Soviet Avant-Garde – Origin of New Materials and Construction Methods or Extension of Europe`s Modern Movement? A Critique

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ABSTRACT: This paper exclusively refers to the time between 1920 and 1934, when a revolution in construction technology hit Europe. The Architectural Avant-garde of the former Soviet Union is well known for its unique icon buildings, such as the Narkomfin Commune House (1930, arch. M. Ginzburg), the House and Studio of Konstantin Melnikov, both in Moscow, or the Gosprom House of the State Industry in Kharkov/Ucraine (1925–35, arch. S. Serafimovich, M. Felger, S. Kravets). However, few is known about the materials and construction methods that were used to erect constructivist buildings during the years 1920 -1932 in the Soviet Union. Slag concrete, peat mull, shotcrete-concrete are typical materials of the 1920s early Modern Movement. At the time experiments to minimize the external wall by inserting insulation materials such as peat mull or wooden chips were carried out in several countries. Who was first? Did soviet architects take part in this process? What was their philosophy of materiality? Does the term Avant-garde just refer to the unique design of the buildings or does it also refer to the materiality of Russian Constructivism?These questions are discussed based on results of the research project *The Architecture of Russian Constructivism (Moscow 1920-34). Building materials, Construction Methods and Preservation of Buildings* at the Berlin University of Technology, sponsored by the German Research Community (DFG).

CONSTRUCTION TECHNOLOGIES AND MATERIALS OF THE RUSSIAN AVANT-GARDE: COPY OR ORIGINAL?

Decades of publishing and discussing historic documents about Russian avant-garde projects and buildings especially in the western parts of the world passed by. It started with Khan-Magomedov`s *Pioniere der sowjetischen Architektur*, first published in 1983 (Dresden, Germany) up to the latest editions of the new Moscow based Russian Avant-garde Foundation and Richard Pare`s *Lost Vanguard* (New York 2007). Today time has come to fix and value the historic position of the Soviet architectural Avant-garde within an international context. This is one of the main aims of the current research project *Architecture of Russian Constructivism (Moscow 1920-34). Building materials, Construction Methods and Preservation of Buildings*, at the Berlin University of Technology. With reference to the title of this article the main question could have been expressed in an even more provocative way: Construction Technologies and Materials of the Soviet Avant-garde Architecture (1920 -1934)– Copy or Original?, because the collected information would allow for another thesis: Whereas the projects and designs of the Russian avant-garde architects such as Konstantin Stepanovich Melnikov, Mosei Jakovlievich Ginzburg, and Ivan Sergeievich Nikolaev (1901-1979) became icons of the avant-garde for their brave and innovative conceptual ideas, the construction technologies and materials used to realize their architectural projects have nearly all been developed outside the former Soviet Union. How can one dare to make such a statement?

Genius Soviet architects and engineers

With no doubt there are genius inventors among the soviet architects and engineers. If we look at Ivan Ilich Leonidov (1902-1957) with his utopic ideas, for example his project for the Lenin Institute, published in Sovremmennaya Arkhitektura in 1927, no. 4-5, p.121, he was about fifty years ahead of the time. Tragic enough that he did not get the chance to realize a single of his projects. Konstantin Melnikov turned out to be a master not only in generating new architectural concepts for worker`s clubs and garages but also in the innovative use of traditional materials such as brick and wood. Both he used to create his famous own house and studio. However, he was not in favour of the new construction materials at all saying that he

> personally thinks that there is no use in going especially for the new materials in architecture and that one should not take heraclith, solomith and all the various other "substitute" construction materials as regular materials with which the architect has to work. One should not forget that architects use them to a certain extent as substitute for materials with a better level of quality from technical as well as from architectural point of view. I try to avoid them within my practical work. If they satisfy us as insulation materials, from sanitary point of view they are even dangerous... (Melnikov, K. S., 1934).

Consequently Melnikov preferred traditional materials such as brick, wood and metal for his buildings. Tragically Ivan Leonidov together with Konstantin Melnikov was chosen as personification of the evil western influence in the Soviet Union and became victims of the state propaganda against modernist architecture in the late 1920s. When the public diffamation campaign against constructivism started with the decree about the reorganization of the artist unions from 23 April 1932 terminating all liberal discussions about architecture, both architects were barred from further practical works for their entire lives. Ivan Sergeievich Nikolaev (1901-1979) was more lucky. He managed to build probably the biggest and most brave constructivist structure ever built at all, - his dormitory (2000 beds) for the students of the Textile Institute on Ordzhonnikidze street in Moscow. This building perfectly illustrates the strong non compromised ideas of the architects in the 1920´s, when these buildings landed in Moscow like unknown flying objects with their strange modern appearance so far away from ordinary people's life… The same refers to Mosei Jakovlievich Ginzburg`s (1892-1946) and Ignaty Frantsevich Millinis` (1899-1974) Narkomfin commune house (Narkomfin = Narodnyj komitet financov, Ministry of Finances,1928-30). The house is located on 25, Novinskyi Bul'var in Moscow. It was one of seven communal houses in Moscow representing the new socialist housing ideas of that time, when it was ideologically intended to dissolve the family and realize collective living for example by minimizing individual space and kitchens and maximizing collective space. This house is all over the world acknowledged as the finest example of the rational housing ideas of the Russian Avant-garde and today well known as prototype for the Unites d`habitation designed by the French architect Le Corbusier in the 1940-1950s.

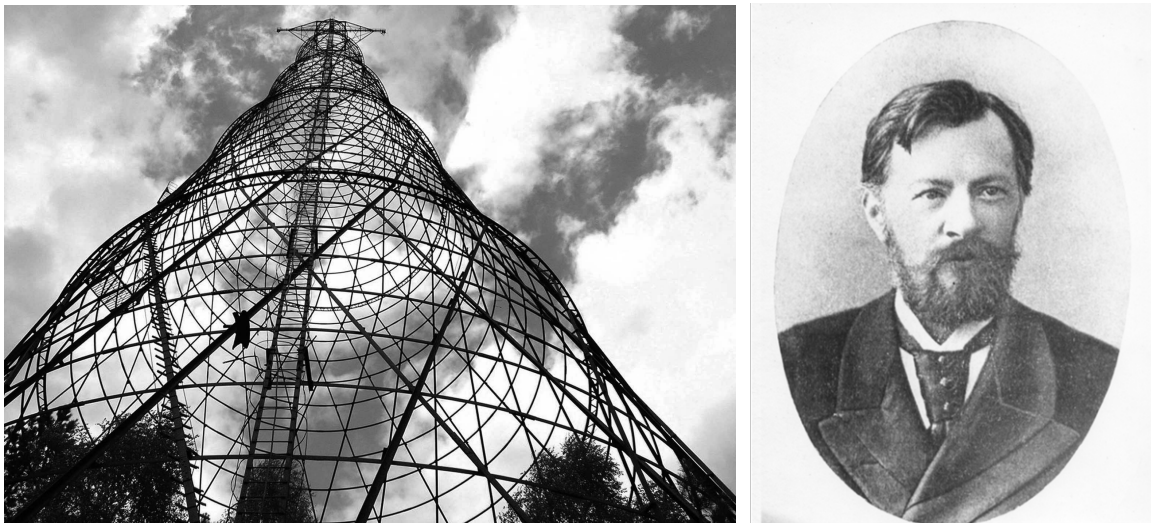

Figure 1: NIGRES – High Voltage Tower near Dzerzhinsk, 1927, in 2005 (left), designed by V. G. Shukhov (1853-1939) (right); (S. Zelenova, Nizhnij Novgorod)

There are genius engineers as well. Most famous became Vladimir Grigorevich Shukhov (1853-1939), the Russian Gustave Eiffel, famous for his pioneering works in the design of technical equipment for the oil industry and railway bridges, but also for his legacy to the Constructivist architecture of early Soviet Russia. He was the leading specialist of metallic structures such as hyperboloid structures, thin-shell structures and tensile structures. His most famous building is probably the Shabolovka – radiotower in Moscow (1923), which became kind of symbol for Constructivism all over the world. Yury P. Volchok points at T. M. Makarova to be most likely the first engineer who worked with parabolic hyperboloids as roof coverage. She even achieved a patent on this technology - a fact which remained underestimated to this very day (Volchok, 1993, p. 71).
Despite Shukhov and Makarova one should remind of the structural engineer Arthur Ferdinandovich Loleit (1868-1933). Loleit must be honoured today as Russia's pioneer in concrete construction. In 1892 he designed the 14m long bridges for the GUM Warehouse at Red Square in Moscow and in 1895 he planned together with the fifteen years older Shukhov the 32m long bridge for the All-Russian Industrial Exhibition in Nizhnij Novgorod (1896). His main achievement probably was the calculation and realization of beamless slabs, first built in the laundry-house of the *Khludovyj*-Factory and in the tram depot in Zolotorozhsk in 1909 (Lopatto, p. 20). To be mentioned as well is Alexander Vassilievich Kuznetsov (1874-1954) He worked as an engineer and architect in Moscow. He designed the main building of the famous Stroganov school building, later named VKHUTEMAS, on Rozhdestvenka street in Moscow. From 1926—28 he was the chief architect of several new founded scientific institutes in Moscow such as the State Aero- and Hydrodynamic Institute (CAGI) on Radio street and the Moscow Electrotechnical Institute (VEI) on Krasnokazarmennaya street built in 1929-30. His main

contributions to the new construction technologies of the Russian Avant-garde Kuznetsov made in the field of shotcrete concrete and flat roof constructions for the mentioned institutes. In the detail design of his roofs for the Electrotechnical Institute, he already separated the waterproofing and the insulating layer. By using ventilation he tried to avoid internal damages. Maybe he even first invented "cold", or ventilated flat roofs at the time.

Figure 2: Ventilated roof with shotcrete-waterproofing at the Electrotechnical Institute Moscow, 1929 (left), by A. V. Kuznetsov (right);
(Stroitelnaya Promyshlennost 1929, No. 1, p. 50 (left) and Schusev- Museum, Mocow)

LACK OF BUILDING TRADITIONS AND IMPORT OF CONSTRUCTION TECHNOLOGIES

On the other hand there are a couple of conclusions to be made from investigating historic documents, which dramatically affected the construction process of the Avant-garde projects in the Young Soviet Union after years of civil war and under the circumstances of a run-down economy. The context in which the icons of the Russian avant-garde were erected in the 1920s, however, in some points, defers from the situation in Europe or America at the time.

The first phenomenon can be named *lack of building traditions* (despite wooden constructions) in Russia. In the soviet magazines of the time you will always find the word *kustarnichestvo* discussed as one of the main problems within the underdeveloped soviet construction industry and referring to kind of manufactured production processes still usual in the young Soviet Union, whereas in other countries mechanization of the construction process with cranes, concrete mixers and other motorized equipment already became ordinary technologies. This has a lot to do with the missing traditions of construction crafts in Russia, where in the countryside building work was traditionally done as part of the duty of the owners who fixed their houses in summer in order to survive the next winter. Despite civil engineers and some builders in the big cities like Moscow and St. Petersburg there were no professional craftsmen developing construction traditions by themselves and handing on their knowledge to the next generation as it was usual in Europe. Here the guild system was fully developed since the middle ages and later exported to the United States of America.

The second fact is that knowledge was imported on purpose to develop the construction industry. The Soviet government financed excursions and international meetings of professionals. There were several excursions of professionals in order to study foreign technologies. Russian professionals visited congresses such as the world fair in Paris (1925), the exhibition of the German Werkbund in Stuttgart (1927), the Bauhaus in Dessau and the Bauhaus – exhibitions in Moscow (1927 and 1930). Many international competitions were carried out in the Soviet Union at the time. Foreign architects presented their proposals within these competitions. Further to this, since the beginning of the 20th century, when electrification changed the whole world, information through radio broadcasting and printed journals became much more available. Architects and students from both sides used the chance to travel to other countries. All these activities as well as printed media enabled an extensive exchange of information about the latest development within construction technologies to an extent never known before. Several examples illustrate this import of technology:

Import of Construction Technologies

Slag concrete is probably the most typical material for the early Modern Movement. As a leftover of industrial production processes it was added to concrete in order to improve its thermal insulation. The so called *Kossel*–slag concrete, named after the constructor Paul Kossel from Bremen, Germany, became popular. With Kossel`s assistance a German-Russian construction trust RUSGERSTROI built the House of the Red Professors (I. Osipov, 1928) on Pirogovskaya Street in Moscow using *Kossel*–slag concrete. Here it was called *Teplobeton* – warm concrete. The same *Kossel*–slag concrete was used in different mixtures for the houses of Johannes Pieter Oud in the Weissenhof-settlement in Stuttgart (1926). Slag was also the basic material to produce artificial blocks out of concrete to save on expensive bricks at the time. Under the guidance of Walter Gropius the German Bau-

haus first organized the production of building materials directly on site while erecting a workers settlement in Dessau–Törten. In 1928 the construction process of the mentioned Narkomfin building in Moscow was organized as an industrial process on total analogy to these experiments. The hollow cinder blocks were produced on site, which is very likely a result of this exchange of information.
From today`s point of view the real qualities of materials and similarities within construction processes in Europe and in Russia in the 1920s are very difficult to judge. However some evident differences can be stated. If comparing the two types of hollow cinder blocs produced in Dessau and in Moscow one can easily state that the German block with its two round holes is probably more stable as the Moscow one with two square holes (Fig. 3). However the Narkomfin house is still in place and structurally still load bearing.

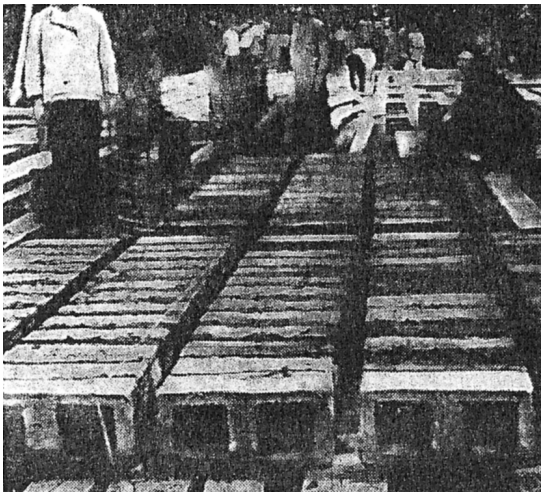

Figure 3: Hollow cinder block used in Dessau, 1926 (left) and in Moscow, 1928 (right);
(Bauhaus Dessau Foundation and Ginzburg, 1934, p.112)

The Narkomfin house also has concrete window frames in some places. This was an experiment appearing in several countries as well. For example the Suisse cement- factory O. Christen & Cie. from Basel was advertising such windows in 1925 in the *ABC Beiträge zum Bauen journal No. 3 / 4, p.18*. In the workers settlement Dessau–Törten concrete window frames with Luxfer glazing were used in 1926.
A lot of experiments were made in order to improve waterproofing-qualities of concrete i. e. with pressure, as *Torkret*-concrete (shotcrete), or through adding special waterproofing substances, such as *Ceresit* to Portland cement. The *Deutsche Torkretgesellschaft* in Berlin invented *Torcrete*-shotcrete as a process where concrete is projected or "shot" under pressure using a feeder or "gun" onto a surface to form structural shapes. In Russia Kuznetsov used this method first in order to waterproof the roof as well as the hydro-channel erected for experiments in 1926 as part of the mentioned Aero- and Hydrodynamic Institute (CAGI) in Moscow. A Russian delegation visited the *Deutsche Torkretgesellschaft* in Berlin in December 1927 for an exchange of knowledge in this field. Kuznetsov insisted that shotcrete was developed independently in both countries, but with the same quality (Kuznetsov (1929-1), p. 48). Shotcrete was used as well to erect the cupolas of various planetariums that have been built in the 1920s. The leading engineer in this field was Friedrich Dischinger. As the chief engineer at *Dyckerhoff & Widmann Construction company* at the time he developed the *Zeiss-Dywidag-stressed skin construction* together with Walther Bauersfeld (1879-1959), the leading scientist at Carl Zeiss in Jena, as a base for housing the Zeiss-projector designed by Bauersfeld. In 1927-1929 the architects M. O. Barsch, M. I. Sinjavskiy and G. A. Sundblat designed the Moscow Planetarium cupola on total analogy of the Jena planetarium erected two years earlier and used the patented *Zeiss-Dywidag-stressed skin construction*. The Zeiss projector was imported from Germany.

Insulation Materials such as Heraclith – Fibrolit and Torfoleum – Torfoplity

Insulating a building with "warm", mostly organic materials is an innovation that came with the Modern Movement as well. It allowed the reduction in thickness of traditional brick walls. Pressed wood wool boards with added cement to consolidate them, called *Heraklith*, were produced in Austria already since 1908 by the Austrian American trust *Österreichisch Amerikanische Magnesit Aktiengesellschaft* in *Radentheim*, Kärnten, who held the patent. In 1928 the Moscow Construction Institute researched the mixture of *Heraklith* and then developed *Fibrolit* - pressed cement-board out of wood wool as a copy. But it was not so easy to analyze the European mixture. According to *Rozov* problems occurred, because the Soviet boards produced before 1933 contained magnesium chloride provoking hydration processes within the construction as a result of reaction with the usually used calc-alabaster-plaster (*Rozov*, 1929). The manufactured production of *Fibrolit* cement-boards suffered a lot from *kustarnichestvo* as it is reported in the journals of the time. Many boards delivered on site were unusable.
Whereas in Germany dry pressed peat-boards called *Torfoleum* were a regular insulation material in the early Modern Movement, in the Soviet Union most often peat mull called *Sfagnum* was used for insulation purposes.

This caused a lot of problems because even, if cleaned, there were still too many organic parts in it. The result, if not ventilated properly, were lots of damages by fungus in walls and roofs of Constructivist buildings. The Soviet research institute INSTORF tried to copy the production of pressed peat-boards. Soviet researchers were analyzing German peat-boards in comparison with the soviet production and came to the result that their boards only minimally divert from the qualities of some German board (Andreievskiy, 1929, p. 740). (s. Fig. 4)

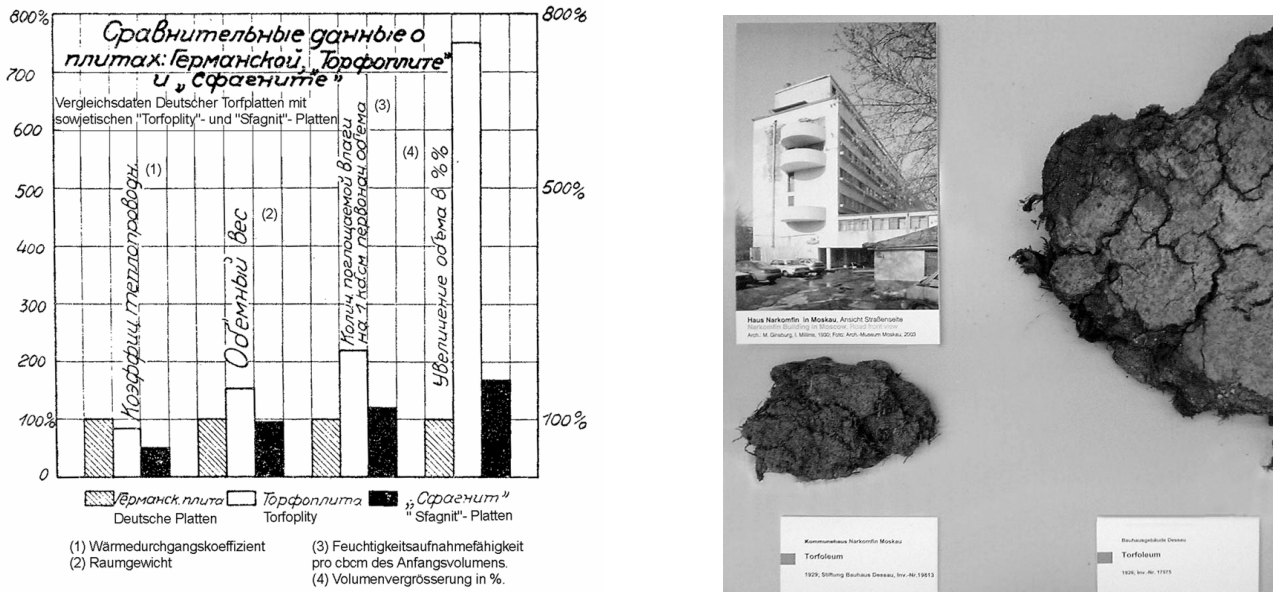

Figure 4: Comparison of German and Soviet peat-boards by the INSTORF-Scientific Institute in Moscow, 1928 (left) and Torfoleum – peatmull insulation from Narkomfin House, Moscow and Bauhaus Dessau, 2007 (right); (Stroitelnaya Promyshlennost 1929, No. 9, p. 740 (left), A. Zalivako, Berlin (right))

Finally it is a well known fact that entire factories were imported from the United States and assembled in the Soviet Union such as the Tscheljabinsk tractor works (1933) based on a prototype by the Ford factories in Detroit by the architect Albert Kahn in order to develop industrialization of the Soviet Union.

CONCLUSIONS

These examples illustrate the revolutionary innovations of the early Modern Movement with regard to construction methods and materials as a parallel development of Europe`s Modern Movement and the Russian Avant-garde in Architecture. Especially the pilot-projects of the Soviet Avant-garde erected between 1927-1929 such as the worker' s clubs, commune houses and technical buildings are to a large extent analogous with the detail design of Europe`s outstanding buildings of the Modern Movement f.e. the Bauhaus schoolbuilding in Dessau or the Werkbund buildings in Stuttgart Weisenhof, Germany.

However, documents and journals of the historic archives in Russia and Germany made it evident that the construction technologies and materials used for the realisation of the constructivist buildings were mostly not originated in the Soviet Union, but to a wide extent the result of copying foreign experiments and products of the time with similar methods and materials. Investigations of about 350 Constructivist buildings from the period between 1924-1932, mainly located in Moscow, revealed as a result, that the detail design of many Constructivist buildings at least in Moscow is a bit more rough in comparison with most preserved Modern Movement sites for example in Germany (s. Fig. 5). With regard to the lack of materials in the Soviet construction market of the time certainly more detail design changes had to be made than in other European countries during the construction process. But this does not automatically mean that the chosen substitute materials, f.e. wood instead of metal framed windows, were inferior in durability. In many cases they have been preserved until today.

At no means this result or evidence must be used as an excuse for not preserving the icon buildings of the Soviet Avant-garde, which were built as pilot projects at the time and did not suffer from lack of materials in the same way as ordinary buildings f.e. housing estates of the 1920s. This is another phenomenon worth to be discussed.

Figure 5: Window and roof details at the commune house for the students of the former textile institute in Moscow, 1929, by I. S. Nikolaev, in 2005; (A. Zalivako, Berlin)

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