

## METHODOLOGY FOR LIGHT DESIGN TRAINING IN THE SPHERE OF ARCHITECTURAL ENVIRONMENT DESIGN

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### ABSTRACT

The problem of development of the new profession of light designer primarily resides in development of the training methodology, cooperation of architects, lighting engineers, psychologists, colourists, social scientists in the sphere of education and their common understanding of importance of both artistic and technical design of lighting. Since the beginning of the 2000's, the methodology for light design training has been created in Vladivostok, and the results of this work are presented in student projects and some theoretical projects, methodological and training guidelines and scientific articles. The methodology is based on contemporary examples and theory of light design in Russia and abroad; studying of media facades and light surfaces, lighting installations, light design of architectural ensembles; modelling of light panoramas of the city and areas of esplanades; training in the basics of light composition. The article describes the logic of the training process, which starts with creation of a light composition for modelling of the light panorama and lighting ensemble and forming of night time architectural and environmental spaces of the city, and methodology for light design in the sphere of architectural environment projects and education of light designers.

**Keywords:** light and colour modelling, light panorama, light ensemble, architectural and lighting environment, light composition, lighting model, education

### 1. INTRODUCTION

Not so long ago, the discussion of the problems and prospects of light design took place in the *Svetotekhnika* Journal [1–3, 5]. Nowadays, there are several large educational projects in the field of light design, architecture and art running both in state and private educational institutions. In a large university, where students, the main authors of practical projects, change artistic tastes and styles of their projects almost every year, it is possible to propose new tasks and modelling objects, to develop and test new methodological concepts. The current reality makes it necessary to train skills of quick presentation of main ideas in the form of sketches. It has been largely stimulated by introduction of design software in the training process, which increased technical level of practical projects in the field of light and colour modelling of architectural environment. Publications of many scientific articles, monographs and study guides, implementation of light-design projects by Russian and foreign authors and development of electronics allowed us to formulate new methods of luminous environment development.

### 2. LIGHT COMPOSITION IN EDUCATION

Development of new creative methods and approaches to lighting, aspiration to enlarge the range of light-composition opportunities in formation of light images of environment objects have re-

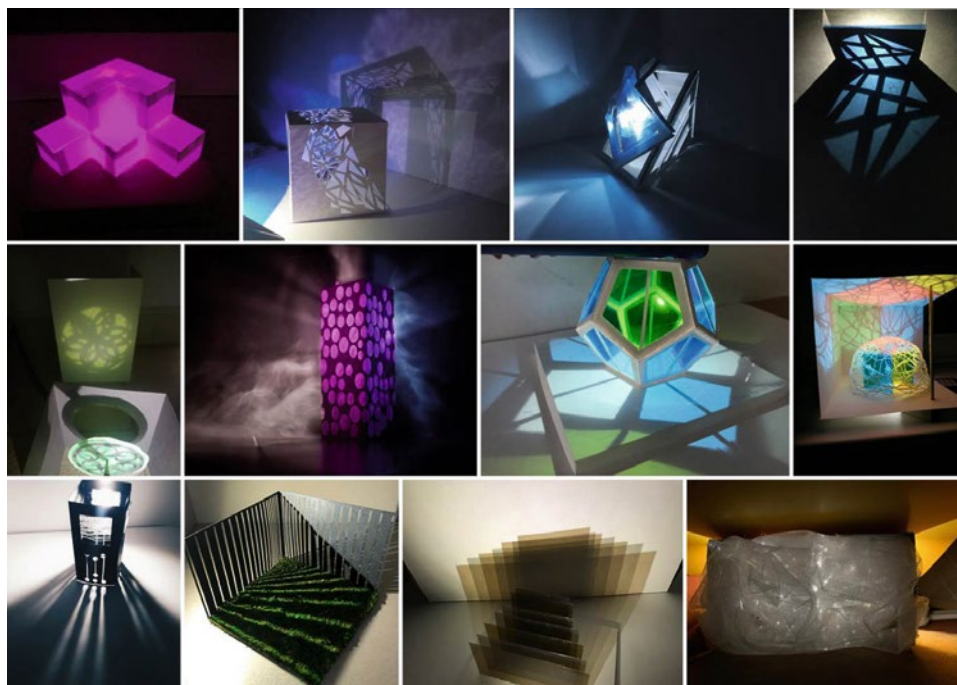


Fig. 1. Training project “Lighting Composition” (students of FEFU, 2019)

quired development of the theory of light composition based on the practice of optic art (op art). Lectures describe development of op art in Italy in the 1960’s, review the principles and works by well-known artists who worked in this field of visual art: James Turrell, Thomas Wilfred, Victor Vasarely, etc. [8–11]. According to the practice task, it is necessary to create a spatial or frontal composition using artistic methods of op art such as reflection, refraction, absorption and translucence of natural or artificial light. A composition may involve light kinetics, coloured light with inclusion of reflective, glossy or matte surfaces to reach a psychological effect of depth and other optical illusions (Fig. 1). Technically, numerous artistic methods in light composition are implemented by means of small-size LED-based light sources (LS) of different colours (in particular, LED strips), wireless control devices (dimmers) and control boards [4, 7].

### 3. LIGHT AND COLOUR MODELLING OF ARCHITECTURAL PANORAMAS OF VLADIVOSTOK IN PRACTICE PROJECTS

Particular landform of the city and many scenery spots on the hills as well as domination of the Zolotoy Rog Bay and the Amur Bay in the central part of Vladivostok allow tourists and local residents to watch its evening and night time light pan-

oramas. By means of light-composition modelling of panoramas, it is possible to change their visual forms and to fill them with new light dominants and accents. In 2008, as part of the practical tasks, the daytime panorama of Vladivostok was studied; architectural monotony of development and lack of land improvement of esplanades were noted. As a result of computer modelling, light and colour dominants were added, landscape was accentuated, facades and the space of the esplanade were illuminated, and light accents on the water were introduced (Fig. 2, *a*). Then in 2009, as part of practice tasks, initial approaches to formation of the light panorama were worked out using a questionnaire and the semantic differential method<sup>1</sup> (Fig. 2, *b*).

In 2010 and 2012, aiming at a detail study of visual perception of the shape of light panorama of Vladivostok and development of its design variant, statistic research (survey) was conducted using the semantic differential method again. Residents and architectural design students participated in the survey. Their opinions on contemporary shape and distinctions of the light panorama were studied. With consideration of the acquired data, the conclusions

<sup>1</sup> Semantic differential is the quantitative methods of studying perception of a studied object by means of a seven-mark grading system ranging from very negative (–3) to neutral (0) and positive (+3) opinion. This method was first introduced by American psychologist Charles E. Osgood in 1952.



Fig. 2. Computer modelling of the lighting panorama of the visual basin of Fyodorov bay of Amur Gulf in Vladivostok: *a* – formation of the lighting rhythm and water lighting in accordance with the concept of night panorama (O.V. Romanenko, student of FESTU, 2008); *b* – formation of light dominants (A. Yu. Balaeva, student of FESTU, 2009)

on aesthetic, artistic, psychological, architectural and town-planning aspects of perception of the daytime and evening time panoramas of Vladivostok from the opposite banks of the Zolotoy Rog Bay were made. The computer models of the light panoramas were created, new light dominants were arranged, the existing architectural verticals were accentuated by means of artificial light, and a new lighting silhouette was formed.

#### 4. ARCHITECTURAL LIGHTING OF SVETLANSKAYA AND ADMIRAL FOKIN STREETS, AND OKEANSKY AVENUE IN VLADIVOSTOK

In 2013, the training project “The Concept of the Architectural Lighting of Svetlanskaya street and Okeansky Avenue in Vladivostok” was presented. As part of this work, graphic, light and colour models with use of artistic lighting methods were created for many historical buildings with distinctive architecture located in the central part of the city. The original main idea of light design was to form a uniform evening time lighting facades of the streets. However, later, in 2014, the concept of lighting of the remaining part of Svetlanskaya st. as a notable interior space and modelling of human-scaled lighting effects appeared. In terms of visual content, the space of the street was imagined as a gallery filled with festive light of yellow street lamps. Both initial and final composition forms, light towers and avant-

corps, corresponding to architectural elements of the facades of the historical buildings were illuminated. For light design of some vertical dominants and buildings with glass facades, the media facade technology was used with application of coloured LED-based LS [4].

As part of a practice work in the field of light and colour modelling in design of urban environment, when designing art lighting of the Admiral Fokin st., its historical and pedestrian environments, remarkable plastic of buildings and perception of the light composition of facades at a level of human eyes were taken into consideration (Fig. 3). Warm white lighting which highlighted initial colours of the facades was used in design of illumination. Local and contour light draws attention to facade elements. Directed-light luminaires form the light rhythm and differently directed light beams create the effect of a three-dimensional light image. Linear LED-based lighting elements (LE) accentuate the cornices. Further studies of the architectural environment of this street involved its spatial light characteristics (V.E. Karpenko, V.I. Kryuchkova, A.E. Kurkina, O.S. Shlykova, 2017). Values of horizontal and vertical illuminance were measured, levels of semi-cylindrical illuminance, and contrast and uniformity of illuminance were calculated, the light-modelling effect was evaluated, and conclusions were made on the light-composition parameters, light saturation, comfort and safety in the evening pedestrian space of Admiral Fokin st. [4].



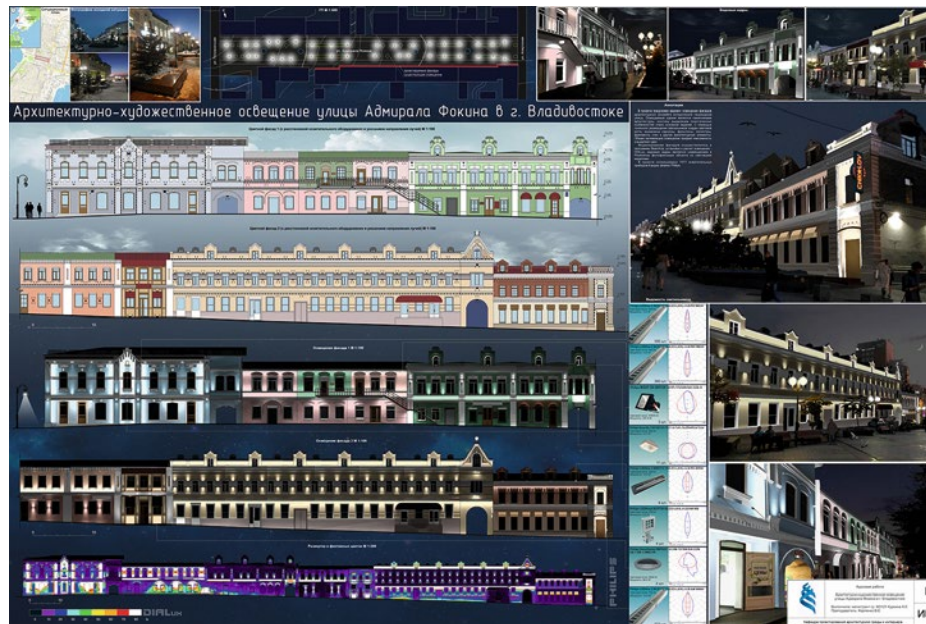


Fig. 3. Architectural lighting of Admiral Fokin st. in Vladivostok (A.E. Kurkina, Master Degree student of FEFU, 2017). (The project was presented at the Russian Light Design contest in 2017 as part of the International Exhibition *Interlight Moscow powered by light + building*, Moscow)

The following training and methodological step conditioned by the town-planning role of the panorama as an active visual background of the coastal city was to develop design of esplanade lighting.

## 5. LIGHT AND COLOUR MODELLING OF THE ESPLANADES

Some coastal parts in the centre of Vladivostok have never been recreational areas. Nowadays, production and ship-repairing facilities are being partially relocated, which leads to appearing of a uniform pedestrian environment which may become safe, comfortable and aesthetically expressive during evening and night time. The training projects of unique public and residential buildings, museum and landscape facilities were developed for the coasts of the Zolotoy Rog and Amur bays. Design of the new architectural environment in the coastal part of the city includes art lighting with use of innovative technologies and marine semantics. For instance, Elena Kiselyova developed energy saving street lamps with contemporary design which include wind generators and LED-based LS (Fig. 4, *a*). The project by Alexandra Vorontsova presents interactive systems in the form of bionic light compositions, along with original art light effects in small architectural forms of the esplanade and elements of decorative lighting (Fig. 4, *b*) [7].

Later the principles of esplanade lighting modelling were developed in some bachelors' projects in which the visual-art and town-planning role of artificial lighting was identified and the principles of design of night time environment of the esplanades were formulated (students of FEFU, 2016). The projects present different variants of such lighting effects as "flight above the ground" and "hovering above the sea" as well as decorative lighting methods such as "constellation" and "plankton fluorescence" in pedestrian pavements (by means of low-size LEDs). Smooth light graphics resembles shapes of marine animals and contour lighting reproduces symbols of digital technologies. Light is an active component of lighting objects in conjunction with translucent and reflective materials and energy-saving technologies, it accentuates structural joints and serves as a warning at the border of the open pier and water [4].

Two projects in the field of light design of pedestrian spaces on the esplanades were awarded at the Russian Light Design contest in Moscow in 2016. Konstantin Rasulov took first place for the project of architectural lighting of Sportivnaya esplanade in Vladivostok, and in 2017, Oksana Shlykova also took first place for the project of architectural lighting of the esplanade of Sportivnaya Harbour and Tsesarevitch esplanade in Vladivostok (Fig. 5). In Shlykova's project, the ideas of lighting of small architectural forms were the project mate-

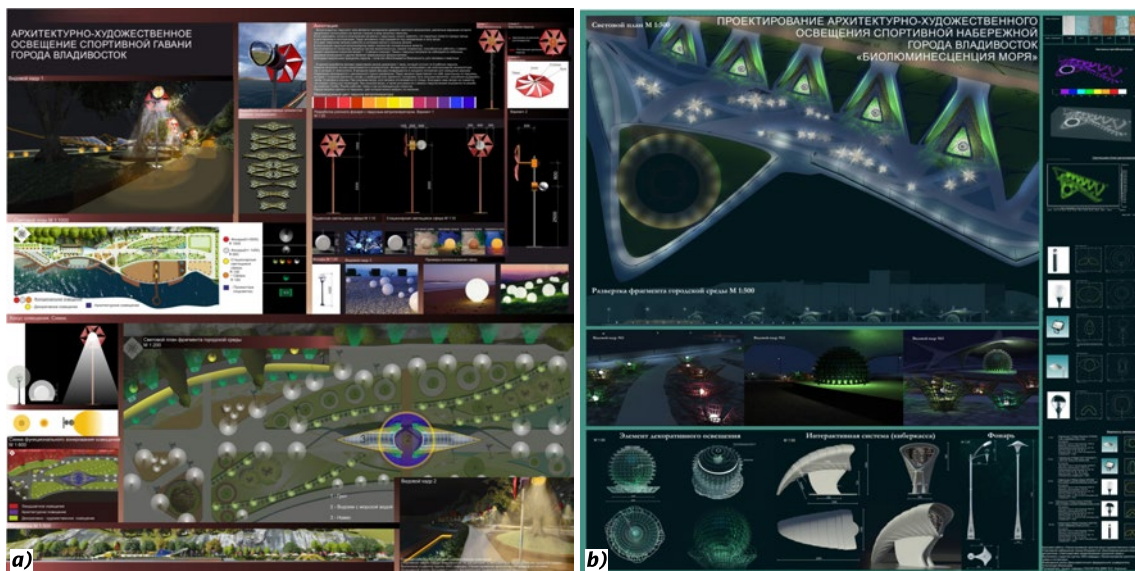


Fig. 4. Light design of esplanades in practical projects of FEFU students: *a* – architectural lighting of Sportivnaya Harbour in Vladivostok (E.S. Kiselyova, student, 2014); *b* – design of architectural lighting of Sportivnaya esplanade (“Sea Bioluminescence”) in Vladivostok (A.I. Vorontsova, student, 2014) [4, 7]

rial for her Master Thesis “Problems of Arrangement of Lighting Environment of the Marine Esplanades of Vladivostok” which was successfully defended in 2018. It describes development of comprehensive principles of lighting of the esplanade, the “curtain facades” which surround the esplanade and the surrounding landscape. To create favourable psychological atmosphere, concepts of formation of the lighting environment of Tsesarevich esplanade, Sportivnaya Harbour esplanade (Fig. 5) and the Olimpiets sports centre esplanade were proposed with consideration of the town-planning analysis, discovered flaws and distinctions of the light and colour condition of the existing areas. The light

plans of the esplanades identify the compositional axes and dominants, transport and pedestrian links between the light-planning elements of the esplanade environment. In accordance with the lighting space model and the selected concept, the problems of esplanade lighting were solved at three levels: urban planning, ensemble-wide, and object-wide.

## 6. WORKSHOPS AND LECTURES BY EXPERTS IN LIGHT DESIGN

The modern light design training approach contains the active component which includes in-situ evaluation of luminance distribution and light fields,



Fig. 5. Architectural lighting of Sportivnaya Harbour esplanade and Tsesarevicha esplanade in Vladivostok (O.S. Shlykova, Master Degree student of FEFU, 2017)



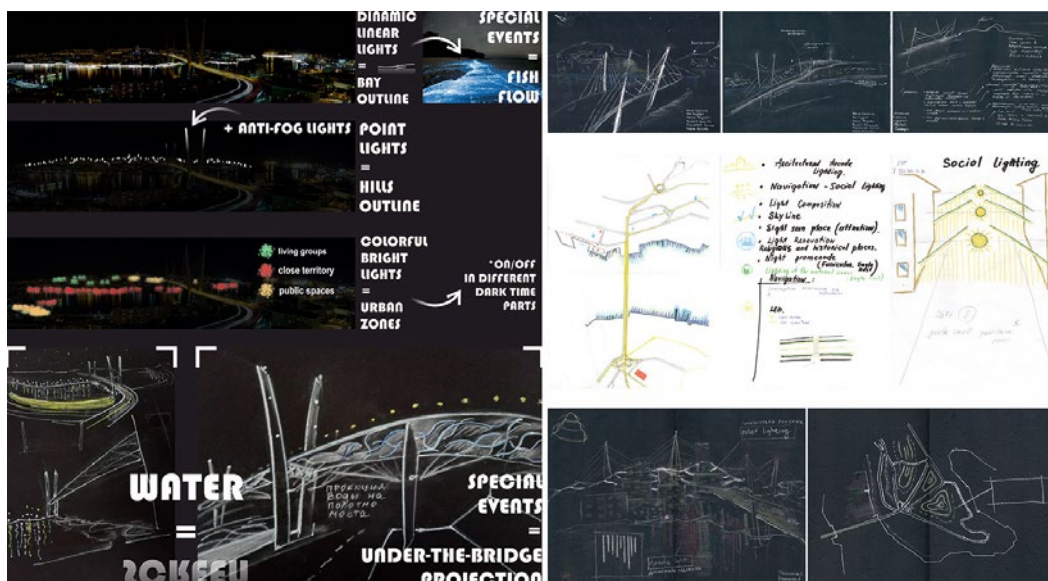


Fig. 6. Concepts of lighting of Vladivostok and the results of the Light Urbanism and Methodology for Lighting Master Plan Design workshop of Roger Narboni in FEFU (FEFU students, 2018)

measurement of light engineering parameters (illuminance and luminance) and then (based on the acquired data) creation of the concept of the city illumination. In 2015, as part of the *Visiting Professors* programme, N.I. Shchepetkov visited FEFU, and this visit included his familiarisation with the architectural and lighting environment of Vladivostok and a cycle of lectures on Urban Light Design covering history, theory, and means of contemporary light design. After the lectures, the workshop on search for the lighting images of historical buildings (through the example of the Vladivostok Central Post Office building) was conducted as well as a consultation for students on light design of objects and selection of their lighting images [4].

In 2018, also as part of the *Visiting Professors* programme, the lectures and the workshop were conducted by Roger Narboni (a globally known French light designer, teacher of professional and training courses on light design in France and other countries). Together with students, he walked around the evening city and visited the city's characteristic scenery spots in the area of the cable tramway and the Opera: on two opposite coasts of the Zolotoy Rog Bay and in the centre of Vladivostok. Dynamics of the architectural and lighting environment, the predominating spectral composition of artificial light and the light-compositional role of the architectural dominants were identified. This was a creative stimulus for consideration, preparation and development of four concepts of the master plan of Vladivostok illumination (Fig. 6) [4].

## 7. DESIGN OF VLADIVOSTOK TOURIST ROUTES ILLUMINATION

Tourists are very interested in Vladivostok in any time of a day. However, the city streets are not safe during evening and night time and lack of lighting does not allow them to see memorial boards and plates, historical architecture objects and landscape; different monuments, memorials and sculptures are almost not marked out. With that, the historical centre of Vladivostok may be illuminated during night time as a museum environment, its streets with landmarks may form a museum exhibition, artificial light of different colours may direct tourists, form the feeling and intimacy of tourist ways and environments, underline their uniqueness and historical and cultural value. To solve this set of environment problems, it was proposed to create a model of a fragment of the urban space. Five student teams created illumination by means of the model with use of small lamps or decorative light strings powered by the supply network or autonomously. Cuts were made in the models to insert small-size LED-based LE. In other cases, LED-based LE of specific chromaticity produced shadows and shone on model walls, steps, fences, etc. Then photos and videos were made (Fig. 7). In one of the works, patterns are projected on opposite walls by means of lighting devices thus creating a particular general level of light saturation, while in another one, the theme of Japanese symbols is being developed, with the fence pattern containing the motives of sakura, Fujiyama,

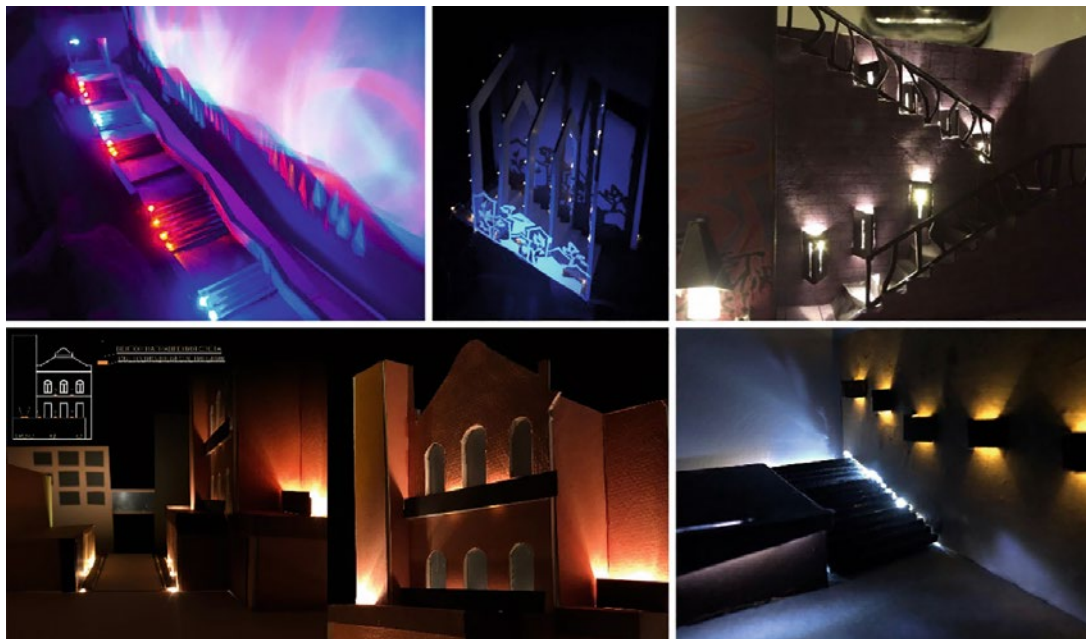


Fig. 7. Modelling of lighting of fragments of urban environment in Vladivostok (FEFU students, 2018)

shapes of roofs, red light (the pattern is projected on walls and creates coloured shadows). Modelling of new lighting in the historical environment of the city does not contrast to the surrounding illumination design; the warm shade of light on the adjacent facades is repeated in the new lighting effects. Random graffiti on the walls are accentuated by neutral white light in the evening. Light accentuate facade plastic, fragments of walls and ledges create a lighting rhythm and different optical effects of contraction or expansion of intimate spaces.

## 8. RESULTS

When forming the methodology for light design training and in the course of training, the logical connection between application of light effects in op art, contemporary visual art and training light compositions was found.

The large-scale visual shape of a light panorama allows us to form new light dominants, accents and background in its space, to accentuate the existing elements and move to detailed design of light ensembles in the urban environment. In this case, a night panorama is a drawing canvas on which a light designer draws light spots, dashes and dots.

The street space is limited by lighted facades of buildings, shop windows, advertising boards, navigation and different types of other light forms which complicate the architectural and lighting environment. Light and volumetric parameters shall be also

taken into account. In view of this, the city space and building volume may be divided into elementary illuminated town-planning and composition elements preventing lighting chaos and limiting the amount of artificial light.

In terms of light structure and perception from the water area, the esplanades are enclosed by the urban light panorama with its lighting being possibly built on the basis of light composition methods and principles, and the lighting effects may be based on visions, symbols and semantics of a coastal city and water.

Application of active types of training with visits to the territory and study of the night-time environment by using measurement devices and further discussion and development of the concepts of the city lighting as well as international workshops in Russia and abroad on sites, which lighting installations and design of urban spaces lighting by means of special equipment are created, make a specific educational and methodological contribution, which allows the importance of the practical part of the training process to identify. Such educational and methodological activity allowed us to form new ideas and approaches in modelling of artificial light using sketch models of the existing territory of the city. At the same time, it is possible to capture the moment, the atmosphere and trace translucence of beams through modelled elements of land improvement, small design and street art objects and enclosing surfaces.

## 9. DISCUSSION AND PROSPECTS OF RESEARCH

Workshops and active training methods in light design may supplement class exercises and accentuate the training process in practical terms, in the real architectural and lighting environment of the city using LS by different manufacturers.

The lighting methodology may include development of light models of urban environment fragments with inclusion of coloured areas, with change of their chromaticity and compositional methods of lighting tested in laboratory conditions under lighting by different test LS. Modelling of lighting by means of small-size LSs in models of urban environment fragments may provide considerable practical and artistic results.

Evaluation and analysis of the measured photometric parameters (illuminance and luminance) in the urban environment may demonstrate the directions towards obtainment of necessary light-modelling effects, uniformity of lighting and light saturation with achievement of visual and artistic expression, visual and psychological comfort and sufficient level of safety.

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