SIMPROLIT BLOCKS

BASIC PROPERTIES

Simprolit blocks for facade and partition walls clearly distinguish themselves from other Simprolit products by their unique relation between: quality - low thermal conductivity - durability - good soundproofing - good waterproofing - small weight of structure - cost-effectiveness.

These blocks have excellent sanitary-epidemiological properties, which are a whole class higher than values required by the GOST R 51263-99 standard. Buildings made with Simprolit blocks are not just very comfortable to live in (according to GOST 30494-96), but also ecologically suitable (according to GOST 30775-2011 and GOST R 51769-2001).

Walls made of Simprolit blocks are declared as "dry" (with less than 4% humidity). In case of plumbing damage and excessive water flow, wet walls dry quickly without permanent loss of physical properties. When exposed to flood, walls made with Simprolit blocks do not absorb water capillary the way that brick, Siporex, gas concrete, expanded clay concrete or other similar materials do (walls made of these other materials absorb water all along their height and afterwards it takes a long period of time for them to dry - sometimes more than a year).

On the other hand, level of water absorbed by Simprolit blocks is just 3-4 cm higher than the flood level and after the removal of the excess water Simprolit block walls dry very quickly which is a fact that has been certified by the lab tests conducted at the Institute for materials and structures - Faculty of Civil engineering in Belgrade.

In the class of light-weight concretes Simprolit polystyrene concrete is one of the lightest composites and the weight of Simprolit products is up to several times smaller then the weight of similar materials. By using Simprolit blocks for facade and partition walls the load carried by structural members becomes considerably reduced, consequently reducing dimensions, required reinforcement and weight of these members which has direct influence on the price of the building.

Thanks to the light-weightiness of the material, building with Simprolit blocks is very suitable in case of adaptation of existing structures or additional building of attics on the top of flat-roof structures. As a rule, when adapting a flat-roof structure the total load of the adapted or additionally built part of the structure is smaller than the weight of all layers of a conventional flat roof - so there is no need for any foundation strengthening.

For example, if it is possible to add two extra stories to the existing structure using other materials, it can be shown that with Simprolit it is possible to build three stories keeping the same weight of the additional structure. Also, the light-weightiness of Simprolit blocks together with simple and fast construction method makes it possible to perform the adaptation without moving out the tenants of the adapted building, which often represents a large difficulty for other similar methods using light-weight materials and prefabricated metal or concrete bearing elements.

The fact to be particularly underlined is that Simprolit blocks have no real competition in their category when it comes to building rooms subjected to increased humidity - such as kitchen or bathroom walls including plumbing.

Simprolit monolith and structures made using Simprolit (class D150 to D1000), produced according to TU 5741-003-52775561-2003, satisfy fire-proofing demands established by NPB 244-97 and have a non-flammable material certificate (NG) according to GOST 30244-94 t.5.2. (Certificate №ССПБ.RU.ОП019.Н00168, valid until 03.11.2006.).

Simprolit blocks with hollow spaces, used for facade and partition walls (block thickness ranging from 8 to 30 cm, class D200-D1000), produced according to TU 5741-003-52775561-2003, **without plaster, with thermo-insulation pads** (which are included in case of increased need for thermo-insulation in extreme climate conditions) **satisfy fire-proofing requirements** according to NPB 244-97: burn ability class G1 according to GOST 30244-94 (**slightly burnable** acc. to SniP 21-01-97); flammability class V1 according to GOST 30402-96 (**difficult to ignite** acc. to SniP 21-01-97); minor smoke-producing ability according to GOST12.1.044-89-t.4.18 (class D1 acc. to SNiP 21-01-97) – Certificate №ССПБ.RU.00019.Н00165, valid until 03.11.2006.

Practically, Simprolit blocks do not burn because polystyrene granules coated with special admixtures and cement vaporize under high temperatures, leaving only concrete "truss" which in prolonged fire conditions becomes porous cement stone - keeping almost all of its physical and thermo-technical properties. The smallest "rib" thickness of a hollow Simprolit block amounts to 4 cm and because of that the fire-resistance tests were conducted using 11 cm thick 3-layer samples (4 cm of Simprolit on both outer sides and 3 cm thick styrofoam plate in the middle).

According to the testing results (Russian Ministery of Defence - Protocol № 626/ИЦ-00, IC«Opitnoe»), the following conclusion has been derived: "**During 90 minutes of fire-resistance testing** of 3-layer Simprolit polystyrene concrete and styrofoam samples according to GOST 30247.1 **limit state of integrity loss (E) and thermo-insulation ability loss (I) did not occur**".

Having in mind that the tested samples had no plaster coating at all and that they kept their fire-resistance for more then 90 minutes, it is obvious that a wall made of Simprolit blocks and plastered on both sides would remain fire-resistant for far more then 90 minutes.

Walls made of Simprolit blocks, filled with concrete, have high strength and seismic resistance - a degree higher then walls made using other block types. Simprolit walls remain resistant even after a very long exploitation period (100 and more years). Using Simprolit blocks, it is possible to build light-weight but also highly-resistant walls, because Simprolit blocks possess vertical and horizontal cavities which allow fitment of steel reinforcement together with monolith concrete.

It is well known that there is a contradiction between structural members' bearing capacity and thermo-insulation ability (bearing capacity demands higher density of the material, and higher density implies lesser thermo-insulation ability). This problem could be solved using Simprolit blocks - they are made of super light-weight polystyrene concrete (max. density 200kg/m^3) having also high thermo-insulation ability.

On the other hand, full bearing capacity of walls built with Simprolit blocks is achieved by filling the hollow spaces with concrete, depending only on the applied class of concrete.

The total weight of Simprolit wall is small, regardless of the fact that Simprolit blocks must be filled up with concrete. For example, a 225mm thick outer wall made of Simprolit blocks (200mm thick Simprolit block, 15mm inner plaster and 10mm outer plaster) weighs together with plaster and concrete 165 kg/m^2 (Simprolit block itself weighs around 3.1 kg/piece or less then 27,5 kg/m^2 of a wall), and a 140mm thick partition wall made of Simprolit partition blocks (120mm thick Simprolit block and 20mm plaster on both sides) weighs together with plaster and concrete 121 kg/m^2 (Simprolit block itself weighs less then 2 kg/piece or less then 20 kg/m^2 of a wall).

Comparing the weight of a (60% thicker) plastered facade wall made of 20cm thick Simprolit blocks (121 kg/m^2) with the weight of plastered partition wall made of 12 cm thick bricks (296 kg/m^2) it is obvious how light-weight Simprolit walls really are.

Concrete poured into hollow spaces of Simprolit blocks contributes not only to the bearing capacity of Simprolit walls but also to many other important properties, such as sound-insulation, summer stability, thermal capacity, etc.

COMPARATIVE ANALYSIS

COMPARISON WITH SIPOREX AND OTHER SIMILAR MATERIALS BASED ON CELL-CONCRETE

Simprolit blocks have many advantages when compared to some of the extensively used similar materials based on light-weight concrete (blocks made of gas concrete - Siporex or expanded clay concrete blocks). Some of these advantages are:

- exceptional light-weightiness;
- simple horizontal and vertical transport;
- excellent workability;
- simple construction (there is no need for high-qualified labor);
- vertical and horizontal joints without thermic "bridges" (blocks are laid without plaster or glue);
- thick plaster layer is not necessary;

- low water absorption and good waterproofing (humidity-resistant);
- contain no lime or any other aggressive substance (presence of lime as a basic ingredient of Siporex and other similar cell-concretes, causes significant corrosion of water pipes and metal connection elements: plugs, anchors, consoles, bolts, etc; therefore, it is essential to isolate these metal elements carefully or else the consequences might be unpleasant and very expensive);

- constant humidity percentage: 4-8%, also taking into account the discharge humidity (gas-concrete products coming straight from the production process usually have significant discharge humidity: up to 25% of their mass and the producers declare a period of 6-18 months as a time required for them to reach the desired 6% - 8% humidity in exploitation; during the first 6 months of ventilation and drying of Siporex (or similar concrete) walls the humidity content decreases to approximately 58% - 60% of discharge humidity and only after 18 months the humidity content becomes balanced around 9%.

- very good relation between heat conductivity coefficient for material in dry conditions and the same coefficient for elements already built in

the wall (heat conductivity coefficient for Simprolit blocks in dry condition amounts to 0.065 and for built in blocks -which is the only valid situation- its value reaches approximately 0.08 depending on the block type; on the other hand, for Siporex (or similar concrete) walls made with blocks having 700 kg/m^3 density the heat conductivity coefficient amounts to 0.223, and for for the same walls made with blocks having 600 kg/m^3 density it equals 0.191 W/m^0K; the experimental results show that 400 kg/m^3 is a critical density value for cell concrete which means that when the density becomes smaller all important physical-mechanical properties decrease drastically, especially frost resistance);

- good ductility and crack deformation resistance of the blocks (other cell-concrete producers recommend that a gap filled with mineral wool should be provided between siporex wall and beam or ceiling, so that the deflections of beams or celings wouldn't cause block deformations and consequently cracks on the walls);

- simply the best summer stability in comparison with other materials with the same thickness;
- remarkably good steam-conductivity (walls made of Simprolit blocks can "breathe");
- ecological suitability;

- possible application as a permanent thermo-insulating formwork (Simprolit blocks can be cut as a formwork for columns and beams - after reinforcement fittment and concrete casting there are no "cold bridges"), the formwork and installation labor costs at the construction site are cut to minimum;
- best comfortability (Simprolit blocks are unique - they are the only blocks in the world satisfying with 30cm thickness the requirements of civil engineering physics in all regions of Russia, even in the most extreme climate regions at the Far East and Siberia);

- ecological suitability – sanitary-epidemiological properties are a whole class higher than values required by the GOST R 51263-99 standard;
- large assortment of different elements made of Simprolit;
- the surface of Simprolit requires no special preparation before finishing; it is also very easy to apply any of the usual finishing materials;
- durability, frost-resistance and stability under intense temperature changes (based on the results obtained by the "Russian Academy of Civil Engineering Science - Institute of Civil Engineering Physics", for temperature changes from +75^{0}C to -30^{0}C every 24 hours, The Recommendation for application of Simprolit blocks at the north regions of the Far East and Siberia has been issued).

COMPARISON WITH BLOCKS WITHOUT CAVITIES MADE OF OTHER TYPES OF POLYSTYRENE CONCRETE

Simprolit blocks have many advantages when compared to some of the similar products based on polystyrene concrete (blocks without cavities). Some of these advantages are:

- building with Simprolit blocks requires no plaster or glue application at block joints (because the block cavities are filled with concrete or polystyrene concrete) - on the other hand blocks without cavities made of polystyrene concrete are plastered or glued together, which decreases for at least 25% the thermo-insulation ability of the material in comparison to the lab properties of the dry material; it is a fact that every Designer must take into account and be very careful when using the heat conductivity coefficient declared by the Producer, who usually gives its value for dry conditions and not for real conditions (in the wall surrounded by the humid ambient) - which automatically increases the required facade wall thickness for more then 25%;

- some of the producers of polystyrene blocks without cavities try to solve the problem of joints and "cold bridges" by application of special expensive glues, declaring that joints in this particular building system are no more then 3mm thick (which can not be achieved even in case of commercial samples - because of the inaccuracy in production technology). Besides, in winter conditions a special anti-freeze addmixture is added to the glue changing its consistency and increasing its setting time, which by the rule makes the glue starting to flow consequently leaving the joints empty;

- most of the producers of polystyrene blocks without cavities use cheap and poor quality raw material for styrofoam balls' production - without weight and dimensions control. Some of them even use crushed styrofoam as a raw material, which has a direct influence on homogeny, geometry and surface quality of the product, also decreasing many of its physical and thermo-technical properties. According to the State Scientific Centre of the Russian Federation - «НИЦ Строительство» and Scientific-research Institute – «ГУП НИИЖБ», most of the polystyrene blocks without cavities used on construction sites in Moscow have a low level of declared characteristics - homogeny, strength, heat conductivity, geometry and surface quality.

SIMPROLIT BLOCKS

Simprolit system has abandoned the application of blocks without cavities in building construction for other, more important reasons:

- by using hollow Simprolit blocks in civil engineering a lot of very important characteristics (besides thermo-insulation ability) could be achieved, such as:
- summer stability,
- heat capacity,
- strength,
- bearing capacity (concrete poured into blocks' hollow spaces takes over the bearing function),
- comfortability,
- use of blocks as a permanent thermo-insulation formwork,
- possibility to compensate the heat loss without changing the thickness of hollow Simprolit blocks (by adding the styrofoam or Simprolit isolation pads it is possible to solve the problem of general thermo-insulation loss caused, for instance, by large glass-facade surfaces; this problem is usually solved by increasing the power of the heating system which consequently means more expenses during construction and exploitation of the building).

* Simprolit hollow blocks are produced according to the Technical conditions, in classes D350 and D450, also in larger dimensions upon special request.

Because of their properties:

- 2-3 times lighter then water,
- strength between 1,5 MPa and 3,6 MPa,
- no capillary water absorption,
- excellent thermo-insulation,
- bio-resistance and ecological suitability, etc.

they are often applied in case of soil alteration beneath road and railway structures, under foundations and foundation plates (esspecially for eternaly frozen ground), for side pressure reduction in case of deep excavation, for bridge abutment construction, etc.

Upon special request, Simprolit hollow blocks could be fitted with chosen structural reinforcement as well as with manipulation or installation anchors. The amount of cement used for production of Simprolit (>350 kg/m^3) is a guarantee that built in steel reinforcement would be adequatly protected from corrosion.

COMPARISON WITH BLOCKS WITHOUT CAVITIES MADE OF OTHER TYPES OF POLYSTYRENE CONCRETE

Recently, as a standard thermo-insulation of facade walls, three-layer panels are used. These thermo-insulation panels have two layers consisting of polymer-cement glue applied over the glass-fiber net and finishing facade plaster, while the third - basic layer consists of so called «effective» isolators in the form of boards (styrofoam, mineral wool, etc.).

Facade walls made of Simprolit blocks have many proven advantages when compared to some of the widely used thermo-insulation systems based on styrofoam or mineral wool application. Some of these advantages are:

- reduced construction complexity (less operating tacts and working phases) for 25–30%;
- significantly better ecological (sanitary-hygienical) building exploitation conditions due to improved steam and air permeability, constant humidity content of facade structures, lack of condensation effects, etc. - all of this having influence on better quality and more comfortable living conditions;
- polystyrene concrete structures have significantly improved durability and exploitation reliability - up to 2-4 times more in comparison with mineral wool or styrofoam thermo-insulation systems (these figures are taken from the State Scientific Center of the Russian Federation - «НИЦ Строительство» and Scientific-research Institute – «ГУП НИИЖБ» testing results);

- Simprolit polystyrene concrete and Simprolit structural elements have a constant heat conductivity coefficient that doesn't depend on humidity content; Simprolit has practically stable humidity percentage: from 4% (in normal humidity environment) to 8% (in very humid environment - up to 99% humidity). On the other hand, if we take mineral wool for example, just 1% increase of humidity content causes 20% reduction of its thermo-insulation ability;

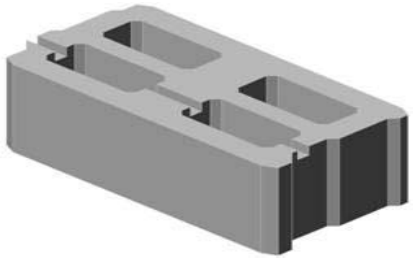
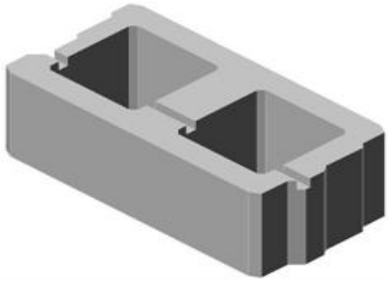
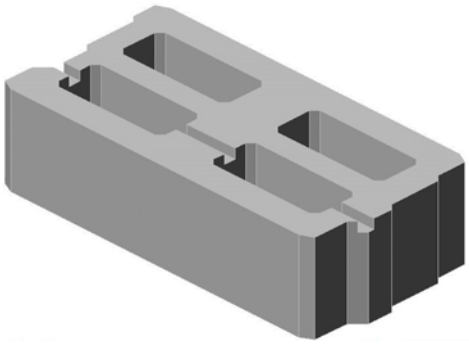
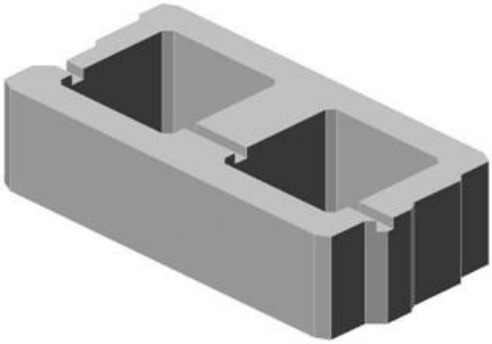
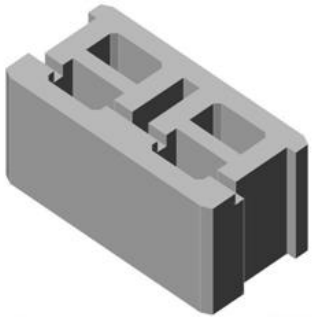
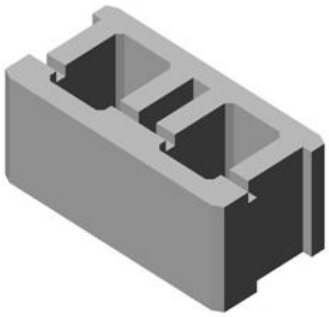
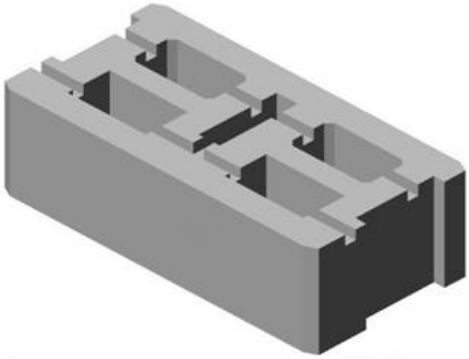
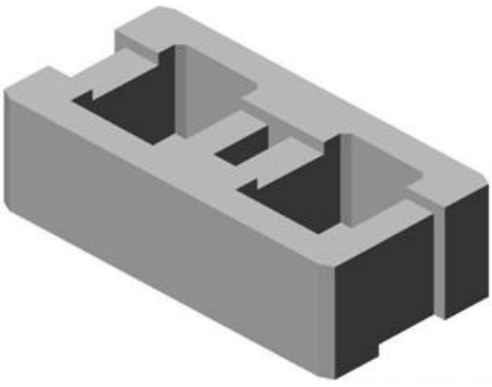
- In distinction from the mineral wool Simprolit is an ecologically clean material. Namely, without proper ventilation mineral wool starts to oxidize, show traces of mildew, fall apart or transform itself into needle-like dust becoming very health-hazardous (especially for children);

- Compressive strength of Simprolit polystyrene concrete is considerably larger then compressive strength of mineral wool; also, mineral wool requires a protective layer either in the form of cement screed or mortar, or in the form of protective screens - in case of ventilated facade application (for example, Simprolit polystyrene concrete can sustain maximum load between 1,5 MPa and 3,6 MPa without deformation, while on the other hand mineral wool sustains barely 3 - 10 kg/м^2 with deformation reaching 10% or more);
- While the cement in polystyrene concrete (in amounts larger then 200 kg/м^3) protects the steel reinforcement from corrosion, mineral wool has particular ability to absorb water which in time dissolves mineral salts forming extremely aggressive solutions - therefore it is necessary to protect any metal surface that has direct contact with the mineral wool;
- Increased humidity of mineral wool reduces its durability and frost resistance. In order to solve these problems, producers recently try to protect mineral wool by adding waterproof layers (organic resins or oils), but as a consequence there is a reduction of steam permeability and fire resistance (standard mineral wool can be applied up to 700^0 C, while waterproofed mineral wool is declared for use only under 250^0 C - if the temperature gets any higher the waterproofing agents either vaporize or burn creating hazardous fumes);

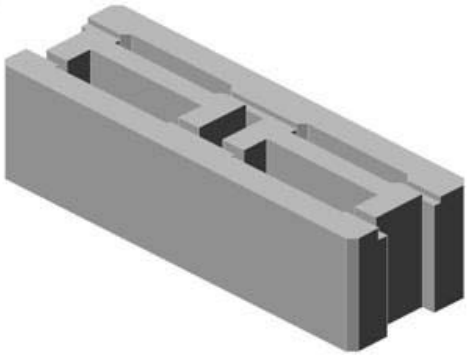
The technology of Simprolit polystyrene concrete production has been designed in the following manner: first, during preparation phase the styrofoam balls are coated with a complex of addmixtures - creating airtight and watertight membranes around these balls; after that, the special organic addmixtures essential for good bonding between inert styrofoam balls and cement are added; at the end, cement, water and other admixtures are added in order to regulate the designed properties of the material. This technology provides that styrofoam balls have no contact with air, thus eliminating all poor characteristics of expanded or extruded polystyrenes (Styrofoam, Styrodur). Namely, these materials have a tendency to loose their compactness when exposed to air for a long period of time but they are also iresistant to different aggressive gases (emited from the industry, thermo-energy plants, tunnels, subways) as well as to the ultraviolet-ray exposure, extreme temperature changes, etc. In order to prove the above stated facts the samples of Simprolit polystyrene concrete were taken from all four licensed producers in Moscow (Simpro too, Simpro Ru, Lasis NT i Simprostroy) and tested at the Moscow State Center for Sanitary-epidemiological Supervision. As a result, Simprolit was declared a non-flammable material that belongs to the flammability class NG.

SIMPROLIT BLOCKS

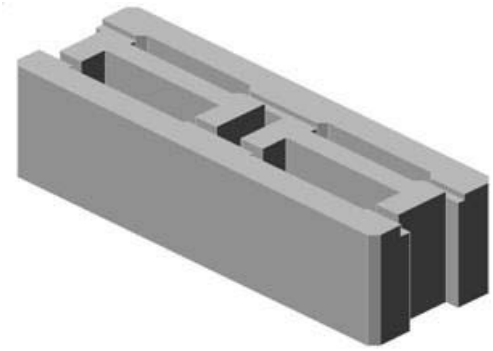
TYPES OF SIMPROLIT BLOCKS

 SB25	 SBD25
 SB30	 SBD30
 SBS25	 SBDS25
 SBS30	 SBDS30

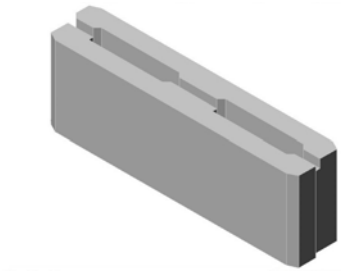
SIMPROLIT BLOCKS



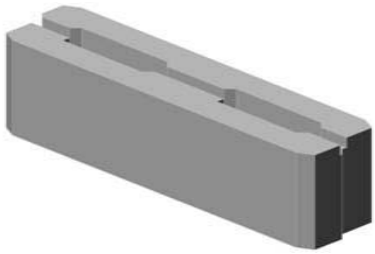
SBS20



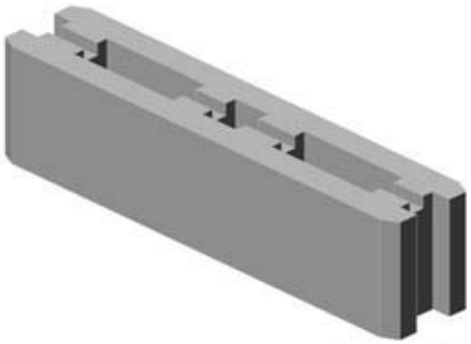
SBDS20



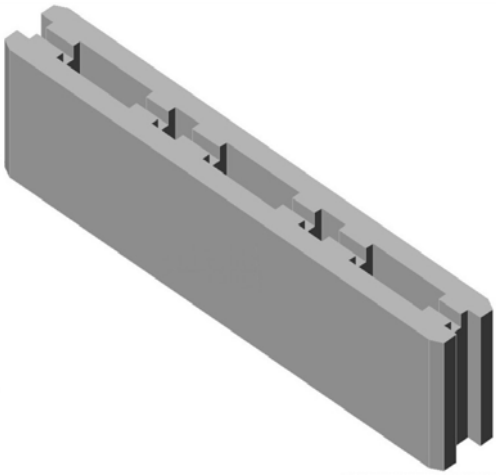
SPB50



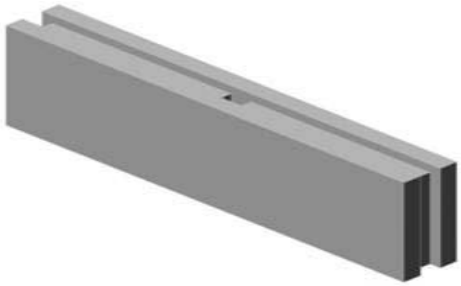
SPB60



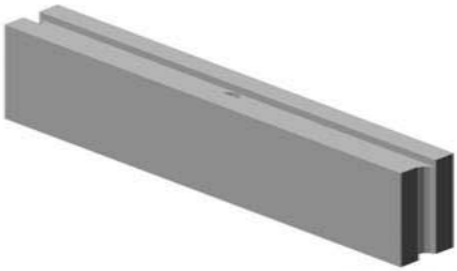
SPBS60



SPBS90

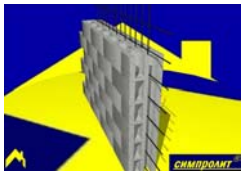


SB 8k



SB 8r

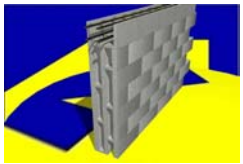
TYPES OF SIMPROLIT BLOCKS



Generally, Simprolit blocks can be classified as blocks for outer walls or blocks for partition walls and facade casing.

Blocks for outer facade walls are produced in 20cm, 25cm and 30cm thicknesses. Depending on the type and the possible application of the block, they have:

- 4 longitudinal cavities, 2 of which are hollow and 2 with the bottom (block types «SB» and «SBS»); if necessary, additional longitudinal thermo-insulation styrofoam or Simprolit pads can be put into cavities with the bottom.
- 2 cavities, both hollow (block types «SBD» and «SBDS»); if necessary, additional longitudinal thermo-insulation styrofoam or Simprolit pads can be put into both cavities next to the outer wall (rib) of the block.
- Except for the above mentioned cavities , Simprolit blocks belonging to series «S» (block types «SBS» and «SBDS»), have additional transversal cavities placed in the middle of the block.



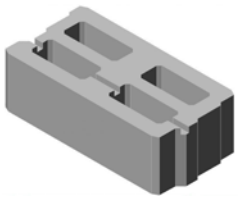
Blocks for partition walls and facade casing are produced in basic thickness of 12 cm. Upon special request, 8cm and 15cm thick Simprolit blocks can also be produced in conformity with Technical conditions.

Thereby:

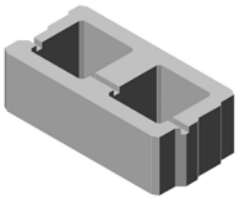
- Classic partition blocks have 2 hollow cavities (Simprolit partition blocks type «SPB»)

Partition blocks belonging to «S» series (Super) have an additional hollow gap in the middle of the block (Simprolit partition blocks type «SPBS»).

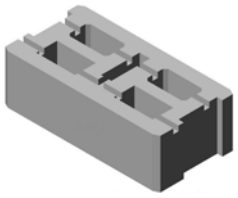
WALL CONSTRUCTION WITH SIMPROLIT BLOCKS



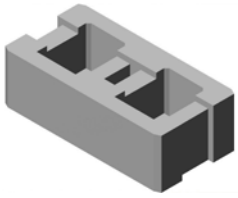
Simprolit blocks are fixed «dry» without plastering between the rows. Upper and lower surface of the blocks are even and the blocks have constant hight and accurate dimensions which means that there is no need for a thick plaster layer to level the wall surface. It also improves thermo-insulating properties of both the blocks and the complete wall. Hollow block cavities can be filled up with concrete, mortar or Simprolit - thus taking the role of a bonding element.



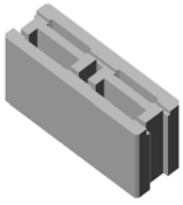
Principally, Simprolit blocks must always be treated as self-supporting and in case that the Designer wants to use them as a permanent formwork their cavities have to be filled with concrete of sufficient quality - according to the designed concrete class.



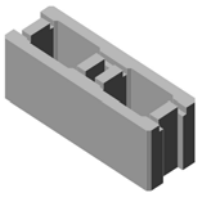
Simprolit blocks are fixed «with bonding on ½ block» and the hollow cavities of each row must exactly coincide with the hollow cavities of the next row of blocks - which has to be strictly controlled. In this manner, the mass of casted concrete forms a vertical system of «concrete posts» between the floor and the ceiling (slab or roof plate).



On the surface of Simprolit blocks there are horizontal longitudinal chanels which are used for installation of ø8mm reinforcement and afterwards are filled up with mortar or concrete. Function of the steel reinforcement is to build «reinforced concrete truss» made of vertical concrete posts and horizontal reinforcement chords - forming a wall that is rigid in its own plane - which often represents a desired wall charasteristic, especially in seismically active regions.



Simprolit blocks are easily cut and brought to the required dimensions, always paying attention that the above mentioned request (vertical hollow cavities of each new row must exactly coincide with the hollow cavities of the previous row of blocks) should be fulfilled as well as the rule by which the blocks forming a new row must be fixed with bonding on ½ block from the previous row.



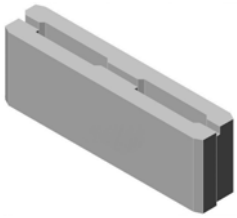
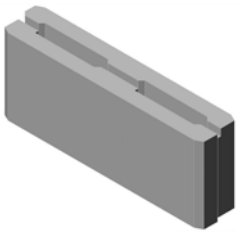
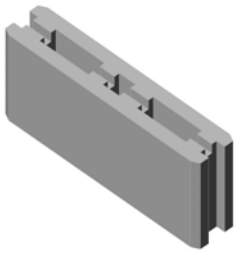
Building with Simprolit blocks requires strictly even and horizontal surface. Therefore, the building surface must be prepared by application of a 10–20mm thick cement plaster layer. This layer must be leveled both longitudinally and transversally. The building is to be continued only when the plaster becomes hard.

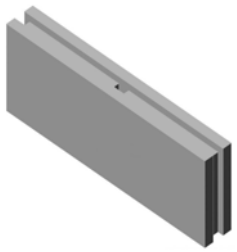
In case that there is a horizontal waterproofing between the wall and the floor foreseen in the project, it has to be applied either as a waterproofing layer between two levelling plaster layers or as a waterproof mortar for surface levelling.

When standard Simprolit blocks (type «SB», «SBD» and «SPB») are used, one must especially consider that cement plaster or glue must be brought on vertical block surfaces in 5–6mm thick layers (to avoid air blowing through the vertical joints). On the other hand, when special Simprolit blocks series «S» (type «SBS», «SPBS» and «SBDS») are applied, the same problem is solved by using vertical transversal styrofoam or Simprolit pads.

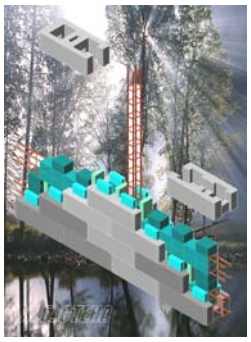
Except for building with Simprolit blocks which hollow cavities are filled with concrete, mortar or Simprolit polystyrene concrete, walls can also be constructed with Simprolit series «Super» blocks using «dry building» technology. According to this technology, it is recommended to pour the concrete or mortar into hollow cavities of the first row of blocks but only up to the 1/2 of their height. After that, special styrofoam or Simprolit pads made of one-layer «SOP» plates and cut to fit blocks' hollow cavities are inserted into these cavities. In this way, the pads stick out from the first row of blocks by 1/2 of their height - becoming specific guides for construction of the next row of blocks, but also providing a stiff connection between two adjacent rows as well as preventing sound penetration, frosting and blowing through the joints.

When exposed to extremely low temperatures, walls made of Simprolit blocks may be constructed using warm Simprolit polystyrene concrete for filling of the hollow cavities. However, the difference between heating up the regular concrete and Simprolit must be underlined. Namely, in case of the regular concrete it is essential to warm up the aggregate (because of its high heat capacity), but for Simprolit polystyrene concrete it is enough to use just hot water (with maximum temperature 70^0C in the boiler or 60^0C in the fresh concrete mass). Warmed up and poured into blocks' vertical hollow cavities, Simprolit polystyrene concrete is placed into some kind of «thermos», providing (together with additional heat which is released during chemical reaction between cement and water in the process of cement hydration) the necessary hardening cycle of the Simprolit polystyrene concrete without any risk of freezing. Besides the described vertical cutting of Simprolit blocks (in case of blocks' overlapping or building between concrete columns and reinforced concrete walls) it is also possible to cut the blocks horizontally. This procedure is recommended in the following situations – if the parapet height under the window does not coincide with the height of the whole row of blocks, or if the height of the whole row of blocks does not coincide with the distance between two slabs. Simprolit blocks are easily cut horizontally and brought to the required dimensions. However, if more then 2/3 of the complete height of the blocks in the last row should be cut off, it is recommended to equally cut not only one but two of the last rows, bringing the blocks in both rows to required dimensions.

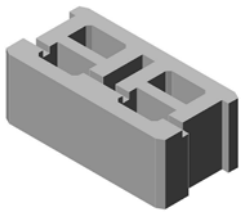



Building with Simprolit blocks in seismically active regions must be performed in the following manner: two horizontal reinforced concrete ring beams are formed along the height of the wall (the lower beam at the level of window or door lintel, and the higher beam at the slab level), or else in every row of Simprolit blocks ø8mm horizontal reinforcement should be installed. Both of the recommended solutions provide more uniform seismic load distribution and contribute to the general bearing capacity of the walls.

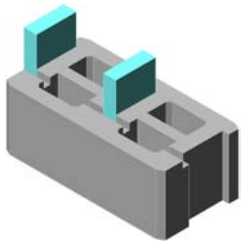


If the Simprolit blocks are reinforced with horizontal or vertical steel reinforcement, it is essential to cover it with either concrete or cement mortar (with cement content higher then 200 kg/m^3), in order to protect the reinforcement from possible corrosion.

The horizontal lintel over the window opening has to be reinforced with minimum two ø8mm rebars. These rebars should be at least 15cm longer on both sides then the window opening and should be anchored into adjacent concrete posts formed by Simprolit blocks. On the other hand, the horizontal reinforced concrete ring beam at the slab level should be reinforced with four ø12mm rebars and ø6mm stirrups at every 24cm along the whole length of the beam (unless it is differently specified in the Design).

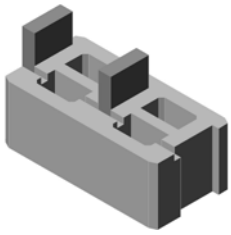


In seismically active regions it is also neccesary to build vertical reinforced concrete ring beams at the walls' end (at the corners of the building or at other wall-joints). These vertical reinforced concrete ring beams should be reinforced with four ø14mm rebars and ø6mm stirrups at every 15cm along the whole height of the beam (unless it is differently specified in the Design).



PLASTERWORK ON SIMPROLIT BLOCKS

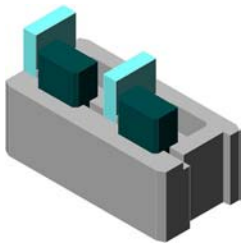
Plaster is an important element of the general structure of the wall - therefore it is necessary to pay special attention to its design and application.



Plasterwork can fix, but also spoil some of the wall's properties, such as: steam permeability, frost resistance, condensation effects, physical-mechanical characteristics, etc. In that regard, fundamental influence have plaster quality, composition and especially thickness of the placed layer.

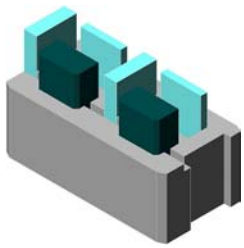
The thickness of the plaster, as well as the relation between outer and inner plaster layer dimensions, have significant importance when the

walls are designed and built using steam-permeable materials, such as: brick, cell-concrete (gas concrete - siporex, foam concrete), polystyrene concrete, etc.



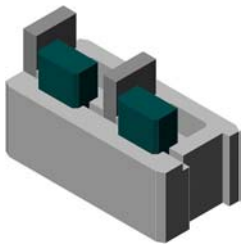
In regard to the fact that plaster layers slow down the steam and air conduction, the above mentioned walls must be designed and built to provide that the quantity of steam that enters the wall through the inner plaster layer and the quantity of steam that comes out through the outer plaster layer are exactly the same.

In that case the walls «breathe» and the steam does not stay inside the wall or under the outer plaster layer. On the contrary, the same steam just after several freeze-thaw cycles, becomes the basic cause of crack development and outer plaster spalling or else there is a moisture and mildew appearance on the inner side of the wall, especially at the thermical «cold bridges» - horizontal and vertical ring beams, window lintels, wall and ceiling joints, etc.



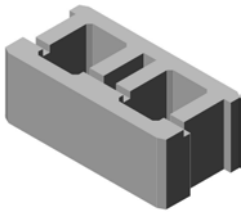
If there is no detailed thermo-technical calculation present, it is possible to use the old rule of the experienced craftsmen: in order to make the walls «breathe» it is recommended that the inner plaster layer should be twice as thick as the outer (for instance, if the outer plaster layer amounts to 2 cm, then the inner layer should be 4 cm thick).

Among the other advantages, building with Simprolit blocks does not require thick plaster layers – dimensions of outer and inner plaster layers stand in relation 2:3, whereas the sufficient outer layer should be between 6mm–10mm thick (or the outer side of the wall could just be skimmed using cement glue or cement paste mixed with some fine sand) and proportionally inner plaster layer should be 10–15mm thick.

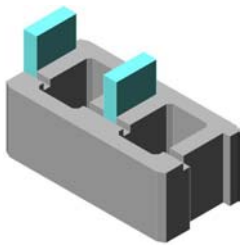


Plasterwork on Simprolit blocks can be done using any of the usually applied plastering materials and the plastering technology depends only on the selected material technology.

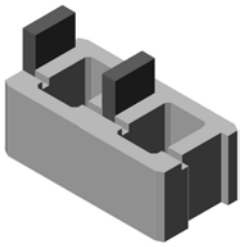
The fact should be pointed out that the walls made of Simprolit blocks do not absorb moisture and the plaster dries toward the outside. On the other hand, drying of the plaster placed on the walls made of other materials is achieved so that half of the moisture evaporates to the outside and the other half to the inside of the wall. Because of that, the plaster layer put on the Simprolit wall dries longer, giving us the opportunity to fine-level (skim) the same layer. There is also another difference: if the walls are built using standard materials the plasterwork is executed in three phases (ground – prime coat, first layer of coarse plaster and finishing layer of fine plaster). On the other hand, when the walls are built using Simpolit blocks, plasterwork is executed in only two phases (first phase consisting of backfilling of inclined vertical joints and prime-coating, second phase consisting of actual plastering together with fine-leveling finish).



TILING
OF SIMPROLIT BLOCKS

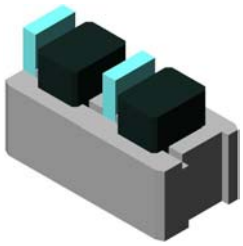


Rough surface and cement based structure of Simprolit blocks makes it possible to lay the inner walls with ceramic tiles or even heavy and large ceramo-granite plates, without additional anchoring - using any of the cement based types of ceramic tile glue.



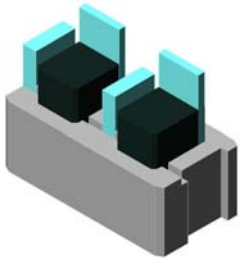
If the outer sides of the facade walls are tiled with steam non-permeable material it is necessary to find a way for steam to leave the wall and exit to the atmosphere. This goal could be achieved in two ways:

- either by filling the joints with a steam permeable material and leaving small openings near the bottom and the top of the tiled wall (the air circulates from one opening to the other, passing between the glue «cakes» which are holding the tiles attached to the facade),



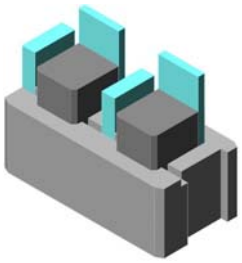
- or by mounting the facade plates on the substructure, thus providing ventilated air-layer (this solution is recommended if the outer coating of facade walls covers more then 70% of the heated storey's height).

FINISHING OF WALLS
MADE WITH SIMPROLIT BLOCKS

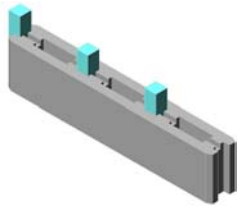


Principally, finishing of walls made with Simprolit blocks can be done using any of the chosen finishing materials.

The walls may also be painted using any of the steam permeable paints, even without previous skimming (although this solution is usually not recommended mostly for economic reasons, because to much paint gets spent due to the rough block surface; it is much more cost-effective to skim the block surfaces even with the mixture of cement paste and fine sand, prior to wall painting).

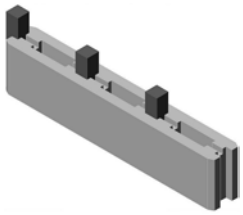


STRUCTURAL DETAILS

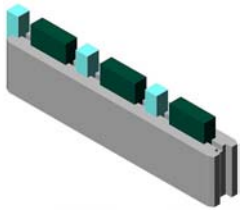


CONNECTION BETWEEN SIMPROLIT AND OTHER ADJACENT WALLS

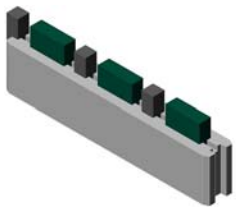
Walls made of Simprolit blocks are easy to connect with other adjacent walls, made of either Simprolit blocks or any other structural material.



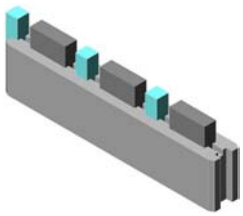
Generally, construction of joints at the connection of two adjacent walls is very simple – it is accomplished by using mortar or cement based glue, together with steel anchors. These anchors have to be installed into the adjacent wall and their position must coincide with the position of horizontal openings (channels) of every third (or fourth) row of Simprolit blocks where there is already present the required horizontal reinforcement.



Considering the fact that Simprolit blocks are easily cut, worked with and brought to the required form and dimensions, there are several other ways to connect Simprolit block walls with any other adjacent wall. For example, it is possible to make the connection using ø6-ø8 mm steel reinforcement, bent in a shape of «Г» letter, which is layed in the same direction at the corners of the building and in other cases in the opposite direction (every second row - alternately).

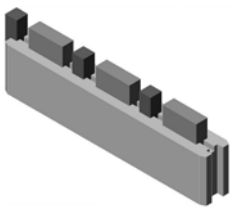


FASTENING OF DIFFERENT OBJECTS TO SIMPROLIT BLOCK WALLS



Simprolit walls consist of «dry» fixed Simprolit blocks - without any horizontal plaster layer, using «bonding on 1/2 block» to make connection with the blocks from the previous row and filling up the hollow block cavities with fresh concrete, mortar or polystyrene concrete.

In that way, the net consisting of vertical concrete «posts» is formed all along the wall's height. On the other hand, the plaster layed on the Simprolit block wall can easily sustain (without deformation) shear load caused by lighter objects such as pictures, clocks, lamps, etc. These objects may be fastened to plastered Simprolit block walls using customary plastic plugs.



In the case of heavy objects fastening, special steel plugs have to be used. These plugs must not be installed into the transversal rib of the Simprolit block, but into the «concrete post» made by filling of the block cavities with concrete (concrete posts cover approximatelly 2/3 of the block's width).

In the situation when the anchor has to be placed on the location away from the corresponding «concrete post» (which may be the case if a kitchen cabinet, boiler or any similar appliance has to be fastened to the wall) it is recommended to put first a metal angle bar or a wooden lath (and anchor it to the «concrete posts» formed by Simprolit blocks) and after that it is possible to fasten any heavy appliance to that angle bar or lath.

In any case, both of the described methods are considerably easier and safer then any method of heavy appliance fastening to the hollow brick wall.

GUIDING OF INSTALLATIONS THROUGH SIMPROLIT BLOCK WALLS

Guiding of installations (such as: water and sewer pipes with diameter up to 50mm, flexible ribbed pipes for electric cable lines, other installation networks, etc.) through Simprolit block walls is very simple, because the blocks are easily «slotted», drilled and cut.

After cutting through Simprolit blocks in order to make installation channels, there is always some waste material left. This material should not be thrown away - it could be mixed with cement and water and the mixture could be used as a thermo-insulating mortar for filling up the channels after laying of installations.

One of the many advantages of Simprolit blocks over siporex and other similar cell-concrete blocks has to be underlined - Simprolit contains no lime (presence of lime as a basic ingredient of siporex and other similar materials, causes significant corrosion and destruction of pipes and other metal elements). Therefore, in a wall made of Simprolit blocks it is not necessary to put additional isolation for metal pipe work protection.

As for the installation of vertical sewer pipes (usually with diameter over 50mm) there are two possible solutions:

- either to install the pipes into the space between «concrete posts» formed inside the blocks and afterwards to fill this space with Simprolit,

- or simply use the hollow cavity inside Simprolit blocks as a sewer vertical channel, without filling it up with concrete during building process.

When building with Simprolit blocks, an experienced Contractor often leaves in each wall a whole vertical "post" without concrete filling, which might later become very useful for fitting of an additional vertical installation channel.

APPLICATION OF SIMPROLIT BLOCKS AS A PERMANENT FORMWORK

An additional advantage of Simprolit blocks that was already mentioned before is their possible application as a permanent thermo-insulating formwork. Namely, Simprolit blocks can be used as a formwork for reinforcement fitting and casting of horizontal and vertical ring beams, for window and door lintels, even for facade columns. Having in mind the fact that they are easily cut (even with a simple wood-saw) and brought to the required forms and dimensions, as well as their fire resistance, Simprolit blocks may also be used for building of a thermal and fireproofing protection coat around metal columns (if it is necessary, inner block cavities could be filled up with concrete - consequently offering a higher degree of fire resistance and much better corrosion protection).

When using Simprolit blocks as a permanent formwork, every Designer of a structural system should also take into account the dimensions of the blocks in order to reduce the amount of the waste material left after cutting.

But even these leftovers should not be thrown away - they can be used to fill up the Simprolit blocks' hollow cavities with bottom.

Generally, the application of Simprolit blocks as a permanent formwork can be classified as following:

a) For construction of vertical ring beams and columns

Simprolit blocks type «SBD» and «SBDS» have two large hollow cavities, basically provided in order to create a permanent formwork for vertical and horizontal ring beams or facade columns; usually, Simprolit blocks type «SBD» or «SBDS» are used in about 10% of the whole number of blocks (at the wall corners, at the joints of bearing walls, for facade columns and ring beams) and the remaining 90% are Simprolit blocks type «SB» or «SBS», which are used for building of facade walls.

In case that the blocks «SBD» or «SBDS» are not available at the construction site, they can easily be replaced using blocks «SB» or «SBS»; this can be done by cutting the bottom and the rib between the hollow cavities of the block using simple wood-saw.

In such a formwork, the designed reinforcement is installed and concrete of the designed class and quality is casted. Although concreting of the vertical ring beams could be done in segments along the height of the wall, the same procedure is not recommended for column construction. Namely, the column reinforcement usually sticks out from the base, reaching sometimes the height of the whole storey (so that lifting of the blocks would be a very tiresome activity).

In such a case, it is recommended to cut the blocks from the sides (if the column is at the corner) or from the front (if the column is in the wall). After the installation of the cut blocks, the other uncut blocks are moved close to them and the building of the wall continues according to the general rules for building with Simprolit blocks.

However, there is another more practical way to do the same procedure: to form the permanent formwork for vertical ring beams or columns using Simprolit "SUP" or "SOP" plates (outer and inner side) and Simprolit blocks on the flanks.

b) For construction of window and door lintels

Production program of Simprolit elements also contains prefabricated window and door lintels. However, these elements can be made at the construction site as well. For this purpose, the block types «SBD» or «SBDS» should be cut (in the shape of the letter «U»), lined up and filled with concrete in the following way:

- at a flat surface of a floor or a board the blocks cut in the shape of letter «U» are lined up forming something like a «trough»,

- then, the reinforcement is installed into this «trough» and afterwards the fresh concrete is poured; the concrete layer should be approximately 5cm thick (minimum 1cm higher then the lower reinforcement) and the reinforcement should stick out from the lintel ends in the length of 25 – 30cm.
- after the hardening of the poured concrete, the formed window or door lintel has enough strength to be lifted and mounted to the required position and subsequently the remaining hollow section of the lintel has to be filled up with fresh concrete.

The described procedure significantly accelerates the building process and the semi-prefabricated door and window lintels could also be produced directly on the construction site during the technological break periods.

c) For construction of bearing facade beams

If the Designer determines the width of the beam to be corresponding to the width of the block's hollow cavities and that the deflection of the beam must not cause any load transfer to the facade wall underneath, he can use the Simprolit blocks type «SBD» or «SBDS» - cutting the blocks horizontally at the half of their height and then lining them up to form the shape of the letter «U».

Cut block elements have to be lined up one next to other and placed on the flat surface of a wooden lath (in case of a free span) or on the top of the wall. Then, the sides of the blocks must be stiffened with wooden boards, followed by the reinforcement installation and filling of the «trough» with concrete.

Using this method, the costs of formwork and its installation are significantly reduced and there is no need for additional thermo-insulation of the beams in order to avoid "thermal bridges".

Besides, it is possible to construct the beams the same way as the door or window lintels (on the ground, placed on the flat surface of a wooden lath and then lifted up and mounted to the planned position), especially if the beam spans are short.

d) For construction of horizontal ring beams

Simprolit blocks may also be used as a permanent formwork for concreting of horizontal ring beams.

However, there is a difference between the above-described method of cutting Simprolit blocks for construction of the permanent formwork for facade beams and the method for construction of the permanent formwork for horizontal ring beams. For this latter method, Simprolit blocks are cut at the flanks and along the inner rib, in a width equal to the block cavity width, at 2/3 of the block's height.

So formed «trough» is not only acting as a thermo-insulation of the horizontal ring beam's sides, but also as a connection between newly poured fresh concrete and "old" concrete from the previously built row of blocks.

In this way, forming a spacious truss made of ring beams, with concrete «posts» as vertical and steel reinforcement as horizontal structural members (in each third or fourth row of blocks), **Simprolit building system represents effectively the most resistant and seismically safe system in comparison with any other «masonry» building system.**