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INVESTIGATING THE ACCESSIBILITY LEVEL FOR DISABLED USERS AT URBAN TRANSPORT INTERCHANGES

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The aim of this paper is to investigate the level of accessibility for people with reduced mobility at urban transport interchanges in Greece. Towards this direction, a review of policies and legislations related to accessible urban transport interchanges, at regional, national and European level was conducted, in order to identify key issues for accessible transportation hubs. Based on the review findings and the assessment of the identified crucial issues, an internet-based survey was designed and implemented, in order to evaluate the accessibility level of a representative Greek urban transport interchange, thus the Thessaloniki railway station.

Research showed that the majority of the respondents addressed the low accessibility level for disabled people, as they indicated the non-existence of blind guides (86%) and ramps (47%) along with personnel to support disabled movements in the interchange (78%).

Keywords: transport interchanges, accessibility, policy, legislation, reduced mobility users

1. Introduction

Transport interchanges play an important role in urban development, embodying attraction cells of movements and facilitating links among different modes, routes and destinations. In addition, transport interchanges act as a junction between the transport system and society, and can be further considered as "open gates" to the city, enhancing access to central activities and social events [1]. Urban integration, minimization of transit time, better use of waiting time, ticketing integration, real time information provision and providence for people with reduced mobility skills are some of the benefits that arise from the development of efficient, thus seamless, safe, clean and smart urban interchanges.

Although urban transport interchanges are crucial for the improvement of accessibility, there are still problems, gaps and barriers, which are mainly indicated in the coordination among difference modes of transport, the use of information systems, infrastructure, travellers' comfort and accessibility [2,3].

Following the introductory section (chapter1), the background analysis is presented in chapter 2 and the methodological approach of the study is presented in chapter 3. Research results are presented in chapter 4 the most important conclusions are discussed in chapter 5 of the present paper.

2. Background

Regarding accessibility and especially referring to people with disabilities, two significant categories of barriers are identified: barriers regarding information provision and barriers referring to the physical movement of travellers [4]. In the first case, the unpredictability of the journey experience is indicated as a significant problem [5], while, the physical problems are mostly related to boarding and alighting of public transport modes at interchanges, as well as to crowding which restricts smooth movement [4].

In Greece, focusing on policies and relevant frameworks, the basic guidelines for the development of urban transport operators are included in the National Strategic Reference Framework (NSRF) 2007-2013 [6]. Also, without having a ratified by the Greek Parliament Paper for the national transport policy

and strategy, some hints for those aspects are described in the Operational Programme – Accessibility Improvement and the respective Regional Operational Programmes for the programming period (OP-AI) 2007-2013, published in 2006 [7]. Although they do not describe national or regional transport policy, they illustrate and utilize transport policies through the prioritisation of investments in transport infrastructures. This prioritisation is based on various criteria, such as the integration of European transport policies for the development of transport infrastructures, the interconnectivity of transport modes and the accessibility of vulnerable users.

Accessibility is affected by many factors like mobility, quality and affordability of travel options, connectivity of the transport system, mobility substitutes and land use features. In Table 1, the results of evaluating the importance of transportation modes by several groups of travellers are presented. Walking and public transport seems to be the most important modes for people with disabilities [8].

Table 1. Importance of Transportation Modes (Rating from 3: most important, to 0: unimportant) [8]

Groups	**Walking**	**Cycling**	**Driving**	**Public Transit**	**Taxi**	**Air Travel**
Adult commuters	2	1	3	2	1	1
Business travellers	2	0	3	2	3	3
College students	3	3	2	2	0	1
Tourists	3	2	3	2	2	3
Low-income people	3	2	2	3	2	0
Children	3	3	2	1	0	1
People with disabilities	3	2	1	3	2	2
Freight delivery	0	1	3	0	1	1

David Simmonds Consultancy et al. (1998) defined accessibility by categorizing the groups of people. Thus, reduced mobility persons rely under a different accessibility definition [9]. Geuers et al, 2001 examined accessibility under the view of combination of transport modes and the easiness to make a combined transit trip [10].

Halden et al. (2002) investigated potential transport barriers to accessibility considering 6 main factors: spatial (i.e. travel time in relation to available time), physical (i.e. topography), temporal (i.e. system capacity), financial (i.e. discounts for traveller group), environmental (i.e. street lighting) and information (i.e. information prior to journey). In the same study, the priority transport concerns by person group categories was analysed, and it was indicated that disabled people seem to worry more about the absence or the provision of poor public transport, the access difficulties when accessing public transport facilities, their personal security, driver attitudes and reduced opportunities, while they worry less for the reliability of public transport and the cost of fares [11].

According to Litman (2012) and his study “suitability analysis of transport modes”, wheelchair movement is more appropriate for short urban trips and requires sidewalk or path, and there are limitations regarding the limited distance and carrying capacity of such movements. The quality and location of a transport terminal, as well as the connection between links and modes, also affect the accessibility level of the terminal [8].

The need of universal design in transport interchanges is associated with the need of providing efficient movements to all categories of travellers. The universal design requires disability access and the level of service in this case is the degree to which transport facilities and services accommodate people with reduced mobility [12, 13].

Except from investigating accessibility for disabled or reduced mobility in general, another perspective is to analyse accessibility for people that are transportation disadvantaged. Towards this direction, Litman (2012) introduced a transport deprivation index example that can be used to sum ratings for identifying people of that category. More specifically, the physical ability of a person is linked to a high rating, differentiating the score upon kind of impairment. Also dependencies are one important factor in this index. Other factors examined in this example are vehicle accessibility, poverty and commute responsibility [8].

Regarding relevant European initiatives, the European Commission through the Action Plan[15] on Urban Mobility set goals for sustainable urban mobility, addressed by 20 measures that encourage authorities to achieve their strategic goals towards this direction. Several of these measures and mainly Actions 4,5 and 6, focus on issues related to accessibility at transport multi-modal systems and interchanges.

Action 4 is a platform dealing with passenger rights in urban public transport. This Action aims to put a set of voluntary commitments in place, focusing on quality indicators, commitments to protect travellers' rights and rights of reduced mobility persons. Commonly agreed complaint procedures, and reporting mechanisms are also included in this Action [15].

Action 5 aims to improve accessibility for persons with reduced mobility. Commission will work with Member States to achieve full compliance with obligations set out in the United Nations Convention on the Rights of Persons with Disabilities by including the urban mobility dimension in the EU Disability Strategy 2010-2020 [14] and by developing appropriate quality indicators and reporting mechanisms. Article 9 of the Convention states that "*Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to (…) transportation, both in urban and in rural areas*" [15].

Action 6 aims at improving travel information. Commission will support the development of national and regional multimodal journey planners, and links between existing planners, with the ultimate aim of providing users with a public transport travel portal at EU level on the internet [15].

In the framework of the European project City-HUB[4], a review on policy and governance for transport interchanges was conducted in a number of representative European countries, Spain, Hungary, Norway, Greece, the Netherlands, United Kingdom, Finland, France and Czech Republic. The review results showed that few of the specific countries have national/regional policies focusing on accessible transport interchanges. Instead, countries usually have groups of legislations/policies which are not specifically focused but address in general the planning and operational issues of multimodal mobility and accessibility themes (i.e. in France there are policies related to the accessibility of reduced mobility persons). However, in United Kingdom, there are many policies related to accessible urban multimodal transport systems and interchanges (i.e. Transport White paper 2011, The Disability Discrimination Act 2005, Access for all station improvement fund 2011, Local Transport Plan 2008, Station Travel Plan etc.) [4,16,17].

The main document for transport planning in Norway, the Norwegian National Transport Plan (2010-2019) [18], focuses on accessibility and securing accessibility to important interchanges for multi-modal transport. In Hungary there is national guidance on transport interchange planning as described in the "Intermodal Public Transport Interchanges (Planning and Assessment Guidelines)" document, produced by the Hungarian Road Society in 2012 [4]. The same year, in Spain, the "Plan de Infraesttucturas, Transporte y Vivienda (PITVI)" was developed and special attention in given on multi-modal transport systems and transport accessibility [19].

All European countries examined in this study, have national or regional guidance in terms of mobility and multimodal transport which relates to accessibility, but the level of focus differentiates at each case.

3. Methodology

Based on the results and assessment of the state-of-the-art analysis and the identification of crucial parameters that enhance accessibility when designing urban interchanges, key indicators for the development and/or reformation of transport hubs were identified under four aspects, thus:

- Accessibility of the station through available modes of transport (car, bus, train, taxi, etc).
- Accessibility (elevators, ramps, "blind" guides, etc.).
- Connection of the station with the wider urban area (city centre, port, airport, etc.).

The above categories of indicators were used for the setting up of the internet questionnaire survey that was conducted in order to investigate travellers' point of view regarding the existing conditions at the Thessaloniki railway station, and record real needs, expectations and proposals for the reformation of the station. The survey ran for two weeks in February 2013 and 46 (valid sample size) respondents (men and women) evaluated the design and spatial development of the hub, and pointed out the ground for interventions.

The questionnaire was structured in four discrete parts. The first part included questions about the demographic characteristics of the respondents, such as age, gender, education, occupation and income, as well as questions about their travelling habits regarding the specific station, like the transit frequency, the usual purpose of travelling (education, work, shopping, etc.), the transport mode to reach the station (car, bicycle, walking, etc.), etc. In the second part of the survey, the respondents were asked to state their opinion on the existing conditions at the station by grading the above indicators on a 6-point scale ranging from 1 (non-existent) to 6 (excellent), where there was always the option DK/NA standing for "Don't

Know/Not Answer" responses. In the third part, alternative mobility scenarios with respect to the case study characteristics were presented to the interviewees and their intentions to follow them were recorded. In this case, respondents graded the scenarios on a 6-point scale, ranging from 1 (negative impact/decrease in movements) to 6 (positive impact/increase of movements). Lastly, in the fourth part, the respondents were invited to make any comments or proposals they have for the upgrade of the railway station.

4. Results

In this chapter, the results of the questionnaire survey are presented, separated in three sections. The first section regards the analysis of the respondents' characteristics, the second one the results of the evaluation of the existing conditions at the Thessaloniki railway station, and the third one, the findings of the evaluation of the alternative mobility scenarios.

4.1. Analysis of sample characteristics

The 56% of the sample was women and the 44% men. The age range of the sample was 2% between 18 to 25, 78% between 26 to 39 and 20% between 40 to 59 years old. The 85% of the respondents holds a Master degree, the 13% are university graduates, and the rest 2% high school graduates. Most of the respondents are freelancers (47%) or employees in the private sector (42%), while the 7% works in the public sector, the 2% are students and the rest 2% pensioners. Regarding the annual income per capita, the 7% of the respondents has an income lower than 9.000 €, the 71% has an average income (10.000 to 24.000 €) and the 22% an income higher than 25.000 €. Lastly, the 90% of the respondents has one car in the household (45%) or two (45%) cars, the 9% of them none, and the 1% more than one car.

4.2. Evaluation of the existing conditions at the station

The respondents were asked to evaluate a number of indicators, and the relevant findings are presented in the following paragraphs. The first indicator examined, was the network accessibility of the station through the available modes of travel, such as car, bus, taxi, etc. As presented on Figure 1, the majority of respondents consider the network connection through bus (80%) as above adequate and similarly they assess the taxi connection (67%). Train, bicycle and walk network connections are assessed as not present in percentages 59%, 57% and 51% respectively. Additionally, below adequate level of connection is evaluated mainly for the car (53%) network.

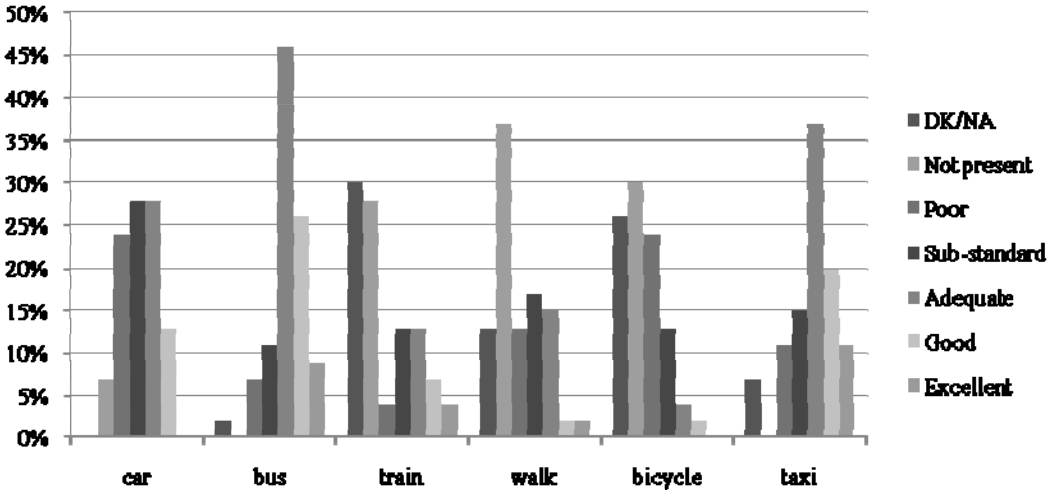

Figure 1. Respondents' opinion on network accessibility

Focusing on the respondents' opinion on accessibility (Figure 2), results showed that escalators are considered above adequate for the 34% of the sample, mainly due to the fact that were recently introduced in the station (the last 2 years) and they are new and in a good condition. Still, the 30% of the sample considers escalators as below adequate, because they are either crowded or not in use. On the

other hand, a high proportion of the sample (36%) believes that escalators do not exist in the station, either because they are not train users (escalators are located in the train platforms entrance) or because they have more than 2 years to use the station. The 86% of the respondents indicates the non-existence of "blind" guides, the 11% considers a below adequate level and the 2% an above adequate level. Similarly, the 78% of the respondents believes that there is no personnel to support disabled in the station and the rest 22% finds a below adequate level for this service providence. Almost the half of the sample (47%) addresses the non-existence of ramps and the 46% assesses them as below adequate. The remaining percentage (7%) is satisfied with that component. From the 60% of those supporting the presence of way finding signals in the station, the 51% assesses them below and the 9% above adequate level.

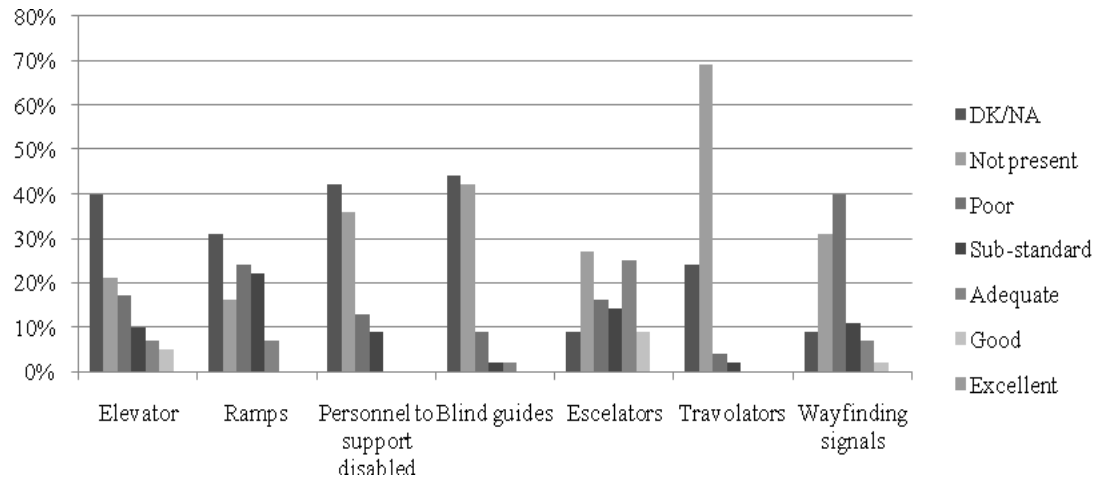

Figure 2. Respondents' opinion on accessibility

The connection of the station with the wider urban area was also addressed. Since the station is located close to the city centre, and is connected by bus efficiently with the majority of urban destinations, the opinion of the respondents was rather positive in this case. Specifically, the majority of respondents consider that the connection of the station to the universities (71%), the city centre (68%), the Macedonia bus Station (58%) the City Hall (48%), the airport (48%), the central shopping centre (47%), technical schools (41%), the port (39%), and is more than adequate. The station's connection with hospitals (46%) and the historic centre (43%) is assessed as below adequate, mainly due to the fact that there is no direct connection these destinations. Finally, the industrial area of Sindos seems to be not connected with the station for the 46% of the sample.

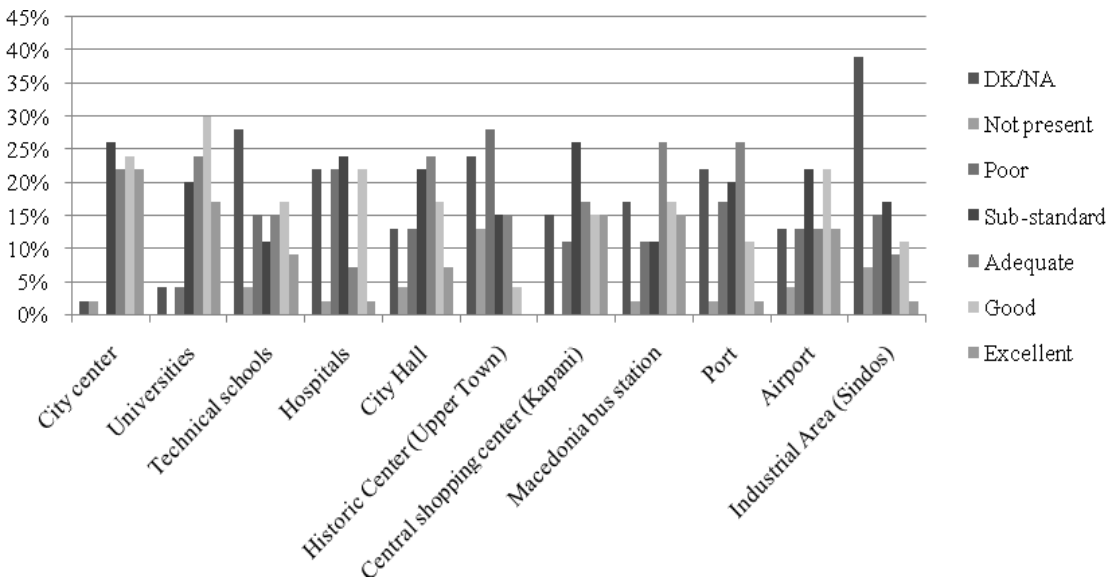

Figure 3. Respondents' opinion on station connectivity with the wider urban area

4.3. Evaluation of alternative mobility scenarios

The findings of the evaluation of seven alternative mobility scenarios related to accessibility are given in the following paragraphs. In order to investigate if there are any differences in the respondents' intentions in relation to gender, hypothesis testing was used and t-tests were conducted, while p-values were estimated so as to indicate the level of significance above which the hypothesis rejection stands. Respondents graded the scenarios on a 6-point scale, ranging from 1 (negative impact/decrease in movements) to 6 (positive impact/increase of movements). The results from the t-tests are depicted in Table 1. In the same table, the information provided includes the number of respondents (N), the average rating (M), the standard deviation of the rating (SD), the t-value, and the p-value.

In general, results showed that the movements of the respondents under the seven scenarios would be affected, and, specifically, it seems that interventions, such the increase of the reliability of the movements related with the station, the existence of sufficient connections of the station with the rest public transport network, would increase the number of their movements. Statistically significant differences between men and women were not observed, however, it seems that the bounding of walking paths inside the station, the real time information provision, the direct connection of the station with crucial destinations (i.e. hospital) would affect men more than women to increase their movements, while, on the other hand, the construction of ramps, the efficient support of people with disabilities and the increase of the reliability of the station are parameters that affect more women than men on their travel choices. If there were sufficient connections of the station with the rest public transport network, then this intervention would affect the movements of men and women at the same degree.

Table 2. Respondents' perceptions under alternative mobility scenarios

Respondents' perceptions under alternative mobility scenarios						
Scenarios	**Groups**	**N**	**M**	**SD**	**t-value**	**p-value**
Scenario 1: Bounding of walking paths inside the station	Men	21	4.67	1.155	1.441	0.157
	Women	25	4.20	1.041		
Scenario 2: Real time information provision	Men	21	5	0.949	0.156	0.877
	Women	25	4.96	0.790		
Scenario 3: Direct connection of the station with crucial destinations (i.e. hospital)	Men	21	4.90	1.044	0.083	0.934
	Women	25	4.88	0.971		
Scenario 4: Construction of ramps	Men	21	4	1.225	-0.528	0.6
	Women	25	4.20	1.323		
Scenario 5: Sufficient connections of the station with the rest public transport network	Men	21	4.81	0.981	-0.635	0.529
	Women	25	5	1.041		
Scenario 6: Increase of the reliability of the movements related with the station	Men	21	5	1.894	-0.318	0.752
	Women	25	5.08	0.812		
Scenario 7: Efficient support of people with disabilities	Men	21	4.05	1.024	-0.517	0.608
	Women	25	4.24	0.422		

5. Discussion and Conclusions

In the framework of the present paper, an effort was made to investigate the level of accessibility for people with reduced mobility at urban transport interchanges in Greece. Towards this direction, a review of policies and legislations related to accessible urban transport interchanges, at regional, national and European level was conducted, in order to identify key issues for accessible transportation hubs. Based on the review results, crucial issues for enhancing accessibility were indicated and further investigated in a representative Greek urban transport interchange, thus the Thessaloniki railway station, through an internet-based survey. The aim of the survey was to study travellers' point of view regarding the existing conditions at the Thessaloniki railway station, and record real needs, expectations and proposals for the reformation of the station.

Most of respondents addressed the low accessibility for disabled people, as they indicated the non-existence of blind guides (86%) and ramps (47%) along with personnel to support disabled movement in the interchange (78%). This is strongly linked with respondents' recommendations for reforming the station into a more accessible to disabled people one.

When evaluating the seven alternative mobility scenarios addressing accessibility, results showed that the movements of the respondents would be affected, and, specifically, it seems that interventions,

such the increase of the reliability of the movements related with the station and the existence of sufficient connections of the station with the rest public transport network, would increase the number of their movements.

This feedback could be further assessed by national, regional and local authorities and operators perspective, to open ground to a participative design process, able to meet expectations and real needs on all sides, towards the development of accessible for all urban transport interchanges.

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