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THE RESILIENCE CITY / THE FRAGILE CITY. METHODS, TOOLS AND BEST PRACTICES.

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The Resilience City/The Fragile City.
Methods, tools and best practices.

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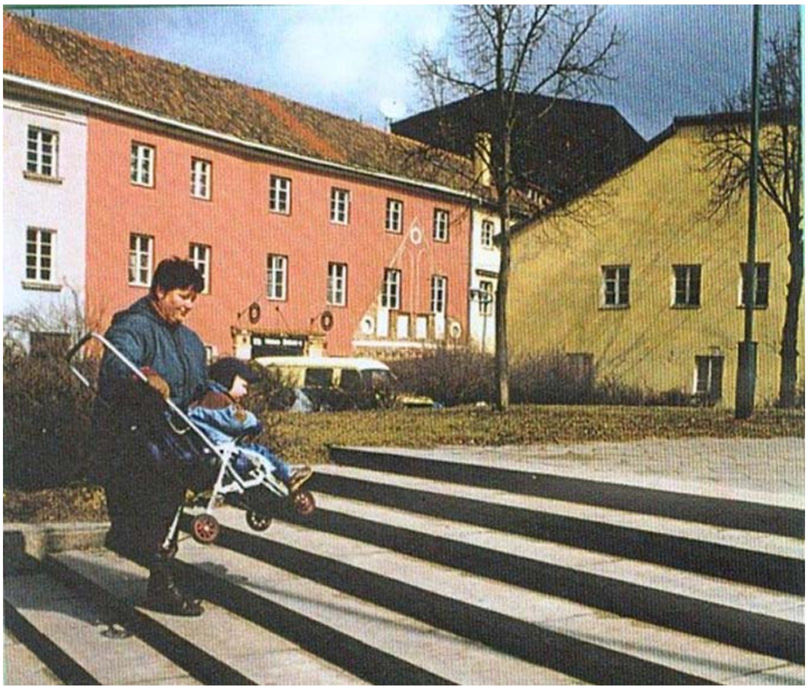

MONITORING USER-BASED ACCESSIBILITY ASSESSMENT IN URBAN ENVIRONMENTS AND IN PUBLIC BUILDINGS

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ABSTRACT
The research features analysis of user-experience-based accessibility assessment and progress monitoring of buildings and public spaces; this analysis is used as a tool for facilitating the development of humane, socially sustainable and an inclusive urban environment and architecture. A group of users representing people with different kinds of disabilities, the elderly and families with children was created to assess the quality of physical access to the buildings of different functions and locations across the cities of Vilnius, Lithuania and Singapore, Republic of Singapore. A school, two hospitals, a rehabilitation centre and two offices were selected for access monitoring in Vilnius City, while a hotel, a café and two metro stations with public squares were chosen for access assessment in Singapore (Fig. 11). The article draws a comparative analysis on accessibility of the selected buildings in Vilnius City and in Singapore where the same pre-tested method was applied to assess accessibility in 2000 – 2017. The results show a definite improvement of access quality over time and identify the critical aspects of urban spaces and buildings. The segment of plot planning represents the lowest quality of access for all assessed building types as compared to the building segment and the external–internal element segments. The paper also draws conclusions that access improvement is a continuous process of implementing advanced urban policy instruments, and city planners can contribute to it by constantly analysing and presenting to public the monitoring data about the progress in accessibility of buildings and urban spaces. Comparing the assessment results between Vilnius City and Singapore – cities that are located in different global regions and in different socio-economic environments – provides a practical tool for benchmarking, monitoring and prioritising this process.

KEYWORDS:
Accessibility; Architecture; Urban Planning; Regulation; Assessment.

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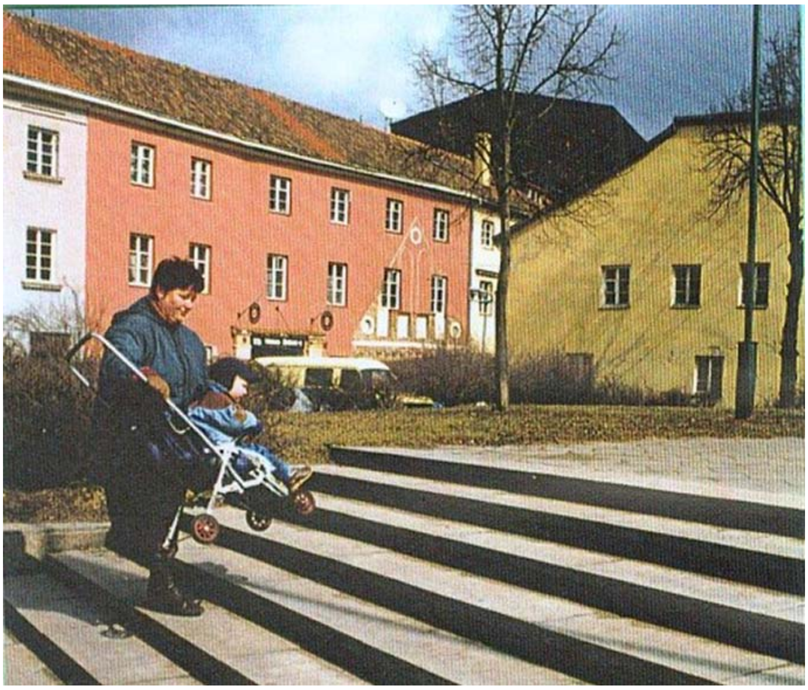

监控城市环境与公共建筑的基于用户的可达性评定

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摘要

本研究分析了建筑与公共场所的基于用户体验的可达性评定与进程监控；本分析被用作促进人文发展、社会可持续发展与包容性城市环境与建筑的工具。成立了一个代表各色人等：残疾人、老人、有子女的家庭的用户小组，以评估立陶宛维尔纽斯与新加坡等城市不同功能与位置的建筑物的实体可达性/出行（physical access）质量。在维尔纽斯选择了一所学校、两家医院、一家康复中心、两座办公楼用作可达性/出行监控，而在新加坡选择了一家酒店、一家咖啡厅、两个有公共广场的地铁站用作访可达性/出行评估（图 11）。本文对维尔纽斯与新加坡两市所选定的建筑的可达性进行了对比分析，而此相同的预测试方法也适用于 2000 – 2017 的可达性评定。结果表明，随着时间的推移，可达性质量有了一定的改善，并确定了城市空间和建筑的关键方面。与建筑部分和外部-内部要素（自然环境）部分相比，建筑用地规划部分代表了所有评估建筑类型的最低可达性/出行质量。本文还得出结论：改善出行条件是实施先进城市政策手段的一个持续过程，城市规划者可凭借不断分析和向公众展示建筑和城市空间可达性进展情况的监控数据来帮助这一点。对比位于不同的全球区域与社会经济环境中的维尔纽斯与新加坡城市之间的评估结果，为此过程的基准测试、监控与优先次序提供了一个实用工具。

关键词：
可达性；建筑物；城市规划；法规；评估

1 AIM OF RESEARCH

The research aims to analyse how the accessibility assessment method that was developed and pilot-tested by the author works in different urban settings and hopes to demonstrate its potentials for monitoring and improving the accessibility of publicly used buildings and urban spaces. The results of this research could be practically used for self-assessment initiatives by the assessed and many other institutions, urban planners, architects, property developers and users. The theoretical approach of the research rests on the methodology of reshaping urban environments by implementing advanced improvement programmes and assessing their results by evaluating, comparing and monitoring the consumer's perspective in local socio-economic environments (Bromley, Matthews, & Thomas, 2007). The research also aims to test the assessment tool for benchmarking the accessibility improvement process in different socio-economic and environmental contexts and therefore the author has selected the cities located in different geographical and cultural environments. It is expected that the compared and monitored assessment results can set the milestones for tracking and fine-tuning the accessibility progress in different environmental locations.

2 BACKGROUND

The researchers demonstrate a growing interest in the assessment of social processes. In the last two decades, the volume of papers in this field has increased immensely: in a Web of Science search on "assessment methods accessibility" (1996 – 6 items, 2017 – 196 items). Most of the papers had a background in the environmental, social and health sciences presenting the research in psychological, medical and bio-climatic aspects of person – environment interaction. The problems of better access to public environments and all kinds of services are frequently analysed as a policy instrument leading modern cities towards socially sustainable urbanism based on non-discrimination, justice and satisfaction for all city dwellers. Having integrated many additional user-friendly environment solutions, accessibility as a knowledge platform has advanced to the inclusive design with user-centred planning and design principles featuring a responsive, flexible, convenient and welcoming environment for all (Mulligan & Fletcher, 2006). In the current research, the accessibility assessment is extended beyond simple access to services and facilities – it also takes into account the qualities of safety, security and comfort in urban environments and in public buildings. This approach corresponds to a complex structure of socio-economic and environmental aspects of the built environment that most modern cities are implementing as their long-term strategy.

Politicians, practitioners and researchers look on urban access as a continuous process, with a clear goal of developing more inclusive and responsive urban communities. Therefore, those cities that have started the process earlier have achieved more by going further and could serve as a good case study for others. The process usually starts with setting a strategy, programming the process and planning adequate measures for accessibility improvement as land use plans for open spaces and buildings of the most diverse functions are drawn up (Stockholm, 2011). Recently, access assessment has focused on the elements of public mobility infrastructure, such as road crossings (Blecic et al., 2017), metro, bus and train stations. Multiple users' needs intersect in a limited space and existing obstacles not only increase the necessary connectivity time but also decrease the number of amenities and comfort for the users of this infrastructure (Sun, 2016). Specific aspects of a safe environment, such as outdoor lighting, are frequently analysed and outlined as having tremendous importance on movement safety and comfort of users in public areas (Johansson et al., 2011). Accessibility programmes currently are developed along with the general sustainability strategy, including life-cycle analysis of constructed buildings and economic, ecologic and cultural aspects of sustainability, and even deliver the platform of educational research for planning and design professionals as well as for city managers (Ahlberg et al., 2003). Creating eco-homes for eco-communities is based on a highest accessibility standards and practices, and the outcomes are assessed in all phases of development, from the concept to the built facility (Bhakta & Pickerill, 2016). Multiple external and internal space planning implications are resolved easily if one looks at the issue from the perspective of the user, who is also a customer buying goods and services (Rosemary et al., 2007).

National and European standards regulate the accessibility features in design and construction, yet there are many specific cases that need individual solutions for providing users with a safer, easier and more pleasing access. The first comprehensive regulation in this field was launched in Lithuania in 1993, and upgraded in 2001 and 2010 (Statybos Techninių Reikalavimų Reglamentas STR 2.03.01:2001, 2001; Statybos Techninis Reglamentas STR 2.03.01:2001, 2010). Singapore, which is the next site of our interest, adopted the access legislation in 2007 (Accessibility Code, 2007), followed by the upgraded version in 2013 (Accessibility Code, 2013). In some countries – for example, in the United States, which has introduced the Americans with Disabilities Act (ADA) in 1990 and upgraded it in 2010 – building standards are accompanied by guidelines that present detailed comments, advice and examples for standard implementation (Americans, 1994; Guidance, 2010). There is research evidence showing that awareness of local authorities is higher than the knowledge needed for implementing the national accessible environment standards (Kamarudin, Hashim, Mahmood, Ariff, & Ismail, 2012). Indeed, accessibility requirements are horizontally integrated in regulation of urban planning, architecture, landscape, mobility, infrastructure and other sectors. Naturally, regulation reflects on national socio-economic and environmental priorities, and adjustments are made in time to meet these goals. Researchers often rely on the national regulation or global design standards if the national ones are vague or non-existent while shaping their evaluation tools (Meşhur, 2016).

Researchers globally apply different self-adapted or authority-recommended access assessment methods to measure and evaluate the quality of the built environment and different kinds of buildings. Accordingly, various assessment tools are developed. It is essential that these tools should correspond to the specific purpose, especially using the survey results: if the aim is to support the owners or managers of facilities to make them more accessible, then the assessment should be detailed enough to figure out the weak points of the said environment that need improvement (Calder & Mulligan, 2014, p. 28). Researchers focus their attention on accessibility at different scales, from public areas to buildings and to their interiors (Bromley et al., 2007) using the corresponding assessment tools. There are a number of assessment tools, such as checklists, questionnaires, interview forms, expert analysis etc., used to evaluate access quality. Calder and Mulligan recommend that researchers consider conducting psychometric assessments of the instruments to be used for an adequate sample size. In addition, easy-to-administer tools with clear scoring benchmarks have rendered more objective and reliable results (Calder & Mulligan, 2014). Still, the tools employing universal user experience for surveys that give the overall evaluation of internal and external qualities of buildings in the public arena are rare to find.

As accessibility is a universal urban paradigm and policy instrument that is implemented to last a long time, methods that allow for comparing and monitoring access progress are needed, and just few research attempts could be found in this area. As a result, benchmarking and comparative analysis are needed to measure and compare access qualities in different urban settings. Society is the major disabling force as it marginalises impaired people socially, economically and politically by allowing the creation of non-accessible spaces and buildings (Gabel & Peters, 2004; Shakespeare, 2006). Traditional city construction has often led to the emergence of inaccessible environments as it follows the sequence of using conventional solutions that turn into barriers for many citizens (Casas, 2007). As a result, impairment-affected individual disability to perform certain actions or functions confront the limiting factors of the environment, which lead to a person's handicap in private or public life and result in the person's isolation to various extents and prevent the person from participating in community and an active social life (Fig. 1). Multidimensional and inter-sectoral accessibility programmes have a goal to divert the process of person–environment interaction from the point of handicap to an accessible environment track (Fig. 2, top) by creating and implementing the complex accessibility approach. The results of these implementations preventing a person from falling into the trap of a handicap and are led back to a normal life track are analysed in this paper (Fig. 2, bottom).

Fig. 1 Traditional flow from personal impairment to disability

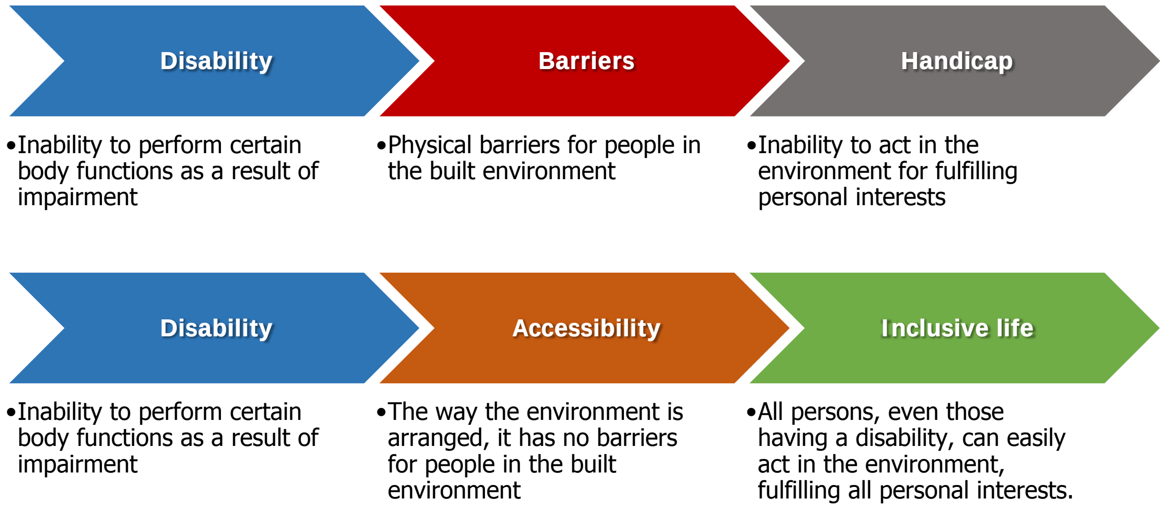

Fig. 2 The sequence of managing disability in barrier-full (top) and accessible barrier-free (bottom) environments

As it emerges from the background analysis, there is a need for a comprehensive, objective and easy-to-use system for access assessment and monitoring that fits different urban environments and diverse socio-economic conditions. The assessment tool should function over the variety of scales of urban environments from interior details, public and commercial buildings and to open spaces, mobility and infrastructure facilities. The assessment tool based on users' experience and clear scoring benchmarks could report on the access quality – both at the level of fundamental needs for safety and security, and the higher user's aspirations for comfort and satisfaction – as required by the universal design principles that emerged on the ground of accessibility philosophy and practice (Universal, 2007). Users' groups involved in assessment should cover a wide array of disabilities and could extend to the elderly and families with children.

Moreover, comparative analysis and monitoring of access quality progress is important in the fundamental and applied senses as it adds one more important quality segment to a highly complex planning and design agenda (Simon, 1962).

2 METHODOLOGY

A participatory access assessment method involving people with disabilities was created by the author and practically tested at several urban spaces and buildings in Vilnius City (Stauskis, 2017). The method features a comprehensive assessment matrix of 59 aspects for the assessors to report their on-site experience while testing by using the particular building's system or element. The same method, with some adjustments, was used to assess several public premises in Singapore in 2012 (Fig. 11) and in Vilnius in 2017. The paper draws an analysis based on the assessment results in Vilnius and Singapore, and discusses the trends that are specifics for these two cities.

At first glance, Vilnius and Singapore are two very different locations. However, there is an essential similarity in common for them and for many other urban centres. On the one hand, these cities are located in different geo-climatic and socio-economic regions: Vilnius – in North-East Europe, with a moderate cold continental climate, developing economy in an ethnically homogenous society; Singapore – in South-East Asia, with a hot tropical climate, ethnically heterogeneous society and world-leading economy. On the other hand, both cities are on the same path of improving accessibility of the urban environment and buildings by implementing different regulations in the context of regional traditions and economic potential.

Therefore, it is scientifically important, acceptable and practically adequate to evaluate accessibility in these two different places by using the same method and the same assessment tool. More, it is important to know how efficient is the assessment tool for monitoring accessibility of the same buildings over different time and to analyse the monitoring results.

The accessibility level of the selected facilities was assessed by a team of instructed evaluators according to the specially designed method that comprised a concise matrix of aspects covering different environment segments, structured over three levels: the site (i), the building (ii), and the details (iii). The assessment was carried out according to the original assessment methodology created and previously pilot-tested by the author in assessing several buildings in Vilnius City. The averages from the individual assessment scores were derived for each assessed accessibility aspect, for every environmental segment (i-ii-iii), and finally, for all facilities. As a result, the overall averages were derived for all assessed facilities of the assessment cycle for 2000, 2012 and 2017. The number of negative scores (0–4) granted by the assessors for all environmental aspects was accounted for in the same way. After accessibility was assessed for all aspects in the range of 1–10, the received results were normalised to a 0–1 range using formulas 1 and 2.

$$\mathbf{Z_i = X_i - X_{min} / X_{max} - X_{min}} \quad [1]$$

Z_i = i-th normalised value;

$X = x_1, x_2, \dots x_i$;

X_{min} = minimal value of X;

X_{max} = maximal value of X;

The negative score numbers were normalised using the formula 2:

$$\mathbf{Z_{ni} = X_{ni} - X_{n-min} / X_{n-max} - X_{n-min}} \quad [2]$$

Z_{ni} – i-th negative normalised value;

X_{ni} – $x_{n1}, x_{n2}, \dots x_{ni}$;

X_{n-min} – minimal negative value of X_n;

X_{n-max} – maximal negative value of X_n;

The original methodology was upgraded for the recent assessment cycle by including the evaluation the lowest assessment scores (0–4), which are an important indicator of the extremely low accessibility. As those elements of the environment that were given the lowest scores are principally non-accessible barriers that are critically limiting access to and usability of the whole facility and not just its part, the normalised non-accessible assessment scores were included in the final assessment as the diminishing criterion of the overall evaluation.

The final scores were obtained by subtracting the normalised negative scores from the normalised average assessment scores (formula 3). Formula 3 delivers the final assessment score:

$$Z_{i-fin} = X_{i-ass} - X_{i-neg} \quad [3]$$

Z_{i-fin} – final score of assessment of i-th facility;
X_{i-ass} – normalised average assessment score of i-th facility;
X_{i-neg} – normalised negative assessment score of i-th facility.

Assessments were carried out in reality by a team of seven assessors with varying physical conditions, different environmental needs and diverse capabilities (Fig. 4). The composition of the assessor's team and the social profile wasdesigned to cover the natural array of most vulnerable user groups with diverse needs representing the broad spectrum of modern society (Fig. 11). An elder person and a parent with a baby in a stroller to reflect the interests of the elderly and young families complimented the assessor's teams for Vilnius 2017 and Singapore 2012 tests (Fig. 11). The assessor's team featured a variety of occupations, ages and gender balance (Fig. 3). To increase the quality of the assessor's feedback about usability and performance of the assessed facilities the assessment was practically implemented by reporting an on-site user's experience of testing different environment elements. The individual assessment scores were filled in the summary matrix in decimal grades from 0 to 10 in an Excel spreadsheet.
The usability and performance of buildings and other built facilities in their environment could be assessed by different value levels starting from the basic safety qualities; once this was achieved, it could proceed to the higher level of comfort of use. In addition, if this was realised, assessment could rise to the top qualities that please and satisfy user's aspirations (Gehl, 2010). This structure of values (Fig. 3) suggests that comfort may be only addressed after the basic safety needs are ensured, and pleasure level is targeted on the ground of good performance in safety and comfort aspects. Therefore, the original assessment method was upgraded by grading the value levels of the assessed urban environment and the selected buildings, and the assessors were instructed to evaluate the aspects of: (1) safety, (2) comfort, and (3) pleasure of use (Fig. 3).

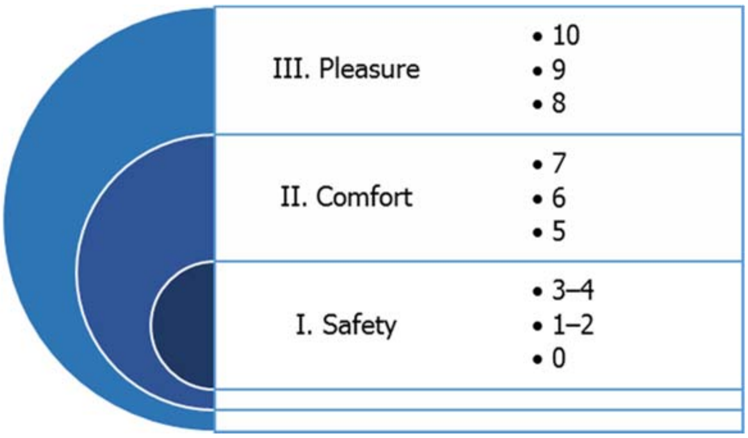

Fig. 3 The scores for assessed value levels of the environment elements and buildings

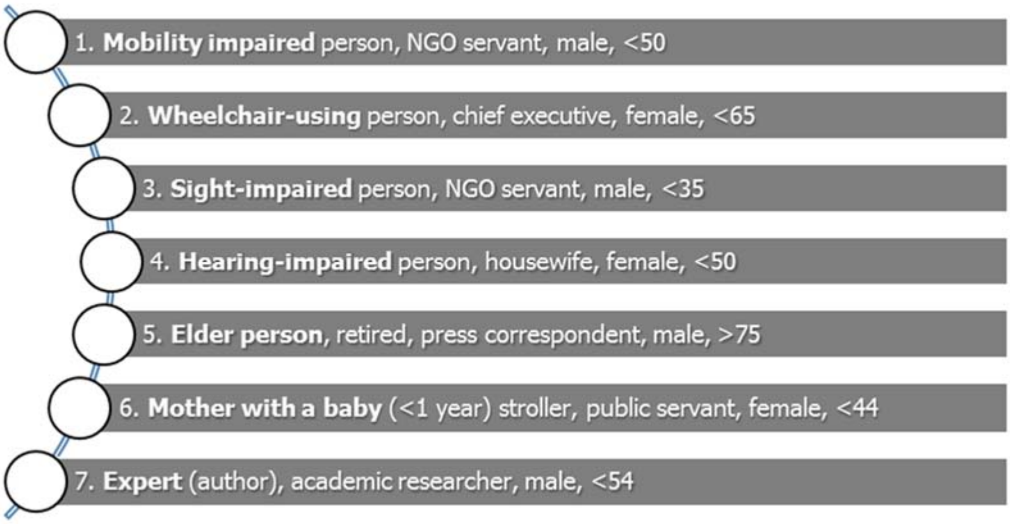

Fig. 4 Assessor's team composition represent the array of physical and social condition, gender, occupation and age

3 RESULTS

As each assessor had an opportunity to experience his own specific environmental needs by testing the use of given environment elements in urban space and in buildings, the overall assessment results reflect the needs of major physically sensitive user's groups.

The summary normalized results (Table 1) show the highest (object 9) and the lowest (object 1) *average assessment* scores, on the one hand. On the other hand, the table outlines the largest (object 4) and the smallest (object 2) numbers for *negative* scores given by the assessors, and these are different objects than those ranked by an average assessment score. According to the *total* assessment grade, the object 9 earns the highest score, object 4 – the lowest score. The highest assessment score was assigned to object 9, the same as for the assessment average, and the lowest – to objects 4 and 11, the same 4 that got most negative scores. In total, six objects received overall negative scores (Fig. 5).

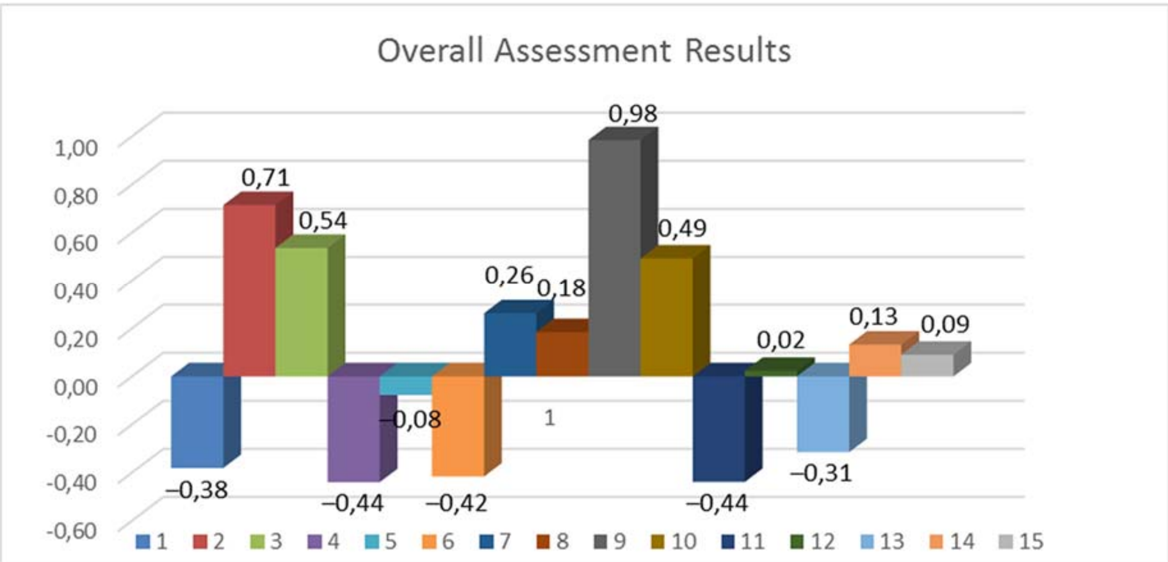

Fig. 5 Overall assessment results for all objects (1–14 Table 1)

No.	Year built or refurbished	Object, city, assessment year	Assessment average		Non-accessible elements assessment		Overall score
			Score	Normal	Number	Normal	
1	1989	Office LŽNS, Vilnius 2000	6,28	0,00	33	0,38	–0,38
2	1998	Office LŽNAPA, Vilnius 2000	8,18	0,71	**9**	**0,00**	0,71
3	2005	Office LŽNAPA, Vilnius 2017	8,17	0,71	20	0,17	0,54
4	1998	Social Affairs and Labour Ministry, Vilnius 2000	7,77	0,56	72	1,00	–**0,44**
5	2010	Social Affairs and Labour Ministry, Vilnius 2017	7,51	0,46	43	0,54	–0,08
6	1990	MM hospital, Vilnius 2000	6,65	0,14	44	0,56	–0,42
7	2011	MM hospital, Vilnius 2017	7,75	0,55	28	0,30	0,26
8	1998	Rehabilitation centre Baldžio Šilas, Vilnius 2000	7,36	0,41	23	0,22	0,18
9	2014	RVUL hospital, Vilnius 2017	8,94	**1,00**	10	0,02	**0,98**
10	2010	Versmė School, Vilnius 2017	8,18	0,71	23	0,22	0,49
11	2005	V-Hotel, Singapore 2012	6,38	0,04	39	0,48	–**0,44**
12	2010	Metro station Dhoby Ghaut, Singapore 2012	6,72	0,17	18	0,14	0,02
13	2010	Metro station Lavender, Singapore 2012	6,54	0,10	35	0,41	–0,31
14	2010	Starbucks cafe, Singapore 2012	6,8	0,20	13	0,06	0,13
15		**Average all objects**					**0,09**
16		Average Vilnius 2000 and 2017					0,19
17		Average Singapore 2012					–0,15
18		Difference Vilnius (2000–2017) and Singapore (2012)					**0,34**

Tab. 1 The summary of all assessment results Vilnius 2000, 2017, Singapore 2012

Comparing the assessment results, the averages of Vilnius's and Singapore's objects show that the combined scores for Vilnius 2000 and 2017 assessments are, by normalisation, 0.32 higher than for Singapore 2012 (Table 1). This may relate to earlier implementation of accessibilty-promoting building regulations, dynamic growth of public awareness after 1990 and some other factors in the respective countries.

The site segment delivered the lowest score (6.52) from all the assessed buildings in all environmental segments (Fig. 6, 11). The highest assessment score was given to the buildings segment (7.64). Comparing assessment averages from all objects, the lowest score (5.61) was assigned to the site segment in Vilnius in 2000 and the highest score (8.57) to the building segment in Vilnius in 2017. Average assessment of Vilnius's objects in 2017 got the highest score (8.18) while comparing all three assessment cycles (Fig. 7).

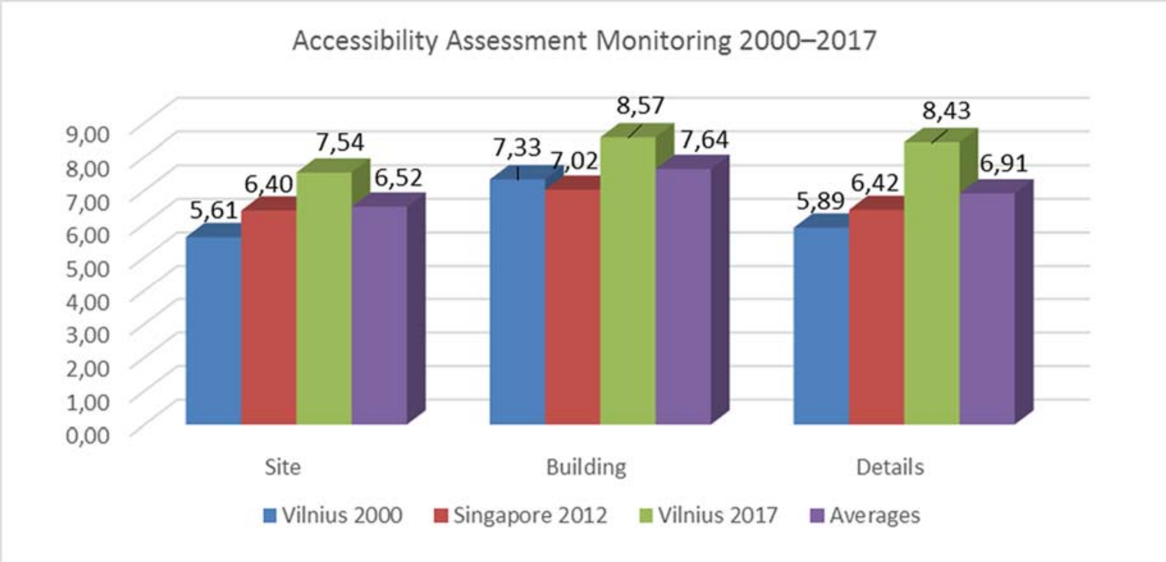

Fig. 6 Accessibility assessment monitoring 2000–2017

Comparing average assessment scores in Vilnius, we see a 30.2% improvement from 2000 to 2017 (Fig. 7). Some objects have increased their assessment grades from 2000 to 2017 (4–5 and 6–7, Table 1), but one has decreased its grade (2–3). All objects assessed in 2017 have earned overall positive grades (3, 5, 7, 9, 10). For Singapore, object 14 has rendered the highest positive score (0.13), which is one of the lowest compared to Vilnius City object's assessment scores.

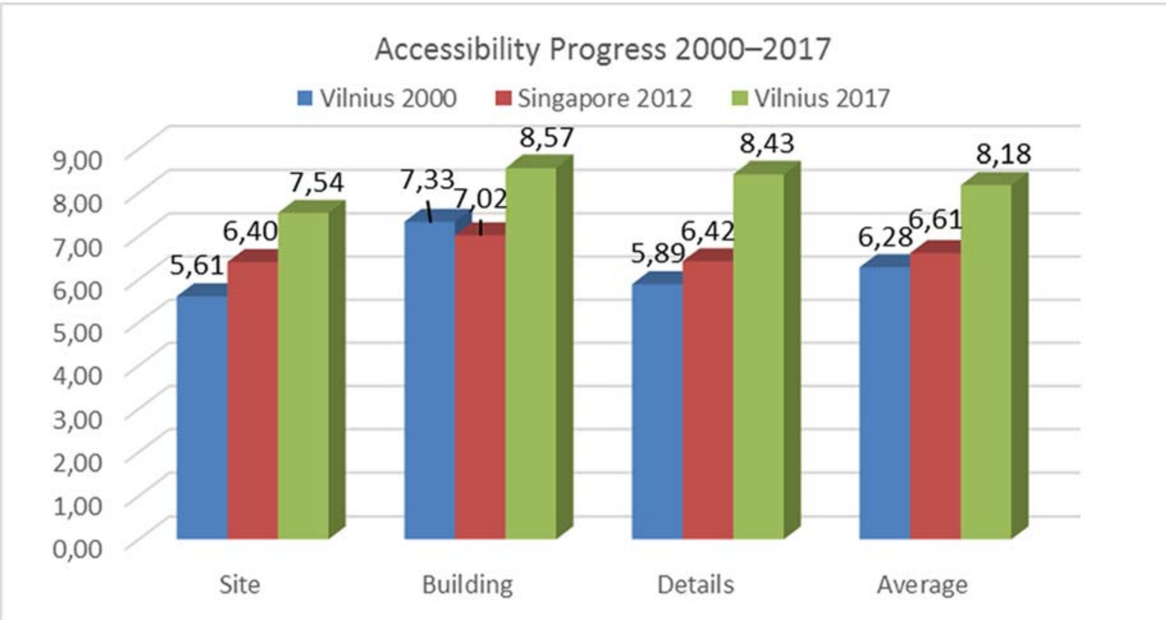

Fig. 7 Accessibility assessment for different environment segments

Finally, assessment results allow for monitoring the accessibility quality in the analysed urban sites and buildings at different times (Fig. 7). Accessibility level in all environment segments has increased in the period 2000–2017 by 30.2%. The elements of the ***site*** segment were graded the lowest scores through all assessment periods. The biggest progress through the analyzed period is observed in the segment of ***site and building details*** (43%) and the ***building's site*** (34.3%).

This shows the precise impact of the variety of accessibility promoting measures as more strict regulation and control, intensified professional upgrade, rising public awareness and others that urban planning and architectural design practices take into account for improving the quality of both public and private environments and buildings. Analysing the assessment results according to the year of construction (or refurbishment) of the surveyed buildings in the interval of 1989–2014 reveals a definite increase in accessibility scores from −0.38 for facilities built in 1989 to 0.98 for those built or refurbished in 2014 (Fig. 8). This trend has become especially evident after 2005 and continues until recently, and the more strict control of the regulation requirements is one of the reasons along with the improved skills of city planners and architects

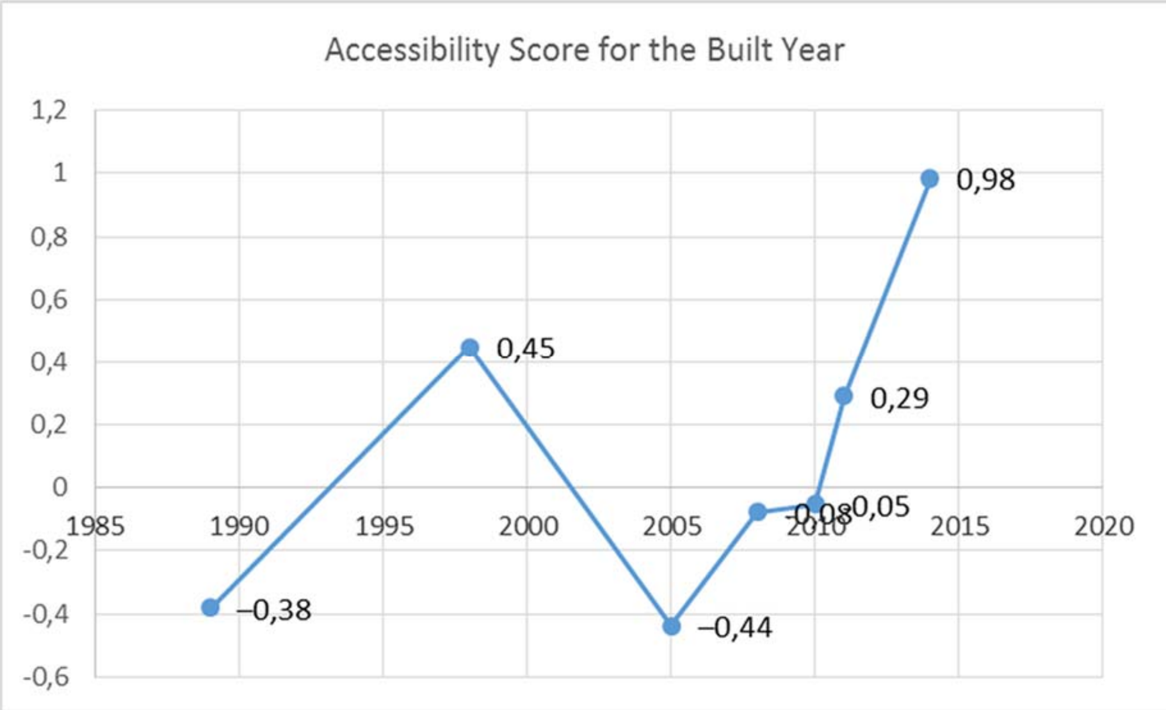

Fig. 8 Accessibility assessment scores for the year of construction of the object

As assessor's team was composed to represent a group of people with varying conditions, of different occupations, ages and experiences, the comparison of each assessor's average grades was also drawn up. The data analysis shows that the lowest assessment scores were delivered by the assessor with limited mobility, who was walking with additional support (the expert's scores are excluded). The hearing-impaired assessor delivered the highest average scores (Fig. 9). Consistency is another important aspect of the obtained accessibility assessment results. The scores assigned by different assessors present great variety for the different positions and environment segments. Examples in Figures 10, 11 show that the assessment averages for all aspects of two assessed objects differ from two to nine. It could be assumed that the grades lower than the average (6,5 – red line on Fig. 10) for the given object are below the lowest acceptable threshold and these assessed elements in buildings or in urban spaces need urgent improvement in order to continue using them. The rest of the assessed elements should be improved in the shortest possible time as decided by the authorities for urban spaces and the owners or the users of publicly used buildings and facilities.

As different assessors have different needs in the environment, their assessments reported different results even on the same environment element. E g the curb is a good guide for the sight-impaired person, but the same curb is a real obstacle for the wheelchair user. The question is how different assessments of the same element could be considered to make an impact on the overall design, which has to take into account different human needs, but make one planning or design decision. Analysis of the assessment matrix reveal that there are cases when assessors' scores coincide, but there are also cases when these scores differ greatly (Fig. 11).

Quality of parking, external ramps, main entrance, elevators and signage have all delivered radically different (4–10, 3–9) scores. However, many environment elements scored in the same high or low way (external rest places, warning surfaces, floor material and others).

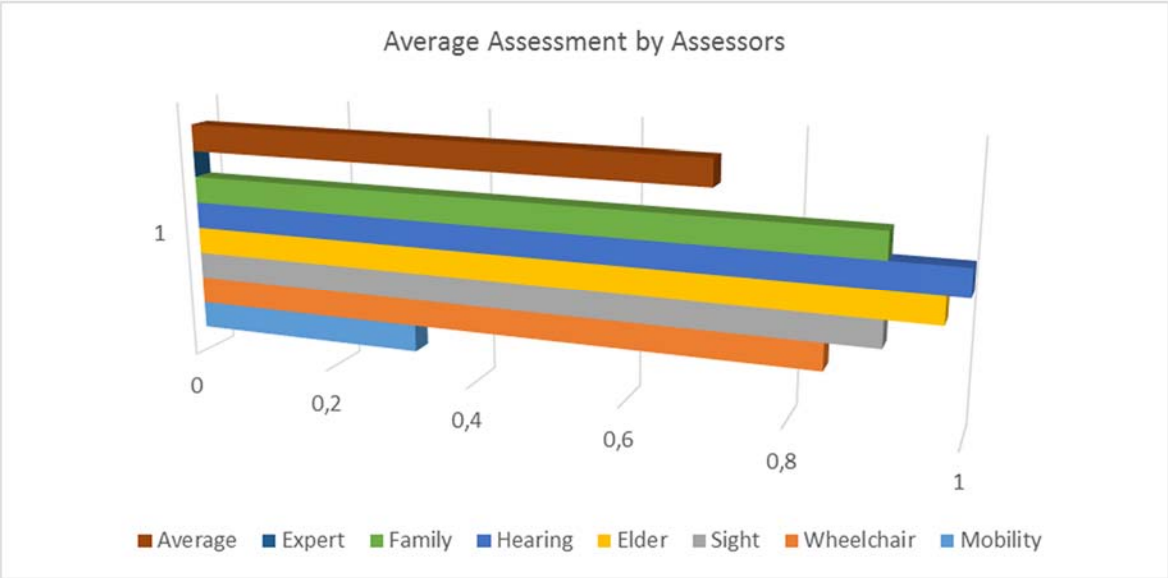

Fig. 9 Normalised average assessment by different assessors (0–1)

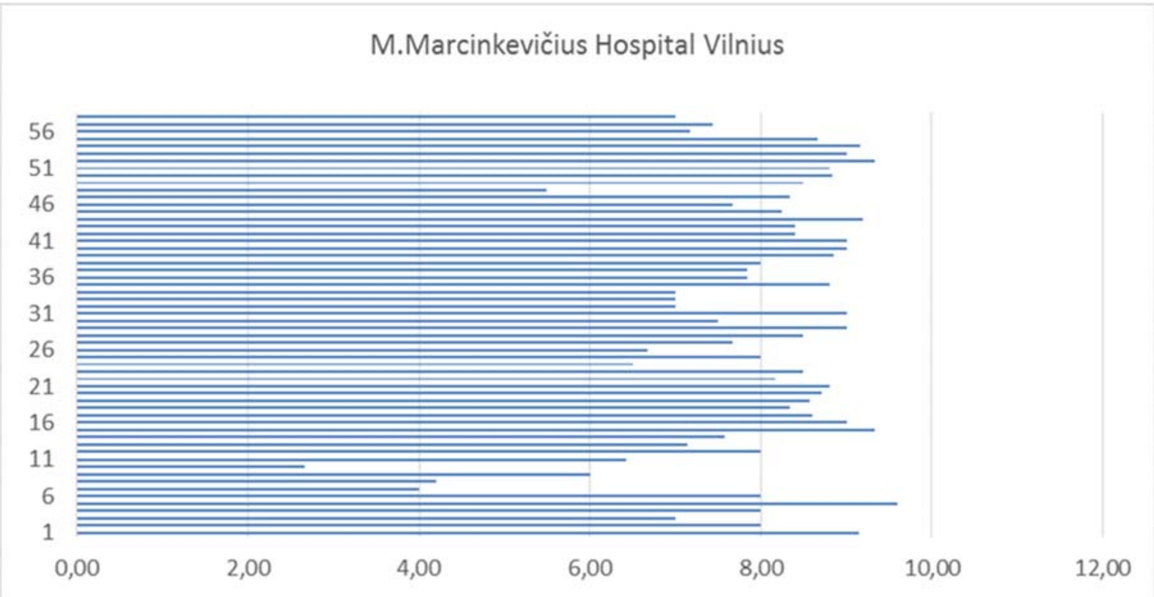

Fig. 10 Assessment averages for all aspects of 7 (MM Hospital in Vilnius City) and 12 (MRT Station in Singapore) objects

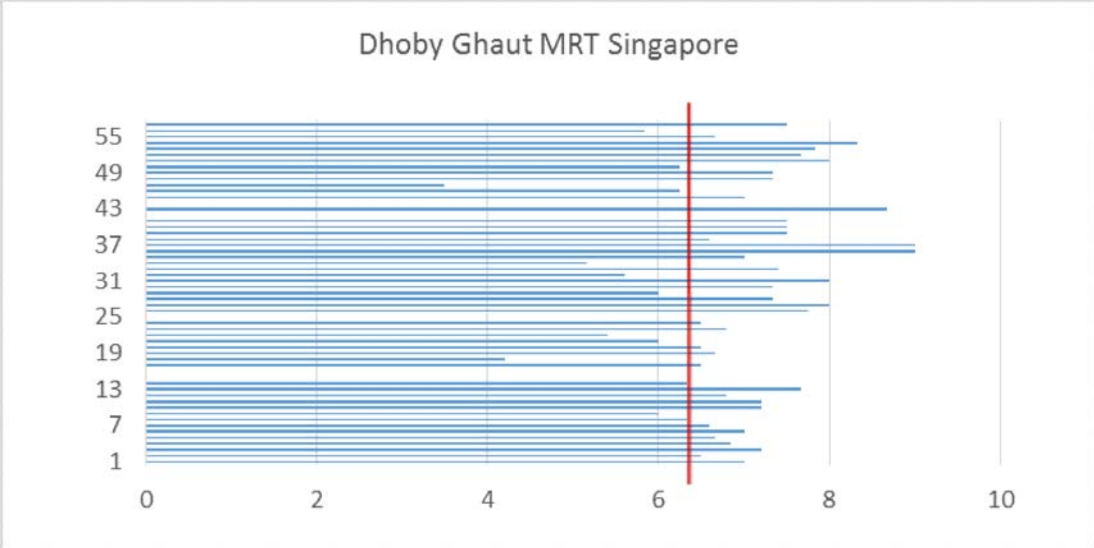

Fig. 10.a Assessment averages for all aspects of 12 (MRT Station in Singapore) objects

Building	Assessor	The Site												
		Assessment aspects												
		1	2	3	4	5	6	7	8	9	10	11	Sum	Aver
												Negative	7	
1. LŽNAPAoffice	1. Moving with supports	n	n	n	8	n	n	7	7	5	5	n	32	6,4
	2. Wheelchair user	10	n	n	10	10	10	10	10	10	5	n	75	9,375
	3. Blind person	5	n	n	7	n	n	n	n	8	n	n	20	6,667
	4. Elder person	9	n	9	n	10	n	8	9	9	n	n	54	9
	5. Mother with a baby	8	n	n	8	8	7	8	10	10	8	n	67	8,375
	6. Expert	9	n	n	8	4	n	8	9	5	3	n	46	6,571
	Average:	8,20		9,00	8,20	8,00	8,50	8,20	9,00	7,83	5,25		294	7,731
												Negative	14	
2. Social Affairs Ministry	1. Moving with supports	8	n	5	0	8	0	3	1	1	n	n	26	3,25
	2. Wheelchair user	7	n	7	7	n	9	4	4	0	4	n	42	5,25
	3. Blind person	8	n	n	7	n	9	9	9	n	n	6	48	8
	4. Elder person	6	n	n	6	10	6	6	6	8	n	n	48	6,857
	5. Mother with a baby	4	n	n	8	8	9	4	9	10	4	n	56	7
	6. Hearing impaired person	9	n	n	9	9	7	n	n	n	n	n	34	8,5
	7. Expert	6	n	n	7	8	n	6	9	4	2	n	42	6
	Average:	6,86		6,00	6,29	8,60	6,67	5,33	6,33	4,60	3,33	6,00	296	6,408
												Negative	7	
3. RVUL Hospital	1. Moving with supports	n	n	10	10	10	8	8	9	9	8	n	72	9
	2. Wheelchair user	10	n	n	10	10	10	10	10	10	4	n	74	9,25
	3. Blind person	5	n	n	7	n	7	n	n	10	n	n	29	7,25
	4. Elder person	9	n	10	n	10	10	9	10	10	n	n	68	9,714
	5. Mother with a baby	8	n	n	9	10	9	9	10	9	10	n	74	9,25
	6. Expert	8	n	n	7	9	5	5	5	5	4	n	48	6
	Average:	8,00		10,00	8,60	9,80	8,17	8,20	8,80	8,83	6,50		365	8,411
												Negative	8	
4. School Versme	1. Moving with supports	9	n	n	8	9	n	9	4	6	4	n	49	7
	2. Wheelchair user	8	n	7	7	8	n	10	10	4	4	n	58	7,25
	3. Blind person	n	n	n	7	n	n	n	8	n	n	7	22	7,333
	4. Elder person	n	n	n	8	7	8	8	8	6	6	n	51	7,286
	5. Hearing impaired person	10	n	n	10	9	9	n	n	9	7	n	54	9
	6. Mother with a baby	8	n	n	10	10	n	10	10	5	n	n	53	8,833
	7. Expert	6	n	n	6	7	n	4	4	4	4	n	35	5
	Average:	8,20		7,00	8,00	8,33	8,50	8,20	7,33	5,67	5,00	7,00	322	7,784
												Negative	9	
5. M. Marcinkevičiaus Hospital	1. Moving with supports	8	n	n	8	10	n	4	4	6	4	n	44	6,286
	2. Wheelchair user	6	n	6	7	10	n	0	0	n	0	n	29	4,143
	3. Blind person	10	n	n	7	n	n	n	n	n	n	n	17	8,5
	4. Elder person	9	8	8	n	n	n	n	n	6	n	n	31	7,75
	5. Hearing impaired person	10	n	n	9	9	n	6	6	n	n	n	40	8
	5. Mother with a baby	9	n	n	8	10	10	7	8	n	n	n	52	8,667
	6. Expert	8	n	n	6	9	6	3	3	6	4	n	45	5,625
	Average:	8,57	8,00	7,00	7,50	9,60	8,00	4,00	4,20	6,00	2,67	#DIV/0!	258	6,996
														7,466
	Good - very good	8 9 10												
	Low - very low	4 3 2 1 0												
	Total average:	7,97	8,00	7,80	7,72	8,87	7,97	6,79	7,13	6,59	4,55	#DIV/0!		7,47

Fig. 11 Assessment matrix, section The Site, Vilnius City 2017. Good – very good scores are in green highlight, low – very low scores are in red highlight

Fig. 12a Assessment of mobility system in Singapore 2012

Fig. 12b Assessment of urban open space in Singapore 2012

Fig. 12c Assessment of metro station in Singapore 2012

Fig. 12d Assessment of the cafe entrance in Singapore 2012

4 DISCUSSION

The results for all 14 assessed objects – open spaces and building (Table 1) show that eight objects have earned an overall positive assessment result and six have gained negative results (Fig. 5). The negative assessment results indicate that the urban space or the building is, in general, inaccessible and point out several critical obstacles that should be improved. The exact elements that need the improvement are listed in the assessment matrix and could guide the individually tuned accessibility programme and design for the given buildings in both cities (Fig. 11). This especially applies to the objects No. 1, 4, 6, 11 and 13 (Table 1). The used assessment method and the applied tool are suitable for accounting for and representing the low and high grades of accessibility that correspond to the low or high quality of accessibility to particular spaces and buildings. They can also serve as a proper comparing and monitoring tool that indicates the amount of progress or drawback in accessibility quality achieved over a certain period.

Assessment results, when grouped by the environment segment, identify the access level and its change in the outlined site, building and detail's segments. It is helpful for the building owner or facility manager to monitor access progress over time to figure out how efficient the taken measures are and to modify them according to the monitoring results, if needed. In this case, monitoring the assessment results shows that the site segment needs more attention from authorities, from academic institutions and professional associations to raise the competence of urban planners and architects for developing the best site planning and design solutions. Better legal regulation and support by guideline is needed for this segment as well. By evaluating the results from the point of the year of construction of the assessed spaces and buildings, one can see definite improvement in accessibility level – the new and the refurbished buildings are designed according to the valid regulations and the best design and management practices. One could suppose that higher user expectations are also driving further improvement of professional architect and planner practices by increasing the pressure on professionals to provide for safer, more comfortable and more pleasing urban planning and architectural design solutions.

The variety of assessment results delivered by different assessors recommend keeping and even extending the wide spectrum of representatives of various user groups to cover more specific needs and interests. In spite of evident and fully understandable differences in assessing various aspects of the built environment, the wide array of the assessors is a pre-condition for obtaining universal and comprehensive access assessment results that are both up-to-date, reliable to analyze and practical to implement. Looking at the consistency of assessment results, it is evident that certain elements that scored low or very low exist for each assessed object. Even objects that have earned relatively high average scores have several critically unfit elements for urgent improvement. All elements that have a result lower than the average for the whole object or the average for the given environment segment should be taken as a non-accessible barriers limiting the overall usability of the object. There is a contradiction in the results from the point of assessment by different assessors. This is understandable and justifiable as different physical conditions lead to frequently very different environmental needs and consequently different assessor's attitudes. It is a challenge for city planners and architects to find the optimal solution that fits all space users most: this is a search more for a varying optimal compromise and not for the fixed ideal.

Monitoring the progress of accessibility over time is an evident additional merit of the employed methodology and city politicians, researchers, architects, the media and the public at large could widely exploit it. It helps to set the milestones for progress and demonstrate the reach of certain goals. The overall assessment shows quite an unequal spread of the results: the negative scores represent an accessibility level that is currently an unacceptable barrier for the users as they represent the elements that essentially limit the access and give very low functionality and no comfort. One facility in Vilnius City has dropped in its average accessibility level score from 2000 to 2017 (LZNAPA office), and two have improved their scores (MM Hospital and The Social Affairs and Labor Ministry). On the one hand, this shows that even newly built office buildings need constant supervision and proper maintenance of their essential features, and on the other, that constant implementation of a long-term access improvement program leads to an improved situation, even in very complicated cases at the earlier designed and constructed buildings and urban spaces.

The author of this research took part in the assessment of the presented buildings and spaces as well but these scores were excluded from the calculations. In future, also ordinary citizens could be included in the assessment group as to figure out their degree of satisfaction while using urban spaces and buildings. The assessor's role could be also useful for urban planning, architecture students and young professionals as to strengthen their practical understanding of academic accessibility knowledge and getting the design-related skills and feedback from real space users.

The possibility to shape the assessment tool according to the nature of the assessed objects is open as well: by doing that, the chances for comparing the assessment results of different buildings would be lost, but the results would reflect more the specifics of the particular building's typology.

5 CONCLUSION

It is important to underline that in each case, the assessment tool should be adjusted to the local socio-economic conditions and legal environment by fine-tuning the existing method. The used assessment method should correspond to the way we are going to use the survey results. In the case of the current survey, its result render the best outcomes when applied for analytic purposes, also for creating access improvement programs and monitoring implementation in a flexible, consistent and fluent way.

The user–experience-based assessment tool has demonstrated that it is appropriate for evaluating both the public and the private urban areas and buildings on different scales – from the site planning and functional layout to the design and instalment of interior elements. Involving the extended assessors' group into the assessment process, including people with different disabilities, the elderly and families makes the tool and the process more participatory and more inclusive, with more reliable and representative results. Therefore, we may suggest this easy-to-use and flexible tool for improving the quality of city management in Vilnius and in Singapore and in many other urban communities.

The wider question of what is a good access and what is an unacceptable one arises. Definitely, the objects that have several non-accessible assessment scores (0–4) and an overall negative result (<0) are seriously compromising their usability and comfort by multiple barriers and should urgently generate access improvement programs by using the particular scoring data from this research for replanning and redesign. However, monitoring access progress is an important task for the local authorities that take care of the quality of the public environment and of public buildings.

The used accessibility assessment method contributes to the wider attempts to improve the overall problems of urban environment quality (noise, pollution, climate, etc.). It also contributes to creating a higher value for the built urban spaces and buildings by addressing the issues of enhanced personal safety and security, satisfaction and pleasure for the users. All these measures improve the quality of public spaces and buildings, and by that, contribute to creating better livable cities.

Simultaneously with the recommendations for improving the urban environment and buildings, the question of legal regulation should be constantly looked at. It is evident from the results of research (see Fig. 7) that the urban planning segment needs more attentive regulation in the accessibility aspect from the national and European authorities. Besides the regulation, the professional guidebooks might also contribute to the continuous professional development of architects, city planners, landscape architects, building engineers and city managers.

The more general lessons learnt from this research show that even a single non-accessible element in urban space or in a building could critically prevent people from getting through the space or into the building. This means that every aspect assessed by using this methodology or alternatively the national regulation should be treated as an essential element of space planning or building design, construction and use including refurbishment and renovation. The aesthetical quality of accessible design that architects and designers apply is still problematic as it lacks intuitive logic and artistic quality. Frequently designed elements pop out of the whole project or building by that over-emphasize and exclude accessible space elements as ramps or handrail from the overall architectural style. Architects should more boldly take on the challenges of accessibility and turn them into the outstanding architectural projects. The methodology that we tested in this case for the monitoring efficiency allows adhering to the functional, ergonomic and use requirements that are universal and usual for all citizens.

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IMAGE SOURCES

Fig. cover: picture by the author. Vilnius. Lituania

Fig. 1: Traditional flow from personal impairment to disability. Own elaboration.

Fig. 2: The sequence of managing disability in barrier-full (top) and accessible barrier-free (bottom) environments. Own elaboration.

Fig. 3: The scores for assessed value levels of the environment elements and buildings. Own elaboration.

Fig. 4: Assessor's team composition represent the array of physical and social condition, gender, occupation and age. Own elaboration.

Fig. 5: Overall assessment results for all objects (1–14 Table 1). Own elaboration.

Fig. 6: Accessibility assessment monitoring 2000–2017. Own elaboration.

Fig. 7: Accessibility assessment for different environment segments. Own elaboration.

Fig. 8: Accessibility assessment scores for the year of construction of the object. Own elaboration.

Fig. 9: Normalised average assessment by different assessors (0–1). Own elaboration.

Fig. 10: Assessment averages for all aspects of 7 (MM Hospital in Vilnius City) and 12 (MRT Station in Singapore) objects. Own elaboration.

Fig. 11: Assessment matrix, section The Site, Vilnius City 2017. Good – very good scores are in green highlight, low – very low scores are in red highlight. Own elaboration.

Fig. 12: Assessment of mobility system (a), urban open space (b), metro station (c) and the cafe entrance (d) in Singapore 2012. Pictures by the author.

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Gintaras Stauskis – doctor of the Humanities in Architecture, is a professor with Vilnius Gediminas Technical University, conducting academic research at the Department of Urban Design. He is involved in European Union collaborative research programs. His current research fields are green architecture, sustainable urbanism, accessibility of environment, health care networks and urban recreation. The author has presented the research results in a number of national and international publications and conferences that could be seen on relevant databases (https://vgtu.academia.edu/GintarasStauskis).