**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: 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

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.

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: 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

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 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.