Investigation about the choice of tensile membrane in city metabolism

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ABSTRACT

Today in the world of construction, textile and inflatable structures have seen an evolution from a technical and technological point of view (from the design of the material itself to the maintenance of these structures). The computer implementation in turn allows this sector to adapt to the needs and architectural and temporary constraints.
Membranes are very efficient structures, which have many qualities: (1) architectural: lightness, shape, resistance, ambiances..., (2) implementation: ease of installation and removal, time, space..., (3) adaptation, communication: advertising, commercial..., aesthetics etc. They are also a low polluting alternative to traditional materials used for construction.
In spite of all the technical performances and the capacities of adaptation of these envelopes, they have difficulty in finding their place within the urban metabolism of our cities, and remain an under-used architectural solution compared to the other traditional building materials (such as concrete, steel, wood, glass...).
The overall objective of our research is to (1) make evident the merits of the use of textile envelopes to the actors (from decision makers to users, through designers) by comparing it to other materials and to be able to integrate it into decision support tools (modeling / simulation software). (2) to identify the impact of these structures in the socio-economic construction of the urban morphology of cities, in an environmental approach in order to respond to the urban metabolism.
This research work is addressed to the actors of the building sector (forming the chain of decision, going from the public/private order to the company of installation while passing by the designers, the town planners or the users) as well as to the various stakes confronted at the various scales of our actors (starting from the ICU, the Albedo, the socioeconomic stake; until the comfort of the individual).
First, an interdisciplinary bibliography was carried out in order to (1) understand and identify all the themes addressed, (2) define the methodology and approaches of the research, (3) identify the appropriate tools to answer our questioning (survey by interview and questionnaire, data analysis, software etc.).
Secondly, a survey work (by interview followed by questionnaire according to the need) will be carried out with interlocutors (decision-makers, urban planners, architects / engineers, installers in building sites, industrial companies, ... up to the simple uses of the building) in a comparative approach with other traditional materials, will come to question :

1. The choice of materials,

a. Choice of material family,
b. Choice of process families,
c. At what phase of design
d. Design requirements,
    i. Functionality,
    ii. Constraints,
    iii. Objectives,
e. Classification of design requirements (technical, economic, environmental, aesthetic...)

2. Once the material characteristics are defined, which selection technique to use
    a. By analysis,
    b. By synthesis,
    c. By similarity,
    d. By inspiration....

3. Socio-economic impact,
4. Environmental impact,
5. Comfort criteria...

As well as other parameters will be questioned... with the aim of identifying the brakes and the stakes which prevent these membrane structures in spite of their performances from being able to interact in the urban metabolism of our cities in a more or less obvious way...
My paper proposes to restitute the results collected from this multidisciplinary work of investigation and to analyze these results in order to produce recommendations...

REFERENCES

[1] R. Houtman, "3 - Materials used for architectural fabric structures," in *Fabric Structures in Architecture*, J. I. de Llorens, Ed. Woodhead Publishing, 2015, pp. 101–121.
[2] B. Forster and M. Mollaert, Eds., *European design guide for tensile surface structures: TensiNet*. Brussel: Vrije Univ. Brussel, 2004.
[3] R. Motro, Ed., *Flexible Composite Materials in Architecture, Construction and Interiors:* Berlin, Boston: DE GRUYTER, 2013.
[4] M. Grosjean, J.-P. Thibaud, and P. Amphoux, Eds., *L'espace urbain en méthodes*. Marseille: Parenthèses, 2001.
[5] A. Moore, "Rethinking scale as a geographical category: from analysis to practice," *Progress in Human Geography*, vol. 32, no. 2, pp. 203–225, Apr. 2008, doi: 10.1177/0309132507087647.
[6] S. A. Marston and N. Smith, "States, scales and households: limits to scale thinking? A response to Brenner," *Progress in Human Geography*, vol. 25, no. 4, pp. 615–619, Dec. 2001, doi: 10.1191/030913201682688968.
[7] N. Brenner, "The limits to scale? Methodological reflections on scalar structuration," *Progress in Human Geography*, vol. 25, no. 4, pp. 591–614, Dec. 2001, doi: 10.1191/030913201682688959.