State-of-the-art requirements to the glazing in Russia

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Abstract

This article is devoted to the normative documents regulating requirements to the glazing in Russia: State and regional building codes; directions of fire prevention, police, Ministry of Health; national and industrial standards. Also we examine connection of these requirements with requirements of consumers and architects.

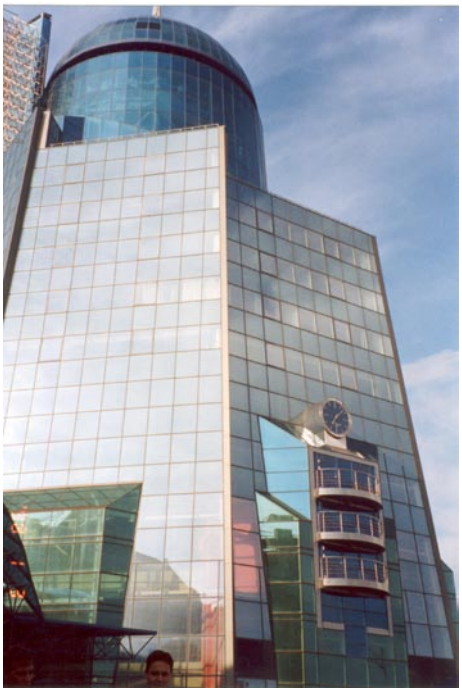
Because of absence of a single document defining requirements to glazing in Russia, designers are forced to follow intricate system of different level norms. They must select documents contained needed for specific project requirements. These requirements depend on purpose of the building under construction, its location and social concernment. This work is very hard because of existing, in addition to national building codes and standards, of large numbers of departmental directions and rules that also contain requirements to the glazing of buildings and installations. Moreover, there are regional norms which supplement and toughen requirements of state norms. With all this going on, departmental and regional documents usually are not published in national references or periodicals and it is very hard to know something about them.

There is another one intricacy. The requirements to the glazing frequently are not segregated or explicit and must be determined from other characteristics. For example, requirement to the daylight illumination are specified and requirements to the dimensions and transmittance of glazing must be discovered from them.

The consumers and architects in Russia have unsatisfactory knowledge about normative requirements and performance specifications of the glazing. They are often guided by only their aesthetic taste, but their requirements contradict to norms. Special skill is required to meet both sides.

Introduction

Today glazing plays a key role in building and constructions outward appearance forming. As an example of this fact we introduce new railway station in Samara on Figure 1. Glazing determines not only appearance of the building but illumination in the inner space, heat loss, necessity of conditioning, strength properties of the façade too. Therefore the requirements to the glazing became very manifold.



It is well seen from this example that architectural expressiveness of the building achieved by using different color glasses, flat and curvilinear glass surfaces, vertical, horizontal and inclined glass plates disposition. Large areas of used glass plates and slight gap between them have high profile too. Such variety of glass application generates great variety of the requirements to the glass and glazing as a whole. In this paper we tried to offer system approach to the forming of the requirements to the glazing complex which can be used during designing and construction of certain building.

Figure 1. An example of state-of-the-art building façade in Russia – new railway station in Samara

The main text

Symbolically, only for the consideration convenience, we divide all requirements to the glazing on three large groups. But this groups are tightly bound one another. The groups are:

- Consumers requirements. They are described nowhere, boundless multifarious, depended only from style and imagination of the customers.
- Architects requirements. This kind of requests is forming under customers influence and architectural fashion trends, local coloring and relief. They concern mainly color, form and sizes of the glazing.
- Normative requirements. There are no single documents in Russia where all such requests are formulated and described. They are divided to:
    - State normative requirements which are in force on all Russian territory
    - Regional normative requirements (municipal, provincial, regional, of a republic, local) which are in force on the territory of certain region.

Let's consider these requirements groups in series. Consumers requirements are the most important from the economical point of view (if you can't be able to comply with them you will not take an order for a design) and the most complicated group.

The main problem is that the customers (at least in Russia) usually formulate their demands extremely vaguely. You can hear: "I want that it'll be good-looking" or "I want that it'll be the best" etc. Therefore the first problem is to realize needs of the client and to express them in technical terms.

On the next stage it is necessary to check up compliance formulated requirements to the normative documents and to make sure that there are no any discrepancies between them. For example, clients frequently want to use heavily darkened glass in glazing (bronze glass is especially popular) but it is very difficult to agree with requirements to indoors daylight illumination in this condition if it is possible at all.

After that it is necessary to examine technical (or technological, physical, chemical) possibilities of realization of the customer formulated requirements. For example, clients often want to use too large glass plates which aren't produced. This is especially applied to insulated glass units and laminated glass dimensions because this types of the glazing can be produced only substantially smaller size than flat glass maximum size.

Thereafter it is necessary to remove any discovered incompatibilities or to fix the customer's liability for possible breaches. In the over case the manufacturer of the glazing will be responsible for all such problems including remake new glazing at his expense. Consumers frequently have their will and take no notice to producer's warnings and it is very important to fix it black and white in order to make consumer amenable to controlling units.

In conclusion it is necessary to fix formulated requirements of the client clearly and in all details in the glazing supply agreement. This step helps to avoid disagreement or dispute between customer, producer and supervisory institutions. Unfortunately, in Russia detailed and clear drawing up an agreement on glazing manufacture isn't become customary yet. Technical requirements section is prepared the most badly as usual. Frequently this section consists of only one sentence: "The glazing must comply with requirements of norms in force in Russia". But such phrase doesn't allow resolving conflicts in the future.

The next requirements group is architects requirements. Due to the fact that majority of the architects in our country are rather artists then engineers, approach to their requests must be the same as for the customers needs.

At the same time it is necessary to draw special attention to glass colors because they are frequently the main requirements of the architects. It is important to take into account that the color may be different from the different side of glass, in reflecting or transmitting, under different illumination. Therefore it is the most important to make agree about sample or reference glass plate, review conditions etc. It is better to make agreement about chromaticity coordinates of glass and allowable variations from the chromaticity coordinates or sample since glasses from different production runs can differ from other in color.

One another problem connected to glass is that the tinted glass absorbs more of solar energy than clear glass and so such glass heats up heavily. This can be cause of uneven heating of the glass (if one part of the glass is into the shadow, other is right in the sun or one part is cooled by the wind but other part is insulated etc) and

initiation of high tensions in it. In its turn it can cause glass fracture. If light absorption factor of the glass exceed 25 %, glass must be tempered but it adversely affect on its price. It is necessary to examine the need in tempering and notify architects and customers in advance so as not to dispute because of the prices.

As a result of architects needs to use large dimensions or curvilinear elements of construction, we must also examine the realizability of such shapes and sizes of glass sheets and strength of resulting construction. For example, to make bended glass with small bending radius is very hard and expensive. Large sizes of the glass require using of thick glasses and increase the glazing weight and strains in attaching points. Together all this factors can hopingly increase the price of the glazing but it can not suit customers frequently.

Next large requirements group that must be taken into account during designing and manufacturing of the glazing is State normative requirements. Supervising institutions make their examinations and acceptance of constructional works according to these norms. Experts rely on them during analysis of conflicting situation. Large quantity of the various normative documents is to the point. During designing and manufacturing of the glazing producer can the most frequent turn to next documents groups:

- Building codes (they are called SNiPs)
- Safety requirements (from Ministry of Internal Affairs, Ministry of Emergency Situations)
- Fire-prevention regulations (Ministry of Emergency Situations)
- Sanitary regulations (Ministry of Health)
- State standards
- Certification requirements (obligatory, voluntary)

Building codes are the main documents to the builders, designers and manufacturers of building materials and assemblies. We list here the most important from our point of view during design work and glazing production from Russian codes (but one should not ignore others):

SNiP II-3-79 contains requirements to tolerable heat loss from the building. Today it is very important parameter both from formal point of view (all controlling units test them) and in essence since costs of the heating and possibilities of comfortable sojourn during most part of the year depend from fulfillment of these requirements.

SNiP 23-05-95 contains requirements to daylight indoor illumination. Unfortunately these requirements are often ignored. It adversely affects health, including eyesight, of the people and consumption of electric power for candlelight. Indeed recently Ministry of Health bodies and trade unions started press for fulfillment of these requirements and impose a fines if they aren't fulfilled in fabrication facilities.

SNiP 2.01.07-85 contains loads affecting on glazing that must be taken into account during projection. All requirements of this SNiP must be fulfilled necessarily. Otherwise designers of the glazing will be acknowledged guilty for the any case of glazing break-up even accidental.

SNiP 23-01-99 contains climatic factors act on the glazing in a given location. Anyone must bear in mind that specific loads on glazing originate from temperature changing. These loads leads to deformation of the glazing and breakage in extreme case. Therefore glazing must be calculated to stand these loads without damage with extremely (minimum and maximum) temperatures and pressure. Otherwise designers of the glazing as in previous case will be acknowledged guilty for the any case of glazing break-up even accidental.

SNiP 2.04.05-91 contains requirements to heating, ventilation and conditioning which bounded very tight with glazing structure. The more powered these system are the less requirements to the glazing are. With weak systems it is necessary to use reflective glasses for the protection of indoor from overheat and low-emission glass for the heat loss reduction.

SNiP 21-01-97 contains fire safety requirements depending on purpose of facility. These requirements must be fulfilled and it can require using of fire-proof or fire-resistant glass.

SN 482-75 is designing, mounting and maintenance of IGU rules. It is very old document but it is still in force and its implementation can insure against many mistakes.

After last acts of terrorism more attention is drown to safety requirements for the glazing because glass debris can be very dangerous and they injures more people than other factors of the blast. Russian Ministry of Internal Affairs and Ministry of Emergency Situations issue a whole series of the documents contained safety

requirements. These narrow departmental papers are very difficult to learn (they are not published in press) but it can be necessary to realize them.

In addition to SNiP 21-01-97 fire-prevention rules can be found in some departmental normative documents of Ministry of Emergency Situations. These documents aren't easy to access and frequently conflict with SNiP but when fire controllers make approval of a building or construction they are guided by these documents.

A lot of requirements to the apartments and correspondingly to the glazing are contained in sanitary rules of Ministry of Health. They include sound insulation, isolation, illumination and aeration requirements.

State standards contain not only requirements for the production but reference values of its properties, transport, storage and maintenance rules. And all of these requirements must be fulfilled in any glazing project. Standards listed below are used often more than usual:

- GOST 111-90 "Polished glass. Specifications"
- GOST 30733-2000 "Hard coat low emissivity glass. Specifications"
- GOST 30698-2000 "Tempered glass for building. Specifications"
- GOST 30826-2001 "Laminated sheet building glass. Specifications"
- GOST 24866-99 "Sealed insulating glass units. Specifications"

Regional norms repeat State norms in many respects but they have usually higher requirements to some parameters. For example it can be heat transfer resistance of the glazing. They are less available for the projectors, designers and constructors, especially from over regions and they may become known to them only during approval of an object by local controlling units. Such norms also change more often and without information in press.

During glazing project realization it is necessary to take into consideration requirements of certification (all certification in Russia divided to obligatory and voluntary) as a work stage that requires time and funds. It is necessary to remember that in addition to the State list of production subjected to obligatory certification, there are regional lists (for example, in Moscow all building materials subjected to obligatory certification) and departmental lists (for example, Ministry of Internal Affairs or Central Bank of Russia). Moreover, any customer may demands certificates and refuses using products without certification.

Conclusions

In conclusion we want to mark our woks that we undertake to ranking requirements for glazing and glazing improving, decrease of probability of the conflicts between consumers, manufacturers and controlling units:

1. We plan to develop and approve new SNiP "Building and constructions glazing. Designing norms". This SNiP will contains general rules of using of the glazing products modern types (energy-efficient; sound insulation; safety; action-proof – bulletproof, blast-resistant, fire-resistant, impact-resistant, static and dynamic loads resistant) in buildings and constructions. Here we try to summarize experience of high-performance and multifunction glazing designing available in Russia.

2. We work under modifications and add-ins to SNiPs into force which considering requirements and recommendations for using in Russia modern types of glass and glass products (tempered, laminated, coated glass, IGUs) in buildings of different purpose, disposition and construction.

3. It is in plan to develop territorial norms and rules for application of state-of-the-art glass types and products from them in different regions with taking into account all environmental and climatic conditions, requirements to the energy conservation, sound insulation and safety.

References

[1] GOST 24866-99 "Sealed insulating glass units. Specifications"
[2] GOST 30698-2000 "Tempered glass for building. Specifications"
[3] GOST 30733-2000 "Hard coat low emissivity glass. Specifications"
[4] GOST 111-90 "Polished glass. Specifications"
[5] GOST 30826-2001 "Laminated sheet building glass. Specifications"