



The Insufficient Capacity of the HVAC System in the Original GMD Building of Collier County

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- Abstract-

Collier County is located in the Southwest of Florida. The Collier family constructed the Growth Management Division Building in 1989, which was bought by the County to establish government offices. Through the years, visitors and employees have complaint of drastic temperature fluctuations in areas of the building. Investments are made annually by replacing rooftop units without success. A mechanical engineer is contracted to study the situation, verify complaints and solve the problem. Analysis and studies concluded that the original installation of the heating, ventilating and air conditioning system was deficient, and improvements made to the offices also have affected its capacity. A new design of a heating ventilating and air conditioning system occurred and rooftop units are replaced by air cooled chillers due to ease of maintenance and City code regulations. Construction will occur during the night, so public services will not be affected. Employees and directors are aware of possible inconveniences.

- Introduction-

Collier County is located in the Southwest region of the state of Florida. It has a population of around 321,250 people. It is the largest county in Florida with a total area 2,305 square miles bigger than the state of Rhode Island. The Growth Management Division (GMD) building is a 27-year-old building built in 1989 by the Collier family and sold afterward to the Collier County to accommodate their main public permit offices. Today this building houses more than three hundred workers and is visited by hundreds of visitors on a daily basis.

This building's HVAC system is composed of ten rooftop units and air ducts. Through the years visitors and employees have a complaint that there are areas in the building that have drastic temperature fluctuations. This building has suffered some minor interior modifications throughout time and also the replacement of rooftop units. The County has spent a lot of money through time trying to solve this situation, and nobody has until now.

The final goal of this project is to find the real cause of the temperature fluctuations in the building without interrupting daily services and in a feasible budget. For this job a team of professionals were selected that work at the GMD building and the Facilities Department responsible of the building maintenance and infrastructure.

As senior project manager and team leader representing the Facilities Department, meetings and discussions were done to analyze the situation and present possible solutions or alternatives for the problem. To verify complaints, a survey to visitors and employees was prepared.

During a week visitors and employees participated in a survey and the results obtained are shown in Table I. According to the survey, visitors complained of three areas of the building and employees mainly about different areas.

After analyzing the results, it was concluded that the problem with the HVAC system is a major one affecting most of the building. The issue here is, what is causing this? Since this has been a problem for many years and everybody has tried to solve it by replacing the rooftop units and the problem persist, a decision was made to contract a mechanical engineer to study this and resolve the problem.

Table I

Survey of Areas where A/C is not working properly

Area	According to Visitors	According to Employees
Lobby	75%	16%
Document Vault	9%	0
Conference Rooms	0	0
Environmental	0	29%
Engineering	0	24%
Permitting	16%	8%
Offices	0	0
Planning Review	0	23%

- Literature Review-

An HVAC system is a technology used to create environmental comfort by heating, ventilating and air conditioning. The final goal is to provide an excellent indoor air quality for an area at a comfortable temperature. This system is an essential part of residential and commercial buildings. The heating process assures to get the air in the building to a desirable temperature already established in the system. The ventilating process involves the process exchanging the indoor air quality in an area [1]. It removes moisture in a zone and undesirable smells by entering the outside air and assuring that the air is circulating at all times. The air conditioning or cooling occurs by using a condenser which transfers the heat to air or heat to the fluid so it can be carried away. An air handler is used to circulate the air and distribute the air through the ductwork and returns it back to the air handler [2].

Rooftop units (RTU) are air handler designed for outdoor use, usually on the roof of buildings or houses. RTU's have a significant advantage when a building is constructed for the first time since they save lots of space around the building allowing the use of it for other purposes. The problem is that they require lots of maintenance for them to operate efficiently and the access is difficult.

Usually, in the major commercial buildings, the cooling of the air in an HVAC system is made by chillers. A chiller removes heat from a liquid using vapor-compression or absorption refrigeration cycle. This cooled liquid flows through pipes in a building and passes through coils in air handlers cooling the air in the building. There are two types of chillers: air cooled and water cooled. Air cooled chillers are outside of the building and consist of condenser coils that are cooled by outside air. Outside air circulates mechanically through the condenser coil and the heat transferred to the atmosphere. The water cooled chillers usually are located inside a building. The heat transfer from this chiller occurs by circulating water to an outdoor cooling tower creating a heat transfer to the circulating water [3].

The chillers can require a lot of power consumption but when they are installed and well maintained they can also help save lots of money with an efficient air conditioning system.

- Analysis/Discussion-

The contracted mechanical engineer revised the original drawings and design of the building concluding that the design was accurate and the problem shouldn't be occurring. A verification of the existing HVAC system was done to make sure the original construction complied with the construction drawings. For everyone's surprise in the team, the design presented in the drawings was not the one built in the building. Areas of the building had no return vents, conduits were not connected properly, and the HVAC system was not adjusted when the construction of new walls and offices happened. This reason was the cause of the persisting problem that no one has ever found. The design process consists of four different stages and drawings are reviewed in each one. The stages are: schematic, 60%, 90%, and 100% design.

Schematic Phase

In the first stage, the engineer presented to the team the new HVAC schematic design and various alternatives. During the review of the schematic drawings, the engineer requested the amount of temperature controlled zones required at the building. During a meeting with the GMD director, a list of zones was discussed and later presented to the mechanical engineer. The Directors asked for sixty-seven zoned controlled areas in the building.

60% Review Phase

The engineer presented design drawings in the 60% and 90% revision stages. During the 60% review the discussion if the use of a chiller to supply cold air to the building or rooftop units arise. The engineer's recommendation was a chiller, but budget wise the team preferred the rooftop units. After subsequent meetings were the possibility of using rooftop units was discussed the engineer presented a major reason why we should use a chiller. The installation of rooftop units is not an option due to code regulations by the City of Naples. By the actual City code if we were to replace this type of units in the roof the façade has to cover them so no one can see them from the front of the building. Because structural design modifications were too costly, and maintenance difficulty this alternative is not considered.

- Analysis/Discussion cont.-

90% Review Phase

The team reviewed the 90% delivery of drawings and specifications and discussed the findings. The HVAC Facilities Maintenance team provided their feedback and comments to drawings as requested by the team. The construction process is a major concern because all services have to continue on a daily basis without interruptions. A meeting to discuss the construction phases with department directors occurred and all questions and concerns accurately answered satisfied everyone.

100% Review Phase

After the 100% final delivery of drawings was made the team considered the construction estimate and determined it was in budget.

As per our request, Directors made the last meeting before the bid process started and all questions employees had were answered and explained including the type of inconvenience they would encounter during construction. The permit process has started and it should be completed during the next month. The construction will last for five months during the nights starting next January.

- Conclusions-

After many years replacing rooftop units, making repairs to the HVAC system of the building and spending thousands of dollars the problem that was causing areas of the building to have temperature fluctuations was solved. The installation of a new HVAC system including new air ducts, air handling units, and two air-cooled chillers is scheduled to start during the month of January 2017. The construction of all interior duct work is during the nights, so there is no interruption to the public services offered to the public. The work is scheduled to be done in four phases and finish in a five month period.

The replacement of the existing chiller and the installation of the new one will take place first, and it can start simultaneously with the interior work since they will not have a conflict. Proper communication techniques used during the design process made possible Directors and personnel in the building know and understand the construction process schedule and how it will develop.

- References-

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