applied prior to laying the bituminous mix or between layers of the bituminous mix, in accordance with Section 15 of the Specifications.

PART B - ASPHALTIC CONCRETE FOR SURFACING

1601B DEFINITION

The Asphalt Concrete for the main road carriageway and shoulders shall be Type I binder course. However, modifications to the Standard Specification have been made below to correspond with SHRP SUPERPAVE system recommendations on the design of bituminous materials for heavily loaded sites. The design of hot mixes shall be in accordance with the procedure detailed in Overseas Road Note 19 – "A guide to the design of hot mix asphalt in tropical and sub-tropical countries". The Contractor shall provide copies of ORN 19 and Asphalt Superpave Manual Series No. 2 to the Engineer at the start of the Project.

1602B MATERIALS FOR ASPHALT CONCRETE

(a) Penetration grade bitumen

Bitumen for asphalt concrete shall be 60/70 penetration grade and shall meet the requirements of Table 4.3 in ORN 19 as summarised below.

Test	Min	Test Method (ASTM)	Pen 40/50	Pen 60/70	Pen 80/100
Based on original bitumen penetration at 25^{0}C		D5	40-50	60-70	80-100
Softening Point (^{0}C)		D36	49-59	46-56	42-51
Flash Point (^{0}C)	Min	D92	232	232	219
Solubility in trichloroethylene (%)	Min	D2042	99	99	99
TFOT heating for 5hr at 163^{0}C		D1754			
a) Loss by mass (%)	Max		0.5	0.5	0.5
b) Penetration (%)	Min	D5	58	54	50
c) Ductility at 25^{0}C	Min	D113	-	50	75

(b) Aggregate

Coarse aggregate (retained on a 6.3mm sieve) shall consist of crushed stone free from clay, silt, organic matter and other deleterious substances. The aggregate shall be class 'a' and shall comply with the requirements given in Table 16b-1(b):

TABLE 16B-1(b) Requirements for coarse aggregate

Coarse Aggregate (retained on a 6.3 mm sieve)	
Test	Maximum value
LAA	30
ACV	25
SSS	12
FI	25

The coarse aggregate shall be entirely crushed rock, with a crushing ration not less than 60%.

Fine aggregate (passing a 6.3 mm sieve) shall consist entirely of crushed rock free from clay, silt, organic and other deleterious matter and shall be non-plastic. The Sand Equivalent of the fine aggregate shall not be less than 40 and the SSS not more than 12.

(c) Mineral filler

Mineral filler shall consist of finely ground particles of limestone, hydrated lime, Ordinary Portland cement or other non-plastic mineral matter. It shall be thoroughly dry and free from lumps. At least 75 % (by weight) shall pass a 0. 075mm sieve and 100% shall pass a 0.425rnm sieve. It shall have a bulk density in toluene measured in accordance with BS 812 of between 0.5 and 0.9 g/ml.

TABLE 16B-1 (a) GRADING REQUIREMENTS FOR ASPHALT CONCRETE

Sieve size (mm)	Percentage by weight passing Type I
	Wearing course
	0/20
28	100
20	90 -100
14	75 - 95
10	60 - 82
6.3	47 - 68
4	37 - 57
2	25 - 43
1	18 - 32
0.425	11 - 22
0.300	9 -17
0.150	5 - 12
0.075	3 - 7

1603B GRADING REQUIREMENTS

The grading mixture of coarse and fine aggregate shall be within and approximately parallel to the grading envelopes as given in Table 16B-1(a) for 0/20 mm Type I asphalt concrete wearing course. In addition, the material shall comply with the requirements below.

The Contractor shall investigate a number of gradings so that a workable mix, which also retains a minimum of 3% voids in mix (VIM) at refusal density, is identified. As guidance towards identifying a suitable grading, recommendations are provided in Tables 16B-1(c) and (d).

TABLE16B-1(c) SUPERPAVE aggregate grading control points

Nominal Maximum Size (mm)	Sieve size (mm)	Control Point (per cent passing)	
		Minimum	Maximum
37.5	0.075	0	6
	2.36	15	41
	25.0	-	90
	37.5	90	100
	50.0	100'	-
25.0	0.075	1	7
	2.36	19	45
	19.0	-	90
	25.0	90	100

	37.5	100	-
19.0	0.075 2.36 12.5 19.0 25.0	2 23 - 90 100	8 49 90 100 -
12.5	0.075 2.3s 9.5 12.5 19.0	2 28 - 90 100	10 58 90 100 -

TABLE 16B-1 (d) SUPERPAVE boundaries of aggregate restricted zone

Sieve size within restricted zone (mm)	**Minimum and maximum boundaries of sieve size for nominal maximum aggregate size. (Minimum/Maximum percent passing)**			
	37.5	25.0	19.0	12.5
4.75	34.7-34.7	39.5-39.5	-	-
2.36	23.3-27.3	26.8-30.8	34.6-34.6	39.1-39.1
1.18	15.5-21.5	18.1-24.1	22.3-28.3	25.6-31.6
0.6	11.7-15.7	13.6-1 7. 6	16.7-20.7	19.1-23.1
0.3	10.0-10.0	11.4-11.4	13.7-13.7	15. 5-15.5

Note (1) - The SUPERPAVE definition of 'Nominal Maximum Size of Aggregate' is one sieve size larger than the first sieve to retain more than ten per cent of the aggregate.

It is recommended that where possible the largest particle size used should not be more than 25rnm so that the requirements of the Marshall Test method can be complied with.

Mixes identified for compaction trials shall be manufactured to the laboratory design bitumen content and two other bitumen contents of + 0.5% and + 1.0% additional bitumen. Cores will be cut to determine the density of compacted material. The core will then be reheated to 145 ± 5°C in the appropriate mould and compacted to refusal in the vibrating hammer test. The cores cut from the compaction trial must have a density equivalent to 95% refusal density.

The compaction trials will identify a workable mix which can be made to a bitumen content which gives minimum 3% Voids in Mix (VIM) at refusal density.

1604B REQUIREMENTS FOR ASPHALT CONCRETE

The mixture shall comply with the requirements given in Table 16B-2.

TABLE 16B-2 REQUIREMENTS FOR ASPHALT CONCRETE

Asphalt Type	No. of blows Marshall compaction	Minimum Stability (kN)	Flow (mm)	Voids (%)
Type I	2x75[1]	7 - 9	2 - 4	3-5

Note[1]: *Satisfactory volumetric composition must be confirmed by refusal density testing*

The nominal binder content shall be 5.0%. In addition to the requirements given in Table 16B-2, the maximum Marshall Stability for 2x75 blows shall be 18 kN, and at compaction to refusal shall ensure minimum 3% VIM.

In order to determine the suitability of a coarse aggregate source a Marshall Test programme shall be carried out. It will be advantageous to use a crushed rock which is known from past experience to give good results in this test procedure. A grading conforming to the Type 1 Binder Course detailed in Table 16B-1(a) 0/20 of this Specification should be tested (but with 100% passing the 25 mm sieve) and it shall meet the requirements of Table 16B-2 of this Specification.

Having established the suitability of the aggregate source several gradings shall be tested in the laboratory, including that used for the Marshall test, to establish relationships between bitumen content and VIM at refusal density. For each mix, samples will be made up to a range of bitumen contents and compacted to refusal using a gyratory compactor and a vibratory hammer in accordance with the procedure described in BS 598 (Part 104: 1989), with one revision;

It should first be confirmed that compaction on one face of the sample gives the same refusal density as when the same compaction cycle is applied to both faces of the same sample. The procedure which gives the highest density must be used.

From the bitumen content-VIM relationship it will be possible to identify a bitumen content which corresponds to a VIM of 3%. If it is considered that the workability of the mix may be difficult then compaction trials should be undertaken. It is advisable to establish two or more gradings for compaction trials.

The mixes identified for compaction trials should be manufactured to the laboratory design bitumen content and to two other bitumen contents of +0.5% and +1 % additional bitumen. Cares will be cut to determine the density of the compacted material; having completed the core will then be reheated to 145+/- 5°C in the appropriate mould and compacted to refusal in the vibrating hammer test. To be acceptable the cores cut from the compaction trial must have a density equivalent to at least 95 % of refusal density.

The compaction trials will identify a workable mix which can be made to a bitumen content which gives 3% VIM at refusal density.

1605B MIXING AND LAYING ASPHALT CONCRETE

The temperature of the bitumen and aggregates when mixed shall be 110 ± 3oC above the softening point (Ring and Ball) of the bitumen.

Compaction shall commence as soon as the mix can support the roller without undue displacement of material and completed before the temperature of the mix falls below 900C.

The mixing and placing of asphalt concrete must be carried out only under favourable weather conditions. Mixing and placing of asphalt concrete will not be allowed if the moisture content of aggregate affects the uniformity of temperature, of if free water is present on the working surface. Mixing shall not be allowed to take place more than two hours before placing begins unless provision had been made for storing. Storage of mixed materials will only be permitted in insulated hot mix bins. In any case storage will not be permitted for a period longer than 12 hours after mixing, unless otherwise approved by the Engineer.

1606B COMPACTION

Rolling shall be continued until the voids measured in the completed layer are in accordance with the requirement for a minimum mean value of 95 per cent of refusal density (with no value less than 93 per cent).

1607B SEALING OF ASPHALT CONCRETE WEARING COURSE

After the asphalt concrete wearing course has been trafficked and has hardened enough to prevent excessive embedment of chippings into the layer, the wearing course shall be sealed with 10/14 mm chippings on the carriageway and 6/10mm on the shoulders, all in accordance with Section 15 of the Specification. The period of hardening will depend on the traffic level and shall be determined using the surface hardness Probe Penetration Test given in Appendix E of the UK Transport Research Laboratory Overseas Road Note 31. The Contractor will propose and the Engineer will approve a section to be ready for sealing.

SECTION 17 – CONCRETE WORKS

1703 MATERIALS FOR CONCRETE WORKS ON CULVERTS AND BRIDGES

(a) General

This work shall consist of provision, mixing, delivering and placing of the concrete for the construction of box culvert walls and slabs, in accordance with these Specifications and in conformity with the requirements shown on the Drawings.

Concrete class 30/20 shall be used for box culvert walls and slabs.

(b) Cement

Cement shall be Ordinary Portland Cement type and shall conform to the requirements of Kenya Standard "KS 1725 2001 CEM 1 42.5N"

The contractor shall select only one type and brand of cement. Changing of type or brand of cement will not be permitted without a new mix design approved by the Engineer. All cement is subject to the Engineer's approval; however, approval of cement by the Engineer shall not relieve the Contractor of the responsibility to furnish concrete of the specified compressive strength.

Conveyance of cement by jute bags shall not be permitted. Storage in the Contractor's silo or storehouse shall not exceed more than two (2) months, and age of cement after manufacture at mill shall not exceed more than four (4) months. The Contractor shall submit to the Engineer for his approval the result of quality certificate done prepared by the manufacturer.

Whenever it is found out that cement have been stored too long, moist, or caked, the cement shall be rejected and removed from the project.

(c) Fine aggregate

Fine and coarse aggregate must be clean, hard, strong and durable, and free from absorbed chemicals, clay coating, or materials in amounts that could affect hydration, bonding, strength and durability of concrete.

Grading of aggregates shall conform to the following requirements:

Grading of Fine Aggregate

Sieve Size	Percentage by Weight Passing
10 mm	100
5 mm	89-100
2.5 mm	60-100
1.2 mm	30-100
0.6 mm	15- 54
0.3 mm	5- 40
0.15 mm	0 - 15

Other requirements for aggregates are as follows:

Fine Aggregates

Fineness Modulus, AASHTO M-6 : 2.3 – 3.1
Sodium Sulphate Soundness, AASHTO T104 : Max. 10% loss
Content of Friable Particles AASHTO 112 : Max 1% by weight
Sand Equivalent, AASHTO T176 : Min. 75

(d) Coarse Aggregates

Grading of Coarse Aggregates

Size of Coarse Aggregate	Amounts finer than each standard sieve percentage by weight							
	40	30	25	20	15	10	5	2.5
	100	-	-	90-100	-	30-69	0-10	-

Other requirements for aggregates are as follows:

Coarse Aggregate

Abrasion, AASHTO T96 : Max. 40% loss
Soft Fragment and shale, AASHTO M80 : Max. 5% by weight
Thin and elongated Pieces, AASHTO M80 : Max. 15%

(g) Water for concrete and mortar

All sources of water to be used with cement shall be approved by the Engineer. Water shall be free from injurious quantities of oil, alkali, and vegetable matter and salt as determined by the Engineer.

(h) Admixture

Only admixture, which have been tested and approved in the site laboratory through trial mixing for design proportion shall be used.

Before selection of admixture, the Contractor shall submit to the Engineer the specific information or guarantees prepared by the admixture supplier.

The contractor shall not exclude the admixture from concrete proportions.

1704 THE DESIGN OF CONCRETE MIXES

(a) Classes of concrete

Concrete class 30/20 shall be used for culvert walls and slabs. The requirements of Concrete class 30/20 are provided as follows unless otherwise the Engineer will designate any alteration.

Design compressive strength (28 days) : 30N/mm^2
Maximum size of coarse aggregates : 20mm
Maximum water/cement ratio of 45% with slump of 80mm

(b) Design of proposed mixes

The Contractor shall consult with the Engineer as to mix proportions at least thirty (30) days prior to beginning the concrete work. The actual mix proportions of cement, aggregates, water and admixture shall be determined by the Contractor under supervision of the Engineer in the site laboratory.

The Contractor shall prepare the design proportions which has 120% of the strength requirement specified for the designated class of concrete.

No class of concrete shall be prepared or placed until its job-mix proportions have been approved by the Engineer.

1705 MIXING CONCRETE

(i) Batching

Batching shall be done by weight with accuracy of:

Cement	: 0.5 percent
Aggregate	: 0.5 percent
Water and Admixture	: 1 percent.

Equipment should be capable of measuring quantities within these tolerances for the smartest batch regularly used, as well as for larger batches.

The accuracy of batching equipment should be checked every month in the presence of the Engineer and adjusted when necessary.

(ii) Mixing and delivery

Slump of mixed concrete shall be checked and approved at an accuracy of +25mm against designated slump in these specifications.

1708 PLACING OF CONCRETE

(i) Concrete in hot weather

No concrete shall be placed when the ambient air temperature is expected to exceed thirty three degrees celsius (33^0c) during placement operations).

(ii) Concreting at night

No concrete shall be mixed, placed or finished when natural light is insufficient, unless an adequate approved artificial lighting system is operated, such night work is subject to approval by the engineer.

(iii) Placing

In preparation of the placing of concrete, the interior space of forms shall be cleaned and approved by the engineer prior to placing concrete. All temporary members except tie bars to support forms shall be removed entirely from the forms and not buried in the concrete. The use of open and vertical chute shall not be permitted unless otherwise directed by the engineer.

The Contractor shall provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms.

1721 FORMWORK FOR CONCRETE CULVERT CULVERTS AND BRIDGES

This work shall consist of all temporary moulds for forming the concrete for culvert walls and slabs together with all temporary construction required for their support. Unless otherwise directed by the Engineer all formworks shall be removed on completion of the walls and slabs.

Materials:
Forms shall be made of wood or metal and shall conform to the shape, lines and dimensions shown on the Drawings.

All timber shall be free from holes, loose material, knots, cracks, splits and warps or other defects affecting the strength or appearance of the finished structure.

Release Agents – Release agents shall be either neat oils containing a surface activating agent, cream emulsions, or chemical agents to be approved by the Engineer.

1741 MEASUREMENT AND PAYMENT

(a) Item: Concrete
Unit: m^3 of each class

Measurements for the concrete of each class for bridges, box culvert walls and slabs shall be made in cubic metre for the walls and slabs actually constructed, measured from their dimensions shown on the Drawings. The rate for the concrete include for the full compensation for furnishing all materials of the concrete mixing, delivering, placing and curing the concrete, equipment and tools, labour and other incidentals necessary for the completion of the work in accordance with the Drawings and these Specifications and as directed by the Engineer.

SECTION 20 – ROAD FURNITURE

2001 ROAD RESERVE BOUNDARY POSTS

Road reserve boundary posts shall where directed by the Engineer be provided to the dimensions shown in the drawings and in compliance with Standard Specification clause 2001. They shall be placed at a nominal 250m intervals along the boundary of the road reserve on both sides.

2003 EDGE MARKER POSTS, SERVICE DUCTS, BOLLARDS

Edge marker posts and **culvert markers posts** shall be manufactured from recycled plastic to the dimensions shown in the drawings, and painted with one coat of approved primer and two coats of approved gloss paint. They shall be fitted with a red reflector on one side and a white reflector on the opposite side.

Edge marker posts and culvert markers posts shall be erected where directed at the outer edge of the paved shoulder. Culvert markers posts shall be installed in pairs on both sides at the start and end of each culvert headwall and as close to the line of the culvert as physical constraints permit.

Bollards: Where shown on the Drawings or instructed by the Engineer, the Contractor shall construct permanent bollards. The bollards shall be 150mm diameter class 25/20 precast concrete posts as shown on the drawings and shall be erected where directed.

2004 PERMANENT ROAD SIGNS

Permanent Road Signs shall be provided as directed by the Engineer and in compliance with the requirements of the "Manual for Traffic Signs in Kenya" Part II and standard Specification clause 2004.

The road signs shall be manufactured from an approved aluminium composite material comprising two layers of aluminium sheet bonded on either side of a polyethylene core. The retroreflective sheeting shall be high intensity reflective vinyl sheet to ASTM D4956. The signs are to be mounted on recycled plastic square section posts.

2004B EXISTING ROAD SIGNS

Where directed by the Engineer, the Contractor shall take down road signs including all posts, nuts, bolts and fittings, and remove and dispose of the concrete foundation and backfill the post holes. The signs shall cleaned and stored as directed by the Engineer.

Measurement and payment for taking down road signs shall be made on dayworks basis.

2005 ROAD MARKING

Material

Paint for road marking shall be internally reflectorised hot applied thermoplastic material complying with KS 2157-1:2009.

The material shall be of a type approved by the Engineer. The Contractor shall, prior to delivery, submit samples of his proposed thermoplastic material for road marking to the Engineer for approval at least 6 months prior to the proposed use.

The thermoplastic material and marking shall comply with the following requirements;-

(a) Composition

The thermoplastic material shall consist of light coloured aggregate, pigment and extender bound together with resin plasticized with oil as necessary, in the following proportions;

- Aggregate, including glass beads 60%
- Pigment and extender 20%
- Binder 20%

The maximum size of the aggregate shall be 2mm.

The binder shall be plasticized synthetic resin and the material shall be reflectorized by mixing in 20% by mass class A glass beads.

The material shall have a minimum softening point of $85^{O}C$.

(b) Reflectorization

(i) Internal Reflectorization

Reflectorization shall be by glass beads to Australian/New Zealand Standard AS/NZ 2009:2006, which shall be made up of approximately 20% of the total mix, and shall be treated as part of the aggregate. The glass beads shall be reasonably spherical and free from flows and of a size suitable for this method of Reflectorization, subject to a maximum size of 2mm.

(ii) Surface Reflectorization (drop on glass beads)

Surface Reflectorization of the paint shall be by application of ballotini beads to Australian Standard ASE42 as the paint is applied at a spread rate of 0.5 – 0.7 kg of ballotini beads for each kilogram of applied paint.

The ballotini shall be reasonably spherical and free from flaws and of a size suitable for this method of reflectorization, subject to a maximum nominal size of 0.8mm.

(c) Thickness

The thickness of the road marking shall be 4.5mm with a tolerance of ±0.5mm.

(d) Colour

The colours of applied marking shall be bright white or yellow.

The colour of yellow marking material shall be to BS Colour no. 08E51 or BS 4800 and having luminance factor of 49 – 51%.

The colour of white marking s shall be to BS Colour no. 00E55 of BS 4800 and having a luminance factor of not less than 70%.

(e) Skid resistance

The skid resistance of all types of marking materials shall comply with the requirements of BS 7941 – 1:2006 or BS 7941-1:2000 or equivalent.

Application Equipment

The thermoplastic road marking material shall be applied to the pavement in a molten state by mechanical means. The equipment used shall have a pressurized method of application with a computerized mode of selecting spray rate and line width.

The rates inserted in the Bills of Quantities for road marking shall include for prior application of approved tack coat.

Retroreflective delineators (road studs)

Road studs shall be of an approved type conforming to the requirements of BS EN 1463-1:1998 and BS EN 1463-2:2000 to be installed in accordance with the drawings and as instructed. Measurement and payment shall be by the number installed and the rate shall include for the cost of provision and transport of all materials, preparation of the road surface, application of adhesives and full compliance with the manufacturer's instructions.

2006 GUARDRAILS

(a) Materials

(i) Beams for guardrails shall be "Armco Flex beam" or similar galvanised steel W-beams obtained from a manufacturer approved by the Engineer complying with the requirements of AASHTO M180.

(ii) Guardrail posts shall be standard galvanised steel RSJ Post 127X76mm of 1.8m length or approved equivalent tubular hollow section CHS set vertically into the shoulder support as directed by the Engineer.

(iii) Spacers shall be galvanised steel 150x75x5mm sections or tubular hollow section CHS.

2007 KERBS

Precast kerbs and channels shall comply in all respects with the requirements of BS 7263 Part 3. The mean bending strength of kerbs or channels submitted to transverse testing shall not be less than 4.2 MPa and no individual result shall be less than 3.4 MPa.

Vertical Joints: Vertical joints between adjacent kerbs shall not be greater than 5 mm in width and shall be filled with a mortar consisting of 1:3 cement: sand by volume.

2008 KILOMETRE MARKER POSTS

Kilometre marker posts shall be provided as directed by the Engineer and in compliance with Standard Specification clause 2008.

2009 RUMBLE STRIPS, ROAD HUMPS AND RAISED ZEBRA CROSSINGS

Where directed by the Engineer, the Contractor shall provide, place, trim, shape and compact to line and level asphaltic concrete rumble strips on the finished shoulders or road humps and raised flat–top zebra crossing on the carriageway all to the respective dimensions shown on the drawings.

Road humps shall be painted with white thermoplastic paint 45o diagonal stripes as shown on the drawings. Raised flat–top zebra crossing shall be painted with white thermoplastic paint transverse stripes as shown on the drawings.

2011 MEASUREMENT AND PAYMENT

(d) Item: Reflective road studs
Unit: No
Reflective road studs shall be measured by the number instructed. The rate shall include for the cost of provision and transport of all materials, preparation of the road surface, application of adhesives and full compliance with the manufacturer's instructions.

(o) Item: Rumble strips, road humps, raised zebra crossing
Unit: linear m for each type
Rumble strips, road humps, Raised zebra crossing shall be measured by the length of each type installed. The rate shall include for provision, installation and compaction to the satisfaction of the Engineer and removal of surplus material.

(p) Item: Streetlighting Columns and lanterns
Unit: Number
The rate shall include for supply of new streetlighting columns complete with lanterns, all excavation, erection and connection; supply, erection in place of feeder pillars and all fittings and wiring as specified, connection and testing.

(q) Item: Floodlights
Unit: Number
The rate shall include for supply and erection of floodlighting masts complete with lanterns, all excavation, erection and connection; supply, erection in place of feeder pillars and all fittings and wiring as specified, connection and testing.

(r) Item: Cables
Unit: m
The rate shall include for supply of cables of each type for streetlighting and floodlights as instructed; excavation of cable trench of minimum 600mm depth but not exceeding 1.5m along the road sides and 900mm deep across the roads, laying and fixing of the cable and covering with "Hatari" precast concrete tiles and backfilling, connection and testing.

2012 STREELIGHTS AND FLOODLIGHTS

Where directed by the Engineer, the Contractor shall provide all materials and install new street lights and floodlights including trenching for and installation of electrical cables, erection of lighting columns and mounting of street light lanterns, installation of controls and all associated electrical wiring, liaison and payment of fees to the electric power provider, and testing and commissioning of the full system.

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Permits, Certificates or Licenses must be held by all tradesmen for the type of work in which they are involved where such Permits, Certificates or Licenses exist under Government Legislation.

The Contractor shall comply with the Government Electrical Specifications No. 1 and 2 and all requirements of Kenya Power and Lighting Company Limited, IEE wiring regulations and Communications Commission of Kenya (CCK).

Street lighting columns and lanterns

Street lighting columns shall be made from galvanized steel pipe sections conforming to BS 1840:1952. The columns shall be 10 metres street lighting galvanised steel round column 150mm/100mm diameter with side entry single arm of 1.8metres and a tilt of 5.0 degrees, painted with rust proof aluminium paint with a lockable anti-vandalism door 1700mm from ground level. The column base shall be sunk to a minimum of 1000mm into the ground on a 750mm square x 300mm deep class 20/20 concrete foundation, and the pole up to 150mm from the ground level shall be surrounded in 250mm 20/20 concrete.

Street lighting lanterns shall be side entry lanterns for High Pressure Sodium HPS-T lamp with high performance reflector, polycarbonate bowl gear tray with anti-cycling igniter and as Phillips SGS102 K SON – T250W II MR AS ST complete with an approved high pressure sodium lamp of 250Watts rating at 240Volts and a frequency of 50Hz as Nikkon type S419-250 or similar approved. All columns shall be complete with fused cutout type MC 040 SL manufactured by Lucy Oxford or equivalent approved. The lantern is to be secured with anti-vandalism mechanism on to the steel columns.

Wiring system for Street Lighting: Cables shall be 6mm^2 2-core and 4-core laid in a cable trench of minimum 600mm depth but not exceeding 1.5m along the road sides and 900mm deep across the roads and 900mm away from the road kerb or 1,500mm away from the edges of the road. 'Loop-in' and 'Loop-out' arrangement shall be used at every pole. Wiring to the lanterns on each pole shall be with 1.5mm^2 PVC twin insulated and sheathed cable with earth wire shall be laid at least 600mm below the finished road level on a compact bed of murram at least 50mm thick and covered with a concrete surrounded 150mm thick.

High Mast Floodlights

Where instructed, the Contractor shall supply al materials and erect 12m high mast floodlighting structures fabricated from continuous taper polygonal cross-section galvanised steel columns each with a luminaire carriage assembly complete with 4No.400W LED floodlights.

The mast shall be painted with reflective red/white paint to meet the requirements of the Kenya Aviation Authority and Energy Regulation Commission.

Each mast shall be provided with a 1500VA photocell control unit as Thorn Cat No. QPK complete with 80A contactor with 240V AC contactor coil as Telemechanique or equivalent fitted at 3m height on the main mast with a bracket.

The column shall be embedded in a reinforced concrete class 20/20 base of dimensions 1.2x1.2x0.95m deep. An approved 200W obstructive aircraft warning flashing light (aviation light) shall be mounted on top of each mast as Thorn or equivalent with catalogue number TBA

The switching mechanism and electricity supply meter shall be mounted in a lockable anti-vandalism cabinet. Each pole shall be equipped with a 10A Circuit Breakers and 100A mains switch, 400A operating earth circuit breaker with rated an earthing conductor 6mm ECC; and

1500mm long by 15mm diameter copper earth electrode with a driving tip and clamp in a 300mm by 300mm man hole.

Wiring system for Floodlights: Cables shall be 2.5mm^2 six core flexible cable and 10mm^2 two core steel armoured cable.

SECTION 22 – DAYWORKS

2202 MEASUREMENTS AND PAYMENT

(a) Plant

Where items of major plant listed in the schedule of Dayworks are specified by type (e.g. Concrete mixer etc.) the power rating if such items of plant are provided by the Contractor shall not be lower than the power ratings of such plant manufactured within the last two years prior to the date of Tender. Any item of major plant employed upon Dayworks that has a power rating lower or capacity than specified above shall be paid for at rates lower than those in the schedule of Dayworks. The reduction in the rate payable shall be in proportion to the reduction in power rating or capacity below that specified.

SECTION 25A – ENVIRONMENTAL, SOCIAL, HEALTH AND SAFETY

2501A SCOPE

The Contractor should use the services of a suitably qualified environmental, social, health and safety specialist/s to develop and oversee the implementation of an environmental, social, health and safety policy that will apply to the project.

2502A ENVIRONMENTAL, SOCIAL, HEALTH AND SAFETY POLICY

The Policy shall integrate environmental protection, occupational and community health and safety, gender, equality, child protection, vulnerable people (including those with disabilities), sexual harassment, gender-based violence (GBV), sexual exploitation and abuse (SEA), HIV/AIDS awareness and prevention and wide stakeholder engagement in the planning processes, programs, and activities of the parties involved in the execution of the Works. Other issues to be addressed include climate adaptation, land acquisition and resettlement, indigenous people, etc.

The policy should set the frame for monitoring, continuously improving processes and activities and for reporting on the compliance with the policy.

The policy shall include a statement that, for the purpose of the policy and/or code of conduct, the term “child” / “children” means any person(s) under the age of 18 years.

The policy should, as far as possible, be brief but specific and explicit, and measurable, to enable reporting of compliance with the policy in accordance with the Particular Conditions of the Contract Sub-Clause 4.21 and Appendix C to the General Conditions of Contract.

As a minimum, the policy shall set out the commitments to:

1. apply good international industry practice to protect and conserve the natural environment and to minimize unavoidable impacts;
2. provide and maintain a healthy and safe work environment and safe systems of work;
3. protect the health and safety of local communities and users, with particular concern for those who are disabled, elderly, or otherwise vulnerable;
4. ensure that terms of employment and working conditions of all workers engaged in the Works meet the requirements of the ILO labour conventions to which the host country is a signatory;
5. be intolerant of, and enforce disciplinary measures for illegal activities. To be intolerant of, and enforce disciplinary measures for GBV, inhumane treatment, sexual activity with children, and sexual harassment;
6. incorporate a gender perspective and provide an enabling environment where women and men have equal opportunity to participate in, and benefit from, planning and development of the Works;
7. work co-operatively, including with end users of the Works, relevant authorities, contractors and local communities;
8. engage with and listen to affected persons and organizations and be responsive to their concerns, with special regard for vulnerable, disabled, and elderly people;
9. provide an environment that fosters the exchange of information, views, and ideas that is free of any fear of retaliation, and protects whistleblowers;

10. minimize the risk of HIV transmission and to mitigate the effects of HIV/AIDS associated with the execution of the Works;

The policy should be signed by the Contractor's senior manager. This is to signal the intent that it will be applied rigorously.

Minimum Content of ESHS requirements

In preparing detailed specifications for ESHS requirements, the specialists should refer to and consider:

- project reports e.g. ESIA/ESMP
- consent/permit conditions
- required standards including World Bank Group EHS Guidelines
- relevant international conventions or treaties etc., national legal and/or regulatory requirements and standards (where these represent higher standards than the WBG EHS Guidelines)
- relevant international standards e.g. WHO Guidelines for Safe Use of Pesticides
- relevant sector standards
- grievance redress mechanism including types of grievances to be recorded and how to protect confidentiality e.g. of those reporting allegations of GBV/SEA.
- GBV/SEA prevention and management.

The detail specification for ESHS should, to the extent possible, describe the intended outcome rather than the method of working.

The ESHS requirements should be prepared in manner that does not conflict with the relevant General Conditions of Contract and Particular Conditions of Contract, and in particular:

<u>General Conditions of Contract</u>

Sub-clause 1.13	Compliance with Laws
Sub-clause 2.2	Permits, Licenses and Approvals
Sub-clause 4.1	Contractor's General Obligations
Sub-clause 4.4	Subcontractors
Sub-clause 4.8	Safety Procedures
Sub-clause 4.14	Avoidance of Interference
Sub-clause 4.18	Protection of the Environment
Sub-clause 4.23	Contractor's Operations on the Site
Sub-clause 4.24	Fossils
Section 6	Staff and Labour (includes health and safety)
Sub-clause 7.1	Manner of Execution
Sub-clause 11.11	Clearance of Site
Sub-clause 12.3	Evaluation (reference ITB 14.2 "Items against which no rate or price is entered by the Bidder shall be deemed to be covered by the rates for other items in the Bill of Quantities and will not be paid separately by the Employer.")

Minimum Requirements for the Bidder's Code of Conduct

The Contractor shall establish a Code of Conduct that will contain obligations on all Contractor's Personnel (including sub-contractors and day workers) that are suitable to address the following issues, as a minimum. Additional obligations may be added to respond to particular concerns of the region, the location and the project sector or to specific project requirements. The code of conduct shall contain a statement that the term "child" / "children" means any person(s) under the age of 18 years.

The issues to be addressed include:

1. Compliance with applicable laws, rules, and regulations
2. Compliance with applicable health and safety requirements to protect the local community (including vulnerable and disadvantaged groups), the Employer's Personnel, and the Contractor's Personnel (including wearing prescribed personal protective equipment, preventing avoidable accidents and a duty to report conditions or practices that pose a safety hazard or threaten the environment)
3. The use of illegal substances
4. Non-Discrimination in dealing with the local community (including vulnerable and disadvantaged groups), the Employer's Personnel, and the Contractor's Personnel (for example on the basis of family status, ethnicity, race, gender, religion, language, marital status, age, disability (physical and mental), sexual orientation, gender identity, political conviction or social, civic, or health status)
5. Interactions with the local community(ies), members of the local community (ies), and any affected person(s) (for example to convey an attitude of respect, including to their culture and traditions)
6. Sexual harassment (for example to prohibit use of language or behavior, in particular towards women and/or children, that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate)
7. Violence, including sexual and/or gender based violence (for example acts that inflict physical, mental or sexual harm or suffering, threats of such acts, coercion, and deprivation of liberty
8. Exploitation including sexual exploitation and abuse (for example the prohibition of the exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading behavior, exploitative behavior or abuse of power)
9. Protection of children (including prohibitions against sexual activity or abuse, or otherwise unacceptable behavior towards children, limiting interactions with children, and ensuring their safety in project areas)
10. Sanitation requirements (for example, to ensure workers use specified sanitary facilities provided by their employer and not open areas)
11. Avoidance of conflicts of interest (such that benefits, contracts, or employment, or any sort of preferential treatment or favors, are not provided to any person with whom there is a financial, family, or personal connection)
12. Respecting reasonable work instructions (including regarding environmental and social norms)
13. Protection and proper use of property (for example, to prohibit theft, carelessness or waste)
14. Duty to report violations of this Code
15. Non- retaliation against workers who report violations of the Code, if that report is made in good faith.

The Code of Conduct should be written in plain language and signed by each worker to indicate that they have:

- received a copy of the code;
- had the code explained to them;
- acknowledged that adherence to this Code of Conduct is a condition of employment;
- understood that violations of the Code can result in serious consequences, up to and including dismissal, or referral to legal authorities.

A copy of the code shall be displayed in a location easily accessible to the community and project affected people. It shall be provided in languages comprehensible to the local community, Contractor's Personnel, Employer's Personnel, and affected persons.

Timing:
ESHS activities shall commence at the start of the construction period and continue throughout the contract period to ensure a sustained impact.

2503A MEASUREMENTS AND PAYMENT

Item: Environmental, Social, Health and Safety

Unit: Provisional Sum

A Provisional Sum is provided for the delivery of ESHS activities including HIV counselling service, and GBV/SEA awareness and sensitization, plus a percentage for the Contractor's liaison and coordination, overheads and profit associated with the provision and implementation of this campaign.

Payments shall be made in equal monthly instalments spread over the contract period, subject to satisfactory implementation of the ESHS activities and submission of monthly progress report.

SECTION 25B – HIV/AIDS AWARENESS

2501B SCOPE

This specification sets out the Contractor's obligations with regard to on-site HIV/AIDS awareness campaign and preventive measures, which are to be instituted as an integral part of the Contractor's workplan.

2502B HIV/AIDS AWARENESS AND PREVENTION CAMPAIGN

The Contractor will, subject to the Engineer's approval, subcontract the HIV/AIDS awareness and prevention campaign responsibilities to a registered organisation with proven experience in the provision of HIV/AIDS awareness and prevention activities.

The implementing organisation (sub-contractor) will be required to employ and designate a qualified HIV/AIDS expert, who will work closely with the Contractor, the Engineer and other Government and NGO agencies to implement the HIV/AIDS awareness and prevention activities. This will ensure maximum effectiveness and integration with construction activities.

The implementing organisation (sub-contractor) will on behalf of the Contractor institute an HIV/AIDS awareness and prevention campaign amongst the Contractor's workers and local residents along the site of the works for the duration of the contract. Activities for HIV/AIDS awareness and prevention will be broad-based targeting both individuals and groups. They may consist of:

i) AIDS awareness and information posters in all buildings frequented by workers employed on the contract, where such buildings fall under the control of the Contractor (offices, workshops, eating houses, guest houses, vehicles etc.) as well as local market centres and towns.
ii) Availability of socially marketed condoms from an approved manufacturer at the Contractor site offices, workshops, eating houses, and guest houses. The Contractor shall make available at least 500 condoms every month through dispensing machines or other approved method of distribution. The Contractor shall at all times keep the site adequately supplied with condoms.
iii) Peer educators (reference people) drawn from the Contractor's labour force and local area of the works educated in HIV/AIDS issues for discussions with colleagues (estimate 1 per 100 employees).
iv) Small focus group discussions and information covering key issues
v) Theatre groups and video presentations
vi) Promotional events such as sports to encourage openness and discussion of HIV/AIDS issues
vii) Promotional billboards to raise awareness of the integration of construction and HIV/AIDS activities
viii) Availability of promotional material such as t-shirts, caps, umbrellas, bumper stickers, key rings etc.

In addition to the scope and objectives of the HIV/AIDS awareness and prevention campaign, specific, but not exclusive, issues to be addressed by the Contractor are:

a) Scheduling of appropriate timing and duration for the implementation of HIV/AIDS activities as part of the contractor's workplan. The target beneficiary groups should include

labourers, supervisors and local residents of the surrounding area of the road project and construction camps, including patrons of local bars and eateries, and other service providers who interact with the construction worker. Designated rest times such as lunch breaks and pay days should be excluded.

b) Identification of suitable individuals for education from recruitment records for education with the implementing organisation.
c) Provision of suitable sites for communication activities and for condom distribution.
d) Monitoring the implementation of peer educational activities.
e) Provision of necessary support to the implementing organisation.

The implementing organisation (sub-contractor) will on behalf of the Contractor, produce the following reports to be submitted to the Engineer, the Employer, and NACC (National Aids Control Council of Kenya);

- Monthly progress briefs for inclusion in site meetings.
- Quarterly reports detailing activities carried out in the road construction site, including contractual approaches, communication activities, educational tools developed and disseminated, availability of materials, liaison with existing organisations, etc.; issues arising; follow up; etc.
- Final report detailing the methodology and activities carried out under this project including lessons learnt, impact, liaison with the Contractor and other parties, etc.

In addition, a report with the recommended approach will be produced. This will be a synthesis of project activities. It will be developed with all parties involved in the construction activities to ensure the wide range of views and experiences is gained.

The final report highlighting recommended approach for integration of HIV/AIDS awareness and prevention activities in the road construction sector will be presented to the Engineer, the Employer, NACC and other interested organisations including private sector, funding agencies and NGO's.

Timing:
Activities shall commence at the start of the construction period and continue throughout the contract period to ensure a sustained impact. Reporting and dissemination activities shall continue for three months after the project is completed to ensure integration into current practice.

2503B MEASUREMENTS AND PAYMENT

Item: HIV/AIDS Awareness and Prevention Campaign

Unit: Provisional Sum

A Provisional Sum is provided for the provision and implementation of the HIV/AIDS awareness and prevention program as specified by the approved Sub-Contractor on behalf of the Contractor including liaison and coordination, reporting and dissemination activities amongst the Contractor's workers as specified, plus a percentage for the Contractor's liaison and coordination, overheads and profit associated with the provision and implementation of this campaign.

Payments shall be made in equal monthly installments spread over the contract period, subject to satisfactory implementation of the HIV/AIDS awareness and prevention campaign and training and submission of monthly progress reports.

SECTION 26 – ROAD SAFETY ACTIVITIES

2601 SCOPE

This specification sets out the Contractor's obligations with regard to a road safety campaign in order to increase the awareness of the dangers of the road among the Contractor's workers as well as public road users along the project road. This involves Road Safety Awareness Campaign and Training executed by a specialist sub-contractor on behalf of the contractor.

2602 ROAD SAFETY AWARENESS CAMPAIGN AND TRAINING

At the commencement of the works, the Contractor will, subject to the Engineer's approval, subcontract the Road Safety Awareness Campaign activities to a registered organisation with proven experience in the provision of Road Safety awareness and training activities. The Contractor, through the sub-contractor, shall implement a road safety campaign amongst his workers for the duration of the contract.

The sub-contractor will be required to implement the road safety awareness campaign, whose activities may consist of at least the following:-

a) Identify stakeholders affected by the road. These may include drivers and operators of public transport and commercial firms including matatu, bus and commercial vehicles drivers, and boda-boda riders; local institutions such as schools, county/national government officials and the general public in local market centres
b) Carry out baseline study on road safety awareness amongst stakeholders, existing road safety knowledge attitudes and practices
c) Formulate and implement a structured road safety awareness education stakeholders campaign for stakeholder focus groups
d) Training of peer educators recruited from the stakeholder groups
e) Provide and disseminate road safety information, flyers and brochures, display road safety posters at strategic locations including institutions and markets and in all buildings under the control of the Contractor (offices, workshops, eating houses, guest houses, vehicles etc.)
f) Carry out a structured awareness and training campaign for Contractor's staff. Carry out driver refresher courses for all drivers of vehicles and construction plant operators employed by the Contractor, including drivers assigned to the Resident Engineer. Emphasis should be placed on awareness creation and enforcement of road safety precautions including wearing safety belts, observance national speed limits, and use of speed limiting / recording devices, basic first aid skills kits and defensive driving
g) Promotional events such as sports and video presentations to highlight road safety issues. Supply promotional material bearing road safety messages such as t-shirts, caps, umbrellas, bumper stickers, key rings etc.
h) Provision of reflective jackets and/or helmets to boda-boda riders bearing road safety messages
i) Compile monthly and quarterly reports on road safety campaign activities for submission to the Contractor and Resident Engineer.

2603 MEASUREMENT AND PAYMENT

(a) Item: Road Safety Campaign

Unit: Provisional Sum

A Provisional Sum is provided for the provision and implementation of the road safety program as specified by the approved Sub-Contractor on behalf of the Contractor including liaison and coordination, driver training, reporting and dissemination activities amongst the Contractor's workers as specified, plus a percentage for the Contractor's liaison and coordination, overheads and profit associated with the provision and implementation of this campaign.

Payments shall be made in equal monthly installments spread over the contract period, subject to satisfactory implementation of the road safety awareness campaign and training and submission of monthly progress report.

SECTION 27 – FIBRE OPTIC INSTALLATIONS

2701 INTRODUCTION

The Contractor shall be required to make provision for underground optic fiber cable (OFC) to be laid in the future within the road reserve between Samatar and Tarbaj by the Information and Communication Technology Authority (ICT Authority). This will form the main fiber backbone route. In addition to serving many of the major and some minor centers in the vicinity of the new road, it will provide Smart Road Management (SRM) features to the highway and service to the National and County government administration offices and government institutions such as dispensaries, hospitals, citizen service offices (Huduma centers), schools, colleges; security and law enforcement posts, border immigration and customs centers, businesses and industries.

2702 TRENCHING

(a) Scope

Trenches shall be excavated to a uniform depth of 1500mm below ground as directed by the Engineer in consultation with the ICT Authority.

The different trenching and protection procedures and specifications are described in the specifications section of this document.

Trenching will be provided with 2 ducts in the main route (along the road).

River and stream crossings as well as marshy areas will require Gabion Protection in the trench.

Bore Drilling may be required for crossing below the road pavement

Cross culverts will be installed for access fiber to schools and designated towns/market centres

(b) Trenching Equipment

The Contractor must meet the following minimum trenching equipment requirement:

i) A hydraulic excavator will be used in all terrains except over rocky ground.
ii) A trencher must be used in rocky soils due to its ability to trench through hard rock while maintaining clean trenching, floor and walls, and producing fine material for the backfill at the same time.
iii) Padding material in rocky ground (150mm above the bedding and around the cable conduits) should not contain particles of more than 10mm in diameter.
iv) Backfill 300mm above the padding in rocky ground must not contain particles of more than 20mm in diameter.
v) If an excavator is used in trenching a rocky ground, the spoil can consist of large particle rocks that are not appropriate as a backfill, the spoil must be externally removed and crushed to fine particles: 10mm D for padding and anywhere close to 20mm D for the first 300mm backfill, as mentioned above.

(c) Standard Trenching For Normal Soil

Standard/Normal soil is that which is not very loose, sandy or eroded. It refers to normal red, black cotton and brown soil as well as **laterite** sub-rocky soil, often referred to as (murram). The following specifications must be met when trenching in Standard/Normal soil:

Item	Description	Spec
1	Trenching Depth	1500mm
2	Minimum trench width at 1500mm (bottom)	300mm
3	Minimum trench width at 0 depth (Top)	400mm
4	Compacted treated Bedding at bottom of trench	150mm
5	Warning Tape depth	750mm
6	Depth of compacted treated backfill at top of trench	300mm

(d) Special Trenching For Sandy, Loose and Eroded Soil Areas

This is used mainly at dry riverbed crossings or in areas that are susceptible to soil erosion. The following specs must be maintained for trenching along sandy, loose and erosion prone soils.

Item	Description	Spec
1	Trenching Depth	1500mm
2	Trench width at 1500mm (bottom)	300mm
3	Trench width at 0 depth (Top)	400mm
4	Compacted treated Bedding at bottom of trench	150mm
5	Warning Tape depth	750mm
6	Depth of compacted treated backfill at top of trench	450mm
7	Width of compacted treated backfill and erosion protection at top of trench	2400mm

(e) Special Trenching With Gabion Protection

Gabions will be employed mainly at river/laga crossings, where installed optic fibre cables can be damaged by flood waters. Gabions' trenching and construction must meet the following specifications:

i) Gabion mesh-wire should be of minimum 2.8mm galvanized wire with double twist. The Wire should be Hot Deep Galvanized class 1 at 366g/m^2 of zinc coating.
ii) Gabion rockfill shall be natural solid non-porous hard-rock particles of a minimum dimension 100mm and maximum 150mm.
iii) Inside the gabion, the ducts should be GI 50mm OD galvanized steel pipe and must protrude 1m on both ends of the gabion to interface with the regular HDPE duct.
iv) The following are the specifications for Gabion that is covered with a soil erosion protection treatment—soil stabilization over gabion.

Item	Description	Spec
1	Trenching Depth	1500mm

2	Trench width at 1500mm (bottom)	300mm
3	Trench width at 0 depth (Top)	400mm
4	Compacted treated Bedding at bottom of trench	150mm
5	Warning Tape depth	N/A
6	Depth of compacted treated backfill at top of trench	600mm
7	Width of compacted treated backfill and erosion protection on sides of Gabion	1000mm

(f) Soil Stabilization

Where instructed, the contractor will stabilize the insitu soil along the OFC trench in areas where soil erosion is prevalent, as specified below:

i) The contractor shall carry out cement improvement in accordance with section 14 of the Standard Specification for Road and Bridge Construction (Ministry of Transport and Communications, 1986).
ii) The cement to be used shall comply with Kenya Standard KS 1725 2001 CEM 1 42.5
iii) A mechanical ramming machine must be used for compaction.
iv) The soil stabilization will cover an area 2.4m wide (1.2m on either side of the center of the trench) and 600mm deep along the whole length of soil treatment area.
v) In the case of trench bedding the treated soil will be 150mm deep at the bottom of the trench.

(g) Trenching Compaction

The Contractor must ensure that:

i) Manual compaction is performed until the ducts are covered by both a 150mm layer of padding and 300mm of backfill, at which point a vibratory plate compactor can be used.
ii) The compaction of the final backfill layer at river banks and in erosion prone areas, especially where soil stabilization is indicated, shall be done by means of a compaction machine and shall be compacted to a density close to that of the virgin soil parallel to the trench.
iii) After completion of the backfill compaction at a soil stabilization point, a DCP test must be done. This test must be documented.

(h) Bore Drilling

The bores must meet the following conditions and specifications:

i) Bores must be at a depth of 1.5m across spur subsidiary roads and 2m across the main highway from the tarmac level
ii) Bores must exiting at a depth of 1.5m; same level as the trench.
iii) Bores will typically span to lengths of 15m-20m but could span to a maximum of 30m if need be.
iv) The equipment must be able to drill bores spanning to a maximum of up to 30m long:
v) The drilling head must be able to accommodate rock drilling bits: for rocky ground.

vi) After making a bore across the road, two (x2) 102 mm diameter galvanized pipes or two 110mm HDPE plastic pipes (one to act as spare for future use) are to be inserted through the bore.
vii) Bores must be well marked on both ends with marked reinforced concrete pillars.
viii) Conduits inside a bore must be equipped with draw-wires.
ix) The operation pits must be backfilled, unless there is need to install a Hand-hole on the pit location.

2703 CONDUITS/DUCTS

(a) Scope

Cable conduits (ducts) protect OFC Underground cables from external physical and chemical damage and eliminates maintenance costs common to buried cables.

2 no. HDPE conduit ducts 1.75mm shall be laid in the trench along the main fiber backbone route 2m from the edge of road reserve. Where road crossings are instructed, 0.6m diameter pipe culverts shall be installed with invert 1.5m below finished road level.

(b) Conduit/Duct Specifications

HDPE conduits must have the following physical characteristics and technical specifications:

3.3.1 Physical characteristics

Item	Description	Spec
1	Conduit Type	HDPE
2	Outside diameter (mm)	50
3	Inside diameter (mm)	40
4	Standard straight length (m)	n/a
5	Standard length coils (m)	Min 50
6	Min. bending radius (mm) 6m length	n/a
7	Min. bending radius (mm) coils	150

Technical Specifications

Item	Description	Spec	Units	Method
1	Density	0.95	g/cm^3	DIN 53 479
2	Tensile strength at break	23 – 30	N/mm2	DIN 53 455
3	Ball indentation hardness	30 – 65	N/mm2	DIN 53 456
4	Notched bar impact strength	> 5	mJ/mm2	DIN 53 453
5	Thermal conductivity	0.40 – 0.46	W/m K	DIN 52 612
6	Coefficient of elongation	$1.5–2.0 \times 10^{-4}$	K-1	DIN 52 328
7	Dielectric strength	800 – 900	kV/cm	DIN 53 481

8	Specific insulation resistance	10^{16}	Ohm. cm	DIN 53 482

2704 MANHOLES AND HANDHOLES

(a) Scope

1000 x 1000 mm manhole chambers shall be constructed in urban towns such as Wajir and Tarbaj for the project. For the drawing in of cables, making splicing connections; inspection, maintenance, and other OFC cable related services

900mm diameter x 1000mm deep plastic chamber hand-holes are to be located every 5km along the trench to facilitate the splicing of the OFC 48 Core and 96 Core cables at main Joints

600mm diameter x 600mm deep plastic chamber hand-holes are to be located at all entry points as flexible terminal points where the OFC cable enters schools, hospitals, office buildings, telecoms offices, etc. to facilitate the splicing of the OFC 96 Core cable for Drop and Insert of signals at every Access point.

Each Manhole/ Hand-hole installation should be as follows:

i) Hand-holes must be located outside of sidewalks and side-roadways.
ii) Hand-holes must be located a minimum of 2 meters off the edge of pedestrian way, and 3m from the off of the side-roadways
iii) Hand-holes shall not be located in the ditch line or in an erosion-prone location.
iv) All Underground OFC Joint splicing shall be housed inside the 900/1000mm Hand-hole.
v) All Access Point splicing will be housed in the 600/600mm Hand-holes.
vi) The pulling of the cable shall be hand assisted at each Manhole or Hand-hole. Sufficient slack shall be left at each end of the cable to allow proper cable termination and enough spare cable (50 meters at the Joint Hand-hole and 30 meters at the Access Hand-hole) to facilitate repair of damaged OFC sections.
vii) Slack coils must be stored without violating the minimum recommended slack coil diameter; as specified in the cable specs depending on the size. Typically D>=20x Cable OD
viii) The cable shall be marked and labelled at each Manhole and Hand-hole and at all entry and termination points of the fibre optic cables.
ix) The soil around the Hand-hole shall be compacted and stabilized and in line with the provided drawings on the Hand-hole chamber installation.
x) Upon final acceptance of the conduit system, all Manholes and Hand-holes shall be free of debris.

(c) Manhole Specifications

i) Manhole walls will be 200mm thick and made of either stone blocks or cement mortar blocks. The floor will be concreted to 150mm slab. The roof slab will be of reinforced concrete. The inside of the manhole will be plastered using specially approved waterproof cement.
ii) Manholes/Hand-holes shall be covered by a flat watertight lid.
iii) Manhole/Hand-hole lids shall be labeled with the provisioning authority's name—ICTA.

(d) Hand-hole Chamber Specifications

The network will employ two (X2) sizes of Hand-hole chambers: 600mm diameter x 600mm depth and 900mm diameter x 1000mm depth chambers.

The 600mm chambers are used to facilitate the splicing of the OFC 96 Core cable for Drop and Insert of signals at every Access point. They are also used at all Entry points as flexible terminal points as the OFC cable enters schools, hospitals, office buildings, telecoms offices, etc.

The 900mm chambers are to be used mainly to facilitate the splicing of the OFC 48 Core and 96 Core cables at main Joints—every 5km. Spare slack cables, 30m for each of the 48 Core and 96 Core cables are stored inside these chambers.

These two types of chambers are of the following characteristics and specification:

i) Chambers should be cylindrical in shape.
ii) Sizes of the two chambers are: 1) 600mm deep x 600mm D and 2) 1000mm deep and 900mm D.
iii) Cover must be mechanically lockable with special key and fully water and weather proof.
iv) Chamber and cover materials must be of high strength; made of a Glass Reinforced Polymer (GRP) such as Sheet Molded Compound (SMC).
v) The chamber cover should have a load rating of at least 40KN (SANS 558 Medium Duty)
vi) It should have slack management brackets inside the chamber, position to secure the splicing boxes and at least 8 x 50mm split cable entry holes.
vii) The chamber must be equipped with a knock out drain at the bottom.

(e) Hand-hole Installation Specifications

The installation of Hand-hole chambers must meet the following specs:

i) Dimensions of the chamber pit should be minimum depth: 1500mm with coping diameter 1000mm for the 600mm chamber and daylight opening of minimum 350mm diameter round opening cover.
ii) Dimensions of the chamber pit should be minimum depth: 1500mm with coping diameter 1300mm for the 900mm chamber and daylight opening of minimum 650mm diameter round opening cover.
iii) Hand-hole chambers must be installed, using sub-meter GPS mapping equipment, at the location specified in the Contract Documents and as staked by the Engineer or their representative.
iv) The bottom of each Hand-hole chamber pit must be set on a compacted 200mm to 500mm deep aggregate drain bed. The aggregate should be between 20mm-40mm diameter
v) A 15o (Approximately 800-2400mm long x 200-500mm tall, depending on the chamber type) ramp of anti-erosion treated and compacted soil is built from the fibre trench bedding to the chamber cable entry holes.
vi) The Hand-hole chamber pit is backfilled up to 1200mm from the ground level or to the top of the chamber.
vii) An area 1600mm/2000mm in diameter and 300mm/400mm deep is first excavated and then backfilled around and at the top of the 1000mm/1300mm chamber pit with properly compacted and stabilized soil.

viii) The Hand-hole chamber must be covered by a minimum 300mm layer of firm stabilized soil to avoid chamber exposure due to soil erosion and thus avoid eventual vandalism.

(f) Smart Road Management (SRM) Point (For Information purposes)

Smart Pole Unit is a highly integrated, environmental friendly Smart Road Management (SRM) infrastructure that is mounted on a pole at every 10km along the route. Featured with precise environmental weather sensing and monitoring units (temperature, rain, humidity, wind), HD video surveillance, speed detectors, conspicuous outdoor digital signage, versatile public addressing and one-button enabled emergency call. Solar modules, batteries and associated charge controller constitute the sites -48V DC Power Plant. **This Poles will be located next to the road (at the shoulder) for proper operation hence, the fiber ducts must be brought to this point at alternating sides of the road and a hand-hole located next to the pole location.**

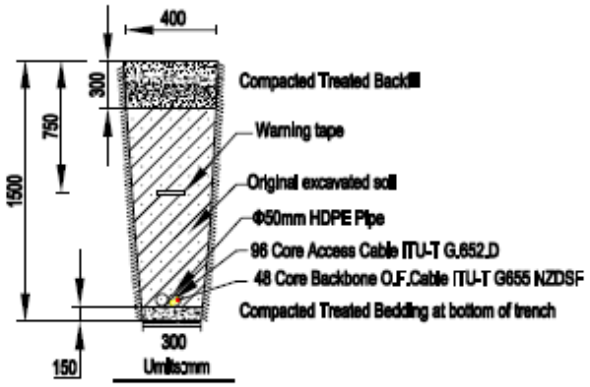
2705 FINAL AS-BUILT REPORTING

i) The As-built drawings and documents shall identify the actual apparatus units at each Core and Aggregation structure and other information such as the structure type and dimensions, cumulative distance to each termination point from the Core structure, and any detail of changes done. These drawings and documents are typically the construction detail sheets that have been corrected to reflect any changes during construction.
ii) The As-built drawing shall record all deviations, removals and additions with respect to the original scope.
iii) Such documentation must contain the following information:
iv) Photos taken of every procedure as proof of existence;
v) Position of the completed trenches
vi) Position and location of installed Gabions and Bores and their lengths
vii) Position of the installed conduits
viii) Position and location of installed Hand-holes
ix) Position and location and span length of installed poles
x) Soil Stabilization accomplished; position and length of stabilized area

2706 DRAWINGS

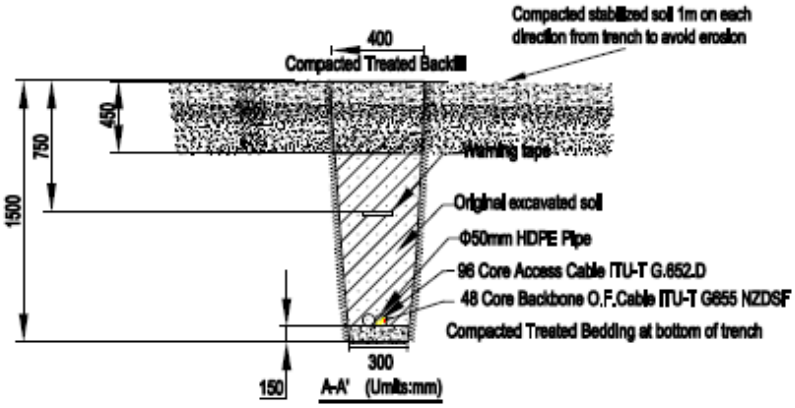
Specification	Project	Signature	Date
Trenching	EARTTDRP		August 2017

STANDARD TRENCHING FOR NORMAL, HARD CLAY AND NON ERODED SOIL



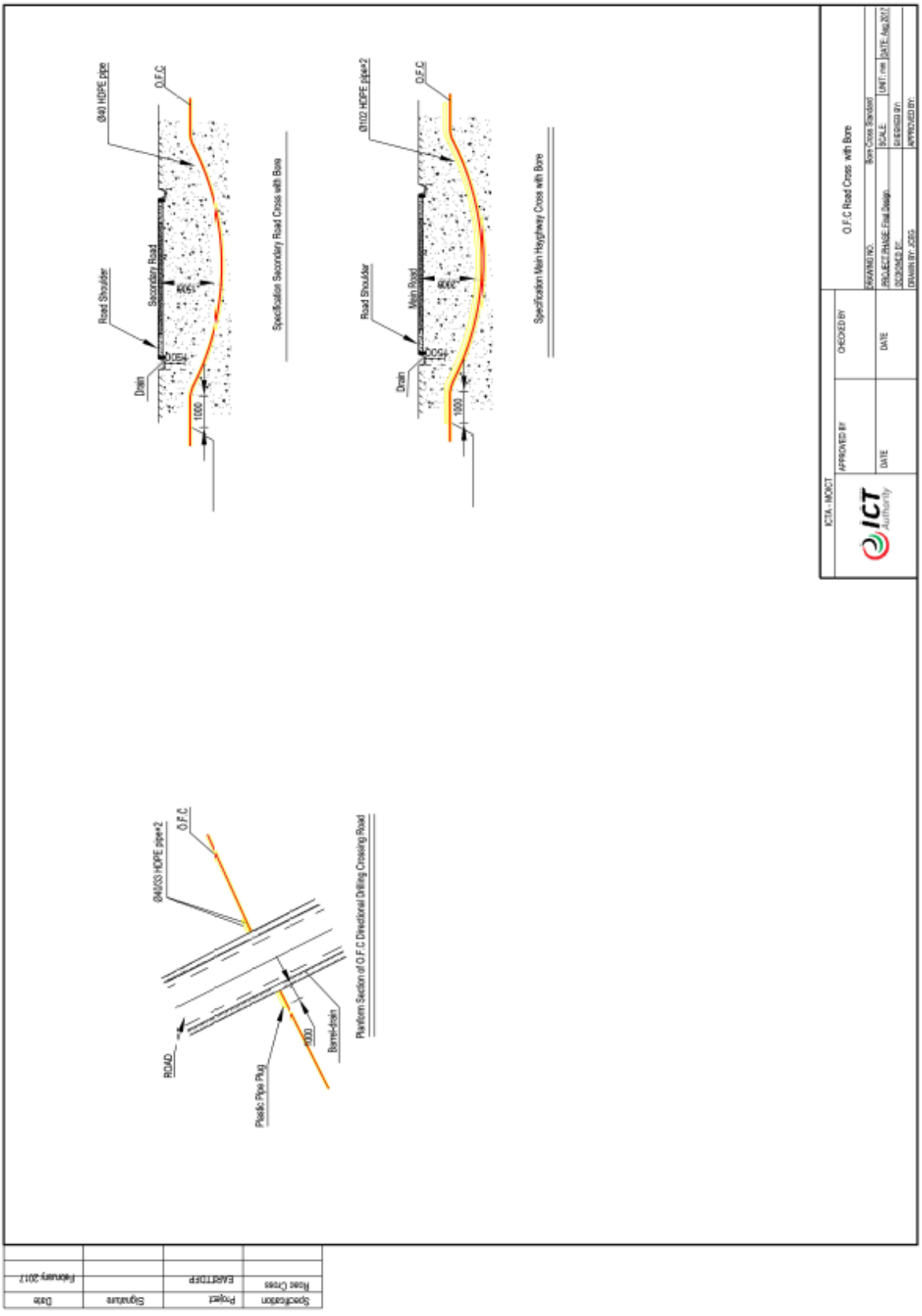
NOTE: Treated Bedding and Backfill is to be done by non-binding soil stabilization. Typically using Consolid

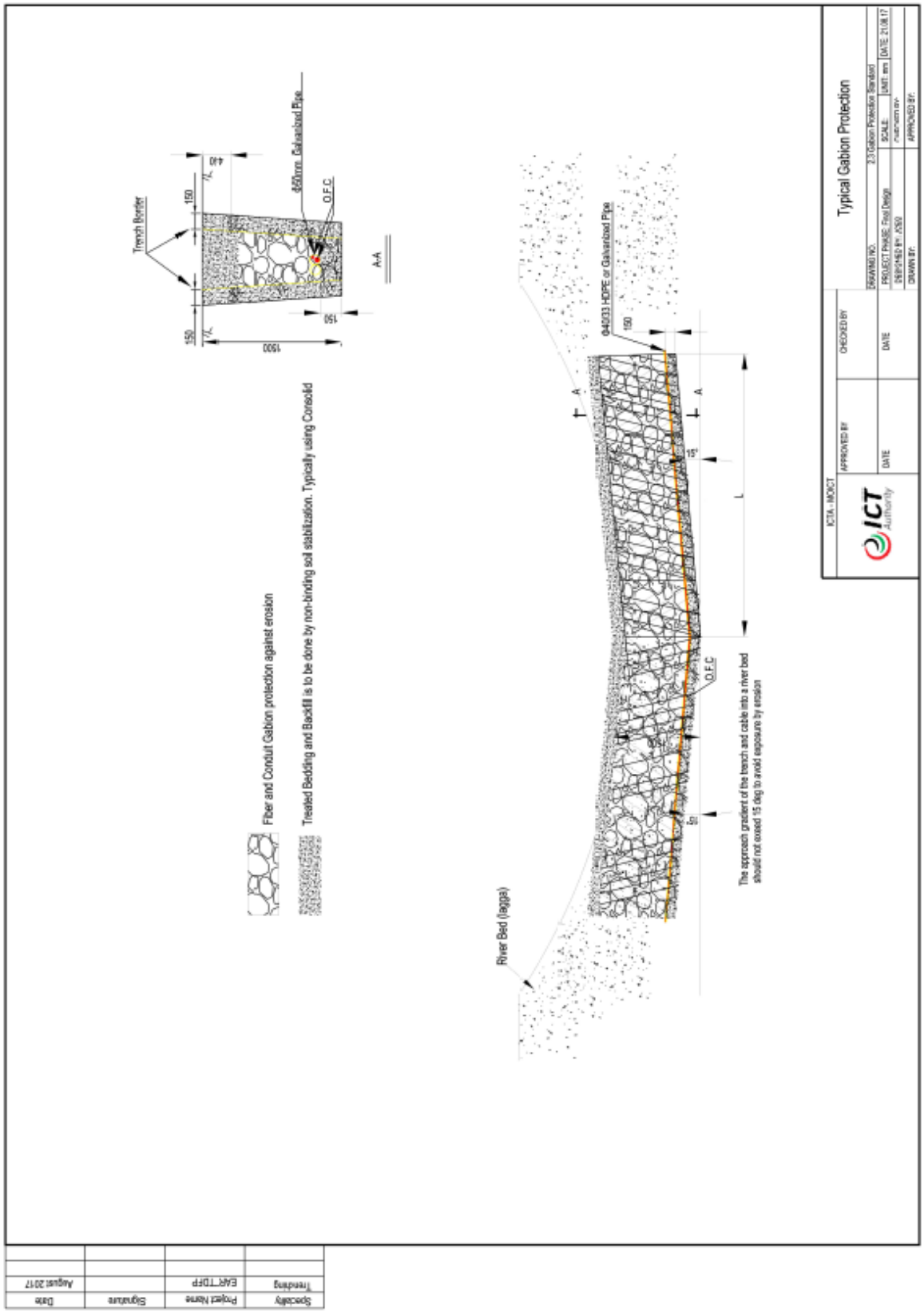
SPECIAL TRENCHING FOR SANDY, LOOSE AND ERODED SOIL



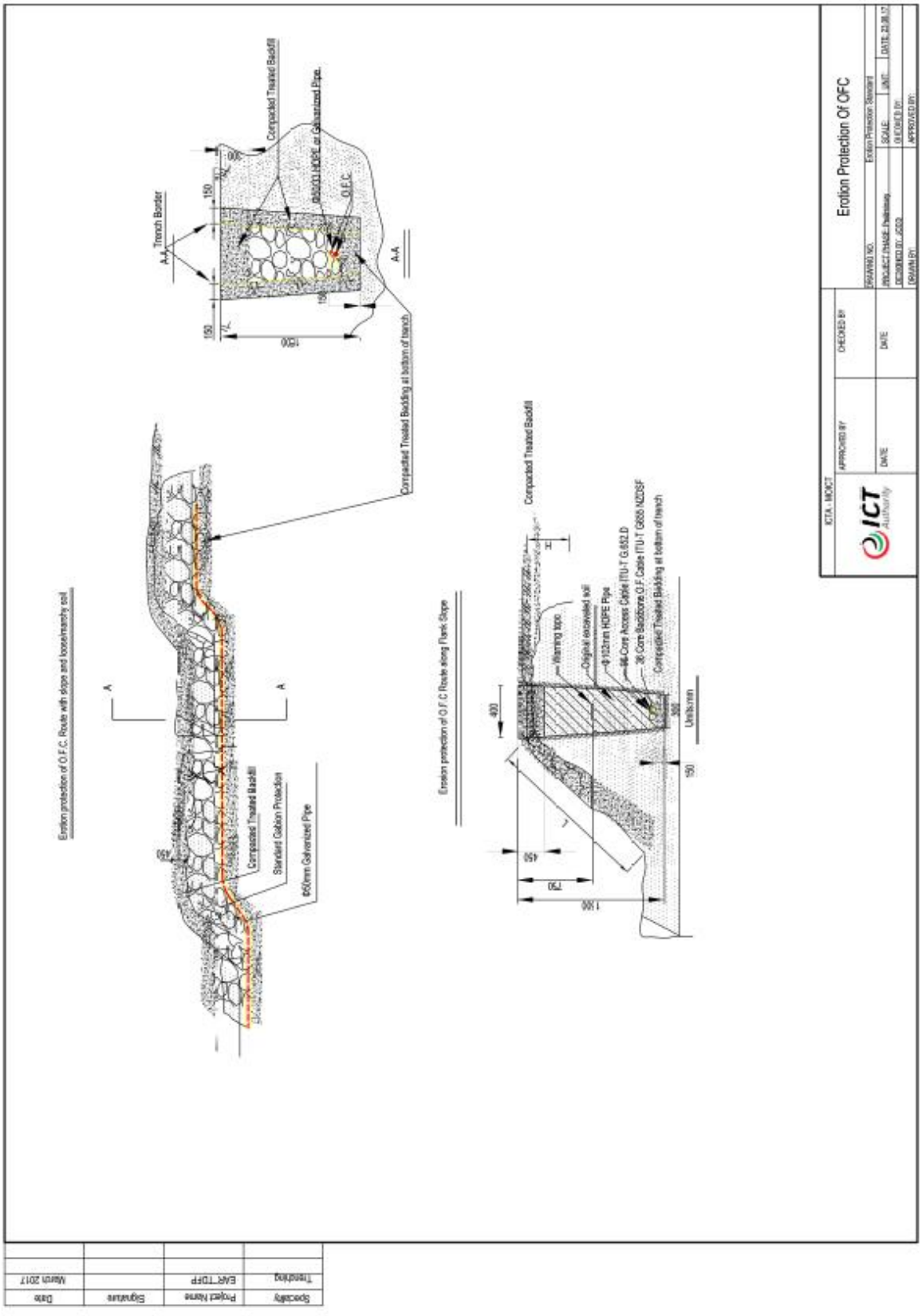
NOTE: Treated Bedding and Backfill is to be done by non-binding soil stabilization. Typically using Consolid

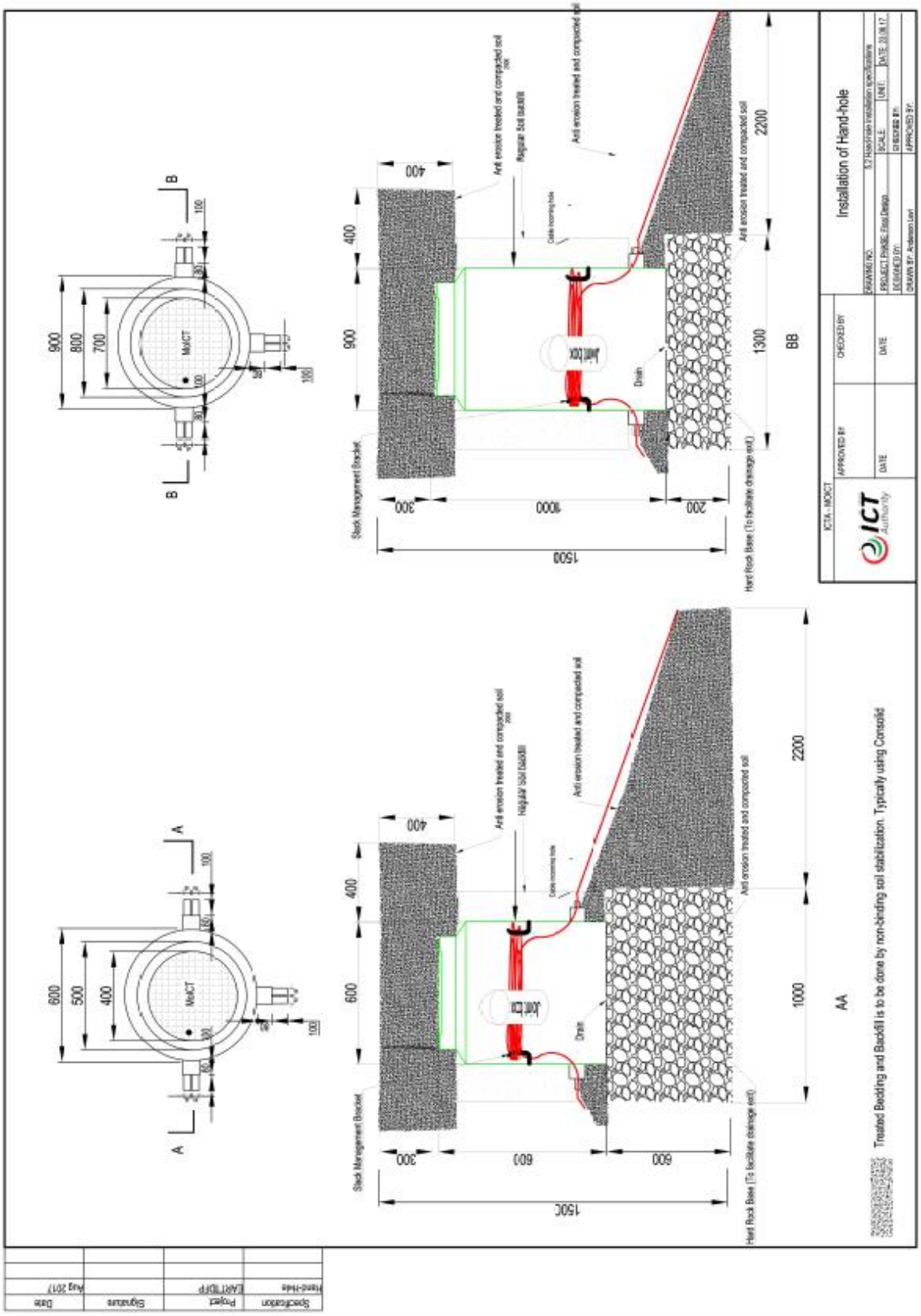
ICTA - MOICT			
ICT Authority	APPROVED BY	CHECKED BY	O.F.C Trench Standard
	DATE	DATE	DRAWING NO. 2.1-2.2 Trenching Standard
			PROJECT PHASE: Final Design / SCALE: / UNIT:mm / DATE: 17.02.13
			DESIGNED BY: JCEG / CHECKED BY:
			DRAWN BY: / PPROVED BY:


Ø40 HDPE pipe
O.F.C
Road Shoulder
Secondary Road
Drain
1000
Specification Secondary Road Cross with Bore
Ø1102 HDPE pipe×2
O.F.C
Road Shoulder
Main Road
Drain
1000
Specification Main Highway Cross with Bore
ICTA - MOICT
ICT Authority
APPROVED BY
DATE
CHECKED BY
DATE
O.F.C Road Cross with Bore
Bore Cross Standard
DRAWING NO.
SCALE:
UNIT: mm
DATE: Aug.2017
PROJECT PHASE: Final Design
DESIGNED BY:
DRAWN BY: JOEG
CHECKED BY:
APPROVED BY:
Specification
Road Cross
Project
EASTTOP
Signature
Date
February 2017
Ø40/33 HDPE pipe×2
O.F.C
ROAD
Plastic Pipe Plug
1000
Barrel-drain
Planform Section of O.F.C Directional Drilling Crossing Road



Specialty	Project Name	Signature	Date
Trenching	EAR_TDFP		August 2017


Erotion Protection Of OFC
Erotion protection of O.F.C. Route with slope and loose/marshy soil
Erotion protection of O.F.C Route along Flank Slope
Compacted Treated Backfill
Standard Gabion Protection
Trench Border
Compacted Treated Backfill
Compacted Treated Backfill
Compacted Treated Backfill
Warning topo
Original excavated soil
Unit:mm
Specialty
Project Name
Signature
Date
Trenching
EAR-TDFP
March 2017


Installation of Hand-hole
Treated Bedding and Backfill is to be done by non-binding soil stabilization. Typically using Consolid
Stack Management Bracket
Hard Rock Base (To facilitate drainage exit)
Anti erosion treated and compacted soil
Regular Soil backfill
Drain
Joint box
MoICT
AA
BB
Specification
Project
Signature
Date
Hand-hole
EARTIDFP
Aug 2017

2707 MEASUREMENT AND PAYMENT FOR OPTIC FIBRE WORKS

(d) Item: Trenching
Unit: m run of trench excavation

(i) Trench excavation in normal soil
(ii) Trench excavation in sandy, loose and eroded soil areas.
(iii) Trench excavation in rock
(iv) Bore Drilling
The rate shall include for the cost of excavation in each material, removal of excavated material to spoil, backfilling with selected material after installation of ducts and compaction all in compliance with these specifications.

(e) Item: Bore Drilling
Unit: m run of bore drilling

The rate shall include for the cost of Bore Drilling in rock and installation of ducts in compliance with these specifications.

(f) Item: Conduits and Ducts
Unit: m of each nominal size and type

The rate for conduits and ducts shall include for the cost of providing, cutting, jointing conduits all in accordance with these specifications.

(g) Item: Manholes
Unit: number of each type of manholes

The rate for conduits and ducts shall include for the cost of providing all materials, excavation, construction and backfilling all in accordance with these specifications.

(h) Item: Hand-hole Chambers
Unit: number of each type of hand-holes of each size and type

(i) Hand-hole chambers: 600mm diameter x 600mm depth
(ii) Hand-hole chambers: 900mm diameter x 1000mm depth
The rate for conduits and ducts shall include for the cost of providing and installing hand-holes of each type including covers, all materials required, excavation and backfilling, all in accordance with these specifications.