

PUBLIC TRANSPORTATION ON WATER, CASE STUDY LISBON

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Abstract:

Public transportation of passengers using all types of vehicles for land, water and air, with high commercial speed, high level of comfort and safety, using less carburant, at a low price per fair and most of all preserving the environment is one of the new challenges for the public transport operators. In this paper we present the situation of Lisbon public transportation of passengers on water by highlighting the five routes for commuters that have to cross river Tagus to arrive in Lisbon. Also we present the entire fleet of ships that are used by the local transport operator Transtejo and Soflusa. The paper is focused on finding solutions for the problems discovered to a particularly transport route that is Barreiro-Terreiro do Paço. The problem is that the transport operator is using boats with a capacity of 600 passengers out of rush hour and these boats are not even half loaded. Our solution is to use small boats with a capacity of 500 passengers out of rush hour, this small modification will generate a big impact for the transport operator, passengers and environment as it will be showed in the paper. The paper is structured as follow: introduction, operating routes and data regarding the entire operating ship fleet, case study of route Barreiro-Terreiro do Paço, solutions for the problem, conclusions and further research, acknowledgment, reference list.

Keywords: boat fleet, transport operator, public transportation, management

1. INTRODUCTION

Finding new ways for traveling at a high commercial speed, comfortable, safe, cheap and preserving as much as possible the environment by using less fuel is the new challenge for the public transport operators that run their business in the 21st Century. One of the alternatives for the passengers that are using public transportation vehicles is to travel using water buses or ferries. This way of transportation can be seen in many capitals and big cities around the world such as: Amsterdam, Budapest, Lisbon, Paris, Rotterdam, Venice and many others. In these cities we can see many floating vehicles for public transportation of passengers such as: water taxis, water buses, amphibious [1], vaporettos, ships, ferries. This new alternative is fast because there are no: traffic lights, traffic queues, many stops and offers a high commercial speed compared to the other public transportation vehicles such as buses, trolleybuses, trams. It is safe because there are not so many accidents as there are on land with the buses, taxis and other public transportation vehicles. It is cheap for passengers because in the price per fair they can carry many luggage and sometimes even cars example using ferries, but it is also cheap for the public transportation operator due to the large transportation capacity of the ship and the operating cost is less than other public transportation vehicles. This type of transportation can be divided into two categories one for transportation people from point A to point B per example helping passengers to go to work or link them with important transportation hubs where they can change their public transportation vehicle and the other for sightseeing such as hop on hop of trips[1]. In this paper we will analyze the category that helps passengers connect with other means of transportation and helping them reach their desired destination point. This analyze will be focus on river Tagus that separates Lisbon from the other cities such as: Almada, Barreiro and Montijo. There the public transport operator Transtejo, Soflusa establish 5 connections between the two river banks using three types of boats taking into consideration the capacity and two types referring to the cruising speed. The paper will be focused on route Barreiro-Terreiro do Paço presenting the actual situation and will provide some solutions for a more efficient public transportation on rivers Tagus with less consumption of fuel using smaller boats with a lower transportation capacity and increasing the frequency of transportation by increasing the travel speed. The main goal is to obtain benefits for the passengers and public transportation operator and at the same time to protect the environment. The paper is structure in four parts: short introduction, the second part presents: the 5 routes, the entire fleet of boats used by the transport operator, prices per fair, operating costs, time schedules, routes, departure and destination points for every route, third part is a case study of route Barreiro-Terreiro do Paço and the fourth part offers solutions for the problem. In the end of the paper are presented the conclusions and further research along with the acknowledgment and reference list.

2. THE 5 OPERATING ROUTES AND FLEET OF BOATS THAT SERVES THEM

The public transport operator offering services for commuters that want to cross river Tagus is Transtejo Soflusa and began with the “founding of Transtejo in 1975 and later, with the creation of Soflusa in 1993.”[2] “The operational fleet consists of 33 vessels of which 20 are Catamarans, 4 ferries (monohulls and catamarans) for passengers and vehicles and 9 conventional vessels.”[3] In Table 1 are presented 29 boats out of 33, (ferries excluded), their main characteristics and crew number.

Table 1: Main characteristics of boat fleet used by Transtejo Soflusa

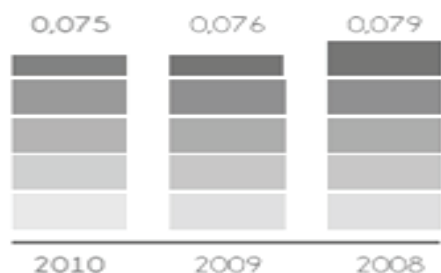
Boat Model	Quantity	Transport Capacity	Service Speed	Average Consumption	Crew
Cacilhense	6	480	≈7 Knots	50 L/h	4
Martim Moniz	2	1000	≈7 Knots	180 L/h	5
Marvila	1	293	≈7 Knots	38 L/h	4
Algés	4	496	22 Knots	410 L/h	4
S. Juliao	4	496	22 Knots	540 L/h	4
Cesário Verde	2	292	22 Knots	320 L/h	4
Fantasia	1	146	22 Knots	110 L/h	4
Damiao de Goes	9	600	22 Knots	600 L/h	4

Source: <http://www.transtejo.pt>

According to Table 1 more than half of the fleet is form by new boats, the declared service speed is 22 Knots for new boats and around 7 knots for old boats. The highest fuel consumption is registered at the new 600 passengers' boats that are used also to serve route between route Barreiro and Terreiro do Paço. In Picture 1 is represented the medium fuel consumption per passenger/km during 3 consecutive years for the entire fleet.

Picture 1: Medium Fuel Consumption per passenger/km (L/P.Km) during one year for the entire fleet

Medium Fuel Consumption per passenger/km (L/P.Km)



Source: <http://www.transtejo.pt>

The fuel consumption is decreasing from 2008 to 2010 due to the fact that the transport operator introduced new boats; some routes were redesign and became shorter and the schedule modified by operating the boats at a lower service speed and increasing trip time with an average of 5 minutes. So instead of staying 5 extra minutes at the docs the boats are cruising at a lower service speed and this fact increase the trip with 5 extra minutes. One example for this situation is route Barreiro - Terreiro do Paço. In Table 2 are presented the 5 routes operated by Transtejo Soflusa and also the emission of CO₂, the price per fare and the number of bicycle that can be carried onboard the ship.

Table 2: Main characteristics of the 5 routes operated by Transtejo Soflusa

Route	Distance [Km]	CO ₂ Emissions [g]	Price/Reg. Ticket	No. of Bicycles
Trafaria - Porto Brandão - Belém	4,20 km	21g	1,15€	15
Cacilhas - Cais do Sodré	2,21 km	114g	1,20€	3 ¹
Seixal - Cais do Sodré	7,50 km	374g	2,30€	3
Montijo - Cais do Sodré	15,00 km	751g	2,70€	3
Barreiro - Terreiro do Paço	8.10 km	406g	2,30€	2 or 5 ²

Source: <http://transporlis.sapo.pt>

The CO₂ emissions are determined not only by the route length but also by the boat model and cruising speed that influence the fuel consumption. Price is calculated taking into consideration the length of the route and the number of passengers that use it. This is why the price for one ticket between Cacilhas and Cais do Sodré is 1.20€ with 0.05€ more than on route Trafaria - Porto Brandão - Belém which is with 2km longer. Another example is Montijo - Cais do Sodré that is twice as long as Seixal - Cais do Sodré but the price for one ticket is just with 0.40€ more. The facilities for passengers that want to take their bicycles with them depend on some regulations that are specified in the

¹ In the ferries, this service is not allowed on weekdays, during the following periods: From: 06h30 to 09h30, in a South / North and From: 17:00 to 20:00, in the North / South.

² Is only allowed to transport 2 bikes on weekdays, at the following times: From: 06h30 to 09h30, in a South / North; From: 17:00 to 20:00, in the North / South and is permitted to carry a maximum of 5 bikes, weekday off-hours listed above, as well as to the purposes weekends and holidays.

footnotes. It is not only the time but also the space management and the ebb and flow of the river for the safety of the passengers. In Picture 2 is represented the interface of ground public transportation with the fluvial transportation. It highlights the 5 routes and also the facilities for passengers (commuters) that have to change from one vehicle to another to arrive at their destination. Picture shows that Lisbon has a well design infrastructure and transfer hubs are very good equipped helping passengers satisfied their needs regarding public transportation.

Picture 2: Interface with fluvial transportation



Source: MUBi - Associação pela Mobilidade Urbana em Bicicleta

3. CASE STUDY OF ROUTE BARREIRO-TERREIRO DO PAÇO

We identify this route from Barreiro to Terreiro do Paço with some issues that can be fix for obtaining benefits for: passengers, transport operator (Transtejo Soflusa) and for the municipality of Lisbon and also protecting the environment. The main problem that we discovered here is that the operator is using all the time the same model of boat with the same capacity for passengers and does not take into consideration the capacity demand on rush hour and out of rush hour. This apparent small thing generate lots of problems for: passengers, transport operator and last but not least created environmental issues. According to local transport operator Transtejo Soflusa prefers using big boats with a capacity of 600 passengers in spite of the fact that out of rush hour the demanded capacity is less than 200 passengers. According to table 1 fuel consumption for a boat with a capacity of 600 passengers is 600L/h and for a boat with a capacity of 500 passengers is 410L/h. The operating speed will remain the same because both boats are fast and have a cruising speed of 22Knots and also the crew number will be the same 4 persons. In table 2 on route Seixal - Cais do Sodré where the boats with a capacity of 500 passengers are operating CO₂ level is lower with 32g per each trip. Time schedule will remain the same but the trip will be faster with 5 minutes, instead of 25 minutes that is now out of rush hour it will be 20 minutes. The difference of 5 minutes will be spent by each ship in the docs. Now the trip last 25 minutes because boats with capacity of 600 passengers are not operating at 22Knots as normal to save fuel making the trip longer for each passenger that uses this route out of rush hour. The number of bicycles that can be taken onboard will increase by 1. The single small inconvenient is that the operator has to switch the boats three times per day when entering and exiting the rush hour. Next table presents: the number of boats on each route, day time, along with some characteristics.

Table 3: Number of boats for each route and time table

Route	Boat Model	Boat Capacity	No. Boats Of In Rush Hour	No. Boats Out of Rush Hour
Trafaria - Porto Brandão - Belém	Cacilhas Class - slow boat	470 pass.	1 boat	1 boat
Cacilhas - Cais do Sodré	Cacilhas Class - slow boat	470 pass.	3 boats	2 boat
Seixal - Cais do Sodré	Algés Class São Julião Class Pedro Nunes Class All fast boats	500 pass. 500 pass. 300 pass.	2 boats	1 boat
Montijo - Cais do Sodré	Algés Class São Julião Class Pedro Nunes Class All fast boats	500 pass. 500 pass. 300 pass.	2 boats	1 boat
Barreiro - Terreiro do Paço	Almeida Garrett Class - fast boat	600 pass.	7 boats in the morning 6 boats in the evening	2 boats After 23h30 until 2am - 1

Source: <http://www.transtejo.pt>

4. SOLUTIONS FOR BETTER MANAGEMENT AND MORE EFFICIENT PUBLIC TRANSPORTATION ON ROUTE BARREIRO-TERREIRO DO PAÇO

Our proposal to increase the efficiency of public transportation on route Barreiro-Terreiro do Paço is to change out of rush hour the actual boats that have a capacity of 600 passengers with smaller ones with a capacity of 500 passengers. This small change will bring benefits for: passengers, Transtejo Soflusa and municipality and will protect the environment.

4.1 Benefits for passengers

The passengers will spend less time on each trip out of rush hour from 25 minutes to 20 minutes. They will be allowed to carry more bicycles on board from 2 that are now to 3. And probably the ticket will be cheaper out of rush hour due to the fact that operating costs will decrease for transport operator.

4.2 Benefits for the transport operator Transtejo Soflusa

This action will generate better management for the fleet and increase income of transport operator by decreasing the operating costs. Will allow 5 extra minutes for the crew to rest in the docs at the end of each trip. Will save fuel and will avoid exploiting the boats engines below the operating speed of 22Knots. By decreasing the price per ticket the transport operator can attract more passengers.

4.3 Benefits for municipality of Lisbon

If a higher number of passengers are using the boat service to cross river Tagus this leads to a decongestion of the 2 main bridges that connect Lisbon with the cities located on the other side of the river. On the other hand makes the zone to be more quiet and cleaner by reducing the traffic on the 2 bridges and the CO₂ level produced by road vehicles and bigger boats. Generate a higher income by

increasing the number of passengers that use public transportation and also by decreasing costs with maintaining the road infrastructure of the 2 bridges.

4.4 Benefits for the environment

It reduces the CO₂ level produce by the bigger boats that are in use now and by the vehicles that are using the bridges to cross the river Tagus. Also reduce the noise and dust in that area helping the birds to live there. In picture 3 is presented a boat with a capacity of 600 passengers and in picture 4 is a boat with 500 passengers that are in service now.

Picture 3: Boat with a capacity of 600 passengers



Source: <http://www.transportes-xxi.net/forum/download/file.php?id=109531&mode=view>

Picture 4: Boat with a capacity of 500 passengers



Source: <http://www.transportes-xxi.net/forum/download/file.php?id=109531&mode=view>

5. CONCLUSIONS AND FURTHER RESEARCH

A good management is when all the stakeholders in our case: the municipality, the transport operator and passengers obtain the results that they predict without destroying the environment. The municipality wants to have a clean and green city and very good connections between city centre, the suburban places and other cities. Also to have a transport operator that makes his job and bring income to the municipality budget. The operator wants to attract as many passengers as possible to obtain profit, to have lower operating costs with fleet maintenance and infrastructure and if it is possible to obtain a monopoly of the area where it operates. The passengers want to travel fast, safe, comfortable, at a lower price and with less number of transfers between routes. Also the passengers need mobility to take with them their bicycles and cars in our case and easy access to information panels and for purchasing tickets. If possible to travel with one “contactless card and the possibility to use it for other porpoises and recharge it from ATM, internet or vending machines”. [8] Saving money, time and protect the environment is possible by: using less papers tickets due to the implementation of the “ticketing system” [9], also increase the commercial speed and reduce the CO₂ emissions by using

hybrid engines or electrical power vehicles such as “amphibious that are used in Budapest and Rotterdam”[10] “and for ground transportation Phileas buses as in Eindhoven”[11]. It is faster and safer to travel by boat but infrastructure and fleet are very expensive and if you do not have a river that everything is reduce to public transportation with ground and underground vehicles. “Timișoara is one of the cities that have the oportunity to develop a public transportation on water but struggle with the investment in infrastructure and fleet.”[12] “In his book (Ghionea, 2010, pp.0-344) says that there should be a philological level for transfers from one vehicle to another that should not be crossed. In his example for citizens living in big cities the total number of transfers during a trip should not exceed one and for commuters should not be higher than three.”[13] The conclusion to this fact is that commuters are more tolerant than citizens living in big cities and for Lisbon passengers that use boats have to change just once or twice due to the fact that the bots terminal are connected in most of the cases with all the public transportation vehicles such as: taxis, buses, trams, metro, trains as showed in picture 2. One question that is presented in (Clayton, 1987, pp.29-35) paper is „if hovercraft can be the new solution for high speed channel ferries” [14] this topic represents the further research for this paper.

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