



Technical Specifications for General items

Annex III-A-Volume 1

REHABILITATION OF RURAL ROADS In Rukha Kiri District, Battambang Province

Cambodia, September 2022

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General

Preamble

Each work item of the General items (Item I) specified in these Technical Specifications corresponds to the same number in the Bill of Quantities.

Works specified under this contract shall include:

- preparatory and general works, materials and works of any kind necessary for the due and satisfactory rehabilitation, construction, completion and maintenance of the works to the intent and meaning of the Drawings and these Specifications and any further drawings and orders that may be issued by the Project Engineer.
- compliance by the Contractor with all Conditions of Contract, whether specifically mentioned or not in these specifications;
- all materials, apparatus, plant, machinery, tools, fuel, water, strutting, timbering, and tackle of every description, transport, offices, stores, workshops, staff, labour;
- the provision of proper and sufficient protective works, temporary fencing, lighting, and watching required for the safety of the public and the protection of the works and adjoining land;
- the provision and maintenance of first aid equipment and sanitary accommodation for the staff and workers;
- the management and effecting of the payment of wages, salaries, fees, royalties, duties and other charges;
- the clearance of rubbish, reinstatement and clearing up and leaving the site in good condition.

These specifications are written on the basis that the Works shall be constructed using a labour-based (light equipment supported) technology. The Contractor will be expected to maximise the use of labour for all operations where it can be effectively used to attain the required standards.

Provision of Land

The Project Engineer shall coordinate with the local authorities and communities to make available free of charge to the Contractor all land on which the works are to be executed or carried out; all as indicated on the Drawings or as detailed in these specifications. Such land shall include the road reserve, road deviations, borrow pits outside of the road reserve and access roads thereto but shall exclude any land required by the Contractor for his own camps, offices, houses, other temporary works or any other purpose.

Programme of Work

The programme of work required in the scope of the Contract shall be submitted to the Project Engineer not later than 15 days after the issuing to the Contractor of the Notification of Award.

The work programme shall be in the form of a bar chart and shall clearly show the anticipated quantities of work to be performed each month. The contractor should update the programme each month. However, in cases where quantities fall substantially below targets, the parties shall establish in writing an amended work plan, which shall be attached to the Contract.

If the programme is to be revised because of the Contractor falling behind the agreed work programme, he/she shall produce a revised programme showing the modifications to the original programme necessary to ensure completion of the works or any part thereof within the time for completion as defined in the contract. Any proposal to increase the progress of work must be accompanied by positive steps to increase production by providing more labour and plant on site, or by using the available labour and plant in a more efficient manner.

Failure on the part of the Contractor to work according to the work programme or revised schedules shall be sufficient reason for the Project Engineer to take steps as provided for in the Conditions of Contract and shall be construed as not executing the Works in accordance with the Contract.

The approval by the Project Engineer of any work programme shall have no contractual significance other than that the Project Engineer would be satisfied if the work is carried out according to such programme and that the Contractor undertakes to carry out the work in accordance with the programme, nor shall it limit the right of the Project Engineer to instruct the Contractor to vary the programme should circumstances make this necessary. The above shall not be taken to limit the right of the Contractor to claim for damages or extension of the time to which he/she may be fairly entitled to in accordance with the Contract for delay or disruption of work activities.

Should the Project request and the Contractor undertakes to finish the whole or part of the Works ahead of the time originally required by the Contract, payment for accelerating the work shall only be made if agreed to beforehand by the parties in writing and according to the terms of such agreement.

Environment, Safety and Health

The Contractor shall ensure compliance with applicable national requirements and international good practice standards regarding occupational and public health and safety and ensure that the implementation of the Works is consistent with applicable **Occupational Health Standards and Guidelines**.

The Contractor is responsible for the safety of all activities on Site and shall provide all personnel on site with adequate safety protection equipment and clothing as appropriate to the work being performed, as well as instruction on Occupational Health and Safety as part of the induction process for new workers.

Workmanship and Quality Control

The onus rests on the Contractor to perform the works, complying in quality and accuracy of detail with the requirements of the Specifications and Drawings. The Contractor must, at his/her own expense, institute a quality control system and provide experienced and qualified staff, together with all transport, instruments and equipment, to ensure adequate supervision and positive control of the works at all times. The Contractor shall provide assistance and personnel for the Project Engineer to carry out checks on the works.

The costs of all supervision and process control, including testing carried out by the Contractor, shall be deemed to be included in the rates tendered for the related items of work except that the cost of certain tests and the provision of certain items of testing and sampling equipment will be paid for separately as provided for in those sections of the Specifications where this applies.

The Contractor shall submit to the Project Engineer the results of all relevant tests, measurements and levels indicating compliance with the Specifications on completion of every part of the Works and submission thereof to the Project Engineer for examination.

Liaison with Government Officials

The Contractor shall maintain close contact with the police and other responsible local authorities regarding their requirements as to the control of traffic and other matters and shall provide all assistance and facilities, which may be required by such authorities in the execution of their duties.

Maintenance of Traffic

Throughout the duration of the Contract, traffic shall be maintained over a reasonable smooth travelled way which shall be marked in such a manner that any person who has no knowledge of the conditions may safely and with a minimum of inconvenience and discomfort, drive or walk, day or night, along the road under construction - provided that such a section of the road was passable to traffic prior to the Contractor having taken possession of the site.

Unless approval in writing has been obtained from the Project Engineer, no road shall be closed to traffic or public access.

Temporary Works

The Contractor shall allow in his/her rates where appropriate, for provision and maintenance of any temporary works including structures and deviations, and for the provision, erection and maintenance of the road signs for the safe passage of traffic during construction of the road and ancillary works.

Unless provided for separately, the accommodation of traffic shall be included in the general rates except that any detours required and instructed by the Project Engineer shall be paid for under the appropriate items in the Bills of Quantities.

Land Compensation

The Contractor shall not take possession of the site, nor enter any land or commence any operations until such time as he/she receives formal confirmation from the Project Engineer. Should the Contractor enter land or commence any operations without first obtaining a confirmation he/she shall be solely liable for all additional costs and/or legal charges, which might arise there from.

The Project shall be responsible for negotiations with the community in respect of land to be permanently acquired and incorporated in the works within the road reserve, together with all buildings, crops, trees and any other properties so defined from the land.

The Contractor shall be responsible for the payment of compensation for crops, structures and any other costs in respect of land temporarily acquired, including the Contractor's spoil areas outside of the road reserve, work areas outside of the road reserve for camps, offices, temporary works, etc. The Contractor should allow in his rates for making such compensation payments for land temporarily acquired as no separate payment will be made.

The Contractor shall be responsible for payment of compensation in respect of land temporarily acquired, Contractor's spoil areas and working areas, sites for Contractor's accommodation, and land acquired for gravel quarries.

Measurement

(a) Units of measurements

All work shall be measured in accordance with the S.I. System of metric units.

(b) Bill of Quantities

The quantities set out in the Bill of Quantities are estimated quantities and are used for the comparison of Tenders and awarding of the Contract. Only the actual quantities of work completed will be measured for payment, and that the billed quantities may be increased or decreased as provided for in the Conditions of Contract.

(c) Measurement of completed work

The work is measured for payment on the satisfaction-completed basis.

(d) The contractor should allow in his/her rates for compliance with all requirements of this Specification for which separate payment is not made under the Contract.

Payment**(a) Contract rates**

In computing the final Contract price, payments shall be based on actual quantities only of authorised work done in accordance with the Specifications and Drawings. The tendered rates shall apply, subject to the provisions of the Conditions of Contract, irrespective of whether the actual quantities are more or less than the billed quantities.

(b) Prices to be inclusive

The Contractor shall accept the payment provided in the Contract and represented by the prices tendered in the Bill of Quantities, as payment in full for executing and completing the work as specified, for procuring and furnishing all materials, labour, supervision, plant, tools and equipment, for wastage, transport, loading, offloading, handling, maintenance, temporary work, testing, quality control including process control, overheads, profit, risks and other obligations and for all other incidentals necessary for the completion of the works and maintenance during the Construction Period.

This Clause shall be applicable in full to all pay items except as these requirements may be specifically amended in each case.

(c) Meaning of certain phrases in payment clauses.

(i) where any of the words "supply", "procure" or "furnish" (material) are used in the description of a pay item it shall mean the supply and delivery to the point of use of all materials of any kinds required for the work covered by the particular pay items, including all taxes, unless otherwise notified by the Project Engineer purchase costs, claims, damages, royalties and transport costs involved excluding overhaul. In the case of gravel, stone and sand, it shall also include all negotiations with owners concerned, royalties, excavating, producing, preparing, processing, testing, hauling and delivering the material to the point of use; the construction, repair, maintenance and making good after completion of all access roads, and all work required in opening, using and reinstating borrow pits to ensure that soil and water from these do not interfere with the adjacent roads, farmlands or otherwise cause a risk to local communities or more generally and in all respects do not have un-aesthetic appearances, which is not covered by other pay items in the Bill of Quantities.

(ii) "Placing material"

The phrase "placing material" shall mean the off-loading, spreading, blending, processing, watering, mixing, shaping and compacting (where specified) the material in the location of the work as procuring, furnishing, applying and mixing of water; breaking down oversize material, removing such that cannot be broken down, correcting irregular or uneven surfaces or deficient thickness, finishing off to within the specified tolerances, refilling test holes and maintaining the completed work.

(d) Pay items

The descriptions under the pay items in the various sections of the Specifications, indicating the work to be allowed for in the tendered prices for such pay items, are for the guidance of the Contractor and do not necessarily repeat all the details of work and materials required by and described in the Specifications.

These descriptions shall be read in conjunction with the relevant Specifications and Drawings and the Contractor shall, when tendering, allow for his/her prices to be inclusive as specified in Sub-clause (b) above.

Guidance on the measurement method is also provided as follows;

1. Measured Before Construction (MBC)
2. Standard Design Drawings (SDD)
3. Actual Work Done (AWD)

1. Measured Before Construction (MBC)

This is the preferred quantity measurement method under the project and where ever feasible this approach shall be applied. All measurements under this category are based on a detailed Bill of Quantities prepared by the project during detailed survey of the work. In case of any major discrepancies between quantities in the BoQ and Contractor, a third joint-measurement shall be carried out. The Project Engineer and the contractor will then certify that these quantities are final by their signatures on the revised BoQ prior to the Possession of Site by the Contractor.

2. Standard Design Drawings (SDD)

This measurement category applies for all pay items for which standard drawings have been prepared, primarily standardised structure items. The drawings shall be accurate enough to provide the contractor with all key dimensions and quantities so that he/she shall be able to cost an "all inclusive" price per pay item. The location of where a particular structure item shall be needed will be indicated in the Contract.

3. Actual Work Done (AWD)

This measurement category shall only be used for pay items that are difficult to assess accurately in advance of construction. Actual quantities of these pay items shall then be jointly measured by the Project Engineer and the contractor during construction and the measurement sheets be signed by both parties.

Section 1 General Items

1.1 Contractor's Establishment and Site Camp

1. Description

This item is the mobilization and demobilization of equipment, plant and hand tools to and from the site and the establishment of site camp.

2. Details

- **Mobilization and demobilization of equipment, plant and hand tools.**

The Contractor shall mobilize equipment, plant and hand tools listed in the equipment plan to the site of works. In no case shall the Contractor remove from the site, equipment, plant and tools without the written approval of the Project Engineer. The equipment and plant may include rollers, water, dump trucks, concrete mixers and hand tools. Quantity of hand tools may vary depending on the number of workers employed.

After completion of the contract the contractor shall demobilize all equipment, plant and hand tools from the work site to original locations.

- **Establishment of site camp**

The Contractor may establish a site camp for the efficient operation of the contract. This may be done by renting a premise or by constructing a temporary office. These facilities may include: site office for the Contractor's staff, adequate storage for cement, steel bars, bitumen, fuel, tools or other materials, kitchen, toilets and sleeping accommodation if required. The site camp shall include adequate security and operation of the site camp.

The buildings shall be made of locally available durable materials. They must be well ventilated and protected against flooding. Toilets must be private and secure and within 500 metres of all work sites, beyond the camp limits as required.

Offices and warehouses shall be lockable and secure against break-ins. Offices and first aid rooms must have adequate tables and chairs. The buildings should be kept in good condition during the contract. The location of each building will be selected by the contractor in consultation with the Project Engineer and community members before construction starts. In the site camp, the contractor shall make available a room with an office desk and chair for the Project Engineer as his/her site office.

Upon completion of the Contract, and after receiving approval in writing from the Project Engineer, the Contractor shall remove all structures forming part of his/her own camp, yard and workshops including removal of all drains and culverts, back-filling of trenches, filling of pit latrines, etc. and restore the site, as far as practicable, to its original condition and leave it neat and tidy.

- **Site camp facilities**

The Contractor shall also include pricing in the BOQ for the site camp facilities and operation. The site facilities may include but not limited to, a security guard, electricity power, lighting, ventilation, sanitation facilities, fire extinguisher and water supply.

3. Payment

This item is paid in full after all the equipment, plant and hand tools have been mobilized and the site camp has been established and equipped with all the required site camp facilities.

1.2 Insurance

1. Description

This item is to cover injury or death of workers recruited by the contractor and third-party liability for damage to property of - and injury to third parties. The lump sum figure in the BoQ is the maximum available for this activity and fixed by the Project. The amount is reimbursable upon contractor's submission of proof of payment of the insurance policy.

2. Method

- The Contractor shall take workers' compensation and third-party liability insurance before mobilizing the works.
- The insurance should cover injury or death of workers and damage/injury to third parties.
- A copy of the Insurance should be submitted to Project Office for filing.
- The insurance should cover:
 - Personal accident insurance covering all staff and workers for the duration of the contract with a maximum cover of US\$5,000
 - Third-party liability insurance with a maximum cover of US\$5,000

3. Payment

The cost of the insurance will be reimbursed upon receipt of proof that the payment of the insurance premium has been paid in full.

1.3 Safety and Health

1. Description

This item covers the provision of general safety and health measures as well as measures to limit transmission of COVID-19. The lump sum figure in the BoQ is the maximum available for this activity and fixed by the project. However, specific safety measures may be included in other pay items.

2. Details

Safety Measures

- Carry out a safety and health and COVID-19 briefing for all workers before works begin. Make sure work is organized so that each worker has enough space to carry out his or her task without endangering co-workers.
- The Contractor shall keep the work sites in such condition that traffic is accommodated safely and that road users and workers are protected. The Contractor shall place warning signs or cones at each end of the work area. The warning signs should be placed 50-100 m away from the working areas.
- All equipment operators must be trained in the use of their equipment (trucks, rollers, mixers, etc.). Equipment must be in good condition and safety covers for moving parts should be used.
- Deep excavations for foundations etc. shall be clearly marked and fenced off based on the instruction of the Project Engineer in a way that people or traffic do not fall into the excavation. The sides of excavations must be made safe, either by ensuring a sufficient angle of the slope or by shoring up the side walls, so that they do not collapse onto workers.
- Reinforcement bars sticking out where concrete has not yet been poured must be clearly marked to avoid cutting or spearing accidents. The entire such area should be clearly marked and fenced off to make sure no one accidentally steps or falls into uncompleted structure works.
- No children are allowed to enter the work area.

- The contractor shall not allow the use of alcohol or drugs at the work site or in the site camp.
- All workers including equipment operators and supervisory staff shall comply with prevailing COVID-19 regulations.

Drinking water: Drinking water shall be available within 50 meters of all work sites. A minimum of 2 litres should be available per worker per day.

Safety Gear and PPE including for COVID 19: The Contractor is responsible for safety on site and must explain clearly for all workers any potential danger related to each and every work activity and what precautions to take to avoid any accidents on site, including prevailing COVID-19 measures. The Contractor shall provide in sufficient numbers appropriate safety gear and PPE. All workers shall be instructed how and when to use safety gear and PPE for COVID-19 and items shall be replaced when unusable or lost.

The Contractor shall provide safety gear to all workers as listed below:

- Safety jackets in bright colours for supervisors and for all workers if working on a road that has traffic;
- Closed shoes and gloves for all workers for general works. Note that cotton gloves need to be replaced regularly;
- Gum boots and good quality gloves when mixing and placing concrete, working in muddy places or areas with wet soil conditions;
- Hard hats (or helmets) for workers working in places in danger of falling objects, such as in deep drains, in quarries, under bridges, etc.;
- Dust masks when working with activities that produce excessive amounts of dust or bad smell. Note that dust masks must be replaced regularly;
- Safety goggles must be used when breaking rock or crushing stone or anytime there is a risk for eye injury.

PPE for COVID-19 for all workers, equipment operators and site supervisory staff as listed below:

- Surgical face masks: to wear when it is not possible to keep a safe distance between workers.
- Thermometer: to measure temperature of all workers, equipment operators, site supervisors and visitors before allowed to enter the work site.
- Disinfectant: disinfecting all hand tools before handing over to workers and after receiving from the workers. Handwashing facilities are preferred for regularly disinfecting hands.

First Aid: A first aid kit shall be provided on site and shall be regularly checked and restocked, containing the following items:

- Plasters
- Bandages
- Disinfectant
- Antiseptic cream
- Clean water for washing eyes
- Saline water
- Irrigation syringe
- Sterile dressings
- Adhesive tape

- Scissors
- Surgical gloves

3. Measurement and payment

This item is paid as a lump sum amount when all measures described above are in place and available during site inspection.

1.4 Reinstatement of Quarries

1. Description

This item is used to quickly and simply reinstate quarries and other damaged sites, such as those where spoil is dumped. It includes trimming slopes, removing loose material, covering with topsoil, etc.

If the required works are more substantial, other activities in the BoQ (retaining walls, bio-engineering works, etc.) shall be applied. The lump sum figure in the BoQ is the maximum available for this activity.

2. Details

Each item of work will be agreed between the Contractor and the Project Engineer before the work starts.

3. Measurement and payment

Approximate quantities and fixed unit rates for this activity will be agreed between the Contractor and the Project Engineer before each item of work starts. When the work is similar to other activities in the BoQ, those unit rates shall be applied.

The item is paid based on unit rates agreed in advance of the activity and based on measured quantities of completed work.

1.5 Materials Testing

1. Description

This item includes the testing of material in a laboratory such as gravel for surfacing, compressive strength test for concrete for major structures and gradation test for aggregate and sand to be used for major structures.

2. Details

- **Test for gravel:** This activity is the testing of gravel before selection of a gravel quarry. The contractor with the agreement of Project Engineer shall identify a gravel quarry and take samples of gravel of about 50 kg for the testing in a laboratory. The test should include: gradation test, plasticity test, Proctor test and CBR test. The result of the tests shall be submitted to the Project Engineer before deciding whether or not to use the quarry.
- **Testing for concrete (compressive strength test):** This activity is the testing for concrete strength for major structures such as bridges and large box culverts. The Contractor with the agreement of Project Engineer shall fill a minimum of 3 moulds (cube or cylinder) during mixing the concrete and curing for 7 days, then send the moulds for compressive strength test. The result of the tests shall be submitted to the Project Engineer.
- **Gradation test for aggregate or sand.** This activity is the gradation test in a laboratory for aggregate or sand to use for concrete work or in a road pavement. When requested by the Project Engineer the contractor shall send a sample of aggregate or sand for the test. The result of the test shall be submitted to the Project Engineer before deciding whether or not to use the quarry.

3. Measurement and payment

The payment for this item shall be deemed to be included by the contractor in his/her unit rates for the various items related to the testing work and shall not be paid for separately.

16 Project Sign Board

1. DESCRIPTION

This item involves the supply and construction of a durable project signboard to present information on the contract, funding and contractor to passing road users.

The Project Engineer will provide the contractor with the final template. The Contractor shall follow the attached visibility plans and submit all documents for approval before execution. The Contractor shall not change, add, distort or edit the template without approval. The size, height and letters of the sign board as shown in the design drawing in [Annex III-D](#).

3 MATERIALS

- **Concrete Bases** (for sign boards). Sign base dimensions shall be as shown on detailed drawings. Concrete shall be in accordance with the requirements of the Specification using 2.5cm maximum aggregate size. The quality shall be that of reinforced concrete.
- **Bolts:** Bolts, nuts and washers shall be of stainless steel, conforming to ASTM A-276 chroming-nickel grade with a minimum yield strength of 2400 kg/sq.cm.
- **Posts for project signboard:** Posts shall be galvanized pipes with dimensions and thicknesses as shown and detailed on the Drawings. The top of posts shall be closed or capped with a PVC cap.

- **Signboard**

Sign plates shall be constructed from one or more of the following materials:

- Galvanized sheet steel or strip of minimum thickness 1.5 mm for road signs. The weight of the galvanized zinc-coating shall be a minimum of 350 grams per square meter.
- Sheet aluminium and sheet aluminium alloy of minimum thickness 3.0 mm for unstiffened signs or 2.5 mm for bent-edged stiffened signs.
- Sign plates shall be non-porous, smooth, flat, rigid, weather-proof and shall not rust or deteriorate. They shall be so cut that there are no sharp edges and that the corners are rounded.

- **Sign film**

- The material for the film may be acrylic, pvc, or aluminium composite recommended for permanent outdoor use, and the lamination should be conducted by heating to ensure adhesion (no bubbles). The film shall then be processed onto the plate.
- Prior to the application of the film, the sign plate shall be cleaned and wax free.
- The sign film after application to the sign plate shall not come off the edges nor shall it peel off nor warp. The surface shall be smooth, flat and free from any bubbles, pimples, edge chipping or edge shattering. It shall be washable and weatherproof.
- The sign film shall have a life of 5 years after application to the face of the sign.
- The back face of the sign plate shall be painted with medium grey colour.

4 METHOD

Erection of Signs

- The project sign board shall be installed at locations and in accordance with details shown on the drawings and in accordance with the approved samples and materials.
- Sign plates shall be attached to the posts with stiffeners, bolts, and screws which shall be painted in the same colour as the corresponding area of the sign plate.
- The exact location of the sign shall be designated by the Project Engineer.
- Holes for posts shall be provided to a depth, which will permit the installation of the post and the base to the depth indicated on the Drawings or required by the Project Engineer. All loose material shall be removed from excavation and bearing surface of footings and excavation shall be cleaned and cut to a first surface prior to the placement of concrete base. Approved backfill material shall be used.

5. SAFETY ON SITE

- Safety gear and PPE for COVID-19 measures, refer to Item 1.3.

6. CHECKING

- Ensure that signs are located as shown on the plans. These are tentative locations subject to field adjustments by the Project Engineer. No sign shall be erected prior to the Project Engineer's final approval of the location.
- If the signboard and structure deteriorate during the contract period or is removed, it must be replaced.

7. MEASUREMENT AND PAYMENT (AWD)

This item is paid by the number of completed road signs installed. The unit rate includes the cost of the sign plate, galvanized steel post, concrete base, lettering, as shown in the design drawing in [Annex III-E](#).

Payment: The unit rate shall be the full compensation for labour, tools, materials and any other incidentals that may be required in carrying out the work for this item.

17 Surveying and Setting Out

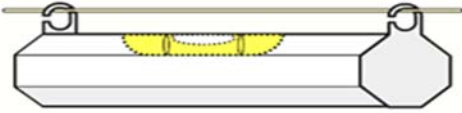

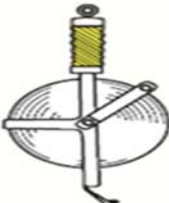
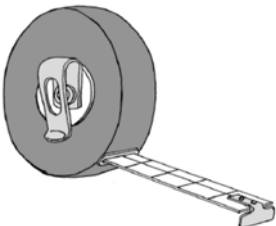
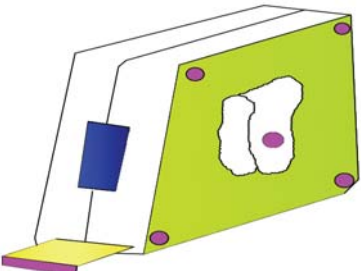

1. Description




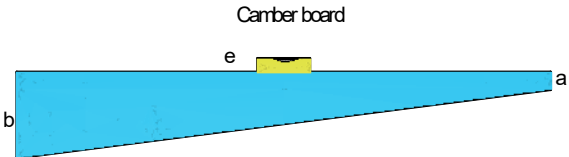
This item is paid for the services to be provided by the surveying engineer for setting out the locations, alignment, resection, and elevations for all road components as well as structural works to be carried out by the contractor. This provision sum is fixed and shall cover for the completion of the works. The Project Engineer will monitor the work and provide necessary instruction.

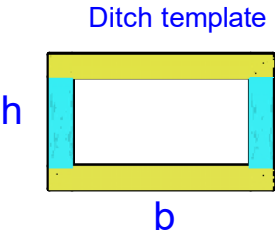
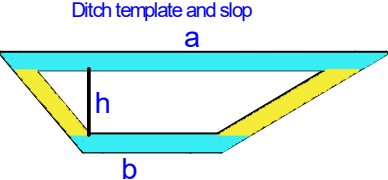
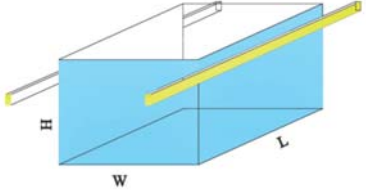

2. Payment

The payment for this item shall be deemed to be included by the contractor in his unit rates for the various items related to the surveying work and shall not be paid for separately.

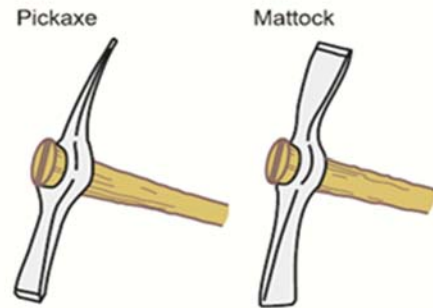
Section 2 Hand Tools

Description	Setting out tools
<p>A line level together with a nylon string is used to transfer the exact level of one location to another point. The line level is a short spirit level (about 100mm long) with a hook at each end to hang it from a smooth nylon string. This instrument needs two persons to operate – one at the end of the line, and the second to watch the spirit level.</p>	
<p>Water-tube level: is used to transfer the exact level of one point to another point. The water tube level is a transparent plastic tube (diameter 10 mm) filled with water. The length of the water tube level varies depending on the distance between the two objects/locations where the level is to be transferred. This instrument needs two persons to operate – one at each end of the water tube.</p>	
<p>Measuring tapes: The most common length of tape measures used for setting out are: Long tape 30-50m and short tape 3-5m.</p> <p>Measuring tapes are made of steel, plastic or linen. The long tape is used for measuring long distance especially for measuring longitudinal alignments while short tapes are used for measuring smaller dimensions and setting out levels.</p> <p>The numbers/marking on the tape becomes unreadable after a period of use. It is Important to keep the tape clean from dirt and dust.</p> <p>Note: The zero point is not always located at the same place on different tape measures.</p>	 
	
<p>String line is used with pegs for setting out activities and quality control for road and drainage works. The string line is commonly made of nylon with a diameter of 3-4 mm.</p>	

<p>Hammer: There are different sizes and weights of hammers that are used for different purposes. A big hammer is made of solid steel usually with a wooden handle. The weight of the hammer is between 3-5 kg, fixed with a wooden handle of length between 50-70cm depending on the weight of the hammer. Big hammers are commonly used for breaking stone.</p> <p>Small hammers are also made of solid steel with a wooden handle. The weight of the hammer is between 1-3 kgs. The length of the wooden handle is between 30-40cm depending on weight of the hammer. Small hammers are commonly used for carpentry works as well as hammering pegs and metal spikes for setting out.</p>	 <p>Club Hammer</p>
<p>Pegs are locally made and used for setting out. They are made from bamboo or wood. Their length is usually within 30 cm to 50 cm. The pegs should have a diameter between 3-5 and have one pointed end. When setting out in hard soils, a metal peg can be used to create a hole in which wooden pegs can easily be placed.</p>	
<p>Metal spike/pointed chisel: This tool is used with a hammer to make a hole before placing the ranging rods or pegs in the ground, when the setting out is carried out in hard and compact soils.</p> <p>Metal spikes are usually manufactured either as round or octagonal section rods. For setting out works, the diameter should be minimum 20mm. The length is required to be within 30 cm to 40 cm. The spike is made of carbon steel and should have one pointed end.</p>	 <p>Metal Spike</p>
<p>Camber boards can be used for checking a road camber. The camber board consists of a timber plank of trapezium shape. The longer side of the plank is designed to cover the half width of the road carriageway. The thickness of the plank is between 2-3 cm. The dimensions of <i>a</i>, <i>b</i> and <i>e</i> as shown in the right-hand side figure depend on the design width of the road and the cross slope of the camber:</p> <p><i>Example: If the road width is 4 m with a 10% camber, then with $a=5\text{cm}$, $e=200\text{cm}$ and $b=5+200/10=25\text{cm}$.</i></p> <p>A spirit level is placed at the middle of the plank as shown in the figure to ensure that the top side of the plank is horizontal when checking the camber.</p>	 <p>Camber board</p>

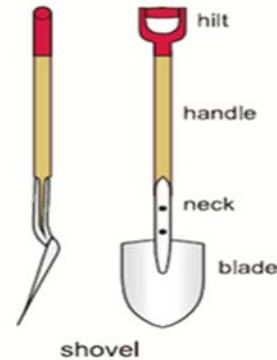
<p>Ditch templates are used to secure the correct dimensions of road side drains. A rectangular template is used before cutting the slope of the side drain.</p> <p>This ditch template is made of timber frame of rectangular shape. The width of the timber frame between 5-7 cm and thickness 2-3 cm.</p> <p>The size of the template depends on side drain dimensions. A common size of the ditch template is $b=50-60\text{ cm}$ and $h=30-50\text{ cm}$.</p>	<p style="text-align: center;">Ditch template</p> 
<p>Side drain templates are used for checking the complete side drains of a road. The side drain template is made of timber frame of trapezium shape. The width of the timber frame is usually between 5-7 cm and thickness 2-3 cm.</p> <p>The size of the template is commonly: $b=50-60\text{ cm}$ and $h=30-50\text{ cm}$ and $a=140-150\text{ cm}$</p>	<p style="text-align: center;">Ditch template and slop</p> 
<p>Gauge boxes are used to batch, or measure volumes of materials, to control the mix proportions of concrete. The size of the gauge box should be calculated based on the quantity of 1 bag of cement.</p> <p>The gauge box must be filled level with the top so that the volume of the sand and stone measured out is equal to the volume of a bag of cement. The sand and stone in the gauge box must not be compacted when filled up.</p> <p>For 1 bag of cement (40 kg) $W=30\text{ cm}$, $H=30\text{ cm}$, $L=32\text{ cm}$ $\text{Volume}=0.029\text{ m}^3$</p>	
Description	Hand tools
<p>Hoes are used for excavating soils, spreading gravel and mixing concrete or mortar. It consists of a blade and a handle.</p> <p>The blade of the common hoe has a straight cutting edge. The eye can be round or oval, although for road works the oval eye is recommended. The round eye makes it easier to replace the handle but the blade tends to turn while working. The hoe should have a suitable length handle (1.2-1.5m) so that you can work standing upright.</p>	

Pickaxes and mattocks are used for excavating stony, hard soils which are difficult to penetrate with hoes. These tools have an oval eye so that the handle cannot turn in the eye. Weights of the pickaxe is between 2.7 and 3.6kg and the mattock between 1.8 and 2.7kg. They have double edge striking tools and have straight handle with an elliptical rather than circular cross-section. The handle should be provided with a raised safety grip to prevent the handle slipping out of the hand of the worker.



Shovels are used for scooping up material and throwing it on to a truck, wheelbarrow or directly to where the material is needed and also used for mixing concrete and mortar. The shovel has a rounded or pointed blade.

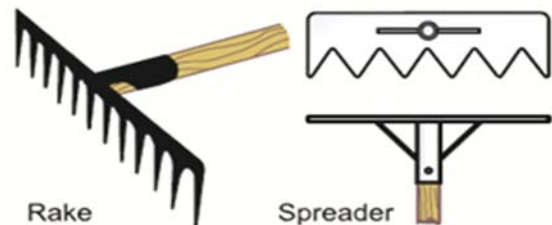
The handle for the shovel should be long enough to allow the worker to throw the soil with little effort. Shovels should not have sharp joints which damage the hands of user.



Spreader and rake

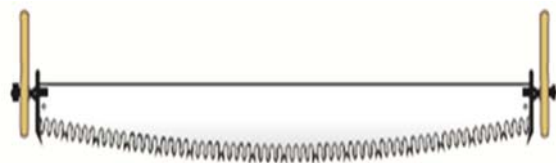
Rakes are used in road works for collecting vegetation from loose soil when grubbing, but can also be used for spreading if the soil is not stony. Rakes have 10 to 16 teeth, each about 75-100mm long, with an overall width of about 400-450mm. They require straight handles made of hard wood or metal tubes.

Spreaders are used for spreading out the soil on fills. A spreader can be a heavy-duty rake. The spreader is very useful when forming the camber and for spreading gravel. It is made of sheet metal (3-4mm thick) and have a ridge for crushing lumps of soil. Spreader can be pointed or flat, depending upon the nature of the gravel to be spread.



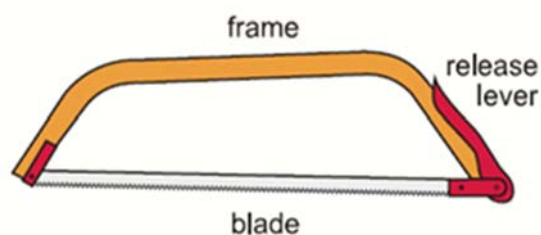
Saws are used to cut trees, branches, bush and wood. There are different types of saws used for cutting different sizes of trees, bush or wood.

Large saws are used to cut big trees or wood, operated by two persons, while small saws (steel frame bow saw) can be used by a single person.

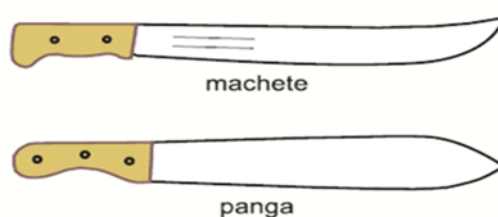


Big saws are made from steel blade, 1.5-2 m long, with wooden handles fixed at both end of the blade.

Small saws (steel framed bow saws) are used for cutting small trees, tree branches and bush. A narrow blade is held in tension by the frame. A quick release lever applies tension to the blade. The lever, combined with an oval sectioned frame, provides a comfortable hand grip. Blades are 20-25mm wide and are produced in a standard length. The frame is made of mild steel and the blade is made of high carbon alloy steel.



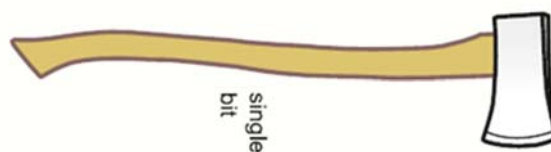
Bush knives are used for clearing bush and cutting tree branches along the road alignment. They are also used for cutting and sharpening pegs. Bush knives are made of steel shaped blades with wooden round handles.



Axes are used to cut bush, trees, branches and stripping branches of felled trees. The axe can be shaped as a cutting edge (blade) on one side, while the head of the axe can be used instead of a hammer.

The eye of the axe is oval and is fixed to the handle with a wedge. Handles are normally 70 to 90cm long made from seasoned hardwood shaped in an ergonomically sound fashion.

Smaller axes, also referred to as hatchets, are often used for cutting small trees and branches instead of a bush knife. They are also used for producing setting out pegs.



Wheelbarrows are useful for transporting materials over short distances (up to 200 metres). Wheelbarrows are used in earthworks and structure construction for transport of soils, sand, aggregate, stone, concrete etc. Wheelbarrows are made in many different shapes and quality. A good wheelbarrow should take a big load (struck capacity approximately 60 to 70 litres) and be easy to balance and tip. The common wheelbarrow is fitted with a single front rubber tyre.



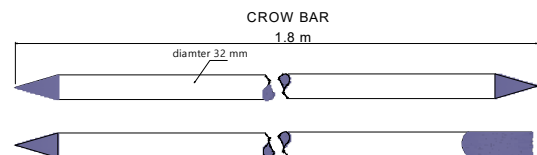
Baskets are used for carrying soil or gravel for a short distance. A typical basket has a pay-load of 5 to 6 kilograms of soil. Baskets can be made from local basket making materials (bamboo), used tyres or manufactured in plastic. Bamboo baskets are suitable for dry soil, and although they are not as durable, they are made from local materials and cost about half the price.

Plastic and Rubber Tyre baskets are more suitable when handling wet soils. Baskets can be carried individually or two can be balanced on a shoulder pole, at the end of ropes, like a scale, depending upon the workers strength and preference.



Crow bars are used mostly for excavating stony or hard soils or moving the boulders or heavy items when used in the right way as a lever. The crowbar looks like a simple tool, but it has to be of very strong material that does not bend easily and be well designed to function properly.

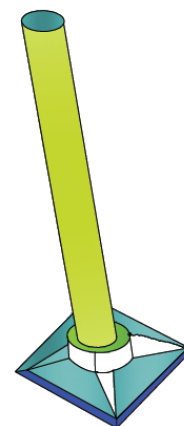
Crowbars are manufactured either as round or octagonal section rods. For infrastructure work the diameter should be minimum 30mm. Their length is required to be within 1.5 to 1.8 meters. The bar is made of carbon steel and should have one pointed end and one chisel end or should have both pointed ends.

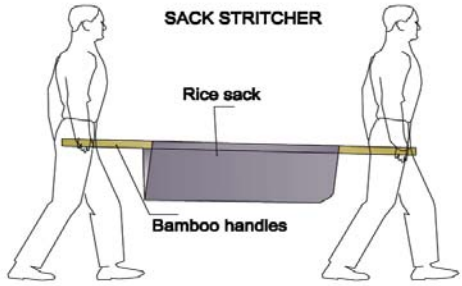
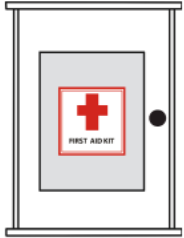











Hand rammers are used for compacting soil and gravel and consists of a weight with a long handle. The weight can be made of various materials such as steel, concrete or solid wood. Ideally, the weight should be as large as possible and the area as small as possible. A rammer which can be handed by a worker should therefore have a weight of some 6– 8kg and a surface size of 13 cm x13 cm to 15cm x 15 cm. The handle must be long enough, between 1.5 to 2 m.

Hand rammers are used to compact in small and confined areas such as around culverts, potholes and other places where it is impractical or difficult to access with rollers.

HAND RAMMER



<p>Sack Stretchers are locally made for carrying soil and gravel. An empty rice sack is cut open. Two thick straight bamboo poles about 1.5 meters long are sewn along the length of either side of the cloth, to make a stretcher.</p> <p>The soil to be carried is placed on the sack and carried by two persons.</p>	 <p>The diagram shows two people carrying a stretcher. The stretcher consists of a purple rice sack with two long bamboo poles (handles) attached to its sides. Labels include 'SACK STRETCHER', 'Rice sack', and 'Bamboo handles'.</p>
<i>Description</i>	<i>Safety measures and safety gear</i>
<p>First aid kits include items like plasters, bandages, disinfectant, antiseptic cream, clean fresh water for washing eyes, saline water, irrigation syringe, sterile dressings, adhesive tape, scissors and disposable gloves.</p> <p>The First Aid Kit must be available on site, regularly checked and restocked.</p>	 <p>The image shows a white first aid kit box with a red cross symbol and the text 'FIRST AID KIT'.</p>
<p>Markings and detours: Warning signs and cones are placed at each end of work areas. The warning signs should be placed 50-100 m away from the working areas. The text on the warning signs should read: "Attention"</p> <p>Excavated trenches for foundations, etc. shall be clearly marked and fenced off in a way that people cannot drive or fall into the excavation.</p>	 <p>The image shows a construction site with a large excavation. Orange traffic cones and yellow warning signs are placed around the edge of the excavation to mark the area and warn of the hazard.</p>
<p>Safety Goggles should be used when there is a risk for eye injury, e.g. when:</p> <ul style="list-style-type: none"> • breaking rocks • welding, cutting and grinding 	 <p>The image shows a pair of black safety goggles with a strap.</p>
<p>Boots should be used when:</p> <ul style="list-style-type: none"> • mixing concrete and mortar • working in wet or muddy places • working with sharp tools <p>Closed shoes should be worn at all other times</p>	 <p>The image shows two types of footwear: a pair of red closed shoes and a pair of black safety boots.</p>
<p>Gloves should be used when:</p> <ul style="list-style-type: none"> • carrying heavy loads and when using hand tools 	 <p>The image shows a pair of grey work gloves.</p>

<ul style="list-style-type: none"> • working with concrete and masonry work (rubber gloves) • bending and fixing steel bars • breaking rocks 	
<p>Safety hats or helmets shall be used when working at heights or in danger of falling objects such as:</p> <ul style="list-style-type: none"> • in deep drains or during foundation excavation • under bridges • when felling trees 	
<p>Bright vests are used to easily identify workers and other staff at the worksite. If working on a road with traffic then all workers must wear a safety vest or jackets with bright colours.</p>	
<p>Masks are used when working in places that produce a lot of dust or bad smell.</p>	
Description	PPE for COVID-19 MEASURES
<p>3 ply surgical face masks are worn when it is not possible to keep a safe distance between workers</p>	
<p>Disinfectant: are for</p> <ul style="list-style-type: none"> - cleaning hand tools before and after use. - cleaning hands, apply directly into hand then rub till dry - for surfaces: equipment or appliances <p>The contractor can choose to wash the hand tools and hands with soap and water instead.</p>	

Thermometers can be used to measure temperature to ensure that workers are in good health before entering the work site.

