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Evaluation of a Municipal Services Building Under the Energy Performance of Buildings Regulation

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***Abstract* - The environmental damage caused by entering into the building process without considering the energy performance of the building in residential areas with a high density of residents and people such as Istanbul is at a considerable level. In such metropolitan cities, it is known that the majority of areas devoted to residential + commercial areas. Much of the reconstruction areas that have been have been the part of commercial area are often utilized as shopping malls (business centers) and such huge commercial buildings have a say in the energy usage policies of the area in which they are built.**
In this study; the "Municipality Service Building" located in the district of Bagcilar, Gunesli in Istanbul province, which is one of the most frequently used structures among the above-mentioned high-density regions, is examined within the scope of the Energy Performance Regulation No. 27075. The project, detail points are examined and the architectural, mechanical projects are considered together and evaluations have been tried to be made.

***Keywords* - Energy Performance; Regulation; Building Energy Performance.**

I. INTRODUCTION

Energy efficiency is the reduction of energy consumption per unit of service or product quantity, without leading to a decline in living standards and service quality in buildings, in production quality and quantity in industrial enterprises [1]. Various laws and regulations, which regulate the Building Energy Performance show a road map and which are compatible with the construction conditions, have been issued, especially in the developed countries. In Turkey, Building Energy Performance Regulation No. 27075 dated December 5, 2008, which is under the authority of the Ministry of Environment and Urbanization, is in force to determine and regulate the energy usage criteria of constructions.

Technological developments increase human's dependency to energy. Therefore, it has critical role in country's economic growth and development. But energy become an important issue in world's agenda due to lack of non-renewable energy sources in near future and environmental pollution which is produced from non-renewable energy source consumption. As it is known building sector is responsible from significant portion of energy consumption and greenhouse gas emission. Therefore, energy efficiency in buildings have important role for country's economic growth and development [2].

The environmental damage caused by entering into the building process without considering the energy performance of the building in residential areas with a high density of residents and people such as Istanbul is at a considerable level. In such metropolitan cities, it is known that the majority of areas devoted to residential&commercial areas. Much of the reconstruction areas that have been have been the part of commercial area are often utilized as shopping malls (business centers) and such huge commercial buildings have a say in the energy usage policies of the area in which they are built.

In this study; the "Municipality Service Building" located in the district of Bagcilar, Gunesli in Istanbul province, which is one of the most frequently used structures among the above-mentioned high-density regions, is examined within the scope of the Energy Performance Regulation No. 27075. The project, detail points are examined and the architectural, mechanical projects are considered together and evaluations have been tried to be made (Figure 1)

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Figure 1 Bagcilar Municipality Service Building Entrance Facade

1. Design And Calculation Basis:

The work area which is owned by Bagcilar Municipality; is in Istanbul Province, Bagcilar District, Gunesli quarter. It is planned to construct Bagcilar Municipality Service Building with a total construction area of 37,965 m² in the 7556 m² sqm area gross floor area. The building which is used as a service building in the form of 2 basements + ground floor+ 5 floors is being constructed in the parcel.

Figure 2 Inner court of the building

The energy performance of the buildings as a passive system and the energy efficiency of the mechanical and electrical-electronic systems in the building are directly related to the architectural design parameters of the building (Figure 2). Among these parameters, the most important ones are the location of the building according to other buildings, the position, direction, form, and building shell. Each of these parameters should be determined in relation to each other in such a way that each of them plays an important role in energy efficient building design and therefore intelligent building design and the effects on the energy performance of the building are related to one another and that each of them makes optimum use of renewable energy resources [3].

Heating, cooling, natural ventilation, lighting needs are kept at minimum level and natural heating, cooling, ventilation and lighting facilities are utilized at the maximum level considering architectural design of the buildings, zoning and island / parcel condition [4].

The place where the building is located; it is also important to know the values of the climate elements such as solar radiation, air temperature, air movement and humidity affecting energy expenditures, as well as the micro-climate conditions which play a very important role in the energy efficiency of the building (Figure 3) [5].

Solar control and natural ventilation systems may be needed on the building envelope as well as the design variables listed above, so that the building can be protected from environmental factors such as solar radiation and wind when necessary. In order to keep the building's energy costs to a minimum, these systems must be designed in the appropriate shapes and sizes in the appropriate directions [6].

Figure 3 Satellite view of the area

The heating and ventilation loads were determined as follows by taking into account the interior design conditions specified in the Chamber of Mechanical Engineers, Turkish Standards and ASHRAE standards (Table 1).

Table 1 Summer and winter seasons standard indoor temperatures

Category	Winter Temperature (˚C)	Summer Temperature (˚C)
Offices	20	24
Wet areas	18	-
Other areas	20	24

1.1. Thermal insulation

The "TS 825 Building Thermal Insulation Standards" published on 14 June 1999 and the "Thermal Insulation Regulation" published on May 8, 2000 together are applied as mandatory standards for all licensed buildings to be built in our country as of June 14, 2000.

Some of the reasons for using this standard can be listed as follows:

- Protection of temperature influences in people's living or working areas is important for human health, repair costs, fuel economy and initial construction costs.
- Sufficient protection from temperature effects is a key condition for ensuring an internal, climate-friendly environment for health.
- Heat requirements and heating costs of the volumes depend on the thermal insulation and heat storage capabilities of the components.
- Adequate protection from temperature effects reduces water vapor condensation on the surfaces of surrounding volume components and minimizes movement caused by temperature changes in the components thereby reducing maintenance costs, reducing fuel costs and preventing further damage to the structure.

And through the use of this standard;

- It provides energy saving by limiting the amount of energy used for heating the buildings in the country.
- specifies the standard calculation method and value to be used during the calculation of the energy demand.
- Ensure that buildings with energy-efficient comfort conditions are produced.

1.2. Heat Loss Calculations

- Heat loss calculations are made according to DIN-4701 infiltration method.
- External climatological conditions for the building are accepted as described in previous chapters.
- Building indoor conditions are accepted as described in previous chapters.
- All facades of the building are considered free (Figure 4).

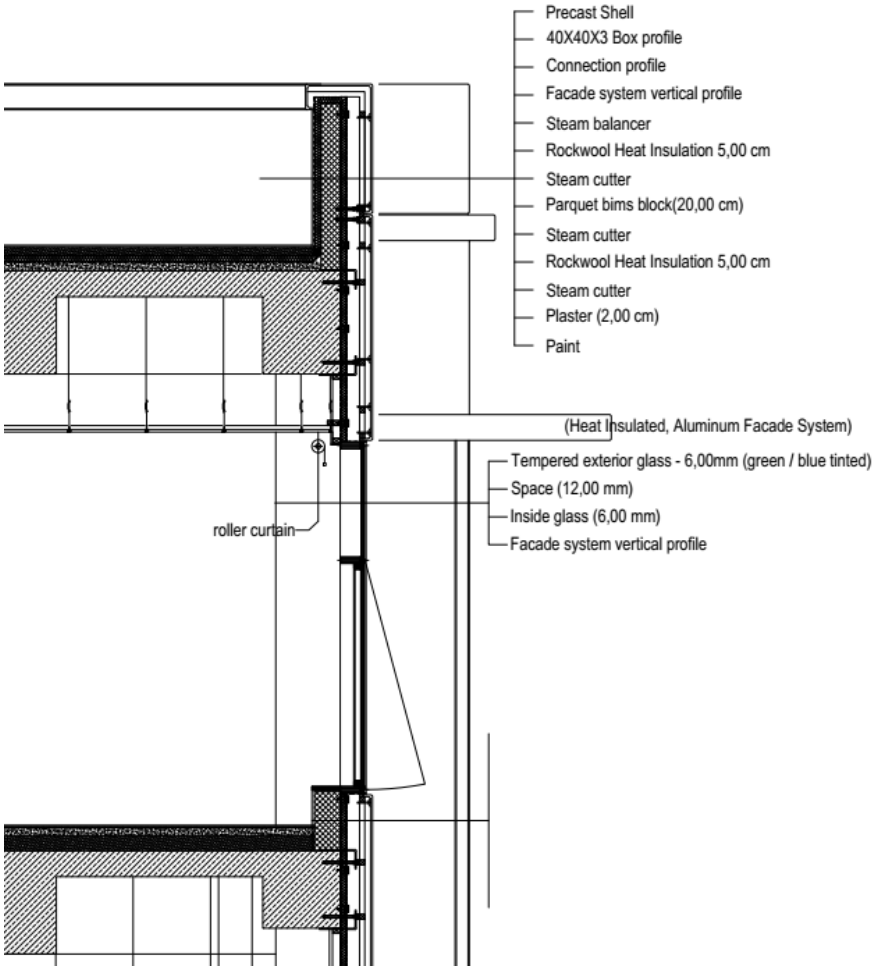

Figure 4 Facade Detail

1.3. Heat Gain Calculations

- Heat gain calculations are made according to ASHRAE Standards.
- External climatological conditions for the building are accepted as described in previous chapters.
- Building indoor conditions are accepted as described in previous chapters.

- The following loads are taken into consideration in the calculation of the heat gain of the air conditioning system.

  a. External Loads:

    - Heat gain from windows
    - Periodic heat gain from walls and roof
    - Convection heat gain from windows
    - Convection heat gain from non-air-conditioned areas
    - Heat gain with infiltration

  b. Internal Loads:

    - Heat gain from electrical devices
    - Heat gain from illumination
    - Other electrical appliances, motors, etc.
    - Heat gain from people

- The conditions for conditioning the environment are determined by the date and time at which the maximum heat gain occurs, within the framework of radiation acquisition from glass surfaces that are affected by the heat transfer from the roof and walls, which are influenced by a certain time delay.
- Lighting heat gain is taken as 15-25 W/m2.
- Heat gain from people is taken as follows:

Table 2 Heat gain from people

Body Activity	Sense Heat (W)	Hidden Heat (W)
While sitting, resting	70	35
While sitting, light duty	70	45
Office work, normal	75	55
Standing business	75	70
Walking, slow work	75	55

1.4. Using Hot and Cold-Water Installation

It is thought that the use of cold water from the existing water network is to be stored and pressurized in the water storage in the basement. Reserving water in sufficient quantity for fire water and fire pump group and usage water hydrofoils are arranged on the third basement floor.

1.5. Automatic Irrigation

The entire green area was planted and the irrigation is made with dripping pipes with pressure regulated at intervals of 30 cm taking into consideration the planting shapes and distances of the plants. The amount of water to be used by all plants is calculated and the system is created in accordance with effective root depth.

In the sprinklers, white foamy water effects and a wind resistant 'sparkling' system were used to provide a contrasting, living water image (Figure 5).

Figure 5 Sprinklers and irrigation

II. Result

Building Energy Performance analysis; as a valuable and important element of a building as architectural and static design conditions, it finds acceptance and application area before construction. In addition to the sense of safety and comfort of the people living within a structure, what type of energy use / saving behavior should be seen as one of the main criteria of the calculation criteria. In this context; public buildings, which are centers of attraction for settlements, should be considered as a primary priority in the context of energy performance. In this study; The energy performance data of the municipality service building, which is under construction in Bagcilar Municipality borders, has been analyzed, heat insulation, hot and cold-water usage, automatic irrigation, heat loss and gain analysis have been made and the results have been tried to be evaluated.

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