Valletta City Gate in Valletta: The Buildings of The New Parliament And The Opera House Theatre

The design of the buildings of the new Parliament and the Opera House Theatre is included in the plan of urban redevelopment called Valletta City Gate Project, which involves redesigning the entrance area of the island's capital, Valletta.

1) INTRODUCTION

The new parliament includes two buildings facing the main street (Republic Street), flanked to the north by the "open air" theatre called Opera House Theatre, that was developed amongst the ruins of the old theatre. The three buildings are located in an area surrounded by historic buildings such as the St. James Cavalier Building and the Bank of Valletta.
The project RPBW-ARUP involves the construction of steel structures with a reinforced concrete core, connected together and integrated at various levels with already existing structures, including an underground tunnel that runs through the whole area from north to south.

2) DESCRIPTION OF THE WORKS

The area where the new structures of the City Gate Project are located has been subject at an early stage to the demolition of some existing buildings, of a stretch of road, but especially of the access entrance to the city of Valletta. These interventions – which are needed both from a design and a logistic point of view – have deeply altered the access to the capital and the perimeter of the existing sites. The inclusion of the new structures and the redesign of the existing ones will drive the redevelopment of the whole area.
The plan not only includes the construction of the new headquarters of the Maltese Parliament and the premises dedicated to related activities, but also allows citizens to share new paths and public spaces at various times during the day. In particular, the Opera House Theatre will welcome the public in its various seasonal configurations and will allow people to appreciate the area during the evening hours.
The construction site was developed both at the level of the urban streets of Valletta but also partly in the underground area, through the existing tunnel. Given the complexity of the site and the access restrictions, some activities were carried out directly underground in order not to interfere with the flow of citizens who daily go to the capital city.
The new Parliament is composed of two buildings, called Office Building and Chamber Building, with a load-bearing metal structure connected on the first and third floor and the roof.

The intended use of the two buildings is as follows:

Office Building: The 3 storey building, for offices and personnel services, includes on the ground floor an area open to the public, characterised by the colonnade supporting the building (photo 1). The building includes a steel frame structure and reinforced concrete stairs called ***core***, whose function is to brace the structure. The outer roofing of the two upper floors is made entirely of blocks of local stone, quarried on the nearby island of Gozo.

[PHOTO]
Foto 1 – Columns on the ground floor of the Office Building

The columns up to the first level above the ground are from a structural point of view steel and concrete composite columns, consisting of a box-section (20 mm sheet S355J0 steel), a reinforcement cage pre-assembled off site (steel B450C) and concrete made on site. These columns arise from different levels including the ground floor, the basement Lower Garden and also the underground tunnel, which represents the old rail access to the area. Because of the size of some of the artefacts and the site logistics - which is

rather difficult due to the extremely limited space available - it became necessary for some columns a joint welded on site (image 2). After being positioned, they were filled with concrete constructional work.
The load-bearing structure on the first floor includes box beams located throughout the perimeter of the floor, and it is made of welded mixture with a height of about 1 meter, connected together through bolted joints (image 3). Such structures are not positioned in axis with the underlying columns in order to allow the subsequent support of the facade elements. Moreover, on the two sides of the building the box beams are not directly supported by the columns, but overhang from the welded pillars of the cantilevers. The remaining floor beams are made of rolled section bars and present installation holes.

The box beams, as well as forming the support perimeter for the floor slabs, include the connections of the frame structures of the facades and couplings of the substructures of the coating in stone. The main difficulty lies in the interface between the construction of large welded elements and small couplings to assist the firm in charge of building the facades.
In addition, in order to properly assemble the structure on site, temporary access hatches and appropriately sized lifting eyebolts were built. The cross sections of the box beams, which in some cases reach a weight of about 28 tons, were lifted in some cases using two cranes, after building temporary shafts.

These activities had to face the difficulty represented by a rather narrow building site. The load limitations and the difficult accessibility for the means with higher capacity resulted in a more complicated assembly process on site (photo 2).

[PHOTO]
Image 1. Detail of a column to be welded on site

[PHOTO]
Image 2. Detail of a box beam

[PHOTO]
Photo 2 – Box beams assembly in the Office Building

The frame facade (image 3) consists of multi-storey columns in box section at the top of the building that surround the various bays. The internal modules are made up of RHS 150 * 100 * 12.5 section bars welded off site so as to form frames of transportable size in standard conditions.
The section bars present holes to connect the fastening substructures of the stone covering.

The couplings of the various frames are made by welding pipe stubs at the bottom of the various modules. Once welded, the modules are lifted with a crane at the construction site and connected to the bolted joints of the floor beams.
For this reason, the assembly phase had to take into account the need to install at the same time facade modules and floor beams in the same area (image 4).

[PHOTO]
Image 3. Detail of the facade on box beams

[PHOTO]
Image 4. Detail of the connection between the facades and the main structures

[PHOTO]
Photo 3 – Multi-storey structure and facade frames of the Office Building

Chamber Building: It is a building similar in structure to the Office Building and it includes the big empty space of the parliamentary chamber and the stairs for the sessions of the parliament. In this case the reinforced concrete cores, apart from operating as braces, provide room for the service spaces, stairwells and lift shafts. The perimeter structure, covered in stone like the previous one, supports the roofing which consists of two large asymmetric trusses and an irregular pattern of secondary beams (image 5).

The roof trusses, 25 and 32 meters in length, are made of two segments each connected to HEM section bars (image 6). The central joint is represented by a stump in section 457 * 16 and welded connecting discs (image 7). The secondary beams are arranged radially and are made of welded mixture. The connecting beams are UPN section bars (image 4).

The parliamentary chamber reaches a height of about 11 meters and receives light from above the glass covering perimeter. On top of the cover a photovoltaic system will be installed.

The frame structure of the facade of the Chamber consists of windbracing modules for each facade, and internal modules in RHS 200 * 150 * 10 section bars welded off site (image 5). The assembly of the various parts will be carried out directly through bolted joints on site. The vertices of the structure of the facade on the west side, facing the main street (Republic Street), were made by tripods in welded mixture using a unique piece. All section bars present, like for the Office Building, holes to connect the fastening substructures of the stone covering (image 8).

[PHOTO]
Image 5. Model of the roofing of the Chamber Building

[PHOTO]
Image 6.Detail of the springer of the covering truss

[PHOTO]
Image 7. Detail of the central join of the trusses

[PHOTO]
Image 8. Detail of the west facade of the Chamber Building

[PHOTO]
Photo 4 – Detail of the roofing of the Chamber Building

[PHOTO]
Photo 5 – Detail of the west facade of the Chamber Building

Bridges: The two buildings described above are connected to each other on the first and third floor by pedestrian catwalks, while the roof is connected by a simple covering platform roof. These connecting structures are very light and were made using a central box beam welded to the structure. Such structures of unique elements of approximately 18 meters will be covered according to the architectural criteria of the project, i.e. stone for the walkways and glass for the railings.

[PHOTO]
Photo 6 – Connecting bridges

Opera House Theatre: The structure of the new open air theatre Opera House is north of the Chamber Building and emerges from the ruins of the old theatre bombed during War World II (image 7). The project involves the construction of a structure designed to be easily transformed through movement mechanisms

to be used and enjoyed in different seasons. The theatre season refers to the summer, while in winter it is going to be used as a public space and a place for exhibitions.

The open structurework is as follows:

- **Columns:** The perimeter columns are located within the existing ruins and define the space of the new structure. They also represent a support for the American beams for normal lights and spotlights. The box section of the elements includes welded sheets with a thickness of 20/25 mm, with a variable height up to almost 16 meters and a weight of about 3 tons each (image 9). The ridge height remains unchanged while the height of the foundations changes from rod to rod. This way, each column is a unique unrepeatable piece.

- **Seating Area:** It includes a space for the audience and it is made of overturned trusses (with a length of approximately 22 meters and a height of 3, weighing about 7,100 kilos) called "trusses". These are appropriately braced and connected to ridge beams. Below this area there are spaces connected to the old head of the theatre. The seats are removable to create a "public space" during the winter.

- **Orchestra pit:** It is the place for the orchestra and it consists of a mobile platform connected according to the project guidelines to a slide system depending on whether it is used as an orchestra or as a public place together with the Stage.

- **Stage area:** It is a structure similar to the seating area and it is formed by four horizontal trusses that represent the stage. At the back there is an area called "revolving area", which has the ability to rotate, creating a continuous plane with the stage and the orchestra (image 10).

- **Catwalks and walkways:** There are walkways connecting the ground floor to link the different levels to the existing structures. Higher up there are walkways for inspection and plant engineering.

The recurrent architectural motif is given by the coupling of metal discs - forming the structure of the columns -, trusses and many other elements, which connects the details of the project specifically designed.

[PHOTO]
Image 9 – Prospective drawing of the assembly of the columns

[PHOTO]
Image 10 – Revolving beam area

[PHOTO]
Image 7- Opera House before and after

3) OFFSITE CONSTRUCTION PROJECT

Given the complexity of the work, the need for continuous inspections, studies and solutions, a specific software design / 3D modeling (TEKLA) was used. This choice allowed to fragment the structure, with sub-phases according to the construction type so as to facilitate and improve the management of the project in terms of its planning, domestic production, transport and assembly on site.

4) SURFACE TREATMENT

The surface treatment of the structures required materials and specific uses depending on the function and fire resistance requirements of the project.

Structures treated with intumescent: All the facilities of the new Parliament, except for the columns up to the first floor and the connecting bridges, were treated with a coat of primer on site and, after their installation, intumescent products were applied, to ensure the required level of fire resistance. The

characteristics required by the project are R60 for the above-ground structures and R90 for the underground structures.

Columns, bridges and Opera House: The structures in greater contact with the outside atmosphere or totally exposed such as the Opera House were treated using a three-coat paint system. The first layer consists of primer with a high content of zinc, followed by an intermediate product (epoxiprimer) and a final coat of acrylic enamel, for a total thickness of about 300 microns.
The final result of the study is based on several samples taken, colour codes specifically designed for the project Valletta City Gate and their meticulous use on site. The final result, even for the elements treated with intumescent, evokes the metallisation or metal-spray process.

5) ASSEMBLY PLAN

Regarding the buildings of the new Parliament, assembling the structures was carried out through a construction crane with an arm of 40 meters and peak loading equal to a little less than 4 tons, placed in the centre of the construction site and with the help of cranes for areas outside this range.
The assembly line in general was carried out according to the following phases:

- Placement of the columns;
- Installation of interior beams of the first floor;
- Installation of box beams;
- Installation of facade structures
- Assembly of the internal multi-level structures up to the roofing.

As for the structure of the Opera House, the assembly of the structures was done through mobile cranes on the internal street to the construction site (Ordinance Street).
The assembly steps were as following:

- Placement of the columns on the side of Zachary Street;
- Installation of trusses and braces in the seating area;
- Construction of the structure of the Orchestra pit;
- Installation of trusses and braces in the stage area;
- Placement of the columns on the side of Ordinance Street;
- Assembly of catwalks and walkways of service;
- Assembly of the tilting beams of the Revolving Area.

6) QUANTITY OF STEEL

The quantity of steel supplied for the construction of the buildings of the new Parliament is approximately 1,100 tons, which consist of about 730 tons of metal sheets and 370 of laminated section bars. For the Opera House about 240 tons were employed, equally divided between section bars and worked metal sheets.

7) CONCLUSIONS

The buildings of the new Parliament and the Opera House Theatre constitute the main part of the Valletta City Gate Project, which implies the large urban redevelopment of the entrance of the capital city, Valletta. The project redesigns the urban and road network and the use of a very important area, which was for a long time indefinite and degraded. The new access and new features represent a challenge for a better economic and social future, reconnecting and enhancing the pre-existing historical and cultural sights of the island.

CREDITS

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Technical Data
– Steel structures weight: Office Building (approx. 600 tonnes) - Chamber Building (approx. 500 tonnes) - Opera House (approx.240 tonnes)
– Steel Quality: S355J0

Client:
GHRC – Grand Harbour Rehabilitation and Corporation – Malta
BOVIS LEND LEASE Project Management
Firm awarded the tender:
RIMAX-BIT Joint Venture
Architectural Design:
RPBW – Renzo Piano Building Workshop - Paris
Construction Project:
Ove ARUP – London
Metal structures:
BIT Spa – Cordignano (Italy)
Construction Project:
BIT Spa Technical Office
Assembly Plan:
BIT Spa Technical Office