Fire Risks in the Field of Architecture and Urban Planning
Design Process of the Civil Constructions, Management, Evaluation and Control

GHEORGHE BREAZU, Arch.
CRISTIAN DUMITRESCU, Arch.
Faculty of Architecture
“Politehnica” University of Timisoara
Address: Traian Lalescu st., 2/A no. Timisoara
ROMANIA
georgebreazu@hotmail.com, cristian_dumitrescu@yahoo.com

Abstract: Based on the text study of the Firefighting Law, a series of conclusions are risen, that are, in the same time, tasks of fire risks management, evaluation and control within architecture and urban planning design process of constructions.
Fire risks prevention and reduction is established by an integrated ensemble of specific activities connected to the emergency situations, risk factors and types incorporated in the assessment and risk covering plan on reference territorial units.
Due to the fact that defense against fire is a permanent activity of national public interest, it implies the elaboration, at the central level, of a republican defense strategy, as well as sector strategies on fields of competencies.
In perspective, the complexity of the fire risks prevention activities implies elaborating – at the republican level – educational topics and activities that are included in the programmes of all educational forms, in the extra-scholastic trainings plans, as well as in the adults’ lifelong learning programmes, on condition that the state controls all the decisive phases of construction realization, e.g. research, designing, execution, utilization and post-utilization.
The present material proposes, through identification and grouping, a plan model and a spatial model of construction relationship with fire risk types.
Seen as a system, the model can contribute, through detailing the constituting subsystems, to the lifelong learning and training in the field of fire risks management, evaluation and control, to the architecture and urban planning design process of constructions.

Key-Words: fire risk, architecture and urban planning design process, educational model

1 Introduction
Fire risk management, evaluation and control within the architecture and urban planning design process of constructions are obligations of the designers included in a large suite of legislative or technicalnormative documents. [1-10]
Thus, fire risks prevention and reduction represent an integrated assembly of specific activities of management, evaluation and control at state level based on a risk assessment and covering plan included in the national firefighting strategy. [1]
Also, according to the law, the firefighting activity represents an activity of public interest with permanent features binding both the public administration and the natural and juridical bodies.
At central level, on fields of competency, there are settled themes and types of practical-applicative activities, as well as educational activities regarding firefighting which are included in the syllabus for all forms of education, in the extracurricular activities programme and the lifelong programmes for adults.
The methodology regarding fire risks identification, evaluation and control issued according to the law, establishes the stages to be followed, factors, parameters, techniques and procedures used within the identification, evaluation and control of fire risks, in the same time with the conditions that the staff executing these activities need to fulfill.
So it seems obvious the need to correlate the type of activity with the level of preparation of the operating staff, as the level of the final result depends on this correlation.
Although the methodology does not expressly mention it, it is compulsory, early in the decisive architectural design and urban planning stage, to set a framework for an educational model in the
aim to interpret and correlate the fire risks to the construction.

The firefighting measures refer to both the design of new constructions and the interventions made on existing buildings in the aim to meet the fundamental “fire security” request mentioned in the law regarding quality in civil constructions.

The objectives of fire risks management consist of achieving security for the construction’s users and the intervention teams, protecting property of tangible assets, ensuring the performance of economical activities in the aim to reduce losses, protecting the environment and the architectural patrimony as well as other cultural values.

Fire risks management implies the analysis of a series of factors: loss of human lives reported at 100,000 inhabitants; impact on environment and costs of the rebuilding operations; damage of property of constructions/tangible assets and duration of bringing them to their initial state; restoration of constructions of architectural patrimony; ensured value losses or the amount of economical activity interruption.

Then, it is equally important to take into consideration the effects on the image of the economical operator, of the institution and even the designer and constructor of the building.

The acceptability of fire risk accredits the idea that in any evaluation process there is a certain level of risk generically called acceptable risk, whose level is being established based on prior experience and the suite of applied foreseeing reasoning related to the determining accomplishment phases of constructions, since the conception-design to the execution and utilization and further on to the post-utilization.

The identification of fire dangers takes into consideration the reaction to fire class of materials and construction elements, the nature of materials and substances used or processed in correlation with the preliminary conditions that may start a fire.

The gravity level of fires implies the cumulative evaluation of the direct impact of fires coordinated with the response operational capacity.

The fire risk evaluation implies the accordingly application of some categories of methods: qualitative - dealing with the consequences and the probability; significant, based on statistical data bases regarding losses; or taking into account the fire models based on the worst scenario hypothesis; quantitative through the estimation of losses or economical – expressed through the cost-profit-benefit ratio, studied in calculation programmes with integrated approach.

The whole fire risk management, evaluation and control activity in the decisive phase of constructions’ conception-design supposes the coordination with:
- the control activity of activities implying major accidents dangers
- the marketing conditions of products for constructions
- the stipulations of classification and positioning regulations regarding products for constructions, based on their fire behavior performances
- the elaboration methodology of fire security scenarios

according to the Prevention and Firefighting General Norms.

The ample, complex and long lasting process, now being undertaken, of Romanian laws and standards’ harmonization to the European and international ones also makes it compulsory to coordinate them with the adopted stipulations of European standards:
- quality management systems, fundamental principals and requirements
- fire classification of products for constructions and construction elements.

Because of the amplitude and the large range of types of activities necessary in the field of fire risks for the conception and design of constructions it is compulsory to thoroughly formulate the problems to be solved.

We should also mention that in the essential phase of conception-design, the elaborated technical project is being submitted to verification in its whole, while in the architecture project there are not to be verified the following: the architecture design, the principles of compositions, volumetric and esthetic solutions established by the architect in agreement with the resistance structure designer. It arises then the architect’s high degree of freedom in architectural design which implies an equally high responsibility in professional practice.

Concomitantly, at European level, Architects’ Council of Europe through its “professional experience” work group ascertains the disparity
between the academic education of the architect and the architect profession’s practice.

2 Groups of fire risks ranked on types of constructions according to the constructions’ importance degree.

Fire risks are a distinct subsystem that must be correlated with the other risk subsystems in the architecture and urban planning designing, which are presented as following:

2.1 Risks regarding the implementation area

In order to understand the risks that can be linked to the nature of the land that is to be built upon we will take into account the most common case found in architectural and urban planning practice. Considering that the land is free of previous developments, is situated within the city boundaries, has a certain usage and possible occupation patterns established by a urban plan (either a general urban master plan or a local master plan) and by other specific urban planning regulations, we can identify the following major risks:

- The improper orientation of the building spaces in relation with the cardinal point thus impairing the correct natural illumination
- Incorrect building alignment in respect to the streets predetermined alignment rules and regulations as established in the urban planning master plans
- Incorrect building heights and volumetric proportions in relation with the existing neighbouring buildings
- Incorrect instances between the facades with openings or balconies and the boundaries of the terrain
- Incorrect distances between the windows of different facades facing each other on the same ground
- The impossibility of creating a passage between a blocked terrain and the public street system on one of the neighbouring plots
- The incorrect placement of fresh water wells or drill holes without taking into account the allowed distances to possible pollution factors existing on the terrain
- Incorrect volumetric proportions in areas that are already defined or protected by special regulatory acts

- Incorrect ratio between the buildings function and the amount of tendered green areas generated on site as established by the environmental regulations
- Contradictions between the typology of the boundary enclosure and the character of the area

2.2. Risks concerning the buildings end users

Achieving the required exigency levels for the correct utilization of the building during its projected lifetime thus ensuring that the exploitation risks are eliminated implies certain measures that are to be taken during the design process.


The following risks can be identified when considering environmental and health issues;

- Failing to supply the interior spaces, according with their functional usage as well as the number of persons utilising it, with the necessary amounts of fresh air
- Improper choices of materials for the architectural finishing that might generate noxious residues
- Improper handling and management of the garbage and other solid residues generated inside and outside the building
- Improper natural and artificial lighting levels in the interior spaces as required by the specific functions housed by the building

2.2.2. Safety measures during the normal lifetime of the building

The risks that are common in this group mainly concern the architectural detailing of the common areas in a building mainly the circulation, evacuation and open areas.

- Improper finishing materials used for horizontal surfaces that favor slippage, and are not adherent
- Improper dimensioning of the widths of passageways for both vehicles and people. This is a concern especially when considering emergency escape routes. This can also affect supply and delivery of goods by means of mechanized transport.
- The interference of architectural elements into the circulation paths thus creating dangerous unforeseen obstacles for the common user
- Lack of proper access and evacuation means that can be used by handicapped persons
2.2.3. Protection from noise
- Improper buffering of the interior spaces (according to their specific function) of a building against outside aerial noise that is above the normed limits.
- Improper attenuation of impact noise generated transmitted through the buildings construction elements.
- Improper buffering of the noise that are generated from the building towards the exterior spaces and buildings, thus affecting the comfort of the neighboring inhabitants.

2.2.4. Energy efficiency and thermal insulation
- Ignorance toward the local climateric reality can lead to solutions that are not in tune with their environment.
- Failure to create a comfortable living and working environment in the interior spaces of the building based on the specific type of activities generated accordingly
- Inefficient architectural solutions for both the structure as well as the enclosing façade materials that can affect the energy efficiency and natural lighting parameters of the building.
- Architectural details that favor the condensation of the interior spaces either because of the appearance of a thermal bridge in the structure of the enclosure, or because of the shift of the dew point in the interior structure of the materials comprising the façade, due to an incorrect placement of the thermal insulation
- Improper sealing against water either in the infrastructure elements or the enclosing elements

2.3 Cultural risks on the level of the community
- Five major risks concerning the cultural implications of a new development can be identified as follows:
  - Improper relations between the buildings specific functions and the exterior architectural expression,
  - Contradictions between the general proportions and volumetric solutions of the new building and the character of its surroundings,
  - Improper understanding of the general architecture and urban planning regulations generally accepted,
  - Failure to maintain the required distances from the protected areas of historic monuments or sites,
  - Failure to comply to the rules that regulate the implementation of new buildings in exiting historical sites.

When ranking the groups of fire risks, two essential legislative documents were taken into consideration:
- categories of approved constructions and works being submitted for notification and/or authorization concerning the fire security
- regulation and methodology regarding the setting up of constructions’ importance degree

2.4. Categories of approved constructions and works being submitted for notification and/or authorization concerning the fire security.
Here are briefly enumerated the construction types for which, in the essential design phase, a fire security scenario is being drawn up needing the issue of a specialty notice:
- high or very high civil construction buildings
- crowded halls
- civil construction buildings from the categories of exceptional and special importance
- historical monuments buildings submitted to modernization or change of destination works
- trade, production or warehouse buildings with the gross building area ≥600 square meters or arranged as collective dwelling buildings
- public alimentation with gross building area ≥200 square meters
- underground civil construction buildings or arranged in the attic or on the terrace of civil construction buildings.
- constructions for tourists’ accommodation structures, including the public alimentation units within.
- buildings for public authorities headquarters
- buildings for offices with gross building area ≥600 square meters
- buildings for health care
- buildings for education
- buildings intended as railway station, bus station or subway station
- buildings for worship
- buildings for sport activities for 200 seated places or 2,500 places in open area
- constructions for temporary arrangements for shows or meetings of 200 seats or intended for trade with gross building area ≥2,500 square meters
- constructions for warehouse of Braden head gas
- gas stations
- public parking places for more than 20 vehicles
- firefighting systems
- stock farms with gross building area >600 square meters.

The above enumeration clearly highlights the types of functions/human activities for which it is necessary to apply the suite of principles of fire risks management.

2.5. Constructions importance categories; principles of establishment

New or existent constructions can be part of:
- global importance categories, called “importance categories”, that concern the whole construction under all aspects
- specific importance categories, called “importance classes” that concern the whole construction or parts of it under some aspects

Importance categories established for constructions are as following:
- exceptional (A)
- unusual (B)
- normal (C)
- reduced (D)

The basic principles of the importance category establishment are succinctly described:
- the construction itself is taken into consideration, with all its characteristics
- activity types connected to the construction realization (determinative phases: conception – designing, execution, exploitation)
- construction role and position determined by its functions and existence in the social, cultural and economic context
- risk prevention and the quality assurance model leading to appropriate performances
- content main elements that fundament the following:
  • vital involvement in society and nature determined by the risks raised due to dysfunctions
  • functional involvement; rating between the built environment and natural environment
  • construction own characteristics: long-lasting utilization

The previously mentioned principles led to the formulating and the necessity of evaluating six decisive factors and 18 associated criteria, presented as following:
- vital importance:
  i) directly involved people in case of construction malfunctions
  ii) indirectly involved people in case of construction malfunctions
  iii) evolution character of dangerous effects in case of construction malfunctions

- social-economical and cultural importance:
  i) size of the community that use the functions of the construction and/or the assets value sheltered by the construction
  ii) function value of the construction in that specific community
  iii) nature and importance of those specific functions

- ecological involvement:
  i) how much the construction building and exploitation intervenes in the perturbation of the natural and built environment
  ii) degree of unfavourable influence over the natural and built environment
  iii) active role in the protection/remake of the natural and built environment

- necessity of taking into account the utilisation (existence) duration:
  i) estimated duration of utilisation
  ii) degree of construction performances in which they depend on knowing the evolution of the action (solicitations) during the utilisation period
  iii) degree of functional performances in which they depend on the evolution of the requests during the utilisation period

- necessity of adapting to the field and environment local conditions:
  i) degree in which insuring the constructive solutions depends on the field and environment local conditions
  ii) degree in which the field and environment local conditions evolve unfavorably in time
  iii) degree in which the field and environment local conditions determine special activities/measure for the construction exploitation

- amount of necessary work and materials:
  i) rating of the involved work and materials amount
ii) necessary activities amount and complexity in order to maintain the construction performances during its existence period

iii) special activities during the construction exploitation imposed by the its functions.

Criteria are valued as following:

<table>
<thead>
<tr>
<th>Appreciated level of criteria influence</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-existent</td>
<td>0</td>
</tr>
<tr>
<td>Reduced</td>
<td>1</td>
</tr>
<tr>
<td>Average</td>
<td>2</td>
</tr>
<tr>
<td>Appreciable</td>
<td>4</td>
</tr>
<tr>
<td>High</td>
<td>6</td>
</tr>
</tbody>
</table>

Awarding the points leads to having value groups that characterizes each importance importance, as shown in the next table:

<table>
<thead>
<tr>
<th>Importance importance of construction</th>
<th>Value group of total points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceptional (A)</td>
<td>≥30</td>
</tr>
<tr>
<td>Special (B)</td>
<td>18 ... 29</td>
</tr>
<tr>
<td>Normal (C)</td>
<td>6 ... 17</td>
</tr>
<tr>
<td>Reduced</td>
<td>≤ 5</td>
</tr>
</tbody>
</table>

After establishing the construction importance category comes the fulfillment of the six quality criteria in construction domain and the 46 technical criteria, next given:

A – resistance and stability of static and dynamic solicitors:
1 – Positioning in the seismic area
2 – Establishing the importance category
3 - Establishing the importance class
4 – Data collecting from the geo-technical study
5 – Foundation and infrastructure solutions
6 – Protection solutions against soil, environment and current activities aggression
7 - Conception of structural assembly and stability of compartmental elements, including the finishes
8 – Calculation of the structural assembly

9 – Quality of the necessary structural materials
10 - Solving at detail level

B – safety during exploitation:
1 – Measures to prevent slippering during horizontal circulation
2 – Protection measures against incidents at differences in levels, steps or platformes
3 – Separation of the on feet traffic from the vehicle traffic inside the construction or location
4- Leveling platforms for people and vehicles, including handicaps access
5 – Natural and artificial lighting indoors and outdoors
6 – Protection measures against thefts
7 - Protection measures against prominent elements
8 - Protection measures against burns given by hot surfaces, steams, hot liquids or corrosives and explosions
9 – Electro-security measures
10 – Elimination of the architectural barriers for the free circulation of handicapped people.

C – safety against fire
1 – Fire protection to neighbourhood
2 – Positioning the technological processes in a fire threat category
3 – Fire resistance degree of the building, thermal factor density of fire, as well as its correlation with destination, number of floors and the built area
4 – Limitation of fire propagation indoors and on the facade, measures of smoke and hot gases evacuation
5 – Insuring the people evacuation and exit ways and implementing the fire protection constructive measures of these ways
6 – Supplying with fire extinction machines and protection and safety means
7 – Interior and exterior accessing ways for interventions against fire and measure to secure the intervention teams
8 – Fire fighting self-defense plan.

D - Hygiene, Health and the Environment:
1 – Protection measure against exterior toxins
2 – Air quality insuring measures based on the space destination, activities and users' numbers (air/person volume, air exchange number/hour, other air ventilation/filtration systems)
3 – Finishes quality insuring measures without toxins emission (formaldehyde, radiations, irritating smelly substances etc.)

4 – Hygiene insuring measures

5 - Waste water evacuation measures from construction exterior/interior without affecting the environment and occupants health

6 – Solid waste evacuation measures from construction exterior/interior without affecting the environment and occupants health

7 – Measures against exterior environment pollution by toxins evacuation from the construction interior

8 – Measures to insure natural/artificial lighting conditions as a function of the day/night activities

E – thermal and hydro- protection, energy saving:

1 – Positioning in the environment conditions

2 – interior environment conditions insuring measures as function of the activity type and/or number of occupants in summer/winter conditions

3 – Measures of minimising the used quantity insuring the energy (thermal and lighting) comfort by creating minimum surfaces exposed towards exterior environment

4 – Measure to avoid condensed atmosphere at the interior side of the exterior surfaces and /or those with significant differences in temperature and/or humidity

5 – Measures to avoid water infiltration through the roof

6 - Measures to avoid water infiltration from the soil.

F – protection from noise:

1 - Positioning in the environment conditions

2 – Measure to reduce the airway noise coming from the exterior of the interested area based on the developed activities

3 - Measure to reduce the impact noise coming from the exterior of the interested area based on the developed activities

4 – Measure to avoid noise propagation in the construction exterior in order not to affect the neighbouring area.

Points awarding for the previously mentioned 46 criteria, together with the points given for the 18 criteria and the six decisive factors of the construction importance category are part of the quantifying system of the provisional model proposed by the third chapter. [26]

It is worth mentioning that risk prevention by establishing the adequate importance category imposes the essential requirement level, as well as quality assurance model whose application leads to the aim completion: assurance of the appropriate performances. Global model of construction quality assurance and accomplishing the appropriate performances conduct to setting up a relationship and interpretation detailed model of the construction and risks, more precise the construction and fire risks.

Taking into account the fact that a building is a construction as a closed precincts in which divers activities take place, such as: human activities regarding living, producing, education, health, culture, entertainment, services, administration, cult or transport the following aspects are to be added:

- the carried out human activity presumes a normal utilization/function duration in which the value is recuperated from the fiscal point of view by liquidation way for civil constructions 40-60 years
- thus the normal utilization/function duration is more reduced than the physical life duration of the construction.

For the normal function duration of the constructions in which a human activity takes place, groups of fire risks are established as follows:

- interior fire generated by factors concerning functional specific character, processed materials, groups of the materials / construction elements, level of training, users’ physical status and age
- exterior fire generated by specific factors to the location area
- premeditated fire, named arson.

Fire risk prevention by framing in the adequate importance category imposes the essential requirement level, as well as quality assurance model, and their application should lead to appropriate performances.

3 Problem Solution

Constitution of an interpretation and relationship model of the construction with the fire risk types
covers two major necessities highlighted by the present legislation, as follows:
- necessity to correlate the fire risk identification, evaluation and control activities with the conditions that have to be met by the personnel executing such activities.
- necessity to realize in perspective the complexity of the fire risk prevention by introducing educational topics and activities in all education forms curricula, including the adults’ lifelong learning.

Thus, an interpretation and relationship model of the construction with the fire risk types becomes educational as well.

But the interpretative model of provisional type has to cover two large domains:
- 3.1. – the domain of new buildings design and the interventions design over existing buildings in unprotected areas
- 3.2. - the domain of the interventions design over historical monument buildings, protected areas buildings or historical sites.

For each of the two domains, there is a plan and a special model proposed as following:
- in Figure 1 and Figure 2 there are the plan and spacial model proposed for the buildings mentioned at chapter 3.1
- in Figure 3 and Figure 4 there are the plan and spacial model proposed for the buildings mentioned at chapter 3.1 perfected models compared to the previous models, by eliminated the ambiguity zones
- in Figure 5 and Figure 6 there are the plan and spacial model proposed for the buildings mentioned at chapter 3.2.

A plan model is proposed in Figure 1, a provisional type model, as it highlights possible consequences.

Equilateral triangle graphically represents the balanced relation established by the Vitruvius between the architectural basic attributes, e.g. UTILITAS, FIRMITAS, VENUSTAS. In the model, the triangle angle-points represent these attributes and the points from the triangle internal space represents the architecture objects/buildings. It can be noticed that the point group of the interior triangle located on the weighing center of the basic triangle represents the group of the architecture objects/buildings that are balanced designed; meaning that the distances from each point to the VF, VS and VE angle-points are sensitively equal.

The group of the points within the equilateral triangle towards the angles represents:
- architecture objects/buildings with the function/“utilitas” attribute is dominantly buildings from the functionalist current.
- architecture objects/buildings with the structure/“firmitas” attribute is dominantly buildings from the constructivism/structuralist current.
- architecture objects/buildings with the esthetic/“venustas” – the geometry of the architectural shape attribute is dominantly buildings from the formalist/expressionist current.

Fig. 1. Plan model of correlating the construction with the fire risks types

Legend:
VF – angle/vertex of the equilateral triangle representing “utilitas” - function of the architecture object
VS – angle/vertex of the equilateral triangle representing “firmitas” - structure of the architecture object
VE – angle/vertex of the equilateral triangle representing “venustas” - esthetics of the architecture object
1 – risk of interior fire generated prevalent by the danger of the indoor activity type
2 – risk of interior fire generated prevalent by the construction material/element inadequate for the activity/function type
3 – risk of interior fire generated prevalent by the interior space geometrical configuration and by the compartmental construction elements
4 – risk of exterior fire with action prevalent over the architecture shape geometry of the exterior layer and the interior organization type
5 – risk of exterior fire with action prevalent over the construction system and the interior organisation type of the specific space
6 – risk of exterior fire with action prevalent over the structure and the geometry of the architectural form of the construction exterior layer.

It is well known that the human being is the expression of the adaptive character of their models about the world. They can simulate different versions with the help of the model, in order to choose the best action. [76]

To enhance the possibilities of choice, Figure 2 proposes a spatial model of relationship.

The spacial model is represented by a regulated equilateral tetrahedron that is a constitutive of the plan model. The fourth angle-point of the tetrahedron represents the acceptable fire risk within the normal period of utilization/function of the construction /the physical life period of the construction, a fire risk generate by the human activity developed in the interior space as a feature of the architecture.

The relation between the architecture basic attributes and the human activity and the risk types generated by the activity types on the active/reactive principle, more precisely said the action/response capacity to this, offers a comprehensive image of the studied phenomenon proportion.

This type of relation reflects as well the essence of the European definition of the building; it is seen as a shut precinct with a lateral closure and a zenith closure, having a human activity developed in its interior space: such as living, teaching, health preserving, tourism, sports, cult activities etc.

It should be highlighted that the fire risks governed by the human activities development are taken into consideration in the normal period of utilization/function of the construction and also in the physical life period of the construction. This is done because the developed human activity and the human being itself still need to be protected against the fire risk action, even after 40-60 years of utilization/function of the construction that became a corporal asset or a depreciated fixed mean.
The spatial model in Figure 2 confers the possibility of foreseeing that a certain event could take place in the future, thus offering an anticipation relation of “feed-before” or “feed-forward” type, with an advantage in the learning process compared to the feedback type relations.

A plan model is presented in Figure 5, a foreseeing model that correlates the historical building with the fire risk types. The historical buildings that are monuments or located in protected areas represent a different category for which the acceptable fire risks domain has to be much restricted due to the vulnerability factor and of the value factor impossible to be replaced in case of destruction.

Fig. 3 Perfected plan model of correlating the construction with the fire risks, perfected by eliminating the ambiguity zones
Legend: the same as for Fig. 1

Fig. 4 Perfected spatial model of interpretation and correlating the construction with the fire risks types, perfected by eliminating the ambiguity zones and that creates inside an octahedron-cube that represents the architecture objects determined through balanced designing
Legend: the same as for Fig. 2

Fig. 5 Plan model of correlating the historical building with the fire risks types, using principles of Morley Theorem (1924) – Kleven Theorem (1978).
Legend:
VF – angle/vertex of the equilateral triangle representing “utilitas” - function of the architecture object
VS – angle/vertex of the equilateral triangle representing “firmitas” - structure of the architecture object
VE – angle/vertex of the equilateral triangle representing “venustas” - esthetics of the architecture object
1 – risk of interior fire generated prevalent by the danger of the indoor activity type
2 – risk of interior fire generated prevalent by the construction material/element inadequate for the activity/function type
3 – risk of interior fire generated prevalent by the interior space geometrical configuration and by the compartmental construction elements
4 – risk of exterior fire with action prevalent over the architecture shape geometry of the exterior layer and the interior organization type
5 – risk of exterior fire with action prevalent over the construction system and the interior organisation type of the specific space
6 – risk of exterior fire with action prevalent over the structure and the geometry of the architectural form of the construction exterior layer.

a – area in which structure is in a direct relation with the function/human activity
b – area in which structure is correlated with the architectural form geometry
c – area in which function is correlated with the architectural form geometry

Patrimonial buildings within the existing buildings are represented by a small number of architectural objects, situation that has to be reflected by the proposed model. In order to realize this scope, the model in figure 5 proposes an application of Morley theorem (discovered in 1899, solved in 1924 and completely cleared by the Kleven Theorem in 1978): “in each triangle the trisecting lines of the angles form an equilateral triangle.” The surface of the resulted internal triangle represents, within the model, the patrimonial architectural object.

In the next figure, Figure 6, a space model is presented that correlates the historical buildings with the types of fire risks.

Legend:
VF – angle/vertex of the equilateral triangle representing “utilitas” - function of the architecture object
VS – angle/vertex of the equilateral triangle representing “firmitas” - structure of the architecture object
VE – angle/vertex of the equilateral triangle representing “venustas” - esthetics of the architecture object
VR – acceptable fire risk within the normal period of utilization/function of the construction (DNU)/the physical life period of the construction (DVF)

1 – interior regulated cut tetrahedron representing the group of the patrimonial architecture objects that are nowadays in function with minimum fire risk determined through balanced designing

---→ – fire risks generated by the human activity in interaction with the response capacity of the monument building or patrimonial building to maintain at an acceptable level the fire risk

The model in Figure 6 represents a space application of the Morley/Kleven Theorem. The complexity of the situations presented in Figures 1- 6 is detailed within the doctoral thesis focused on the topic: “Correlation of the architecture and the civil engineering with the risk in constructions”, finalised in September 2011.

Till November 2010, the present material will be completed by:
- checkings by precised mathematical calculations of the situations in which regulated octahedron-cub and cut tetrahedron can be obtained in the spacial models,
- application of the presented quantifiers on the spacial model sizes,
- application of colours on the octahedron, octahedron-cub and cut tetrahedron faces, colours representing features of the construction, thus using the colour and form language in the learning process, [83,84]
- a study regarding deformation from equilateral triangle to a normal triangle, respectively from a regulated tetrahedron to a non-regulated tetrahedron, in case of not adapting the construction to the human activity types and the risk types generated by it,
- establishing a similitude between proposed models and crystallography and mineralogy
studies (see the Au-Cu3/gold-copper3 atom configuration). [91-96]

4 Conclusion
Applying into the education and adults’ lifelong learning processes through detailing the two interpretative and relationship model of the construction with the fire risks types creates a relation between education and personal experience through eliminating the stereotype, widening the future experiences. [80, 81, 86-90]

Proposed models have another advantage: they tend to a multidisciplinary approach; the structure element (firmitas) implies the civil engineering under the aspect of resistance and stability to all stress types, including the stress generated by the fire action. [73, 78]

Models serve also to formulate objectives as specific aspects within the general tendency of the study programme.

Models elements and relations analysis can lead to the elaboration of an action plan or of a series of actions that conduct to a fair evaluation. [69, 70]

It must be mentioned the fact that previous models do exist, such as:
- a logic model of the architecture, starting with the idea of a cube in which sizes, faces and diagonal plans highlight the basic attributes of the architecture, [41]
- a geo-morphic model, a zoo-morphic, anthropomorphic model (from a part towards a whole), vegetal model, or geometric model of the architecture as edificated space. [61]

The proposed models in the present work are different by the mentioned models as they are close to the epistemology and ontology. In the learning process, the human being is seen as a system from “homo humanus” to “homo ethicus”, keeping at a big distance the “homo patiens” state. [70, 82]

References:
[2] Government Decision no. 1739/06.12.2006 regarding the approval of the construction and design categories that have to be approved or authorized regarding the fire security, issued in Official Journal of Romania (O.J) no. 995/13.12.2006
Classification based on results of the fire resistance tests, excluding ventilation systems


[17] MLPAT – Construction Security Norms at Fire
Indicative: P 118 – 99


[19] MTCT no. 217/17.02.2005 for the approval of the Technique Regulation “Norms for the designing, execution and exploitation of fire extinction installations”, Indicative: NP 086 – 05 issued in Official Journal of Romania (O.J) no. 479 bis/ 07.06.2005


[21] Ioan Sasu; Elaboration Methodology of fire security scenario in order to obtain the approval/authorization of fire prevention and extinction. Conditions – Definitions, Mirton Publishing house Timisoara 1999

[22] MLPAT – Guide regarding the elaboration and the approval of local urban planning regulations, Indicative: GM – 007 - 2000

[23] Law no. 10/ 18.01.1995 regarding the Quality in Constructions – updated version on 12.05.2007


[26] MLPAT - INCERC - SCB – BAP Laboratory, Methodology regarding the establishment of the importance category of constructions, issued in the Construction Bulletin no. 4/1996

[27] Government Decision no. 2139/ 30.11.2004 for the approval of the Catalog regarding the classification and the normal functioning periods of the fixed assets, issued in Official Journal of Romania (O.J) no. 46/13.01.2005


[29] MLPAT Order no. 77/N/ 28.10.1996 for the approval: Guide, first part, Quality Technical Verification of the Projects

[30] Law no. 184/12.04.2001 (republished) regarding the organization and the exercising of the architect profession, issued in Official Journal of Romania (O.J) no. 771/23.08.2004


[33] Victor Gioncu; Structure Theory (volume 1 and 2) Polytechnic Institute “Traian Vuia” Timisoara 1975

[34] Victor Gioncu; Theory of structures – Mechanics and structure designing (second edition), Politechnic Institute Traian Vuia, Timisoara, Architecture Department, Timisoara, 1979


[37] Gh. Buicliu; Problems of geometric constructions with the rules and the compass, Editura Tehnica Publishing house, Bucuresti 1957

[38] J. Hadamard; Lessons of elementary geometry, Editura Tehnica Publishing house Bucuresti 1960


[41] Gheorghe Sasarman; *Function, space, architecture*, Editura Meridiane Publishing house, Bucuresti 1979
[42] Eugen Rusu; *From Tales to Einstein*, Editura Albatros Publishing house, Bucuresti, 1971
[45] Florica T. Campan; *Stories with proportions and symmetries*, Editura Albatros Publishing house, Bucuresti, 1985
[47] Eleonora Feru, Ivanca Olivotto; *How do we think the special geometry problems*, Editura Ara Publishing house, Bucuresti, 1994, ISBN 973-95795-7-4
[50] Oystein Ore; *Graphs and their uses*, Editura stiintifica Publishing house, Bucuresti 1968
[51] Ian Tomescu; *Graphs and linear programing - Elementary introduction*, Editura didactica si pedagogica Publishing house, Bucuresti 1975
[53] Ian Stewart; *Nature's numbers*, Editura Humanitas Publishing house, Bucuresti, 2006
[57] Vasile Boban and others; *Dictionary of special mathematics*, Editura enciclopedica romana Publishing House, Bucuresti, 1974
[58] Marcel Melicson; *Modern Architecture – People and ideas – Currents and tendencies*, Editura stiintifica si enciclopedica Publishing house, Bucuresti 1975
[59] Bruno Zevi; *How to understand architecture - Study over interpreting the architecture as space*, Editura tehnica Publishing house, Bucuresti 1969
[61] Vlad Gaivoronschi; *Traditional space matrixes*, Editura Paideia Publishing house, Bucuresti 2000
[63] Ciprian Mihali and others; *Another kind of spaces*, Editura Paideia Publishing house, Bucuresti 2001
[64] Iuri S. Lebedev, Cosma Jurov; *Bionic and bio-climatic architecture*, Editura Tehnica Publishing house, Bucuresti 1985
[65] Igor Mironovici Guberman; *Bionic – engineers at the natures school*, Editura enciclopedica romana Publishing house, Bucuresti 1973
[67] Charles Bouleau; *Secret geometry of painters*, Editura Meridiane Publishing house, Bucuresti 1979
[68] Leon Topa; *Creativity*, Editura stiintifica si enciclopedica Publishing house, Bucuresti 1980
[73] Inter-domains and human science - vol. 1, Editura Politica Publishing house, Bucuresti 1986
[74] Erwin Schrodinger; What is life? & Mind and matter, Editura Politica Publishing house, Bucuresti 1980
[75] Dan D. Farcas; Electronic computer and the human thinking, Editura Albatros Publishing house, Bucuresti 1979
[76] St. Stossel, D.S. Ogodescu; The Human and the informational universe, Editura Facla Publishing house, Timisoara 1978
[77] Ion Baciu; How does the brain work, Editura Dacia Publishing house, Cluj 1974
[81] N. MacKenzie, M. Erant, H.C. Jones; The art of teaching and the art of learning – introduction to new methods and materials used in the superior education level, Editura didactica si pedagogica Publishing house, Bucuresti 1975
[82] Victor Sahleanu, Conceptions about man in contemporary medicine, Editura Dacia Publishing house, Cluj 1976
[84] Pavel Muresan, Colour in our life, Editura Ceres Publishing house, Bucuresti 1988
[85] V. Schiopu, E. Verza; Psychology of the ages, Editura didactica si pedagogica Publishing house, Bucuresti 1997
[88] Ion Albulescu; Pedagogical doctrines, Editura didactica si pedagogica Publishing house, Bucuresti 2007
[89] Jozef Stenfanovic; Psychology of the professor’s pedagogical finesse, Editura didactica si pedagogica Publishing house, Bucuresti, 1979
[90] Florica Ortan; From Pedagogy to Educational Science, Editura didactica si pedagogica Publishing house, Bucuresti 2007
[92] I. S. Jeludev; Electric crystals, Editura tehnica Publishing house, Bucuresti 1973
[93] I. S. Jeludev; Symmetry and its applications, Editura tehnica Publishing house, Bucuresti 1979
[100] Ioan Andreescu, Vlad Gaivoronschi, Complex risk management during restoration and reconversion at an XVIIIth century building complex in Timisoara (English language). Proceedings of the International Management of Risk Management, Assessment and Mitigation (RIMA ‘10) - Recent Advances in Risk Management, Assessment and Mitigation, Bucharest,


