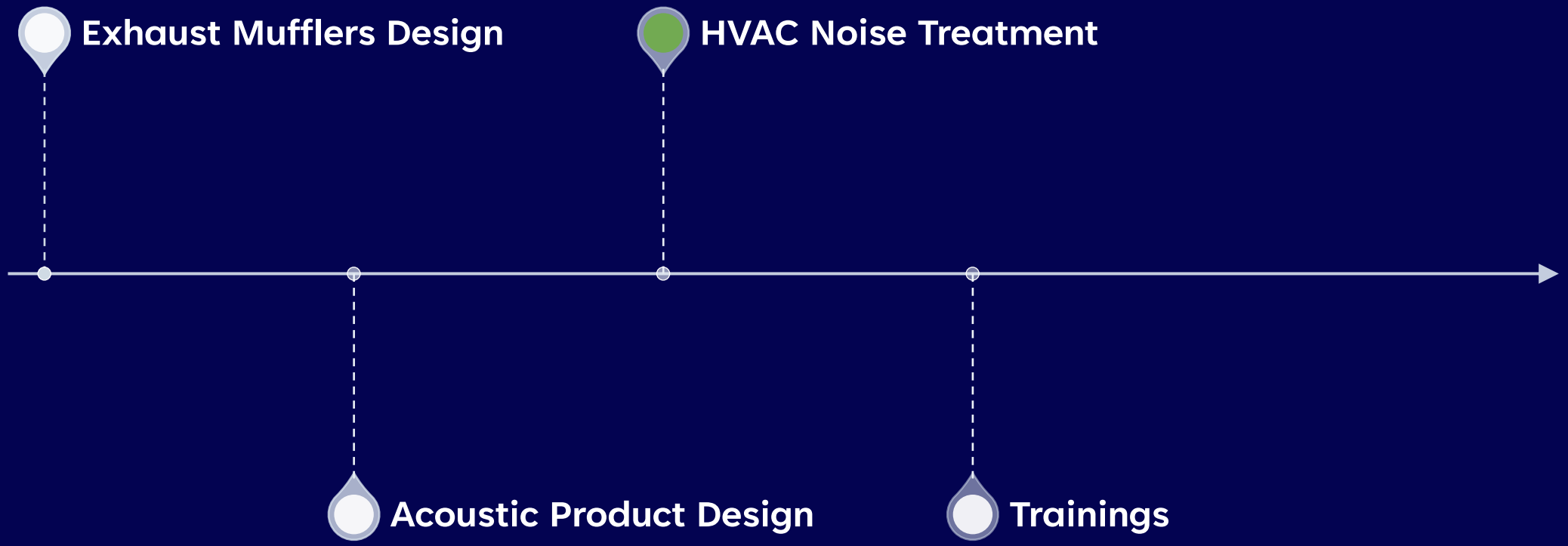
HVAC Acoustic Services

Portfolio

Enostack

What we do


Exhaust Mufflers Design
HVAC Noise Treatment
Acoustic Product Design
Trainings

HVAC Noise Treatment

HVAC Noise Studies

The HVAC noise is generated during the operation of Active and Passive HVAC component during their operation. Active components are mechanical equipment like fans, blowers, compressors...etc., while passive components generate noise due to the air flow noise through them, such as; ductwork, air outlets, control dampers...etc. The solution to this problem can be understood from the below steps;

1. Problem Statement
2. Objective
3. Methodology
4. Standards
5. Measurements
6. Example
7. Work Samples

Problem Statement

HVAC mechanical noise, characterized by vibrations, humming, and other disruptive sounds, can adversely affect human comfort and sound quality in occupied spaces. This noise pollution can lead to several issues, including:

1. **Reduced Comfort:** Persistent HVAC noise can cause discomfort and annoyance, disrupting daily activities and reducing overall satisfaction with the indoor environment.
2. **Health Impacts:** Prolonged exposure to mechanical noise can lead to stress, headaches, and other health problems, negatively affecting the well-being of building occupants.
3. **Decreased Productivity:** In workplaces, excessive noise can hinder concentration and productivity, impacting employee performance and job satisfaction.
4. **Compromised Acoustic Quality:** In spaces such as classrooms, conference rooms, and auditoriums, HVAC noise can interfere with speech intelligibility and the overall acoustic experience, diminishing the effectiveness of communication and presentations.

Objective

To identify and implement effective noise mitigation strategies for HVAC systems to enhance human comfort and maintain high sound quality in occupied spaces. This includes:

1. Conducting thorough noise assessments to pinpoint sources and levels of HVAC noise.
2. Designing and installing noise-reducing components and materials.
3. Studying the effect of the noise on the spaces noise criteria.
4. Regular maintenance and optimization of HVAC systems to minimize noise generation.
5. Saving cost and time of reinstallations, late treatments, or even over designing the systems.
6. Educating building designers and operators on best practices for noise control.

Methodology

As the HVAC Noise is an application of Induct Acoustics the analysis can be done by induct sound power software such as SIDLAB or HVAC noise calculators.

1. **Proper System Design:**
    1. Duct Design: Minimize turbulence by designing ducts with smooth transitions and avoiding sharp bends.
    2. Fan Selection: Choose fans that operate efficiently at the required airflow and pressure with reduced noise.
2. **Ducts Acoustic Treatments:**
    1. Sound Absorbing Materials: Use materials like acoustic glass wool, Arma cells, or rebounds materials to damp the induct noise.
    2. Silencers and Mufflers: Install silencers in ductwork and mufflers on equipment to dampen noise if required.
3. **Vibration Isolation:**
    1. Isolation Mounts: Install vibration isolation mounts for equipment like compressors and fans to prevent vibration from transferring to building structures.
    2. Flexible Connectors: Use flexible connectors in ductwork to absorb vibrations.

Standards

Applications: According to the problem application the solution will be mitigated to select the regulations, standards, and noise criteria (NC) levels. The background sound pressure levels is defined by the NC level, which relates to the human comfort and space application. NC levels are given either from the standards or specific customer needs.

Some practical standards and guidelines are listed below:

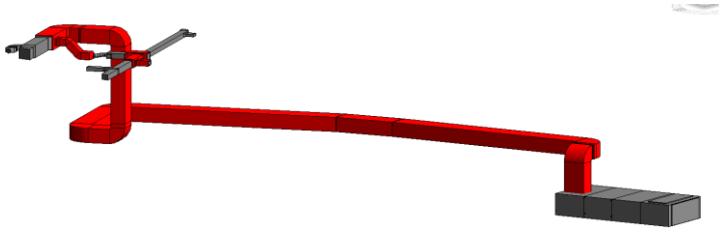
1. Guidelines for Design and Construction of Hospitals, The Facility Guidelines Institute (FGI), 2018.
2. ASHRAE Handbook Chapter 48: Noise and Vibration Control, American Society of Heating, Refrigerating and Air-Conditioning Engineers.
3. DIN 18401-2016: Acoustic Quality in Rooms – Requirements, Recommendations and Indications for Planning, German National Organization for Standardization.
4. LEED v4.1-2019: Building Design and Construction, U.S. Green Building Council.
5. International Building Code 2018, International Code Council.

Measurements

Measurements are used to verify the solution before and after the acoustic treatment implementation.

1. Reverberation time: is a crucial parameter in room acoustics, affecting the clarity, warmth, and overall acoustic quality of a space. It is particularly important in environments like meeting rooms, concert halls, classrooms, and recording studios, where sound quality is essential.
2. NC Level measurements: sound pressure levels across different octave bands (frequencies ranging from 63 Hz to 8,000 Hz) and comparing them to a set of predefined NC curves. The NC rating of a space is the lowest NC curve that is not exceeded by the measured sound pressure levels

Sample Example



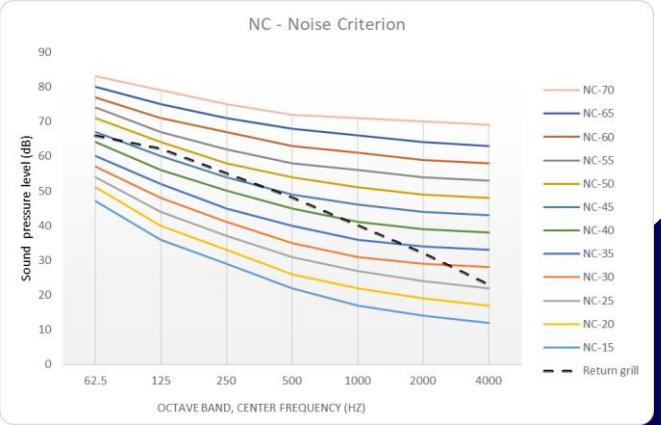
Input data:

1. Active Sources Sound Power Levels.
2. HVAC Design layouts.
3. Air Flow rates.
4. NC of air outlets.
5. Reverberation times of the served spaces.

Analysis

1. Calculate the insertion loss and flow generated noise using an acoustics software.
2. Complete noise analysis including both attenuation and flow noise generation from each component.
3. Add the duct lining at certain ducts to achieve the required NC.
4. Add/select silencers if required.

NO	Element	WxHxL(mm)	Lining (mm)	Velocity (m/s)	63	125	250	500	1K	2K	4K
1	AHU-HS-LG-GR-02C				89	90	89	83	80	76	69
2	Rectangular Duct	1350x699x360	25	9	0	0	0	-1	-3	-2	-2
3	Rectangular Elbow Radius	1350x699	25	9	0	-3	-7	-10	-11	-11	-10
					45	42	37	32	26	19	11
4	Rectangular Duct	1350x699x5550	25	9	-3	-3	-6	-20	-40	-28	-25
5	Rectangular Elbow Radius	1350x699	25	9	0	-2	-3	-5	-6	-6	-5
					45	42	37	32	26	19	11
6	Rectangular Duct	1350x699x1000	25	9	-1	-1	-1	-4	-8	-5	-5
7	Rectangular Elbow Radius	1350x699	25	9	0	-2	-3	-5	-6	-6	-5
					45	42	37	32	26	19	11
8	Rectangular Duct	1350x699x11700	0	9	-7	-5	-3	-1	-1	-1	-1
9	Rectangular Elbow Radius	1350x699	0	9	0	0	0	0	0	0	0
					45	42	37	32	26	19	11
10	Rectangular Duct	1350x699x4500	0	9	-3	-2	-1	0	0	0	0
11	Rectangular Elbow Radius	1350x699	0	9	0	0	0	0	0	0	0
					45	42	37	32	26	19	11
12	Rectangular Duct	1350x699x10100	0	9	-6	-4	-3	-1	-1	-1	-1
13	Rectangular Elbow Radius	1350x699	0	9	-1	-2	-3	-3	-3	-3	-3
					45	42	37	32	26	19	11
14	Rectangular Duct	1350x699x5500	0	9	-3	-2	-1	0	0	0	0
15	Rectangular Elbow Radius	1350x699	0	9	-1	-2	-3	-3	-3	-3	-3
					45	42	37	32	26	19	11
16	Rectangular Duct	1350x699x1900	0	9	-1	-1	-1	0	0	0	0
17	Rectangular Elbow Radius	1350x699	0	9	-1	-2	-3	-3	-3	-3	-3
					45	42	37	32	26	19	11
18	Rectangular Duct	1350x699x5550	0	9	-3	-2	-1	0	0	0	0
19	Rectangular Elbow Radius	1350x699	0	9	-1	-2	-3	-3	-3	-3	-3
					45	42	37	32	26	19	11
20	Rectangular Duct	1350x699x1500	0	9	-1	-1	0	0	0	0	0
21	Tee (Branch Power Split)	1350x699 / 850x600	0	-	-3	-3	-3	-3	-3	-3	-3
					66	61	55	48	40	32	22
22	Rectangular Duct	850x600x500	0	7	0	0	0	0	0	0	0
23	Return grill		-	7	51	40	33	26	22	19	17
Resulted in SWL in dB					**67**	**62**	**55**	**48**	**66**	**62**	**55**
Resulted in SPL@1m in dB					**67**	**62**	**55**	**48**	**66**	**62**	**55**
NC-48											



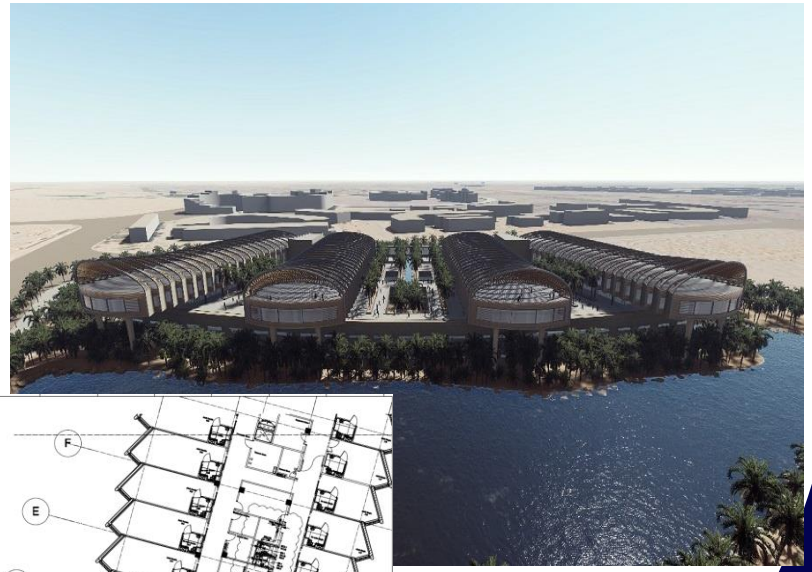
HVAC Noise

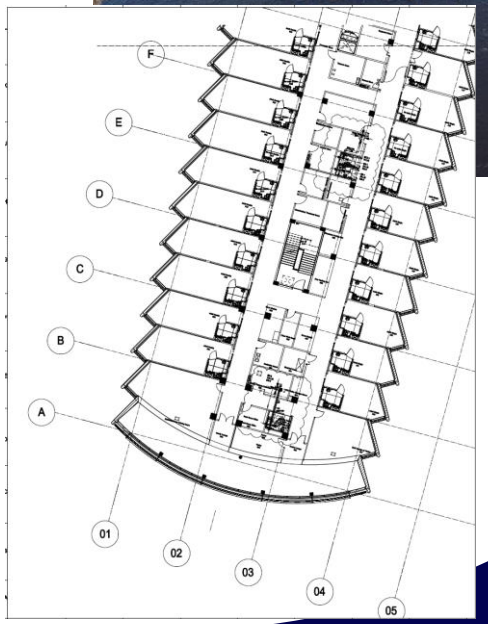
Work Samples

Magdy Yacoub Global Heart Center

Summary: The Magdi Yacoub Global Heart Center is a state-of-the-art medical facility in Cairo, Egypt, dedicated to providing advanced cardiac care, particularly for underserved communities. Founded by the renowned cardiac surgeon Professor Sir Magdi Yacoub, the center aims to offer high-quality, free-of-charge medical services to patients, especially children with congenital heart defects.

An acoustic study was performed for more than 140 HVAC ventilation fan used to vent locations like kitchens, bathrooms, clean rooms...etc. The transmitted Sound Power and Sound Pressure Levels were calculated to ensure the transmitted noise from the fans are within the allowable noise levels in the occupied spaces.





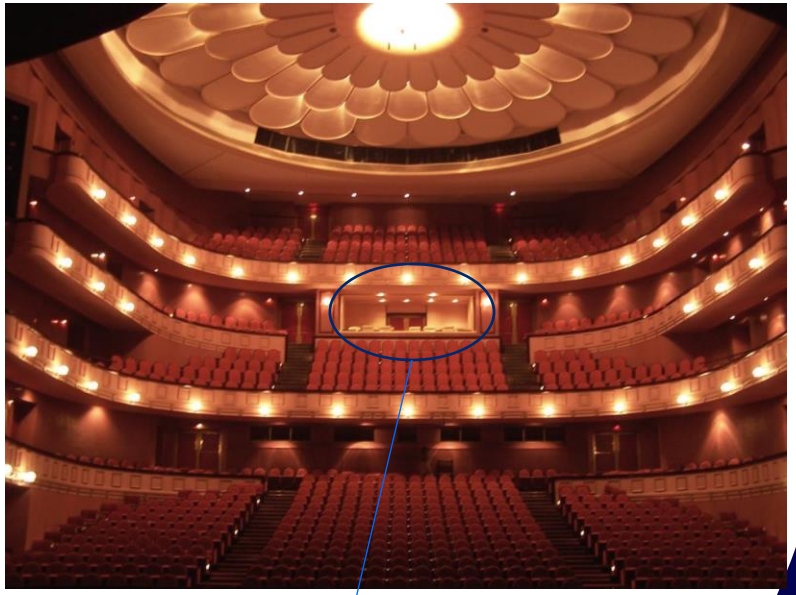
Location: Cairo, Egypt

Project by: Elnady Engineering

Project Date: January 2023

Customer: ORASCOM Construction

New Cairo Opera House



Summary: The New Cairo Opera House, located in the Arts and Culture City of the New Administrative Capital, is the largest opera house in the Middle East. It features a main hall with a capacity of 3,500 individuals, a music concert theater for 1,300 people, and another theater for plays that can accommodate 700 people.

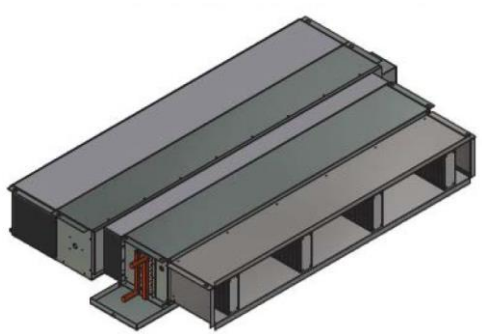
An acoustic study was performed for the Fan Coil Units used to cool the VIP Lounges, and performance Control Rooms to reach NC levels down to NC 18. The original HVAC design was modified and FCU submittals were selected to reach the standard Noise Criteria's.

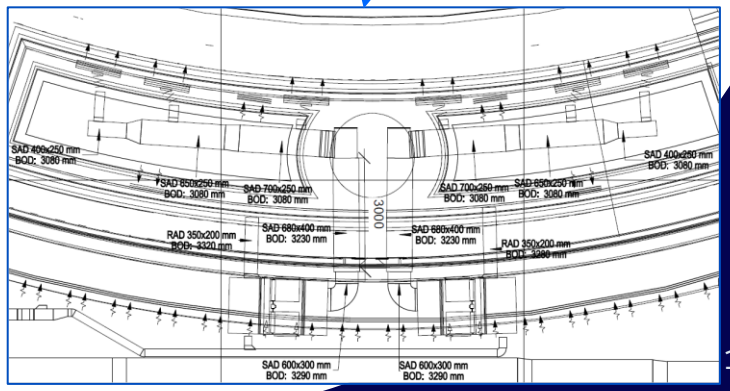
Location: Cairo, Egypt

Project by: Elnady Engineering

Project Date: 2019-2022

Customer: ORASCOM Construction

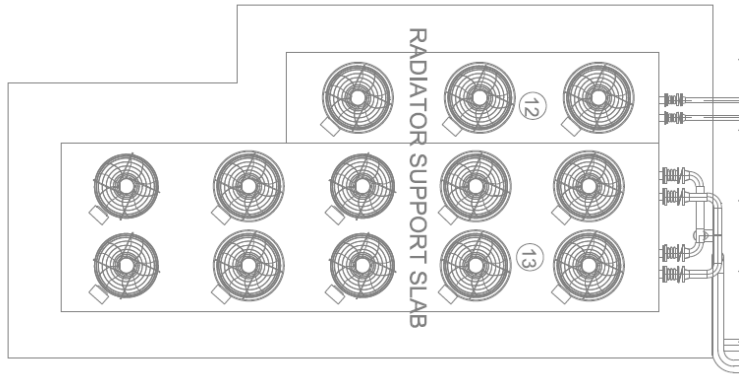




Alexandria East Wastewater Treatment Plant

Summary: The Alexandria East Wastewater Treatment Plant (WWTP) is a significant facility in Alexandria, Egypt, designed to handle large volumes of wastewater. The plant has undergone expansions to increase its capacity and improve its treatment processes.

A numerical simulation was performed for the acoustic levels at extreme working conditions at different distances from the powerhouse. The acoustic damping materials, sound attenuators, and air louvers for the generator sets rooms were selected to reach 50±3 dBA near the residential areas.

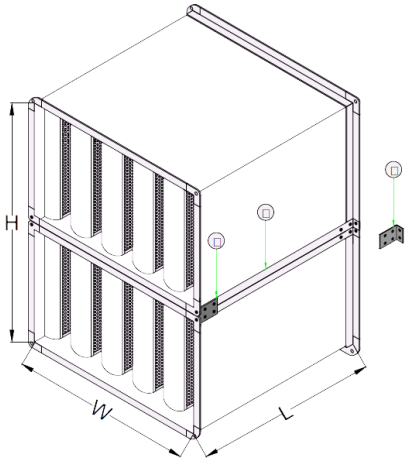


Location: Cairo, Egypt

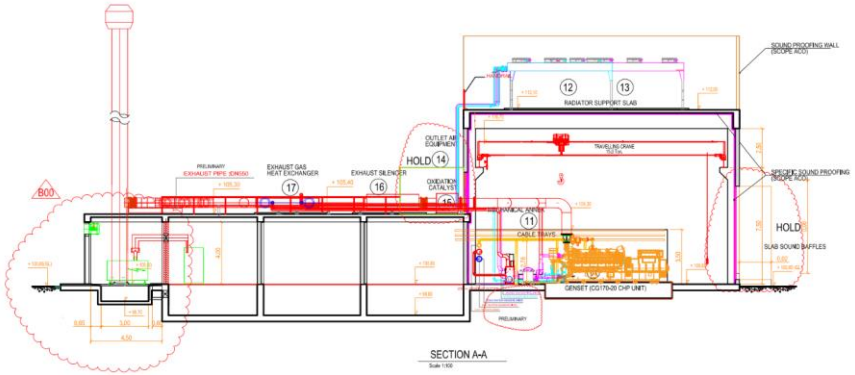
Project by: Elnady Engineering

Project Date: 2019

Customer: Suez



Isometric View



Cooling Tower Vibration Isolation

Summary: To serve the HVAC system inside the Center for Sound, Vibration and Smart Structurers laboratories, a high level of vibration isolation is required. The cooling tower supplying cool air to the laboratories was isolated by a large steel truss to prevent the vibration from the pumps, and chillers.

Location: Cairo, Egypt

Project by: Ain Shams University

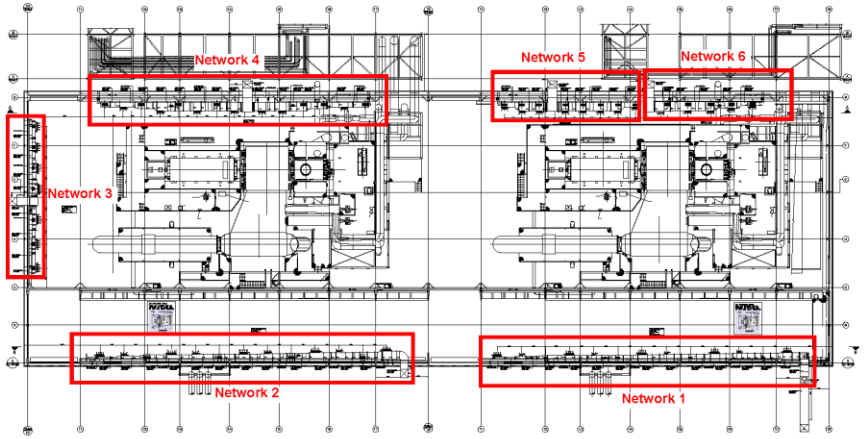
Project Date: 2018

Customer: Center for Sound, Vibration and Smart Structurers

Beni Suef Combined Cycle Power Plant

Summary: The Beni Suef Combined Cycle Power Plant is a significant power generation facility in Egypt. The plant has an installed capacity of 4.8 gigawatts (GW), making it one of the largest combined-cycle power plants in the world. The project was part of Egypt's Megaproject, aimed at boosting the country's power generation capacity by approximately 50%. It was constructed by Siemens in collaboration with local partners like Elsewedy Electric.

An acoustics study for the HVAC systems of the Buildings UMA & UMB in Beni Suef Combined Cycle Power Plant was performed to ensure that the noise levels are in compliance with the required criteria below 85 dB(A), and 92 dB(A) for the generators annex.



Location: Cairo, Egypt

Project by: Elnady Engineering

Project Date: 2017

Customer: PSP Elsewedy Electric

Grand Egyptian Museum

Summary: The Grand Egyptian Museum (GEM), located near the Giza Pyramids, is set to be the largest archaeological museum in the world dedicated to a single civilization. GEM will house over 100,000 artifacts, including the complete collection of King Tutankhamun's treasures, many of which will be displayed for the first time.

An acoustics and thermal study were performed for MEP work to ensure no heat or sound is transmitted from the MEP located above the false ceiling to the Museum Halls or Corridors.

Location: Giza, Egypt

Project by: Elnady Engineering

Project Date: 2015-2016

Customer: ORASCOM Construction