SUSTAINABLE PROPERTIES OF LATE 19TH CENTURY RESIDENTIAL PALACES IN LJUBLJANA

Vladimir Brezar
Faculty of Architecture, University of Ljubljana
Slovenia

ABSTRACT

After the severe earthquake of 1895 the city of Ljubljana had been radically rebuilt. One of the most important parts of the town between the mediaeval core and the railway has been developed following the modern concept of the architect Fabiani. The layout is based upon the rational grid of the ancient Roman city Emona as well as on the important axis from the old town to the railway station. The new streets embrace building blocks comprising terraced residential and mixed use buildings. They are rather large and with rational but decorated elevations with distinctive "Secession" architectural elements. This was the era of such buildings all over Europe: with several built by Plecnik and Fabiani in Vienna.

After more than 100 years these buildings and the urban space which they form have been recognized as a good example of sustainable urban housing in terms of several definitions. They have been built atop the existing but demolished part of the city (land recycling). They have been constructed from sustainable traditional materials (stone, brick, wood, and only a small part from concrete and steel). The railway and man and animal power have been used for transportation. They have been designed as compact entities, with thick brick walls to meet even modern energy consumption standards. The ceiling spans and heights allow for the installation of new equipment and the spaces can be used for any modern residential or other purpose as has been proven several times throughout the last century. The buildings are easy to maintain and by no means obsolete. They promise use in the future without a problem and their architectural quality will sustain, perhaps even increase the sense of identity. They have already become an integral part of Ljubljana’s mental image.

Keywords: Sustainability; Residential; Palaces; Identity
Introduction

The issues regarding sustainable development, sustainable building and correspondent behavior are well known and generally appreciated or at least kindly believed. But they are far from being implemented.

The time yardstick is very important here. Certainly this world and mankind will meet their end some day – we don't know when and it lies within the margin of reason. So talking about sustainability really concerns much less than external existence of everything. But it is quite legitimate to be afraid of death individually, to care about the fate of our grandchildren and to worry generally about tomorrow's living conditions on Earth. In this context the term future is only vaguely defined. From the cosmic point of view, sustainability too has its end.

Let me propose a simple scheme describing the levels of existence:

a. cosmic (the existence of matter)
b. geological (solar system, earth with its land, water, atmosphere...)
c. biological (life in general)
d. anthropological (the existence of mankind)
e. cultural (civilization, science, art...)

The higher levels are younger, with shorter histories and unknown futures. Each level exists only on the basis of a lower one. In the past decades knowledge and concern about levels c and d have dramatically increased, with levels a and b in general neglected as man has little or no means to influence them and level e not yet regarded as a field of concern.

The cultural achievements of mankind have to be preserved for the simple reason that they are an imminent part of human identity. The standard doctrine of "sustainable development" has been reduced to the preservation of a suitable environment or even the ecosystem (the complex combination of land, water, energy, atmosphere, flora and fauna) with the only one final goal: to enable mankind to survive. It is meant biologically, never culturally – as if culture were just some type of "added value".

Spiritual or artistic values (beauty, harmony, love, compassion) are human inventions. Nature does not know them. But mankind is a part of nature so things cannot be separated that simply. As we consider our position as above or beyond the realm of nature it is quite understandable to believe that "nature acts against culture". Works of art deteriorate, buildings disintegrate and vanish, old temples become overgrown with vegetation, and desert sand erodes stone monuments. Ancient cities have been destroyed by fires, earthquakes and wars. As common issues of sustainability care about the future destiny of the environment it is often understood that every human activity represents damage to it. Building, planning, transport and energy use are suspicious at all times. Such attitudes have become a fashionable excuse for stopping any "progress" or "development" and even for manipulating the general public. Architecture as the imminent part of culture is always created on behalf of the environment; its quality has a price.
Further on I would like to discuss a case where the overall sustainable concept also resulted in reasonable high urban and architectural qualities worth being preserved.

**The Sustainable Urban Layout and Public Space**

As is usually the case after an earthquake, a new settlement is rebuilt on the same site. There are several reasons for this. In the first place the location has been chosen for its imminent qualities: strategic position, water supply, good soil, good accessibility and traffic control, good insulation and vicinity of materials and energy resources. During centuries of development the settlement becomes complex, infrastructure is improved, public buildings and spaces are established, production of goods as well as trade increase, the population grows and the place acquires its own identity. At the end it has a unique character with important artistic achievements, architecture playing the most important part.

Our case has all the attributes mentioned above. The history of Ljubljana can be described in several stages and this paper will deal with the third one – rebuilding after the earthquake at the end of the 19th century (the first one being the Roman town Emona and the second the Medieval town between the castle hill and the river). The situation was a typical one: when the railway Vienna – Trieste was constructed it passed the existing town centre half a mile to the north. The most important street was developed between the railway station and the centre (every town located along a railway has got such a street, called "Bahnhofstrasse" in German). In the 50 years between the construction of the railway and the earthquake in 1895 a growing and important part of the town has been built along the street. After its demolition it still remained the most attractive district to be developed. It was realized in a new, organized and planned way.

The short-term act of reconstruction was based on countrywide financial help together with private initiatives which recognized the opportunity and the value of the site.

The plan of the architect Fabiani is based on a grid derived from two parallel axes: the new Station Street and the old main street as the prolonged Cardo Maximus of the Roman Emona [Fig. 1]. Since the emergence of a new profession called urbanism the rational structures and organization of cities has been researched and promoted as well as old definitions of public spaces such as the street, square, park and similar. From the very beginning of town building the rectangular grid has proven to be the easiest and best understood tool for managing the organization of space in a short time. It is also the best system for people to understand the structure of a settlement and to orientate themselves.
The standard building block was defined by four perimeter streets. The building line and height were strictly prescribed. But the use of space was less rigidly controlled. In fact most of the blocks have been built as compact terraces of residential blocks (palaces); some of them boasting a larger portion of retail and services with also the new law court and several hotels. Here and there some blocks were left unbuilt to provide open spaces - squares and parks.

The concept has proven to be a successful one and has remained valid even after a century. Apart from parking problems which have remained even after the construction of a multilevel car park on the site of an ancient penitentiary, a whole range of new functions appeared without any problems. The amply dimensioned flats have easily met new higher standards of dwelling culture and comfort. The ground floor level has been transformed into offices as traffic noise made them less appropriate for living. In general the entire portion of the city discussed here has remained one of the most important and attractive ones. It is a typical example of long term use and re-use of land (urban space) that can be described in terms of literary theory as a palimpsest.

The Sustainable Design

The building stock discussed here has been the investment of rather prominent private and public developers. The average quality and living standard were placed on the highest level of the times. No social housing schemes have been included as the importance of the area followed the logical concept of attracting the bourgeois and well-off townspeople. Accordingly, the dwelling layout was organized for families (owners or tenants) still structured in the traditional paternalistic pattern and usually employing a servant (cook, maid). The floor plan contained a set of rooms, neutral in function and often
interconnected. The rooms were named differently from how they are to-day: there was no living room, bedroom... but: the husband's room ("Herrenzimmer"), the daughter's room, the salon, the library... They were aligned on the front (street) side of the building. The corridor separated them from auxiliary rooms oriented towards the courtyard. There were the kitchen, maid's room, larder, toilet, and even the most modern achievement – the bathroom [Fig. 2].

![Fig. 2: Typical plan and section of residential palace](image)

It was an appropriate disposition to accommodate people who were used to being served. Later the living pattern changed dramatically. But the sizes and layouts of these flats have nevertheless been able to accommodate the new circumstances and needs without any problems. This was possible because the design of these buildings followed several simple solutions:

1. The longitudinal load bearing walls at ample spans of 5-6 meters and built in massive brick 50-70 cm thick left open longitudinal space to be divided at random. That is, of course in opposition to to-day's knowledge and standards of earthquake resistant construction. It is interesting how little feedback was to be found in engineering science after the earthquake and how quickly the general public has forgotten it. Of course very good corner brick bonds, with steel anchors and the overall symmetry helped. Any intervention in the structure of these buildings today is allowed only if certain measures are taken to improve the earthquake resistance of it.

2. The disposition of windows follows the strict axial composition of facades regardless of the partition walls. The window sizes ensure daylight illumination even by modern standards. The intervals between them make the positioning of partitions easy, able to meet any special size of a room (unlike the modern skeleton design where there partitions can be put only in the modular grid of mullions).
3. The floors are usually of combined steel and timber structures 30 -40 cm high. Lightweight partitions can be positioned at any desired place. The floor-to-ceiling height is usually 3 meters or more. So the introduction of suspended ceilings, new wiring and plumbing or insulation layers is possible.

4. The cellars were intended for individual fuel storage (wood and coal). Nowadays their use is limited to the deposition of obsolete furniture, bicycles and sports requisites. As they are often only half-dug they are sufficiently ventilated and illuminated enough to be transformed into office and archives space.

5. The size, adaptability and ceiling height allowed several flats, especially on lower floors to be transformed into office space, often for independent professional people.

6. The attics under steep roofs are very attractive for penthouse builders. They were found to be one of the ways of providing housing for young urban population.

The summarized experience of the last hundred years has shown that the durability, flexibility and adaptability of these buildings will be prolonged in the future without any major problems. The only danger would be posed by an unexpected catastrophe. It can not be foreseen, but damage can be potentially diminished by additional reinforcement of the structures. It can be taken into account at any moment or occasion like moving or changing the owner or tenant, adaptation and similar, just as an added cost to total investment sum.

The Sustainable Building Technology

The buildings discussed here had been constructed predominantly in the first two decades of 20th century. It was the time of established long distance railway transportation while in the cities horse driven carriages prevailed and cars were a rare curiosity owned by the extravagant rich. Even electricity was an expensive commodity used only for domestic illumination and rarely as a power source. Thus building technology has been limited to the choice of materials found locally to reduce transportation problems, dependant on the cheapest and most available means: horse and man power, and steam powered engines in extreme needs.

The so-called "classical" wet technology based on stone, brick, sand, timber, lime and in certain cases, steel and concrete was the most rational choice. In the close perimeter of the town (1-2 km) sand pits were to be found with several brick yards operating in the suburbs. Good stone was gained 20 kilometers from the town and brought in by river transport. Only cement and steel were delivered from more than 50 kilometers away by railroad. Good timber was acquired from the many saw mills around the town.

The following is a schematic overview of the technological issues concerning the building discussed here:
A
Production of materials: excavation of sand, clay, stone, felling of trees, cutting of stone, production of timber, brick making, production of lime, production of cement and steel
*Energy source: water, wood, coal, steam, horse and man power*

B
Site works: excavations (foundations, cellars)
*Energy used: steam, horse and man power*

C
Construction: concrete foundations, concrete and stone cellars, RC floors over cellars, brick laying, steel and timber floors, wooden roof structure and tiling
*Energy used: man power*

D
Finishes: floors (steel UB, timber beams, sand, parquet), walls, ceilings (lime and gypsum plaster), painting (lime, chalk, glue, mineral pigments), doors, windows (wood, glass, varnish), facades (plaster, render, paint, stucco)
*Energy used: man power*

E
Transport: delivery of materials, excavations and material disposal, vertical transport
*Energy used: railway (steam engines), horse and man power*

The first conclusion to be drawn from the above overview is the high proportion of man and horse power input utilized during construction. The impact of energy use on the environment was quite low by modern standards. The same can be said about the material sources. Sand, clay and stone pits had been abandoned long ago but are intensively used for new purposes: whether filled by rubble and waste or used as artificial ponds; the most common practice has been to use the sand pits as appropriate excavations for multilevel car parks under the mixed use development above.

The long term use and possibility of recycling is imminent to the materials used here. Stone, brick, timber and steel are all well recognized as such. Thus even the initial energy input used for their production has been a rational investment.

The maintenance of the structure and building parts is simple and inexpensive. It can be implemented on the smallest scale (repairing of plaster, painting or even replacement of windows, floor finishes...). Modernization has been easy at each stage (introduction of new power wiring, plumbing, kitchen and bathroom equipment, new heating systems). It is only a matter of cutting brick walls and drilling through wooden floors. While chimneys have become obsolete they are easily adapted to function as ventilation ducts (for kitchen and utility exhausts). Additional thermal insulation can be applied only inside the buildings which demands more sophisticated
solutions so as to avoid condensation. As the dimensions of rooms are very generous the introduction of new domestic machines has always been easy enough.

Energy Consumption during the Use of the Buildings

The starting point of this consideration is by all means the primeval hut or tent with the fireplace in the middle. The logical layout concentrated around the only source of heat had remained existent for thousands of years up until modern times. There are some typical derivations in different eras and different technological stages. The Scandinavian log house has a massive masonry core, a giant stove with multiple accesses and functions. The old Slovenian farmhouse has an oven for heating and baking bread positioned in the centre of the house. The standard rental block in the 1st part of 20th century already had a stove in every room concentrated in the middle of the layout. And at the very end of the development period one can only admire the Californian concept of solar heating with warm water storage in the middle of the living room featured as a decorative set of columns.

In our case this concept has been executed to a very consequent result. The massive spinal brick wall contains all the chimneys. Individual stoves are not necessarily operating at the same time but the warmth of the entire wall is maintained constantly. Its heat storage capacity helps to minimize temperature extremes and heat distribution is pleasant, a considerable portion arising from radiation. Later the number of individual stoves burning wood and coal led to a considerable source of air pollution with the introduction of central heating reducing the number of chimneys to one per building. Radiators were placed along the perimeter of the building and heat transfer was implemented by the flow of air from the windows to the interior. It was still happily combined with the natural ventilation process, through window and door joints. Recently these buildings have been connected to the municipal long distance heating system. The physical performances of the buildings have remained the same while the constant and easily controlled supply of hot water keeps the inner climate stable; the heat storage of the whole building supports the system, the ecological impact is reduced locally and transferred to the municipal power plant where there it is controlled and rationalized.

The Sustainable Architectural Qualities

The buildings and the entire district of Ljubljana discussed above have been examined to assess and verify their properties in any orthodox understanding of the term sustainability.

What remains to be analyzed is the overall architectural and urban quality of the area and buildings. According to the state of art existent at time of construction, the openness of the city to European cultural movements, especially to Vienna and its advanced potential of modern architectural trends (the era of Wagner, Plecnik, Fabiani, Sitte, etc) it was obvious that the already new style of Secession (Art
nouveau) in Europe was put forward to embellish and modernize the then capital of Dukedom of Krain.

The architect Max Fabiani is the author of the urban concept of the city as a whole and the district discussed here was just the most prominent part of it. He also designed several buildings on the key sites of the concept.

There is no need to describe the style (or fashion) known all over Europe at the time. The Ljubljana case is just a far echo of it, accomplished upon humble resources. Even so it remains one of the most popular and distinguished parts of the city. It has outlived the era of Modern movement and later trends, to be appreciated by professionals and the general public alike. The happy combination of an essentially rational order of street elevations and modest decoration executed in structured render surfaces, retained colors, inlaid ceramic tiles and even the distinguished lettering style has made the architecture an important symbol of the city’s identity. Of course it is listed as an architectural heritage both as a whole and individually. Any maintenance works or reconstruction has to be executed under the strict surveillance, using proper traditional materials and methods.

Conclusions

In his letter to AJ criticizing the "global scheme" J. Waldron put forward a short and precise definition of sustainable housing:

...Sustainable housing and communities demand solutions that are robust, adaptable over the long term and suited to the topography and climate of the locality, as well as its culture and materials...The issues are about increasing and renewing the existing housing stock, making the best use of land resources and the existing infrastructure...

The buildings and the part of the city discussed in this paper have been proven to be a good answer to this, namely through:

- sustainability of the site: it has been reused or recycled in a way described as palimpsest (a new text over an old one) and its concept makes it possible to do the same in the future;
- sustainability of construction: traditional materials found close to the site have been employed using mainly man and horse power;
- sustainability in energy consumption during use: good physical performances of massive brick and timber structure;
- sustainability of long term use: ample dimensions and large spans provide flexibility and adaptability;
- sustainability of architectural qualities: after a century it has been proven and established as the imminent part of the mental image of the city.

Nevertheless it has to be pointed out that these buildings represented the highest technological and architectural quality of the time. They were not a cheap
investment. But time has shown that it was indeed a wise one. Of course a lot of questions have remained, still requiring discussion. Sustainability, durability and adaptability are not always compatible. And it must be admitted that there is always some hidden threat which can deny everything said above: earthquake, fire, war, air pollution, unauthorized interventions... Sustainability is a very relative issue.

References

6. Municipal Archives of Ljubljana