



**DEVELOPING MASONRY TECHNOLOGY IN THE
FORMER SOVIET UNION BASED ON CANADIAN
AND NORTH AMERICAN STANDARDS**

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ABSTRACT

To be able to grasp the essence of the present socio-economic problems facing most of the Former Soviet Union (FSU) countries, it is necessary to look at the political system that controlled and dictated, for almost a century, practically every facet of civic life. Although the Soviets were successful in their space programs and the developments of a modern type of military armaments, they failed miserably in providing even the most basic necessities of everyday life to their people. The construction and housing industry is underdeveloped by practically any standard. This is primarily due to the lack and shortages of construction materials. New construction methodology will require good quality materials and new techniques. The development and upgrading of masonry products has been initiated by several groups, with the introduction of western type of concrete block and brick manufacturing technologies.

POLITICAL SITUATION - PAST AND PRESENT

The totalitarian experience of the USSR, controlled rigidly by the central government in Moscow, imposed harsh conditions that not only crushed the individual and society but also controlled everything as an all-powerful, undemocratic and totally authoritarian state that permeated all facets of the society. Citizens had very few rights and were regarded as the property of the state. The Central Committee and the Politburo in Moscow made all the decisions and expected regional administrators to carry out their orders.

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This system created a society that existed in a non-market oriented economy, where 98% of the work-force was employed by state enterprises. As a result the society was totally undifferentiated and everybody was supposed to be more or less equal. The system created a centrally controlled planning structure that was relatively simple to administer. It set bank rates. It set product prices. If one was told to build a bridge he obeyed or, to stay out of trouble, pretended to obey. Such a system had no need for rules or regulations. It demanded unquestioned obedience and it was only necessary to follow orders from a superior. The most important function of a government official was to ensure that materials arrived in time and were not stolen along the way. Nobody thought about environmental impact, environmental review, zoning, planning - such things were not important. As a result, if there was no anti-monopoly law, there was no need for anti-monopoly committees; if there was no environmental legislation, there was no need for a Ministry of the Environment; if there was no justice, there was no need for a Ministry of Justice, and so on.

As the Soviet Union disintegrated and new countries evolved proclaiming their independence, all the agreements and bonds that held the former Union members together were no longer valid and many problems surfaced as these countries started to form new democracies. Since this transformation occurred very suddenly with no time for adjustment in the transition, their task became very difficult, especially when they had only the autocratic Soviet Union as a model.

The new states had to start building their own central governments. Paradoxically, if the state is to play its function of a regulator of a democratic society, it has to start building up a bureaucracy. New ministries had to be created. People were needed to fill the president's administration. Positions in the Cabinet of Ministers as well as positions in all the ministries were also needed to be filled. As the number of experienced bureaucrats was small and as most of them remained in Moscow, the new states found themselves in short supply of qualified personnel. Canada has helped very much in this area by setting up numerous training and educational programs and in organizing and promoting tours to show the workings of many branches of our governments.

That fact that all these countries were nothing other than colonies of a huge empire, had an enormous impact. The case of Ukraine can serve here as a prime example. As the second most populous of the FSU countries, it was also one of the most industrialized and as late as 3-4 years ago, as much as 93 - 94% of its economic activity was controlled by the central government in Moscow. All of that country's products were brought to about 80% completion and then shipped to many other destinations all over the Soviet Union for the final stages of production. This product was not sold on an open market, but was simply delivered to government owned stores or outlets for distribution at set prices. In addition, a third of the USSR's military-industrial complex was situated in Ukraine, accounting for over 2.5 million jobs. Once the Soviet system fell apart, the consequences were disastrous as orders dried up and the economy plunged into a crisis. It is ironic that Ukraine's malaise, despite its broader industrial base, was greater than that felt in countries

such as Uzbekistan and Kazakhstan that relied primarily on their own raw materials. Yet all of the new countries had their own serious problems that were similar.

It may be appropriate to mention here that, during the entire reign of the USSR, there were chronic shortages of almost any product or commodity. People stood in long lines at the government stores and many were turned away as they were told that there was nothing left for them to buy. In such cases a grandmother was a great asset to a family, as normally she had more time to stand in lines early enough before everything in the store was sold out. On the other hand many communist members and officials were supplied with whatever they wanted, frequently free of charge.

Many people in these new countries have been persuaded and are accepting the contention that the implementation of economic reform is a necessity for further progress. Many are beginning to believe that establishing a market economy system based on free trade and on private ownership of property are important priorities for basic social conditions that will lead to a better quality of life. Some changes are coming about, but slowly. Reforms are ardently being resisted by the socialistic factions in the new governments and the old managers, consisting primarily of former communists, who still hold substantial power and do not want to lose their positions of privilege and prominence. In effect, it is this group that blocks the implementation of reforms and changes.

PROCEDURE TO OBTAIN PERMISSION FOR CONSTRUCTING A BUILDING

To obtain permission to build a building in the former USSR it was necessary to follow a procedure that contained three stages:

1. Obtaining permission for land use.
2. Providing all necessary documentation.
3. Obtaining permission for project financing.

The first step was to get the local authorities, such as municipal or regional government agencies to approve a land site for the proposed project. This would then go to a local Architectural Planning Board, which had to give its approval that the project fitted into the general plan and the development scheme for the locality. The land site remained the property of the government and it was transferred to the new government enterprise for the purpose of balancing the accounts. Therefore, this stage in actual fact depended upon obtaining minutes of the meeting of the local executive branch of the respective government agency endorsing the agreement permitting the client to use the land.

In providing all of the necessary documentation it meant that it had to be justified as to the appropriateness and necessity for allocating money to such a project. The documentation had to conform fully to all site conditions and to fit into the general plan for the zone. A full set of architectural and engineering drawings, fully detailed, showing all construction and shop details, and all relative documents for all phases of engineering that were

required to bring the project to completion, had to be presented. All of the engineering work, as described above, was also carried out by government institutions. On the basis of these complete sets of drawings and documents an exact cost for the project was established. After all of the above information had been gathered, it was then recommended whether to continue with the construction of the project.

The last stage included the obtaining of permission for the financing of the project. It had to meet all of the above requirements. It was then decided if it was expedient to continue with the project or to choose other alternatives. If it was approved, a document was then issued that provided a permit for the construction of the project to go ahead. A local government-owned construction firm would then be authorized to build the project.

In many cases it could be foreseen that various types of jobs, such as reconstruction, some new construction, improvements and alterations may have caused nonconformity and difficulties to obtain permission for construction in the prescribed way. But since most of the entrepreneurships were government controlled, all clients in fact acted on the government's behalf with the result that all of the above procedures were only a formality.

With the introduction of private ownership, the private client came on the scene and all the procedures for obtaining permission for construction became much more complicated. As no final decision on the privatization issue has been reached and because of the absence of a legal base for privatization, the local government administrators have inherited the right to distribute the land for the purpose of construction and have assumed the role of owners of the land, which they were holding for sale. Therefore all the procedures for obtaining permission for construction have been converted to the buying of land from local government agents, providing the buyer with no proper legal documentation of ownership or title to the land.

CONSTRUCTION MATERIALS

Steel is quite abundant in many countries of the FSU. There are large steel mills in regions of Ukraine and Russia. They produce large quantities of rolled shapes, which are suitable for building construction. Steel has been used for construction of industrial plants, warehouses and bridges both for highways and railroads. Steel was not used extensively for buildings, as most of it was appropriated for military use and armaments and their installations. However this may now change as less military equipment is being built. According to the State Standards of the former USSR, there is a great number of different grades of steel that may be used in steel structures with their use conforming to the Construction Standards and Regulations for Steel Design (СНИП II-23-81*).

Most of the construction of buildings consist primarily of precast concrete and, to a lesser extent, of monolithically cast-on-site reinforced concrete. This type of construction is covered by the document Construction Standards and Regulations for Concrete and Reinforced Concrete (СНИП 2.03.01-84*). Concrete is classified as follows:

- heavyweight (normal) concrete , average density from 2200 kg/m³ to 2500 kg/m³,
- fine concrete, average density from 1800 kg/m³,
- lightweight concrete with compact and porous structure,
- cellular concrete,
- prestressed concrete.

Many different concrete strengths are available, ranging from 2.7 to 43 MPa, depending on the class of concrete. Reinforcing steel consists of two types - smooth wire (rods), which also includes welded wire mesh, and deformed reinforcing steel bars. They also come in a variety of steel strengths, ranging from 225 to 980 MPa.

The use of precast concrete elements such as foundation blocks, columns, beams, walls, partitions, floor slabs, flight of stairs, landings, lintels and others is widespread. Precast concrete appears to be the most favourable method of construction, especially for multistory buildings. Roofs of industrial buildings may also be supported by wide-spanning precast reinforced concrete trusses. Almost all large cities of the FSU have plants that manufacture precast concrete.

Good finishing materials are rare. The ones that are available are of low grade, lacking in quality with respect to both appearance and durability. Many buildings are faced with tiles of various types. Good ceramic tiles for exterior applications are available but are in short supply. Brick units of good quality for facing of building enclosures are difficult to obtain. Clay brick units of low strength, with porous consistency and high permeability, are extensively used for both exterior walls and interior partitions. The exterior walls must be coated with a cement-based parging on the outside for protection against the elements, while the use of bricks for basically all interior partitions adds disastrously to the shortages in the supply of this material.

Concrete block units are predominantly hand-made, but there are a few mechanized plants. Their use in construction has become more popular within the last few years. Nevertheless concrete block units are being used for low buildings such as small storage sheds or car parking enclosures, although they are also being used as substitutes for bricks in housing construction.

There are many and large fields of granite, marble, shell rock and other natural stones in many regions of the FSU countries. The materials are being quarried and prepared as building materials, mostly for finished surfaces for floors and walls, for both the interior and exterior uses. They constitute some of the better products for these applications. However the surface finish may not be of the highest standard as there is no adequate equipment for final grinding and polishing.

BUILDING STANDARDS AND CODES

Generally the accepted and acting Construction Standards and Regulations cover the construction and design of many types of different building structures. They are written in a form that define five main divisions.

1. Organization, Administration, Management and Economics of Construction.
2. Standards for Design.
3. Performance and Acceptance of Work.
4. Standard for Cost Calculations.
5. Standards for Evaluation of Materials and Labour Resources.

The main divisions are broken down into many sub-divisions, containing detailed descriptions and guidelines. Most of the Standards, especially those that are frequently used, are available and can be obtained from the design institutions. The following subjects are covered in the Standards: permits and drawings; quality assurance; materials; placing embedded items; analysis and design; strength and serviceability; flexural and axial loads; shear; details and development of reinforcement; walls; columns; pilasters; beams and lintels. Included also is an empirical design method applicable to buildings meeting the requirements of specific locations as well as special construction criteria.

In many ways the Construction Standards and Regulations are very similar to American Building Codes, but are differently structured. There is no special Masonry Construction Standard, but it is possible to find all needed information pertaining to such a standard in different divisions of the Construction Standards and Regulations. Generally, many people seem to be familiar with most rules and regulations needed for masonry construction and the following information describes the basic masonry product and how it is used.

At present, there seems to be only a very limited variety of different unit sizes, which are used in masonry construction. The dimensions for a typical and most common unit are 125 x 65 x 250 mm. Exterior masonry walls are unnecessarily very massive, partly because of tradition but mainly to provide for thermal resistance as insulation. Such external walls are normally 510 mm thick but may be 770 mm thick in regions of colder climates. Thus the thermal transmission seems to be the primary requirement for wall design, but it may also be governed by loading conditions. Interior wall classifications are based on walls being either loadbearing or non-loadbearing. For loadbearing interior walls, the masonry wythe width can vary from 250 mm to 380 mm, or as needed by structural requirements. For partitions the allowable minimum width is 65 mm. Masonry column cross-sectional area is determined by engineering analysis.

The high labour content in multi-wythe walls, consisting of triple, quadruple or more elements, provided an incentive to maintain high employment. Consequently, units produced need not have high strength. In fact 2.5 to 3.5 MPa were adequate in view of the large bearing area and finally the degree of workmanship, or more appropriately lack thereof, was not critical given the self policing requirements of multi unit walls. Aesthetics

were addressed by the normal practice of stucco parge finishes to improve, as a primary consideration, air and water resistance.

Similarly to North-American building codes, the Construction Standards and Regulations prescribe requirements for the structural design and construction of masonry elements that must conform to the requirements of the legally adopted general building standards.

RECENT DEVELOPMENTS

The process towards a free market economy has placed an inevitable demand on consumer products. Glasnost, removal of travel restrictions and exposure to increased information about other parts of the world by printed and electronic media, have awakened desires to seek more than basic bare bones existence. This trend is continuing and has been made possible through exposure to Western style living standards. Many new products are now available in stores, foreign automobiles may be frequently seen on streets and roads, and larger houses, with many features modelled from Western style homes, are being built. But these things can only be afforded by very few, as most people must cope with many difficulties to provide for every day survival.

The housing situation in the FSU countries is to-day the most critical problem. There are great shortages of living accommodations with conditions that are quite inappropriate, mainly because of lack of adequate building products. This need for living accommodations is greatly aggravated by citizens returning from both military and advisory service in the erstwhile Soviet Block Countries such as Poland, Hungary, East Germany, the former Czechoslovakia, Romania and Bulgaria. These were separate countries, formally not part and supposedly independent of the Soviet Union. But, in contrast, some of the new countries that were formed from the Soviet Union itself, have decided not to repatriate their army officers only because there are no living quarters available for them. As an example most Russian officers, stationed in Ukraine, stayed to serve in the Ukrainian army while many Ukrainian officers serving in Russia, Kazakhstan and other newly founded countries remained to serve with the forces where they were stationed. It is apparent that the need for housing can not be overlooked.

Progress in construction and housing sector is fundamental to economic growth and stability, as is very evident in these new countries. The demand for building products, attainment of almost complete social freedoms and the trend to the free market structure have encouraged many foreigners to seek investment opportunities in these developing countries. As most existing processes for the manufacturing of building materials are very crude providing a low production output and of poor quality, it seemed that the new efficient Western manufacturing processes producing high quality products would find instant success. A great number of joint ventures were formed, but most of them are encountering difficulties with their bureaucracies, constantly changing laws or absence of laws, financial instability, limited private resources, inefficiency, lack of urgency with respect to performance and production, and an adverse investment mentality.

Yet in spite of these confronting obstacles, opportunities appear to be enormous. Introduction of an efficient masonry design and construction system combined with ready availability of materials of consistent good quality may have appeared to provide a reasonable incentive for establishing a successful venture with a potential possibility for a profitable return on investment.

A partnership of Canadian and Ukrainian interests has been founded, resulting in the formation of a Joint Venture Company. It was organized in 1991 for the purpose of manufacturing concrete block producing equipment, using up-to-date western technology. The company is located in Lviv, Ukraine, in a large machinery manufacturing facility, which has highly qualified and trained technical staff. The design and all drawings for this equipment were recreated, under Canadian supervision, and translated from English to Ukrainian.

The first line of this equipment has already been completed and has been installed in an existing precast plant, which has been converted into a concrete block/brick manufacturing facility, where block production is currently underway. Additional equipment is being manufactured and when it is installed in new plants and its operations tried and tested by running successfully for some time, it is planned to expand the marketing of the equipment to the other FSU countries as well as to other parts of the world. Interest has been expressed by groups in Kiev and Lugansk in Ukraine and further afield in Moscow, St. Petersburg and Y'ekaterinburg in Russia.

With the introduction of these processes, the new building materials will require appropriate developments and modifications in their existing standards and codes, design methods and construction techniques. At the same time, it is critical that the products obtain approval by testing for certification. This step is underway through the materials Faculty of the Polytechnic University of Lviv. The same body will initiate the development of a new masonry code using the Canadian (CAN CSA S304) and the US (ACI) Masonry Codes as guides. With similar climatic requirements as in most of the countries of the FSU, Canada, with great resources in construction expertise, manufacturing and design knowledge and a wealth of technical literature, is well equipped to assist these countries in areas of their needed development.

An additional important activity involves upgrading the skills of the labour force in meeting the design requirements and material properties. The program provided by the Ontario Masonry Training Centre in Mississauga, Ontario, could provide the basics for the development in this area.

Finally, it is recognized that there is a need for promotion and marketing, as well as for an Information Program to familiarize the Design Community with the "new" masonry process. This acceptance may well be the most difficult achievement, particularly with the more experienced engineers who have developed confidence and familiarity with other construction systems. A long term objective will be to introduce courses on Masonry in

Undergraduate Design Curricula. In conclusion, while originally the primary motivation to improve Masonry Technology may have been profit oriented, it has become more of an effort to improve the lot of the land of origin for most of the investors.