

THE PROJECT OF THE NEW PORT OF CAIO IN CABINDA

REPUBLIC OF ANGOLA

LOT1 - PORT OF CAIO

BUILDINGS - MAIN GATE

DESIGN REPORT

ARCHITECTURAL ENGINEERING

Design Stage: Detailed Design

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1 INTRODUCTION

Project Name: Projecto do Novo Porto do Caio.

Item Name: Main Gate.

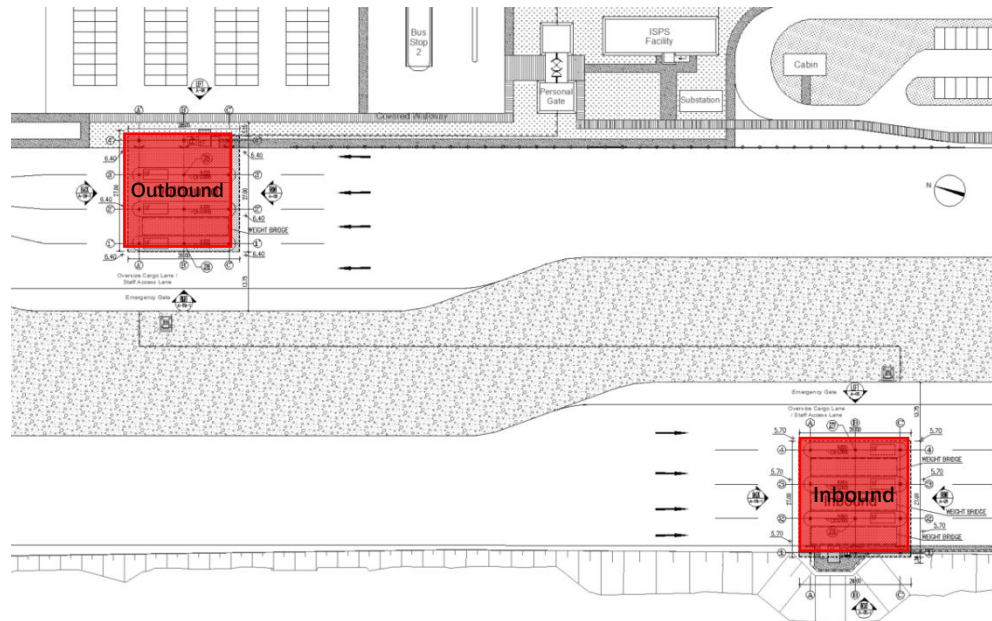


Figure 1-1 Location of the Main Gate on the Onshore Terminal Layout

Project location: Cabinda of Angola.

The Main Gate includes an outbound and an inbound. Outbound includes a steel shed, 3 traffic islands, 3 office containers and a fiscal and border police's room. The floor area is 714.0 square meters, one storey in total; the length is 27.0 m, the width is 26.0 m and the height is 8.12 m. Inbound is the same as outbound, The total floor area of Main Gate is 1428.0 square meters.

The function is serving the control and checking of all in and out going containers which reach or leave the terminal by truck.

The structural form of steel shed is steel structure, The fiscal and border police's room is a reinforced concrete structure.

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 – Main Gate.

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;

SERIES 3600 MAIN GATE ;

(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 W/(m²·K).

(2) According to the meeting minutes document"2024-06-03_Meeting Protocol CRBC Visit_lhe", internal sun blinds for the smaller buildings like main gate and Bus stop are used..

3.3 DESIGN REQUIREMENTS

(1) The area per toilet shall not be smaller than 1 m².

(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) To direct the truck traffic towards the gate lines each traffic island shall be extended with cross striped self reflecting white or yellow road markings, painted 25 m in front and after each island. The paint has to be resistant against abrasion and ultraviolet radiation and has to be approved by the Engineer.

(5) Safety rails of 70cm height ,extended with cross striped self reflecting black and yellow road markings,are installed to surround the island.The paint has to be resistant against abrasion and ultraviolet radiation and has to be approved by the Engineer.

(6) The safety rails, which also serve as crash barriers for the office containers, shall be of strong, galvanized steel with vertical posts every 2.00 m. The necessary concrete foundation for each post has a thickness of 50 cm of C20/25.

4 ARCHITECTURE DESIGN

4.1 TRAFFIC ISLAND

Each traffic island, 24.0 m long and 3.5 m wide, with a height difference of 0.12 m from the road. The outer surface shall be made of reinforced concrete with a 2% slope outward.

Weight bridges are located between the traffic islands. There are three in inbound and one in outbound. The weighing range is from 0 to 50 tons. The specification parameters of the office container will be submitted for approval separately later.

To direct the truck traffic towards the gate lines each traffic island shall be extended with cross striped self reflecting white or yellow road markings, painted 25 m in front and after each island. The paint has to be resistant against abrasion and ultraviolet radiation and has to be approved by the Engineer.

Safety rails of 70 cm height, extended with cross striped self reflecting black and yellow road markings, are installed to surround the island. The paint has to be resistant against abrasion and ultraviolet radiation and has to be approved by the Engineer.

The safety rails, which also serve as crash barriers for the office containers, shall be of strong, galvanized steel with vertical posts every 2.00 m. The necessary concrete foundation for each post has a thickness of 50 cm of C20/25.

4.2 STEEL SHED

4.2.1 PLAN DESIGN

Each steel shed is of steel frame structure with 12 steel columns on the sidewalks and traffic islands.

The steel components and the exposed metal components of the steel shed all meet the C5 anti-corrosion requirements. The NDFT of the anti-corrosion paint should be $\geq 240\mu\text{m}$, including 70 μm of primer, 70 μm

of intermediate coating, and 100µm of final coat.

Steel components such as roof purlins and structural beams for steel structures of the building will be finalized by the supplier in the form of manufacturing drawings and confirmed by the consultant before purchase orders can be placed and construction can commence.

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 85µm.

The dimensions of the steel shed are detailed in the table below:

Length	27.00m
Width	26.00m

4.2.2 ELEVATION AND SECTION DESIGN

The exterior wall color is light gray and ral 9006 color number should be selected. Detailed information can be found in www.ralcolor.com.

The height of the steel shed is 8.12 m.

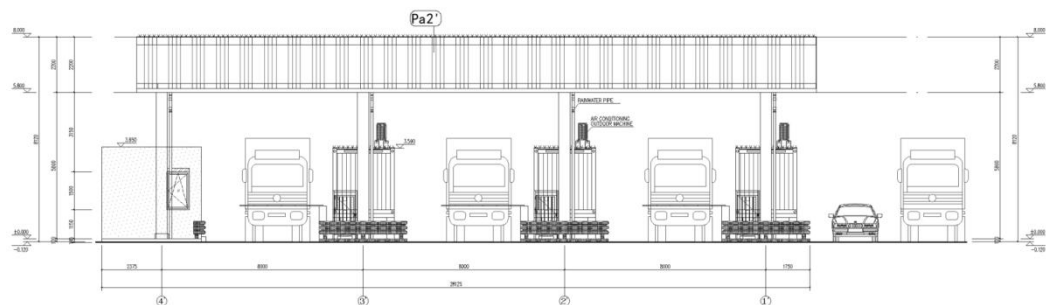


Figure 4-1 Elevation of the Main Gate

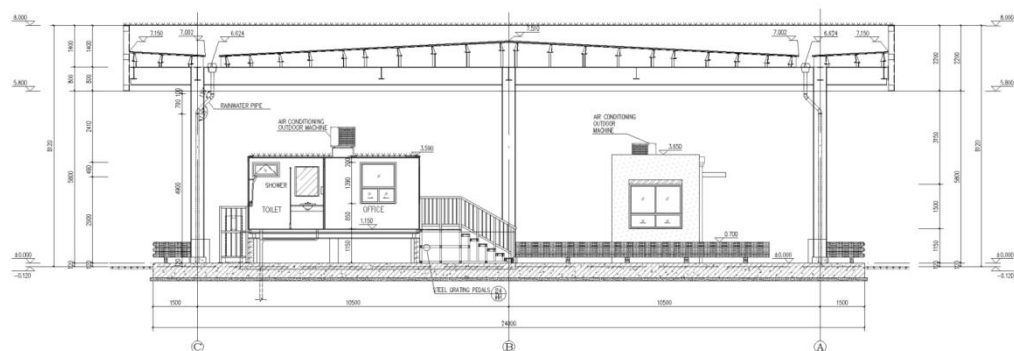


Figure 4-2 Section of the Main Gate

4.2.3 EXTERIOR WALL ENGINEERING

0.5mm thick profiled steel plates were used as exterior walls between levels 5.8 and 8.0.

4.2.4 ROOF ENGINEERING

(1) The roof of the building is a sloped roof made of 0.5mm thick profiled steel sheet with a slope of 5%.

(2) The lighting equipment has to be designed to generate 300 lx within the truck checking area. The works include delivery and installation of all necessary floodlights, bulbs, tubular fluorescent lamps, cables, fuses and switches. All the electrical installations ready for operation.

(3) 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.

(4) 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.

(5) 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 85µm (Steel 5mm thick and over) . The minimum coating thickness is 64µm (Steel under 5mm thick but not less than 2mm).

(6) Down pipes have to be protected from accidental traffic loads by safety rail.

4.3 OFFICE CONTAINER

4.3.1 PLAN DESIGN

- (1) Container: Length 5.80m, Height 2.59m, Width 2.44m
- (2) Flooring: PVC floor covering
- (3) Finished PVC white interior
- (4) Rain gutters with interior steel tubing from roof to ground. The anti-corrosion performance should be C5 grade, and the component anti-corrosion paint NDFT thickness should be $\geq 240\mu\text{m}$, including $70\mu\text{m}$ of primer, $70\mu\text{m}$ of intermediate coating, and $100\mu\text{m}$ of final coating.
- (5) Insulation: 75-mm-thick rock wool sandwich panels for external wall / 50-mm-thick glass wool sandwich panels for roof.
- (6) Six electrical outlets
- (7) Four fluorescent lighting fixtures
- (8) Air conditioning
- (9) Post height: 1.00 m above surface
- (10) Stairway with platform for entrance to the container, made of steel gratings.
- (11) The container is equipped with twist locks on each corner. This construction again allows easy change and moving if necessary.
- (12) For easy communication with the truck drivers the windows of the office containers shall be at the same height as the seats of the truck drivers. Therefore each container shall be raised 1.00 m above the surface of the ready laid pavement. The works include the post and beam construction with the foundations, the stairways with hand-rails on both sides of the stairs and gratings as shown in the drawing, all made of hot-dipped galvanized steel, the statically calculations as well as the complete installation ready for operation.
- (13) The posts shall be connected with the bottom twist locks in the same way like containers are fixed to the load floor of the road trucks, so that the container can be moved just by opening the twist lock.
- (14) The container shall be connected to the electric cable pipe system (LT

and IT) as shown on the relevant drawings and be equipped with internal lighting, at least 6 wall-socket, fuses and switches as well as 2 IT-wall-sockets for personal computers.

(15) The office container should be supplied by the supplier and relevant manuals when the material specifications have to be defined or reports should be provided. purchase orders can be placed and construction can be commenced only after the approval of product by the engineer.

4.3.2 DOORS AND WINDOWS ENGINEERING

(1) All doors and windows are equipped with matching hardware accessories. doors and windows and all metallic components (hardware, leafs, thresholds, profiles etc) has to meet the C5 anti-corrosion requirements. doors and windows has to be sealed on all four sides.

(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) $U\text{-value} \leq 5.00 \text{ W}/(\text{m}^2 \cdot \text{K})$ (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.

(6) 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) $U\text{-value} \leq 1.70 \text{ W}/(\text{m}^2 \cdot \text{K})$ (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.

(6) Internal sunshades are installed in front of the office windows.

(7) 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.

4.3.3 SANITARY WORKS

(1) All sanitary material and equipment are according to EN regulations.

(2) Sanitary Objects and equipment

WC: wall mounted toilet of vitreous china, incl. concealed Cistern and Push Button

Dual Flush, seat with cover, paper holder, spare paper holder, brush set.

Wash basin: approx. 40 cm wide cold water tap and towel hook.

Mirror: 80 x 100 cm, above wash basin.

(3) Sanitary ware Ceramic sanitary ware is adopted for the toilet, urinal and washbasin. toilet, shower room partition using raw wood color trihydroamine partition board. The toilet is equipped with a mirror is installed above the wash basin.

(4) The sanitary wares and equipment in the kitchen 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.

4.4 FISCAL AND BORDER POLICE'S ROOM

4.4.1 PLAN DESIGN

The floor area of each fiscal and border police's room is **12.00 square meters**. The fiscal and border police's room is equipped with office and toilet room.

Length	4.00 m
Width	3.00 m

4.4.2 ELEVATION AND SECTION DESIGN

The floor height of fiscal and border police's room is 2.80 m.

The exterior wall color is light gray and RAL 9016 color number should be selected. Detailed information can be found in www.ralcolor.com.

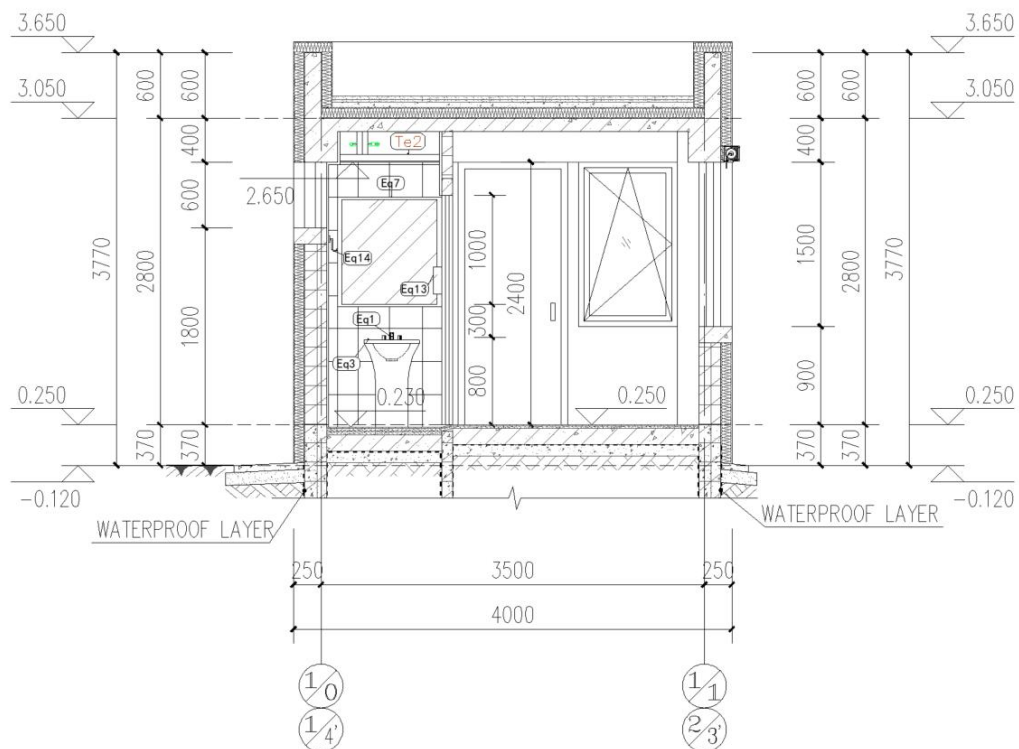


Figure 4-3 Section 5-5

4.4.3 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 $\geq 8.00\text{m/m}^3$. 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:

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

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

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

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

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

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

Surface resistance $(m^2 \cdot K)/W$	Direction of heat flow		
	Upwards	Horizontal	Downwards
R_{si}	0.10	0.13	0.17
R_{se}	0.04	0.04	0.04

NOTE 1

The surface resistances apply to surfaces in contact with air. No surface resistance applies to surfaces in contact with another material.

NOTE 2

The values for internal surface resistance are calculated for $\varepsilon=0.9$ and with h_{r0} evaluated at 20°C . The value for external surface resistance is calculated for $\varepsilon = 0.9$, h_{r0} evaluated at 10°C , and for $v = 4 \text{ m/s}$.

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

$$R_1 \quad d/\lambda = 0.10 / (0.040 \times 1.2) = 2.08 \text{ (m}^2 \cdot \text{K)/W}$$

$$R_2 \quad d/\lambda = 0.2 / 1.10 = 0.18 \text{ (m}^2 \cdot \text{K)/W}$$

$$R_3 \quad d/\lambda = 0.015 / 0.93 = 0.02 \text{ (m}^2 \cdot \text{K)/W}$$

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

(m²·K)/W

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

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

4.4.4 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 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 $> 15 \text{ N/mm}^2$.

4.4.5 ROOFING 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, $\rho \geq 110 \text{ kg}/\text{m}^3$. 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 $U\text{-value}=0.41 \text{ W}/(\text{m}^2 \cdot \text{K})$

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

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

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

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

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

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

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

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

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

(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.

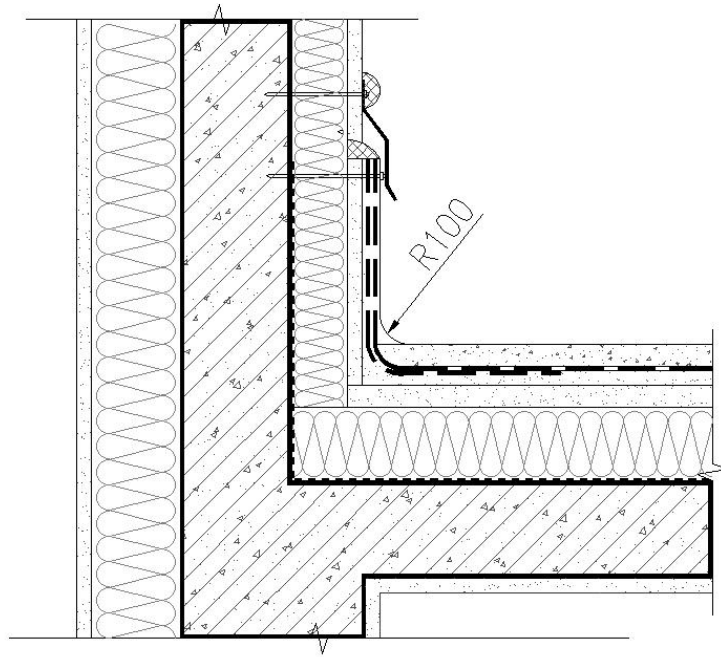


Figure 4-2 Curved at the junction with parapet

(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.

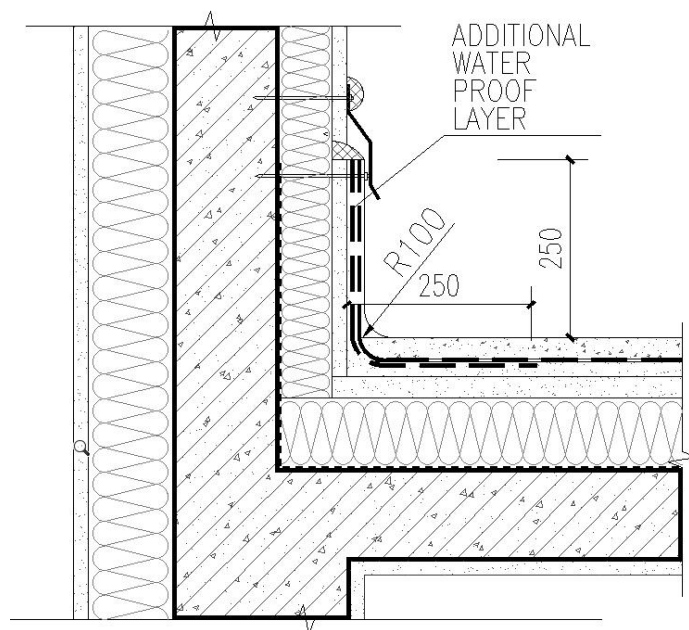


Figure 4-2 Additional Waterproofing Layer Details

4.4.6 DOORS AND WINDOWS ENGINEERING

(1) All doors and windows are equipped with matching hardware accessories. doors and windows and all metallic components (hardware, leafs, thresholds, profiles etc) has to meet the C5 anti-corrosion requirements. doors and windows has to be sealed on all four sides.

(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-value $\leq 5.00 \text{ W}/(\text{m}^2 \cdot \text{K})$ (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-value $\leq 1.70 \text{ W}/(\text{m}^2 \cdot \text{K})$ (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.

4.4.7 OTHERS

- (1) The main steel elements (such as steel columns, steel beams, roof purlins, wall purlins...) should be derusted in the factory. The steel components of the building and the exposed metal components of the building all meet the C5 anti-corrosion requirements. The NDFT of the anti-corrosion paint should be $\geq 240 \mu\text{m}$, including $70 \mu\text{m}$ of primer, $70 \mu\text{m}$ of intermediate coating, and $100 \mu\text{m}$ of final coat.
- (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) Steel components such as roof purlins and structural beams for steel structures of the building will be finalized by the supplier in the form of manufacturing drawings and confirmed by the consultant before purchase orders can be placed and construction can commence.

(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 sanitary wares and equipment in the 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.