Case Studies in the Emilia Romagna Region in Support of Intermodality and Accessibility of Public Transport

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Abstract. The concept of intermodality is becoming increasingly important for the development of global communication and environmental sustainability. Creating an intermodal network capable of increasing connections between the inland and coastal areas of the same country or between different countries is fundamental in order to improve the mobility and the level of service offered. In Italy numerous projects have been presented to increase national intermodality. An example is the Emilia-Romagna Region which, thanks to the Inter-Connect project, aims to enhance the accessibility of passengers between the city of Bologna and the coastal areas, by promoting the use of collective transport. In this study, an analysis has been carried out on the connectivity between Bologna and Ravenna and on the introduction of an integrated ticket bus-train to reduce the journey time on the railway line and increase the use of collective transport. The analysis provided for the redesign of the railway stops to have a faster and more efficient service, improving user satisfaction. In addition, an integrated bus-train ticket was created to promote the use of public transport. The results have shown that this new solution has allowed to have less delays on the line even if the reorganization of the stops has previewed the cancellation of some of them. In addition, numerous surveys have shown that the use of an integrated bus-train ticket helps improve intermodality within cities. However, the survey highlighted that new ticket advertising campaigns are needed to make users more informed.

Keywords: Intermodality, sustainable mobility, integrate bus-train tickets, environmental improvements.

1 Introduction

An intermodal mobility behavior is defined as the flexible combination of different means of transport during a single trip (Chlond (2013); Jones et al. (2000)). Intermodality is integral part of sustainable mobility and its enhancement is of great importance, especially in congested urban areas. (Pitsiava-Latinopoulou and Iordanopoulos (2012); Infas (2010); Yeh, (2008)). An improvement of intermodal connectivity will be useful both to promote travels and communication within a country (Ryosuke and Hironori (2019)) and to reduce congestion (Allard and Moura (2016)) with the aim of boosting economy and local tourism
An inadequate planning of travel solutions leads to a reduction of the level of public transport resulting in a shift of user choices towards different means of transport,

mainly private cars. (Pitsiava-Latinopoulou and Iordanopoulos (2012); Allard and Moura (2016))
The study on mobility shows how the level of service offered to passengers affects their behaviour about the transport mode (Pitsiava-Latinopoulou and Iordanopoulos (2012)). One of the most important indicators when evaluating the quality of the urban public transport service offered to passengers is how long it took the users to travel. (Kopylova et all. (2018)) The total amount of time taken by users for a single move is equal to the sum of the travel time, of the journey time and of the waiting time at interchange points. (Vande Walle and Steenberghen, (2006); Xumei, Qiaoxian and Guang, (2011)). Oostendorp and Gebhardt (2018) showed that time efficiency is a very important aspect for intermodal users and underlined how binding it was for most of them when choosing the means of transport. Lu et al. (2018) showed how socio-demographic characteristics of passengers and their travel options have an impact on the value of waiting time and of the time on board. The better users are informed about the different modes of travel the shorter the waiting time is perceived. Therefore, user needs shall be taken into account in urban planning whenever aiming at getting the best advantages from intermodal transport combinations for an efficient urban transport system. Monzon et al. (2017) state that the weakest point when managing intermodal travel solutions is the lack of internal coordination which negatively affects the quality of information given to passengers. In their study about intermodal transport of passengers, Allard and Moura (2016) identify three key factors relevant to intermodal transport: connectivity, cooperation and choice.
Another aspect to consider in the intermodal travel solution is the higher ticket fee due to the use of different means of transport just in one journey. On one side travellers don't like long waiting times involved in interchange solutions, but on the other side they are not willing to accept a higher cost for intermodal transfers (Yen, Tseng, Mulley, Chiou and Burke (2017)). The union of complementary or cooperative network structures and the integration of fares and information provision are defined as the integration of different transport solutions (Clifton and Mulley (2018).
The purpose of this paper is to provide alternative solutions to enhance the use of public transport by improving connection between inland and coastal areas thus increasing the level of service offered to users. Special solutions have been sought not involving large investments and yet, offering valid options to private transport without too high costs. This study is divided in two parts analysing connections for short and long distances: in the first case the focus will be on reducing delays of trains at stations, in the second case bus-train integrated solutions will be studied.

2 The case of the Emilia-Romagna Region in the Inter-Connect project

With its high-quality industrial base producing wealth and creating employment and a coastline that during the summer season is an attractive destination for tourists, Emilia-Romagna is one of the biggest and wealthiest regions in Italy.

The main transport planning tool of the Region is called “PRIT – Piano Regionale Integrato dei Trasporti” (Transport Integrated Regional Plan) and its purposes are:

- To guarantee passenger and freight accessibility in the region
- To reduce transport-related energy consumption
- To reduce transport-related emission (pollutants and greenhouse gases)

With regards to passenger transport, PRIT aims to promote an integrated system built upon a core regional transit network (trains, trams, buses). Figure 1 shows the transport modal distribution for all kinds of journeys within single municipalities. Intra-municipality trips (i.e. urban trips) seem to be more sustainable with 40% of people using public transport, bike or walking. When considering all kinds of journey, as per Fig. 1, a 10% decrease is to be pointed out. However, public transports are increasing, from 7,2% urban to 8,3% for all trips.

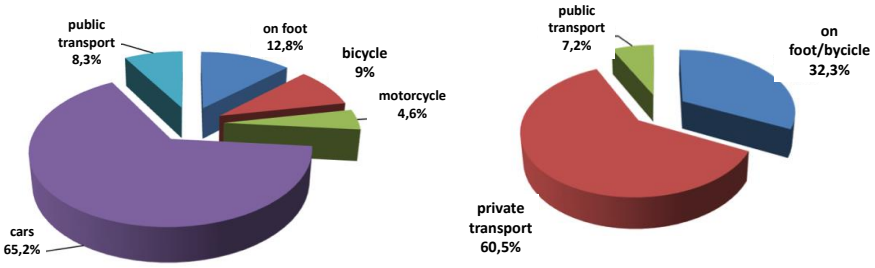

Fig. 1. Emilia-Romagna mode share transport modal distribution in 2018. On the left all trips, on the right only intra-municipalities trips.

Emilia Romagna Region aims at improving its railway transport for passengers within Bologna and Romagna Area to enhance accessibility of coastal areas (Romagna – provinces of Ravenna, Forlì-Cesena and Rimini) and connections to inland hubs (Bologna). The rail passenger transport should be improved with a network which will connect different areas within Emilia Romagna. Although transport of passengers is highly seasonal, especially in the coastal part, both “summer” flows, mainly of tourists, and “winter” flows of commuters have been investigated in order to achieve the best and more convenient railway transport for both types of users. The comparative analysis has shown a delay in improving the main inter-urban links despite the increasing demand. The connection between Bologna and Ravenna, for example, hasn’t been improved for 10 years. Among the main destinations from Bologna, Ravenna is the closest in terms of travel distance, but the farthest in terms of travel time. While the connections with other towns have faced a reduction of travel time, the connections with Ravenna only partially have. In fact, only 4 services per day are faster than in 2008 and 16 take a longer time than in 2008.
This case study will look at how to improve travel time without major infrastructure investment but focusing on re-designing train stops to have a faster and more satisfac-

tory service. As for the railway line along Ravenna-Rimini coastal line, given the tourist vocation of this area, in recent years local authorities (i.e. Rimini municipality) have emphasised the need to promote public transport for tourists as a measure meant to reduce negative environmental externalities like traffic congestion, environmental impact, road safety, etc.. The analysis is therefore divided in two different study cases, A and B, described in Table 1, with the same purpose, namely enhancing and fostering intermodal transport within the region.

Table 1. Emilia-Romagna case study overview

	CASE STUDY A	**CASE STUDY B**
• **Title**	*Fast rail connection between Bologna and Ravenna.*	*Bus-train integrated and discounted ticketing for tourists in the Romagna area.*
• **Description**	*The case study aims at:* • *Improving the life of Ravenna commuters.* • *creating a reliable rail connection between Ravenna coast and Bologna Airport.* • *avoiding worsening the journey of other customers.*	*The case study aims at:* • *attracting more tourists not travelling by car.* • *offering tourists affordable and reliable transport solutions without using their own car.*

3 3 Case studies

3.1 3.2 Case study A: fast rail connection between Bologna and Ravenna

The aim of case study A is to improve and revitalize the passenger railway service between the towns of Ravenna, Rimini and Bologna reducing the travel time to reach the destination. The railway lines connecting Rimini to Ravenna and Ravenna to Castel Bolognese are single track lines as shown in Fig. 2.
An infrastructural improvement of these lines would involve large investments and long time. So, in order to get an improvement without high costs, this study will focus mainly on definition and testing of solutions capable of reducing train travel time.
The number of passengers on the Bologna-Rimini-Ancona line significantly increased in 2018 compared to the previous years. During the winter months the rise in the number of passengers was especially at the stations in Bologna, Imola and at the intermediate stations between the two towns. In summer the number was higher between Bologna and Rimini and at the other stations along the Adriatic Coast of Romagna.

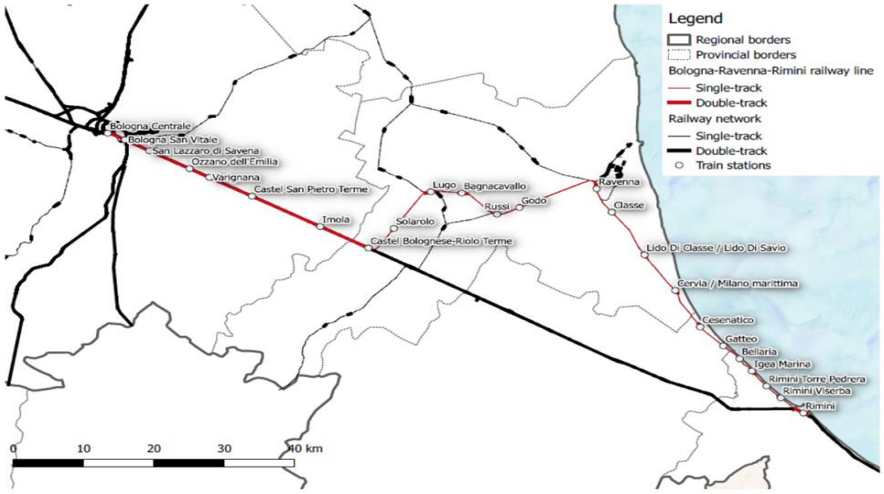

Fig. 2. Rail infrastructures in the pilot area

In order to size the rail network properly according to the users' needs, an analysis has been carried out using data from on-board train surveys made during those times of the year considered to represent the passenger flow at best, usually July and November. The data collected in different days can be averaged to obtain the most significant day. The same data can also be extended, according to some balancing standards, to similar periods in order to represent the year total value. The stations served by regional trains in Emilia Romagna are 258 and, according to the recognition acquired, passengers daily getting on a train in 2018, on an "average working day" in winter in the region were about 159,100 (in 2017 they were about 149,300). The average number of passengers throughout the year is nearly 47,100,000. The figures show an increase in passengers in 2018 compared to the previous years, both during winter and summer times. After some years of stability of data, in year 2018 a sharp increase in the winter data was pointed out (+ 8% compared to 2017) as well as a rise during the summer (+4% compared to 2017).The increasing in the number of passengers catching a train to move within the region resulted in an increase in delays on lines.

The analysis of relevant data shows a worsening of travel times (negative trend has gone on for three years): after a positive result in 2015, 2016, 2017 and above all in 2018 negative results occurred as for punctuality, back to levels registered in 2013/2014. Apart from June and July, punctuality was always below the standard and worse than in 2017. Furthermore it should be taken in consideration that, following the extension of the railway line with the introduction of high speed rail services operating in the last decade, the travel time from Bologna towards the main Italian capital cities significantly decreased between 2008 and 2018. On the contrary, this didn't happen between the different towns in Emilia Romagna as the rail infrastructure remained almost unchanged.

After studying delays on the line and the users' needs compared to size of the railway line, a new solution has been found capable of reducing travel time from Bologna,

Ravenna and Rimini in order to make the railway services more attractive, both for tourists and commuters, without modifying the railway infrastructure.
The main goals of the study were as follows:

- Reduce travelling time between Bologna, Ravenna and Rimini from 81“-83” to 69” in both directions. The objective is to reduce the travelling time of 12”-14”
- Reduce journey time between Ravenna and Rimini serving all the coastal towns of Romagna at best. The objective is to reduce the journey between Ravenna and Rimini and vice versa to less than an hour
- A 3% increase of direct trips by train (12,475 to 12,888)
- Generate benefits on the whole line of regional trains.

The best technical solution provided by the analysis of train stops along the railway between Bologna and Ravenna (Fig. 3) in order to shorten travelling time consisted in reducing the number of stops. Some train stops at stations with the lowest numbers of passengers every day were removed accordingly. In the present case, some stops were cancelled at Russi and Classe for some trains (see picture below). In the case of Russi stops of the most used trains have been granted every day, while all stops in Classe would be cancelled.

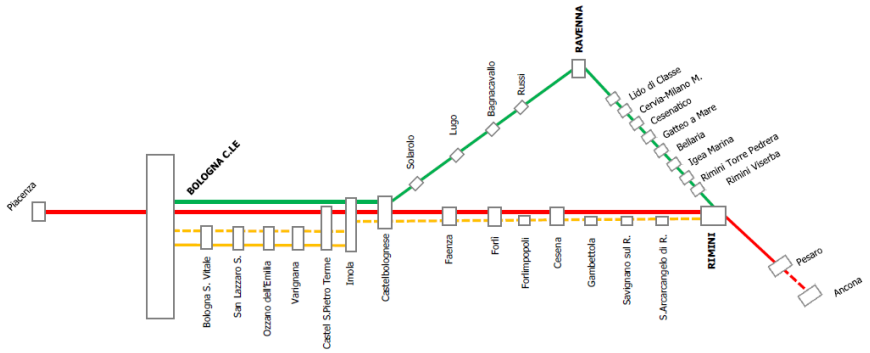

Fig. 3. Railway stations between Bologna and Ravenna

Here below data of the two railway stations of interest:

- Godo: 110 was the average number of passengers a day. They were mainly commuters with a season ticket. Train stops would be reduced from 34 to 12 per day
- Russi: 70 was the average number of passengers a day. They were mainly commuters with a season ticket here too.

Since the reduction of the train stops gave rise to significant difficulties for passengers, new services of public buses were introduced linking the two above stations to the nearest railway station with active stops. Moreover, the connection of buses to the rail stations allowed the development of intermodal public transports highly interest-

ing both for tourists and workers. In fact, some train times were coordinated to the times of two buses serving industrial areas and the city centre. This was possible thanks to an increase in the train service in both directions during the peak hours (7 to 9 in the morning and 4 to 6 in the afternoon).

3.2 3.1 Caso studio B: il sondaggio a Rimini.

Method

The case study B deals with the bus-train connection, within the whole of costal area, thanks to a single ticket. The increasing number of tourists getting to Roma-gna during the summer from different countries has elicit the request of a new survey about their needs as far as the intermodality of public transport in that region is concerned. A survey was conducted in Rimini, the main hub town with an airport, a train station and several bus stations, in the period August-September 2018, the one with the highest peak of tourists, on four working days. A sample group of 163 people was interviewed, 141 interviews took place at the Rimini railway station, at the Riccione bus station in Piazzale Curiel and on buses number 4,8,11. The 42 remaining interviews were held at Rimini's "Federico Fellini" Airport. The 53% of the sample interviewed was made up of foreign tourists (mainly from Russia) while the rest were Italian tourists. The survey aimed to collect data on the travel experience of tourists in Romagna as a whole, assessing whether they were aware of the existence of an integrated bus ticket (Romagna Smart Pass), mapping their interest in a new type of integrated ticket (bus + train) and stating how far they are willing to pay for it. Since the interviews were conducted at the airport or railway station, the fact that most of the tourists interviewed had arrived in Rimini by train or plane should not be considered a significant event. The analysis on the means of transport chosen by tourists to move to Romagna during their holidays seems to be more relevant.

Results

From the results obtained it was observed that the average holiday lasts 7.5 days. Foreign tourists spend longer holidays on average than Italian tourists - 8.8 days against 6.2 days. Each person interviewed was on vacation with 2.3 people, on average, regardless of nationality.

Since the interviews were conducted at the airport or train station, the fact that most of the tourists interviewed arrived in Rimini by train or plane should not be considered a significant event. More relevant seems to be the analysis on the means of transport chosen by tourists to move to Romagna during their holidays. 44% of tourists use the bus, while 22% move on foot. Moreover, the main tourist destination in Romagna is Rimini followed by Riccione.The cities of Romagna are the main holiday destinations for Italian tourists while foreign tourists still prefer the major Italian attractions such as Venice, Rome, Florence. For these tourists, Rimini is only a hub from which to start their journey through Italy. Independent travelers mainly use high-speed trains, while others join organized trips and travel by bus. In both cases, San Marino is the main tourist attraction for a trip to Romagna. Although interest in an

integrated bus-train flat-rate ticket valid within the Romagna region turned out to be quite high, only a few tourists (18%), no matter if foreigners or Italians, knew about Romagna Smart Pass. The availability to pay an integrated nus-train flat-rate ticket valid in Romagna area was evaluated according to different costs tourists were willing to pay for it. The results showed that foreign tourists (57%) are willing to spend more on an integrated ticket, both for 3 and 7 days, compared to Italian tourists (48%). More than 60% of the tourists interviewed were interested in visiting and/or had visited at least one of the tourist attractions using a Romagna Smart Pass (discounts on tickets and services). This percentage shows the importance of these kinds of agreements in order to better promote Romagna Smart Pass among tourists. The highest request is for a tourist integrated flat rate ticket lasting 7 days (40%) or 3 days (33%). For each kind of ticket, a range of three different prices were suggested. Prices were set in collaboration with Emilia-Romagna Region and Rimini municipality on basis of the prices of 2018 Romagna Smart Pass (11€ for a 3-day ticket, 22€ for a 7-day ticket) and of the price of the ticket for the longest train line within Romagna (Riccione-Faenza, 6.65€ for a one-way ticket by local trains).

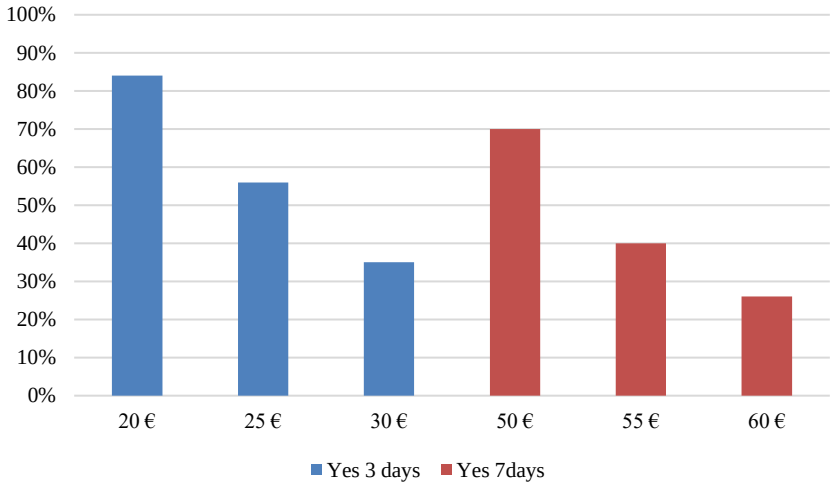

Fig. 4. Availability to pay for the integrated ticket lasting 3 days or 7 days (% of responses).

As shown in Fig. 4, which shows the percentage of tourists available for the purchase of an integrated 3 or 7 day flat-rate ticket for buses and trains valid in the Romagna region, the willingness to pay for a 3-day ticket in free circulation is less than € 27 while for a 7-day ticket is willing to pay less than € 55. Furthermore, the results showed that foreign tourists are willing to spend more on both integrated tickets than Italian tourists.

4 Conclusion

In this study, an analysis was carried out on the connectivity of collective transport services in order to encourage their use. The results obtained show that the redesign of the railway stops, with the elimination of some stations, has the consequence of having a faster and more efficient service, improving user satisfaction. This new solution which provides for the elimination of stations used by fewer users, has made it possible to have fewer delays on the line, managing to provide a better service following the ever-increasing demand. Furthermore, the connection of bus services with railway stations has made it possible to develop intermodal public transport solutions available to users who used transport in the eliminated stations. In particular, it was possible to coordinate train timetables with two bus services serving industrial areas and the city center. To offer efficient and economic intermodal solutions capable of attracting users who move from central areas to coastal areas, the main results show that both foreign and Italian tourists are interested in an integrated flat-rate ticket valid in Romagna. In general, it is possible to see as foreign tourists are usually more interested than Italian tourists in a flat rate integrated ticket and they are even willing to spend more for such a ticket. In fact, the interest for an integrated ticket is higher among foreign tourists (57%) compared to Italian tourists (48%). As for the duration of the flat rate integrated ticket, the data collected shows as the most requested duration for an integrated ticket is 7 days (40%) or 3 days (33%). In relation to the costs of the future Smart Pass tickets, the analysis carried out shows as, on average, tourists are willing to pay less than 27€ for a 3-day flat rate integrated ticket and less than 55€ for a 7-day flat rate integrated ticket. These data on tourists' availability to pay suggest maintaining both the existing integrated Smart Pass bus tickets and the new integrated bus-train tickets (case A) since higher prices for the integrated bus-train tickets may reduce the number of people using these tickets.
However, the analysis found that only 18% of the tourists interviewed knew about the existence of an integrated ticket already available in the areas examined. Moreover, the qualitative observations collected by the interviewers show that the ticket is not properly promoted at the main tourist transport hubs. Therefore, in order to encourage the use of public transport by users, effective promotional campaigns aimed at launching the integrated bus-train ticket should be implemented and supported at the main tourist transit hubs.

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