Updating a modern building

Renovation of the elementary school J. H. Pestalozzi

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Abstract

The elementary school Johann Heinrich Pestalozzi was built as a donation from the Swiss government after the disastrous earthquake in Skopje in 1963 /IX degrees MCS/, according to the principles of newly introduced seismical building as well as the principles both of the modern education and modern architecture. For forty years, thanks to its flexible organization and good architectural design, it was capable of satisfying the different demands in the education process posed in front of it. At present the school is in poor condition mainly due to negligence and lack of maintenance.

Today, when faced with necessary renovation (restoration, partial reconstruction and repalcement, together with the question how to renew the building, there are other questions which pop up and that have never been asked before:

- is this building to be treated as a heritage
- how to define its values
- how to renew/restore a modern building

Still, the building has a certain future, not being endangered in a sense of being abandoned or out of function.

Figure 1: The elementary shool Jochan Heinrich Pestalozzi

Introduction

There is relatively big number of school buildings built after the WW2 in Macedonia. However, most of them are following the same shablonized concept not capable of satisfying the complex modern educational needs.

In that sense, the elementary school named “Johan Heinrich Pestalozzi” is special—connected with the name of two big figures in the field of modern education:

- Alfred Roth, famous Swiss architect specialized in the field of school facilities, capable to follow the changes in the modern education and
- J.H.Pestalozzi– a great Swiss educator from XVIII and XIX century to whom the school is dedicated; a person who introduced new methods in the education process and was one of the founders of modern, more liberal schools /learning through action, work, practice/. It was not just a case that this school building was connected with a figure that is a kind of a symbol in the field of education.

Background

Being always on important crossroads, the territory of Macedonia has a rich historical background and Skopje is no exception from it. The capital exists on more or less same territory throughout centuries: from ancient Scupi, mediaeval Byzantine and ottoman Skopje, through XIX century till today, under changes of different foreign domination, surviving wars, floods, earthquakes of disastrous proportions, fires, invasions etc.

However, not going deeper in the history, the accent of this paper is on the second half of the XX century, a period that hardly even enters in the citizens perception as a part of the history.

Today when faced with very careless behavior towards the architecture of this period in general, the question of its values should be posed, having in mind that it is almost half a century old and under no legal protection.

Geography

Skopje, the capital of the Republic of Macedonia is situated in the northern part of the country /longitude: 21˚ 26´ east, latitude: 42˚ 0´ north; elevation: 240m above sea level/.

The city has a longitudinal disposition in direction east-west, divided with the river Vardar in two parts. In the north-south direction its growth is limited with the position of the mountains Vodno (south) and Skopka Crna Gora (north).

Figure 2. Skopje – Panormic view towards south

According to the official sources from 2001 from the total number of inhabitants in the country (2.071.210) 533.700 inhabitants live in Skopje, unofficially the number is near to a million; and having in mind the daily commuters – close to 1.5 millions.

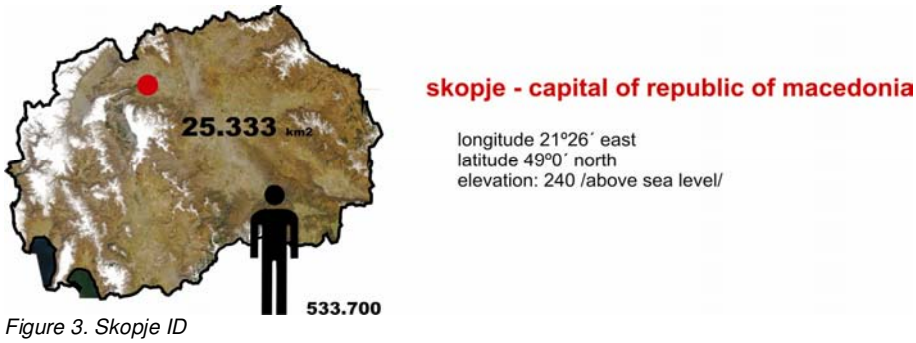

Figure 3. Skopje ID

Climate

Although being very near the Mediterranean basin, the city experiences a continental climate, with warm and dry summers and cold winters. The

lowest temperature is usually in January, said to be around -5º C and the warmest in July and August, around 31º C. However, lately, these temperature amplitude is even bigger; lately, the temperature in summer often goes up to 45º C and in winter up to -20º C (-25º C).

Recent history

- On July 26th 1963 Skopje suffered an earthquake of disastrous proportions /IX degrees MCS/[1]. 1070 people died under the ruins, more then 3300 were severely wounded and more then 80% of the dwellings were totally ruined or damaged beyond possible repair. From the total number of 200.000 inhabitants more then 150.000 suddenly became homeless. In the earthquake suffered infrastructure, schools, hospitals etc. The calculation of the total damage was between 600 and 800 million of dollars (today three times more in value).
  The notice for the Skopje earthquake was immediately spread throughout the world and necessary help for the people without a shelter begun to arrive immediately in form of blood, food, clothes, tents, financial aid etc. The type of help slowly changed according to the needs of the suffering city- solid objects, hospitals, schools, whole residential areas with prefabricated houses were then assembled and are still in use - symbols of different countries solidarity and participation in the city rebuilding.
  The disastrous clearance that happened with the earthquake caused complete changes in the environment. The catastrophe was survived and the life had to carry on; the tendency was to build a modern city up to date with the global mainstream then. Space was opened so that the contemporary architectural scene could enter – first of all with the general plan of Kenzo Tange[2]. The city grew up in area and in number of inhabitants.
  In that time, the Swiss government as a help for the ruined city, commissioned a school from the famous Swiss architect Alfred Roth[3].
- 1965 – the contract was signed
- 1967 – the building process started
- 1969 – was the official opening of the school; since then, in a period of almost 40 years, the building works with an unchanged function as an elementary school.
- 2007 spring/summer – The Swiss Embassy in Skopje asked the Faculty of Architecture to form a team that will do a preliminary research study of the present damages on the building, a repair proposal and preliminary cost estimation.[4]

Location, spatial/functional organization

The elementary school Johann Heinrich Pestalozzi is situated in a residential area in the centre of the city. It includes a complex of buildings (number of pavilions with different functions) and open spaces.

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[1] Empiricaly, it was calculated that the energy released with the earthquake was couple of hundred times bigger than the energy released with the bomb in Hiroshima.

[2] Unfortunately, the leap was too big and great part of the work remained unfinished even today, among them the key issues connected with the infrastructure.

[3] Alfred Roth (1903-1998) is a Swiss architect educated in Karl Mozers and Le Corbusiers atelier, world widely known as a specialist for school buildings.

[4] The team was consisted of: Prof. Ph.D Tihomir Stojkov, architect, Architectural constructions (leader of the team); Prof. Ph.D Vladimir Simovski, civil engeneer, Statics and strength of materials; Prof. Ph.D Mihail Tokarev, architect, History of Architecture and Arts and Protection of Cultural Heritage; Dimitar Papasterevski, architect, assistant on Architectural constructions; Ana Ivanovska, architect, assistant on History of Architecture and Arts and Protection of Cultural Heritage

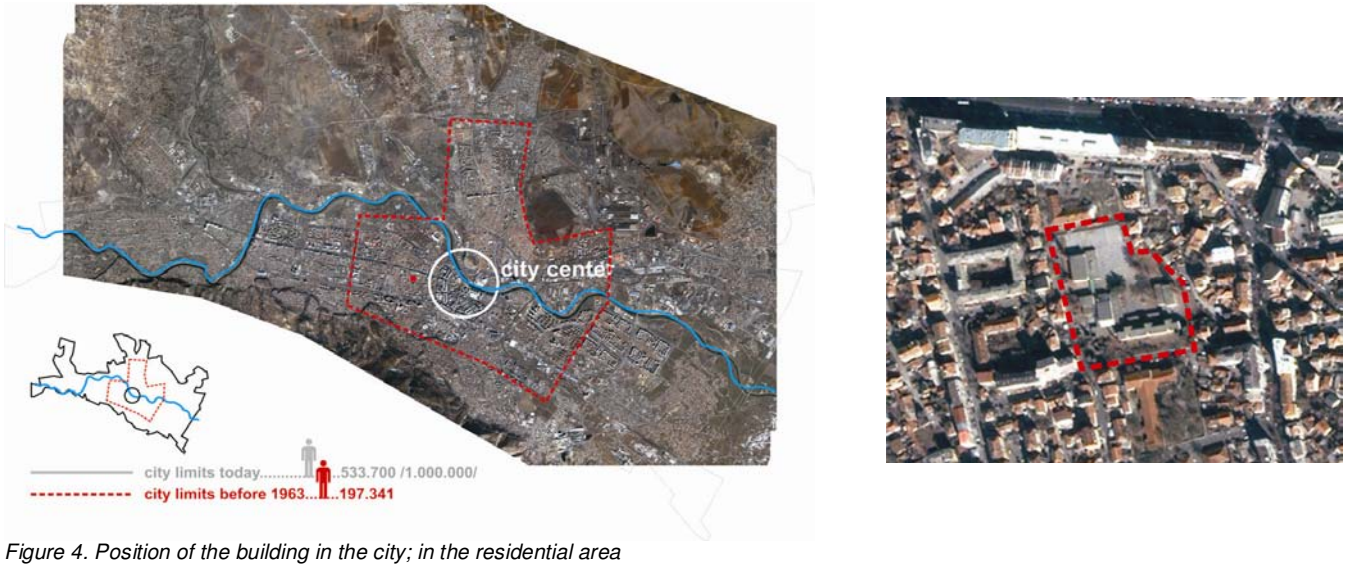

Figure 4. Position of the building in the city; in the residential area

The development of the contemporary thought can be followed in the concept and the spatial organization of the building, very different from the organization of the school buildings before. The design of the building tends to fuse functionality and aesthetic in one. Perhaps, a distant connection could be found with the concept of the Bauhaus school in Dessau especially having in mind that Alfred Roth is one of the last in the generation of modern 50 architects closely connected with the functionalist cause.

The cubic structures vary not only in function but also in their volumes, façade design, spatial structures, surfaces etc.

The building as a whole is divided in number of tracts:

Figure 5. Situation plan

A. three storey wing with classrooms – The classrooms are grouped and between each group there are separate vertical communications and wardrobe. Every classroom has square floor plan that enables rational organization of different ways of teaching/education. A specific silhouette/profile of the building is formed by moving the upper levels towards south. This provides roof light from the north side and shade on the south side.

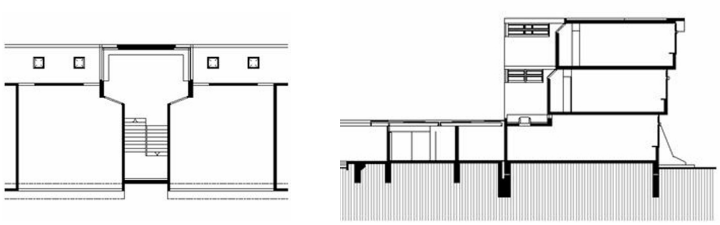

Figure 6. Detail of the plan; Section through the classroom wing

B. two stories of laboratories building (biology, chemistry, ateliers, crafts workshop)- situated on the east side of the complex,

C. festive hall (aula) with additional spaces: library, kitchen, refectory, contact room (for parents), rooms for administration and teachers offices,
D. gym hall - northwest corner of the ensemble,
- the main functional units are connected with lower parts where administration, toilets, corridors and additional secondary functions are placed. The connection is made with closed corridors and semi-closed porches.

With this position of the volumes a square schoolyard is formed in the middle of the location. It can be approached from the semi closed porch. The open sport fields cover approximately 1/3 of the total school area, mainly situated on the north and east side. Originally, it was planned that the gym and the open area playgrounds could be used independently by the people who reside in the neighborhood.

This schoolyard is mainly used as a playground but it could also serve as an open air festive hall (specially having in mind the warm and dry climate in Skopje).

Figure 7. The schoolyard

The total spatial structure has asymmetric and dynamic composition. The pavilions have different appearance depending on their function. Except for the festive hall, whose volume is rising above the rest and is defined by sloped roof, the other are covered with flat roof terraces.

The main entrance in the building is situated on the west side in the part with the festive hall.

Construction and building materials

The main building material in the complex of buildings, in accordance to the time when it was built, is reinforced concrete sincerely showed/exposed on the facades. As it was common with the other modernist buildings new, industrial materials were introduced in order to create crisp, maintenance-free building /once again the concept was proven to be a myth/.

The whole complex is mainly constructed in two systems:
- reinforced concrete in parts **A.** and **B.** – structural elements (walls, ceilings and flat roof terraces)
- steel frame structure **C.** and **D.** - gym and festive hall and lower additional spaces

A. **Classroom wing** – The load bearing structure is totally built from reinforced concrete: floors/ceilings and walls are structural elements in themselves /crosswall construction/ so that there is no need of separate frame here. The walls have 18-22 cm constructive thickness in both directions + 20 cm thick ceilings. However, there is no clean break here since the walls are built in layers – combination of reinforced concrete and brick in order to provide better thermo and acoustic protection. The cavity is filled with thermo insulation. The roof is a flat terrace with rooflights on the first floor. The potential of creating a roof garden was never exploited in this building. Since the floors are slightly recessed towards south, there is possibility for north roof light. The most specific for this part is its seismic resistance obtained through a very unconventional method – this part of the building lies over pneumatic foundations.

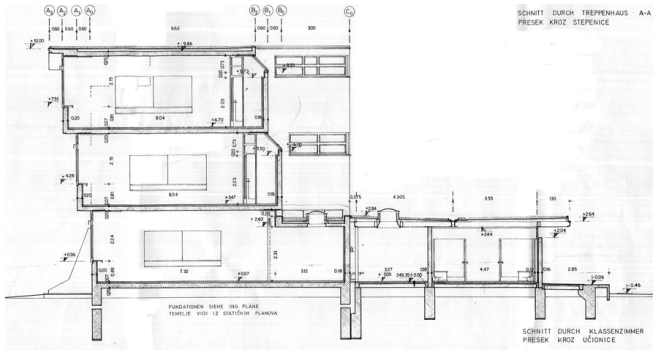

Figure 8. Clasroom wing: photo, section scanned from the original design

B. **The Laboratories wing** – all three floors (basement, ground and first floor) are made in reinforced concrete (walls+ceilings) same as in part **A.**

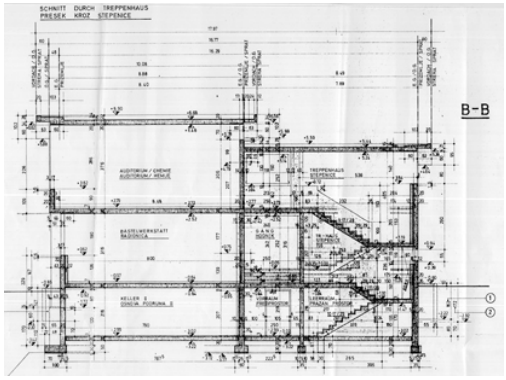

Figure 9. Laboratories: photo, section scanned from the original design

C. **Festive hall + additional spaces** – The main construction is steel frame construction on the part of the festive hall (because of the wider spans) with light panel filling between the columns + reinforced concrete walls and ceilings for the additional spaces. Large part of the facades is covered with flat or waved asbestos-cement plates. The additional rooms are built independently with reinforced concrete construction. Since the roof is sloped/pitched the frames have different height.

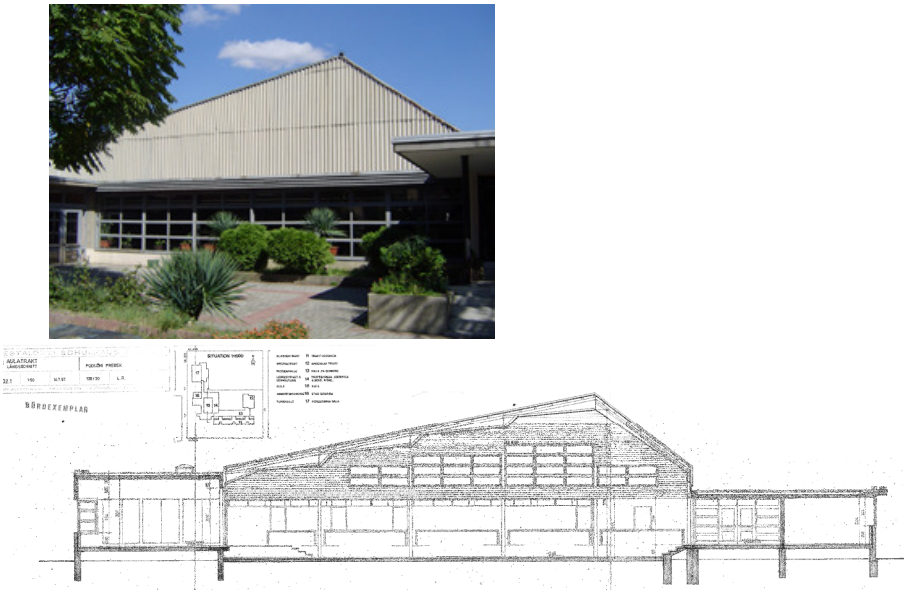

Figure 10. Festive hall: photo, section scanned from the original design

Porches, entrances, hall – they are all on ground level, built with light steel construction (columns Ø110 + U beams 200 mm).

D. **Gym hall** – It is built in two segments: higher (the gym) and lower (additional space, wardrobes, toilets etc). The main construction is steel frame, with lateral reinforced concrete walls /20 cm thickness/. For better thermo insulation the walls are also combined /20 cm concrete+ 5 cm thermo insulation material + 12 cm brick masonry; total 39 cm/. One of the facades is covered with waved asbestos-cement plates.
Steel construction: columns – I profiles 280 mm; beams h=500 mm. Above the main construction, secondary beams are placed I 220 mm; above the structural elements there are light wood-concrete plates 12 cm, slightly angled in order to provide the necessary angle for the roof terrace. [5]
Just like the previous segment the steel and concrete structures are done independently as well.

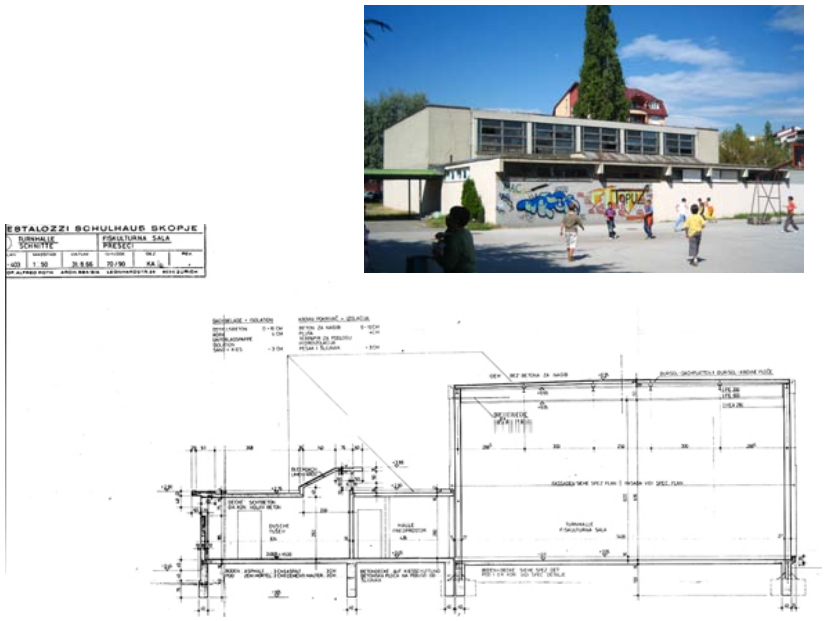

Figure 11. Gym hall: photo, section scanned from the original design

[5] All the information concerning the original design and construction are taken from a copy of the project situated and available for use in the Archive of Skopje.

All doors and windows in the building were originally wooden; the doors are often combined with glass; what is especially interesting is that most of the equipment is designed by the architect specially for this building.

Analysis

Inventory of the possible values:

- special historical value since it was built after the earthquake in Skopje, a date that changed the whole appearance of the city and is still carved in the memory of its citizens
- highly emphasized symbolic value - the building itself represents a symbol of solidarity, help and unity in a time of disasters and crises
- very special architectural value:
    - high architectural and aesthetic qualities
    - utilitarian value – the functional organization of spaces is such that educational needs are satisfied in a great manner
    - introduced a new typology of school building
    - designed by a very famous architect, in this respect being one of the very few buildings in Skopje;
    - special, very rare, aseismic construction /foundation over pneumatic pillows/, very innovative and pioneer in the time when built;
    - high quality of building and equipment

- high pedagogical and cultural value as an example of the high modern architecture on the territory of Macedonia that served as an example for future building; an example of the trends and the way of thinking in the time when it was built; it was mainly designed in Switzerland but Macedonian construction companies were also involved both in the process of design and in the process of building
- the building has strongly expressed identity
- the building has preserved its authenticity; due to a lack of money big changes were not executed.

Legal Protection

Status: Since the legislation in Republic of Macedonia does not treat the buildings from the recent past, the building is not listed for protection or under any legal protection yet.

Having in mind the values and according to the legislation for cultural heritage on the territory of Macedonia, this building can be considered as a built cultural historical heritage from the second category with certain elements from the first category (such as the particular construction system, rare and untypical example on international level with emphasized specialized and scientific character).

Creating the guidelines for protection of this valuable building according to the international conventions for built heritage (working in the same time towards keeping the authentic condition of the building as much as possible but also upgrading and modernizing it in order to follow its intrinsic idea) could serve as an example for future identification and evaluation of the architecture of the XX century on the territory of Macedonia.

Objectives:

- identification and preservation as a historical monument,
- fundamental renovation of the school,
- protection of the ideas of the modern movement which the building embodies for the future generations
- Introducing prevention and especially maintenance in the community consciousness.

Philosophy of renovation/general renovation strategy

Thanks to the flexible and adoptive structure of the building it was continuously used ever since it was built and is still in use.

The general conclusion is that the building mainly kept its original architecture but due to lack of money and complete lack of daily maintenance is in generally bad condition. The extent of the damage is such that this condition in a certain way started to affect the process of qualitative education itself. Certain elements are so damaged that are brought in condition of being unusable. The external appearance is unpleasant, the building in general is left to decay and there is a feeling of general negligence.

Over the time both in the interior and in the exterior a number of small repairs and changes were made /mainly unprofessionally, incompletely and in bad manner/. However, they are mostly removable and don't ruin the authenticity of the building in general.

With the cost estimation study a general inventory of the damages and problems was done from technical, functional and aesthetic aspect.
Since the authentic structure was not damaged to a great extent, there is no need for reconstruction in any part of the building. The general proposal is towards repair of the damaged areas that cause big problems, renewal and maintenance. Despite alterations and certain renovation measures, the building has a large proportion of the original substance retained/preserved. The changes should be removed so the building could be brought back to its authentic condition.

Future changes should be allowed towards introducing improvements (such as improving the technical condition; of the installations and toilets without damaging/changing the outside appearance; replacement of some of the materials with new ones with higher quality and better performances but same or similar texture and appearance; strengthening of the structural load bearing parts—greater stability of the building etc.).

Problem

Small changes /Identification of the previous changes in the history of the building/

As a result of urgent needs a number of minor interventions were done that luckily did not affect much the original architecture and could be easily removed in future:

- Covering of the semi open porches with green sloped metal sheets/plates in order to place the heating installation in the space between the covering and the construction in the in-between space. Effort should be made to keep the heating installation but to make an attempt to bring the look as close as possible to the original;
- Partial change of the windows on the gym hall (on the west and south side) with PVC and Aluminum profiles that differ in shape and in material from the original;
- Steel safety wire/net placed as a protection on the windows on some parts of the building (especially the computer center). They should be replaced with appropriate designed protection;
- Air conditioning equipment installed on several spots of the buildings which points out the obvious need for solving the problem with air conditioning on the level of the entire building, not only partially (having in mind the fact that in summer the temperatures in Skopje often go over 40 deg.). Besides the bad appearance they also damage the hydro insulation;
- The reinforced concrete facades are mainly dirty and on vast surfaces painted white or with graffiti. Therefore cleaning of the visible concrete and removing of the graffiti should be undertaken.

Figure 12. Changes that could be relatively easily removed: covering of the porches, changed windows, safety nets, air-conditioning equipment

Detection of the major problems and possible solutions:
Besides the small changes that happened during longer period of use, there are certain big problems concentrated on several critical positions:

1. **Roof construction and roof covering**

Roof constructions: The roofs are in generally bad condition /both flat terraces and sloped roofs/ due to dampness and leakages caused by inappropriate water evacuation, damages on the waterproof layer and thermo insulation layer, leakages on the places of the glass roof cupolas etc.

The load bearing structure shows almost no signs of damage; the use has not been changed since the original design and no significantly higher load is to be expected in the further use. However, any load change has to be analyzed seriously (with static procedures and calculations) in order to undertake the appropriate reinforcements. The following was concluded according to the of the observation of the present visual appearance:

a. Most critical is the condition of the flat roof terraces (parts **A.** and **B.**), mainly connected with the water removal/evacuation

- for different reasons the systems for evacuation of the water are not functioning properly/are completely out of function – filled with gravel, dirt, garbage etc.
- damages on the hydro insulation – due to the displacement of the protection layer of gravel during time, large areas are open and exposed to different weather conditions (which in Macedonia are quite extreme – from -25°C in winter to over 40°C in summer). This often results in cracking of the hydro insulation layer and leaking of the water inside the construction (eventually the accumulated moisture/damp shows up on different spots on the ceilings and walls).
- damages on the dilatations of the building (between parts with different height)
- critical condition of the roof lights (cupolas) due to natural ageing of the material, exposure to UV rays, serious mechanical damages, human vandalism etc. These damages also enable the rain water to enter inside the construction.
- Mechanical damages on the ventilation

b. slight vertical deformation on the steel frames in the gym hall - part **B.**) that could even increase in winter due to the extra load from the snow. One possible cause is wetting of the light wood-concrete plates bellow the terrace which rise the weight of the plates and additionally cause overload on the construction. To solve this problem there is necessity of a prompt response, more elaborate investigation of the causes and extent of the damages (possible taking samples of the different layers of the roof), thorough static calculation regarding the structure (deformations of the beams, probable/possible corrosion of the steel elements, condition of the plate etc.) as well as, emphasize on the necessity of thorough repair of the roof construction. Attempt should be made towards keeping the building in its original condition in order to maintain the original character of the building.

c. Since both the part **C.** and part **D.** have similar metal construction regardless the different roof covering (flat terrace in the part of the gym hall and sloped roof covered with asbestos cement plates over the festive hall), similar calculation and examination of the steel frame construction should be done in the festive hall. All the repairs

are not supposed to add extra weight on the construction (to have in mind when choosing materials)[6]

Roof covering. Mainly, there are two types of roof coverings:

a. flat terraces covered with protective layer of gravel (both in the parts **A.** and **B.** above the reinforced concrete construction and in the part **C.** above the steel frame construction).

The condition of the roof terraces in general (regardless the construction below) is very serious and ask for a total sanation, cleaning, protection and replacement as a part of the total repair. At present, the fact is that there is a serious problem with steam diffusion and kept moisture (probably even kept water) in the sub construction. Although there are certain methods to remove this moisture and to dry the materials even without removing the thermo insulation, they never guarantee total protection without repeating the same process. The suggestion is to open the construction and clean it thoroughly, to remove all the secondary layers placed over the basic load bearing construction and to replace them with new, high quality materials - high quality UV protection plus a selected quartz sand finishing. The condition of the existing hydro insulation should be considered in order to make a decision weather it should be completely removed or kept as a base for further intervention.

What is important to notice is that a thick layer of gravel finishing has proven to be a good protection for the hydro insulation – therefore it can be repeated as a principal. What is important is to emphasize the necessity for proper maintenance (to refill the layer wherever the gravel is missing, to place a protective net over the gutters etc.).

Figure 13. Main problems on the flat roof terraces

One possible model/solution for the roof terraces is the following:

- removing of the existing gravel protection
- removal, replacement, sanation of the water drainage system (both horizontal and vertical elements) and all the elements in contact with the hydro insulation
- interventions concerning the kept moisture
- new hydro insulation in layers + hydro insulation tape according to the standards
- protection of the domes, walls… gutters with three layers of bitumen
- protection foil + gravel or quartz sand

The estimated cost of this position (according to the elaborate) is 25 €/m2 (without taxes) with a 20 years quality guarantee.

Very important/crucial for this part of the work is to have detailed analysis of the exact condition of the materials in the flat roof terraces before making the complete documentation and cost assumption. Further execution of this part of the work should be given to a company capable of doing all the architectural and engineering drawings as well as all the details; all the materials should be tested so there won't be any doubt about their performances. Solving this problem, regardless the new material substitution should completely keep the existing concept as it is in the original project (the possible change should be towards replacement of the existing materials with new ones with better performances).

* a special case/issue are the parts of the roofs where roof lights are placed:

[6] The analysis regarding the constructions were done by Prof. Stojkov and Prof. Simovski.

a. flat roof terraces with cupolas 86/86 cm. (120/120 cm on the ceiling level)
Since the cupolas are all damaged due to different causes to the extent that they not only no longer perform the original function but also cause leaking problems, replacement with new ones is necessary.

Figure 14. Damaged roof lights

Suggestion: to replace them with new two layers Plexiglas or Polycarbonate cupolas which are available at the market (product of LITTING). According to the manufacturer, the roof light replacement should be performed simultaneously (in the same time) with the roof terraces repair (so that the necessary connection with the hydro insulation could be obtained).

b. sloped glass surfaces (roof light over the corridors over the classrooms)

Figure 15. Slped glass surfaces

As for the flat, sloped roof lights, since they have visible damages and signs of weariness, they should be replaced with similar two-layer polycarbonate transparent or translucent plates. These plates could be fixed over the existing construction.

c. sloped roof construction covered with asbestos cement plates - over the festive hall. The characteristic appearance of this part of the building is determined/defined with waved asbestos-cement plates, both on the roof and the facades. The used material has low price and quality, with a short life span of 15-20 years (in time when the school was built it was considered as an economic solution). Later it was discovered that the asbestos is not only with low durability but is also a health hazardous material. Therefore it should be completely removed and replaced with new, similar material with ecological performances such as silicate fiber plates that contain silicate instead of asbestos[7]. Another possible solution with a slightly different material could be waved metal plates that by color and texture would not differ and would provide similar architectural appearance. If larger damages are detected after the opening of the roof, the construction below should be renewed just as well.
Roof-lights above the festive hall – although they are not in bad condition, renewal of the lights is recommended; remaking in the same material over the existing sub-construction.

[7] One possible proposal for the change are the silicate fiber plates, product of ANHOVO, Slovenia, which have longer durability and better structural performances.

Figure 16. Sloped roof over the festive hall

2. Facades/building envelope

The outside walls are in relatively good condition; however different interventions are required here too: sanation, renovation, cleaning, partial or total replacement of the façade material etc. In general, there are two types of facades:

1. Visible concrete – the reinforced concrete facades are mainly dirty, on vast surfaces painted white or with graffiti. In the lower parts near the ground, cracks and spalling of the superficial layer have been detected as well as white areas/spots (probably due to salts). These damages could be a result of different causes:
   - bigger amount of dampness near the ground;
   - environmental conditions – rain, snow (freeze-defrost cycles), high temperature changes;
   - not very thick protection layer of concrete over the steel reinforcement or even more – unequal disposition of this layer (in the time when the building was built using tools for keeping equal distance between the steel and the concrete wasn't common);
   - local corrosion of the steel reinforcement; the rust increases the volume of the steel by 10 times which causes bigger pressure and cracks on the surface layer;[8]
   - erosion of material simply due to aging.

Figure 17. Damages on the façade concrete walls

Figure 18. Concrete wall covered with graffiti

Important thing is that no structural cracks caused by overloads were detected. The conclusion after the preliminary field survey is that the cracks are not structural and active but are from local character. Regardless the cause, the cracks and the lost of the superficial material did not affect the general stability of the building (only small areas are damaged+the concrete walls are reinforced with steel net that make the whole surface load bearing). In a case like this complicated procedure of cutting off the parts of the reinforcement and replacement is unnecessary; cleaning of the affected concrete areas from the cracked/ damaged concrete, cleaning the rust from the reinforcement and applying new layer of concrete or a special kind of plaster is sufficient.
The repairs are quite difficult, regarding the appearance (possible change of color and texture) and the durability. However, the techniques and the materials available today can extend the life of such structure for an indefinite period.

Another issue that could be considered as damage over the concrete facades are the vast areas covered with graffiti. Done in different materials, black and colored, mainly they are sprayed over the concrete surface. These are wall inscriptions and drawings that exist for a longer period and attract even more graffiti. It is already well known that hasty and untested removal attempts can cause harm to the historic surfaces. Therefore, a detailed examination and analysis is needed in order to find out all the types of color applied; how

8 http://www.nps.gov/history/hps/tps/briefs/brief15.htm
Coney, William B. Preservation of Historic Concrete. Problems and General Approaches

deep under the surface the paint has entered; the materials and methods that can be used to remove them. It is also important to ask help from people who have already done the procedure, having always in mind the health and safety concerns.
After the removal, the next step should be preventing and controlling graffiti. As for everything else, prevention and maintenance is important when dealing with graffiti. Some aspects that could help are: prompt removal as soon as graffiti show up – discourages further drawing, lighting of the graffiti prone surfaces (physical protective barriers could be counterproductive), but most of all raising the community awareness for the value of the building and pride for having the building in the neighborhood.

2. Asbestos cement plates placed on the gym hall façade wall. For this façade the same procedure should be taken as for the roof construction. Not only due to the bad condition (mainly with cracks), but mainly because being discovered as a health hazardous material, this façade should be completely dismantled and replaced with a new one (the same silicate fiber plates).
The asbestos cement plates on the facades are placed over light contemporary timber frame construction and forms total thickness of the wall of 24 cm. Therefore, after the removal of the superficial covering, the construction and insulation have to be checked (especially the condition of the thermo and hydro insulation); replacement with contemporary hydro insulation material is recommended (PVC foil).

Figure 19. Asbestos cement façade on the gym hall

Doors and windows – since being neglected and not maintained properly during the 40 years period of existence of the building, the wooden parts of the doors and windows are damaged to a great extent; occasionally the glass is also broken. In worst condition are the windows on the eastern side of the gym and festive hall. (the window of the gym hall that have already been replaced with new ones with Al and PVC profiles should be returned to the previous condition and replaced with replicas of the original ones).
The renewal of the joinery in the whole building is a serious issue/position (both as an amount of work and as an amount of money). Therefore it should be considered with attention, especially because there are in a way unique - designed for this particular building. Therefore an effort should be made to keep their authentic look as much as possible. However, the solution should be sought for not only in direction of keeping the authenticity of the design and details but also having in mind the progress in the field of energy efficiency that happened meanwhile.[9] Unlike the times before the energetic crisis, when the energy sources were considered almost infinite, energy efficiency is an important issue today. Today, when renewing this building we must have in mind the contemporary norms for total energy efficiency of the building in general (and especially having in mind the use of the building as a school).

The possible repair of the existing windows in under question since there is a lack of craftsman that could do the repair. A partial solution (ex. keeping the original wooden frames and changing the

[9] After the energy crisis in the 70ties the insulation requirements rise; after the 90tieswhen the question of the global warming and the emission of CO^2 was emphasized - there are big differences in the design and calculations of the buildings envelope.

glass only) could be difficult if not impossible to execute because of the deformation of the frames. Also, the present type of double wing window is not recommended today because of its complicated construction, thermo and acoustic protection, difficult for maintenance and cleaning. This leaves the question open for the moment; however it was suggested that the replacement should be done with new, energy efficient kind of glazing.

Serious damages are detected on the sun protection tents as well as the mechanisms for their opening/closing. Therefore total replacement was suggested, if possible with same type of sunshade (since they were also designed specially for this building).

Figure 20. Damages on the joinery

3. Flooring and floor construction

Most damaged are the floors in the gym and festive hall. At certain spots they are brought to the extent when the use of the space is put under question.

In the gym hall the floor is totally damaged and out of use. The original construction was: reinforced concrete floor/wooden elements/wooden floor/final layer of special linoleum (material that has relatively short life span 10-15 years). Today not only the final layer is damaged, but also the subconstruction at certain points is unusable. Therefore it should be completely removed and totally replaced - both the finishing and the subconstruction (no partial solution is possible for this floor). With the cost estimation study two solutions were suggested: with rubber finish and with laminate finish.

In the festive hall the floor is worn out from long and intensive use but it's also damaged from water (due to the leakage from the roof). The floor is made from wooden parquet that could be partially replaced in the most damaged areas. Here the question of approach rises: should the floor be totally renewed since the hall has a representative character or should it be only partially replaced in order to save as much as possible from the authentic material.

There are certain spaces in the building that are already repaired and re-covered with new high quality linoleum floors (there is no need to make any intervention on them).

Figure 21. Main flooring positions: the gym hall, damaged beyond use and the festive hall

4. Foundations

What is very specific for this building and makes it unique in that manner is the foundation system under the main building (the building with the classrooms) – a system of seismic base isolation. The whole building is based over 54 pneumatic foundation 70/70/35 cm made from natural rubber, each with load-bearing capacity of 45-50t. The idea of this system is to enlarge the predominant period of oscillation of the building [10] to over 1 s. Therefore a resonance will be avoided which makes the building almost insensitive to strong earthquakes.

Furthermore, these foundations have allowed movement of max 20 cm in both directions before the fixed concrete foundation wall. It is estimated that with strong earthquake the covering concrete plates should brake or move out from their places and the whole building could move/glide horizontally to max 20 cm.

The system was produced in Zurich, Switzerland and tested on ETH. In the time when it was applied in Skopje it was a kind of a pilot project (later the same principal was applied to other buildings too ex. School in Marseilles, France).

[10] The empirically calculated predominant period of oscillation of the Skopje earthquake is 0.1-0.2 s.

The pneumatics under the foundations are covered with removable concrete plates in order to obtain possibility for occasional control over them and their repair. For years, every two years the system was checked and maintained by the representatives of the company from Zurich. However, through the years some of the plates were removed from their original position and the pillows are exposed to all weather conditions /sun, rain, snow…/ and also to vandal human behavior.
Currently, IZIIS /Institute of Earthquake Engineering and Engineering seismology/ is doing a replacement; the pneumatic are taken out and new neoprene foundations with better technical performances from the natural rubber are to be placed instead.

Figure 22. Pneumatic foundation, condition September 2007 and February 2008

Methodology

Information

It was possible to obtain all the necessary information about the building in two ways:

- analysis of the existing archive material and other existing documentation
    - the original drawings (both for the architecture and static calculations and drawings and details) that could be found in the Archive of the city of Skopje
    - original photographs
    - written texts
    - interviews with people who were involved in the design and building process (since the final design was developed in a local construction company, as well as the building process)
- on site survey (updating the drawing and photo documentation) – the building that exists in situ is the best witness of all the changes that happened in this period of forty years of existence.

Further on, transformation of the drawings into AutoCAD files was crucial (scanning and re-drawing of all the necessary documentation: plans, sections, elevations, architecture and engineer details etc.).

Setting up a data base is not only necessary for the process of renewing the building, but will also help the future conservation, maintenance and management of the building.

Budget

- summer 2007, The Swiss Embassy asked The Faculty of Architecture in Skopje to form an expert team that will make a basic research of the damages and a preliminary cost assumption for the general repair
- during 2008 it is expected that a detailed design should be made sponsored by the Swiss government. The drawings will be made in a construction company in Skopje with consultation with the Faculty of Architecture, Skopje (with the professors involved in the cost assumption part).
- The expenses of the renewal should be divided equally between the Swiss and the Macedonian government.

Suggested phases in the intervention

1. Roof construction and finishes /flat terraces, sloped surfaces, roof lights, dilatations, eaves, gutters…/ are the absolute priority. Recommendation: to do all the necessary drawings during the winter and spring months and to begin with the realization in the summer months, both because of the good weather condition + time when the school does not work.

2. Floors
3. Façade surfaces and windows

*All the structural reinforcement work as well as the repair of the foundations are under authority of IZIIS (Institute of Earthquake Engineering - University Ss. Cyril and Methodius)

As it was wrongly believed that the buildings of the XX century are low maintenance or no maintenance buildings and it proved to be an illusion (no matter how strong concrete or other synthetic materials might seem, they do wear out with intensive use), no matter how successful renewal is undertaken it would wear out soon if not maintained properly. After the renewal of the building it keepers should always have in mind the main reasons for the damages in order to obtain better management and maintenance of the building. One of the most important issues is to raise public awareness and to introduce prevention and maintenance primarily in the consciousness of the users and the closest community.

Conclusions

Macedonia as a country that always laid on important crossroads has cultural heritage from different periods; in that sense Skopje, its capital, is no exception. Nevertheless the special situation with Skopje earthquake made possible a specific situation: accumulation of huge amount of buildings that are more or less built within a ten years distance and that mainly carry the same idea within - the idea of modernism, functionalism, brutalism etc. The architecture of the late 60ties and 70ties had a dramatic impact over the total appearance of the city. It is neither scarce nor special but today it is endangered. There is widely spread disaffection with this architecture mainly because of the outside appearance, seen as ugly and inhuman but also because it is often connected with other time and ideology (socialism).

A lot of the buildings have already suffered unsympathetic alterations (additions, new floors, pitched or mansard roofs, vivid coloring, devastation of the surrounding etc.) and it is becoming more and more difficult to ensure their survival although still being the most powerful and best designed XX century buildings in the city.

This case study can be the initial step in evaluation and protection of the XX century buildings in Macedonia.

In that sense, this was an effort to pose a question, to start a process that could continue in investigation and recognition of other significant buildings; that would further lead in thorough studies of their fabric, understanding of their context and defining the current significance.

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Appendix 1

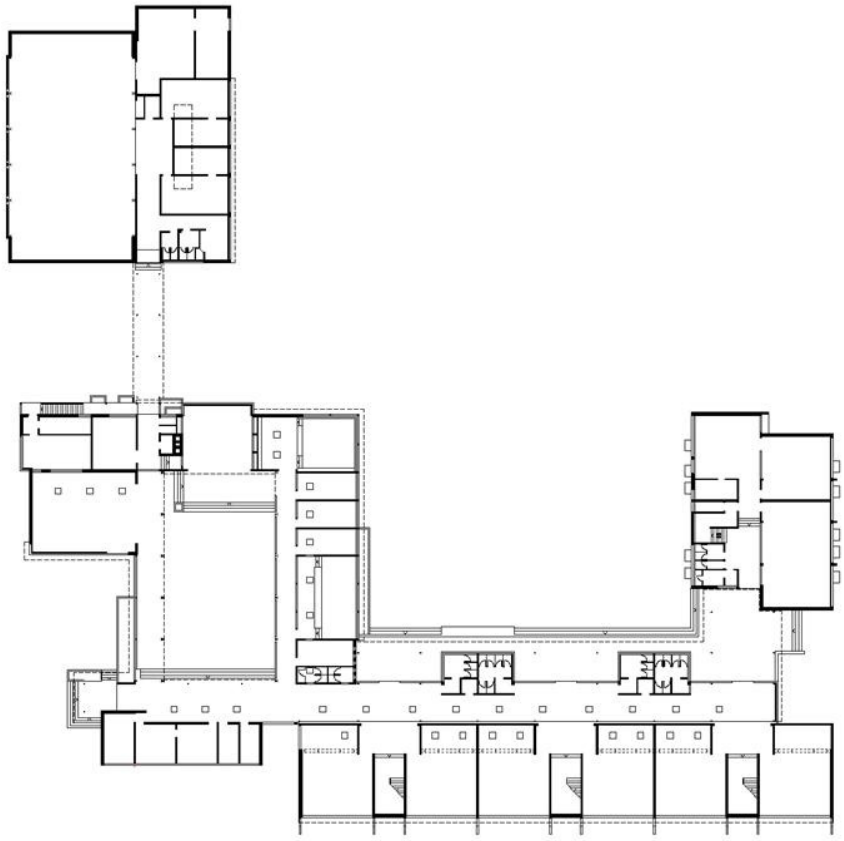

Figure 23. Ground floor, plan

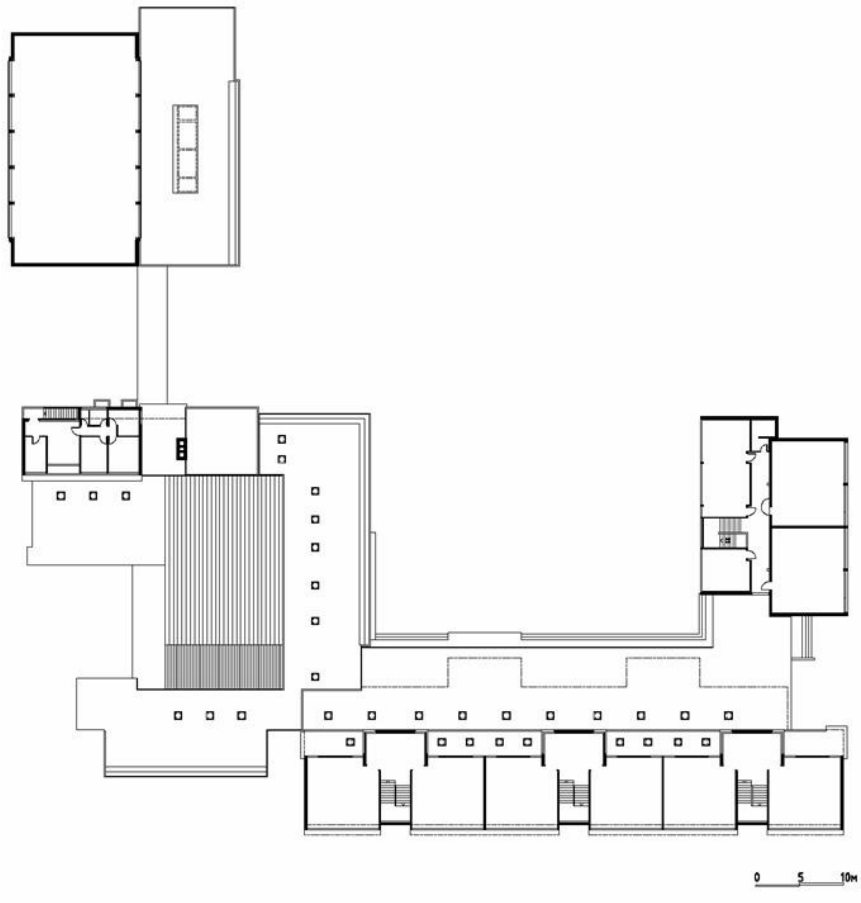

Figure 24. First floor, plan

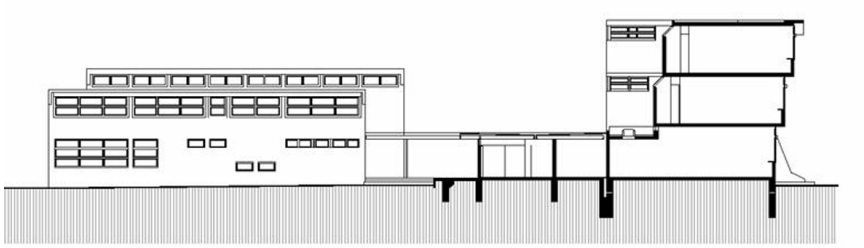

Figure 25. Section through the classroom wing

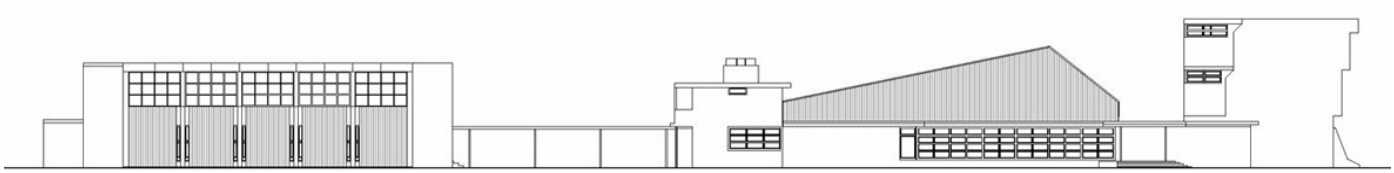

Figure 26. West silhouette of the complex

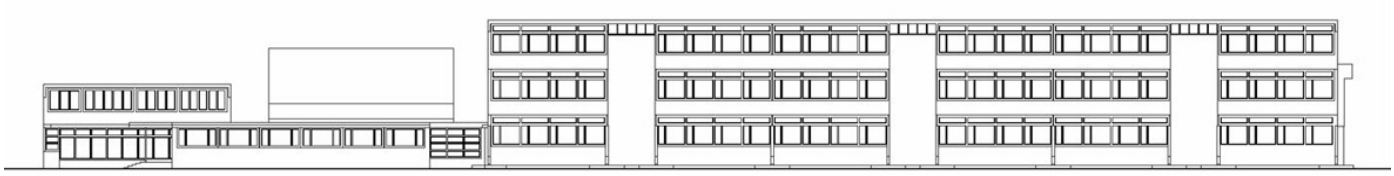

Figure 27. South silhouette of the complex