

Procurement of	Maubin - Pyapon Road Rehabilitation Project
Bid Documents issued:	12 December 2016
ICB No.:	MP G1
Employer:	Ministry of Construction, Department of Highways
ADB Loan No.	3199 - MYA
Country:	Myanmar
Package	Laboratory and Field Testing Equipment for soil, concrete and asphalt

Addendum 1

Ref	Reference	Subject	Amendment
AD01-1	Section 2 ITB 24.1	Deadline for Bid Submission	The deadline for bid submission is revised to: Date: 7 February 2017 Time: 10 a.m.
AD01-2	Section 5	Eligible Countries	Section 5 is replaced entirely by the attached page. (No change to list of eligible countries, but text "No nationality restrictions apply, other than any restrictions arising from ITB 4.7." is deleted)
AD01-3	Section 6	Schedule of Supply	Section 6 is replaced entirely by the attached pages. (Various revisions of equipment quantities and specifications)

Section 5 - Eligible Countries

Afghanistan	Italy	Samoa
Armenia	Japan	Singapore
Australia	Kazakhstan	Solomon Islands
Austria	Kiribati	Spain
Azerbaijan	Korea, Republic of	Sri Lanka
Bangladesh	Kyrgyz Republic	Sweden
Belgium	Lao PDR	Switzerland
Bhutan	Luxembourg	Taipei, China
Brunei Darussalam	Malaysia	Tajikistan
Cambodia	Maldives	Thailand
Canada	Marshall Islands	The Netherlands
China, People's Republic of	Micronesia, Federated States of	Timor-Leste
Cook Islands	Mongolia	Tonga
Denmark	Myanmar	Turkey
Fiji Islands	Nauru	Turkmenistan
Finland	Nepal	Tuvalu
France	New Zealand	United Kingdom
Georgia	Norway	United States
Germany	Pakistan	Uzbekistan
Hong Kong, China	Palau	Vanuatu
India	Papua New Guinea	Viet Nam
Indonesia	Philippines	
Ireland	Portugal	

Section 6 - Schedule of Supply

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1. List of Goods and Related Services

Lot No. : 1			
Lot Name : Laboratory equipment for Concrete testing			
Item No.	Name of Goods or Related Services	Unit of Measurement	Quantity
Goods			
1.01	Compression Machine 2200kN, motorized loading, servo controlled, digital readout	No.	2
1.02	Flexural Testing Machine, 100kN, 150 x 150 x 600/750 mm, motorized loading, digital readout	No.	1
1.03	Compression Machine Dual frame 2200kN for concrete test + 250kN for mortar test, motorized loading, servo controlled, digital readout	No.	2
1.04	(deleted)		
1.05	Compression Machine Dual frame 2200kN for concrete test + 100kN for flexural load test, motorized loading, servo controlled, digital readout	No.	1
1.06	Load Calibrating Equipment (Digital tester + 2200 or 3000 kN + 50kN load cells)	No.	2
1.07	Vibrating Table for concrete sample preparation	No.	2
Related Services			
1.08	Mobilization of staff to support for installation, calibration, and training. Cost for return travel to the Site	Return trip	1
1.09	Support for installation, calibration, and training – one person for 1 week in Yangon at 5 working days per week Price for remuneration, local transportation, and accommodation (travel days are not paid separately)	Working day	5
1.10	Obligations during warranty period	Sum	Cost to be fixed at 5% of the subtotal of above pay items

Lot No. : 2			
Lot Name : Laboratory equipment for Soil testing			
Item No.	Name of Goods or Related Services	Unit of Measurement	Quantity
Goods			
2.01	Triaxial Apparatus – Digital readout, Automatic pressure control (3 cells) (CU, CD and UU Test), and accessories	No.	2
2.02	Auto Direct Shear Apparatus, digital readout, and accessories	No.	1
2.03	CBR machine motorized, 50kN, dial gauge readout, and accessories	No.	1
2.04	Oedometer (Auto), 3 lever arms, and accessories	No.	1
2.05	Combination Permeability Apparatus (ASTM D 2434)	No.	1
2.06	Compaction permeameter (ASTM D 2434 / EN ISO TS 17892)	No.	1
2.07	Horizontal Sample Ejector with Accessories	No.	1

2.08	Harvard Miniature Compaction Apparatus	No.	1
2.09	Point Load Test (digital readout)	No.	1
2.10	Large Capacity Drying Oven (750 L)	No.	3
2.11	Soil Grinder	No.	2
2.12	Sieve Shaker with Set of Sieves for Soil (9 sieves), electromagnetic	No.	1
2.13	Set of Sieves for soil (9 sieves)	No.	16
2.14	High Speed Stirrer	No.	1
2.15	Motorized Liquid Limit Machine	No.	1
2.16	Plastic Limit Roller	No.	1
2.17	Moisture determination balance	No.	18
2.18	Triple Beam Mechanical Balance (2610g)	No.	16
2.19	Triple Beam Mechanical Balance (311g)	No.	16
2.20	Portable Precision Laboratory Balance (digital,1000g)	No.	1
	Related Services		
2.21	Mobilization of staff to support for installation, calibration, and training. Cost for return travel to the Site	Return trip	1
2.22	Support for installation, calibration, and training – one person for 1 week in Yangon at 5 working days per week Price for remuneration, local transportation, and accommodation (travel days are not paid separately)	Working day	5
2.23	Obligations during warranty period	Sum	Cost to be fixed at 5% of the subtotal of above pay items

Lot No. : 3			
Lot Name : Laboratory equipment for Asphalt testing			
Item No.	Name of Goods or Related Services	Unit of Measurement	Quantity
	Goods		
3.01	Hamburg Wheel Tracking Tester	No.	1
3.02	Sample compactor for Hamburg Wheel Tracking test machine	No.	1
3.03	Marshall Stability Testing machine (50 kN load frame) motorized, gauge readout + related equipment	No.	4
3.04	Marshall Stability Testing machine (50 kN load frame) motorized, digital readout + related equipment	No.	1
3.05	Emulsified asphalt distillation apparatus	No.	2
3.06	Cut-back asphaltic products distillation apparatus	No.	2
3.07	Asphalt Mixer & Accessories	No.	2
3.08	Specific Gravity of Hydraulic Cement - Le Chatelier flask	No.	1
	Related Services		
3.09	Mobilization of staff to support for installation, calibration, and training. Cost for return travel to the Site	Return trip	1
3.10	Support for installation, calibration, and training – one person for 1 week in Yangon at 5 working days per week Price for remuneration, local transportation, and accommodation (travel days are not paid separately)	Working day	5

3.11	Obligations during warranty period	Sum	Cost to be fixed at 5% of the subtotal of above pay items
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Lot No. : 4			
Lot Name : Field test equipment for soil, concrete and pavement			
Item No.	Name of Goods or Related Services	Unit of Measurement	Quantity
Goods			
4.01	Plate Bearing Test, including 3 plate sizes, Y-measuring frame	No.	16
4.02	Dynamic Cone Penetrometer, including auger	No.	2
4.03	Sand Density Cone, including Standard Sand 50kg	No.	16
4.04	Non-nuclear gauge for site soil compaction control, stiffness and young's modulus	No.	2
4.05	Universal Core Drilling Machine, 150mm, (for AC & Concrete), including diamond core bits	No.	4
4.06	Concrete Test Hammer (Digital)	No.	2
Related Services			
4.07	Mobilization of staff to support for installation, calibration, and training. Cost for return travel to the Site	Return trip	1
4.08	Support for installation, calibration, and training – one person for 1 week in Yangon at 5 working days per week Price for remuneration, local transportation, and accommodation (travel days are not paid separately)	Working day	5
4.09	Obligations during warranty period	Sum	Cost to be fixed at 5% of the subtotal of above pay items

2. Delivery and Completion Schedule

The delivery period shall start as of the date of the Notification of Award

Item No.	Description of Goods or Related Services	Delivery Schedule (Duration)	Location	Required Arrival Date of Goods or Completion Date for Related Services
All	As list of goods and related services	24 weeks	Road Research Laboratory, Kamarkyi Road, Thuwanna Township, Yangon	Not applicable

3. Technical Specifications

No	Specification	Bidder's proposal
	General	
1	The equipment is to be used for a national level research laboratory. It must have the highest levels of quality, accuracy, reliability and durability	<i>(no comment required)</i>
2	Equipment must be products of internationally renowned manufacturers, with proven reputation for quality and service	Manufacturer's names:
3	The manufacturer(s) must demonstrate experience of satisfactory provision of equipment for national level institutions globally.	National level laboratories supplied:
4	Proposed equipment should be from a single or small number of manufacturers in order to simplify the Purchaser's future service and maintenance administration.	Number of manufacturers:
5	Bidders may be required to provide samples of instruction manuals (English language) to demonstrate the quality / clarity of the documentation.	<i>(no comment required)</i>
6	Warranty period is for the duration stated in the Particular Conditions of Contract (36 months). During this period, the Supplier shall provide assistance to the Purchaser for calibration of the equipment once a year. Calibration shall in principle be made at the following times a) installation, b) end of year 1, c) end of year 2, and d) end of year 3.	<i>(no comment required)</i>
7	For each item of equipment, the bidder must state manufacturer's name and model number. The model number should correspond to an item in the manufacturer's published catalogue to demonstrate that it is an existing production model.	<i>(no comment required – please enter information in the tables below)</i>
8	For each item of equipment, the bidder must insert details in the tables below of the specifications of the proposed equipment to demonstrate compliance with the required specification. If there are differences in specification, the difference should be highlighted and a justification given.	<i>(no comment required – please enter information in the tables below)</i>
9	These specifications describe the minimum acceptable quality and/or performance level of the equipment to be purchased. Superior alternatives will be considered as compliant to the specifications	<i>(no comment required – please enter information in the tables below)</i>
10	Operating and service manual shall be provided for each equipment. One hard copy, and one electronic copy is requested. Each manual shall contain installation, operation and maintenance procedures, detailed schematics. Each manual shall also contain a complete list of spare parts and recommended spare parts storage levels. The manuals shall give detailed instructions for the use of the delivered equipment with all options.	<i>(not required at bidding stage)</i>
11	During the period of assistance in installation, calibration, and training by the Supplier, the acceptance test shall be initiated. The acceptance test shall consist of checking the equipment for compliance with the Specifications.	

No	Specification	Bidder's proposal
	<p>If the equipment does not meet the Technical Specifications set out in this section, the Supplier will have one opportunity to repair or replace the equipment to cure all defects. The equipment will be returned to the vendor freight collect. The Supplier will have 60 days after the original receiving date or 60 days after being informed of any defect (whichever is later) to deliver acceptable equipment. The Supplier will be responsible for repair of all defects whether or not the purchaser initially declared the defects. After correction of the defects by the Supplier, the acceptance test shall be completed within 60 days after the receipt of the repaired equipment.</p>	
12	<p>If failure of the equipment occurs during the warranty period, and application of routine troubleshooting procedures described in the operating and service manual identifies a malfunctioning component or part, the Supplier shall ship a replacement component or part at no cost, and within 7 days of notification.</p> <p>In the event equipment develops a malfunction during the warranty period which cannot be solved by application of routine troubleshooting procedures described in the operating and service manual or by component or part replacement, the Supplier shall send trained service personnel to repair the equipment at the Purchaser's laboratory. The Purchaser shall have the option of returning the equipment, at Supplier's expense, to the Supplier's repair facility. In either case, the Supplier shall deliver the equipment to the Purchaser within 60 days after the initial date of notification, or provide operational, equivalent equipment within the same 60 day period, for use as a substitute until the original equipment has been repaired.</p> <p>The Supplier shall agree to supply spare parts for the equipment for at least 7 years following the date of acceptance. The Supplier shall agree to ship replacement parts to the Purchaser within 30 days after receiving a parts order.</p> <p>The Supplier shall guarantee all replacements parts to be of equal or superior quality to parts in the original unit.</p> <p>The Supplier shall pay for the shipment of replacement or defective components, parts, or equipment to and from the Supplier's repair station during the applicable warranty period.</p>	<i>(no comment required)</i>
13	<p>Prior to issue of the Letter of Award, the proposed Supplier shall, at the option of the Purchaser, deliver to the Purchaser a working unit for inspection and test. The Supplier shall have 30 days to deliver the unit after written request. The unit delivered for the inspection shall be the same as the bid unit(s) with all specified options. The pre-purchase inspection shall not exceed 30 days. (this only applies to smaller items of equipment)</p>	<i>(no comment required)</i>
14	<p>All equipment must operate with power supply 230V 1 phase 50 Hz</p>	<i>(no comment required)</i>

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	Lot 1: Concrete Testing	
1.01	Compression Machine 2200kN, motorized loading, servo controlled, digital readout	
	<u>Description</u> Testing compressive strength of concrete specimens using destructive method to ASTM C39.	
	<u>Performance</u> <ul style="list-style-type: none"> - Vertical daylight at least 330 mm - Compression platens dia at least 250mm - Capacity: at least 2,200kN - Display divisions: Equal to or less than 0.10 percent of the full scale load - Calibration accuracy: Grade 1.0 (max error less than 1%) above 10% of full range - Automatic servo control for fully automatic test throughout all phases - Max ram travel 50 mm approx. - Hydraulic device to stop the piston's stroke at its max excursion, to avoid pumping the piston out of the cylinder 	
	<u>Components</u> <ul style="list-style-type: none"> - 2,200 kN or 3,000 kN capacity frame - Compression platens and coupling pieces - Distance pieces - Hydraulic pump assembly - Safety guards + any other ancillary items required for performing the specified tests	
1.02	Flexural Testing Machine, 100kN, 150 x 150 x 600/750 mm, motorized loading, gauge readout	
	<u>Description</u> Flexural strength testing of concrete beams to ASTM C78, C293.	
	<u>Performance</u> <ul style="list-style-type: none"> - Capacity 100kN - Max vertical daylight between upper/lower rollers; 160mm - Rollers dimensions: dia. 40 x 160mm - Complete with 4 adjustable and articulated rollers for two-point loading - Distance between lower rollers adjustable from 100 to 455mm - Distance between upper rollers adjustable from 40 to 155mm - Possibility to place in the centre one upper roller for centre point loading - Rollers are hardened, casehardened and rectified - Graduated scales for easy roller adjustment - Gauge diameter 250 mm and div.0.5kN - Max. ram travel 50 mm approx. - Calibration accuracy: grade 1.0 - Hydraulic device to stop the piston's stroke at its max excursion, to avoid pumping the piston out of the cylinder - Mould Size 150 x 150 x 600/750 mm 	
	<u>Components</u>	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	<ul style="list-style-type: none"> - Main Machine - Hydraulic pump assembly - Mould - 2Nos. + any other ancillary items required for performing the specified tests	
1.03	Compression Machine Dual frame 2200kN for concrete test + 250kN for mortar test, motorized loading, servo controlled, digital readout	
	<u>Description</u> Testing compressive strength of concrete specimens using destructive method to ASTM C39, and mortar specimens to ASTM E447.	
	<u>Performance</u> <ul style="list-style-type: none"> - As above 2200kN compression test machine - both frames supplied by single hydraulic pump unit - both frames controlled by single control unit 250kN frame for mortar <ul style="list-style-type: none"> - To test Cubes up to 50mm side - Automatic loading cycle - Accuracy: Grade 1 starting from 1/10 of the scale 	
	<u>Components</u> <ul style="list-style-type: none"> - As above 2200kN compression test machine - 250kN compression test machine for mortar, with digital readout - Compression platens and coupling pieces for 250kN machine - Distance pieces for 250kN machine - Desktop computer, software for compression tests on concrete and mortar + any other ancillary items required for performing the specified tests	
1.04	(deleted)	
1.05	Compression Machine Dual frame 2200kN for concrete test + 100kN for flexural load test, motorized loading, servo controlled, digital readout	
	<u>Description</u> Testing compressive strength of concrete specimens using destructive method to ASTM C39, and flexural strength to ASTM C78, C293.	
	<u>Performance</u> <ul style="list-style-type: none"> - As above 2200kN compression test machine - As above 100kN flexural test machine - both frames supplied by single hydraulic pump unit - both frames controlled by single control unit 	
	<u>Components</u> <ul style="list-style-type: none"> - As above 2200kN compression test machine - As above 100kN flexural test machine - Desktop computer, software for compression tests on concrete and flexural test on concrete + any other ancillary items required for performing the specified tests	
1.06	Load Calibrating Equipment (Digital tester + 2200 or 3000 kN + 50kN load cells)	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	<u>Description</u> Digital tester for calibration, together with load cells for calibration of concrete and soil test equipment, to EN ISO 376 Class 2	
	<u>Performance</u> <ul style="list-style-type: none"> - Digital tester to EN ISO 376 Class 2 - Executes verification cycle following the EN - At the end of the test the unit automatically elaborates the stored value and displays: <ol style="list-style-type: none"> a) Effective Applied Load b) Measured Load (over three verification cycles) c) Average measured Load d) Accuracy in % e) Repeatability f) Relative readability g) Max error - Tester's accuracy ± 0.5 % of the indicated load or better - Load cell linearity / hysteresis $\pm 0.3\%$ of fsd,, repeatability $\pm 0.03\%$ of full scale, Class A or better 	
	<u>Components</u> <ul style="list-style-type: none"> - 1 No. Digital tester - 1 No. Load Cell 2200 or 3000kN to match compression test machine capacity (for concrete test apparatus) - 1 No. Load Cell 50 kN (for soil test apparatus) + any other ancillary items required for performing the specified tests	
1.07	Vibrating Table for concrete sample preparation	
	<u>Description</u> Vibrating machine for preparation of concrete specimens to measure compressive and flexural strength following ASTM C31 and C 192.	
	<u>Performance</u> <ul style="list-style-type: none"> - Cushioned impact vibrating table with load capacity of at least 1000kg - Vibration rate approx. 3600 vpm - Used to vibrate beam forms, cylinder molds, concrete products and soil specimens - Deck 500 mm x 500 mm or equivalent - Robust construction 	
	<u>Components</u> <ul style="list-style-type: none"> - Vibrating table - Clamp accessories 	
	Lot 2: Soil Testing	
2.01	Triaxial Apparatus – Digital readout, Automatic pressure control (3 cells) (CU, CD and UU Test), and accessories	
	<u>Description</u> Determination of shear strength and stress-strain relationships of cylindrical specimens either undisturbed or remolded saturated cohesive soil. Specimens are isotropically consolidated and sheared in compression without drainage at a constant rate of axial deformation (strain controlled). Test method following ASTM D 2850 and ASTM D4767. Automatic data acquisition and	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	processing.	
	<u>Performance</u> <ul style="list-style-type: none"> - Unconsolidated-undrained or consolidated-undrained testing to ASTM D 2850 - Consolidated-undrained testing to ASTM D 4767. - Frame max load capacity 50 kN - Frame vertical clearance at least 900mm horizontal clearance 350 mm - Can test soil specimens up to 50 mm diameter x 100 mm long. - Fully variable speed, 0.0001 to 9.9 mm/min. - Rapid approach, speed at least 20 mm/min - Microprocessor control. 	
2.02	<u>Components</u> <ol style="list-style-type: none"> 1. <u>Data System Triaxial Test Set</u> <ul style="list-style-type: none"> - Data acquisition and processing system - 5 kN submersible load transducer/piston assembly, accuracy 0.1%, non-linearity 0.1% or better - Axial strain transducer, 50 mm travel, independent linearity <0.3% or better - 3 x Pressure transducers - 1000 kPa - Electronic volume change unit 80 cc - Universal pump/pressure controller / indication panel, 1700 kPa capacity - 2 x Bladder type air/water pressure assembly, 1700kPa capacity - Silent air compressor unit, 700 kPa working pressure - De-air water system, at least 20 litre, including vacuum pump - 10 meters x 6 mm dia Nylon tubing - 30 m Nylon Tubing - Stainless Steel Distance Piece - 16-Channel Data Acquisition Capacity - Computer and Laser Printer - UU/CU/CD Effective Stress Triaxial Software 2. <u>50 mm Triaxial Cell Kit</u> <ul style="list-style-type: none"> - 50 mm triaxial cell, 1700 kPa - 50 mm base adaptor - Membrane placing tool, 50 mm - Suction membrane device, 50 mm - Two-way Split Former, 50 mm - Pressure Pad, 50 mm - Rubber membrane, 50 mm Pack of 10 - O-ring, Pack of 10 - Porous Disc, 50 mm. Pack of 2 - Filter Paper Drains, 50 mm. Pack of 50 - Piston Restraint Clamp Assembly 3. As above for 75mm Triaxial Cell Kit 4. As above for 100mm Triaxial Cell Kit <p>+ any other ancillary items required for performing the specified tests</p>	
2.02	Auto Direct Shear Apparatus, digital readout, and accessories	
	<u>Description</u> Testing to ASTM D 3080. Computer controlled, consolidated drained testing of undisturbed or remoulded	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	samples.	
	<u>Performance</u> <ul style="list-style-type: none"> - Can test specimens 60 mm, 100 mm, square or 2.5 inches diameter. - Microprocessor controlled drive system and keyboard entry - Bench mounting - 10:1 lever loading - On-board LED screen display - Rapid approach and return to start datum - Fully variable speed, 0.0001 to 9.9 mm/min - Test specimens up to 100 mm 	
	<u>Components</u> <ul style="list-style-type: none"> - Digital Direct/Residual Shear Apparatus - Load ring - 4.5 kN - Transducer load ring for compression only (4.5 kN) - Vertical dial-gauge 10 mm travel x 0.01 mm div - 10 mm vertical displacement transducer - Horizontal dial-gauge 25 mm travel x 0.01 mm div - 10 mm horizontal displacement transducer - Set of 50kg slotted weights - 0.25 kg, 0.5 kg, 1 kg, 2 kg, 5 kg, 10 kg - Circular shear box - 2.5 inch dia x 1 inch thk. - Square shear box - 60 mm x 60 mm x 25 mm thk. - Porous discs - Specimen cutter for each specimen size - Specimen extrusion tool for each specimen size - Data acquisition / processing system - Analysis / reporting software + any other ancillary items required for performing the specified tests	
2.03	CBR machine motorized, 50kN, dial gauge readout, and accessories	
	<u>Description</u> Motorized, 50kN capacity machine for CBR testing to ASTM D 1883	
	<u>Performance</u> <ul style="list-style-type: none"> - Bench mounted machine with twin column frame - Motorized drive system 1.27 mm/min - Frame maximum clearance at least 800 mm, horizontal clearance at least 200 mm, platen diameter at least 120 mm, platen travel at least 100 mm - Specimen size up to 6 inch dia x 7 inch height - Load capacity 50 kN 	
	<u>Components</u> <ul style="list-style-type: none"> - CBR auto machine load frame - 2 kN load ring with calibration chart - 10 kN load ring with calibration chart - 28 kN load ring with calibration chart - 50 kN load ring with calibration chart - Penetration piston - 3 in2 and 3.7 kg - Penetration swell dial-gauge 25 mm travel x 0.01 mm divisions. - Bracket and adaptor of piston - Dial-gauge holder with magnet + any other ancillary items required for performing the	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	specified tests	
2.04	Oedometer (Auto) 3 lever arms, and accessories	
	<u>Description</u> One-dimensional consolidation test for simultaneous testing of 3 samples. Automatic data acquisition and processing system. Testing to ASTM D2435, ASTM D4546, AASHTO T216.	
	<u>Performance</u> <ul style="list-style-type: none"> - Permit testing to ASTM D2435, D4546 and AASHTO T216 - Simultaneous testing of three samples - Triple beams ratio - 9:1, 10:1, 11:1 - Test load with capacity at least 8,500 kPa - Automatic data acquisition, processing - Computer software for reporting 	
	<u>Components</u> <ul style="list-style-type: none"> - Consolidation frame with 3 lever arms - 3 No. Sets of weights, 100 kg comprising 9x10 kg, 1x 5 kg, 2x2 kg, 1x1 kg. - 1 No. Additional weight set, 60 kg comprising 6x10 kg. - Floor-mounting stand for 3 oedometers - 3 No. Dial gauges - 10 mm travel x 0.002 mm div - 3 No. 10 mm displacement transducers fitted with 5 pin DIN plug - Equipment for calibration - Automatic data acquisition and processing system, and software for reporting - 12 No. brass consolidation cells diameter 50 mm and spares (cutting ring, calibration disc, upper porous disc, lower porous disc) + any other ancillary items required for performing the specified tests	
2.05	Combination Permeability Apparatus (ASTM D 2434)	
	<u>Description</u> A transparent plastic chamber for soil specimens of either fine or coarse grained soils, testing to ASTM D 2434	
	<u>Performance</u> <ul style="list-style-type: none"> - Testing to ASTM D2434 - Cell is seated at the top so that vacuum may be used to saturate the specimen. Porous stones located at the top and bottom of the cell prevent sample flaking or washout. - Constant head tests to maximum head of 550 mm - Falling head tests to maximum head of 1000 mm 	
	<u>Components</u> <ul style="list-style-type: none"> - Constant head cells - 75 mm inside dia transparent plastic with 3 take-off points - Falling head permeability cell - plated seamless tube 100 mm dia x 130 mm height with top plate machined to accept smaller tubes and with base of porous plate with three tie rods. - Specimen size 63.5 mm dia x 63.5 mm length when using lower chamber - Specimen size 63.5 mm diam 140 mm length when using both lower and extension chambers - Transparent plastic chambers, two sections - Top seal - plated steel with gaskets 	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	<ul style="list-style-type: none"> - Base - cast aluminum - Porous stones - 62.7 mm dia x 12.7 mm thk - 550 mm maximum head plastic funnel reservoir (constant head) - Graduated pipette, 100 ml x 0.2 ml x 1000 mm maximum head (falling head) + any other ancillary items required for performing the specified tests	
2.06	Compaction permeameter (ASTM D 2434 / EN ISO TS 17892)	
	<u>Description</u> Permeability of soil specimens is measured by simulation in this apparatus with over-head pressure of water through soil grains (fine or coarse grained).	
	<u>Performance</u> <ul style="list-style-type: none"> - Seamless steel designed for performing either constant head or falling head permeability tests on undisturbed, remolded or compacted soils. 	
	<u>Components</u> <ul style="list-style-type: none"> - 101.6 inside dia x 116.4 mm height mould - Machined seamless steel tubing - Overflow valve on top of mold - Base with inlet/outlet fitting hole - Porous stone - 12.7 mm thickness - Standpipe panel with three glass tubes of 1.5, 3 and 5 mm dia bore, approximate 1.4 meters long (3 ways outlet valves) - De-airing tank with de-airing jet inlet and a flow outlet connection with flexible tubing - Soaking tank with fixed overflow - Set of 3 replacement glass tubes + any other ancillary items required for performing the specified tests	
2.07	Horizontal Sample Ejector, with accessories	
	<u>Description</u> Hydraulically driven horizontal sample ejector for Shelby tubes	
	<u>Performance</u> <ul style="list-style-type: none"> - Ejection of 3" (76.2mm) x 30" (762mm) thin-wall sample tubes (Shelby Tubes). - Hydraulic system accurately controls the horizontal force for smooth ejection - Piston capacity at least 25kN - Hydraulic pump, powered by electric motor - Hydraulic oil reservoir 	
	<u>Components</u> <ul style="list-style-type: none"> - Ejector - Sample Trough, Round Bottom - Conversion Kit for 2" Sample Tube - Conversion Kit for 2-1/2" Sample Tube + any other ancillary items required for function	
2.08	Harvard Miniature Compaction Apparatus	
	<u>Description</u> Used for moisture - density tests using small samples, its compaction action duplicates the kneading action of a sheepsfoot roller.	
	<u>Performance</u> <ul style="list-style-type: none"> - Mould dimensions 1.2625" (33mm) 1D by 2.816" 	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	(71mm) H - compaction tamper with 20lb (9.07kg), 37.5lb (1kg), and 40 lb (18.2kg) springs	
	<u>Components</u> Set includes: - specimen ejector - collar remover with spacer plate - mould holder - mould and collar - tamper	
2.09	Point Load Test (Digital readout)	
	<u>Description</u> Used to determine the strength values of a rock specimen both in the field and in the laboratory	
	<u>Performance</u> - Load frame capacity 50 kN - Load cell / digital readout with at least 50,000 divisions, 0.001 kN resolution, Linearity: 0.05 %, Hysteresis: 0.03 %, Repeatability: 0.02 % or better - Accommodates specimen with height up to 100mm	
	<u>Components</u> - Load frame - Manual hydraulic jack - 2 No. Sets of hardened conical points - Load cell and digital load readout - Carry case, goggles, accessories	
2.10	Large Capacity Drying Oven (750 L)	
	<u>Description</u> For drying large quantities of soils and aggregate samples and maintains temperature in accordance with EN 932-5, BS1377-1	
	<u>Performance</u> - Capacity at least 750 Liters - Forced ventilation - Digital thermostat - Temperature range 40 to 250°C - Temperature fluctuation $\pm 0.4^\circ\text{C}$ or better - Rated power heater elements around 4500 W - Number of Shelf positions: 8 (typical) - Stainless steel chamber and trays - Insulation thickness around 60mm	
	<u>Components</u> - Drying oven - 5 No. Shelves	
2.11	Soil Grinder	
	<u>Description</u> Prepares soil samples to designated particle size for accurate, repeatable test results.	
	<u>Performance</u> - Grinds one-pint sample in 15 seconds or less - Stainless steel construction.	
	<u>Components</u> - Soil grinder - No. 4 perforated, stainless plate - No. 10 perforated, stainless plate - No. 35 perforated, stainless plate	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	<ul style="list-style-type: none"> - 2 mm perforated, stainless plate - Beater Assembly 	
2.12	Sieve Shaker with Set of Sieves for Soil (9 sieves), electromagnetic	
	<u>Description</u> Used to determine the grain size distribution of the coarse fraction of a soil by sieve analysis. Electromagnetic impulses give triple action (vertical, lateral, rotational).	
	<u>Performance</u> <ul style="list-style-type: none"> - Sieve diameter 200 mm (8") - Electromagnetic impulses give triple action (vertical, lateral, rotational). - Digital control panel can adjust vibrating intensity, and the pauses between one vibration and the following one - Sieves, woven wire mesh, stainless steel mesh and frame, label showing mesh size and serial number 	
	<u>Components</u> Shaker Digital control unit Sieves <ul style="list-style-type: none"> - 3/4"(19mm) - 1/2"(12.5mm) - 3/8"(9.5mm) - No(4) 4.75mm - No(8) 2.36mm - No(30) 600 µm - No(50) 300 µm - No(100) 150 µm - No(200) 75 µm 	
2.13	Set of Sieves for Soil (9 sieves)	
	<u>Description</u> Used to determine the grain size distribution of the coarse fraction of a soil by sieve analysis.	
	<u>Performance</u> <ul style="list-style-type: none"> - woven wire mesh, stainless steel mesh and frame, label showing mesh size and serial number 	
	<u>Components</u> One set comprises sieves <ul style="list-style-type: none"> - 3/4"(19mm) - 1/2"(12.5mm) - 3/8"(9.5mm) - No(4) 4.75mm - No(8) 2.36mm - No(30) 600 µm - No(50) 300 µm - No(100) 150 µm - No(200) 75 µm 	
2.14	High Speed Stirrer	
	<u>Description</u> Used for dispersing soil suspensions used in hydrometer method ASTM D422	
	<u>Performance</u> <ul style="list-style-type: none"> - 10,000RPM (no load) - Stirring apparatus with stainless steel paddle - Chrome - plated dispersion cup with 4 sets of permanent interior baffles. 	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	- Rounded cup bottom prevents soil accumulation	
	<u>Components</u> - Stirrer unit - 2 No. stirrers - 2 No. cups - 2 No. anti-splash baffles	
2.15	Motorized Liquid Limit Machine	
	<u>Description</u> Used to determine the liquid limit of a fine grained soil using Casagrande's percussion cup method to ASTM D4318	
	<u>Performance</u> - Testing to ASTM D4318	
	<u>Components</u> - Liquid limit machine - Removable brass cup - 3 No. Grooving tool to ASTM D4318	
2.16	Plastic Limit Roller	
	<u>Description</u> Used to determine the plastic limit of a fine grain soil	
	<u>Performance</u> Testing to ASTM D4318	
	<u>Components</u> - Case - Glass / acrylic plate - Rod - Spatula - Moisture content tins - Porcelain mixing dish	
2.17	Moisture Determination Balance	
	<u>Description</u> Precision digital balance with heater for automatic determination of soil moisture content	
	<u>Performance</u> - Sample size at least 45g - precision digital scale, 0.01g sensitivity or better - Readability moisture 0.01% or better - Infrared lamp heater with adjustable heat control, at least 350W - Built in timer 0 – 60 minutes with auto power off at end of drying cycle - Display of moisture loss percentage and residual mass	
	<u>Components</u> - Balance	
2.18	Triple Beam Mechanical Balance 2610g	
	<u>Description</u> Triple Beam Balance, 0.1 g readability	
	<u>Performance</u> - At least 2500g capacity - 0.1 g readability or better	
	<u>Components</u> - Balance, stainless steel pan, weights	
2.19	Triple Beam Mechanical Balance 311g	
	<u>Description</u> Triple Beam Balance, 0.01 g sensitivity	
	<u>Performance</u>	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	<ul style="list-style-type: none"> - At least 300g capacity - 0.01g sensitivity or better - Vernier - Zero adjustment 	
	<u>Components</u> <ul style="list-style-type: none"> - Balance, stainless steel pan, weights 	
2.20	Portable Precision Laboratory Balance (digital,1000g)	
	<u>Description</u> Used to determine the weight of soil samples	
	<u>Performance</u> <ul style="list-style-type: none"> - Application: <ul style="list-style-type: none"> - Weighing - Percentage weighing - Parts counting - Below balance weighing - Weight accumulation - Readability 0.01g, Repeatability 0.05g, linearity 0.1g or better - Battery powered, auto power off, DC adaptor - Backlit LCD display - Manual internal calibration with built in internal mass - Non-slip adjustable levelling feet - Sealed keyboard - Stainless steel pan - Overload protection - USB interface - US and metric weighing units - Zero Tracking - Capacity tracker 	
	<u>Components</u> <ul style="list-style-type: none"> - Stainless steel pan - Removable draft shield - DC adaptor - ASTM 2 - 1000g calibration weight 	
	Lot 3: Asphalt Testing	
3.01	Hamburg wheel tracking test equipment (EN 12697-22 and AASHTO T324)	
	<u>Description</u> Simulation and testing of wheel track on road pavement following testing standards AASHTO T324 and EN 12697-22. Applies specified load, speed and temperature while the development of the rut profile is monitored at specified intervals during the test. Simultaneous testing of two samples. Computer controlled testing, data acquisition and reporting.	
	<u>Performance</u> <ul style="list-style-type: none"> - Permit testing to both AASHTO-T324 and EN 12697-22 - Simultaneous testing of two samples - Test modes - Wet, Wet heat, Dry and Dry heat - Computer controlled for fully automatic operation, including display of test result on computer screen - Sample size: 280 x 340 mm, 300 x 300 mm - Sample height: 40 – 100 mm - Test load: up to 705 N - Temperature range of water: 30 – 70 °C 	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	<ul style="list-style-type: none"> - Uniformity and accuracy of Temperature $\pm 1^{\circ}\text{C}$ - Measuring range of wheel track: 0 – 20 mm, 0.1 mm accuracy - Robust construction, stainless steel 	
	<p><u>Components</u></p> <ul style="list-style-type: none"> - Main tester (Wheel Tracking Test Apparatus air/water) - Hood for safety and for Temperature control - Rubber wheel dia. 203x 50 mm width for EN: 2 wheels - Steel wheel dia. 203x47 mm width for AASHTO: 2 wheels - Clamps for prepared samples: 2 sets - Clamps for cored samples: 2 sets - Computer and control / analysis software <p>+ any other ancillary items required for performing the specified test</p>	
3.02	Roller compactor for preparing specimens for Hamburg Wheel Tracking Test	
	<p><u>Description</u></p> <p>Roller Compactor for laboratory specimen compaction giving slabs of asphaltic paving materials with properties closely simulating highway condition. Slabs can be compacted to target mixture densities using loads that are equivalent to those of full-scale compaction equipment.</p>	
	<p><u>Performance</u></p> <ul style="list-style-type: none"> - For testing to EN 12697/33 and AASHTO T324 - Rolling force: 0 – 30 kN per 305mm roll width or equivalent - Rolling speed: 10 passes/minute. - Sample dimension: 280 x 340 mm, 300 x 300 mm - Sample height: 40 – 100 mm - Roller compactor mould dimensions should be compatible with wheel-track tester sample dimensions - Automatic control permitting selection of the number of passes and compaction load levels 	
	<p><u>Components</u></p> <ul style="list-style-type: none"> - Main equipment – Quantity: 1 machine - Moulds: Stainless steel 3 No. AASHTO, 3 No. EN - Plastic moulds for double cores 150 mm tested simultaneously to be inserted in Stainless Steel Mould - Mould lining paper – Quantity: 1 roll 	
3.03	Marshall Stability Testing machine (50 kN load frame) Motorized, gauge readout + related equipment	
	<p><u>Description</u></p> <p>Intended for the measurement of the resistance to plastic flow of cylindrical specimens of bituminous paving mixture loaded on the lateral surface.</p>	
	<p><u>Performance</u></p> <ul style="list-style-type: none"> - Permit testing to ASTM D 1559 - Platen rate 50.8mm/min maintained by electric motor - At least 30kN loading capacity - Auto stop at max load 	
	<p><u>Components</u></p> <ul style="list-style-type: none"> - Specimen Mould Assembly: Mould Cylinder 4" 	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	<p>(101.6 mm) in diameter by 3 in (76.2 mm) in height, base plates and extension collars. [3 Nos.]</p> <ul style="list-style-type: none"> - Specimen Extractor: Steel, in the form of a disk with a diameter not less than 3.95 in (100 mm) and ½ in (13 mm) thick - Compaction hammer: a flat, circular tamping face and 10 lb (4536 g) sliding weight with a free fall of 18 in (457.2 mm) - Compaction Pedestal: 8" x 8"x 18" (203.2 x 203.2 x 457.2 mm) wooden post capped with a 12" x 12"x 1" (304 x 304.8 x 25.4 mm) steel plate. - Specimen Mould Holder - Tensile splitting device (ASTM D4123) - Breaking Head - Loading Jack: consist of a screw Jack mounted in a testing frame and shall produce a uniform vertical movement of 2 in (50.8 mm)/min. An electric mortar may be attached to the Jacking mechanism. - Ring Dynamometer Assembly: One ring dynamometer of 5000 lb. (2267 kg) capacity and sensitivity of 10 lb (4.536 kg) up to 1000 lb (453.6 kg) and 25 lb (11.340 kg) between 1000 and 5000 lb (453.6 kg and 2267 kg); micrometre dial div 0.00001 in / 0.0025 mm) - Flowmeter: consist of a guide sleeve and a gauge. Graduation of flowmeter gauge shall be in 0.01 in (0.25 mm) divisions. - Ovens or Hot Plates - Mixing apparatus - Water bath: at least 6in (152.4 mm) deep and thermostatically controlled so as to maintain the bath at 140 ± 1.8F (60 ± 1.0C) - Hand Operated Sample Ejector: To extract asphalt samples from 4" Compaction moulds. - Sieve (ASTM): 8 in (200 mm) diameter [Stainless Frame/Stainless Mesh] - Miscellaneous equipment: Container, Mixing tool, Thermometer 50 to 400F, Balance 2kg, 5 kg, Rubber gloves, Scoop, Spoon <p>+ any other ancillary items required for performing the specified tests</p>	
3.04	Marshall Stability Testing machine (50 kN load frame) motorized, digital readout + related equipment	
	<p><u>Description</u> As Marshall Stability Testing machine (50 kN load frame) Motorized, gauge readout, but with load cell and electronic displacement transducer</p>	
	<p><u>Performance</u></p> <ul style="list-style-type: none"> - As Marshall Stability Testing machine (50 kN load frame) Motorized, gauge readout - Load cell, 50kN capacity, high precision strain transducers - Displacement transducer 50mm stroke, 0.1% linearity or better 	
	<p><u>Components</u></p> <ul style="list-style-type: none"> - As Marshall Stability Testing machine (50 kN load frame) Motorized, gauge readout, but with load 	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	cell and electronic displacement transducer - Software for analysis and reporting	
3.05	Emulsified asphalts distillation apparatus	
	For distillation of emulsified asphalts.	
	<u>Performance</u>	
	- Permit testing to ASTM D 244	
	<u>Components</u>	
	- Aluminium-Alloy Still	
	- Connection Apparatus: 12.5 ± 0.5 mm glass or metal connecting tube	
	- Graduated Cylinder: 100-mL, with graduation intervals of 1.0 mL	
	- Thermometer: to ASTM 7C or 7F (range 2 to 300°C)	
	- Digital balance: Capacity 3500 g, div 0.1 g or better	
	+ any other ancillary items required for performing the specified tests	
3.06	Cut-back asphaltic products distillation apparatus	
	<u>Description</u>	
	Used for the distillation of cut back asphaltic products.	
	<u>Performance</u>	
	- Permit testing to ASTM D 402	
	<u>Components</u>	
	- Distillation Flask, 500-mL side-arm	
	- Condenser, standard glass-jacketed, of nominal jacket length from 200 to 300 mm and overall tube length of 450-610 mm	
	- Adapter, heavy-wall (1-mm) glass	
	- Shield, steel, lined with 3-mm fire proof insulation and fitted with transparent mica windows, used to protect the flask from air currents and to reduce radiation.	
	- Shield and Flask Support: Two 15-cm ² sheets of 16- mesh Chromel wire gauze on a tripod or ring	
	- Heat Source: Electric with thermoregulator.	
	- Receiver: A standard 100-mL graduated cylinder conforming to dimensions of Specification E 133, or a 100-mL Crow receiver	
	- Residue Container: A seamless metal container with slip on cover.	
	- Thermometer: ASTM High Distillation Thermometers having a range from 6 to 400°C (20 to 760°F)	
	+ any other ancillary items required for performing the specified tests	
3.07	Asphalt Mixer and Accessories	
	<u>Description</u>	
	Used for laboratory mixing of bituminous materials to prepare the specimens to be used for asphalt concrete mix design.	
	<u>Performance</u>	
	- Mixer with bowl capacity - 5 litres	
	<u>Components</u>	
	- Bench-mounting mixer (5 litres capacity)	
	- 5 No. Stainless steel bowls	
	- 5 No. Whisks	
	- 5 No. Beaters	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
3.08	Specific Gravity of Hydraulic Cement - Le Chatelier Flask	
	<u>Description</u> Glass flask for determination of specific gravity of hydraulic cement.	
	<u>Performance</u> <ul style="list-style-type: none"> - Permit testing to ASTM C 188 - Capacity 250 ml - Graduated from 0 to 1 ml and from 18 to 24 ml graduation - Accurate to 0.05 ml 	
	<u>Components</u> <ul style="list-style-type: none"> - Le Chatelier Flask 	
Lot 4: Field Testing		
4.01	Plate Bearing Test, including 3 plate sizes, Y-measuring frame	
	<u>Description</u> Used to get the load deformation characteristics for determining the ultimate bearing capacity of foundations.	
	<u>Performance</u> <ul style="list-style-type: none"> - Permit testing to BS-1377, ASTM D 1194, D 1195, D 1196 	
	<u>Components</u> <ul style="list-style-type: none"> - Hydraulic Jack 500 kN capacity, with dial gauge, div 2kN - Pressure System - Aluminium alloy Y-measuring system datum bar - Four dial gauges 50 mm travel (0.01 mm divisions) and supports / clamps - Bearing Plate (305 mm dia x 25 mm minimum thickness with 2 lifting eyes) - Intermediate plate 160mm - 450mm plate - 760mm plate + any other ancillary items required for performing the specified tests	
4.02	Dynamic Cone Penetrometer, including auger	
	<u>Description</u> Portable device for field testing of soil strength / depth profile	
	<u>Performance</u> <ul style="list-style-type: none"> - Testing to ASTM D6951-03 - Portable, lightweight, hand operated - Weight 30kg +/- 5kg (excluding auger) - Galvanised / protected against corrosion 	
	<u>Components</u> <ul style="list-style-type: none"> - Sleeved drive hammer - 60 degree heat treated penetration cone - Drill rod extension rods (at least 3m) - Auger head, handle - Auger extension rods (at least 3m) - Case, wrench, accessories 	
4.03	Sand Density Cone, including Standard Sand 50kg	
	<u>Description</u> Test for insitu field density to ASTM D1536	
	<u>Performance</u> <ul style="list-style-type: none"> - 6.5 inch / 165.1mm diameter 	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	<u>Components</u> <ul style="list-style-type: none"> - Metal double cone assembly with valve - Galvanised / stainless steel base with center hole - Plastic jar 5 liter - 50kg standard sand 300 – 600 micron 	
4.04	Non-nuclear gauge for site soil compaction control, stiffness and young's modulus	
	<u>Description</u> Dynamically measurement of in-place engineering properties using structural layer stiffness, MN/m (klbf/in) and Young's Modulus of a material, MPa (kpsi)	
	<u>Performance</u> <ul style="list-style-type: none"> - Testing to ASTM D6758 - Layer Stiffness 3 to 70 MN/m - Young's Modulus (in-place) 26 to 610 MPa - Measuring Depth 230 to 310 mm - Measuring Duration approx. 75 seconds - Battery powered - Software application for download and storage of test data, printing of data reports 	
	<u>Components</u> <ul style="list-style-type: none"> - Test unit - Software - Connector 	
4.05	Universal Core Drilling Machine, 150mm, (for AC & Concrete), including diamond core bits	
	<u>Description</u> Used for cutting cores up to 150mm diameter from concrete, asphalt and similar hard construction material.	
	<u>Performance</u> <ul style="list-style-type: none"> - Ideal for remote sites - 3 hp engine typical - 180 to 400 rpm variable speed - Water cooled core barrel - weight 75 kg +/-10kg - Petrol motor unit - Facility for rapid return of the drill assembly at completion of drilling. - Feed mechanism can be rotated enabling variable drilling angles. 	
	<u>Components</u> <ul style="list-style-type: none"> - Base unit - Support column - Feed unit - Bullseye spirit level - Motor with water swivel attachment - Base adjustable feet - 3 No. Diamond core bit ID 50mm - 10 No. Diamond core bit ID 100mm - 3 No. Diamond core bit ID 152mm + any other ancillary items required for performing the specified tests	
4.06	Concrete Test Hammer (Digital)	
	<u>Description</u> Determine the average strength of concrete by non-destructive method on horizontal surface or vertical surface.	
	<u>Performance</u>	

Item No	Name of Item and Specifications	Bidder's proposed Manufacturer, Model number and Specifications
	<ul style="list-style-type: none"> - Testing to ASTM C805, ASTM D5873 - Silver Schmidt Hammer, with extended memory capacity or equivalent. - Software for rapid uniformity assessment with summary view; sorting of data; user-defined conversion curves 	
	<u>Components</u> <ul style="list-style-type: none"> - Schmidt hammer - Software - Case 	