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Water-based Public Transport Accessibility. A Case Study in the Internal Waters of Northern Italy

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ABSTRACT

Accessibility to public transport systems is a key factor for the social inclusion and quality of life of people with disabilities. This paper presents an analysis of the accessibility of the water public transport service run by Navigazione Laghi on lakes Maggiore, Como and Garda in Northern Italy. The study is focused on 'water buses', namely small ferries operating on short, scheduled routes, with one or two decks, that do not transport vehicles and that are not equipped with bed cabins. In particular, as a case study, this paper examines a ferry of the series *Airone*, 24 m passenger-only units built in 2008–2011. These units are relevant because they represent about 10% of the whole fleet of Navigazione Laghi.

Keywords: Design, Accessibility, Public Transport, Ferry, Internal waters

INTRODUCTION

Studying the accessibility of ferries is difficult because—unlike rail and air transport, which offer narrowly focused services within strict design limits—vessels show a great variety of features. Also docks and piers are constructed in a wide variety of sizes and shapes to serve the different ferry types, under varying sets of site constraints like available water sheet, currents, and coastline characteristics (Bruzzone, 2012). Navigazione Laghi operates 97 ferry units on 105 docks. Its ferries can be grouped in five typologies, of which about twenty different models of water buses (see Figure 1). Which is the level of accessibility of the provided transit service? Which are the most positive and negative features?

In the first part of the paper, the importance of the topic is depicted, together with the EU law framework. Then, the paper presents a short literature review—focused mainly on reports and technical agendas compiled by national transport authorities. In this paper, accessibility is considered in a broad sense, taking into account the different typologies of fragile users: people with physical, sensory or intellectual disabilities, being them inherited, congenital or acquired impairments.

In the second part, the features of a ferry of Navigazione Laghi are analyzed and compared as a case study. All the data were collected by direct observation and measures. Aspects of the designs which were analyzed are i.e. signage, means to communicate verbal messages, alarms, lighting, floor surfaces, corridors and passageways, stairways, handrails, elevators, doorways and doors, counters, layouts of passenger lounges and washrooms.

Though in principle Navigazione Laghi guarantees the right of accessing the transport service for all passengers, some of the ferries do not match basic requirements, such as the presence of toilets suitable for use by persons who use a wheelchair. Other characteristics are not so obvious, i.e. concerning signage; thus the usefulness of the study for designers, operators, and planners.

The ambition of this paper is to encourage the operator to improve the accessibility of the transit service. From the scientific point of view, literature on ferry ergonomics is scarce, thus the study could establish a basis for comparison with new, different case-studies.

Navigazione Laghi

The water public transport service on the widest lakes of Northern Italy (lakes Maggiore, Como and Garda) is operated by Gestione Governativa Navigazione Laghi (GGNL), a state-owned company managed by government authority. Though highly seasonal, the service has the characteristics of a public transport system: it is operated continuously on preset itineraries, with preset timetables and fares; and it provides mass mobility. The services is subsidized from tax revenue, tickets covering about the 60% of the costs, which is a high rate for public transit.

In 2011, the operator served nearly 8 million passengers (Gestione Governativa Navigazione Laghi, 2011). The user base is mixed, composed mostly by tourists, but the service is very important for the mobility of the people living on the shores of the lakes too. The percentage of commuters rises to a maximum of 60% of the passengers on the east cost of Lake Como, where road infrastructure is weaker. Commuters—mainly students— have very different needs and expectations than day-trippers and tourists.

The network counts 105 stopovers, shared in the following way: 25 in the Italian part of Lake Maggiore and 11 in the Swiss part; 27 stops in Lake Garda; and 42 in Lake Como.

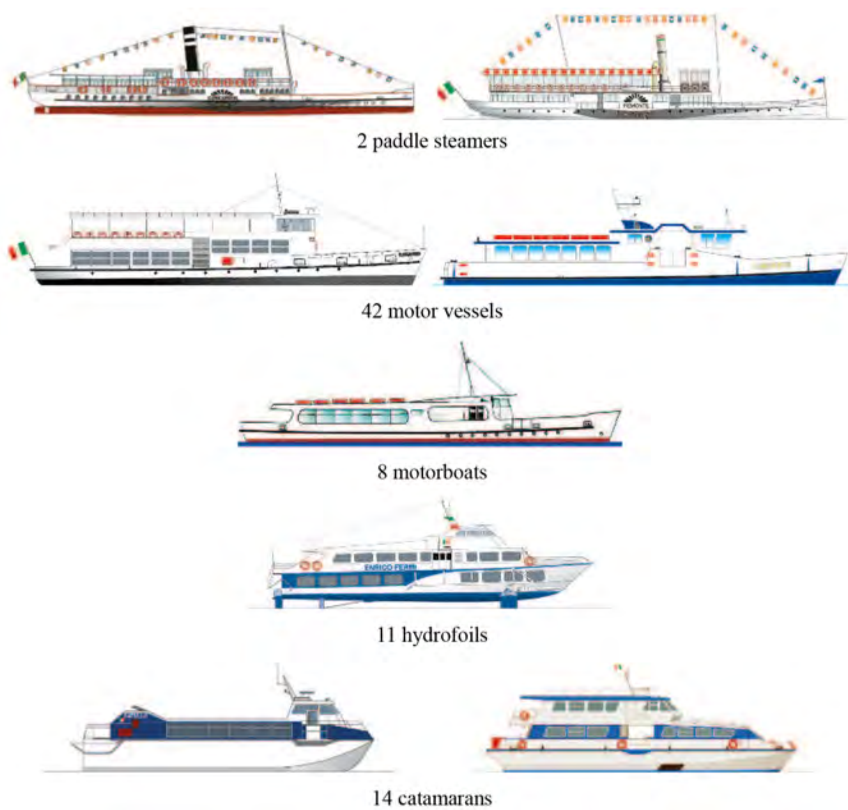


Figure 1. The fleet of passengers-only ferries of Navigazione Laghi.
Picture from Gestione Governativa Navigazione Laghi (2011).

The fleet is composed by 97 units, of which 78 passengers-only boats. The fleet is very heterogenous, as it counts 2 paddle steamers built at the beginning of the 20th Century, 11 hydrofoils built by Rodriquez and Navaltecnica shipyards in Messina in the 1980s and 1990s, 14 catamarans and 50 motor vessels with user capacity spacing from 44 passengers of the motorboat *Isole di Brissago* to 1100 passengers of the motor vessel *Verbania*. Both the biggsest and smallest vessels of the Company are operated on Lake Maggiore, which also counts the highest number of ferries (35 units). Lake Como has the highest number of hydrofoils, five units, while Lake Garda the highest of catamarans, six vessels.

One vessel, many users

Public transport should benefit citizens in general, and thus also people with disabilities and with reduced mobility (EU Regulation No. 1177/2010). As suggested by the approach of Design for All, considering all the users as young and healthy is misleading: it is necessary to pass from stereotypes to the real persons (Bandini Buti, 2008). The distinction between disabled and "normals" should be passed too, because everyone could experience a disability in a certain period of his life, and because people display more variability than what generally recognized by the designer. The aim of this paragraph is to show the importance of the issue.

The Association of European Metropolitan Transport Authorities (EMTA) estimates that 12% of the European population is disabled, and the percentage is rising Fiedler (2007). This is mostly due to the aging of the population, because of declining birth rates and increasing longevity. Within Asia, North America, and Europe, the current percentage of the population over age 65 ranges from 6% to 22%. By 2030, these percentages are estimated to range from 17% to 29%. The fastest growing subgroup represents those over 80 years of age. In particular, the Italian population is the oldest in Europe, on a par with Germany, and second in the World only to Japan (United Nations, 2011). Disability is strongly connected to age: the 80% of people with disabilities is 65 years old or more, and the Italian Institute of Statistics estimates that the national percentage of people with disabilities will rise of 65–75% by 2035 (ISTAT, 2010).

Mobility is strongly correlated to age. While only 10% of the persons aged from 45 to 54 years in the European Union suffer from motor disabilities, it rises to 20% for persons aged 65–74 and to 50% for persons aged 85 or more. It is interesting to notice that, above the age of approximately 75, women are more likely to suffer from such a disability than men (Fiedler, 2007). These data show the growing importance of the theme of accessibility, which is recognized by law too. The European regulation on the rights of passengers traveling by sea and internal waters (EU Regulation No. 1177/2010, articles 6 and 7) states that "in deciding on the design of new ports and terminals, and as part of major refurbishments, the bodies responsible for those facilities should take into account the needs of disabled persons and persons with reduced mobility, in particular with regard to accessibility, paying particular consideration to 'design for all' requirements. Carriers should take such needs into account when deciding on the design of new and newly refurbished passenger ships".

In its policies, Gestione Governativa Navigazione Laghi (2011) states that, concerning the planning, regulation and control of the offered service, the Company pledges to offer for all the users the principles of equality and equity, continuity, efficacy of the service and participation. Moreover, it pledges to offer to persons with reduced mobility—because of a disability, age, or other causes— assistance and services at conditions similar to those offered to all the other passengers, undertaking for future improvements in accessibility and assistance, "consistently with the economic capacity of the Company".

Considering the "person with disabilities" as a synonym of "person on the wheelchair" is a common misconception. The current International Symbol of Access, designed by Susanne Koefoed in 1968, uses the figure of speech of *synecdoche*: a term for a part of something is used in reference to the whole of something, or the contrary. The designer generalized the drawing of a person on a wheelchair to mean the wider spectrum of people with disabilities. In effects, the first efforts to improve accessibility focused on the removal of physical barriers in the physical environment. The problems faced by people with cognitive impairments or mental health problems—such as behavioral difficulties, depression etc.—are much less well understood, and the strategies for assisting these people with their mobility are far less well documented (Tricker and Barham, 2005). Although these conditions are largely 'invisible', they are often very restricting in their effect of limiting an individual's mobility and participation in mainstream society, so it is important that the designers consider them in their projects. As shown by a focus group with older adults conducted by Fisk *et al.* (2009), over 50% of the problems of daily living reported were potentially addressable through human factors interventions.

MATERIALS AND METHODS

EU legal framework

In Italy, the aspects of safety and accessibility of vessels for public transport are determined by European directives. The most important is the Directive 2006/87/EC, which lays down technical requirements for inland waterway vessels. It covers all the aspects of ferry design, classification, and construction. It also covers some aspects that are relevant for ensuring accessibility, such as handrails, width of passageways, design of stairways etc.

Then, the Directive 2009/45/EC determines safety rules and standards for passenger ships. It covers all the aspects concerning emergency exits, safety equipment, outfitting of public spaces etc. In Annex III, it sets some guidelines for safety requirements for passenger ships and high-speed passenger craft for persons with reduced mobility. This part of the document establishes the goals, i.e. "Signs provided on a ship to aid passengers should be accessible and easy to read for persons with reduced mobility (including persons with sensory disabilities), and be positioned at key points". Technical parameters are developed in dedicated documents, i.e. by the European Standard Committee.

Finally, the Regulation No. 1177/2010 of 24 November 2010 sets the rights of passengers when traveling by sea and inland waterway. This document does not fix technical prescriptions, but sets the rights to safety, accessibility, assistance, obligations of carriers etc. The regulation declares that "disabled persons and persons with reduced mobility, whether caused by disability, age or any other factor, should have opportunities for using passenger services and cruises that are comparable to those of other citizens".

This paper analyzes whether the ferry chosen as a case study respects all the regulations, and evaluates the result of their application in accordance with the declared principles of accessibility and non-discrimination.

International best practices

The regulations of the United States provide an interesting comparison for the subject case study because they fix clear and measurable values for all the aspects of accessibility. The Passenger Vessel Access Advisory Committee (PVAAC) was created in 1998 by the Architectural and Transportation Barriers Compliance Board (US Access Board, www.access-board.gov), an independent Federal agency concerned with accessibility for people with disabilities. The Board is responsible for developing and maintaining accessibility requirements for transit vehicles. PVAAC criteria are an adaptation to the marine environment of the American with Disabilities Act Accessibility Guidelines (ADAAG). The guidelines are a very useful tool because they are very precise, detailed and complete. I.e., concerning onboard signage, US regulations fix character proportions, style, stroke thickness, etc. A study conducted by Chapman (2004) in New York on New Jersey Harbor Private Ferries, which critiques a small ferry (74 passengers, 16.2 m LoA) in respect of the PVAAC criteria of accessibility, was an inspiration for the present study.

Besides US legislature, the Minister of Public Works and Government Services Canada (1999) developed a clear code of practice for ferry accessibility for persons with disabilities. This short document is an interesting touchstone for the evaluation of the subject case study.

Finally, an interesting comparison is offered by the Guidelines for Accessible Maritime Passenger Transport completed by the Department of Transport of Ireland and NDA (2012). The document recaps clearly all the aspects concerning ferry accessibility. Beyond normative point of view, the Guidelines examine all the phases of the travel by ferry (see Figure 2) and explain to the service operators how to remove barriers to travel.

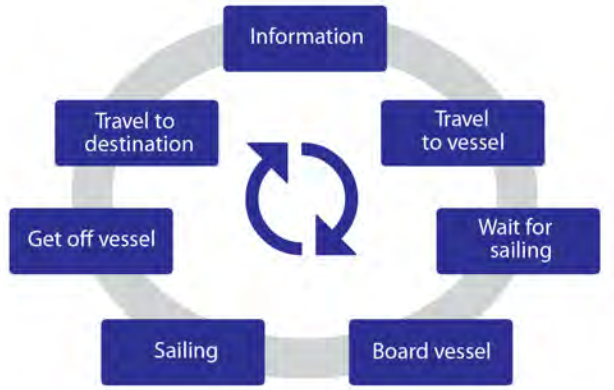


Figure 2. Travel chain diagram showing various stages of a journey by vessel.
Picture from Department of Transport of Ireland and NDA (2012)

CASE STUDY

The ferry chosen as a case study is a 24 m passenger unit named *Cicogna*, which is operated in Lake Maggiore. The ship is interesting for different reasons: because of its small size, which highlights accessibility issues; because she is one of the newest of the entire fleet, so it should display the most up-to-date solutions; and because she is part of a series of ten identical vessels, thus representing 10% of the whole fleet of Navigazione Laghi. The series is called *Airone*, from the name of the first unit. All the ferries were built for Navigazione Laghi between 2008 and 2011 by Cantieri Navali di Chioggia-Ravenna. Four units are assigned to Lake Maggiore: *Airone*, *Albatros*, *Cicogna*, and *Pellicano*. Four are operated in Lake Como: *Cormorano*, *Fenicottero*, *Grifone*, and *Civetta*. Finally, two are allocated to Lake Garda: *Sparviero*, and *Condor*.

Figure 3 (left). General view of the ferry *Cicogna* leaving the shipyard of Navigazione Laghi in Arona, March 2014.
Figure 4 (right). View of the stern of *Cicogna* moored in the shipyard of Navigazione Laghi in Arona, March 2014.
During the winter, ferries operate on reduced service and are subject to seasonal maintenance.

The model was designed by Studio Tecnico Bortolato of Marghera, Venice. It is certified Maltese Cross Passenger Ship – Inland Waterways by the Italian National Registry (RINA), which means it was built under direct survey of the Registry. The main characteristics of the vessel are: length overall 24 m (78.8 ft), beam 5.48 m (17.8 ft), capacity 132 passengers, speed 25 Km/h (about 13.5 kn/h).

The ferry is operated by a crew of two persons, whose roles are defined in the Company's operating rules (Gestione Governativa Navigazione Laghi, 2004): the master, who has the role of guiding the ship, and the steward, who is in charge of the engine room and of the docking. In high season, they are flanked by a ticket clerk. Apart motorboats (see Figure 1) which are operated by a single man, these units require the smallest crew of the fleet. This point is worth of note because the staff has the task of assisting persons with disabilities.

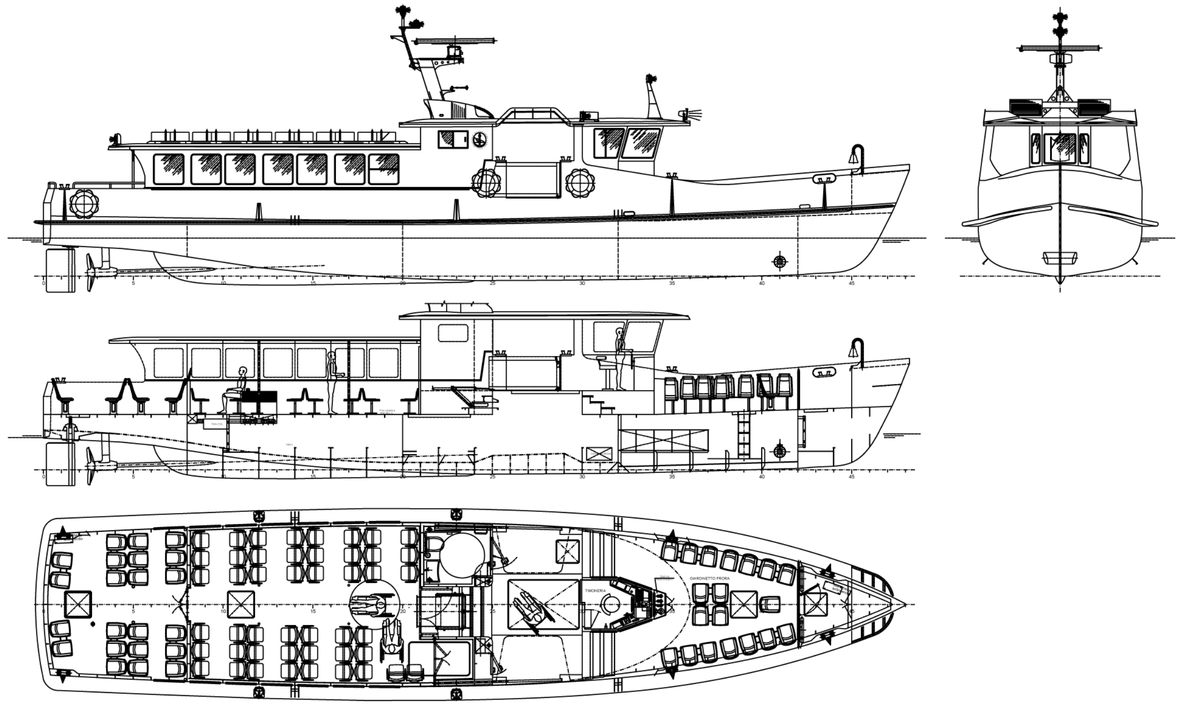


Figure 5. Passenger ferry of the *Airone* type. Scale 1:200. Image courtesy of Gestione Generale Navigazione Laghi.

Entrance area and relation with the wharf

The access from the wharf to the ship is always characterized by manmade and environmental height barriers. A study by the Environmental Engineering Division and Volpe National Transportation Systems Center (1996) proposed five practicable and widely applicable access solutions which include extra-long gangways, fixed intermediate ramps, extra floating docks, and accessible gangways to the vessels' decks. The wharfs of Navigazione Laghi display a mix of all the previous elements and are generally barrier-free.

Figure 6 (left). View of the entrance area from the control cabin. The cable on the gangplank is due to the ship on maintenance.
Figure 7 (right). Access to the ferry from the wharf of Arona. The grade of the gangway can cause a step at its extremities.

The critical point is the last gap between the wharf and the ferry, which is bridged with a steel gangplank. The gangway has a clear width of 900 mm and a variable length, depending on the single wharf (maximum length is 3.50 m). The width of the passage allows the access to persons using manual or electric wheelchairs (PVAAC requires 815 mm), but the plank has a thickness of 50 mm, which easily form higher steps with its slope due to the level of the lake and to the motion of the ferry (see Figure 7). The step could be easily fixed with a hinged flat plate at the base, as already available on different gangway models; in the US, this feature is requested by the American with Disabilities Act.

Layout and on-board routes

The ship is organized on a single deck. She is designed for side mooring, as all the fleet of Navigazione Laghi, and she can be moored to both sides. The entrance area, placed at the back of the control cabin, is approximately at 1/3 of the length of the ferry.

The entrance area is a semi-open space: it is protected by a roof but it is open on the sides. It is positioned on a higher level than the passenger cabins (see Figure 5); the difference in height is 660 mm. Thus, the entrance is connected to the passenger cabin with four steps (see Figure 9). The passage has a width of 1440 mm, but approximately 300 mm are occupied by a stairlift. The passages to the prow area are on the sides of the control cabin and each of them counts four steps too, with a minimum width of 1160 mm (see Figure 8). This layout is critical for persons with reduced mobility, persons to whom the access to the prow deck is precluded. The presence of the stairlift, while providing them access to the passenger cabin, does not seem a good design choice. The drive of the stairlift could require assistance by the steward, it is a time-consuming operation and it completely obstructs the passage when in use. A flat deck structure would have been more enjoyable for the passengers and would have required less support and maintenance for the Company.

All the stairs are provided with handrails. Because of the stairlift, the main stairs have a single handrail on the right side. Prow stairs have a handrail on the side of the control cabin and the other on top of the bulwarks.

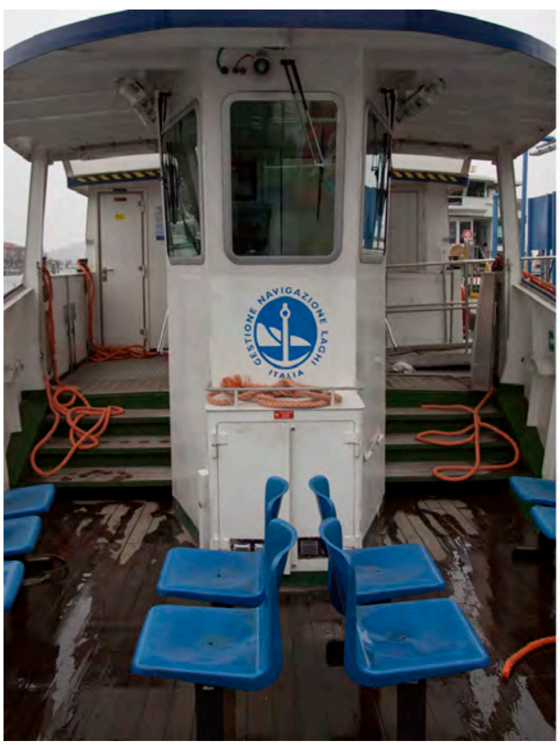


Figure 8 (left). The control cabin and the two side stairs which lead up to the entrance area.
Figure 9 (right). Steps from the entrance area to the main cabin, equipped with a stairlift.
The pictures were shot during maintenance operations in the shipyard.

Accommodation design

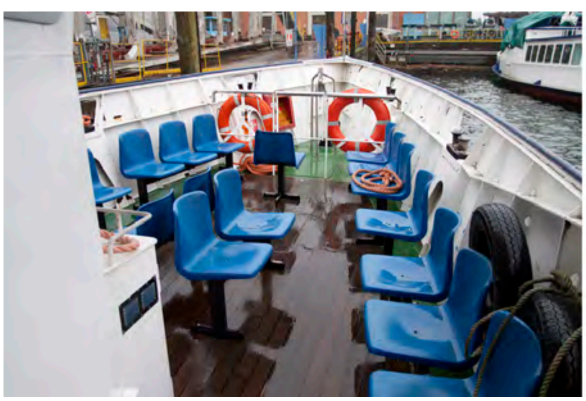
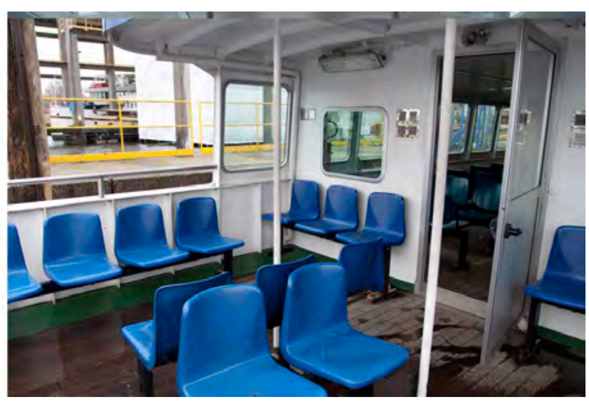
The ship is divided in three main passenger areas: the bow open deck (see Figure 12), which has an area of 15.5 m^2 and 19 seats, while the passenger cabin has an area of 28.5 m^2 and 44 seats (see Figures 10 and 11). Finally, the stern open deck has an area of 15.5 m^2 and 22 seats (see Figure 13). The total capacity of the ferry is 132 persons, because 47 standing passengers are contemplated too (the total of free areas is about 24 m^2, thus each standing passenger has an available area of 0.5 m^2). The ferry does not have dedicated areas for persons who use wheelchairs, nor is it equipped with wheelchair tie-downs, which would increase the level of safety.

The passenger cabin is connected to the stern deck with an emergency door (see Figures 11 and 13). The door is equipped with a coaming, which is the vertical surface at the base, designed to deflect or prevent entry of water; it has a height of 130 mm. The coaming is an impassable obstacle for a person which uses a wheelchair, if not assisted. Not only it blocks the access to the stern deck, but it is an obstacle on the emergency exit.

The passenger cabin is equipped with four stanchions (vertical grab poles connected to the floor and to the ceiling), which are a useful aid for moving inside the cruising ferry. The poles are not enough to provide stability to standing passengers in case of full load. This is a critical point, because people that travel standing up are susceptible of suffering falls and injuries, particularly elderly people. Thus, the cabin could be equipped with grab handles attached to seats and hanging straps suspended from the ceiling.

The prow deck has limited horizontal handrails in correspondence of the enclosed prow safety area and on the front side of the control cabin. Handrails are installed on top of the bulwarks, but they are not useful for standing passengers because of the seats and of the tire fenders.


Figures 10 and 11. Shot and countershot of the main cabin area.

Figures 12 and 13. Open passenger areas on the prow (left) and on the stern (right). On the right picture, the door coaming is clearly visible. The pictures were shot during maintenance operations in the shipyard.

Toilet

The vessel is equipped with a unisex toilet room. It is located on the left side of the ferry, near the left entrance. It has been designed in conformity with architectural standards for accessible toilets. In the US, the topic of onboard accessible toilets has been studied by Chapman (2006). There are not significant differences in the layout and equipment. However, the case study presented poor signage, perhaps due to inadequate maintenance. The door has a threshold of 15–25 mm, which does not constitute an obstacle. The toilet is not accessible when the ferry is moored on the left side, because it interferes with the entrance gate (see Figure 6).

Staff area

The staff room is located on the right side of the ferry, symmetrically to the toilet. Unlike the previous, the access is not from the entrance area, but from the passenger cabin; the area is not defined by doors (see Figure 10, visible on the right deep end). The area is on the same level of the passenger cabin and the deck does not have thresholds.

Information systems

Information systems can be divided in three levels (Department of Transport of Ireland and NDA, 2012): level 1, urgent safety information or immediate boat or vessel departures; level 2, general timetable information, information about making complaints and general safety information; and level 3, advertising.

For the subject vessel, alarm systems are present, consistent with the rules of RINA ship registry. Level 3 information was absent, and this is a positive aspect, because though advertising can be an important source of revenue, it should not be too prominent or intrusive, and it should not distract passengers who are relying on clear visual information when making their journey (Rentzsch and Karsten, 2010). Level 2 information must be examined more in depth; it can be subdivided in the following way:

1. Clear external signage showing vessel destination(s).
2. Instructions on how to get assistance.
3. Location and details of the facilities on board.
4. Visual and audible information on delays, including how long the delay will be.
5. Visual and audible instructions on what to do in the event of an emergency.
6. Information on how to make a complaint.

The first point is absent; no signage shows the destinations on the exterior of the ship. In winter the schedule is reduced, so it is difficult to get confused; but in summer, the busiest locations can have more than to one vessel moored at the same time, so this aspect could be improved. Instructions on assistance requests were absent too.

The third aspect had serious omissions. The general plan of the ship is hung on the right side of the stairs which connect the entrance area with the passenger cabin, but it is in a high position and partially hidden by the door. The different areas of the ship were poorly marked: the only area with a plate is the passenger cabin. The toilet icon was missing, probably for lacking maintenance.

As for the fourth aspect, it is managed by the staff, through the loudspeaker system. Visible information are not available.

Regarding the fifth aspect, a sheet with emergency instructions is placed at the entrance, above the ticket machine. The sheet is written in English, without icons or drawings, and the font size is small. It could be improved with pictograms and bigger texts in two languages.

The sixth aspect is described in the panels hung near the ship general plan, together with the rules onboard with timetables. Though present, this information could be provided in a more readable format.

RESULTS AND DISCUSSION

The studied water bus is similar to the series 80 of the *vaporetti* (small passenger ferries) operated by ACTV of Venice, which have a very similar size (LoA 23.90 m, beam 4.16 m), operating staff (2 persons) and load capacity (130 passengers for series 80). The most striking difference is in the deck: the entrance area of the *vaporetti* is on the same level of the passenger cabin and of the open decks. The flat deck structure guarantees a great accessibility, but the control cabin offers poor visibility, requiring passengers on the prow to be seated (see Figure 14).

The problem of visibility is solved differently on *vaporetti* series 90 (see Figure 15), which have the same length of *Airone*-type and series 80, a beam of 4.22 m and a load capacity of 210 passengers. Series 90 shares the single-deck structure of series 80, but the control cabin is wider and the prow is not accessible to the passengers, being dedicated to the housing of lifesavers.

Figure 14 (left). ACTV series 80. Figure 15 (right). ACTV series 90.
Photos by Michael Day (online available at: www.flickr.com/photos/13706945@N00), licensed under CC BY-NC 2.0.

The control cabin of the *Airone* series is in a vantage point, being 660mm over the passenger spaces. Thus, passengers can stand up without obstructing the master’s view, although this design choice has negative consequences in respect of the accessibility for persons with mobility impairments. The higher entrance/control cabin area is due to the need of matching the height of the wharfs. Lake Maggiore, differently than Lakes Garda and Como, features high variations in the water level, connected to seasons, thus wharfs are high.

Though partially accessible if supported by helpers or staff, the ferry chosen as a case-study does not allow an independent use. Some aspects would require a complete redesign, i.e. different levels of the deck, and toilet door in correspondence of the left entrance gate. Other aspects would require small interventions, i.e. development of adequate signage, rampings to door coamings, and hinged plates at the base of the gangways. Though easy, such focused actions could greatly improve the user experience onboard and the accessibility for all the passengers.

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