ANNEX II
Traduccion Tercera Llengua
3. Stage 1: Survey Data

This section will be a data gathering in order to understand how the building, its features, its strengths and weaknesses in aspects of energy efficiency, by further research to make improvements for action achieve improved energy and efficiency.

To accomplish this task, there are two different types of data gathering:

- Static-data
- Dynamic-data

The survey data of the school was carried out during the visits where was analyzed the components of the building and has been scoring all its features to make it a collection and subsequent analysis exhaustive of the situation in which the building is located.

The data is not visible to the naked eye, such as the interior components of the building envelope or partitions, taken from the archive of the school and the knowledge of the technician responsible for it.

3.1 Static Data

Considered as static data, give those architectural features of the building, because they vary over time.

Static data must be classified according to the information provided:

- Architecture
- Construction
- Facilities
- Profile-use

3.1.1 Architecture

Data architecture helps to understand how the building respects the environment. Can influence several factors such as: the orientation of the object of study, the volume occupied or shadows that can occur on the front due to the surrounding buildings.

This old building has a story behind it. Formerly a part of the present building was the Escola Dominical Nostra Senyora del Carme and the remaining parts houses. It was later acquired by the nuns Missionaries of the Immaculada Concepció and was officially opened in 1934, was the second educational institution for girls who were in the city. In Plaça de les Tereses front of the school, also had Monastery of the la Immaculada Concepció de les Carmelites Descalces where during the Civil War in 1936 the community was scattered and burned the monastery. Because of the impending disaster and the religious revolt were forced to change the name of the school and they called Mútua Escolar Carme Gibert, in memory of the woman who had donated the house Street San Rafael, current street El Torrent. The school grew through the acquisition of adjoining houses where the original structure retained intervening only in the unification of the façades and opening doors to connect with each other dwellings. The building consists of the merger of five houses. Reports dating back to the construction of the entire building about 1924, but it is evidence that the houses are made of which is over 150 years old. In 1975 the Escola Pia de Mataró absorbs the nuns of the Immaculada Concepció.

Thus, we see the structure of the building clearly differs in 5 modules. The front main street El Torrent is listed in the catalogue of the Special Plan Architectural Heritage from Mataró, because it has engravings. The level of protection that is present b / f, ie, protecting the façade inscription appears.

The school has a total floor area of 2,531.60 m², 637.30 m² of which belongs to the surface area of the patios. The building has direct access to the street El Torrent lobby with access to the school and to the square of the Tereses with access to the patio. It consists of ground floor, first floor, second floor and third floor. All plants are sectored each other and connected by a lift and stairs.

The school is intended for use in teaching kids - kindergarten, so has distribution facilities appropriate to the age of the users.

Ground floor is equipped to:

- Main entrance / lobby of the school
- 4 Classrooms P3 (3-4 years) with toilet each
- Room-teachers
- Room-psychomotor
- Sales of visits
- Room-material
- Room-maintenance
- 2 Yards

First floor is equipped to:

- 4 Classrooms P4 (4-5 years)
- Classroom-English
- Small-Dining
- Dining-large
- Room of teachers
- Kitchen
- Bedroom
- Toilet

Second floor is equipped to:

- 4 Classrooms P5 (5-6 years)
- Room-teachers
- Split-Classroom
- Classroom-Music
- Multi-Classroom
- Classroom-English
- Toilet
Third floor is equipped to:
- Library unused

All plants are connected internally by a secondary staircase located in the south-west corner of the building is not currently used by the users as it has a difficult access and a lift. The main staircase connects the ground floor to the second floor through the first floor was built 2 years since the previous was obsolete. Also found a high level outdoor courtyard that connects the first floor corridor outside.

Like all construction is very important to analyze the orientation of the building, as a good orientation is synonymous with good running passive strategies. The building work object can be divided now into two front wings, the first consisting of common areas, common room and classrooms; this is adjacent to the adjoining outbuilding and the other parties to the facade with much patio shade that does not cause the outbuildings can take advantage of the solar collector. The second wing is divided on each floor that leads to a main dealer in the classroom. Dividing classrooms with access to the north-east, who can enjoy direct solar energy, and the facades with access to the south side to enjoy throughout the day direct solar energy as the outbuildings do not produce no shadow on the building, causing only a small part shade in the yard throughout the year as the effects of the sun.

Later it will be interesting to find a system to take this incident solar energy producing benefits available.

### 3.1.2 Construction

The data provide information on construction works as the building itself, if you do it correctly or harmful. These data help to understand what the function is convex in the heat balance of the building; considering the types of enclosures, the materials involved in the construction system and the layout and number of openings present on the walls.

A study of building construction systems subject as provided in the CTE Basic Document HE Energy Saving as construction elements and the coefficient of thermal transmittance calculated with the LEADER program as established by the CTE of the thermal envelope, interior partitions and vertical and horizontal openings depending on the type of wood that have.

The elements of the vertical components are arranged inside to outside of the building, and the horizontal components from top to bottom. The thicknesses of materials are expressed in meters.

#### Thermal envelope

The thermal envelope must have certain minimum general. Must function as support is ensuring stability against static behaviour and movements compatibility between physical materials (static deformations, thermal and hygroscopic) and chemicals (chemical incompatibilities and rheological movements). Comfort is also an important factor, as occur for an optimal energy exchange must take into account the isolation system, the inertia that has set and must present a radiation control.

This includes the walls and items in contact with the ground.

<table>
<thead>
<tr>
<th>Monolayer Wall 30cm</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cement rendered</td>
<td>0.020</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Solid brick 1 Catalan food</td>
<td>0.280</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. White plaster</td>
<td>0.020</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This construction system is in the north-east, southeast and southwest of the second wing of the building where there are classrooms.
Monolayer Wall 15cm:

Façade Monolayer 15 cm

1. Cement rendered 0.020
2. Solid brick 1/2 Catalan food 0.115  \( U = 2.80 \text{ W/m}^2\text{K} \)
3. White plaster 0.020

This construction system is the exterior facades southeast, southwest and northwest of the first wing of the building.

The construction system of the facades of the building is heavy monolayer, since the time of building regulations was not regulated system insulation or air chamber.

Dividing Wall:

Dividing Wall

1. White plaster 0.020  \( U = 1.95 \text{ W/m}^2\text{K} \)
2. Solid brick 1 Catalan food 0.280
3. White plaster 0.020

This construction system is the outbuilding, which share a party wall, a portion of the north-west of the building.

Sloped Roof:

Sloped Roof

1. Spanish tile 0.020  \( U = 2.54 \text{ W/m}^2\text{K} \)
2. Cement mortar 0.020
3. Ceramic plank 0.100

This dividing wall is the building forming the longitudinal end of the previous homes before the merger to create the building as it is known today.

Earth Ground contact:

Earth Ground Contact

1. Clay tile 0.020  \( U = 3.03 \text{ W/m}^2\text{K} \)
2. Mass concrete 0.250

Interior partitions

You also need to study the elements that form the internal partitions of the building, as these sectored in the living areas, living areas and areas not unconditional.

This section will differentiate between horizontal and vertical partitions inside that differentiate the different areas of the building.

Charge Wall:

Charge Wall

1. White plaster 0.020  \( U = 1.95 \text{ W/m}^2\text{K} \)
2. Solid brick 1 Catalan food 0.280
3. White plaster 0.020

This type of gap has a size large enough to being a partition, this is because it belonged to the closing of an old house before it merged to form the current building set.

Rammed Earth Wall:

Rammed Earth Wall

1. White plaster 0.020  \( U = 1.74 \text{ W/m}^2\text{K} \)
2. Rammed Earth 0.500
3. White plaster 0.020

This dividing wall is the building forming the longitudinal end of the previous homes before the merger to create the building as it is known today.
### Interior Wall 10 cm:

<table>
<thead>
<tr>
<th>Layer</th>
<th>Insulation Value</th>
<th>U Value (W/m²K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. White plaster</td>
<td>0.020</td>
<td></td>
</tr>
<tr>
<td>2. Ceramic partition</td>
<td>0.060</td>
<td>2.64</td>
</tr>
<tr>
<td>3. White plaster</td>
<td>0.020</td>
<td></td>
</tr>
</tbody>
</table>

### Interior Wall 5 cm:

<table>
<thead>
<tr>
<th>Layer</th>
<th>Insulation Value</th>
<th>U Value (W/m²K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. White plaster</td>
<td>0.020</td>
<td></td>
</tr>
<tr>
<td>2. Ceramic partition</td>
<td>0.040</td>
<td>3.03</td>
</tr>
<tr>
<td>3. White plaster</td>
<td>0.020</td>
<td></td>
</tr>
</tbody>
</table>

### Floor structure between floors and under roof:

<table>
<thead>
<tr>
<th>Layer</th>
<th>Insulation Value</th>
<th>U Value (W/m²K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clay tile</td>
<td>0.020</td>
<td></td>
</tr>
<tr>
<td>2.1 Cement mortar</td>
<td>0.100</td>
<td>3.03</td>
</tr>
<tr>
<td>2.2 FSU ceramic between balk</td>
<td>0.300</td>
<td></td>
</tr>
<tr>
<td>3. White plaster</td>
<td>0.020</td>
<td></td>
</tr>
</tbody>
</table>

As seen in the images, the wall load of 30 cm apart mud walls and set 5 homes that make up the building today.
Openings

One of the important components in analyzing the building is also the number of openings that present, and especially the building work object that appears in many of its facades. As mentioned above the fate of the building was to be demolished, but it was decided to rehabilitate it. One of the steps we took in 2013 was start changing joinery windows. Due to the high cost with efficient thinking facade began to cool, the northeast since the Northwest does not have openings. So in the building there are two types of openings.

Wood Openings:

<table>
<thead>
<tr>
<th>Glass type</th>
<th>Frame</th>
<th>% Frame</th>
<th>Permeability m³/h m² a 100Pa</th>
<th>U (W/m²K)</th>
<th>Solar protector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Window with wood frame</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass type</td>
<td>Monolithic de 4 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame</td>
<td>High wood density</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Frame</td>
<td>10,00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permeability m³/h m² a 100Pa</td>
<td>50,00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U (W/m²K)</td>
<td>5,35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar protector</td>
<td>0,77</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Door with wood frame and glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass type</td>
</tr>
<tr>
<td>Frame</td>
</tr>
<tr>
<td>% Frame</td>
</tr>
<tr>
<td>Permeability m³/h m² a 100Pa</td>
</tr>
<tr>
<td>U (W/m²K)</td>
</tr>
<tr>
<td>Solar protector</td>
</tr>
</tbody>
</table>

Metallic Openings:

<table>
<thead>
<tr>
<th>Glass type</th>
<th>Double glass with camera 4-12-4 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame</td>
<td>Thermal failure breaking 12 mm</td>
</tr>
<tr>
<td>% Frame</td>
<td>10,00</td>
</tr>
<tr>
<td>Permeability m³/h m² a 100Pa</td>
<td>27,00</td>
</tr>
<tr>
<td>U (W/m²K)</td>
<td>1,84</td>
</tr>
<tr>
<td>Solar protector</td>
<td>0,64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Glass type</th>
<th>Double glass with camera 4-12-4 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame</td>
<td>Thermal failure breaking 12 mm</td>
</tr>
<tr>
<td>% Frame</td>
<td>30,00</td>
</tr>
<tr>
<td>Permeability m³/h m² a 100Pa</td>
<td>27,00</td>
</tr>
<tr>
<td>U (W/m²K)</td>
<td>2,32</td>
</tr>
<tr>
<td>Solar protector</td>
<td>0,52</td>
</tr>
</tbody>
</table>

Thus, the facade facing north-east is composed of aluminium frame windows with double glazing and with the features described in this section, and all other windows are composed of windows with wood frame and glass monolithic. The door with aluminium frame and double glazing is the passage of the courtyard of the school hall. And the door is wood complete passing of the courtyard room psychomotor. The remaining openings of windows and doors are composed of monolithic glass and wood frame.

It then shows the % of openings that have facades of the building:

- Northeast: 36.38% of openings
- South-east: 25.84% of openings
- South-west: 29.46% of openings
### 3.1.3 Facilities

The data relating to various systems installed, facilities are also important in nature. Need to analyze the type of existing heating and cooling system in the building; and Lighting system and the production system, hot water and ventilation system.

#### Heating and Cooling

The building has no cooling system, as the hottest months of the year are when it is closed and is not necessary.

The heating system in the building is peculiar to the current situation. The building has a unique heating method; this consists of a set of electric resistance heaters connected to the mains. The electric heaters are radiant panels to heat production, most of them are brand Tymesa, which have a power of 2600 W, and brand Kendal with a power of 2800W. These are 35 years old and are no longer for sale on the market. Those classrooms where the stove was damaged heater has been replaced by a more modern but with the same characteristics. These stoves are scheduled to open during the winter months at 7 am and close at 6 pm.

Being a nursery they should be placed at a height of 1.80 m with respect to the ground for safety of children, this occurs in the area of the classroom floor (below The 1.80 m) where the users do not reach as warm as we know warm air tends to rise uphill. The building cannot operate passively without this system.

Users indicate that this heating system during the winter months do not get the optimum level of comfort suitable for a school.

#### Lighting System

The system and lighting in the building is based almost entirely on 36-watt fluorescent lamps to be added to the consumption of electromagnetic ballast that consumes 16 watts and 7, causing an average consumption of 48 W for each fluorescent approximately.

Partly lamps are inside the classroom, inside are sectored by a special system on and off. At the entrance of each classroom there are usually three switches for lamps with a sticker on each switch. The switch with the green sticker indicates that the lights are always open to keep the switch with the yellow sticker indicates a missing light in the study area can be opened and finally the red dot indicates that open in If missing a lot of light. The progressive system of colours imitates the colour of the traffic light where the green and red is permissive abuse.

Although classroom system is sectored in some cases this is wrong, because the zoning promotes the use of solar energy as a source of light, some classrooms have no sectored system adjacent lamps in the windows. That helps promote energy saving lights.

#### Hot water system producing

The school does not have locker rooms with showers, as only kindergarten and do not usually use them for performing gymnastics. For this reason the use of hot water is scarce. Only used in the kitchen to the dining room for washing dishes.

To supply this demand small amount of hot water are installed next to the kitchen under the porch on the first floor of the building, a natural gas boiler with an electric accumulator brand and model GV THERMOR ACI 100 T2L with a power 24000W, 230V electric potential and a maximum pressure of 0.8 MPa / 0.8 bar.

#### Ventilation system

The ventilation system used in school spaces is done through the windows of the building, taking advantage of the many openings they have.

All classrooms and most areas of the school contain large front openings that allow natural ventilation also live part of a natural light that works with energy saving.

As a general appearance to the building there is a system of separation of sewage system nor use of gray water. The building does not contain a common area with specific containers, different materials are deposited in the bins in each classroom along with recycling system and transported to specific containers located closer to the street adjacent to the southeast facade of the building.

### 3.2 Data Dynamics

Dynamic data are considered to those that do not remain constant, because they can vary over time depending on many factors.

It should be classified as dynamic data monitoring occurs:
- Follow-Consumer
- Monitoring the Intensity of Use
- Monitoring Management
- Analysis of Temperature and Humidity

#### 3.2.1 Monitoring of Consumption

This project has been monitored data resources and energy consumption of the building. This monitoring has been possible thanks to the facilitation of data required by the Escola Pia de Mataró, analyzed and classified in different years and periods in order to establish the thermal demand of the systems and carry out a subsequent rating building energy.

Electricity:

The electricity demand of the building can be divided into three groups according to their performance. The demand intended for the use of heating, lighting • Lighting + Strength.

Most of the electricity demand corresponds to the use of heating, as explained above is a system of electric heaters connected to the mains. Light system it would respect the secondly percent electricity demand, being a school has a lot of lights throughout the building. The use of force equipment would be reduced, not comparable with the demand of the other systems, as this represents a small percentage.

The power contracted by the school to the electric company is 71kWh, and this reflects the monthly bills of electricity. We have studied the different demands detailed and organized in 2013 to define the daily consumption of energy per day (kWh / day) and the amount of power
allocated to the heating system, which covers most demand in winter months. Section 4.4.1 explained later Consumption Analysis of Electric Power, will be represented in diagrams of the evolution of electricity consumption.

Monitoring of electricity is carried out every month when the bill arrives for the previous month.

**Natural Gas:**

The natural gas consumption is very low, because as stated above is only used to heat water for washing dishes in the kitchen after eating the meal. The boiler to be natural gas must be located in a ventilated, in this case is located under the porch on the first floor next to the kitchen.

As in the previous section, chapter 4.4.2 Analysis of Natural Gas Utilities, will be represented in diagrams how the consumption of natural gas during 2013.

Monitoring the consumption of natural gas is carried out every two months when the bill reaches the previous two months.

**Water:**

Water consumption is seen more dispersed, as it is consumed in the rooms of the building hygiene, the different sources of the yard, wash the dishes, to perform the daily tasks of cleaning among others.

As has been done in the previous sections, chapter 4.4.3 Analysis of water consumption, there is a diagram representation of the evolution of water consumption during 2013.

The monitoring of water consumption is conducted quarterly bill when it reaches the previous three months.