Advertisements and information objects’ positioning technologies based on the territorial zoning of the city of Tomsk

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Abstract. The main results obtained in the analysis of existing advertising facilities in the city of Tomsk were considered as a basis for media planning while choosing the most effective advertising medium and its location depending on the area of territorial and functional purpose of the city.

1. Introduction
Nowadays in the contexts of the dense urban construction and abundance of advertising on the streets it has become impossible to use the standard principles of media planning without violating the aesthetic component of advertising and the image of the city as a whole. It is essential to create a visually comfortable advertising look without losing the perceptual efficiency of the outdoor advertising.

The territory of any big city is divided into three main zones - historical heritage, special city significance and public city significance areas, which generally imposes certain restrictions on outdoor advertising positioning, taking into account the city’s architecture and block density. The historical heritage zone includes: architectural and cultural monuments and adjacent territories, nature reserves, parks and squares. Positioning of outdoor advertising in this area is unacceptable. The only exception is the area along the road where it’s permitted to place a man-proportionate advertising objects that do not cover the view of the building of historical and cultural heritage. The zone of the special city significance includes: central highways, squares on the main streets and avenues, squares at the railway stations, the area around the government buildings. It is prohibited to place certain types of advertising objects infringing architectural and spatial environment of the city in this area. The public significance zone includes the remaining area of the city: exit, entrance to the city, sleeping areas.

2. Positioning of the advertising constructions.
The cost of outdoor advertising and its effectiveness depends on the location area. Correspondence of the streets in Tomsk with the functional zones has enabled to identify the main categories of advertising objects positioning (Fig.1) [1].

Under Category №1 mainly fall information constructions, as well as advertising objects, not exceeding 10 square meters. Rationale: the inadmissibility to overlap the main scenery spots, historically-formed landscapes, architectural ensembles.

With Category №2 it is recommended not to use a large-scale advertising, billboards 6x3 m or more. The main advertising construction is city format with the advertising space no more than 1,2x1,8 m. It’s also possible to use city board with the space of 3,7x2,7m. Rationale: retaining of “sight corridors” of cultural heritage within the pedestrian zone [2].

Category №3. Prohibition of positioning large-format advertising constructions with the space of the advertising field over 10 sq.m. Rationale: retaining of "sight corridors" of cultural heritage, ensembles of residential compounds and neighborhoods.
Category №4. Prohibition of positioning large-format advertising structures with the space of the advertising field over 18 sq.m. Rationale: This category includes the territory of roadides, mostly passing through the dwelling zones.

Category №5. All types of advertising constructions are permitted except for banner constrictions. Rationale: This category included the territory of roadsides, passing mainly through industrial development zone.

Positioning of the advertising construction in any given area within the city depends on a man’s perception of this construction in the context of the historical environment of the city, the distance to the object and the formation of the free pedestrian traffic. Thus, a distance to the outdoor advertising objects ensuring comfortable movement for the people and their perception of the historical character of Tomsk has been determined (Fig.2).

The calculation was performed using the formula:

\[ X = B - (B1 + B2), \]

where \( X \) - permissible width of the information field; \( B \) - total width of the sidewalk; \( B1 \) – the minimum permissible width of the passage between the curb and the advertising construction, determined by existing regulatory documents; \( B2 \) - the distance from the curb to the advertising construction.
In accordance with the requirements of the Construction Standards and Regulations (SNIP) II -60-75 «Planning and development of cities, towns and rural settlements", the width of the footways of the streets and roads of different categories should not be less than that specified in Table 1.

**Table 1. Correspondence of streets and the size of the sidewalks.**

| Category                          | Streets and roads                  | Width of the sidewalk, m | Width of advertising object, m | Advertising objects |
|-----------------------------------|------------------------------------|--------------------------|-------------------------------|--------------------|
| **Main streets**                  |                                    |                          |                               |                    |
| 1,2 City streets                  |                                    | 4.5                      | 1.5                           | v                  |
| 3 Streets of district value       |                                    | 3                        | 0.8-1.4                       | v                  |
| **Streets and local roads**       |                                    |                          |                               |                    |
| 4 Residential streets             |                                    | 2.5                      | -                             | -                  |
| 5 Industrial and municipal        |                                    | 1.5                      | 4-12                          | v                  |
| roads of warehouse districts      |                                    |                          |                               | v                  |
| 5 Township streets                |                                    | 1.5                      | 6-12                          | -                  |

According to All-Union State Standard (GOST) P 52044-2003 «Outdoor advertising on highways and areas of urban and rural settlements»:

"6.1. Outdoor signs should not limit the visibility of traffic management facilities, reduce the size of engineering structures, and should not be placed:
- Alongside of the highway or the road at a distance of less than 10 m < * > from the edge of the road bed of the highway (the curb stone) outside urban areas and at a distance of less than 5 m < * > - in the settlements/population centers;
  < * > The distance to the nearest edge of the outdoor advertising.
- Alongside of the highway or the road at a distance of less than the height of the outdoor advertising, if the top spot is located at a height of over 10 meters or less than 5 m above the traffic way”.

In the above calculations we used the average value. For city-format the distance to the edge of the road is 1 m, for Pillars, city boards, bill boards the distance is 2-2.5 m.

The calculation of the perception of outdoor advertising contributed to identifying the type of advertising construction relevant to its territorial location. The apparent sizes of objects, including signs, are defined in angular values.

The distance to the object is calculated by the formula:

\[ L = \frac{H}{2\tan\alpha/2}; \]

where \(\alpha\) – sight angle; \(H\) – height of the advertising construction; \(L\) – distance to the object.

The \(L\) value must be calculated in terms of optimal (\(\alpha = 30^\circ\)), admissible (\(\alpha = 45^\circ\)) values of the visual field. The distance of the object’s perception will determine the following parameters - the height of the advertising construction and its location. Based on ergonomic data there was defined a distance of viewing the main advertising objects in Tomsk, at the angle of \(\alpha = 30^\circ\) (Table 2).
Table 2. Location of advertising objects depending on their perception.

| Advertising objects | Construction height, m (mean value) | Distance to the outdoor advertising objects, m | Functional zone                        |
|---------------------|-------------------------------------|-----------------------------------------------|----------------------------------------|
| City Format         | 2                                   | 3.5                                           | Historical heritage zone               |
| Stand/Pillar        | 3                                   | 5                                             | Zone of the special city significance   |
| City board          | 6                                   | 10                                            | Zone of the special city significance   |
| Super board         | 16                                  | 28                                            | Public significance zone                |

In the course of the study there were revealed a number of violations in placing advertising constructions in the central part of the city of Tomsk in the area of the historical heritage, which is not consistent with the norms of advertising objects positioning in the urban environment and has a detrimental effect on the perception of the historical look of the city (Fig. 3) [3, 4].

![Figure 3. Outdoor advertising objects impeding the perception of the historical part of the city](image)

3. The illumination of advertising constructions

The important factor in placing information and advertising constructions in the urban environment is to provide high quality lighting for efficient visual perception and to preserve the aesthetic look. Creating a harmonious lighting requires consideration of the psychophysiological abilities of the observer and the surrounding urban environment, architectural and functional peculiarities, including the auxiliary lighting of the architectural structures, alleys or residential districts. Taking into consideration all the parameters for creating a visually comfortable look of the modern and informative urban environment requires calculations based on capacity of human vision, reactions of the visual apparatus depending on the energy parameters and spectral quality of the light in the perception of emitting sources at night [5].

Light emission is characterized by photometric parameters: luminous flux, luminous intensity, brightness, illumination. These parameters are taken into account in calculation of parameters of the interaction of various techniques ensuring the lightening of the city objects and advertising constructions, depending on their location in different functional areas of the city. The modern light sources, commonly used in everyday life and advertisement, with their calculated photometric parameters to compare are shown in Table 3.
Table 3. Photometric parameters of the modern light sources

| Types of light sources          | Luminous flux, Lm | Luminous intensity, Cd | Illumination to the area 1m², Lx | Brightness, Cd/m |
|--------------------------------|-------------------|------------------------|----------------------------------|------------------|
| Incandescent lamp 100 W        | 1350              | 100                    | 1350                             | 2*10⁶            |
| Halogen incandescent lamp 70 W | 1170              | 90                     | 1170                             | 1*10⁶            |
| Fluorescent Lamp 200 W         | 11400             | 900                    | 11400                            | 10*10⁶           |
| Light-emitting diode 3.5 W     | 540               | 40                     | 540                              | 2*10⁵            |
| Light-emitting lamp 10 W       | 860               | 60                     | 860                              | 6*10⁵            |
| LED strip 1m, 240W             | 1200              | 90                     | 1200                             | 1.2*10⁶          |

If the parameters of the light source are available, it’s possible to make all necessary calculations to create a balanced sign lightning. At that, it’s important to keep in mind the fact that the upper threshold of the eyes sensibility, delectability of the light emission on the black background, which can be compared with the night-time, is \(10^6 \text{ Cd/m}^2\) and is characterized by pain, which roughly corresponds to the direct radiation of the filament lamp of 100 W at a distance \((1.5 ÷ 2)\) m.

When performing calculations in the outdoor advertising design, one must consider what area of the city it will be located. The historical heritage zone covers architectural structures of historical significance, illuminated at night. As a rule, they are illuminated by the point light sources directed to the front of the building, floodlighting is used rarely. Therefore, when calculating the lighting it's necessary to consider not a luminous flux of the light sources, but the reflected light flux on the basis of the reflection coefficient of the material. 

\[
\rho = \frac{\Phi_o}{\Phi}
\]

Where \(\Phi_o\) — reflected light flux, \(\Phi\) — luminous flux of the source.

Hence it follows that if the light wood facade is illuminated by halogen lamps of 1170 lumens, the reflection coefficient in this case is 50%. while luminous flux directed to the observer will be 585 lumens. If a city-format sign lightened by energy-efficient fluorescent lamps of 40 W with a luminous flux of 2000 lm, is placed against the building, even if taking into account the transmission coefficient of the thick glass closed by the advertising banner, this city format will completely distract and disturb the aesthetic and artistic perception of architectural structures with its brightness. A great example of this effect are Christmas decorations as shown in Fig. 4.

Powerful LEDs completely neutralize the effect of illumination of the building and distract the attention. In this case, they do not break, but substitute the functional purpose. During the Christmas holidays, this is a good example of how bright LED advertising can draw attention away from the architectural structures of historical significance [6].

City-format can also be bright enough, Fig. 5. As already discussed, even the most energy-efficient fluorescent lamp that backlight a city format creates a luminous flux of 2000 lm.

This level of lighting will be expedient in the special city significance area, highways and railway stations. At the same time on the highways and public roads advertising lighting should not be brighter than road and automobile lighting. Advertising constructions should not create a luminous flux more than 800 lm. If an advertisement is placed in the shopping areas, the brightness of its backlight with the abundance of advertising structures should be comfortable for perception and be no more than \((10^4 ÷ 10^5) \text{ Cd/m}\).
The illumination of advertising constructions should be harmonious and balanced. This is the reason why it is necessary to make calculations using different lighting equipment within one zone for the purpose of presenting an excellent advertising that provides complete and accurate information and is the most effective at any time of day [7].

Thus, the effectiveness of the advertising construction depends on its size, the size of the advertising field and the physical location as well as on the level of illumination considering the external lights (lighting of buildings, street lights, highway lighting) [8, 9]. It’s also important to consider the potential audience of a particular location of the advertising object. For example, doubling advertising on the city-formats is more susceptible and effective for the pedestrians in the area of historical heritage, for automobilists in the special city and public areas city and super boards are more effective.

References
[1] Berdyshev S 2010 Effective Outdoor Advertising 132
[2] Jerome Jewler A, Bonnie L. Drewniany 2002 Creative Strategy in Advertising 384
[3] Seryakov V 2010 Conceptual setting of the exhibitions facilities. Modern techniques and technologies (MTT) 3
[4] Seryakov V and Tuzovskaya A 2013 The Meaning of Public Transportation Stops in the Modern Communication Environment. Modern techniques and technologies (MTT) 3
[5] Kukhta M, Solovyev R 2014 Complex approach to design quality evaluation. Design. Materials. Technologies (DMT)
[6] Kukhta M, Solovyev R 2013 Demonstration Platform with an Interactive Control Works of the Academy of Industrial Aesthetics and Design 1 pp 17-21
[7] Kukhta M, Solovyev R 2013 Platform with an Interactive Control in the Design of Shop- Windows of the Industrial and Museum Complexes. Design. Materials. Technologies (DMT) 3 pp 16-19
[8] Kukhta M, Seryakov V 2010 The Specifics of Industrial Display Design’s Forming and Structuring. Design. Materials. Technologies (DMT) 1 pp 18-24
[9] Kukhta M, Seryakov V, Sokolov A 2012 The Design of Expositions and Shop-windows: theory and practice. Monograph, Saarbrucken: Palmarium Academic Publishing 184