AESTHETICS OF THE MAIN TYPES OF STRUCTURES

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ABSTRACT:
The structural aesthetics issue is a frontier field which the structure engineering does not study and which the architectural studies and projections neglect. This leads to severe consequences in various aspects, as the discrepancies between the architectural idea and the resistance design lead to: 1) Difficulties in the static and dynamic stability of structures; 2) Compromise occurs in the structural completion of the architectural designs; 3) Additional or useless expenses; 4) Non-aesthetic value of the constructions. The simplest definition on aesthetical value requires the congruence of form with substance. Seeing how in architecture, form is determined by: A: The geo-climatical agent; B: The technico-economical agent. While substance is determined by C: The socio-cultural agent. Therefore, the construction value, and the architectural work respectively, results from the congruence between the three dual environments, which concludes that neglecting any of the six agents is a source of aesthetic irrelevance. One can propose that a series of norms be settled concerning the correct projection of the architectural form, yet this would only provoke architects and architecture critics to argue that they predict a difficult quantification of socio-cultural fields which disrupt the building. Considering the present situation, the most appropriate formula would be generating guides, in order to generate a correct projection of the architectural form.

KEYWORDS:
Wood, Masonry, Ferroconcrete, Metal, Architecture.

INTRODUCTION

The constructions' form depends on three dual agents:

- The geo-climatical agent
- The technico-economical agent
- The socio-cultural agent

The simplest definition on aesthetical value requires the congruence of form with substance.

Seeing how in architecture, form is determined by:

- The geo-climatical agent
- The technico-economical agent

While substance is determined by

- The socio-cultural agent,

Therefore, the construction value, and the architectural work respectively, results from the congruence between the three dual environments, which concludes that neglecting any of the six agents is a source of aesthetic irrelevance.

Architecture's classical triad: function - structure – form only takes into consideration some of the requirements which the social environment has for function, the technical environment, for structure, neglecting and mixing the form with the determinants.

Another troubling phenomenon arises in the projection praxis. As communication fails to happen between the architect and the engineer in the very first phases, when the construction conforms, and architects do not have enough knowledge concerning resistant constructions or when – going beyond the given boundaries – structural engineers come up with subsequent adjustments and compromise for a projection that respects the on-going rules, the final result turns out to be questionable for the aforementioned reasons.

Due to the client's or architect's requirements, structural extravagance is sometimes appealed regarding openings, heights or potential consoles, which, in the eventuality of execution faults or earthquake risks can produce inestimable loss.

METHODOLOGY

In order to create a useful panoramic comparison, the specific regulations present in the beginning of

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the XXI century in Romania have been analyzed, regarding the main types of structures:

Wood structures

1. Solid
2. Cradles
3. Large panels
4. Lamellar wood

Masonry structures

5. Solid
6. With ferroconcrete beams

Ferro-concrete structures

7. Diaphragms
8. Cradles
9. Large panels
10. Lamellar wood

Metallic structures

11. Cradles
12. Reticular

Equilibrium between mass and rigidity: is a general requirement which implies a compact and equable volume on all three spatial dimensions, with one, two or - ideally - even three axes of symmetry.

3.1. Aesthetics of wood structures

Four structural systems can be obtained when structuring different types of wood:

Hardwood:

1 Plane figure – resembling a square

2 Solid figure – 1-2 levels

3 Embrasures – small, split by butt joints

4 Optimal dimensions - 3 to 4 m

5 Covering system – high roof truss

6 Over-all features: small sized constructions, with distinct roof trusses and the prevailing of fullness over embrasures.

Cradled wood

1 Plane figure – resembling a square

2 Solid figure – 1-3 levels

3 Embrasures – large, excluding the wind braces area

4 Optimal dimensions - 4 meters module

5 Covering system – normal roof truss

6 Over-all features: small and medium sized constructions, with regular roof trusses and large embrasures, which can be located on the foundation, except from the wind braces area.

Wood in large panels

1 Plane figure – resembling a square

2 Solid figure – 1-2 levels

3 Embrasures – small, inserted only for a purpose

4 Optimal dimensions - 3 to 4 m module

5 Covering system – low roof truss

6 Over-all features: small sized constructions, with low roof trusses and the prevailing of fullness over emptiness.

Lamellar wood

Lamellar wood is a composite material which mixes wood with adhesives, suiting special structures with wide openings [1].

1 Plane figure – resembling a square

2 Solid figure – 1 level

3 Embrasures – wide

4 Optimal dimensions – 6 - 18 m

5 Covering system – spatial roof trusses with a simple arch

6 Over-all features: wide openings constructions, with free solid figures, preferably with a simple arch and the prevailing of emptiness over fullness.

3.2. Aesthetic of masonry structures

In time, small module masonry structures of rock, clay and burnt brick have been intensely exploited, as there had always been a ground of massive construction, which often required rehabilitations. Embrasure ceramic modules are used currently [2].

Heavy Masonry

1 Plane figure – resembling a square

2 Solid figure – 1-3 levels

3 Embrasures – vertical, according to the butt joints at the edges and on the groundwork

4 Optimal dimensions – 3-5 m

5 Covering system – normal roof trusses

6 Over-all features: massive buildings, with vertical embrasures closed by vertically overlapping arcades and normal roof trusses.

Masonry with ferroconcrete columns

Current brick constructions (with embrasures) use, for the corners and supporting wall junctions,

concrete columns, which frame masonry panels and strictly dimensioned embrasures into ferroconcrete casings.

1 Plane figure – resembling a square

2 Solid figure – 1-4 levels

3 Embrasures – resembling a square, respecting the butt joints at the edges and on the groundwork

4 Optimal dimensions – 4 – 6 m
5 Covering system – small roof trusses
6 Over-all features: massive buildings, with vertically overlapped almost square embrasures, vertically arranged, and small trusses.

3.3. Ferroconcrete structures

The mixture of concrete, which corresponds to compressions, with steel, which corresponds to stretching, led to the attainment of a versatile composite material, which combines both qualities into an appropriate cooperation [3].

Ferroconcrete diaphragms

1 Plane figure – resembling a square
2 Solid figure – 5-15 levels
3 Embrasures – strictly delimited
4 Optimal dimensions – 4 – 8 m
5 Covering system – terraces
6 Over-all features: massive buildings, with clearly delimited embrasures, including butt joints and terracing.

Ferroconcrete Cradles

1 Plane figure – resembling a square
2 Solid figure – 5-15 levels
3 Embrasures – large, and can be set on any point of the groundwork
4 Optimal dimensions – 4 – 6 m
5 Covering system – terraces
6 Over-all features: massive buildings, with large embrasures and terraces.

Large ferroconcrete panels

For reasons such as prefabrication, this system is mostly applied in those constructions which are repeated enough times, that it covers prefabrication expenses, still bearing specific restrictions.
1 Plane figure – resembling a square
2 Solid figure – 5-10 levels
3 Embrasures – square, the groundwork
4 Optimal dimensions – 3 - 5 m
5 Covering system – terraces
6 Over-all features: massive buildings, with large embrasures placed on the groundwork.

3.4. Metallic structures

Metal, steel respectively, is used more and more for a structural purpose, other types and technologies using composite materials, which consist of aluminium, copper, titanium…being used on a small scale, especially for closings [4].

Metallic wind brace cradles structures

1 Plane figure – resembling a square
2 Solid figure – over 10 levels
3 Embrasures – large, on the groundwork
4 Optimal dimensions – 6 – 12 m
5 Covering system – terraces
6 Over-all features: rectangular modulated buildings, with large embrasures loosely ste on an unstructural closing cover.

Spatial reticular structures

1 Plane figure – free, resembling a circle
2 Solid figure – free, with a double curve
3 Embrasures – large, free, in casings
4 Optimal dimensions – minimum 10-20 m
5 Covering system – empty surfaces with a double curving
6 Over-all features: free form and large embrasure constructions, from geodesic domes, to furrowed areas, in which entry and illuminating embrasures can be placed anywhere along the unstructured casing.

CONCLUSION

Structural norms have direct determinations upon the architectural form, which is often treated munificently on the architectural projecting market, seeing how the extravagancies requested by the architect or the client, are delivered after serial compromises the structure engineers make in order to gain a contract or a momentary notoriety. There are countless examples of works where the architectural form result from an incorrect choice of the structural type, structural imitation made of different materials or structural resolutions masking an incorrect usage of materials' quality.

One can propose that a series of norms be settled concerning the correct projection of the architectural form, yet this would only provoke architects and architecture critics to argue that they predict a difficult quantification of socio-cultural fields which disrupt the building.

Considering the present situation, the most appropriate formula would be generating guides, in order to generate a correct projection of the architectural form, concerning geo-climate positioning, the existing structural systems, of economical resources, the social necessities and the cultural environment in which the construction takes place, an ample initiative which this essay foreshadows.

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