Teatru Manoel

Sustainable Thermal Comfort in a Baroque Theatre

Robert Ghirlando

How I got involved in this project

The Teatru Manoel was very much part of my life with my late wife Maria.

Maria, was a pianist and music lover who passed away in 2010 at the young age of 58.

For the first 17 years of our marriage, she was the music critic for the Times of Malta, which meant that we attended most concerts at the Manoel.

For the next 17 years, she was a member of the Teatru Manoel Management Committee and was still a member when she died. This meant that we now attended most performances at the Manoel.

This theatre has a special place in my heart.

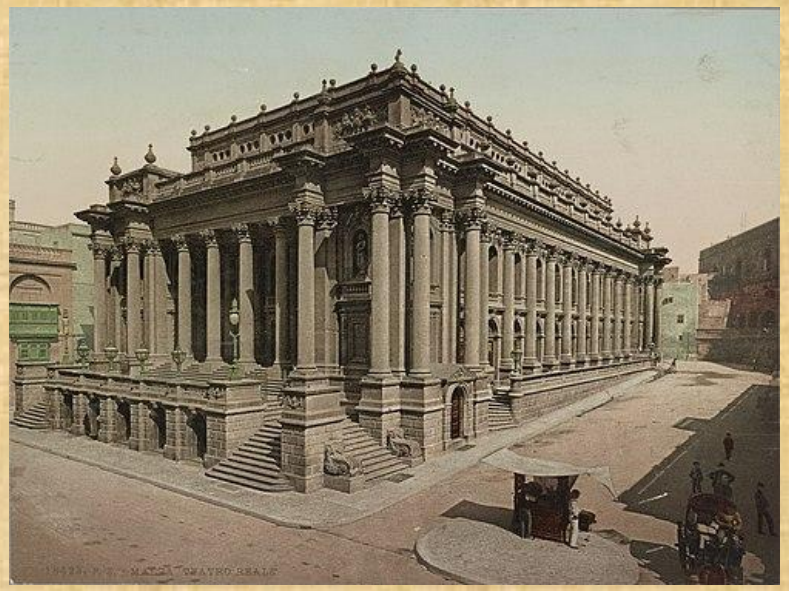
Brief History of the Manoel Theatre (Teatru Manoel)

The Theatre was built during the reign of Grandmaster Antonio Manoel de Vilhena

Ad Honestatem Populi Oblectationem

1732 – Theatre opens with La Merope, a tragedy by Scipione Maffei
1798 – Napoleon captures Malta from the Order of St John
1800 – Start of the British period after expulsion of the French from Malta
1812 – Major changes to theatre layout
1861 – Theatre sold by Government to private individuals
1866 - Royal Opera House opens – Teatru Manoel suffers the competition
1873-1877 – Royal Opera House closes due to a fire – Teatru Manoel again supreme
1927 – Teatru Manoel cannot compete with Royal Opera House and becomes a cinema
1942 – Royal Opera House bombed; becomes an open-air theatre only in August 2013.
1957 – Government acquires again Teatru Manoel and renovates it.
1960 – Teatru Manoel reopens with ballet Copelia performed by Ballet Rambert from UK
Over more recent years, various restoration and improvement projects are undertaken

Royal Opera House



As originally built in 1866

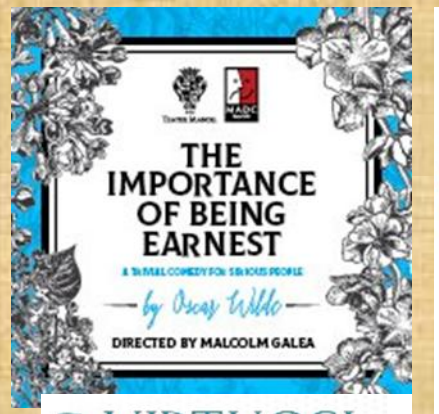
(NWM)

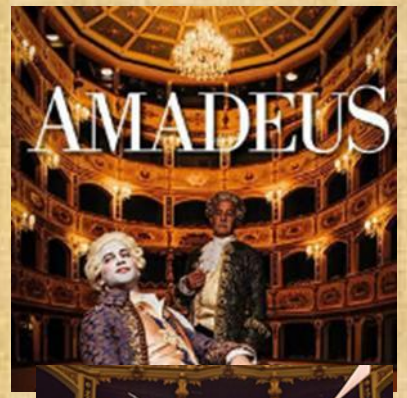
The Royal Opera House in ruins.

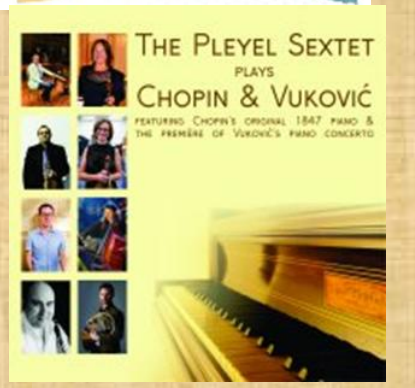
After the bombing raid of 7th April 1942

As it is now

Teatru Manoel – A Theatre for Everybody







The Climate Control Project for Sustainable Thermal Comfort

The problem:

(i) Poor ventilation

(ii) Cold in winter, hot in summer

Because of the heat, the theatre would close from June to September. With the installation of climate control, the theatre can be used all the year round; an almost 50% increase in utilisation.

Theatre Management sought solutions.

After many attempts to identify the best way of solving the problem, In 2012, the theatre management identified a young Italian engineer, Filippo Aguzzi, who gave them a proposal.

Ray Attard, the Theatre General Manager at the time asked me to assess and comment professionally upon this proposal. My assessment was positive.

Filipo was engaged. That was the start. I did not have any specific role in the project but attended many project meetings and discussions where I gave whatever input I thought appropriate. I did it in true Rotary spirit.

Manoel Theatre Climate Control Project

Total Cost of Project = €1.8 Million - Part financed by the European Union

Design Team

Heating, Ventilation and Air-conditioning (HVAC) System: Filippo Aguzzi from Aguzzi - Studio e Progettazione Impianti

Architecture and Civil Engineering: David Drago, Guillaume Dreyfuss, Joe Calleja and Charlene Darmanin - AP Valletta Ltd

Mech & Electrical Engineering: Attilio Pace and Sebastiano Genovese - MTS Ltd

Technical consultant: Robert Ghirlando

Additionally

Acoustic Consultant - Massimiliano Tonelli

Seating Consultant - Anne Minors

Manoel Theatre Team: Micheal Grech, Elizabeth Ebejer (took over from Ray Attard), Kenneth Zammit Tabona, Diane Degabriele and Brian Bonnici

Contractor: J.Micallef Builders Ltd

Design Constraints

- Historic Building (built 1732) – interventions to the building must be kept to the barest minimum
- Location and passage of pipes and ducts very restricted
- Ceilings in boxes are low
- Where to locate the plant room
- Extremely low noise levels (Teatru Manoel is a theatre!)
- System must be operated 24/7 to avoid large temperature and humidity variations in the Theatre that could affect the woodwork, painting and gilding
- Time window for works very limited – Theatre management reluctant to close theatre for very long (and in particular, the theatre was required to be available by 1st January 2018, for Valletta, European Capital of Culture)

Project Timeline

2012 – Filippo Aguzzi is engaged to design the system

2012 – 2016 - the Design Team works on finding workable solutions

2016 – The Theatre secures EU funding

29/11/2016 - tender is published and closes on 30/1/2017

17 April 2017 - Theatre season closes and works start on 7/7/2017

23 December 2017 – all internal works completed and Theatre re-opens in time for Valletta 2018

August 2018 – system started operating on ventilation

March 2019 – system switched on to automatic mode

April 2019 – Installation of acoustic panels around machinery on roof

At the same time, a number of changes not connected to the Climate Control Project were also undertaken.

(i) the main one being the re-introduction of the Parterre Boxes, thus restoring the theatre to it original set-up. Eventually, facilitated the introduction of ventilation.

(ii) New seating arrangement

(iii) New parquet flooring and inclined at a soft angle to improve the visibility of the stage from the stalls

(iv) Restoration of the façade and other restoration works.

Before

Central aisle and no parterre boxes

After

Side aisles and parterre boxes

Solving the problem where to place the machinery

A two-storey steel structure resting on a very solid part of the side walls over the stage area

The two-storey structure built to accommodate the machinery

Solving the Ventilation Problem

1. Using the Oculo to extract the stale air

2. Air enters the theatre through grilles under the parterre boxes

3. Air enters the theatre through a cloth pipe at level of the gallery

4. Air is also ducted to the stage area

Note that to improve the energy efficiency of the system, there is heat exchange between the incoming air and outgoing air.

The Oculo

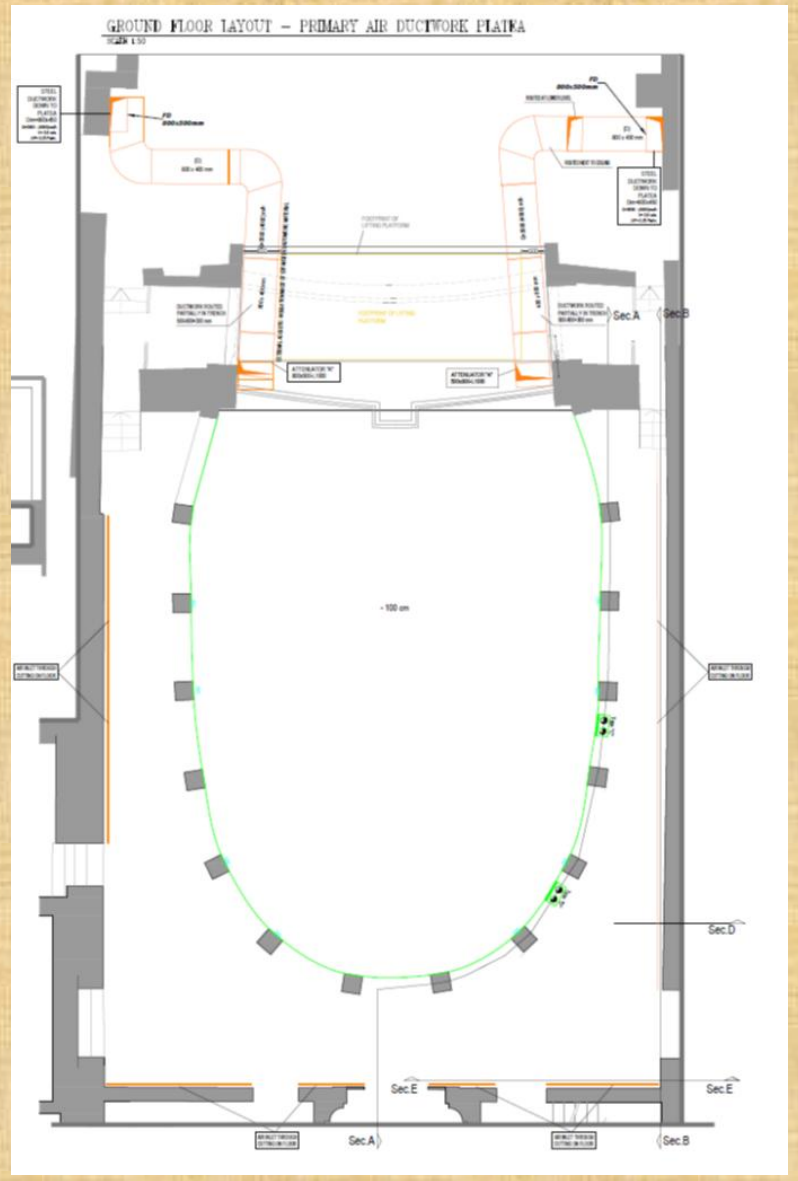
This is a hole in the centre of the ceiling of the theatre and was meant to provide ventilation
It was again utilised for ventilation in the new project.

An failed attempt to improve ventilation by sucking air through the Oculo

The air is extracted through the Oculo, and through the wooden plenum to the Air Handling Unit (the machine that circulates the air). To save energy, the outgoing air and incoming air exchange heat without mixing.

When the floor of the theatre was dug up, the remains of the garden of the priory of Navarra was uncovered.

Air ducting, plenum and air outlets in the stalls



The remains of the garden found when the plateau of the theatre was dug up to a maximum of 1.5 meters.

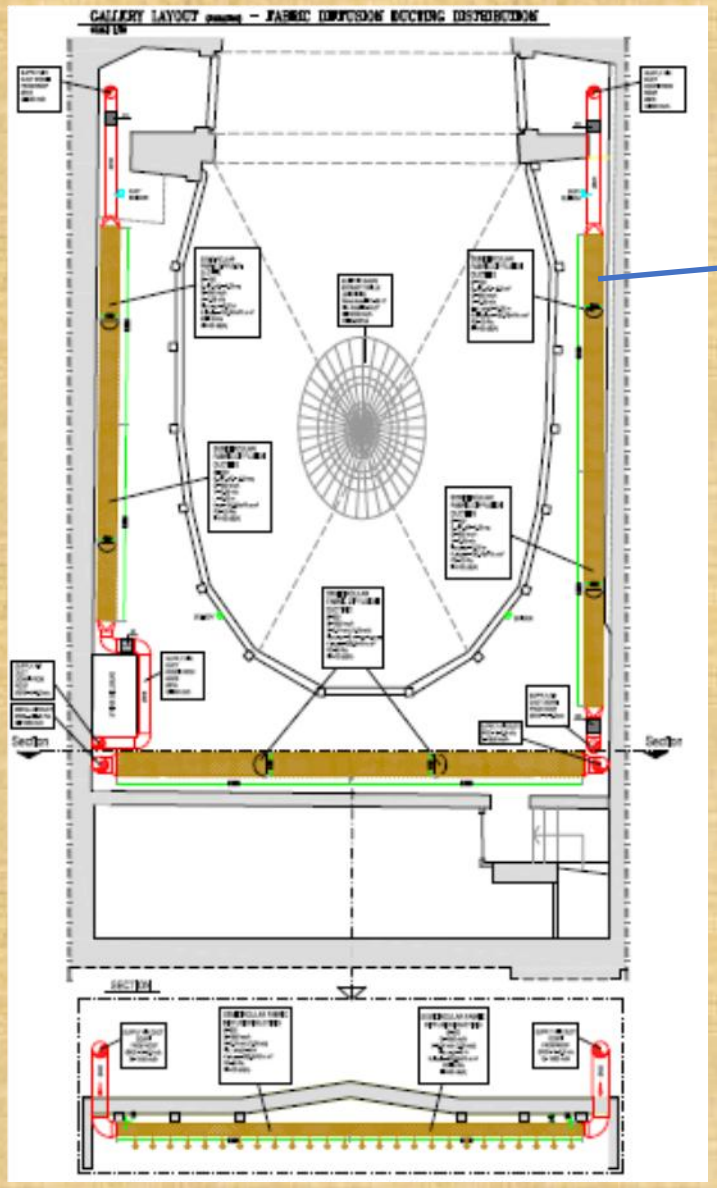
This was covered with rubble, plastic and concrete to protect it while leaving space under the floor for a plenum chamber

The fresh air is supplied at the right temperature and humidity and low velocity through:

i) grilles at the edge of the stalls area and from underneath the parterre boxes.

ii) In the gallery, through a cloth duct in the gallery

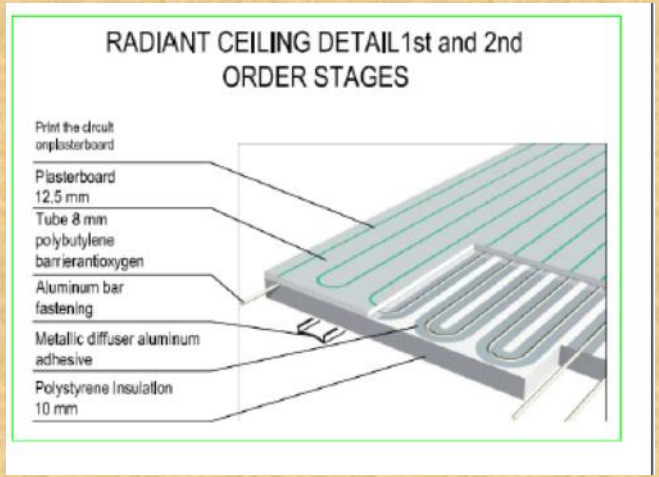
The parterre boxes with the air grilles under the boxes



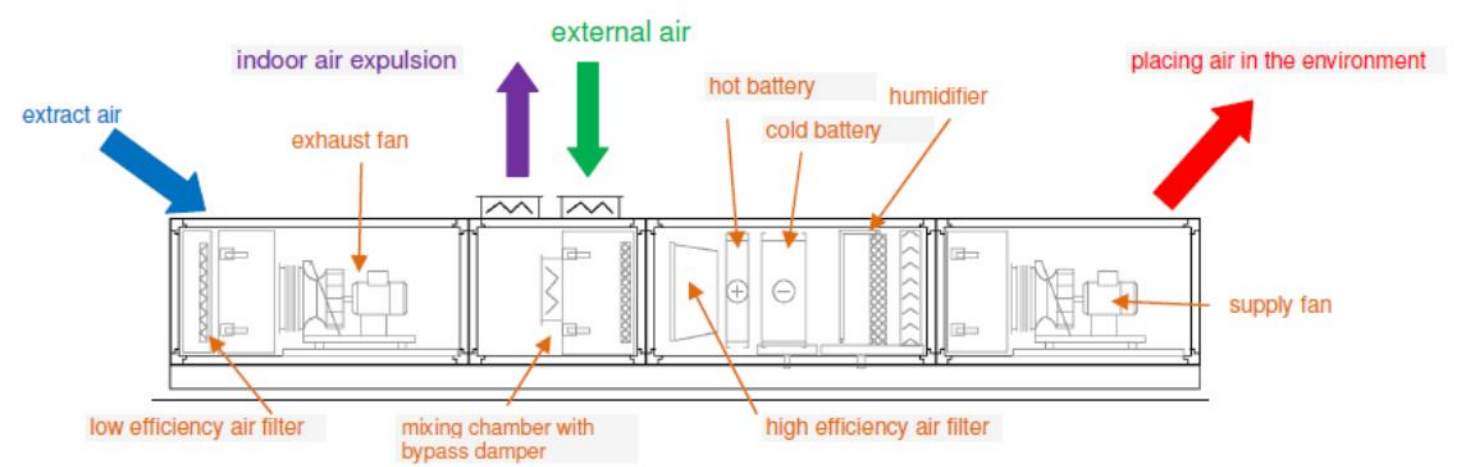
In the gallery, the distribution of the air is via ducts made of fabric.

The heating and cooling problem is solved through:

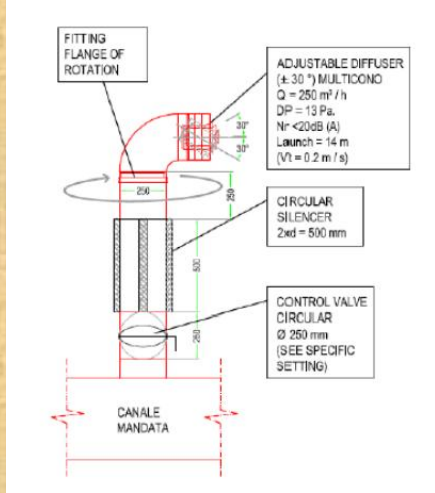
1. Heating or cooling the incoming air
2. Underfloor cooling/heating of the stalls through the circulation of cold/hot water.
3. Overhead cooling/heating in the boxes by circulating cold/hot water.
4. Fan coil units for the stage and back-stage



The radiant panels in the boxes on the 3rd tier



Compositional scheme of the stage area air handling unit



The Air Handling Unit is right above the stage, so indoor air extraction is direct.

Adjustable diffusers at the sides of the stage.

Measures to improve energy effciency

Heat recovery for dehumidification and post-heating.

Pumps are inverter controlled for higher efficiency.

Automatic software control of temperature at the various levels of the theatre

Varying the fresh air intake depending on the activity in the theatre and the required CO_2 levels to avoid wasting heat. System runs 24/7, but can be run on two different regimes:

(i) Low use. Hence low ventilation rate, reduced air flow and internal air recirculation. No air-conditioning in atrium, corridors and orhestra pit.

(ii) High use. All systems go.

During the installation of the system, all hot work was avoided in order to avoid risks to the wooden structure.


Grazzi