

THE PROJECT OF THE NEW PORT OF CAIO IN CABINDA

REPUBLIC OF ANGOLA

LOT1 - PORT OF CAIO

BUILDINGS - PERSONAL GATE FREEZONE

DESIGN REPORT

ARCHITECTURAL ENGINEERING

Design Stage: Detailed Design

Document Number: LOT1_DD_DR_1022-A-01

Revision: 01



CHINA ROAD AND BRIDGE CORPORATION

Mar. 23th, 2024

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Design Stage: Detailed Design

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01	Mar. 23 th , 2025	Revised according to RAD-CRBC-134
00	Nov.14 th , 2024	First Submittal.
Rev.	Date	Description

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1 INTRODUCTION

Project Name: Projecto do Novo Porto do Caio.

Item Name: personal gate freezone.

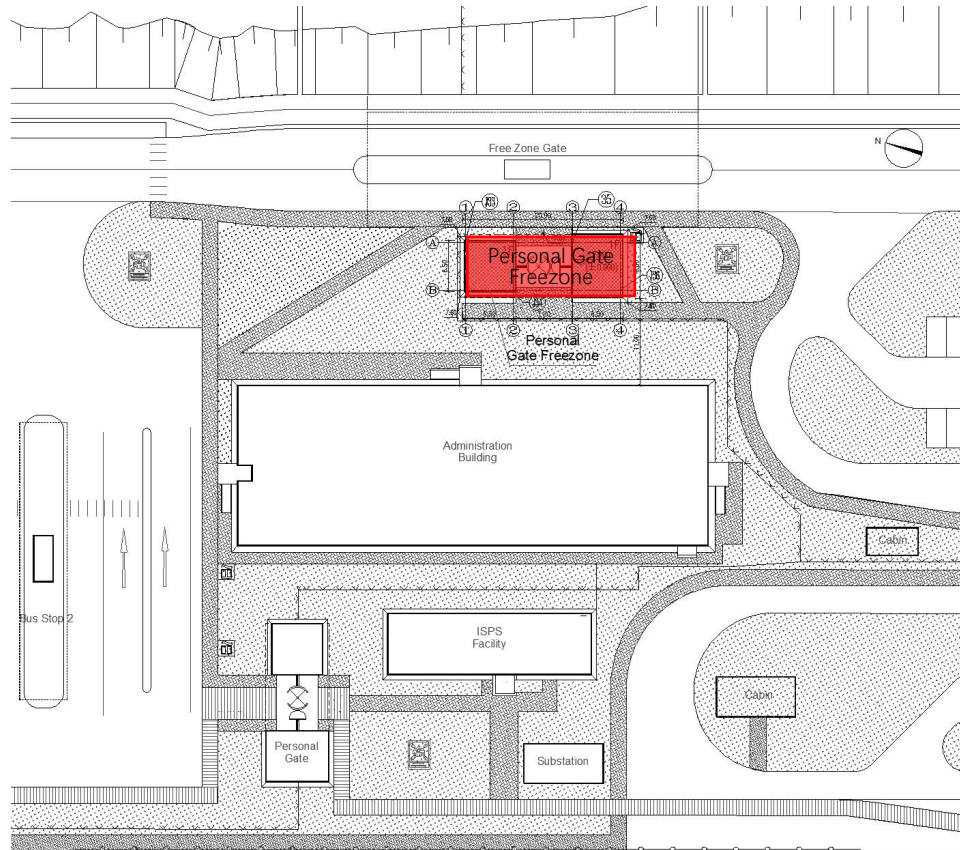


Figure 1-1 Location of the personal gate freezone on the Onshore Terminal Layout

Project location: Cabinda of Angola.

The main rooms of personal gate freezone include reception and information desk room, guard's room, bed room and toilet. The floor area is **160.00** square meters, the length is **20.00** m, the width is **8.00** m and the height is 6.2m.

The structural form is reinforced concrete frame.

The absolute level of the building and the coordinates of the control points are shown in the general plan.

2 DESIGN SCOPE

This report is scoped with the architectural engineering for Port Buildings – Personal Gate Freezone.

3 DESIGN BASIS

3.1 CODES OF PRACTICE FOR ARCHITECTURE DESIGN

- (1) BS 9999 Code of practice for fire safety in the design, management and use of buildings.
- (2) Port of Caio Project - Republic of Angola Bidding Document - Phase 1: PART II-SECTION A: SPECIFICATIONS.

SERIES 0300 BUILDINGS

SERIES 3300 BUILDINGS

- (3) Conceptual design plan.
- (4) BS EN 14351-1 2006 Windows and doors - Product standard, performance characteristics - Part 1: Windows
- (5) BS EN 10346 2015 Coated steel products for building - Specifications
- (6) ISO/FDIS 10456:2007(E) Thermal insulation - Determination of declared and design values of thermal resistance and related properties - In - situ measurements
- (7) EN 12524:2000 Building hardware - Seals and gaskets - Requirements and test methods
- (8) ASTM C645 Standard Specification for Precast Architectural Concrete Wall Panels
- (9) EN 14195:2014 Building hardware - Electromechanical door - locking and door - closing devices - Requirements and test methods
- (10) 2024-06-03_Meeting Protocol CRBC Visit_lhe

3.2 DEVIATIONS

(1) According to the meeting minutes document "2024-06-03_Meeting Protocol CRBC Visit_lhe", heat transfer coefficient of whole window U-value = $1.7 \text{ W}/(\text{m}^2 \cdot \text{K})$.

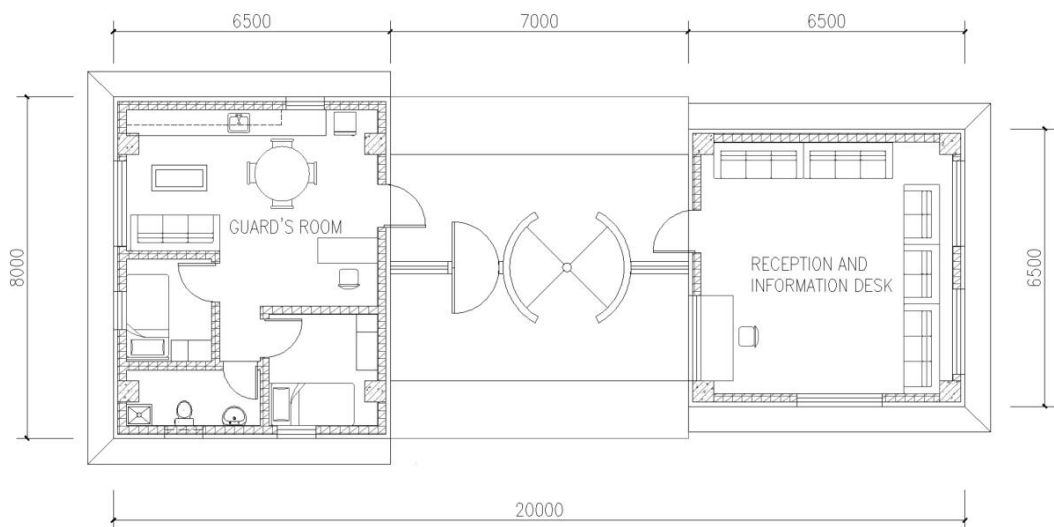
3.3 DESIGN REQUIREMENTS

- (1) The area per toilet shall not be smaller than 1 m^2 .
- (2) The clear opening of the doors shall be of 2.0 m height.
- (3) To prevent accidental impact on structural members due to vehicle collision, metal parapets shall be installed.

4 ARCHITECTURE DESIGN

4.1 PLAN DESIGN

The floor area is **160.00** square meters. The main rooms of personal gate freezone include reception and information desk room, guard's room, bed room and toilet.



	Length	Width
Guard's Room	6.50m	8.00m
Reception and Information Desk Room	6.50m	6.50m
Total	20.00m	8.00m

4.2 ELEVATION AND SECTION DESIGN

The exterior wall color is white and light gray.Ral 9010 and ral 9016 color number should be selected.

The height of personal gate freezone is 6.2 m.

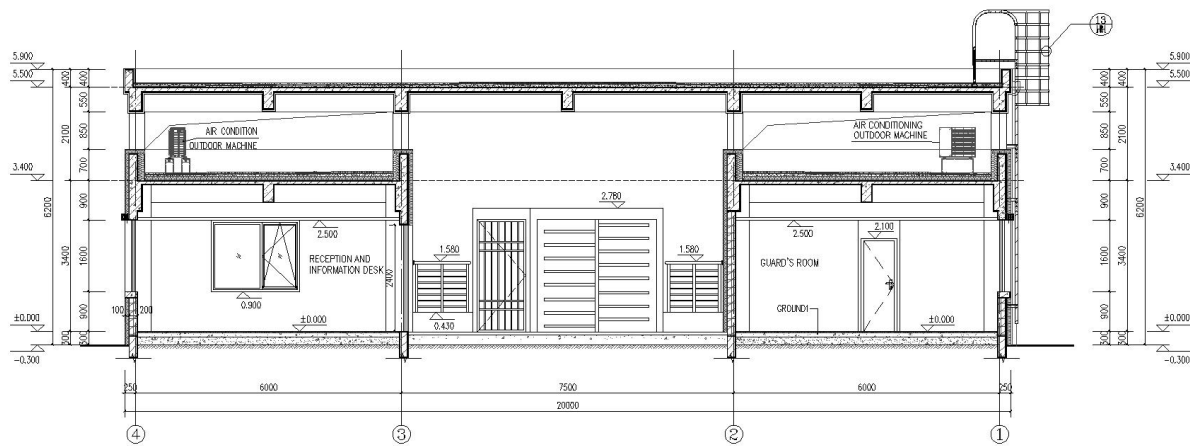


Figure 4-1 Section of the personal gate freezone

4.3 WALL ENGINEERING

(1) Inner wall

100mm thick concrete hollow blocks will be adopted for construction of interior walls, with dry density of $\geq 1.2\text{t/m}^3$ and strength of $\geq 8.00\text{N/mm}^2$. The wall surface finishing should be of U3 grade.

(2) External wall

The external walls above ± 0.000 shall be made of 200mm-thick concrete hollow bricks with 100 mm thick rock wool board insulation layer, The thermal conductivity of rock wool board is $u \leq 0.040 \text{ w/(m}\cdot\text{k)}$, fire rating level is A, and density $\rho \geq 110 \text{ kg/m}^3$, belongs to incombustible material.

(3) The external wall method to calculate the U-value

In the case of the simplified calculation method, the thermal transmittance is given by:

$$U = \frac{1}{R_{\text{tot}}}$$

U is the thermal transmittance, in $\text{W}/(\text{m}^2 \cdot \text{K})$;

R_{tot} is the total thermal resistance, in $(\text{m}^2 \cdot \text{K})/\text{W}$.

$$R = \frac{d}{\lambda}$$

R is the thermal resistance, in $(\text{m}^2 \cdot \text{K})/\text{W}$;

d is the thickness of the material layer in the component, in m;

λ is the design thermal conductivity of the material, in $\text{W}/(\text{m} \cdot \text{K})$.

The total thermal resistance, R_{tot} , of a plane building component consisting of thermally homogeneous layers perpendicular to the heat flow shall be calculated by the following expression:

$$R_{\text{tot}} = R_{\text{si}} + R_1 + R_2 + \dots + R_n + R_{\text{se}}$$

R_{tot} is the total thermal resistance, in $(\text{m}^2 \cdot \text{K})/\text{W}$;

R_{si} is the internal surface resistance , in $(\text{m}^2 \cdot \text{K})/\text{W}$;

$R_{\text{se}}, R_2 \dots R_n$ are the design thermal resistances of each layer, in $(\text{m}^2 \cdot \text{K})/\text{W}$;

R_{se} is the external surface resistance , in $(\text{m}^2 \cdot \text{K})/\text{W}$.

Surface resistance ($\text{m}^2 \cdot \text{K})/\text{W}$	Direction of heat flow		
	Upwards	Horizontal	Downwards
R_{si}	0.10	0,13	0.17

Rse	0.04	0.04	0.04
<p>NOTE 1</p> <p>The surface resistances apply to surfaces in contact with air. No surface resistance applies to surfaces in contact with another material.</p> <p>NOTE 2</p> <p>The values for internal surface resistance are calculated for $\epsilon=0.9$ and with h_{r0} evaluated at 20°C. The value for external surface resistance is calculated for $\epsilon = 0.9$, h_{r0} evaluated at 10°C, and for $v = 4$ m/s.</p>			

The values given in Table are design values. In cases where values independent of heat flow direction are required, e.g. the declaration of the thermal transmittance of components, the values for horizontal heat flow shall be used.

Material group or application	Density (Kg/m ³)	Design thermal conductivity [W/(m·K)]	adjustment factor α	
			α	Part
Concrete hollow blocks	1200	1.10	1.00	Wall/Roof
Rock wool	110	0.040	1.20	Wall/Roof
Cement mortar	1800	0.93	1	Wall/Roof
Light- Weight Concrete	1000	0.89	1	Roof

Concrete hollow blocks external walls

The mineral wool design thickness of the building wall is 100mm , By calculation

$$\begin{aligned}
 R_1 &= d/\lambda = 0.10 / (0.040 \cdot 1.2) = 2.08 \text{ (m}^2 \cdot \text{K)/W} \\
 R_2 &= d/\lambda = 0.2 / 1.10 = 0.18 \text{ (m}^2 \cdot \text{K)/W} \\
 R_3 &= d/\lambda = 0.015 / 0.93 = 0.02 \text{ (m}^2 \cdot \text{K)/W}
 \end{aligned}$$

$$R_{\text{tot}} = R_{\text{si}} + R_1 + R_2 + \dots + R_n + R_{\text{se}} = 0.13 + 2.08 + 0.18 + 0.02 + 0.04 = 2.45$$

$(\text{m}^2 \cdot \text{K})/\text{W}$

$$U = 1/R_{\text{tot}} = 1/2.45 = 0.41 \text{ W}/(\text{m}^2 \cdot \text{K})$$

The wall construction meets the thermal transmittance $U \leq 0.45 \text{ W}/(\text{m}^2 \cdot \text{K})$.

4.4 GROUND ENGINEERING

- (1) The ground of the office is porcelain tile, the ground of the toilet and shower is anti-slip ceramic tile.
- (2) The ground of the toilet building is 20 mm lower than the floor of the adjacent room.
- (3) Waterproof layer shall be made for toilet and shower room. If the slope of the whole room is not indicated in the drawing, 1% slope slope drain shall be made within 1m around the floor drain.
- (4) Porcelain tile, breaking strength $\geq 35 \text{ mpa}$. Dimensional errors should be controlled within $\pm 0.6\%$. The tile surface should have no visible defects (such as cracks, bubbles, color deviations, etc.) planarity $+0.5\% \sim -0.3\%$, water absorption $< 10\%$, bending strength $> 15 \text{ N/mm}^2$.
- (5) 0.4mm thick polyethylene film is installed for ground moisture protection.

4.5 ROOF ENGINEERING

- (1) Concrete roof

Rock wool board insulation is used for the roof, the heat transfer coefficient $u \leq 0.040 \text{ W}/(\text{m} \cdot \text{K})$, fire rating level is A, $\rho \geq 110 \text{ kg/m}^3$. 0.4mm polyethylene film is fully laid on the cast-in-place reinforced concrete slab. the roof waterproofing layer uses 4mm thick modified asphalt ii type waterproof rolls. The roof protective layer uses 30mm fine aggregate concrete (with r8-250 two-way steel mesh inside).the roof construction meets the thermal

transmittance U-value=0.41 W/(m²·K)

The calculation process of the U-value for roof insulation is as follows:

The rock wool board design thickness of the roof is 100mm, By calculation

$$R_1 = d/\lambda = 0.03/1.1 = 0.03 \text{ W/(m}^2\cdot\text{K)}$$

$$R_2 = d/\lambda = 0.02/0.93 = 0.02 \text{ W/(m}^2\cdot\text{K)}$$

$$R_3 = d/\lambda = 0.03/0.89 = 0.03 \text{ W/(m}^2\cdot\text{K)}$$

$$R_4 = d/\lambda = 0.10/ (0.040*1.2) = 2.08 \text{ W/(m}^2\cdot\text{K)}$$

$$R_5 = d/\lambda = 0.13/1.1 = 0.12 \text{ W/(m}^2\cdot\text{K)}$$

$$R_{tot} = R_{si} + R_1 + R_2 + \dots + R_n + R_{se} = 0.10 + 0.03 + 0.02 + 0.03 + 2.08 + 0.12 + 0.04 = 2.42 \text{ W/(m}^2\cdot\text{K)}$$

$$U = 1/R_{tot} = 1/2.42 = 0.41 \text{ W/(m}^2\cdot\text{K)}$$

The roof construction meets the thermal transmittance U-value ≤ 0.45 W/(m²·K)

(2) Roof drainage adopts organized drainage, and drainage slope is 2%. The rainwater drainage pipe is galvanized steel pipes.

(3) At the junction between the parapet wall and the roof protective layer, a curve with radius of 100mm should be installed to the protective layer to prevent water accumulation and cracking.

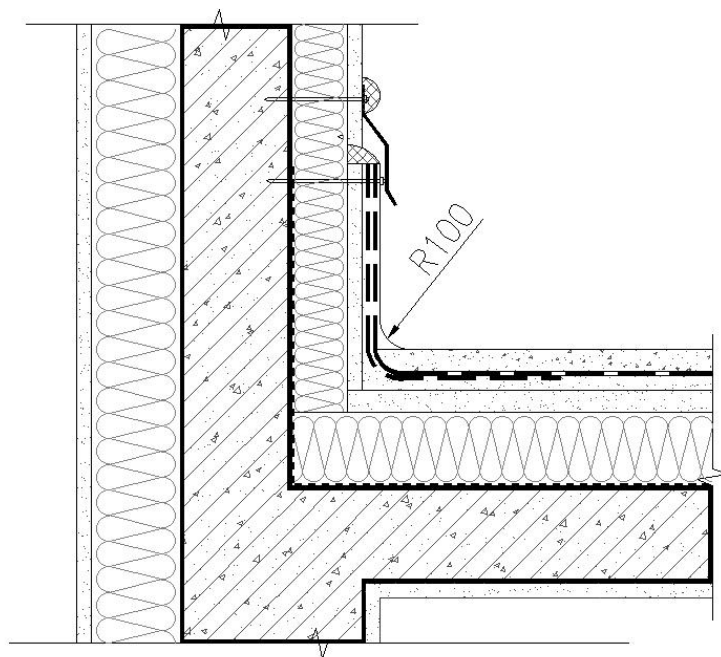
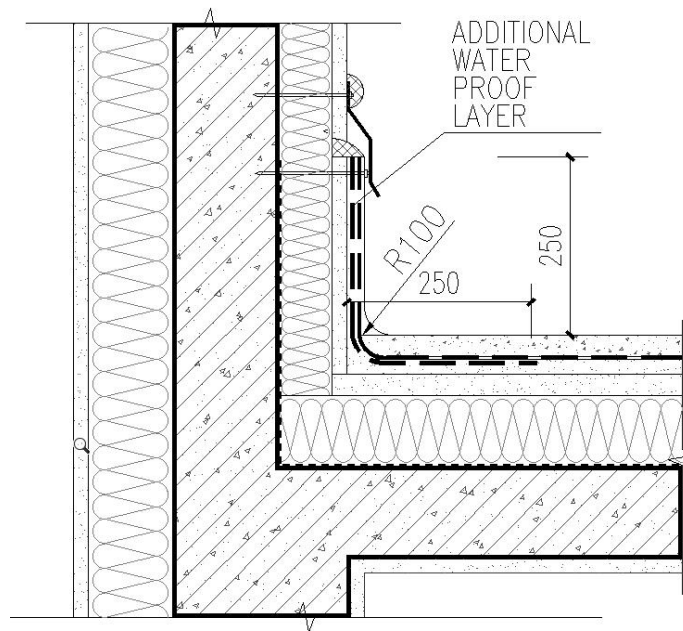


Figure 4-2 Curved at the junction with parapet

(4) The waterproof membrane should extend into the parapet wall or vertical wall surface with a 250mm turn up, with an additional layer of waterproof membrane installed at this junction to reinforce waterproofing effectiveness. An extra layer of waterproof membrane should be applied around the rainwater outlet.

**Figure 4-2 Additional Waterproofing Layer Details**

4.6 DOORS AND WINDOWS ENGINEERING

(1) All doors and windows are equipped with matching hardware accessories. Doors and windows has to be sealed on all four sides. The exterior side of the access door and external window frames is gray, and the interior side is white.

(2) The exterior side of the access door and external window frames is gray, and the interior side is white.

(3) Access doors:

a) double-skinned insulated steel door, single-leaf, tight-fitting, warp and weather resistant.

- b) galvanized steel sheets ≥ 1.5 mm.
- c) $U\text{-values} \leq W/(m^2 \cdot K)$ (heat transfer coefficient) of whole door.
- d) resistance to wind pressure as required in accordance to en 12424 and static calculations. wind pressure resistance level of the door is 3.
- e) Sound insulation ≥ 35 dB.
- f) Sealed continuous on all four sides.
- (4) Double glazing windows:
 - a) tilt and turn windows, opening inwards.
 - b) plastic steel and double glazing(6low-e+12ar+6) with clear insulation glass, argon-filled void between, UV-Transmission $\leq 20\%$.
 - c) $U\text{-values} \leq 1.70 W/(m^2 \cdot K)$ (heat transfer coefficient) of whole window.
 - d) glass is grey.
 - e) resistance to wind pressure as required in accordance to en 12424 and static calculations. the wind pressure resistance level of the window is level 3, the deformation deflection control level of the window is level b, the fire resistance performance is level c, and the water tightness level is level 7a, drop height(mm): 450, with an air tightness level of 3. sound insulation ≥ 35 decibels.
- (5) External sunshades are installed in front of the office windows.
- (6) All the door and windows should be supplied by the supplier and relevant manuals when the material specifications have to be defined (type of sound reduction and wind resistance, etc) or reports should be provided. purchase orders can be placed and construction can be commenced only after the approval of product by the engineer.

4.7 OTHERS

- (1) All building components exposed to outdoor environment should be provided with anti-corrosion measures of C5 rating. All indoor building

components should be provided with anti-corrosion measures of C1 rating.

(2) All galvanizing works where specified shall be hot-dip galvanized and shall conform to the requirements of en iso 1461:2009. The minimum coating thickness is $85 \mu\text{m}$ (Steel 5mm thick and over) . The minimum coating thickness is $64 \mu\text{m}$ (Steel under 5mm thick but not less than 2mm).

(3) The detailed roofing system (solar panels supports included) will be prepared and detailed by the supplier, and its metal components should meet the C5 corrosion resistance requirements, fasteners should be effectively secured and firmly fixed. The waterproof level and performance of sealing components of solar supports should be consistent with that of the roof, and the original waterproof system should not be damaged.

(4) The rainwater pipe is made of galvanized steel, the drawings will be prepared and detailed by the supplier. The anti-corrosion performance should be C5 grade. The rainwater pipe clamp is made of metal and can firmly fix the riser with a spacing of less than 1,500 mm.

(5) The sanitary wares and equipment in the pantry and bathroom shall be determined by the manufacturer in the form of shop drawings, including the characteristics of the materials in terms of durability, impact resistance, water resistance, chemical resistance and fire resistance.

(6) Sanitary ware Ceramic sanitary ware is adopted for the toilet, urinal and washbasin. The toilet is equipped with a mirror is installed above the wash basin.

(7) The pantry equipment includes cabinets, desktop multifunctional coffee machines, and can be disinfected using hot and cold water, microwave ovens, desktop water purifiers, and refrigerators.

(8) The office ceiling is made of gypsum board, 12mm paper faced gypsum is non combustible, with a smooth and flawless surface.

(9) The toilet ceiling is made of PVC board, 2.5mm thick pvc board) density $\geq 1.3\text{g/cm}^3$, tensile strength $\geq 40\text{mpa}$, bending strength $\geq 60\text{mpa}$, fire resistance rating b1.

(10) The tensile strength of light steel keel should be $\geq 300\text{mpa}$.