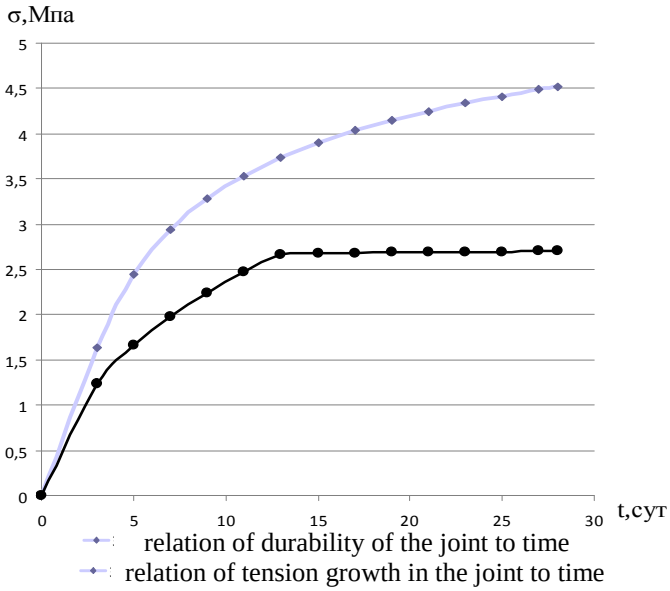

Fig. 2. Data comparison

The data received guarantee the durability of the contact joint because of the stress by in-situ concrete curing. The durability of the joint is almost 27 per cent higher than working shearing stress. So we are sure that shrinkage strain of in-situ concrete influences a pre-cast beam as well as the whole construction. The rate of influence of shrinkage strain on the deflected mode of a construction during its operation requires additional studies.

REFERENCES

1. Чикалина, О.П. Усиление железобетонных конструкций намоноличиванием с применением модифицированных бетонов : дисс. … магистра техн. наук / О.П. Чикалина. – 2003.
2. Голышев, А.Б. Расчёт сборно-монолитных конструкций с учётом фактора времени / А.Б. Голышев, В.П. Полищук, Ю.А. Колпаков. – 1969.
3. Современные строительные технологии [Электронный ресурс]. – Режим доступа: http://parthenon-house.ru/content/articles/index.php?article=7649. – Дата доступа: 14.02.2014.
4. Тур, В.В. Прочность и деформации бетона в расчетах конструкций / В.В. Тур, Н.А. Рак. – 2003.

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TECHNOLOGICAL AND METHODOLOGICAL WORKING-OUTS IN THE SCOPE OF GRADUAL REDUCTION IN POWER CONSUMPTION BY HEATING AND VENTILATION SYSTEMS OF BUILDINGS DURING THEIR MODERNIZATION

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The working-out refers to the technique of heating and ventilation and is proposed for use in the town-planning industry for energy- and resource- saving in heating and air supply to buildings with modern warm attics and ventilated transparent facade systems.

According to current regulations, the ventilation of residential buildings is carried out by means of infiltration through unorganized arrival of outside fresh air into the living space through leaks in the exterior walling, vent or any other ventilation devices. In this case, all the power inputs to heat outdoor air are compensated by the heating systems, which exceed the heat loss through the exterior envelope of buildings. The removal of the ventilation air flow from areas of maximum allocation hazards (kitchens, bathrooms and toilets) is organized through exhaust openings in the volume of warm attics, with the subsequent release of warm air into the atmosphere through the sectional exhaust shafts. This technological scheme of heat and air supply to buildings is too power-consuming, as it does not use the secondary and natural energy sources.

The reduction in power consumption from external sources of heating and ventilation of buildings requires a gradual modernization of technological schemes and design, the creation of new technological solutions, the development of theoretical fundamentals of heat and mass transfer processes and analytical methods of calculation and design of systems of heat and air supply airtight buildings in terms of energy efficiency.

According to the results of research the technological scheme of using warm attics not as three-dimensional sectional exhaust chambers, but as the supply volume chambers with preheating outdoor air due to transmission of heat lost by the building through the floor of the upper floor and the natural heat of solar radiation through the warm floor of the attic with subsequent heat removed exhaust air through the plate heat exchanger installed in the volume of warm attic, for preheating outdoor air supply ventilation air has been developed. (Patent № 9618 «Technological attic of the building» 22.07.2013.)

Hinged transparent facade systems turn out to be very efficient by virtue of architectural and aesthetic parameters, the protection of facades of buildings from atmospheric influences, durability, economy, simplicity of design and a number of other positive qualities of slot ventilated air layer, in which under the influence of the greenhouse effect natural heat of solar radiation is accumulated on the outer side and on the inner side the transmission heat lost through the outer fence is closed by a hinged facade, reinforcing the effect of preheating of outdoor ventilation air supply. (Patent № 8381 «Regenerative device ventilation building» 04.03.2012 г.).

According to Figure 1, it is seen that with a gradual modernization of the building by introducing the technological scheme of warm attics, suspended translucent facades and data sharing activities, the load on the heating system is significantly reduced, and therefore, these activities are energy efficient.

Based on the analysis and generalization of the known technical solutions a complex of measures on further improvement of heating and ventilation systems on the criterion of minimizing energy consumption from external sources due to a more extensive use of internal reserve of potential secondary energy resources and natural heat of solar radiation has been developed. The methodological basis for the analytical calculation and design of systems of heat and air supply to energy efficiency buildings has been formed, confirming the significant reduction of their energy consumption from external sources.

The results of the research are used for educational purposes during lectures and practical sessions, carrying out research on the state budget subject and can be widely used in the practice of urban planning.

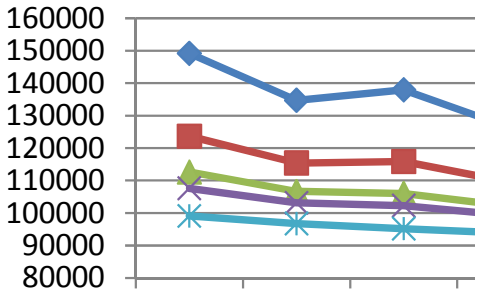

Fig. 1. Diagram showing changes in the thermal load on the heating system with a phased modernization of the building with the introduction of the technological scheme of warm attics and wall facades

REFERENCES

1. Lipko, V. Ventilation sealed buildings : in 2 volumes / V. Lipko. – Vol. 1. – Novopolotsk : PSU, 2000. – 300 p.
2. Lipko, V. Ventilation sealed buildings. in 2 volumes / V. Lipko. – Vol. 2. – Novopolotsk : PSU, 2000. – 246 p.
3. Lipko, V. Energy-efficient and resource-efficient district heating and gas supply civil buildings : in 2 volumes / V. Lipko. – Vol. 1. – Novopolotsk : PSU, 2004. – 212 p.
4. Lipko, V. Energy-efficient and resource-efficient district heating and gas supply civil buildings : in 2 volumes / V. Lipko. – Vol. 2. – Novopolotsk : PSU, 2004. – 392 p.
5. Fresh air ventilation device : Pat. the Republic of Belarus, 4410A IPC (2001) F24F13/08/ V. Lipko, V. Borvanov; the claimant Polotsk State University. – №a19981165; statement. 23.12.1998; published. 30.03.2002/Officia/newsletter/Nat. Eleven.
6. Positioning the air device : Pat. 4693A. the Republic of Belarus, IPC (2002) F24F13/08/ V.I. Lipko; the claimant Polotsk State University. – №a19990196; statement. 26.02.1999; published. 30.03.2003 / Officia/newsletter/Nat. Eleven. – 2002.
7. Recuperative exhaust ventilation element: Pat. 4651A Republic of Belarus public, IPC (1998) F24F13/08/ V. Lipko, V. Borvanov; the claimant Polotsk State University. – № a19980753 statement. 12.08.1998; published. 30.09.2002/Officia /newsletter/Nat. Eleven. – 2002.
8. Ventilation device : Pat. the Republic of Belarus, the IASC 892 (2002) F24F13/08 / V. Lipko, A. Bendo; the claimant Polotsk State University. – № i20020288; statement. 15.10.2002; publish. 30.06.2003/Officia /newsletter/Nat. Eleven. – 2002.
9. Heating and ventilation system of the building : Pat. 1134 the Republic of Belarus, the IASC (2003) F24F7/00 / V. Lipko, V. Borvanov; the claimant Polotsk State University. – №i20030177; statement. 21.04.2003; published. 01.08.2003/Officia /newsletter/Nat. Eleven intelektual. ulasnasvd. – 2003.

10. Supply air ventilation window block : Pat. the Republic of Belarus, CIV 947 (2002) E06B7/02,7/10/ V.I. Lipko; the claimant Polotsk State University. – № i20020379; statement. 04.12.2002; published. 30.09.2003/Officia/newsletter/Nat. Eleven. – 2003.
11. Regenerative device and exhaust ventilation: application № i20120004 Republic of Belarus, IPC (2006.01) P24O7/0000 / V. Lipko, S. Lipko; the claimant Polotsk State University. – № i20120004; statement. 02/01/2012; the decision to grant a patent for utility model 20.03.2012/Officia/newsletter/Nat. Eleven. – 2012.
12. Technological attic of the building: application № i20120004 Republic of Belarus, IPC (2006.01) E04H1/02 / V. Lipko, E. Dobrosolceva, S. Lipko, S. Lankovich; the claimant Polotsk State University. – № i20120004; statement. 02/01/2012; the decision to grant a patent for utility model 22.07.2013/Officia/newsletter/Nat. Eleven. – 2013.

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COMBINED AIR AND HEATING SUPPLY SYSTEMS OF AIRPROOF BUILDINGS

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Nowadays the exterior envelope of buildings demands the constant increase in its heat-shielding characteristics. The buildings are designed according to the normative base of the Republic of Belarus. But on the stage of calculating the temperature balance there often occurs the following situation: the heat loss is much less than the heat gains. In this case the entire heating load is directed to the heating of infiltrating air. This air has to be taken inside disorderly but that is not possible because of the high airtight packing of the building envelope. This report represents the technological schemes and practical solutions to the effective energy and heat air supply to the leak tight buildings.

The embedded panel systems are widely used in the buildings with the high standard comfort. The heating elements of the embedded panel systems are normally the coil pipes made of stainless steel.

Water is basically used as a heat carrier in the house construction. Steam is rally used at industrial enterprises and domestic household. This report considers the possibility of overheated air use. The latter can be used as a heat carrier which can be low n through the evacuated canals of concrete panels. This will solve two problems at the same time: heating and air supply.

Heat supply and ventilation systems are the most power- and resource-consuming. Modern engineering equipment must provide the reliability and comfort of handling together with its low value, steel intensity, labor intensity during its installation and the high-tech industrial development of the building construction.

Heat energy, gas and electric power are the most widespread types of power consumption in urban planning branch of economics.

Gas is still most widely used for cooking and water heating but in the near future it will be replaced by electric power because of the hygienic, economic and strategic reasons.

City and industrial heat power plants, big district boiler houses are the source of heating in residential and public places. Individual local boiler houses will be used more seldom because of the air contamination.

The production efficiency of the heat energy is 2,5 times higher than that of the electric power at the ordinary heat power plant. Still the use of the electric power can be economically practical because of the considerable transit waste of heat energy of the branchy centralized systems in big cities or far-away districts.

According to sanitary and ecological standards the biggest heat supply sources are located outside cities. That increases the cost of the construction and operation of heat supply systems.

Heat supply troughs are constructed for heating, ventilating and hot water supply systems. Their structure of the feed through is complex and demands considerable space (from 15 to 100 square meters) depending on the equipment, type and parameters of the carrier. The presence of boosting recycling pump demands the increase of space up to 25 square meters.

Heating systems are related to ventilating systems concerning their final goal-the creation of human comfort in the buildings. That is why the foreign experience of the use of air conditioning systems shows its high operational characteristics.

To compare the achieved level and perspectives of heating-ventilating systems development one must take into consideration the climatic conditions. The climate of the Republic of Belarus is colder than that of many foreign countries. The open air average temperature of the coldest month in Minsk is -6,9 °C, in Vitebsk -7,9 °C, in Berlin -0,3 °C, New York +0,8 °C, in Paris +2,3 °C, in London +4 °C. Because of these differences man) heating-ventilating devices can't be applied in our country.

The research in the sphere of updating the heating-ventilating systems has been constantly carried out for over 25 years by the Chair of Heat/Gas Supply and Ventilation at Polotsk State University. It has been either state financed or self-supported. The huge amount of work has been fulfilled within the sphere of its implemen-