Development Prospects of Railroad Complex “Belarussky Railway Station” in Moscow with Accessible Environment Device for Disabled People and Other Groups with Limited Mobility

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Abstract. The development and modernization of existing stations is conducted under very cramped conditions. The requirements to space-planning solutions are increasing. The list of premises that must necessarily be in place is enlarging. Transit zones are being adapted to barrier-free access for people with disabilities, the environment is becoming more comfortable. But along with this, the arrangement of vertical communications (lifting devices, elevators, stairs, ramps) is complicated because the existing transit zones overall dimensions are not designed for increased passenger traffic and any restriction is not permissible. The article proposes the concept for the development of the railroad complex "Belorussky Railway Station" in Moscow by increasing the number of storeys and the above tracks space development.

1. Introduction
The Belorussky railway station in Moscow was designed by the architect I. I. Strukov in 1907-1912. The last reconstruction was carried out in 1976. The object is an architectural monument. This is a transport interchange hub where passengers of suburban and long-distance communication stay. And opened on August 27, 2009, the Aeroexpress terminal attracted airline passengers to the station.

The changes revealed the lack of means for admission and movement for disabled people and other groups with limited mobility there (hereinafter GLM), the nonconformity of the passenger areas of the suburban railway station, to the regulatory requirements. With the increasing of passenger traffic, there was a need to the Aeroexpress area expansion and the air passengers service improving.

Engineering communication wear limits the possibility of improving the sanitary facilities quality and the internal station premises climate. The transit zones and waiting rooms overall dimensions do not allow the effective using of commercial opportunities and creating more comfortable ways for passengers to travel. Also the station has unattractive interiors.

2. Analysis of the study object
The existing station complexes are a symbiosis of the historic buildings of the station, including the station area, and the adoption of functional elements that meet modern requirements for the organization of all categories passengers transportation into the already existing environment. As a
rule, the stations location, both on the basis of existing buildings and newly constructed, is historically
determined. Therefore, the railway infrastructure development takes place in very cramped urban
conditions. The station territory construction boundaries, as a rule, remain unchanged. With the
comprehensive modernization of railway stations and other railroads infrastructure facilities the
acquisition of additional useful areas is through the introduction of vertical communications (Fig. 1) to
existing buildings and to the station territory with the increase of complex storeys number.

Figure 1. Means of vertical communications: ladders (a), ramps (b), elevators (c), lifting
devices (d).

Usage of above tracks space to expand the transit zones and waiting rooms with ensuring of
meeting passengers demands in social services is currently the most promising. The main problem in
this direction is the fact that the station building has the status of a monument of architectural heritage.
In these conditions, any changes of the facade and layouts should not change the overall appearance
of the building. And new buildings (including extensions) should look stylistically either as
background buildings and emphasize the historical identity of the building in contrast, or as a
continuation of the building and have architectural elements of the existing appearance of the station
on the facade and in the interiors. Despite the high requirements for compliance with the rules and
regulations for the arrangement and modernization of public spaces with respect to architectural
monuments, the preservation of its historical appearance remains paramount. "In modern practical
activities, such objects of monument protection as overall dimensions, window and door openings,
architectural decor of the front facade are defined" [1]. Methods for reconstruction, including the
increase in useful areas, are quite diverse and widely used in cities with a high density of development
of the historic center. [1].

Any modernization (and new construction) should provide conditions for adaptation of the
environment for groups with limited mobility (hereinafter GLM). These categories according to
SP59.13330.2012 "Accessibility of buildings and structures for groups of population with limited
mobility" [2] (from 05/05/2017 SP59.13330.2016) comprise:

- people with physiological and mental characteristics in development, moving independently
  and with outside help. (the visually impaired, the blind, people with wheelchairs, crutches,
  with canes, people with mental disabilities, hearing impaired people, etc.)
- elderly and aged people
- pregnant women
- passengers with children (and more often with strollers)
- children
- people who have temporarily lost their ability to work (with various injuries and sick people)
- passengers with heavy bags and luggage

Public space can be fully or partially adapted. To include in adaptation only transit zones, to make
them convenient for movement of GLM. In SP 31-102-99 "Requirements for the accessibility of
public buildings and facilities for disabled people and other groups with limited mobility" [3], depending on the projected share of IGOS and the financial capabilities of the customer, two such options are considered:

- **option "A"** - availability of any place of service for the disabled; there should be provided the establishment of common universal access roads for healthy, disabled and groups with low mobility and accommodation for needs of people with health problems, special service places from the common number of such places;

- **option "B"** - in the level of entrance area there should be allocated special rooms, zones or blocks adapted for the service of the disabled; establishment of special entrances, expressly arranged parallel paths and places of service for people with health problems should be taken into consideration.

Adaptation is necessary on the station territory too in accordance with the requirements for the arrangement of urban space [4].

3. Result

The Belarussky railway station has a complex rectangular shape. It seems to be "hugging" the station square from the side of the city and "deployed" from the side of the roads. In the proposed concept, this configuration was decided to use, placing the objects of station development like "rays" above the tracks around the historic station. And only the hall of higher levels of comfort for passengers of aeroexpress can be joined to the existing building. The passengers of suburban traffic were decided to place on the middle platform and transit through the old building. All the premises for them are located just above the tracks. For communication with the zero level, various means of vertical communications were proposed. For GLM these means are elevators, for the rest of passengers they are stairs and escalators. Long-distance passengers should remain at the same place. For their comfortable stay it was decided to increase the area of waiting rooms and social amenities accommodating. Shopping areas and public catering facilities were planned to be placed in a spacious above track space. This concept is aimed at improving passengers stay conditions at the station (Figure 2).

![Figure 2. The layout of vertical communications.](image)

Advantages of the concept are a) a clear distribution of passenger traffic; b) comfortable service for “Aeroexpress” passengers; c) possibility of long-distance passengers to travel through a warm transition to platforms; d) increase of efficiency of long-distance station area; e) preservation of the historical appearance of the existing station building, since the facade of the annex to it is made using the architectural decoration of the front facade of the station; f) creation of independent entrances for long distance passengers, for passengers of “Aeroexpress and passengers of suburban communication
that allows to have a single rate in the flows, to isolate passengers from crossing. In the architectural appearance, it is possible to combine the preservation of the architectural monument authenticity, modern style and usage of modern building materials (Figure 3).

Figure 3. The concept of the station development.

4. Conclusion
Co-operation of railway stations with other public institutions, technical services leads to the formation of multifunctional complexes, unified structures, transport and transfer junctions. A network of people serving the station is being developed. Conditions are created for the transformation of the station premises from transit ones to accommodations for people to meet their daily needs. The time-saving factor requires the spatial convergence of stations with other urban facilities, as well as the integration of social welfare facilities in the infrastructure of the station, "giving each individual greater freedom of choice in meeting specific needs" [5-12].

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