



GENERAL SPECIFICATIONS



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101.1 ADDITIONAL LABOUR

101.1.1 Description

This item is to employ workers to carry out work that is not listed elsewhere in the BOQ. The contractor should include a unit rate to employ additional workers.

102. SITE CLEARANCE

102.1 BUSH CUTTING, GRASS CLEARING AND GRUBBING

102.1.1 Description

This item is the cutting of bush, clearing grass, grubbing, removal and safe disposal of all vegetation, bush and grass except woody trees with a diameter larger than 10 cm. It includes the removal of other items, such as dead vegetation and small rocks.

102.1.2 Materials

No additional materials are required.

102.1.3 Method

The area of bush, grass and vegetation which should be cleared and grubbed will be marked by the supervisor. The bush, grass and vegetation should be cleared and grubbed to a depth of 15 cm. The cleared grass, bush and vegetation should be disposed of in a safe.

102.1.4 Safety on site

- Workers must be well spaced to limit the risk of injury when using cutting tools.
- Safety gear refers to item 209.3.

102.1.5 Checking

The following will be checked:

- Adequate clearing, cutting, grubbing and removal of the grass, bush and vegetation.
- Safe disposal.

102.1.6 Measurement and payment



This item will be paid by the area of cut, cleared and grubbed of vegetation, bush and grass measured in m².

102.2 REMOVAL OF TREES

102.2.1 Description

This item is the complete removal and safe disposal of trees of diameter between 10 to 20 cm including stump and roots.

102.2.2 Material

No additional materials are required.

102.3 REMOVAL OF TOP SOIL

102.3.1 Description

This item is the removal and safe disposal of topsoil layers and of unsuitable soils such as soft clay and saturated soil to a depth of 20 cm.

102.3.2 Materials

No additional materials are required.

102.3.3 Method

The area from which topsoil is to be removed will be marked by LeRelief Project Engineer. The top soil, which typically consist of unsuitable materials for road construction such as soft clay and saturated soil should be removed to a depth up to 20 cm and disposed of in a safe place

102.3.4 Equipment

This activity requires hand tools.

102.3.5 Safety on site

- Workers must be well spaced to limit the risk of injury when using hand tools.
- Safety gear refers to item 209.3.

102.3.6 Checking

The following will be checked:

- Complete removal of the topsoil.
- Safe disposal.

102.3.7 Measurement and payment

This item will be paid by the area from which topsoil is removed, measured in m².

102.4 REMOVAL OF ROCK FROM CARRIAGE WAY IRRIGATION ALIGNMENT

102.4.1 Description

This item is the removal and safe disposal of large rocks in or on road carriage way, typically with a volume of more than 0.5 m³.

Smaller rocks should be removed during activity (bush and grass clearing).

102.4.2 Materials

No additional materials are required.

102.4.3 Method

The rock to be removed will be marked by the Project Engineer. It should be broken into pieces as required and then disposed of in a safe place with the agreement of the Project Engineer.

102.4.4 Equipment

The activity requires hand tools.

102.4.5 Safety on site

- Attention must be paid when splitting rocks workers must wear boots eye protection glasses/goggles and gloves. When boulders are to be buried, care must be taken so that the boulder does not roll into the pit while workers are still digging or working inside the pit.
- Safety gear refers to item 209.3.

102.4.6 Checking

The following will be checked:

- Complete removal of the rock.
- Safe disposal.

102.4.7 Measurement and payment

This item will be paid by the volume of the rock, measured in m³

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.

103. EARTH WORKS

103.1 EXCAVATE AND DISPOSAL -SOFT SOIL

103.1.1 Description

This item is the cutting (or excavation/digging) of soft soil from the road surface, the alignment of an intended drain or a slope next to the road or irrigation canal. Soft soil is defined as that which can be cut with a shovel or hoe.

The soil may be kept on the road or canal and used to form a camber or fill canal embankment or disposed of safely.

103.1.2 Materials

No additional materials are required.

103.1.3 Method

The soil should be excavated as instructed by the Project Engineer.

- If the soil is of good quality (well graded, hard particles, clean of organic material, low plasticity) and a road camber/filling embankment of a canal is to be constructed, the Project Engineer may instruct that the soil should be spread along the road or canal for subsequent use for the camber/embankment filling of the canal.

- If the soil is to be used for the road camber/ or embankment filling, the shaping, watering and compaction work will be done using item (Fill and form camber by selected material).
- If the soil is of poor quality or a camber or leveling layer or embankment is not required, the Project Engineer may instruct that the soil should be disposed of in a safe place.

103.1.4 Equipment

The activity requires hand tools.

103.1.5 Safety on site

- Slopes must be excavated as per instruction. Attention must be paid when excavating high slopes to avoid soil or rocks or trees falling uncontrollably.
- Workers must be well spaced to limit the risk of injury when using hand tools.
- Safety gear refers to item 209.3.

103.1.6 Checking

The following will be checked

- Cutting and excavating of the soil at the instructed location, to the instructed slope and volume.
- Spreading or disposal as instructed.

103.1.7 Measurement and payment

This item is paid by the volume of soil cut and removed to either the road surface or to a safe place, measured in m³.

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.

103.2 EXCAVATE AND DISPOSAL -HARD SOIL

103.2.1 Description

This item is the cutting (or excavation/digging) of hard soil from the road carriage way, the alignment of an intended drain or a slope next to the road or irrigation canal. Hard soil is defined as that which can be cut with pick axe.

The soil may be kept on the road and used to form a camber or leveling layer or canal embankment or disposed of safely.

103.2.2 Materials

No additional materials are required.

103.2.3 Method

The soil should be excavated as instructed by the Project Engineer.

- If the soil is of good quality (well graded, hard particles, clean of organic material, low plasticity) and a camber or canal embankment is to be constructed, the Project Engineer may instruct that the soil should be spread along the road or along the canal for subsequent use in the camber or embankment.
- If the soil is to be used in the road camber or fill canal embankment, the shaping, watering and compaction work will be done using item (Fill and form camber by selected material).



- If the soil is poor quality or a camber or embankment is not required, the Project Engineer may instruct that the soil should be disposed of in a safe place.

103.2.4 Equipment

The activity requires hand tools.

103.2.5 Safety on site

- Slopes must be excavated as per instruction. Attention must be paid when excavating high slopes to avoid soil or rocks or trees falling uncontrollably.
- Workers must be well spaced to limit the risk of injury when using hand tools.
- Safety gear refers to item 209.3.

103.2.6 Checking

The following will be checked

- Cutting and excavating of the soil at the instructed location, to the instructed slope and volume
- Spreading or disposal as instructed

103.2.7 Measurement and payment

This item will be paid by the volume of soil cut and removed to either the road surface/canal alignment a safe place, measured in m³.

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.

103.3 EXCAVATE AND DISPOSAL -SOFT ROCK

103.3.1 Description

This item is the cutting (or excavation/digging) of rock from the road surface, the alignment of an intended drain or canal or a slope next to the road. Rock is defined as that which can be cut with a hammer and chisel. The rock may be kept on the road or near-by the canal alignment and used to form a camber or road base or fill canal embankment or disposed of safely.

103.3.2 Materials

No additional materials are required.

103.3.3 Method

- The soft rock should be cut or excavated as instructed by the Project Engineer.
- If the rock is of good quality (well graded, strong, clean of organic material) and a camber or embankment is to be constructed, the Project Engineer may instruct that the rock should be spread along the road or near-by the canal alignment for subsequent use in the camber or road base or embankment.
- If the rock is to be used in the road camber or road base or embankment, the shaping, watering and compaction work will be done using item 3.6 (Fill and form camber by selected material).
- If the rock is good quality and if instructed by the Project Engineer, it may also be used for other structural works.
- If the rock is poor quality or a camber or embankment is not required, the Project Engineer may instruct that the rock should be disposed of in a safe place.

103.3.4 Equipment

The activity requires hand tools.

103.3.5 Safety on site

- Attention must be paid when splitting rocks workers must wear boots eye protection glasses /goggles and gloves. When boulders are to be buried, care must be taken so that the boulder does not roll into the pit while workers are still digging or working inside the pit.
- Slopes must be excavated as per instruction. Attention must be paid when excavating high slopes to avoid soil or rocks or trees falling uncontrollably
- Workers must be well spaced to limit the risk of injury when using hand tools.
- Safety gear refers to item 209.3.

103.3.6 Checking

The following will be checked:

- Cutting and excavating of the rock at the instructed location, to the instructed slope and volume.
- Spreading or disposal as instructed.

103.3.7 Measurement and payment

This item will be paid by the volume of rock excavated and removed to either the road surface or a safe place, measured in m³.

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.

103.4 FILL AND LEVEL BY SELECTED MATERIAL (HAULAGE WITHIN 50M)

103.4.1 Safety on site

- Workers must be well spaced to limit the risk of injury when using hand tools.
- All operators must be trained in the use of their equipment (water truck, roller, tampers). Equipment must be in good condition and safety covers for moving parts should be used.
- Safety gear refers to item 209.3.

103.4.2 Method

The following steps should be followed:

- Find a source of good quality soil
- Obtain approval from LebRelief Project Engineer for the soil
- Excavate the soil
- Haul the soil to the site
- The existing road surface should be cleaned of topsoil and other unsuitable soils such as soft clay and saturated soil using activity (Removal of top soil)
- Fill and spread the soil in layers no thicker than 15 cm and to the required shape.
- Water the soil and allow it to soak until the entire layer is at optimum moisture water content. This is achieved when the soil can be squeezed into a ball but water does not drip out
- Compact the soil using compaction equipment until the point at which it does not compact any more under successive passes of the equipment (this is called 'refusal')
- After one layer has been fully compacted, spread, water and compact another layer as before until reaching the level of the road shoulder.

103.4.3 Checking

When available, simple tests should be used to test the soil for grading, particle strength, particle shape, absence of organic material and plasticity. If not available, the Project Engineer will assess the soil manually and visually.

- Layer thicknesses.
- Moisture content before compaction.
- Compaction to refusal.
- Final shape of the fill, level of the filled and compacted soil.

103.4.4 Measurement and payment

This item will be paid by the total volume filled, measured in m³ after compaction.

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.

103.5 FILL AND LEVEL BY SELECTED MATERIAL (HAULAGE DISTANCE - KM)

103.5.1 Safety on site

- Workers must be well spaced to limit the risk of injury when using hand tools.
- All operators must be trained in the use of their equipment (water truck, roller, tampers). Equipment must be in good condition and safety covers for moving parts should be used.
- Safety gear refers to item 209.3.

103.5.2 Checking

When available, simple tests should be used to test the soil for grading, particle strength, particle shape, absence of organic material and plasticity. If not available, the Project Engineer will assess the soil manually and visually.

- Layer thicknesses
- Moisture content before compaction
- Compaction to refusal
- Final shape of the fill, level of the filled and compacted soil

103.5.3 Method

The following steps should be followed:

- Find a source of good quality soil
- Obtain approval from the Project Engineer for the soil
- Excavate and load the soil into trucks
- If space is available, pile up and mix the soil next to the source to improve its uniformity
- Carry the soil to the site by hauling by truck
- The existing road surface should be cleaned of topsoil and other unsuitable soils such as soft clay and saturated soil using activity (Removal of top soil)
- Fill and spread the soil in layers no thicker than 15 cm to the required shape.

- Water the soil and allow it to soak until the entire layer is at optimum moisture water content. This is achieved when the soil can be squeezed into a ball but water does not drip out
- Compact the soil using compaction equipment until the point at which it does not compact any more under successive passes of the equipment (this is called ‘refusal’)
- After one layer has been fully compacted, spread, water and compact another layer as before reach to the level of road shoulder.

103.5.4 Measurement and payment

This item will be paid by the total volume filled, measured in m³ after compaction.

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.

103.6 FILL AND FORM CAMBER BY SELECTED MATERIAL

103.6.1 Safety on site

- Workers must be well spaced to limit the risk of injury when using hand tools.
- All operators must be trained in the use of their equipment (water truck, roller, tampers). Equipment must be in good condition and safety covers for moving parts should be used.
- Safety gear refers to item 209.3.

103.6.2 Method

The following steps should be followed:

- The existing road surface should be cleaned of topsoil and other unsuitable soils such as soft clay and saturated soil using item (Removal of top soil).
- If the surface is damaged it may be leveled using item (Fill and level by selected material).
- Find a source of good quality soil.
- Obtain approval from LebRelief Project Engineer for the soil.
- Excavate, haul (transport), fill and spread the soil in layers no thicker than 15 cm to the required camber, as instructed by LebRelief Project Engineer.
- Water the soil and allow it to soak until the entire layer is at optimum moisture water content. This is achieved when the soil can be squeezed into a ball but water does not drip out.
- Compact the soil using compaction equipment until the point at which it does not compact any more under successive passes of the equipment.
- After one layer has been fully compacted, if more layers are required, fill and spread, water and compact as above
- Continue until the camber is as instructed, the crown is sharp, super-elevation is present where instructed and the longitudinal profile is smooth.

If a camber can be formed from soil from cut from the existing road with material approved by the Project Engineer, it is not necessary to identify and obtaining approval of a new source of materials for the camber.



103.6.3 Checking

When available, simple tests should be used to test the soil for grading, particle strength, particle shape, absence of organic material and plasticity. If not available, LebRelief Project Engineer will assess the soil manually and visually.

The following will be checked:

- Layer thicknesses
- Moisture content before compaction
- Compaction to refusal
- Final shape of the fill
- Cross fall, crown and profile if the soil has been formed into a camber

103.6.4 Measurement and payment

This item will be paid by the total volume filled, measured in m³ after compaction.

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.

103.7 FILL EMBANKMENT

103.7.1 Method

The following steps should be followed:

- Find a source of good quality soil
- Obtain approval from LebRelief Project Engineer for the soil
- Excavate, carry the soil to the site: If the source of soil within 150m soil should be carried by wheel borrow and source of the soil beyond 150 m soil should be carry by trucks
- The existing road surface should be cleaned of topsoil and other unsuitable soils such as soft clay and saturated soil using item (Removal of top soil)
- Fill and spread the soil in layers no thicker than 15 cm and to the required shape.
- Water the soil and allow it to soak until the entire layer is at optimum moisture water content. This is achieved when the soil can be squeezed into a ball but water does not drip out
- Compact the soil using compaction equipment until the point at which it does not compact any more under successive passes of the equipment
- After one layer has been fully compacted, fill, spread, water and compact another layer as before until reach to the level of road shoulder.
- Sloping and use material from the sloping to form road camber, watering and compaction.

103.7.2 Safety on site

Workers must be well spaced to limit the risk of injury when using hand tools.

All operators must be trained in the use of their equipment (water truck, roller, tampers). Equipment must be in good condition and safety covers for moving parts should be used.

Safety gear refers to item 209.3.

103.7.3 Checking

When available, simple tests should be used to test the soil for grading, particle strength, particle shape, absence of organic material and plasticity. If not available, LebRelief Project Engineer will assess the soil manually and visually.

- Layer thicknesses
- Moisture content before compaction
- Compaction to refusal
- Final shape of the fill, level of the filled, shape of the slopes and compacted soil

103.7.4 Measurement and payment

This item will be paid by the total volume filled, measured in m³ after compaction.

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.

103.8 ROAD BASE (WHERE THE NATURAL GRAVEL IS NOT AVAILABLE THIS MATERIAL WILL BE USED AS ROAD SURFACE FOR THE AGRICULTURAL ROAD)

103.8.1 Method

The following steps should be followed:

- Find a source of good quality base material.
- Obtain approval from the Project Engineer then supply on site.
- If the prepared surface is old, has lost its shape or dirty, it should be restored, cleaned of

topsoil and other unsuitable soils such as soft clay and saturated soil using item (Removal of top soil) above.

- If the surface is damaged it may be repaired using item (graveling).
- Spread the base material in layers as specified in the contract, no thicker than 15 cm and to a camber of 6-8 %.
- Watering to optimum moisture content and compaction of 8-10 passes by roller capacity more than 6 tons with vibration. Compaction shall be done from edge of the road toward the road center in layer by layer which each layer should not be exceeded 15cm loss thickness.

103.8.2 Safety on site

- Workers must be well spaced to limit the risk of injury when using hand tools.
- All operators must be trained in the use of their equipment (water truck, roller, tampers). Equipment must be in good condition and safety covers for moving parts should be used.
- Safety gear refers to item 210.3

103.8.3 Checking

A simple laboratory tests shall be carried out to test the gravel for grading, particle strength, particle shape and plasticity before using the quarry. The strength of the compacted layer should be checked by DCP. If not available, the Project Engineer will assess the quality of the gravel layer manually and visually.

The following will be checked:

- Width of the material layer.
- Thickness of the material layer.
- Camber.
- Sharp and straight crown.
- Smooth longitudinal profile.
- The entire layer is at optimum water content when compacted.
- The surface has been compacted to refusal.

103.8.4 Measurement and payment

This item will be paid by the volume of base material placed, measured in m³ after compaction.

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.

104. STRUCTURE WORKS

104.1.1 Method

- The layer on which the concrete of 1:3:6 will be constructed should be prepared and strong and clean
- Formwork should be fixed in place to the required width and height
- The concrete should be mixed by labour using small concrete mixer of a capacity of 0.2 to 0.4 m³The concrete should be used within 30 minutes of the water being added
- The concrete should be placed between the side formwork and then compacted until no more air bubbles are seen
- The concrete should be protected from use for 2 days after which the side formwork can be removed, and should be cured for 5 days by keeping it wet and covered with dampened sand, cloths or sacks

104.1.2 Safety on site

- Attention must be paid when mixing concrete. Workers must use boots and strong gloves. When moving or transporting heavy materials such as cement bags, aggregates for mixing the concrete etc, either use a wheelbarrow or make sure that two lift together.
- All operators must be trained in the use of their equipment (concrete mixers, truck, rollers). Equipment must be in good condition and safety covers for moving parts should be used.
- Safety gear refers to item 210.3

104.1.3 Checking

The following will be checked:

- Quality of the layer on which the concrete will be constructed
- Quality of the side formwork
- Quality of materials used for the concrete, include cement, sand and aggregate
- Quality of the lean concrete after mixing and after curing
- Protection of the concrete while it is curing
- When possible concrete cubes will be made and tested for strength after 28 days
- Required strength and slump

104.1.4 Measurement and payment

This item is paid by the volume of lean concrete constructed, measured in m³. The unit rate includes the cost of the side formwork and the curing.

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.

104.2 CONCRETE OF MIX PROPORTION 1:2:4

104.2.1 Method

- The layer on which the structural concrete will be constructed should be prepared and strong and clean
- Side formwork, underside formwork and all necessary false work/scaffolding should be fixed in place as shown on the contract drawings
- Reinforcement should be fixed as shown on the contract drawings
- The concrete should be mixed by labor using small concrete mixer of a capacity of 0.2 to 0.4 m³
- The concrete should be used within 30 minutes of the water being added.
- The concrete should be placed within the formwork and then compacted until no more air bubbles are seen.
- Place the concrete in layers no thicker than 30 cm, remove the air from this layer before placing more concrete.
- The concrete should be protected from use for 5 days after which the side formwork can be removed, and should be cured for 5 days by keeping it wet and covered with dampened sand, cloths or sacks
- The underside formwork can be removed after 14 days.

104.2.2 Safety on site

- Attention must be paid when mixing concrete. Workers must use boots and strong gloves. When moving or transporting heavy materials such as cement bags, aggregates for mixing the concrete etc, either use a wheelbarrow or make sure that two lift together.
- All operators must be trained in the use of their equipment (concrete mixers, truck, rollers). Equipment must be in good condition and safety covers for moving parts should be used.
- Safety gear refers to item 209.3

104.2.3 Checking

The following will be checked:

- Quality of the layer on which the structural concrete will be constructed.
- Quality of the side and underside formwork and the false work, the absence of leaks and its rigidity against movement.
- Quality of the materials used, including cement, sand aggregate and steel.
- Quality of the reinforcement (see (Reinforcement steel bar)).
- Quality of the structural concrete after mixing and after curing.
- Protection of the concrete while it is curing
- When possible concrete cubes will be made and tested for strength after 28 days
- Required strength and slump.

104.2.4 Measurement and payment

This item is paid by the volume of concrete constructed, measured in m³. The unit rate includes curing. Cost of the side and under side formwork and supports is paid under activity (Formwork and support). The reinforcement is paid under activity (see Reinforcement steel bar).

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.

104.3 CONCRETE OF MIX PROPORTION 1:1.5:3

104.3.1 Method

- The layer on which the structural concrete will be constructed should be prepared and strong and clean
- Side formwork, underside formwork and all necessary false work/scaffolding should be fixed in place as shown on the contract drawings.
- Reinforcement should be fixed as shown on the contract drawings.
- The concrete should be mixed by labour using small concrete mixer of a capacity of 0.2 to 0.4 m³
- The concrete should be used within 30 minutes of the water being added.
- The concrete should be placed within the formwork and then compacted until no more air bubbles are seen.
- Place the concrete in layers no thicker than 30 cm, remove the air from this layer before placing more concrete.
- The concrete should be protected from use for 5 days after which the side formwork can be removed, and should be cured for 5 days by keeping it wet and covered with dampened sand, cloths or sacks.
- The underside formwork can be removed after 21 days.

104.3.2 Safety on site

- Attention must be paid when mixing concrete. Workers must use boots and strong gloves. When moving or transporting heavy materials such as cement bags, aggregates for mixing the concrete etc, either use a wheelbarrow or make sure that two lift together.
- All operators must be trained in the use of their equipment (concrete mixers, truck, rollers). Equipment must be in good condition and safety covers for moving parts should be used.
- Safety gear refers to item 209.3.

104.3.3 Checking

The following will be checked:

- Quality of the layer on which the structural concrete will be constructed
- Quality of the side and underside formwork and the false work, the absence of leaks and its rigidity against movement.
- Quality of materials used including cement, sand, aggregate and steel.
- Quality of the reinforcement (see Reinforcement steel bar).
- Quality of the structural concrete during after mixing and after curing.
- Protection of the concrete while it is curing.
- When possible concrete cubes will be made and tested for strength after 28 days.

Table below show Compressive strength and Slump test requirement for concrete deference concrete mix (minor works)

<i>Mixed Minimum</i>	<i>Minimum Compressive Strength</i>				<i>Permitted Slump (m m)</i>	<i>Purpose</i>
	<i>Cube 15 cm</i>		<i>Cylinder 15 x 30 cm</i>			
	<i>7 days</i>	<i>28 days</i>	<i>7 days</i>	<i>28 days</i>		
	1 : 1.5 : 3	175	260	145		
1 : 2 : 4	150	210	125	175	50-125	Culvert slab. Lightly Reinforced Structure
1 : 3 : 6	-	-	-	-	25-100	Non-reinforced Structure

104.3.4 Measurement and payment

This item is paid by the volume of structure concrete constructed, measured in m³. The unit rate includes curing. Cost of the side and under side formwork and supports is paid under activity (Formwork and support). The reinforcement is paid under activity (Reinforcement steel bar).

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.

104.4 REINFORCEMENT STEEL BAR

104.4.1 Method

- The reinforcement steel should be cut and bent to match each bar as shown on the contract drawings

- Each bend should be made around a post of 5 times the diameter of the steel so that the reinforcement steel is not excessively deformed
- Steel should not be heated as it is being bent
- These bars should be fixed together to match the mesh as shown on the concrete drawings
- Spacer blocks should be fixed to the reinforcement steel to prevent it moving close to the formwork when the concrete is being poured
- All fixing wire should be bent inwards away from the formwork
- At no point may the reinforcement steel or the fixing wire be closer to the formwork than the cover as given on the concrete drawings, usually the cover must be at least 30mm.
- The entire mesh should be fixed tightly so that it does not bend or move closer to the formwork when concrete is being poured or when workers walk on the mesh
- If necessary, a length of reinforcement bent into a shape which can keep the top and bottom mat of a deck mesh at the required separation when concrete is being poured or when workers walk on the mesh

A single length of reinforcement steel is not long enough to form an entire bar as shown on the contract drawings, two lengths can be used with an overlap equal to 40 times to the diameter of the steel for rounded bar and 28 times to the diameter of the steel for deformed bar (at least 30 cm). The overlap must be fixed with at least three separate loops of fixing wire.

The reinforcement steel must be checked and approved by the Project Engineer before the concrete is poured.

104.4.2 Safety on site

- Care must be taken when cutting and bending reinforcement bars.
- Reinforcement bars sticking out where concrete has not yet been poured must be clearly marked to avoid cutting or spearing accidents. The whole such area should be clearly marked and sealed off to make sure no one accidentally steps or falls into uncompleted structure works
- Reinforcement bars are sometimes used as offset pegs. In such cases they must be clearly marked and the end pointing upwards must be bent to avoid cutting or spearing accidents;
- Safety gear refers to item 209.3.

104.4.3 Checking

The following will be checked:

- The quality of the reinforcement steel
- The correctness of the fixing to match the contract drawings
- Cleanliness of the reinforcement steel
- Adequacy of the overlaps
- Placement of spacer blocks
- Adequacy of the cover
- Strength of the fixing so that the reinforcement steel does not move when the concrete is being poured

104.4.4 Measurement and payment

This item is paid by the weight of reinforcement fixed, measured in kg. The unit rate includes the cost of the overlaps, fixing wire and spacer blocks.

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.

104.5 BACK FILLING FOR STRUCTURES

104.5.1 Method

The following steps should be followed:

- Find a source of good quality soil
- Obtain approval from the Project Engineer for the soil. Excavate, load and carry the soil to the construction site
- All excavated foundations shall be backfilled around the permanent structure to original ground level.
- Any protective supports, bracing or shoring shall be removed as the backfilling progresses
- After one layer has been fully compacted, spread, water and compact another layer as before to reach level as instructed by Project Engineer.
- The back of abutment and wing walls with weep holes shall be provided with a vertical layer of granular fill materials in the specified thick to serve as a filter.
- Back filling of the foundation shall be filled in layer of not thicker than 100mm, watering and compaction by using compaction equipment (mechanical tamper).
- The backfill for embankment for approach road, soil shall be laid and compacted in layer of not thicker than 150mm. Compact the soil using compaction equipment until the point at which it does not compact any more under successive passes of the equipment

104.5.2 Safety on site

Safety gear refers to item 209.3.

104.5.3 Checking

When available, simple tests should be used to test the soil for grading, particle strength, particle shape, absence of organic material and plasticity. If not available, the Project Engineer will assess the soil manually and visually.

- Layer thicknesses.
- Filter material is used for vertical fill layer for the abutment walls and wing walls
- Compaction to refusal
- Final shape and level of the fill and compacted soil.

104.5.4 Measurement and payment

This item will be paid by the total volume filled, measured in m³ after compaction.

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.

104.6 FORMWORK AND SUPPORT

104.6.1 Method

- Place poles for the supports on solid ground. If the ground is not firm enough put the poles on a rock or piece of timber/wood. The space from one pole to another should be between 40-50 cm. If the height of the poles is more than 2 m bracing is required to connect from one pole to other. The bracing should be placed at the middle of the poles

- Timber beams are placed for each row of the support poles and fixed by nails. The timber beams should be placed and align with the abutment wall of a bridge, culvert or building
- Place timber poles and cross the beams with spacing from one to other not larger than 50 cm. The crossbeams must be fixed by nails
- Place timber planks on and cross the poles as close as possible to minimize gap at joint between each plank. The planks must be fixed by nails
- Place side formworks of all edges and fix by nails.
- Removal of formwork. The formwork must be removed after minimum 21 days after the concrete is poured. LebRelief Project Engineer shall be informed in advance by the Contractor of his/her intention to remove any formwork.

104.6.2 Checking

The following will be checked:

- The quality of the timber and wooden poles.
- The correctness of the fixing to match the instruction of the Project Engineer.
- Spacing between the support poles and ensuring the support poles are placed on firm ground. Ensure bracing are place and nails properly.
- Level of surface of the timber planks after placing and ensuring minimum gaps at the joint of each timber plank.

The formworks and support must be checked by the Project Engineer before placing steel bars.

104.6.3 Measurement and payment

This item is paid by the number of structures as a lump sum amount after completion of the formwork. Payment for removal of formwork is included in this item.

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.

104.7 SUPPLY AND INSTALL REINFORCED CULVERT PIPE INTERNAL DIAMETER: 60 CM, 80 CM, 100 CM

104.7.1 Method

- Supply or manufacture reinforced concrete culvert pipe rings, cure concrete pipes for not less than 28 days, transport culvert pipes to the locations of work,
- Excavate and shape trench, place pipes and join them, lay to minimum 2% gradient → establish levels or as described by the drawings.
- The disposal of surplus material shall be done at locations approved by the Project Engineers.
- Where there is traffic, excavation of trench(s) and lying of pipe rings shall be carried out in stages to allow vehicles to pass.
- Installation work shall wherever possible start from the outlet side.

104.7.2 Safety on site

- Safety gear refers to item 209.3.
- Adequate traffic signs shall be provided.



104.7.3 Checking

The following will be checked:

- Quality of the concrete pipe
- Ensure the foundation is well prepared and appropriate gradient as per drawing
- Ensuring the concrete pipes are in good condition before and after laying on the foundation.

104.7.4 Measurement and payment

Payment shall be effected upon completion of culvert lines to sealing stage and upon approval of the works and on the basis of the length measured and computed after construction.

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.