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Research paper

Research and Analysis on Accessibility of Small populations to the Alternated and Undergraound Pedestrian Transitions on Automobile Roads

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Abstract

In the present article the results of field and sociological studies as well as analysis of accessibility of people with limited mobility of various categories of existing overhead and underground pedestrian crossings, equipped with ramps, on public roads are presented.

Keywords: *Accessibility, Small populations, Alternated Pedestrian, Undergraound Pedestrian, Automobile* Roads

1. Introduction

One of the main problems of highways design in the Russian Federation is the absence of regulatory and technical documents at the intergovernmental and national level of a single interconnected set of requirements for ensuring accessibility of people with limited mobility to the underground pedestrian crossings, equipped with ramps. They require a more thorough study of their location and arrangement parameters, taking into account the actual operating conditions [2-4].
Under-mobile population groups (UPG) are people who have difficulty in moving independently, receiving services, necessary information or orientation in space [5].

2. Brife description of research technique

Assessment of accessibility of UPG to the overhead and underground pedestrian crossings is carried out on the basis of the following methods:
a) field studies:
1) the method of field reconnaissance research to establish a list of objects that meet the established requirements;
2) the method of observation at the object (visual determination of the elements of the arrangement and services available for the UPG, the paths through the object and the approaches to it, the observation of the behavior of the UPG at the object of study);
3) the method of expert assessments (verbal assessment of the availability of elements of the arrangement of objects by experts of public organizations of persons with disabilities);
4) the method of instrumental measurements of linear and angular parameters of the elements of the arrangement of the object under study;
b) Sociological studies:
1) intelligence sociological research on objects by the method of a point free interview of the UPG;
2) a selective sociological study of UPG living in areas adjacent to the studied pedestrian crossings.

Selective set: because of the need to study the peculiarities of using pedestrian crossings by small social groups, a target, rather than a representative sample has been established. This avoids the small proportion of UPG in the general population, which are for her statistical "tails" [6-8].
The work was done on the roads of Novaya Moscow, as well as Moscow, Tula and Kaluga regions [9].
To evaluate the results, quantitative and qualitative methods of statistical data analysis, as well as the method of expert assessments, were used [10].

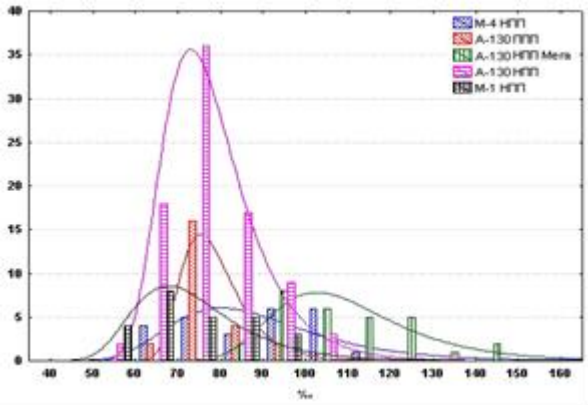
3. Results of research

Results of field studie:
Of the total number of surveyed above-ground and underground pedestrian crossings with ramps, 61.5% do not have accessible and continuous pedestrian approaches from settlements. However, only 27% of respondents noted accessibility problems (the fifth part - users of stairs, the rest - users of ramps).
Most of the objects (83%) have thresholds 34 ± 17 mm in front of the entrance to the ramp, with a permissible value of 15 mm [1]. On some objects, an unacceptable cross slope at the entrance to the ramp (41-47), and sections of the junctions of upper marches and the horizontal part of the transition, up to 1 m long, is noted - longitudinal slopes 103-229 ‰.
Values of the longitudinal and transverse ramps for several homogeneous groups of pedestrian crossings are given in Table 1. The distribution of the values of the longitudinal slopes (Figure 1) shows that they are inaccessible for independent movement of people in a wheelchair.

Table 1: The values of slopes ramps pedestrian crossings

№ pp	Highway	Transition type	Slopes, ‰			
			longitudinal		transverse	
				standard	fact	standard
1	M-4 "Don"	SPE	88,1±5,6	≤ 50	10-22	≤ 20
2	A-130 "Kaluga highway"	SPE "MEGA"	110,1±5,2		0-12	
		SPE	78,2±2,3		1-10	
		SPT	77,8±1,9		0-6	
3	M-1 "Belarus"	SPE	73,6±4,3		10-13	

Note: NPP - overhead pedestrian crossing; PPP - underground pedestrian crossing



M-4 - M-4 Don highway; A-130 - Kaluga highway; M-1 - the highway M-1 "Belarus";
NPP - overhead pedestrian crossing; PPP - an underground pedestrian crossing;
Fig. 1: The distribution density of the values of the longitudinal slopes of the ramps at pedestrian crossings by their main types

In 25% of cases, the lengths of marches pandas were 9.5–11 m, which was higher than the standard value (9.0 m [1]). The values of all intermediate horizontal platforms were maintained (standard ≤ 1.5 m [1]).

48% of the objects have a longitudinal slope of the horizontal areas between the ramps, and 26% exceed the norm (20 [SP59]). The mean value was 22 ± 4 ‰ with a standard deviation of 12.

The width of the space between the ramps' rails was 1.75-1.82 m, with a normality for two-way traffic 1.8 m [1]. Considering the low intensity of pedestrian traffic (less than 20 people / h), this caused two comments: use of wide ramps in rural areas; b) about the actual impossibility of using double-sided handrails for a disabled person in a wheelchair on wide ramps.

The height of the sides on the side of the ramp was 75 ± 13 mm with a standard deviation of 24 mm (not contrary to the standard ≥ 50 mm [1]).

The height of the handrail was:

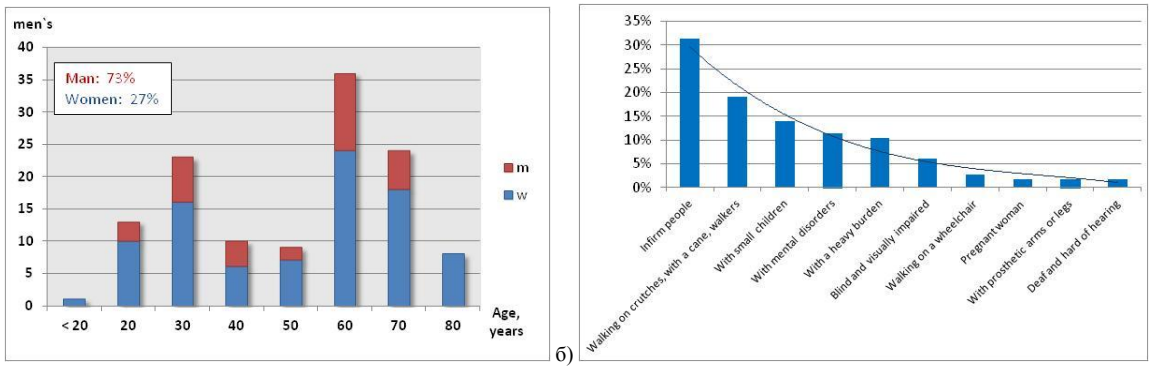
- upper ramps handrails: 888 ± 7 mm (standard 900 ± 30 mm [1]);
- lower rails handrails: 648 ± 24 mm (standard 700 ± 30 mm [1]);
- the upper handrails of the stairs: 850-1130 mm (standard 900 ± 30 mm [1]);
- the lower handrails on the stairs are missing (not standardized).

Handrails on ramps in some cases have a violation of the integrity of the surface, interrupted, placed at a dangerous distance from the walls or inconvenient to use. The handrails on 62% of the stairs do not comply with the regulatory requirements. The ground tactile indicators on all objects are made by offenses of GOST R 52875-2007.

2.2. The results of sociological research

The survey was conducted in five cities of the Moscow region and 19 rural settlements of the Moscow, Tula and Kaluga regions. In the zone of their influence there are 15 above-ground and underground pedestrian crossings, equipped with stairs and ramps. 120 questionnaires corresponding to the study conditions were accepted for processing.

The distribution of respondents by gender, age and categories is presented in Figure 2.



а) б)

Fig. 2: Distribution of respondents by gender and age characteristics (a) and by categories of UPG (b)

Among UPG, 43% of them use, 8% do not use crossings. Depending on the situation, both options are used. Among the UPG was 82%, ramps — 49% (Figure 3).

In cities, above-ground and underground pedestrian crossings are used by MHN more often than in rural settlements (Figure 4).

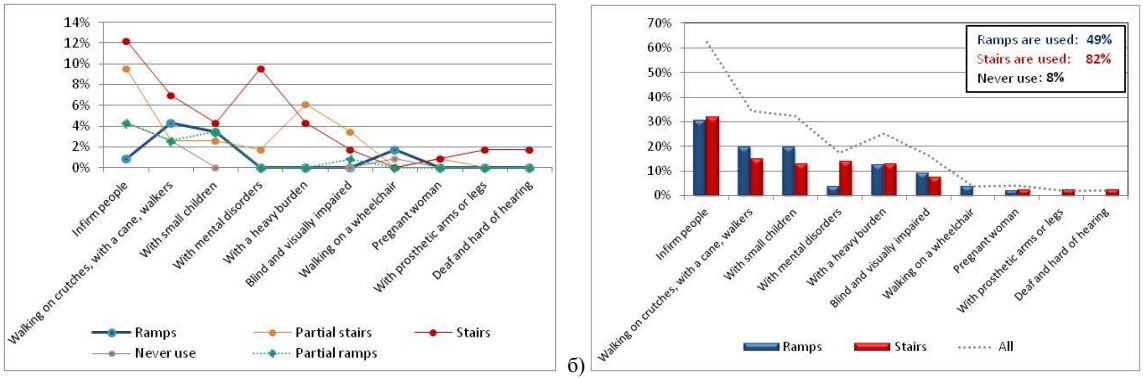


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Fig. 3: Distribution of respondents according to the degree of use of stairs and ramps of UPG by categories of elevated and underground pedestrian crossings

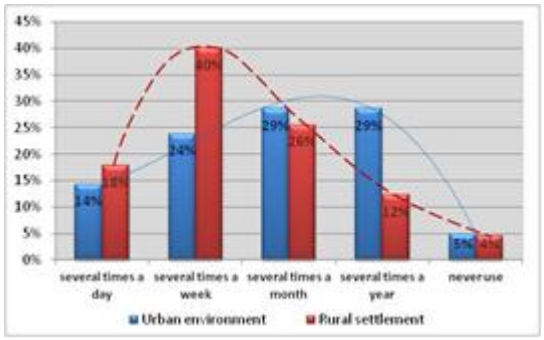

Fig. 4: Frequency of use of pedestrian crossings in urban and rural areas

The time spent on foot from the place of residence or the object of construction to the structure is, on average, 20 ± 2 minutes with a standard deviation of 11 min availability. according to the UPG , distances of approaches to pedestrian crossings vary from 0.4 to 2.1 km and, on average, are 1.1 ± 0.4 km (Figure 5), which is almost three times the recommended standard value of 300 m [SP 140].

Fig. 5: Examples of graphical analysis in terms of the distance of accessibility of the studied pedestrian crossings from the places of residence of UPG

The degree of use of crossings for the purpose of walking or for traveling by public transport, expressed as a percentage, turned out to be the same - 50%.

The main problems on ramps of pedestrian crossings were the respondents who indicated their greater length (people with difficulties, people on crutches or with a cane, people with wheelchairs with disabilities, including having an escort), large longitudinal slopes and those who use crutches), dirt, stuffiness, lack of an elevator in cities, inconvenience of handrails, barriers at the entrance to the ramp. They correspond to the findings of field studies.

4. Conclusions and recommendations

1. The decision to build a pedestrian crossing with a ramp should be accompanied by an agreement with local authorities on the arrangement of accessible and continuous pedestrian approaches to it.

2. Construction of pedestrian crossings without ramps or stairs is impractical, because the share of their users among UPG, due to the nature of their health, is about 50 and 80%, respectively.

3. The distance of the influence of above-ground or underground pedestrian crossings for UPG in rural areas should be considered: the main is up to 600 m, the full one is up to 2 km.

4. For populated areas, in which the population within a walking distance of up to 500-600 m is less than 1000 people. narrow ramps should be provided (0.9-1.0 m between the handrails).

5. Priority in choosing one of the two types of pedestrian crossings should be given to the underground, as having a smaller length compared to the above-ground and is less expensive during operation.

6. The rational ratio of length and longitudinal slope ramp is: in length - no more than 120 m; on the slope of the elevated ramp - more than 60-80 ‰, underground - 40-60 ‰. A rational bias, taking into account the conditions for the independent movement of people in a wheelchair, is recommended 50-60, in cramped conditions - no more than 80.

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