

## Little floors town-planning complexes with energy protect building systems and new types concrete in Russia at 2007

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### ABSTRACT

Research of adaptability to manufacture of application of designs from porous concrete with the help of methods expert estimating has shown a high level of adaptability to manufacture of the developed decisions in view of factory, transport, assembly, operational adaptability to manufacture and adaptability to manufacture of modernization and reconstruction. Thus the integrated criterion of adaptability to manufacture is equal 0,665, that promotes increase of general efficiency of process of erection little floors town-planning complexes.

### 1. INTRODUCTION

**Urgency of a theme** of complex research and design-industrial work on a theme: « **Little floors town-planning complexes with energy protect building systems (experience of Saint Petersburg in 1999-2007)** » low cost and labour input of works is caused by necessity of development new energy protect building systems for little floors town-planning complexes, and also maintenance of the population with habitation, research of new technologies little floors constructions in country zones where determinatives are the reduced terms of erection of buildings.

### 2. MAIN TEXT

Progressive technologies of housing construction with use of multilayered designs are in 2006 one of the most important directions of increase of efficiency of a cycle in building sphere of Russia.

The analysis of references has allowed to establish, that used single-layered designs from a brick, a tree and concrete blocks do not provide efficiency and profitability of construction that leads to to a significant thickening of walls and weight of buildings. On the other hand, transition to multilayered designs with application of expanded polystyrene, mineral cotton wool and others warm - keepings materials is not always justified because of fragility of polymeric materials at their long operation. Besides their application restrains the insufficient fire resistance, harmful ecological influence on the person and a number of other factors.

The analysis of a condition of manufacture of effective materials has shown high efficiency of cellular concrete. However, their manufacturing is carried out exclusively industrially as a principal cause is the requirement of normative documents on temperature of air not below 15°C. The given circumstance is caused by features of formation of structure of cellular concrete and limits area of his use, not allowing to carry out manufacture in conditions of building sites. In this connection application of cellular concrete in mass housing construction restrains it enough in high cost of manufacturing industrially. On objects of construction as a constructive material it is frequently used gas concrete only pressed manufacturing or foam concrete of factory manufacturing.

Therefore there is a problem of development of more perfect technology housing construction with application of designs from a nonconventional material – porous concrete (TPB).

The urgency of a theme of research is defined also by the following factors:

- Modern requirements on increase of heat-shielding properties in external protecting designs of apartment houses;
- Necessity of depreciation of building materials and costs 1m<sup>2</sup> objects of housing construction;
- Improvement of operational qualities of a building, increase of fire resistance, reliability and durability of building designs from porous concrete;
- Necessity of the further perfection of technology little floors housing construction with application of nonconventional kinds of concrete, in particular, aerated concrete.
- The purpose of work is development new energy protect building systems for little floors housing construction with application of designs from porous and the thermo-vacuum concrete, providing increase of heat-shielding properties of external protecting designs, walls and overlappings and depreciation of construction.
- For achievement of the purpose put during research by a group of authors the following problems are solved:
  - The technology of preparation and stacking monolithic porous a concrete mix in building conditions little floors housing construction is proved;
  - The technology of application of elements of a fixed timbering for erection of monolithic designs from porous concrete mixes is developed;
  - Theoretical researches of technical and economic ef-

efficiency of application porous concrete in designs of walls and overlappings are lead;

- Introduction and check of efficiency of technological decisions in conditions of building sites are carried out at erection little floors town-planning complexes.

As object of research act little floors town-planning complexes at all stages of a work cycle of their erection. Object of research is the technology little floors housing construction with use new energy protect building systems - designs from porous concrete prepared in conditions of a building site.

Technique of researches: the system analysis and synthesis; mathematical statistics and the theory of probability; kvalimetry; theoretical and experimental researches in laboratory conditions of processes porous creating and aerations of concrete mixes; a theoretical and experimental substantiation of parameters of perfection of technology of reception and application porous mixes and aerated concrete.

Reliability of results of research proves to be true enough of the lead experiments, use of the checked up equipment and standard techniques, a choice of adequate models and methods, application of methods of statistical processing of the information with the help of a computer, sufficient convergence of practical and theoretical results of the research, the constructed town-planning complexes in Saint Petersburg in 2000-2006.

*2.1 Scientific novelty of research consists in the following:*

1. The technology of preparation porous mixes and aerated concrete in conditions of a building site is proved on the basis of cement, sand, sawdust, перлита, waters and foam creator with average density 1150 - 1250 kg / m<sup>3</sup> and durability at compression 5 - 8,5 MPa.

2. The technology of application porous monolithic concrete as constructive – warm keeping a material for multilayered designs of external walls and in designs of overlappings in little floors housing construction is developed.

3. The technology of application of elements of a fixed timbering is offered on the basis of the unified obverse and ordinary products from effective concrete by thickness of 40 mm and width of the various length 300 mm, allowing to lower transport and an overhead charge at construction.

4. Rational scopes porous concrete in little floors housing construction are revealed in view of his bearing and protecting functions, durability and warm protecting properties.

5. Technical and economic efficiency of application of designs from porous mixes and the aerated concrete, consisting in depreciation of building materials and budget cost of construction, and also in increase of heat-shielding properties of external protecting designs is proved. The practical importance of work consists in use of sub-

stantive provisions in practice in the construction organizations and in educational process of higher educational institutions of Saint Petersburg. Results of research are finished with an opportunity of their practical realization. On the basis of results of research the production schedules on erection малоэтажных at home from collect-monolithic designs with a fixed timbering are developed. Substantive provisions have been discussed and submitted at scientific and technical conference « Technology and economy of construction. Problems and ways of their decision » in the Siberian state academy of means of communication of Ministry of Railways of the Russian Federation (Novosibirsk, 1997г.), at 54-th Scientific and technical conference young scientific (post-graduate students, candidates for doctorate) and students « Actual problems of modern construction » at St.-Petersburg state architectural-building university Minobrazovanija of the Russian Federation (Saint Petersburg, 2000г.), at the international scientific-practical conference « Town-planning problems at the present stage » at Military nonproduction university MO of the Russian Federation (Saint Petersburg, 2006).

For an estimation of efficiency as basic two variants of traditional technology of erection of external brick walls for little floors apartment houses (tab. 1.) are accepted.

Table 1: Manufactures of works for the device of external walls of apartment houses

System of Technical and economic parameters	Variants		
	№ 1 continuous brick wall	№ 2 layered brick wall with gas concrete blocks	№ 3 brick wall with aerated concrete
Thickness of a wall, sm	77	58	81
Durability, MPa	10	2	5
Heat conductivity, W/m°K	0,26	0,10	0,25
Volumetric density, kg / m <sup>3</sup>	1100	400	1150
Cost of 1 m <sup>3</sup> , rub	1500	820	350
Frost resistance, cycles	25	25	25

USE charges, rub	Are accepted identical		
The sizes, mm	250x120x65	600x300x250	Monolithic variant
Fire resistance	Group of nonflammable building materials in accordance with GOST 30244		
Cost of 1 m <sup>2</sup> , rub	1171	622	562
Use of waste products of manufacture	No	No	Is

Variant №1 - a continuous brick wall from the effective hollow ceramic brick made according to GOST 530-95 NPO "Ceramics" of Saint Petersburg.

Variant №2 - a layered brick wall with gascocrete the blocks made 211 KGBI in items. Sertlovo of Saint Petersburg and a brick by a variant №1.

Thus, it is logical to draw the following conclusions.

1. The technology of application energy care building systems in little floors town-planning systems with use of designs from porous sawdust-and perli concrete is developed. The technique of a technical and economic estimation of efficiency of the offered technology at all stages of a production cycle is proved: factory manufacturing, transportation, performance of civil and erection works, operation of the erected designs.

2. The analysis of variants of use of designs from aerated concrete has shown their high technical and economic efficiency in comparison with comparable modern analogues. In comparison with technology of a continuous brick wall from porous a ceramic brick in density of 1100 kg / m<sup>3</sup> heat conductivity 0,26 Вт/м 0К manufactures НПО "Ceramics" (of Saint Petersburg) the effect makes 609 roubles on 1 m<sup>2</sup> of a surface of an external wall. Expenses for a bricklaying make 1171 roubles / m<sup>2</sup>, and on a concrete laying - 562 roubles / m<sup>2</sup>, i.e. in 2,1 times it is less. In comparison with technology of a bricklaying with use газобетонных blocks in density of 400 kg / m<sup>3</sup> heat conductivity 0,10 Вт/м 0К manufactures 211 KGBI (item. Sertlovo) the effect makes 60 roubles / m<sup>2</sup>. Expenses on газобетонную a laying are made with 622 roubles / m<sup>2</sup>, that in 1,11 times is higher than the developed monolithic technology.

3. Research has shown high efficiency and perspectivity of expanded use of the offered technology porous concrete for the construction organizations in Saint Petersburg at erection little floors apartment houses. Rather - economic efficiency of technology at use of one mixing installation at service by one working reaches 1,734 million roubles a year, and two installations with two working - 4,624 million roubles a year.

4. Introduction of the developed technology porous

concrete and check of efficiency of technological decisions in conditions of building sites of Saint Petersburg is executed at erection little floors apartment houses. The technology is used by Open Company « the Master Build the Company » at construction of two and three-tier apartment houses in. Pushkin and. Pavlovsk in 1999 - 2006. Experience of use of technology has shown sufficient convergence of theoretical settlement parameters of efficiency with practical estimations on the facts of construction and operation. Thus the technology of works with porous concrete differs the economic charge of accessible building materials and simplicity of performance. The technology allows a message of work at negative temperature (up to -15 0C) with use against frost additives and a covering бетонизируемых surfaces warm keeping mathes.

5. The technology of use porous the concrete, based on preparation of a mix in specially developed optimum concrete mixes is offered to installation and stacking of a mix between an internal and external layer of a multilayered bricklaying in external walls of apartment houses. Offered technological and constructive decisions allow to use optimum constructional (bearing) and heat-shielding (protecting) properties porous concrete on the average a layer of a wall, to reduce quantity of seams and joints and to organize technological process on a building site. It provides achievement of an object in view, depreciation of construction and increase of heat-shielding properties of external protecting designs.

6. Research of adaptability to manufacture of application of designs from porous concrete with the help of methods expert estimating has shown a high level of adaptability to manufacture of the developed decisions in view of factory, transport, assembly, operational adaptability to manufacture and adaptability to manufacture of modernization and reconstruction. Thus the integrated criterion of adaptability to manufacture is equal 0,665, that promotes increase of general efficiency of process of erection little floors town-planning complexes.

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A panorama of houses from the party



Figure 1 6-room .Complex of 2 floor buildings Domestic facades;

Figure 1 : A town-planning complex of a housing estate two-storied houses with the penthouses erected in SPb in 2006. Pushkin, Pavlovsk highway, д. 61, 63, 65.



a) A domestic facade



б) A multilayered external wall with an internal layer from porous monolithic concrete

Figure 2 : Little floors a town-planning complex of 3 floor apartment houses with penthouses in Saint Petersburg. Pavlovsk, street. Vasenco, h. 5. Year of construction - 2006.



a) Absence of operational remarks for 2 years



б) porous monolithic concrete in external walls and overlappings in a mansard floor

Figure 2 : little floors a town-planning complex from 3 floor apartment houses with penthouses in Saint Petersburg. Павловске, street. Vasenco, h.5. Year of construction – 2006:

### 3. CONCLUSIONS

- The technology of use porous the concrete, based on preparation of a mix in specially developed optimum concrete mixes is offered to installation and stacking of a mix between an internal and external layer of a multilayered bricklaying in external walls of apartment houses. Offered technological and constructive decisions allow to use optimum constructional and heat-shielding properties porous concrete on the average a layer of a wall, to reduce quantity of seams and joints and to organize technological process on a building site. It provides achievement of an object in view, depreciation of construction and increase of heat-shielding properties of external protecting designs.
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