Performance Based Building

PeBBu

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PERFORMANCE BASED BUILDING THEMATIC NETWORK 2001-2005

NAS STATE OF THE ART REPORT ON PERFORMANCE BASED BUILDING

PeBBu Final Report

Performance Based Building Thematic Network
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NAS State of the Art Report on Performance Based Building

PeBBu Report

FINAL NAS SotA REPORT

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Performance Based Building Network (PeBBu) is a thematic network funded under the European Commission's (EU) 5th framework – Competitive and Sustainable Growth and has been operational from October 2001 till September 2005. This project has been managed by CIBdf, The Netherlands. The PeBBu Network has been facilitating in enhancing the existing performance based building research and activities by networking with the main European stakeholders and other international stakeholders. The network has also been producing synergistic results for dissemination and adaptation of performance based building and construction. More than 70 organisations worldwide have been participating in the PeBBu Network.

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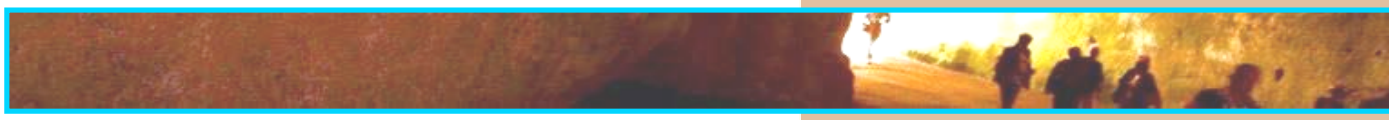
FOREWORD



In the course of 2001, when it became obvious that the EU would be expanded to include the EU-NAS – Newly Associate States, the response of the PeBBu Network was to manage a **PeBBu NAS expansion** that formalised through a PeBBu contract amendment in the beginning of 2003**.** This ensures a **complete European perspective for the stimulation and establishment of Performance Based Building practices**..

One of the main tasks under the PeBBu **NAS programme** was to produce a **State of the Art report** on the status of PBB in the NAS countries, the result of which is this document. The **PeBBu NAS State-of-the-Art Report** addresses the background, the present situation and the vision and strategies of future implementation of PBB – Performance Based Building in the respective NAS (newly associated states of Europe) countries. Task members are 13 organizations from **Bulgaria, Czech Republic, Hungary, Lithuania, Slovakia, Slovenia and Poland.**

The **NAS SotA Report aims** to enlighten, why the NAS countries show plenty of **common features** even if they are belonging to different regions, different language families, they have different historical background, different size and economical situation. A main feature of this report is to investigate the situation, the barriers and the opportunities of PBB related to the **historical background** of the NAS countries that strongly determined the possibilities of PBB and still influence the development of the construction sector. First of all this is due to the artificial socio-economical system that developed in these countries after the 2nd World War during the time of socialism.

Comparing with the East European Regional Platform's (EEP) Status Report of PeBBu, the NAS Status Report thus focuses on status and the common features as a consequence of the common historical background and analyses the situation related to the following historical periods: the time of socialism; the transition period; and the present time after the EU accession. In contrast, the EEP Status Report focuses on regional aspects, describing status in each country and is based more on national reports and status in the countries.
This Report also gives a detailed description of the status of PBB in general in the NAS countries considering the **PeBBu scientific domains & other domain areas**. **Vision to the future and overall strategies** of PBB implementation in the NAS countries are described in the last chapter. On the annexes a summarizing **table of barriers, strategies & actions** related to historical periods and several **best-practice examples of PBB** in the participating countries are presented.
As regards the **methodology**, the report was prepared on the basis of the lessons learned from: PeBBu workshops; special PeBBu NAS workshops; PeBBu documents; contribution of the PeBBu NAS members; relevant literature and the scientific background of the task leaders.

The authors wish to **thank the task members** of the NAS Platform, especially **Mrs. Evelina Stoykova (BG), Mr. Peter Matiasovsy (SK), Mr. Milos Kalousek (CZ) and Mr. Piotr Bartkiewicz (PL)** for their valuable contribution. Special thanks are due **Mrs. Mansi Jasuja** PeBBu Programme Manager (NL) who assisted all workshops and the preparation of this report

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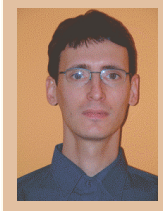

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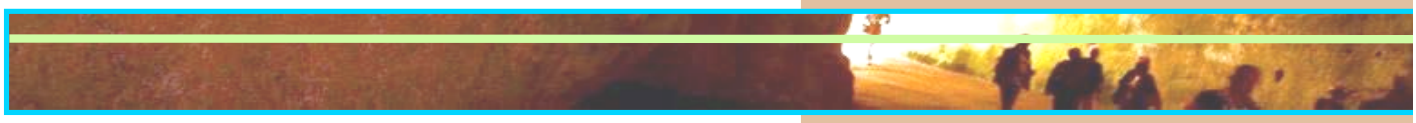
EXECUTIVE SUMMARY



The **scope** of the PeBBu NAS State-of-the-Art Report is to give an analysis of all aspects of potential relevance to the envisaged future implementation and actual application of PBB – Performance Based Building in the respective NAS (newly associated states of Europe) countries. Task members are representatives from Bulgaria, Czech Republic, Hungary, Lithuania, Slovakia, Slovenia and Poland.

The **objective** of the Report is to present the background and the Status of PBB in the NAS countries with special focus on the ongoing PeBBu scientific domains and other PeBBu domain areas. Further **aim** is to provide a future vision and strategies for the implementation of PBB in the NAS countries in general and in the PeBBu domain areas.

The **1st section** describes the **historical background** of the NAS countries, summarizing the main common characteristics of history that determined the possibilities of PBB and still influence the development of the construction sector. After the WW II all of the NAS countries were occupied by the Soviet army, and within some years became **soviet satellite states** with a very similar structure. An artificial socio-economical system was developed that determined the development of he construction sector and the possibilities of implementing the concept of PBB. There were special barriers of PBB due to this artificial system. In 1989/1990, the soviet systems collapsed, and new, democratic states were established. A **transition period** started from a planned economy to a market oriented economy in 1990s with consequences and changes in every sphere of life. New barriers raised and the PBB thinking became even weaker than it was before the changes. In 1995 the NAS countries applied for EU membership and in the 1st of May 2004 ten of these European nations became **member states of the EU**. This situation gives new challenges and also new opportunities for these countries. These challenges and opportunities determine the development of the construction sector and the possibilities and strategies of further implementation of the PBB concept

The **2nd section** of the report analyses how the **construction sector** has been developed in the NAS countries, that determines also the barriers and opportunities of PBB. The former socialist system determined the development of the sector with the dominant role of the state and the practice of industrialization and mass production, that resulted a significant construction boom but with low quality buildings. Opportunities of getting proper building materials were very low, the lack was the most general feature and generally the performance criteria was adjusted to the only available solution. The changes in the sector during the transition period occurred as a consequence of the former building practice. The strong role of the public sector stopped and there was a high decline in the production. The market type building demand became dominant and the investor began to be a dominant partner that often resulted in the lack of acceptable architectural quality. International companies have had a continuously increasing role. The transition period had also its difficulties as low skilled workers, low workmanship, low onsite safety, lack of quality inspection, instable financial background, high corruption rate and extremely high black market. Also the problem of housing affordability emerged. On the other hand all up-to date products are available and also there are several prominent investments in the NAS countries. The special situation of the construction sector results also a special status of PBB in the NAS countries.

The **3rd section** describes the **status of PBB** in the NAS countries. Building activities in the NAS countries are the least performance-based among the PeBBu regions. Although CPD is entirely implemented in the NAS countries, the standardisation process is still rather weak and perspective in character. As a result of the NAS countries' accession to the EU, it is expected that also the introduction of the performance concept will accelerate. There is a general agreement among professionals of its wider introduction.

The **4th section** aims to point out the general **barriers and opportunities of PBB** according to different historic periods in the NAS countries, namely before the political changes, in the transition period and after the EU extension. In the time of socialism, special barriers obstructed the implementation of PBB in the artificially isolated NAS countries, as the mass production, the COCOM list, the PLAN driven economy, etc. Most of these features are already over but some of them are still living or have influence. As regards the implementation of PBB, after the political changes new barriers and opportunities raised. There are still remnants of socialist mentality and short term thinking. Lack of holistic approach, lack of cooperation, lack of finance, the weak credit systems and the low level of responsibility are all strong barriers. On the other side the transition period resulted also new opportunities, as the CPD implementation, the availability of new products and high quality buildings. The EU extension gives again new barriers and opportunities for PBB implementation in the NAS countries. Opportunities are partly related to obligations. New barriers can be some deformations of the market, influence of some interest groups, cartel agreements, tax policies or governmental decisions. On the other hand the free market environment and the support for several sectors provide new opportunities for PBB in general and in the various domain areas.

The **5th section** addresses the **status of PBB in the 6 ongoing PeBBu domains**: Life performance of construction materials and components; Indoor environment; Design of buildings; Legal and procurement practices; Regulations; Innovation. On the bases of the current situation some strategies are listed that can serve the future implementation of PBB in the discussed scientific area.

In **Domain1 "Life time of building materials and components"** we can see a development of quality and plenty of new up-to-date products, a product evaluation system and developing standards on one hand, however still plenty of low quality items on the market on the other hand. There are several researches related to durability issues, however few reference service life data are available and the factor method is not used in the NAS countries. Well defined performance criteria, indicators, measurement and simulation tools are needed for further development.

Regarding **Domain 2 "Indoor climate"**, there are legal regulations containing requirements on the maximum concentration of certain pollutants. There are many problems of moulds. In practical design generally only aspects of comfort are considered, a more holistic approach to indoor climate and healthy building is seldom realised and this would be needed. Strategies should also address simulation, modelling and testing tools in order to predict complex indoor environment performances and also training special designers for indoor climate.

As regards **Domain 3 "Design of Buildings"**, the former large state building design companies operated in the NAS countries divided into small design offices and the new situation caused new problems as well. In practice the successful PBD usually depends explicitly on the responsibility and possibilities of all decisive partners and their quality, but mainly on architect - client cooperation. Unfortunately, architects generally have a narrow orientation. Often "Ideal catalogue construction solutions" are applied and no explicit criteria and methodologies of the whole building performance monitoring and testing is used. A main barrier of PBD is that particular design participants do not consider the construction and its results as one complex system. Explicit performance criteria, less empirical approaches, more complex tools & databases, whole life education & training are needed as a strategy.

Concerning **Domain 6 "Legal and Procurement practices",** building affairs belong to the public administrational proceedings in the NAS countries. As former former Ministries responsible for construction were ceased, responsibility for sector was distributed among 3-8 ministries. Inefficient operation was the consequence and especially housing policy became critical. The development of the institutional background, a construction policy and strategies are strongly needed. Regarding the procurement process, the building manager is responsible for it. The level of the application of performance criteria depends in particular cases on the building manager - his cooperation with architect, designer, contractor and his communication with

the client. In strategies it is important to develop construction process coordination and optimisation, facility management and the tendering process. Also more information and databases are needed.

According to the main points in **Domain 7 "Building Regulations"**, the regulatory framework in NAS is composed of the Act on Construction and the Act on Construction products; National Technical Standards, European Standards (EN) and International Standards (ISO). The competent governmental institutions develop laws and decrees, while the Standards Institutions develop standards. Regulations are partly performance based. Although performance based concept has been integrated in the NAS Building Regulation in many areas, the national standardization process is still rather weak. Thus, main strategies are to develop the institutional background of regulating the construction process and to develop performance based regulations and national standards on the bases of complex performance criteria and whole life cycle approach.

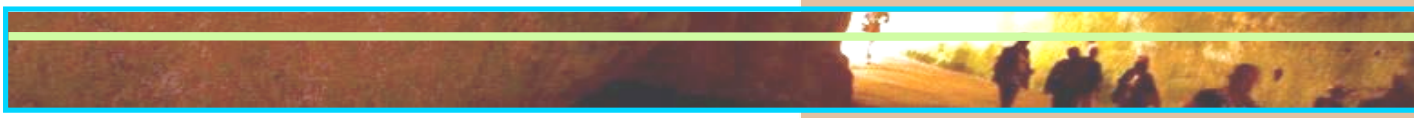
As regards **Domain 9 "Innovation",** after 1989 as large construction companies and central programs, also large research institutes were ceased and financial funds radically decreased. Mainly the Academic Research Workshops, Higher Educational Institutions, Innovation Parks, and Institutions for quality control exercise research activities today. Although there were several research programs related to PBB during decades, the application of innovation has several barriers as the common attitude of builders, the lack of R&D capacities of construction companies and the strong financial barriers. Great part of the innovative products comes out of the international research but there are excellent results also in the NAS countries. Several strategies could be defined, but first of all it is necessary to identify long-term values and make a balance between values and interests. Governments should promote innovation, education and training.

The **6th section** gives a summary of the **situation and the potential strategies** in the following **other PeBBu domain areas**: Built Environment; Organization & Management; Information and documentation; Fire safety & engineering; Accessibility; Facilities management; Energy & water management; Environmental sustainability; Education & training; Intelligent buildings; Structural design & engineering; Construction products directive (CPD).

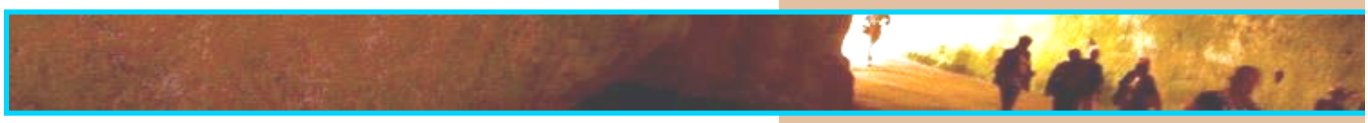
After providing some **best practice examples** of PBB application in the NAS countries in the **7th section**, the report discusses the vision to the future and some overall strategies to realize that vision. The main **vision to the future** concerning the implementation of PBB is that after 10 years the differences between the NAS countries and the former EU countries will be decreased to a minimum level and most of the barriers will be ceased. Regional cooperation will be increased. Several **strategies** are needed to realize this vision. Authorities should have an increasing role in developing construction policies, housing policies and strategies and in realizing these strategies. The institutional background of the construction sector should be developed in the NAS countries. The development of the national standardization processes is a key issue of strategy in implementing the PBB concept. It is important to raise the awareness of the professionals of the importance in thinking in performance terms. In order to spread the PBB concept in practice, clear performance criteria should be defined. In order to measure the performance in practice, indicators, measurement, testing and simulation tools should be developed. In order to increase the level and quality of regional and international cooperation, learning foreign languages should be promoted. These needs suppose the systematic institutional stimulation of research, development, educational and construction activities at regional/national levels.

In **conclusion**, the complex solution how to support the PBB in NAS must issue form the promotion and propagation of cooperative approach of all partners to the construction based on complex building performance knowledge. The possibility of equal opportunities and the minimum threshold degree of economical freedom and stability are the fundamental conditions for this. The accession to the European Union provides new opportunities, partly as obligations for implementing PBB in the NAS countries. If the key strategies will be conducted, the vision to the future related to PBB in eliminating the differences between the NAS countries and the former EU countries has real and good chances.

CONTENTS



Introduction



CHAPTER 1

1. INTRODUCTION

In the course of 2001, it became obvious that in the coming years the **EU** would be **expanded to include the EU-NAS – Newly Associate States**. In this case, soon after the construction markets in those countries would be open for construction firms from the current EU countries (and vice-versa). It would be of strategic importance for the building and construction sectors in the current EU countries as well as in the NAS countries that building operational frameworks in all countries should be maximally compatible.

In response, the PeBBu Network submitted a proposal to the EU for expansion to include stakeholders in the development and implementation of Performance Based Building in those NAS countries with available financial EU support. The EU financial support to the - **PeBBu NAS expansion** was formalised through a **PeBBu contract amendment in the beginning of 2003**. The respective amendment to the initial PeBBu contract has enabled representatives from the NAS countries to participate in the defined PeBBu Scientific Domains, Regional Platforms and in the Research Mapping Activity.

In the second year, the network spread beyond its initial conception to include the NAS (Newly Associate States). This ensures a **complete European perspective for the stimulation and establishment of Performance Based Building practices**. **13 new organisations from the NAS countries** are now members of the PeBBu Network. These NAS members are listed in Annex I of this report.

One of the main tasks under the **NAS programme** was to produce a **State of the Art report** on the status of PBB in the NAS countries, the result of which is this document.

1.1 Scope & Objectives of the Report

The scope of this report is to give an analysis of all aspects of potential relevance to the envisaged future implementation and actual application of PBB – Performance Based Building in the respective NAS (newly associated states of Europe) countries: Bulgaria, Czech Republic, Hungary, Lithuania, Slovakia, Slovenia and Poland. Most of the NAS countries belong to the East European Regional Platform of the PeBBu network. The difference between the East-European Regional Platform and NAS is that the East European Platform has more regional characteristic (climatic, etc.), while the NAS countries are those belonging to the former Soviet block. Lithuania belongs to NAS, but otherwise to the North European Platform, while another NAS country is Slovenia that belongs to the Mediterranean Platform of PeBBu.

The NAS SotA Report aims to enlighten, why the NAS countries show plenty of **common features** even if they are belonging to different regions, different language families, they have different historical background, different size and economical situation.

The **objective** of this Report is to present the **background and the Status of PBB** in the NAS countries with special **focus on the ongoing PeBBu scientific domains and other PeBBu domain areas**. Further aim is to provide **a future vision and strategies** for the implementation of PBB in the NAS countries in general and in the PeBBu domain areas.

At first this report describes the background, why the situation of these countries is so unique related to other PeBBu platforms. It will describe the **historical background** of these countries that determined

the possibilities of PBB and still influence the development of the construction sector. The common features of the **construction sector** in the NAS countries will be pointed out. The document will highlight the **main barriers of PBB** application in the NAS countries and on the bases of the background and the barriers it will discuss the **opportunities and potential strategies** of spreading the PBB concept in these countries. On this aspect, the **accession to the European Union gives also a special situation** and opportunities for these countries.

PeBBu International SotA Report obviously will show some differences and similarities, that are strongly related to regional and national characteristics, culture of engineering, history and traditions, size and economic strength of the countries, formal strong regional cooperation, common or similar languages, or commonly used foreign languages. There will be some common, sometimes natural reasons of barriers and stimulations of PBB on national or regional levels.

This report will investigate the situation and the potential strategies of PBB in the NAS countries in the following ongoing PeBBu scientific domain areas:

- Domain 1: Life performance of construction materials and components
- Domain 2: Indoor environment
- Domain 3: Design of buildings
- Domain 6: Legal and procurement practices
- Domain 7: Regulations
- Domain 8: Innovation

The situation and the potential strategies will be analyzed also in the following other domain areas:

- Built Environment
- Organization & Management
- Information and documentation
- Fire safety & engineering
- Accessibility
- Facilities management
- Energy & water management
- Environmental sustainability
- Education & training
- Intelligent buildings
- Structural design & engineering
- Construction products directive (CPD)

1.2 Methodology

This report was prepared on the bases of the lessons learned from:

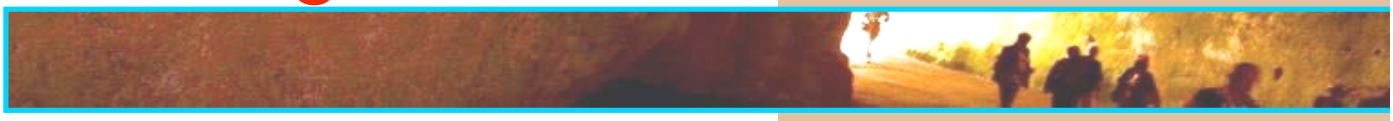
- PeBBu workshops
- Special PeBBu NAS workshops
- PeBBu documents
- Contribution of the PeBBu NAS members
- Relevant literature
- Scientific background of the task leaders

For assisting the preparation of this report **two special NAS workshops** were organized by the task leader, both in Budapest, Hungary and there was also an informal NAS workshop held on the Manchester meeting. The first meeting was joined to the first series of PeBBu workshops on the 23-25th of March 2003. After this workshop a **first version of the NAS report** was prepared. A **first draft for commenting** was prepared by the task leader and sent to all NAS members. After further work

conducted by the task leaders, Dr Angela Lee and Professor Peter Barrett (University of Salford, UK) assisted the preparation of this first version. For developing the NAS Status Report, a second workshop was organized in Budapest, Non-profit Company for Quality Control and Innovation in Building (ÉMI npc) in the 9th of July 2004. The minutes of the meeting was prepared by Dr. Gábor Tiderenczl (ÉMI npc) and sent out for commenting among all NAS members. On the bases of the lessons and documents connected to this workshop and the advanced PeBBu work during this period, the first version of the NAS Report was changed in many aspects and developed further by the task leaders. This **2nd version of the NAS Report** was also sent out to the NAS member and to Mansi Jasuja, the Programme Manager of PeBBu. The report was finalized on the bases of the comments from the members and from the PeBBu Secretariat.

The **final version of the NAS Report** was developed in the last year of the PeBBu work. The NAS members had **two workshops** during this time. The first workshop was organized in the 11th and 12th of April 2005 in Bratislava. On this workshop the PeBBu NAS State of the Art Report was presented. Presentations and discussions were made on barriers and opportunities of PBB in the NAS countries, best practice options, visions, strategies and actions of implementing PBB in the NAS countries. Also the next tasks were discussed and approved on this workshop. The last workshop was organized in the 21st and 22nd of July 2005 in Sofia. On this workshop further best-practice examples were presented, the differences in content and approach of the NAS Report and the EEP Report were discussed, final PeBBu tasks and necessary contributions were discussed and approved. After preparing the "final draft" of the NAS Status Report, it was sent for **commenting** to all partners and also to the PeBBu Domain leaders. After integrating all received comments, the NAS Status Report was finalized during August 2005.

Historical Background related to Performance Based Building in the NAS Countries



CHAPTER 2

2 Historical Background Related to Performance Based Building in the NAS Countries

This section will summarize the main common characteristics of history in the NAS countries that determined the possibilities of PBB and still influence the development of the construction sector. The focus will be on the last 50 years. As the NAS countries are those belonging to the former Soviet block, the common features of the soviet system will be highlighted and the special construction related characteristics of the transition period from a planned economy to a market oriented economy in the 1990s will be described.

2.1 Before 1990

Regarding the number of the **population** of the seven current NAS countries as compared to other European countries, Poland could described as the sixth of the "Big five", Czech Republic, Hungary and Bulgaria as upper medium, Slovakia medium, Lithuania as lower medium and Slovenia as a small country.

Counting the last three Centuries as historical background **Lithuania** – formerly belonging to the **Polish Kingdom** - had a strong relation with Poland before its independence after the First World War (WWI); **Hungary, Czech Republic, Slovakia and Slovenia were belonging to** the **Austrian-Habsburg Empire** before its independence after the WWI. **Bulgaria** - belonging the longest to the **Ottoman Empire** - gained its independence just before the WW I. Except Hungary, all other six nations belong to **Slavic language** countries.

Before the WW II all of the NAS countries were independent and economically close to the European average. **After the WW II all of these countries** were occupied by the Soviet army, and within some years **became soviet satellite states** with a very similar structure. Although the system varied from country to country, and even different periods could be defined, the general features of the soviet system were very similar. There was an **inverse of the Marshall Aid**, namely the countries had to pay to the Soviet Union a "reparation" contribution, which comprised a rather heavy burden on the countries' budget for several years.

The main unique feature of the **soviet system** was, that it was an unnatural, **artificial system**. Almost nothing remained what they used to be, getting a name, which was not true. Isolated from other countries, the ruler society tried to make the population believe that everything was going in its best way, close to achieve the proper society, where everybody are equal, wealthy, healthy etc. The life of the society was very centralized, led by **PLANs**, which were lasted normally 3-5 years.

As **in the seventies** the system became softer than it was during the fifties, **more international exchanges** were possible to make, mainly towards the middle east and Africa, and a few researcher or university teacher had possibilities to spend some time in "western" EU countries (it included at that time of course the Nordic states and the Mediterranean states, meanwhile Yugoslavia was treated as a "semi western" state) or even overseas, and also a few engineers could have a job or a scholarship in the developed countries for shorter-longer time. The **Performance Concept was introduced** by this pioneers, and via the existing networks like CIB, RILEM etc. There was an interesting feature of the performance-based thinking that corresponded to **Value-analysis**, which became very popular in the Industry during the seventies-eighties.

However we must remember the fact, that innovative or modern systems has its **COCOM list**, that means, that **these systems or products was not allowed to import from western countries**. Even the researchers or engineers, who left illegally the country, were not allowed to visit their homeland, and the communication was quite rare. Ordinary people could visit privately another country only once in each three years for a month (if they had money for that).

The **official and mandatory language in the school was Russian**, a few people learnt German, and quite a few English. **International relations were limited**, but there were some good opportunities of bilateral or multilateral cooperation. In the late seventies more and more countries realized the need of more information from "West". Inside the Soviet block cooperation was much more easy – assisted by some important international organizations or bodies, however real success in this field was rather unique.

2.2 The transition period after 1990

In 1989/1990, the soviet systems collapsed, and new, democratic states were established. Trade between Eastern and Western Europe grew. Western nations began to make commercial investments in Eastern Europe.

The NAS region underwent **two transitions**: from a market oriented economy to a centrally controlled planned economy in the 1950s, and from a planned economy to a market oriented economy in 1990s. These two radical changes of socio-economical system strongly influenced all spheres of life. The main transition changes were in the changes of the property system, nationalization, and re-privatisation of the state property and its division into the governmental and private sectors. The privatisation has been accompanied with corruption scandals. The bank sector has been affected by fraud and bankruptcy; payment periods are very long with consequent secondary debts.

In 1995 the NAS countries applied for EU membership. In 1997 the EU agreed to open membership talks with Cyprus, the Czech Republic, Estonia, Hungary, Poland, and Slovenia. In 2000 the EU opened accession negotiations with Bulgaria, Latvia, Lithuania, Malta, Romania, and Slovakia. In 2002, the EU agreed to formally admit **10 of these European nations** — all except Bulgaria and Romania — **as member states on May 1st 2004**: Cyprus (Greek part), the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

The majority of the NAS nations have **various social subsidiaries systems, decreasing population rate** (ageing society raises new challenges), **inadequate rental housing, and diversification of salaries** with significant decrease for certain occupations and regions. The mass **unemployment** occurred as a new phenomenon after 40 years, mainly in the east parts of the countries. The **state budgets have deficit and GDPs are generally low**. The tax system is permanently changing and in many cases the **inflation and taxes are very high.** In the NAS countries, there is a tendency of **state central control** at all levels of decision-making and quite controversially, **state withdrawal from ownership** in all sectors is an important factor.

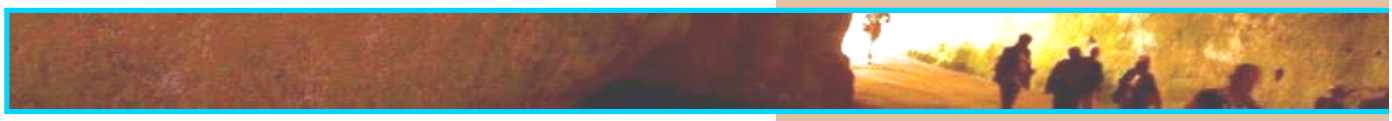
There are **frequent changes in political circumstances, regulations, key personals and legislature. Corruption** is the tool that influences the decisions, neglecting the legal and moral principles. This can have different effects at different levels: forcing the personal or local interests, suppressing the competitive environment etc.

In the NAS countries the legal system supports foreign companies, the state support and advantaging for national entrepreneurs (the small and medium size enterprises especially) activities is much less.

Conclusion of the section:

After the WW II all of the NAS countries were occupied by the Soviet army, and within some years became soviet satellite states with a very similar structure. An artificial socio-economical system was developed that determined the development of he construction sector and the possibilities of implementing the concept of PBB. There were special barriers of PBB due to this artificial system. In 1989/1990, the soviet systems collapsed, and new, democratic states were established. A transition period started from a planned economy to a market oriented economy in 1990s with consequences and changes in every sphere of life. New barriers raised and the PBB thinking became even weaker than it was before the changes. In 1995 the NAS countries applied for EU membership and in the 1st of May 2004 ten of these European nations became member states of the EU. This situation gives new challenges and also new opportunities for these countries. These challenges and opportunities determine the development of the construction sector and the possibilities and strategies of further implementation of the PBB concept.

Status of Construction in the NAS Countries



CHAPTER 3

3 STATUS OF CONSTRUCTION IN THE NAS COUNTRIES

This section analyses how the construction sector has been developed in the NAS countries, that determines also the barriers and opportunities of PBB. It will highlight how the former socialist system determined the development of the sector with the dominant role of the state and the practice of industrialization. This section describes how the changes in the sector during the transition period occurred as a consequence of the former building practice. The current situation of the construction sector will be presented, including the status of design, research and building materials. The role of the international companies will be pointed out. A special focus will be on housing developments.

3.1 The construction sector before 1990

After 1945 in the construction industry the state sector became dominant in the NAS countries and there was a **significant boom** in the construction activities. In a period of 1950 – 1990 the construction industry was divided into the dominant state and minor private sectors. The private sector was oriented to the construction of **single-family residential houses** in small towns and villages realised by the **do-it-yourself way**. In these construction activities the **traditional empirical methods** were applied and the design process was based on the implementation of verified traditional or catalogue solutions, often inspired by neighbours. (These roots of conservative mentality are living up to now.)

In this period the **state sector was oriented to industrialisation, prefabrication and typifying** in construction and the use of such new materials and technologies, which support the mass building production. The construction was evaluated strongly by such **economical criteria as low costs and short construction times**, which in the planned economy resulted in the **low quality of buildings and living**, accompanied by the building maintenance neglect. In larger towns the former brickwork residential building systems were in the 60'ies replaced by **large-panel concrete building systems**, which were dictated by the typifying strategy and the consequent large-scale manufacture technologies.

Further shortcoming was caused by the fact that the new technologies were not assessed by the adequate simulation and testing tools, which resulted in the numerous **defects and damages** origin.

As regards the application of **building materials and systems**, **the opportunities were at a very low level**, a typical feature was the "lack", that means it was not possible to get something on real price. As an example, in 1985 an extruded PS foam, which is necessary for inverted roof was hardly possible to buy, or it needed very special permission. (5 years later a domestic plant for manufacturing this product was established in a NAS country, namely Hungary.) The **"lack"** and the **general use of low quality materials** set a situation, where the standard matched the real opportunity. This means that the requirement was settled so that the only product one could get in the market should have passed the evaluation or test. Therefore, classically here the **solution influenced the performance criteria**. This method was very general. Building industry was based mainly on low or medium quality **domestic products**. The total construction time due to delays of partial material and technology supplies was quite long, the planning work was underestimated and underpaid, very frequently the contractor built as they wanted, sometimes absolute disregarding the plan.

By the end of eighties (referred as "perestroika"), the domestic competition became a bit stronger, and more and more **international companies tried to seek the possibility to find a market** or a new manufacture plant in the Soviet Bloc countries. **Piloting projects**, thanks for the great demand, were

extremely successful. By the time of the political changes most of the countries the society was open for new opportunities.

3.2 Status of Construction in transition period after 1990

In the NAS countries the construction industry during the period **1990 – 2003** got over the changes that is reflected in a considerable **decline of production**. This decline was caused by the **sudden decrease of a formerly dominant share of a public sector** in the whole production. After this decrease the volume of construction activities until now has not reached the construction production in 1989. The share of construction industry in GDP is permanently at very low level during this period of stagnation. At present the construction industry employs less than half of the people in comparison with the eighties.

The **sudden increase of the construction costs after 1989** significantly influenced the liberty of design and the available building materials assortment. The **investor began to be a dominant partner** in the process, however his independent and dominant role very often results in the production of a **chocolate-box art**. Simultaneously one of the main criteria for a client making decision on a construction or purchase of building is of economical character. In both cases the role of **architectural quality** is considered to be fundamental.

The **construction process parties** traditionally force their own interests, issuing from the effort of companies to sell the own products. It is accompanied by the promotion of their definitive **catalogue ideal constructional solutions** among the architects and material producers.

As regards **research**, the first years of the transition time were very critical in any field. As the system collapsed, the State as a main client lost his position and lot of things turned just to the opposite side. The mostly liberal thinking of governments and the lack of capital in general support to establish a "week state" system resulted a lot of pitfalls in the first period and still is very relevant. That means a lot of deregulation without substituting the former regulations with new systems of codes or decrees.

The **culture of design was changed** as well. The gigantic planning offices and former large state designer companies were split into small private engineering and architectural offices, which still remained underpaid. The design time were shortened, sometimes it even did not give opportunity for careful work. The **short time of design** is not favourable for the time consuming and risky (as professionals feel) performance based thinking. The high costs of computational design tools, databases, international standards and relevant literature contribute negatively to this situation.

As the society has changed and became much more diverse, private based, **market type building demand** became dominant. The private clients started to act as a source of Performance Based Building due to the "greater benefit on a reasonable prize" principle. The private investors – mainly with foreign capital - started to think on a lifecycle bases.

Although the **Bank sector** has developed a lot during the previous years, the credit systems are still rather bureaucratic, slow, and not really client based. It is interesting to see, how the behaviour of a multinational Bank is changed, when working in these newcomer countries, matching itself for the old fashioned, rather non-tolerable systems. This is possible due to the fact, that the Central – mostly privatised – domestic ruling banks still have power above the others. The clients - and the whole building Industry – suffer of credit systems. However, this unpleasant situation seems to be changing because the increasing market influence and pressure to introduce international Best Practice tools and methods.

Meanwhile the "post-war" generation are working theirs last minutes, **new generation** has an increasing role. The 65, or even older Bosses are replaced – most of the time – by 30 years younger ones, mainly in

the financial sector. The new generation is in some aspects generally more open to Performance/Results driven approach, and understand better the lifecycle feature of performance.

In the building sector **the international companies – seeking for new clients** – have increased importance, especially in **office and commercial building**. These companies like METRO, AUCHAN, CORA, IKEA, etc. bring their culture of building, sometimes even using certain material or system they accustomed at their formal projects. This trend can be observed in the industrial sector as well, where big clients as NOKIA, GM, IBM, GE etc. insist on their Best Practice solution proved by recent projects and time. This of course can bring some base formal performance based approach, but very frequently are just a copy of ones, disregarding the requirement of local culture and suppliers. Most of the time, these are accompanied by urgent and too short construction time, which doesn't sponsor careful, project based design (they built sometimes a project within one year after the decision of having that!).
In the transition period, after certain waiting time, more and **more international building manufacturer companies bought or built its domestic plant in the NAS** countries enjoying the preferable condition of taxes, cheap workmanship, and growing, promising market even towards more Eastwards (as bridgehead for Ukraine and formal Soviet states.)

Huge international companies came to NAS countries just to gain new market and they basically **make R&D in home countries**. For companies the idea of performance is generally just for marketing and selling products. SMEs can be in dangerous position (most important in building market) because of the leading role of huge international companies. However, there are several initiatives for cooperation. There are also **possibilities of getting benefit from the leading role of international manufacturer companies in domestic PBB implementation.** A huge company can be a source of data and also a source of fund. They can give new directions for research. (A barrier of this is that innovation is normally a secret because of the competition). Companies can promote new ideas for communication with clients ("this is performance requirement and we give the solution").

Stakeholders on the building market became quite different in the NAS countries concerning their size, level of organization and performance (quality, price, terms etc.). Sometimes we can find good examples of fruitions of PBB carried out in a framework of a pilot project.

Competition and competitiveness are limited due to unequal positions of particular subjects on the market. The construction companies have tendency to create the stable networks of cooperators and clients and it is practically impossible to join it for the new partners. Controversially, the competition is growing.

Low skilled workers, low workmanship, low onsite safety, lack of quality inspection and lack of a competitive market often characterize construction. The construction market is not free; it is characterized by fast/ radical development and domination of several strong usually foreign companies. Information on the construction process is not available on a satisfactory level.

The Building Industry in the NAS countries suffers from **instable financial background**, late or delayed payments, **high corruption rate and extremely high black market**, not just in construction works, but also in the market of building materials. This is related also to the design phase. In one hand, small companies could adjust themselves better to the rapidly changing market situation, on the other hand, the lack of experience, the weakness of most of the small enterprises gives warning sign for the governments for creating better circumstances for SME-s dealing with projects of long-term benefits. There are certain governmental programs to support this, but the real breakthrough is still far away.

The **smaller enterprises have no financial reserves and not satisfactorily diversified production**, which causes the problem of their further existence. This stay naturally results in the

decrease of the competitiveness in a construction market. The similar expectations are in export, expressed by the loss of the markets with subsequent decrease of the quantity.

The construction companies define the following **barriers of the desirable production increase**: great competition (due to the small market and low purchasing power of its participants), seasonal factors, high production costs (e.g. due to a high interest rates), low potential demand and the **difficult availability of a bank credits**. The banks according to the opinion of construction enterprises are not willing to invest into such a risk sector as the construction industry is. The solution could be in governmental guarantees of the given credits. However the general solution - the agreement among the construction companies, government, and financial institutions - still does not exist.

As regards **building materials and systems**, **all up-to date products** are available in NAS and international companies own most of the producers. However the general quality of building is still behind the European average. **Prominent investments** as e.g. in the bank sector, diplomatic buildings, commercial centres and headquarters of international companies present the latest systems and technologies in comparatively same prize levels as in other European countries.

Figure 1. Prominent investments in Budapest.

a) Siemens offices (architect: Lázár & Reimholcz) b) Police station (architect: Finta)

The guilds barriers and orientation to routine methods characterise the attitude of the national **chambers of architects and engineers**. The representatives of the faculties of architecture see the situation as the **problem of the quality of architecture and the quality of work**, or generally of the professionalism of all it concerns. The dualism of the design and realisation is apparent here.

The transition from the state-controlled economy to the market economy has had significant consequences also in the field of **housing.** It has raised the problem of housing affordability in a society, which has become economically segregated. During the period of socialism, getting a flat was seen as a basic human right in the NAS countries and this attitude had the concomitant of mass housing. In that time the term "social housing" presupposed the care of the State but was marked by gross unfairness of distribution. Some strata of the society could get a flat while others were neglected. Some social criteria were applied to "deserving cases".

After 1990, due to the transformation of the national economies, there was a radical change in financing housing development. Housing construction decreased dramatically as a result of a decreased engagement of the governments in housing construction financing. The **privatization of the housing stock** started in 1990 when new owners bought their flats at a very low price, but did not have the financial capacity to do

the necessary renovation. In this way the former public housing stock deteriorated and lost about half of its value. The average family in the NAS countries can hardly afford the price of a decent home, which would cost about 6-8 years total household income. A gap between supply and demand and – because of the increasing gap between housing prices and household incomes - a **constant problem of housing affordability** emerged. High inflation, lack of reasonable credit system in one hand, **improper rental sector, too high owner occupied sector** (mainly in Hungary, Bulgaria, Slovakia, Slovenia and Lithuania), extremely low rent in the remained public sector and the decreased and not relevant subsidy systems on the other hand sustain this bad situation. Although some intergovernmental programs like Matra (NL) in Hungary, Danish know-how transfer in Lithuania, HLM know-how transfer (SK and CZ), the housing system of these countries suffers from under-financing, bad structure and a **state participation and subsidy systems** which **does not consider quality aspects**. Also the **strong and relevant bodies in the governments** (Ministry, or strong independent office) **are generally missing**. Most of the countries, like Lithuania, Slovenia, Czech Republic and Poland has Best Practise oriented strategy and knowledge, and even started to built new structures, meanwhile Hungary, Slovakia and Bulgaria has no overall and European Best Practise based systems. However, also good examples can be seen, Warsaw for example shows a very dynamic development in the last years. For the reaching of the average level of EU in the apartment provision, the intensity of construction of 5 to 6 apartments per 1000 inhabitants per year would be required as a long-term perspective.

Table 1. The main indicators of dwelling stock in the NAS countries

Country	*Dwellings per 1000 inhabitants, 1990*	*Dwellings per 1000 inhabitants, 1999*	*Share of dwellings with bath or shower, 2001, %*	*Distribution of dwelling stock, 1999, %*		
				owner occupied	*private rental*	*social rental*
Bulgaria	377	421	75	92	5	3
Cyprus	374	418	92	..	..	..
Czech Republic	352	427	84	49	7	24
Estonia	..	455	67	..	..	..
Poland	289	309	87	54	..	..
Latvia	358	401	67	..	..	..
Lithuania	310	372	68	..	..	..
Hungary	372	409	90	92	3	5
Slovakia	310	318	90	78	..	..
Slovenia	343	360	92	88	..	..

Source: Yearbook of housing statistics 2003, Hungarian Central Statistical Office, 2004.

Approximately the half of the housing units in the NAS countries are in dwelling houses and the rest are family houses. There are a lot of buildings as state property of non-dwelling and non-productive buildings. This amount represents roughly one half of the whole number of those buildings. Approximately 50 % of the mentioned volume of buildings in state and community property is used for education.

The **new regional policies** started to be formulated after the year 1990. Principles of the regional economic policy constituted a proposal for system measures for solving regional issues and regulating the development in problematic territorial units. By this document the basic principles and objectives of regional planning complying with the European standard of the European Charter of Regional/Territorial Planning have been formulated.

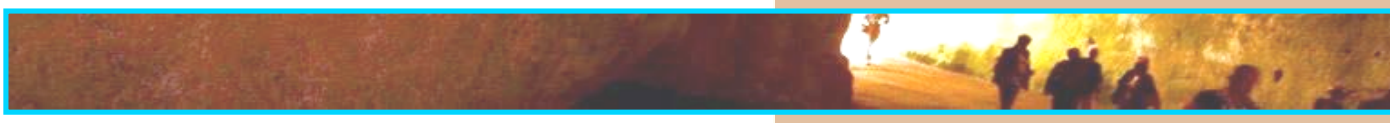
Very generally saying, **the closer is a topic to the market, the more realistic approach and visible development could be registered**. Oppositely, the closer is a topic to central governmental issues and budget, related to the big public supply chains as education, health service, social welfare, military etc., the more out of fashioned or unreal systems are sustained. In this aspects local governments with their twelve years experience – and less influenced by daily politics - understand better the significance of long-term investments and handle more properly this kind of issues. Therefore, **PBB on local level seems to be better achieved** than higher level.

Regarding the field of **regulation**, the main problem is the **lack of finance.** It is obvious, that simply the interpretation of EN's or hEN's is in very week stage. Generally governmental offices are open to any European models and idea, but the lack of information in civil servant level is also rather great. As regards the facts, that political changes has even nowadays a few direct influences on civil servants' life, it is easy to imagine, that working for government is not a safe, great prestige work in these countries. That could make great influences in the whole process of the regulations as well.

Conclusion of the section:

The historical background concerning the last 50 years determined the development of the construction sector in the NAS countries. After the WWII the state sector became dominant that – with the practice of industrialization and mass production - resulted a significant construction boom. The building practice of that time had a concomitant of low quality of buildings and living with plenty of defects and damages. Opportunities of getting proper building materials were very low, the lack was the most general feature and generally the performance criteria was adjusted to the only available solution. After the political changes the strong role of the public sector stopped and there was a high decline in the production. The market type building demand became dominant and the investor began to be a dominant partner that often resulted in the lack of acceptable architectural quality. International companies have had a continuously increasing role. The transition period had also its difficulties as low skilled workers, low workmanship, low onsite safety, lack of quality inspection, instable financial background, high corruption rate and extremely high black market. Also the problem of housing affordability emerged. On the other hand all up-to date products are available and also there are several prominent investments in the NAS countries. The special situation of the construction sector results also a special status of PBB in the NAS countries.

Status of PBB in the NAS Countries



CHAPTER 4

4 STATUS OF PBB IN THE NAS COUNTRIES

This section will shortly describe the status of PBB in the NAS countries. Characteristics of the standardization process and the implementation of the CPD will be presented. The potential effects of the EU accession will be mentioned.

4.1 Status of PBB as a consequence of historical background

As a consequence of the discussed historical background and construction industry state, out of all of the PeBBu regions, **building activities in the NAS countries are the least performance-based**. Currently, construction in NAS is largely prescriptive, even though the building regulations are adjusted to European Law. The majority of **construction professionals are not aware of the term** or its practices, and are currently in the early development stages of PBB (particularly Poland, Slovenia and Slovakia)

Although PBB has been integrated in NAS Building Regulations in many areas, like building constructions, fire protection, acoustics, road and bridge construction etc, the national **standardisation process is still rather weak** due to a lack of finance.

Research programs concentrate on the performance of load-bearing structures and energy efficiency of buildings. **CPD is** however almost entirely **implemented** by the NAS members.

The **standardisation committees** are operating in the area of civil engineering, appointed on the basis of authorisation by stakeholders (industry, business, administration, consumers, universities and research organisations). Basically, it can be said that the **national building standards are still highly prescriptive and inhibit both organisational and technological innovation** in the construction industry. Therefore, a slight shift to performance-based orientation would surely create a stronger stimulus for product and process innovation and enhance the consumer-orientation.

4.2 PBB after the EU accession

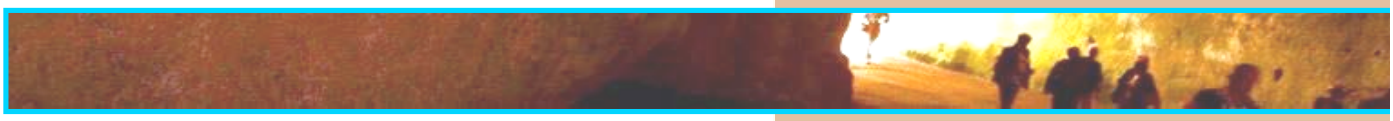
Entering the EU in 2004 May, the **harmonization processes** in the NAS countries become more and more intensive. **Construction Product Directive determines the codes and decrees** in all countries, waiting just for some modification arising from the full membership of the countries. The base would be the **nominated Institutes** of the countries for notification as ITB in Poland, TZUS in Czech Rep. TSUS in Slovakia, ZAG in Slovenia, EMI in Hungary. These Institutes can **act as a bridgehead of Performance Based Building** regarding their background and essential role in the certification, testing and attestation of conformity processes.

The propagation of PeBBu basic principles is at present in purview of **research institutes and universities participating in the 5th and 6th EU RTD Framework programmes**. Many activities in this area, even if in a limited extent, result from the scientific projects of the national grants agencies.

Conclusion of the section:

Building activities in the NAS countries are the least performance-based among the PeBBu regions. Although CPD is entirely implemented in the NAS countries, the standardisation process is still rather weak and perspective in character. As a result of the NAS countries' accession to the EU, it is expected that also the introduction of the performance concept will accelerate. There is a general agreement among professionals of its wider introduction.

Main Barriers, Opportunities of PBB in the NAS Countries



CHAPTER 5

5 Main Barriers & Opportunities of PBB in the NAS Countries

Several barriers and opportunities were discussed in the previous sections and will be discussed in the following sections of this report. In this section more general barriers and opportunities will be pointed out according to different historic periods in the NAS countries, namely before the political changes, in the transition period and after the EU extension.

5.1 Main PBB barriers before the changes (1990)

The following barriers of PBB can be highlighted from the period before the political changes:

- **Artificially isolated countries** with limited exchange and communication
- **PLAN driven industry** based on 5-year plans, 10-year plans etc., oriented to quantitative criteria, extensive economical development
- **Mass industrial production** of narrow assortment construction products
- **COCOM list** for modern systems and materials, scientific and technical information.
- **Language problems**, no common language were spoken
- **Inverted Marshall Aid** (lack of money for innovations due to Russian occupation)
- **Short term thinking** (due to restrictions of individual initiatives and activities in trade and industry)
- **Artificial life** in many aspects, heavy political pressure on daily life
- **Strong political influences** on UNI teachers, management and other key persons

Some features are over and/or even turned to the opposite side (e.g. plan driven industry versus state withdrawal from important fields) **while other features are still living or have influence** (e.g. short term thinking – the lack of development conceptions for longer future periods; political pressure in daily life e.g. in appointing key persons, etc.). University teachers' situation is even worse on many aspects than before, teaching is not enough for living assurance.

5.2 Main PBB barriers and opportunities in the transition period (1990-2004)

After the political changes **new barriers and opportunities** raised as concern PBB implementation in the NAS countries.

Some barriers of PBB in the transition period:

- **International manufacturing companies** came and rule the building industry
- **State strong withdrawal** from building industry (regulation, subsidies, R&D)
- **Changing design culture**, cheap and not proper design, SMEs are the main actors
- **Low housing promotion** and retrofitting
- Regulation are focused on harmonisation
- **Weak credit systems**, delayed payments, extremely large black market.
- International companies does not prefer innovation in NAS countries, they make research and innovation at home

- Segregation and fragmentation of design, engineering and construction
- **Low level of liability and responsibility**
- **Lack of cooperation** between architects, decision makers, urban planners, builders and users (disintegration of design, engineering and construction).
- **Lack of modern systems** supporting building organisation and management.
- **Reducing costs** on every stage of the building process, replacing materials and technologies with cheaper and worse ones. The most desirable project feature is low investment cost (however some of the life-cycle costs are being calculated by designer as well).
- **Delayed payments** especially among building companies.
- Lack of cooperation between science and industry.
- **Low level of R&D investments** in the construction industry.
- Following the rules is much easier and safer than creating new ideas.
- Negative selection for working in building industry and building schools.
- Fossilized educational system for architects, manufacturers etc.
- Unfavourable environment: law, the state of economy and construction industry, building bureaucracy.
- **Remnants of socialist mentality** – no answer to needs.
- Hard achievement of a breakthrough in habits joint to prescriptive regulations.
- A significant **lack of the education and training** of different stakeholders, like designers, researchers, building officials, and building certifiers. It takes a lot of time to become familiar with the performance-based approach.
- The **lack of relevant indicators** and appropriate methods of measurements and testing on several areas for measuring building performance.
- Sometimes the **interest of producers is against PBB** (e.g. the majority of building products have a weak performance in sustainability issues, in ecological and health aspects.)
- High production costs due to a **high interest rates**
- Low demand and **difficultly to obtain bank credits**. Banks are not willing to invest into such a sector
- **Lack of holistic approach** (project, building, usability, demolition, influence on environment etc.) for building
- Most building projects are universal – not especially made for one place and one investor
- **Lack of finance** (expensive credits etc). Bank credits are available with difficulties and the interesting rates are very high
- Domestic technical literature is sparse and expensive. Few people in practice understand construction information in English

Some opportunities of PBB in the transition period:

- **CDP implementation** (almost entirely implemented in the NAS countries)
- **New building products** from foreign international companies are available to NAS countries
- **High quality buildings became more common**
- **Verification** of project documentation by an independent party
- Universities teachers' changing situation
- **To deal with SMEs** since they occupy 90% of positions.
- PeBBu could have a common language to help solving the problem of segregation of stakeholders.
- **Relatively low wages** in construction industry – more money for design, construction phase and technical aspects. Because of relatively low costs of building process the cost of design is not very important. That's why investors can afford expensive designs. The most important factor for decision of buying a design is functionality of the building. It means that investors do not think only about investments cost but also about its life cycle costs. However, the project economy is still not much important.

5.3 New barriers and opportunities after the EU extension

The **EU accession gives new opportunities, partly because of obligations** in PBB implementation in the NAS countries. However, also further barriers can be raising.

Some barriers of PBB in NAS that can raise after the EU extension:

- **Market deformations** (probably temporary effects)
- **Influence of strong interest groups on international level** (not really free market)
- **Cartel agreements among producers** (the price levels of same type of products are the same)
- **State budget deficit restriction** (3 % of GDP limited by EU)
- **New tax policies** (not harmonized with EU)
- **Governmental decisions** (different interest and liabilities from EU bodies), etc.

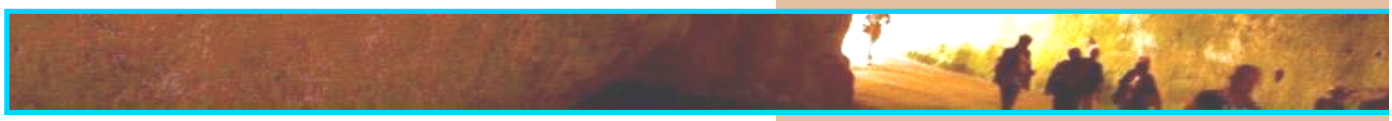
Some opportunities of PBB in NAS after the EU extension:

- **Free market environment** (long-term character)
- Construction industry and market **need new solutions** and ideas
- Minimisation of regional & social differences
- **Regional development** & growth
- **Education & research support**
- Increasing the level of the education and knowledge
- As there is a lack of **housing** stock in NAS countries and also a lack of housing promotion, this is an important field of PBB with strong opportunities.

Conclusion of the section:

In the time of socialism, special barriers obstructed the implementation of PBB in the artificially isolated NAS countries, as the mass production, the COCOM list, the PLAn driven economy, etc. Most of these features are already over but some of them are still living or have influence. As regards the implementation of PBB, after the political changes new barriers and opportunities raised. There are still remnants of socialist mentality and short term thinking. Lack of holistic approach, lack of cooperation, lack of finance, the weak credit systems and the low level of responsibility are all strong barriers. On the other side the transition period resulted also new opportunities, as the CPD implementation, the availability of new products and high quality buildings. The EU extension gives again new barriers and opportunities for PBB implementation in the NAS countries. Opportunities are partly related to obligations. New barriers can be some deformations of the market, influence of some interest groups, cartel agreements, tax policies or governmental decisions. On the other hand the free market environment and the support for several sectors provide new opportunities for PBB in general and in the various domain areas.

PBB Status & strategies in the NAS countries related to PeBBu scientific domains



CHAPTER 6

6 PBB Status & Strategies in the NAS Countries related to PeBBu Scientific Domains

This section addresses the status of PBB in the 6 ongoing PeBBu domains: Life performance of construction materials and components; Indoor environment; Design of buildings; Legal and procurement practices; Regulations; Innovation. On the bases of the current situation that will be described in each domain, some strategies will be listed that can serve the future implementation of PBB in the discussed scientific area.

6.1 Domain 1: Life performance of construction materials and components

6.1.1 Status

At present **any type of the new and most up-to-date products are available on the NAS building market. Quality has been improved significantly** during the last 10 years (e.g. new thermally insolated windows and premixed plasters appeared). The performance of the domestic products of building elements increased as well, **however still low quality items** - and often without certificate of quality - are presented on the market because of their low prices.

For assuring the quality of building materials and products, a **product evaluation system** has been developed gradually in NAS. The product evaluation system is realized in a **technical specification system** and in a **certification of conformity system**.

Already in the nineties of the 20th century in the Building code the **requirements issuing from the EEC Council directive** of December 21, 1988. "On the approximation of laws, regulations and administrative provisions of the member states relating to construction products. 89/106/EEC." were included. The directive is also implemented into the acts on the construction products.

The need of the independence and existence of mechanisms precluding the assertion of subjective interests have been formulated. The **implementation of the European Standards (EN)**, particularly of the EN 1990 "Basis of Structural Design", would conform to the established reliability standard of the design of structures in EEC. Still a little used approach – risk analysis, probabilistic optimisation, plan of inspections and maintenance based on the cost assessment would be integrated.

At present, the **building structures are designed mainly according to the original national standards** (the main reason being the software). The domestic investors accept also the preliminary EN regulation. The foreign investors assert Eurocodes or American Standards. It is assumed that the complete set of Eurocodes will be in operation till the year 2012.

Currently there is **no comprehensive programme for the PeBBu application in the design of the building structures.** The comprehensive approach to the building structure design is not included into educational programmes of the technical universities. There are partial approaches that are to be fully developed and implemented at the universities in the future. Similarly, the activities of the occupational organisations of civil engineers are at present in the beginning stage. Research and development are aimed to the innovation of engineering properties of concretes and cements. At the same time, important economical and ecological aspects are taken into consideration.

The **diagnostics and data gathering** mainly in civic structures are performed by the organisations arising after 1993 as succession of the disintegrated branch research institutes. In spite of the raising awareness about the importance of durability, **relatively few reference service life data** are available. **For estimating service lives** of building structures and components, like for example that of load-bearing structures, components of building facades, roof coverings or sanitary equipments, some **methods of expert evaluation, design guidelines, recommendations of producers and undertaking guarantees are used. The factor method, however, is practically not yet applied in NAS.**

6.1.2 Strategies

- Addressing **performance criteria for durability, adaptability, reliability and maintenance** of building structures.
- Addressing issues of **ecological performance criteria**, e.g. scarce information is available about the influence of aggressive gases on the mechanical properties of concrete.
- Development of new methods and facilities for **measurement, testing, assessment and verification.**
- Development of appropriate **indicators and sensors** related to performance issues,
- **Specification of quality assurance, diagnostics** and renewing of structures.
- To develop a comprehensive approach to the **creation of Reference Service Life data Specification** of economic aspects of performance based regulations.
- Evaluation of the technical state of **panel buildings** for renovation, reconstruction and modernization.
- Development of **models and simulation tools for durability performance prediction.**
- Development of specially designed **materials for building renovation**.

6.2 Domain 2: Indoor environment

6.2.1 Status

Conditions for indoor environment in NAS are determined in legal and technical regulations. There are **legal regulations** containing requirements **on the maximum concentration** of NO_x, CO, particles, SO_2, HCHO, NH_3, C_7H_8, Xylene, Styrene, Tetrachlorethylene, CS_2, H_2S, asbestos and the concentration of bacteria as well as moulds and pathogenic and non-pathogenic organisms.

More than 90 % of the buildings in the NAS countries have **central heating**. As a result of energy saving and indoor temperature decrease, **problems of moulds** very often occur in dwellings with thermal bridges in external walls, especially on the top floors. The process of refurbishment of dwelling houses is subsidized partly by the state. In the NAS there are the regulations concerning the State funding for the development of housing.

In NAS a special code or standard of the Performance Based Building approach does not exist. Generally buildings and their indoor environment have to be designed by architects according to the building code and the related regulations and standards. Indoor design criteria and requirements are specified in **standards covering whole environment aspects, i.e. thermal and acoustic comfort, daylighting, indoor air pollution, radon etc**. However, indoor air quality (all non-thermal attributes of the air of comfort spaces which influence humans' comfort) and other impacts related to healthy buildings and the sick-building syndrome was not really considered universally in the design process.

The **environmental research tasks** are continually opened in the NAS and depending on the financial resources the new solutions allow the application of new methods and technologies improving the quality of the indoor environment. Prevailing solutions are aimed to residential or office buildings (especially office,

education and hospital buildings). The complex covering of all building types is missing in the PBB approach in NAS.

6.2.2 Strategies

- To promote and realize more **holistic approach to indoor environmental design** and healthy buildings.
- To develop better **simulation, modelling and testing tools** in order **to predict complex indoor environment performances.**
- To develop less empirical approaches and to provide a wider measurement equipment availability. These need new funding sources.
- The main subject should be a **special designer for indoor climate.**

6.3 Domain 3: Design of buildings

6.3.1 Status

In the years of 1990's the **former large state building design companies** operated in the NAS countries **divided into small design offices** with few persons. Generally design teams are incomplete: representation of the most professional fields is precluded. **Computer aided design (CAD)** became very characteristic, as one of the most positive achievement of the R&D. However, lot of **failures happens due to the small size** of offices and the lack of control. Still a lot of buildings are constructed simply in possession of building permit without specification and implementation plans.

The **design process in the NAS countries is regulated on three basic levels: 1. legal acts, 2. regulations, 3. standards.** In the contemporary building code versions the performance requirements in a form of "the general technical requirements to a construction" are defined. These documents contains the list of urban planning requirements, requirements to building, requirements to building structures, requirements to building services, requirements to demolition work, specific requirements concerning some types of buildings, general technical requirements to buildings occupied by disabled persons, etc. Particular requirements have a descriptive (not quantitative) character with references to the relevant standards.

The current **research activities concerning Performance Based Design (PBD)** are separated in particular fields of interest. The attempt to a more complex approach is visible in the fields connected with the development and application of the methodologies of energetic and environmental audits and the complex diagnostics processes.

The research results are expressed in the **education** process partly. The contemporary quality of education can be considered not satisfactory for a more complex and systemic PBD approach. A qualification in the construction is narrowly specialised, characterised by a small adaptability. The education structure does not correspond to the required structure of knowledge. However new education system has been prepared, applying new approaches towards the building design focused on the complex evaluation of the construction process.

In the project **practice the successful PBD usually depends explicitly on the responsibility and possibilities of all decisive partners and their quality, but mainly on architect - client cooperation**, which is individual from case to case. No general tool how to provide it has been created up to now. The designers ordinary do not work in interdisciplinary teams and do not approach the design in a wider context: they do not focus on conditions of use, maintenance, refurbishment, demolition,

recycling, etc in their projects. They **generally have a narrow orientation and specialisation** and do not use alternative or variant solutions.

It is difficult to decide explicitly in **which project types PBD is exercised** more or less intensively. This **is strongly individual**. The general regulations and standards consider requirements for practically all types of buildings. In the last period numerous **"ideal catalogue construction solutions"** have been created and published. These solutions still influence the architects who many times apply them without any deeper assessment of their actual suitability. The problem of how successfully and inventively the particular actual solutions are applied changed or improved to how innovative the design is. The actual result depends on personal and economical capacities/limitations and also on the question whether inventive or commercial aspect of the construction will prevail. Of course the **role and character of an architect and engineer is always dominant**.

In the last years mainly **non-residential buildings** have been erected in NAS. Some of them have been declared as examples of the ideal solution and realisation. However **no explicit criteria and methodologies of the whole building performance monitoring and testing** during the evaluation of these buildings were applied. The buildings were assessed mainly from the aesthetic – architectural point of view so it is discussible to give absolute decisions about their whole performance quality. PBD is applied on medium scale in NAS. As regards **new headquarters of companies, banks, commercial and office buildings**, there are several examples with high value of performance and architecture, however some mass production character – regardless of the local character, urban structure and the environment - of certain retail buildings invested by international chains can be also widely seen.

There are very **few examples of schools and hospitals**. In most cases only the requirements to eliminate the defects on the buildings are fulfilled and only in some cases the refurbishment of existing buildings have been realised. New buildings for education and health care are not constructed at present.

As regards **housing**, some innovative examples of high level of architectural performance exist, but **most of the family houses still reflect the forms and techniques of the former self-built** practice. The **routine traditional solutions** are still commonly used. The characteristic feature is that the building materials producers try to offer and propagate typical constructional details solutions composed of their own products.

Innovative solutions are seldom realised, they are considered as risky, expensive and time consuming. However, wooden-frame houses are also spreading (that was not used traditionally), although the majority of them with no special architectural value. In case of large family houses many cases the poor and very expensive solutions are produced. These solutions often issue from abroad catalogues. This phenomenon could be partly explained by the low competitive level in the architect community. On the other hand the PBD status in NAS is influenced by low level of the future clients´ knowledge and experience. It is up the architects and engineers to educate their future clients in terms of PBD. **The main requirement for dwellings is their low construction cost** and easy and cheap maintenance. So it depends merely on a client or end user if and how PBD is used in this type of buildings construction.

In **larger scale housing investments** (apartment houses, 'residential parks') for selling out flats, the main important aspect is low construction cost, which is a serious barrier of realizing performance requirements. However, some of them are built in high quality of architecture.

The **liability and responsibility is supposed to be a dominant factor enhancing the PBD**. In practice it is defined as the relationship of the construction process partners to profession, client, process, products and environment. Or by other words as the **quality of people participating at all stages of the construction**. Third party certification will support the environment of liability and responsibility.

The need to prove the project documentation by an independent party is formulated by the clients many times.

At present the **PBD has more dominant role in the refurbishment and upgrading** activities. This concerns also the modern buildings constructed at the end of the 20th century characterised by the very low level of their performance. The research is also focused on the problems of upgrading and refurbishment of existing buildings in order to fulfil all requirements of 89/106/EEC and the durability and reliability requirements.

The **research dealing with the simulation models and tools for design** concerns the relevant particular performances only. The research institutions developing the software systems modelling a more complex building or building structures performance do it within the framework of an international cooperation. The already developed more complex performance simulation tools are **not available to the architects and engineers**. The designers have no personal/financial capacities to utilize these tools. Most of them are of abroad origin.

The **larger construction companies** are aware of the existing situation of performance requirements and they define it as a problem of the complex quality of construction process. They see the solution in a wider application of the ISO 10006 on Project management or the ISO 10014 Guidelines for managing the economics quality.

In general the **participants of the construction design process in NAS are aware of PBD importance in practice**. The construction companies belong to the main subjects in construction process underlie it. This can be explained by their requirements to currently reach and maintain the maximum quality of their products. **The need of PBD is formulated as the need of the complex quality of construction**, **which should be provided by the quality management**. The **barriers of wider PBD** application in practice are seen in the fact that the **particular design participants do not consider the construction and its results as one complex system.** The reason of this barrier is the lack of professionalism, responsibility and ability to cooperate as well as the lack of the adequate knowledge

6.3.2 Strategies

- A **stronger control of technical and environmental performance** and that of **architectural quality** should be created (Regulations now focus only on technical parameters, and aspects as location on site, built-in area, building height, etc, however in some districts of Budapest and major cities a jury of architects evaluate also the quality of architectural appearance.)
- To develop **explicit criteria and methodologies of the whole building performance monitoring** and testing
- To develop design methods and **evaluation tools for comparing design solutions**
- To **develop design solution and construction works on a performance based analysis**
- To design for particular performances with an interactive character.
- To manage the design process on the bases of the **design triangle: 1. Prediction/ simulation process, 2. Assessment process, 3. Practical design**
- To develop better **simulation, decision support and testing tools in order conduct complex performance modelling,** whole performance simulation, realization and testing.
- To **increase the education and knowledge level** as a fundamental condition of the progress of PBD. The architects and engineers should have a stronger feeling of the system: inhabitants - building structures and services - environment. It can be said that the level of a systematic approach in the construction process gives the degree of PBD practice.
- According to the Directive 2002/91/ it is necessary **to create new requirements for new, renovated and existing buildings** including the energy performance certificate. The certification

process starts up in EE. The certificate should describe the actual energy-performance situation of the building and it shall be accompanied by recommendations for an energy performance improvement.

- In summary, **explicit performance criteria, less empirical approaches, more complex tools & databases, whole life education & training is needed as a strategy.**

6.4 Domain 6: Legal & procurement practices

6.4.1 Status

The **building affairs** belong to the **public administrational proceedings** in the NAS countries. Act is the main legal instrument of the regulation system. It has been an acute problem in the construction sector, that in many NAS countries after 1989 the **former Ministries responsible for construction were ceased and the responsibility for the sector was distributed among several other ministries** depending on the actual government's policy. The consequence of this was that it has been quite difficult to handle any problem related to construction. **Housing policy has been especially inefficient**, as it has been hopeless to discuss any new proposal among several ministries. Later the construction industries got back its independency by establishment of the new related institutions.

The changes during last 10 years and the current situation in the construction industry have reflected also in the **procurement process**, mainly in the quality of its particular steps and elements. The classical scheme of this process in NAS consists of the following steps (according to a building code): **collection of information on wider relationships, brief, design, production, maintenance, adaptation, refurbishment, assignation**. These steps are involved in and **create the structure of the model contracts** on the building design and realisation. Ideally, the **procurement process is managed by** one person, which is responsible for its success – a **building manager**, having the mandate of a client. The **particular details of the steps inherently contain the requirements of performance criteria**. However **the level of their application depends in particular cases on the building manager - his cooperation with architect, designer, contractor and his communication with the client.** This approach is individual from case to case, and its quality has been strongly influenced by the changed economical situation in the construction industry and particular performance criteria and relevant information are taken into a consideration with different weight. The tendering restrictions according to Acts on public procurement represent the real problems in a construction practice.

6.4.2 Strategies

- To develop the **institutional background** of the construction sector, in several NAS countries there is a need to establish **own Ministries** responsible for construction, housing and regional planning.
- To develop a prospective, consistent national **construction policy and strategy** of its implementation.
- To develop **construction process coordination and optimisation** (Subject: all parties (incl. Contractors & sub-contractors, but designer & user dominant)
- **More information and databases** available for all parties;
- To make **performance monitoring & testing**;
- To implement **facility management** on higher level;
- To make **more transparency of tendering**.

6.5 Domain 7: Building Regulations

6.5.1 Status

The regulatory framework in NAS is composed of the Act on Construction and the **Act on Construction products; National Technical Standards, European Standards (EN) and International Standards (ISO). Most of the EN and ISO are implemented in NAS standards**. Gradually EN-Standards and their implements will substitute the majority of technical standards. The legislation review procedure requires safety regulations on the building process, building materials and components as well as requirements that focus on **structural safety, sanitation, health, safety in case of fire and security**.

The regulation process is meanly handled by the above mentioned **Act on Construction and the Act on Construction Products**, that is focused on: utilization of certified materials and building components, design and projection of building by authorized architects and engineers, execution of building by certified firms or under knowing attendance, documentation of building.

Relevant Ministries (e.g. the Ministries of Environment, the Ministries of Construction and Regional Development or other Ministries responsible for construction) **approve construction technical regulations.**

The regulations aim: to ensure safe and healthy living conditions for all the inhabitants; to protect the civil rights of inhabitants, to protect the environment and secure the efficient and economic use of land, water, forests and other natural resources, to provide accessibility for vulnerable and disabled people in buildings and built environment, to preserve national heritage.

Building Regulations are developed partly by the competent **governmental institutions**, as far as laws and decrees are concerned, and partly by the **Standards Institutions**, as far as standards are concerned. Regulations should be met as well as procedures and techniques to be followed in design, construction (manufacture) and use of buildings, structures, construction products and materials. Regulations are applied from a governmental level, however some additional requirements can be added or some modifications can be done on the local level. The **local authorities issue building permissions**. Although performance based concept has been integrated in the NAS Building Regulation in many areas, like building constructions, fire protection, acoustics, road and bridge construction etc., the **national standardization process is still rather weak** due to the bad economical situation of that standardization area.

Regulations are partly performance based in the NAS countries. In some countries, e.g. in Hungary a performance-based regulatory system has been introduced step by step from the 70's (International initiatives, like the work of CIB W60 group motivated the introduction of such kind of regulations.)

Regulations in Lithuania has special situation. When Lithuania regained independence in 1990, the construction industry was redeveloped. In 1991, the system was confirmed by a decree issued by the Minister for Construction and Urban Development. By 1996, this system was approved by Seimas (Parliament) when the first Construction law for Lithuania was adopted. With slight corrections the system of regulating documents was included into the new construction law, which came into effect in July 2002. The system of construction regulation includes legal and technical documents. The legal documents consist of construction law, post legislation acts approved by Government and other legislation approved by Seimas. Technical documents regulating the construction include construction technical regulations; standards; construction codes and construction rules; technical approvals and technical specifications.

6.5.2 Strategies

- To develop the institutional background of regulating the construction process
- To develop performance based regulations on the bases of complex performance criteria
- To implement building whole life cycle approach
- To develop the national standardization processes in performance-based terms

6.6 Domain 9: Innovation

During the socialism era in the NAS countries R&D activities and innovation were regulated and controlled by the state that provided special subsidies for research institutions and universities for working on central pilot programs. Large construction companies' departments for technical development had a role in research activities.

6.6.1 Status

Large construction companies and central programs, also large research institutes were ceased and financial funds radically decreased. Mainly the Academic Research Workshops, Higher Educational Institutions, Innovation Parks, and Institutions for quality control exercise research activity. Many research programs were conducted during decades related to performance issues and also performance-based regulations. However the application of innovation has several barriers.

- the common **attitude of builders, as traditional way of construction and traditional techniques are highly preferred** in order to minimise risk and maximise profitability in construction.
- after privatisation, **construction companies** are stressed to strengthen their organization and financial stability and have **no capacity for R&D**
- **strong financial barrier** in R&D activities and innovation.

In **Hungary** Infrastructure and financial background does not support research & whole-life training, in 2002 only 1.7 % of the total R&D support addressed construction. In **Bulgaria** there is also a lack of funding for research and this situation will not change easily. It is more realistic to look for Bulgarian building products and to use local building materials. In **Slovakia** there is a large list of research needs concerning development and application of new building materials, energy efficiency, living and the regional development. In universities there is a rivalry between various faculties such as architecture and civil engineering. In **Poland** there is a special need for research in indoor air quality, building materials, installations, etc. There are no interesting results for labelling for building. Knowledge is fragmented and people need to work together and cooperate to show the links with these researchers. In the **Czech Republic** the Government supports research & whole-life training. In **Romania** research is at very low level. There is a focus on seismic research.

Innovation in market conditions is more influenced by the imported materials and components. After opening the NAS market the innovation would be more notable. **Great part of the innovative products comes out of the international research but there are excellent results also in the NAS countries** (e.g. ARCHICAD of Graphisoft). Detailing of the new regulation and establishment of the statutory framework is in progress.

6.6.2 Strategies

- To **identify long-term values and make a balance between values and interests** in construction activities.
- Efficient **communication** is needed among stakeholders with different interest.

- The governments have a responsibility for providing a background for the success of long-term social interest and for creating a good quality, sustainable built environment. For achieving this, **governments should promote innovation**
- To **get know the users' needs**
- To develop efficiency of the whole construction process (investment, planning and design, construction, operation, disposal, reuse)
- To develop new materials, techniques and assessment tools
- To improve environmental performance
- To raise the performance of the working-force through proper **education and training**
- To follow international trends and to transmit them to domestic stakeholders
- To **participate in international research** activities

Figure 2.

An example for Innovation Centre:

Graphisopt Park, Budapest

(architect: Cságoly)

Conclusion of the section:

In this section the status of PBB in the six ongoing PeBBu domains were described with added strategies for further implementation of PBB within each domain.

In ***Domain1 "Life time of building materials and components"*** *we can see a development of quality and plenty of new up-to-date products, a product evaluation system and developing standards on one hand, however still plenty of low quality items on the market on the other hand. There are several researches related to durability issues, however few reference service life data are available and the factor method is not used in the NAS countries. Well defined performance criteria, indicators, measurement and simulation tools are needed for further development.*

Regarding ***Domain 2 "Indoor climate"****, there are legal regulations containing requirements on the maximum concentration of certain pollutants. There are many problems of moulds. In practical design generally only aspects of comfort are considered, a more holistic approach to indoor climate and healthy building is seldom realised and this would be needed. Strategies should also address simulation, modelling and testing tools in order to predict complex indoor environment performances and also training special designers for indoor climate.*

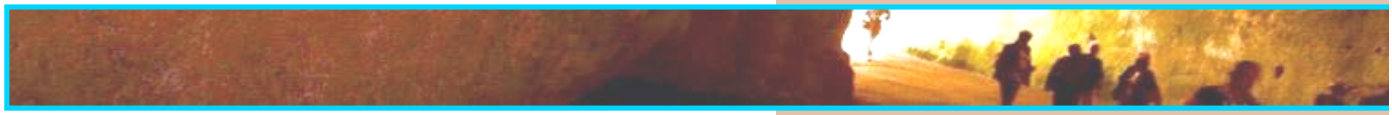
As regards ***Domain 3 "Design of Buildings"****, the former large state building design companies operated in the NAS countries divided into small design offices and the new situation caused new problems as well. In practice the successful PBD usually depends explicitly on the responsibility and possibilities of all decisive partners and their quality, but mainly on architect - client cooperation. Unfortunately, architects generally have a narrow orientation. Often "Ideal catalogue construction solutions" are applied and no explicit criteria and methodologies of the whole building performance monitoring and testing is used. A main barrier of PBD is that particular design participants do not consider the construction and its results as one complex system. Explicit performance criteria, less empirical approaches, more complex tools & databases, whole life education & training is needed as a strategy.*

Concerning ***Domain 6 "Legal and Procurement practices",*** *building affairs belong to the public administrational proceedings in the NAS countries. As former former Ministries responsible for construction were ceased, responsibility for sector was distributed among 3-8 ministries. Inefficient operation was the consequence and especially housing policy became critical. The development of the institutional background, a construction policy and strategies are strongly needed. Regarding the procurement process, the building manager is responsible for it. The level of the application of performance criteria depends in particular cases on the building manager - his cooperation with architect, designer, contractor and his communication with the client. In strategies it is important to develop construction process coordination and optimisation, facility management and the tendering process. Also more information and databases are needed.*

According to the main points in ***Domain 7 "Building Regulations"****, the regulatory framework in NAS is composed of the Act on Construction and the Act on Construction products; National Technical Standards, European Standards (EN) and International Standards (ISO). The competent governmental institutions develop laws and decrees, while the Standards Institutions develop standards. Regulations are partly performance based. Although performance based concept has been integrated in the NAS Building Regulation in many areas, the national standardization process is still rather weak. Thus, main strategies are to develop the institutional background of regulating the construction process and to develop performance based regulations and national standards on the bases of complex performance criteria and whole life cycle approach.*

As regards ***Domain 9 "Innovation",*** *after 1989 as large construction companies and central programs, also large research institutes were ceased and financial funds radically decreased. Mainly the Academic Research Workshops, Higher Educational Institutions, Innovation Parks, and Institutions for quality control exercise research activities today. Although there were several research programs related to PBB during decades, the application of innovation has several barriers as the common attitude of builders, the lack of R&D capacities of construction companies and the strong financial barriers. Great part of the innovative products comes out of the international research but there are excellent results also in the NAS countries. Several strategies could be defined, but first of all it is necessary to identify long-term values and make a balance between values and interests. Governments should promote innovation, education and training.*

Status & strategies of PBB in the NAS countries in other domain areas



CHAPTER 7

7 Status and Strategies of PBB in the NAS countries in Other Domain Areas

This section will summarize the situation and the potential strategies in the following other PeBBu domain areas: Built Environment; Organization & Management; Information and documentation; Fire safety & engineering; Accessibility; Facilities management; Energy & water management; Environmental sustainability; Education & training; Intelligent buildings; Structural design & engineering; Construction products directive (CPD).

7.1 Built environment

7.1.1 Status

An increasing proportion of **European population** - currently **more than 50% - is living in cities.** This tendency is connected in Europe and also in NAS with **leaving the cities** in large numbers, with the symptom of **sub-urbanization**. This indicates the loss of prestige of urban areas and at the same time - besides its advantages - this phenomenon can call for the **deterioration of inner city areas** and the increase of unfavourable social processes. At the same time, the **demand for good quality urban living would require opposite urban processes** and this is proved by the tendencies that can be observed all over the world.

In NAS, the architectural, historical and urban significance of the **housing stock** (most dominant in the built environment) built by traditional building techniques is provided by the building stock **built within nearly 100 years from the middle of the 19th century** to the middle of the 20th century. This housing stock **could hardly fit for today's demands**, the functional arrangement of dwellings, the lighting and energy consumption of them and its whole environment can not serve up-to-date requirements. Also the **structure** of these buildings **became old and run-down** and its condition can threaten the condition of the whole building. In Hungary according to experts' opinion the privatised and the still-local governments' housing stock together have lost half of its value since 1990. The deterioration of the general technical condition and within other factors the elevations of the buildings brings about the general deterioration (slums) of the environment and large parts of the cities. The living quality is damaged also by air pollution and noise.

In several NAS countries (e.g. Hungary, Slovakia) another significant part of the housing stock (in some NAS countries can reach about ¼ of the whole stock) is **mud-construction family houses** mainly in villages and small towns. Due to their construction method, the lack of insulations and old type functionality, neither these houses can serve today's requirements.

Another ¼ of the housing stock in the NAS countries were built in the time of socialism. The future of **large panel blocks** and its environment from this period are a major challenge today. Altogether, more than 50% of the stock cannot meet today's housing needs and performance requirements.

The **regulation of the development of the built environment** together with the conceptions of the detailed development plans containing protection of the built environment **is delayed** by the lack of financial funds, therefore the influence of these arrangements can be hardly seen in practice.

The **basic rules**, concerning the creation of the built environment are listed in the **Building Acts**, in the part of **regional planning**. Here the regional planning solves in a systematic and complex way the

functional utilization of a region, predicts principles of its organization and coordinates the construction and other activities influencing the regional development. The regional development creates the preconditions to provide the sustained harmony of all natural, civilization and cultural values in a region, especially considering the protection of environment and its main components – soil, water and air. Direct competencies for the area of regional development are delegated to the Ministries of Construction and Regional Development in some NAS countries.

Contemporary relevant local studies in the NAS are dealing with all aspects and components of the built environment creating, e.g.: the reasons of tension in the process, sustainable growth, environment-town, value and quality, methodology of strategic evaluation, limits and possibilities of planning, etc. In practice the particular results depend on personal responsibility, experience and expertise of the construction process partners.

7.1.2 Strategies

- The **process of sub-urbanization and urbanization should be balanced**.
- Increased attention should be paid for **renew, maintain and operate existing buildings**, especially in case the building is part of the cultural heritage, has aesthetical or historical value. Inner city **urban renewal programmes** should be developed. (One best practice example is the renewal of *Ferencváros* is Budapest)
- **Regulations** of the built environment should be improved and deal with the environment in a complex way.
- **Information channels** should be developed in order to **inform all partners of the construction process and in authorities** about problems and complex solutions concerning the built environment and its sustainability.

7.2 Organisation and management

7.2.1 Status

The enterprises in the NAS countries have consistently began to build the **quality management systems.** After acquirement of quality certificate and after some time they begin to build **environmental management system**, as next competitive advantage. (It is known reality, that companies, which have established the quality management system have no problem with creating the environmental management system.) The result is achievement of **next certificate**. At about third of certified systems there is a **lack of another certificate in safety systems.**

Work and health safety have got long tradition in building production concerning its specific character. Elaborated and applied systems in building companies however have not position at present, especially in small companies. Market economy makes to this field hard force. It isn't exceptional approach of uncaring for safety because of "chase" schedule or "saving" costs.

At the present time, a complicated process of transformation of the economy and society and the **establishment of the required institutional and legislative framework for the adoption and implementation of the EU rules** is going on in NAS. In Slovakia the so-called Competence Act lay down the competencies and responsibilities of central bodies of state administration. An instrument for attainment of the tasks of implementation of the EU rules is the National Plan of Regional Development of the Slovak Republic, presented to the European Union as a basic programming document for the implementation of regional policy, as well as a basic framework for future projects in the area of reducing regional disparities.

7.2.2 Strategies

- To develop further **quality management systems and environmental management systems** of enterprises
- To develop **safety in management systems**

7.3 Information and documentation

7.3.1 Status

Documentation is related to the procurement process. The classical scheme of this process in NAS consists are the following steps depending on the detail of the project:

- Providing of the input data
- Pre-design documentation for the decision about location of a building
- Documentation for a building license
- Detailed documentation
- Documentation for construction
- Documentation of the actual state after the construction process

These steps are involved in and create the structure of the **model contracts** on the building design and realisation. The absence of a specific performance contract document, providing the performance-oriented model, means that **in NAS the trends of traditional procurement model are dominant.** In practice the performance criteria complexity principles in project process are often influenced by the low level of information flows among particular partners, by the interests of construction enterprises and by the low availability of necessary financial means.

*There **are several barriers** to the performance approach in this field, like:*

- The lack of a complex system of construction information (in comparison with the previous period),
- Incompleteness of the widely available knowledge, tools and databases for complex performance simulations,
- Lack of the stimulation/funding/competitiveness.

On the other side, **several professional journals and periodicals** are issued related to building and construction. Publishers are very active in the market. Although a **complex information on a performance bases is still not available** for designers, investors or builders, the work of the participants of the construction process is assisted by various information material, as handbooks, catalogues, web-pages, CD-s, prospects of building-products, etc. There are some tools for performance simulation (e.g. for thermal performance for buildings), but these tools are not used in practical design. The actual task in documentation and the registration of building performance parameters is changing.

7.3.2 Strategies

- To develop **performance-oriented models** in the procurement process.
- Besides the procurement structure there is also the need to evaluate the weight and impact of the particular **information flows** during the whole procurement process and to analyze them from the aspect of their significance at particular steps. **Complex information on performance bases** should be created to stakeholders.
- The chambers of Architects and Engineers should be more active in **dissemination of the new tendencies**. (Mostly research institutions, as well as Universities organize conferences in construction research and development fields.)

- The PBB approach could be disseminated by several activities, mainly by publishing articles/papers in national journals and at conferences, education, preparation and submission of relevant project proposals, organisation of seminars and campaigns **influencing awareness** of people.

7.4 Fire safety & engineering

7.4.1 Status

Fire safety gains a high recognition as it has a direct influence on inhabitants. ITB (Poland) and ÉMI (Hungary), FIRES (Slovakia) possess the Fire Testing Laboratory accredited by European Group of Official Laboratories for Fire Testing. These **Labs are issuing certificates and approvals** of materials and building elements from fire safety point of view.

The **regulations** in the NAS countries are mainly prescriptive, some performance elements are used in design, construction and management processes. It forecasted that the process of implementation of performance requirements in Europe would take 10 years, however the fireman are generally aware of performance based criteria. In Hungary it is allowed to use **performance concept** in evacuation calculation and the fire risk analysis. In Czech Republic this domain is regulated by the Act No. 314/2001 on the fire protection and the Regulation of MV SR No. 288/2000 by which technical requirements for fire safety related to construction and usage of construction sites are specified (valid only for new buildings).

7.4.2 Strategies

- To develop building materials, products and structures on the bases of performance criteria in case of fire
- To provide **complex information** for architects and improve their cooperation fire engineering specialists
- **To develop** fire regulations on performance bases

7.5 Accessibility

7.5.1 Status

The **criteria of accessibility are specified in the Building Regulations** in most NAS countries. The requirements to the buildings occupied by disabled persons are subdivided into specific parts e.g. concerning the providing of the access, local communication and public area, the solution of the residential buildings, the flat of specific purpose, one family house of specific purpose and the building with a protected working place, the solution of non residential building and the engineering structure in the parts suited for public use. For **public buildings several items are mandatory** to keep, however only few residential buildings are constructed on the bases of accessibility.

7.5.2 Strategies

- To **raise the public's awareness** of the importance of accessibility and universal design
- To provide **more information** for designers concerning accessibility issues
- To **develop regulations and proposals of accessibility in residential buildings**

7.6 Facilities management

7.6.1 Status

Facilities management is applied by the group of the owners of the buildings of different age, technical state and equipment. The development of housing and its financing has undergone a series of changes, reflected in the number but also in the structure of housing units. Since 1990 the **tenure structure** of constructed flats changed considerably as well. In the years 1948 to 1960, the share of private flats was ca 50%, while the second half were the flats in the share of state and the communal flats. In the years 1981 to 1990, the share of private flats was 30%, the share of state and communal flats 20%, and the share of cooperative flats was 50%. According to the acts on the property of flats and non-flat spaces most of the communal and cooperative flats have moved to the individual ownership.

The **strong process of privatisation** after the political changes has had serious consequences in maintenance and facilities management. In the housing sector, privatisation resulted the rapid decline of the stock of former local authorities' housing. This rental dwelling stock almost disappeared. After buying the dwellings, the majority of users had no more money for renovation and maintenance and the majority of this stock run down and became slums. There are a lot of problems with facilities management for this stock.

The individual owners are grouping into **associations of the flat owners**. Several block of owner occupied flats are managed by **special companies or housing corporations**, that are facility management companies. At present all economic, facility management companies perform technical and administrative-custodian activities for the great real estate owners and for the associations of flat owners. **New acts** are regulating their operation and organization. In spite of foreign experience most of the owners pay not satisfactorily attention to this domain in comparison with the attention paid to their main activities.

7.6.2 Strategies

- **Acts** regulating the operation and organization of facility management companies should be **further developed**, with special consideration to a new future stock of non-profit rental housing
- The **role of facilities management should be continuously increasing** in NAS.

7.7 Energy & water management Status

7.7.1 Status

More than 25 % of the gross energy consumption in NAS is the **operational energy** consumption of buildings. According to the relevant data the majority of the **houses are poorly insulated** and there is a special problem in this issue with the block of flats built with industrialized technologies. The owners take seriously into consideration the need of **energy conservation measures** even if there hadn't been any ageing in the physical state of the building stock.

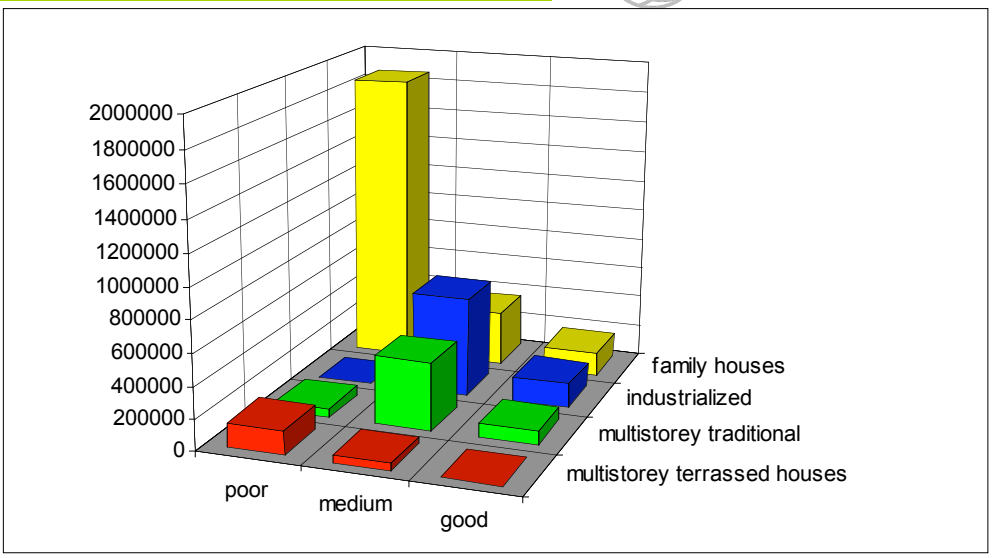


Figure 3. Distribution of the existing housing stock from the point of view of Thermal insulation level in Hungary (the figure is similar in most of the NAS countries)

The energy management is regulated by the **acts on energetics**, with the consequent regulations by which the way of the heat measurement and supply is specified. The Acts on water regulates the **water management**, with consequent regulations about the execution of certain provisions related to the water act.

7.7.2 Strategies

- To **combine reconstruction activities with additional thermal insulation** and new surface finishing – in such a way several problem of durability of constructional joints, air tightness and weather proofness, condensation and mould growth can be solved. As, additional thermal insulation may change the appearance of the building, thus the aspects of the cultural heritage should carefully handled.
- The practice and experiences of the EU countries should be carefully studied and consequences drawn in the NAS countries
- To develop and apply **assessment tools** is a precondition, as performance regulation without assessment does not have any effect (e.g. the Hungarian regulation of energy in buildings)

7.8 Environmental sustainability

7.8.1 Status

As regards the issue of sustainable development, environmental protection and energy saving, in principle all countries are engaged for development, but in real term the **national programs generally are rather week**. The situation can be described more as piloting, than real strong overall program. This is valid for the retrofitting issues as well, although the demand is very high, having a huge backlog of maintenance. Certainly there are a lot of financial barriers to tackle these issues, but one could feel that this is not simply a financial issue, but more the lack of real **political will** is the factor, that influence the situation.

The ministries of the environment are the authors in the NAS countries of all relevant **acts and regulations** concerning the environmental sustainability related explicitly to the act. Besides the governmental institutions the actual state in this domain is monitored by the national environmental NGOs.

7.8.2 Strategies

- To raise the **public's awareness** and form the social outlook on "sustainable development and construction".
- To identify a set of measurable **sustainability indicators** for the building sector and handle them together with "ill-defined" problems, non- or less-measurable aspects with a proper ranking of related issues.
- To rank and benchmark a number of indicators for measuring sustainability issues in building projects.
- To establish the **practical measures** for improving the performance of buildings and construction against the defined indicators and other aspects.

7.9 Education & training

7.9.1 Status

Universities are always good places for new ideas, and the Building Performance Concept was very soon introduced in higher education and research thanks to the good cooperation during the seventies and early eighties. The **opportunities of the universities changed** rather radically in the transition period. In the first phase, almost all governmental linked bodies or Institutes (like academic institutes, building research institutes) suffered from the lack of money, as the State withdrew itself from all field of the economy and society, which needed financial subsidy but did not have promising very fast payback. **Neither education**, which is from its nature a long term investment, **nor research got the necessary support** from the budget, which caused also the closing of some institutions. On the other hand Universities started to get benefits from participating in **international programs** like Tempus, or later Leonardo. With the decreasing support for international activities it became more difficult for UNIs to participate on conferences or starting its own research programs. A lot of laboratories stopped their developments or were closed because of the lack of finance. Industry withdrew a lot of field – mainly in the building sector – by giving jobs to the universities, finding a more economical way to finance direct the teachers by their private companies. That makes UNI teachers' status less popular and challenging.

In some countries, like in Hungary, the education has a **backlog from the former political engagements** that means, that even in the eighties a potential lecturer should have shown strong political link to the ruler Communist Party (e.g. a department leader should have been a principle member of the Communist Party; and similar requirements existed also in the Construction Industry, where higher rank leaders of companies should have been members of the Communist Party). As talent and ability couldn't be tied to political engagements, and also because of the low salaries, the good quality engineers - mainly with good ability of speaking languages - tried to find a job rather in international companies having much better salaries and shorter carriers. Of course, time has solved lot of these problems, as the new generation has far less of them, and even the salaries have been starting to increase during the last years.

The university education related to building and construction is provided by **technical universities at the faculties of civil engineering and the faculties of architecture** in the NAS countries. The universities oriented e.g. to the wood and transportation construction play a specific role in education. The education on the secondary schools gives a traditional information and knowledge. There is a need to improve the general level of education in the NAS countries, and also to make more training related to PBB.

In Bulgaria all the good architects do private practice and not teach since there is no money in teaching. 'Political persons' occupy all teacher positions. In Hungary the situation became a bit better as regards to salaries. In Slovakia there is a lack of PhD Students. In the Czech Republic there are more PhD Students and few people with practice.

As regards **training**, professionals are given training when a new product / process is implemented in the regulation.

7.9.2 Strategies

- To **improve the general level of education** and to integrate in the education of technical universities the PBB concept with larger emphases.
- **Performance criteria** need to be trained to everyone involved in the construction process – from users, to masons.
- Besides postgraduate studies, universities should be able to carry out high quality education and **research**.

7.10 Intelligent buildings

7.10.1 Status

In Bulgaria all the good architects do private practice and not teach since there is no money in teaching. 'Political persons' occupy all teacher positions. In Hungary the situation became a bit better as regards to salaries. In Slovakia there is a lack of PhD Students. In the Czech Republic there are more PhD Students and few people with practice.

The intelligent buildings concept covers the area of heat sources, heating control, cold sources, air conditioning, control systems, i.e. complex regulation of energy systems, protection and fire protection system, locking systems, energy consumption measurement, CCTV. Mainly the owners of **new administrative and industrial buildings** apply this approach.

7.10.2 Strategies

- To raise the awareness of the advantages of intelligent building systems regarding **safety, security, indoor comfort and cost reduction** achieved by intelligent solutions.
- To apply the intelligent building concept also in case of residential buildings

7.11 Structural design & engineering

7.11.1 Status

In the NAS countries Building Code defines **essential requirements** for buildings. The first and one of the most important is **safety of construction** as a performance-based requirement. (e.g. buildings and devices connected with them should be designed and executed into such way, to avoid: 1) destruction of the whole or parts of building, 2) dislocations and deformations about inadmissible sizes, 3) damage of part of buildings, connections or installed equipment in result of considerable dislocations of elements of construction)

Currently, the **performance of load bearing structures** of buildings is addressed very strictly in the NAS countries. Internationally recognized researches should be continued in this field in the NAS countries.

7.11.2 Strategies

- To continue **internationally recognized researches** of the NAS countries in the field of structural design and engineering.

7.12 Construction products directive (CPD)

7.12.1 Status

CPD was known from the time of origin in the NAS countries and some principle like **Essential Requirements** came in law in the middle of the 90's. There is **a lack of information of the control**. E.g. there are the essential requirements for buildings & products but no control of implementation. Misunderstanding can be very dangerous. CPD should be performance based and assessment based.

CPD is an obligation and a good possibility in breakthrough in the NAS countries related to PBB. It is assumed, that in the near future CPD will entirely introduced in all countries and all countries would notify national institutes for EOTA, since majority have now observer member status.

7.12.2 Strategies

- There should be a **greater emphasis on health, energy, acoustic**, etc.
- CPD should be also **assessment based**.
- Effects should be integrated in **simulation & testing**.
- **Clients' needs should have priority**.

Conclusions of the section:

This section addressed the status and strategies of PBB in other PeBBu domain areas, including the 3 terminated PeBBu domains.

*As regards the domain of **built environment** more than 50% of the European population is living in cities, where two adverse processes can be observed. The symptom of sub-urbanization and deterioration of inner city areas are on one side and the increasing demand for good quality urban living is on the other side. The majority of the housing stock in the NAS countries cannot meet today's needs, especially the run down and functionally obsolated inner-city blocks, the old mud houses and the large panel housing estates. Regulation of the development of the built environment and also regional planning has plenty of problems to solve. The process of sub-urbanization and urbanization should be balanced. There is a strong need for renewing, maintaining and operating existing buildings and for conducting complex urban renewal programmes. Information channels should be also developed in order to inform all partners of the construction process and in authorities about problems and complex solutions concerning the built environment and its sustainability.*

*Considering the issues of **organization and management**, the enterprises in the NAS countries have consistently began to build and should further develop the quality management systems and environmental management system, as next competitive advantage. There is lack of another certificate in safety systems that should be also created.*

***Documentation** is related to the procurement process. In NAS the trends of traditional procurement model are dominant. Developing performance-oriented model is an issue of strategy and several barriers should be surmounted. As regards **information**, several professional journals and periodicals are issued and information materials available related to building and construction. Complex information on a performance bases should be created to stakeholders.*

*As regards the domain of **fire safety**, this issue gains a high recognition in the NAS countries. Testing laboratories are issuing certificates and approvals of materials and building elements from fire safety point of*

view. To develop fire regulations on performance bases and to provide more complex information on the subject would be necessary.

Regarding the domain of ***accessibility****, the criteria are specified in the Building Regulations in most NAS countries, however only for public buildings are mandatory items to keep. More information and awareness and also proposals of accessibility in residential buildings are needed.*

The group of the owners of the buildings applies facilities management*. Since 1990 the tenure structure changed considerably in he NAS countries where the strong process of privatisation has had serious consequences in maintenance and facilities management. Associations of the flat owners, special companies or housing corporations were established for facilities management. New acts are regulating their operation and organization, that should be further developed and the role of facilities management should be continuously increasing in the NAS countries.*

As regards the domain of ***energy and water management****, in the NAS countries the majority of houses are poorly insulated and strong energy conservation measures are needed. Reconstruction activities should be combined with additional thermal insulation. Also the practice of EU countries should studied and assessment tools developed.*

In the issue of ***environmental sustainability****, all NAS countries are engaged for development, but in real term the national programs generally are rather week. Financial and political barriers are characteristic. To raise the public's awareness, to identify indicators for evaluation and to make proper practical measures for increasing environmental sustainability are strong challenges.*

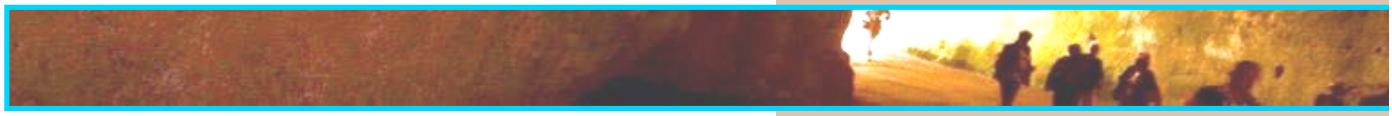
As regards ***education and training****, in the transition period the opportunities of the universities changed in the NAS countries. Neither education nor research got the necessary support. On the other hand international programs became open to NAS countries. PBB concept should be integrated in education, the general level of which is also necessary to improve.*

Concerning the domain ***of intelligent buildings,*** *mainly the owners of new administrative and industrial buildings in the NAS countries apply the concept. It is needed to raise the awareness of the advantages of intelligent building systems regarding safety, security, indoor comfort and also to apply them in case of residential buildings.*

As regards ***structural design and engineering****, safety of construction is a performance based essential requirement in every NAS country. The performance of load bearing structures of buildings is addressed very strictly in the NAS countries. Internationally recognized researches should be continued in this field.*

CPD *was known from the time of origin in the NAS countries and some principle like Essential Requirements came in law in the middle of the 90's. However, there is a lack of information of the control. CPD is an obligation and a good possibility in breakthrough in the NAS countries related to PBB. CPD should be also assessment based and clients' needs should have priority.*

Vision for the Future & overall strategies of PBB Implementation



CHAPTER 8

8 Vision for the Future and Overall Strategies of PBB Implementation

8.1 Basic Conditions and vision of PBB implementation

The state of the art of the PBB in NAS countries has been identified. It issues from the specific history of the region in 20th century. The **EU accession** gives new opportunities, partly because of obligations in PBB implementation in the NAS countries, nevertheless, also further barriers like: market deformations, influence of strong interest groups on international level, cartel agreements among producers, state budget deficit restrictions, new tax policies, governmental decisions, etc. can be raising. In general it can be said that only a **stable political, legislative, economical and social environment** in NAS will provide the optimum conditions enabling the creation of the infrastructure necessary for a wider PBB implementation.

In particular that means **providing for a future**:

- Neither restrictive, nor deficit, reasonably proportional **state budgets**, supporting education, research and development in the construction sector.
- The solution of the adequate **R&D funding** on national level.
- Transformation of **educational systems**.
- Creating a complex system on **building information**.
- Equal **competition rules** for the large companies, as well as SMEs, real state support of their innovative activities, formulation of new solutions and ideas for construction industry and market.
- Stronger **involvement of stakeholders**, standardisation offices, chambers of architects and engineers in the PBB concept – national platforms.
- More **intensive cooperation** among universities and research and testing institutions on the NAS level.
- **PBB application in solution of specific acute problems** as: old civic and residential building stock, large panel concrete buildings, old industrial areas, mud-construction buildings, new construction activities.

The main **vision to the future** concerning the implementation of PBB is that **after 10 years the differences between the NAS countries and the former EU countries will be decreased to a minimum level and most of the barriers will be ceased. Regional cooperation** will be increased**. Several strategies are needed to realize this vision**.

In summary, the state-of-the-art analysis of the PBB in the NAS countries has formulated following **basic conditions necessary for the application of performance based building principles**:

- **Economic conditions** – providing that the construction process is not significantly limited by the investor's budget.
- **Material/technological conditions** - providing the availability of a wide material assortment at the market satisfying the local needs.
- **Organisational/personal conditions** – providing optimum cooperation of partners with good expertise.
- **Informational/communicational/educational conditions** – providing all information necessary for a good decision-making during construction.
- **Legislative/trade/standard conditions** – providing generally accepted rules enabling the acceptation of the opinions of all construction partners concerned.

The realisation of these conditions in future will depend on the **involvement of the potential PBB holders - relevant construction process partners: clients, architects, contractors, producers, facility managers into the performance based concept in practice**. Their involvement will suppose to interpret/transform the conditions for PBB application listed above into their practice as an inherent part increasing their benefits in the construction process in future. The specified conditions for optimum realisation of PBB for each of construction process partners must be accompanied with the adequate complete information necessary for their fulfilment. In particular the **basic conditions for PBB implementation needed by construction process partners** follows.

8.2 Role of Process Partners

Clients will require the trust of his good decisions concerning the building performance and costs. For this he will need to be:

- well informed about the building performance requirements, their clear specification and monitoring, trust of the other partners,
- in the main contact with the chief engineer able to manage and mediate their needs.

Architects/engineers should have:

- the PBB principles awareness, the understanding that a building is a complex performance system with a long lifespan, the adequate time and technical equipment for design, as well as the adequate technical information,
- the adequate price of their work and ability to respect/cooperate with all professions involved.

Contractors will need:

- a good project of construction work issuing from the architectural design and ending at the organization of his work. Simultaneously he needs to have the knowledge on the technologies used and the work organization.

Producers will need:

- an access to all necessary testing, certification and monitoring tools, not deformed by the client's effort to save the money, applying cheap non certified products.

Facility managers will need:

- the tools providing a detailed information and assessment of the building performance in time, within the context of the contemporary performance requirements, including monitoring, testing, diagnostics and simulation tools.

Taking into consideration the present status, the barriers and opportunities of realizing these conditions, **the following vision for the PeBBu approach can be expected for the coming 20 years in the NAS countries related to the legislative framework and the construction process partners:**

The legislative framework:

- It could be said that the improvement of the legislative framework is going on the right way in the NAS countries and it could be expected that in the coming 20 years the PeBBu approach will be widely implemented in it. The law and regulations concerning the energy efficiency of buildings are good examples that should be extended and aspects such environment and life cycle cost of buildings should be examined in the same way,

The producers of building materials:

- With the market economy producers of building materials had to face with the competition of imported products. The implementation of the European standards and certification of

conformity is currently going on in NAS. This should lead to a better market supply with higher quality products. Here it should be underlined that the building products should be certified not only with regard to their energy saving characteristics, but also with regard to their environmental impact and life span. It could be expected that in the coming 20 years the producers in NAS will offer higher quality building materials according to PB requirements.

Designers:

- One of the main barriers toward the implementation of PB design is the conservative mentality of the designers. They usually would prefer to apply ready deemed-to-satisfy solutions and well-known materials and technologies instead to experiment with new solutions. As the designers are also the main consultants of the clients, their conservatism reflects on the client's brief and on the whole further process. Moreover, a PB design requires much more time, work and efforts, and would be more expensive. On the other hand, the designers have to comply with the requirements of the legislation. An adequate legislation could stimulate the professionals to work with a PB approach. For the implementation of PB design it is also necessary to improve the educational system through the implementation of new subjects dealing with energy efficiency, life-cycle cost, environmental impact, etc. In summary, the implementation of PB design depends on the legislative framework, the educational system and the attitude of the architects and engineers. In the coming 20 years PB design should be implemented at the design of big public and office buildings, as well as at the design of some more luxurious single-family houses.

The constructors:

- Construction companies usually have a set of tools for the execution of building works following traditional methods. The implementation of a new construction method would require the purchase of new equipment and a training of the workers. This would lead to an increase of the construction costs. The implementation of new building technologies is possible only after a life-cycle cost assessment of the building where it will be proved that the additional costs for these technologies will be paid back through lower maintenance costs (including lower energy consumption) and longer life span of the building. In the coming 20 years the building companies would prefer to execute construction works with traditional technologies and materials, as far as these materials and technologies meet the requirements of the approved design. If these requirements are given in performance terms, the constructors would prefer traditional methods. New materials and technologies would be applied only if the client or the designers require it.

The clients:

- A building is a very complex and often expensive structure that requires a mature consideration at each stage of its realization. Unfortunately, most of the clients in NAS are not used to use consultancy services, they trust more to statements like "a friend of mine told me that…". Usually their brief for designing is "the bigger possible built area at the lower price", even if compromises with the functionality and the quality are needed to reach such area. A long time and an increase of awareness among the whole society are necessary to reach a change of this mentality. The client's behaviour may be the crux of the matter. Neither designers nor constructors can work in performance-based terms if this is not the desire of the client. Following a large awareness raising campaign among the whole society, in the coming 20 years PeBBu could be implemented in NAS in big public, office and dwelling buildings, as well as in some single-family houses owned by people that are concerned with the problems of the environment, the energy saving and that require higher quality and longer life span for their dwelling.

8.3 Developing the Fundamental PBB Infrastructure

The realization of the above mentioned needs in future will need the realisation of **fundamental PBB infrastructure** necessary for the construction process partners:

- Complex performance models and simulation tools
- Information system for modelling and decision-making,
- Monitoring, control, testing tools, relevant indicators and testing institutions

The creation of this infrastructure is strongly dependent on the mutual **support of the all participating partners** and will require a relatively long period, approximately 10 years. Therefore, the construction process partners should support the creating of this infrastructure and subsequently **realise the PBB conditions on the national level**, where the **following existing institutions should be involved**:

- Chambers of architects and engineers
- Guilds of contractors and producers
- Universities, research institutions
- Testing institutions
- Ministry of construction and regional development
- The main arbiter of PBB in practice will be the local architect with special responsibility for PBB

The **international cooperation** in this field, minimally at **regional level**, will be naturally anticipated.

8.4 General Strategies of PBB Implementation

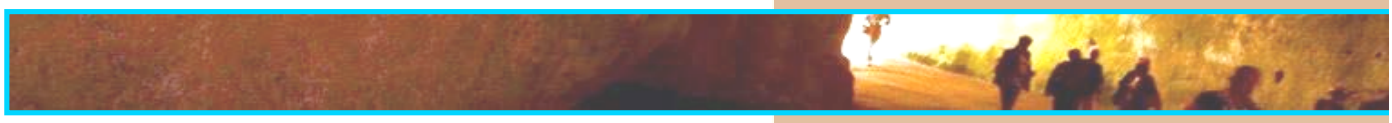
As regards general strategies the followings can be stated:
Domain related strategies were pointed out in the 5th and 6th section of this report after the status analysis of each domain. In the followings some **overall strategies** are to be discussed. It seems that **authorities** should have an increasing role in developing **construction policies, housing policies and strategies** and in realizing these strategies. The **institutional background** of the construction sector should be developed in the NAS countries. The development of the **national standardization processes** is a key issue in implementing the PBB concept. It is important to **raise the awareness** of the professionals of the importance in thinking in performance terms. In order to spread the PBB concept in practice, **clear performance criteria** should be defined. In order to measure the performance in practice, **indicators, measurement, testing and simulation tools** should be developed. For increasing the level and quality of regional and international cooperation, learning **foreign languages** should be promoted. These needs suppose the **systematic institutional stimulation of research, development, educational and construction activities** at regional/national levels.

Conclusion of the section

In general it can be said that only a stable political, legislative, economical and social environment in NAS will provide the optimum conditions enabling the creation of the infrastructure necessary for a wider PBB implementation. The main vision to the future concerning the implementation of PBB is that after 10 years the differences between the NAS countries and the former EU countries will be decreased to a minimum level and most of the barriers will be ceased. Regional cooperation will be increased. Several strategies are needed to realize this vision. The realisation of the basic conditions necessary for the application of performance based building principles in future will depend on the involvement of the potential PBB holders - relevant construction process partners: clients, architects, contractors, producers, facility managers into the performance based concept in practice. Taking into consideration the present status, the barriers and opportunities of realizing the basic conditions, it could be expected that in the coming 20 years the PeBBu approach will be widely implemented in the NAS legislation. The producers will offer higher quality building materials according to PB requirements. The implementation of PB design depends on the legislative framework, the educational system and the attitude of the architects and engineers. In the coming 20 years PB design should be implemented at

the design of big public and office buildings, as well as at the design of some more luxurious single-family houses. In the coming 20 years the building companies would prefer to execute construction works with traditional technologies and materials, even if requirements are given in performance terms. New materials and technologies would be applied only if the client or the designers require it. Following a large awareness raising campaign among the whole society, in the coming 20 years PeBBu could be implemented in NAS in big public, office and dwelling buildings, as well as in some single-family houses owned by people that are concerned with the problems of the environment, the energy saving and that require higher quality and longer life span for their dwelling.

Conclusions



CHAPTER 9

9 CONCLUSIONS

Status of construction in NAS is strongly influenced by the historical background. The main common features of the **former socialist system** were the artificial international isolation of the countries with limited exchange and communication, prohibition of the import of modern information, systems and materials in the second half of 20th century. The consequences of it are as follows: common communication language problems, lack of money for innovations, restrictions of individual initiatives and activities in the trade and industry, with simultaneous strong political influences on positions of UNI teachers, management and other key persons.

In NAS the state sector was oriented to **industrialisation, prefabrication and typifying** in a construction and the use of new materials and technologies, which support the mass building production of narrow assortment products. The construction quality was evaluated by low costs and short construction times, which in the planned economy resulted in the **low quality** of buildings and living, accompanied by the building maintenance neglect. In private sector traditional empirical methods were applied and the design process was based on the implementation of verified traditional solutions. This approach is still living up to now.

The **construction industry** during the period 1990 – 2003 got over the changes that have reflected in a considerable **decline of production** lasting until now. The share of construction industry in GDP was permanently at very low level during this period and the construction industry employs less than half of the people in comparison with the eighties.

The sudden **increase of the costs** after 1989 significantly influences the liberty of design and realisation. The investor began to be a dominant partner in the process however his independence and dominant role very often results in the production of a poor performance. Simultaneously one of the main criteria for a client making decision on a construction or purchase of building are of economical character. In both cases the role of architectural quality is considered to be fundamental.

As regards **research,** the first years of the transition time were very critical in any field. The state as a main client lost his position and lot of things turned just to the opposite side. The mostly liberal thinking of governments and the lack of capital in general support to establish a "weak state" system resulted a lot of pitfalls in the first period and still is very relevant. That means a lot of deregulation without substituting the former regulations with new systems of codes or decrees.

The **culture of design** was changed as well. The gigantic planning offices and former large state designer companies were split into small private engineering and architectural offices, which still remained underpaid. The design time were shortened, sometimes it even did not give opportunity for careful work, which is not favourable for the time consuming and risky (as professionals feel) performance based thinking. The high costs of computational design tools, databases, international standards and relevant literature contribute negatively to this situation.

The **Bank sector** has developed a lot during the previous years, the credit systems are still rather bureaucratic, slow, and not really client based. The clients - and the whole building industry – suffer of credit systems. The situation is accompanied by delayed payments, extremely large black market.

Huge **international companies** came to NAS countries just to gain new market and they basically make R&D in home countries. For companies the idea of performance is generally just for marketing and selling products. SMEs are in dangerous position (most important in building market) because of the leading role of

huge international companies. This results in the lack of cooperation between science and industry and low level of R&D investments in the construction industry.

Low skilled workers, low workmanship, low onsite safety, lack of quality inspection and lack of a competitive market often characterize construction. The **construction market** is not free; it is characterized by fast/ radical development and domination of several strong usually foreign companies. Information on the construction process is not available on a satisfactory level.

The transition from the state-controlled economy to the market economy has had significant consequences also in the field of housing. It has raised the problem of **housing affordability** in a society, which has become economically segregated.

Very generally saying, the closer is a topic to the market, the more realistic approach and visible development could be registered. Oppositely, the closer is a topic to central governmental issues and budget, related to the big public supply chains as education, health service, social welfare, military etc., the more out of fashioned or unreal systems are sustained. In this aspects **local governments** with their twelve years experience – and less influenced by daily politics - understand better the significance of long-term investments and handle more properly this kind of issues. Therefore, PBB on local level seems to be better achieved than higher level.

Regarding the field of **regulation**, the main problem is the lack of finance. It is obvious, that simply the interpretation of EN's or hEN's is in very weak stage. Generally governmental offices are open to any European models and idea, but the lack of information in civil servant level is also rather great.

Although the **performance concept** has been integrated in the NAS Building Regulation in many areas, like building constructions, fire protection, acoustics, road and bridge construction etc., the national standardization process is still rather weak due to the bad economical situation of that standardization area. There is still the long way from EN implementation and their application in practice.

The **accession to the European Union** gives also a special situation and opportunities for PBB concept application in these countries.

The status of PBB is determined by the main contemporary carriers of this approach in NAS.

The standardisation committees are operating in the area of civil engineering, appointed on the basis of authorisation by stakeholders (industry, business, administration, consumers, universities and research organisations). Basically, it can be said that the **national building standards** are still highly prescriptive and inhibit both organisational and technological innovation in the construction industry. Therefore, a slight shift to performance-based orientation would surely create a stronger stimulus for product and process innovation and enhance the consumer-orientation.

Entering the EU in 2004 May, the **harmonization processes** in the NAS countries become more and more intensive. Construction Product Directive determines the codes and decrees in all countries, waiting just for some modification arising from the full membership of the countries. The base would be the nominated institutes of the countries for notification, which can act as a bridgehead of Performance Based Building regarding their background and essential role in the certification, testing and attestation of conformity processes.

CDP have been almost entirely implemented in the NAS countries. New building products from foreign international companies are available to NAS countries. **High quality buildings** became more common, verification of project documentation by an independent party is more applied in practice. Universities teachers' situation is slightly changing. The dealing with SMEs becomes more and more

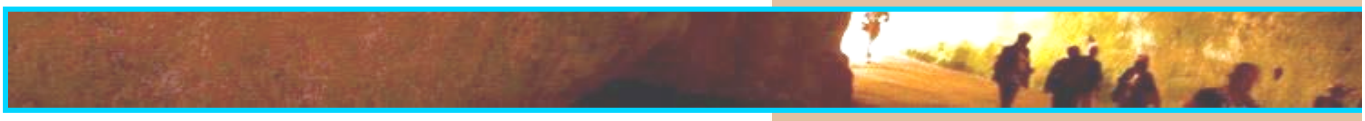
significant, since they occupy 90% of positions. The PeBBu could have a common language to help solving the problem of segregation of stakeholders.

Because of relatively low costs of building process the cost of **design** is not very important. That's why investors in principle can afford expensive designs. The most important factor for decision of buying a design is functionality of the building. It means that investors do not think only about investments cost but also about its life cycle costs. However, the project economy is still not much important.

In general it can be said that only a **stable political, legislative, economical and social environment** in NAS will provide the **optimum conditions** enabling the creation of the infrastructure necessary for a wider PBB implementation. The **main vision to the future** concerning the implementation of PBB is that **after 10 years the differences between the NAS countries and the former EU countries will be decreased to a minimum level and most of the barriers will be ceased**. Regional cooperation will be increased. Several strategies are needed to realize this vision. The realisation of the basic conditions necessary for the application of performance based building principles in future will depend on the **involvement of the potential PBB holders** - relevant construction process partners: clients, architects, contractors, producers, facility managers into the performance based concept in practice. Taking into consideration the present status, the barriers and opportunities of realizing the basic conditions, it could be expected that in the coming 20 years the PeBBu approach will be widely implemented in the **NAS legislation**. The **producers** will offer higher quality building materials according to PB requirements. The implementation of **PB design** depends on the legislative framework, the educational system and the attitude of the architects and engineers. In the coming 20 years PB design should be implemented at the design of big public and office buildings, as well as at the design of some more luxurious single-family houses. In the coming 20 years the **building companies** would prefer to execute construction works with **traditional technologies and materials**, even if requirements are given in performance terms. New materials and technologies would be applied only if the client or the designers require it. Following a large **awareness raising campaign** among the whole society, in the coming 20 years PeBBu could be implemented in NAS in big public, office and dwelling buildings, as well as in some single-family houses owned by people that are concerned with the problems of the environment, the energy saving and that require higher quality and longer life span for their dwelling.

The complex solution how to support the PBB in NAS must issue form the promotion and propagation of **cooperative approach** of all partners to the construction based on complex building performance knowledge. The possibility of equal opportunities and the minimum threshold degree of **economical freedom and stability** are the fundamental conditions for this. The accession to the European Union provides new opportunities, partly as obligations for implementing PBB in the NAS countries. If the key strategies will be conducted, **the vision to the future related to PBB in eliminating the differences between the NAS countries and the former EU countries has real and good chances.**

Annexes



10 ANNEXES

10 ANNEXES

10.1 Annex: PeBBu NAS members

Contacts Task 15: Regional Platform 3 East Europe					
Country	**Last name**	**First name**	**Task**	**Organisation**	**e-mail address**
Hungary	Matolcsy	Károly	Task Leader	ÉMI	mat.k@emi.hu
Slovakia	Matiasovsky	Peter	Task Leader	Institute of Construction and Architecture, Slovak Academy of Sciences	usarmat@savba.sk
Hungary	Tiderenczl	Gábor	Support to Task Leader	ÉMI	gtideren@emi.hu
Netherlands	Jasuja	Mansi	Network Secretariat	CIBdf	mansi.jasuja@cibworld.nl mansijasuja@hotmail.com
Bulgaria	Stoykova	Evelina	Task Member	Sofia Energy Centre Ltd.	estoykova@sec.bg
Czech Republic	Kalousek	Milos	Task Member	Brno University of Technology	kalousek.m@fce.vutbr.cz
Poland	Bartkiewicz	Piotr	Task Member	Warsaw University of Technology - Institute of Heating and Ventilation	Piotr.Bartkiewicz@is.pw.edu.pl

10.2 Annex: Barriers, strategies and actions for PBB implementation in the NAS countries

Barriers to PBB from heritage of Iron Curtain	Background	PBB related issue	Strategy for PBB implementation	Actions for PBB Implementation
Artificially isolated countries with limited exchange and communication	Cold war	Difficult to follow-up of new things	Communication and cooperation, based on clear principles	Not relevant any more
PLAN driven industry, small playground on performance thinking	Soviet totalitarian system, also bureaucracy	Limited responsibility and activity on strategic issues and limited creativity	Limited existence by now, the tendencies of detailed planning and centralism are coming back from Brussels. A balance should be found.	Strengthening awareness of decision makers and NGOs
COCOM list for modern systems and materials	Cold war	Lack of high quality systems, delay of all computer based technologies	Limited existence minimisation of the existing technological delay by specific support measures	Not relevant any more
Very few of the population/ stakeholders can speak or read English	Isolation, mandatory Russian learning, lack of communication	Few people understand English literature	Finding solutions to the intermediate period and less educated stakeholders	More awareness to the EU, national platforms, information materials and standards in national languages, education
Inverted Marshall Aid	Russian occupation, heavy burden on budget, strong economical influence of a state	Bad economic situation insists on capture the fire rather than innovation	Bad heritage, although very slowly changing, creating the innovation infrastructure and environment	Not relevant any more
Short term thinking	Russian occupation, 'barrack life'	Hard implementation of long term/ life cycle issues	Raising awareness for the public sphere, stressing on the economical benefices of long term issues	Incentives and support for long term solutions and concepts
Artificial life in many aspects, heavy political pressure on daily life	Soviet system	PB thinking related to certain freedom of thinking	Limited existence, still residual.	Strengthening NGOs, limiting political influence
Strong political influences on UNI teachers and other key persons	Soviet systems	Contra selection, greater number of undereducated, non talented teachers and key persons	Limited existence, open competition conditions, accreditation of universities	Not relevant any more
University teachers' life lost reputation in financial and in general aspects	State withdrawal from UNI, Industry prefers working with the private firms of the teachers	Lack of UNI interest in progressive methods and thinking	Change the mentality, Raise the awareness for quality aspects, More competition	PBB Inter UNI exchange program, Best practice examples from the EU, better salaries

Barriers and stimulations arising from the transition situation	Background	PBB related issue	Strategy for better PBB implementation	Actions for PBB Implementation
International manufacturing companies rule the building industry	Lack of national capital, preferable circumstances for foreign investors, relatively cheap workmanship	PBB implementation would be easier by international companies in theirs field	Investigation, whether the process is working, or Int. Companies behave in another way in these countries. To influence companies to be innovative	Structural Funds, Tenders, PB thinking in European Aid
State strong withdrawal from building industry related the regulation and subsidies, as well as supporting R&D projects	Building industry lost its formal position in central budget, there are much 'hotter' areas	Certain PBB implementation is necessary to obtain state participation	Raising the awareness of government, national standardization committees, etc, because of public interests.	Structural Funds, Tenders, PB thinking in European Aid
Design culture has changed, SMEs are the main actors	Natural changes, instability	Newly start SMEs has other problems than seeking risky, innovative solution	Supporting SMEs	Special programs for SMEs
Cheap and not proper design	Bad habit not to pay for 'paperwork', underestimated design phase, unrealistic time frame	Design phase would be one of the major opportunity for PBB	Awareness of stakeholders on this issue and their consequences, more focus on design, stronger criteria for designers, more respect of design	To allow more time for design, better payment, qualification systems, guidelines and performance assessment tools
CPD are implemented almost entirely in all countries	There was not strong objection of that	CPD has rather PBB features	Use CPD as a catalyst of PBB, more understanding of CPD as system, than a list of requirements	Training, manuals (CPD in practice)
International strong clients insist their culture in NAS countries as well and want to sell lower quality items in NAS	Globalisation feature of Int. Companies	There are positive aspects, however local performance requirements would be still relevant, originality will be still dominant	Cooperation with user platform in this issue, changing the thinking	Stronger legislation on quality, better control, more publicity for responses
Low housing promotion, low retrofitting activities in residential sector	State withdrawal from housing, cutting subsidies, not relevant subsidy systems, ill structure	Residential building has important role in a sustainable society and in PBB in raising the quality of life	To develop effective national housing policies	Best practice implementation, piloting, raising awareness of governmental bodies. More cooperation inside the EE Platform.
Regulation are focused on harmonization	Governments don't want to resist any European movement	Performance based regulations	More PBB in the harmonized regulation	Cooperation with new CPD domain, more involvement of CPD
Weak credit systems, delayed payments, extremely high black works	Non sufficient systems, no visible strong governmental will, strong corruption	Performance Based Thinking demand good financial background and clear intentions	Awareness of all stakeholders as tax-payers on this issues. To develop better financial background for construction	Improving credit systems and tax policies

Barriers and stimulations after the EU extension	Background	PBB related issue	Strategy for PBB implementation	Actions for PBB Implementation
International companies do not prefer innovation in NAS countries, they use their own R&D centers	High unemployment rate in Europe wide	Without strong innovation demand PBB implementation has weak background	Stronger networking and cooperation of interested parties	Wider European policies to support innovation in NAS
High quality building became more common	Private clients claims for higher performance	Good piloting project possibilities and Best Practice	publicity of good authors and retaliators	Competition / tenders to make Best Practice examples
Segregation and fragmentation of design, engineering and construction	Lack of cooperation between stakeholders, week general contractors, low budget	Performance based construction with project team systems should solve the problems	Hard issue, there is a good experience with 'engineering activities'	To develop and apply tools for better cooperation and decision support
Low liability and responsibility	Bad heritage	Could be one of the most dominant factor of PBB	The still formal role of the chambers of architects and engineers should be changed	Clear framework for responsibilities, more cooperation, better discussing of overlaps
Lack of awareness among the population regarding dwelling construction qualities	Bad heritage	Contradiction between the expectations and the real qualities	The old mentality like "a friend of mine told me that…" should be changed and the awareness of life-time, maintenance costs, energy consumption and environmental impact of housing should be improved	Large-scale awareness campaigns for the population, organized by universities, NGOs, consulting companies with the support of municipalities and ministries
Market deformations	Transition period	Hard to introduce new solutions and ideas	To support innovations and raise the awareness of the advantages of new solutions, deflection from industrial thinking to innovative one, better balance system	Better quality and prize awareness, labelling system, easy access to information, CPD related actions
Influence of strong interest groups on international level	Still not really free market	Barrier to equal opportunities, unrealistic prize is a risk	To create free market environment on long-term, to find performance based influence	Stronger legislation on quality, better control
Cartel agreements among producers	The price level of same type of products are the same	No incentive for develop better performance products	Better quality should have better position in the market	Stronger legislation on quality, better control
State budget deficit restriction	3 % of GDP limited by EU	Strong influence of economic situation to technical solution	More market orientation	Out of PBB competence
New tax policies	High taxes in NAS and not harmonized with EU	Construction activities and performance issues are influenced by taxes	Taxes should reflect more the quality and aims	Harmonization and tax incentives for environmentally friendly solutions and quality, European action is needed

Barriers and stimulations after the EU extension	Background	PBB related issue	Strategy for PBB implementation	Actions for PBB Implementation
Governmental decisions	Different interest and liabilities from EU bodies, too liberal Governments ("market will solve the problem")	Strong influence on construction	Education & research support, Support for housing. Minimisation of regional & social differences	European and bilateral best practice change
Weak governmental support of SMEs	Governmental support of large companies	Minimum conditions for innovative solutions	To support and create the innovation infrastructure and environment enabling the transfer of new solutions to a practice	Put PBB on the SME's level (attractiveness)
Artificial differentiation among fundamental and applied research and technical development	The trends of ministries to diversify and minimize the research funding to their own sectors	The university and sectorial research has many times a compilation character and is not innovative	Support of the complex R&D chain up to the application	More fundamental research on international level, more cooperation

10.3 Annex: Best-practice Examples of PBB in NAS Countries

10.3.1 Slovakia

In this section best practice examples of PBB will be presented from a selected characteristic NAS country, **Slovakia**.

10.3.1.1 Best Practice Example of Housing Complex with 130 dwellings Kramáre in Bratislava

Peter Matiašovský, Stanislav Darula, ICA SAS Bratislava
Peter Moravcík, Bratislava
Bratislava 2005

Basic data

Architects:	Peter Moravcík, Karol Stassel, Juraj Šujan, Lucia Žalmanová – Marušicová
General Constructor:	ZIPP Bratislava, spol. s r.o. Bratislava
Investors:	K.A.X., spol s r.o., Bratislava, Prvá stavebná sporitel'na, a.s. Bratislava and Tatra banka, a.s. Bratislava
Construction time:	1999 – 2000
Location:	Bratislava – Kramáre
Main functions:	Apartment building
Award:	**CE SA AR** of the Slovak Chamber of Architects in 2002 in the category "The best residential building"

10.3.1.2 Description of the housing complex

Number of buildings:	3
Number of flats:	130
Category of flats:	1 – 4 rooms, the flats with 3 and 4 rooms are prevailing
Flat floor area:	40 - 150 m^2
Amenities:	shops, services and feeding area of 820 m^2
Home garages:	165 parking places at two underground floors

Whole building performance criteria

As a classical construction system (brickwork and monolithic reinforced concrete structures) has been chosen, the architectural design process was based mainly on tightness, hygrothermal, air purity, acoustical, visual, tactile, dynamic, hygiene, health and environment, suitability of spaces for their specific uses, durability, economic (including energy economy and beat retention) performance criteria. These criteria have been involved into the architectural concept, with a specific effort to the performances concerning the indoor environment and energy performance.

The mechanical resistance, stability and dynamic performances, concerned the loadbearing structures, as well as the fire safety and the safety in use criteria, were considered as an inevitable ones and have been fulfilled according to relevant national standards requirements.

Architectural design concept

Standards: *STN 73 4301* 1998 Dwelling buildings
The design concept issued especially from the realisation of following requirements:

- Configuration, shape, height and location of each building will be in accordance with the effective utilisation of daylight and sunshine in flats.
- The layout of particular flats will respect the zoning of noisy and quiet spaces in buildings.
- The living rooms will be located in order to be predominantly adjacent to sunny external walls.
- The market prices and the acceptable costs requirements will be considered in the design of flats dimensions and living areas.
- The court area among the buildings will be utilized for the underground garages construction.
- The green roof of garages serves as a recreational zone.
- The analyses concerning the indoor environment based on the results of preliminary surveys will be implemented in the design (e.g. the basement protection against ground radon emission).
- Envelope is designed with standard required thermal properties.
- The thermal parameters of windows will correspond to the products of a higher than standard quality, with a low energy loss.
- The controlled heating system allowing the effective utilisation of conventional fuel sources will be applied.
- Entrances into flats and communications will be designed without barriers.
- Flats furnishings, materials of floors, doors, the wall coatings, bathrooms and a build in furniture will be designed in accordance with the requirements of users.

Hygro-thermal performance

Standards: *STN 73 0540* Thermo-technical properties of engineering structures and buildings. Nomenclature. Requirements and criteria, *STN 73 0542* Thermo-technical properties of engineering structures and buildings. Calculation methods.
Criteria and requirements:

Flats

Thermal resistance: walls 3.0 m^2 K W^{-1}, roofs 5.0 m^2 K W^{-1}, windows U-value: 2 W m^2 K^{-1}
Minimum internal surface temperature: dew point temperature at 20°C indoor temperature, 60 % indoor relative humidity and -15°C outdoor temperature
Energy consumption for heating: 30.5 kWh m^{-3} $year^{-1}$
Temperature damping: 13.5
Maximum thermal absorbability of floors: 700 W $s^{0.5}$ m^{-2} K^{-1}
Yearly amount of condensed and evaporated water vapour in external structure: within a yearly course the amount of the water vapour in the building structure must be lower than the amount of evaporated moisture
Air permeability of envelope structures: maximum decrease of the internal surface temperature due to air infiltration is 0.2 K, maximum windows crack air permeability is $1.4.10^{-4}$ m^2 s^{-1} $Pa^{0.67}$
Thermal stability of rooms: in winter season - minimum permissible sum of indoor air and mean surface temperatures in room at the end of the heating pause is 32°C, in summer season – maximum permissible sum of indoor air and mean surface temperatures in room is 51°C
For the minimum internal surface temperatures the requirement is not less than 12.5°C

Table. Prediction of energy consumption for heating of particular apartment houses – requirement is not more than 30,5 kWh.m^{-3}.year^{-1}

Object	Total heat loss [kW]	Volume of enveloped space [m^3]	Specific energy consumption for heating [kWh.m^{-3}.year^{-1}]
A	240	19 949	27,6
B	153	12 702	27,7
C	156	13 044	27,5
D	70	5 913	27,2
E	134	11 137	27,6

Underground garages:

Thermal resistance: optimum considered the high required forced ventilation rate 1.7 h^{-1}, the total heat balance and the water vapour condensation risk during a year
Whole year thermal performance: the required temperature of tempered garages is 5°C
Internal surface temperature: intensive water vapour condensation is not permissible
Temperature damping: 9.3
Yearly amount of condensed and evaporated water vapour in external structure: interstitial water vapour condensation is not permissible
Temperature stability of rooms: in summer season – maximum permissible sum of indoor air and mean surface temperatures in room is 51°C

Daylight performance:

Standards: *STN 73 0580* Daylighting in buildings, *STN 73 05 80-2* Daylighting of residential buildings
Criteria and requirements:
All indoor spaces with requirements for visual tasks have to be designed with a sufficient daylighting. The Daylight Factor is a criterion for the evaluation of interior daylighting. The visual tasks are classified into 7 classes with DF = 0.25 % to 3.5 %.
Daylight in the rooms of residential buildings is evaluated at two reference points located at the half distance from window and 1 m distance from lateral walls of the room. Average DF from these two values has to be higher than 0.9 %.

Insulation of flats:

Standard: *STN 73 4301* Dwelling buildings
Criteria and requirements:
All flats must be insulated longer than 1.5 hour at every day during the period between 1st March and 13th October for in the one third of its living floor area.

Further best-practice examples of Slovakia

- Several pilot and demonstration projects of **refurbishment**, **energy saving and eliminating the systematic defects on existing panel dwelling houses** have been realized in Slovakia. The decrease of energy consumption to the level between 30-55 % has been reached.
- VVÚPS-NOVA company took the first place in 1996 in Utrecht within the framework of Urban and Regional Energy Efficiency Programme (NOVEM) with a Phare INSULATE Project (refurbishment of a dwelling house in High Tatras - Dolný Smokovec, Pod lesom 52; comprising additional insulation of external structures, replacing of windows, installation of heating control system and construction of new flats in the roof superstructure, energy awareness campaign).

- Since 8th December 1999 the Slovak Government Conception (Resolution No. 1088) about upgrading of building stock focused on the dwelling houses stock has been valid.

Concerning the PBD practice within the framework of granted research technical projects several pilot and demonstration projects focused on refurbishment and elimination of systematic defects of large panel houses have been realised:

- Pilot project of the upgrading of dwelling houses built in national large panel construction systems ZT, P1.14 and P 1.15, PV-2 (incl. diagnostics and general analyses for those types of panel houses).
- Pilot project of the upgrading of typified primary school building (incl. general analyses of the school buildings in Slovakia).
- Pilot project of the panel dwelling house upgrading (balconies, loggias).

Concerning the new construction as examples of the best practice following results from Bratislava can be mentioned: National Bank of Slovakia, a department store specialized in furniture Atrium, a housing complex in Kramare and the Roman Catholic centre.

Figure. Examples of new construction activities in Bratislava, Slovakia
a) National Bank of Slovakia,
b) Roman Catholic centre,
c) furniture department store Atrium,

Failures:

- Small room areas, especially of kitchens or cellars caused by the restraint of the structural system used.
- Poor aesthetic performance of buildings caused by an industrial character of technology justified by the functionalism principles.
- Inadequate finishes, of PVC, wall - paper, etc. justified by the need of quick, cheap and dry technologies.

- No sun protection independently on orientation, in the country with frequent occurrence of tropical days in summer.
- Unreliable heating control of the collective heating systems.
- Bad hygrothermal performance caused by a low knowledge on the heat and moisture production and transport mechanisms in buildings.
- Deterioration of materials and contact layers caused by poor knowledge on material properties and the processes in materials and structures - the consequence of inadequate solutions.
- Flat roofs and joints realization and maintenance measures represent in practice truthfully the nature of failures: the low responsibility and knowledge levels.
- As a result of very quick construction a very high indoor humidity in buildings occurs accompanied with the creation of moulds and some other defects.
- The neglecting of any maintenance of buildings is a general phenomenon.

10.3.2 Hungary

The Palace of Arts, Budapest

Main data of the building:

Architect:
Zoboki, Demeter & AssociatesGeneral
Constructor:
Arcadom Épít□ pari Rt
Construction time:
2002 - 2005
Location:
Budapest, IX., Pest side of Lágymányos bridge
Main functions:
- National Concert Hall : 1.800 persons seating capacity
- Festival Theater: 500 persons seating capacity
- Ludwig Museum
Plot area:
10.030 m^2 (100% built up)
Total floor area:
64.000 m^2
Budget:
31,298 Billion Ft
(~125 Million €)
PPP (Public Private Partnership)

Figure. The entrance lobby and the main floor plan of the Palace of Arts

Description of the concert hall:

- Floor space of the section: close to 20,000 m^2
- The National Concert Hall is located in the heart of the building and its "shoebox" shape defines the architectural character.
- Dimensions: The hall is 25 m high, 25 m wide, 52 m long – the dimensions of a Gothic cathedral. It has a total Capacity: 1699 persons + 190 persons (back of the stage)

- The orchestra podium: located in the open auditorium, with mobile units facilitating the creation of three different stage sizes and an orchestra pit if required

PBB feature: Acoustical design:

The National Concert Hall strives to compete with the world's leading concert halls with its quality, which meets the highest acoustic requirements. The guarantee is that the world-class acoustic system is the work of renowned American acoustic design company ARTEC and its Director, Russell Johnson (www.artecconsultants.com)

Performance criteria:

- zero noise and resonance;
- reverberation time from less than 1 second to 4 seconds.

Figure. The auditorium of the Palace of Arts

Applied solutions:

- **Building in a building** construction on springy foundations in order to avoid all external noise and resonances (zero noise and resonance)
- **Acoustic canopy** over the concert podium extending out to the auditorium. The canopy has mobile wings, it rises, sinks and revolves, and accommodates the installation of special lighting / microphone system / a screen and loudspeaker units for film projection. The height can be regulated in a range of 18 metres by computer control – which also influences the acoustics. The canopy weighs 70 tons, and is suspended on 40 steel cables. The structure comprises of 5 separate mobile parts.
- The acoustics are adjustable, with the **resonant chamber system** placed next to the side walls and the podium and **large movable doors** serving to modify the size of the concert hall and influencing the reverberation time.
- The concert hall, when functioning also as a recording studio, **can be upholstered** all around in order to decrease the reverberation time.

Performance assessment:

- If the doors of the 84 reverberant chambers that circle the inner space are opened, the reverberation at certain places can extend to as long as 4 seconds.
- When the concert hall is upholstered, the reverberation time can be decreased to less than 1 second.

10.3.3 Poland

The Tulipan House in Warsaw

The Tulipan House is a commercial office building to be realized in Warszawa by Grontmij Real Estate. Light, space, care for the natural environment, flexibility and comfort are main features of the building. Special features will be sustainability and energy-efficiency. The goal is to achieve 30% energy savings compared to a standard building and to use renewable energy sources for 50% of the total energy-use for indoor climate. For the Tulipan House sustainable building

means balancing an agreeable indoor climate with energy-efficiency.

Figure. The "Tulipan House", Warsaw, Poland: the entrance lobby; view from the street.

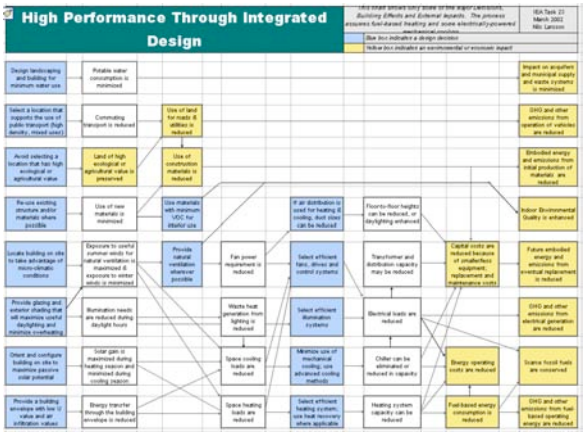
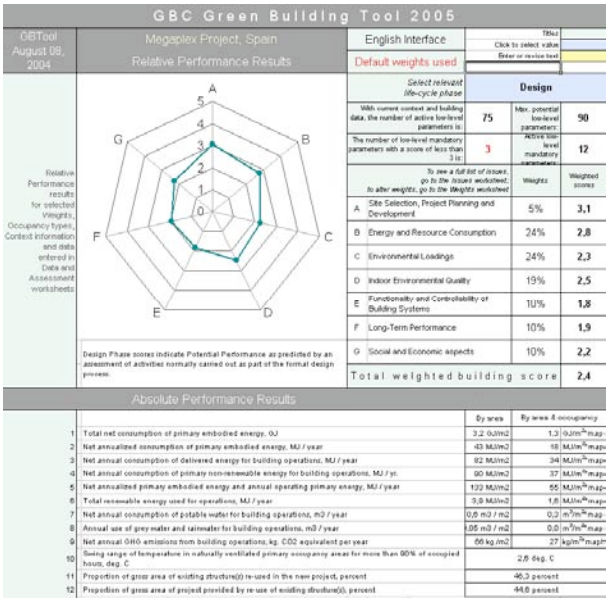


Figure. Complex environmental assessment for the "Tulipan House"



10.3.4 Czech Republic

In the Czech Republic few examples of PBB partial recognition may be quoted:

1. Shell Forms

An example of sustainability principle best practice: use of recycled plastic from throwaway bottles for production of plastic shell elements to be used as a permanent formwork in construction of ribbed or waffle RC floor slabs. The utility period of primary raw material could be thus prolonged several thousands times in comparison to waste disposal of used plastic bottles in non-sorted municipal waste. Note: original design of floor structure was composite RC slab. Use of shell installation fillers resulted in reduction of concrete consumption 34%.

This technology has been tested in Czech Technical University laboratories in Prague and experimentally used in the construction of Senior-Centre in Moravany, East Bohemia. Fore more details see: *Hajek, P. 2003, Integrated Environmental Design and Optimization of Concrete Slabs, Proc., 21st CIA Confer. Concrete in the third millennium, Brisbane*

Performance requirements:
- To develop and use floor slab shell forms from recycled/wasted material.
- Reduction of concrete consumption by uses these shell forms.

Performance assessment:
- Reduction of concrete consumption was 34%.

2. Sazka Arena in Prague

Location: Prague, Czech Republic
Project commencement date: September 2002
Project completion date: March 2004
Structure: Arena, Universal Hall
Number of floors: 6
Floor space: 35,000 m²
Capacity: up to 18,000 spectators
Parking: 280 places

Performance requirements:
- Acoustic comfort in a big hall

Solutions to meet the requirements:
- Used special absorption material for balancing of reverberation time.

3. Tubes Of Uderground In Prague

This tunnel shifting (pushing/pulling) method was used to build a tunnel of such parameters for the first time not only in the Czech Republic, but also world-wide. The contractor, Metrostav, a joint-stock company, decided to use this method in mutual agreement with the promoter (investor) of the Work, because it was more advantageous in the given section of metro line than any other method commonly used to build tunnels under water (heading/driving, sheeted building pit). This structure has got the price of FIB.

Performance requirements:
- To move the tunnel concrete blocks to working place in the water.

Solutions to meet the requirements:
- New method "pushing/pulling".

4. Demonstration Project Rumburk - Renovation

Performance requirements:
- Thermal comfort and save heating

Solutions to meet the requirements:
- Thermorenovation and regulation saved 48% energy for heating.

5. NATIONAL Moravian Library in Brno

Performance requirements:
- Daylighting and thermal comfort in a glass building (overheating)

Solutions to meet the requirements:
- Used seven types of envelope with shading and ventilation in double facade.

10.3.5 Bulgaria

The examples given below are designed by arch. Rossen Savov. Arch. Rossen Savov has a long experience in the design of buildings. Since 1982 he focused his attention to the problems of the energy consumption and the indoor climate in buildings. His research activities are focused on architectural and urban planning methods for the design of energy efficient buildings with utilization of passive solar, wind and geothermal energy. He is the author of a very useful **"**Designer's Manual for the Energy Efficiency of new buildings".

The activities of arch Rossen Savov show examples of PB approach at the design of buildings, but also examples how this approach should be promoted. As part-time assistant professor at the Department of Industrial and Agrarian Buildings to the University of Architecture, Civil Engineering and Geodesy of Sofia, Head of the section "Architecture and Energy" to the Union of Architects in Bulgaria and President of the Association "Sustainable energy" arch Rossen Savov presents to the students and to other professionals the ideas of energy efficient and sustainable buildings, stressing on the importance of a PB approach that take into consideration the energy performance, the life-cycle performance and the environmental impact of the building.

The designs of buildings given below are examples of a PB approach regarding the energy consumption and the indoor climate. They show how can be reached up to 50% of heat energy savings through the implementation of elements of the bio-climatic and solar architecture.

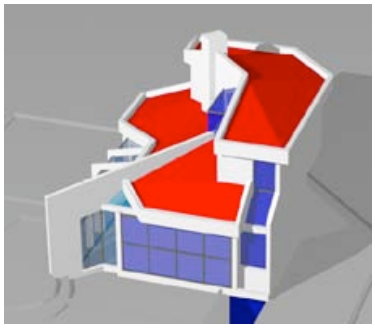
These designs show that a precise orientation of the building and an optimal distribution of the premises can lead to big energy savings at very low costs (only the costs for a more investigated design). In these buildings are implemented:

- Passive solar systems as: "Trombe walls" (acting as heat accumulators in winter and cooling element in summer) and "sun spaces" (south oriented glazed spaces acting as heat accumulators in winter);
- Air and water solar collectors for domestic hot water supply and heating;
- South orientation of main facades with large openings – living rooms, dining rooms, bed rooms; services as stairs, WC and bathrooms are with north orientation and small size windows.

Single-family house in Svilengrad, Bulgaria

Designed in 1984
The house includes 3 bedrooms,
a living room, a dining room,
a kitchen and services.
The built-up area is 180 m^2
Solar applications:

- Sun spaces – 12 m^2;
- Trombe walls – 15 m^2;
- Water solar collectors – 4 m^2.

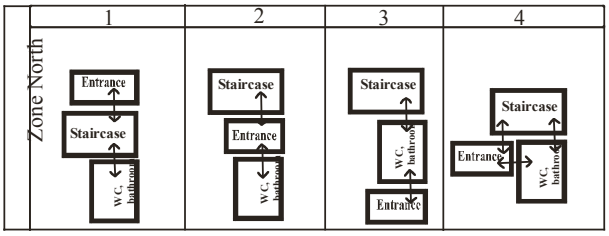


According to the calculations, the share of the passive solar heating systems represents 51% of the necessary heat load for the period November – April.

Multi-dwelling building with 54 flats in Minsk, Belarus

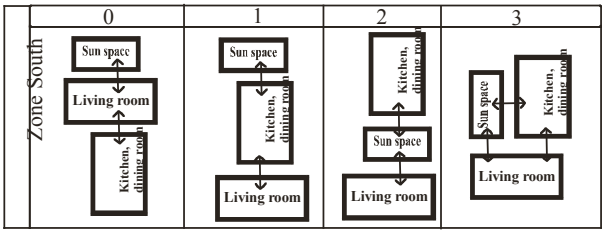
Designed in 1984
Floor area 1500 m²
Built-up area 8500 m²
Solar applications:

- Sun spaces – 540 m²;
- Trombe walls – 860 m²;
- Water solar collectors – 92 m².



Possible functional connections - zone North

On the basis of optimisation schemes of the functional connections in the dwelling and the requirements of the active and passive solar systems are elaborated models for the design of the 5-7 storey building.



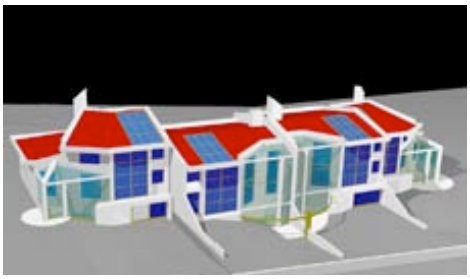
Possible functional connections - zone South

South elevation

Multi-dwelling building with 4 flats in Topolovgrad, Bulgaria

Designed in 1989
Built-up area 576 m²
Solar applications:

- Sun spaces – 60 m²;
- Trombe walls – 48 m²;
- Water solar collectors – 24 m².

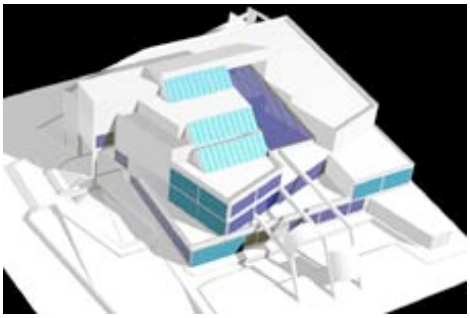


Youth Cultural Centre in Sofia, Bulgaria

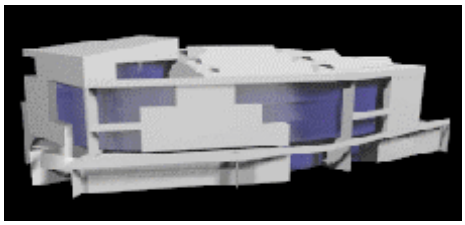
Designed in 1991
Built-up area 12800 m²

Solar applications:

- Sun spaces – 145 m²;
- Trombe walls – 465 m²;
- Water solar collectors – 144 m².

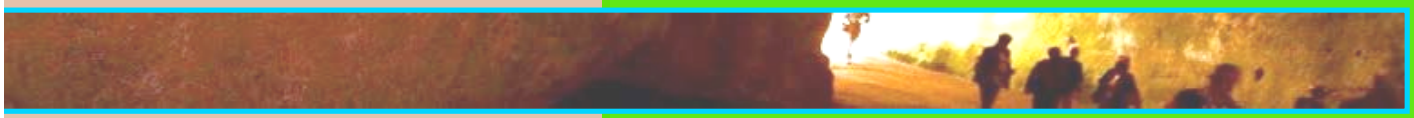


Multi-dwelling building with 10 flats in Gabrovo, Bulgaria



Designed in 1989
Floor area 576 m²
Built-up area 2590 m²
Solar applications:

- Sun spaces – 60 m²;
- Green spaces – 280 m²;
- Water solar collectors – 48 m²;
- Transparent insulation areas: on southwest 39 m² and on south 18 m².



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