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Airport Accessibility and Mobility: Infrastructures, Services and Perception of Passengers with Reduced Mobility

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Sofia Raquel da Silva Gaspar

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Orientador: Prof. Doutor Jorge Miguel dos Reis Silva

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Dedicatory

This dissertation work is dedicated to my parents and some special friends who always supported me and without whom I would not be what I am today.

Thank you very much!

“The world we have created is a product of our thinking; it cannot be changed without changing our thinking”

Albert Einstein

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Thank you all.

Abstract

The aviation industry has changed considerably since the 70s to the present. With the liberalization of the airspace, first in the United States and then in Europe, there was the opportunity for the entry of new airlines with new types of offer. However, the quality of services provided to passengers with reduced mobility has not improved as much as the quality of services provided to passengers without disabilities.

The right to accessibility is something that should assist all citizens. Transportation systems, in particular air transport, present some obstacles to passengers with reduced mobility, although there is legislation requiring the adaptation of airport infrastructures and aircraft for the safe and comfortable transportation of these passengers.

A demographic analysis focusing on the average life expectancy allowed to establish that due to the increase of the world population and to the aging process, the percentage of people with reduced mobility is expected to increase significantly in the coming years, becoming this a significant target-population that demands and justifies the investment in the air transport accessibility. Although there already are some changes in services and airport facilities, this tendency should be expanded to all the airports. The present study aimed to explore the service needs of passengers with reduced mobility and identify factors that inhibit them to travel in this type of transport.

Therefore, an analysis of various documents regarding these passengers' experience within the airport, since the airport entrance accesses to all the inside facilities, was developed to identify the main obstacles that compromise their rights. It was found that the terminals and their points of boarding and deplaning of the aircraft are the major obstacles in the land-air interface, as well as the use of services at the airport, which are always dependent on the help of a third person, compromising the passenger right to autonomy. In summary, this work is trying to improve air transport accessibility, through an analysis of the current situation.

Keywords:

Accessibility; Reduced Mobility; Autonomy; Airport.

Resumo

A indústria da aviação sofreu grandes transformações desde os anos 70 até aos dias de hoje. Com a liberalização do espaço aéreo, primeiro nos Estados Unidos e depois no continente Europeu, surgiu oportunidade para a entrada de novas companhias aéreas com novos tipos de oferta. Contudo, a qualidade dos serviços prestados aos passageiros com mobilidade reduzida não evoluiu tanto como a qualidade dos serviços prestados aos passageiros sem mobilidade reduzida. O direito à acessibilidade e à não exclusão social é algo que deve assistir a todos os cidadãos. Os sistemas de transporte, nomeadamente, o transporte aéreo apresenta alguns obstáculos aos passageiros com mobilidade reduzida, embora exista legislação que exige a adaptação de infraestruturas aeroportuárias e aeronaves para o transporte confortável e em segurança destes passageiros.

Neste trabalho foi feito um levantamento das normas atuais referentes às infraestruturas aeroportuárias e como estas devem estar preparadas para funcionar de modo a respeitar o conceito de acessibilidade, permitindo que os passageiros, cuja capacidade de se relacionarem com o meio e de o utilizar é limitada, se possam movimentar com segurança e autonomia.

Uma análise demográfica com enfoque na esperança média de vida permitiu constatar que devido ao aumento da população mundial, e ao processo de envelhecimento, a percentagem de pessoas com mobilidade reduzida é expectável de um aumento significativo nos próximos anos, tornando-se este um público-alvo de peso que exige e justifica o investimento na acessibilidade ao transporte aéreo, por ambas as partes ar e terra. Verificou-se também que os terminais e respetivos pontos de embarque e desembarque de aeronaves são os grandes obstáculos na interface terra-ar, bem como a utilização dos serviços no aeroporto que se revelam sempre dependentes do auxílio de uma terceira pessoa, violando o direito de autonomia do passageiro.

Este estudo pretendeu explorar as necessidades de serviços dos passageiros com mobilidade reduzida e identificar os fatores que os inibem a viajar neste meio de transporte, assim como encontrar soluções para os problemas existentes. Apesar de já existirem algumas mudanças nos serviços e instalações aeroportuárias, esta tendência deve ser ampliada e requer uma atenção constante a nível internacional. Em síntese, esta dissertação tem como finalidade analisar a acessibilidade existente no transporte aéreo para pessoas com mobilidade reduzida.

Palavras-Chave:

Acessibilidade; Mobilidade Reduzida; Autonomia; Aeroporto.

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List of Acronyms

ACAA	Air Carrier Access Act
ACAPO	Association of Blind and Partially Sighted of Portugal
ACI	Airports Council International
ADFA	Association of Disabled of the Armed Forces
ANA	Portugal Airports
ANAC	Portuguese Civil Aviation Authority
APD	Portuguese Association for Handicapped People
APCC	Coimbra Cerebral Palsy Association
ASQ	Airport Service Quality
DOT	Department of Transportation
EASA	European Aviation Safety Agency
EC	European Committee
ECAC	European Civil Aviation Conference
EU	European Union
FAA	Federal Aviation Administration
ICAO	International Civil Aviation Organization
INE	Statistics National Institute
INR	National Institute for Rehabilitation
ISO	International Organization for Standardization
ONU	United Nations Organization
PRM	People with Reduced Mobility
TTY	Teletypewriter
USA	United States of America
WHO	World Health Organization

Chapter 1 – Introduction

1.1. Motivation

Air transport is considered one of the main means of transport. Due to its characteristics (speed, flexibility and security), hundreds of millions of people use the airports every day, including people with reduced mobility (PRM) which face the greatest problems of locomotion in these infrastructures.

The lack of training, awareness and sensibility in human resources, prevents the provision of excellent services. The lack of policies to implement strategies to eliminate structural and communicational barriers affect the development of accessible infrastructures.

Air transport evolution, including its extension to population with some permanent or temporary disability, has brought new offers, development opportunities and at the same time great challenges, to this means of transport.

Society seems to forget that disability may arise at any time in life of an individual and can strike anyone, whether in the event of an accident or even during old age. It is intended that instead of continuing to consider disability as a condition, to focus on the social, economic, cultural and political obstacles that society presents to the individual.

Studies about Accessibility at airports can contribute for the creation of new quality offerings, and build and expand a new complementary market. This analysis can help airports to become more accessible, it can economically benefit airports and countries concerned with the costs associated to these passengers (with increased revenue), and it can stimulate a change of mentality in relation to discrimination and marginalization of people with special needs.

This research is also motivated by a need of new information about practices and ideas being developed in the last years.

1.2. Objectives

First of all, this work has as one of the objectives the collection of as much information as possible about airport accessibility, in order to improve access in the airport land side, thus facilitating the flow of passengers with reduced mobility. As such, accessibility issues should be analysed carefully in airports infrastructures to increase PRM mobility at these places, therefore contributing to social integration and respect for all citizens' rights.

One of the objectives of this thesis is also to raise everyone's awareness for the problem of reduced mobility in air transport; to analyse this concept and reflect on the "state of the art" (concerns legislation and initiatives on this theme) in Portugal and abroad; and to identify the measures that should be adopted to comply with the existing legislation. Analyse the interventions already made and find new solutions in accessibility's context, and identify guiding documents (concerns national and international references) on accessibility for people with disability. Contribute to better disseminate this theme, highlighting and emphasizing the disabled conditions.

Other of the objectives is to understand mobility-impaired persons within the air transport, and consequently to examine their perception about airports and respective services, that is, through an online survey aimed at individuals with reduced mobility attending the air transport, as well as to analyse accessibility conditions on national airports and assistance service provided to these passengers on the basis of the accessibility criterion in order to validate the results collected during the survey.

Thus, in addition to a survey, a field work will be made in order to collect the dimensions of facilities and observe the real constraints faced by PRM in these airports. With the objective of analysing the functioning of assistance service in national airports, a trip accompanying one person with reduced mobility will be made.

In short, this research wants to deepen knowledge on air transport accessibility problem, to understand what is the dimension of the problem, what is the level of service offered by stakeholders, which achieved targets and plans to put into practice.

1.3. Dissertation Structure

The first chapter is divided into three sub-chapters, the motivation, the objectives, and the structure of the dissertation.

The second chapter contains the state of the art. It focuses on the concept of accessibility and reduced mobility, generally describing what it involves. This chapter analyses the existing legislation, national and international, regarding the rights of people with reduced mobility. Lastly, in the second chapter stands out different types of barriers that PRM have to face when they want to travel and the final part explain the assistance service for passenger with reduced mobility existing in Portugal compared to other service existing in another country.

In the third chapter are addressed restrictions and travel inhibitions of PRM. It is possible to observe the survey analysis, and the results obtained from the visit to two national airports as

well as the results of the travel accompanying one passenger with reduced mobility to analyse the functioning of assistance service for these passengers.

The fourth chapter presents the discussion of third chapter. These results show the difficulties that passengers with special needs have to overcome during a plane trip.

In the end, the last chapter corresponds to the dissertation synthesis, the final considerations and the projections for future investigation in the field of accessibility, and it aims to raise awareness of the problem of reduced mobility in air transport.

Chapter 2 – Literature Review

2.1. Introduction

International agreements and treaties have been signed on this issue, but when United Nations, in the Universal Declaration of Human Rights proclaimed and agreed that everyone is entitled to all the rights established therein, discrimination was recognized against any person based on disability, as a violation of the dignity and value of human person.

Since there is legislation that protects the rights of special passengers, one of the goals of this thesis is to identify the measures that should be adopted to comply with the law to guarantee these rights. The chapter 2 will be an analysis of several technical documents developed by relevant authorities which contains national and international legislation, as well as an analysis of the regulation on the rights of disabled persons and persons with reduced mobility in air transport issued by European Parliament and the Council.

In this chapter are also listed the different types of barriers faced by people with reduced mobility when they travel, as well as the existing assistance service that aims to help the PRM to face these obstacles and reduce the current discrimination in air transport.

2.2. Accessibility and Reduced Mobility

In this work, there is a need to understand some basic concepts, especially the concept of accessibility associated to reduced mobility. Accessibility is not associated exclusively to people with disabilities, because at any time of life the health we have today cannot have tomorrow, and so anyone can become dependent of others help (World Health Organization, 2011).

It can be said that awareness of the specific needs of people with disabilities is the beginning of solving the problem of inclusion, as well as a change of mentality sign, because accessibility is mainly a problem of solidarity. It is considered as an environmental number of characteristics edified to allow its use by anyone, regardless of their physical, sensory or intellectual abilities (World Health Organization, 2011). Accessibility means making possible the participation of persons with reduced mobility in all activities of the society, in other words, all the people who have a disability, physical or psychological limitation, temporary or permanent. Therefore, promoting accessibility is promoting the elimination of barriers providing conditions that allow the use of all equipment and spaces with autonomy and safety (McKercher et al., 2003).

According with Article 9 of the Convention on the rights of persons with disabilities, Member States shall adopt appropriate measures to ensure access to PRM, on equal basis with others

citizens, to the physical environment, to transportation, to information and communications systems, including technology and other facilities and services open or rendered to the public (World Health Organization, 2011). These measures include the identification and elimination of obstacles and barriers to accessibility. Applying these to air transport, the PRM have a journey according to the concept Seamless, i.e. comfortable, safe and interruption travel by providing adequate assistance to their personal needs (ICAO, 2013).

In other words, to ensure the success of social inclusion process, similarities and differences must be understood in order to establish a good relationship between all people. Based on these assumptions about social inclusion, it should not separate passengers with reduced mobility of the passengers without reduced mobility. Since the public spaces are common, accessibility should be guaranteed for all (McKercher et al., 2003). This way ensures the increase of interaction possibilities between the various segments of society and PRM. Thus, at the airport it must be possible that the passenger can move safely and autonomously even if specific equipment is required to do that.

The convention on the rights of persons with disabilities recognizes disability as an evolving concept and it results from the interaction between persons with impairments and attitudinal and environmental barriers (European committee, 2006). These barriers are preventing PRM from being able to participate in society. Persons with disabilities include those who have physical, mental, intellectual or sensory impairment (World Health Organization, 2011).

Discrimination based on disability means any distinction, exclusion or restriction based on disability that would have the effect of preventing or nullifying the recognition on an equal enjoyment or exercise of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other. This definition also includes the denial of reasonable accommodation (World Health Organization, 2011).

Humans are all different because some characteristics such as skin, hair and eyes colour are different. Additionally, there are other significant differences, such as the lack of an arm, a leg, the inability to see, hear or walk, or difficulty to understand the world due to permanent or temporary limitations make it impossible to have autonomy in everyday situations (Gregg et al., 1991). However, despite being born different, we have equal rights and duty to respect the differences. Disability is caused by several reasons. There are cases of people who are born with some kind of disability and there are other cases in which disability is motivated by the physical or biological changes that may arise through the years. There are also deficiencies caused by disease or caused by an accident (Gregg et al., 1991).

It should be emphasized that there is a difference between having reduced mobility and having disabilities, i.e., having reduced mobility does not necessarily mean that the person is disabled, it signifies that the person has limited mobility or an effective reduction of flexibility,

coordination and perception, temporary or permanent. Although many of documents designate persons with reduced mobility and disabled people as synonyms, in fact these are different terms. It can be said that a person with disability is a PRM, but a PRM is not necessarily a person with a disability (World Health Organization, 2011).

Sometimes it is not a disability which causes the need for adaptation of a person. An elderly, for example, is not a disabled person, but he has difficulty getting around for places with stairs, unevenness and other impediments to free circulation in environments. This happens because due to aging they are more likely to acquire some diseases such sclerosis, heart disease, arthritis, among others. Well as articulations weaken and it becomes more difficult locomotion (Mein et al., 2014). Therefore, the elderly need easier access, which greatly facilitate life of those who have reduced mobility.

Another example is an obese person. This person also has some difficulties when the issue is circulating out there. Several problems appear in a simple walk, because many places have very steep steps or ramps hindering the mobility of these people (Forhan and Gill, 2013).

The Regulation (EC) no. 1107/2006 (European committee, 2006) defines person with reduced mobility (PRM), any person whose mobility when using transport is reduced due to any physical disability (sensory or locomotor, permanent or temporary), intellectual disability or impairment, or any other cause of disability, or age, and whose situation needs appropriate attention and the adaptation to his or her particular needs of the service made available to all passengers. It can be stated that a person with reduced mobility has a limited ability to relate with the environment and using it, are example the elderly, the disabled, pregnant women, obese etc.

- **Physical Disability**

There are different types of physical disability (Gregg et al., 1991), usually it is the same as mobility-impaired: paraplegia (total or partial paralysis of the legs and lower body, typically caused by spinal injury or disease), tetraplegia (total or partial paralysis of all four limbs), cerebral palsy (a condition marked by impaired muscle coordination or other disabilities, typically caused by damage to the central nervous system), amputation (total or partial loss of one or more members of the body), dwarfism (people of small stature which have serious mobility problems in cities planned for people with middle or high stature), etc.

- **Visual Disability**

There are many types of visual impairment (Gregg et al., 1991). Some people have defective sight in which objects cannot be properly seen. There are people who are not totally blind, instead, they have what is mentioned to as low vision, i.e., permanently reduced vision that cannot be corrected by medicine methods (glasses, contact lenses, surgery), but they are able to use reduced vision for planning and execution of a task. And, people who are unable to see (sightless).

- **Hearing Disability**

Hearing impairment is a reduction or absence of the capacity to hear certain sounds, at different levels of intensity (Gregg et al., 1991). Hearing loss characteristics are dependent on the type and severity of causes and depending if it is acquired before or after the speech.

- **Intellectual Disability**

Intellectual disability or cognitive-impaired (Gregg et al., 1991), consisting of mental functioning significantly below average originated from the development period, simultaneous with limitations associated with two or more areas of adaptive behaviour or everyday social and practical skills, in the following areas: communication, special cares, family performance and commodity, independence in the mobility, health and safety, school performance, leisure and work.

- **Multiple Disabilities**

Multiple disability is an association of two or more disabilities (Gregg et al., 1991): intellectual disability associated with physical disability; hearing disability associated with intellectual disability and physical disability; visual disability associated with physical disability.

2.3. Passenger Rights

People with reduced mobility represent a significant and growing percentage of the world population and are the largest minority in the world. According to World Health Organization, there are approximately 7 billion people around the world and 1 billion people have some kind of disabilities (World Health Organization, 2011). It should be noted that this number is increasing with population growth, medical advances and the aging process. For the first time

in history, most people can expect to live into their sixties and beyond. By 2050, the world's population aged 60 years and older is expected to total 2 billion, up from 900 million in 2015. Today, 125 million people are aged 80 years or older (United Nations, 2015), as shown in figure 1.

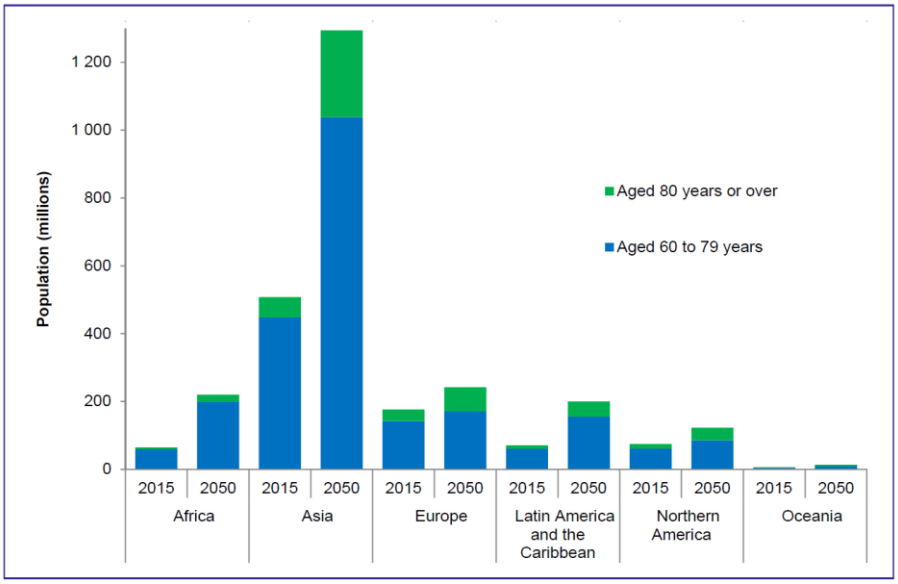


Figure 1: Estimated growth of older persons between 2015 and 2050 (United Nations, 2015)

In Portugal, according to data from the National Statistics Institute in 2011, approximately 40.5% of people between 15 and 64 years old had at least one health problem or a prolonged disease and 17.4% had some difficulties in performing basic activities. According to the results of the 2011 Census, about 50% of elderly people have difficulty or are unable to perform all day-to-day activities (National Statistics Institute, 2011). Musculoskeletal problems and difficulties in mobility, especially walking and climbing steps, were the main health problem and the major difficulty of the survey population (National Statistics Institute, 2011). As shown in figure 2, advancing age increases the number of difficulties in carrying out the basic activities.

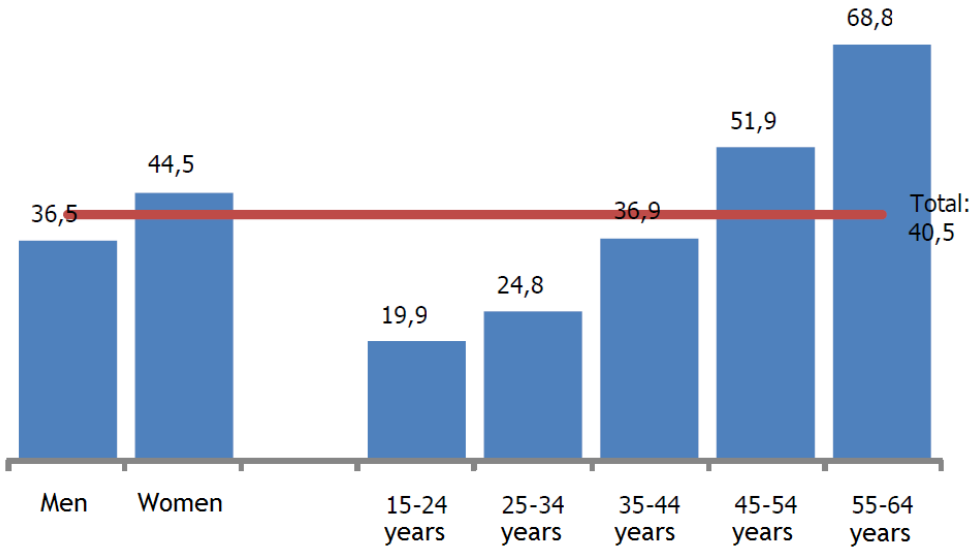


Figure 2: Percentage of people with health problems by gender and age group (National Statistics Institute, 2011)

For a long time, the inclusion of people with disabilities was seen as an isolated problem, it was the family and the specialized entities responsible for their care. However, institutions and concerned groups have emerged to integrate these people the best possible way. Accessibility affects everything in society. The quality of services adapted in terms of accessibility to get people with disabilities (elderly, sick, disabled, children, etc.) begins today to be seen as an opportunity. This type of service is a very important success differentiator when it comes to competitive advantages (Ray and Ryder, 2003).

Due to the aging population, promoting equal access to employment and other integration policies, there is a significant increase in people with reduced mobility with economic conditions to travel (Ray and Ryder, 2003). In this sense it is necessary to continually study, minutely, the needs of the persons with special needs, in order to subsequently obtain positive responses to their requirements.

Currently, the legislation establishes general rules and criteria promoting accessibility for people with reduced mobility. It is essential to get compliance with legislation and adequate airport infrastructure to these passengers to move with autonomy and independence.

In 2006, the United Nations adopted the International Convention about the Rights of Persons with Disabilities that expressly prohibits all forms of discrimination based on disability. Discrimination is a violation of human rights that can be expressed by attitudes and individual behaviours, or institutional policies and practices (Preston and Rajé, 2007). Participation in society is a right of all individuals. Thus, the implementation of strategies to minimize the physical and attitudinal barriers becomes a responsibility of the whole community (Preston and Rajé, 2007). The air transport is an international business and so, airlines that fly to different countries must follow local laws and regulations, due to the bilateral agreement.

2.3.1. National Legislation

The right to non-discrimination is enshrined for all citizens by the Constitution of 1976 and in subsequent revisions. Although Article 13 of the Constitution does not specifically mention disability as a foundation for discrimination, this clause is generally interpreted as including disability (Constitutional Law 1/2001). The prohibition of discrimination based on disability was most recently implemented in two juridical documents - Prevention, Rehabilitation and Integration of People with Disabilities Law (Decreto-Lei 38/2004) and Antidiscrimination Law (Decreto-Lei 46/2006). These decrees forbid direct and indirect forms of discrimination based on disability and present the principle of affirmative action or positive discrimination, as a way to compensate structural inequalities faced by people with disabilities. The Decree-Law no.38/2004 requires that State and other public and private entities provide information in accessible formats to people with disabilities, including sign language for example. According to Antidiscrimination Law, to deny and limit access to public transportation is expressly forbidden (Decreto-Lei 46/2006).

The Accessibility law, i.e., the Decree-Law no.163/2006 of 8 August presents a number of normative provisions designed with the intention of offering higher quality of life to people with disabilities by removing barriers on the road and public spaces, collective facilities and buildings, thereby contributing to improve accessibility to persons with reduced mobility (attached). Consequently, this Decree also requires that all transport infrastructure (including airports) be accessible to people with disabilities (Decreto-Lei 163/2006). Deadlines for the implementation of accessibility standards vary according to the year of facilities construction. After these deadlines, non-conformance with accessibility standards is sanctioned. However, exceptions exist in this law as the elimination of architectural barriers if it is disproportionally difficult, requires disproportional (or not available) economic and financial means, and even if the implementation of accessibility standards affecting significantly the cultural and historical patrimony (Decreto-Lei 163/2006).

There is still a decree, Decree Law no.135/99, about priority attendance. In accordance with this law, the priority attendance should be given to the persons with reduced mobility, i.e., elderly, unhealthy people, pregnant women, people with disabilities or accompanied by children and other cases with priority service needs (Decreto-Lei 135/99).

According to the Decree Law no.145/2007 (April 27), ANAC is responsible for informing users and operators in the public sector about aspects concerning them. This authority determines the creation of appreciation mechanisms of all user complaints from the operators and check their functionality (Decreto-Lei 145/2007). It should also ensure compliance with regulations

and legislation protecting the rights of air passengers, namely, Regulation (EC) No. 1107/2006 concerning the rights of passengers with reduced mobility.

2.3.2. International Legislation

Around the world there are several aeronautical authorities which regulate air operations within their territories. In case of Portugal, ANAC is the authority responsible for regulating air transport in the country. In the United States, there is the Federal Aviation Administration (FAA) which regulates aviation in its territory. In Europe, there is the European Aviation Safety Agency (EASA) whose purpose is work and legislate to ensure flight safety. Both authorities, FAA and EASA, basically set the standards and rules to follow in the world of aviation and in regard to training of all stakeholders in civil aviation, they are very strict in their criteria for obtaining certificates, licenses and approvals. Above all these regulators is the International Civil Aviation Organization (ICAO) laying down the general guidelines for global aviation.

The Federal Aviation Administration (FAA) in the United States (Chang and Chen, 2012a) recommends that airports, airlines and administrators as the airport infrastructures and airline employees are fully prepared and trained to deal with emergencies and evacuation situations of passengers with reduced mobility. The on-board bathrooms and the bathrooms inside the airport infrastructures should be fully accessible to passengers with reduced mobility, being equipped with grab bars and extensible wide doors. Airports should have available wheelchairs or other kind of motorized equipment in entry and exit areas of the terminal for the use of passengers with reduced mobility. It also recommends that in all airport gaps or stairs should exist ramps large enough to accommodate a wheelchair or cart. However, not all airlines and airport operators follow the recommendations of FAA (Chang and Chen, 2012a).

The Air Carrier Access Act (ACAA) in the United States obliges the foreign air carriers to have facilities, aircraft and accessible services for disabled passengers or passengers with any kind of disability (Chang and Chen, 2012a). The ACAA applies to all flights to and from the US, as also prohibits the discrimination based on disability in air travel and requires the accommodation of these customers by the air carriers. The Airlines cannot limit the number of disabled passengers on a flight but they may require an advance notice, up to 48 hours before, if there is need for preparation of certain accommodations that require time organization. The Department of Transportation (DOT) of the United States interprets and applies the Access Act, with the issuance of the regulation 14 CFR Part 382 in force since May 13, 2009 (U.S. Department of Transportation, 2003).

As the Regulation (EC) No 1107/2006 on the European Union, the Regulation 14 CFR Part 382 does not allow airlines to refuse a passenger based on their disability, except for duly justified

safety reasons (U.S. Department of Transportation, 2003). The Regulation 14 CFR Part 382 maintains that an airline can legally require a passenger to travel with a safety assistant after this request to be physically helped. In some cases, boarding/deplaning assistance should be provided according to safety and passenger needs using means and appropriate equipment. When the capacity of autonomy of a passenger to travel safely generates doubts, the airline may require a medical certificate that clearly states that the passenger is clinically stable for that. There are different perceptions depending on the airlines or check-in staff, they may allow them to travel alone or refuse boarding, what will force them to cancel the flight. The most affected passengers are those whose autonomy raises doubts at the check-in counters and do not provide a medical certificate at the time. It is necessary to ensure that the facilities of the terminals that allow access to air transport are easily accessible and usable by persons with reduced mobility. It must exist in all audio-visual monitors located somewhere in the terminal, high-contrast subtitles in order to be visible, so that, the information is equally accessible to all passengers (U.S. Department of Transportation, 2003).

The UK Department for Transport sustain that employees should receive an adequate training to the functions they perform, and must have the knowledge of the relevant legal rights (Chang and Chen, 2012a). The training of these employees should begin before they start their job and should be updated at regular intervals of time. Thus, training should include information based on a number of deficiencies that may even be hidden or barely visible, it should also include necessary skills for providing assistance to passengers with reduced mobility, allowing the team to deal with unexpected situations. This training should arouse employees to attitudinal, environmental and organizational barriers that people with disabilities have to deal, and should suggest proposals to eliminate these difficulties and establish access audits (Chang and Chen, 2012a).

In the European Union (EU), Regulation (EC) no.1107/2006 reinforce the rights of passengers with disabilities and reduced mobility on air transport. This regulation states that all airports in the European Union should be comparable in terms of accessibility to passengers with disabilities or reduced mobility. This Regulation (European Committee, 2006) should not affect other rights of passengers established by other regulations, in particular Regulation (EC) no. 261/2004 of the European Parliament and Council, February 11, establishing common rules on compensation and assistance to passengers in case of denied boarding and cancellation or delay of flights. If an event origins similar right to repayment or rerouting in both regulations, the passenger must choose and exercise that right only once (European Committee, 2004).

The passenger should notify the airline of their particular needs with 48 hours in advance to the flight. In the absence of notification, the managing body shall make all reasonable efforts to provide the necessary assistance. At airports the assistance should enable disabled persons and persons with reduced mobility to proceed from a designated point of arrival in airport to an aircraft and from the aircraft to a designated point of departure from the airport, including

boarding and deplaning. It is essential that in these points clearly identified, the PRM be able to obtain basic information about the airport, announce their arrival at the airport and request assistance (European Committee, 2006).

This regulation (European Committee, 2006) states that a person with reduced mobility should have opportunities to travel by plane similar to those of other citizens, for such point, at the airport and inside the aircraft the adequate assistance for these people should be given in order to support their specific needs, using personal and all necessary equipment, free of charge. The assistance for passengers is the responsibility of the airport management entities and should be organized in order to avoid interruption and delays. The air transport information should be given in the same languages that are available to normal passengers in alternative formats accessible to all persons with disabilities and reduced mobility. In the case of loss or damage of wheelchairs or other mobility equipment during handling at the airport or on-board the aircraft, the passenger to whom the equipment belongs should be compensated.

Airlines and airport authorities should ensure that all staff providing direct assistance to disabled persons and persons with reduced mobility have knowledge of how to meet the needs of PRM. These entities should provide all staff working at the airport in direct contact with passengers training on equality of treatment of people with special needs and raising awareness of disabilities, as well as ensuring that, upon recruitment, all new employees receive training on disability, and that staff receive an update training from time to time (European Committee, 2006).

Regulation (EC) no. 1107/2006, claims not only the importance of designing airport infrastructure and aircraft accessible to PRM but also the importance of the renovation of existing ones in order to take into account the needs of PRM. The European Commission of transport considers that these measures proposed in regulation (European Committee, 2006) are an effectively response to the needs of a growing sector of the population. As much the proposals of the European Commission as the measures proposed in the regulation are in agreement on the prohibition of denying reservations and boarding of elderly or disabled passengers based on discrimination, ensuring they are entitled to get free assistance in airports and on board aircraft. However, this regulation (European Committee, 2006) concerns that the transport can be denied to these passengers for justified reasons such as security reasons and under the law, for example when the size of the aircraft or its doors make it physically impossible to carry. So, some airlines rely on Regulation (EC) no. 1107/2006 to deny boarding to severely disabled passengers when they travel alone. In case of denied boarding or refused booking for justified reasons by the airline, its agent or the tour operator should provide efforts to propose an acceptable alternative to the passenger. If the denied boarding was only justified with the disability condition, the reduced mobility passengers have the right to be reimbursed, as well as, the person who is supporting him. If the passenger considers that the regulation was

infringed, he can claim to the airport operator, the concerned air carrier, or to the Member State organism responsible for applying sanctions.

It should be noted that the Member States must supervise and ensure compliance with this regulation. It is crucial that Member States establish legal sanctions applicable to infringements of the Regulation and to guarantee that they are applied (European Committee, 2006).

There is also a guide with recommendations on services and features needed to meet the needs of persons with reduced mobility in air transport "Manual on Access to Air Transport by Persons with Disabilities" (ICAO, 2013). In accordance with this guide, the service request by PMR should be professional and "seamless", i.e. no points where these people can be abandoned or unattended. For this to occur the operators of airports and aircraft should consult and consider the involvement of organizations representing people with special needs in the development and assessment of services and training programs and in the conception of systems and equipment to ensure that people special needs have equal access to air transport. The body responsible for the enforcement of rules and guidelines shall carry out regular checks of customer service to guarantee that standards are maintained and improved, and ensuring that rights of persons with reduced mobility are respected (ICAO, 2013).

- **Training**

Training for all staff providing air transport services is essential to offer quality and respectful service to people with disabilities. It is vital that workers know their responsibilities and are able to perform them. Training should approach the behavioural, environmental or physical and organizational barriers affecting PMR in air transport, as well as emergency procedures in evacuating those passengers with special needs (Guerrinha et al., 2015). It is recommended that aircraft and airport operators offer this training regularly, i.e., annually or every two years, to recycle knowledge (ICAO, 2013).

This training should include an understanding of disability and diversity, namely, learning disabilities, cognitive problems, physical disabilities, hearing impaired, visually impaired, etc. So they must be able to provide information in an appropriate format. Staff should also be unaware of existing national and international legislation and regulations for passengers with reduced mobility (ICAO, 2013).

- **Accessible Information**

Information should be published guidance material on air transport in appropriate formats and technologies to different types of disabilities, such as electronic, web-based accessible, in large print and audio, without additional charge. This information include, hours of operation, location of designated parking areas, local drop-off and areas pick-up, the phone numbers for accessibility information, wheelchair services or electric cart, place of relieving areas for animals service, the inter-terminal transport access, accessible ground transportation, pass by fellow not travel, complaint resolution services, notice requirements, check-in and flight departure times, requirements for transporting locomotion aids, the types of services available at the airport and in flight, including the available loading equipment (ICAO, 2013).

The information counters should be accessible to all persons with reduced mobility. Airport and aircraft operators shall also ensure that the machines check-in kiosks or under their control are accessible and identified with the universal symbol of accessibility. These authorities shall also ensure that public announcements regarding delays, schedule changes, gate changes, connections and baggage claims are made verbally and visually. The monitors must be installed to be easily seen and to avoid glare by PRM, including those who use wheelchairs. The information displayed on monitors must be in simple language, accessible, and should avoid the use of acronyms (ICAO, 2013).

- **Planning and Construction/Renovation of Airports Facilities**

Airport operators must ensure that, from planning to construction and renovation of airport facilities, they respect accessibility standards. It is necessary to provide seating in waiting areas for people with special needs, since seats should not be placed where it blocks the evacuation routes. These entities should ensure that new barriers are not created and any obstruction is removed (ICAO, 2013).

Airport authorities must incorporate wayfinding methods which are appropriate for people with disabilities, for example, visual contrast, detectable (e.g. tactile) patterns on floors and walls indicating direction, arrangement of architectural elements such as walls and columns, etc. These facilities, designed for people with disabilities, should have adequate signage. It should be noted that it is also important to ensure that in the airport there is an area available for service animals to relieve themselves (ICAO, 2013).

- **Adequate Signage**

Airport operators must ensure, when people with special needs reach an airport, a clear signal allowing to find their way around easily through airport and route to toilets, emergency exits,

elevators, stairs, accessible communication systems, etc. The signs should have letters or symbols free of glare in high contrast colours and a universal font and size. These must be supplemented by Braille wherever possible. Signs should be placed where they can easily to be seen by PRM, including wheelchairs users (ICAO, 2013).

- **Boarding/Deplaning**

Aircraft and airport managing team must provide regular updates to PRM on the status of their flights and inquire about their needs, for example every 30 minutes. All safety procedures must be reported verbally or visually according to the case. If the national security regulations allow, airport operators must be able to provide temporary passes to persons who are not travelling, for PRM can be accompanied by a person of their choice in addition to aircraft operator or terminal personnel through secured areas boarding gates. People needing assistance should have the opportunity to board before other passengers and deplaning after them. This method is generally more dignified and less stressful for the passenger and more efficient for aircraft operator (ICAO, 2013).

The PRM has the right to be helped during boarding and deplaning. This help takes account of transfer the disabled person's own wheelchair to a boarding chair or other kind of mobility aid provided by the airport or aircraft operator, allocation of a disabled person from his wheelchair or mobility aid to his aeroplane seat and vice-versus, assistance with baggage, including the support in immigration and customs procedures as well as assistance in main public areas such as bathrooms, stairs, etc. Whenever a PRM request for help, they should be attended by the airport staff mainly to reach a connection flight where sometimes the schedules are very short (ICAO, 2013).

- **On Board**

Aircraft authorities must maximize the accessibility level in the construction and refurbishment of aircraft, choosing design options and features that meet the needs of people with reduced mobility, for example, accessible bathroom and tactile directional signage around the cabin to assist passengers with visual disability locomotion, as well as boarding stairs with handrails on each side and steps with anti-slip surfaces. The aircraft must have seats which are designated as accessible for PRM. These seats must be occupied by other passengers at the last moment (ICAO, 2013).

Sometimes, people with disabilities need a service animal, consequently there is a need of having seats with sufficient space for the animal to remain on the floor where the passenger’s

feet rest. If there is no appropriate seat on the flight, airport operators must suggest other options to the passenger, e.g., travelling on another flight with a more spacious seating. These entities should not require costs for transporting service animals (ICAO, 2013).

Safety briefings or other information must be provided individually for persons with reduced mobility, as requested or required in order to meet passenger needs (ICAO, 2013). As indicated in the Regulation (EC) no. 1107/2006 there are security reasons which can determine necessary for a disabled person to travel with an assistant, for example, in order to understand and respond to safety briefings, or to assist an emergency evacuation. Another reason is that staff do not provide personal care (e.g. assistance within the bathroom or feeding), some people who need this care must travel with an assistant during the flight (European Committee, 2006).

- **Damaged or Lost Equipment**

In the event of damage or lost mobility aids and if it is not available for a passenger at the moment of their arrival, airport operators must provide a temporary and free replacement of the equipment until they repair it or refund the disabled person according as the applicable conventions (ICAO, 2013).

- **Complaints**

Airport and aircraft operators must have procedures available for people with disabilities to make complaints. These entities must accept verbal and written complaints, besides they have to ensure that the complaints procedure is accessible to people with disabilities who may need assistive technology, such as TTYs, for submitting a claim (ICAO, 2013).

2.4. Accessibility in Airport Infrastructures

According to ANA, airports have a quality policy, i.e., they have to provide services ensuring international quality standards in the infrastructures and to promote continuous improvement, especially, in terms of safety and aircraft operations, in order that these services meet and exceed customer expectations. This quality policy aims an increase of air traffic by means of appropriate marketing and improving services provided to passengers and airlines (ANA, 2012). In this sense, they should also provide services that maximize satisfaction of passengers with reduced mobility. Sometimes the movement through the airport means travelling long distances or get in unfamiliar facilities which can cause fatigue and/or disorientation. These conditions

are especially sensitive for those who have mobility problems (such as age for example), or even disability (Mein et al., 2014).

A passenger without reduced mobility to catch a flight, made the following route: He arrives early at the airport or by public transport, taxi or car, makes the check-in (if not already done it previously at home as recommended), and he does hold baggage registration. Then he has to confirm his identification (ID or passport) and boarding pass, and makes the passage through security and appropriate x-ray. Finally, with the number of the gate on the ticket is only paying attention to the screen indicating the opening of the gate, allowing the boarding on aircraft. However, the passenger with reduced mobility faces several difficulties during this route (Chang and Chen, 2012a). For solving this, it appeared services providing assistance to passengers with special needs at airports, in the case of national airports there is MyWay service, and within the EU Member States there are other similar assistance services.

For evaluating the airport accessibility, during route of passenger with reduced mobility, must be taken into account also: the modes of transport on airport access; circulation areas in access to the airport; available car park slots at the departures and arrivals infrastructure; personalized attendance to passenger with reduced mobility; ticket boarding passes; check-in; waiting areas; availability of PRM assistance equipment in loading and unloading; communication and signage; elevators; toilets; other spaces and general circulation areas.

2.4.1. Needs of Passengers with Reduced Mobility

It can be said that social exclusion is not due to a lack of social opportunities but it is a lack of access to those opportunities, for other words, as a basic condition for inclusion, it is essential to guarantee access for all people, without discrimination, in the normal activities of the society (Preston and Rajé, 2007). Living with a disability means challenges to travel because PRM have more things to consider and sometimes they have not the inner strength to endure the negative attitudes around them (McKercher et al., 2003). Participations in simple life situations involves complex interactions, including social and family attitudes, architectural structures, policies, and it involves the capacity of individual to surpass psychological and physical barriers (Lee et al., 2012).

There are a number of factors that influence the decision and the desire to travel common to all persons, such as personality, lifestyle, socio-economic and cultural characteristics. For PRM there is still a lack of accessibility to external barriers and obstacles that can be found in the respective infrastructures (Gaspar et al., 2015a). According to Yau, McKercher and Packer, the first step for participation of an individual with reduced mobility as an active member in society is this one accepts his own disability. When the person doesn’t accept her own condition she

tends to avoid public spaces, consequently, she will reduce her flight frequencies or will not travel. Personal acceptance is influenced by the support within the family and this support is also very important in all decisions on day-by-day (McKercher et al., 2004). If the PRM parents do not support his decision of flight, it will be necessary more persistence to surpass his own resistance but also the family resistance. “Once I needed to travel for a long distance and it involved taking a flight. My mother tried to stop me from going and said it was very dangerous. I had to persuade her many times even till the last day before my departure. She insisted that it would be dangerous and she worried that there would be no one to help me. She was so worried that she could not sleep for a few nights. Eventually, I did not go, as she had influenced my decision” (McKercher et al., 2004, pp.951).

Awareness of the needs of passengers with disabilities and the ability to communicate them effectively is an important step in removing barriers such as lack of information about accessibility and accessible facilities. The personnel involved in design, management and provision of services, needs to have a precise understanding of how their work affects people with disabilities, with knowledge and ability to ensure that people with reduced mobility are included (Gaspar et al., 2015b). One reason why many people with disabilities do not travel it is simply because the facilities are not physically accessible (Chang and Chen, 2012a). Therefore, to address this issue, in air transport, an environment without barriers should be provided at the airport terminal and on board the aircraft by airport operators and airlines, respectively.

Already in 1979, the Federal Aviation Administration of the United States after evaluating several problems associated with transportation of PRM concluded that for facilitating air transport of persons with disabilities would be necessary (Chang and Chen, 2012a):

• Airline and airport staff specially trained to deal with emergency situations, as the evacuation of passengers with reduced mobility;

• Toilets on board (at least one toilet) and into the airport terminals equipped with expansion port and grab bars;

• Wheelchairs or other motorized equipment should be available for the use of PRM at the arrival and departure areas of the airport;

• There must be stairs and ramps in every changes of level at airports. All ramps should be large enough to accommodate a wheelchair or trolley.

However, after all these years, according to Chang and Chen, there are not many airlines and airport operators to follow these recommendations. Information for disabled passengers is provided on their websites, but the services and accommodations differ between airlines.

Usually only flights of more than 5 hours are equipped with adapted toilets and wheelchairs to the PRM move inside the cabin (Chang and Chen, 2012a). This type of specific information is not always available on the websites of companies, as well as emergency evacuation procedures, seen as important to PRM, are not referenced (Chang and Chen, 2012a).

Y.C. Chang and C.F. Chen made a questionnaire to passengers with reduced mobility of Taiwan in order to understand their needs and concluded that due to the fact that PRM move slowly and unstable, one of the main priorities is to check the conditions of the floor at the airport in order to prevent falls (Chang and Chen 2011). In order to increase accessibility for PRM, ramps and elevators accesses should be always accessible, as much as, the availability of equipment (such as wheelchairs) near the entrance/exit ramps for these passengers' use. So, one of the main priorities is to have anti-slip floor in these infrastructures and ramps without obstacles. Other items are analysed such: seats selection, cabin seats, distance between the restroom and cabin seats on board, and inaccessibility of toilets (figure 3). This distance is inconvenient to persons without mobility, due to lack of wheelchairs on board, resulting an uncomfortable experience. The same happens if the toilets are not adapted to meet the special needs of such passengers. In spite of airlines keep high-priority places for PRM, usually, near the bathrooms and exit doors, sometimes it does not happen due to many reasons, such as, the delayed reservation by the passenger with reduced mobility or the reservation of these seats by other passengers justified by personal preferences. The priority and assistance of loading and unloading these passengers is also relevant in the terms of safety. In addition, according to the same study, the items that refer to the satisfaction of these consumers (PRM) are the attitudes of the cabin and assistance staff in loading and unloading, as well as the attitudes of the check-in staff. For a greater satisfaction, the passengers with reduced mobility should have priority or be treated separately from passengers in general, because the waiting area is usually very small at peak hours and often these passengers don't have an exclusive desk to support their needs (Chang and Chen 2011).

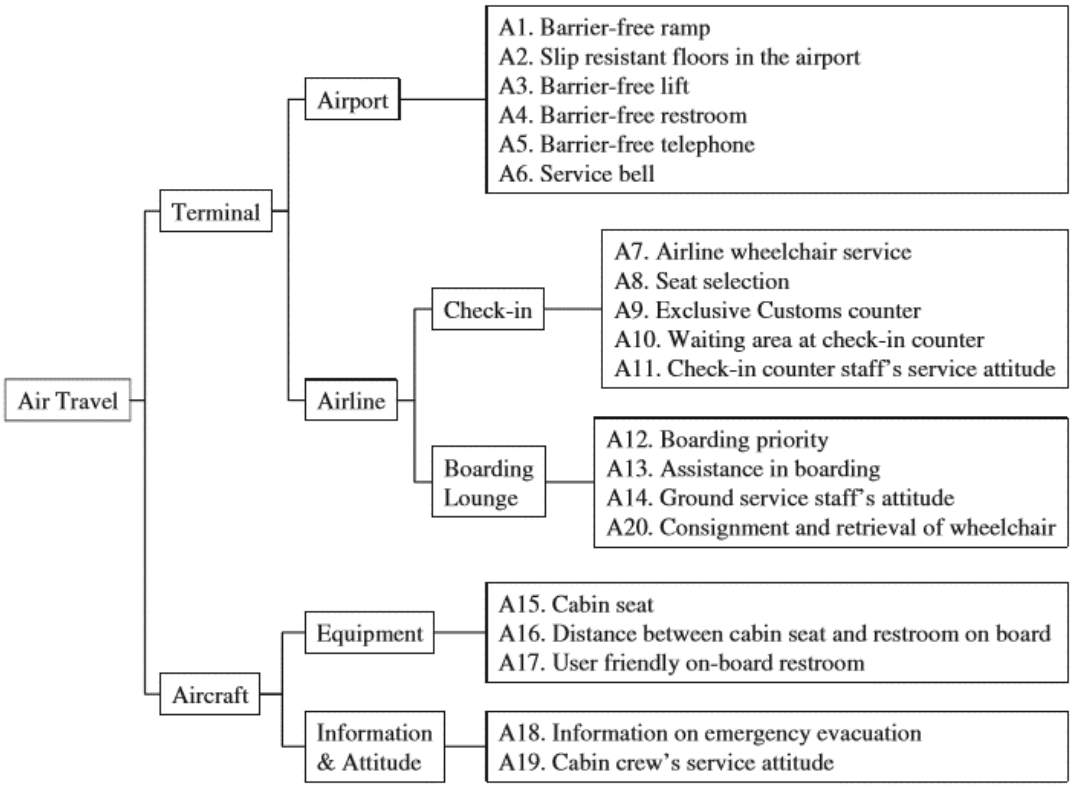


Figure 3: Facilities and services for PRM during an air travel (Chang and Chen, 2011)

The Chang and Chen study also reveals that distance between parking lot and terminal and accessibility between terminals are very important to Passengers with reduced mobility. For PRM, a successful flight depends on the quality of service provided along the number of points of the journey. Therefore, airports and airliners CEOs must recognize that a quality of service provided for people with disabilities could improve their business reputation and image. As such, the training programs continues to have the leading role, and should include: attitudinal, environmental or organizational barriers that people with disabilities face, and suggestions to solve these; principles of accessibility audits; information about the complexity of disability, including hidden or less visible disabilities; and the skills needed to assist passengers with special needs. Training should also prepare the staff to deal with unexpected situations, and should be provided before the employee starts his functions, and updated at regular intervals (Chang and Chen, 2012a).

- **Aging People**

The number of elderly passengers is increased and the explanation is people are living longer. This group is more expose to diseases and health problems which cause impact on an older traveller's ability to navigate an airport terminal because a general deterioration in physical and mental functions can be expected with advancing years (Mein et al., 2014). Aging travellers tend to be less flexible than young passengers. It can be noted that there are different

generations of aging people, for example, “young seniors” deal more easily with technology than “older seniors” (Mein et al., 2014). There are multiple factors that increase the complexity of the journey, namely, the signage. Even young and experienced air travellers when they are at an unfamiliar airport they have moments when locating a facility or service which seems an impossible mission, especially at large airports. When elderly people use remote parking facilities due to many reasons, for example, economic problems or lack of knowledge, they are exposed to the weather and have to walk long distances to the appropriate terminal entrance or probably there may be long waits for shuttle buses (Mein et al., 2014). Thus, fatigue is a greater issue and this also origins problems with dealing with baggage through the airport, and problems with check-in areas and security points. These points are particular stressful because they include waiting in line and prolonged standing, and then depositing personal items of clothing and handling luggage in tubs. Another frequent problem facing aging passengers is the long walking distances involved in getting to the gate and between gates. In order to resolve this problem, some terminals are reducing their escalators and replacing it with more elevators and ramps (Mein et al., 2014).

According to a research realized at Taoyuan International Airport in Taiwan from the perspective of elderly passengers, there are specific special needs that must be guaranteed (Chang and Chen, 2012b). Elderly people are commonly covered by the definition of passengers with reduced mobility, once they have often hearing and vision problems or mobility difficulties and also troubles in following and adapt to technological/automation advances. The special requirements for the elderly passengers should include more than announcement of cancellation and delay of flights. It should include information about emergency exits, special meals for seniors, information about the directions in the airport terminal, and information about the transport means to get in and out of the airport (Chang and Chen, 2012b). Elderly passengers are often not familiar with the type of service facilities when they are booking the ticket, including the catering services and the selection of seats, once automation of check in counters and kiosks at the airport have been increasing and further complicate air travel for these passengers. The ability to understand, read, listen to the information and instructions given at the airport is hampered by lack of vision and hearing as well as the decreased cognitive abilities. So often elderly people get lost in the airport, or feel unable to travel long distances in the terminal due to physical limitations of mobility. The constricted toilets facilities are other important reason to not travel (Gaspar et al., 2015a).

In order to satisfy the needs of these passengers (Chang and Chen, 2012b), some items should be taken into account in particular the importance of the attitude of the check-in staff, user-friendly boarding, seats selections, ground service team attitudes, exclusive customs counter and priority boarding. Y.C. Chang and C.F. Chen revealed that above all the needs that have to be guaranteed for the elderly passengers, there are some that actually are not being carried out by the airport infrastructure, like the special meals and the transmission of relevant

information. The importance of special services provided by airlines and airport authorities increases with increasing age of the passenger (Chang and Chen, 2012b). Thus, these entities should pay an immediate attention to improve facilities and services to meet the needs of the elderly passengers, with the aim of improving the quality of the travel experience of these customers.

2.4.2. Accessibility Constraints

There are reasons to believe that PRM wish to travel like anyone else, then airports and airlines should invest in this market segment. However, for these passengers to travel it must be taken into account existing barriers and constraints (McKercher et al., 2004). The PRM who travel represent a market segment that provides a mix of opportunities and challenges due to, for example, lack of specialized equipment, physical demands on the staff, extra time required by each customer, etc. However, marketing to travellers with disabilities also brings a market for new or modified products, such as, flexible mobility equipment more appropriate for travel or leisure activities (Ray and Ryder, 2003).

The decision to travel is based on a complex set of intrinsic variables, which may affect the decision-making process, such as the existence of any external barriers or obstacles that can be found along the way faced during the trip. An intention to travel is in part formed by overcoming various constraints that may be present in different phases of the decision-making process (Agarwal et al., 2012). For example, the search for information begins immediately after overcoming intrapersonal constraints, e.g. lack of travel desire, or religious beliefs, and interpersonal constraints, e.g. lack of company. Moreover, the intention to travel is the result of overcoming the constraints such as the lack of information about services are being provided and which could ask to be provided during the process of booking airline tickets, as wheelchair service or selection of seats, or information about accessibility in airport facilities, lack of opportunities, or lack of time (Agarwal et al., 2012). Thus, to promote the participation in air travel, the priority is to develop knowledge and comprehension of the constraints arising in the decision-making process.

Thus, there are several factors that inhibit passengers with reduced mobility to travel and use the airport infrastructures (Gaspar et al., 2015b). These factors include environmental barriers, such as, attitudinal, architectural and economical barriers; interactive and communication barriers; and intrinsic barriers which are able to represent the greatest obstacle because they are associated with the physical, psychological or cognitive functioning of each person. Culture and social attitudes about reduced mobility are different among people and between countries and can be the most difficult barriers to overcome (McKercher et al., 2003). When an individual is surrounded by negative and discriminatory attitudes, he can assimilate these negative

attitudes changing his vision of himself (McKercher et al., 2004). According to a research carried out for N. M. Ray and M.E. Ryder, in addition to the barriers, these special passengers must be prepared to deal with unexpected situations because a simple delay or flight cancellation can become a huge discomfort for all passengers but especially for passengers with disabilities whose resistance to deal with unpredictable situations is limited. "A few years ago, there occurred a terrible travel experience in the Denver airport because no flights were arriving and departing, no transportation was available to get to local hotels and even emergency medical supplies at the airport were depleted. Passengers were sleeping on the floor of the airport for several days and there was a passenger with reduced mobility in the airport. He had a spinal-cord injury and was a quadriplegic in a wheelchair. He had to literally sit up in his chair for 3 days, which quickly became immobile after its battery ran down. Another passenger complained that she was terribly uncomfortable, because she had recently undergone surgery and was unable to manoeuvre airports and crowds with her usual stamina" (Ray and Ryder, 2003, pp.57).

Sometimes, a major problem with the companies and airport operators is that when the wheelchairs are requested they arrive late or do not arrive at all. Occasionally, their wheelchairs and other mobility equipment don't arrive intact. The first travel experience is essential to convince the passenger to travel again or not. In other words, if the first travel experience is positive it means that the passenger surpassed the barriers imposed and will, probably, travel again. Sometimes when the constraints and barriers are not overcome and the passenger has a negative experience, feeling that he has no control over what happens to himself, this one can completely abandon the desire to return to travel, while another might continue to persist in their desire of travelling. However, if the bad experience is repeated more often even the most persistent can suffer a loss of self-confidence, lack of control, and exhibits feelings of helplessness regarding the trip (Agarwal et al., 2012).

Some important information for passengers with reduced mobility are published on websites of airlines, however the services and regulations are different and sometimes passengers with disabilities need to contact the airline's reservations central for more details (Chang and Chen, 2012a). One factor that may discourage a passenger to travel by air is the failure or lack of information provided in an accessible format. This is usually cited as a major problem experienced by people with disabilities (Agarwal et al., 2012).

The passenger with reduced mobility can spend a long time to make a reservation. If the passenger could not make the online reservation by lack of information or for any reason, he makes a reservation at check-in counters where he needs to explain his condition and he may be required to get a medical certificate or be refused the boarding (Chang and Chen, 2012a). In services and airport infrastructures it is hard to find restaurants, shops, restrooms, bathrooms and lounges in the gate area without barriers (Chang and Chen, 2012c). And, occasionally, as can also happen that disabled passengers needed to wait in line for passport control and safety inspection, and had no time for shopping at the duty free (Chang and Chen, 2012a).

Many people with disabilities do not use air transport because the facilities and services do not meet their needs (Chang and Chen, 2012c). If the barriers were eliminated in airport infrastructure and during the flight, the percentage of passengers with reduced mobility using air transport would increase (McKercher et al., 2004). According to a study carried out for Y.C. Chang and C.F. Chen, the procedures of air transport services can be divided into four segments as shown in figure 4: pre-travel, pre-flight, during the flight and post flight. Difficulties of any segment can completely discourage travellers with reduced mobility to take the journey (Chang and Chen, 2012a).

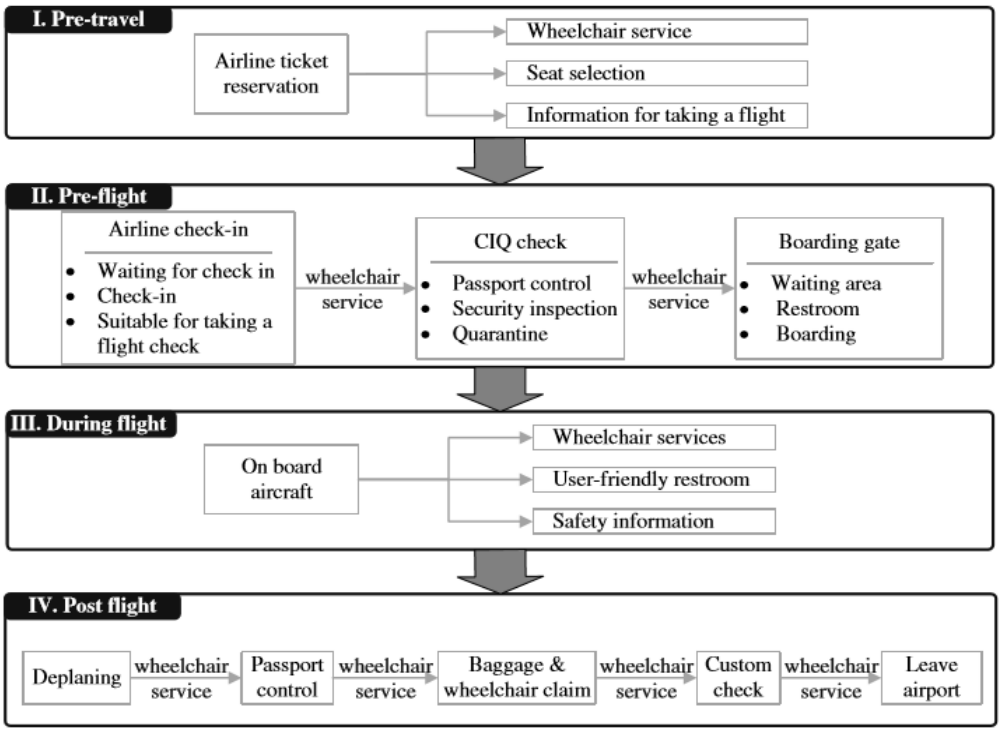


Figure 4: Phases of flight (Chang and Chen, 2012a)

2.4.3. Existent Accessibility Solutions/Services

MyWay is a service to provide personalized assistance to passengers with reduced mobility using air travel to, from or transiting through an airport located within a member state of EU. The MyWay service must be requested always 48 hours in advance of the flight in order that information is timely forwarded by the airline company to the airports involved which will provide the necessary assistance (MyWay, 2008).

ANA assures MyWay service with trained and qualified personnel, committing itself to comply with the quality levels of service, as proposed by the ECAC, i.e., at the moment of boarding "80% of these passengers should wait no longer than 10 minutes for assistance", "90% of these passengers should wait no longer than 20 minutes for assistance" and "100% of these passengers should wait no longer than 30 minutes for assistance" (after contact with the service previous

request). In case of deplaning, “80% of these passengers should wait no longer than 5 minutes for assistance”, “90% of these passengers should wait no longer than 10 minutes for assistance” and “100% of these passengers should wait no longer than 20 minutes for assistance”. If there is no previous request, no passengers must wait more than 45 minutes for assistance, after the beginning of landing (MyWay, 2008).

There is also a rule about boarding vehicles for persons with reduced mobility, ISO15845:2014, which assumes that a PRM “can be accompanied by at least one attendant” and “the design of the vehicle, with relevance to safety, are the consideration of psychological aspects, i.e. feelings of well-being and security, and the physical comfort of the passenger and the avoidance of panic” (ISO 15845:2014).

- **Boarding**

When arriving at the airport (at least 2 hours in advance), the passenger with reduced mobility should be looking for the indicated signage, i.e. the Designated Points of Arrival (figure 5) and inform the MyWay service he has come to the airport. There are several points along the access allowing to request the service. Each access point has a phone that will be immediately answered, so the passenger just has to identify himself to a MyWay staff to find him. If the passenger comes from another airport, to activate the service should do the same. During the journey in the airport, including check-in, security controls, border control points and boarding, the passengers will always be accompanied to their seats on the plane, and be entitled to personal assistance and luggage. This service offers to passengers the possibility of not wasting time, and not getting lost on the way until the gate. This accompanying does not preclude the PRM to make purchases in the Free-shop services, since a meeting between MyWay staff and passenger can be agreed. Thus, the passenger has the possibility to go shopping until the time agreed between them (MyWay, 2008).

Figure 5: Designated point of arrival (Trip Accessible, 2015)

- **Deplaning**

On Deplaning, the airline must notify the airport about the need for MyWay service, in order that the passenger has the right to receive personal and baggage assistance and to be accompanied from his seat on the aircraft up to a designated point of departure (figure 6), located in outside, in the arrivals area of the airport, along the transport access (MyWay, 2008).

Figure 6: Designated point of departure (Trip Accessible, 2015)

- **Mechanical Means**

The MyWay service is free to the user and includes both mechanical means facilitating mobility (airport van, airport boarding bridge, ambulift, or wheelchair into the aircraft) as qualified professionals (Trip Accessible, 2015). The airport van (figure 7) is used only when there is a long way on foot until the aircraft (Trip Accessible, 2015).

Figure 7: Airport van (Trip Accessible, 2015)

The airport boarding bridge (figure 8) is a device that makes the connection between the airport terminal and the aircraft allowing the entry and exit of passengers into a kind of tunnel, protecting passengers from rain and wind (Trip Accessible, 2015).

Figure 8: Airport boarding bridge (Trip Accessible, 2015)

There is also the ambulift, a vehicle with an incorporating elevator (figure 9). The passenger gets into the vehicle which shifts to the entry of the plane (Trip Accessible, 2015).

Figure 9: Ambulift (Trip Accessible, 2015)

Due to the dimensions of the aircraft's interior, the passenger must be transferred to a special chair, sometimes referred to as "aisle chairs" (figure 10), with the help of trained staff, and from this for the seat plane. Thus, the passenger's wheelchair follows in the hold with the baggage and will be returned after arrival at the airport. On deplaning, the passenger must be transferred back to his mobility equipment (Trip Accessible, 2015).

Figure 10: Aircraft wheelchair (Trip Accessible, 2015)

A manner similar to MyWay service, there are other services intended to make the airport infrastructures accessible to PRM, such as ELO System (figure 11). This system is being implemented in Brazil and it emerged to fight the discrimination existing at airports. While the MyWay service is focused on assistance to PRM, the ELO system is focused on adapting airport

facilities. Basically, it is a system of connectors, duly acclimatized, designed for connection at ground level between the gate and the aircraft (Infraero Aeroportos, 2014).

Figure 11: ELO system, a system of connectors (Infraero Aeroportos, 2014)

This system allows all passengers, including passengers with reduced mobility, transit simultaneously at the moment of boarding and deplaning with comfort, safety, accessibility and autonomy. In the final part of the connectors (figure 12) there is stairs and a lift access adapted to the special needs with capacity up to 225 kg (Infraero Aeroportos, 2014).

Figure 12: The final part of the connectors (Infraero Aeroportos, 2014)

2.5. Conclusion

Within the European Union, the rights of passengers with reduced mobility are ensured by a common regulation for all Member States. If their rights are not respected, passengers should contact the corresponding airline or airport. If necessary, the passenger can submit a complaint to the national authority of the Member State where the problem occurred. In Portugal, the Portuguese Civil Aviation Authority is the body responsible for the enforcement of the passenger rights relating to flights departing from national airports and flights from other countries to national airports made by Community air carriers. Companies operating outside the EU, regardless of their nationality, when providing services into the European space they must respect the existing rules.

The legislation on passengers' rights contains specific rules for people with reduced mobility, but sometimes the airlines refuse boarding or impose restrictions based on security reasons. Even in situations of delay, cancellation or overbooking, the law requires that priority on boarding should be given to these people. To avoid problems, the European Commission recommends that passengers inform the airline of their condition, with at least 48 hours in advance to flight, allowing the management of the service. The collection of the passenger assistance service infringes the regulation, so this service is free for PRM, since the costs of care are distributed equally by all passengers. It should be noted that companies may demand a medical certificate only in case of risk to the health or safety of the citizen and risk for other passengers or crew. Another issue is to require that the passenger travels with a companion, however this is only legal when the PRM are unable to fulfil the security and autonomy requirements. The PRM must also consider that airlines are not obligated to assist the person at the moment of the meals, taking medicines during flight, or providing assistance in terms of personal cares.

Taking into account the existing study material on the accessibility issue in airport infrastructures, it can be concluded, even though the authorities involved have been trying to provide more facilities and services for passengers with special needs, that many people do not travel because the facilities are not yet appropriated for their needs. According to existing researches, the main problems are dissuading people with reduced mobility from travelling are: the attitude of the service staff and the lack of specialized personnel; the architectural barriers; lack of information in accessible formats and lack of safety information on emergency evacuation.

It is important to have an awareness raising in Portuguese society concerning the disability issue to demystify preconceptions and negative or value stereotypes, recognizing a disabled person as a human being with absolutely equal rights. For that to happen it is essential to promote continuous training in accessibility for all professionals and staff working with people with special needs for a better assistance and services provided to these people, always respecting their rights. Within the scope of ensuring social inclusion, sometimes, it is necessary to perform "Reasonable adjustments", i.e., in most of the cases appropriate and rational modifications, in order to ensure that persons with disabilities exercise, on an equal basis with others, their rights and fundamental freedoms. To sum up, to have the best assistance possible, a PRM should plan their journey with time and explain to the airline all their needs in advance.

Chapter 3 – Case Studies

3.1. Introduction

Despite several efforts, people with reduced mobility are continuing to face barriers in their participation as equal members of society, and violations of their human rights around the world. Although more legislation and an increasing on concern for the rights of persons with reduced mobility has become, it seems that is not enough because problems are happening right now, in the twenty first century. Every day, air transport continues to impose heavy constraints on those passengers.

With the purpose of assisting in the assessment on airports accessibility, there will be carried out an online survey whose objective is to consider the perception of PRM on this issue.

In this work will be specifically discussed existing barriers at the Lisbon and Oporto Airports as well as the existing assistance service to people with reduced mobility. To solve the lack of accessibility in air travel there must be identified existing barriers in the different phases of flight: pre-travel, before the flight, during the flight and after the flight.

3.2. Methodology

In order to analyse PRM accessibility conditions within airports environment and the related assistance services provided to help their mobility: firstly, an online survey was conducted to understand the perception of PRM in air transport; and secondly a trip between two national airports was made by a PRM to evaluate the assistance service.

It should be noted that the airport infrastructures, namely Lisbon and Oporto ones involved in this study, are analysed accordingly with the "Mobility and Accessibility for All" guide developed by the author as in Annex 2. This guide is based on an already existing document created for a better understanding of the Decreto Lei no.163/2006 (SNRIPD, 2009).

3.3. Survey

The main thesis objectives are to include mobility-impaired persons in the air transport, and consequently to examine their needs through recent researchers and an online survey, as well as to examine accessibility conditions on national airports and assistance service provided to these passengers. Some possible conclusions seem obvious. After all, it would be much easier

for a person without reduced mobility to fly than a person with reduced mobility and accessibility conditions should be further improved in order to obtain an increase of mobility impaired passengers.

This survey to allow to analyse which services need to be improved. These questionnaires were divided into three parts, first, there were questions about nationality, age, gender, type of reduced mobility, then there were questions about personal opinion in terms of airport infrastructures and final part is about accessibility in aeroplane. These parts include multiple choice questions, as well as open answer questions as shown in annex 1. The respondents were required to indicate how they felt about constraints in airport and aeroplane using a scale rating from “Very important”, “Important”, “Indifferent”, “Something Important” to “Nothing important” and “Do Not Know”.

The online survey was complete by a large group of people in general, but the numbers of respondents with reduced mobility was also perfectly acceptable. To this end, it was necessary to contact associations and institutions linked to reduced mobility in order to share the online survey to as many people as possible. Thus, an email was sent to several national institutions, explaining the purpose of the study and asking if they were willing to take part in the survey; the link to the enquiry was also on the email. In particular, the organizations which collaborate in disseminating of this survey were: Salvador Association, APCC, centre for independent living, Lisbon Inaccessible, APD, ADFA, Portal of Disabled Citizens, Centre for Rehabilitation and Integration of Disabled People, Senior Academy (Covilhã), INR, and Foundation LIGA. Many others organizations were contacted but they have not replied.

The survey, as shown in annex 1, collected 164 valid questionnaires between 28 July 2015 and 28 July 2016. The data were collected using Google Forms system, these were stored in a single database table and analysed using the statistical analysis software SPSS 23® for Microsoft Windows® and Microsoft Excel 2010®.

3.3.1. Socio-Demographic Profile of Respondents

In this survey, four variables were defined for the characterization of the participants: nationality, age, gender, and type of reduced mobility. For the analysis of the first three variables, it was used cross-reference table’s information, i.e., crossing the respective variable with the question “Do you have any type of reduced mobility?”.

- **Nationality**

According to table 1, with a total of 164 participants and 160 valid responses more than half of the respondents (129) indicated that they belong to the Portuguese nationality. Question 1 was answered by approximately 129 Portuguese, among which 58 were people with reduced mobility and the remaining 71 were people without reduced mobility. The second majority corresponds to the Brazilian nationality (13), among which only 5 are PRM. The third majority of the participants is Spanish (4) and one of which has reduced mobility. The other participants of the survey are distributed uniformly across the other nationalities contained in table 1. Between these participants with reduced mobility, there are: 1 Angolan, 1 Argentine and 1 French.

Table 1: Nationality of participants

		4. Do you have any type of reduced mobility?		
		No	Yes	Total
1.Nationality:		3	1	4
	Angolan	0	1	1
	Argentinean	5	1	6
	Brazilian	8	5	13
	Colombian	1	0	1
	Ecuadorean	1	0	1
	French	0	1	1
	Mexican	1	0	1
	Mozambican	1	0	1
	Portuguese	71	58	129
	Spanish	3	1	4
	Venezuelan	1	0	1
	Cape Verdean	1	0	1
Total		96	68	164

- **Age**

As shown in table 2, only 160 people indicated their age in the questionnaire. As can be seen, the age where there is a higher incidence of reduced mobility is between 26 and 32 years old (10) followed by the group between 32 and 38 years old with a frequency of 8 PRM. According to table 2, the age group, less often, with reduced mobility was 68 to 74 years old.

Table 2: Survey participants by age groups

		4. Do you have any type of reduced mobility?		
		No	Yes	Total
3. Age:	[14-20[	1	6	7
	[20-26[	10	3	13
	[26-32[	9	10	19
	[32-38[	11	8	19
	[38-44[	9	6	15
	[44-50[	8	6	14
	[50-56[	10	5	15
	[56-62[	13	6	19
	[62-68[	8	6	14
	[68-74[	7	2	9
	[74-80[	5	3	8
	[80-85]	4	4	8
Total		95	65	160

According to figure 13, of the 95 participants without reduced mobility, there are 74 under the age of 65 and 21 respondents aged 65 or older. As regards to 65 respondents with reduced mobility, 52 are under the age of 65 and 13 respondents are 65 years old or more.

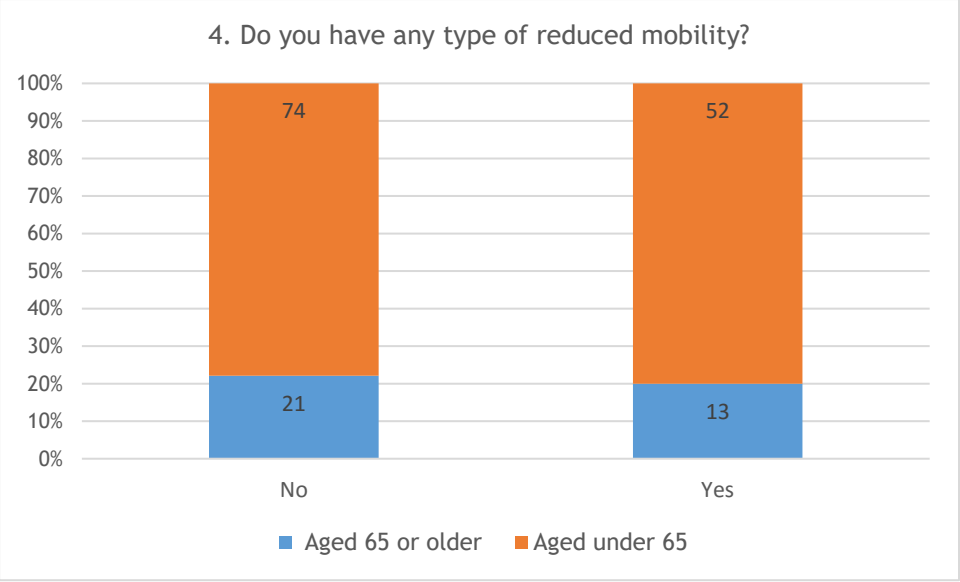


Figure 13: Percentage of people with reduced mobility by age

- **Gender**

As can be seen from table 3, there was not invalid responses in question 2, there were obtained 164 valid responses. In this survey, participants are predominantly men (89) and these 39 reported having any type of reduced mobility. In a total of 75 women, 46 claim not to have reduced mobility, so there are only 29 participants of the female gender with reduced mobility.

Table 3: People with reduced mobility by gender

		4. Do you have any type of reduced mobility?		
		No	Yes	Total
2. Gender:	Female	46	29	75
	Male	50	39	89
Total		96	68	164

- **Reduced Mobility**

Figure 14 helps to show, in percent, the number of respondents with and without reduced mobility (41% and 59%, respectively). In its turn, the information contained in the secondary graph shows that within the group of people without reduced mobility (59% of 164, i.e., 96 persons) there are 31 persons (19% of 164) who have accompanied reduced mobility people and 65 persons (40% of 164) who have never accompanied a PRM. In this study, the opinion of PRM is fundamental, however, the opinion of people without reduced mobility who have accompanied someone with reduced mobility is also very relevant in terms of the existence of accessibility in aircraft and airport infrastructures.

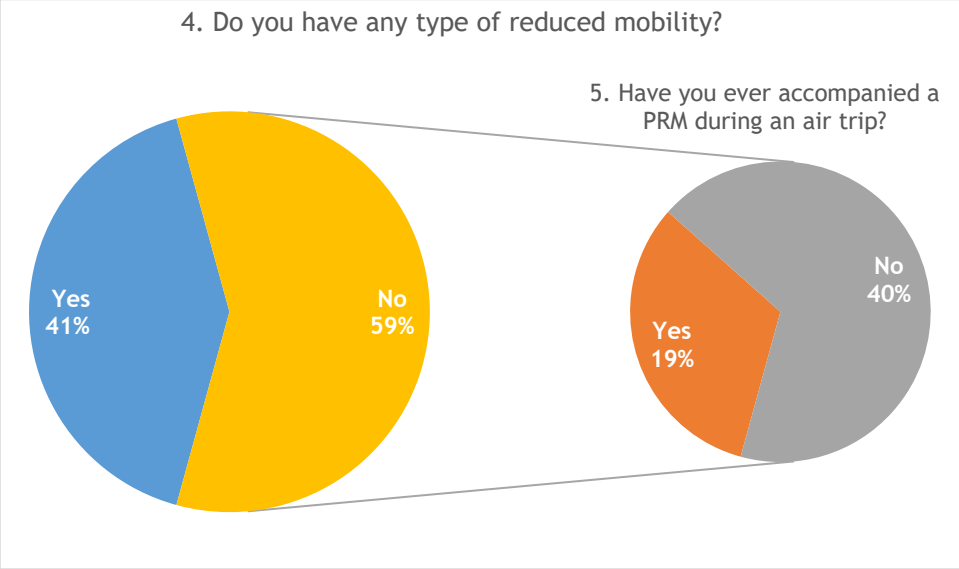


Figure 14: Percentage of people who have accompanied reduced mobility people

Figure 15 indicates, in percent, the types of reduced mobility mentioned by respondents. Despite the 68 participants have reduced mobility, only 64 revealed the type of disability they are. Thus, it can be seen that the type of reduced mobility, more common, was physical disability with 75.0% (48 persons). It should also be noted that there is a high percentage related to sensory impairment (15.6%), i.e., adding 4.7% corresponding to 3 persons with hearing disability, with 10.9% corresponding to 7 persons with visual disability.

Intellectual disability, i.e., mental diseases, presents less frequency among respondents, because only 2 persons (3.1%) mentioned it. Only 4 persons (6.3%) reported having multiple disabilities, i.e., three persons have physical disability associated with visual impairment and only one has visual and hearing disability simultaneously.

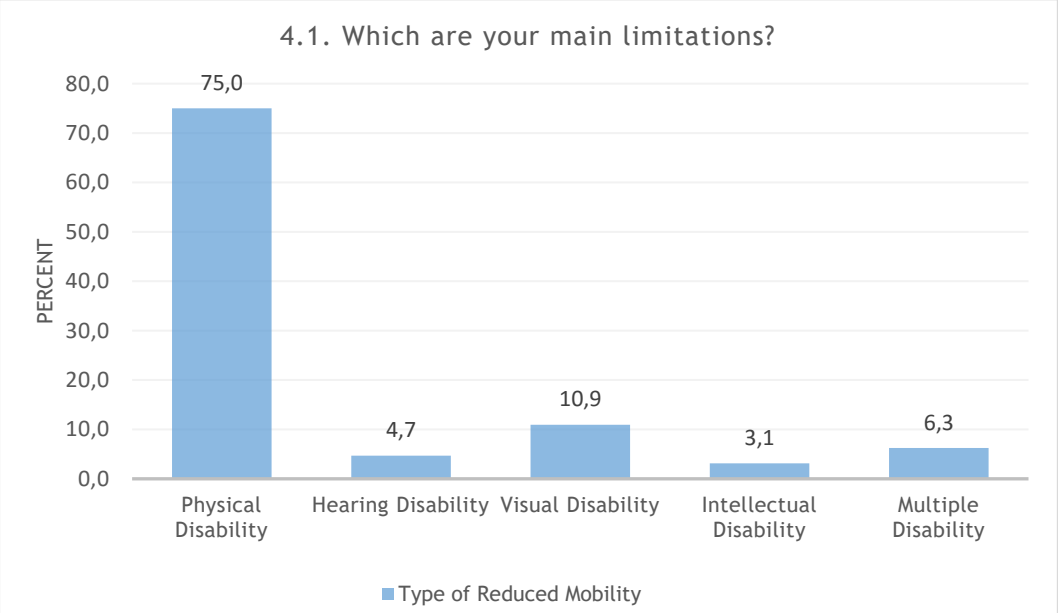


Figure 15: Types of reduced mobility mentioned by respondents

3.3.2. PRM perception about Air Transportation

The answers of PRM were analysed on six questions involving their perception about air transport, as shown in figure 16 and figure 17.

It was concluded, as illustrated in figure 16, that 51.5% of the respondents believe that air transport isn't an easy mode of transportation for PRM, against 27.9 % who say it is accessible and 20.6 % of respondents didn't have an opinion about it. Of the all sample of PRM, 64.7% mentioned that information about the services for PRM on the airport and airline's websites is hard to obtain, only 22.1 % consider it is easy. As it was to be expected for these results, almost half (around 39.7%) of respondents say that PRM prefer travel in other transportation mode than flying, against 33.8 % who think that they don't choose other means of transport and 26.5 % of respondents didn't have an opinion about it. A very expressive part of the inquired, i.e., 86.8% stated that there is a need for a regulatory change where airports and airlines should be obligated to guarantee a certain level of autonomy for PRM.

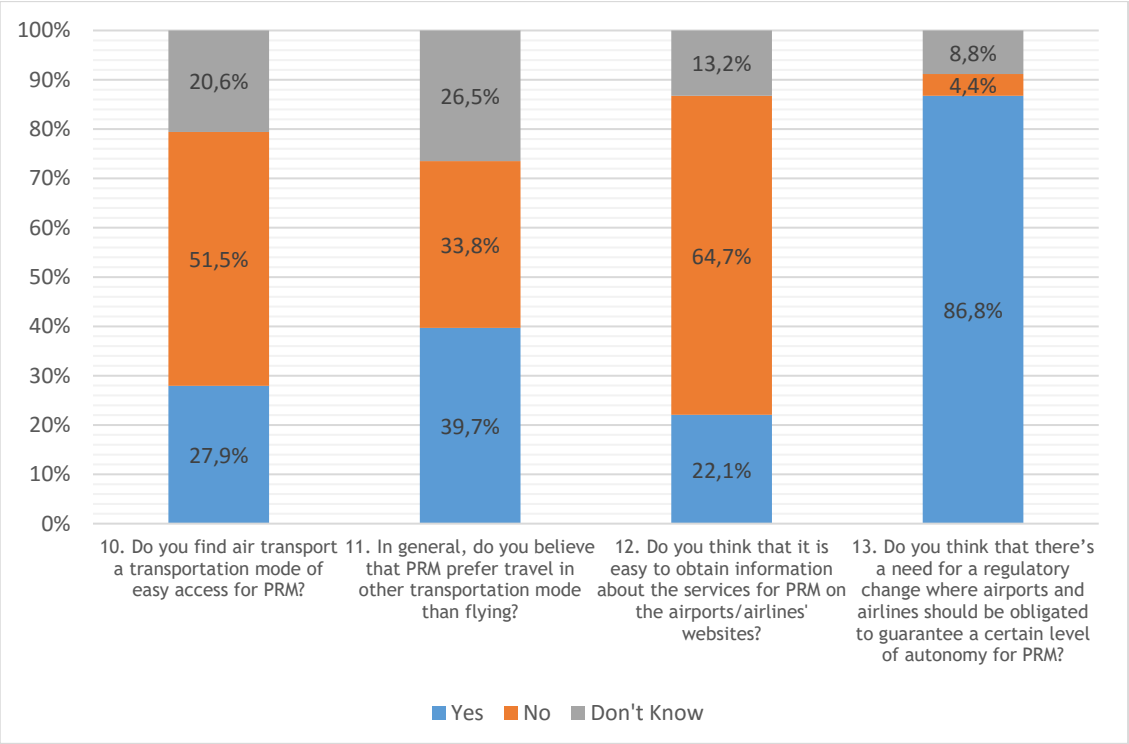


Figure 16: PRM perceptions about air transportation (Questions 10, 11, 12 and 13)

As shown in figure 17, even though more than half of PRM (69.1%) stated that they had never given up of flying for a certain airport or with a certain airline due to a previous bad experience, 29.4% of respondents had already given up of flying and 66.2% affirmed that would travel more frequently if the quality of service provided was better. Only 10.3% of PRM answered that they wouldn't travel more if the quality service provided was better.

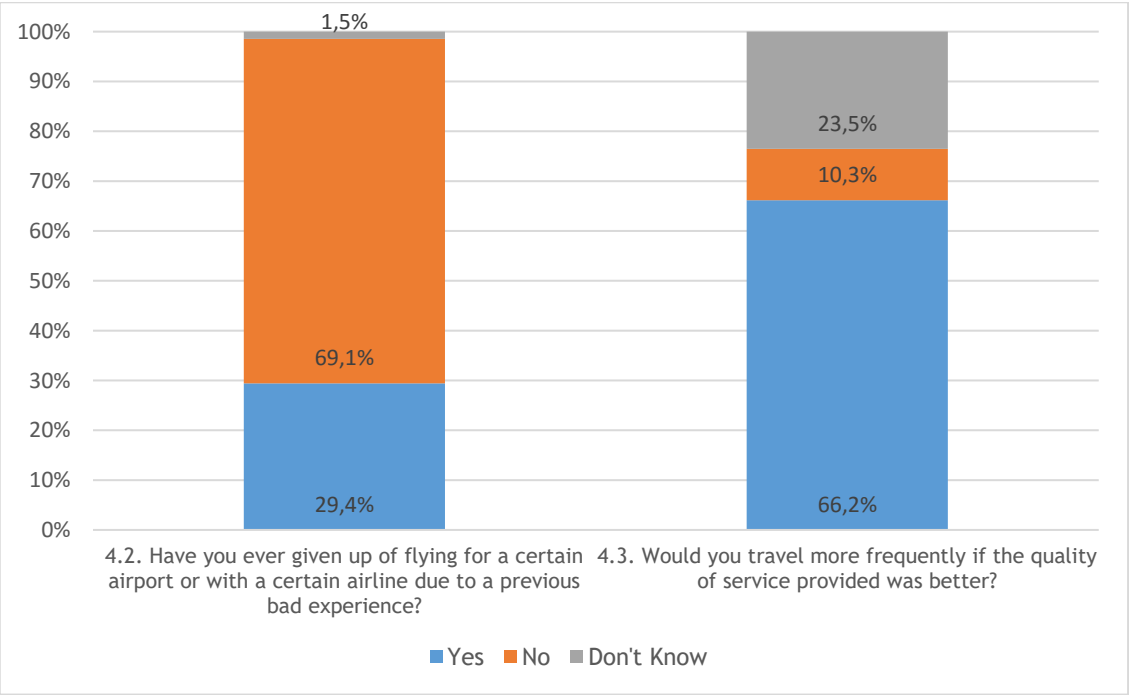


Figure 17: PRM perceptions about air transportation (Questions 4.2 and 4.3)

In figure 16, it can be seen that 33.8% of respondents think that they do not choose other means of transport, perhaps the explanation for this percent is in response to one of the PRM that says "no preferred to travel in other means of transport instead of air transport because others are also inaccessible".

There is still a long way to go in combating discrimination on the part not only of employees but also of other passengers without reduced mobility. The main problem seems to be the "lack of awareness of people and lack of respect towards others". Sometimes "the prevailing thought is: if you have limitations do not travel".

From the responses received, there is an increasing lack of civic spirit in society which explains, in the case of Lisbon Airport, the crowd of people inside the Shuttle T2 pushing all people around trying to enter and exit before others. Lisbon airport was mentioned, particularly by having ATM and check-in counters inadequate to PRM. It was also reported as "too big to be travelled on foot". One of the PRM said airport shuttle between Terminal 1 and Terminal 2, on Lisbon airport, as "completely inaccessible", "as well as other means of transport allowing access to the airport, such as subway". Another mentioned specifically the lack of conditions in Terminal 2, i.e., no parking, lack of suitable areas to eat and rest and lack of cleaning in the toilets. He also mentioned the lack of adequate signage and tactile floor.

One respondent noted the importance of "Taking seriously the suggestions described in this type of surveys". In addition to the recommendations contained in table 4, many PRM considered necessary to reinforce the existing legislation and measures in order to improve the accessibility in airports and inside the aircraft. The air transport should provide a service without accessibility barriers, i.e., a service without discrimination "as if all passengers were PRM".

Table 4: PRM perceptions about air transportation

	Constraints	Recommendations
Within the Airport	Specialized staff on assistance to PRM;	Specialized staff for PMR wheelchair transfers; Helping assistant for PMR needs before boarding (they may wish to do some shopping or go to the toilet).
	Qualified staff in sign language;	Interpreters in sign language at the airport terminal, would be helpful for PRM integration and safety;
	The unfamiliarity about MyWay service, the difficulty of finding MyWay points and physical interaction are not suitable for PRM purposes;	Regarding the elimination of airport barriers, the ELO system allows the PRM to get to the aircraft "autonomously" without being subject to weatherproof;
	Eating places, ATM machines and elevators are not always prepared for people with reduced mobility;	_____
	The lack of adequate signage for mobility inside the airport, i.e., signage and tactile floor;	The improvement of the signage is essential for PRM to orient themselves without help of others;
	Airport wheelchairs are not always in the best conditions;	The PRM should be able to use its own mobility equipment until the time of boarding;

	The priority boarding is disrespected, "PRM are usually the first to board but the last to depart";	It is important the PRM has space and conditions to accommodate themselves;
	"The boarding/deplaning process is not always done with appropriate equipment, so this process is sometimes carried out by stairs";	It is important the PRM feels that "boarding and deplaning is effected in accessible environment";
	The ambulift "increases the boarding time" and "when there are delays the fault is always of the PRM";	For delays minimization, each airline should have/request its own assistance equipment or use boarding bridges to facilitate the PRM boarding;
	"The existence of long distances (covered on foot) to the aircraft";	Use mechanical walkways, elevators or other complementary means (special chairs and vehicles free) along the airport;
	The lack of information about which services are available for PRM, causing a "lack of confidence in those services";	Provide clear information concerning the services and how these in fact are carried, "including emergency evacuations";
	The damage of mobility equipment occurs frequently and an "appropriate problem-solving process" sometimes doesn't happen.	Ensure staff training to handle the luggage of air passengers with special needs, e.g., electric wheelchairs;
	The lack of means of transport, designed or specially adapted for reduced mobility, facilitating access to the airport, e.g., taxis;	_____
	The required 48 hours in advance for check in and the hold baggage delivery are procedures that require waiting times being undesired for those who has limited mobility;	"It should only be required a normal check-in" and the procedures should be more facilitated;
	The number of PRM and accompanying person allowed per flight;	It would be important that the airlines do not limit the number of PRM per flight, or at least to reveal how PRM can accept on each air travel;
Within the Aircraft	Specialized staff ("they do not know the procedures required for the transport of PRM") and qualified staff in sign language;	Ensuring the training of on board assistance staff about the needs of persons with reduced mobility;
	The aisle chair is only available on long haul flights;	_____
	The lack of adequate signage for mobility inside the aeroplane, i.e., signage and tactile floor;	The improvement of the signage is essential for PRM to orient themselves without help of others;
	The lack of reserved seats for PRM; Reduced space between seats is a cause of discomfort in air travellers, e.g., in the case of the blind people they have to accommodate an assistance dog;	The importance of having seats with easier access to allow the PRM to be "assisted in transfers and toilet visits". Seats located near the entrance or exit of the aircraft, reserved and available for PRM because "these are occupied by people without reduced mobility";
		PRM should travel in business class for the same price (the transfers and movements would be easier because there is more space and toilets are closer);
	Difficulty in using the emergency exits (if necessary);	Improve the configuration of the aircraft, redesign the emergency exits and minimize the space constrains inside the aircraft.
	The toilets do not have enough space and the PRM privacy is usually committed.	

3.3.3. Airport Barriers

Concerning the airport constraints that PRM face within the airports, it has taken into account the answers of PRM and PMR companions, resulting in a total of 99 respondents. As can be observed in figure 18, a significant part of respondents considered the lack of specialized and trained personal (55.1%), the airport information and assistance services (53.9%), the transfers at the airport terminal (53.8%) and the baggage claim (51.6%) as very important issues to overcome. The check-in (49.5%) and boarding areas (47.7%) were also mentioned by a relevant part of the sample as very important constraints. Among the very important and important constraints were the check-in (81.4%), the lack of specialized and trained personal (76.4%), the

transfers at the airport terminal (76.4%), the boarding areas (73.8%), the baggage claim (73.1%), and the emergency exits (69.3%). The less important issues, identified as somewhat important and not at all important, were the Duty Free shop (55.3%), the waiting areas (30%) and the lavatories (27%).

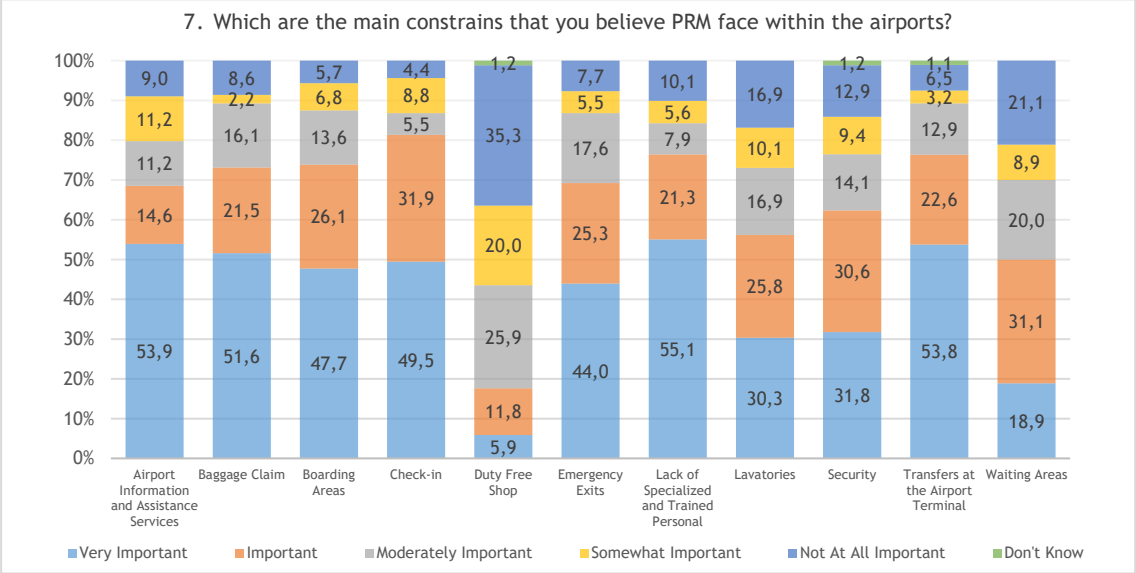


Figure 18: Airport barriers

Through the analysis of table 5, it can be seen that, among the airports the most mentioned, Lisbon airport is the most used by the PRM (58), followed by Oporto airport with 22 answers. Funchal and Ponta Delgada airports were mentioned less often (3). Although there were other international airports mentioned, only the Portuguese airports were analysed.

Table 5: The airports more mentioned by PRM on survey

	6.1. Do you think that/those airports have the sufficient conditions to make PRM experience as autonomous and comfortable as possible?			
6. Which are the airport(s) you regularly use?	Yes	No	Don't Know	Total
Lisbon Airport	18	32	8	58
Oporto Airport	7	12	3	22
Faro Airport	2	3	1	6
Ponta Delgada Airport	3	0	0	3
Funchal Airport	0	2	1	3

The graph in figure 19 illustrates the information contained in table 5, allowing to see more easily if the national airports are considered (or not) as accessible by PRM.

It can therefore be concluded that of the 58 respondents who have used Lisbon airport, 32 (55.2%) consider that this infrastructure has not sufficient conditions to offer autonomy and comfort to the PRM.

In the case of Oporto Airport, of the 22 users, 12 (54.5%) do not consider it as accessible.

Of the 5 airports analysed, only Ponta Delgada airport was considered as accessible by all users, on the contrary, Funchal airport was not considered as accessible by any of the respondents.

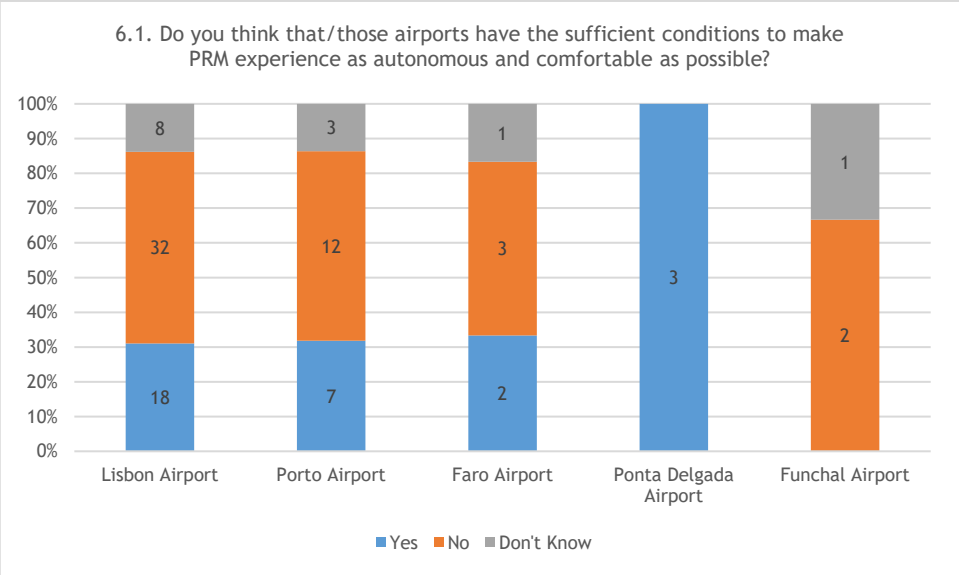


Figure 19: Accessibility in Portuguese airports

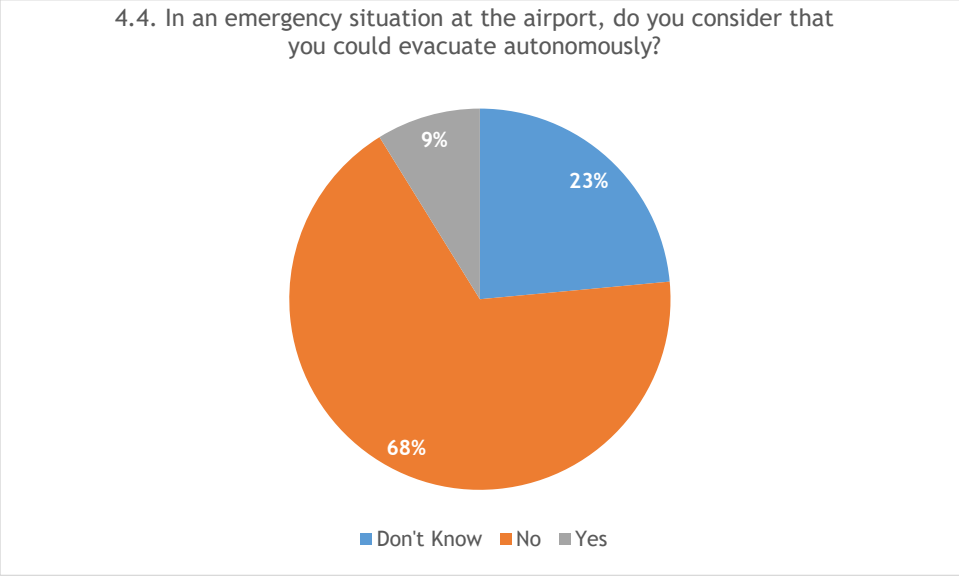


Figure 20: Emergency evacuation of the PRM at the airport

As can be seen in figure 20 regarding emergency situations at the airport, about 68% reported that they wouldn't be able to evacuate autonomously. From those, as shown in figure 21, 89.1%

stated that would feel safer if airports made available information about the emergency plans and exits, and 80.4% referred that there isn't enough available information about evacuation procedures for PRM.

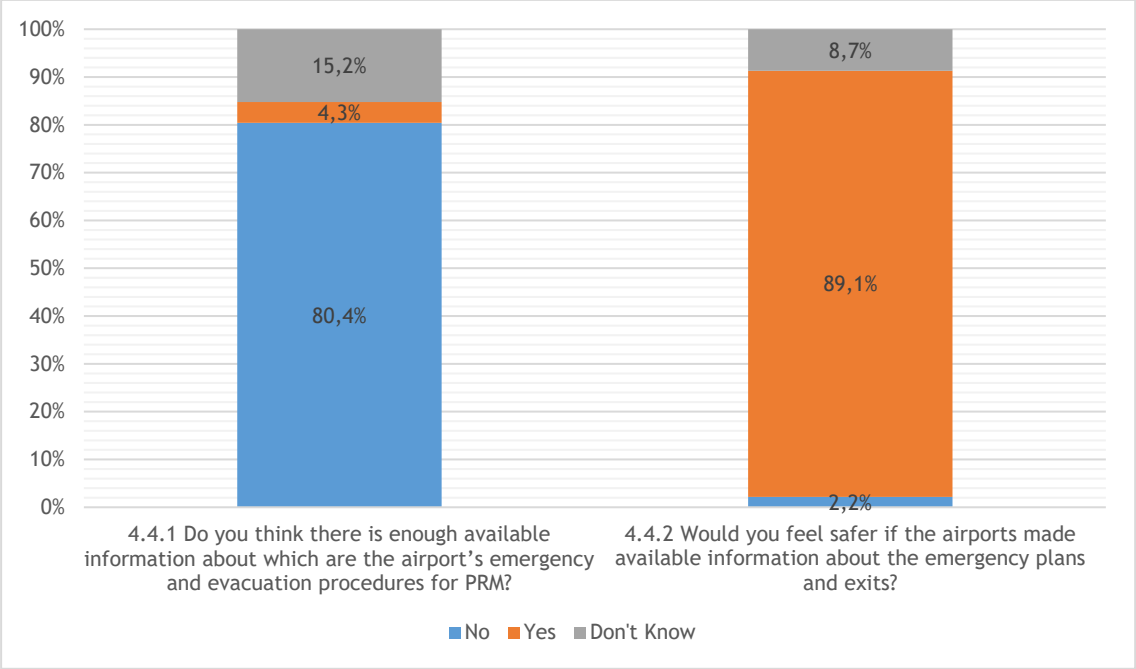


Figure 21: PRM perception about emergency and evacuation procedures

3.3.4. Aircraft Barriers

Concerning the aircraft constraints, it has taken into account the answers of PRM and PMR companions, resulting in a total of 99 respondents. As can be observed in figure 22, an expressive part of answers pointed, the boarding/deplaning transfers (68.2%), the space between seats (67.8%), the lavatories (63.7%), the mobility inside the aircraft (63.7%) and the seat transfers (59.8%) as very important obstacles. Among the very important and important constraints were the seat transfers (88.5%), the space between seats (87.8%), the boarding/deplaning transfers (85.2%), the lavatories (84.6%) and the mobility inside the aircraft (84.6%). The less important issues, identified as somewhat important and don't know, were the seat-belt (22.8%) and the accommodation of the carry-on baggage (13%).

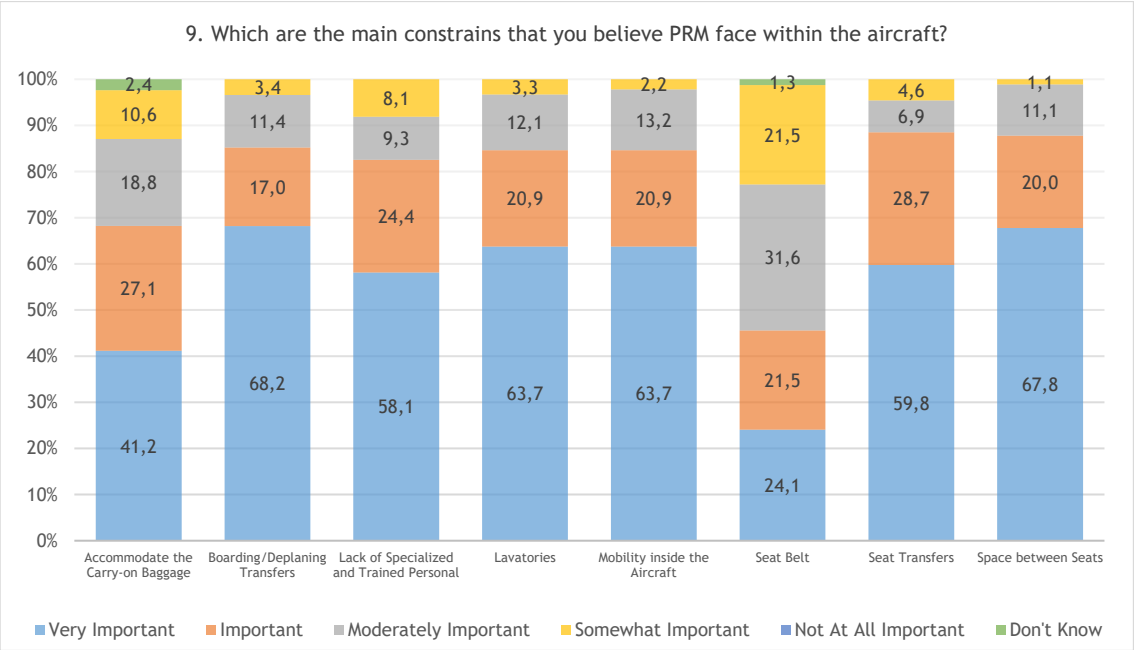


Figure 22: Aircraft barriers

Through the analysis of the table 6, it can be seen that, between the airlines more mentioned, TAP as the airline most used by PRM, indicated in 52 answers. This is followed by the Low Cost airlines, Ryanair (18) and EasyJet (10). SATA is the airline less mentioned by PRM, with only 5 answers. Although there were mentioned several other airlines, only those more frequently referred (TAP, Ryanair and EasyJet) and effecting routes within Portugal (SATA, while not very mentioned, makes sense to analyse because it is a Portuguese company) were analysed.

Table 6: The airlines more mentioned by PRM on survey

	8.1. Do you think that/those airlines have the sufficient conditions to make PRM experience as autonomous and comfortable as possible?			
8. Which are the airline(s) you regularly travel with?	Yes	No	Don't Know	Total
TAP	23	24	7	54
Ryanair	1	17	1	19
EasyJet	6	3	1	10
SATA	3	2	1	6

The bar graph in figure 23 illustrates the information contained in table 6, allowing to see more easily if the airlines mentioned are considered (or not) by the PRM as accessible. It may be concluded that of the 52 respondents who have flown with TAP, 24 (44.4%) consider that this company does not have sufficient conditions to offer autonomy and comfort to the PRM. In the case of Ryanair, of the 19 users, 17 (89.5%) consider it inaccessible. In the case of EasyJet, the results were more positive because of the 10 passengers with reduced mobility have already

flown in this company, only 3 (30%) considered it as inaccessible. Although uncommon among participants with reduced mobility (5), SATA has only 2 answers stating that it has not adequate conditions.

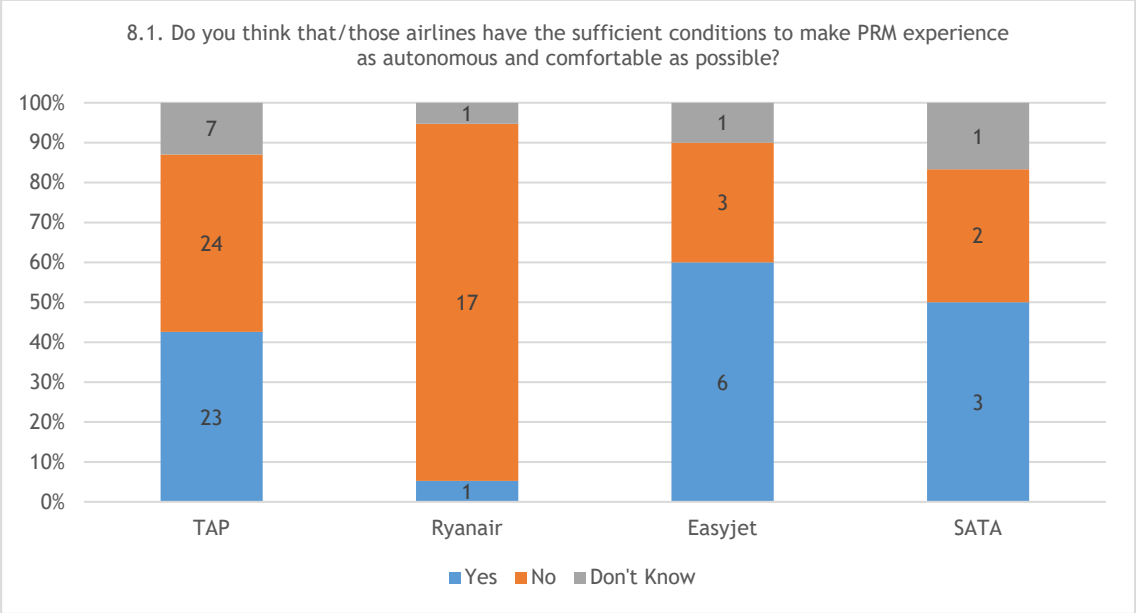


Figure 23: Airlines accessibility

3.4. Accessibility in Lisbon and Oporto Airports

Although it is possible to define accessibility as the ease of achieving the intended destination, this concept may result in diverging approaches (Preston and Rajé, 2007). However, for a person with special needs, the accessibility can be defined as the possibility of using airport areas and aircraft with security and autonomy. Thus, the improvement of the accessibility for these passengers means to facilitate access to airport services. After making the decision to travel, in the case of air transport, the passenger has yet to decide how he will move to the airport, which airport to use, and which company he will fly. When it is a question of choosing an airport, if the region has more than one, accessibility can be a decisive factor in this choice.

In this study, we will evaluate the accessibility of Lisbon airport and Oporto airport in accordance with Accessibility law, Decree-Law 163/2006 of 8 August, which presents a number of normative provisions designed with the intention of improving accessibility to persons with reduced mobility by removing barriers on public spaces or collective facilities and buildings, including airports (Decreto-Lei 163/2006).

The Airport Service Quality program, developed in collaboration with the Airports Council International, has the objective of improving the provided service at the airports. In the ANA is implemented the certification of airports directed at quality management (ASQ Assured) and

the study evaluating passenger satisfaction (ASQ Survey). Lisbon, Oporto, Faro and Ponta Delgada airports are certified in ASQ (Airport Service Quality), with this tool the airport managers intend to adopt a perspective of continuous improvement and a culture of management focused on the client (ANA, 2012). However, despite of quality commitment at the airports, according to the ANAC activities report, only in 2015, were received 37 complaints (27 in 2014 and 10 in 2015) from passengers with reduced mobility suggesting that not everything goes as expected (ANAC, 2016).

Thus, to verify if the existing legislation is being complied a visit was made to Lisbon airport and Oporto airport, in order to collect the dimensions of facilities and to see if there are other barriers inside the airport infrastructure.

All the analysed dimensions were compared with those defined in the accessibility guide (Annex 2), "Mobility and Accessibility for All", developed to facilitate the interpretation of the Decree Law no. 163/2006.

3.4.1. Lisbon Airport

Lisbon airport among the national airports is what has the largest area and the most air traffic (ANA, 2012). This airport was analysed in terms of physical barriers for passengers with reduced mobility through an on-site visit. The airside areas of Terminal 1 were not checked.

- **Airport Accesses to Other Means of Transport**

It was verified the existence of means of transport adapted for PRM allowing access to the airport. In Lisbon, regarding the public transport, the PRM can take the taxi, Aerobus, Carris buses, or metropolitan. The Aerobus is classified as accessible (Aerobus, 2016), and the Lisbon metropolitan has some stations with the Symbol of Accessibility, such as the airport station (Metropolitano de Lisboa, 2012). The Carris has some buses identified as accessible with stops at Lisbon airport in particular 705, 722, 744 and 783 (Carris, 2010). In relation to taxis, there are some companies operating in the Lisbon area and which have adapted vehicles, namely, *Auto Taxis Serra D'Arga Lda* (Auto Taxis Serra D'Arga Lda, 2010), and Auto Coope – *Cooperativa de Táxis de Lisboa* (Coop Taxis Portugal, 2015).

- **Parking Areas**

Regarding parking lots, a few items are important, in particular, space dimensions, identification with the International Symbol of Accessibility, vertical signs, and number of spaces.

There are temporary parking spaces, in Terminal 1, in the arrivals area. These spaces meet the minimum dimensions (5x2.5m), but they are not marked in contrasting colour on the floor surface. The temporary parking spaces are marked with a horizontal signal of accessibility (painted without contrasting colour). There is also one vertical sign with the symbol of accessibility for the signal to be visible when the vehicle is parked and one vertical sign indicating the meeting point of the MyWay service.

In the reserved parking area (P2) of Terminal 1, the minimum dimensions of each reserved spaces are larger than 5x2.5m. The number of places reserved for PRM, compared with the total number of places for people without reduced mobility, respects the required by law. These are marked in contrasting colour on the surface of the floor, marked with one horizontal accessibility sign and one vertical sign with the symbol of accessibility.

In Terminal 2, there are no parking spaces.

- **Pavements and Kerbs**

As mentioned in accessibility guide, the height of kerbs near the pedestrian crossings is not higher than 0.12m and there is a kerb downgrade equal to 0.02m, both in Terminal 1 and in Terminal 2. The minimum width of the pavements when there are obstacles is not lower than 1.5m. The floors provide good adherence, and the height of fixed signposts is 2m.

- **Pedestrian Crossings**

The interception of the islands in the middle of a zebra crossing with the pedestrian crossings has a length of 1.5m or more, as recommended, and the island width is not less than the width of the pedestrian crossing. The pedestrian crossing's surface has a different texture than what was used on the pavements and roads but it does not have a contrasting colour as recommended by ACAPO. There are no traffic lights at the pedestrian crossing.

- **Floor Inside the Airport**

Regarding the circulation areas inside the airport, there was found adequate floor with stairs, ramps, travellators and escalators, and elevators between floors. However, there is no tactile signage on the floor, i.e., directional tactile floor or alert tactile floor. This is recommended by ICAO manual (mentioned in Chapter 2 of this thesis).

- **Communication and Signage**

Both in Terminal 1 and in Terminal 2, there is a lack of materials in Braille in the information and check-in counters, in the commercial areas, or safety equipment in Braille on the aircraft (ICAO, 2013). Regarding the signage, there are signs with letters in a contrasting colour and free of brightness, at a height of 2m from floor level and indicating the location of accessible bathrooms, the elevators etc.

- **Ramps**

In Terminal 1, there is a ramp at the departures area with a horizontal projection of approximately 12m to overcome about 1.20m of difference in level existing. This ramp has a width of 1.2m with handrails on both sides at a height of 0.95m. Along the extension of the ramp, in addition to the sideguards, there are lateral protections with the height of 0.1m. The floor of the ramp has good adhesion. However, in accordance with equation 1, the slope of the ramp is about 10% and in the middle of the ramp there is no rest platform, which means this is not in compliance. There is still in the interior of building, a ramp curve. This ramp has an 8% incline with a radius of curvature not less than 3m and floor with good adhesion (in compliance with the accessibility guide in Annex 2).

There are also ramps along the pedestrian crossings. These have a width greater than 1.2m and an inclination of 8%, a gap of 0.12m and a horizontal projection of 1.5m. As in Terminal 1, in Terminal 2, there are ramps to overcome the difference of kerb (0.12m) along the pedestrian crossings with an inclination of 8% (in accordance with equation 1) and a horizontal projection of 1.5m and a width of 0.90m. It can be said that these ramps are in accordance with the law.

$$Slope = \frac{Height * 100}{Width} \quad (1)$$

- **Stairs**

In Terminal 1, all stairs have a width not less than 1.50m. With the exception of two that do not have handrails, all the others are equipped with handrails on both sides with a height of 0.90m and a diameter of 0.05m. All the stairs have sideguards. At the start of the stairs, there is no approach area, i.e., a different floor in terms of texture or colour as recommended. Only two of the existing stairs in the airport have a strip with different texture and colour contrast with a width of 0.04m on the edge of the steps. While the other stairs have multiple rough strips without colour contrast, on the edge of the steps, instead a single and continuous one with 0.04m of width, so this part is not in accordance with the recommendations. The stairs have a maximum height of 0.16m between steps and a minimum depth of 0.28m, the dimensions of which remain constant over each staircase. All the stairs contain rest platforms with depth greater than 1m and a width not less than the width of the steps. Six stairs were found, but

only two have handrails which extend 0.3m beyond the last step, parallel to the floor. On the basis of these two stairs, the handrails extend beyond the first step in a length equal to the size of the step depth and keeping the slope of the stairs.

There are no stairs in Terminal 2.

- **Lifts**

In Terminal 1, in public areas of the airport, there are lifts moving between existing floors. These were analysed under the standards of accessibility attached, in compliance with various specifications. Thus, the elevators in Terminal 1 are equal to or exceeds the minimum size (1.10mx1.40m), as recommended, and in all the doorway has a minimum useable width of 0.90m. There is an obstacle-free area equal to or greater than 1.5x1.5m in front of the entrance door. Not all call buttons are located on the right side of the door, but they are at a height of 1.2m. The control buttons are between 0.9 and 1.3m inside the elevator. These have references in Braille and raised characters and luminous device around them. There are grab bars, inside the cabin, located at a height of 0.9m and 0.05m from the wall. The lifts have no sound information.

In Terminal 2, there are no lifts for passengers because this terminal has only one floor. The existing lifts are used only by staff.

- **Doors**

All doors have a width of 0.90m or more, without revolving handles. The locks and pullers are located at a height of 1.10m, as recommended. The automatic outside doors have a width no less than 2m, and they are in accordance with Accessibility law.

- **Building's Aisles**

The width of building's aisles is more than 1.8m, i.e., the aisles are in accordance with the accessibility guide.

- **Waiting Room**

Both in Terminal 1 and in Terminal 2, the width of the aisles in the waiting room corresponds to the minimum specified (0.9 and 1.5m) in the Annex 2. However, there are no spaces reserved for passengers in wheelchairs.

- **Toilets**

For analysing the accessibility in the toilets, some items were evaluated, for example, toilet dimensions, water tap used, adequate height of washbasin, grab bars, alarm device height, mirrors position, etc.

In Terminal 1, the toilets respect the minimum area, with dimensions greater than or equal to 2.2 x 2.2m, except one. One toilet thought has an area higher than the minimum specified, it has one dimension smaller than 2.2m (3x2 .07m). In the toilets there is access from both sides of the toilet bowl, and there are double supports on both sides of that at height of 0.65 and 0.8m. These supports are folding in vertical position. The bars extend beyond the front edge of the toilet bowl by about 0.20m. The toilet bowl is located at height of 0.45m relative to the floor and the front edge of that is at a distance of 0.75m from the wall. The taps are lever faucets, and the washbasin is placed at height of 0.8m from the floor. Mirrors are tilted and the lower part doesn't exceed 1.1m of height. The upper part of the mirror is at height of the 1.8m. The wall hangers are at a height of 1.3m from the floor. The warning system does not exceed 0.5m of the height. The doors open outwards with a width of 1m.

In Terminal 2, the existing toilets respect the areas and minimum dimensions required. These two toilets offer the same characteristics of the Terminal 1, however there are the following differences: there is no access from both sides of the toilet bowl, and one of the grab bars is fixed.

- **Counters**

The existing counters at the airport should take into account the special requirements of passengers with reduced mobility. Thus, some items were analysed, namely, if the counters are at an appropriate height, and if there is a free area for frontal approach of these passengers.

In Terminal 1, there are three information counters: tourist information counter, ANA airports information counter, and MyWay service counter. Through a site visit, it was found that only the MyWay service counter has an appropriate height and area for frontal approach. This counter has an adapted area with length not less than 0.8m and a height of between 0.75m and 0.85m, as required. The frontal approach space has a height not less than 0.7m and a depth not less than 0.3m. In Terminal 2 there is only one information desk, MyWay service counter, and this was closed at the time of evaluation.

Regarding the ticket sales and customer support counters, both in Terminal 1, TAP, as in Terminal 2, Portway and Easyjet, have counters with approximately 1.3m of height and without frontal approach area.

In relation to airlines check-in counters, both in Terminal 1 and Terminal 2, the lack of counters were identified in accordance with the dimensions required. These counters are at a height of 1.2m. At the time of check-in, online or in loco, the assistance service for boarding and deplaning can be requested by passenger.

Regarding the other spaces and public areas, in Terminal 1, establishments with service counters (restaurants, post office, etc.) were found to not have accessible dimensions and have not a frontal approach area for PRM. In Terminal 2, in public areas, such as, restaurants counters or other commercial counters there are not adequate adjustments, however the exchange service counter is in compliance with the Accessibility law.

At Lisbon Airport, counters with priority assistance were not found.

- **Telephones**

At Lisbon Airport, there are MyWay service telephones, ANA airports telephones and PT telephones, all of them have keyboard without Braille references or raised characters. These have a free area which enables a frontal or lateral approach. In the case of PT telephones, the slot for coins and keyboard are at a height between 1m and 1.3m as required by law.

- **Self-Service Equipment's**

The ATM and the self-check-in machines have a touch screen interface, and the information is not transmitted in sound version (only audible warnings are transmitted). The exiting slots for inserting or withdrawal of cards or other have tapered entry. The insertion and withdrawal products area is located between 0.40m and 1.20m of height and the command and controls area at a height between 0.80m and 1.20m as required by law. In ATMs, the keyboard is not identified with Braille but some buttons have tactile references. In self check-in machines, the operating buttons are not identified with braille or tactile references. In either cases, the equipment doesn't provide a frontal approach area.

- **Post Boxes**

The post boxes are placed at height of 1.4m. Although it is recommended as good practice a maximum height of 1.20m.

- **Boarding/Deplaning Aids**

The distance from the aircraft to the landing area or from the boarding area to the aircraft is usually covered on foot, and the aircraft access is usually made by stairs, which means a difficult locomotion in these areas. Although there are vehicles with a lifting mechanism to solve these problems, the ambulift, the vehicles are not always available to assist in loading and unloading.

- **Relief Areas for Service Animals**

There are no relief areas at Lisbon airport.

3.4.2. Oporto Airport

Oporto airport among the national airports is which has the second largest area and the second with the most air traffic. It having been awarded by the Airports Council International (ACI) as one of the best European airports (ANA, 2012). This airport was analysed in terms of physical barriers for passengers with reduced mobility through an on-site visit, as the Lisbon Airport.

- **Airport Accesses to Other Means of Transport**

It was verified the existence of means of transport adapted for PRM allowing access to Oporto airport, namely, taxis, buses, and metropolitan. Regarding the buses, the STCP has some buses with access to the airport and which are classified as accessible to PRM, in particular, 601, 602, 604 and 3M (STCP, 2012). In relation to taxis, there are a few companies operating in the Oporto area and which have adapted vehicles, in particular, *Táxis Pinheiro Lda*. (Táxis Pinheiro, 2014). The Oporto metropolitan and metropolitan airport station are classified as accessible (Metro do Porto, 2011).

- **Parking Areas**

Regarding the temporary parking spaces for loading and unloading, these are located near the building door and they are identified with the international symbol of access. These spaces have dimensions equal to the minimum required, vertical and horizontal signage with international symbol of access and a MyWay service sign, but they are not marked in contrasting colour on the floor surface. In the temporary parking spaces, there is a lateral range access and it is shared by two adjacent spaces. The lateral range has a width of not less than 1m. There is an elevator between floors and reserved parking area of the Oporto airport. In the reserved

parking area of the airport, the dimensions of each reserved spaces are larger than 5x2.5m. The number of places reserved for PRM, compared with the total number of places for people without reduced mobility, respects the required by law. These are marked in contrasting colour on the floor surface, and they are identified with a vertical and horizontal signage with international symbol of access.

- **Pavements and Kerbs**

As recommended in Annex 2, the height of kerbs near the pedestrian crossings is not higher than 0.12m. There is a bump between the road surface and the kerb equal to 0.02 m near the pedestrian crossings and these are higher than the road surface. The minimum width of the pavements when there are obstacles is not lower than 1.5m. The floors provide good adherence, and the height of fixed signposts is 2m.

- **Pedestrian Crossings**

The interception of the islands in the middle of a zebra crossing with the pedestrian crossings has a length of 1.5m or more, as recommended, and the island width is not less than the width of the pedestrian crossing. The pedestrian crossings surface has a different texture than what was used on the pavements and roads but it does not have a contrasting colour as recommended by ACAPO. There are no traffic lights at the pedestrian crossing.

- **Floor Inside the Airport**

Regarding the circulation areas inside the airport, there was found adequate floor with stairs, ramps, escalators, and elevators between floors. However, there are no tactile signage on the floor, directional tactile floor, or alert tactile floor.

- **Communication and Signage**

There is a lack of materials in Braille in the information and check-in counters, in the commercial areas, or safety equipment in Braille on the aircraft (ICAO, 2013). Regarding the signage, there are signs with letters in a contrasting colour and free of brightness, at a height of 2m from floor level and indicating the location of accessible bathrooms, the elevators etc.

- **Ramps**

There are ramps near the temporary parking spaces to overcome the difference between the kerb and the asphalt. These have a width greater than 0.9m and an inclination of 12%, a gap of

0.12m and a horizontal projection of 0.8m. It can be said that the existing ramps are in accordance with the Accessibility law.

- **Stairs**

All stairs have a width not less than 1.50m, and they are equipped with handrails on both sides with a height of 0.85m and a diameter of 0.05m. All the stairs have sideguards. At the start of the stairs, there is no approach area, i.e., a different floor in terms of texture or colour as recommended. The existing stairs in the airport have a strip, with different texture but without contrasting colour, with a width of 0.04m on the edge of the steps. The stairs have a maximum height of 0.16m between steps and a minimum depth of 0.28m, the dimensions of which remain constant over each staircase. All the stairs contain rest platforms with depth greater than 1m and a width not less than the width of the steps. The handrails of the stairs extend 0.3m beyond the last step parallel to the floor, and extend beyond the first step in a length equal to the size of the step depth and keeping the slope of the stairs. The stairs exhibit sharp edges.

- **Lifts**

At Oporto airport there are lifts moving between existing floors. The lifts are equal to or exceeds the minimum size recommended (1.10mx1.40m) and in all the doorway has a minimum useable width of 0.90m. There is an obstacle-free area equal to or greater than 1.5x1.5m in front of the entrance door. Not all call buttons are located on the right side of the door, but they are at a height of 1.2m. The control buttons are between 0.9 and 1.3m inside the elevator. These have references in Braille and raised characters and luminous device around them. There are grab bars, inside the cabin, located at a height of 0.9m and 0.05m from the wall. The lifts have no sound information.

- **Doors**

At Oporto airport, all doors have a width of 0.90 or more, without revolving handles. The locks and pullers are located at a height of 1.05m, as required. Although it is not recommended, the airport has automatic and revolving doors to the outside.

- **Building's Aisles**

The width of building's aisles is more than 1.8m, as required.

- **Waiting Room**

In the waiting rooms, the width of the aisles corresponds to the minimum specified (0.9 and 1.5m) in the Annex 2, but there are no spaces reserved for passengers in wheelchairs.

- **Toilets**

The toilets respect the minimum area, with dimensions greater than 2.2 x 2.2m. In the toilets there is access from both sides of the toilet bowl, and there are double supports on both sides of that at height of 0.65 and 0.8m. These supports are folding grab bars in vertical position. The bars extend beyond the front edge of the toilet bowl by about 0.20m. The toilet bowl is located at a height of 0.45m relative to the floor and the front edge of that is at a distance of 0.75m from the wall. The washbasins are equipped with sensory taps and they are placed at a height of 0.8m from the floor. Mirrors are fixed and the lower part exceed 0.9m of height. The upper part of the mirror is at height of the 1.8m. The wall hangers are at a height of 1.3m from the floor. The warning system does not exceed 0.4m of the height. The doors open outwards with a width of 1m.

- **Counters**

There are two Information counters: ANA airports information counter, and MyWay service counter. It was found that these have an appropriate height and area for frontal approach.

Regarding the ticket sales and customer support counters, namely, TAP, Portway, GroundForce and EasyJet have counters in accordance with accessibility guide. In relation to airlines check-in counters, it was identified the lack of counters in accordance with the dimensions required. These counters are at height of 1.2m.

Regarding the other spaces and public areas, it was found establishments with service counters such as, post office or exchange service, which have accessible dimensions and have a frontal approach area for PRM. However, restaurants, commercial counters, Custom House counter, Viagens Abreu or Passport Shop have not adequate adjustments.

- **Telephones**

There are MyWay service telephones, ANA airports telephones and PT telephones, all of them have keyboard without Braille references or raised characters. These have a free area which enables a frontal or lateral approach. In the case of PT telephones, the slot for coins and keyboard are at a height between 1m and 1.3m, as required.

- **Self-Service Equipment's**

The ATM and the self-check-in machines have a touch screen interface, and the information is not transmitted in sound version (only audible warnings are transmitted). The exiting slots for inserting or withdrawal of cards or other have tapered entry. The insertion and withdrawal products area is located between 0.40m and 1.20m of height and the command and controls area at a height between 0.80m and 1.20m, as required. In ATMs, the keyboard is not identified with Braille but some buttons have tactile references. In self-check-in machines, the operating buttons are not identified with braille or tactile references, as recommended. In either case, the equipment doesn't provide a frontal approach area.

- **Post Boxes**

The post boxes are placed at height of 1.4m. Although it is recommended as good practice a maximum height of 1.20m.

- **Boarding/Deplaning aids**

Although there are vehicles with a lifting mechanism to assist in loading and unloading, the ambulift, these vehicles are not always available.

- **Relief Areas for Service Animals**

There are not areas available for service animals to relieve themselves at Oporto Airport.

3.4.3. Functioning of MyWay Service Assistance

This sub-chapter contains a report with detailed overview of flight phases (figure 24) of the journey departing from Lisbon airport and arrival at Oporto airport. This journey was made on 10 May 2016 by CP with temporary reduced mobility (she moved with the aid of crutches due to a right knee injury) and me, Sofia Gaspar, the accompanying person without reduced mobility.

- **Plane ticket reservation (online) and assistance service request:** April 29, 2016
- **Check-in Online:** May 5, 2016
- **Date and Flight time:** May 10, 2016 at 12:50 p.m.
- **Airline:** Ryanair
- **Assistance service for people with reduced mobility:** MyWay

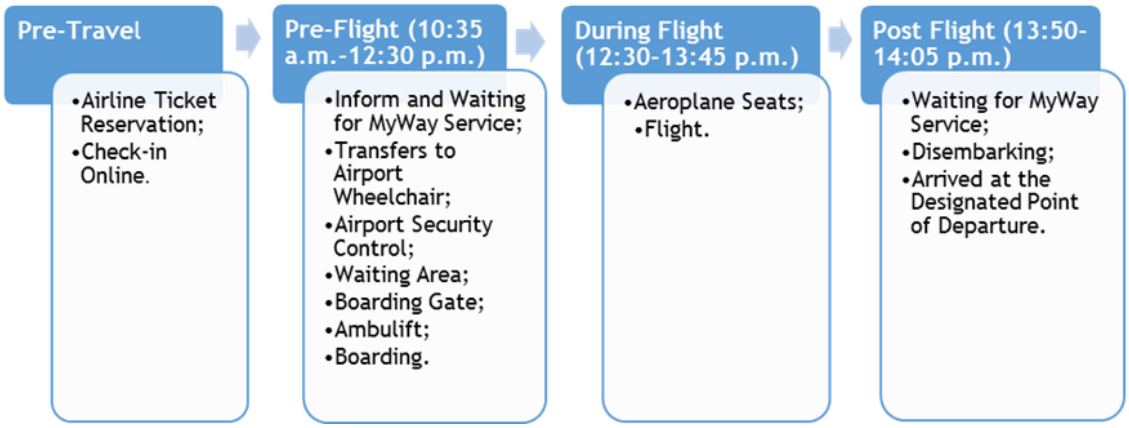


Figure 24: Flight phases

10:35 a.m.: We arrived at Terminal 2 of Lisbon airport with two hours and 15 minutes in advance (the PRM must be at the airport at least 2h before the departure of their flight). Thus, in order to inform MyWay service of our arrival, we head to the MyWay service telephone at the meeting point (near the entrance of the building). However, initially the telephone was not working and we called a MyWay employee who circulating around the building, to tell us how to proceed. We got no help, she said "now I'm busy, I will come back here later". We tried to phone again and the answer on the other side was "Can you go to the check-in counter? If yes, go to the check-in counter because is better and faster".

Figure 25: 10:40 a.m.

10:40 a.m.: Before addressing ourselves to the check-in counter, we asked a Portway employee for information and he informed us that we had to talk to the employee who was doing the check-in and "we could get to the head of the line and be immediately attended". Even with 10 minutes in advance over 2 hours requested, we surpassed the number of people waiting in line to check-in (what was an awkward position). Then, we told the check-in employee that we had already made the check in online to save time and we just wanted to inform the MyWay

service of our arrival. He asked if we spoke Portuguese, asked for our identification and air tickets and he told us we would have to wait a while because the MyWay service telephone was not available at that time. After 5 minutes, the employee could get in touch with the service and he informed us that we could wait for the MyWay assistants in the room seats.

Figure 26: 11:25 a.m.

11:25 a.m.: We waited some time without knowing how long it would take to for someone to come, about 15 minutes after, two employees of MyWay were walking close to us and they said "Wait here we come back later". It was 11 hours and 25 minutes when finally, the MyWay assistant came with an airport wheelchair.

Figure 27: 11:30 a.m.

11:30 a.m.: We went to airport security control (CP, MyWay assistant and me). While CP was carried on an airport wheelchair, I took my hand luggage and part of hers. CP took in her lap the other part of her hand luggage. We have no hold luggage.

Figure 28: 11:35 a.m.

11:35 a.m.: When we reached the security control (after waiting in line), I put our luggage and personal belongings in boxes on the belt and I passed through the metal detector. Then, CP removed her jacket to pass the security barrier and next she was carelessly searched by hand. The employee touched her hurt leg without asking first which disability she had. Thereafter I took all our belongings from the boxes and returned to CP her luggage.

11:40 a.m.: Finally, we reach the airside area. After informing us that she would come back at 12 p.m., the MyWay assistant left CP "parked" next to the first row of chairs in the waiting room in front of the information flights placard.

Figure 29: 11:45-11:55 a.m.

11:45-11:55 a.m.: We went to the restaurant area to eat something before the flight. We opted for McDonald's to be quick (we had just ten minutes). In this short time, we face some difficulties, particularly at the counter to buy the food. CP due to be sitting in the wheelchair, she could not approach the counter for ordering (it had no frontal approach area for PRM) and to make the payment, and then the difficulty of CP's ability to sit down to eat her meal with no area for her approaching frontally at the table. It would have been impossible to have lunch if she did not have an accompanying person to help, taking into account she would need to take the luggage and the food alone, pushing at the same time her own wheelchair. Shortly before the agreed time, we head to the meeting point.

12:00 p.m.: We came to the agreed place and waited two minutes until the employee appeared. Then, we went to the boarding gate.

12:05 p.m.: At the boarding gate, the employee asked for our identification and informed us of the need to have brought a document which had been supposedly delivered at the check-in counter (when we head to the check-in counter to report our arrival). We explained to her that we hadn't received any document and she said that as we did not know there was no problem but for the next time we should ask for the document and if we don't, the assistance service in the boarding and deplaning can be refused. After this process we passed the boarding gate through the priority access. However, priority boarding was not respected since the PRM joined the same waiting line as passengers without reduced mobility during a wait of 20 minutes with the small hall after the gate. When staff finally opened the hall doors all passengers were able to move in the direction of aeroplane simultaneously.

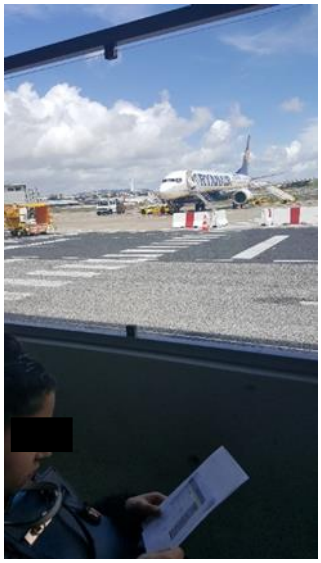


Figure 30: 12:25 p.m.

12:25 p.m.: We head to the ambulift (CP, me and a MyWay assistant) which allows the boarding of PRM without using the stairs.

Figure 31: 12:27 p.m.

12:27-12:30 p.m.: When the lifting equipment began to rise, CP was scared due to vibrations inside the ambulift. Then, the platform stayed at the aircraft door level and the assistant led CP to the entrance, but as the platform does not link fully to the aircraft and oscillates a little, she panicked and decided to use her crutches until the aeroplane seat. When CP came into the aircraft, half of Ryanair passengers had already taken their seats. We sat down in our seats and one stewardess asked CP to hand the crutches to her. Thus, the stewardess kept them in the cabin baggage and said if CP needed to get up, she had to call and wait for her to give her back the crutches.

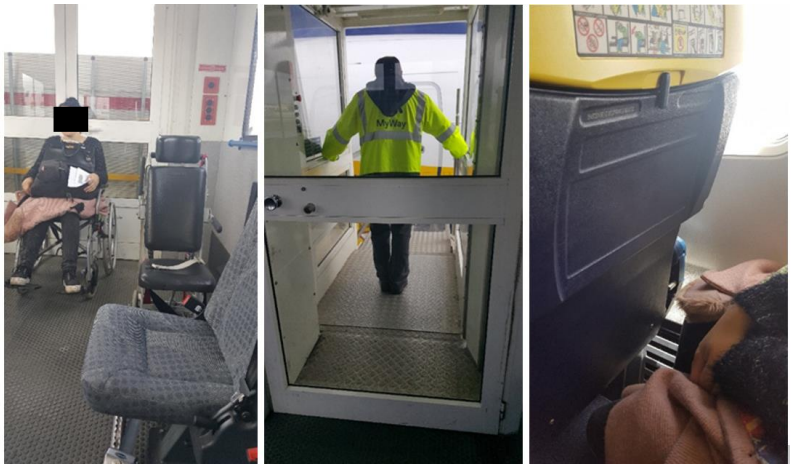


Figure 32: 12:30 p.m.

13:40-13:45 p.m.: The aircraft landed and all passengers came out except us.

13:50 p.m.: After we waited that all passengers leave the aircraft, one of the stewardesses spoke to us to inform that assistance was being treated and therefore we should wait for a MyWay assistant to help in deplaning.

13:55 p.m.: The assistant came and asked CP if she could go down the stairs, she said it was better not to because she had difficulties. That said, the MyWay assistant said that the disembarking would be easier and faster if it was made by stairs. He reinforced that she would be able to go down stairs with his help and that "she had all the time she needed", CP (without another solution) decided to accept. At the end of the stairs there was another assistant of MyWay with the airport wheelchair waiting to lead CP to the designated point of departure.

Figure 33: 13:55 p.m.

14:05 p.m.: With the help of assistant, CP arrived at the designated point of departure situated on the ground floor of the Oporto airport.

Figure 34: 14:05 p.m.

General observations: At Lisbon airport (Terminal 2), MyWay service counter was closed. As Terminal 2 has no parking, we parked near the arrivals (Terminal 1) and we used the Shuttle T2 to go to Terminal 2. This bus does not have conditions to carry PMR, since the ramp was not extended and when the driver saw CP's crutches he didn't ask if it was necessary to extend the

ramp or if she needed help. However, the biggest problem was the exaggerated number of passengers who entered into the bus, with people squeezed against each other. Even the place reserved for PMR was being occupied by countless people without reduced mobility and their baggage. So there was a lady carrying a baby carriage, CP and I very squeezed somewhere in the supposed reserved space for PRM, in the middle of the bus.

Inside the aircraft, in this case a Boeing 737-800, in addition to an aisle of about 0.6m and a space between seats of 0.3m, there is a toilet identified as accessible with an area not exceeding 0.55m^2. This area is lower than recommended taking into account that the minimum dimensions when a toilet is installed inside a cubicle are 1.6x1.7m.

3.5. Conclusion

There is a set of intrinsic variables affecting the decision to travel, to which are added barriers and obstacles that can be found during the journey. It can be said despite a slight improvement of accessibility in air transport, it remains a priority to adopt a policy of continuous improvement because the transports inaccessibility is a factor inhibiting social participation of people with reduced mobility.

In order to promote the participation of PRM in air travel, it is important to know and understand the intrinsic variables in the decision process but also to meet and solve the existing physical barriers and attitudinal barriers by staff and other passengers towards passengers with special needs. A negative experience can lead a passenger with reduced mobility to not wish to travel again. It should also be noted that obstacles can be found in all phases of flight. These obstacles or constraints for passengers without reduced mobility can even be easily overcome, but for PRM any constraint can be a traumatic experience, for example a delay or cancellation of flight, or damaged mobility equipment. By conducting a flight Lisbon-Oporto airport, it was possible to verify the existing physical barriers in their airports infrastructures (Among the national airports, they have the larger area and higher traffic). It was also possible to check the functioning of the passenger assistance service for passengers with reduced mobility (MyWay), accompanying a PRM during all phases of the Lisbon-Oporto flight. Despite the quality commitment at the airports, both Lisbon Airport and Oporto Airport are points to improve in terms of infrastructure and services provided to PRM. In relation to airport infrastructures, it may be mentioned that in all analysed areas there is always something that does not comply with the accessibility guide, or even if not mentioned in this legislation it is mentioned in the ICAO Manual for the accessibility of PRM in air transport (e.g. a tactile floor at the airport and Braille information in the information counters). Regarding the PRM assistance service, it should be noted the disrespect for priority at security checkpoints, and the failure of priority boarding

(referred to in Regulation (EC) no. 1107 / 2006) and the lack of equipment available on the landing.

Failure to comply within the accessibility principles in building infrastructures, and the lack of human resources training create problems and limitations on mobility and social participation. This chapter also mentioned an online survey about accessibility constraints on the air transport. The survey was conducted in order to include in this work the opinion of a considerable number of passengers with special needs. Thus, it was possible to analyse their specific needs and faced barriers during an air travel.

Chapter 4 – Discussion

4.1. Introduction

With the goal of evaluating the accessibility of airport infrastructures, a visit was made to the Lisbon and Oporto airports, in order to know dimensions and to observe physical and architectural barriers. With the objective of identifying attitudinal barriers and constraints in the assistance service for passengers with reduced mobility it was necessary to accompany a PRM during a flight between the two airports mentioned.

Additionally, the investigation of accessibility at the airport required also the identification and evaluation of opinions of people with disabilities. Thus, the main research tool was a structured questionnaire. All the participants on survey were asked to complete a questionnaire concerning their perceptions of their service needs. Consequently, this survey was applied to identify which are the main constraints at the airport and aircraft.

It can be said that this chapter analyses the results of study cases carried out in the previous chapter, i.e., an analysis and interpretation of Oporto and Lisbon airports, an analysis of MyWay assistance and a survey analysis. A variety of perspectives about the same issue allows us to conclude what really are the existing barriers in each phase of the flight.

4.2. Survey

The target population of this study was people with disabilities but also people who accompanied reduced mobility people during an air trip that responded to the online survey. We collected a total of 164 responses, 68 from individuals with any type of reduced mobility and 31 from individuals that accompanied people with reduced mobility.

The highest incidence of reduced mobility occurs before the age of 65, once in this survey participated 68 persons with reduced mobility and only 13 respondents aged equal 65 years or over. The disabilities mentioned are mainly physical impairment (75%) and sensory impairment (15.6%). According to respondents the disability is almost always associated with locomotor disability, but it should take into account the needs of passengers with other types of disabilities.

Most PRM (51.5%) said that air transport is not accessible and 29.4% of respondents have already given up flying due to a bad experience. According to 86.8% of the participants it is necessary to reinforce the legislation to ensure the autonomy of the PRM during the journey. If the quality of service was improved, 66.2% of the passengers would travel more. It is also required a greater

dissemination of existing assistance services at airports, and increased availability of information about the airports and airlines in their websites.

Regarding the airport barriers, the lack of specialized and trained personal (55.1%), the airport information and assistance services (53.9%), and transfers at the airport terminal (53.8%) are the most important barriers for these passengers. It should be noted that only 22.1% consider it easy to obtain information about services for PRM on the airports/airline's websites. The Lisbon and Oporto airports were the national airports most cited in the survey and more than half of the participants considered that these infrastructures do not have the necessary conditions for an autonomous and comfortable experience.

The training of staff to deal with reduced mobility should be reinforced, adding training in sign language so they can communicate with passengers with hearing disabilities. The training of staff and the training of staff in relation to the management of hold baggage containing the passenger's mobility equipment should also be reinforced so that the equipment not be damaged during the journey.

Regarding the aircraft barriers, the boarding/deplaning transfers (68.2%), space between seats (67.8%), lavatories (63.7%), mobility inside the aircraft (63.7 %) and seats transfers (59.8%) were mentioned as most important constraints to overcome. In relation to the airlines with air routes between the national airports most mentioned by PRM (TAP and Ryanair), Ryanair was the company with more negative responses (89.5%), which means that most participants consider that this company does not offer a positive flying experience for passengers with special needs.

According to the most of PRM (80.4%) there is not enough information about evacuation procedures and consequently in case of emergency at the airport they cannot evacuate autonomously (68%).

These results show that passengers with reduced mobility consider that there is still a long way to go in terms of reinforcement of the legislation, and to eliminate airport and aircraft barriers in order to these passengers be able to travel with the same comfort that passengers without reduced mobility. Many passengers mention the training of the staff as essential to overcome the existing barriers.

4.3. Accessibility in Lisbon and Oporto Airports

4.3.1. Lisbon Airport

As mentioned in Chapter 3, at Lisbon airport, for each item analysed some irregularities were found.

There are means of transport to the airport classified as accessible, namely, taxis, metropolitan, and buses. However, if the passenger chooses to travel in a private vehicle and his flight is in Terminal 2, he will have no parking spaces at this terminal. In this case the passenger will have to park at Terminal 1. The temporary parking at Terminal 1 does not have contrasting lines from the floor (as recommended), but the car park (P2) is accessible. If the passenger does not go directly to Terminal 2, He will have to use the Shuttle T2 between Terminal 1 and Terminal 2. Despite being equipped with ramps, the shuttle is not accessible because he carried more passengers than his capacity and consequently the reserved area for PRM is occupied by passengers without reduced mobility and their luggage.

In terms of dimensions, the pavements, kerbs and pedestrian crossings are in agreement with the accessibility guide. However, the pedestrian crossings neither have contrasting colour, as recommended by ACAPO, nor have traffic lights to the secure crossing.

The flooring inside the airport is appropriate but it doesn't have a tactile floor. This is an essential resource to provide safety, orientation and mobility to people with reduced mobility. There is no directional tactile floor, showing at least the way to the information counter (CREA-SC, 2004). The directional tactile floor must be installed in the direction of displacement, it has a width of 0.20m and 0.60m, and having a contrasting colour compared to the adjacent floor. There is also no alert tactile floor. This is used to signal situations involving safety risks, such as uneven surfaces, and for identifying start and end ramps/stairs, escalators, or lifts (CREA-SC, 2004). The alert tactile floor must have a minimum width of 0.25m, but is recommended a width 0.40 to 0.60m (CREA-SC, 2004). Although these recommendations do not appear in the accessibility guide, according to ICAO manual (ICAO, 2013), airports must incorporate wayfinding methods for people with disabilities, for example, visual contrast, detectable patterns on floors and walls Indicating direction, arrangement of architectural elements such as walls and columns, etc. There is signage (to indicate toilets, elevators, etc.) at a height of 2m as required but they have not found materials containing information in Braille on the information or check-in counters, shopping areas, or security information in Braille or even inside the aircraft.

It can be said that the ramps to overcome the height differences between the kerb and the road are in conformity with Accessibility law (both Terminal 1 and Terminal 2). However, the ramp to overcome the difference in level existing between floors, in Terminal 1, it is too inclined for that horizontal projection. To solve this problem, in the middle of the ramp there should be a rest platform, so they would be two ramps on a 6% gradient to overcome a height of 0.6m and with a horizontal projection of 6m each one as recommended.

Concerning to the existing stairs, they have appropriate dimensions, rest platforms and sideguards. In all should have handrails on both sides extending in the base and top of stairs as recommended, an approach area on the floor with a different texture and colour, and a strip with texture and contrasting colour with 0.04m in width on the edge of the steps. Unlike what would be expected, none meets all these characteristics simultaneously.

The lifts are in conformity in terms of dimensions, handrails, door's width, height of call and controls buttons (with tactile references). These don't have sound information and some lifts have the call button on the left side, however it is recommended as good practice the call button on the right side and sound information in all lifts.

It can be said that all doors, corridors and waiting rooms have dimensions in conformity. However, the waiting rooms do not have seats reserved for PRM as recommended both in the Annex 2 and in the ICAO manual. According to ICAO Manual, it is necessary to provide seating in waiting areas for people with special needs, since seats should not be placed where it blocks the evacuation routes.

In Terminal 1, toilets are accessible to PRM, although one of these have one of dimensions lower than recommended. In relation to Terminal 2, two irregularities were found in the toilets, namely, there is no access from both sides of the toilet, and one of the toilet's grab bars is fixed.

Except for the MyWay service information counter (Terminal 1) and the exchange counter (Terminal 2) which have a frontal approach area with the right dimensions, there are no more counters adapted for PRM. Thus, the check-in counters, ticket sales and customer support counters as well as counters of the restaurant area have no frontal approach area and they have a height greater than recommended. It should also be noted that there is no priority assistance (Decreto-Lei 135/99), i.e. the PRM will have to wait in line as passengers without reduced mobility.

At Lisbon airport, despite telephones (MyWay service, ANA, or PT) permit a frontal or side approach, and slots for coins and keyboard are at a suitable height, the keyboard has no tactile references. It can be said that the self-service equipment could suffer improvements in accessibility. Both in the ATM as in the self-check-in machines, the slots for input/output products and the location of commands and controls are in conformity. However, only in the ATM, the existing keyboards are identified with tactile references. Besides, in the self-service machines, the information is not transmitted in sound version and there is not a frontal approach area.

The post boxes meet the legal requirements, but they could be at a lower height and to be more accessible to the PRM as good practices recommend.

It should be noted that although there are vehicles to assist in the boarding/deplaning, these are not always available, representing a big barrier for passengers with reduced mobility, especially passengers with physical or locomotor disabilities (ICAO, 2013).

Even though the relief areas are not mentioned in accessibility guide, the ICAO manual mentions them. It is important to ensure that at the airport there is an area available for service animals to relieve themselves (Smith and McKinney, 2015). While in some international airports, such as, San Diego International Airport (Smith and McKinney, 2015), there are relief areas, at Lisbon airport these do not yet exist.

It can be concluded that all items analysed have some irregularities and these irregularities should be solved to improve the accessibility at the airport. The refurbishment of the airports is essential in order to remove the existing barriers; and additional periodic inspections should be made to verify if new barriers are not created. It is also crucial to ensure the accessibility on the stairs, ramps, lifts, toilets, commercial areas, service counters, parking lots and airport outside areas. If there is no directional or alert tactile floor this should be created to guide passengers with visual disabilities at the airport and the existing telephones should be changed by TTY. In waiting rooms, it should also be noted the need for adequate seats reserved for PRM more spacious and comfortable so that they can rest. The accessibility of the shuttle buses that run between the terminals must be guaranteed through a periodic supervision. Thus, it must be ensured that these buses have ramps and that reserved areas for PRM are respected and not occupied by other passengers.

4.3.2 Oporto Airport

At Oporto airport, some irregularities were also found in each item analysed.

The means of transport to the airport are classified as accessible, namely, taxis, metropolitan, and buses. If the passenger decides to move to the airport by car, he may park in the airport parking with accessible parking spaces for PRM. There are also temporary parking spaces but these have not lines with contrasting colour and the existing ramps to overcome the difference between the kerb and the road have a slope greater than recommended.

The pavements, kerbs and pedestrian crossings are in agreement with the law, in terms of dimensions. However, the pedestrian crossings have not contrasting colour and have not traffic lights.

Similarly, to Lisbon airport, the flooring inside Oporto airport is appropriate but it doesn't have a tactile floor. In relation to signage, there are signals indicating toilets, lifts or other facilities but there is no material with information in Braille.

All stairs in the airport have appropriate dimensions, rest platforms, sideguards and handrails on both sides extending in the base and the top of steps. However, there is no approach area on the floor with different texture and colour as recommended. Moreover, the stairs have a strip with a width of 0.04m on the edges of the steps, but this strip must have a different texture and contrasting colour and these stripes have only different texture. In addition, the stairs have sharp edges, which is danger, especially, for passengers with visual disabilities.

Regarding the lifts, these are in conformity in terms of dimensions, handrails, height of call and controls buttons (with tactile references), and door's width. However, the lifts did not have sound information and the call button in some cases is not on the right. When there are multiple floors at the airports it is necessary to have lifts an alternative to stairs, but there should also be ramps as an alternative, because in case of emergency or when the lifts break down, the PRM are unable to move between floors.

It can be said that interior doors, corridors and waiting rooms have dimensions in conformity. However, the waiting rooms do not have seats reserved for PRM as recommended both in the accessibility guide and in the ICAO manual. In addition, the outside doors are revolving doors what is not recommended.

The existing toilets, identified with the international symbol of accessibility, have the necessary adaptations to PRM in terms of dimensions, taps, toilets, washbasins, grab bars and alarm. Only the base of the fixed mirror on the wall is at a height of more than 0.9m.

At Oporto airport, there are accessible counters to PRM, in particular, Information counters, ticket sales and customer support counters, the exchange counter and CTT. However, the check-in counters are not adapted, as well as counters in the restaurant area, custom house counter or passport shop. In addition, there aren't priority assistance in existing counters.

The existing telephones in airport (MyWay service, ANA, or PT) permit a frontal or side approach, and slots for coins and keyboard are at a suitable height, but the keyboard has no tactile references. It should be noted that both in the ATM as in the self-check-in machines, the slots for input/output products and the location of commands and controls are in conformity, but only in the ATM the keyboards are identified with tactile references. Moreover, in the self-service machines, the information is not transmitted in sound version and there is not a frontal approach area.

The post boxes meet the legal requirements, but they could be at a lower height in order to be more accessible to the PRM.

In Oporto Airport, there are vehicles to assist passengers with reduced mobility in the boarding/deplaning but these vehicles are not always available.

As in the Lisbon airport, in the Oporto Airport there are no relief areas for service animals which creates a barrier to service animals that assist the visually impaired passengers in the airport circuit and inside the aircraft (Smith and McKinney, 2015).

Finally, it can be seen that all items analysed at this airport can also suffer improvements to solve the existing irregularities. To enhance the accessibility of air transport to the people with reduced mobility, an increased dissemination of information about the available services at the airport is important, for example information about MyWay service. This dissemination may be made through promotional videos on the airport and airline websites, as well as using information leaflets and information materials in Braille at the airport. It is also necessary to provide information about emergency evacuations, and existing means of transport adapted with access to the airport, for example, about taxi companies with adapted vehicles and existing bus classified as accessible.

4.3.3 Functioning of MyWay Service Assistance

The MyWay system is an assistance service that allows passengers to overcome obstacles at the airport with the help of assistant service and equipment to help in loading and unloading, while the ELO system is a set of infrastructures allowing the PRM to be autonomous as the other passengers without being exposed to weather conditions. The disadvantage of this system is that the passenger continues to travel long distances. So ideally it would join the two systems in one, i.e., the infrastructure of the ELO system with the assistance of MyWay service in order to help the passenger (if necessary) to cover the distance to the aircraft and to assist the passenger with luggage, security points, check-in… During an air trip accompanying a passenger with reduced mobility it was possible to identify some problems in terms of assistance service.

This journey begins for not complying with Regulation (EC) no. 1107/2006 where it is written that at the point of assistance service to PRM, the PRM be able to obtain basic information about the airport, to announce their arrival at the airport and request assistance. This is not respected because the PRM had to move to the check-in counter to activate the assistance service.

The waiting time for MyWay assistant, in the pre-flight phase, almost exceeded the time limit referred to in quality commitment of service (30 minutes). In accordance with this commitment, 80% of the passengers shouldn’t wait more than 10 minutes and CP waited about 30 minutes. According to the ICAO Manual the service request by PMR should have no points where these people can be abandoned or unattended.

It may also be mentioned the lack of assistance with hand luggage and the lack of care of the employee's security control to inspect the PRM. In accordance with Regulation (EC) no. 1107/2006, all staff providing assistance to persons with reduced mobility have knowledge of how to meet the needs of PRM.

In the restaurant and commercial area, the lack of locals adapted and prepared to receive PRM should also be mentioned as a barrier to overcome.

It can be said that both the PRM attendance priority as the boarding priority were not met in the various phases of flight. In accordance with Decree Law 135/99, the priority attendance should be given to the PRM (what is not being respected) and according to the ICAO Manual mentioned in chapter 2, people with reduced mobility should have the opportunity to board before other passengers and deplaning after them because it is more dignified and less stressful for the passenger. The boarding priority must not be disrespected; thus, the legislation should be strengthened to this end. It would also be convenient, as one respondent said, each airline had its loading and unloading equipment so that it was always available.

There is a standard about boarding vehicles for persons with reduced mobility, ISO15845:2014. This standard mentions the importance of boarding vehicles offer a sense of comfort to the passenger. At the moment of boarding, CP was panicking with equipment oscillations and that cannot happen (ISO15845:2014).

It should be noted that the seats available in the aircraft for PRM follow only the criterion of not being close to an emergency door. The conclusion therefore is that there are no reserved seats on the aircraft for these passengers. According to the manual ICAO, the aircraft must have seats which are designated as accessible for PRM and these seats must be occupied by other passengers in last place. If a passenger with reduced mobility is in need of service animal or is in some way injured, e.g., broken leg, it is required that the seat one should occupy fulfils the needed requirements of space in order to travel comfortably. As suggested by one of the respondents on the online survey due to the lack of space between the seats inside the aircraft, it would be useful to permit PRM travelled in first class (where there is more space) at a price of economy class. However, it would be more effective a refurbishment in the interior of the aircraft in order to make more spacious toilets as well as the aisles and more spaces between the seats. Their seats must have more space and must be reserved for PRM next to the entrance/exit door of the aircraft or next to the lavatories in order to the passenger to move as little as possible. In the case of an aircraft refurbishment would also be useful to add directional tactile signage in the corridors for passengers with visual disabilities can be guided themselves on the aircraft, as well as to add a relief area for service animals of these passengers.

Finally, it should be noted that there are ambulifts both at Lisbon airport and at Oporto airport, however these vehicles were not available at the moment of deplaning and CP had to walk down stairs. This does not agree with the purpose of the assistance service in boarding and deplaning. In accordance with the Regulation (EC) no. 1107/2006, at the airport and inside the aircraft the adequate assistance for these people should be given in order to support their specific needs, using personal and all necessary equipment.

Taking into account the analysis of study cases it appears that at any phase of flight can be referred some barriers, namely, the lack of information in Braille or personal specialized in sign language. According to ICAO manual it should be published guidance material on air transport in appropriate formats and technologies to different types of disabilities. It should be noted the lack of specialized staff to deal with the needs of passengers depending on the type of reduced mobility, as well as specialized staff in baggage handling including mobility equipment of PRM. Furthermore, the negative attitudes to disability on the part of the staff and other passengers must be also mentioned as a major barrier in all phases of flight. It should also mention the inexistence of Relief areas during all phases of flight, which causes a big inconvenience to service animals. It can be said that the barriers found, in the analysed airports and in the assistance service for passengers with reduced mobility, coincide with the barriers mentioned in the documents analysed on this work as well as the barriers mentioned by survey respondents.

- **Pre-Travel**

In this phase, when the ticket reservation is made online, it is essential that the person is aware of the existence of the assistance services to passenger with reduced mobility, so that at the time of reservation, he selects this option and makes the seats selection (the seats cannot be adjacent to an emergency door). The first barrier can be a lack of knowledge about existing assistance services. If reservation is made in the airport, at the counters for this purpose should be the employee to inform and help the passenger to request special assistance and make the selection of appropriate seats. Another problem is these counters are not always adapted.

It should be noted that if the passenger does not request assistance will have to overcome all the barriers alone sometimes travelling great distances at the airport without being prepared physically for it. If the reservation is not made online, the passenger goes to the airport and in this case is necessary to find accessible means of transport or accessible parking spaces for car. It is also essential that the airport outside areas are accessible and not representing a barrier for these passengers, particularly in terms of pavements, kerbs and pedestrian crossings as well as the entry/exit airport door.

It should also be mentioned that there are a limited number of PRM per flight, and when the PRM plans to travel, the aircraft may already be without seats for more a passenger in need of assistance.

- **Pre-Flight**

In the pre-flight if the reservation is made online, the passenger goes to the airport in this phase, so as referred to in the pre-travel, it is necessary to find accessible means of transport or an accessible parking spaces for car, as well as it is important that the airport bus between the terminals is accessible to PRM. Sometimes the means of access to the airport are the first barrier to air travel.

During the pre-flight may be referred to obstacles, such as, the lack of signage at the airport and the lack of directional and alert tactile floor for PRM with visual disabilities to guide themselves inside the building at least until the adapted information counter or the telephone assistance service. Without adequate signage the PRM cannot find the Myway points to activate the service. If the PRM have hearing and visual impairments and the telephone assistance service is not TTY or not even have tactile references, this is another difficulty he will have to overcome. In an emergency, the PRM faces another problem, i.e., the lack of information about emergency procedures for an autonomous evacuation. When there are multiple floors at the airports and there are no lifts or ramps an alternative to stairs the PRM are unable to move between floors.

In this flight phase, the PRM have to go to the check-in counter if they have not checked-in online or self-checked-in (these machines sometimes do not have the necessary adaptations). It should be noted that the PRM must notify the airport 48 hours in advance of the flight and on the day of the flight should be at the airport at least 2 hours in advance, i.e., the passenger with reduced mobility cannot decide to travel in an instant like other passengers. During the check-in phase may also be required an accompanying person or a medical certificate. If the passenger is not prepared for this type of requirement, the boarding can be refused. Sometimes, although the PRM have done the online check-in, he has to face the same barriers in check-in counter which may not have the necessary adaptations (in terms of height) and not have a space to priority in attendance (involving the PRM be exposed to the indiscreet looks of other passengers at check-in lines). According to the ICAO manual, the service counters should be accessible to all persons with reduced mobility. Airport and aircraft operators shall also ensure that the machines check-in kiosks or under their control are accessible and identified with the universal symbol of accessibility.

Following is the passport control and security Inspection after a waiting time for MyWay service assistant. This waiting time without news and information is a major barrier for passenger with reduced mobility he feels he was abandoned there. It should be noted the importance of waiting

rooms with seats reserved for PRM, because the lack of seats for these passengers to rest comfortably while waiting for staff assistance service is another barrier. It is also important to underline the availability or lack of condition of airport wheelchairs, as well as the importance of the assistant's help with hold baggage.

The security Inspection may cause some inconvenience, if the priority attendance is not met or the employee is not qualified to do the inspection of PRM. The carriage of hand luggage along the airport should be part of the service assistant functions, however, sometimes it is the companion who carries the luggage of PRM or PRM have to carry their own luggage which is certainly a barrier to overcome. Both airside as landside, the facilities without necessary adjustments represent barriers to these persons, namely, bathrooms, commercial areas, ATM without frontal approach and waiting rooms without reserved seats for PRM rest (or with inadequate dimensions).

The Boarding Gate is a barrier when boarding priority is not respected and the PRM must wait in line to board like other passengers and when there is a lack of available equipment to assist in the boarding. The last barrier in this phase is the transfer of the airport wheelchair to the aisle chair. Besides being a small wheelchair making it uncomfortable for passengers, it is essential that it is available and in good conditions.

- **During Flight**

On board the aircraft, the biggest problems faced are the small size of the corridors and the bathrooms, as well as the reduced space between seats making the flight uncomfortable for these passengers. Sometimes on the aircraft there are no reserved seats for passengers with special needs. Thus, they are seated at a place which may be away from the entrance/exit door and away from the bathrooms. It should be noted that the PRM cannot be seated adjacent to the emergency door and in case of emergency the PRM will not be able to evacuate autonomously. The passenger also has to take into the passenger cabin his hand luggage if he has not an accompanying person with him or if MyWay service assistant do not do it.

The crew tries to transmit some safety information to passengers during the flight, but these may not be able to understand this information due to visual or hearing limitations. In order to overcome the communication barrier on the plane, as indicated in the ICAO manual, information should be provided in Braille and sign language, as well as it should be placed in tactile directional signage throughout the cabin.

- **Post Flight**

At this stage, the waiting time for MyWay service assistance and the lack of available equipment to assist the landing (such as boarding) represent a barrier to the passenger with reduced

mobility. If there is no available equipment, passengers have to go down the stairs of the aeroplane on foot. When it is necessary, both the passport control as hold baggage reclaim and customs house are possible barriers to overcome with the help of MyWay service assistant.

As in the departures area inside the airport, in the arrivals area the PRM may also face difficulties in terms of facilities which do not meet the requirements, for example, bathrooms, waiting rooms, commercial areas, ATM, telephones, lifts, stairs, ramps... There is still a lack of adequate signage and directional or alert tactile floor representing great constraints, as well as the lack of procedures to an emergency evacuation. The outside areas at the airport are also important barriers, thus it is necessary to have pavements, kerbs, pedestrian crossings and entry/exit airport door as recommended.

When these barriers are overcome, the passenger has yet to leave the airport through accessible means of transportation at the airport (if any, and the PRM is aware of these) or by car (using the accessible parking spaces, if any). Without accessible transports or accessible parking for PRM, these persons face a great challenge to leave the airport.

4.4. Conclusion

With the online survey can be concluded that the great majority of people with reduced mobility does not consider the air transport as accessible. And the main constraints at the airport mentioned by respondents are the lack of specialized and trained personal, the airport information and assistance services, the transfers at the airport terminal and baggage claim. Another fault detected is the lack of information about evacuation procedures and consequently in case of emergency at the airport they cannot evacuate autonomously. In addition, the main constraints at the aircraft mentioned by participants are the boarding/deplaning transfers, the space between seats, the lavatories and mobility inside the aircraft.

The importance of the existing barriers in the airport infrastructure is dependent on the type of passenger limitation, i.e., what is important for a passenger with mobility difficulties may not be important for a passenger with sensory impairments, and vice versa.

Considering the Lisbon case, the main problems are transfers between the airport's terminals due to airport bus (Shuttle between Terminal 1 and Terminal 2), the waiting time for assistance service and the quality of it as well as the lack of adapted service counters. It should also be noted that the toilets in Terminal 2 should be improved. Just as there must be respect for priority assistance. People with reduced mobility should have the opportunity to board before

other passengers and deplaning after them, however during the Lisbon-Oporto flight the priority boarding was not respected.

Considering the Oporto airport, although most service counters are in conformity, check-in counters are not yet (They have a height greater than recommended). In addition, there are other problems as the revolving doors at the airport and the lack of availability of the equipment on boarding and unloading, representing a big barrier for passengers with reduced mobility.

Both at Oporto airport and Lisbon airport, there are means of transport to the airport classified as accessible, as well as accessible parking lots. For each item analysed some irregularities were found, namely, ramps and stairs. The waiting rooms analysed do not have seats reserved for PRM and it is necessary to provide seating in waiting areas for people with special needs can rest. It is also necessary to provide a tactile floor at the airports as well as tactile references in telephones and in self-equipment to passengers with visual disabilities. There are many other items that can be improved for improving accessibility.

At the moment the infrastructures analysed do not have the necessary conditions for an autonomous and comfortable experience. It was verified that there are barriers in the following phases of flight: pre-travel, pre-flight and post flight. There is still a long way to go in terms of reinforcement of the legislation, in order to eliminate all barriers in air transport. In conclusion, it can be said that the responses obtained in the survey, which identify the barriers at the airport and inside the aircraft, are in accordance with the barriers found in two airports analysed as well as the barriers found inside the aircraft during an air travel made with the company of a passenger with reduced mobility. Thus, the suggestions for improvement mentioned in this work should be applied in all airports, especially in national airports, and in aircraft.

Chapter 5 – Conclusion

5.1. Dissertation Synthesis

One of the objectives of this thesis is to raise everyone's awareness for the problem of reduced mobility in air transport. It is known that people with reduced mobility represent a significant and growing percentage of the world population. As participation in society is a right of all individuals, ensuring the quality of services adapted in terms of accessibility becomes a responsibility of the whole community. Thus, the implementation of strategies to minimize the physical and attitudinal barriers is essential.

Within the European Union, the rights of passengers with reduced mobility are ensured by a common regulation for all Member States (Regulation (EC) no. 1107/2006) and if their rights are not respected, passengers should contact the corresponding airline/airport or can submit a complaint if necessary. In Portugal, it is important to highlight the Accessibility law which presents a number of normative provisions designed with the intention of offering higher quality of life to people with reduced mobility by removing barriers on infrastructures, including airports. Taking into account all the documents analysed about accessibility and reduced mobility, it can be said even though the authorities involved have been trying to provide more facilities and services for passengers with special needs, many people do not travel because the facilities are not yet appropriated for their needs.

In this work, by conducting a flight Lisbon-Oporto, it was possible to verify the existing physical barriers in these airports infrastructures and It was also possible to check the functioning of the passenger assistance service for passengers with reduced mobility (MyWay), accompanying a PRM during all phases of flight. In relation to airport infrastructures, it may be mentioned that in analysed areas there is always something that does not comply with the Accessibility law or there is something that can be improved. Regarding the PRM assistance service, it should be noted the disrespect for priority at security checkpoints, the failure of priority boarding referred to in Regulation (EC) no. 1107/2006 and the lack of equipment available on deplaning. In order to include the opinion of a considerable number of passengers with special needs, an online survey about accessibility constraints on the air transport was also conducted. Thus, it was possible to analyse their specific needs and faced barriers during air travel and it was possible to verify if their opinions are in according with analysed documents.

The results of this work showed that the importance of the existing barriers in airport infrastructure is dependent on the type of passenger limitation. With the online survey it can be concluded that the great majority of people with reduced mobility does not consider the air transport as accessible. Considering the Lisbon case, the main problems are transfers between airports, the waiting time for assistance service and the quality of it as well as the lack of

adapted service counters, and the disrespected for priority boarding. Considering the Oporto airport, there are problems with height of check-in counters, the revolving doors at the airport and the lack of availability of the equipment on boarding and unloading. It can be concluded that the infrastructures analysed and the assistance service provided do not have the necessary conditions for a seamless journey because there are barriers in all phases of flight. In conclusion, in order to eliminate the existing barriers, it is necessary a reinforcement of the legislation and a periodic audit to verify and ensure that new barriers are not being created.

5.2. Final Considerations

The PRM is a person whose mobility is reduced due to a physical or psychological limitation, temporary or permanent. In order to promote their participation in air travel, it is important to know and understand the intrinsic variables in decision to travel process but also meet and solve the existing physical barriers and attitudinal barriers that may inhibit them to travel or limit their travel satisfaction.

Currently, due to a social and political environment in evolution, airlines and airport operators should be more attentive to the needs of people with reduced mobility. In general, it is possible to conclude that it is critical to promote continuous training in accessibility for all PMR working staff in order to provide a better assistance and services to these people. Furthermore, it is urgent to implement measures and develop reconstruction plans in airport infrastructures to solve the problems mentioned throughout this work. The process of removing architectural barriers should be done involving a number of people with disabilities in the project of accessibility ensuring that interventions are correctly implemented. It is also important that there is a reinforcement in legislation and that the legislation ensuring the rights citizens with disabilities or reduced mobility should be made according to the viewpoint of these people and should be entirely applied. In addition, there should be more available information about the services to PRM at the airports and airlines websites.

Finally, it can be said that this work was very important to know the existing barriers not only in national airports but also the barriers at airports in general. For that achievement the national airports analysis and the analysis of the airport's assistance service were essential, as well as the information contained in the documents considered to realise this thesis.

5.3. Prospects for Future Work

Progress has been made in terms of accessibility in air transport but many important questions remain. Thus in this work there should cross the following lines of research:

- Extend this study to other national and international airports, comparing the barriers between them;
- Design an airport completely accessible, i.e., without physical barriers for PRM;
- Check if there are other problems in the assistance service for passengers with reduced mobility;
- Find new solutions to solve the existing problems at airports.

References

Aerobus, 2016. FAQ's, 01 Why should I choose the Aerobus?. Accessed 15/05/2016 https://www.aerobus.pt/pt-PT/FAQS.aspx

ANA, 2012. Livening up Airports. Sustainability Report 2012.

ANAC, 2016. Activity Report, Management and Accounts 2015, 46-47.

Auto Táxis Serra D'Arga Lda, 2011. Service Vehicles. Accessed 15/05/2016 http://www.taxisarga.pt/

Carris, 2010. Reduced Mobility Service on Regular Public Service Buses. Accessed 15/05/2016 http://carris.transporteslisboa.pt/en/reduced-mobility/

Chang, Y.C., Chen, C.F., 2011. Identifying mobility service needs for disabled air passengers. Tourism Management 32, 1214-1217.

Chang, Y.C., Chen, C.F., 2012a. Meeting the needs of disabled air passengers: Factors that facilitate help from airlines and airports. Tourism Management 33, 529-536.

Chang, Y.C., Chen, C.F., 2012b. Service needs of elderly air passengers. Journal of Air Transport Management 18, 26-29.

Chang, Y.C., Chen, C.F., 2012c. Overseas travel choice for persons with reduced mobility. Journal of Air Transport Management 20, 43-45.

Constitutional Law 1/2001. Portuguese Official Journal no. 286 (12 December 2001), Series I, Part A, Article 13.

Coop Taxis Portugal, 2015. Services – The largest Portuguese Taxi Fleet. Accessed 15/06/2016 http://cooptaxis.pt/en/services/

CREA-SC, 2004. Guidebook to Accessibility. The implementation of the decree 5.296/04.

Decreto-Lei 38/2004. Portuguese Official Journal no. 194 (18 August 2004): 5232–5236.

Decreto-Lei 46/2006. Portuguese Official Journal no. 165 (28 August 2006): 6210–6213.

Decreto-Lei 135/99. Portuguese Official Journal no. 94 (22 April 1999): 2126-2135.

Decreto-Lei 145/2007. Portuguese Official Journal no. 82 (27 April 2007): 2712-2719.

Decreto-Lei 163/2006. Portuguese Official Journal no. 152 (8 August 2006): 5670–5689.

European committee, 2004. Regulation (CE) no 261/2004 of the European Parliament and of the Council establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights. Official Journal of the European Union.

European committee, 2006. Regulation (EC) no 1107/2006 of the European Parliament and of the Council concerning the rights of disabled persons and persons with reduced mobility when travelling by air. Official Journal of the European Union.

Forhan, M., Gill, S., 2013. Obesity, functional mobility and quality of life. Best Practice & Research Clinical Endocrinology & Metabolism 27, 129–137.

Gaspar, S., Zorro, S., Silva, J., 2015a. Accessibility constraints in the airport terminal facilities. 14th International Conference on Mobility and Transport for Elderly and Disabled Persons, Lisbon, Portugal, Jul 2015.

Gaspar, S., Zorro, S., Silva, J., 2015b. Airport Infrastructures and Persons with Reduced Mobility. International Conference on Engineering, University of Beira Interior, Covilhã, Portugal, Dec 2015.

Gregg, C., Vanderheiden, R., Katherine, R., 1991. A brief introduction to disabilities. Trace Research and Development Center.

Guerrinha, C., Zorro, S., Silva, J., 2015. Constraints in the airports emergency protocols for passengers with reduced mobility. 14th International Conference on Mobility and Transport for Elderly and Disabled Persons, Lisbon, Portugal, Jul 2015.

ICAO, 2013. Manual on Access to Air Transport by Persons with Disabilities, Doc 9984, First Edition 2013.

Infraero Aeroportos, 2014. Accessibility-ELO. Accessed 12/04/2016 http://www.infraero.gov.br/index.php/institucional/acessibilidade-elo.html

ISO 15845:2014. Aircraft ground equipment. Boarding vehicle for persons with reduced mobility. Functional and safety requirements.

Lee, B.K., Agarwal, S., Kim, H.J., 2012. Influences of travel constraints on the people with disabilities' intention to travel: An application of Seligman's helplessness theory. Tourism Management 33, 569-576.

McKercher, B., Packer, T., Yau, M., 2004. Travelling with a disability more than an access issue. Annals of Tourism Research, Vol. 31, No. 4, 946-960.

McKercher, B., Packer, T., Yau, M., Lam, P., 2003. Travel agents as facilitators or inhibitors of travel: perceptions of people with disabilities. Tourism Management 24, 465-474.

Mein, P., Kirchhoff, A., Fangen, P., 2014. Impacts of Aging Travelers on Airports. Airport Cooperative Research Program Synthesis 51.

Metro do Porto, 2011. Accessibility. Accessed 17/05/2016 http://www.metrodoporto.pt/pages/316

Metropolitano de Lisboa, 2012. Accessibility, Mobility for all. Accessed 15/05/2016 http://metro.transporteslisboa.pt/eng/customer-info/accessibility/

MyWay, 2008. Livening up your mobility. Assistance for persons with reduced mobility (Flyer, 26 July 2008).

National Statistics Institute, 2011. Health and Disability in Portugal.

Preston, J., Rajé, F., 2007. Accessibility, mobility and transport-related social exclusion. Journal of Transport Geography 15, 151-160.

Ray, N.M., Ryder, M.E., 2003. ‘‘Ebilities’’ tourism: an exploratory discussion of the travel needs and motivations of the mobility-disabled. Tourism Management 24, 57-72.

Smith, J., McKinney, E., 2015. Issues Related to Accommodating Animals Travelling Through Airports. Airport Cooperative Research Program Synthesis 64.

SNRIPD, 2009. Guide: Accessibility and mobility for all. Notes for a better interpretation of the DL 163/2006 (8 August).

STCP, 2012. Easy access network. Accessed 17/05/2016 http://www.stcp.pt/en/travel/accessibility/easy-access-network/

Taxis Pinheiro, 2014. Vehicles. Accessed 17/05/2016 http://taxispinheiro.pt/

Trip Accessible, 2015. Accessibility. Accessed 30/03/2016 http://www.tripaccessible.com/en/experience/transportation/airport/

United Nations, 2015. Population ageing and sustainable development. Population Facts, No.2014/4/Rev1, 1-4.

U.S. Department of Transportation, 2003. Non-discrimination on the Basis of Disability in Air Travel. 14 CFR Part 382.

World Health Organization, 2011. World report on disability. WHO Library Cataloguing in Publication Data.

Annex 1- Survey

Transportation systems, in particular the air transportation, presents some obstacles to passengers with reduced mobility. This survey aims to explore and identify the main constraints that compromise the rights of Persons with Reduced Mobility (PRM) and reduces their will of using air transportation. This study is part of an investigation within a Master and a PhD thesis regarding the accessibility constraints in air transportation. The answers are anonymous and confidential.

Contacts:

Sara Zorro: saramzorro@gmail.com
Sofia Gaspar: software_gaspar@hotmail.com

* Required fields

1. Nationality

_____

2. Gender

   - Male
   - Female

3. Age

_____

4. Do you have any type of reduced mobility? *

   - No
   - Yes

If you answered **no**, please go to **question 5**.

4.1. Which are your main physical or/and psychological limitations?

_____

_____

_____

4.2. Have you ever given up of flying for a certain airport or with a certain airline due to a previous bad experience?

- o No
- o Yes
- o Don't know

4.3. Would you travel more frequently if the quality of service provided was better?

- o No
- o Yes
- o Don't know

4.4. In an emergency situation at the airport, do you consider that you could evacuate autonomously?

- o No
- o Yes
- o Don't know

4.4.1. Do you think there is enough available information about which are the airport's emergency and evacuation procedures for PRM?

- o No
- o Yes
- o Don't know

4.4.2. Would you feel safer if the airports made available information about the emergency plans and exits?

- o No
- o Yes
- o Don't know

5. Have you ever accompanied a PRM during an air trip?

- o No
- o Yes

6. Which are the airport(s) you regularly use?
   Please list the airports from the most used to the less

_____

_____

_____

6.1. Do you think that/those airports have the sufficient conditions to make PRM experience as autonomous and comfortable as possible?

Please answer following the order you mentioned in the previous question. Ex: 1 - (Lisbon) Yes, 2 - (Oporto) Yes, etc.

	No	**Yes**	**Don't Know**
1			
2			
3			
4			
5			

7. Which are the main constrains that you believe PRM face within the airports?

Please identify the importance of the following sentences.

	Very Important	Important	Moderately Important	Somewhat Important	Not At All Important	Don't Know
Airport Information and Assistance Services						
Baggage Claim						
Boarding Areas						
Check-in						
Duty-Free Shop						
Emergency Exits						
Lack of Specialized and Trained Personal						
Lavatories						
Security						
Transfers at the Airport Terminal						
Waiting Areas						

Others:

_____

_____

_____

8. Which are the airline(s) you regularly travel with?

Please list the airlines from the most used to the less

_____

_____

_____

8.1. Do you think that/those airlines have the sufficient conditions to make PRM experience as autonomous and comfortable as possible?

Please answer following the order you mentioned in the previous question. Ex: 1 - (TAP) Yes, 2 - (Lufthansa) Yes, etc.

	No	Yes	Don't Know
1			
2			
3			
4			
5			

9. Which are the main constrains that you believe PRM face within the aircraft?

Please identify the importance of the following sentences.

	Very Important	Important	Moderately Important	Somewhat Important	Not At All Important	Don't Know
Accommodate the Carry-on Baggage						
Boarding/Deplaning Transfers						
Lack of Specialized and Trained Personal						
Lavatories						
Mobility inside the Aircraft						
Seat Belt						
Seat Transfers						
Space between Seats						

Others:

_____

_____

_____

10. Do you find air transport a transportation mode of easy access for PRM?

- o No
- o Yes
- o Don't know

11. In general, do you believe that PRM prefer travel in other transportation mode than flying?

- o No
- o Yes
- o Don't know

12. Do you think that it is easy to obtain information about the services for PRM on the airports/airlines' websites?

- No
- Yes
- Don’t know

13. Do you think that there’s a need for a regulatory change where airports and airlines should be obligated to guarantee a certain level of autonomy for PRM?

- No
- Yes
- Don’t know

14. What do you think that should be improved in airports and inside the aircraft to better suit for PRM needs?

_____

_____

_____

15. Observations and/or suggestions:

_____

_____

_____

_____

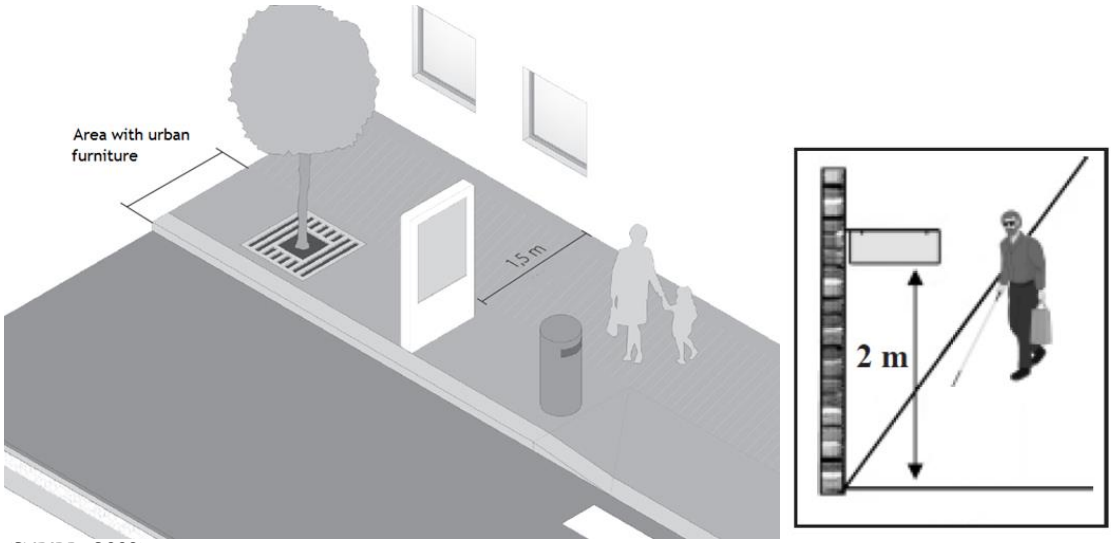
Thank You!

Annex 2- Mobility and Accessibility for All

The airport infrastructures, namely Lisbon and Oporto ones involved in this study, are analysed accordingly with the "Mobility and Accessibility for All" guide developed by the author as in this Annex. This guide is based on an already existing document created for a better understanding of the Decreto Lei no.163/2006 (SNRIPD, 2009).

Pavements and Access Ways

The maximum incline of the pavements and surrounding access ways to buildings, in the longitudinal direction is 6% and in the transversal direction is 2%. The height of the kerbs near the pedestrian crossings is 0.12m and it is 0.02m in height across the entire width of pedestrian crossing. The minimum width of the pavements should be 1.5m. The pavements must have an anti-slip surface. The minimum height of signs fixed on posts, walls or other is 2m.

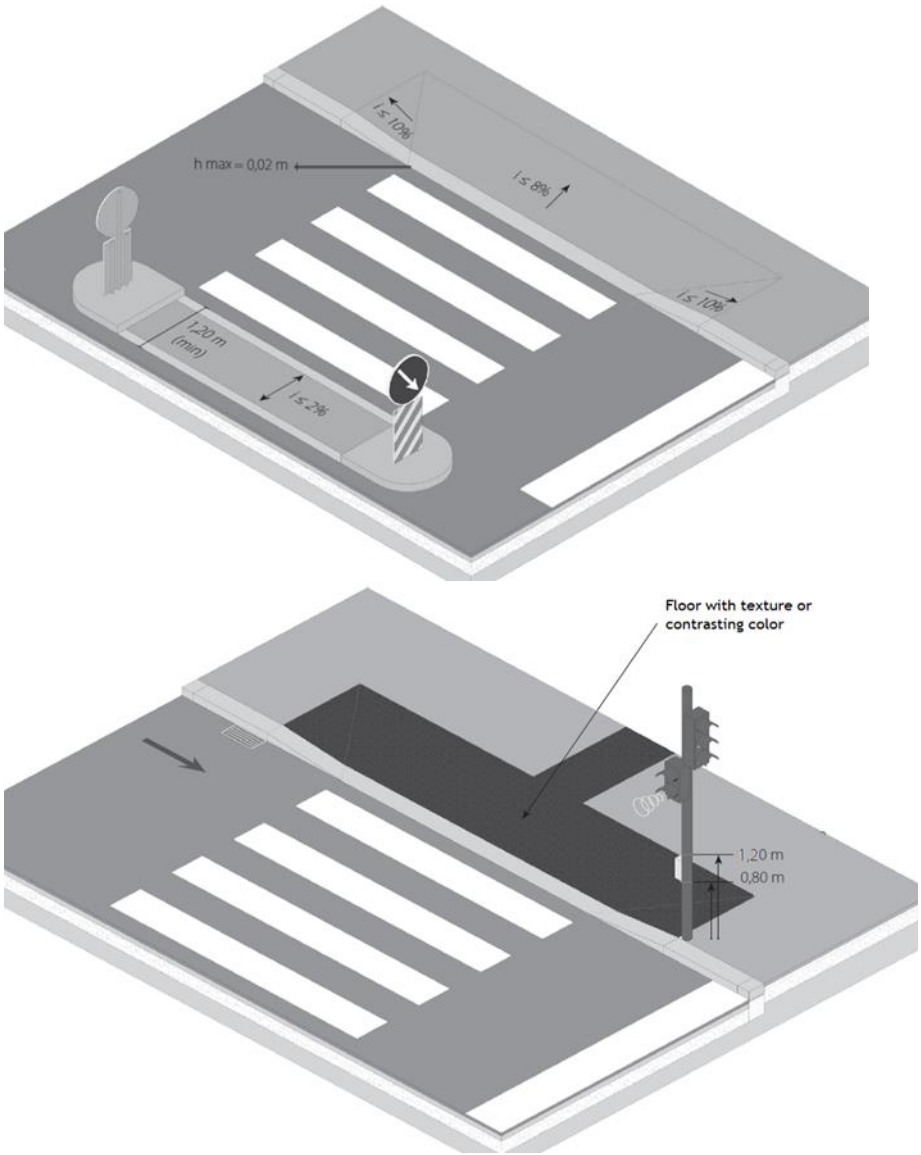


(SNRIPD, 2009)

Pedestrian Crossings

The interception of the islands in the middle of a zebra crossing with the pedestrian crossings should have a length of 1.2m or more (it is recommended 1.5m), and the island width should not have less than the width of the pedestrian crossing. The pedestrian crossing's surface should also have contrasting colour and a different texture than what was used on the pavements and roads. The colour recommended by ACAPO is bordeaux. There should be traffic lights at the pedestrian crossings. When there are traffic lights, the green light must be open enough time

to allow a safe passage (at a speed of 2m/5s). There should also be additional audible signals and the button should be between 0.8m and 1.2m of height.



(SNRIPD, 2009)

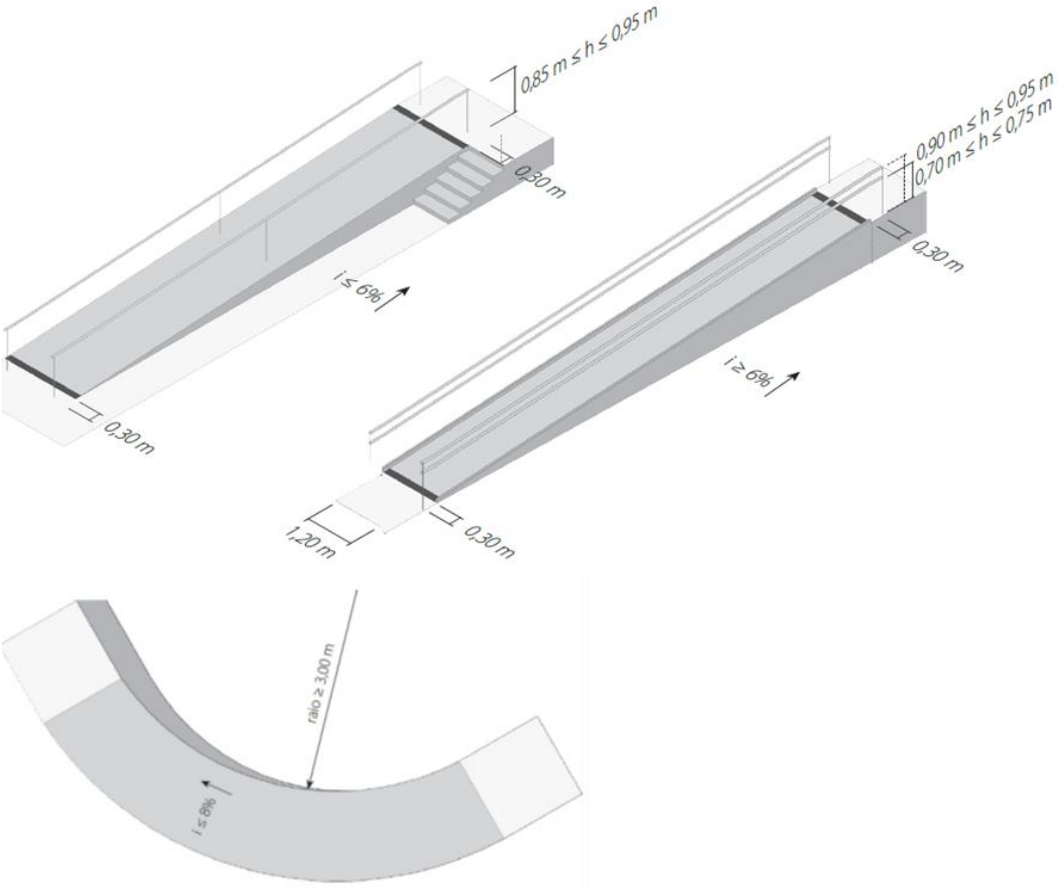
Ramps

The ramps should have the minimum possible incline. If the slope is equal to or less than 6%, the ramp must overcome the maximum height difference of 0.6m and to have a horizontal projection not exceeding 10m. If the slope is equal to or less than 8%, the ramp must overcome the maximum height difference of 0.4m and to have a horizontal projection not exceeding 5m. Ramps should have horizontal rest platforms (with length equal to or greater than 1.5 m and width not less than the ramp width), when the horizontal projection is higher than specified

for each slope, and in places where there is a change of direction with an angle equal to or less than 90°.

Ramp slope	Maximum horizontal projection	Maximum gradient
6%	10.00m	0.60m
8%	5.00m	0.40m
10%	2.00m	0.20m
12%	0.83m	0.10m

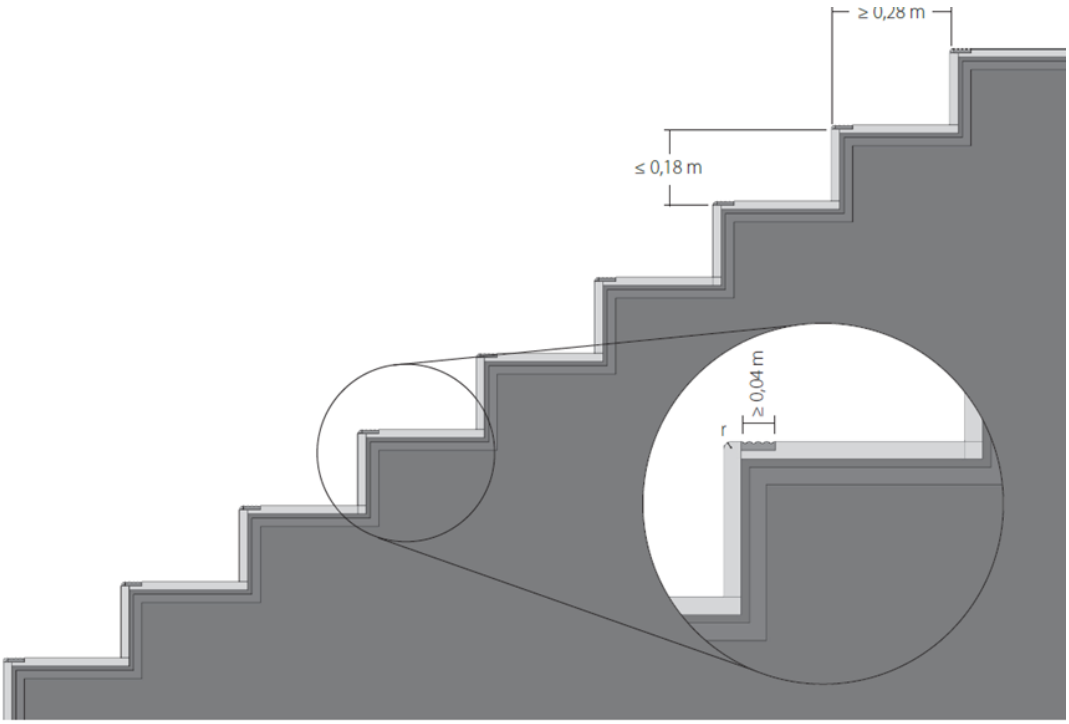
Ramps should have a minimum width of 1.2m (or 0.9m if the ramp has a horizontal projection less than 5m and if there are two ramps for the same route) with double handrails on both sides (one between 0.9m and 0.95m as well as other between 0.7m and 0.75m). The handrails should extend 0.3m at the base and at the top of the ramp and these should be parallel to the ramp. The ends of the handrails are rounded. If the gradient is equal to or less than 0.2m, there can be no handrails, or if the gap is between 0.2m and 0.4m and the ramp does not have a slope greater than 6%, only handrails can exist on one side between 0.85 and 0.95m of height. The ramps floor must be made of material with good grip and they should also have a lateral protection between 0.05 m and 0.1 m of height along its entire length. There should be an area with different texture and contrasting colour in the beginning and the end of the ramps. If there are curved ramps, the minimum radius of curvature is 3m, and the slope is equal to or less than 8%.



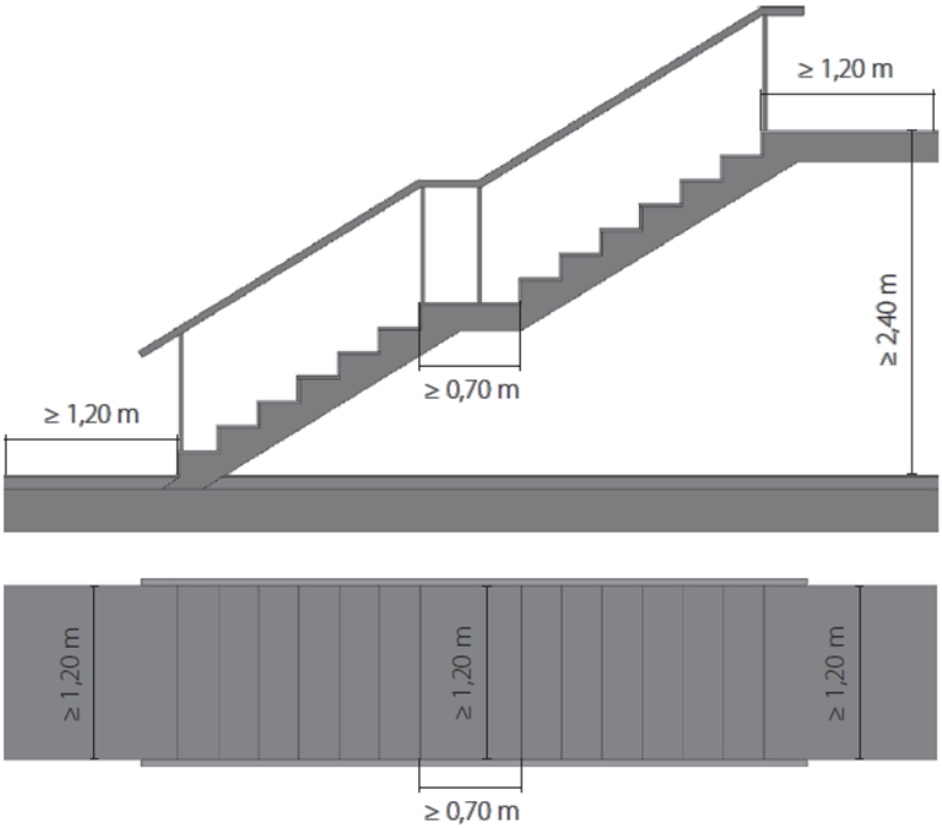
(SNRIPD, 2009)

Stairs

The stairs must have a width not less than 1.50m (or 1.2m if the stairs have access to the interior of the building) and they should have a surface with good grip. These should have sideguards and handrails (with a height of 0.85m or 0.90m and a diameter of 0.04m or 0.05m) on both sides. The handrails should extend 0.3m beyond the last step, parallel to the floor. On the basis of the stairs, the handrails should extend beyond the first step in a length equal to the size of the step depth and keeping the slope of the stairs. At the start of the stairs, there must be an approach area with different texture and yellow in colour (this area should have a width of 0.6m and 0.5m away from the first step). On the edge of the steps there must be a strip (slip resistant) with different texture and colour contrast with a width not less than 0.04m. The stairs should have a maximum height of 0.18m between steps and a minimum depth of 0.28m (these dimensions should remain constant along the staircase). If the stairs exceed 2.4m in vertical rise, these should contain rest platforms with depth greater than 0.7m and a width not less than the width of the steps. The various components of the stairs shall exhibit no sharp edges or any points of possible danger.



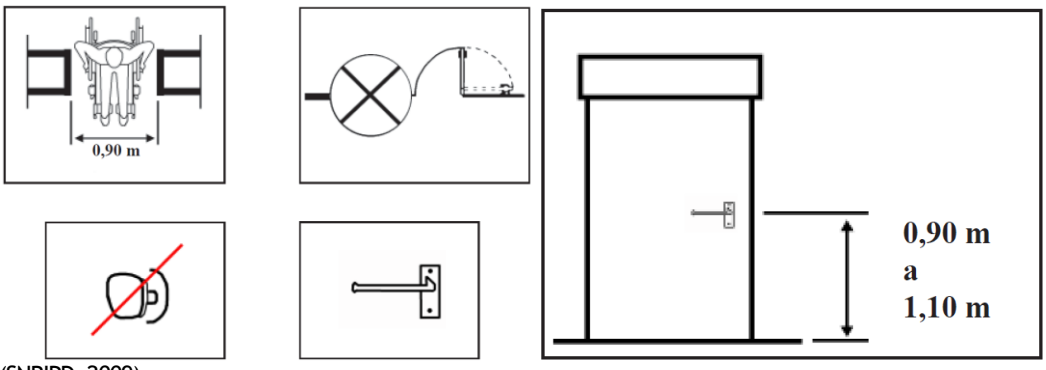
(SNRIPD, 2009)



(SNRIPD, 2009)

Doors

All doors should have a width of 0.90 or more, without revolving handles. The locks and pullers should be located at a height between 0.9m and 1.10m. The revolving doors should be avoided.

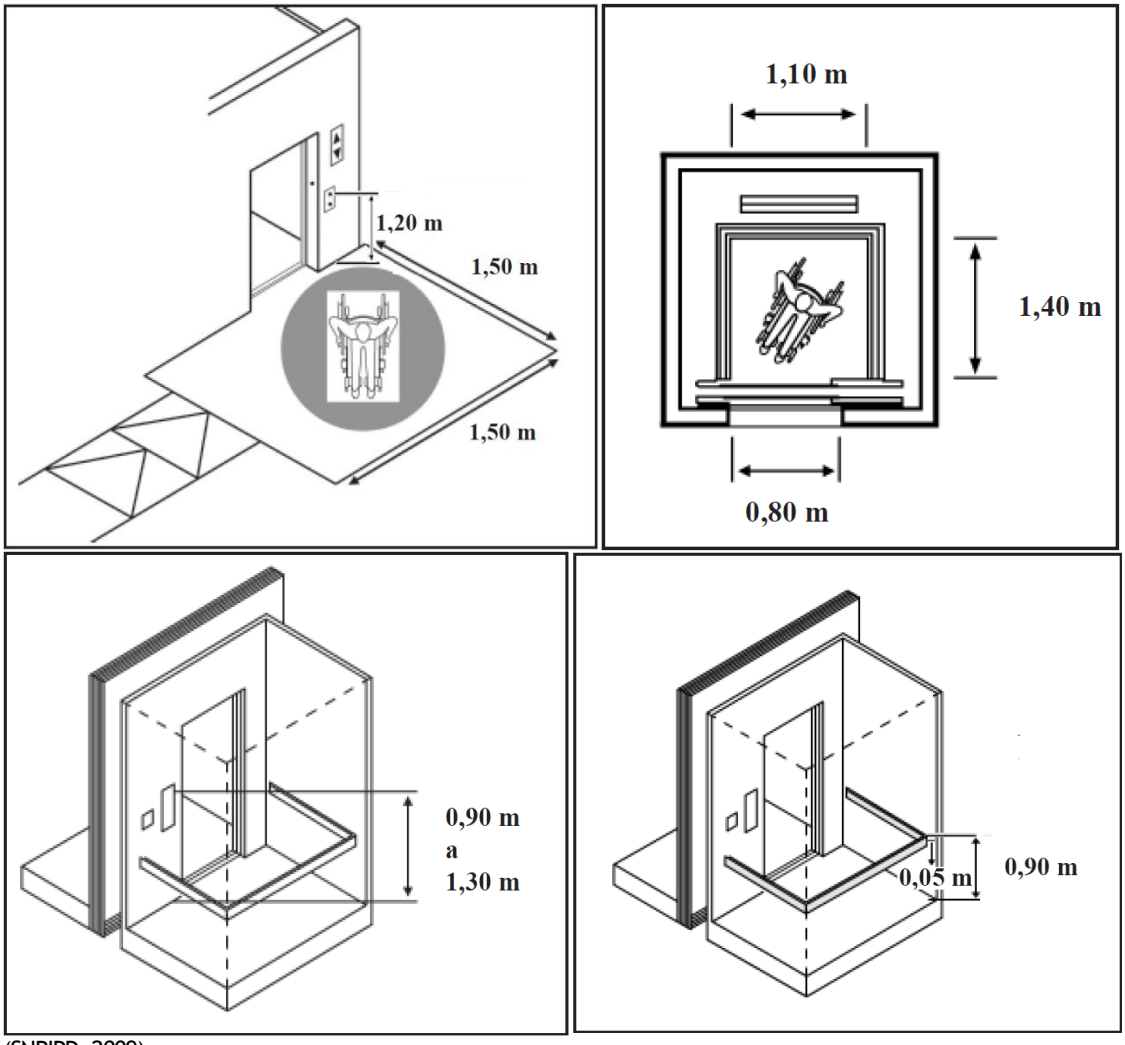


(SNRIPD, 2009)

Lifts

The lift car must have the minimum size, i.e., an area of 1.10mx1.40m, and the doorway must have a minimum useable width of 0.8m. In front of the entrance door there should be an

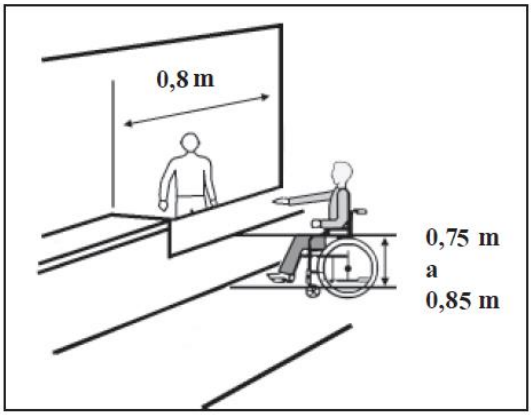
obstacle-free area equal to or greater than 1.5mx1.5m. The call buttons should be located on the right side of the door, at a height of 1.2. The control buttons inside the lift should be between 0.9m and 1.3m of height. The buttons should have tactile references in Braille, raised characters and luminous device around them. Inside the cabin, there should be grab bars located at a height of 0.9m and 0.05m from the wall. It is recommended as good practice that the lifts have sound information (in addition to visual information).



(SNRIPD, 2009)

Service Counters

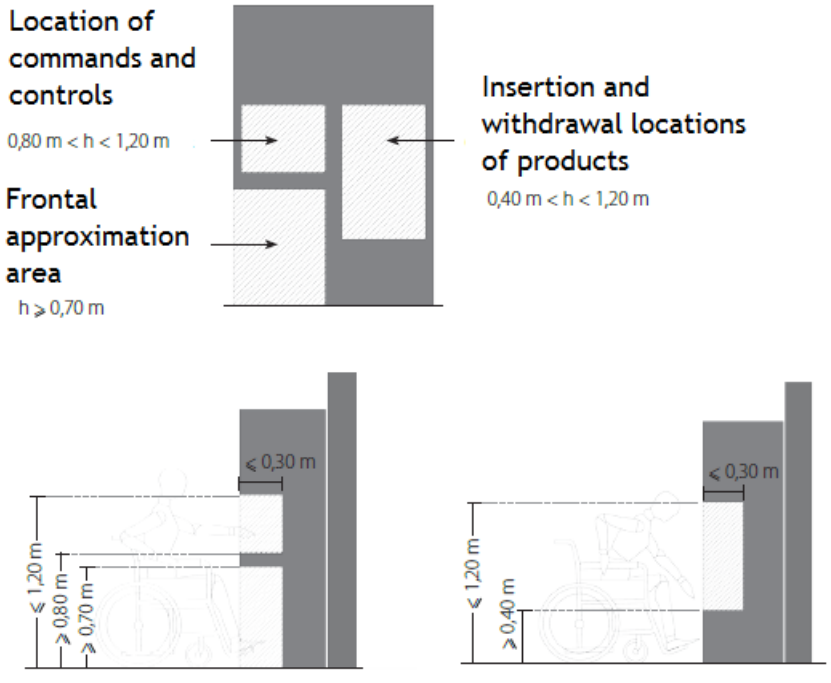
The service counter should have an adapted area with length no less than 0.80m and a height between 0.75m and 0.85m. It is essential to provide a frontal approach area at height not less than 0.7m and a depth not less than 0.3m.



(SNRIPD, 2009)

Self-Service Equipment's

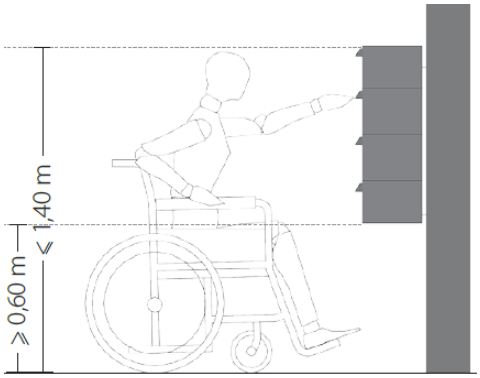
If the interface is a touch screen, the information should also be transmitted in sound version. The existing slots for inserting or withdrawal coins/cards must have tapered entry. The insertion and withdrawal products area must be located between 0.40m and 1.20m of height and the command and controls area at a height between 0.80m and 1.20m. The keyboard should be identified with tactile references, in Braille or raised characters. If the approach to self-service equipment is frontal, there must be a free space to provide a frontal approach area with not less than 0.7m of height and with a depth of not less than 0.3m.



(SNRIPD, 2009)

Post Boxes

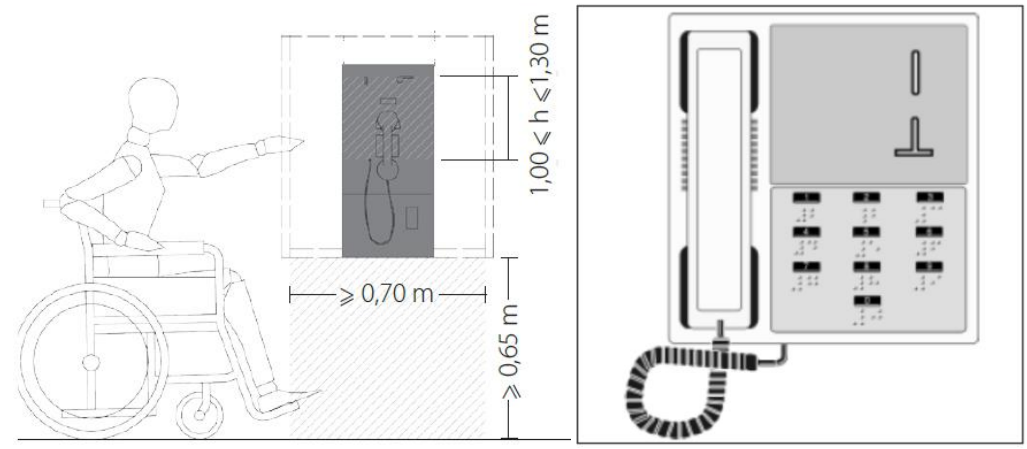
The post boxes should be placed at height between 0.6m and 1.4m. Although it is recommended as good practice a maximum height of 1.20m.



(SNRIPD, 2009)

Telephones

The telephones must have keyboard with tactile references, in Braille or raised characters. There must be a free area for a frontal or lateral approach, the telephone can also be suspended with a free area of a width of 0.7m or more and a height of 0.65m or more. The slot for coins/cards as well as the keyboard must be at a height between 1m and 1.3m.

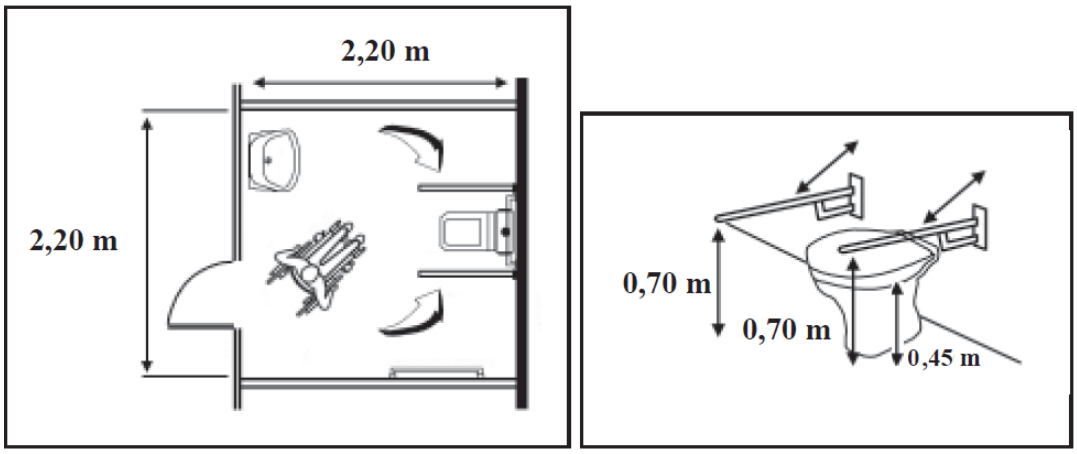


(SNRIPD, 2009)

WC

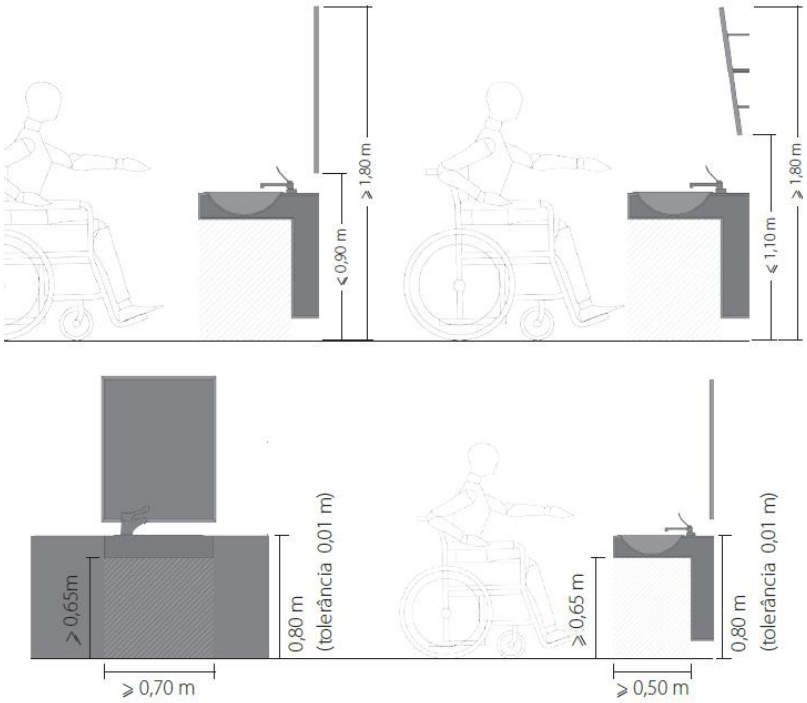
The toilets must respect a minimum area of 2.2 x 2.2m. If it is a cabin toilet, there should be a respected minimum area of 1.6mx1.7m. There must be access from both sides of the toilet bowl and there must also be supports on both sides of that at a height of 0.7m (these supports should be foldable in vertical position). The grab bars should be extended beyond the front

edge of the toilet bowl between 0.20m and 0.45m. It should also be noted that the toilet bowl should be located at height of 0.45 to the floor and the front edge should be located at a distance of 0.75m from the wall to facilitate the transfers between the wheelchair and the toilet bowl.



(SNRIPD, 2009)

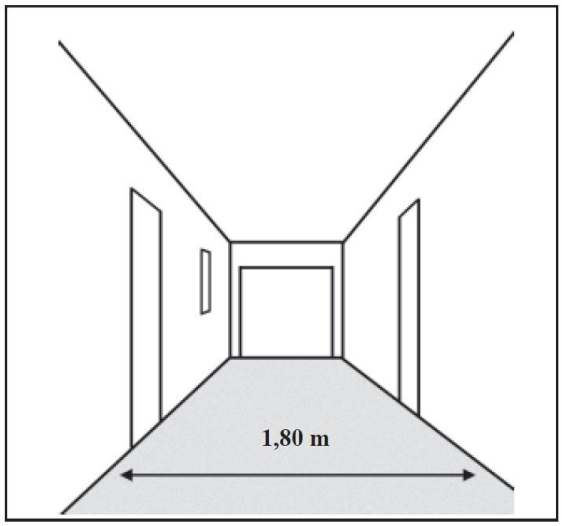
The washbasin must be located between 0.7m and 0.8m of height. The taps should be lever or sensor faucets. If the mirrors are tilted, on the base these should be a maximum height of 1.1m. If the mirrors are fixed in vertical position, on the base they should be located at a maximum height of 0.9. On the top, the mirrors should be located at a minimum height of 1.8m. When there are wall hangers, these should be at a height of 1.3m from the floor. The warning system should not exceed a height between 0.4m and 0.6m so that the alarm can be reached by a person lying on the floor after a fall or by a wheelchair user. The doors shall open outwards or they should be sliding doors.



(SNRIPD, 2009)

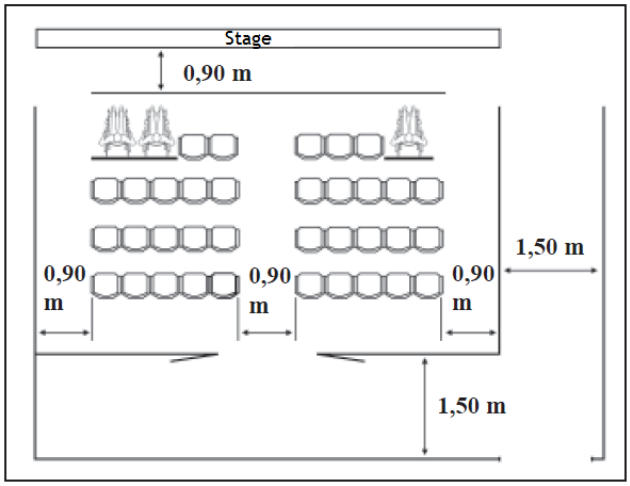
Building's Aisles

The building's aisles should have a dimension equal to or greater than 1.8 m.



(SNRIPD, 2009)

Waiting Rooms



(SNRIPD, 2009)

In the waiting rooms, the width of the aisles must correspond to the minimum specified, i.e., 0.9m and 1.5m. There must be spaces reserved for passengers in wheelchairs with a minimum area of 1mx1.5m.

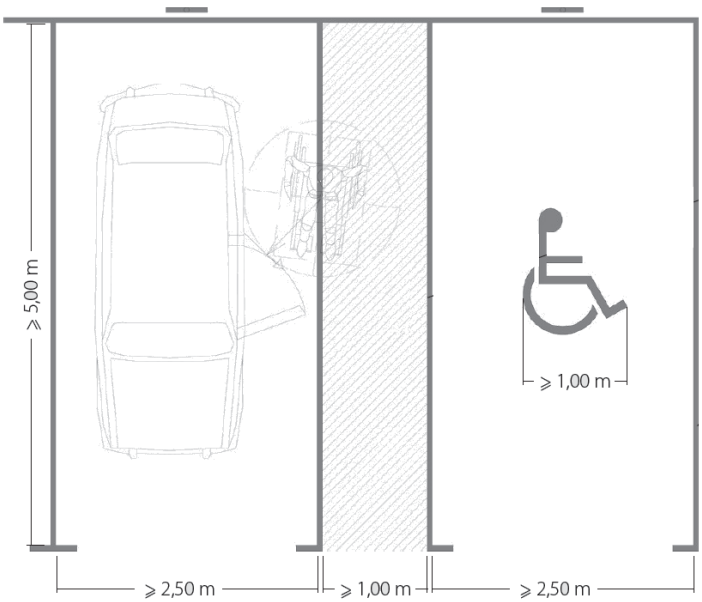
- Up to 300 seats: 3 seats for PRM

- Within 301-1000 seats: 5 seats for PRM
- Above 1000 seats: 5 for each 1000

Parking Areas

When the parking space is located above or below street-level, the access to the parking areas should be guaranteed by ramp and lift. In the reserved parking areas, the minimum dimensions of each reserved spaces are 5mx2.5m. Reserved spaces for PRM must be marked in contrasting colour on the floor. These must be identified with horizontal accessibility sign with a size not less than 1m and painted on the floor with a contrasting colour as well as vertical sign with the international symbol of accessibility. There must be lateral range access with at least 1m in width. This can be shared by two adjacent spaces. The number of places reserved for PRM, compared with the total number of places for people without reduced mobility, use the following criterion:

- Up to 10 spaces: 1 space for PRM
- Within 11-25 spaces: 2 spaces for PRM
- Within 26-100 spaces: 3 spaces for PRM
- Within 101-500 spaces: 4 spaces
- Above 500 spaces: 1 space for each 100 spaces



(SNRIPD, 2009)

Annex 3- Scientific Article Accepted for Publication at the 14th International Conference of TRANSED

ACCESSIBILITY CONSTRAINTS IN THE AIRPORT TERMINAL FACILITIES

SOFIA GASPAR

LAETA-UBI/AEROG, Aerospace Sciences Department, University of Beira Interior, Covilhã, Portugal

software_gaspar@hotmail.com

SARA ZORRO

LAETA-UBI/AEROG, Aerospace Sciences Department, University of Beira Interior, Covilhã, Portugal

saramzorro@gmail.com

JORGE SILVA

LAETA-UBI/AEROG, Aerospace Sciences Department, University of Beira Interior, Covilhã, Portugal

jmiguel@ubi.pt

ABSTRACT

The right to accessibility should assist all citizens. Transportation systems, specially air transport, present some obstacles to passengers with reduced mobility, although there is legislation requiring the adaptation of airport infrastructures and aircraft for the safe and comfortable transportation of these passengers. A demographic analysis focusing on the average life expectancy in Europe allowed to establish that due to the increase of the world population and to the aging process, the percentage of people with reduced mobility is expected to increase significantly, becoming a target-population that demands the investment in the air transport accessibility. Although there already are some changes in services and airport facilities, this tendency should be expanded to all the airports. The present study aimed to explore the service needs of passengers with disabilities and identify factors that inhibit them to travel in this type of transport. Therefore, an analysis of various documents regarding these passengers' experience within the airport was developed to identify the main obstacles that compromise their rights. It was found that the terminals and their points of boarding and deplaning of aircraft are the major obstacles in the land-air interface, as well as the accesses at the airport entrance and to taxis area.

Keywords: Accessibility; Reduced Mobility; Autonomy; Airport; Boarding.