

ORIGAMI

**Optimal Regulation and Infrastructure for Ground,
Air and Maritime Interfaces**

DELIVERABLE D4.1

REVIEW OF NEEDS OF LONG- DISTANCE TRAVELLERS

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EXECUTIVE SUMMARY

The first deliverable of the ORIGAMI Project aims to explore user needs for long-distance intermodal journeys. Specifically, it aims to *perform a systematic and comprehensive review of available literature on the needs of travellers when using different transport interchange facilities...The review will include the needs of the full range of travellers, including more vulnerable groups, such as older and mobility-impaired people...and all modal interchanges will be considered (bus, rail, ferry and air)...The review will include evidence related to more engineering/ergonomic aspects, e.g. how the physical layout of interchange facilities facilitates or restricts ease of use from a user perspective, as well as more psychological aspects, such as users' perceptions of comfort and effort involved in accessing and using facilities.*

For users, a long-distance intermodal journey can be a complex undertaking involving several transport modes and requiring several interchange points. Accordingly, user needs will differ according to the mode combinations used and the number and type of interchange facilities involved in each intermodal journey. Taking this into account, the deliverable begins by considering user needs for long-distance intermodal trips at a generic level (i.e. all modes and interchange points) before looking at user needs at an individual mode level (i.e. air, rail, bus/coach and ferry) to identify any mode-specific user requirements, and also user needs relating to the access/egress intermodal journey stage (i.e. local public transport, walking, cycling). It then reviews evidence related to how user needs vary according to both personal (i.e. age/mobility-impairment) and situational (i.e. trip purpose) factors. The main findings of the literature review are then summarised and discussed, highlighting any problems with available data and research gaps, before a final user need classification is presented.

Based on previous European research which has examined user need requirements for long-distance intermodal journeys (e.g. LINK; KITE; CLOSER), eleven main user needs were identified, related to various *network characteristics*, facilities provided at *interchanges* (transfer points), available *baggage handling facilities*, provision of *door-to-door information*, *whole journey cost*, *level of comfort*, *safety* and *personal security*, *total journey time*, *accessibility issues* and the way intermodal journeys are *promoted*. When considering individual modes that make up long-distance intermodal journeys (i.e. air, rail, coach/bus and ferry) a further four user needs were identified, related to the behaviour of *employees*, the amount of *effort* expended by users when undertaking the journey, *in-vehicle facilities* and *environmental concerns*.

Many of these broad factors overlap and are interrelated to each other. For example, journey time includes the time required for users to access terminals (and is thus related to accessibility) and is also linked to network characteristics and interchange facilities, in that aspects such as speed of transfer and frequency of connecting services will affect the overall journey time; comfort is (may) be related to the in-vehicle facilities provided; and effort will be related to the type and amount of transport services available (i.e. accessibility).

Having identified the main user requirements for long-distance intermodal journeys, including individual mode segments and interchange points, it is also important to identify those aspects that are of greatest importance to users. However, available evidence for the relative importance of user needs for long-distance intermodal journeys and some individual main mode journey components (specifically long-distance rail and coach/bus) is currently scarce and often contradictory, and further research is required before any reliable conclusions can be made.

The report also considers the role of personal (e.g. level of mobility, cognitive ability, age related etc.) and situational factors (i.e. trip purpose) in determining the relative importance of user needs. Whilst no specific personal or situational users needs were identified (from those 15 listed earlier), the relative importance attached to individual user needs was shown to vary for some traveller groups/and or be dependent on their trip purposes. For example, mobility-impaired travellers, depending on their level of mobility-impairment, attached greater importance to user aspects such as accessibility (whether transport terminal facilities and main mode vehicles/vessels are fully accessible to them), information provision (details of barrier-free routes required for them to make the journey, and whether this information is provided in formats they can understand and use) and whether staff are trained (disability awareness) to fully understand their specific needs.

Similarly, for those on business related trips, aspects such as overall journey time, in-vehicle facilities (e.g. WIFI availability), comfort and reliability issues (likelihood of delays) are more important to them, compared to travellers making the same journeys for leisure purposes, where aspects such as cost and information provision (due to their unfamiliarity of making these journeys) are more dominant.

In summary, this report had identified eleven broad, although, interrelated user need aspects that apply to all long-distance intermodal journeys, as well as four additional ones that have been identified in relation to individual mode components of long-distance intermodal journeys. These 15 user requirements are summarised below:

Eleven main user need categories

- **Network characteristics:** Users require transport services that depart and arrive at interchange points that are of sufficient frequency to meet their needs for each journey; transport services are available that cover an area that allows them to travel to the places they want to go; transport modes are available to allow them to travel to their desired destinations that match their personal mode preferences; available transport services depart/arrive matched to times required by them (convenient); and available transport services run on time.
- **Interchange facilities:** Users require that interchange facilities are designed, managed and equipped to a sufficient standard to allow them to make required connections between different modal stages of their journey as safely (see personal security later), quickly (see Journey time) and comfortably (see comfort) as possible. Interchanges also need to be fully accessible for users (i.e. barrier free), which includes use of facilities sited within interchanges including toilets, ticketing machine, shops, cafes etc.
- **Baggage handling facilities:** Users require that baggage handling facilities to be provided that are safe, simple to use, and reliable. For some travellers assistance will also be required.
- **Door-to-door information:** Users require that sufficiently detailed high quality information is provided for pre-trip, wayside and on-board journey stages to allow users to efficiently plan their whole journey. For some travellers this information needs to be provided in formats that allow all users to fully use and understand the information provided (e.g. in Braille, talking maps etc.).
- **Cost:** Users require that costs involved in planning and undertaking the journey are affordable, according to individuals' financial means. This includes costs involved to access (first mile) and egress (last mile to desired destinations) transport terminals, as well as the costs involved in each main mode component of the journey.
- **Comfort:** Transport services (vehicles) and facilities (interchange terminals) should be designed and maintained to ensure users are comfortable throughout the whole journey. This includes aspects such as ensuring facilities and vehicles are clean, protection from weather conditions is provided, seating and waiting areas are provided, and food and drink facilities are provided.
- **Safety:** Users need to feel safe when making long-distance intermodal journeys (i.e. from the risk of accidents).
- **Personal security:** Users need to feel secure when accessing, and using different mode components of the intermodal journey (i.e. from theft, attack, intimidation etc.).
- **Journey time:** Users require the total journey time involved in long-distance intermodal journeys to be as short as possible (i.e. minimal access, waiting, transfer and in-main mode vehicle/vessel time).
- **Accessibility:** Users require transport terminals to be fully accessible by all feeder transport modes, specifically to access modes they wish, but may be restricted (e.g. because of mobility difficulties) to use, as well as the vehicles that they are required to use for the main mode components of the full journey.
- **Promotion of intermodality:** Users need to be aware of intermodal services that are available to them and they need to be marketed in a way that is attractive to them.

Additional four aspects

- **Employees:** Users require (expect) employees (at interchanges and on-board vehicles/vessels) to be able to assist them (if required), provide the correct information to them, are smartly dressed and courteous, etc.
- **Effort:** Users require that the total effort (physical, cognitive and affective) they need to expend to undertake a journey is reasonable (i.e. is acceptable for them, not uncomfortable for them etc.).
- **In-vehicle facilities:** Users require (expect) various services to be provided, or be available for them (primarily for main mode elements of the journey), including aspects such as catering facilities, communication facilities (wireless access, plug sockets) and entertainment facilities (newspapers, TV/films, games etc.).
- **Environmental concerns:** Users have expectations that transport companies and operators are taking actions to minimise the environmental impact (i.e. using low emission vehicles, fuel etc.).

Whether these additional four mode specific aspects apply to all long-distance intermodal journeys, as well as which of these 15 aspects are of greatest importance (relative to each other) to users, or how these aspects influence individuals' decisions to undertake long-distance journeys (or not) and which modes to use when making such journeys is not fully clear and needs to be established in future research.

1 INTRODUCTION

1.1 ORIGAMI PROJECT

ORIGAMI is concerned with improvements in long-distance¹ door-to-door passenger transport chains through both improved co-modality and intermodality.

It starts from the premise that, with the continuing increase in trip length in interregional travel, effective use of the available transport modes as well as the interconnection between trip legs will become increasingly important for a growing proportion of passenger journeys, particularly of those which contribute most to the regional and national economies. Any substantial investment in transport infrastructure should anticipate who will be using it and how - not only immediately once it is constructed, but for a much longer time horizon, which, given lengthy planning and construction phases for major projects, could stretch up to 30 years.

The topic has particular relevance at the European level because the European Transport Networks' role as integrated international networks is compromised by poor interconnectivity and because the next generation of European transport policies (for the Transport White Book 2010-2020 revision and TEN-T update) will have to be sensitive to the differences between short, medium and long-term transport markets and the market advantages of each transport mode. In this context, a realistic assessment of co-modal and intermodal opportunities is a key ingredient to future policy development. Effective co- and intermodality requires the provision of integrated networks and services which are attractive to potential users and this is likely to require co-operation between a range of authorities and providers in the public and private sectors and may necessitate a wider vision than might otherwise prevail. Moreover, the creation of effective co-operation and interconnection may sometimes conflict with the priorities of authorities and providers who have hitherto been concerned solely with serving a local constituency.

The proposal addresses the potential for greater efficiency and reduced environmental impact of passenger transport by judicious encouragement of integration, co-operation and, where appropriate, competition in the provision of these local connections. Thus the project encompasses physical characteristics of the network, characteristics of the modes, the co-ordination of operators as well as integration, and the cohesiveness of multi-modal networks.

On the other side of the coin are the users of the transport system, their demand for travel, their expectations and their reaction to the transport supply that will be on offer. The profile of users varies across European countries and regions and so will their actual and future travel behaviour. A number of factors, such as demographics and social groups, will influence this behaviour and these factors need to be taken into account when trying to assess the potential effectiveness of any intervention.

1.2 DELIVERABLE D4.1

This first deliverable of the ORIGAMI project focuses on the identification of the specific needs (and expectations) for users when undertaking long-distance intermodal journeys. More specifically, as stated in the Description of Work, the main objective of Task 4.1 is *to perform a systematic and comprehensive review of available literature on the needs of travellers when using different transport interchange facilities...The review will include the needs of the full range of travellers, including more vulnerable groups, such as older and mobility-impaired people...and all modal interchanges will be considered (bus, rail, ferry and air)...The review will include evidence related to more engineering/ergonomic aspects, e.g. how the physical layout of interchange facilities facilitates or restricts ease of use from a user perspective, as well as more psychological aspects, such as users' perceptions of comfort and effort involved in accessing and using facilities.*

¹ Long-distance trips are, within ORIGAMI, defined as all trips over at least 100 km.

2 LITERATURE REVIEW

2.1 INTRODUCTION

For users, an intermodal journey can be a complex undertaking (LINK, 2010), involving several transport modes and requiring several interchange points. Accordingly, user needs will differ according to the mode combinations used and the number and type of interchange facilities involved in each intermodal journey. Taking this into account, the review begins by considering user needs for intermodal trips at a generic level (all modes and interchange points) before looking at user needs at an individual mode level (i.e. air, rail, bus/coach and ferry) to identify any mode specific user requirements, and also user needs relating to the access/egress intermodal journey stage (i.e. local public transport, walking, cycling). The chapter concludes by reviewing evidence related to how user needs vary according to both personal (i.e. age/mobility-impairment) and situational (i.e. trip purpose) factors.

2.2 GENERIC USER NEEDS: INTERMODAL TRIPS

At a broad level ILS (2004) concluded there are five main quality elements (user requirements) of intermodal seamless journeys, namely: *Networks and interchanges*; *Door-to-door information*; *Tariffs and Ticketing*; *Baggage handling*; and *Promotion of intermodality* (see also LINK, 2007). Each of these areas is examined in more detail, as well as additional factors of *Cost*, *Comfort*, *Safety*, *Personal security*, *Journey time* and *Accessibility*) that have been suggested in later research projects (e.g. KITE, CLOSER).

2.2.1 Networks and Interchanges

All intermodal trips will entail (at least) two main mode components and (at least) one interchange (transfer) point, and *this interconnectivity of different networks is a key issue to intermodal travellers* (LINK, 2010). The main user needs identified for these two main components are described below.

Networks characteristics

Several user need requirements have been identified that can be related to network characteristics, including:

- **Frequency of services:** Transport services depart and arrive at interchange points that are of sufficient frequency to meet users' needs for each journey. This aspect is identified as a key user requirement for rail (Crockett et al., 2004, Brons, Givoni and Rietveld, 2009), air (Gilbert and Wong, 2003; Pakdil and Aydin, 2007), bus (Tyrinopoulous and Antoniou, 2008; Eboli and Mazzulla, 2011) and ferry (Jørgensen, Mathisen, and Solvoll, 2008) travellers.
- **Spatial coverage:** Transport services cover an area that allows users to travel to places they want to go. This aspect is identified as a key user requirement for rail (Crockett et al., 2004) air (Gilbert and Wong, 2003; Pakdil and Aydin, 2007), and bus (Tyrinopoulous and Antoniou, 2008; Eboli and Mazzulla, 2011) travellers.
- **Modal coverage:** Modes are available to users to travel to their desired destination that match their personal mode preference (Ben-Akiva and Morikawa, 2002; KITE, 2008).
- **Convenient departure/arrival times:** Available services depart/arrive matched to times required by travellers. This aspect is identified as a key user requirement for air (Gilbert and Wong, 2003; Pakdil and Aydin, 2007), rail (Crockett et al. 2004), bus (Tyrinopoulous and Antoniou, 2008) and ferry (Pantouvakis, 2007; Jørgensen, Mathisen, and Solvoll, 2008) travellers.
- **Reliability of services:** Available services run on time, which is a key requirement for intermodal journeys especially when several modal transfers are required. It is also identified as a key user requirement for air (Gilbert and Wong, 2003; Pakdil and Aydin, 2007), rail (Crockett et al., 2004), bus (Ben-Akiva and Morikawa, 2002; Eboli and Mazzulla, 2011) and ferry (Jørgensen, Mathisen, and Solvoll, 2008) travellers.

Interchange facilities

A key component of any intermodal trip is the transfer point or interchange between modes. For example, KITE (2007) note *The main focus is accessibility for passengers when changing from one mode of transport to another. Interchanging points between different transport networks, e.g. rail and air, have to be available* (KITE, 2007, 19).

Several classifications of user needs for interchanges have been suggested (e.g. MIMIC, 1999; GUIDE, 2000; PIRATE, 2001; SWITCH, 2001; Wardman, Hine and Stradling, 2001; KITE, 2009a; and Transport for London (TfL), 2009).

In one of the first EU funded projects to examine interchange user needs (PIRATE), a survey of both public transport users and non-users asked to rate the importance of 21 service dimensions, clustered into 5 main dimensions, at 13 interchange facilities in 6 European countries. As can be seen in Table 2-1, overall, there were no real differences between the two groups in terms of user expectations for each dimension. Overall, *Total impression* aspects were identified as the most important aspect for both users and non-users, followed by *Interchange and the city*, *Information*, *Connecting travel modes*, and lastly *Equipment and services* aspects. In relation to individual service dimensions, some differences in importance ranking were observed. For example, *Safety and security* was the most important aspect for both groups, although for users traffic and *Travel information/car parking* was ranked second, whereas for non-users *Walking environment* was ranked second.

Table 2-1 Importance of interchange aspects: PIRATE (2001)

Aspect and dimensions	Users (mean importance)	Non users (mean importance)
Total impression	4.34	4.32
Safety and security	4.50	4.53
Operational efficiency	4.38	4.26
Information	4.37	4.33
Internal accessibility	4.26	4.30
Comfort	4.19	4.16
Interchange and the city	4.29	4.23
Location	4.40	4.34
Accessibility of entrances	4.17	4.12
Information	4.28	4.22
Traffic and travel information	4.44	4.41
Clocks	4.33	4.19
Orientation	4.07	4.07
Connecting travel modes	4.20	4.15
Car parking	4.44	4.42
Drop off/pick up	4.37	4.26
Bus/tram stops	4.36	4.38
Platforms	4.27	4.10
Walking environment	4.21	4.50
Cycle parking	4.15	3.81
Taxis	3.62	3.59
Equipment and services	3.78	3.76
Security features	4.24	4.13
Automatic ticket machines	4.05	3.98
Comfort and convenience	3.73	3.74
Commercial services	3.09	3.21

An alternative classification of user needs was provided by SWITCH (2001) who categorised user needs into the following broad categories:

- **Logistical and operational:** timetables, journey times, average waiting time at interchanges (from the arrival of one mode to the time of departure by another);
- **Economic:** cost of tickets and affordability;
- **Psychological and social:** users' fears and feelings for personal security; the need to overcome language, cultural, physical or sensory barriers; feelings of social exclusion due to socio-economic status;
- **System information:** information or instructions on how to operate ticketing machines;
- **Physical design:** accessibility and pedestrian flow, vertical and horizontal physical obstacles between modes, availability of physical amenities, lighting, security cameras, ease of transfer, cleanliness, access to information, ticketing systems;
- **Local planning and land use:** physical accessibility to places/centres of employment (services/industry) and services, leisure and recreation, shopping, other facilities e.g. health, residential areas, education.

The main difference between the PIRATE and the SWITCH classification is the inclusion of more psychological and social factors in the latter. Similarly, Wardman, Hine and Stradling (2001) suggested 15 aspects related to Scottish local bus interchanges that were identified as important for users, although include more subjective additional needs related to *the behaviour of other passengers, simplicity of obtaining tickets and protection from weather whilst waiting and travelling*.

Finally, KITE (2009a) suggested a comprehensive user requirement classification broadly divided into 4 main categories, namely:

- Intermodal integration of modes
This field includes circumstances at an interchange terminal that integrate and promote the availability and the usage of all public transport modes (long-distance modes and local public transport) as well as good access for individual transport modes for passengers (KITE, 2009a, 22). Aspects include
 - Availability of long distance modes and quality of connections;
 - Availability of public transport (urban train, underground, bus, tram) for access to and egress from the terminal;
 - Provision of direct access to the major road network (e.g. motorway);
 - Supply of car parks or garages;
 - Availability of taxis in a central position;
 - Existence of cycle lanes leading to/from the interchange point;
 - Availability of cycle stands.
- Passenger services to support intermodality
Beside the optimal availability and integration of different transport modes at the terminal, supporting services for their use are crucial to seamless passenger travel (KITE, 2009a, 23). Aspects include
 - Short transfer times between long distance modes;
 - Sufficient information about arrival and departure times and about further connections (integrating all modes);
 - Short waiting times at all capacity restraint points (check-in, ticket counter);
 - Easy ticketing (ticketing vending machines, integrated tickets etc.);
 - Intermodal luggage handling.

- Design aspects of the intermodal interchange

At railway stations, airports and ports the constructional design and interior equipment play an important role to guarantee seamless travel for passengers (KITE, 2009a, 23). Aspects include

 - Distances for transfer between long distance modes (between gates, platforms etc.);
 - Distances between transport modes and service facilities within the terminal;
 - Barrier free accessibility and interchange for disabled persons;
 - Easy way finding (good and understandable signage);
 - Feeling of safety within terminal.
- Additional services for passengers convenience

Further services, facilities and characteristics to support that passengers travelling on long-distance journeys for private as well as for business purpose feel comfortable during their stopover at an interchange terminal (KITE, 2009a, 24). Aspects include;

 - Waiting conditions (e.g. availability of seats);
 - Feelings of personal safety;
 - Availability of left-luggage lockers;
 - Shops and facilities;
 - Availability of accurate and easily understandable information about destination (hotels, sights, events etc.).

See also MIMIC (1999) and GUIDE (2000) who provide similar definitions and guidance.

Relative importance of user needs for interchanges across modes

As part of the EU KITE Project, 19 operators of interchange terminals across Europe were asked to assess the importance of various interchange facilities at intermodal interchanges for long-distance travelling (KITE, 2009a). As can be seen in Table 2-2, accessibility by cycle was rated the most important factor (shaded red) for air and ferry (along with availability of luggage lockers, intermodal luggage handling and barrier free accessibility), whereas for rail interchanges the availability of information at destinations was the most important. This difference in ranking of importance was observed for all other attributes, across the different modes.

Table 2-2 Relative importance of user needs across air, rail and ferry: KITE (2009a)

Attribute	Mean importance score (rank ordered)			
	All	Mode		
		Rail	Air	Ferry
Easy way finding	1.5(15)	1.4(12)	1.2(13)	3.0(3)
Availability of long distance modes and connections	1.7(14)	2.4(7)	1.0(14)	1.5(6)
Easy ticketing	1.7(14)	1.7(10)	1.8(11)	1.5(6)
Information about arrival/departure times/ and connections	1.8(13)	1.4(12)	1.7(12)	3.5(2)
Availability of public transport for access/egress	1.9(12)	1.6(11)	2.0(10)	3.0(3)
Feeling of safety	1.9(12)	1.3(13)	2.2(9)	3.0(3)
Short transfer times between modes	2.0(11)	2.0(9)	2.0(10)	2.0(5)
Short waiting times at check-in, ticket barriers	2.1(10)	2.3(8)	2.2(9)	1.0(7)
Short distances between modes and service facilities	2.1(10)	2.4(7)	1.7(12)	2.5(4)
Supply of car parking	2.3(9)	1.7(10)	3.0(5)	2.5(4)
Integration into major road network	2.5(8)	2.9(4)	2.5(8)	1.5(6)
Availability of taxis	2.5(8)	2.6(6)	2.2(9)	3.0(3)
Short distance for transfer between modes (gates, platforms)	2.5(8)	2.6 (6)	2.5(8)	2.5(4)
Barrier free accessibility	2.6(7)	1.7(10)	3.0(5)	4.5(1)
Good supply of shops	2.6(7)	2.3(8)	2.8(6)	3.0(3)
Convenient waiting conditions	2.7(6)	2.7(5)	2.7(7)	3.0(3)
Availability of baggage storage	2.9(5)	2.3(8)	3.2(4)	4.5(1)
Intermodal luggage handling	3.3(4)	3.6(2)	2.7(7)	4.5(1)
Availability of cycle parking	3.4(3)	2.4(7)	4.5(2)	3.5(2)
Availability of information at destination	3.9(2)	3.9(1)	4.0(3)	3.5(2)
Cycle lanes to from, or passing interchange point	4.1(1)	3.4 (3)	4.8 (1)	4.5(1)

User needs in relation to interchange facilities are also shown to be dependent on users' trip purpose (TfL, 2009; NICHES+, 2010a) - see Section 2.4.5.

2.2.2 Door-to-Door Information

A second key user requirement for intermodal journeys concerns the provision of information for travellers. ILS (2004) for example, noted that *Integrated and real-time door-to-door information systems are a key tool in developing workable and attractive long-distance and European intermodality. Well promoted, accessible, timely, real-time, rich yet simply and transparently presented information in necessary to smoothly plan for and negotiate transfers, especially in the case of disruptions to service or road traffic.*

However, despite the general consensus that integrated multimodal public transport information is important for users, and a *key component to optimise multimodal travel chains* (EC, 2011) there has been little empirical research on what kind of multimodal information travellers need (Grotenhuis, Wiegmans and Rietveld, 2007).

At a general level CEN/BT/WG 141 (2002) suggest the following multimodal user information needs that should be supported by telematics:

- Information on timetables, fares, rules in different European countries, in different languages;
- Easy comprehension of messages before, within and after interchanges and capability to attract the attention of travellers;
- Easy support in planning a multimodal trip;
- Availability of information along the trip with real-time and immediate information about delays; even when the user is in modes preceding the affected mode;
- Provide location based warnings in case of emergency, natural disaster;

- Personal profile information.

In relation to interchange facilities, SWITCH (2001) identified 7 main user information needs, namely:

- Provision of information concerning the overall transport system in an area;
- Information about individual modes within an overall network;
- Information concerning access routes to an interchange;
- Information about the location of specific modes and facilities within an interchange;
- Directional information within an interchange;
- The format of information within interchanges to help disadvantaged groups;
- Information about specific arrival and departure times.

Information needs are known to be highly dependent on different stages of a journey (see Infopolis 2, 1999; Federal Transit Administration (FTA), 2003), specifically:

- **Pre-trip:** The pre-trip stage is essentially the travel planning step, when the user prepares his/her future travel. This pre-trip planning typically takes place at the origin of the travel, e.g. at a person's home or work place.
- **Wayside:** Wayside locations can be bus stops, stations, ferry docks, public transport centres, park and rides, etc. Among wayside locations, first stop locations and interchanges can be distinguished. The difference is that at first stop locations travellers are usually much more familiar with the stop or station than on intermediate stops, which affects their need for information.
- **On-board:** On-board information consists of information provided inside a vehicle, and is always preceded by pre-trip information and wayside information.

In a survey involving Dutch adults, Grotenhuis, Wiegmans and Rietveld (2007) used this distinction to examine public transport user information requirements.

As shown in Table 2-3, for the pre-trip stage, 11 different information needs were identified. Most of these needs are required to plan the journey (e.g. routes by journey planners, arrival and departure times, route maps etc.). Six information types were identified for the wayside stage, which relate to ensuring they are able to reach and board their transport mode on-time. Five information types were identified for the on-board stage, which relate to information provision that allows travellers to monitor the remaining part of the journey and ensure this is as smooth as possible and they arrive at their destination (or next transfer point) on time.

Table 2-3 User information requirements according to journey stage: Grotenhuis, Wiegmans and Rietveld (2007)

Pre-trip	Wayside	On-board
Maps with all interchanges	Signage of walking routes to connecting modes	Interchange on route
Integrated connections in timetables and on signs	Scheduled arrival and departure times	Alteration and cancellations
Quickest route by multimodal journey planner	Real time arrival and departure times	Real time information on delays
Alternative route by multimodal journey planner	Platform information	Route advice to avoid delays
Total travel time	Real time information of delays	Real time information of connecting vehicle
All interchanges on route	Route advice to avoid delays	
All arrival and departure times in one glance		
Waiting times		
Alterations and cancellations		
Real-time information on delays		
Route advice to avoid delays		

2.2.3 Tariffs and Ticketing

A third main requirement identified for intermodal travellers relates to the tariff and ticketing arrangements available to users. For example *Integrated tariffs and ticketing systems are of high importance for an attractive and user friendly intermodal passenger transport system* (ILS, 2004) and a *precondition for a seamless journey* (KITE, 2007).

The European Commission highlighted in its 2001 Transport White Paper that integrated ticketing is *one of the three priority action fields for intermodal passenger transport, as travellers encounter often highly problematic conditions when they have to order tickets for a journey that involves several transport companies or different means of transport* (European Commission 2001).

LINK (2010a) emphasise that *Tariffs and ticketing systems should be integrated, not only for urban areas or regions but also extended to the long distance traveller who may even cross borders during his journey... Easy ticketing with simple single booking and (pre)payment, using as few interfaces as possible and including customer oriented services and standards could contribute significantly to the improvement of intermodal passenger transport.* (LINK, 2010).

As noted by SWITCH (2001), intermodal ticketing is an important feature of any intermodal transport system for two main reasons:

- *Firstly, it helps passengers who only use public transport to make more efficient use of the network, as they have freedom to move from one mode to another without the need to purchase separate tickets for each stage of their journey.*
- *Secondly, the option of travelling by multiple modes of transport simply from the purchase of one ticket is a valuable incentive to encourage people to transfer from private to public transport.*

2.2.4 Baggage Handling

Most travellers undertaking long-distance intermodal journeys will be travelling with baggage of some form (suitcases, rucksacks etc) and thus making this aspect of the journey as safe and simple as possible for travellers is a key user requirement (e.g. Gilbert and Wong, 2003; Pakdil and Aydin, 2007).

As part of the Euro-TraCS project, the main user requirements for baggage handling 'issues' were identified as *assurance and confidence* (peoples luggage would be transported safely and would arrive

at the destination with them), and the process for checking in baggage was *as simple and quick as possible* (EuroTraCS, 1998). This is echoed by KITE (2007b) who concluded that in relation to baggage handling facilities, for users, *reliability and simplicity are the main focus on this topic for the passenger within an intermodal journey* (KITE, 2007).

Last and Manz (2003) suggest that baggage handling issues are likely to be more important to intermodal travellers where public transport modes are the main modal components. For example, rail or coach/bus travellers are responsible for their luggage throughout the whole journey (including during transfers), whereas for air travellers once checked-in, the responsibility is with the airline to transport it to their destination. Despite this observation, baggage handling is consistently identified as an important aspect for air travellers (Gilbert and Wong, 2003; Chen and Chang, 2005).

Finally, ILS (2004) note that *it is a key decision factor in the choice of certain travel modes or chains for travellers with heavy luggage, especially those with restricted mobility* (ILS, 2004a) - see section 2.4.

2.2.5 Promotion of Intermodality

Although, not in the strictest sense a user need, intermodal travellers (potential and actual) need to be aware that intermodal solutions are available for their journey needs and, in order for intermodal journeys to be able to compete with the private car, they need to be aware of factors such as the availability of integrated ticket/tariff arrangements, modes available, interchange facilities, to entice them to use public transport.

This was highlighted by LINK (2010): *Interconnected transport networks as well as efficient and comfortable interchanges are primary requirements for intermodal travel. The provision of one-stop information and integrated services such as ticketing or baggage handling are equally important. The necessary improvements in these domains do not automatically lead to intermodal travel behaviour. Travel behaviour and especially modal choice are underlying strong routines and changes do not come easy. For a better utilisation of intermodal alternatives not only a good product is essential. The product also needs marketing.*

For example, in relation to rail travel, Crockett et al., (2004) noted that *Marketing has a key role to play in reducing some of the psychological factors which inhibit rail usage*. Likewise, Stradling (2002) suggests that marketing campaigns which focus on allaying user concerns over public transport, will assist in increasing current user satisfaction levels, as well as attracting new users.

Promotion and advertising was also one of the key issues of intermodality recognised in the KITE project, who noted that users have to be aware of, and be able to access (be exposed) to offers relating to intermodal products (KITE, 2007).

2.2.6 Additional Factors

In addition to the 5 main factors discussed in the previous sections, additional user requirements for intermodal journeys have been identified in recent EU research projects.

For example, in the first deliverable of the KITE Project (KITE, 2007) 14 'key issues of intermodality' were identified, which included both *Attributes of the process* (legal and Regulatory Framework, *Coordination and cooperation, Resources and know how, Organisational and development procedures, and Assessment and evaluation*), and most relevant to this report, attributes of the *product service*. In addition to *networks and interchanges, baggage handling, information, booking and ticketing and promotion and advertising*, covered earlier, three other aspects are suggested, namely:

- **Technical issues:** *From the passenger's perspective usability and comprehensibility of all kinds of devices he is confronted with is paramount* (KITE, 2007, 18), for example the ability to understand station announcements, information signs, ticket vending machines etc.

- **Products and services:** Passengers are interested in intermodal products, if they are advantageous compared to unimodal travel (KITE, 2007). For example, this relates to integrated services such as the availability of cross-modal tickets (see ticketing earlier).
- **Safety and security:** This relates to both general safety issues (e.g. safety from accidents - Ben-Akiva and Morikawa, 2002) and also the requirements for passengers to feel safe when accessing, waiting for and using transport services. Feeling safe and secure is a key user requirement identified for air (e.g. Gilbert and Wong, 2003), rail, both whilst waiting for services and using them (Crockett et al., 2004, Brons, Givoni and Rietveld, 2009), coach/bus (e.g. Ben-Akiva and Morikawa, 2002; Eboli and Mazzulla, 2011) and ferry (Pantouvakis, 2007) travellers.

Finally, CLOSER (2010) identified ten main factors reflecting intermodal traveller's needs², including ticket integration, information, network characteristics, interchange facilities, safety, security (discussed earlier), and additional factors of:

- **Comfort:** This covers general needs such as protection from weather whilst waiting for services, cleanliness of vehicles and terminals, provisions of seating and waiting areas at terminals/interchanges (Ben-Akiva and Morikawa, 2002; Crockett et al., 2004), as well as more in-vehicle characteristics such as *ride quality, seating comfort, ventilation and ambience* (e.g. Wardman and Whelan, 2001).
- **Journey time:** The time required for users to complete the whole journey, and thus linked to network characteristics (interconnections between services, reliability of services to avoid missed connections etc.) as well as accessibility of transport terminals. This is recognised as a key user requirement for rail (McDonald et al., 2003; Crockett et al., 2004), bus (Hensher, Stopher and Bullock, 2003; Tyrinopoulos and Antoniou, 2008) and ferry (Jørgensen, Mathisen, and Solvoll, 2008) travellers, and indirectly for air travellers (e.g. non-stop flights, Gilbert and Wong, 2003; Pakdil and Aydin, 2007).
- **Cost:** Covering user needs related to the cost of tickets, availability of discounts (i.e. are fares affordable), also costs associated with accessing terminals (e.g. Crockett et al., 2004). This aspect is identified as a key user requirement for air (Mason and Gray, 1995), rail (Brons, Givoni and Rietveld, 2009), bus (Tyrinopoulos and Antoniou, 2008; Eboli and Mazzulla, 2011) and ferry (Pantouvakis, 2007; Jørgensen, Mathisen, and Solvoll, 2008) travellers.
- **Accessibility:** the ease of access for users to access/egress from transport terminals - discussed later in section 2.3.5 (The first/last mile).

Having looked at suggested user needs for 'generic' intermodal trips, the following sections consider evidence related to user needs for individual modes that singularly, or in combination would be part of the travel chain in intermodal trips.

2.3 USER NEEDS FOR INDIVIDUAL MODES

2.3.1 Air Traveller Needs

Several authors have examined user needs specifically towards air travel (e.g. Elliot and Roach, 1993; Mason and Gray, 1995; Gilbert and Wong, 2003; Chen and Chang, 2005; Bieger, Wittmer and Laesser, 2007; Pakdil and Aydin, 2007).

For example, an early classification by Elliot and Roach (1993) suggested six broad factors of *on-time performance, baggage handling, food quality, seat comfort, check in service* and *in-flight services* as the main criteria for airline service quality based on the expectations of users.

Mason and Gray (1995) examined the needs of business air travellers leaving Stanstead Airport in the UK and identified five main service dimensions. These dimensions and associated aspect are:

- **Business travel exclusivity and added value:** Return boarding card, availability of a business lounge, city centre check-in, duty free and frequent flier scheme;

² Although these user need factors are suggested, no description of these factors is provided by CLOSER.

- **Comfort and experience:** In-flight service, seat comfort, punctuality, past experience of an airline and safety record;
- **Air service user-friendliness:** Ease of reservation, lack of ticket restrictions, seat allocation at reservation, parking assistance and quality of ground service;
- **Price:** Ticket price and discount;
- **Scheduling:** Timing of outward flight and timing of return flight;
- **Local airport:** The airport should be easily accessible.

Although Mason and Gray's classification is broadly similar to Elliot and Roach's, additional dimensions of cost, safety and accessibility dimensions are included in the latter, although baggage handling requirements were not specifically acknowledged.

A more comprehensive user need classification was suggested by Gilbert and Wong (2003) which included 26 service attributes, clustered into seven broad service dimensions (see Table 2-4 and Table 2-5). Notably, neither cost nor accessibility to/from airport aspects (two key issues identified earlier for long-distance intermodal trips) are included, although additional aspects more related to employees' attitudes and behaviour have been added.

In order to examine the relative importance of each dimension/attribute, Gilbert and Wong surveyed passengers departing from Hong Kong Airport, and asked them to rate the importance of each factor (on 7 point Likert scales). Overall, assurance (safety, behaviour of employees gives confidence and employees have knowledge to answer questions) was ranked first (most important), followed by reliability (on-time departure and arrival, consistent ground/in flight services, performs service right first time and responsiveness (efficient check-in and baggage handling, willingness of employees to help, prompt service by employees, prompt handling of requests/complaints). The other four factors, flight patterns, employees, facilities and customisation were rated as relatively less important (see Table 2-4).

Table 2-4 User needs service dimensions - air travel: Gilbert and Wong (2003)

Service dimension	Mean ³
Assurance	1.1098
Reliability	2.7165
Responsiveness	2.8963
Flight patterns	4.3659
Employees	4.4299
Facilities	6.0427
Customization	6.4543

A more detailed analysis of the individual service dimension attributes showed that the patterns of importance varied according to individual service attributes. As can be seen in Table 2-5, safety was ranked 1st overall, followed by on-time departure and arrival, efficient check-in/baggage handling, employees willingness to help and prompt service by employees. For other dimensions relatively lower importance was attached by users.

³ Mean 1 = most important, 7 = the least important.

Table 2-5 User needs service attributes - air travel: Gilbert and Wong (2003)

Service attribute	Service dimension	Mean score
Safety	A	7.9
On-time departure and arrival	R	7.84
Behaviour of employees gives confidence	A	7.57
Efficient check in/baggage handling	RS	7.27
Employees are always willing to help	RS	7.25
Prompt service by employees	RS	7.12
Courteous employees	E	6.97
Employees handling requests/complaints promptly	RS	6.96
Convenient flight schedules and enough frequencies	FP	6.93
Clean and comfortable interior/seat	F	6.9
Consistent ground/in flight services	R	6.88
Employees have knowledge to answer questions	A	6.8
Non-stop flights to various destinations	FP	6.7
Perform service right first time	R	6.6
Neat and tidy employees	E	6.44
Individual attention to passengers	C	6.33
Understanding of passengers specific needs	C	6.26
Food and beverage	R	6.03
Availability of global alliance partners' network	FP	5.99
In-flight entertainment facilities and programmes	F	5.89
Availability of loyalty programme	C	5.88
Availability of frequent flyer programme	C	5.79
Availability of waiting lounges	F	5.26
Availability of air/accommodation packages	C	4.22
Availability of travel related partners, e.g. hotels, car rentals	C	4.15
In-flight internet/email/fax/phone facilities	F	3.57

A = Assurance; R = Reliability; RS= Responsiveness; FP = Flight patterns; E = Employees; F = Facilities; and C = Customisation.

Based on a literature review of previous studies, Pakdil and Aydin (2007) proposed a further classification, based on eight main service dimensions and 34 associated attributes - see Table 2-6. Although there are many similarities to Gilbert and Wong classification some notable differences are apparent:

- Pakdil and Aydin include additional attributes to responsiveness (quality of reservation services; employees approach to unexpected situations);
- Pakdil and Aydin add a new dimension of tangibles, which includes more aspects related to in-flight services (newspapers), although, includes several attributes classified by Gilbert and Wong's Facilities dimension (e.g. availability of waiting lounges etc);
- Pakdil and Aydin combine reliability and assurance into one single dimension, incorporating Gilbert and Wong's safety attribute in this new dimension;
- Pakdil and Aydin include a new dimension of employees, which is broadly reflective of Gilbert and Wong's Responsiveness dimension;
- Pakdil and Aydin add a new dimension of image.

To measure the relative importance of user need attributes, Pakdil and Aydin (2007) surveyed 385 passengers departing from Ataturk Airport (Turkey), who were asked to rate the importance for each attribute. As can be seen in Table 2-6, and in contrast to Gilbert and Wong's findings, overall, responsiveness was rated the most important, followed by empathy, tangibles, reliability and assurance, employees, flight patterns, image and availability.

Table 2-6 User needs service attributes - air travel: Pakdil and Aydin (2007)

Service dimension	Service attribute	Mean score
Responsiveness	Handling of delayed baggage	15.648
	Efficient check-in/baggage handling services	
	Employees speed at handling requests/complaints	
	Quality of reservation services	
	Employees' approach to unexpected situations	
	Employees' willingness to help	
Empathy	Employees' behaviour to delayed passengers	13.395
	Individual attention to passengers	
	Availability of air/accommodation packages	
	Advertising of the airline company	
	Handling of fare problems	
	Understanding of customer's specific needs	
Tangibles	In-flight newspaper/magazines	11.754
	In-flight internet/email/fax/phone	
	Availability of waiting lounges	
	Quality of food and beverages	
	In flight entertainment programs/facilities	
Reliability and assurance	Safety	11.370
	On-time arrival and departure	
	Clean and comfortable interior seat	
	Consistent ground/in-flight services	
Employees	Behaviour of employees	11.159
	Knowledge of employees	
	Courtesy of employees	
	Appearance of employees	
Flight patterns	Flight problems	9.298
	Convenient flight schedules/enough frequencies	
	Non-stop flights	
Image	Image of airline company	8.909
	External appearance of the airplane	
	Employees' foreign language level	
Availability	Availability of global alliance partners	6.910
	Performing services right first time	
	Availability of travel related partners	

Finally, in a study involving Taiwanese passengers travelling on domestic flights, Chen and Chang (2005) distinguished between ground service and in-flight user needs. In relation to ground service needs, they identified 17 aspects, and for in-flight service needs 15 aspects - see Table 2-7. The most important ground user needs relate more to service staff qualities (efficiency and courtesy), whereas the most important in-flight needs focus on aircraft conditions (cleanliness, equipment).

Table 2-7 User needs related to ground service and in-flight - air travel: Chen and Chang (2005)

Ground service needs	Mean importance score (rank ordered)	In-flight needs: ranked ordered	Mean importance score (rank ordered)
Service efficiency of traffic agents	4.505	Clean and pleasant interior	4.564
Courtesy of traffic agents	4.503	Good cabin equipment conditions	4.500
Traffic agents ability to handle unexpected situations	4.476	Cabin crews ability to handle unexpected situations	4.499
Courtesy of reservation staff	4.44	Seat comfort	4.485
Baggage handling	4.437	Courtesy of cabin crew	4.459
Service efficiency of reservation staff	4.432	Cabin safety demonstrations	4.415
Traffic agents ability to handle customers complaints	4.414	Cabin crews ability to handle customers complaints	4.383
Convenient ticketing and check in procedures	4.390	Inspection of passengers seat belts	4.332
Convenient flight schedules	4.317	Cabin crew are proactive	4.322
Fairness of passengers standby procedures	4.325	Clear and concise cabin announcements	4.277
Traffic agents are proactive	4.319	Appearance of cabin crew	4.245
Signs for guiding passengers	4.318	Guidance by cabin crew	4.228
Traffic agents ability to understand passengers specific needs	4.296	In-flight entertainment materials and programs	3.955
Provision of flight information	4.286	In-flight snack service	3.913
Reservation staff response when called	4.245	Speed at which in-flight snack service is provided	3.859
Up-to-date airport facilities	4.214		
Appearance of traffic agents	4.144		

User needs for air travel are shown to be dependent on travellers' level of mobility (Chang and Chen, 2011 a), age (Chang and Chen, 2011b), trip purpose (Gilbert and Wong, 2003) and class of flight booked (Bieger, Wittmer and Laesser, 2007). These differences are explored later in Section 2.4.2.

2.3.2 Rail Traveller Needs

Whilst no specific user need classifications were identified specifically in relation to long-distance rail journeys, several user need classifications for rail travel at a general level have been proposed.

Crockett et al. (2004) for example identified 13 service dimensions that are important for rail travellers, Nathanail (2008) suggested 7 broad dimensions and 20 sub-attributes, and Brons, Givoni and Rietveld (2009) identified 10 service attributes and 36 sub-attributes.

As can be seen in Table 2-8, there are many differences between the three user-need classifications which are summarised below:

- Both Crockett et al. and Brons, Givoni and Rietveld include a separate *accessibility* dimension, although, the dimension is interpreted differently and separate dimensions are included (Accessibility and inclusion/accessibility);
- Whilst all three classifications include a comfort dimensions (*Comfort*; *Passenger comfort* and *Travel comfort*), the individual attributes included in each dimension differ;
- Crockett et al. include a Convenience dimension, which is broadly reflective of Brons, Givoni and Rietveld's Accessibility dimension, and include facility attributes included by Nathanail as Service dimension;
- Crockett et al. and Nathanail both split safety and security into two separate dimensions, whereas Brons, Givoni and Rietveld include only one dimension which includes only personal safety attributes;
- Only Crockett et al. include a *Time* dimension;
- Only Crockett et al. include an *Effort* dimension;
- Only Crockett et al. and Brons, Givoni and Rietveld include a *cost* dimension;
- Brons, Givoni and Rietveld include a separate dimension of station organisation and information.

Table 2-8 User needs attributes - rail travel: Crockett et al (2004), Nathanail (2008), and Brons, Givoni and Rietveld (2009)

Crockett et al (2004)		Nathanail (2008)		Brons, Givoni and Rietveld (2009)	
Dimension	Attribute	Dimension	Attribute	Dimension	Attribute
Accessibility and inclusion: Extent to which the whole journey is physically and financially accessible	Physical barriers to usage			Accessibility	Secure cycle parking
	Information barriers				Connections with public transport
	Social exclusion				Car parking capacity
					Train taxi
Comfort: Comparability of rail (and other modes to support the whole journey) with comfort requirements and expectations	In station	Passenger comfort	Train temperature	Travel comfort	Approachability of train conductor
	In vehicle		Seat comfort		Friendliness/helpfulness of conductor
	Cleanliness		Rest comforts		Seat capacity inside train
	Crowding				Riding and sitting comfort inside train
					Heating and ventilation inside train
				Cleanliness on train interior	
	See Comfort	Cleanness	Train interior cleanness	See Travel comfort	
			Station cleanness		
			Train exterior cleanness		
Convenience: Convenience of taking whole journey	Access/egress	See servicing		See accessibility	
	Station facilities/environment				
	Interchange				
Cost: Monetary cost of planning an undertaking the whole journey	Fares			Price-quality	Price-quality ratio
	Terminal cost/access fare				
Customer service: Support from the user from staff and facilities in order to enhance delivery of the whole journey	Staffing	Servicing	Personnel behaviour	Personnel	Approachability of service personnel
	Service provision		Frequency of service		Friendliness of service personnel
	Facilities		Quality and price of catering		Approachability of train conductor

Crockett et al (2004)		Nathanail (2008)		Brons, Givoni and Rietveld (2009)	
Dimension	Attribute	Dimension	Attribute	Dimension	Attribute
			Easiness of ticket purchasing at station		Friendliness of train conductor
			Speed		
			Personnel appearance		
			Ticket purchasing facilities		
			Bed services		
			Escorted vehicle services		
Effort: The amount and nature of effort and the consequences of that effort needed to plan and undertake the whole journey	Physical				
	Cognitive				
	Affective				
Flexibility: Ability of the service to adapt to changing user requirements when planning and undertaking of the whole journey	Departure times	See servicing		Service schedule	Connections with other trains
	Frequencies of service				Service frequencies
	Destinations				
Information: Knowledge of and access to information to support preparation and undertaking of the whole journey	Planning	Passenger information	Information during trip	Dynamic information	Information available at home
	Undertaking		Information at station		Intelligibility of audio messages at station
	Journey support				information on delays and platform changes
					Intelligibility of audio messages on train
Psychological and attitudinal factors: Comparability of rail use (and other modes to support	Image				Information in train on departure and arrival
	Lifestyle				Information in train during delays
	Autonomy and privacy				
	Familiarity				

Crockett et al (2004)		Nathanail (2008)		Brons, Givoni and Rietveld (2009)	
Dimension	Attribute	Dimension	Attribute	Dimension	Attribute
the whole journey) with social and cultural considerations and expectations	Awareness				
	Society and the environment				
Reliability: Confidence in the delivery of the whole journey	Punctuality	Itinerary accuracy		Travel time reliability	Travel time reliability
	Risk of delay/journey failure				
	Non-time journey elements				
Safety: The degree to which undertaking the journey is seen to be safe	Risk of accidents	System safety	Safety during trip		
			Safety at stations		
Security: Implications for personal security of undertaking the whole journey	Fear of crime	See system safety		Personal safety	Personal safety during day at station
	Graffiti/vandalism				Personal safety during night at station
	Anti-social behaviour				Personal safety inside train
Time: Time required to plan and undertake the whole journey	Access				
	Waiting				
	In-vehicle				
				Ticket service	Possibilities to buy a ticket
					Queuing time at ticket vending machine
					Queuing time at ticket counter
					Friendliness of staff at ticket counter
				Station organisation and information	Station overview
					Signage at station
					Cleanliness of station
					Protection for rain, wind and cold
					Travel information at station

User needs for rail travel (public transport) are shown to be dependent on travellers level of mobility (Stahl and Wretstrand, 2008; Alauzet et al., 2009) and trip purpose (Preston, Wall and Whiteing, 2006) - see Section 2.4.

2.3.3 Coach/Bus Traveller Needs

As with rail travel, no specific long-distance coach/bus user classifications were identified in this literature review, although, several 'generic' bus user classifications have been suggested.

Hensher, Stopher and Bullock (2003), for example, concluded that there are 13 main user need attributes for local bus services, namely:

- Bus travel time;
- Fare;
- Ticket type;
- Buses per hour (frequency);
- Bus arrives on-time;
- Time required to walk to bus stop;
- Seat availability on bus;
- Information at bus stop;
- Physical access to bus vehicle;
- Bus stop facilities (seats and shelter);
- Temperature on bus;
- Driver attitude;
- Cleanliness of bus.

del'Olio, Ibeas and Cecin (2010) propose a different classification based on focus group research with Spanish bus users and suggest the most important *desired quality elements* for public transport are *waiting time at stop, journey time on the bus, vehicle occupancy, cleanliness of the vehicle, driver kindness and comfort of the bus*. In a later stated preference survey with bus users, they found that waiting time, cleanliness and comfort to be the most desired factors (del'Olio, Ibeas and Cecin, 2011), although, some aspects suggested by Hensher, Stopher and Bullock, i.e. cost and information provision (and others-see below) were not measured in the study.

A more recent and comprehensive user need classification is provided by Eboli and Mazzulla (2011), who propose a classification based on 11 service aspects and 26 associated attributes - see Table 2-8. In addition to aspects suggested by Hensher, Stopher and Bullock (2003), they include a comfort dimension, and in addition to Hensher, Stopher and Bullock and del'Olio, Ibeas and Cecin (2010), a safety/security and environmental protection dimension, as well more detailed sub-attributes for each dimension.

Table 2-9 User needs service aspects and user needs - bus: Eboli and Mazzulla (2011)

Service aspect	User requirement
Route characteristics	Buses go on routes customers want
	Sufficient stops and short distance between stops on route
	Bus stop located conveniently for users
Service characteristics	Sufficient frequency of service to match customers needs
	Daily service time match customers needs
Service reliability	Reliability of services match customers requirements
	Services are on-time
Comfort	Low level of crowding on bus
	Comfortable seats
	Air conditioning on bus
	Low level of noise and vibration on bus
	Availability of shelter and seating at bus stops
Cleanliness	Cleanliness of bus interior
	Cleanliness of bus exterior
Fare	Cost of ticket
Information	Schedule and map information on bus
	Schedule and map information at stop
	Information is available by phone/internet
Safety and security	Safety and competence of drivers
	Security against crime on bus
	Security against crime at bus stop
Personnel	Personnel are of smart appearance
	Personnel are helpful
Customer service	Tickets easy to purchase
	Complaints handled satisfactorily
Environmental protection	Bus vehicles are environmentally friendly

Tyrinopoulos and Antoniou (2008) suggested a user need classification for public transport in Athens, which includes local bus, trolley bus, metro and over ground light-rail services. Importantly, this classification covers interchange (transfer points) and accessibility aspects, which is more relevant to intermodal trips. The classification relates to four broad service dimensions and 23 associated sub-attributes:

➤ **General characteristics of a public transport system**

- **Service frequency:** Frequent services (where passengers want/need to travel);
- **On-time performance:** Services arrive/depart on-time;
- **Service provision hours:** Services operate at times passengers need;
- **Network coverage:** Services operate to/from places (spatial coverage) people want/need to travel to;
- **General information provision:** Sufficient information is provided to customers about the general characteristics of the transit services, such as the lines, terminals and stops points, departure times, tickets and passes available;

-
- **Types of tickets and passes:** Sufficient types of tickets and passes with respect to the coverage of the needs of the public are provided;
 - **Prices of tickets and passes:** The price structure of the various types of tickets and passes available, is good;
 - **Tickets selling network:** Refers to the sufficiency of the tickets selling network and the ease to purchase tickets from the various selling points;
 - **Personnel behaviour:** The behaviour of the various types of personnel of the transport operator (e.g., drivers, station officers and ticket counter officers), when communicating and transacting with the passengers, is good and acceptable to users;
 - **Existence of bus lanes:** Refers to the sufficiency and performance of the bus lanes to facilitate the efficiency of the transit service;
 - **Measures for environmentally friendly public transit:** Refers to the contribution of public transit in the protection of the environment and the adequacy of the relevant actions and measures taken by the relevant authorities.
- **Terminals and stops**
- **Walking distance to terminals and stops:** The distance that passengers have to walk from the origin point to the closest terminal and stop, is as short as possible;
 - **Information provision at terminals and stops:** Sufficient information is available to the passengers about the services provided at the terminals and stops;
 - **Conditions at terminals and stops:** The conditions of the terminals and stops concerning shelter, visibility, seating capacity, etc. are acceptable to users;
 - **Safety at terminals and stops:** Passengers feel safe when waiting at the terminals and stops to use the public transit service.
- **Vehicles**
- **Onboard conditions:** The conditions inside the vehicle during the execution of a journey, mainly concerning crowded situations and the provision/condition of available facilities (e.g., seats and air-conditioning) are acceptable to users;
 - **Vehicles cleanliness:** The level of cleanliness of the vehicles from various standpoints (seats, handles, windows, doors, floor, etc.) is acceptable for users;
 - **Driving behaviour:** The driving performance of the vehicle's driver is safe;
 - **Onboard information provision:** Sufficient provision of information inside the vehicle during the trip, such as next stop and estimated arrival time at the next stop;
 - **Accessibility to disabled and mobility impaired people:** Sufficient provision of facilities by the transit operator to facilitate the accessibility of transit services by disabled and mobility-impaired people.
- **Transfer points**
- **Distance between transfer points:** Minimal distances that passengers have to walk between transfer points in order to continue their trip.
 - **Waiting time at transfer points:** Minimal time that passengers have to wait at transfer points in order to continue their trip.
 - **Information provision at transfer points:** Sufficient information is provided to passengers at the transfer points about the combination of the various lines and modes, and their time schedules.

Older people and those with mobility difficulties have different and more specific user requirements, which are described later in Section 2.4.

2.3.4 Maritime Traveller Needs

Ferry services play an important role in the national transport services in many EU countries, especially so for those countries with long coastlines and off-shore inhabited islands (Mathisen and Solvoll, 2010), as well as island countries such as the UK and Ireland to allow access to mainland Europe (Whitney, Keith, Kolar, 2005); thus maritime services are an integral part of intermodal transport systems. Despite their importance within the wider transport system, literature examining user needs for ferry services is limited (Pantouvakis, Chloumoudis and Dimas, 2010) - see below.

Based on a review of related user need service aspects, Pantouvakis (2006) suggested six main service factors and 18 service elements that are important for users using port facilities - see Table 2-10.

Table 2-10 User needs - port facilities: Pantouvakis (2006)

Service factor	Service dimension
Information	Arrival and departure information times
Services	Politeness of port staff
	Availability and willingness of port staff to assist passengers
	Time taken for staff to respond to passenger requests
	Waiting time for passengers in queues (e.g. ticket purchase etc.)
	Luggage handling assistance
	Ability to keep to time schedules and promises
Security and safety	Feelings of safety within port
	Number of staff within port
	Lighting systems within port
Cleanliness	Overall cleanliness of port area
	Cleanliness and the adequacy of toilets and washrooms
	Adequacy and efficiency of information signs
Guidance/communication	Quantity and quality of communication facilities (telephones etc.)
	Quantity and quality of waiting facilities (lounges, seating areas, shops, cafes etc.)
Parking facilities	Long-term parking availability
	Short-term parking availability
	Prices charged by port

NB: Service factors identified via Factor Analysis of service dimensions identified from previous literature

Based on a literature review and based on a survey of 213 ferry passengers travelling from three Greek ports (Piraeus, Patras and Heraclion) who were asked to rate these aspects (good to bad on 5 point Likert scales), Pantouvakis (2007) suggested that customers' needs for ferry services entail 13 service attributes (see Table 2-11).

Table 2-11 User needs - ferry: Pantouvakis (2007)

Service factor	Service attribute
Price	Fares are value for money
	Availability of discounted tickets
Service quality	Vessels are safe
	Locality of ferry terminals (i.e. accessibility)
	Ferry services are fast
	Staff are polite
	Staff provide assistance if problems occur
	Ferry company gives confidence to users
	Ferry trip is financially viable
Convenience	Departures at suitable times
	Arrivals at suitable times
	Politeness of staff
	Choice of services to use

NB: Factors identified via Factor Analysis of user responses to 13 service attributes

A later study by Jørgensen, Mathisen, and Solvoll (2008) suggested 16 user requirements that were important for Norwegian car ferry users - see Table 2-12. Overall cost (fares and available discounts) was identified as the most important user requirement, followed by capacity issues (likelihood of boarding), and network characteristics (service frequency and departure times). Other aspects, of cleanliness, journey time, reliability and on-board services related to were rated as relatively less important. Notably, information was ranked last, and baggage handling facilities were not included, both, key user requirements identified earlier for long-distance intermodal trips.

Table 2-12 User needs - passenger ferries: Jørgensen, Mathisen and Solvoll (2008)

Service element	Description	Mean (rank ordered)
Fare	Cost	4.5
Discount	Any discounts to full price fare	4.4
Capacity summer	Probability to board (summer)	4.4
Capacity winter	Probability to board (winter)	4.4
Frequency	Number of departures per day	4.1
Opening hours	Time between first and last departure	4.1
Time table	Planned departure times	4.1
Ferry size	Size and capacity of ferry	4.1
Cleaning	Cleanliness of ferry interior	4.1
Service	Attitudes of ferry crew	4.1
Speed	Crossing time	4.0
Punctuality	That planned departures are not behind schedule	3.9
Comfort	Comfort on board ferry	3.9
Regularity	That planned departures are being carried out	3.7
Catering	Catering provided on-board ferry	3.6
Information	Information about schedules and fares	3.5

The main differences between the two classifications are:

- Jørgensen, Mathisen, and Solvoll include a reliability (punctuality), comfort and information dimension;
- Pantouvakis includes an accessibility dimension.

More specific user needs for mobility-impaired passengers are outlined later in Section 2.4.

2.3.5 The First/Last Mile: User Requirements

Whereas car travel is typically door-to-door, all other alternative modes entail travelling to the transport (coach, rail, air, ferry) terminal, and upon reaching the destination typically involve travelling by an alternative mode to reach the final destination. Since most air and ferry, and to a lesser extent rail and coach, terminals are located relatively far from travellers' origin point (e.g. home), getting to and from them is an important part of any long-distance single mode or intermodal journey. This journey part is referred to as the 'first and last mile' e.g. CLOSER (2010), or:

- **Home-based access/egress:** Mode use between home and main mode terminal, i.e. the first mile; and
- **Destination-based access/egress:** Egress mode use between journey main mode and destination, i.e. the last mile.

Krygsman, Dijst and Arentze (2004) noted that access/egress stages (i.e. the first and last mile) are the weakest part of a multimodal public transport chain. In relation to rail, for example, Givoni and Rietveld (2007) found that the accessibility of a station can be a factor in determining whether rail is chosen to be a travel alternative, or not. Brons, Givoni and Rietveld (2009) also examined the relative importance of rail station accessibility. Overall, accessibility (connections with public transport, secure cycle parking, car parking capacity and taxi services) was ranked 7th out of the 10 service attributes (see Table 2-8 earlier), although was identified as been more important for infrequent rail users, and ranked 3rd.

Walking

Information on the needs of pedestrians is available from numerous sources (e.g. Gallin, 2001; PROMPT, 2003; DfT, 2003; Carreno and Stradling, 2007; Coffel et al., 2009; Dowling et al., 2010) and can be summarised according to seven main factors and associated attributes, namely:

- Perceptions of security (from traffic; from other people);
- Crossing facilities (number of crossing facilities; safety of crossing facilities; amount of available crossing time; audibility of crossing signals);
- Space considerations (amount of space for pedestrians; level of crowding; ability to walk at desired walking speed);
- Aesthetic quality (cleanliness of street area; attractiveness of buildings; amount of trees/flowers; level of air pollution);
- Amenities (quality of eat/drinking facilities; number of resting places; number of public toilets);
- Ease of movement (condition of pavement surface; amount of tactile paving; amount of low kerbing; amount of obstacles);
- Accessibility (by public transport; by car; amount of parking facilities close-by);
- Information provision (number of information signs; readability of information signs).

Cyclists

Similar to pedestrians, the needs of cyclists are well documented (e.g. Dixon, 1996; DfT, 2003; Soren, 2007; Dowling et al., 2010) and can be summarised as follows:

- Feeling safe from traffic (e.g. presence of dedicated cycle lanes);
- Good connectivity of cycle networks;
- High quality cycle networks (e.g. road surface);
- Low topology;
- Cleanliness of cycle routes (litter, potential dangerous objects in road);
- Aesthetic quality (e.g. low levels of air and noise pollution, scenic routes);
- Protection from weather (e.g. trees on cycle routes providing shade);

- Information provision (signs and maps).

Terminal arrival facilities

Users' requirements upon arrival at transport terminals (interchange points) will depend on the access mode used, and can be summarised below:

- Cyclists: Aside from the existence of cycle lanes leading to/from terminals, relate to available, cheap and secure parking facilities at terminals;
- Taxi users: Aside from cheap and available taxi services to/from terminals, relate to taxi ranks at terminals (departure/arrival gates);
- Bus users: Aside from frequent /reliable services to/from terminals, bus stops at the terminals;
- Private car: Aside from road access to/from terminals, relate to available, cheap and secure parking facilities at terminals;
- Pedestrians: Footpaths leading to/from terminals.

(e.g. KITE, 2009a; NICHES+, 2010b)

2.4 SPECIFIC ISSUES FOR DIFFERENT USER GROUPS

Having looked at user needs for both generic intermodal journeys, and for individual modes separately, this final section considers how user needs can vary according to both personal (age/mobility-impairment) and situational aspects (trip purpose).

2.4.1 Older People/Mobility-Impaired Needs for Public Transport

In addition to the more generic users' needs for public transport (coach/bus/rail) identified earlier in Sections 2.3.2 and 2.3.3, older/mobility-impaired people have additional more group specific needs.

At a general level, ILS (2004) noted that *societal and demographic developments play an important role when looking at the elements of seamless travel change. Not only older people but mobility-impaired people have special needs and requirements with respect to intermodality. This may be more so in relation to aspects such as baggage handling, accessibility of interchanges and user friendly information.* (ILS, 2004a).

DETR (1998) for example, concluded that for many older people, their main user requirements relate to being able to board and alight from vehicles safely, transport staff understanding their specific needs, assistance or ease of carrying bags/luggage, and cost.

DPTAC (2002) concluded that in many respects the transport priorities of disabled people differ very little from the general population as a whole. However, *in addition to more frequent and reliable services, more comfortable services and lower cost services, improving access for disabled people is a key priority. Many priorities also relate to the 'softer' aspects, i.e. the way in which services are delivered rather than the actual services themselves. In particular, improving attitudes of transport staff is perceived as a key issue* (DPTAC, 2002).

In relation to accessing transport services (and interchange points) NICHES+ (2010c) note that for mobility-impaired travellers *Accessibility does not only mean the physical access to transport services...It can also be hindered by sensory, cognitive and psychological constraints, loss of flexibility, the deceleration of reaction and decisions, or simply the lack of knowledge or confidence on how to use certain means of transport... therefore accessibility not only means 'easy to reach', but also 'easy to use'*. This may prevent many older and mobility-impaired travellers from making long-distance intermodal trips, unless suitable transport feeder modes are available to them.

In relation to public transport, two recent EU projects, EUROACCESS and ACCESS2ALL, have reviewed and summarised mobility-impaired (including older people) transport needs.

Defining mobility-impaired travellers

Stahl and Wretstrand ('EUROACCESS' 2008) and Alauzet et al. ('ACCESS2ALL' 2009) note that mobility impaired travellers are a very heterogeneous group. For example, Mobility-impairment covers users...*ranging from those with physical (i.e. motor, visual, hearing, speech, etc.) impairments to cognitive (memory, reaction time, orientation and way finding, etc.) and communication (i.e. ability to read and write, language understanding, dyslexia, etc.) limitations. In addition, the degree of the problem may differ, i.e. from physical and cognitive problems, due to physiological ageing, to limb amputation, or Alzheimer memory lapse issues. Also, the users' experience to cope with one's limitations may substantially differ, from those that are born with a mobility impairment to those that are suffering temporarily from one, such as a broken leg.*

- Stahl and Wretstrand (2008) distinguish between 5 main groupings, namely; Mobility-impaired; Sensory-impaired (visual and hearing impairment); Cognitive-impaired; Mental health problems, and those with; Environmental sensitivity and allergies.
- SWITCH (2001) also included people who are overweight, particularly tall or short, pregnant women, using pushchairs and those carrying heavy luggage.
- Alauzet et al. (2009) suggest a more detailed classification based on 13 restricted groups, each of whom have specific needs according to the difficulties they experience when using public transport (see Table 2-13).

Older people/mobility-impaired public transport needs

Based on a review of available literature and a survey amongst different mobility impaired groups Stahl and Wretstrand (2008) concluded that at a broad level:

- Mobility impaired people have high user requirements in terms of physical design - *vehicles must be accessible, systems must be reliable, and stops and terminal facilities must be proximate and user-orientated;*
- People with sensory impairments (sight and hearing), cognitive impaired and people with mental health problems have *in many cases, the same requirements as mobility impaired people. However, increased emphasis must be placed on information and orientation. For some trained and supportive staff is essential;*
- People with environmental sensitivities and allergies main concerns relate to *local climate conditions, surfaces and passenger/staff encounters* (Stahl and Wretstrand (2008, 7)

As can be seen in the final column of Table 2-13, Alauzet et al. (2009) conclude that mobility-impaired people experience a wide range of problems when using public transport that reflect a wide range of different user needs for them to use public transport safely. The specific needs of older and mobility-impaired people will thus vary on an individual basis, depending on the type of difficulties they experience, and also the severity of impairment[s] they experience.

Finally, NICHES+ (2010c) highlight specific user needs for mobility-impaired people in relation to information requirements at interchange facilities, namely:

- **Static information requirements:** Related to the accessibility of the built environment/vehicles involved in the journey, and types of assistance that is available at interchange/transport terminal facilities. The provision of easy to read maps and timetables, easy to understand routing information, simple maps describing the layout of terminal/interchange (platforms, toilets, elevators etc.).
- **Dynamic information elements** (advanced systems): Provision of detailed information on a barrier-free travel journey for the journey, which may not be the shortest route, but corresponds to individual users needs (e.g. wheelchair accessible route).

Table 2-13 Transport related user needs - mobility-impaired: Alauzet et al. (2009)

User group	Sub group	Effects on public transport use
Lower limb impairment: Limitations in motion, or strength, or, coordination or, anthropometric limitations of lower limbs.	Light or moderate limitations: No walking aids	Difficulties standing and walking and getting in and out of vehicles, reaching transport networks, crossing streets.
	Severe limitations: Use walking aids	
Wheelchair users: Limitations in motion, or strength, or, coordination or, anthropometric limitations of lower limbs resulting in use of wheelchair.	Light or moderate limitations	Difficulties in standing and walking and getting in and out of vehicles.
	Severe limitations	No standing and walking and difficulties in unassisted getting in and out of vehicles, transfer to seat and toilets.
Upper limb impairment: Limitations in motion or strength, or coordination, or anthropometric limitations of upper limbs and touch limitations	Light or moderate limitations	Difficulties in moving arms and hands, grasping, handling objects- e.g. ticket validation problems
	Severe limitations	No moving arms and hands, handling objects- e.g. ticket validation
	Touch limitations	Difficulties in activities involving touch- e.g. touch screens, displays
Upper body impairment: Limitations in motion, or strength, or coordination of upper body (head and trunk)	Light or moderate limitations	Difficulties in head and trunk movements- e.g. luggage handling, car manoeuvres, scanning limited
	Severe limitations	Difficulties in head and trunk movements- e.g. luggage handling, car manoeuvres, no scanning
Physiological impairment: Limitations in physiological or psycho physiological state	Limitations in physiological state: e.g. reduced stamina, incontinence, sudden loss of consciousness, allergies	Difficulties in long journeys without sanitary facilities, transfer between modes, climbing stairs, long walking distances, travelling alone, risk of fall, risk of allergies.
	Limitations in psycho physiological state: e.g. low vigilance, drowsiness, low balance	Difficulties in using mechanical stairs, standing in moving vehicles
Psychological impairment: Limitations in psychological or psychomotor state	Psychological problems: e.g. phobias, unstable behaviour, lack of confidence	Difficulties in using some modes of transport (air, subway), panicking, travelling alone, making decisions, conflicting with others
	Psychomotor problems: e.g. reduced or no reaction, low coordination	Difficulties in emergency situations, making decisions, using controls, performing precision tasks.
Cognitive impairment: Cognitive limitations in operating and performing tasks	Limitation in information processing	Difficulties in operating new technology
	Attention problems	Difficulties in concentrating
	Limitations in short term memory	Reduced ability in retaining recent information, e.g. travel itinerary

User group	Sub group	Effects on public transport use
	Limitations in long term memory	Reduced ability in recalling information or knowledge, e.g. travel itinerary
	Limitations in spatial ability	Difficulties in moving and orientation in complex environments
Vision impairment: Visual limitations or other visual limitations	Light or moderate limitations: e.g. visual acuity	Difficulties in reading, identifying symbols, alternating between displays and road environment
	Reduced field of vision	Difficulties in seeing approaching traffic, crossing streets etc.
	Limited night and colour vision	Difficulties in darkness or understanding maps etc.
	Sever limitations: Blindness	No reading ability
Hearing impairment: Hearing limitations or other audio limitations	Light or moderate	Difficulties hearing vocal information, audible signs, warning messages etc.
	Severe limitation or total deafness	No hearing vocal information, audible signs, warning messages etc.
Communication difficulties: Limitations in speech, or writing, or reading, or with local language, or other communication limitations	No speech or very limited speech	No using or difficulties using telecommunications, or asking for information, or help
	No speaking or very limited speaking local language	Difficulties asking for information or help etc.
	No writing or very limited writing	No writing or difficulties writing information or writing to ask for information
	No reading or very limited reading	No reading or difficulties reading information
	No or very limited understanding of local language (written or spoken)	No understanding of information or some words
	Learning difficulties	Dyslexia etc
	Low volume of speech	Difficulties asking for information or help etc.
Anthropometric difficulties: Motion limitations related to under or over sized body	Extra high stature	Difficulties of being physically accommodated in every public transport mode
	Very low stature (dwarf)	Difficulties in reaching distances and highs (e.g. accommodate luggage, reaching stop buttons, pushing buttons to open doors, etc.)
	Obesity	Difficulties in being accommodated in every public transport mode. Slow and limited movements

2.4.2 Mobility-Impaired/Older People’s Needs for Air Travel

Whilst guidance documents are available which provide design solutions to address older/mobility-impaired travellers needs for air travel, specifically regarding physical (ergonomic) elements (e.g. DPTAC, 2004), only limited research has been identified in this review that is specifically related to the needs of older and mobility-impaired air travellers for other aspects of an air journey. Apart from the generic requirements of air travellers which were described earlier in Section 2.3.1, older/mobility-impaired people have other specific needs.

Wolfe (2003) identified six 'unique' needs of older air travellers, which were linked to age-related decline in physical, sensory and mobility impairments (see also Ipingbemi, 2010). These specific needs are:

- Many older people experience problems with their vision which would affect their ability to read direction signs and information boards at airports - and would require adapted signage (e.g. large print);
- Many older people experience hearing problems which makes it hard for them to hear flight announcements/boarding gate information etc. - and would need assistance;
- Many older people experience a decline in cognitive abilities, which could result in restricted way-finding at airports - and may need assistance to navigate airports;
- Many older people experience a decline in physical strength, which makes it difficult for them to wait in-line (for any length of time) at check-in and security gates, and carrying luggage - and would need assistance/priority access;
- Many older people have limited mobility which would prevent them from walking long-distances within airport - and would need assistance;
- Due to cognitive and physical limitations, many older people would experience difficulties understanding 'safety information' provided on-planes, and some of the actions required for emergency situations may be beyond their physical capabilities (e.g. emergency evacuation) - and again would need assistance.

Chang and Chen (2011a) analysed the needs of disabled passengers from the point they reached the airport to the point they were on-board the aircraft. They concluded that their needs can be categorised by 20 separate attributes - see Figure 2-1 and Figure 2-2.

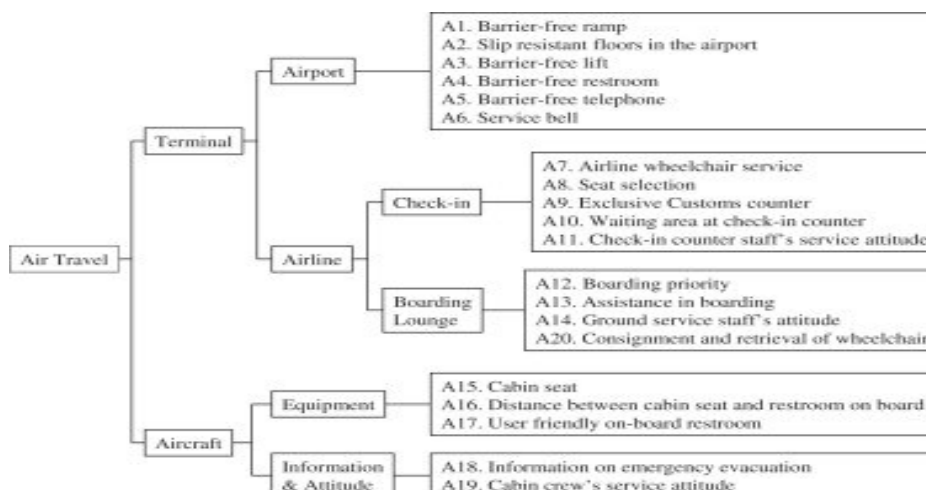


Figure 2-1 Overview of mobility-impaired user needs - air: Chang and Chen (2011a)

Overall, the most important needs identified related to attributes *slip resistance floors within the airport, boarding priority and convenience of wheelchair consignment and retrieval.*

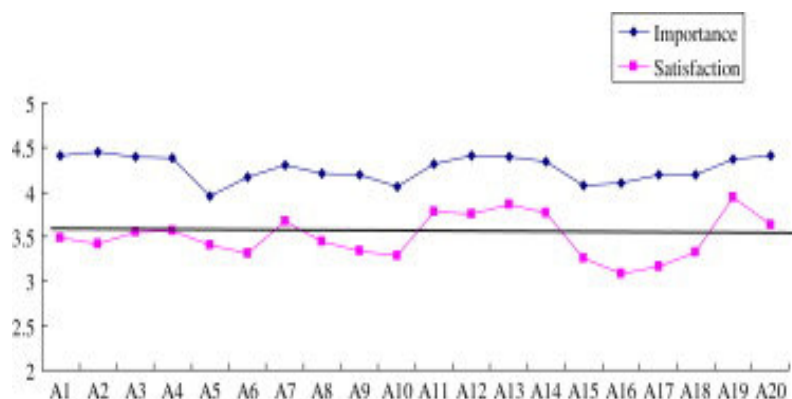


Figure 2-2 Mobility-impaired users needs according to level of impairment: Chang and Chen (2011a)

In a different study by Chang and Chen (2011b) older peoples' needs asked to rate importance of 21 airline service aspects, namely:

- A1: Restrooms at airport;
- A2: Information on directions in the airport;
- A3: Transport information to/from the airport;
- A4: Flight information on-board;
- A5: Information broadcasts;
- A6: Announcement of cancelled flights/delays;
- A7: Special services for the elderly;
- A8: Special meals for the elderly;
- A9: Seat selection;
- A10: Exclusive customs counter;
- A11: Waiting area at check-in counter;
- A12: Check-in counter staff's attitude;
- A13: Boarding priority;
- A14: User-friendly boarding;
- A15: Assistance in boarding;
- A16: Ground staff's service attitude;
- A17: Distance between cabin seats and restroom;
- A18: Easy to use on-board restroom;
- A19: Meals;
- A20: Information on emergency escape;
- A21: Cabin staff's service attitude.

Overall, the most important needs identified for older travellers relate to *special services for the elderly, announcements of cancelled flights and delay, special meals for the elderly, information on directions within the airport, information of transport to/from the airport* (Figure 2-3).

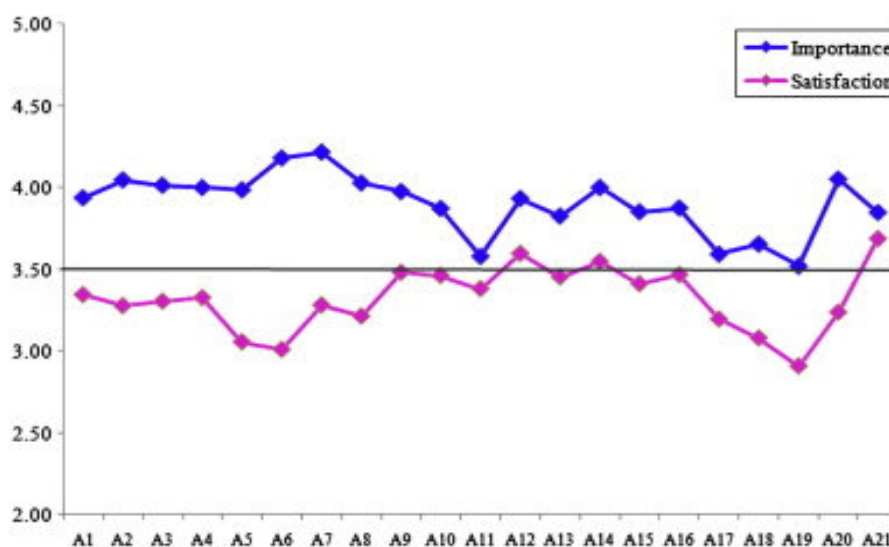


Figure 2-3 User needs for older people - air: Chang and Chen (2011b)

2.4.3 Mobility-Impaired/Older People's Needs for Ferries

DPTAC (2000) provide a detailed overview of mobility-impaired travellers needs for passenger ships. The main requirements are summarised below:

- **General information needs before boarding:** Information about the services and assistance available to them, and availability of information in different formats (e.g. large print, Braille etc.);
- **Access to the terminal:** Availability of public transport (at prices comparable to able-bodied members of the public), accessible taxi services, barrier-free movement between entrances and exits of the terminal building, accessible facilities (toilets, shops, restaurants etc.), reserved seating, disability aware staff;
- **Access to the ship:** Accessible access to allow passengers to embark and disembark in a safe way, e.g. lifts etc;
- **On-board ship:** Preferable parking on car ferries, parking assistance, barrier free corridors, accommodation, facilities (e.g. sufficient space for wheel chairs, handrails etc.), lifts between decks, evacuation assistance (if needed);
- **Staff training:** Disability awareness training for all staff so disabled passengers' needs are understood.

In relation to information needs, Whitney, Keith and Kolar (2005) note that *in order to travel successfully on large passenger ships or ferries blind and particularly sighted people require that the information they need is presented to them in a way that they can use and understand. This will include the information that they need before commencing the journey in order to plan and book the journey and the information they will use when travelling in order to enable them to travel to the ship, around the ship and to locate the relevant facilities* - see also DPTAC (2010).

2.4.4 Mobility-Impaired Pedestrian Requirements: The First/Last Mile

Several studies have examined the specific requirements for mobility-impaired pedestrian groups (e.g. RNIB, 1999; Dunbar, Holland and Maylor, 2004; Living Streets, 2004; Carreno and Stradling, 2007).

Based on the main user needs identified for pedestrians, identified in Section 2.3.5, Carreno and Stradling (2007) surveyed a range of mobility-impaired groups and asked them to rate the importance of each aspect. For all mobility-impaired groups and able-bodied pedestrians, eight aspects (in red) were identified as the most important (80%+ of respondents rating as important), related to having enough space to walk freely, the provision of safe crossings, feeling secure from traffic, low levels of crowding, feeling secure from other people, having sufficient time to cross roads safely, low levels of air pollution and clean street areas. Three additional aspects (in green) were identified as very important

for all mobility-impaired groups (and older-unimpaired): sufficient resting places, pavement surfaces in good condition and sufficient number of crossings, and for all mobility-impaired groups one additional factor (in blue) related to the provision of toilet facilities. For other aspects the relative importance attached was group specific, e.g. low kerbs for locomotive-impaired pedestrians, tactile paving for visually-impaired pedestrians.

Table 2-14 Relative importance of street aspects - mobility-impaired groups: Carreno and Stradling (2007)

Aspect of street area	AB	EU	P	VI	LI	HI	CI
Amount of space	80+	80+	80+	80+	80+	80+	80+
Safety of crossings	80+	80+	80+	80+	80+	80+	80+
Security/traffic	80+	80+	80+	80+	80+	80+	80+
Level of crowding	80+	80+	80+	80+	80+	80+	80+
Security/people	80+	80+	80+	80+	80+	80+	80+
Crossing time	80+	80+	80+	80+	80+	80+	80+
Level of air pollution	80+	80+	80+	80+	80+	80+	80+
Clean street area	80+	80+	80+	80+	80+	80+	80+
Resting places	40+	80+	80+	80+	80+	80+	80+
Pavement condition	60+	80+	80+	80+	80+	80+	80+
Number of crossings	60+	80+	80+	80+	80+	80+	80+
Number of toilets	40+	60+	80+	80+	80+	80+	80+
Obstacles	60+	60+	60+	80+	80+	80+	80+
Audibility of signals	60+	60+	40+	80+	80+	80+	80+
Readability of signs	40+	40+	20+	80+	60+	40+	60+
Number of info signs	20+	40+	20+	80+	60+	40+	60+
Tactile paving	4	20+	20+	80+	60+	40+	40+
Low kerbs	13	40+	80+	60+	80+	60+	80+

AB= Able-bodied; EU= Elderly-unimpaired; P= Parents; VI= Visually-impaired; LI= Locomotive-impaired; HI= Hearing-impaired; CI= Circulatory-impaired.

2.4.5 Trip Purpose

Travellers' trip purpose is identified as a key determinant for the relative importance attached to specific user needs, in relation to air and rail travel, and use of interchange facilities.

Air travel user needs - trip purpose

Gilbert and Wong (2003) also examined how user needs differ according to trip purpose, using a distinction between Business travellers, Holiday makers and passengers visiting friends/relatives. Based on the 26 service dimensions identified in Section 2.3.1 (Table 2-4 and Table 2-5) they concluded that the main differences between the three groups' specific needs were as follows:

- **Business travellers:** Have the lowest expectations of quality service in relation to food and beverages; individual attention by airline employees; prompt service and in-flight entertainment facilities/programmes, among the three categories identified. They have relatively higher expectations of internet/email/fax/phone and travel related partners of airlines. They have higher expectations of waiting lounges; convenient schedules and flight frequencies; loyalty and frequent flyer programmes than others.
- **Holiday-makers:** Among the three categories, they have the highest expectations of food/beverages quality; in-flight entertainment facilities/programmes; individual attention; helpful airline employees who deliver prompt service and understand their specific needs, as well as efficient in handling requests and complaints. Given holiday-makers normally fly on the cheapest fares then this finding can create a dilemma to the airline wanting to reflect lower price by having lower cost.

- **Passengers visiting friends/relatives:** They have generally the lowest expectations of the various service dimensions among the three categories, except in areas such as individual attention; food/beverages quality; prompt service and for in-flight entertainment facilities/programmes, their expectations are higher than those of business travellers.

Class of flight

Related to trip purpose, a study by Bieger, Wittmer and Laesser (2007) involving passenger travelling via Zurich airport demonstrated how user needs differed according to class of flight booked.

Both economy and business class passengers were asked to rate the importance of 10 service attributes. As can be seen in Table 2-15, for 7 of the 10 attributes the importance attached varied according to class of flight, with only sympathy, mileage programme and number of daily connections ranked equally important for both groups. For economy class travellers, safety was ranked the most important attribute, followed by direct connection and punctuality, whereas for business class travellers, the top three most important aspects were direct connections, safety and travel time.

Table 2-15 User needs according to class of travel - air: Bieger, Wittmer and Laesser (2007)

Economy class		Business class	
Service attribute	Mean Rank ordered	Service attribute	Mean Rank ordered
Safety	5.032	Direct connection	5.267
Direct connection	4.900	Safety	5.045
Punctuality	4.869	Total travel time	5.030
Travel comfort	4.857	Punctuality	5.001
Total travel costs	4.834	Travel comfort	4.962
Total travel time	4.821	Time departure and arrival	4.798
Sympathy	4.583	Sympathy	4.545
Time departure and arrival	4.513	Total travel costs	4.498
Mileage programme, status	3.557	Mileage programme, status	4.260
Number of daily connections	3.452	Number of daily connections	3.791

Rail travel user needs - trip purpose

Based on the 13 service dimensions suggested by Crockett et al., 2004 (Section 2.3.2, Table 2-8), Preston, Wall and Whiteing (2006) suggested that the relative importance of rail user needs varies according to three distinct trip purposes, namely:

- **Business travellers** place a high value upon published travel times and variations around this mean value. In addition, information provision and comfort are also key factors, with users more willing to pay for improvements. Some qualitative factors such as convenience, customer service and flexibility are also likely to play a role in decision-making.
- **Commuters** value reliability above other factors; cost, time and flexibility are also important considerations. Other issues are of less importance, many as a result of the repetitive nature of, and thus familiarity with, the journeys involved.
- **Leisure travellers:** cost and information are important needs for leisure travellers. In comparison to commute and business travellers, a wider range of factors come into play for leisure travellers, including those related to perceptions of the service - either from experience or secondary sources. Values of time are lower than for other journey purposes.

Port user needs - frequent vs. infrequent travellers

Based on the 6 service factors identified by Pantouvakis (2006) (Section 2.3.4, Table 2-10), two main user groups were identified:

- **Frequent travellers:** who are familiar with the port facilities (layout, facilities and where to find them), and whose needs primarily revolve around *service* and *safety* aspects. This type of user

typically passes through the port facility as quickly as possible, perhaps linked to their main trip purpose of commuting/business.

- **Infrequent travellers:** who are less, or not at all familiar with the ports facilities and whose needs revolve around the other four factors *cleanliness, guidance and communication, parking facilities* and *information*. This type of user typically has more time to spend within the port, and is likely to include tourists and holiday makers.

Interchange user needs - trip purpose

In relation to interchange facilities, NICHES+ (2010b) noted that the function of passenger friendly interchanges has to meet the needs of different traveller groups. They make a distinction between three main traveller groups, whose specific needs are summarised below:

- **Daily commuters:** they want to travel smoothly, reliably and fast, which can be guaranteed by providing smart guidance, and short distances/ transfer times between transport modes.
- **Tourists and first-time users:** they require safety, cleanliness, service staff, support for orientation and complementary services. To this end, understandable, accessible multi-language information, high quality infrastructure and guidance, restaurant, shopping and leisure facilities should be provided.
- **Elderly and children:** they want to travel easily and safe. Therefore 'easy to reach, easy to use' design is crucial as well as avoiding level differences, and providing sufficient lighting. Service staff should be available.

Similar to NICHES+ (2010b), Transport for London (2009) make a similar distinction between 'commuters' and 'other passengers (tourists and leisure travellers)', and suggest the following needs classification:

- **Commuters:** accessibility, maximum convenience, minimal journey times and distance (within interchanges), reliability, safety, free from passenger congestion, and availability of convenience shopping;
- **Other passengers- same needs as commuters plus:** staff presence (for assistance), simple and intuitive way finding within interchange, provision of service and local information, pleasant ambience, good waiting areas, cleanliness, ticket sales and information (available and easy, and availability of comparison shopping).

2.4.6 Frequency of Use

Finally, FTA (2003) made a distinction between familiar travellers, who frequently use public transport, and unfamiliar travellers, who occasionally or never use public transport. Familiar travellers usually know their itinerary so they do not need much information in the pre-trip stage; in contrast, unfamiliar travellers will have a high need for pre-trip planning.

3 DISCUSSION

3.1 OVERVIEW

Having reviewed and presented available evidence related to user needs for long-distance intermodal journeys (including interchange and individual mode elements), this evidence is now summarised and discussed before final conclusions are drawn in Section 4.

3.2 USER NEEDS FOR LONG-DISTANCE INTERMODAL TRAVEL

3.2.1 Summary of Evidence - Long-Distance Intermodal Journey User Needs

Despite the increasing focus of long-distance travel in national and European policy objectives, empirical research concerning travellers' needs is still heavily concentrated on short-distance journeys (Last and Manz, 2003). This is more so in relation to specific main mode elements, i.e. rail, coach/bus/ferry that make up such journeys. Although evidence related to user needs for rail and coach/bus is well documented for short-distance journeys, whether the results of short-distance travel research are transferable to long-distance travel remains unclear (Limtankool, Dijst and Schwanent, 2006). For example, long-distance trips involve more time and monetary costs for travellers, and thus these factors may take on additional importance for users, compared to when making shorter trips. Similarly, in relation to interchange facilities, SWITCH (2001) suggested that many of the factors that are identified as important for interchange users are likely to be relevant to all interchange facilities across Europe; however, they also note that due to cultural differences, differences in national regulations and variations in the provision of different transport modes within a city's transport system, the results of user needs are not guaranteed to be 100% transferable.

Despite these caveats, several key user need requirements have been identified in previous European research projects - see below.

3.2.2 Key User Needs for Long-Distance Intermodal Travel

At a general level previous EU projects have suggested user needs can be categorised into five broad categories, namely, *Networks and interchanges*, *Door-to-door information*, *Tariffs and ticketing*, *Baggage handling* and *Promotion of intermodality* (ILS, 2004, and later adopted by LINK, 2007). In the original study these categories and specific needs appear to have been selected according to current European policy objectives, rather than available evidence. This shortcoming is recognised in later projects (KITE; CLOSER) who both suggest additional user requirements. These result in eleven broad user needs categories related to: *Network characteristics*, *Interchange facilities*, *Baggage handling facilities*, *Door-to-door information provision*, *Comfort*, *Cost*, *Safety*, *Personal security*, *Journey time*, *Accessibility* and the *Promotion of intermodality*. A more detailed description of these factors is provided in Section 4: Conclusions.

Given that each long-distance intermodal journey will consist of various mode combinations, it is also important to consider any more mode-specific user needs. These aspects are discussed in the next sections.

3.3 USER NEEDS FOR INDIVIDUAL TRAVEL MODES (RELEVANT TO INTERMODAL JOURNEYS)

3.3.1 Air

Several air traveller user need classifications were identified within this review (see Section 2.3.1 earlier). Whilst none of the user need classifications identified included all of the eleven key intermodal user needs, if combined, ten of the eleven key aspects are covered. The one exception is in relation to *journey time*, although, arguably, *non-stop flights* (Gilbert and Wong, 2003; Pakdil and Ayman, 2007) can be viewed as a proxy journey time measure.

Gilbert and Wong (2003), Chen and Chang (2005) and Pakdil and Ayman (2007) all introduce a new service dimension related to airline *Employees*. Whilst the specific definition of this dimension's attributes differs between authors, this relates to the approachability of staff, assistance provided, problem-solving abilities, empathy shown, as well as general appearance of staff, at both the ground service and in-flight stages of an air journey.

Mason and Gray (1995), Gilbert and Wong (2003), Chen and Chang (2005) and Pakdil and Ayman (2007) also identify user requirements for the provision and type of in-flight services, e.g. entertainment, communications equipment, food and beverages etc. Whether this user requirement applies to other modes cannot be confirmed, although the fact that such facilities (catering, internet connections, magazines etc.) are provided by (most) rail and coach/bus operators would suggest this is in recognition of users expectations (see also section 3.3.4. Ferries).

3.3.2 Rail

Whilst no specific long-distance user need classification for rail travellers was found, several generic rail users need classifications were identified.

As with air travel, no single user need classification covered all eleven of the key long-distance intermodal aspects, although, if combined nine of the eleven aspects are covered. The two exceptions are in relation to promotion of services and baggage handling facilities. However, in relation to the latter, this may just be reflect the fact that the user need classifications reviewed in this report were not specific to long-distance journeys where this aspect is more relevant.

Similar to air travellers' needs, Crockett et al. (2004), Nathanail (2008) and Brons, Givoni and Rietveld (2009) all suggest an additional service expectation related to rail employees (i.e. *Customer service, Servicing or Personnel dimension*). As with air travel, this relates to the level of assistance provided by staff, appearance, helpfulness and approachability/friendliness of staff.

Crockett et al. (2004) suggest an additional dimension of *Effort*, which relates more to the individual expenditure required by users in terms of the physical, cognitive and affective effort required to make each journey. Effort is defined as *the amount and nature of effort, and the consequences of that effort, needed to plan and undertake the whole journey* (Crockett et al., 2004). Effort is expended by users at all stages of a journey, more specifically (Stradling, Hine and Wardman, 2000):

- Physical effort is expended in accessing transport networks, waiting and carrying and maintaining back posture;
- Cognitive effort relates to the expenditure of effort in information gathering and processing for route planning, progress monitoring and error correction; and
- Affective (or emotional) effort expenditure occurs in journeys when users are faced with uncertainty of travel conditions, which may be related to concerns over personal security, reliability or aspects such as comfort (may not get a seat).

Whilst effort is suggested only in relation to accessing and using rail services (in this report), the concept will apply to all individual modes involved in long-distance intermodal journeys.

3.3.3 Coach/Bus

As with rail, no specific user need classification for long-distance intermodal coach/bus journeys was identified. Similar to air and rail, none of the user need classifications identified covered all of eleven key user aspects, but when combined nine out of eleven. The two exceptions related to promotion of coach/bus services and baggage handling.

Again, as with rail, the omission of baggage handling facilities may reflect the focus of user need classifications reviewed in this report to short, rather than long-distance journeys.

Again, similar to air and rail, an additional user need related to employees was included by Sopher and Bullock, 2003 (*Driver attitude*), Tyrinopoulos and Antoniou, 2008 (*Personnel behaviour*) and Eboli and Mazzulla, 2011 (*Personnel*).

Furthermore, both Tyrinopoulos and Antoniou (2008) and Eboli and Mazzulla (2011) add an additional aspect related to users' perceptions of the public transport (bus and light rail) operators commitment / measures taken towards protecting the environment, i.e. *measures for environmentally friendly public transit* (Tyrinopoulos and Antoniou, 2008), *bus vehicles are environmentally friendly* (Eboli and Mazzulla, 2011).

3.3.4 Ferry

Similar to air, rail and coach/bus, none of the ferry user need classifications identified covered all of eleven key user aspects, but when combined ten of the eleven. The one exception related to promotion of ferry services.

Again, as with air, rail and coach/bus an additional user need requirement related to employees was included by Pantouvakis, 2006 (under *Services*), Pantouvakis, 2007 (under *Convenience* and *Service quality*) and Jørgensen, Mathisen, and Solvoll, 2008 (under *Service*).

Similar to air travel, an additional user need was identified in relation to facilities provided on ferries, although only in relation to catering facilities (Jørgensen, Mathisen, and Solvoll, 2008).

3.4 WHICH ASPECTS ARE MOST IMPORTANT FOR USERS?

3.4.1 The Most Important User Needs for Long-Distance Intermodal Journeys

Specific to long-distance intermodal journeys generically, earlier European projects have suggested that the most important user need aspects relate to *Network characteristics and interchanges*, *Door-to-door information*, *Tariffs and ticketing*, *Baggage handling* and *The promotion of intermodality* (ILS, 2004, LINK, 2007). However, as mentioned earlier, it is not fully clear whether these five factors were identified on the basis on empirical research, or just reflective of then current European policy statements regarding intermodal travel. Later European projects (e.g. KITE; CLOSER) do add in additional user needs, although do not attempt to prioritise or rank order these aspects in terms of importance to users.

A few authors have attempted to identify the most important aspects for users in modal choice decisions for long-distance journeys (Last and Manz, 2003; KITE, 2009c). KITE (2009c) concluded that mode choices for long-distance travel are based on time and cost. However, in this study only four factors were considered (travel time, access time, costs and number of transfers) and as shown in this report, these are not the only user needs identified as important to travellers.

Several authors suggest that the first/last miles stages of an intermodal journey are the weakest part of any intermodal journey (Krygsman, Dijst and Arentze, 2004; Brons, Givoni and Rietveld, 2009), and in this respect it could be concluded that this aspect is the most important user requirement. This assumption would need confirming in further research.

More promising to the identification of which aspects are most important to users are the results from more academic/empirical research projects, which have looked at individual components of long-distance intermodal journeys - these are summarised below.

3.4.2 The Most Important Needs for Interchange Users

Only two studies were identified that have specifically attempted to rank order the most important user needs for interchange facilities (PIRATE, 2001 and KITE, 2009a). PIRATE, in a survey involving transport user and non-users, found that aspects related to *total impression*, were rated most important, more specifically *safety and security* which was the most important aspect for both groups. For users this was followed by *traffic and travel information provision*, *car parking availability*, *interchange location*, *operational efficiency and information (in general)* and *drop off and pick up facilities*. For non-users, *safety and security* was followed by the *walking environment leading to the interchange*, *car parking availability*, *traffic and travel information* and *interchange location* - see Table 2-1.

In contrast, in a survey by KITE (2009a) involving three different types of interchange operators (rail, air and ferry) concluded that overall (all modes) cycle lanes to / from / passing interchange facilities was the most important aspect, followed by availability of information at destination, availability of cycle parking, intermodal luggage handling and availability of baggage storage.

When considering individual modes, the identification and rank ordering of most important aspects varied, namely

- **Rail:** Firstly, availability of information at destination, followed by availability of cycle parking, availability of cycle lanes, integration into road network and convenient waiting conditions;
- **Air:** Firstly, availability of cycle lanes, followed by availability of cycle parking, availability of information at destination, availability of baggage storage and barrier/free accessibility
- **Ferry:** Firstly, availability of cycle lanes/intermodal luggage handling/availability of baggage storage/barrier-free accessibility, followed by availability of cycle parking/availability of information at destination/information about arrival, departure and connection times, convenient waiting conditions/supply of shops/availability of taxis/feeling of safety/availability of public transport for access and egress and easy way-finding in interchange, distance required for transfer between modes/distance between modes and services/car parking availability, and transfer times between modes.

However, that cycle lanes and cycle parking have reached the top of the list for air operators has to be seen as surprising, to say the least, and certainly does not reflect the most important user needs, since, given the luggage that most air travellers carry, very few of them would really wish to arrive by bike at an airport. This casts some doubt on the overall results of the KITE survey.

Apart from that, there are other reasons that could explain the differences of outcome between the two studies:

- The ranking of importance suggested by PIRATE were derived from actual and potential travellers, whereas, for LINK, rankings were identified from operators;
- The specific aspects travellers or operators were presented with and asked to rank were not consistent between the two studies, and included any additional aspects suggested as (also) important by other authors (e.g. Wardman, Hine and Stradling, 2001);
- Respondents in the PIRATE survey were rating public transport interchanges generally, whereas, in the LINK survey, the interchanges were mode-specific.

Accordingly, no clear or consistent findings are available for which user aspects are most important for interchange facilities.

3.4.3 The Most Important Needs for Air Travellers

In relation to air travel, two of the user need classifications reviewed in this report examine the relative importance of user requirements for air travel, although the conclusions reached varied between the two.

Gilbert and Wong (2003) concluded that, overall, aspects related to an *Assurance* service dimension were the most important, followed by *Reliability*, *Responsiveness*, *Flight patterns*, *Employees*, *Facilities* and *Customization* - see Table 2-4. In terms of specific attributes of these broader service dimensions, safety was ranked the most important, followed by on-time arrivals and departures, the behaviour of employees gives confidence to customers, efficient check-in/baggage handling, and employees willingness to help customers - see Table 2-5.

In contrast, Pakdil and Aydin (2007) concluded that, overall, aspects related to a *Responsiveness* service dimension were the most important, followed by, *Empathy*, *Tangibles*, *Reliability and assurance*, *Employees*, *Flight patterns*, *Image*, and *Availability* - see Table 2-6. In contrast to Gilbert and Wong, Pakdil and Aydin did not attempt to identify the relative importance of the individual service attributes associated for each service dimension.

The inconsistencies in rank ordering of importance attached to the broad service dimensions between studies may be due to several factors:

- The sample respondents in each study differ, i.e. Gilbert and Wong surveyed travellers departing from Hong Kong airport, whereas Pakdil and Aydin surveyed travellers departing from Ataturk airport in Turkey. The differences obtained between studies could thus be reflective of cultural differences in user needs and expectations.
- The number of individual service attributes included differs between studies. Gilbert and Wong suggest 26 service attributes, whereas Pakdil and Aydin suggest 34.
- Although some service dimensions are broadly similar in the attributes they contain, they are named differently, e.g. Gilbert and Wong refer to a *Customisation* dimension, whereas Pakdil and Aydin refer to a *Availability* dimension, Gilbert and Wong to a *Facilities* dimension and Pakdil and Aydin a *Tangibles* dimension.
- Pakdil and Aydin combine reliability and assurance, whereas Gilbert and Wong treat the 2 dimensions separately.
- Pakdil and Aydin suggest eight service dimensions compared to Gilbert and Wong's seven, which may have affected the rank orderings obtained.
- On the selection of service attributes, Both Gilbert and Wong and Pakdil and Aydin (appear) to have focussed more on user needs at airport facilities, whereas Chen and Chang (2005) distinguish between ground service and in-flight user needs, and include further service attributes, not included by Gilbert and Wong and Pakdil and Aydin.
- Finally, the two studies reviewed do not include accessibility factors (i.e. first/last mile to reach/leave the airport). If this aspect were to be included and if the whole long-distance intermodal journey (involving air) were to be evaluated, the importance rankings obtained here might change.

Accordingly, whilst the user needs classification reviewed in this report seem to confirm those suggested for long-distance intermodal journeys generically, with added inclusions of employees and in-flight service dimensions (see earlier), the most important aspects for long-distance intermodal journeys need to be confirmed with further studies.

3.4.4 The Most Important Needs for Rail Travellers

Whilst several user need classifications for rail travel were identified within this report, none attempted to identify which aspects were most important for users. As such no real conclusions can be made, and also taking into account the user needs classifications identified related to rail travel generally (not specifically long-distance intermodal journeys) further research is required to address these knowledge gaps.

3.4.5 The Most Important Needs for Coach/Bus Travellers

As with rail, although several user need classifications were identified for coach/bus services in this report, only one study attempted to rank which aspects were the most important, namely del'Olivo, Ibeas and Cecin (2010). Based on focus group research, they suggested waiting times (at stops), journey time, vehicle occupancy, cleanliness of vehicles, driver attitudes and comfort (on bus) are the most important user requirements. However, as with rail, this research focussed on coach/bus journeys generally, and for long-distance intermodal journeys additional considerations such as baggage handling, door-to-door information (etc.) are likely to affect these conclusions.

As such no real conclusions can be made and further research is required.

3.4.6 The Most Important Needs for Ferry Travellers

Only one study was identified in this report which examined the most important factors for ferry users Jørgensen, Mathisen and Solvoll, 2008). Overall, cost was identified as the most important aspect, followed by available discounts, the likelihood of boarding (in summer and winter), and frequencies of service and departure times. However, the study involved short-distance ferries (less than 100km)

and whether a different ordering would be identified for long-distance ferry routes cannot be confirmed, especially as aspects including baggage handling that would be more relevant for longer distances were not included in the aspects users rated.

3.4.7 The Most Important Needs for First/Last Mile Stages

No studies were identified that attempted to rate the relevant importance of aspects related to the last/first mile of long-distance intermodal journeys. However, the relative importance of this journey stage will be dependent on the individual modes used to access/egress transport terminals. Accordingly, the relative importance of user needs related to rail/coach/bus and walking (see section 2.4.4) identified will apply here.

3.4.8 The Impact of Personal Factors on Importance

A further issue that must be considered when identifying the importance attached by users to various aspects is 'personal' factors. These include individuals' level of mobility, whether through mobility-impairments or due to factors such as travelling with luggage or small children, as well as other personal factors such as cognitive/learning difficulties and sensory impairments (see Section 2.4).

Whilst no unique user needs were highlighted from those already identified for individual modes and first/last mile journey stages, some of these user need attributes will have more importance according to these factors. For example, in relation to accessibility issues, this would include aspects such as low floor access to feeder and main mode vehicles, staff disability awareness training, information provided in special formats (Braille, talking maps etc.) and barrier-free access at interchange facilities.

There are other personal factors, such as gender, income and cultural based user requirements that were not identified / reviewed in this report that may also affect the relative importance of user needs, which would require investigation via further research.

3.4.9 The Impact of Situational Factors on Importance

In addition to the influence of personal factors, the importance attached to different user need requirements is also shown to vary according to situational factors. The main factor identified in this report related to individuals trip purpose. As with personal factors, no unique user needs were identified according to these factors, although evidence reviewed suggests that different service dimension attributes are more important to individuals' trip purpose, i.e. primarily whether they were travelling on business or for leisure purposes (see Section 2.4.5).

4 CONCLUSIONS

In summary, this report had identified eleven broad, although interrelated user need aspects that apply to all long-distance intermodal journeys, as well as four additional that have been identified in relation to individual mode[s] components of long-distance intermodal journeys. Whether these additional four aspects apply to all long-distance intermodal journeys needs to be established.

Eleven main user need categories

- **Network characteristics:** Users require transport services that depart and arrive at interchange points that are of sufficient frequency to meet their needs for each journey; transport services are available that cover an area that allows them to travel to the places they want to go; transport modes are available to allow them to travel to their desired destinations that match their personal mode preferences; available transport services depart/arrive matched to times required by them (convenient); and available transport services run on time.
- **Interchange facilities:** Users require that interchange facilities are designed, managed and equipped to a sufficient standard to allow them to make required connections between different modal stages of their journey as safely (see personal security later), quickly (see Journey time) and comfortably (see comfort) as possible. Interchanges also need to be fully accessible for users (i.e. barrier free), which includes use of facilities sited within interchanges including toilets, ticketing machine, shops, cafes etc.
- **Baggage handling facilities:** Users require that baggage handling facilities to be provided that are safe, simple to use, and reliable. For some travellers assistance will also be required.
- **Door-to-door information:** Users require that sufficiently detailed high quality information is provided for pre-trip, wayside and on-board journey stages to allow users to efficiently plan their whole journey. For some travellers this information needs to be provided in formats that allow all users to fully use and understand the information provided (e.g. in Braille, talking maps etc.).
- **Cost:** Users require that costs involved in planning and undertaking the journey are affordable, according to individuals' financial means. This includes costs involved to access (first mile) and egress (last mile to desired destinations) transport terminals, as well as the costs involved in each main mode component of the journey.
- **Comfort:** Transport services (vehicles) and facilities (interchange terminals) should be designed and maintained to ensure users are comfortable throughout the whole journey. This includes aspects such as ensuring facilities and vehicles are clean, protection from weather conditions is provided, seating and waiting areas are provided, and food and drink facilities are provided.
- **Safety:** Users need to feel safe when making long-distance intermodal journeys (i.e. from the risk of accidents).
- **Personal security:** Users need to feel secure when accessing, and using different mode components of the intermodal journey (i.e. from theft, attack, intimidation etc.).
- **Journey time:** Users require the total journey time involved in long-distance intermodal journeys to be as short as possible (i.e. minimal access, waiting, transfer and in-main mode vehicle/vessel time).
- **Accessibility:** Users require transport terminals to be fully accessible by all feeder transport modes, specifically to access modes they wish, but may be restricted (e.g. because of mobility difficulties) to use, as well as the vehicles that they are required to use for the main mode components of the full journey.
- **Promotion of intermodality:** Users need to be aware of intermodal services that are available to them and they need to be marketed in a way that is attractive to them.

Additional four aspects

- **Employees:** Users require (expect) employees (at interchanges and on-board vehicles/vessels) to be able to assist them (if required), provide the correct information to them, are smartly dressed and courteous, etc.

- **Effort:** Users require that the total effort (physical, cognitive and affective) they need to expend to undertake a journey is reasonable (i.e. is acceptable for them, not uncomfortable for them etc.).
- **In-vehicle facilities:** Users require (expect) various services to be provided, or be available for them (primarily for main mode elements of the journey), including aspects such as catering facilities, communication facilities (wireless access, plug sockets) and entertainment facilities (newspapers, TV/films, games etc.).
- **Environmental concerns:** Users have expectations that transport companies and operators are taking actions to minimise the environmental impact (i.e. using low emission vehicles, fuel etc.).

Many of these broad factors overlap and are interrelated with each other. For example, journey time includes the time required for users to access terminals (and thus related to accessibility), and is also linked to network characteristics and interchange facilities, in that aspects such as speed of transfer and frequency of connecting services will affect the overall journey time. Similarly, comfort is (may) be related to the in-vehicle facilities provided, and effort will be related to the type and amount of transport services available (i.e. accessibility).

The report also identified the role of personal (e.g. level of mobility, cognitive ability, age-related etc.) and situational factors (i.e. trip purpose) in determining the relative importance of user needs. Whilst no specific personal or situational user needs were identified (from those 15 identified above), the relative importance attached to individual user needs was shown to vary for some traveller groups and / or be dependent on their trip purposes. For example, mobility-impaired travellers, depending on their level of mobility-impairment, attached greater importance to user aspects such as accessibility (are transport terminal facilities and main mode vehicles/vessels fully accessible to them), information provision (details of barrier-free routes required for them to make the journey, and this information is provided in formats they can understand, and use) and whether staff are trained (disability awareness) to fully understand their specific needs.

Similarly, for those on business related trips, aspects such as overall journey time, in-vehicle facilities (e.g. WIFI availability), comfort and reliability issues (likelihood of delays) are more important compared to travellers making the same journeys for leisure purposes, where aspects such as cost and information provision (due to their unfamiliarity of making these journeys).

However, which of these 15 user need aspects are of greatest importance (relative to each other) to users, or how these aspects influence individuals' decisions to undertake long-distance journeys (or not), or which modes to use when making such journeys is not fully clear and needs to be established in future research.

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