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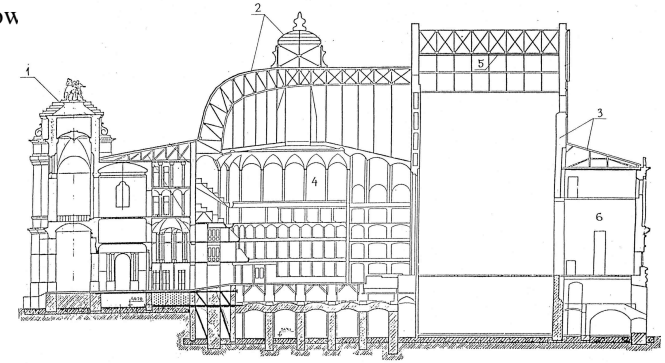
THEATRE BUILDING ENGINEERING ARCHITECHTONICS

Lisenko V.A., Zakorchemniy U. O., Voznuk I. O., Dorofyeyeva Z. H.
(Odessa State Academy of Building Engineering and Architecture, Odessa)

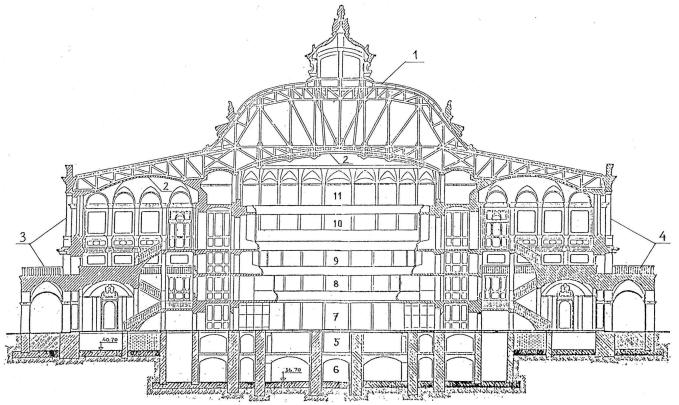
On an example of Odessa Opera and Ballet Theatre principles of engineering decision of theatre buildings of the 2nd part of XIX century is described. The history of theatre reconstruction is represented. Basic methods of reconstruction and restoration are formulated.

Architecture of the theatre

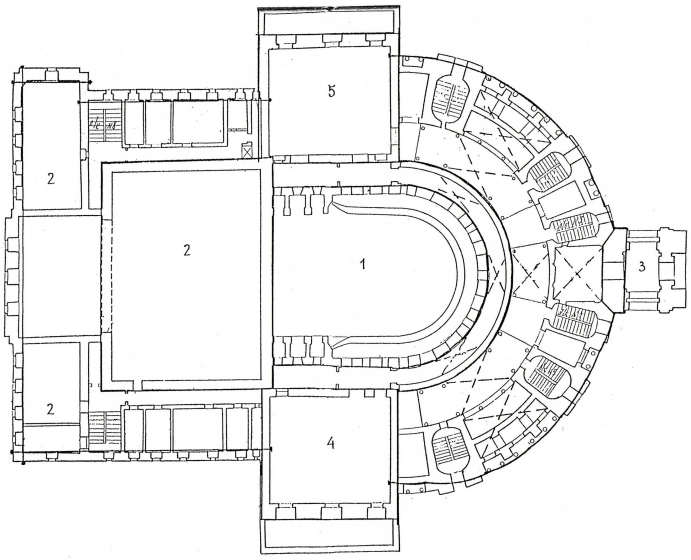
Odessa opera theatre is well-known as the first of all for its architecture on the lay-out and under specifications does not concede to the best in Europe. In plan it consists of horseshoe-shaped auditorium with galleries covering it, foyer and a rectangular scenic part with back offices. On a longitudinal axis of a building — two-story with high attic front entrance portal (pic.1a), on transverse axis — arcade galleries of lateral inputs (pic.1b). The planning is radial — from the centre on radiuses in different directions evacuation passes to exits are laid. The ladders leading directly to a theatre exit (pic.2) also have circles. The building is covered by a system of metal farms with a covering of zinc plates. The auditorium covering reminds a part of ellipsoid surface, cut by planes on horizontal and vertical axes of symmetry; it is topped by a round lantern with a dome, completed with a low



1. Portico of the main entrance with Melpomena. 2. Dome with a tower. 3. Scenic part. 4. Spectator part. 5. Ferro-concrete covering. 6. Back scenes.
Picture 1a. Longitudinal section.



1. Hemisphere dome with a tower. 2.Covering farms. 3. Western portico with main ladder. 4. Eastern portico with main ladder. 5. Upper cellar. 6. Lower cellar. 7. Parterre. 8. Dress circle. 9. First circle. 10. Second circle. 11. Third circle (gallery).
Picture 1b. Transversal section.



1. Spectator part. 2. Scenic part. 3. Portico of a main entrance. 4. Western portico. 5. Eastern portico.
Picture 2. Plan of the theatre on dress circle level.

The theatre building is designed in style of Viennese "baroque" which was the core in the European art from the end XVI and to the middle of XVIII century. The building structure is difficult and at the same time extremely simple: horseshoe-shaped a forward part with three adjoining porticoes "planted" at different height, over them a dome – as a crown.

Internal appearance of the theatre is impressive. The ground floor and parterre and lower boxes, foyer in the form of a wide corridor going by a semicircle, wardrobe, corridors before the lower boxes, the gorgeous ornamentation of ladders… But the most beautiful part of a building is an auditorium. The architecture of the auditorium, calculated for 1664 places, is severed in style of late French "rococo". Special interest causes a ceiling. Four pictures of artist Leflera are put in a basis of its composition in the form of medallions. Floors made of marble crumb with special drawing for each floor. The electricity has been applied to building illumination for the first time in Odessa. Unique acoustics of a horseshoe-shaped auditorium allows to bring even whisper from a scene to any corner of it.

Engineering design

Height of a building of theatre is 30m, of a scenic part – 40m, length - 78m, width-85m. The building volume makes more than 90 thousand m^3, of them auditorium - 25 thousand m^3. The area of a scene is 500 m^2, back scene — 200 m^2, width of a portal is 15m, height — 12 m. In the high-rise relation the central part has seven circles: the bottom cellar, the top cellar, an orchestra, boxes of dress circle, a box of 1 and 2 circles, 3 circle-gallery. Cellars are available only under a spectator hall, a scenic box and an administrative part.

The base under all walls - strip footing, and under columns - separately standing pillar put on various depth. Walls of cellars of the most loaded parts of a building (the scenic box, outer walls of a spectator part) are made of a red brick, the others - from stones of limestone of the correct form, alternating through 6 ranges with 2 ranges of a bricklaying.

The theatre building design documentation is lost.

Odessa opera theatre is in danger from the beginning of its creation. In 1883 at day when foundation have been laid the there was an awful rain; it's possible to consider this event as a bad sign. More than hundred years the theatre lives with "the fatal diagnosis" – subsidence of the ground under the structure that threatens with full destruction of a building. All these years the monolith of 52 tons reveals as a rose bud, as a result theatre was divided into 30 parts. Now restorers managed to rearrange a theatre building to the new reinforced footing.

To stop the building subsidence, caused formation of cracks in bearing structures of a construction, in 1955-1956 works have been performed on strengthening of the basis of theatre by its silicatization with liquid glass (pouring of the fused glass through pits in a subfoundation — it has been poured out about 6 million liters). Soviet government has spent 4 million roubles and 9 kg of pure mosaic gold.

To the middle of 90th years of the XX-th century the building has come to a catastrophic condition, and in 1996 the decision on carrying out of capital restoration was accepted. The Cabinet Council of Ukraine recognized a theatre condition catastrophic and has allocated means for restoration. The termination of works was planned from the beginning for 1999, and then repeatedly transferred because of stress of money.

Reconstruction cost under the estimate of the Cabinet Council of Ukraine has made 197 million UAH (in the prices of 2004, including civil and erection works — 12 million UAH). Also in the estimate specifications of theatre after reconstruction are specified: quantity of places — 1636, the ground area under a building and adjoining territory — 2,96 hectares, the building area — 0,54 hectares, the general cubic capacity — 102757,7 m^3, a total area — 8123,6 m^2.

The foundation has been strengthened (by means of 1800 piles), is executed complex modernization of technical systems of theatre has been made full restoration of a facade and internal placements (on theatre decor has gone about 7,5 kg of mosaic gold)

Conclusion

As a result of deformations the building was divided into several separated parts. The decision of reinforcements in the Opera House building was designed and based on the analysis of the features of engineering design and the degree of damage. Our academy took a great part in these researches. In this direction actively worked: Dorofyeyev V. S., Lisenko V. A., Mishutin A.V., Vyrovoj V. N Zavoloka M.V., Plahotniy G. N., Novskiy A.V., Kolesnikov L.I. This is an excellent example of brilliant engineering work for saving great architecture masterpieces.

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