**ITEM NAME: LAYOUT AND LAYOUT OF CIVIL WORKS WITH TOTAL STATION**

**UNIT: Global**

**1. DESCRIPTION**

This item includes the layout and tracing of civil works with a total station, necessary for the layout and location of the project on the intervention site, for works to be executed according to the plans.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- NAILS

- WOODEN STAKES

- STUCCO

- MATTE SYNTHETIC PAINT

- EQUIPMENT:

- TOTAL STATION

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any other materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those presented in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor to ensure that the works are executed and completed properly and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

All staking out work will be initiated after prior notification to the Works Supervision, who must approve said work.

The layout and design of the works to be executed will be carried out by the Contractor in strict compliance with the dimensions, slope determination, location and indications of the corresponding plans and/or the instructions of the construction supervisor.

The layout carried out must be approved in writing in the order book by the Works Supervisor prior to the start of any work, following verification and interpretation of the project plan.

The Contractor shall determine the arrangement of the axes, which shall be secured with stakes spaced according to the instructions of the Construction Supervisor.

Whatever the method used in determining slopes, the Contractor must have marks and signs at all times for rapid verification of the same, Likewise, given the conditions of the terrain, it must foresee, verify, identify and demarcate all existing services in the area so as not to hinder the normal development of the work.

The contractor will demarcate the entire area to be worked on so that, later, there will be no difficulties in measuring the quantities executed.

The canvases will be laid out to achieve perfect parallelism. The foundation widths and/or the location and perimeter of the single foundations will then be marked with stucco.

The layout will be carried out by fixing stakes and easily identifiable marks at the required points that cannot be altered during the execution of the works. The guides will be arranged with a topographic instrument according to the layout axes or lines indicated on the plans.

The contractor shall be solely responsible for the care, maintenance, and replacement of the stakes and marks required for measuring the volumes required to be executed on site.

The layout and staking out must receive written approval from the Construction Supervisor before proceeding with the following works.

**4. MEASUREMENT**

This item will be measured by the GLOBAL (Gl.), duly completed by the contractor and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: EXCAVATION WITH TRACKED EXCAVATOR**

**UNIT: Cubic meters**

**1. DESCRIPTION**

This activity consists of carrying out open-air excavations using tracked excavator-type machinery in areas with difficult access and rugged topography, according to the dimensions established in plans and/or instructions from the construction supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

This activity consists of carrying out open-air excavations using machinery such as:

-TRACKED EXCAVATOR

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any other materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those presented in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor to ensure that the works are executed and completed properly and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

This activity must include all the necessary supplies to ensure industrial safety on site, both for construction personnel and passersby. These supplies must be required by the supervisor for strict compliance during the execution of the work.

Once the layout has been completed and the areas to be excavated and/or earthworks have been defined, the supervisor will authorize the start of the activity using the planned machinery, instructing the elevation to which the excavation should be carried out according to the type of work to be carried out.

Excavations and earthworks will be carried out in the open air according to the project plans, ensuring that the intended elevation is leveled and finished so that the base offers firm and uniform support throughout the entire excavated section.

Any excess excavation that is not authorized must be filled by the Builder at his own expense with the appropriate material and equipment, and such work must be approved by the supervisor.

Throughout the excavation process, the Constructor will exercise the utmost care to avoid destabilization of the areas where the excavation is being carried out and damage to structures and/or buildings located adjacent to the excavation. The Constructor will take appropriate measures to maintain all existing services, such as drinking water, sewage, electricity, and others, without interruption. In the event of damage to these services, the Constructor must restructure or replace them at its own expense.

As the excavation progresses, special care will be taken to ensure the behavior of the walls to avoid landslides. If this happens, the foundation cannot be laid without first completely clearing any material that could reach the bottom of the excavation.

When excavations require the construction of shoring and shoring, these must be designed by the Contractor and reviewed and approved by the Construction Supervisor. This approval shall not exempt the Contractor from any liability that may arise in the event of their failure.

The excavated and removed material must be placed in the locations indicated in writing by the Construction Supervisor, in such a way as not to harm the project. Otherwise, the Contractor must, at its own expense and without charge, relocate the material to the authorized locations.

**4. MEASUREMENT**

The measurement of this item will be carried out by CUBIC METER (m3), taking into account only the net volume of excavation and approved by the construction supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: SLOPE PROFILING**

**UNIT: Square meters**

**1. DESCRIPTION**

It consists of smoothing slopes with surface irregularities using hand tools and equipment, so that they remain, as far as possible, stable and free from severe erosion processes.

The objective is to maintain a stable slope, preventing the fall of loose material or rocks and preventing landslides that could compromise safety. The goal is also to achieve a good visual appearance and improve the environmental impact.

The condition of the slopes must be permanently inspected.

**2. MATERIALS, TOOLS AND EQUIPMENT**

The Contractor shall provide all materials, tools, and equipment necessary for the execution of these works, as well as for their care and maintenance during the execution period. In general, all materials the Contractor intends to use in the execution of these works must be previously approved by the Supervision.

**3. METHOD OF EXECUTION**

The Supervisor will instruct the areas to be worked on. Warning signs and safety devices must be posted in these areas, and measures must be taken to ensure worker safety, including harnesses, lifelines, or similar equipment required for the job. Warning signs must also be posted at the foot of the slope.

The entire surface will be removed, with a thickness defined according to the type of terrain, in a more or less geometric shape.

Clearing, weeding, removal of bushes, stones, and debris removal for slope grooming will be carried out by leveling the surface to the gradient defined in the plans or as instructed by the Site Supervisor.

The materials will be loosened and extracted from the ground, selecting those that will be used later to fill cavities. These will be stacked appropriately, and those that will not be used will be transported off the site.

The leveling must complete the cleaning work, removing any protruding or protruding elements, leaving a smooth, flat finish with a percentage slope from its longitudinal central axis toward the lateral exteriors, to facilitate the runoff of surface water.

Using a hand tamper, and in the most orderly manner possible, the paving will be carried out, keeping the previously placed canvas level, so that the surface is completely smooth and smooth.

The remains will then be removed and deposited in the place determined by the Construction Supervisor, so that they do not interfere with the normal development of the work.

Neither vehicular nor pedestrian traffic; likewise, no mound of these materials may remain for more than 24 hours, and it is the Contractor's obligation to remove them immediately.

The Supervision will accept the slope combing work when it has verified that it was carried out satisfactorily, complying with these specifications, and that as a result, no stones or loose materials are present on the surface of the slopes.

This item may not be used as an excavation, since the objective of this item is to free loose areas, boulders or promontories that protrude from the rest of the surface or the marked baseline, as well as grasses or shrubs.

**4. MEASUREMENT**

The leveling will be measured by SQUARE METER (m2) executed by the Contractor and approved by the

Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: GEOTEXTILE (INCLUDES LAYING)**

**UNIT: Square meters**

**1. DESCRIPTION**

This item refers to the provision and placement of geotextile on a level platform (embankments), slopes, retaining walls, drains, riprap, waterproofing, reinforcement and soil containment in the sectors identified in the detailed plans and/or those instructed by the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

-200gsm nonwoven geotextile

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The geotextile must have high puncture resistance to avoid breakage due to puncture by angular stones or other sharp materials, and it must also have high permeability.

**3. METHOD OF EXECUTION**

On embankments

The geotextile will be placed at the elevations or levels indicated on the plans, taking care not to damage it. The geotextile will be secured at one of its longitudinal ends and then filled with selected material, placed over the geotextile to secure it. The thickness indicated on the plans or as instructed by the site supervisor can be used as fastening elements. Steel rods or other elements can be used to secure the geotextile to the leveled platform.

The arrangement of the geotextile must comply with the provisions of the project plans.

On slope

The geotextile is spread, anchoring it to the slope at the top and bottom, and protecting it with filler material (gabion, riprap, compacted earth or prefabricated slabs).

Once the deployment task is complete and the geotextile is in good condition and free of external elements, the successful supplier must proceed to overlap each geotextile by approximately 5 cm using heat fusion. For this task, an industrial-grade hot air gun must be used to ensure that the geotextile bonding performs its vital function of protecting the geomembrane being deployed.

**4. MEASUREMENT**

The unit of measurement for this activity will be SQUARE METER (m2), taking into account only the net surface area executed and approved by the supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: 1.50MM THICK SINGLE-SIDED TEXTURED HDPE GEOMEMBRANE IN 7.01**

**X 150M ROLLS**

**UNIT: Square meters**

**1. DESCRIPTION**

This item includes the provision and installation of a single-sided textured HDPE geomembrane of 1.50 mm by the Contractor, including labor, fuel, materials and necessary tools, and prior work such as: preparation of the work area, cleaning and removal of excess material.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- HDPE GEOMEMBRANE 1.50 MM TEXTURED ON ONE SIDE THICK IN ROLLS OF 7.01

MX 150 M

High Density Polyethylene Geomembrane GM 13: TEXTURED ON ONE SIDE 1.50 mm. It is characterized by its low permeability, high resistance to leaching processes, high

tensile strength, chemical inertness, and excellent low-temperature performance for storing liquids and solids. It is resistant to UV radiation due to its carbon black content. It must also meet the following technical standards.

|  |  |
| --- | --- |
| **PROPERTIES** | **RULE** |
| Average Thickness | ASTM D 5199 |
| Lowest Individual Minimum  Density | ASTM D 792 |
| Tensile Properties: | ASTM D 6693 |
| Yield stress | Type IV |
| Breaking Tension |  |
| Yield elongation |  |
| Elongation at Break |  |
| Tear Resistance | ASTM D 1004 |
| Puncture Resistance | ASTM D 4833 |
| Crack Resistance Carbon | ASTM D 5397 |
| Content | ASTM D 4218 |
| Carbon Dispersion | ASTM D 5596 |
| Oxidative Induction Time (OIT) a) |  |
| Standard OIT | ASTM D 3895 |
| b) High OIT pressure | ASTM D 5885 |
| Oven Aging at 85 ºC a) | ASTM D-5721 |
| Retention 90 days standard OIT | ASTM D-3895 |
| b) 90-day High Pressure Retention | ASTM D5885 |
| UV resistance | ASTM D-7238 |
| Retention 1920 hr. ILO-HP. | ASTM D-5885 |

EQUIPMENT FOR INSTALLATION AND EXTRUSION OF HDPE MEMBRANE

This equipment involves the following:

- Thermofusion machines for sealing sheets (certified and calibrated).

- Extrusion machines for minor repairs (certified and calibrated) Field.

- Tensiometer.

Not being limiting since the installation must be complete for the membrane to fulfill the waterproofing function according to the project.

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

The provision and installation of single-sided textured HDPE geomembrane e=1.50 mm will be carried out by the Contractor. This activity includes the following activities:

3.1. Preliminary activities: Includes the following activities:

- Unloading of materials: Once the materials are loaded onto the construction site, they are unloaded at sites selected by the Supervisor.

- Transfer of HDPE rolls to the warehouse: The material must be stored in a protected area away from the elements, avoiding moisture.

- Warehouse storage: the geomembrane rolls are stored in the warehouse designated for this purpose.

- Transfer to the placement point: This involves transporting the material from the warehouse to the site where the project is located.

- Alignment: This includes laying out the material at the project site.

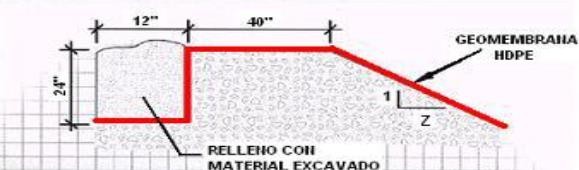
3.2. Installation of the geomembrane

a) Land preparation: the necessary earthworks and leveling must be carried out so that the surface is suitable for the installation of the geomembrane; this will be paid for with the corresponding item.

The supervisor will approve the surface where the geomembrane will be installed, and after this approval, the installation can be carried out.

Before placing the geomembrane, it will be verified that there are no promontories or angular material that could damage the geomembrane. In such case, the contractor will proceed to clean these areas.

b) Anchor trench: The trench excavation will be carried out in advance and will be canceled with the corresponding item. The anchor trench will be excavated with earthworks in depth and width in accordance with the established design prior to the installation of the geomembrane.



The sites where the geomembrane enters the trench must be free of irregularities, protrusions, etc. to avoid potential damage to the material. Backfilling must be carried out when the geomembrane is at its most constricted to avoid possible damage due to dimensional instability. Special care must be taken when filling and compacting the anchor trenches to avoid damaging the geomembrane.

**NOTE:** Both trench excavation, backfilling and activities involving earth movement must be cancelled by the corresponding item, and are not part of this activity, and are paid with the corresponding item.

3.3. Placement of the geomembrane

1. Panel layout: Before starting, a panel layout must be completed showing the location of each geomembrane panel. This layout is for informational purposes only and is typically based on the project plans and specifications. During geomembrane installation, panel placement may differ from the proposed layout.

The project scale drawing will show the actual panel placement in the field. This activity must be supervised by a Site Supervisor.

b) Panel identification:



Each installed panel must be assigned a distinctive number. The panel numbering system must reflect the manufacturer's actual roll number followed by a letter indicating the chronological order of deployment (ex., 1-8522-A, 2-8522-B). Each panel is identified by its number both on the scale drawing and physically on the panel using permanent marker (or spray paint, where permitted).

c) Panel placement: During panel placement, care must be taken to avoid damaging the geomembrane and/or compacted soil. Walking on the geomembrane, as well as traffic, should be kept to a minimum. No one wearing shoes that could puncture, scratch, or otherwise damage the geomembrane should be allowed to walk on it. During panel placement, anchors and ballast (sandbags or other) must be used to prevent wind uplift of the geomembrane. The overlay material (when applicable) should be installed as soon as installation, testing, and repairs to the geomembrane are completed. This will greatly reduce the risk of wind uplift of a large area of the installed geomembrane.

d) Weather conditions: Geomembrane panels should not be deployed or left unsewn overnight. The geomembrane should not be deployed when weather conditions are uncertain or unsuitable for field seams. Extreme temperatures, high humidity, rain, etc. are all unfavorable conditions for field seams. Both the Contractor and

the Supervisor must determine whether the seam can be performed adequately to achieve quality seams.

e) Field Sealing: In general, all seams shall be oriented parallel to the slope, not across them. Related seams (perpendicular to the slope) shall not be located within 5 feet (1.5 meters) of the toe of the slope. The welding technician (Contractor) shall ensure that the seam area is free of dust, moisture, or any other object that could affect the quality of the seam. All intersections in the Panel (“T” seams) shall be extrusion welded to ensure a proper seal. As often as possible, the Contractor

shall cut a 1-inch (25 mm) wide sample at the end of the seams and then perform a peel test.

If the sample fails, welding must be stopped immediately with the designated equipment. The contractor will delineate the defective area and repair it appropriately. A new test seam will be required for the welding technician to resume welding.

f) Sealing procedure: The primary method used should be the hot wedge welder. This automated equipment allows for a higher welding speed as well as a more consistent welding method. Geomembrane panels are overlapped ten (10 cm) apart.

This allows for double-fusion welding and leaves enough material for shear and

peel testing on seam samples taken on-site. These welds include an air channel that allows for air pressure testing of the seam.

- Fusion sealing: This type of sealing is applied longitudinally to join two rolls of geomembrane. This seal leaves an internal channel for quality control.



- Extrusion sealing: This type of sealing is applied to restricted areas such as corners and tight connections where a wedge welder cannot be adequately used; a manual extrusion fillet welder is used. Before any extrusion fillet welding, the geomembrane must be grounded to ensure proper adhesion of the pressure-stretched or extruded material.

- Weld Bead: The extrusion bead or pellet must be made entirely of the same resin, have the same polyethylene type, and be from the same supplier as the geomembrane. Process additives and antioxidants, other than carbon black, must be identified by name and percentage. The total combined percentage of processing media, antioxidants, carbon black, and other additives must be less than 3.5% by weight. All additives must be dispersed throughout the extrusion bead or pellet. There must be no foreign material contamination in the extrusion bead or pellet.



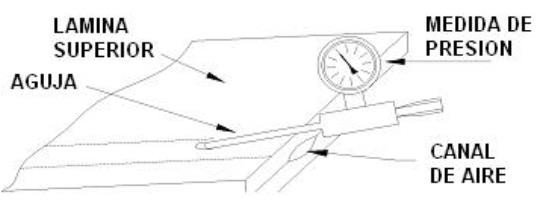
- Test Sealing: Test seals or seams are made before each displacement and at intervals of no more than four or five hours. Test seams must reproduce the same conditions encountered when welding geomembrane panels: type of material, ambient temperature, etc., when climatic conditions vary considerably.



For each test seam, the Contractor cuts four 1-inch (25 mm) wide samples with a die cutter. These samples are then subjected to peel and shear strength testing using a field tensiometer. All four samples must meet or exceed the project requirements for shear and peel testing and exhibit a Film Tear Bond (FTB) failure type. Please refer to NSF-54 for failure types. The test seams are tested and approved by the Contractor, who will document each test seam with the following information: test seam number, welding parameters (speed and temperature), welding technician name, equipment number, date and time, shear and peel test results, etc.

The supervisor may also request test seams from the Contractor when deemed appropriate.

- Documentation: For each seam, the welding technician must mark his initials, equipment number, and the time the welding began on the coating. The Contractor will record this information and provide it to the Supervisor.



- Non-destructive Testing: All seams must be inspected for continuity (100%) using a non-destructive testing method. These methods include the air pressure test and the vacuum box test (the most common methods for polyethylene geomembranes). Any seam that fails either of these tests is reconstructed or repaired until a satisfactory result is obtained. All non- destructive testing results must be recorded on the appropriate form. The supervisor may also request non-destructive testing from the Contractor at his discretion.

- Air Pressure Test (ASTM D5820): The air pressure test is used as much as possible because it is less dependent on observation and provides a supplemental mechanical test for the seam. This test involves injecting air into the center channel of two-way fusion seams at a predetermined pressure of approximately 30 psi (208 kPa). After a monitoring period of three to five minutes, the Quality Control Inspector will record the pressure drop and ensure that it is within the project requirements (see Table 1 for initial air pressure and Table 2 for maximum allowable pressure drop).



Table 1. Initial pressure table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Thickness | Material | Pressure | Minimum | Pressure | Maxima |
| ml | mm | Psi | kPa | Psi | kPa |
| 40 | 1.00 | 24 | 165 | 30 | 207 |

Source: GRI Standard – GM6 Geosynthetics Research Institute

Table 2. Maximum permissible pressure differential after 3 minutes

|  |  |  |  |
| --- | --- | --- | --- |
| Material thickness | | Pressure drop | |
| ml | mm | psi | kPa |
| 40 | 1.00 | 4 | 27.5 |

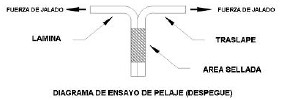
Source: GRI Standard – GM6 Geosynthetics Research Institute

Once the pressure test of a seam has been completed, the edge of a seam opposite the pressure gauge shall be cut to ensure that air pressure can flow freely along the entire seam. If air pressure cannot be removed from the opposite edge of the seam, the blockage of the air channel must be located. If the blockage cannot be visually located, the seam shall be cut in half and both sides of the cut retested. The same procedure must be repeated until the blockage of the channel is located.

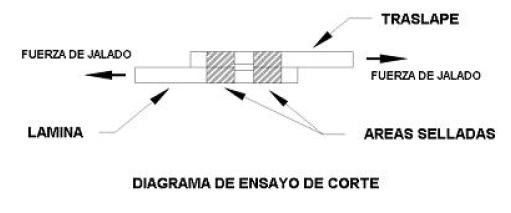
If the seam does not hold air pressure, verify that both edges are properly sealed and retest. If the seal still does not hold pressure and the leak cannot be visually located, the seam overlap must be cut and the seam tested using the Vacuum Box method. The seam can only be considered satisfactory if one of the non-destructive testing methods yields a satisfactory result.

The supervisor may also request non-destructive testing from the Contractor when deemed appropriate.

- Destructive testing: In order to evaluate the seam in the field, tests must be carried out on destructive samples both with respect to detachment and destructive samples are usually marked at a frequency of one for every 500 feet (150 meters) of seam length, unless otherwise specified. This frequency represents an average frequency for the entire project. These tests are performed on a portable device called a tensiometer.



Either the Contractor or the Supervisor will indicate the sample locations. When possible, destructive samples should be taken in such a way that repair procedures are minimal or unnecessary (e.g., in the anchor channel). Care must be taken to ensure that all destructive samples cut from the geomembrane are patched or covered on the same day to avoid possible damage to the compacted soil due to night rains or strong winds. The Contractor must verify the destructive tests with the Supervisor and inform him or her of the locations of all tests so that they can be patched later that same day.



The Contractor shall test four one-inch-wide (25 mm) specimens for shear and peel strength. In the case of double-sided fusion seams, both sides of the seam shall be tested for peel strength.

If all four samples meet the project specifications, the seam is considered to have passed the field test, and the remaining samples can be sent to the laboratory for further testing.

Regarding laboratory tests, passing four out of five samples is considered acceptable. At the end of the project, each field seam must be linked to two passing destructive tests.

The Contractor shall document the destructive tests with the following information: date and time, destructive test number, seam number, location, results of the shear and peel strength tests and type of failure for each sample, which shall be provided to the Supervisor.

The supervisor may also request destructive testing from the Contractor when deemed appropriate.

**4. MEASUREMENT**

This item will be measured by square meter (m2), correctly installed by the contractor and approved by the supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: GEOMET 7 MM**

**UNIT: Square meters**

**1. DESCRIPTION**

This item includes the provision and installation of 7 mm thick HDPE geonet by the Contractor. It includes labor, fuel, materials and necessary tools, and preliminary work such as preparing the work area, cleaning, and removing excess material.

**2. MATERIALS, TOOLS AND EQUIPMENT**

GEONET HDPE 7MM IN ROLLS OF 2.00 MX 50.00 M. BINDING STAPLES

Suitable for collecting and conducting fluids in its plane towards an evacuation system, it must comply with the following technical standards:

|  |  |
| --- | --- |
| **PROPERTIES** | **RULE** |
| Compressive strength | ASTM D 1621  950 kPa |
| Transmissivity | ASTM D 4716  Gradient Hydraulic  =0.1  Pressure=100 kPa  1.0\*10-4 m3/s/m |
|
|
|
|
| Thickness | ASTM D 4716  5MM |
|

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

The provision and installation of 7 MM geonet will be carried out by the Contractor. This activity includes the following activities:

3.1. Preliminary activities: Includes the following activities:

• Unloading of material: once the materials are loaded onto the work site, they are unloaded.

at sites selected by the Supervisor.

• Transfer to roll warehouse: The material must be stored avoiding humidity, in a place

covered from the elements.

• Warehouse storage: the rolls are stored in the warehouse designated for this purpose.

• Transfer to the placement point: consists of taking the material from the warehouse to the work site where

the project is located.

• Alignment: This includes laying out the material at the project site.

3.2. Installation of the geomembrane

a) Land preparation: earthworks and leveling must be carried out necessary for the surface to be suitable for the installation of the geonet, this will be paid with the corresponding item.

The supervisor will approve the surface where the geonet will be installed, and after this approval, the installation can be carried out.

Before installation, it will be verified that there are no bumps or sharp material that could damage the material. In this case, the contractor will proceed to clean these areas.

b) Anchor trench: the trench excavation will be carried out in advance and will be cancelled with

the corresponding item. The anchor trench and earthworks in depth and width according to the established design prior to installation.

The locations where the geonet enters the anchor trench must be free of irregularities, protrusions, etc. to avoid potential damage to the material.

Location of each geonet panel. This layout should be presented for informational purposes only and is typically based on the project plans and specifications. During geonet installation, panel placement may differ from the proposed layout. The project scale drawing will show the actual panel placement in the field. This activity must be supervised by the Site Supervisor.

c) Panel placement: During panel placement, care must be taken not to damage the

Geonet and/or compacted soil. Walking on the panel and traffic should be kept to a minimum. No one should be allowed to wear shoes that could puncture, scratch, or otherwise cause damage. During panel installation, anchors and ballast (sandbags or other) must be used to prevent wind uplift. The underlayment (when applicable) should be installed as soon as installation, testing, and repairs are completed. This will greatly reduce the risk of wind uplift over a large installation area.

d) Field Sealing: In general, all joints should be oriented parallel to the slope, not across. Related joints (perpendicular to the slope) shall not be located within 5 feet (1.5 meters) of the slope toe.

The tests required to verify the proper installation of the geosynthetic will be those requested by the construction SUPERVISOR, based on the specific characteristics of the project.

**4. MEASUREMENT**

This item will be measured by square meter (m2), correctly installed by the contractor and approved by the supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: FILL AND COMPACTED WITH SIFTED SOIL (MATERIAL NOT INCLUDED)**

**UNIT: Cubic meters**

**1. DESCRIPTION**

The work corresponding to this item consists of filling and compacting with sifted earth, using equipment (material not included), in layers, each one duly compacted, according to the location and quantity established in the detail plans, and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MACHINERY AND EQUIPMENT:

SMOOTH ROLLER VIBRO COMPACTOR

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

Organic material must be removed from the areas where filling and subsequent compaction will be carried out.

The material to be used will be the same as the excavated area or, if it is not suitable, the contractor will provide the material to be used.

After the supervisor approves the material to be used for this activity, the contractor will be asked to perform the MODIFIED PROCTOR test to determine the degree of compaction and optimal moisture content. The test must be submitted to the supervisor before beginning compaction work.

Compaction will be carried out using a smooth roller vibratory compactor of adequate capacity to achieve the required compaction level.

The Construction Supervisor will require the execution of density tests on site at different levels of the fill, with at least one (1) test every 150 m3 or one test every 100 m on roads for each layer and, if the volume is less than these, at least 1 density test.

The cost of carrying out these tests must be borne by the contractor.

The degree of compaction should be around 95% of the MODIFIED PROCTOR.

If the required percentage has not been reached, the indicated degree of compaction must be required, so the contractor must redo the work carried out until the degree of compaction is reached.

Compaction requested, this work will be at the contractor's own risk and expense, without any compensation.

Compaction is limited to a layer-by-layer process, each layer with a maximum thickness of 20 cm, and each layer must be compacted before starting the next. When necessary, the material must be moistened until it reaches its optimum moisture content to achieve the required compaction.

Maintaining the optimum moisture content of the fill material is less critical for granular materials than for fine materials such as silts and clays. These procedures should not be considered when the water content cannot be brought to the specified optimum due to uncontrolled factors, such as ambient humidity.

Occasionally, when the fill material is very fine, a little detergent or soapy material can be mixed in to reduce the natural surface tension of the water used to moisten the material and better lubricate the fill particles. A suggested ratio of 0.25 kg of detergent (at the contractor's expense) per cubic meter of water for the fill is recommended.

**4. MEASUREMENT**

The volume of work corresponding to this item will be measured by CUBIC METER (m3), taking into account only the net volume executed by the contractor and duly approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: FLEXIBLE PERFORATED PIPE (HDPE) FOR DRAINAGE Ø6"**

**UNIT: Linear meter**

**1. DESCRIPTION**

The works corresponding to this item consist of the provision and laying of high-density polyethylene (HDPE) pipe with a diameter of 6”.

**2. MATERIALS, TOOLS AND EQUIPMENT**

High-density polyethylene (HDPE) pipe, 6” diameter.

|  |  |
| --- | --- |
| TECHNICAL CHARACTERISTICS | |
| Nominal minimum diameter | 150.00 mm |
| Average minimum external diameter | 177.00 mm |
| Average minimum internal diameter | 151.00 mm |
| Minimum wall thickness | 0.70 mm |
| Minimum tube stiffness at 5% deflection according to ASTM D2412 | 340.00 KPa |
| Drilling type | Slot |

The pipe must comply with AASHTO M252 regulations.

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

The Contractor must verify the vertical or horizontal alignment of the pipes, as well as the correct location of the accessories in the system, following the slopes indicated in the respective plans.

The pipes must be cut square, using a fine-tooth saw or hacksaw, removing any burrs that may remain after cutting the inside and outside of the pipe.

Once the tube has been cut, it will be beveled. This will be done using a file or rasp

(depending on the diameter of the tube) and at an angle of approximately 15° degrees and a length of twice the thickness of the pipe wall. The thickness of the beveled end should be approximately half the thickness of the original wall and not less.

It is clearly established that this cutting work should not be considered as an independent item, but should be included in the unit price of the line.

Once the pipe has been cut, the length of the spigot that will be inserted into the prepared end will be marked with 15 cm longitudinal cuts, simulating the function of a bell. The joint will be completed by inserting the spigot into the prepared 15 cm, tying a geotextile knot at the joint to ensure the pipe's continuous collection function.

Once the excavated trenches have been approved by the Construction Supervisor, the pipes will be laid.

The pipes will be moved to the installation points in such a way as to avoid impacts, breakage, or damage, taking care not to loosen them or let them fall into the trenches. Under no circumstances will the pipes be joined outside the trench and subsequently installed there.

The pipe shall be laid in accordance with the diameters, slopes, and elevations specified in the construction plans and/or the Site Supervisor's instructions, always proceeding from downstream to upstream, ensuring that the pipes rest evenly along their entire length. The pipe shall be installed so that the bells face upstream or opposite the direction of

flow.

Regardless of the method used to determine slopes, the Contractor must always have marks and signs available for rapid verification of the same.

During the execution of the work, the free ends must be closed with suitable plugs, and the use of paper or wood for this purpose is prohibited.

Any changes, regarding slope, alignment, and others, must be previously approved expressly and in writing in the Order Book by the Construction Supervisor.

**4. MEASUREMENT**

The provision and laying of pipes will be measured by METER (m) correctly executed by the contractor and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: 1 1/2" STONE AND GRAVEL DRAIN**

**UNIT: Cubic meters**

**1. DESCRIPTION**

This item refers to the provision and placement of 1 1/2" stone and gravel drainage in filter galleries, intake works, retaining wall drainage, and other sectors identified in the construction detail plans and in accordance with the provisions of the proposal submission form and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS

- BOLON STONE

- 1 1/2" GRAVEL.

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The stone to be used must have the following characteristics:

a) Be of good quality, homogeneous structure, durable and good appearance.

b) It must be free of defects that affect its mechanical properties, without cracks or

fracture planes.

c) Free of clays, oils and adherent or encrusted substances.

d) It must not contain organic compounds.

e) The size of the stone unit will be 0.2 meters and no greater than 0.35m.

The gravel will be 1 ½” in size, clean and free of organic matter.

**3. METHOD OF EXECUTION**

Once the excavation and cleaning of the work site has been completed, the drains will be installed. The Contractor must request prior approval from the Construction Supervisor for the placement of the filter material.

Before installation, the material must be washed and free of organic matter, grease, and other materials that could alter its physical, chemical, and mechanical characteristics.

This material must be placed in layers as specified in the plans or instructions from the Construction Supervisor.

The proportion of stone and gravel shall be 80% and 20% respectively for each cubic meter, unless the supervisor instructs another proportion according to the design.

When the plans or proposal submission form also require the placement of a drainage pipe, it will be installed parallel to the placement of the filter material, following the relevant specifications.

Note: The pipe and excavation will be cancelled with the corresponding item.

**4. MEASUREMENT**

The unit of measurement will be the cubic meter (m3), taking into account only the net volumes placed.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: 10" SDR-41 PVC PIPE RUBBER RING, LAYING**

**UNIT: Linear meter**

**1. DESCRIPTION**

This item includes the provision and installation of 10" SDR 41 unplasticized polyvinyl chloride (PVC) pipes, in accordance with the construction and detail plans and/or instructions of the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIAL:

PVC LUBRICANT (FLEXIBLE JOINT UNION) PVC PIPE 10" SDR-41

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

PVC pipes must comply with the following standards:

- Bolivian Standards NB 1070, 213, 888, ASTM 1784

- Standards equivalent to the previous ones

But in no case may lower quality PVC pipe be used.

The external and internal surfaces of the pipes must be smooth and free of cracks, fissures, undulations, and other defects that impair their quality. The ends must be properly cut and perpendicular to the pipe axis.

The tubes must be of a uniform color.

The pipes will be manufactured from the factory by injection molding. The use of special pieces obtained by cutting or joining pipes cut at an angle is not accepted.

Likewise, under no circumstances should the pipes be heated and then bent; for this purpose, elbows of different angles must be used, as required.

The joints will be of the bell-and-spigot type, as specified in the project.

PVC pipes are easy to handle because they are lightweight. However, extreme care must be taken when unloading them and they should not be thrown, but placed on the ground.

PVC pipes should be stored on suitable supports and stacked no higher than 1.5 m, especially if the ambient temperature is high, as the lower layers could become deformed. They should not be exposed to sunlight for extended periods.

The PVC material must comply with Bolivian Standard 1070. Regarding marking, an indelible marker with a color that contrasts significantly with the pipe material must be used. The marking must be longitudinal and must indicate the following:

• Manufacturer identification

• The nominal diameter and class of pipe according to this standard.

• The legend “Bolivian Industry” or Bolivia

The construction supervisor must verify this fact to certify compliance with the general and special requirements.

The Contractor shall be solely responsible for the quality, transportation, handling, and storage of the pipes. Any material that is damaged or does not comply with the specified standards and specifications shall be replaced before use on site, without any additional payment.

The Contractor must include in its prices the cost of performing the necessary tests required by the Construction Supervisor in accordance with Bolivian Standard NB 1070.

The materials must be certified by the manufacturer, guaranteeing their good quality.

**3. METHOD OF EXECUTION**

The Contractor must verify the vertical or horizontal alignment of the pipes, as well as the correct location of the accessories in the system, following the slopes indicated in the respective plans.

Pipe cutting

The pipes must be cut square, using a fine-tooth saw or hacksaw, removing any burrs that may remain after cutting the inside and outside of the pipe.

Once the pipe has been cut, it will be chamfered. This will be done using a file or rasp (depending on the pipe diameter) at an angle of approximately 15 degrees and a length twice the thickness of the pipe wall. The thickness of the chamfered end should be approximately half the thickness of the original wall, and no less.

It is clearly established that this cutting work should not be considered as an independent item, but should be included in the unit price of the line.

The absence of chamfering will result in the dislocation of the rubber ring inserted in the bell of the other tube.

Union with rubber ring or quick joint

Once the tube has been cut and beveled, the length of the spigot that will be inserted into the hood will be marked according to the manufacturer's recommendations. The parts to be joined will then be thoroughly cleaned with a clean, dry cloth soaked in a special cleaner, (consult the pipe manufacturer) to remove all traces of grease or other impurities.

The lubricant recommended by the manufacturer will be applied to the beveled part of the tube in a minimum thickness of 1 mm.

The beveled end will be inserted into the pipe socket using a small key. It can also be inserted using momentum by firmly pushing the pipe, twisting slightly and applying pressure inward. Care must be taken to ensure that the insertion is not all the way into the socket, as the joint also acts as an expansion joint.

It is advisable to make the joints with two or more workers (depending on the pipe diameter), so that while one holds the end of the pipe with the socket, the other or others insert it into the socket, ensuring the pipe is aligned. It is extremely important to ensure that the pipes are inserted straight, ensuring proper alignment.

The lubricant must never be derived from petroleum; only vegetable lubricants must be used.

Pipe laying

Once the excavated trenches have been approved by the Construction Supervisor, the pipes will be laid.

The pipes will be lowered to the bottom of the trenches in such a way as to avoid impacts, breakage, or damage, taking care not to loosen them or let them fall into the trenches. Under no circumstances will the pipes be joined outside the trench and subsequently installed therein.

The pipe shall be laid in accordance with the diameters, slopes, and elevations specified in the construction plans and/or the Site Supervisor's instructions, always proceeding from downstream to upstream, ensuring that the pipes rest evenly along their entire length. The pipe shall be installed so that the bells face upstream or opposite the direction of

flow.

Regardless of the method used to determine slopes, the Contractor must always have marks and signs available for rapid verification of the same.

During the execution of the work, the free ends must be closed with suitable plugs, and the use of paper or wood for this purpose is prohibited.

Any changes, regarding slope, alignment, and others, must be previously approved expressly and in writing in the Order Book by the Construction Supervisor.

Fastening suspended pipes

Suspended or exposed horizontal pipes must be fixed to slabs or non-structural elements using fixed and sliding clamps placed at a spacing of no less than 2 meters.

All brackets must be metallic and secured with bolts or screws embedded in the walls, partitions, or slabs; these accessories will be the contractor's responsibility.

There may be cases where a damaged pipe already laid must be repaired, which will be done by cutting and discarding the damaged portion, without any additional payment being recognized to the Contractor.

The Contractor will provide the necessary equipment and devices for laying and personnel with extensive experience in installations.

Evidence

Once the pipes have been laid, the Construction Supervisor will conduct a thorough review of the work carried out. If defective work is detected, the contractor will repair and replace the material at his own cost.

The hydraulic test defined by the construction supervisor will then be carried out.

Any leak that occurs during this test will be repaired by the Contractor at its cost. The works will be considered completed when the result of the hydraulic test is

satisfactory.

**4. MEASUREMENT**

The supply and laying of 10" SDR 41 PVC pipe will be measured by LINEAR METER (m) executed by the contractor and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: OLYMPIC MESH NO. 8**

**UNIT: Square meters**

**1. DESCRIPTION**

This item refers to the provision and installation of construction elements with Olympic mesh of galvanized steel No. 8, according to the requirement, dimensions and sectors identified in the plans and/ or instructions of the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

CORRUGATED STEEL

OLYMPIC MESH WIRE NO. 8

ELECTRODE 6010 2.5

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The Olympic mesh will be made of No. 8 galvanized wire with rhombic openings (a quality certificate from the mesh manufacturer must be presented). The Olympic mesh is made of galvanized steel wire, resulting in a product that guarantees a longer lifespan, even in highly corrosive areas.

The mesh must be of good quality and must be approved by the Supervision.

The steel bars will be corrugated and must comply with the requirements of Bolivian Standard NB

732 for corrugated bars.

For welding, 6010 2.5 mm electrode will be used.

The Contractor shall provide all necessary equipment and tools, welding equipment and tools such as wire cutters, metal saws, pliers, etc.

**3. METHOD OF EXECUTION**

The Olympic mesh will be secured and tensioned using corrugated steel, which will be welded on all four edges, in accordance with the project design plans or the instructions of the Construction Supervisor.

Any welding debris and burrs will be polished so as not to impair the appearance and proper functioning.

The tensioning and laying of the mesh will be carried out according to the type of project. Care must be taken to ensure that the Olympic mesh is properly tensioned.

If the galvanizing is damaged in any place, it must be repaired at the Contractor's expense by applying two coats of anti-corrosion paint and two coats of aluminum paint to the damaged area.

**4. MEASUREMENT**

This item will be measured by SQUARE METER (m2), taking into account only the net area executed by the Contractor and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: BIOGAS CHIMNEY INSTALLATION - SANITARY LANDFILL**

**UNIT: Piece**

**1. DESCRIPTION**

This item consists of the installation of previously identified biogas chimneys, which involves the installation of a turil, filling with apple stone, installing a burner, and painting the turil for identification, according to the Supervisor's details and instructions.

**2. MATERIALS, TOOLS AND EQUIPMENT**

- 220-LITER METAL TURIL,

- APPLE STONE

- WHITE OIL PAINT OIL PAINT

- DIFFERENT THINNER COLORS

-

- STEEL BIOGAS BURNER

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The materials to be used must be specific and appropriate for this activity.

The paint must be made from alchemical resins and selected solvents.

The stone to be used will be the so-called "block" stone, sourced from riverbeds, without angles, of more or less uniform size, with maximum dimensions of 0.14 x 0.14 x 0.14 m and minimum dimensions of 0.10 x 0.10 x 0.10 m; it must have the following characteristics:

a) Be of good quality, homogeneous structure, durable and good appearance.

b) It must be free of defects that affect its mechanical properties, without cracks or fracture planes.

c) Free of clays, oils and adherent or encrusted substances.

d) It must not contain organic compounds.

The drums must be in perfect condition, clean, free of any dirt, contaminants, or stickiness; they must not have any dents on their surface and must be approved by the supervisor prior to use.

Any material, which in the Supervisor's judgment is unsuitable for the job, will be rejected.

**3. METHOD OF EXECUTION**

Identifying the chimney installation points, the following activities will be carried out:

First, the necessary excavation will be carried out to install the metal turret, leveling the surface for the proper functioning of the chimney.

The turril will be installed and filled with apple stone up to the crest point.

A 4" diameter hole will be made in the area of the barrel lid for the burner installation. The burner will be made of galvanized steel according to the instructions of the Site Supervisor.

Finally, the chimney will be marked and identified according to its biogas production. Using white paint, a strip of (17 cm high x 30 cm long) is painted on the upper part with a brush using at least two coats of paint, and finally, on the white oil paint, the identification code “CBG” and the corresponding number are painted with red oil paint.

**4. MEASUREMENT**

This item will be measured per piece (PZA) of chimney that the contractor installed, previously verified and approved by the Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: HDPE-HDPE PIPE 110 MM, PE100, SDR-11, PN16 HEAT FUSION UNION**

**UNIT: Linear meter**

**1. DESCRIPTION**

This item includes the provision and installation of 110 mm high-density polyethylene (HDPE) pipes. The item will be executed in accordance with the construction and detail plans, the proposal submission form, and/or the Construction Supervisor's instructions.

**2. MATERIALS, TOOLS AND EQUIPMENT**

Materials:

-HDPE PIPE - HDPE 110mm PE 100, SDR 11, PN 16

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

High-density polyethylene (HDPE) pipes will be composed of three layers:

Outer layer. Highly resistant to the external environment, sunlight, and high and low atmospheric temperatures. Resistant to contact with lime and cement.

Core layer. Ability to withstand water pressures exceeding 100 kg/cm2, low creep rate, high softening point, and thread resistance.

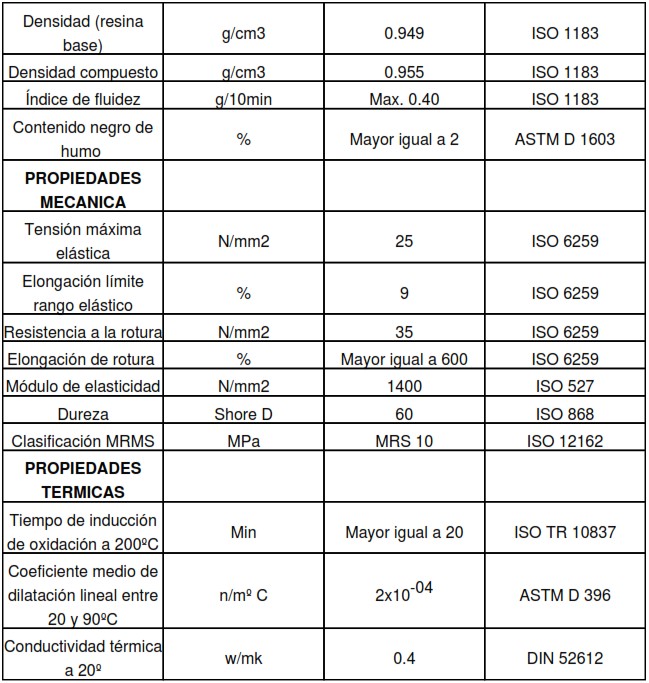
Inner layer. Its surface must be free of porosity, non-toxic, and must not affect the color, odor, or taste of the transported water. It must resist corrosion and be able to conduct boiling water, acids, and alkalis.

The pipe must be manufactured based on the ISO 4427 standard.

The lifespan of the pipeline will be 50-100 years.

The material used for this pipe will be high-strength polyethylene PE 100.

Technical specifications PE100 resin.



The pipe must be of a recognized brand and be approved by the supervisor before its acquisition.

The Construction Supervisor will approve materials that are in perfect condition, without any justification for any causes that may have caused any damage.

The internal and external surfaces of the pipes must be smooth and reasonably free of visible flaws. Any material showing cracks, blisters, or deformations in the circular cross- section must be discarded.

The materials to be used must be of a quality and type that ensure the durability and correct operation of the facilities. They must meet the following general requirements: Constant section, uniform thicknesses, dimensions, weights according to the project requirements, and must be free of defects, cracks, dents and crushing, be of a recognized national or international brand and of certified top quality.

HDPE – PEAD must be resistant to some chemical agents according to the following table:



The pipe must be strong, durable, and suitable for contact with and transport of corrosive chemicals, acids, and salts, as well as having a high tensile strength of 330 kg/cm2 (ASTM D638).

HDPE pipes have a low thermal conduction of 0.45 W/m, ºK.

The coefficient of thermal expansion must be 2x10-4m/mºC.

The pipe must be flexible enough to follow the contours of the terrain and/or be able to change direction without the need for any accessories.

Since HDPE pipes allow for relatively small bend radii, the layout should be chosen so that horizontal changes in direction can be made by simply bending the pipe, eliminating the need for expensive elbows.

The curvature radii will be defined by the manufacturer's recommendations.

HDPE pipes should not be dragged during transport. If a pipe becomes damaged or kinked during handling or storage, the affected portion must be completely removed.

Under no circumstances should the pipes be bent. It is very important to avoid cuts caused by sharp stones or other sharp objects.

For storage, rolls can be placed horizontally one on top of the other, or vertically, one on top of the other. The bars are stored in bundles, strapped with wooden bands that support the weight when stacked.

one on top of the other, they can also be stored on horizontal shelves, providing the necessary support to prevent deformation.

Storage should be in covered areas if possible.

Stored pipes must be positioned so that fuels, solvents, aggressive paints, etc. do not come into contact with them.

Pipes should not be stored in areas where they may come into contact with other steam or hot water pipes and should be kept away from surfaces with temperatures above 50°C.

**3. METHOD OF EXECUTION**

Pipe laying work must be performed by personnel trained in the field. The work is considered complete when the hydraulic test results are satisfactory (the cost of the hydraulic test will be borne by the contractor).

The Contractor shall be fully responsible for the materials required to carry out the installation and shall protect them against damage or loss.

The Contractor is obliged to replace at its own cost any part that has been damaged or destroyed.

The pipe can be joined outside the trench by thermofusion or electrofusion (payment for couplings, if necessary, will be considered in the corresponding item).

For placement, bedding is important and it must be verified that the fill material is adequate, as well as the compaction process.

The installation base must be sufficiently stable, and the bottom of the trench supporting the pipe must be flat and free of sharp objects. To this end, a bed of fine sand or selected material (sifted earth) must be prepared so that the pipe does not come into contact with sharp or pointed objects that could damage it. These activities will be canceled under the

corresponding item.

When the base of the trench contains saturated clay, mud, or silt, lacking the minimum mechanical conditions for pipe settlement, a well-bedded gravel base should be provided. A 15 cm bed of fine sand or selected material should be placed on top of the gravel base.

Once the bedding is complete, the pipe is extended and the lateral or ribbed fill material is placed. The material can be the same as that extracted from the trench, but it must be sifted, avoiding large or sharp objects that could damage the pipe. This fill must be compacted every 10 cm on the sides of the pipe until it covers the crown, and at least 15 cm beyond. Compaction must be done manually.

The remainder of the trench can be filled with excavated material and compacted every 20 to

25 cm using appropriate equipment. It is recommended to compact the trench with a full, pressurized pipe, leaving the joints free for hydraulic testing.

For pipe passage through structural elements, suitable sleeves or sleeves shall be used. The sleeve length shall be equal to the thickness of the element it passes through. The internal diameters of the sleeves must allow 1 cm of play around the pipe.

At the end of the workday, and whenever the end of a pipe must be left uncovered for more than 6 hours, the Contractor is required to install a plug to ensure the interior of the pipe is clean.

The work is considered complete when the hydraulic test results are satisfactory. The contractor must provide all materials and tools necessary to perform the hydraulic test.

The contractor is responsible for the integrity and good condition of the laid pipeline; any defects or damage must be corrected at the contractor's expense.

**4. MEASUREMENT**

The provision and laying of pipes will be measured by METER (m) correctly placed, and approved by the

Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: BACKHOE EXCAVATION**

**UNIT: Cubic meters**

**1. DESCRIPTION**

This activity involves carrying out open-air excavations using backhoe-type machinery, according to the dimensions established in plans and/or instructions from the construction supervisor.

In order not to alter the physical properties of the soil to be removed, it is recommended to excavate up to 25 cm below the desired elevation.

**2. MATERIALS, TOOLS AND EQUIPMENT**

The equipment considered for this activity is of the type:

-BACKHOE

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It is understood that this activity includes all inputs to guarantee industrial safety on site, both for construction personnel and passersby, and these must be required by supervision for strict compliance during the execution of the work.

**3. METHOD OF EXECUTION**

Once the layout has been completed and the sectors to be excavated have been defined, the supervisor will authorize the start of excavation of trenches and/or pits with a backhoe, indicating that it must be done up to

25 cm above the level specified in the plans. The remaining 25 cm will be excavated by hand without altering the desired elevation.

Excavations will be carried out in the open air according to the project plans and/or the supervisor's instructions, using a backhoe. The bottom must be leveled and finished so that the base offers firm and uniform support throughout the entire excavated area.

If excavation is carried out below the lower limit specified in the construction plans or as indicated by the Construction Supervisor, the Contractor shall carry out the backfilling and compaction at its own expense and risk. This backfill shall be proposed to the Construction Supervisor and approved by him before and after its completion. Any additional volume excavated to facilitate its work or for any other unjustified reason not duly approved by the Construction Supervisor shall be borne by the Contractor.

Throughout the excavation process, the Contractor shall exercise the utmost care and take appropriate measures to avoid interruption of all existing services, such as drinking water, sewage, electricity, and others. In the event of damage to these services, the Contractor shall bear the repair costs required by the service provider. To this end, the Contractor shall notify the construction supervisor immediately upon occurrence of the event.

The excavated material must be placed in the locations indicated in writing by the Construction Supervisor, in such a way as not to harm the project. Otherwise, the Contractor must, at its own expense and without any additional charge, relocate the material to the authorized locations.

**4. MEASUREMENT**

The quantification of the excavated material will be done by CUBIC METER (m3), measured in a bench (net volume) and authorized by the construction supervisor, without taking into account any type of swelling.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: SMOOTH HDPE GEOMEMBRANE E= 0.75 MM**

**UNIT: Square meters**

**1. DESCRIPTION**

This item includes the provision and installation of smooth HDPE geomembrane e=0.75 mm, by the Contractor, including labor, fuel, materials and necessary tools, prior work, such as: preparation of the work area, cleaning and removal of excess material.

**2. MATERIALS, TOOLS AND EQUIPMENT**

HDPE GEOMEMBRANE 0.75 MM THICK SMOOTH

High Density Polyethylene Geomembrane SMOOTH 0.75 mm, Minimum density of 0.940 (g/cm3).

It is characterized by its low permeability, high resistance to leaching processes, high tensile strength, chemical inertness, and excellent low-temperature performance for storing liquids and solids. It is also resistant to UV radiation due to its carbon black content. It must also meet the following technical standards:

|  |  |
| --- | --- |
| **PROPERTIES** | **RULE** |
| Average Thickness | ASTM D 5199 |
| Lowest Individual Minimum  Density | ASTM D 792 |
| Tensile Properties: | ASTM D 6693 |
| Yield stress | Type IV |
| Breaking Tension |  |
| Yield elongation |  |
| Elongation at Break |  |
| Tear Resistance | ASTM D 1004 |
| Puncture Resistance | ASTM D 4833 |
| Crack Resistance Carbon | ASTM D 5397 |
| Content | ASTM D 4218 |
| Carbon Dispersion | ASTM D 5596 |
| Oxidative Induction Time (OIT) a) |  |
| Standard OIT | ASTM D 3895 |
| b) High OIT pressure | ASTM D 5885 |
| Oven Aging at 85 ºC a) | ASTM D-5721 |
| Retention 90 days standard OIT | ASTM D-3895 |
| b) 90-day High Pressure Retention | ASTM D5885 |
| UV resistance | ASTM D-7238 |
| Retention 1920 hr. ILO-HP. | ASTM D-5885 |

EQUIPMENT AND MACHINERY:

The equipment involves the following:

- Thermofusion machines for sealing sheets (certified and calibrated)

- Extrusion machines for minor repairs (certified and calibrated)

- Field tensiometer

Not being limiting since the installation must be complete for the membrane to fulfill the waterproofing function according to the project.

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

3.1. Preliminary activities: Includes the following activities:

- Unloading of materials: Once the materials are loaded onto the construction site, they are unloaded at sites selected by the Supervisor.

- Transfer of HDPE rolls to the warehouse: The material must be stored in a protected area away from the elements, avoiding moisture.

- Warehouse storage: the geomembrane rolls are stored in the warehouse designated for this purpose.

- Transfer to the placement point: This involves transporting the material from the warehouse to the site where the project is located.

- Alignment: This includes laying out the material at the project site.

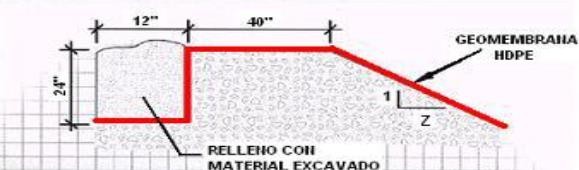
3.2. Installation of the Geomembrane

g) Land preparation: the necessary earthworks and leveling must be carried out so that the surface is suitable for the installation of the geomembrane; this will be paid for with the corresponding item.

The supervisor will approve the surface where the geomembrane will be installed, and after this approval, the installation can be carried out.

Before placing the geomembrane, it will be verified that there are no promontories or angular material that could damage the geomembrane. In such case, the contractor will proceed to clean these areas.

h) Anchor trench: The trench excavation will be carried out in advance and will be cancelled with the corresponding item. The anchor trench will be excavated with earthworks in depth and width in accordance with the established design prior to the installation of the geomembrane.



The sites where the geomembrane enters the trench must be free of irregularities, protrusions, etc. to avoid potential damage to the material. Backfilling must be carried out when the geomembrane is at its most constricted to avoid possible damage due to dimensional instability. Special care must be taken when filling and compacting the anchor trenches to avoid damaging the geomembrane.

**NOTE:**Both trench excavation, backfilling and activities involving earth movement must be cancelled by the corresponding item, and are not part of this activity, and are paid with the corresponding item.

3.3. Placement of the geomembrane

1. Panel Layout: Before starting, a panel layout must be completed showing the location of each geomembrane panel. This layout is for informational purposes only and is typically based on the project plans and specifications. During geomembrane installation, panel placement may differ from the proposed layout. The project scale drawing will show the actual panel placement in the field. This activity must be supervised by a Site Supervisor.

d) Panel identification:



Each installed panel must be assigned a distinctive number. The panel numbering system must reflect the manufacturer's actual roll number followed by a letter indicating the chronological order of deployment (e.g., 1-8522-A, 2-8522-B). Each panel is identified by its number both on the scale drawing and physically on the panel using permanent marker (or spray paint, where permitted).

i) Panel placement: During panel placement, care must be taken not to damage the geomembrane and/or compacted soil. Walking on the geomembrane, as well as traffic, must be kept to a minimum. No one wearing shoes that walking on the geomembrane can puncture, scratch, or otherwise damage it. During panel placement, anchors and ballast (sandbags or other) should be used to prevent wind uplift of the geomembrane. The underlay (when applicable) should be installed as soon as installation, testing, and repairs to the geomembrane are completed. This will greatly reduce the risk of wind uplift of a large area of the installed geomembrane.

j) Weather conditions: Geomembrane panels should not be deployed or left unsewn overnight. The geomembrane should not be deployed when weather conditions are uncertain or unsuitable for field sewing. Extreme temperatures, high humidity, rain, etc. are all unfavorable conditions for field sewing. Both the Contractor and the Supervisor must determine whether the sewing can be performed adequately to achieve quality seams.

k) Field Sealing: In general, all seams shall be oriented parallel to the slope, not across them. Related seams (perpendicular to the slope) shall not be located within 5 feet (1.5 meters) of the toe of the slope. The welding technician (Contractor) shall ensure that the seam area is free of dust, moisture, or any other object that could affect the quality of the seam. All intersections in the Panel (“T” seams) shall be extrusion welded to ensure a proper seal. As often as possible, the Contractor

shall cut a 1-inch (25 mm) wide sample at the end of the seams and then perform a peel test.

If the sample fails, welding must be stopped immediately with the designated equipment. The contractor will delineate the defective area and repair it appropriately. A new test seam will be required for the welding technician to resume welding.

l) Sealing procedure: The primary method used should be the hot wedge welder. This automated equipment allows for a higher welding speed as well as a more consistent welding method. The geomembrane panels are overlapped ten (10 cm) apart.

This allows for double-fusion welding and leaves enough material for shear and

peel testing on seam samples taken on-site. These welds include an air channel that allows for air pressure testing of the seam.

- Fusion sealing: This type of sealing is applied longitudinally to join two rolls of geomembrane. This seal leaves an internal channel for quality control.



- Extrusion sealing: This type of sealing is applied to restricted areas such as corners and tight connections where a wedge welder cannot be adequately used; a manual extrusion fillet welder is used. Before any extrusion fillet welding, the geomembrane must be grounded to ensure proper adhesion of the pressure-stretched or extruded material.

- Weld Bead: The extrusion bead or pellet must be made entirely of the same resin, have the same polyethylene type, and be from the same supplier as the geomembrane. Process additives and antioxidants, other than carbon black, must be identified by name and percentage. The total combined percentage of processing media, antioxidants, carbon black, and other additives must be less than 3.5% by weight. All additives must be dispersed throughout the extrusion bead or pellet. There must be no foreign material contamination in the extrusion bead or pellet.



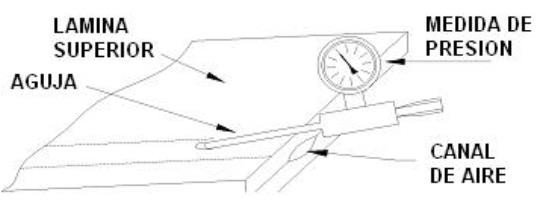
- Test Sealing: Test seals or seams are made before each displacement and at intervals of no more than four or five hours. Test seams must reproduce the same conditions encountered when welding geomembrane panels: type of material, ambient temperature, etc., when climatic conditions vary considerably.



For each test seam, the Contractor cuts four 1-inch (25 mm) wide specimens with a die cutter. These specimens are then tested for peel and shear strength using a field tensiometer. All four specimens must meet or exceed the project requirements for peel and shear testing and exhibit a Film Tear Bond (FTB) failure type. Please refer to NSF-54 for failure types. The test seams are tested and approved by the Contractor, who will document each test seam with the following information: test seam number, parameters for the welding (speed and temperature), name of the welding technician, equipment number, date and time, results of the cutting and peeling tests, etc.

The supervisor may also request test seams from the Contractor when deemed appropriate.

- Documentation: For each seam, the welding technician must mark his initials, equipment number, and the time the welding began on the coating. The Contractor will record this information and provide it to the Supervisor.



- Non-destructive Testing: All seams must be inspected for continuity (100%) using a non-destructive testing method. These methods include the air pressure test and the vacuum box test (the most common methods for polyethylene geomembranes). Any seam that fails either of these tests is reconstructed or repaired until a satisfactory result is obtained. All non- destructive testing results must be recorded on the appropriate form. The supervisor may also request non-destructive testing from the Contractor at his discretion.

- Air Pressure Test (ASTM D5820): The air pressure test is used as much as possible because it is less dependent on observation and provides a supplemental mechanical test for the seam. This test involves injecting air into the center channel of two-way fusion seams at a predetermined pressure of approximately 30 psi (208 kPa). After a monitoring period of three to five minutes, the Quality Control Inspector will record the pressure drop and ensure that it is within the project requirements.



Table 1. Initial pressure table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Thickness | Material | Pressure | Minimum | Pressure | Maxima |
| ml | mm | Psi | kPa | Psi | kPa |
| 40 | 0.75 | 24 | 165 | 30 | 207 |

The values are for reference only and must be verified with the technical specifications of the material and the joining system.

Source: GRI Standard – GM6 Geosynthetics Research Institute

Table 2. Maximum permissible pressure differential after 3 minutes

|  |  |  |  |
| --- | --- | --- | --- |
| Material thickness | | Pressure drop | |
| ml | mm | psi | kPa |
| 40 | 0.75 | 4 | 27.5 |

The values are for reference only and must be verified with the technical specifications of the material and the joining system.

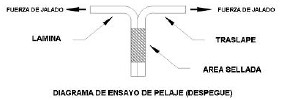
Source: GRI Standard – GM6 Geosynthetics Research Institute

Once the pressure test of a seam has been completed, the edge of a seam opposite the pressure gauge shall be cut to ensure that air pressure can flow freely along the entire seam. If air pressure cannot be removed from the opposite edge of the seam, the blockage of the air channel must be located. If the blockage cannot be visually located, the seam shall be cut in half and both sides of the cut retested. The same procedure must be repeated until the blockage of the channel is located.

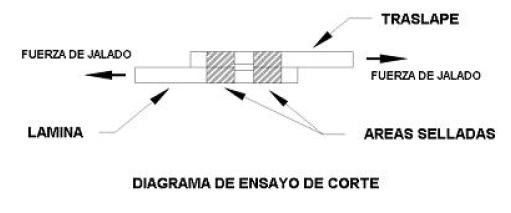
If the seam does not hold air pressure, verify that both edges are properly sealed and retest. If the seal still does not hold pressure and the leak cannot be visually located, the seam overlap must be cut and the seam tested using the Vacuum Box method. The seam can only be considered satisfactory if one of the non-destructive testing methods yields a satisfactory result.

The supervisor may also request non-destructive testing from the Contractor when deemed appropriate.

- Destructive Testing: To evaluate the seam in the field, destructive tests must be performed on samples for both peel and shear strength. Destructive samples are usually marked at a frequency of one for every 500 feet (150 meters) of seam length, unless otherwise specified. This frequency represents an average frequency for the entire project. These tests are performed on a portable device called a tensiometer.



Either the Contractor or the Supervisor will indicate the sample locations. When possible, destructive samples should be taken in such a way that repair procedures are minimal or unnecessary (e.g., in the anchor channel). Care must be taken to ensure that all destructive samples cut from the geomembrane are patched or covered on the same day to avoid possible damage to the compacted soil due to night rains or strong winds. The Contractor must verify the destructive tests with the Supervisor and inform him or her of the locations of all tests so that they can be patched later that same day.



The Contractor shall test four one-inch-wide (25 mm) specimens for shear and peel strength. In the case of double-sided fusion seams, both sides of the seam shall be tested for peel strength.

If all four samples meet the project specifications, the seam is considered to have passed the field test, and the remaining samples can be sent to the laboratory for further testing.

Regarding laboratory tests, passing four out of five samples is considered acceptable. At the end of the project, each field seam must be linked to two passing destructive tests.

The Contractor shall document the destructive tests with the following information: date and time, destructive test number, seam number, location, results of the shear and peel strength tests and type of failure for each sample, which shall be provided to the Supervisor.

The supervisor may also request destructive testing from the Contractor when deemed appropriate.

**4. MEASUREMENT**

This item will be measured by square meter (m2), correctly installed by the contractor and approved by the supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: SUPPLY OF MATERIALS FOR OLYMPIC MESH NO. 10 OPENING 10X10, H=1.9M WITH 2 1/2" GALVANIZED IRON POST, EVERY 2.5M AND CYCLOPEAN CONCRETE ANCHORAGE DICE**

**UNIT: Square meters**

**1. DESCRIPTION**

This item refers to the provision and placement of Olympic mesh with a 2” FG post with a foundation and HºCº anchoring sockets with a height of 1.90 meters with a 2”x1/8” plate for fencing areas according to construction plans, proposal submission form and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS

- CORRUGATED STEEL 6 mm (1/4")

- Running Sand

- CEMENT

- ROUGH STONE

- ELECTRODE 6010 2.5

- FG 2" PIPE

- 3/4" GRAVEL

- 2" X 1/8" PLATE

- OLYMPIC WIRE MESH Nº 10 OPENING 10x10

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

Any material that the supervisor deems unsuitable for the job will be rejected.

The Olympic mesh will be made of No. 10 gauge galvanized wire with rhombic openings of 10 x 10 cm (or its equivalent in inches), with a tensile strength of no less than 380 Mpa.

**3. METHOD OF EXECUTION**

All foundation blocks must be laid out according to the detailed plans or as instructed by the supervisor. The area to be worked on will be identified and the areas in poor condition will be untied, preferably from post to post or from anchor to anchor.

The FG pipes must be embedded in the 25 x 25 cm and 50 cm deep cyclopean concrete cubes; the lower embedded part of the pipe must have an inverted "Y" shaped opening for the respective anchoring.

The embedding must be made with a depth of 45 cm, with a margin of 2 cm.

There will be a 2.5 space between anchor die and die, as mentioned above this measurement should be made from axis to axis.

Before securing the mesh, the verticality of each post must be verified, along with their stability and strength. Therefore, the use of reused pipes or pipes with rust, etc., is prohibited.

The horizontal support between the mesh and the ground will be provided by a concrete foundation with a 1:3:4 ratios, 15 cm thick and 20 cm deep.

The mesh will be fastened to the pipe using galvanized tie wire previously approved by the Site Supervisor. It must then be secured by welding, leaving as few burrs as possible.

6mm corrugated steel will be used at the bottom of the mesh to tension it, securing it by welding. This tensioning work will be approved by the Site Supervisor. If this is not approved by the Site Supervisor, the work must be carried out again at your own cost.

The plate must provide rigidity to the upper part of the mesh, since it will be held with wire, helping to tension the mesh between posts. This wire must be secured to the plate by welding.

**4. MEASUREMENT**

This item will be measured by METER (m) correctly installed, and approved by the construction supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: LAYOUT AND LAYOUT FOR PIPES**

**UNIT: Linear meter**

**1. DESCRIPTION**

This item refers to the layout and routing of pipelines, in accordance with the construction plans, proposal submission form and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS

* TIE WIRE NAILS
* WOODEN STAKES

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

The Contractor will request the Construction Supervisor for the corresponding authorization to carry out the layout of the Work.

The layout and design of the constructions will be carried out by the Contractor in strict compliance with the dimensions and indications of the corresponding plans.

The layout must be approved in writing by the Works Supervisor prior to the commencement of any excavation work.

The contractor will arrange, if the case warrants, the use of axes that will be secured with stakes every 5, 10 and 20 m, according to the authorization of the Construction Supervisor. Whatever the method used to determine slopes, the contractor must have marks and signs available at all times for rapid verification of the same. Furthermore, given the conditions of the terrain, he must foresee and verify all existing services in the area so as not to hinder the normal development of the work.

All references (topographical markings) must remain outside the future earthworks. The general location, alignment, elevations and levels of the work must be properly

marked in the field. Reference points must be clearly identified and maintained

throughout the execution of the work, in order to allow control by the Construction

Supervisor, who must verify and approve the layout carried out.

**4. MEASUREMENT**

This item will be measured by linear meter (m) duly executed and approved by the construction supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: INSPECTION CHAMBER 0.6 X 0.6 X 1 M HºCº 70% DISPLACEMENT STONE**

**UNIT: Piece**

**1. DESCRIPTION**

This item includes the construction of a H°C° inspection chamber with 70% displacement stone, with internal dimensions of 0.60x0.60x1.00 m, does not include a cover, in the designated locations and according to the designs indicated in the construction detail plans and/or according to the instructions of the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS

- Running Sand

- FINE SAND

- CEMENT

- NAILS

- COMMON GRAVEL

- WOOD FOR CONSTRUCTION (3 USES)

- ROUGH STONE

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

- The cement must comply with the provisions of NB 011.

- The aggregate granulometry must comply with the specifications of one of the following standards: ASTM C 33 “Specification for Concrete Aggregates”. CBH-87 “Bolivian Reinforced Concrete Code” Section

2.2.

- The water must comply with the specifications in CBH-87 “Bolivian Reinforced Concrete Code” Section 2.3.

- The water used must be clean and free of harmful substances, such as oils or organic materials.

- The use of stagnant water from small lagoons or from swamps or marshes will not be permitted.

- Wastewater or contaminated water from sanitary or storm sewer discharges may not be used either. Any water of questionable quality must be subjected to the respective analysis and authorized by the Construction Supervisor before use.

In general, aggregates must be clean and free of materials such as clay, adhering mud, slag, cardboard, plaster, pieces of wood or organic matter.

- The stone must be:

• Good quality, homogeneous structure, durable and good looking.

• Free of defects that affect its mechanical properties, without cracks or flat surfaces fracture.

• Free of clays, oils and adherent or encrusted substances.

• It must not contain organic compounds.

• The maximum size of the stone unit will be 15 cm.

- The formwork must be suitable, free from deformations or twists, and have sufficient strength to contain the mixture and withstand the stresses caused by pouring without deforming.

- Aggregates that have demonstrated through practical experience the production of high-strength and high-durability concretes, but do not meet the requirements of the standards specified above, may be used subject to special approval from the Construction Supervisor.

**3. METHOD OF EXECUTION**

Once the excavation has been executed and completed, and the foundation soil has been leveled— activities considered in separate items—the correct location of the chamber will be redesigned, and the slab and finish levels will be determined.

Due care must be taken in marking the excavation site to prevent accidents, both for personnel belonging to the site and for those not involved.

Initially, the foundation slab, made of H°C°, will be poured with a thickness equal to 20 cm, on the leveled and compacted soil.

The slopes that direct water from the inlet pipe to the outlet pipe will be laid on this foundation slab. The surfaces must be finished with cement plaster to facilitate water runoff.

Likewise, the walls will be poured and built on the slab with H°C°, with a thickness of 20 cm.

The H°Cº will be made up of 70% displacement stone and concrete respectively, with a dosage of 1:2:4, with a characteristic resistance of 18MPa at 28 days.

Once the chamber is constructed, the walls and floor must be waterproofed with a cement mortar: fine sand, in a 1:3 ratio, to a minimum thickness of 0.5 cm.

Before pouring, care must be taken to determine the finished height, leaving the correct space for pouring the element that supports the lid.

The base that will house the cover will be supported on the structure in such a way that it is secured against horizontal movement and has sufficient support area to transmit, without being damaged, the loads to the lower structure.

The clearance between the lid and the receptacle must not exceed 5 mm and must be geometrically compatible. Poorly fitted parts will be rejected.

The finished level of the curb must coincide with the roadway grade. Level differences will not be permitted. At the request of the Construction Supervisor, permeability tests may

be performed on these units, especially in areas where groundwater inflow into the collectors is restricted and controlled.

**4. MEASUREMENT**

The inspection chamber will be measured by PIECE (Pza) correctly executed by the Contractor, in perfect operation and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: METAL DOOR WITH OLYMPIC MESH**

**UNIT: Square meters**

**1. DESCRIPTION**

This item refers to the execution of metal doors with Olympic mesh, according to details presented in plans and/or the instructions of the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS

- ANTI-CORROSIVE PAINT (ZINC

- PHOSPHATE) 1" X 10 CM WELDING HINGE

- OLYMPIC MESH WIRE NO. 10 OPENING 5 x 5 cm

- ELECTRODE 6010 2.5

- 2" FG PIPE

- 1" FG PIPE

- CORRUGATED STEEL

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

- Olympic mesh is a metal fence made of galvanized steel wire twisted helically and woven in such a way that it forms a continuous mesh, formed by diamonds or rhombuses

without twists or knots, except at the ends, where knots or twists are made for the edges.

- A factory quality certificate must be obtained to endorse the technical characteristics of the product.

- The electrodes must be of good quality and the welding procedures must be adapted to the type of material to be welded, thicknesses and shapes of the joints that must be indicated in the plans or indicated by the Supervisor and the positions in which the welds must be made to ensure that the metal is satisfactorily deposited along the entire length and thickness of the joint and minimize distortions and stresses due to material retraction.

- FG pipes will be 1” and 2”, with a minimum thickness of 3 mm, free of defects.

- The fixing and rotation elements must ensure the door opens smoothly and quietly with minimal maintenance. Doors must be easy to assemble and disassemble, yet robust and have sufficient fixing elements to ensure adequate impact resistance.

**3. METHOD OF EXECUTION**

Initially, the door structure will be built, using 2" galvanized iron pipe for the frame and 1" for the stiffeners. All pipes must be properly aligned.

To secure the Olympic mesh, Ø 6 iron rods will be used, welded at the edges, so that the

Olympic mesh has a tension free from deformation.

On one side of the door, the hinges will be welded and hung on the door's support structure, in an adequate number, so that they support the door and its opening is easy, firm and free.

Likewise, a handle and rings (padlock-mounted) must be welded from the same material structure according to the door design and/or the Supervisor's instructions.

The door will be painted with two coats of anti-corrosion paint. For proper application, the

Contractor must follow the manufacturer's recommendations.

**4. MEASUREMENT**

The item will be measured by SQUARE METER (m2), taking into account only the net area executed and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: PLANTED LARGE SHRUB SPECIES (H= 1.0 TO 1.5 M)**

**UNIT: Piece**

**1. DESCRIPTION**

This item consists of planting shrubby flowering species. The designated area is established in the detailed plans, proposal submission form, and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS

- BLACK EARTH

- LARGE SHRUB SPECIES (H= 1.0 TO 1.5 M)

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

In general, the soil is prepared by digging at different depths, depending on the plant category, the normal rooting depth, and whether it is annual, perennial, or bulbous.

It is important to work the soil in at least two directions: from north to south and the second tillage perpendicularly, that is, from east to west.

The land must be fully prepared, working it with appropriate tools according to the dimensions of the land, adding vegetable fertilizer (peat), sheep manure and black soil, according to the requirements of the species to be planted.

After preparing the soil, rake it to create the final level. Then, dig an individual hole and plant it, firming it with your fingers, not the palm of your hand. Once planting is complete, water thoroughly, with the plunger set to a mist setting to avoid dragging loose soil or damaging existing plants.

The soil is then fine-tuned using an 80 cm wide ruler. The plants are then distributed at

the specified density per square meter, or according to the plant's diameter. Once the bed is finished, it should be watered thoroughly, but with a fine mist of water; never with a strong jet, as this can damage the leaves and cause erosion of the newly tilled soil.

**4. MEASUREMENT**

The item will be measured by planted shrub species (Sq.), taking into account only the net area executed and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: REPLACEMENT OF ROADS**

**UNIT: Linear meter**

**1. DESCRIPTION**

This item includes the location, layout, layout, alignment and topographic leveling work required for the general and detailed location of the work, in strict compliance with the construction plans and/or instructions of the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- NAILS

- WOODEN STAKES

- OIL PAINTING

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

The contractor will not proceed in any way without the Construction Supervisor authorizing the areas to be intervened; otherwise, the work will not be recognized for payment purposes.

The Supervision Department will provide the Contractor with project plans to locate reference points for the layout and alignment of the axis, both on tracks and in stands.

The contractor will drag and install the necessary BMs to carry out the layout; these must be verified by the construction supervisor. This work must be computed within the costs of this item.

The labor and equipment necessary for the correct execution of this item must be provided by the contractor and will be at his expense.

The contractor is responsible for obtaining detailed cross-sections in advance, which must be approved by the supervisor, to serve as a basis for calculating earthworks.

All information concerning the topographic work must be submitted to the Construction Supervisor in the appropriate format.

The Contractor shall carry out the layout of all sections and works to be constructed based on the project plans and/or as instructed by the supervisor.

The general location, alignment, elevations and levels of the work must be properly marked in the field to allow for control by the Construction Supervisor, who must verify and approve the layout carried out.

The level benches and references of the topographic survey must be carefully maintained by the Contractor. To this end, wooden stakes will be placed at least every meter and painted for identification.

Prior to opening any work front and at least 24 hours in advance, the Contractor must request approval of the topographical plan from the Construction Supervisor.

**4. MEASUREMENT**

This Item will be measured by METER (m) staked out and properly identified by the contractor and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: SUPPLY AND INSTALLATION OF PREFABRICATED OFFICE**

**UNIT: Piece**

**1. DESCRIPTION**

This item includes site preparation, provision and installation of a prefabricated or modular office, in accordance with the plans and instructions of the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- PREFABRICATED OFFICE WITH 3 ROOMS (BEDROOM, BATHROOM AND OFFICE) WITH A MINIMUM SURFACE AREA OF 18 M2.

Structure feature:

- Structure made up of metal porticos manufactured with A-36 structural steel.

- Structure support system

Metal stairs for entry

- Roof made of galvanized steel sheeting.

- Thermal insulation in the ceiling and internal and external walls with polystyrene thermoacoustic panels.

The office must have exterior and interior doors, and sliding windows for all the spaces described.

The floor must be floating; the office must have at least the following items:

- Electrical Connections

- Thermal Distribution

- Board

- Double 220V outlets A/C

- power outlet

- Power Take-Off

- Shower Switches

- Fluorescent luminaires for all environments

- Outdoor Lighting

- Bathroom Extractor

- Hydrosanitary water connection 4"

- PVC sanitary network

- Stopcocks

- Cold water points

- Drainage points

- Mirror

- Bathroom Set (Soap Dish, Towel Rack, Paper Hanger,

- Seat) White Toilet

- White pedestal sink 03 Electric

- Shower

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

Internal electrical and plumbing installations must be included in this item.

**3. METHOD OF EXECUTION**

The land where the prefabricated office will be built must be compacted and leveled.

Following this ground preparation work, the structure's support system will be installed. Depending on the system chosen, the support slab will be poured, supports installed at the ends, or any other support system chosen to guarantee the stability and functionality of the office. These works are included in this item.

Finally, the modular office will be unloaded and installed, taking into account all the minimum aspects listed in the materials, tools, and equipment section, detailed in this item.

**4. MEASUREMENT**

This Item will be measured per piece, prefabricated office installed by the contractor and approved by the

Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: 2300 POLYETHYLENE WATER TANK**

**UNIT: Piece**

**1. DESCRIPTION**

This item includes the installation of a 2300 l capacity plastic tank, with all its inlet and outlet fittings, float, couplings and required accessories, to be used for receiving sanitary water from the administrative offices.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- MATERIALS:

- 4” PVC ELBOW

- 4” PVC TEE

- PVC glue

- 2300 l water tank

The water tank must be of the double-layer type or higher. The tanks used must be made of plastic, free of cracks, and in good condition.

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

The 2300 l tank will be installed according to the plans and/or instructions of the

Supervisor.

The Contractor shall be responsible for providing all materials, equipment, and implements necessary to perform the work properly, in accordance with the number and capacity indicated in the plans.

All pipes leading to or from the tanks must be properly secured to prevent water leaks, in accordance with the tank supplier's standards.

The Contractor will provide all the necessary hardware for the water inlet and outlet regulation system. Once the tank base is supported, the connections must be installed.

For the correct placement of the tank, the Contractor must follow the recommendations of the manufacturer or the Construction Supervisor.

**4. MEASUREMENT**

This item will be measured by PIECE (Pza) installed by the Contractor, in correct operation and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: 1000 L WATER TANK**

**UNIT: Piece**

**1. DESCRIPTION**

This item includes the installation of a 500 l capacity plastic water tank, with all its inlet and outlet fittings, float, couplings and accessories.

**2. MATERIALS, TOOLS AND EQUIPMENT**

- MATERIALS:

- FG 1/2" ELBOW

- TEE FG 1/2"

- TEFLON 3/4

- UNIVERSAL UNION 1/2"

- FG 500 l WATER TANK

- FLOAT AND COUPLINGS FOR 500 L TANK

The water tank must be of the double-layer type or higher. The tanks used must be made of plastic, free of cracks, and in good condition.

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

The 1000 l tank will be installed according to the plans and/or instructions of the

Supervisor.

The Contractor shall be responsible for providing all materials, equipment, and implements necessary to perform the work properly, in accordance with the number and capacity indicated in the plans.

All pipes leading to or from the tanks must be properly secured to prevent water leaks, in accordance with the tank supplier's standards.

The Contractor will provide all the necessary hardware for the water inlet and outlet regulation system. Once the tank base is supported, the connections must be installed.

For the correct placement of the tank, the Contractor must follow the recommendations of the manufacturer or the Construction Supervisor.

**4. MEASUREMENT**

This item will be measured by PIECE (Pza) installed by the Contractor, in correct operation and approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: CONSTRUCTION SIGN 2 X 1 M (METAL SHEET)**

**UNIT: Piece**

**1. DESCRIPTION**

This item refers to the provision and placement of the construction identification sign printed on a metal plate, in color, with a metal frame and placed on wooden uprights, according to the attached design and/or instructed by the construction supervisor.

The sign must remain in place for the duration of the work and it will be the Contractor's sole responsibility to safeguard, maintain, and replace it in case of deterioration or theft.

**2. MATERIALS, TOOLS AND EQUIPMENT**

- TIE WIRE

- NAILS

- 2" X 2" STRIP

- CONSTRUCTION SIGN 2X1m, MADE OF METAL SHEET PAINTED IN FULL COLOR,

- INCLUDES METAL FRAME

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The materials must be new and of good quality, so that they can withstand inclement weather throughout the duration of the work.

**3. METHOD OF EXECUTION**

Prior to installation, the construction supervisor must approve the construction sign, verifying that it contains no errors in the information or color discrepancies based on the established model.

The 2x1 m sign, including the metal frame, will be attached to the wooden uprights (2”x2” wooden slats) using nails and tie wire or other material in its place.

The uprights will then be embedded in the ground, ensuring they remain perfectly firm and vertical.

It is established that the contractor is responsible for the permanence of the construction sign throughout the execution of the same, and must replace it in case of damage or other.

**4. MEASUREMENT**

The sign will be measured by PIECE (Pza) installed, duly approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: INFORMATIONAL, RESTRICTIVE AND PREVENTIVE SIGN 0.60 X 0.90 M**

**UNIT: Piece**

**1. DESCRIPTION**

This item consists of the provision and placement of signs within the work area, as required, to ensure the physical safety of those involved in the construction work and those not involved. The signs will serve to warn the public about the execution of the work and/or the movement of construction machinery and equipment, as well as any activity that poses a risk of accident.

The sign's legend must be clear and relevant to construction activities, precautions, and traffic recommendations; it must correspond to restrictive, preventive, and/or informative signage,

so that it can be easily identified by all persons passing through areas outside the construction site.

Signs will be made according to construction plans, proposal submission form and/or instructions from the Construction Supervisor.

The sign must remain in place for the duration of the works and it will be the Contractor's sole responsibility to safeguard, maintain, and replace it in case of deterioration and/or theft.

**2. MATERIALS, TOOLS AND EQUIPMENT**

- TIE WIRE

- 2½" NAILS

- GASOLINE

- ELECTRODE 6010 2.5

- 1 mm STEEL SHEET 1" x

- 2" STRIPS

- SYNTHETIC PAINT GLOSS

- CORRUGATED STEEL 10 MM (3/8")

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The materials must be new and of good quality, so that they can withstand inclement weather throughout the duration of the work.

The sign to be installed outdoors must be resistant to:

-The climatic effects produced by exposure to the elements.

- High-speed impacts.

- Corrosion.

**3. METHOD OF EXECUTION**

Before starting any type of work, a rough printout will be made at an appropriate scale so that the supervisor can assess the signage presented for subsequent approval.

In general, signage information will be clear, using contrasting colors between the background and the information text or diagram.

Signs must be installed at the start of the work and remain in place until its completion. It is important that they be located in visible locations close to the work areas.

The inscription on the sign may vary depending on the need.

The sign will be designed and painted on steel plate, according to the basic characteristics of dimensions, colors, symbols, among others.

The sign will be 60 x 90 cm in size and will contain a legend that must be visible from a distance.

Warning signs or notices will be posted for the various hazards, as detailed below:

- Geometric shape RECTANGULAR poster Base

- color of the poster: Yellow or Orange Color of

- the informative letters: Black.

- The text will be in black capital letters, Arial type.

- The font size according to the design to be approved by the supervisor.

Environmental signage is a fundamental and mandatory part of the project. It will be used in areas outside the project, providing a constant reminder of the risks to the surrounding population.

To prevent accidents to third parties (pedestrians and passersby, neighbors, and personnel working in surrounding areas), access to the various work areas will be restricted through the perimeter fence, and appropriate environmental signage (preventive, restrictive, and informative) will be implemented.

Signs must be clearly visible, both during the day and at night, with clear and concise messages that warn drivers and pedestrians.

Its construction must adhere in dimensions and form to the construction plans and/or instructions given by the Construction Supervisor.

The corrugated iron must be cut according to the dimensions indicated in the plans.

**4. MEASUREMENT**

The sign will be measured by PIECE (Pza) installed, duly approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: METAL SIGN 0.60 X 0.60 M**

**UNIT: Piece**

**1. DESCRIPTION**

This item consists of the provision and placement of signage within the work area, as required, in order to signal aspects corresponding to internal roads.

The sign must remain in place for the duration of the works and it will be the Contractor's sole responsibility to safeguard, maintain, and replace it in case of deterioration and/or theft.

**2. MATERIALS, TOOLS AND EQUIPMENT**

- TIE WIRE

- 2½" NAILS

- GASOLINE

- ELECTRODE 6010 2.5

- 1 mm STEEL SHEET 1" x

- 2" STRIPS

- SYNTHETIC PAINT GLOSS

- CORRUGATED STEEL 10 MM (3/8")

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The materials must be new and of good quality, so that they can withstand inclement weather throughout the duration of the work.

The sign to be installed outdoors must be resistant to:

- The climatic effects produced by exposure to the elements.

- High-speed impacts.

- Corrosion.

**3. METHOD OF EXECUTION**

Before starting any type of work, a rough printout will be made at an appropriate scale so that the supervisor can assess the signage presented for subsequent approval.

In general, signage information will be clear, using contrasting colors between the background and the information text or diagram.

Signs must be installed at the start of the work and remain in place until its completion. It is important that they be located in visible locations along access roads.

The inscription on the sign may vary depending on the need.

The sign will be designed and painted on steel plate, according to the basic characteristics of dimensions, colors, symbols, among others.

The sign will be 60 x 60 cm in size and will contain a legend that must be visible from a distance.

**4. MEASUREMENT**

The sign will be measured by PIECE (Pza) installed, duly approved by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: CYCLOPEAN CONCRETE FOUNDATION**

**UNIT: Cubic meters**

**1. DESCRIPTION**

This item corresponds to the construction of monolithic structures for foundations, with 40% displacement stone and concrete with a 1:3:4 ratio, in accordance with the project description, proposal submission form and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- Running Sand

- CEMENT

- COMMON GRAVEL

- ROUGH STONE

MACHINERY AND EQUIPMENT:

-CONCRETE MIXER

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The materials used to make the concrete or mortar must be of good quality. If there is uncertainty about this, the supervisor may require the contractor to perform the necessary laboratory tests to support the quality of the materials.

The cement must comply with the provisions of NB-011.

The water must be clean, and the use of stagnant water from small lagoons or sewers, swamps, or marshes is not permitted.

In general, aggregates must be clean and free of materials such as clay, adhering mud, slag, cardboard, plaster, pieces of wood or organic matter.

The Contractor shall wash the aggregates at its own cost in order to comply with the conditions indicated above.

Aggregates that have been shown through practical experience to produce concrete of adequate strength and durability may be used subject to special approval by the construction supervisor via an order book.

The stone to be used must have the following characteristics:

- Be of good quality, homogeneous structure, durable and good looking.

- It must be free of defects that affect its mechanical properties, without cracks or fracture planes.

- Free of clays, oils, and adhering or encrusted substances. It

- must not contain organic compounds.

- The maximum size of the stone unit will be 15 cm.

**3. METHOD OF EXECUTION**

The surface on which the structure will be built will be leveled and cleaned, and must be completely free of any harmful or loose material. Before starting the pouring process, a layer of lean mortar with a 1:7 ratio and a thickness of 5 cm will be laid. This will serve as a work surface for pouring the cyclopean concrete. The pouring will be done in 20 cm thick layers, within which the offset stones will be placed, ensuring that there is enough space between each stone to be completely covered by the concrete.

The cyclopean concrete will be compacted by hand using iron rods, ensuring that the offset stones are placed without any contact with each other and are at least 3 cm apart. The stones, previously washed and moistened before being placed on the site, must rest on their entire surface, ensuring maximum compactness and ensuring that the 1:3:4 dosage mixture completely fills all voids and prevents contact with adjacent stones.

The concrete will be mixed in quantities necessary for immediate use; any mixture intended for use within 30 minutes of preparation will be rejected. In case of doubt regarding the quality of the mixture, the Construction Supervisor may request the taking of test pieces in order to continue

with the respective strength tests. If the results of these tests demonstrate that the quality of the mixture used falls below the limits established in these specifications, the Contractor shall be obligated to demolish and replace at its own expense any volume of the structure that the Construction Supervisor deems to have been constructed with said mixture, without considering the time spent on this replacement for the purposes of extending the completion period of the work.

Cyclopean concrete will have a simple compressive strength in cylindrical test specimens of 180 kg/cm2 after 28 days.

To verify the strength of the concrete, two test pieces will be requested per day of pouring, which will be tested for compression after 28 days.

It is understood that if the indicated resistance is not reached, it will be the contractor's responsibility to demolish and replace the observed elements at its own cost.

**4. MEASUREMENT**

Cyclopean concrete foundations with 40% displacement stone will be measured in CUBIC METERS (m3) correctly executed by the contractor and approved by the construction supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: H25 PLAIN CONCRETE FOR COLUMNS**

**UNIT: Cubic meters**

**1. DESCRIPTION**

This item refers to the preparation, transportation, placement, compaction, protection, and curing of plain concrete for columns with a 28-day strength of 25 MPa. This will be in accordance with the project description and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- ARENA N° 4

- NAILS

- CEMENT

- 3/4" CRUSHED GRAVEL

- CONSTRUCTION WOOD (3 USES)

- MACHINERY AND EQUIPMENT:

- CONCRETE MIXER

- 60 MM NEEDLE CONCRETE VIBRATOR

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

Quality of materials

The cement will be the one specified in the dosage test and must comply with the provisions of NB-011 (for the use of other types of cement, approval from the supervisor will be required, upon presentation of quality certificates that comply with the national standard). It must also correspond to the one used for the selection of the concrete dosage.

The aggregate granulometry must be within the limits of the ASTM C 33 standard

“Specification for Concrete Aggregates” or CBH-87 “Bolivian Reinforced Concrete Code” Section 2.2. Tests using Sieve No. 200, colorimetry, specific weight and unit weight of the aggregates must also be carried out as required.

The coarse aggregate will be the maximum size recommended for the structure and, according to the laboratory dosage, must not contain altered granite. If the supervisor so requires and if the structure is subject to abrasion, the "Los Angeles" test will be performed. Materials with a wear test greater than 50% will be excluded.

In general, aggregates must be clean and free of materials such as clay, adhering mud, slag, cardboard, plaster, pieces of wood or organic matter.

The Contractor shall wash the aggregates at its own cost in order to comply with the conditions stated above.

The water used must be clean and free of harmful substances, such as oils or organic materials. The use of stagnant water from small ponds or swamps or marshes is not permitted.

Wastewater or contaminated water from sanitary or storm sewer discharges may not be used either. All water of questionable quality must be subjected to the respective analysis and authorized by the Construction Supervisor before use.

The materials listed are for reference only, as the contractor must conduct laboratory dosage testing (the cost of which must be included in the contractor's APU costs). The dosage must also be tailored to the structural element to be built.

**3. METHOD OF EXECUTION**

Dosage

With sufficient advance notice, the contractor must conduct weight dosage tests using a recognized laboratory to characterize the materials and determine the appropriate quantities of cement, sand, gravel, and water to be used on the project.

This dosage will take into account not only the mechanical strength and consistency required, but also the type of environment to which the concrete will be subjected, due to the potential risk of deterioration of the concrete or its reinforcements due to external agents.

On-site, the concrete dosage must comply with the type and quantities used in the laboratory's dosage test. If the type of aggregate or cement is changed, the contractor must again submit a dosage test or aggregate test to demonstrate that the aggregates have the same physical and mechanical characteristics as the initial dosage.

On site, dosage will be carried out by weight, using appropriate scales and respecting the quantities defined in the tests.

Exceptions: If, in the opinion of the construction supervisor, the volumes to be emptied are not of magnitude, the contractor will have the following alternatives:

a) If you have dosage tests, you may authorize a volumetric dosage, but the contractor must increase the quantity of cement established by the laboratory test by 10%.

b) If dosage tests are not carried out, the quantity of cement will be increased by 10.

In both cases, daily settlement checks, corrections for aggregate moisture or sand swelling must be carried out, and the number of test pieces established in this technical specification must be multiplied by 2.

Formwork

Formwork may be made of wood, metal, or other sufficiently rigid material, as approved by the supervisor.

They will have the shapes, dimensions and stability necessary to withstand the weight of the pouring, personnel and stresses from the vibration of the concrete during pouring, and they must also withstand stresses due to the action of the wind.

They must be mounted in such a way that their deformations are small enough not to affect the appearance of the finished work.

Formwork must be essentially and sufficiently watertight to prevent mortar leakage. They must be adequately braced to maintain their position and shape. Openings smaller than 3 mm are closed by moistening the formwork; those between 4 and 10 mm can be closed with plugs made from moistened bags of cement. Any other openings will require the formwork to be rejected. When the Site Supervisor finds that the formwork is defective,

he or she will interrupt the pouring operations until the deficiencies are corrected.

As a preliminary measure before placing the concrete, the formwork must be cleaned and moistened, ensuring that no water films remain on the surface.

If the formwork is intended to be used several times, it must be thoroughly cleaned and repaired before being reused.

Mixed

The mixer will have the necessary capacity and be approved by the supervisor (the use of mixers with a minimum capacity of 1 bag or 350 lt is recommended).

As a recommendation, the mixer should not be loaded with more than 70% of its theoretical capacity nor less than 10%, otherwise uneven concrete would be obtained.

Depending on the type of mixer used, the mixer should be horizontal or vertical when mixing the materials, but should not have any inclination angle.

Job-mixed concrete shall be mixed according to the following:

a) The moisture content of the aggregates, especially the sand, will be checked to correct, if necessary, the amount of water poured into the concrete mixer and thus discount this as part of the amount of water required for the mix.

1. Mixing must be done in a mixer of capacity approved by the supervisor. c) The mixer must be rotated at a constant speed.

d) Order of materials, as a recommendation it is established: place 80% of the mixing water, then the gravel, the cement, the sand and finally, the rest of the water.

e) Mixing must continue for at least 90 seconds after all materials are in the drum, unless a shorter time is shown to be satisfactory by mixing uniformity testing in accordance with ASTM C94.

f) Handling, dosing and mixing of materials must comply with the applicable provisions of

ASTM C94.

g) A detailed record must be kept to identify:

- Number of mixing batches produced;

- Dosage of concrete produced;

- Approximate location of the final deposit in the structure;

- Time and date of mixing and placement;

All concrete must be mixed until uniform distribution of materials is achieved and the mixer must be completely discharged before it is reloaded.

Excessively long mixing times should be avoided, as this may cause segregation of the mixture.

Consistency of concrete

Laboratory tests shall indicate the type of settlement or the criteria of ACI 211.1 shall be taken.

The "Abrams Cone" consistency tests must be performed using the methodology and equipment according to the dimensions and test procedures detailed in the recommendations of ASTM 143C. The frequency of the tests must be determined by the site supervisor.

As a recommendation, the settlement should be such that it allows for good compaction at the bottom because the columns are emptied from the top and due to free fall, the mixture would tend to segregate.

Transport

Concrete must be transported from the mixer to the final placement site using methods that prevent segregation, loss of material, or alteration of the mix.

Transportation procedures will be used that are consistent with the composition of the fresh concrete, so that the mixture reaches its placement site without changing its characteristics from when it was first mixed, i.e., without disintegration, intrusion of foreign bodies, or changes in water content.

The mixture must be prevented from setting in a way that prevents or hinders its implementation and vibration.

Under no circumstances should water be added to the mix once it has been removed from the mixer. For conventional transport methods, the concrete must be placed in its final position within the formwork within 30 minutes of preparation.

In the case of using metal pipes or sheets, these must necessarily be made of steel or another material that does not affect the composition of the concrete.

Emptying

Structural elements will not be emptied without prior authorization from the Construction

Supervisor.

Once the concrete pouring has begun, it must be carried out continuously until the panel or section, defined by its predetermined boundaries or joints, is completely filled. When construction joints are required, they must be made as specified in the "Joints" section.

For columns, the maximum concreting height should not exceed 5 m and should be poured in layers and continuously. For greater heights, it should be poured in stages, leaving construction joints with bonding bridges.

In both cases, auxiliary elements must be used to lower the concrete or through windows, so that the free fall of the mixture does not exceed 2 m in height.

The concrete pouring will be carried out according to an organized work plan, taking into account that the concrete corresponding to each structural element must be poured continuously.

Concrete to which water has been added after preparation, or that has been mixed after initial setting, should not be used unless approved by the construction supervisor.

The emptying temperature will be greater than 5°C.

Emptying cannot be carried out during rain.

Large quantities of concrete may not be stored in one location for later spreading.

The maximum thickness of the concrete layer should not exceed 20 cm to allow for effective compaction.

The speed of placement will be sufficient to ensure that the concrete remains plastic at all times.

Concrete may not be poured freely from heights greater than 1.50 m; in this case, gutters, funnels or cylindrical conduits must be used.

Vibrated

Concrete compaction will be carried out by mechanical vibration, eliminating voids or air bubbles within the mass and preventing the aggregates from disintegrating.

Vibration will be performed using high-frequency immersion vibrators that must be operated by specialized workers.

The use of vibrators for transporting the mix will not be permitted under any circumstances.

Under no circumstances will pouring begin without at least two vibrators in perfect working order, unless specifically authorized by the site supervisor in the order book. The vibrator will be inserted vertically, at equidistant points 45 cm apart, for 5 to 15 seconds to prevent disintegration.

The mechanical vibration will be completed with a tamping of the concrete and a tapping of the formwork.

Protection and healing

Protection: Immediately after pouring and during the first few hours, the contractor must take measures to protect against rain, wind, sun and, in general, against any harmful action, using barriers, blankets, membranes or others, in order to avoid temperature loss and drying of the concrete, maintaining it at a temperature above 5°C at least, a process that will extend up to the first 96 hours.

Curing: The minimum curing time will be 10 days from the moment the concrete begins to harden, by watering between 3 and 7 times a day and especially during hours when the ambient temperature is higher or there is wind, the entire exposed area will be moistened.

The contractor may also opt for other means such as waterproof sheets, sand beds, etc., with prior authorization from the supervisor.

Formwork stripping

The formwork stripping time will be established based on the concrete strength, for which additional test specimens will be obtained to those indicated in the section "Test frequency" and they must have 75% of the design strength (these test specimens will not be part of the statistical analysis or acceptance and rejection criteria since they are only informative), otherwise and as a reference, the following criteria are applied:

Column formwork: 3 to 7 days

Formwork and struts must be removed in such a manner as not to adversely affect the safety or operation of the structure.

Formwork removal will be carried out according to a plan submitted by the contractor, which must be previously approved by the Construction Supervisor.

If products are used to facilitate the removal of the formwork or mold, they must not leave any traces on the concrete walls.

The formwork will be removed gradually and without causing any impact, shock or vibration to the structure.

Final formwork removal will not be carried out until the concrete has reached the strength necessary to safely withstand, without excessive deformation, the stresses to which it will be subjected during and after formwork removal.

During construction, it is prohibited to apply loads, accumulate materials, or use machinery that could endanger the stability of the structure.

Formwork removal will require authorization from the Construction Supervisor, which does not exempt the contractor from liability.

Laboratory

All tests will be carried out in a laboratory of recognized technical solvency, with equipment calibrated by IBMETRO, which has professional personnel specialized in the area and duly approved by the Supervisor, in the event that the supervisor considers that the laboratory should be changed objectively for the work, the contractor must agree to said change.

Frequency of tests

The construction supervisor may instruct the number of test specimens and the frequency with which they will be carried out, and the following criteria may be taken as a non-limiting reference:

- No less than one sample (two test tubes) for each day that the concrete is poured.

- The minimum number of compression test specimens to be tested per project and type of concrete shall not be less than 10, except when the total quantity of a given class of concrete is less than 0.5 m3, in which case only 1 strength test (2 specimens) will be required.

Emptying days must be recorded in the order book.

A strength test shall be the average of the strengths of two cylinders made from the same concrete sample and tested at 28 days or at the test age established for strength determination.

Samples for strength testing must be taken strictly at random if concrete acceptance is to be adequately assessed. To be representative, the sampling time or batch of concrete to be sampled must be chosen randomly within the placement period.

The mixing batches from which samples are to be taken should not be selected based on appearance, convenience, or other biased criteria, as statistical concepts become invalid.

No more than one test of a single batch of mix should be made and no water should be added to the concrete after the sample has been taken.

**4. MEASUREMENT**

This item will be measured by CUBIC METER (m3), correctly executed by the contractor and approved by the construction supervisor. If a connection is found with beams, slabs, or other items whose concrete corresponds to another item, the section occupied by them will be discounted.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: H21 PLAIN CONCRETE FOR BEAMS**

**UNIT: Cubic meters**

**1. DESCRIPTION**

This item refers to the preparation, transportation, placement, compaction, protection, and curing of plain concrete for beams with a 28-day strength of 21 MPa. It will be made according to the dimensions described in the project and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- ARENA N° 4

- NAILS

- CEMENT

- 3/4" CRUSHED GRAVEL

- CONSTRUCTION WOOD (3 USES)

- MACHINERY AND EQUIPMENT:

- CONCRETE MIXER

- CONCRETE VIBRATOR

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

Quality of materials

The cement will be the one specified in the dosage test and must comply with the provisions of NB-011 (for the use of other types of cement, approval from the supervisor will be required, upon presentation of quality certificates that comply with the national standard). It must also correspond to the one used for the selection of the concrete dosage.

The aggregate granulometry must be within the limits of the ASTM C 33 standard

“Specification for Concrete Aggregates” or CBH-87 “Bolivian Reinforced Concrete Code” Section 2.2. Tests using Sieve No. 200, colorimetry, specific weight and unit weight of the aggregates must also be carried out as required.

The coarse aggregate will be the maximum size recommended for the structure and, according to the laboratory dosage, must not contain altered granite. If the supervisor so requires and if the structure is subject to abrasion, the "Los Angeles" test will be performed. Materials with a wear rate greater than 50% will be excluded.

In general, aggregates must be clean and free of materials such as clay, adhering mud, slag, cardboard, plaster, pieces of wood or organic matter.

The Contractor shall wash the aggregates at its own cost in order to comply with the conditions stated above.

The water used must be clean and free of harmful substances, such as oils or organic materials. The use of stagnant water from small ponds or swamps or marshes is not permitted.

Wastewater or contaminated water from sanitary or storm sewer discharges may not be used either. All water of questionable quality must be subjected to the respective analysis and authorized by the Construction Supervisor before use.

The materials listed are for reference only, as the contractor must conduct laboratory dosage testing (the cost of which must be included in the contractor's APU costs). The dosage must also be tailored to the structural element to be built.

The type, quantity, and capacity of mixers and vibrators must be approved by the construction supervisor. Likewise, the contractor must have on-site scales of the necessary capacity at the time of execution of the item, in order to be able to perform the dosage of materials by weight (the cost of the scale must be included within the contractor's expenses).

**3. METHOD OF EXECUTION**

Dosage

With sufficient advance notice, the contractor must conduct weight dosage tests using a recognized laboratory to characterize the materials and determine the appropriate quantities of cement, sand, gravel, and water to be used on the project.

This dosage will take into account not only the mechanical strength and consistency that must be achieved, but also the type of environment to which the concrete will be subjected, due to the possible risk of deterioration of the concrete or the reinforcement due to attack by external agents.

On-site, the concrete dosage must comply with the type and quantities used in the laboratory's dosage test. If the type of aggregate or cement is changed, the contractor must again submit a dosage test or aggregate test to demonstrate that the aggregates have the same physical and mechanical characteristics as the initial dosage.

On site, dosage will be carried out by weight using appropriate scales and respecting the quantities defined in the tests.

Exceptions: If, in the opinion of the construction supervisor, the volumes to be emptied are not of magnitude, the contractor will have the following alternatives:

a) If you have dosage tests, you may authorize a volumetric dosage, but the contractor must increase the quantity of cement established by the laboratory test by 10%.

b) If dosage tests are not carried out, the quantity of cement will be increased by 10%.

In both cases, daily settlement checks, corrections for aggregate moisture or sand swelling must be carried out, and the number of test pieces established in this technical specification must be multiplied by 2.

Formwork

Formwork may be made of wood, metal, or other sufficiently rigid material, as approved by the supervisor.

They will have the shapes, dimensions and stability necessary to withstand the weight of the pouring, personnel and stresses from the vibration of the concrete during pouring, and they must also withstand stresses due to the action of the wind.

They must be mounted in such a way that their deformations are small enough not to affect the appearance of the finished work.

Formwork must be essentially and sufficiently watertight to prevent mortar leakage. They must be adequately braced to maintain their position and shape. Openings smaller than 3 mm are closed by moistening the formwork; those between 4 and 10 mm can be closed with plugs made from moistened bags of cement. Any other openings will require the formwork to be rejected. When the Site Supervisor finds that the formwork is defective,

he or she will interrupt the pouring operations until the deficiencies are corrected.

As a preliminary measure before placing the concrete, the formwork must be cleaned and moistened, ensuring that no water films remain on the surface.

If the formwork is intended to be used several times, it must be thoroughly cleaned and repaired before being reused.

The maximum number of uses of the formwork will be obtained from the analysis of unit prices.

The contractor must dispose of the material, which can no longer be used, according to the

Supervisor's instructions.

Mixed

The mixer will have the necessary capacity and be approved by the supervisor (the use of mixers with a minimum capacity of 1 bag or 350 lt is recommended).

As a recommendation, the mixer should not be loaded with more than 70% of its theoretical capacity nor less than 10%, otherwise uneven concrete would be obtained.

Depending on the type of mixer used, the mixer should be horizontal or vertical when mixing the materials, but should not have any inclination angle.

Job-mixed concrete shall be mixed according to the following:

a) The moisture content of the aggregates, especially the sand, will be checked to correct, if necessary, the amount of water poured into the concrete mixer and thus discount this as part of the amount of water required for the mix.

b) Mixing must be done in a mixer of capacity approved by the supervisor. c) The mixer must be rotated at a constant speed.

d) Order of materials, as a recommendation it is established: place 80% of the mixing water, then the gravel, the cement, the sand and finally, the rest of the water.

e) Mixing must continue for at least 90 seconds after all materials are in the drum, unless a shorter time is shown to be satisfactory by mixing uniformity testing in accordance with ASTM C94.

f) Handling, dosing and mixing of materials must comply with the applicable provisions of

ASTM C94.

g) A detailed record must be kept to identify:

1) Number of mixing batches produced;

2) Dosage of the concrete produced;

3) Approximate location of final deposit in the structure;

4) Time and date of mixing and placement;

All concrete must be mixed until uniform distribution of materials is achieved and the mixer must be completely discharged before it is reloaded.

Excessively long mixing times should be avoided, as this may cause segregation of the mixture.

Consistency of concrete

Laboratory tests shall indicate the type of settlement or the criteria of ACI 211.1 shall be taken.

The "Abrams Cone" consistency tests must be performed using the methodology and equipment according to the dimensions and test procedures detailed in the recommendations of ASTM 143C. The frequency of the tests must be determined by the site supervisor.

As a recommendation, the settlement should be such that it allows good compaction at the bottom.

Transport

Concrete must be transported from the mixer to the final placement site using methods that prevent segregation, loss of material, or alteration of the mix.

Transportation procedures will be used that are consistent with the composition of the fresh concrete, so that the mixture reaches its placement site without changing its characteristics from when it was first mixed, i.e., without disintegration, intrusion of foreign bodies, or changes in water content.

The mixture must be prevented from setting in a way that prevents or hinders its implementation and vibration.

Under no circumstances should water be added to the mix once it has been removed from the mixer. For conventional transport methods, the concrete must be placed in its final position within the formwork within 30 minutes of preparation.

In the case of using metal pipes or sheets, these must necessarily be made of steel or another material that does not affect the composition of the concrete.

Emptying

Structural elements will not be emptied without prior authorization from the Construction

Supervisor.

Once the concrete pouring has begun, it must be carried out continuously until the panel or section is completely filled, as defined by its predetermined boundaries or joints. When construction joints are required, they must be made as specified in the "Joints" section.

For beams, the concrete will be poured continuously along its entire length until it meets slabs or walls. For inclined surfaces, concreting must start from the bottom and continue upwards.

The concrete pouring will be carried out according to an organized work plan, taking into account that the concrete corresponding to each structural element must be poured continuously.

Concrete to which water has been added after preparation, or that has been mixed after initial setting, should not be used unless approved by the construction supervisor.

The emptying temperature will be greater than 5°C.

Emptying cannot be carried out during rain.

Large quantities of concrete may not be stored in one location for later spreading.

The maximum thickness of the concrete layer should not exceed 20 cm to allow for effective compaction.

The speed of placement will be sufficient to ensure that the concrete remains plastic at all times.

Concrete may not be poured freely from heights greater than 1.50 m; in this case, gutters, funnels or cylindrical conduits must be used.

Vibrated

Concrete compaction will be carried out by mechanical vibration, eliminating voids or air bubbles within the mass and preventing the aggregates from disintegrating.

Vibration will be performed using high-frequency immersion vibrators that must be operated by specialized workers.

The use of vibrators for transporting the mix will not be permitted under any circumstances.

Under no circumstances will pouring begin without at least two vibrators in perfect working order, unless specifically authorized by the site supervisor in the order book. The vibrator will be inserted vertically, at equidistant points 45 cm apart, for 5 to 15 seconds to prevent disintegration.

The mechanical vibration will be completed with a tamping of the concrete and a tapping of the formwork.

Protection and healing

Protection: Immediately after pouring and during the first few hours, the contractor must take measures to protect against rain, wind, sun and, in general, against any harmful action, using barriers, blankets, membranes or others, in order to avoid temperature loss and drying of the concrete, maintaining it at a temperature above 5°C at least, a process that will extend up to the first 96 hours.

Curing: The minimum curing time will be 10 days from the moment the concrete begins to harden, by watering between 3 and 7 times a day and especially during hours when the ambient temperature is higher or there is wind, the entire exposed area will be moistened.

The contractor may also opt for other means such as waterproof sheets, sand beds, etc., with prior authorization from the supervisor.

Formwork stripping

The formwork stripping time will be established based on the concrete strength, for which additional test specimens will be obtained to those indicated in the section "Test frequency" and they must have 75% of the design strength (these test specimens will not be part of the statistical analysis or acceptance and rejection criteria since they are only informative), otherwise and as a reference, the following criteria are applied:

- Lateral beam formwork: 2 to 3 days

- Beam bottoms, leaving safety struts: 14 days Formwork and struts must be removed in such a way that it does not negatively affect the safety or operation of the structure.

Formwork removal will be carried out according to a plan submitted by the contractor, which must be previously approved by the Construction Supervisor.

If products are used to facilitate the removal of the formwork or mold, they must not leave any traces on the concrete walls.

The formwork will be removed gradually and without causing any impact, shock or vibration to the structure.

Final formwork removal will not be carried out until the concrete has reached the strength necessary to safely withstand, without excessive deformation, the stresses to which it will be subjected during and after formwork removal.

During construction, it is prohibited to apply loads, accumulate materials, or use machinery that could endanger the stability of the structure.

Formwork removal will require authorization from the Construction Supervisor, which does not exempt the contractor from liability.

Laboratory

All tests will be carried out in a laboratory of recognized technical solvency, with equipment calibrated by IBMETRO, which has professional personnel specialized in the area and duly approved by the Supervisor. If the supervisor considers that the laboratory should be changed objectively for the work, the contractor must agree to said change.

Frequency of tests

The construction supervisor may instruct the number of test specimens and the frequency with which they are to be carried out, and the following criteria may be taken as a non-limiting reference:

- No less than one sample (two test tubes) for each day that the concrete is poured.

- The minimum number of compression test specimens to be tested per project and type of concrete shall not be less than 10, except when the total quantity of a given class of concrete is less than 0.5 m3, in which case only 1 strength test (2 specimens) will be required.

Emptying days must be recorded in the order book.

A strength test shall be the average of the strengths of two cylinders made from the same concrete sample and tested at 28 days or at the test age established for strength determination.

Samples for strength testing must be taken strictly at random if concrete acceptance is to be adequately assessed. To be representative, the sampling time or batch of concrete to be sampled must be chosen randomly within the placement period.

The mixing batches from which samples are to be taken should not be selected based on appearance, convenience, or other biased criteria, as statistical concepts become invalid.

No more than one test of a single batch of mix should be made, and water should not be added to the concrete after the sample has been taken.

Break Tests

Laboratory burst tests must meet the criteria specified in ASTM C39.

**4. MEASUREMENT**

This item will be measured by CUBIC METER (m3), correctly executed by the contractor and approved by the construction supervisor. If a connection is found with walls, slabs or other materials whose concrete corresponds to another item, the section occupied by them will be discounted.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: CYCLOPEAN CONCRETE OVER FOUNDATIONS**

**UNIT: Cubic meters**

**1. DESCRIPTION**

This item refers to the construction of cyclopean concrete foundations with 50% displacement stone, according to the dimensions, concrete dosage and other details indicated in the respective plans, and/or in accordance with the instructions of the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- Running Sand

- CEMENT

- NAILS

- COMMON GRAVEL

- WOOD FOR CONSTRUCTION (3 USES) ROUGH STONE

MACHINERY AND EQUIPMENT:

-CONCRETE MIXER

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The materials used to make the concrete must be of good quality. If there is uncertainty about the quality of the materials, the supervisor may require the contractor to carry out the necessary laboratory tests to support their quality.

The cement must comply with the provisions of NB-011.

The water must be clean, and the use of stagnant water from small lagoons or sewers, swamps, or marshes is not permitted.

In general, aggregates must be clean and free of materials such as clay, adhering mud, slag, cardboard, plaster, pieces of wood or organic matter.

The Contractor shall wash the aggregates at its own cost in order to comply with the conditions stated above.

Aggregates that have been shown through practical experience to produce concrete of adequate strength and durability may be used subject to special approval by the construction supervisor via an order book. The stone to be used must have the following characteristics:

Be of good quality, homogeneous structure, durable and good looking.

It must be free of defects that affect its mechanical properties, without cracks or fracture planes.

Free of clays, oils and adherent or encrusted substances.

It should not have organic compounds.

The maximum size of the stone unit will be 15 cm.

Any material that, in the judgment of the Construction Supervisor, is unsuitable for the job, will be rejected.

The formwork must be straight, free of deformations or twists, and of sufficient strength to contain the cyclopean concrete and withstand the stresses caused by pouring without deforming.

**3. METHOD OF EXECUTION**

For foundations, concrete with a 28-day cylindrical strength of 16 MPa with 50%

displacement stone will be used.

Concrete made with cement, sand and gravel will be in a ratio of 1:3:4.

The measurement of aggregates by volume will be carried out in containers approved by the Construction

Supervisor and should preferably be metal or wooden, non-deformable and watertight.

Next, formwork made of wood, metal, or other sufficiently rigid material, free from deformation or twisting, will be placed, as approved by the supervisor.

A 5cm thick layer of concrete with a 1:3:4 ratio will be placed to level the surfaces and also serve as a base for the first course of stone.

The stones will be laid in layers on the concrete base, and in order to interlock the successive courses, stones will be left protruding at different points.

The stones must be thoroughly moistened before placement to prevent them from absorbing the water present in the concrete.

The dimensions of the foundations will strictly conform to the measurements indicated in the respective plans and/or according to the instructions of the Construction Supervisor.

The pouring will be carried out in 20 cm thick layers, within which the displacement stones will be placed, amounting to 50% of the total volume, ensuring that there is enough space between each stone for them to be completely covered by the concrete.

For foundations with one exposed face, wood planed on one side and lightly oiled for easy removal will be used. The oil will be the contractor's responsibility and will not be considered for payment purposes.

The cyclopean concrete will be compacted by hand using barbells or steel rods, ensuring that the displacement stones are placed in the center of the foundation body and that they do not have any contact with the formwork, unless otherwise instructed by the Construction Supervisor.

The removal of the formwork may be carried out twenty-four hours after the pouring has been carried out.

Cyclopean concrete will have a simple compressive strength in cylindrical test specimens of 160 kg/cm2 after 28 days.

To verify the strength of the concrete, two test pieces will be requested per day of pouring, which will be tested for compression after 28 days.

It is understood that if the indicated resistance is not reached, it will be the contractor's responsibility to demolish and replace the observed elements at its own cost.

**4. MEASUREMENT**

Cyclopean concrete foundations will be measured by CUBIC METERS (m3), correctly executed by the contractor and approved by the supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: PLAIN CONCRETE FLOOR, 8 CM, 1:2:3 RATIO, WITH PAVING**

**UNIT: Square meters**

**1. DESCRIPTION**

This item includes the execution of a simple concrete layer with a 1:2:3 ratio and a thickness of 8 cm, the finish of which must be troweled or plastered, on a paving stone pavement, in the areas defined in the plans and/or according to the instructions of the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- Running Sand

- FINE SAND

- CEMENT

- COMMON GRAVEL

- STONE APPLE

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The materials used to make the concrete must be of good quality. If there is uncertainty about the quality of the materials, the supervisor may require the contractor to carry out the necessary laboratory tests to support their quality.

The cement must comply with the provisions of NB-011.

The water must be clean, and the use of stagnant water from small lagoons or sewers, swamps, or marshes is not permitted.

In general, aggregates must be clean and free of materials such as clay, adhering mud, slag, cardboard, plaster, pieces of wood or organic matter.

The Contractor shall wash the aggregates at its own cost in order to comply with the conditions stated above.

Concrete made with cement, sand and gravel will be in a ratio of 1:2:3.

The stone to be used will be the so-called "block" stone, sourced from riverbeds, without angles, of more or less uniform size, with maximum dimensions of 0.14 x 0.14 x 0.14 m and minimum dimensions of 0.10 x 0.10 x 0.10 m; the largest stone should be used only for the "master" stone. The stone must have the following characteristics:

a) Be of good quality, homogeneous structure, durable and good appearance.

b) It must be free of defects that affect its mechanical properties, without cracks or fracture planes.

c) Free of clays, oils and adherent or encrusted substances.

d) It must not contain organic compounds.

Any material that the Construction Supervisor deems unsuitable for paving work will be rejected.

**3. METHOD OF EXECUTION**

Once the base has been completed and compacted, and the surface has been approved by the construction supervisor, a layer of approximately 2 cm will be broken up to serve as a support bed for the stonework. This work will be carried out with hand tools such as picks and rakes.

Subsequently, the master stones or master rows will be placed with the largest stone. The distance between longitudinal master stones should not be greater than 1.00 meters, and between transversal master stones should not be greater than 3 meters.

The stone will be placed between them in combination, ensuring that they present the face with the largest surface area in the direction of the loads to be received.

The appropriate level and slopes must be maintained as indicated in the detailed plans or instructions from the Construction Supervisor.

Prior to pouring the concrete, the construction supervisor must approve the paving.

For concrete pouring, the paving must be free of soil and other impurities, and must have

been watered to clean and saturate the exposed surface of the paving, but without flooding or saturating the underlying soils.

On paving perfectly clean of earth and other impurities, a 7 centimeter layer of concrete and a

1 cm finishing layer of mortar (1:3) will be poured, leaving transversal and longitudinal expansion joints of 1 cm thickness, the sections will be emptied so that none exceeds 2 square meters (m2), the emptying of folders will be in a modular form and alternating sections.

Material dosage

For the production of concrete, the dosage of materials must have a volumetric ratio of

1:2:3 (cement, sand, gravel, respectively).

It will be dosed by whole bag of cement, the measurement of the aggregates in volume will be carried out in containers approved by the Construction Supervisor and preferably they should be watertight, such as wooden boxes or non-deformable metal containers (recommended dimensions for the wooden box 35x35x29 cm)

Mixed

All concrete must be mixed until uniform distribution of materials is achieved and the mixer must be completely discharged before it is reloaded.

Depending on the type of mixer used, the mixer should be horizontal or vertical when mixing the materials, but should not have any inclination angle.

For concrete mixed on site, the following must be met:

a) The quantity of sand must be corrected for the swelling of the sand due to the moisture content and thus correct the quantity of water poured into the concrete mixer.

b) Mixing must be done in a mixer with a capacity for 1 bag of cement or its equivalent, approved by the supervisor.

c) The mixer must be rotated at a constant speed.

d) Order of materials, as a recommendation it is established: place 80% of the mixing water, then the gravel, the cement, the sand and finally, the rest of the water.

e) Mixing must continue for at least 90 seconds after all materials are in the drum, unless a shorter time is shown to be satisfactory by mixing uniformity testing in accordance with ASTM C94.

f) A detailed record must be kept to identify:

• Number of mixing batches produced;

• Dosage of the concrete produced;

• Approximate location of final deposit in the structure;

• Time and date of mixing and placement;

Excessively long mixing times should be avoided, as this may cause segregation of the mixture.

Tolerances for the consistency of concrete

- To determine the consistency of the concrete, the "Abrams Cone" consistency test shall be applied; the frequency of measurement tests shall be determined by the site supervisor. The test dimensions and procedures are detailed in the recommendations of ASTM 143C.

- During the pouring of the folder, the Contractor will be obligated to take samples for laboratory verification of the cylindrical resistance to breakage after 28 days.

Emptying

A 7cm thick concrete layer will be poured in sections, leaving 1cm thick transverse and longitudinal expansion joints.

In the case of expansion joints, the contractor is responsible for providing them with partitions that divide the floor. The sections will be emptied so that none exceeds 2 square meters (m2).

Subsequently, the sealing will be done with epoxy or other waterproof material, work that will be paid for separately.

The concrete must be compacted (pumped) with crowbars or iron rods, ensuring that all the voids between stones are filled. The surface must then be compacted using a metal ruler and tapped.

Once compaction is complete, leveling will be carried out using a metal or wooden ruler, leaving a smooth and uniform surface.

Type of finish

The cement floor itself will then be laid, by pouring and smoothing a 1cm thick layer of cement mortar and fine sand in a 1:3 ratio.

The floor finish will be made with pure cement grout, smoothed with a metal plate, with a special groove or recessed joints, according to the details and/or instructions of the Construction Supervisor.

Protection and healing

Protection: Immediately after pouring and during the first 24 hours, the contractor must take measures to protect against rain, wind, sun and in general, against any harmful action, by means of barriers, blankets, membranes or others, in order to avoid the loss of temperature and drying of the concrete,

maintaining a temperature above 5°C at least, a process that will extend up to the first 96 hours.

Curing: The minimum curing time will be 10 days from the moment the concrete begins to harden, by watering between 3 and 7 times a day and especially during hours when the ambient temperature is higher or there is wind, the entire exposed area will be moistened.

The contractor may also opt for other means such as waterproof sheets, sand beds, etc., with prior authorization from the supervisor.

Laboratory

All tests will be performed in a laboratory of recognized technical solvency, duly approved by the Supervisor. If the supervisor deems it necessary to change the laboratory objectively for the project, the contractor must agree to said change.

Concrete quality control

The construction supervisor may instruct the number of test specimens and the frequency with which they will be carried out, and the following criteria may be taken as a non-limiting reference:

- One sample (two test tubes) for each day that the concrete is poured, but no less than that established in CBH-87.

The supervisor may require additional test pieces as deemed appropriate (this will not entail any additional costs or contractor compensation).

Samples for strength testing must be taken strictly at random if the acceptance of concrete is to be adequately assessed. To be representative, the sampling time or the batches of concrete to be sampled must be chosen randomly within the placement period. The batches from which samples are to be taken should not be selected based on appearance, convenience, or other biased criteria, as statistical concepts become invalid. No more than one test should be performed on a single batch of concrete, and water should not be added to the concrete after the sample has been taken.

A strength test shall be the average of the strengths of two cylinders made from the same concrete sample and tested at 28 days.

It is established that it is the contractor's obligation to demolish and replace structures whose test pieces do not reach the indicated resistance, at its own cost.

Break Tests

Laboratory burst tests must meet the criteria specified in ASTM C39.

**4. MEASUREMENT**

This item will be measured by SQUARE METER (m2), taking into account only the net surfaces executed by the contractor and approved by the construction supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: WATERPROOFING OF OVER FOUNDATIONS**

**UNIT: Square meters**

**1. DESCRIPTION**

This item refers to waterproofing between foundations and walls. It consists of creating a waterproofing barrier to prevent capillary rise of water to the walls, as this would cause deterioration of the plaster and/or coatings. It will be installed according to the project description and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- TAR

- 200 MICRON POLYETHYLENE

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

A layer of diluted tar will be applied to the clean, dust-free upper surface of the foundation. Then, polyethylene cut to a width 2 cm wider than the wall will be laid, extending it across the entire surface. Longitudinal overlaps will be no less than 10 cm. A layer of cement mortar will then be placed to support the first course of bricks, blocks, or other elements that make up the walls (the mortar will be canceled with the corresponding item).

**4. MEASUREMENT**

The waterproofing of foundations will be measured by SQUARE METER (m2) executed by the contractor and approved by the supervision, taking the dimensions of the width of the walls as the measurement basis.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: COATED ROOFING WITH METAL TRUSS**

**UNIT: m2**

**1. DESCRIPTION**

This item refers to the provision and placement of metal structures such as trusses, the support structure necessary to support the roof, in addition to the placement of the corrugated iron roof, according to the characteristics specified in the construction plans and/or instructions of the Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- Metal profiles

- Anti-rust paint

- Electrodes

- Steel cables

- Clamps

- Tension elements

- Corrugated sheet metal No. 28

- Self-drilling bolt 12 x 1 ½”

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

Metal trusses must meet the technical specifications indicated in the plans, in accordance with ASTM specifications, especially regarding section types, dimensions, strengths, and other requirements. As a general condition, the steel profiles or elements must be fine- grained and homogeneous, and must not have any cracks or other defects on the surface or within their mass.

The paints will be of recognized, top-quality brands, supplied in original, sealed containers.

The corrugated iron must be made of a zinc and aluminum alloy (Zincalum) subjected to a painting process with thermo-convertible powder on both sides, ensuring total protection against the action of external weather agents, certified according to ASTM standards with a maximum coverage degree per gauge, with a zinc content of 270 gr/m and 150 gr of hallucin, providing greater durability.

**3. METHOD OF EXECUTION**

Steel will be used according to ASTM - A 36 standard with Fy = 2530 kg/cm² (allowable stress), as well as the different varieties of profiles according to what is specified in the plans and/or supervisor.

The contractor, before manufacturing the elements, must carefully verify the actual dimensions on site.

The manufacturing process must employ appropriate equipment and tools, as well as skilled labor, to ensure satisfactory work.

All cuts may be made with shears, saws, or mechanically guided torches. The latter require a proper finish free of burrs; notches larger than 5 mm will not be permitted.

To join pieces, E 7018 welding and a 1/8" electrode will be used in spots 5 cm every 25 cm. The pieces to be joined by fillet welding must be in contact. The parts to be butt welded must be carefully aligned, correcting misalignments greater than 1.5 mm. Welds will be performed by qualified personnel; the contractor must present the supervisor with certificates demonstrating the welder's experience. Welded areas must be touched up with two coats of anti-corrosion paint.

Splices will not be accepted in bars shorter than 6 meters. The holes for the joints must be drilled; they are not permitted with blowtorches or punches.

Joints must be strong enough to withstand the stresses of transport, installation, and operation. Any remaining burrs and welding residue must be polished so as not to impair their appearance, tightness, and proper functioning.

The installation of these metal structures will generally not be carried out until the masonry work has been completed. The equipment used must be the most secure. They will be aligned at the final location and supported by auxiliary elements in such a condition that they will not shift during the execution of the work.

All elements of the steel structure must be painted once before assembly, and two coats of asphalt-based anti-corrosion paint must be applied once the structure is assembled on site. Before applying the anti-corrosion paint, all traces of rust must be removed, and the structures must be degreased with mineral spirits or another solvent. Once the structure is assembled in its final location, an additional coat of paint must be applied.

The truss must be raised with extreme care, avoiding impacts between the truss and the concrete structures and ensuring the safety of all personnel. All personnel must have the appropriate safety equipment.

The corrugated iron will be fixed with self-drilling bolts with rubber caps at the slope indicated in the plans and with a minimum longitudinal cover of 20 cm.

The Supervision reserves the right to control the execution of bolted joints, which must be at least 5 pieces per node; the Contractor must carry out tests if necessary.

If the test results are not satisfactory, the Supervisor will require a larger quantity of bolts, without any change to the proposed prices.

The use of sheets that have been deformed by impacts or due to improper storage or previous use will not be permitted.

The contractor must thoroughly study the plans and works related to the roof, both to streamline the construction operations and to ensure the stability of the entire structure. To this end, it is important to remember that the Contractor is solely responsible for the stability of these structures. Any modifications deemed appropriate must be approved and authorized by the Supervisor and submitted prior to their execution.

**4. MEASUREMENT**

The cover will be quantified in square meters taking into account the net covered area.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: 6-HOLE BRICK WALL E=18 CM (24X18X12)**

**UNIT: Square meters**

**1. DESCRIPTION**

This item includes the construction of 6-hole brick masonry walls and partitions, with cement and sand mortar in a 1:5 ratio, as specified in the construction plans and/or instructions from the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- FINE SAND

- CEMENT

- BRICK 6H 24 x 18 x 1

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

- The 6-hole bricks will have dimensions of 24 x 18 x 12 cm, a tolerance of +/-0.5 cm in any of the same. Likewise, uniformity in the dimensions of the pieces per batch must be ensured, allowing a tolerance of +/-2% in any of the aforementioned dimensions, in order to avoid significant variations that could affect the appearance of the element, as well as load transfer.

- The bricks will be of the highest quality, well-fired, and will emit a metallic sound when struck. They will have a uniform color and be free of any cracks or chips.

Each batch of these must be approved by the Construction Supervisor for use, and must require quality certificates and compliance with the following parameters, in accordance with standard NB 1211002:

Compressive strength:

- Non-bearing or filling: > 2.0 MPa

- Load-bearing or structural: > 20.0 MPa

Water absorption 8% to 15%.

Efflorescence test (face bricks): Not efflorescent

Freezing: Not freezing

Calcareous inclusions:

- The number of pieces with detachments that produce craters will not exceed one (1).

- The detachment of a facing brick will not be greater than or equal to 7 mm.

- The detachment of a facing brick will not be greater than or equal to 15 mm.

- The cement must comply with the requirements of Bolivian Standard NB-011.

- The water must be clean, and the use of stagnant water from small lagoons, sewers, swamps, marshes, or contaminated springs is not permitted.

- In general, aggregates must be clean and free of materials such as clay, adhering mud, slag, cardboard, plaster, pieces of wood or organic matter.

- The Contractor shall wash the aggregates at its own cost in order to comply with the conditions indicated above.

- Any material that the Construction Supervisor deems unsuitable for the job will be rejected.

**3. METHOD OF EXECUTION**

All bricks must be thoroughly wetted before placement. They must be laid in perfectly horizontal, plumb rows, resting on a layer of mortar at least 1 cm thick.

The bricks will be placed in a "rope" position with the widest side E = 18 cm. ("Rope" is the term used when it is the longest part of the piece that remains visible).

Care will be taken to ensure that the bricks are properly bonded between rows and at the intersections between wall and wall or wall and partition.

Bricks placed immediately adjacent to reinforced concrete structural elements (slabs, beams, columns, etc.) must be firmly adhered to them. To do this, prior to placing the mortar, the surface of the reinforced concrete structural elements must be properly chipped to obtain a rough surface that ensures good adhesion.

To allow the walls and partitions placed between the slab and the reinforced concrete beam to settle without causing damage or separation between these elements and the masonry, the final upper course of bricks, continuous with the beam, shall not be placed until at least 7 days have elapsed. Once the wall or partition has absorbed all possible settlement, this space shall be filled by firmly wedging the bricks corresponding to the final upper course.

The cement-sand mortar, in a 1:5 ratio, will be mixed in the quantities needed for immediate use. Any mortar that is 30 minutes old or older from the time of mixing will be rejected.

The mortar will have a consistency that ensures its workability and the handling of compact, dense masses with a uniform appearance and color.

The thickness of the walls and partitions must strictly conform to the dimensions indicated in the respective plans, unless the Construction Supervisor expressly instructs otherwise in writing.

To finish the rows at the ends, half bricks from the factory or bricks cut with a grinder will be used; those cut by blows are not acceptable.

When constructing walls and partitions, where possible, the necessary spaces will be left to accommodate the pipes for the different types of installations, as well as any boxes, wooden blocks, etc. that may be required.

**4. MEASUREMENT**

All brick walls and partitions with cement and sand mortar will be measured in SQUARE METERS (m2) taking into account the net area of the work executed by the Contractor and approved by the Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: SHEET METAL DOOR**

**UNIT: Square meters**

**1. DESCRIPTION**

This item includes the provision and installation of metal doors according to the dimensions and shapes specified in the plans, proposal submission form, and/or instructions from the construction supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- ANGLE 3/4" x 1/8"

- 4" HINGE

- 1/16" STEEL PLATE e = 1.50 mm 6010 ELECTRODE 2.5

- ANTICORROSIVE PAINT

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The metal sheet will be 1/16" thick and must be free of cracks and rust. For stiffeners, 3/4" X 1/8" angles will be used.

The anti-corrosion paint to be used will be of a recognized brand and the color will be approved by the Construction Supervisor.

**3. METHOD OF EXECUTION**

The installation will strictly adhere to the detailed plans and written instructions of the Construction Supervisor.

The welds must be polished.

Before installation, the doors will receive two coats of anti-corrosion paint.

The metal doors will be secured with three 4" double hinges.

The embedding in columns or walls must be perfectly level and must be approved by the Supervisor.

**4. MEASUREMENT**

This item will be measured per square meter (m2) duly executed and approved by the construction supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: AH 400 STRUCTURAL STEEL**

**UNIT: Kilograms**

**1. DESCRIPTION**

This item includes the supply, cutting, bending, placement, and assembly of reinforcing steel for reinforced concrete structures, which will be installed in the quantities, class, type, and dimensions according to the project's detailed plans and/or construction supervision instructions.

NOTE: Natural hardness steel should be used; cold drawn steel should only be used for leather armor or decorative elements.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- CORRUGATED STEEL

- TIE WIRE

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The reinforcing bars will be corrugated and must comply with the requirements for corrugated bars of NB 732, ASTM A 615M “Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement” or CBH-87 “Bolivian Reinforced Concrete Code” Sections 4.1 to 4.4.

The materials to be used will be provided by the Contractor, as well as the tools and equipment necessary for cutting, tying and bending the reinforcing steel.

For cutting reinforcing steel, cutting shears or other equipment that does not generate temperatures greater than those allowed may be used.

The bars must be inspected before being bent, verifying that they do not present surface defects, cracks or blowholes.

The equivalent cross-section shall not be less than 95% of the nominal cross-section for diameters no larger than 25 mm; nor 96% for larger diameters.

Rebars of different diameters and characteristics will be stored separately to avoid the possibility of bars being exchanged.

The use of different types of steel in the same section is strictly prohibited.

The minimum yield fatigue of the reinforcing steel will be that established in the structural plans or calculation report and/or supervisor's instructions.

**3. METHOD OF EXECUTION**

The corrugated steel bars will be cut and bent to the dimensions and shapes indicated in the plans and reinforcing steel sheets, which must be verified by the Construction Supervisor before use.

Hot cutting and bending are strictly prohibited. Reinforcing steel bars that have been bent may not be straightened or reused without first removing the bent area.

To verify the characteristics of the reinforcing steel, a random cold bending test must be performed. No cracks should appear in the bar tested. This test consists of cold bending the bars 180° on a mandrel (a corrugated steel bar bending machine).

CLEANING AND INSTALLATION

Before inserting the reinforcement into the formwork, it must be properly cleaned with steel brushes, removing dust, mud, grease, paint, and anything that may impair adhesion to the concrete. The use of corroded reinforcement is not permitted. If there are bars with hardened mortar or concrete present at the time of placing the concrete, these must be completely removed.

To support, separate, and maintain the reinforcement coverings, mortar supports (crackers) with metal ties or plastic spacers manufactured exclusively for this purpose will be used, ensuring they have the appropriate shape, thickness, and strength. They must be placed in sufficient numbers to achieve the correct positions. The use of stones, plaster, brick, or wood is strictly prohibited.

The upper reinforcement of the slabs will be adequately secured, for which the Contractor will be obliged to build trestles in a convenient number but not less than 4 pieces per m2.

The wall reinforcement will be held in place by special S-shaped reinforcements, in an appropriate number, but no less than 4 per m2, which must support the external bars on both sides. The cost of the trestles and spacers is included in the Unit Price.

All crossings must be properly tied.

Prior to pouring, the Construction Supervisor must carefully check the reinforcement and authorize, using the Order Book, whether pouring the concrete is appropriate.

All reinforcements will be placed in the precise positions established in the structural plans and/or as indicated by the construction supervisor, in accordance with accepted tolerances.

The tolerance for the longitudinal location of the bends and ends of the reinforcement must be ±

50 mm, except at the discontinuous ends of the brackets or gussets where the tolerance must be ±

12 mm and at the discontinuous ends of other elements where the tolerance must be ± 25 mm. Minimum Bending Diameters:

It will not be less than the value deduced from the following expression:

D= ((2\*Fyk)/( 3\*Fck))\*Ø

Ø = nominal diameter of the bar

Fyk = characteristic strength of steel

Fck = characteristic strength of concrete expressed in the same units Fck

Bent:

The bending will be carried out cold, respecting the bending pin diameter in the manufacturer's technical sheet and must be carried out cold.

Splices in the bars:

It is recommended not to make splices in bars subjected to tension. If such overlaps are made, the necessary measures must be taken to ensure the proper performance of the structural element.

If splices are necessary, they will be located in those places where the bars are subject to the least stress.

In the same section of a structural element, only one splice may be accepted every five bars.

The strength of the splice must be at least equal to the strength of the bar. Splices will be made by overlapping, as indicated below:

The ends of the bars will be placed in direct contact along their entire splice length, which may be straight or with hooks as specified in the plans, said hooks not being permitted in reinforcements subjected to compression.

Along the entire length of the tension splice, additional transverse reinforcements will be placed to improve the splice conditions.

For bar diameters less than or equal to 16 mm:

Compression splice lengths must have a minimum length of 40 times the diameter of the bar.

Tension splice lengths must have a minimum length of 65 times the diameter of the bar.

For diameters greater than 16 mm, the criteria indicated in CBH 87 section 12.2 will apply.

Concrete coatings for reinforcement:

Special care shall be taken to ensure that all reinforcements are protected by the minimum coverings specified in the plans.

The following minimum geometric concrete cover shall be provided to the reinforcing steel.

The minimum cover for bar bundles must be equal to the equivalent diameter of the bundle, but need not be greater than 50 mm; except for concrete constructed against the ground and permanently exposed to it, in which case the minimum cover must be 75 mm.

At the supervisor's discretion, bars with the most representative diameters will be selected so that the contractor can use a laboratory to certify the yield and breaking limits of the steel.

For approval of the item, supervision will require the steel quality certificate.

Additionally, depending on the type of work and the supervisor's judgment, he or she may request tensile tests of the most common bar diameters in the project; this test will be performed at the contractor's expense.

**4. MEASUREMENT**

This item will be measured in kilograms (kg). It is established that the length of splices and losses due to bar cutting will not be taken into account when measuring reinforcing steel; these must be considered by the Contractor in its unit price analysis.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: GREEN AREA WITH SOD**

**UNIT: Square meters**

**1. DESCRIPTION**

This item includes the work required for laying sod in green areas, generally new, or in locations specified in the plans, proposal submission form, and/or indicated by the Construction Supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

MATERIALS:

- TURF

- SELECTED LAND

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

The selected soil must be of good quality with a pH of 5.5 to 6.5.

The tools will be appropriate for this job.

The sods must be selected and not have a mixture of other species such as clover, barley, straw, bogland, and others.

The construction supervisor will approve the sods prior to placement.

**3. METHOD OF EXECUTION**

For the placement of sod, the Contractor shall adequately prepare the base of the ground or topsoil by carrying out:

The removal of soil by raking it to remove all stones, debris, roots and vegetation remains.

If the soil is very compacted, it is necessary to remove the soil, up to about ten or fifteen centimeters deep. Between three (3) and five (5) centimeters of a mixture of black soil, manure and vegetable fertilizer should be added, so that the sod has a good base where it can take root.

Then, rake shallowly, no more than 1 or 2 centimeters, to leave small furrows in the soil, which facilitate the entry of the turf roots.

To ensure that water does not remain stagnant, the ground should be given a slight slope to ensure drainage, thus leveling the surface.

The turf must be properly placed and compacted so that it is all aligned at the same level, leaving no gaps between each other, and so that its roots come into contact with the soil, thus ensuring good take.

The rows should be interlocked, alternating the position of the turf so that the joints do not overlap (like bricks in a wall). When necessary, cut the edges with a knife or shape the green area.

Once placed and compacted, the entire area covered by the turf must be watered.

Poorly laid sod will not be accepted.

**4. MEASUREMENT**

The measurement of this item will be carried out by SQUARE METER (m2) of turf correctly placed and approved by the construction supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: DEBRIS REMOVAL WITH LOADING**

**UNIT: Cubic meters**

**1. DESCRIPTION**

This item refers to the loading, removal, and transportation of all debris left behind after the various works on a construction site have been carried out.

**2. MATERIALS, TOOLS AND EQUIPMENT**

EQUIPMENT:

-Dump Truck

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**3. METHOD OF EXECUTION**

For the development of this activity, workers will be provided with the necessary safety equipment; these will be the responsibility of the Contractor and will not be considered for payment purposes.

The Contractor will require the approval of the Construction Supervisor to begin execution of the item.

Loading of material

It will be carried out using the procedure that the Contractor considers appropriate, at the material storage location or locations, whether these are defined by the project or approved by the Construction Supervisor.

The material to be removed will be anything not considered suitable for construction, such as rubble, very silty material or clay, saturated material, or contaminated material. All of this will be removed with prior authorization from the Construction Supervisor.

Transport equipment

Dump trucks with tilting hoppers will be used to transport the material. To prevent material loss during transport, the use of dump trucks without a rear cover will not be permitted.

Disposable materials will be transported off-site to designated locations or dumps.

The number of dump trucks will be adjusted according to the transport distance from the loading dock to the unloading or storage bin to achieve an adequate cycle time, consistent with the Contractor's plan and approval by the Construction Supervisor.

This item should not be used to remove waste and garbage (boxes, cement bags, plastic packaging, etc.) and/or recoverable material, such as props and other materials generated by the Contractor.

**4. MEASUREMENT**

This item will be measured by CUBIC METER (m3), considering the net volume of demolished structures that would have generated the loaded, removed and transported debris, which must be previously authorized by the Construction Supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.

**ITEM NAME: EXCAVATION AND REMOVAL OF SOLID WASTE WITH MACHINERY**

**UNIT: Cubic meters**

**1. DESCRIPTION**

This activity consists of carrying out open-air excavations using crawler-type excavators for solid waste in areas with difficult access and rugged topography, with the subsequent transfer of the material, according to the dimensions established in plans and/or instructions from the construction supervisor.

**2. MATERIALS, TOOLS AND EQUIPMENT**

EQUIPMENT:

-Dump Truck

- Tracked excavator

However, the preceding list cannot be considered restrictive or limiting with regard to the provision of any additional materials, tools, and/or equipment necessary for the proper execution and completion of the works. In any case, the use of additional supplies beyond those indicated in the proposal and that may be necessary during the execution period of the works shall be the responsibility of the Contractor, in order to ensure that the works are executed and completed appropriately and to the satisfaction of the Construction Supervisor. It is clarified that this aspect will not, under any circumstances, entail additional costs for the Entity.

**3. METHOD OF EXECUTION**

This activity must include all inputs to ensure industrial safety on-site, both for the construction personnel and pedestrians. These requirements must be enforced by the supervisor for strict compliance during the execution of the project.

Once the layout is completed and the areas to be excavated and/or the movement of solid waste are defined, the supervisor will authorize the start of the activity using the planned machinery, instructing to what depth the excavation should reach based on the type of work to be implemented.

The excavations and the movement of solid waste will be carried out in open air according to the project plans, ensuring that the depth to be reached is leveled and finished in such a way that the base offers firm and uniform support throughout the entire excavated area.

Any excess excavation that is not authorized must be backfilled by the Contractor at their own expense, using the appropriate materials and equipment. The work done must be approved by the supervisor.

During the excavation process, the Contractor must exercise the utmost care to avoid destabilizing the areas where the activity is being carried out and causing damage to structures or buildings in adjacent areas to the excavation. The Contractor will take appropriate measures to ensure the uninterrupted operation of all existing services, such as drinking water, sewage, electricity, and others. In case of damage, the Contractor must restructure or replace them at their own cost.

As the excavation progresses, special care must be taken regarding the stability of the walls to avoid landslides. If this occurs, no foundation work can proceed until the material that may have reached the bottom of the excavation is completely cleared.

When excavations require the construction of shoring and bracing, these must be designed by the Contractor and reviewed and approved by the Work Supervisor. This approval does not relieve the Contractor of responsibilities in the event of failure.

The excavated and removed solid waste must be transported to the locations specified in writing by the Work Supervisor, ensuring that the project is not adversely affected. Otherwise, the Contractor must, at their own expense and without any additional charge, relocate the material to the authorized locations.

**4. MEASUREMENT**

The measurement of this item will be carried out by CUBIC METER (m³), considering only the net volume of excavation and transport approved by the work supervisor.

**5. PAYMENT METHOD**

Payment for the item will be based on the unit and price presented. This cost includes full compensation for all materials, labor, tools, equipment used, and other incidentals required by law.