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211101

CHINA ROAD AND BRIDGE CORPORATION
NEW PORTO CAIO BUILDINGS - CABINDA

CABINDA - ANGOLA

Foundations and Structure
Execution Project

JANUARY 2025

TECHNICAL CONDITIONS



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1 INTRODUCTION

1.1 General Aspects

These Technical Conditions refer to the Execution Project for Structures and Foundations of the Buildings for the New Port Caio de Cabinda – Angola requested by CRBC.

In short, the work to be carried out to implement the structure of the facilities consists of:

- Earth movements to create the working platform;
- Stakeout of the building's implementation and in particular the start of the structure;
- Execution of the foundation slab;
- Excavations and backfills in the opening and closing of foundation holes;
- Execution of structural elements in reinforced concrete, including footings, locking and foundation beams, and, in floors, pillars, walls, beams, solid slabs, stairs. The execution of these elements includes:
 - Supply, assembly and disassembly of formwork for concrete elements to be executed in situ, including the respective shoring, bracing, bracing, etc.;
 - Manufacture, supply, transport and placement of concrete;
 - Supply, assembly and placement of steel in reinforcements for reinforced concrete;
- Secondary metal structures;
- Expansion joint.

1.2 REINFORCED AND PRESTRESSED CONCRETE STRUCTURES

1.2.1. REGULATORY FRAMEWORK

In this Specification, European standardization and the application documents (DNA) of these standards provided for Portugal are adopted as reference.

The aspects related to hydraulic binder concrete (specification, performance, production and compliance verification) are considered for the purposes of this project to be covered by the European standard NP EN 206-1 – Concrete. Part 1: Specification, performance, production

and compliance, with the work related to the execution of concrete structures (falsifying and formwork, reinforcement and placement, compaction and curing of concrete) falling under the scope of standard NP ENV 13670 – Execution of concrete structures. Part 1: General rules. Still with regard to reinforced and pre-stressed concrete structures, it is important to indicate as a reference the Portuguese regulations, in particular DECREE-LAW 390/2007, of December 10th and DECREE-LAW 28/2007, of February 12th, regarding the placing on the market or import of steel for use in reinforcements for reinforced concrete and pre-stressed concrete, respectively.

1.2.2. QUALITY PLAN

The Contractor must have implemented and maintain a production quality control system based on the NP EN ISO 9001 standard that ensures the compliance of the manufactured components with the requirements of the standards specified in the Specifications.

The Contractor shall present, before the start of the works, a quality plan for the execution of the structure as referred to in clause 4.2.1 (1) of standard NP ENV 13670-1.

1.2.3. EXECUTION CLASS AND USEFUL LIFE

Within the scope of standard NP EN 13670-1, the work falls within Inspection Class 2 regarding verification of the conformity of the products and materials to be used, as well as the execution of the works, with a useful life of 50 years being intended.

1.2.4. EXECUTION TOLERANCES

The complete structure must comply with the maximum permitted deviations, defined in Chapter 10 and Annex F of standard NP ENV 13670-1, to avoid harmful effects in terms of:

- Mechanical resistance and stability in temporary and service situations;
- In-service behavior during use of the structure;
- Geometric compatibility between the structure and the placement of its non-structural components.

Small accidental deviations from the reference values that do not have significant consequences on the behavior of the finished structure can be disregarded.

In the case of structural elements not covered by the aforementioned standard (for example, deep foundations and prefabricated products), the instructions contained in this Specifications must be followed.

1.3 FIRE PROTECTION REQUIREMENTS

In accordance with the Fire Safety Project, structural elements must satisfy the following mechanical resistance criteria for exposure to standard fire:



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2 GENERAL TECHNICAL CONDITIONS

2.1 PRESCRIPTIONS COMMON TO ALL MATERIALS

All materials to be used must have certification of origin, CE Marking, where applicable, or comply with DECREE-LAW No. 50/2008, of 19 March, and be of the best quality. They must be accompanied by the respective Declaration of Conformity and CE Certification, where applicable, and a Certificate of Origin and also comply with:



- being national, to Angolan Standards, Regulations in force and Specifications of this Specifications;
- being foreigners, to the Standards and Regulations in force in the Country of origin, Approval Documents of Official Laboratories, if there are no applicable National Standards.

The Contractor is obliged to present, with a period of time to be defined by the Inspection, samples of all materials that he intends to apply, which, when approved, will serve as a standard.

The Contractor is obliged to present, with a period of time to be defined by the Inspection, samples of all materials that he intends to apply, which, when approved, will serve as a standard.

The materials to be used in the work will be subjected to the tests and analyses that the Inspection deems appropriate for the perfect knowledge of their properties and which will be carried out in accordance with the regulatory precepts in force, applicable normative documents or even in accordance with the standards and specifications adopted in Angola or in the country of origin.

No material may be applied to the work without prior authorization from the Inspection Department.

The Contractor, when authorized by the Inspection, may apply materials other than those provided for, if they comply with the legislation in force and if the solidity, stability, appearance, duration and conservation of the work are not compromised and if there is no change, furthermore, in the price.

The fact that the Inspection allows the use of any material does not exempt the Contractor from responsibility for its behavior.

The Inspection, whenever it deems it appropriate, to ensure the proper execution of the works, will indicate which tests the materials must undergo after being applied or even the construction itself. These tests will be carried out in accordance with the regulatory precepts or with those prescriptions that, whether or not established by the specifications, allow for the establishment of comparative values of the perfect execution of the work awarded.

Any materials that are found by simple examination or in view of the results of tests or analyses to not meet the required requirements shall be rejected. Any materials rejected for not meeting the required conditions shall be removed by the Contractor at his expense from the site within 72 hours. If the Contractor fails to comply with this obligation, the Inspection Authority shall arrange for such removal, but at the Contractor's expense.

2.2 UNSPECIFIED MATERIALS

All materials not specified and used in the work must comply with the Technical Clauses of these Specifications. In particular, they must comply with the regulations applicable to them: European Standards, Portuguese Standards, Approval and Classification Documents, as well as good construction standards. In any case, they will be submitted for approval by the Inspection Authority, which may order special tests to verify their characteristics.



2.3 MATERIALS FOR CONCRETE AND MORTAR

2.3.1 Cements

Cements to be used in concrete and mortars must comply with the following standards:

- NP EN 206-1 – Concrete. Part 1: Specification, performance, production and compliance;
- NP EN 197-1 – Cement. Part 1: Composition, specifications and compliance criteria for current cements;
- NP 4435 – Cements. Conditions of supply and reception.

The LNEC E 464 Specification: Concretes. Prescriptive methodology for a project service life of 50 and 100 years in the face of environmental actions must also be followed.

The cement should preferably be national, recently manufactured and packaged in such a way as to be well protected against humidity.

Cement must be supplied in bulk and, in specific situations, in bags. Cement supplied in bulk must be stored in silos equipped with thermometers. When supplied in bags, open-air storage is not permitted and must be stored with all the care indicated in standard NP EN 206-1.

Any cement that is hardened, has granules, or is poorly packaged or stored will be rejected. When in bags, any cement that is contained in open bags or shows signs of tampering will be rejected. Rejected cement must be identified and removed from the construction site.

The cement to be used in the concrete prescribed for a given element of the work must, whenever possible, be of the same origin, as proven by certificates of origin. Otherwise, the Contractor must demonstrate, through tests, the equivalence of the physical, chemical and mechanical properties of the cements used, paying particular attention to their alkalinity.

Whenever required by the Inspection Authority, the necessary tests shall be carried out to verify that the characteristics of the cements comply with those specified in NP EN 197-1. These tests shall be carried out at the Contractor's expense and in accordance with the various parts of standard NP EN 196 – Cement Testing Methods.

2.3.2 Aggregates

Aggregates to be used in concrete and mortar must comply with the following standards:

- NP EN 206-1 – Concrete. Part 1: Specification, performance, production and compliance;

- NP EN 12620 – Aggregates for concrete and comply with the requirements of the standard: NP EN 206-1 – Concrete. Part 1: Specification, performance, production and compliance;
- The properties, the normative documents for their determination and the corresponding limits for concrete and mortar aggregates are indicated in Specification “E 467: Guide for the use of aggregates in hydraulically bound concrete”.

Aggregates may be stored outdoors, except in cases where the humidity they contain must be taken into account and the Contractor does not have equipment capable of ensuring the necessary corrections.

When storing aggregates, it will not be necessary to separate them into batches, as long as they are of the same origin. Separation by type will be guaranteed.

Whenever required by the Inspection Authority, the necessary tests will be carried out to verify that the characteristics of the inert materials comply with the specifications in NP EN 206-1. These tests must be carried out in accordance with the specifications in the standards and specifications referred to in Specification LNEC E 467.

2.3.3 Mixing Water

The mixing water must comply with the following standards:

- NP EN 206-1 – Concrete. Part 1: Specification, performance, production and compliance;
- NP EN 1008 – Mixing water for concrete. Specifications for sampling, testing and evaluation of the suitability of water, including water recovered from concrete industry processes, for the manufacture of concrete.

Water storage and transport containers must be given special care to ensure that they do not contain harmful substances such as deposits or dirt.

2.3.4 Adjuvants and Additions

The admixtures to be introduced into the concrete must comply with the requirements set out in the standards:

- NP EN 206-1 – Concrete. Part 1: Specification, performance, production and compliance;
- NP EN 934-1 - Admixtures for concrete, mortar and grout. Part 1: General requirements;
- NP EN 934-2 - Admixtures for concrete, mortar and grout. Part 2: Admixtures for concrete. Definitions, requirements, compliance, marking and labelling;

- The additives to be introduced into the concrete must comply with the requirements set out in the standards:
 - NP EN 206-1 – Concrete. Part 1: Specification, performance, production and compliance;
 - EN 12878 - Pigments for colouring cement and/or lime-based building materials - Specifications and test methods;
 - NP EN 450-1 – Fly ash for concrete. Part 1: Definition, specifications and compliance criteria;
 - NP EN 13263-1 – Silica Fume for Concrete. Part 1: Definitions, Requirements and Compliance Criteria.

The mixing of cement additives on site should only be permitted in exceptional and duly justified cases and when the cement industry does not currently produce certified cements with equivalent characteristics. This mixture must comply with the provisions of Specification LNEC E 464: Concrete – Prescriptive methodology for a design service life of 50 and 100 years in relation to environmental actions.

Additions and admixtures for mortars and concrete must be previously submitted for approval by the Inspection Authority, and the Contractor must provide all necessary information and clarifications regarding their characteristics and method of application.

Admixtures such as water repellents, air entrainers, plasticizers, superplasticizers, water reducers, retarders or setting accelerators may be used, provided that it is proven by tests that the products to be used will maintain the characteristics and qualities of the concrete and reinforcement, without compromising their durability.

The water repellents to be added to the concrete must provide effective protection against the action of external or infiltrated water.

An essential condition for the approval of adjuvants and additions is the written declaration by the Contractor that he undertakes to guarantee throughout the entire work the qualities and characteristics of the approved product as set out in his proposal and this declaration.

Adjuvants and additives must be transported and stored in such a way that their quality is not affected by physical or chemical actions, and must be clearly identified and stored in such a way as to exclude any possibility of mistake.

Whenever required by the Inspection Authority, the necessary tests shall be carried out to verify that the characteristics of the additives and admixtures comply with the specifications in the aforementioned standards. These tests shall be carried out at the Contractor's expense and follow the specifications in the various parts of standard NP EN 480 - Admixtures for concrete, mortar and injection grout. Test methods.

2.3.5 Stone

The stone to be used, whether for crushed stone or for other purposes, must satisfy, in addition to the specific conditions for each case, the following general conditions:

- Not be attackable by water or atmospheric agents;

- No cracks or lesions;
- Be free of soil or any other foreign matter;
- It must not have cavities, have a homogeneous grain and not be ice-cold.

2.4 WOOD FOR FORMWORK

The wood to be used must be well-bonded, properly dried, not burnt or carded, without vicious knots, free from woodworm, cracks or flaws that could compromise its resistance and the final appearance of the concrete pieces.

They must be first choice, that is, selected so that even small defects (knots, cracks, etc.) do not occur very frequently or on a large scale, nor in areas of the parts where the greatest stresses will be installed.

They must have sharp corners and be well straightened, allowing, in cases to be determined by the Inspection, the use of round pieces as props or props, as long as this does not compromise the safety or perfection of the work.

The mold boards must be no less than 2.5 cm thick and will be planed, lined and half-timbered.

The shims or wedges to be applied must be made of hardwood.

2.5 REINFORCEMENT STEEL FOR REINFORCED CONCRETE

The electrowelded bars or meshes for reinforcement to be used in reinforced concrete will be of the types and classes indicated in the Project and must comply with the provisions of the Regulation for Reinforced and Prestressed Concrete Structures (DECREE-LAW No. 349 - C/83, of 30 July).

Steels must be free from galvanizing, painting, tarring, clay, oil or loose rust, must be classified by the National Civil Engineering Laboratory (LNEC) in compliance with article 23 of the Regulation for Reinforced and Prestressed Concrete Structures (REBAP), and satisfy the characteristics set out in the LNEC Specifications:

- E 449: A400 NR Steel Bars for Reinforced Concrete Reinforcement. Characteristics, Tests and Marking;
- E 450: A500 NR Steel Bars for Reinforced Concrete Reinforcement. Characteristics, Tests and Marking;
- E 455: A400 NRSD (Special Ductility) Steel Bars for Reinforced Concrete Reinforcement. Characteristics, Tests and Marking;
- E 456: A500 ER Steel Bars for Reinforced Concrete Reinforcement. Characteristics, Tests and Marking;
- E 458: Electrowelded Meshes for Reinforced Concrete Reinforcement. Characteristics, Tests and Marking;
- E 460: A500 NRSD (Special Ductility) Steel Bars for Reinforced Concrete Reinforcement. Characteristics, Tests and Marking;

- E 480: Electrowelded Trusses for Reinforced Concrete Frames. Field of application, characteristics and tests.

The use of other types of non-current reinforcement, which do not comply with the aforementioned LNEC Specifications, must be preceded by their approval by the National Civil Engineering Laboratory (LNEC).

According to DECREE-LAW No. 390/2007 of 10 December, the use of steel products intended to be used as reinforcement in reinforced concrete will, in addition to classification, be subject to certification by a body accredited by the competent entity in the field of accreditation in accordance with the methodologies of the Portuguese Quality System. All steels received on site for Inspection Class 2 and 3 must be tested, in accordance with DECREE-LAW No. 301/07 of 23 August. These tests will be carried out in accordance with the provisions of the applicable LNEC Specifications, referred to above.

All costs for controlling the characteristics of the steels, whether specifically mentioned or not, are the exclusive responsibility of the Contractor and are considered to be included in the respective unit prices.

2.6 MATERIALS FOR METAL CONSTRUCTION

2.6.1 General

All materials to be used must be of the highest quality and bear the origin marking. They must be accompanied by the respective Declaration of Conformity and CE Certification, if applicable, and by the Certificate of Origin and must also comply with the provisions of clause 5 of standard EN 1090-2.

It should be added that no material may be applied to the work without prior authorization from the Inspection. The Contractor, when authorized by the Inspection, may apply materials other than those provided for, if they comply with the legislation in force and if the solidity, stability, appearance, duration and conservation of the work are not compromised and if there is no change, furthermore, in the price.

2.6.2 Structural Steel

The products making up the steel structures must have a compact and homogeneous texture, with fine grain, free from cracks, inclusions or other defects that could be detrimental to their use.

They must also comply with the steel classes indicated in the design parts and the European standards referred to in NP EN 1090-2 with regard to technical supply requirements and dimensions, namely:

- Definition and requirements:
 - EN 10021 – General technical conditions of supply for steel products.
- Inspection documents:
 - NP EN 10204 – Metal products. Types of inspection documents;

- Technical requirements for the supply of hot rolled structural sheets and profiles (I, H, U, L, T sections):
 - NP EN 10025 – 1 - Hot rolled products of construction steels. Part 1: General technical conditions of supply
- Technical requirements for the supply of hot rolled structural hollow profiles:
 - NP EN 10210 – 1 - Hot-finished structured hollow sections in fine-grained non-alloy steels. Part 1: Technical supply conditions
- Technical requirements for the supply of cold-formed structural hollow profiles:
 - NP EN 10219 – 1 – Cold-formed and welded structural hollow sections in fine-grained non-alloy steels. Part 1: Technical supply conditions

In the case of products not covered by these standards, their properties must be specified.

2.6.3 Screws, threaded bolts, connectors, nuts, washers

Threaded connection elements (screws and threaded bolts), connectors, nuts and washers must comply with the classes indicated in the design parts and clause 5.6 of NP EN 1090-2, which specifies other European standards relating to technical supply and dimension requirements, namely:

- General requirements for screws and threaded bolts:
 - EN 15048-1 – Non-prestressed threaded connecting elements – General requirements;
 - EN 14399 – 1 – High-strength construction threaded connecting elements suitable for prestressing. Part 1: General requirements;
- Screw and nut connections:
 - EN 14399 – 3 – High-strength construction threaded connecting elements suitable for prestressing. Part 3: HR system – Hexagonal bolt and nut connections;
 - EN 14399 – 4 – High-strength construction threaded connecting elements suitable for prestressing. Part 4: HV system – Hexagonal bolt and nut connections;
 - EN 14399 – 7 – High-strength construction threaded connecting elements suitable for prestressing. Part 7: HR system – Countersunk screw and nut connections;
 - EN 14399 – 8 – High-strength construction threaded connections suitable for prestressing. Part 8: HV system Screw connections with adjusting body and hexagonal nuts;
 - EN 14399 – 10 – High-strength construction threaded joints suitable for prestressing. Part 9: System HRC – Direct stress indicators for bolt and nut connections;
 - Flat washers;
 - EN 14399 – 5 – High-strength construction threaded connecting elements suitable for prestressing. Part 5: Plain washers;



- EN 14399 – 6 – High-strength construction threaded connecting elements suitable for prestressing. Part 6: Chamfered flat washers;
- Connectors:
 - EN ISO 13918 – Ceramic studs and rings for arc stud welding.

2.6.4 Welding consumables

Welding consumables must comply with the requirements of EN 13479 – Welding consumables. General product standard for filler metal and fluxes for fusion welding of metallic materials, and with the requirements specified in clause 5.5 of EN 1090-2. The type of welding consumables must be appropriate to the type of welding process and must lead to welds with mechanical characteristics at least equal to those of the base material.

2.6.5 Paints for metal surfaces

All paints must be obtained from suppliers approved by the Inspection Authority and those that are integrated into a painting system must be mutually compatible, produced by the same manufacturer and have the same origin. The paint must be supplied in sealed containers and, in accordance with the Inspection Authority's requests, paint samples of each mixture must be subjected to laboratory tests. Paints and thinners shall be stored in well-ventilated warehouses protected from sparks, fire, direct sunlight and excessive heat. Paints that are subject to deterioration shall, if necessary, be stored in heated rooms.



3 TECHNICAL EXECUTION CONDITIONS

3.1 GENERAL WORKS

3.1.1 Implementation and Staking of the Work

3.1.1.1 Objective

Establishment of the technical conditions to be observed in the implementation and staking out of the work, to be carried out by the Contractor.

3.1.1.2 Technical Conditions

The implementation and staking of the work is the responsibility of the Contractor and will be carried out based on the execution drawings.

The Inspection will provide at least one point of origin of the coordinates, both in plan and altimetric.

The Contractor shall provide, at his own expense, the instruments as well as the equipment and personnel necessary for the Inspection to carry out the checks he deems necessary.

Once the installation work has been completed, the Contractor shall inform the Inspection Authority in writing, which shall then proceed to check the marks. If necessary, the Contractor shall rectify them in the presence of the Inspection Authority.

The Contractor undertakes to preserve the marks or references and to replace them, at his own expense, in identical conditions, either in the final location or at another point, if the needs of the work require it, after having notified the Inspection and the latter having agreed to the modification of the stakeout.

The Contractor is also obliged to maintain all existing marks or references that have been installed on the construction site by other entities and may only move them if authorized and under the guidance of the Inspection.

3.1.1.3 Price Conditions

The implementation and staking of the work is the responsibility of the Contractor, and does not give rise to specific remuneration, considering its costs and the costs of conservation, maintenance and replacement of the marks diluted in the remaining prices of the contract.

3.1.2 Mortar Manufacturing and Application

3.1.2.1 Objective

Establishment of the technical conditions to be observed in the manufacture and application of mortars in structural works.

3.1.2.2 Scope and Price Conditions

The following types of mortars are planned for structural work in the project:

- Type I Mortar: intended for repairing execution defects (in construction or concreting joints and in any plastering of concrete surfaces), which have been accepted by the Inspection, with this repair being the responsibility of the Contractor.
- Type II Mortar: intended for surface repair of concrete (in concreting joints or defective concreting areas), which have been accepted by the Inspection, with this repair being the responsibility of the Contractor.
- Type III Mortar: intended for filling support bases for metal parts, with the cost of this work being diluted in the cost of supplying the metal parts.

This Specification may provide for other types of mortars, in specific works, with this cost being included in the cost of these works.

3.1.2.3 Mortar Characteristics

The mortars defined in the previous point must have the following characteristics:

- Type I Mortar: high-strength, non-shrinkable, pre-dosed cement-based mortar, which can be mixed with sand or gravel according to the supplier's specifications.
- Type II Mortar: Mortar made of cement and selected sands, possibly improved with silica fume and synthetic resins.
- Type III Mortar: High-strength, non-shrinkable cement-based mortar. Its minimum characteristics are as follows:
 - Resistance after 28 days greater than that of the concrete in the parts to which it is applied, with a minimum of 30 MPa;
 - Maximum expansion in the first 24 hours after mixing not exceeding 0.5%;
 - Shrinkage from 24 hours after kneading and up to 6 months of age, in an environment with a relative humidity of 65%, no higher than that observed in the first 24 hours;
 - No exudation should be observed.

3.1.2.4 Technical Conditions

The Contractor is obliged to present, with a period of time to be defined by the Inspection, the study of the composition of the mortars that he intends to use, for approval by the Inspection.

Mortars must be supplied in bags, pre-dosed and accompanied by a quality certificate.

They will be manufactured at the time of use and in proportion to their consumption, in accordance with the supplier's instructions, and any that begin to stick in the kneader or are re-soaked will be rejected.

Type III mortar may be used in the manufacture of microconcrete, when mixed with small aggregates, generally less than 7 mm, and for this purpose the types and granulometries of aggregates and dosages recommended by the mortar manufacturer must be used.

The Inspection, whenever it deems it appropriate, to ensure the proper execution of the works, will indicate which tests the mortars must undergo after being applied or



even before their application. These tests will be carried out in accordance with the regulatory precepts or with those prescriptions that, whether or not established by the specifications, allow for the establishment of comparative values of the perfect execution of the work awarded.

3.1.3 Scaffolding, Formwork and Other Temporary Structures

3.1.3.1 Objective

Establishment of the technical conditions to be observed in the supply, assembly and disassembly of scaffolding, falsework and other temporary structures, necessary for the execution of structural work.

3.1.3.2 Technical Conditions

The Contractor shall submit to the Inspection Authority for prior approval the designs for the supporting structures of the moulds necessary to construct the work in accordance with the processes indicated in the construction drawings or provided for in the project.

The Contractor is free to choose the different types of falsework and other temporary structures, within the conditions stipulated above, and they must be made of metal. The Contractor is required to submit his/her projects to the Inspection for approval, which will consist of checking safety and calculating deformations, as well as construction, overall and detailed drawings, on suitable scales and duly dimensioned. Scaffolding, falsework and temporary structures must comply with the specifications of standard NP ENV 13670, and will be calculated in accordance with standard NP EN 1993 - Design of steel structures, the Safety and Action Regulations for Building and Bridge Structures (RSA), and the provisions of this Specification. All wooden parts must be calculated in accordance with standard NP EN 1995 - Design of Wooden Structures.

The falsework and other temporary construction structures must not, when under load, suffer deformations of more than half a centimetre at any point. In order to measure the settlements and their deformations, precise levelling marks shall be placed and the levelling carried out, work which shall be carried out by the Contractor, at its own expense, and under the guidance of the Inspection.

3.1.3.3 Price Conditions

The supply, assembly and disassembly of scaffolding, falsework and other temporary structures, in compliance with all current standards, particularly with regard to safety, is the responsibility of the Contractor and does not give rise to specific remuneration, considering its costs diluted in the remaining prices of the contract.

3.2 EARTH MOVEMENTS

3.2.1 General Excavation for Creation of Working Platforms

3.2.1.1 Objective

Establishment of the technical conditions to be observed when carrying out excavations to create work platforms up to the levels defined in the project drawings.

3.2.1.2 Unit and Criteria of Measurement

This work is measured in m³, and the corresponding volume is the theoretical volume that is determined geometrically from the construction drawings and is the result of the product of the platform area by the difference between its elevation and the natural ground elevation. The excavation values carried out will be calculated in the project without any swelling or overwidth.

3.2.1.3 Technical Conditions

When carrying out excavations, all provisions in force regarding occupational safety in Civil Construction must be respected.

Excavations must be carried out in such a way that, after compaction, when necessary, the dimensions indicated in the project are achieved, as well as the desired mechanical characteristics. Differences due to deficiencies will not be permitted and differences due to excess for the bottom and side slopes that limit the excavated volume must be less than 10 cm in relation to the limits established in the Project.

If the excavations exceed the dimensions indicated in the project or in the changes introduced therein, whether on the surface or in depth, the Contractor shall be liable for any resulting damage to the work and shall correct the areas excavated in excess at its own expense, using materials and processes approved by the Inspection Authority.

In relation to the aforementioned, exceptions are made for cases where over-excavations have been previously requested in writing by the Inspection, or authorized by the latter at the written request of the Contractor.

Whenever mechanical excavation methods are used, the extraction of soil shall be stopped before reaching the position foreseen for the bottom and the lateral surfaces, in order to avoid the ground being disturbed by the claws of the machines. The excavation shall be finished manually or by any method that does not present this inconvenience.

If necessary, excavations must be properly shoring and/or braced to ensure maximum safety during the execution of the works. In this case, excavations may only begin after approval of the shoring or containment project.

The excavation products that can be used in the work will be applied in the final locations or deposited in locations agreed with the Inspection. The excavation products that are not applicable in the work and in relation to which there is any reservation, legal or in the Specifications, must be removed from the construction site. The contractor must evacuate water from the excavations during the execution of the works.

If necessary, the contractor must have drainage equipment, including pumps, capable of ensuring continuous drainage work. When intensive pumping is used, appropriate measures must be taken to prevent water percolation from causing the removal of fines from the ground and compromising the stability of existing or future works.

Water protection and drainage devices in excavations should only be removed when the progress of the work allows.



Water sources located on the side surfaces or at the bottom of excavations must be captured or diverted from their outlet by processes that do not cause erosion or weakening of the ground.

Errors or omissions in the project or Specifications relating to the type of excavation, the nature of the terrain and the quantities and conditions of the work may not serve as grounds for the suspension or interruption of the work, and it is the obligation of the successful tenderer to have the necessary equipment available in a timely manner.

3.2.1.4 Price Conditions

This work will be accounted for in accordance with article 01.01 of the Bill of Quantities and includes the execution of excavation work and related ancillary works, in accordance with the provisions of this Specification. It also includes the loading and transportation of the excavated products to the dump and any compensation for deposit, as well as the drainage of the waters flowing into or outflowing from the site.

3.2.2 Excavation for opening Foundation Boxes and Pits

3.2.2.1 Objective

Establishment of the technical conditions to be observed in the execution of the holes for the construction of footings, foundation beams or pile caps and wells or pegs.

3.2.2.2 Unit and Criteria of Measurement

The quantification of this work will be carried out in m³, and geometrically will correspond to the theoretical volume limited by the vertical surfaces of the contour of the footings, foundation beams or heading masses, by the foundation plane(s) and by the elevations of the working platforms (or of the natural terrain in the absence of general excavation).

3.2.2.3 Technical Conditions

The excavations to open the foundation holes will be carried out using the processes that the Contractor understands to use, provided that they are accepted by the Inspection.

The pits shall be excavated to the depth indicated in the construction drawings or to the depth indicated by the Inspection after examining the excavation. The excavation shall always be completed by careful cleaning of the pits' foundations and the foundation conditions stipulated in the Project documents shall be respected.

The technical conditions stipulated in the section relating to excavations to create working platforms are still valid.

3.2.2.4 Price Conditions

This work will be accounted for in accordance with article 1.2 of the Bill of Quantities and includes the execution of the excavations and respective ancillary works, in accordance with the provisions of this Specification.

It also includes the loading and transport of the excavated products to the dump and any compensation for deposit, as well as the shoring and shoring of the walls of the pits and the drainage of the flowing or tributary waters, so that the concreting is done dry whenever possible.

3.2.3 Backfilling in Boxes and Foundation Pits

3.2.3.1 Objective

Establishment of the technical conditions to be observed when carrying out landfills in excavated areas for the construction of trenches, corresponding to earthmoving work in very specific conditions.

3.2.3.2 Unit and Criteria of Measurement

The quantification of this work will be carried out in m³, and the corresponding volume is the theoretical volume that is determined geometrically from the construction drawings and results from the product of the foundation area (footing or capping mass) by the difference between the foundation elevation and the final elevation of the land, defined in the project, deducted from the volume of the piece.

3.2.3.3 Technical Conditions

The landfills will be executed with the profiles indicated in the Project or in the Specifications.

The provisional levels to be given to the landfills will be such that, after settlement, the fixed levels are reached, with the respective tolerances.

This work may be carried out using material from the opening of the pits, provided that it meets the conditions defined in the Project or in these Specifications. To this end, the landfill must be free of stones larger than 10 cm and organic matter.

The maximum thickness of the elementary backfill layers, obtained after compaction, when this can be carried out, must not exceed 20 cm.

The technical conditions stipulated in the point relating to general landfills for the implementation of the ground floor are still valid.

3.2.3.4 Price Conditions

This work will be accounted for through article 1.3 of the Bill of Quantities, and includes the backfilling of the foundations with material from the opening of the holes, or the excavation, possibly on loan, of the material to be used in the execution of the backfill and which must comply with the specifications in these General Technical Conditions, the respective loading, transportation, placement, watering and compaction, the final regularization of surfaces, and also the recognition, testing and removal of materials that the Inspection rejects.

3.3 REINFORCED AND PRESTRESSED CONCRETE STRUCTURES

3.3.1 Objective

Establishment of the technical conditions to be observed in the execution of reinforced concrete and prestressed concrete structures, including formwork, concrete and reinforced concrete reinforcement work.

3.3.2 Scope

This work applies to all situations involving reinforced concrete structural elements foreseen in the project.

3.3.3 Unit and Criteria of Measurement

The quantification of the formwork is done in m² and this area corresponds to the area of the molded parts, that is, the sum of the area of all molded faces, determined from the construction drawings.

The quantification of the concrete placed on site is done in m³ and this volume corresponds to the volume of the concreted parts, that is, the sum of the volume of each of the parts after being molded, determined from the construction drawings.

In the case of reinforcement, the measurement is made based on the weight (in kg) of the reinforcement specified in the construction drawings. The ties and assembly rods are included in the unit price. The weight will be determined from the tables of weights of steel rods for reinforced concrete. In the case of prestressing reinforcement, the measurement is made from the weight (in kg) of the reinforcement specified in the construction drawings, considering the length of the cable or bar measured between the anchor plates and the specific weight of the steel. The weight will be determined from the tables of weights of prestressed steel strands or bars.

In the appendix, you can find some additional measurement criteria used in accounting for the quantities of concrete and formwork.

3.3.4 Formwork

3.3.4.1 General Aspects

The moulds, falsework and respective assembly and shoring structures must ensure that the shape and dimensions of the concrete elements, after demoulding, are those indicated in the Project drawings and must be executed in such a way as to satisfy the requirements of the following documents:

- Regulation of Reinforced and Prestressed Concrete Structures (DECREE-LAW 349-C/83), in particular as regards its article 152.
- NP ENV 13670 – Execution of concrete structures.

The Contractor is responsible for preparing the moulds and falsework project, including the moulding and falsework devices, and the counter-arrows indicated in the project drawings must be respected.

In the case of tall and thin parts, the moulds must be designed so that the concrete mass can be placed without segregation or disintegration caused by falling from a great height and so that the concrete is easily accessible for vibration.

Molds for prestressed parts must allow for shortening and easy demolding.

Immediately before placing the concrete, the moulds must be inspected to check their general characteristics (size, shape, watertightness, rigidity, roughness and cleanliness) and the surfaces must be treated with suitable products that prevent the concrete from adhering and guarantee the conditions required for the different types of finish on the moulded surfaces.

Mold treatment products must be applied in accordance with the manufacturer's instructions, ensuring uniform application to avoid stained surfaces.

Contact between mold treatment products and reinforcement must be prevented.

The moulds shall not be fixed using rods embedded in the concrete mass. Special devices must be used to remove the tie rods. These holes shall subsequently be sealed with mortar using a solution to be submitted for approval by the Inspection Authority and the author of the Architectural project.

The lost formwork, necessary for the execution of the forms and pouring foreseen in the Project, will, in general, be made with light and rot-proof materials.

3.3.4.2 Surface Finishing

With the exception of special cases referred to in the Project or Specifications, the finishes of the moulded surfaces must comply with the specifications in the following clauses.

The finishing class required for each concrete surface is that indicated on the drawings. In the absence of this indication, the general rules defined in these Specifications will be applied.

For the purposes of applying these clauses, irregularities in concrete surfaces are classified as sharp or smooth. Protrusions and burrs caused by the displacement or placement of formwork elements, by deficiencies in their connections or by any other local defects in the formwork are considered sharp irregularities and are measured directly. All other irregularities are considered smooth and are measured using a ruler, which will be a straight ruler in the case of flat surfaces, or its equivalent for curved surfaces. The length of this ruler will be one metre.

Three finishing classes are considered, A1, A2 and A3, as follows:

- Class A1: Irregular finish, without any limit to the protrusions. Depressions, sharp or smooth, will be less than 2.5 cm.
- Class A2: Sharp irregularities must not exceed 0.5 cm and smooth irregularities 1.0 cm.
- Class A3: Sharp irregularities must not exceed 0.1 cm and smooth irregularities 0.5 cm. The surface must have a uniform color and texture and be free from stains due to materials foreign to the concrete.

The different finishing classes will have the following applications unless otherwise indicated:

- Class A1: Surfaces in contact with the ground or with concrete masses, and foundation elements, molded on site.
- Class A2: Surfaces intended for coating with mortar or similar materials or which, having no coating, remain permanently hidden.
- Class A3: Exposed concrete surfaces or with very thin coatings.

When, after removing the concrete formwork, it is found that the finish obtained does not meet the specifications, it will be up to the Contractor to propose the technique to be used in its repair, which will have to be approved by the Owner of the Work.

In class A3 finishing, any repairs that need to be carried out must ensure surfaces of uniform colour and texture.

3.3.4.3 Special conditions for exposed concrete surfaces

Special formwork to be used on exposed or fair-faced concrete surfaces must be made in such a way as to obtain a completely level surface and with a regular arrangement of joints between elements and fixing devices. It is important to ensure that the moulds are watertight in order to prevent loss of laitance, which has unpleasant consequences in exposed concrete.

All construction elements that are concreted "in situ" and that, after being removed from the formwork, constitute the final visible finish of the building will be executed with due care, not only to guarantee the appropriate formal quality of texture and color, but also to ensure perfect connection with the remaining construction elements of the building.

In concrete intended for these elements, both compactness and impermeability, as well as high uniformity of appearance, must be guaranteed, using waterproofing admixtures and plasticizers to be approved by the Inspection, reducing the A/C ratio and maintaining high workability.

The usual formwork release oils should not be used, as they can cause grease stains. Therefore, colourless paraffin-based products should be used and applied using paint spray guns.

The finish of exposed concrete elements must be the result of marine plywood formwork, always ensuring a smooth, homogeneous and level surface, and its stereotomy must be in accordance with that specified in the Architectural Project.

In order to avoid any runoff, deformation or loss of liquid, the concreting joints must be carefully sealed to ensure that the mould is completely watertight. To this end, mastics and soft rubber tapes must be used to seal panels end to end and silicones must be applied externally between panel joints.

The free fall height of the concrete during its placement must be reduced (less than 1.5 m) in order to avoid its segregation and disintegration.

Any exposed concrete work that does not comply with the technical conditions set out in these Specifications, duly supplemented by the requirements of the Architectural Project, and that is not accepted by the Inspection or the Designers will be demolished and redone at the expense of the Successful Contractor.

3.3.5 Steel Reinforcement for Reinforced Concrete

The steel used in reinforcing concrete must comply with the specifications in this Specifications.

Steel reinforcements to be used in concrete structures must comply with the requirements of the Regulation on Reinforced and Prestressed Concrete Structures (DECREE-LAW 349-C/83) and standards NP ENV 13670 and NP EN 1992-1-1.

The Contractor must provide the Inspection with all necessary facilities to verify the characteristics of the rods used and the assembly execution techniques.

The transport, storage and handling of reinforcement must be carried out in such a way as to avoid deterioration of the reinforcement and the loss of its identification.

Construction arrangements such as joints, bending and tying of bars and the simultaneous use of different classes or types must comply with the provisions of standard NP ENV 13670, including the respective national application document, and the Regulation for Reinforced and Prestressed Concrete Structures.

If it is intended to perform bar joints by welding, the methods to be used are those indicated in standard NP ENV 13670, and the suitability of the steels used for welding must be proven by means of the approval of a homologation document or a favourable opinion from an official laboratory.

The bars forming the reinforcement shall be suitably joined by annealed wire ties or by spot welding. The ends of the wire ties shall be bent in such a way that, when placed on site, they do not pass through the coating layer of the reinforcement.

The reinforcement must be assembled in such a way as to respect the dimensions of the Project, within the prescribed tolerances, and to ensure sufficient overall rigidity so that the reinforcement maintains its shape during transport, placement and concreting; the constraints linked to the ease of placement and compaction of the concrete must also be taken into account.

The reinforcement bars must be placed in the moulds in such a way as to respect the coverings specified in the Project. The spacers to be used must comply with Specification LNEC E 469 - Spacers for reinforced concrete reinforcement bars.

The electrowelded steel meshes will be of the types indicated in the Project and must comply with the requirements of the respective approval documents.

3.3.6 Hydraulic Binder Concretes

3.3.6.1 Materials

The materials to be used in the manufacture of hydraulic binder concretes will be cement, aggregates, mixing water, admixtures and additions, and must comply with the specifications in standard NP EN 206-1 and in this Specification.

3.3.6.2 Composition of Concrete

The composition of each of the concretes to be used in the work must comply with the specifications in standard NP EN 206-1 and Specification LNEC E 464 and will be established by the Contractor in order to satisfy the requirements specified for fresh and hardened concrete, including consistency, strength, durability and protection of reinforcement against corrosion, taking into account the production process and construction methods envisaged.

The studies and tests necessary to determine the composition of the concrete will be the responsibility and obligation of the Contractor, which must be submitted in advance for acceptance by the Inspection Authority to the entity that will carry them out.

The Contractor is responsible for preparing specific reports on the concrete composition studies, which must be submitted for approval by the Inspection Department before the respective manufacture begins.

In the composition of the concrete, the Contractor may use, at its own expense and in compliance with the provisions of this Specification and the NP EN 206-1 standard, the admixtures whose need is justified, in order to obtain good workability with the lowest possible water-cement ratio.

The Contractor must submit the adjuvants he intends to apply for approval by the Inspection, and the use of additions based on chlorides or any corrosive products is hereby prohibited.

3.3.6.3 Concrete Specification



The concrete to be used is that specified in the Designed Parts and in the Project Descriptive Report.

3.3.6.4 Concrete Manufacturing

The means and techniques to be used in the manufacture of the various types of concrete for the work will be established by the Contractor, respecting the requirements of this Specifications and the NP EN 206-1 standard and being subject to prior approval by the Inspection.

The concrete must be prepared by mechanical means and may be manufactured on site by the Contractor or in industrial plants in the case of ready-mix concrete.

When it is necessary to manufacture concrete in unfavorable temperature conditions, the Contractor shall propose the special measures that he intends to adopt for approval by the Inspection.

The Contractor is obliged to control the manufacture of concrete, in accordance with the provisions of standard NP EN 206-1.

3.3.6.5 Transport, placement, compaction and curing of concrete

3.3.6.5.1 General Aspects

With regard to the transportation, placement, compaction and curing of concrete, the prescriptions indicated in standard NP ENV 13670 must be followed, also taking into account what is indicated in this Specifications and other parts of the project.

The means and processes for transporting, placing and compacting the concrete that the Contractor proposes to use are subject to approval by the Inspection Authority. Such means must be coordinated with each other, take into account the specific conditions of each case, the types of concrete to be used, the dimensions of the structures and the volume and extent of each concreting operation and constitute a system with versatility and reliability of operation suited to the circumstances and atmospheric conditions.

During the transportation and transshipment of concrete, appropriate measures must be taken to avoid segregation, loss of constituents or contamination.

In the case of ready-mixed concrete, the Contractor must provide the Inspection Authority with a copy of the delivery note containing all the elements set out in clause 7 of standard NP EN 206-1.

3.3.6.5.2 Placement, compaction and curing of concrete

During rainy periods, no concrete placement work should be started outdoors. If it rains during concreting, the work may continue as long as the concrete surface is not washed away. Otherwise, the work must be suspended and resumed when the concrete has sufficiently hardened, and the work must be carried out as if it were a working joint.

If the temperature at the construction site is below 0 (zero) degrees Celsius or if this is expected to happen within the next five days, concreting will not be permitted. For temperatures between 0 and 5 degrees Celsius, concreting will only be carried out if the Inspection Authority so permits, depending on the special measures that the Contractor intends to adopt. If the temperature at the construction site is above + 35 (thirty-five) degrees Celsius, or if this is expected to happen within the next five days, concreting will not be permitted unless with the express authorization of the Inspection Authority, based on the special procedures that the Contractor proposes to use.

In order to comply with the provisions of the previous paragraph, the Contractor is obliged to have a properly calibrated thermometer on the site, and must record the temperatures on the days on which the operations referred to in the aforementioned articles are carried out, as well as those of the following five days.

Before placing the concrete, the molds and reinforcement must be carefully cleaned of all foreign materials.

Concrete should be placed as soon as possible after mixing to minimize loss of workability.

The placing of the concrete must be carried out continuously as far as possible. In the event of interruption, the selection of the location and the preparation of the concrete surface for the resumption of the placing must be carried out in accordance with the precautions set out in these Specifications.

The molds must be filled in layers of a thickness proportionate to the compaction methods to be used, and this thickness must never exceed 50 cm.

Compaction must be carried out exclusively by mechanical means, using vibrators with characteristics and in a number appropriate to their perfect efficiency.

The concrete must be compacted in such a way that the concrete forms a homogeneous mass within the moulds and, as far as possible, without voids.

Vibrators must have dimensions suitable for the spaces between the reinforcement when assembled, without affecting their positions.

Concrete must be cured under suitable conditions and for a suitable period of time, in order to encourage the setting and hardening of the concrete and provide it with the expected properties, particularly in the surface area.

Immediately after concreting, measures deemed appropriate should be taken to prevent premature loss of water from the concrete, given environmental conditions and other factors.

3.3.6.5.3 Concrete Joints

The location of the concreting joints must be established before concreting begins, depending, in particular, on the type of structure and the stresses acting on it, the performance of the means of manufacturing and placing the concrete, the compaction process used and the aesthetic requirements, in the case of surfaces that will be exposed. This location must be included in a concreting plan to be drawn up by the Contractor and submitted for approval by the Inspection, and will preferably occur in the least stressed sections of the pieces and with an orientation roughly perpendicular to the direction of the main compressive stresses.

The treatment to be given to the concrete joints must be carried out in accordance with the instructions of the Inspection, with the following procedure being permitted, in principle:

- Before resuming concreting, the surface of the joint must be roughened so that the coarse aggregates are exposed. Depending on the state of hardening of the concrete, water jets, compressed air or sand jets may be used for this purpose, or the concrete may be chipped, taking care not to shake the coarse aggregates that have been exposed. Water jets may be applied as soon as the concrete has reached a state of hardening such that only the surface mortar can be removed without compromising the connection of the other elements to each other.

- Immediately before resuming concreting, the joint surface must be carefully cleaned and washed with a jet of water, with prior chipping if necessary, to obtain a clean and sound concrete surface, from which all residual water must be removed so that it is only damp, with a matt appearance and without excess water shine. It must then be covered with a layer of mortar equivalent to that of the concrete (binding dosage between 600 and 800 kg/m³) approximately 1.5 cm thick.

In cases where it is necessary or convenient to use special processes to join concrete of different ages, the Contractor must submit them for prior approval by the Inspection Authority. An example of these processes is the use of bonding products between new and old concrete. The application of these products must comply with the manufacturer's instructions.

In joints where elevated elements overlap, to be executed later, 2 to 5 hours must be spent cleaning the areas to be occupied by these upper elements, treating these areas in a manner similar to that indicated above.

Likewise, if during concreting the concrete already placed begins to set before it is covered with a new layer, or new concrete is placed on top of it (in the same layer), concreting must be suspended and a working joint must be created.

If an interruption in concreting leads to a poorly oriented joint, the concrete shall be demolished to the extent necessary to obtain a properly oriented joint. In this case, before resuming concreting, and if the previous concrete has already begun to set, the surface of the joint shall be carefully treated and cleaned so that it is not inert and likely to come loose. The surface thus treated shall be wetted so that the concrete is adequately moistened, and concreting shall not be restarted while water is running off or has accumulated.

On the visible faces of the elements in elevation, joints will only be permitted in the sections coinciding with the formwork joints. Runoffs or differences in sections will not be tolerated, so the formwork joints will have to be suitably sealed and the formwork carefully tightened against the parts already concreted.

3.3.6.5.4 Desmolding and Disassembly

Demoulding and dismemberment and the respective deadlines must comply with the provisions of the following documents:

- Regulation of Reinforced and Prestressed Concrete Structures (DECREE-LAW No. 349-C/83), namely as regards its article 153;
- NP ENV 13670 – Execution of concrete structures.

All edges of concrete surfaces must be chamfered at 45 degrees, with the triangular section resulting from the chamfer having a 2.0 cm leg, whether this corresponds to a filling or a cut of the chamfered piece.

3.3.6.6 Quality Control

The manufacture, placement and curing of concrete must be subject to quality control in accordance with the procedures referred to in standards NP EN 206-1 and NP ENV 13670.

The sampling plan and compliance criteria to be adopted for compressive strength are those defined in standard NP EN 206-1.

The division into lots in which compliance is verified must be established by prior agreement between the Inspection and the Successful Contractor, in compliance with standard NP EN 206-1.

If the test results of the moulded specimens do not satisfy the compliance requirements or are not available, or if execution defects or the influence of external weather conditions give rise to doubts as to the strength and durability of the structure, additional tests may be required on cores removed from the structure (in areas duly approved by the designer) or non-destructive tests on the structure, in accordance with standards NP EN 12504 – Tests of concrete in structures. Parts 1 and 2, and Standard NP EN 13791 – Assessment of the compressive strength of concrete in structures and prefabricated products.

If the material is rejected, the corresponding part of the work will be demolished, unless another solution is agreed between the Inspection and the Contractor, ensuring that the safety conditions and regulatory provisions in force are met.

3.3.7 Special Technical Conditions for the Execution of Shallow Foundations

The footings, foundations, beams and other foundation elements will be executed using traditional processes, provided that they are accepted by the Inspection, observing what is indicated in this Specifications and other Project parts.

A layer of cleaning and leveling concrete will be poured on all foundations, as indicated in the drawings. All gum deposited on the upper surface of this concrete will be removed until the sound part of the concrete is visible, and only then will the reinforcement be placed.

The excavation to be carried out must take into account this thickness of cleaning and leveling concrete.

Concreting operations shall be carried out so that there is no dragging or leakage of the concrete laitance. For this reason, the moulds shall be placed on the levelling concrete so that the volume to be filled is adequately watertight, proceeding beforehand and if necessary, to sealing any leakage areas with mortar or sealing materials that are approved by the Inspection.

The lateral and upper surfaces of the foundations that remain accessible after their execution, when provided for in the project, must be treated with waterproofing paint, in accordance with the specifications in the project parts.

3.3.8 Price Conditions

The quantification of these works is done through the articles contained in Chapter 2 – Formwork, Chapter 3 – Concrete and Chapter 4 – Reinforcement.

The articles in Chapter 2 of the Bill of Quantities refer to the execution and/or assembly of the moulds required for the casting of concrete parts, and include all work, namely the supply and transport of materials, manufacturing, assembly, disassembly, loading, transport, unloading, repair and cleaning, etc. They also include all complementary operations necessary for their completion, such as, among others, the selection of partial elements and their assembly as determined in the CE, the necessary shoring, falsework and other auxiliary structures to support the formwork, strapping, levelling,

the application of products intended to facilitate formwork removal, waterproofing paint on buried elements and the prior cleaning of the moulds before new application.

The articles in Chapter 3 refer to the supply, placement and vibration of concrete on site, as provided for in the project, and include: formulation studies; supply, which may result from the site's own production or be purchased externally in the case of ready-mixed concrete; transportation; lifting, which may involve the use of a crane and bucket or concrete pumps; compaction, normally carried out with vibrators; and curing, which requires watering or the application of products to all possible surfaces, particularly those exposed to the air, as well as, where appropriate, equipment to create a suitable atmospheric environment. All additional work is also included, such as the execution and possible treatment of concrete joints, the smoothing of non-formworked surfaces and the watering of the lower parts in order to prevent runoff of cement gum from soiling them.

The articles in Chapter 4 refer to the installation of the steels provided for in the projects for reinforced concrete structures and include the supply, installation and assembly of the reinforcement, strictly in accordance with the construction drawings. It also includes bending, overlapping, welding or any other joining system, ties, hooks and prefabricated wedges in mortar or micro-concrete intended to ensure the distance between the reinforcement and the moulds.

3.4 METAL STRUCTURES

3.4.1 Objective

Establishment of the technical conditions to be observed in the execution of metal structures.

3.4.2 Preparation and manufacturing

The requirements for all components of the preparation and manufacturing phase of structural steel parts, namely cutting, molding, drilling, assembly of composite structural elements, are specified in clause 6 of standard NP EN 1090-2.

The tracing of the metal structure parts must be done with great care so that they have exact contours, in accordance with the preparation drawings for manufacturing, and that the edges or ends fit perfectly along the entire length of the joints.

Before starting to draw the pieces, the contractor must confirm on site whether the dimensions relating to other parts of the construction, which connect with the structure to be manufactured, correspond to the values provided for in the Project drawings, making the necessary adjustments to the dimensions which will be submitted for approval by the Inspection.

The holes relating to the same screw, in overlapping parts, must allow the free insertion of the connecting element of the parts, with a tolerance of 1 mm being permitted in the eccentricity, on the condition that this difference is cancelled out by the mandrel;

The tolerance for drilling irregularities will be a maximum of 1 mm for the distance from one of the holes to the one following it, and 2 mm for the distance to the extreme holes in the same line;

In parts where holes have been drilled, the burrs on both sides in contact must be removed so that they fit perfectly one over the other.

3.4.3 Welding

Welds must comply with the specifications in clause 7 of standard NP EN 1090-2.

3.4.4 Bolted connections

The requirements for the execution of bolted connections, including tightening of screws, are specified in clause 8 of standard NP EN 1090-2.

In the case of prestressed bolts, their manufacturer must specify the tightening moments according to class K and in accordance with the requirements of clause 8.5 of NP EN 1090-2.

If, in addition to tightening, there are other measures for securing the nuts, these must be specified.

Some connections subject to significant vibrations should have a specific locking method, unless it is a connection with pre-stressed bolts.

Bolts and nuts should not be welded unless specifically indicated.

In cases of coating with reduced thickness, washers should be used to reduce local damage to the coating.

3.4.5 Surface treatment

The requirements for the treatment of imperfect surfaces, including welded surfaces, suitable for the application of paints and related products, are specified in clause 10 of standard NP EN 1090-2.

3.4.6 Painting

An anti-corrosive protection scheme must be applied that is appropriate to the C5-M corrosivity level and guarantees high durability.

The aesthetic characteristics of the outer layer of the paint scheme must be in accordance with the Architectural Project.

3.4.7 Assembly

3.4.7.1 General

The final assembly process of the structure must comply with the specifications in clause 9 of standard EN 1090-2 and must be approved in advance by the Inspection Body to which the assembly plan will be submitted. This approval, however, does not relieve the Contractor of responsibility for assembly and subsequent operation.

All equipment to be used in the assembly of the structures will be submitted for approval by the Inspection Department, together with the assembly plan. When

carrying out work in the construction area, the internal safety standards issued by the Owner of the Work must be respected.

The Contractor must prepare and submit for approval by the Inspection the design of the temporary bracing and shoring systems, if any, and these must allow for fine adjustment of the level of the supports and their slow lowering to enable the gradual transfer of loads to the structure.

3.4.8 Price Conditions

The quantification of these works is done through the items contained in Chapter 6 of the List of Quantities.

Metal structures for covering buildings are measured per m² of covered area, corresponding to the gross area of the roof slab on which the metal structure rests.

The applicable price per square meter includes all necessary work, supplies and means as described in the following paragraphs.

Article 6.1 refers to the supply and application of metal elements, in commercial steel profiles or composite metal parts, including all supplies and work, equipment rental and specialized labor. The price also includes projects, tests, drilling, notching, connection plates, screws, fixings, anchors, nuts and locknuts, washers, and all accessories used in connections, sealing, grout application, pickling, metallization, painting (anti-corrosive protection schemes, final painting), transport and travel on site, as well as additional work that is necessary for its complete execution and assembly. It also includes work related to the fire protection scheme when specifically indicated.

3.5 SEVERAL

3.5.1 Ground Floors

3.5.1.1 Objective

Establishment of the technical conditions to be observed in the execution work of the ground floor slab, when applicable, as detailed in the project.

3.5.1.2 Unit and Criteria of Measurement

This work will be quantified in m², and the corresponding area is determined by the sum of the plan areas of the ground floors where its execution is foreseen in the project.

3.5.1.3 Technical Conditions

The ground floors will be built according to the following scheme, illustrated in the drawings:

- Soils compacted in a layer of not less than 0.30 m, in order to guarantee a degree of compaction of 95%, determined based on the application of the modified PROCTOR test.
- Riprock in sound, unaltered stone obtained by mechanical crushing, with a maximum dimension of 40 mm.
- 0.2 mm double-ply polyethylene film (colorless LDPE sleeve).



- Reinforced concrete slab of class C25/30, with water-repellent additive of the "SIKA PLASTOCRETE 05" type, surface hardener of the "SIKAFLOOR -3 QUARTZTOP" type and finished with a mechanical trowel, including separation joints and contraction joints (sawn).

The platform on which the ground floor rests, in the case of an excavation area or a landfill area, will be prepared in accordance with the specifications in these Specifications.

When executing the reinforced concrete slab, the provisions contained in this Specifications, relating to Reinforced Concrete Structures, apply.

In the case of separation joints, the details shown in the drawings should be followed. Expanded polyethylene or, alternatively, black cork agglomerate should be used as the filling material. The joint should be sealed with mastic. In the cases indicated, a sealant may also be used.

3.5.1.4 Price Conditions

This work will be accounted for through the specific item, when applicable, of the Bill of Quantities, and includes all supplies and work necessary for the execution of the ground floors, as defined in the drawings and in this Specification.

3.6 UNSPECIFIED WORKS

All work not specified in these Specifications, which are necessary for the fulfillment of this contract, will be carried out with perfection and solidity, taking into account the Regulations, Standards and other legislation in force, the project indications and the Inspection instructions, considering their costs diluted in the remaining contract prices.

4 ANNEX I

MEASUREMENT RULES FOR REINFORCED CONCRETE STRUCTURES

1. Measurement Rules for Pillars and Walls:

The determination of the volume of concrete in pillars and walls shall follow the following rules:

- The height of a concrete column or wall on a given floor of a building shall correspond to the distance between the upper face of the concrete slab or beam of that floor and the upper face of the concrete slab or beam of the floor above. In the case of the column section above the foundation, its height shall correspond to the distance between the upper face of the foundation footing or beam and the level of the rough floor of the first floor.
- In case the cross section is variable, the measurement will be carried out from the average cross section.
- In the case of pillars that suddenly change section, the measurement will be carried out taking into account both sections and their respective heights.

2. Measurement Rules for Beams and Lintels:

- The determination of the volume of concrete in beams and lintels shall comply with the following rules:
- The lengths will be determined according to simple geometric shapes, defined by the faces of the pillars or beams that intercept the beams and lintels.
- If the cross-section is variable, the measurement can be made from the average cross-section.
- The measurement of the volumes incorporated in the thickness of the slabs will be included in the measurement of the concrete of the beams and lintels.

3. Measurement Rules for Solid Slabs:

The determination of the volume of concrete in slabs will follow the following rules:

- The length and width will be determined between the faces of the beams, lintels, pillars and walls between which the slabs are inserted.
- Deductions relating to openings in slabs will only be considered when their area is greater than 0.50m².
- When measuring funnel-shaped slabs, the excess thickness corresponding to the capitals must be added to the concrete volume of the slabs.

4. Formwork Measurement Rules

The determination of the formwork area in concrete elements shall comply with the following rules:

- The measurements will be obtained from the geometric shapes of the moulding surfaces indicated in the project. In slabs and beams with an



inclination greater than 15° , the moulding of the upper surfaces must also be considered.

- Deductions relating to openings (significant cuts in the continuity of the formwork) to be made in the moulds will only be considered when their area is greater than 0.50m^2 .

Luanda, January 20, 2025

Carlos HR Gaiao
Civil Engineer - AO – N°1115