# Rail passengers' preferences for on-board Wi-fi internet access

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Submitted: 1st August 2008

Word Count: 3,616 + (250 * 10) = 7016

**Cite as:** Connolly, D., Caulfield, B. and O'Mahony, M.M., Rail Passengers' Preferences for On-board Wi-fi Internet Access, *88th Annual Meeting of the Transportation Research Board*, *Washington D.C.*, 2009

**ABSTRACT**

This paper presents the results of a survey which was conducted on an Irish Rail service to ascertain how the value of travel time may change if individuals could partake in another activity while travelling. The survey included a stated preference section which uses a multinomial logit (MNL) model to estimate the benefits individuals would derive from having access to the internet while they travel on public transport. In the survey, respondents were asked would they rather have wi-fi internet access throughout the train or in segregated wi-fi carriage.

The results from this study show that multi-tasking while travelling by rail is extremely common, with the majority of respondents participating in two or more activities. The most frequent form of multi-tasking was the use of a mobile phone. This study examined the potential for wi-fi internet access while travelling by public transport. The results found that approximately two thirds of respondents said if wi-fi internet access was available they would use it once or more every week.

## INTRODUCTION

Travel is considered to be a derived demand where individuals engage in it to reach activities they desire. From this perspective, travel time can be considered wasted time. However, the utility of travel time can increase when people engage in other activities while travelling. Rail systems offer greater opportunities to engage in activities while travelling, compared to driving by car. Using travel time more productively has been greatly increased with the advent of information communications technologies (ICTs) such as laptops and mobile phones.

New technologies offer people more opportunities. Information may be made available to passengers at four different levels: at home, on the train, at the station and through passengers' personal electronic devices (mobile phones, PDAs, laptop computers). Information includes not only train company information, timetabling for integrated systems, user-friendly way-finding, promotions, but advertising, intermodal transport information and tourist and cultural information. The information extends also to the egress stage of the rail journey in which people face relatively unfamiliar situations.

To date, little research has been conducted to ascertain how rail passengers would benefit from the introduction of wi-fi (wireless internet) internet services. Kanafani et al *(1)* conducted an evaluation in a pilot project to introduce wi-fi internet access for rail users in California. The results of this study found that business passengers and those with longer trip times were found to be willing to pay more for wi-fi internet access *(1)*. Lyons et al *(2)* examined the use of office equipment such as laptops and mobile phones while travelling by rail. The results of this study found that the majority of rail users did not use these devices while travelling. This finding suggests that while one might expect individuals to multi-task, that in some instances this is not the case *(2)*.

Sheldon *(3)* examines the use of wi-fi access on rail services in England. This study found that 30% of respondents to an on-board survey were aware of the wi-fi internet services available on-board the train and were planning to use these services. This study also found the main reason respondents indicated that they would not use wi-fi services, was because they did not have access to a laptop *(3*). Leonard *(4)* describes the potential benefits of installing wi-fi internet access for both passengers and rail operators. The potential benefits to operators are defined as the provision of real-time information, monitoring of critical train systems and live streaming of close-circuit television. Lehmuskoski *(5)* also examines the potential benefits of wi-fi services on bus services in Helsinki. Vehicle tracking and the provision of real-time information are cited as some of the potential benefits of introducing wi-fi internet services *(5)*.

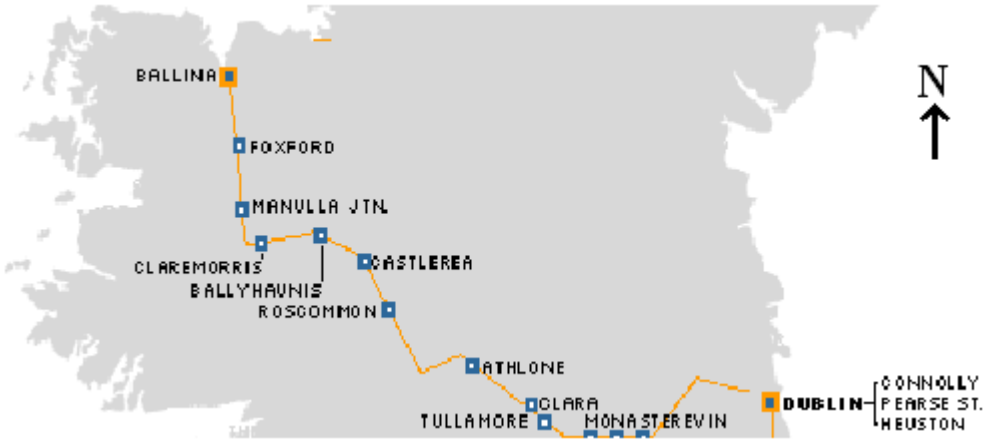
This paper examines the potential benefits of introducing wi-fi internet access on-board rail services. The paper begins with a description of the methodologies used in this study. The first set of results presented relate to the instances of multi-tasking and the potential benefits to be derived from introducing wi-fi internet access on-board rail services. The following section of the paper presents the results of the multinomial logit model which examines benefits of introducing wi-fi internet services.

## METHODOLOGY

### Survey sample

To examine how often individuals multi-task while travelling by public transport, a survey of rail users was conducted. This research was focused on both inter-urban travellers and daily commuters. The choice of train line and time of the train service were two key factors in order to receive a good response rate. The Dublin-Ballina train line was chosen as a suitable line (see Figure 1). This line was selected as it services a number of commuter towns (to Dublin) initially which gradually give way to long distance destinations. The survey was conducted on Friday 25th of January 2008. A total of 83 responses were received. The response rate to the survey was 21%.

**FIGURE 1 Map of rail line**




### Stated preference design

Table 1 presents the attributes and attribute levels examined in this study. As displayed in Table 1 below, there were two scenarios. The first scenario is where wi-fi internet access would be available throughout the entire train. The second scenario is where wi-fi internet access would only be available in a specified carriage (referred to from now on as 'wi-fi carriage'). In the survey, respondents were told that the wi-fi carriage would be a segregated area on the train where passengers could access the internet. The internet access options presented to the respondents were defined by three attributes; computer facilities available, cost of accessing the internet and time spent online. Each attribute had three varying attribute levels. Table 1 presents all attributes and their levels.

**TABLE 1 Attributes and alternatives**

| Attributes | Wi-fi access throughout the entire train | Wi-fi access only in a special wi-fi carriage |
|---|---|---|
| **Computer Facilities available** | No lap top available | No lap top available |
| | Complementary lap top and printing services available | Complementary lap top and printing services available |
| | Complementary lap top available | Complementary lap top available |
| **Cost of accessing the internet** | 0c | 0c |
| | €3.50 | €3.50 |
| | €7 | €7 |
| **Time spent online.** | 30mins | 30mins |
| | 1 hour | 1 hour |
| | Full trip | Full trip |

In this research *SPSS Conjoint* was used to produce a fractional factorial. *SPSS Conjoint* is a statistical package and the method of producing a factorial using this software is described by Hensher et al *(6)*. The fractional factorial produced 18 treatment combinations to be examined in this research. The 18 treatment combinations were split between 3 versions of the survey and a total of 6 choice combinations in each survey. Figure 2 presents an example of one of the scenarios presented in the survey.

**FIGURE 2 Stated preference scenario**

**SCENARIO THREE: Based upon the information below with regard to the computer facilities available, the cost of accessing the internet and the time spent online, please choose between the two options of gaining access to the internet.**

| | Wi-fi internet access throughout the entire train | Special wi-fi carriage |
|---|---|---|
| Computer facilities | Complementary lap top available | Complementary lap top available |
| Cost accessing the internet | €7 | €0 |
| Time online | 1 hour | Full Trip |
| Please choose one ✓ | ☐ | ☐ |

## SURVEY RESULTS

### Personal characteristics

Table 2 presents the personal characteristics of the sample. 57% of the respondents were female and 43% male (see Table 2). 83% of people who completed the survey were under the age of 35 and 67% were under 24 (see Table 2). 58% of respondents were students (see Table 2). The high proportion of students may be related to weekend travel out of Dublin on a Friday. Over half of the respondents were earning

less than €10,000 per annum or did not wish to answer. 33% of respondents indicated that they owned a laptop, 35% have a WAP (wireless application protocol) enabled mobile phone and 30% had a MP3 player (portable digital audio player) (see Table 2).

**TABLE 2 Socio-economic characteristics of the sample**

| **Characteristic** | **N** | **%** |
|---|---|---|
| **Gender** | | |
| Male | 36 | 43 |
| Female | 47 | 57 |
| Total | 83 | 100 |
| | | |
| **Age** | | |
| Under 24 | 56 | 67 |
| 25 – 34 | 13 | 16 |
| 35 – 44 | 6 | 8 |
| 45 - 54 | 5 | 6 |
| 55 – 64 | 1 | 1 |
| 65 and over | 2 | 2 |
| Total | 83 | 100 |
| | | |
| **Annual Household Income** | | |
| Less than €10,000 | 11 | 13 |
| €10,000 to €19,999 | 4 | 6 |
| €20,000 to €29,999 | 7 | 8 |
| €30,000 to €39,999 | 7 | 8 |
| €40,000 to €49,999 | 6 | 7 |
| €50,000 to €59,999 | 5 | 6 |
| €60,000 or more | 11 | 13 |
| I do not wish to answer | 32 | 39 |
| Total | 83 | 100 |
| | | |
| **Technology ownership** | | |
| MP3 player | 60 | 30 |
| PDA (Personal digital assistant) | 2 | 1 |
| Blackberry (wireless handheld device) | 3 | 1 |
| Laptop | 66 | 33 |
| Mobile phone (with WAP capability) | 71 | 35 |
| Total | 202 | 100 |
| | | |
| **Occupation** | | |
| Farming, fishing and forestry work | 2 | 2 |
| Manufacturing | 2 | 2 |
| Building and construction | 4 | 5 |
| Clerical, management or government | 5 | 6 |
| Communications or transport | 1 | 1 |
| Sales and commerce | 3 | 4 |
| Professional, technical and health workers | 9 | 11 |
| Student | 48 | 58 |
| Education | 8 | 10 |

| | | |
|---|---|---|
| Other | 2 | 2 |
| Total | 83 | 100 |

**Activities undertaken while on public transport**

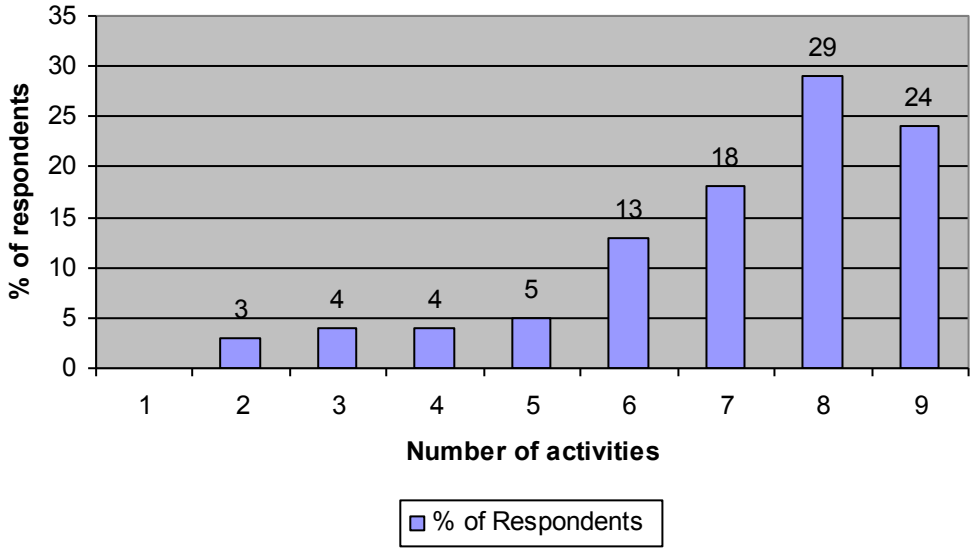
Respondents were asked what activities they participate in whilst travelling, the results of which are presented in Table 3. 30% of respondents said that when travelling they always listen to music or the radio (see Table 3). 31% of respondents said they always use their mobile phone for leisure when travelling (see Table 3). Nearly one quarter of respondents said they always eat or drink when they are travelling. 42% indicated that they either 'often', 'very often' or 'always' read for work or college while travelling. 35% of respondents either 'often', 'very often' or 'always' use a laptop while travelling (see Table 3). The results presented in Table 3 demonstrate that all of the respondents to the survey currently undertake two or more activities while travelling by rail. The use of a laptop was not ranked as one of the most frequent activities undertaken while travelling by rail. It should be noted that on the rail service surveyed it was not possible to access the internet.

**TABLE 3 Multi-tasking activities undertaken**

| | Never | Very rarely | Rarely | Sometimes | Often | Very Often | Always |
|---|---|---|---|---|---|---|---|
| **Listen to Music/Radio** | 10% | 4% | 5% | 15% | 16% | 20% | 30% |
| **Use mobile phone for leisure** | 3% | 8% | 4% | 17% | 19% | 18% | 31% |
| **Reading for work/college** | 14% | 11% | 12% | 21% | 18% | 12% | 12% |
| **Reading for leisure** | 8% | 7% | 9% | 26% | 24% | 13% | 13% |
| **Use a laptop** | 23% | 16% | 10% | 16% | 9% | 13% | 13% |
| **Sleep** | 16% | 13% | 6% | 23% | 15% | 16% | 11% |
| **Eat / Drink** | 8% | 6% | 8% | 19% | 18% | 18% | 23% |

Figure 3 shows the amount of activities respondents said they engage in while travelling. All respondents were found to participate in two or more forms of an activity other than travelling. Considering the primary activity of every respondent was travelling, this shows that 100% of respondents multi-tasked. 84% of respondents were found to participate in 5 or more activities and over a half were conducting 8 or 9 activities (see Figure 3). This result mirrors the findings of Kenyon and Lyons *(7)*. Kenyon and Lyons *(7)* found that at least one incident of multi-tasking is recorded on 99% of days and individuals undertake three or more parallel activities at any one time on 81% of days.

**FIGURE 3 Number of activities undertaken while travelling**




In the survey, respondents were asked to state what factors made them choose to travel by rail (see Table 4). The results show that 30% of commuters regard cost as a very important factor. 43% of respondents said that the ability to use a laptop had no significance when deciding on type of transport. Time taken, availability and frequency of service were all regarded as very important by the majority of commuters. 38% of commuters consider comfort, seat availability and relaxation very important factors. 27% of respondents indicated that the option to eat/drink while travelling by public transport was very important. 28% of respondents indicated that they the option to use a laptop while travelling by rail was either 'important' or 'very important' (see Table 4).

**TABLE 4 Factors influencing the choice of transport**

| | No Significance | Slightly Important | Significant Influence | Important | Very Important |
|---|---|---|---|---|---|
| Cost | 17% | 13% | 22% | 17% | 30% |
| Time taken | 4% | 4% | 18% | 18% | 54% |
| Availability | 4% | 13% | 13% | 30% | 39% |
| Frequency of service | 9% | 23% | 9% | 18% | 40% |
| Health and Safety | 17% | 22% | 17% | 17% | 26% |
| Comfort / Seat availability / Relaxation | 14% | 5% | 24% | 19% | 38% |
| Ability to use laptop | 43% | 9% | 19% | 9% | 19% |
| Ability to eat / drink | 27% | 24% | 14% | 5% | 27% |

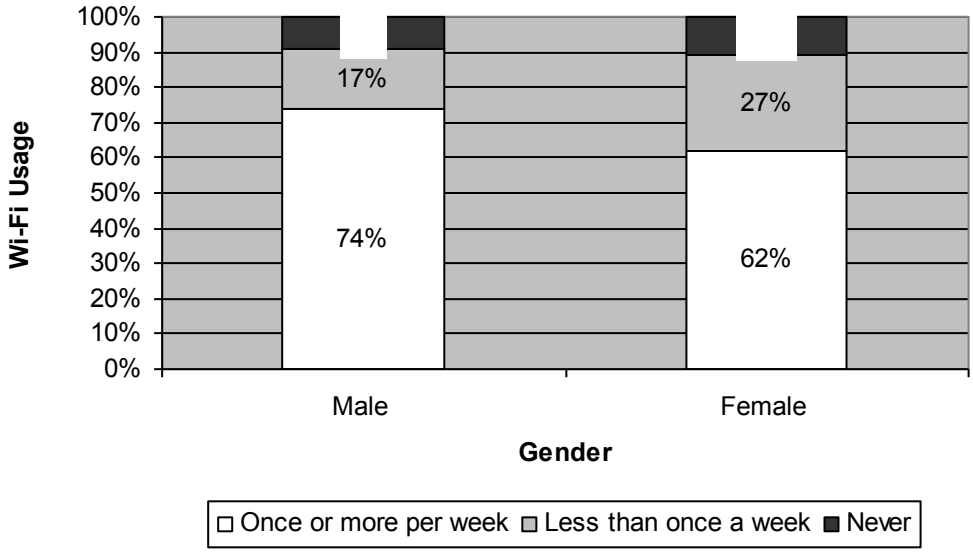
In the survey respondents were asked if wi-fi internet access were available on public transport, would they use this service (see Table 5). 21% of respondents said they would use it every day. 19% said they would use it 2-3 times per week and 27% said they would use wi-fi internet access, at least, once a week.

**TABLE 5 Use of internet on-board public transport**

| | N | % |
|---|---|---|
| Never | 9 | 11 |
| Less than 10 times per year | 11 | 14 |
| 1-3 times per month | 7 | 9 |
| Once a week | 22 | 27 |
| 2-3 times per week | 15 | 19 |
| On a daily basis | 17 | 21 |
| Total | 81 | 100 |

The results presented in Table 5 are segmented by gender and presented in Figure 4. A higher percentage of males (74%) were found to be willing to use wi-fi internet access once or more per-week. 27% of females and 17% of males indicated they would access the internet less than once a week while travelling by public transport (see Figure 4).

**FIGURE 4 Use of internet on-board public transport – segmented by gender**




## MNL MODELLING RESULTS

A traditional multinomial logit modelling approach was used in this study, the results of which are presented in Table 6. The cost of accessing the internet and time spent online are significant in both options. In the base model both $\rho^2(0)$ and $\rho^2(c)$ values (0.257 and 0.241) ranged between 0.2 and 0.4 and indicate a good model fit.

The coefficient representing the use of a complementary laptop, in a special wi-fi carriage, was estimated to be 0.375 (see Table 6). The *t*-ratio value was 3.1,

indicating that the variable is significant at the 99% confidence level (see Table 6). This implies that there would be demand for computer facilities if they were made available in a wi-fi carriage. The complementary laptop available coefficient (outside of a wi-fi carriage) was estimated to be 0.172 and was found to be significant at the 95% confidence level (see Table 6). This coefficient demonstrates that individuals would derive a benefit from the provision of a complementary laptop. The results presented in Table 6 demonstrate that respondents did not derive a benefit from the provision of on-board printing facilities.

All of the cost coefficients presented in Table 6, were found to be negative. The cost coefficient (€7 per-trip) for wi-fi internet access throughout the train was found to be -0.365 with a *t*-ratio of -6.4, indicating that this variable is significant at the 99% confidence level. The coefficient for the cost (€7 per-trip) of wi-fi internet access in a special carriage was found to be -0.208. The *t*-ratio was estimated to be -8.5, indicating that the variable is significant at the 99% confidence level (see Table 6). These results demonstrate that individuals are likely to pay more for wi-fi access in a specific carriage dedicated for this purpose.

The time spent online coefficient was found to be positive in both cases. The coefficient for wi-fi internet access throughout the train, for a commuter's full trip, was found to be 0.048 and had a *t*-ratio of 5.8, indicating that this variable is significant at the 99% confidence level. The coefficient for wi-fi internet access in a wi-fi carriage (for the full trip) was found to be 0.071. The *t*-ratio was estimated to be 3.3, indicating that the variable is significant at the 99% confidence level (see Table 6). The difference between the two coefficients is minimal; therefore it is fair to say the time spent on line variable is not influenced by where the individual accesses the internet.

A dummy variable called LTOWNERS was created to examine if laptop owners were more likely to derive a benefit from wi-fi internet access. The variable LTOWNERS has a value of 1 if the respondent was a laptop owner and 0 if not. The coefficient for the LTOWNERS variable was found to be positive with a value of 0.522 and significant at a 95% confidence level with a *t*-ratio value of 2.1 (see Table 6). This result indicates that respondents who own a laptop are more likely to benefit from the availability of wi-fi internet access compared to those who do not own a laptop.

Commuters and inter-city rail passengers are the two types of rail users surveyed in this study. A dummy variable called COMMUTE was created to measure if commuters derive a greater benefit from accessing wi-fi internet services compared to inter-city rail users. The COMMUTE variable takes a value of 1 if the respondent is a commuter and 0 if the respondent is an inter-city rail passenger. The COMMUTE variable was found to be negative and significant at the 99% confidence level with a t-value of -3.4 (see Table 6). The negative COMMUTE coefficient indicates that inter-city rail users derive a greater benefit from using wi-fi internet access. This result suggests that respondents with a longer travel time are more likely to derive a benefit from wi-fi internet access.

The GENDER variable is a dummy variable which takes a value of 1 if the respondents are male and 0 if female. The GENDER variable was estimated to be positive and significant at the 95% confidence level (t-value 2.2) (see Table 6). The positive coefficient indicates that males are more likely to derive a benefit from accessing wi-fi while travelling by rail.

**TABLE 6 MNL Model results**

| | | |
|---|---|---|
| **Wi-fi internet access through the entire train** | | ***t-value*** |
| | | |
| *Computer Facilities available* | | |
| No lap top available | 0.071 | 1.9* |
| Complementary lap top and printing services available | 0.117 | 2.1* |
| Complementary lap top available | 0.172 | 2.5* |
| | | |
| *Cost of accessing the internet* | | |
| 0c | -0.094 | -2.7** |
| €3.50 | -0.214 | -3.1** |
| €7 | -0.365 | -6.4** |
| | | |
| *Time spent online* | | |
| 30mins | 0.017 | 4.1** |
| 1 hour | 0.031 | 2.4* |
| Full trip | 0.048 | 5.8** |
| | | |
| **Wi-fi access only in a special wi-fi carriage** | | |
| | | |
| *Computer Facilities available* | | |
| No lap top available | 0.041 | 1.9* |
| Complementary lap top and printing services available | 0.207 | 2.1* |
| Complementary lap top available | 0.375 | 3.1** |
| | | |
| *Cost of accessing the internet* | | |
| 0c | -0.010 | -2.7** |
| €3.50 | -0.124 | -4.3** |
| €7 | -0.208 | -8.5** |
| | | |
| *Time spent online* | | |
| 30mins | 0.011 | 2.7** |
| 1 hour | 0.051 | 2.4* |
| Full trip | 0.017 | 3.3** |
| | | |
| LTOWNERS | 0.522 | 2.1* |
| COMMUTER | -0.762 | -3.4** |
| GENDER | 0.344 | 2.2* |
| | | |
| N | 478 | |
| *ρ2 (0)* | 0.257 | |
| *ρ2 (c)* | 0.241 | |

* Significant at a 95% confidence level
** Significant at a 99% confidence level

## CONCLUSIONS

This research demonstrates that multi-tasking is an important factor while travelling by rail. The majority of respondents indicated that they participated in two or more forms of activity. These activities include using a mobile phone, listening to music, eating/drinking and reading, amongst others.

The results demonstrate that there is a demand for wi-fi internet services, as approximately two thirds of respondents said that if wi-fi internet access was available they would use it once or more every week. The use of wi-fi internet access to browse the internet or download music for leisure purposes could mean that individuals equate train travel with leisure time. The findings presented in this paper demonstrate that individuals would derive benefit from internet access while travelling by rail. The results indicate that individuals are willing to pay more for accessing the internet while in a wi-fi carriage compared to throughout the rest of the train. Laptop owners were found to derive a greater benefit from wi-fi internet access compared to non-laptop owners. The model results demonstrate that males derive a greater benefit from the provision of wi-fi internet access. Passengers with longer trip times were shown to derive a greater benefit from internet access compared to passengers travelling shorter distances. These findings support the growing body of evidence that suggests travel time should not always be considered a negative way.

## ACKNOWLEDGEMENTS

The authors would like to thank Irish Rail for their help in conducting the on-board survey.

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