**Wayfinding Project**

Final Report of Initial Project Work

Final Version 1

**RNIB Innovation Unit**

July 2010

**Prepared for:**

RNIB Wayfinding Project Board and Stream Lead

By:

John Worsfold and Edward Chandler

Innovation Unit

Royal National Institute of Blind People

# Table of Contents

[1 Introduction 5](#_Toc268697994)

[1.1 Scope 5](#_Toc268697995)

[2 Phase one: Review the current available solutions 5](#_Toc268697996)

[2.1 Technology review 5](#_Toc268697997)

[2.2 Literature review 6](#_Toc268697998)

[2.2.1 RNIB React User Evaluation March 2010 6](#_Toc268697999)

[2.2.2 Summary of the first round of Member Forum Discussions on Inclusive Travel, Shopping and Control of Money (Programme E) March 2009 7](#_Toc268698000)

[2.2.3 Audio and Visual Information on Buses: Moving Towards Inclusion 2006 7](#_Toc268698001)

[2.2.4 Travellers’ tales – making journeys safer April 2002 8](#_Toc268698002)

[2.2.5 Summary of the Network 1000 Survey November 2008 9](#_Toc268698003)

[2.2.6 Travel, Transport and Mobility of people who are blind and partially sighted in the UK April 2009 9](#_Toc268698004)

[2.2.7 Functionality and the Needs of Blind and Partially-Sighted Adults in the UK 2007 10](#_Toc268698005)

[3 Phase 2: Understanding the problem 10](#_Toc268698006)

[3.1 What makes up a journey? 11](#_Toc268698007)

[3.1.1 Activities 12](#_Toc268698008)

[3.1.2 Actions 13](#_Toc268698009)

[3.2 Barriers and Solutions 13](#_Toc268698010)

[3.3 Wayfinding in different environments 14](#_Toc268698011)

[3.3.1 Internal Environment (controlled space) 15](#_Toc268698012)

[3.3.2 External Environment (uncontrolled space) 15](#_Toc268698013)

[3.3.3 In a vehicle (buses, trains, [car] and flight) 15](#_Toc268698014)

[3.4 The four principles of wayfinding 15](#_Toc268698015)

[3.4.1 Getting information and using it 15](#_Toc268698016)

[3.4.2 Orientating within the environment 16](#_Toc268698017)

[3.4.3 Navigating within the environment 16](#_Toc268698018)

[3.4.4 Entrance and Exit Identification 17](#_Toc268698019)

[3.5 Planning 17](#_Toc268698020)

[3.6 Consolidating environments, principles and technology groups 18](#_Toc268698021)

[3.7 Key findings of phases 1 and 2 20](#_Toc268698022)

[3.7.1 General 20](#_Toc268698023)

[3.7.2 Journey related 21](#_Toc268698024)

[3.7.3 Technology related 22](#_Toc268698025)

[3.7.4 Principle related 22](#_Toc268698026)

[4 Phase 3: Identifying the next steps 22](#_Toc268698027)

[4.1 Identification of focus areas 23](#_Toc268698028)

[4.1.1 Mapping Information 23](#_Toc268698029)

[4.1.2 Augmented Reality (AR) 25](#_Toc268698030)

[4.1.3 Personal Positioning System (PPS) (including GPS + IPS) 26](#_Toc268698031)

[4.1.4 Triggered Information 28](#_Toc268698032)

[4.1.5 Triggered Assistance 29](#_Toc268698033)

[4.1.6 Optical Character Recognition (OCR) 30](#_Toc268698034)

[4.1.7 Location and suitability of information 31](#_Toc268698035)

[4.1.8 Compass 32](#_Toc268698036)

[4.1.9 Additional considerations 32](#_Toc268698037)

[5 Recommendations 34](#_Toc268698038)

[5.1 Phase one 35](#_Toc268698039)

[5.1.1 Conduct a series of pilots 35](#_Toc268698040)

[5.1.2 Research Augmented Reality (AR) solutions 35](#_Toc268698041)

[5.1.3 Research Internal Positioning Systems (IPS) (buildings/in-vehicle). 36](#_Toc268698042)

[5.1.4 Improve existing wayfinding solutions 36](#_Toc268698043)

[5.1.5 Generate a Personal Positioning System (PPS) functional specification 37](#_Toc268698044)

[5.1.6 Improve access to Real Time Information (RTI) Systems. 37](#_Toc268698045)

[5.1.7 Provision of a “help me” service 38](#_Toc268698046)

[5.1.8 Utilise a homing beacon 39](#_Toc268698047)

[5.2 Phase two 39](#_Toc268698048)

[5.2.1 Improve the accessibility of maps 39](#_Toc268698049)

[5.2.2 Standardise the location of information 40](#_Toc268698050)

[5.2.3 Influence mainstream with a single online portal 40](#_Toc268698051)

[5.2.4 Maximise Points of Interest (POI) information 41](#_Toc268698052)

[5.2.5 Influence Augmented Reality (AR) development 41](#_Toc268698053)

[5.2.6 Enhance audio announcements 41](#_Toc268698054)

[5.2.7 Increase access to transport information 42](#_Toc268698055)

[5.2.8 Further enhance RNIB REACT 42](#_Toc268698056)

[5.2.9 Utilise Community Base 43](#_Toc268698057)

[5.2.10 Maximise user preferences 43](#_Toc268698058)

[5.2.11 Expand the use of Optical Character Recognition (OCR) on mobile devices 44](#_Toc268698059)

[5.3 Phase three 44](#_Toc268698060)

[5.3.1 Improve choice of map sources 44](#_Toc268698061)

[5.3.2 Encourage the creation of internal maps 45](#_Toc268698062)

[5.3.3 Enhance the location of goods and services 45](#_Toc268698063)

[5.3.4 Enable control of the environment 46](#_Toc268698064)

[6 Appendix One – Phase One Evaluations 47](#_Toc268698065)

[7 Appendix Two – Technology Group Requirements 50](#_Toc268698066)

[7.1 Planning 50](#_Toc268698067)

[7.1.1 Getting information and using it 50](#_Toc268698068)

[7.1.2 Orientating within the environment 51](#_Toc268698069)

[7.1.3 Navigating within the environment (Dry runs) 51](#_Toc268698070)

[7.1.4 Entrance and exit identification 52](#_Toc268698071)

[7.2 Internal Environment 53](#_Toc268698072)

[7.2.1 Getting information and using it 53](#_Toc268698073)

[7.2.2 Orientating within the environment 55](#_Toc268698074)

[7.2.3 Navigating within the environment 56](#_Toc268698075)

[7.2.4 Entrance and Exit Identification 58](#_Toc268698076)

[7.3 External Environment 59](#_Toc268698077)

[7.3.1 Getting information and using it 59](#_Toc268698078)

[7.3.2 Orientating within the environment 61](#_Toc268698079)

[7.3.3 Navigating within the environment 63](#_Toc268698080)

[7.3.4 Entrance and Exit Identification 64](#_Toc268698081)

[7.4 In a vehicle (buses, trains, [car] and flight) 65](#_Toc268698082)

[7.4.1 Getting information and using it 65](#_Toc268698083)

[7.4.2 Orientating within the environment 67](#_Toc268698084)

[7.4.3 Navigating within the environment 68](#_Toc268698085)

[7.4.4 Exit Identification 70](#_Toc268698086)

[8 Appendix Three - Glossary of Wayfinding terms 72](#_Toc268698087)

# Introduction

This report highlights the results of the initial phase of the wayfinding project. The wayfinding project forms part of RNIB’s five year strategy aimed at ending the isolation which blind and partially sighted people face. In particular, this project addresses   
Goal 8 – That more blind and partially sighted people are able to make journeys independently.

This initial phase of work provides recommendations which will guide further project work.

This report has been summarised within a separate report entitled ‘E45 Wayfinding Executive Summary Report V 4.0’.

A glossary of Wayfinding terms is provided at the end of this document.

## Scope

Within this project there have been three distinct phases of work. These have been carried out to identify innovative solutions to existing barriers which hinder blind and partially sighted people when making journeys. These three phases are:

1. Review the current available solutions

2. Understanding the problem

3. Identifying the next steps

The aim of this report is to present the biggest problem areas associated with making journeys and provide strategic recommendations for RNIB to try to address them.

# Phase one: Review the current available solutions

## Technology review

The project team for this phase included RNIB Innovation and the Digital Accessibility teams, plus resource from Guide Dogs for the Blind. The team performed desk based research on more than 60 wayfinding solutions which had been identified from within the group. This provided a list of known wayfinding solutions rather than identifying the solutions which might be needed to allow for successful wayfinding.

By separating out the technologies into categories and identifying their use it is now easy to comprehend the spread of technologies that are used. A breakdown of the evaluations can be found in  
6 Appendix One – Phase One Evaluations

## Literature review

The technology review research was focused on technology-based solutions and innovation, rather than policy and campaigning recommendations. So, the project team obtained and reviewed previous user research conducted by RNIB and organisations allied to RNIB, to ensure that they also took into account direct feedback from individuals, and their perception of the issues faced were correct. The following is a summary of the main research reviewed.

### RNIB React User Evaluation March 2010

Heather Cryer, Centre for Accessible Information (RNIB)

This user evaluation involved blind and partially sighted users of the Birmingham RNIB React orientation system, and the Brighton Real Time Information (RTI) system. A total of 12 people took part in the evaluation. Usage of both systems varied between frequent and infrequent use (Brighton system), and those that felt they no longer needed it, to those that were not confident in using it (Birmingham). The findings of the research show both good and bad points about the RNIB React system. The research highlighted that there had been some difficulty in recruiting participants for this research evaluation due to the lack of awareness of the system. The following is a summary of the main points:

* The research recommended a need for better communication between councils and residents, to help raise awareness of the system, and better promote how to obtain a trigger fob.
* Participants expressed some concerns about the reliability and consistency of the system (in terms of maintenance), and that these concerns should be taken seriously (by the system owners).
* Whilst the existing RNIB React installations are useful they do not meet every user need
* RNIB React is not the only solution but is a part of the overall wayfinding solution

### Summary of the first round of Member Forum Discussions on Inclusive Travel, Shopping and Control of Money (Programme E) March 2009

Julie Polzerova, Membership and Talk and Support (RNIB)

Moira Fraser, (Travel content analysis) Campaigns (RNIB)

This research involved focus groups made up of RNIB members and guests. These were held across the UK over the autumn and winter of 2008. Each focus group consisted of roughly ten people and focused on programme E of RNIB’s strategy which included issues related to wayfinding. The following is a summary of the main points:

* From this research it was clear that usage of buses was a big problem. Of the issues highlighted only two arose which were not related to bus company policy and bus driver/company attitude or training. Lack of audible announcements on buses and at bus stops, and the difficulty in accessing bus information, especially when using unfamiliar routes were mentioned in particular
* Comments regarding trains focussed on the use of assistance at stations rather than issues related to independent travel. The participants reported similar assistance issues in connection with taking flights but also highlighted that the lack of audio announcements at airports was a problem.
* In connection with walking, the participants highlighted problems with pedestrian crossings in terms of provision of tactile paving, and the use of audible signals or rotating cones. As there doesn’t seem to be a standard, it can be difficult to know what to do. Finally the participants highlighted obstacles in the environment as causing problems.

### Audio and Visual Information on Buses: Moving Towards Inclusion 2006

Dr Femi Nzegwu (GDBA)

This piece of research was conducted between May and September 2005 involving 60 participants using focus groups and one to one interviews. The objective of the research was to explore and establish people’s experiences of bus travel and to identify priorities for bus travel. The following is a summary of the main points:

* The report findings highlighted that the participants felt very strongly about having the ability to identify the right bus. This included getting the correct information prior to leaving the house but also when they were at the bus stop. Identifying the approaching bus was important, especially when there were several buses in a row to know which one was the correct one.
* On leaving the bus, the participants highlighted that they needed to know exactly where they were getting off and have confirmation that the stop was the one they had intended to stop at. The group felt very strongly that audio-visual announcements were important to improving the experience.
* Finally the participants felt that standardised bus design would greatly improve their ability to navigate through them.

### Travellers’ tales – making journeys safer April 2002

Nana Yerassimou

The main conclusion of this research was that a journey was compared to a chain in that a chain has a number of links in order to make a complete chain. If a link is not “safe” it can deter people from making a journey. The recommendations were far reaching including the design of crossings and the design and maintenance of street environments. The following is a summary of the main points:

* The findings showed that buses are a common form of transport.
* Having access to information prior to travel, at the bus stop and onboard are all seen as important and make people feel secure and confident. Therefore audio-visual systems to provide information are important.
* In terms of train travel, again, access to information before and during the journey was important so that informed decisions could be made. As per bus transportation the report recommended audio visual systems at stations to provide information. As well as this, onboard information should be given to inform users of the size of the gap between the train and the platform, and which side to exit the carriage from.

### Summary of the Network 1000 Survey November 2008

Lisa Hughes, RNIB Research Department

The Network 1000 report was a far reaching survey covering the views of 1000 blind and partially sighted people over many different aspects including employment, money and travel. A lot of information was captured on the travel habits of blind and partially sighted people which highlighted the following things:

* The results focussed on travel frequency and frequency of making journeys by themselves and the links between age and going out.
* In terms of barriers to travelling, a lack of confidence and obstacles in the street where given.
* The summary report highlighted that there was a substantial difficulty using all forms of transport. Taxis were listed as the easiest with the underground being the hardest.
* It is uncertain whether the questions were focussed on local travel rather than national and international travel.
* Locality and use of crossing points were mentioned as a particular problem.

### Travel, Transport and Mobility of people who are blind and partially sighted in the UK April 2009

Sue Pavey, Andrew Dodgson, Graeme Douglas and Ben Clements

Visual Impairment Centre for Teaching and Research, University of Birmingham

The aim of this research was to gather opinions of travel, transport and mobility from blind and partially sighted people. The results were collated from the Network 1000 research. The report results were broken down into mobility on foot and public transport:

* Feedback from the “mobility on foot” section highlighted that obstacles on the pavement were problematic and crossing busy roads was difficult.
* The results form the “public transport” section highlighted that getting the required information to use public transport was difficult. This included knowing bus numbers, train and flight destinations and the lack of audio announcements on journeys.

### Functionality and the Needs of Blind and Partially-Sighted Adults in the UK 2007

Tom Pey, Femi Nzegwu, Gary Dooley

The aim of this research was to gather information on the impact of sight loss on all aspects of a person's life. As this was a far reaching piece of research the majority of the findings are out of scope for this report and this summary is restricted to just the elements of the research related to making journeys.

* The results highlighted that when walking, street furniture, crossing roads and unexpected obstacles all caused problems
* When reviewing the results associated with transport, it was clear that taxis were the most frequently used vehicle with buses the most second frequent. That being said significant problems were identified in the use of public transport including, buses, trains, planes, ferries, underground trains and airplanes.

# Phase 2: Understanding the problem

Whilst phase one identified some potential wayfinding solutions, the complexity of wayfinding was not completely appreciated. Therefore these solutions could not be usefully applied. So, in order to fully understand wayfinding ‘per se’, the project team needed to define what a journey and wayfinding is.

Making journeys/wayfinding is such a complex and interwoven task that no single solution will solve the underlying problem. Therefore to understand the problem properly it was necessary to break wayfinding down. In order to do this the team had to find common themes and similarities within journeys.

## What makes up a journey?

The project team identified different journeys that ranged from simple (e.g. going to a local shop from home) to complex (e.g. taking a flight to another country to go on holiday). These journeys were defined as separate stages and any combination of these stages can make up a complete journey. Therefore making a journey cannot be regarded as a single act. These were defined as:

1. Information gathering/pre-journey planning

2. Walking

3. Getting Car/taxi

4. Catching a bus from a bus stop

5. Catching a bus from a bus station

6. Catching a train from a staffed train station

7. Catching a train from an unstaffed train station

8. Catching a plane from an airport

9. In an Internal structure (Navigating within a building)

Whilst there are other forms of transport such as tram, tube and ferry, these are quite similar to other journey stages (e.g. train and flight). Therefore it was felt that there was no requirement for these to be defined separately.

Walking is the journey stage which binds the other journeys together and is therefore very important. It is also the journey where there is the least amount of information or assistance to help the individual.

Stations and airports have been separated from “internal structures” for several reasons. Firstly stations and airports might be external or have an external part to them (e.g. a train ticket office is in a building whereas the platforms are outside). As a result it would complicate matters as more journey stages would have to be created to encompass the different possible station/airport configurations. Secondly, although a person will enter the station or airport they will not exit from it on the same journey (unless they break and change their journey). They will leave via a train/bus or plane. For this reason stations and airports were classified as a “closed/controlled environment”.

An internal structure therefore is any other building which does not facilitate travel (e.g. places of work, shops and shopping centres, museums and hospitals)

Catching a bus from a bus stop and a bus station has been separated for several reasons. Firstly a bus station is larger and will have a number of bus stops within it. Therefore the chances of going to the wrong stop are increased. Secondly, bus stations are likely to be staffed and therefore the likelihood of getting assistance is greater than at a bus stop. Thirdly a bus station is likely to be a closed/controlled environment whereas a bus stop isn’t.

Catching a train from a staffed and unstaffed train station have been defined and separated for several reasons. Firstly a staffed train station is likely to be bigger (although not always) which makes navigation around it more difficult. Secondly a staffed train station is likely to have more trains using this station and therefore the chances of catching the wrong train are increased. Finally a staffed train station means that people will be available to provide assistance.

### Activities

These nine journey stages were further refined to include ‘activities’ that make up the journey together with the subsequent ‘actions’. An ‘activity’ is a major milestone of a journey which encompasses a number of actions. An ‘action’ is a discrete decision making process/task which may be required within the activity.

An example of a journey stage (catching a bus from a bus from a bus stop) is as follows:

Activities within the journey stage

1. [Follow on from previous journey stage]
2. Arrival at the stop
3. Catch the bus
4. On the bus
5. Intermediary check on progress
6. Approaching/arriving at destination
7. Off the bus and onward journey
8. [Proceed with next journey stage]

### Actions

The following actions for the activities ‘arrival at the stop’ and ‘catch the bus’ are detailed below.

Actions within the activity “Arrival at the stop”

1. Orientating yourself around the stop
2. Determining the availability of information/assistance and using it
3. Confirming the stop is the one you need

Actions within the activity “Catch the bus”

1. Determining the availability of information/assistance and using it (e.g. is this stop a mandatory or a request stop?)
2. Determining the time of the bus you need to catch
3. Determining if the next bus is the one that is needed
4. Flagging down the correct bus (if at a request stop)
5. Navigating to the entrance to get on the bus

## Barriers and Solutions

Now that the journeys had been documented in detail, the ‘barriers’ which a person may face, together with the appropriate ‘solutions’ needed to overcome these, were identified.

As an example the barriers for the action ‘Determining the time of the bus you need to catch’ are detailed below:

Action - Determining the time of the bus you need to catch

* No one to ask.
* Someone is available but they don’t know or are unable/willing to guide you
* Trusting information received (is this correct)
* Not having the technology to facilitate. (No RTI)
* Not getting the information needed (stop number, next bus, number of buses coming, route stops)
* Determining if the next bus is the one that is needed

Solutions were added using a red, amber and green methodology.

This was adopted to highlight coping strategies and technical solutions which are currently being adopted as well as solutions which could be implemented or utilised further.

* Green: Widespread availability and commonly used
* Amber: Could be used, but is not widely adopted
* Red: Possibilities not utilised or not available.

The solutions for the action ‘Determining the time of the bus you need to catch’ are detailed below:

Action - Determining the time of the bus you need to catch

Green: Talking to people/using a help line, via TXT message, or via the web using mobile device

Amber: RTI (RNIB React, triggerboard), using an application providing RTI on a smartphone such as Brighton bus real time, having unique bus stop id, utilising map Points of Interest (POI)

Red: Optical Character Recognition (OCR) information such as timetable, triggered information

Combining the solutions identified in section 2.1 Technology review, with the technologies under the red, amber and green system above, common technology groups were highlighted. These are:

* Mapping information
* Augmented Reality (AR)
* Personal Positioning Systems (PPS), combining GPS and IPS
* Triggered information
* Triggered assistance
* Optical Character Recognition
* Location and suitability of information
* Compass

Unfortunately these processes are too large to enable them to be copied into this report; however they are supplied in electronic format along with this report.

## Wayfinding in different environments

The 9 journey stages were drawn together and consolidated into the types of environments they can be performed in. Three different environments were identified and these are as follows:

1. Internal environments
2. External environments
3. In Vehicle

### Internal Environment (controlled space)

This is any journey which is conducted within either an “internal structure” (e.g. a shopping centre) or a “closed/controlled environment” (e.g. train station). It is classified as a controlled space because it has specific entrance and exit points. As mentioned in 3.1 What makes up a journey?, a closed/controlled environment could be in or have an external area but is still within the internal environment.

### External Environment (uncontrolled space)

This is a journey which is conducted outdoors. This would include the journey stages of “walking”, and “catching a bus from a bus stop.” The external environment is classified as an uncontrolled space and therefore does not include a closed/controlled environment even if it has an external area.

### In a vehicle (buses, trains, [car] and flight)

This environment is classified as any situation where you are in a vehicle (e.g. a train, bus, taxi and plane) to get from one place to another.

## The four principles of wayfinding

When reviewing the detailed journey stages across the three environments, it was identified that there were four basic principles that are used to make journeys. These principles bind wayfinding together and are relied upon when making journeys. They are

1. Getting information and using it
2. Orientating within the environment
3. Navigating within the environment
4. Entrance and Exit Identification

### Getting information and using it

This principle concentrates on identifying information sources, being able to access that information in a medium which a person can understand. The relevance and usefulness of the information is important to allow a person to continue their journey. Without information the journey is made considerably more difficult. Typical questions asked might be:

* Where is the information?
* How do I get what I need?

The relevant technologies which aid getting information and using it are:

* Location and sustainability of information
* Triggered/Beaconed/automated Information (including RNIB React REACT/RTI)
* Triggered Assistance
* Internal and External Mapping information
* Internal Positioning System (IPS)
* Global Positioning System (GPS)
* AR
* OCR

### Orientating within the environment

Orientation is reliant on gathering information to understand a person’s current position relative to their surroundings. This involves understanding what is around you and the direction you need to go. Typical questions asked might be

* Where am I?
* Where is [person or object]?

The answer can be user generated (e.g. using touch) or pulled from the environment using various technology aids such as a compass, or map data. The relevant technologies which aid orientation are:

* Mapping information
* AR
* Compass (linked to mapping information and including accelerometer)
* OCR
* Triggered Information/Beacon (including RNIB REACT)

### Navigating within the environment

This principle involves moving through the environment to the intended destination. This is facilitated by the previous two principles (gathering information and orientation). This may or may not be a planned route. Typical questions asked might be:

* Am I on the correct route?
* Have I passed the place I needed to be at?

Similarly to orientation the answer can be user generated (e.g. mental map) or pulled from the environment using various technology aids such as a compass, or map data. The relevant technologies which aid navigation are:

* Triggered Information/Beacon (including RNIB REACT)
* Triggered Assistance
* AR
* Internal mapping information
* PPS (GPS + IPS)

### Entrance and Exit Identification

When the journey involves a vehicle or internal environment a person will have to enter or exit it. Therefore finding this entrance or exit is important to being able to continue the journey.

This principle focuses on the ability to identify an entrance or exit to either an internal environment or a vehicle. Once an entrance or exit has been identified a person can navigate to and through it. Therefore finding the entrance or exit is important to being able to continue the journey. The relevant technologies which aid entrance and exit identification are:

* Triggered information [close proximity] via RFID, IR, RF.
* AR
* IPS

## Planning

Prior to any journey being made, a planning stage can be performed to obtain the required information, to understand the route and decide which methods of transports and routes to use. This stage would usually be performed at home or at a convenient point where planning is possible (such as the office or library) so that routes can be previewed before undertaking them. The four wayfinding principles are applicable to the planning stage.

## Consolidating environments, principles and technology groups

To understand the problem the following has been identified:

1. What makes up a journey

* Journey stages, activities, and actions
* Solutions and barriers which exist

1. Wayfinding environments

* Internal, external and in vehicle

1. The four principles of wayfinding

* Getting information and using it
* Orientating within the environment
* Navigating within the environment
* Entrance and exit identification

In order to identify recommendations, the principles and environments which had been exposed and separated (through the identification of different journey stages/activities and actions), were brought together. Using the environments as the top layer, the principles were introduced into each environment. This showed the relationship between the principles and the environments. This can be seen below:

1. Internal

* Getting information and using it
* Orientating within the environment
* Navigating within the environment
* Entrance and exit identification

1. External

* Getting information and using it
* Orientating within the environment
* Navigating within the environment
* Entrance and exit identification

1. In vehicle

* Getting information and using it
* Orientating within the environment
* Navigating within the environment
* Entrance and exit identification

The technology groups which had been identified in section 3.2 Barriers and Solutions, were introduced into the above. By doing this, it was evident that the technology groups were interwoven within the principles and environments.

An example of this, using the internal environment for the principles “Getting information and using it” and “Orientating within the environment” can be seen below:

1. Getting information and using it

* Location and sustainability of information
* Triggered information/Beacon
* Triggered assistance
* Mapping information
* IPS
* AR
* OCR

1. Orientating within the environment

* Triggered information/beacon
* Mapping information
* AR
* Compass (linked to mapping information)
* OCR

To the technology groups, detail was added. The detail identified the requirements of that technology group. The following is an example of the requirements for “Triggered information/Beacon.” This technology group is within the “internal” environment and the “getting information and using it” principle:

Triggered information/Beacon

* Needs to inform users of its existence, on Points of Interest to identify them (tactile maps, RTI signage, Information desks)
* Needs to provide accurate and up to date information
* Text or audio delivered via a speaker or to a smart/specialist device
* Infrastructure based (sensors/transmitters/markers on POI’s) and personal (trigger either via phone or a specialist device)
* If an information point it needs to be located in a centralised and standardised position (e.g. to the left of the entrance/point)
* An automated beacon could permanently transmit a signal on a specific wavelength to identify the main information point
* Expansion of layered information about the environment (basic/advanced information genre)
* Daisy chaining, acting as wayfinding as well as orientation
* Push/Pull Technology
* Needs to inform users of vehicle (driver) existence (transmitter onboard received by smart/specialist device and RTI)
* Need to know the correct arrival order of a vehicle within a known tolerance (smart/specialist device, RTI)
* Need to know where the entrance to the vehicle is
* Doesn’t guide just provides information to confirm the entrance

Full details can be seen in 7 Appendix Two – Technology Group Requirements

By analysing the information within 7 Appendix Two – Technology Group Requirements, it was evident that specific requirements of the technology groups existed between the different principles. This identified that end users have different needs from the technology according to the principles they are trying to satisfy when making journeys. This reinforces the fact that wayfinding is interwoven and implementing one solution for one mode of transport in isolation will not solve wayfinding as a whole.

## Key findings of phases 1 and 2

### General

* In order to evaluate wayfinding, it needs to be thought about in terms of ‘user needs’ and the barriers faced throughout the journey stages that have been defined.
* To provide a solution for wayfinding a holistic approach needs to be taken. Given that a journey consists of many stages (each containing activities and actions), it is clear that solving the problems of one single stage/activity/action will not necessarily solve the problems for a journey as a whole.
* It is not possible to change the environments and principles, however, it is possible to introduce technology to change or remove the barriers.

### Journey related

* It is clear that there were various but consistent barriers and solutions across the different journey stages.
* Of the journeys, ‘walking’ is the most frequently used. It is an integral part of other stages and indeed the glue that combines the other activities together.
* Navigating whilst walking can make be one of the hardest stages to complete successfully
* The “flight” journey stage has the most activities and actions. At this time there is a lack of technological solutions and without assistance a person would likely fail.
* For many activities the common solutions currently available are mobility aids (such as the ‘cane’, ‘dog’) and being able to ‘ask someone.’ These solutions allow someone to ‘navigate by trial and error’ although ideally we are looking for more streamlined and reliable solutions.
* The validity and relevance of information can have a direct effect on the confidence level of the person undertaking a journey.
* A known journey will involve fewer ‘intermediary checks on progress’ whereas, for an unknown journey most people will regularly check where they are going.
* The lack of accessible information at street level makes it difficult to successfully walk in a new environment without making significant errors.
* The various solutions and the barriers identified within the nine journey stages are very rarely unique and only confined to one stage. They are in fact interwoven within the activities and actions across journey stages.
* The use of the solutions “cane”, ”dog” and ”asking someone” (identified in the section 3.2 Barriers and Solutions) were common across actions in the journey stages. At present they allow someone to “navigate by trial and error” although ideally we are looking for more streamlined and reliable solutions.

### Technology related

* Technology currently in use and those technologies that could be employed were tightly interwoven within many activities and actions within all journey stages.
* Many solutions exist however they are not being exploited to their full potential
* The technology solutions were summarised into the following technology groups:
* Mapping information
* AR
* PPS (GPS + IPS)
* Compass
* Location and suitability of information
* OCR
* Triggered Information
* Triggered Assistance
* To facilitate Internal Positioning both mapping information and a method of determining current location (using transmitters) are needed at the same time.

### Principle related

* The principle, ”Getting Information and using it” has been considered the most important one. Without relevant and meaningful information the decisions made along the journey process may be flawed
* The principles are encompassed within the environments
* Successful orientation within the environment is dependent on the availability of relevant information

# Phase 3: Identifying the next steps

Phase three consisted of analysing the work carried out in phases 1 and 2 to identify strategic recommendations for RNIB. Using the specific requirements produced in phase 2, focus areas along with exemplar solutions were identified within the various technology groups. It is intended that the focus areas will form the basis for the strategic recommendations.

## Identification of focus areas

To identify how wayfinding could be improved, it was necessary to put the focus back onto the technology groups. To maintain a holistic approach the technology groups encompass the four principles to show how the technology can be utilised.

### Mapping Information

#### Getting information and using it

* Accessible cartography
* In vehicle layout mapping is not available
* Internal layout mapping is not available
* Content could be provided by infrastructure and users. (quick win)
* Additional user functionality to enable decision making base on tolerances (Points of Interest (POI), distances and times e.g. a POI is 15 minutes away and can I get to it in the time I have)
* Presenting map data via user profile settings (types of maps, layers of information and order of presented information)
* Ability to switch map sources within the application, source toggle/utilise different technology as applicable. This could provide awareness of your external environment (route, mile stones) within a vehicle whilst understanding the internal mapping information (on a train and need to know in advance if time to get a coffee).

#### Orientating within the environment

* Location aware delivery
* Utilise compass where possible

#### Navigating within the environment

* Getting the most suitable maps for the situation/environment, (in vehicle and internal not widely available)
* Updating/enhancing information base during the journey (including POI’s and actual maps) e.g. coffee shop to tin of beans.

#### Entrance and exit identification

* Location of entrance/exit is indicated on the map

#### Focus areas

* Engage with key cartography suppliers (Tele Atlas supply Google) to provide accessible cartography
* Engage with building owners to enable the creation of mapping information e.g. shopping centres, public buildings to improve map sources
* Investigate the generation and use of detailed mapping source information using technology such as laser distance measurement techniques
* Utilise community base to provide additional mapping information (Quick win?)
* Providing useful (accurate) map data (ordnance survey) of street furniture that could be ‘layered’ onto navigational cartography. Would elevate some of the issues faced with pedestrian travel, reducing the anxiety level of not knowing what and where obstacles might be.
* Enhance existing commercial wayfinding solutions with the internal layout data and routing, .e.g. Tesco store finder to efficiently guide you around the store.
* Improve mapping functionality by allow for route navigation which highlights user driven POI’s
* User profiles and preferences (speed/distance/avoidance criteria)

Exemplar solution:

* London Borough of Chelsea notifies Ordinance Survey of tree planting, street furniture and other on-street changes
* Ordinance Survey
* Avego <http://www.avego.com/>
* Horizon Project (Nottingham University)
* TomTom (in car) navigating with petrol station POI’s on and avoiding motorways.

### Augmented Reality (AR)

Note: With or without mapping data.

#### Getting information and using it

* Comprehensive tagging of the environment
* Access to real time web services (cloud) where possible
* RTI (“this is train x going to y in z minutes”)
* User sharing, uploading and retrieval to community/specific genre
* User profile allowing for customisation (layer\personal information)
* POI’s tagged accordingly (meaningful up to date information)

#### Orientating within the environment

* Spatial Audio feedback (orientation and navigation)

#### Navigating within the environment

* Guided trail which the user follows (sonic hoops)
* Spatial Audio feedback (orientation and navigation) to guide to a POI
* Utilising mapping information to allow for tolerances and feedback.

#### Entrance and exit identification

* Actual identification
* Pin point location of entrance and exit
* Highlight main entrance and exit
* Display additional information of entrance and exit (open times, ramp, stairs, door type and other restrictions)
* Guides you to the door

#### Focus areas

* To engage and enhance AR community/solutions in terms of accessibility needs
* To enhance AR solutions in terms of functionality (profile, layered information, feedback tolerances)
* To investigate the usefulness of AR on smart/specialist devices.
* Investigate and trial the integration of AR solutions (such as spatial audio and guidance hoops) with mapping and PPS solutions to provide a detailed picture of current location and navigation

Exemplar solution:

* Looktel.com – Smartphone with artificial vision, accessible applications, OCR, AR, mobile interface – partnered by National Institute of Health (NIH), National Eye Institute (NEI). Object Recognition, Remote Assistance, Text Reader, and Smartphone accessibility services. The bundle includes LookTel Mobile, which runs on a compatible Windows Mobile Smartphone, and LookTel BaseStation, which runs on Windows-based PCs.
* Google street view with AR available on Nexus One smart phone
* Nottingham University guide hoops system

### Personal Positioning System (PPS) (including GPS + IPS)

Within this document PPS includes the following:

* GPS, the mechanism used to locate your position outdoors.
* IPS, the mechanism used to locate your position indoors (when GPS is not available).

#### Getting information and using it

* Informing users that it is available
* Access to Real time web services (cloud push pull services, this shop has this offer and it lasts this long)
* Needs to be accurate for pedestrian wayfinding
* Comprehensive tagging of the environment
* User sharing, uploading and retrieval to community/specific genre (using predefined routes)
* User profile allowing for customisation (layer\personal information)
* POI’s tagged accordingly (meaningful up to date information)

#### Orientating within the environment

* Accuracy of receivers to facilitate accurate bearing and positioning on map data (smart phone are generally less accurate than specialist devices).
* Feedback of the current accuracy of the infrastructure/technology

#### Navigating within the environment

* Includes transition technology between IPS and GPS when entering/exiting
* Adjusting to errors made (e.g. turning left instead of right)
* Need to understand how IPS will work better from the available technologies:
* GPS + TV signals
* Wi-Fi
* Radio
* Pseudo GPS (indoor)
* Beacon
* Integrate with accelerometer to provide better experience
* Plots journey so it can navigate you back to your starting point

#### Entrance and exit identification

* Transition technology between IPS and GPS needs to be operational
* Identifies existence of IPS technology around the entrance
* Infrastructure (sensors/transmitters/markers on a building) and Personal (e.g. smart/specialist device)

#### Focus areas

* At this time internal and in vehicle positioning systems do not widely exist.
* Investigate suitable infrastructure to enable IPS (usefulness of exiting Digital TV broadcast infrastructure for use as an IPS providing location services e.g. GPS+TV)
* Focus on transition/handover mechanism from external to internal to external systems.
* Engage with existing suppliers on improving the functionality/usability of PPS (layered information, tolerances, multiple map sources, accessibility etc)
* In order for PPS’s to be successful, mapping information and compass solutions need to be fully integrated.
* To be useful both systems require access to mapping information.

Exemplar solution:

* Use of existing digital TV signals as the method to determine the location of the smart specialist device receiver - Hybrid chip called ‘Alloy’ that uses GPS+TV signals to provide location based services for internal environments, convey advertisements to mobile TV broadcast smart devices.
* Drop GPS, a tactile handheld GPS device that utilises mapping information using braille cells to mimic the position of roads and buildings.
* Kapsys, TomTom – makers of the Kapten, and TomTom might be willing to collaborate on improvements
* Nokia shopping centre pilot.
* Telesoftas – transition software which allows mobile device to connect seamlessly to millions of WiFi hotspots worldwide including public WiFi networks. Its new release includes Location Based Services (LBS) functionality called Landmarks

### Triggered Information

There are lots of ways of providing triggered information (RFID, IR and RF). There are also several ways of triggering the information (specialist device/fob, smart device, voice commands and touch)

#### Getting information and using it

* Daisy chaining to provide greater information en-route (RNIB REACT)
* Needs to inform users of vehicle (driver) existence (transmitter onboard received by smart/specialist device and RTI)
* Need to know the correct arrival order of a vehicle within a known tolerance (smart/specialist device, RTI)
* Need to know where the entrance to the vehicle is
* Expansion of layered information about the environment (basic/advanced information genre)
* Improve methods of delivery (either via a speaker or to a smart/specialist device)
* Provides information along the route of your journey (e.g. audio announcements so you know when to get the vehicle to stop or the vehicle will be stopping)
* Could provide frequency/channel information to guide to you other POI (RNIB REACT, info points) within the environment
* Explore rationale for using push technology over pull

#### Orientating within the environment

* Requires transmitters at all entrance points + main areas/points (such as concourses, information desks) and placed in standardised places

#### Navigating within the environment

* An automated beacon could permanently transmit a signal on a specific wavelength to navigate you to the main information point
* Provides POI information as you walk past things

#### Entrance and exit identification

* Markers are located around the entrance and exit to allow for identification
* Audio could be delivered via a speaker or to a smart/specialist device
* Text could be delivered to a smart/specialist device

#### Focus areas

* Improve and build on the functionality and use of RNIB REACT (daisy chain, functionality, layered information)
* RNIB to focus on which technology to use and ideally these should be sympathetic to each other.
* Determine if permanent beacon’s would be beneficial
* Improve the method of delivery, i.e. explore push technology to deliver relevant information based profile/need (inform of vehicle existence)
* Investigate fully how accessibility can be integrated into current RTI systems (in terms of budget provision and infrastructure constraints)
* Investigate how new RTI systems can include accessibility features (e.g. audio announcements) before they are implemented.

Exemplar solution:

* RNIB REACT
* Bristol talking buses
* London iBus

### Triggered Assistance

#### Getting information and using it

* Making a request to inform someone that a service is required (e.g. Addison Lee iPhone app or phoning someone)
* “Help me I’m in trouble” trigger (Emergency services, or help service or staff with smart/specialist device). Ideally need to be location aware (linked to PPS) to fully understand where you are.
* Geo tagged photographs sent to allow service to determine where you are and where to go.

#### Navigating within the environment

* Trigger a temporary change within the environment. Crossing roads and intersections could be made safer with the use of remotely controlled crossings (infrastructure traffic lights, pedestrian crossings)

#### Entrance and exit identification

* Making a request to inform someone that a service is required (e.g. helping with bags and locating the entrance)

#### Focus areas

* Investigate usefulness of geo tagged photographs sent to online service as a navigation aid. (you are here and you need to go here)
* Investigate the usefulness/creation of a ‘help me’ service that utilises location aware devices to aid subjects whilst within the environment.
* Investigate the usefulness of triggering infrastructure to invoke a temporary change in the environment, e.g. remote traffic lights or pedestrian crossings.

Exemplar solution:

* Geo tagged imagery is being used to aid in disaster assistance.
* E911 location aware emergency service system (USA)
* Accessible Pedestrian Signals, European blind Union, Czechs have acoustic crossings which can be turned on and off remotely when needed, ("Czech Blind United" also used in Sweden) (APS, www.accessforblind.org/adb\_projects.html)

### Optical Character Recognition (OCR)

#### Getting information and using it

* Need to identify a cheap solution on a smart device
* Identify signage at a distance
* Identify images

#### Focus areas

* Investigate usefulness of smart/specialist device with OCR on the move.

Exemplar solution:

* Google Goggles
* Looktel.com – Smartphone with artificial vision, accessible applications, OCR, AR, mobile interface – partnered by National Institute of Health (NIH), National Eye Institute (NEI). Object Recognition, Remote Assistance, Text Reader, and Smartphone accessibility services. The bundle includes LookTel Mobile, which runs on a compatible Windows Mobile Smartphone, and LookTel BaseStation, which runs on Windows-based PCs.
* Tesco Wine finder

### Location and suitability of information

#### Getting information and using it

* Single point of access information – government web portal (direct.gov.uk)
* Software based interactions are normally visual only (e.g. touch screen kiosk)
* Consistent location of where information can be found (e.g. bus timetables are on the left hand side of the bus stop, online on single source portal)
* Continuous connectivity and awareness of ‘black spot’ locations

#### Focus areas

* The creation and availability of information, both infrastructure and user driven should be made available in the most efficient, maintainable and user friendly way. This could be achieved using real time web or cloud services and technology that improves connectivity, such as Femtocells with GPS.Physical sources of information could be located in standard locations. Examples could be as follows:
* This could be as simple as providing relevant information at appropriate distances near entrances such as within bus stations and train stations.
* Bus times tables are positioned on the left hand side of the stop, then a user would a) know where to find it, so the information could be OCR’d on a handheld device b) equally important to know information is not available so the subject can employ other means to retrieve the relevant information.
* Online sources information could be located within a single accessible portal that provides a collection of access points to accessible wayfinding information.E.g. Government portal – direct.gov.uk would be a mainstream portal that we could promote accessible services within. These would be exemplar websites that provides an accessible useful service.

Exemplar sources:

* Orange World – delivers repurposed source content as a single portal to mobile devices that is accessible. This is a proprietary solution and therefore has limited exposure.
* www.transportdirect.info
* www.directenquires.com
* www.describe-online.com

### Compass

#### Orientating within the environment

* Links with mapping/AR/PPS solutions to assist in location identification.

#### Focus areas

* Integrate the use of compass (including accelerometer where possible) within PPS solutions

### Additional considerations

#### Assistance services

Any journey no matter how well planned or how frequently completed can go wrong, and when it does, it inevitability leaves the subject with a lack of relevant information and sometimes stranded. Within the USA they have adopted a location aware emergency service system called E911, by working with mobile phone companies to locate a caller within 111 yards (100 metres) of the caller's geographic location – hence the emergency services know where you are even if you do not. This concept could be enhanced by providing a ‘help or assistance service’ that specifically caters for blind and partially sighted people. This could be as simple as:

* speaking to an operator and asking for assistance (operator aware of your location)
* providing additional information regarding public transport needs
* the uploading of a geo tagged image (location or information) to determine which way to go, what’s around, the release of information (image of timetable, or sign)
* location aware buddy scheme

(This would not negate or interfere with the assistance provided by the Emergency services.)

#### Person identification

With the onset of social networks going location aware such are Twitter, Facebook, Google latitude/buzz, msn etc), allowing you to share your current locations and therefore locate the whereabouts of ‘contacts’ within your location, this could be extended to other useful pursuits:

* Buddy scheme within the Assistance services, putting you in touch with ‘buddies’ who would be able to assist you in your specific location.
* Conference network facilitator – based on profile information the Location Based Services link you with like minded or those interested in the same topic within a conference or exhibition environment. PPS provides you with their location and how to navigate there.

A subject’s location is sensitive data and people should be careful with whom and when they share it because if you are saying you are at X then that would mean you are not at Y (home).

#### Training

Although the wayfinding technologies would help blind and partially sighted people, they are not sufficient on their own. Being able to effectively use and exploit the technology independently may not be that straightforward. This can be improved by offering training to enable the effective use of the technology. A secondary gain is that feedback collated during training sessions can be passed back to the manufacturers and suppliers to shape development.

#### Convergence

The convergence of functionality being found on smart/specialist devices is providing the users/infrastructure with more and more possibilities in providing access/information.

One issue that manufacturers face is the ability to provide high quality components within a device that has a capped price point. An example of this would be the GPS receivers found in mobile devices being generally cheaper components than that of the discrete GPS devices. As such they cannot provide an equivalent accuracy needed for pedestrian navigation. Another issue is the interaction between the technology and the user. With increased functionality there is a danger that interfaces will become more complicated and therefore more difficult for people to use.

# Recommendations

For each technology group, the focus areas from section 4 Phase 3: Identifying the next steps, have been analysed and consolidated into 23 strategic recommendations for RNIB. These have been categorised into three phases of work and are outlined below:

In conjunction with these 23 recommendations it is suggested that the following areas are considered:

* Use the Olympic Games to leverage positive change
* Determine whether ePayment systems and retail can be linked to wayfinding systems
* Maintain a ‘watching brief’ in technology advancements throughout the life cycle of any subsequent projects.

## Phase one

### Conduct a series of pilots

Perform a number of pilots to:

a) Test how blind and partially sighted people interact with current technological wayfinding solutions, adding new solutions as they become available

b) Validate the theories from the wayfinding report and to provide a means to determine progress.

Benefit: To give blind and partially sighted people the opportunity to tell us how useful and practical they find the various wayfinding technologies

### Research Augmented Reality (AR) solutions

Research AR on mobile and other devices with the following aims:

a) Investigate how AR can be integrated with PPS solutions and mapping technology (e.g. Google Streetview on a handheld device)

b) Investigate and trial the integration of spatial audio (audio with positioning information) with AR as a means to provide feedback

c) Determine if there is a need to mix the audio feedback with audio from the live environment (to avoid isolation)

d) In partnership with University of Nottingham investigate user requirement and potential wayfinding solutions e.g. guidance hoops.

Benefits: To determine how blind and partially sighted people can utilise AR solutions to enhance their understanding of their environment, by presenting them with additional information.

Linked to the following recommendations:

* 5.1.5 Generate a Personal Positioning System (PPS) functional specification
* 5.2.1 Improve the accessibility of maps
* 5.2.5 Influence Augmented Reality (AR) development
* 5.3.2 Encourage the creation of internal maps

Section in the Report: Augmented Reality

### Research Internal Positioning Systems (IPS) (buildings/in-vehicle).

Research internal (buildings) and in vehicle positioning systems both current and up and coming to:

a) Understand the problems and potential solutions

b) Investigate suitable infrastructure to enable IPS (e.g. usefulness of existing Digital TV broadcast infrastructure,   
Wi-Fi, etc)

c) Investigate suitable mapping to enable IPS

d) Focus on transition/handover mechanisms from external to internal systems and vice versa

e) Investigate the integration of IPS with mapping

Benefits: To determine how blind and partially sighted people might use technology to navigate through buildings (e.g. such as open shopping centres).

Linked to the following recommendations:

* 5.1.4 Improve existing wayfinding solutions
* 5.1.5 Generate a Personal Positioning System (PPS) functional specification
* 5.2.1 Improve the accessibility of maps
* 5.3.2 Encourage the creation of internal maps
* 5.3.3 Enhance the location of goods and services

Section in report: PPS

### Improve existing wayfinding solutions

Working with manufacturers of mainstream wayfinding solutions (e.g. GPS, IPS and RTI) to:

a) Identify manufacturers and solutions to work with

b) Improve accessibility of their solutions

c) Where possible improve the functionality and usability (e.g. layered information, tolerances, multiple map sources, etc)

Benefit: To enable blind and partially sighted people to take better advantage of existing mainstream wayfinding solutions, by making them accessible.

* 5.1.3 Research Internal Positioning Systems (IPS) (buildings/in-vehicle).
* 5.1.5 Generate a Personal Positioning Systems (PPS) functional specification
* 5.2.1 Improve the accessibility of maps
* 5.3.1 Improve choice of map sources

Section in report: Personal Positioning Systems

### Generate a Personal Positioning System (PPS) functional specification

Creating a functional specification which defines:

a) The integration of internal and external positioning functionality

b) The mechanism for handover between internal and external systems

c) The integration of suitable complimentary systems such as compass and accelerometer

d) The use of internal and external mapping information

Benefits: To enable us to better communicate the needs of blind and partially sighted people to the key providers of wayfinding systems.

Linked to the following recommendations:

* 5.1.3 Research Internal Positioning Systems (IPS) (buildings/in-vehicle).
* 5.1.4 Improve existing Wayfinding solutions
* 5.2.1 Improve the accessibility of maps
* 5.2.4 Maximise Points of Interest (POI) information
* 5.3.1 Improve choice of map sources

Section in report:

* Personal Positioning Systems
* Location and suitability of information

### Improve access to Real Time Information (RTI) Systems.

Research to:

a) Understand what RTI solutions and barriers exist, and what the current state of play is, liaising with the RTI group as appropriate, and identifying the most appropriate option

b) Investigate how accessibility can be integrated into current and new RTI systems (in terms of budget provision, infrastructure constraints and user interaction) in different transport infrastructures. This would include RNIB REACT.

c) Determine the most effective ways of conveying information in terms of importance, order and delivery method.

Benefits: To provide blind and partially sighted people access to RTI in a form they can understand, which will enable them to make independent decisions about their journey.

Linked to the following recommendations:

* 5.2.6 Enhance audio announcements
* 5.2.7 Increase access to transport information
* 5.2.8 Further enhance RNIB REACT

Section in the report: Triggered Information

### Provision of a “help me” service

Engage with key stakeholders to create a sustainable and viable ‘help me’ service that could be used when you get lost out and about and need assistance. With the aim of facilitating the following:

a) A buddy system. This will allow you to request personal assistance that will guide you from one place to another or provide you with information.

b) Call back system - this will allow someone to send a photograph or make a video call (ideally geo tagged for location information) which an operator or system will respond back with relevant information.

c) Easy access - This will allow the user to access different types of help me solutions via, an operator, Interactive Voice Response (IVR), TXT message, mobile application.

Benefits: This will provide a means for people to get help when they need it to overcome barriers/difficulties. This will encourage blind and partially sighted people to make more successful journeys as they know help is available should they need it.

Linked to the following recommendations:

* 5.2.3 Influence mainstream with a single online portal
* 5.3.2 Encourage the creation of internal maps

Section in the report: Triggered Assistance

### Utilise a homing beacon

Investigate methods that provide an awareness of the existence of systems/markers that:

a) Will guide people to existing wayfinding solutions e.g. a type of 'homing' system e.g. to find RNIB REACT units

b) Will provide wayfinding points/markers to allow navigation e.g. join the dots concepts

c) Will identify Points of Interest

d) Will identify building feature e.g. entrances or information desk

e) Could be triggered/activated based on user profile and need e.g. push technology to alert you to the arrival of the appropriate train

Benefits: This will enable blind and partially people to home in on systems that would help them in their journeys (e.g. RNIB REACT). Currently a system is rendered useless unless a blind or partially sighted person becomes aware of its existence and is in range of the system.

Not linked to any other recommendations

Section in the report: Triggered information

## Phase two

### Improve the accessibility of maps

Improve external and internal (where available) mapping by:

a) Create a functional specification of what an accessible map is and how it is navigated

b) Engage with key stakeholders (e.g. Tele Atlas that supply Google, software developers and building owners) to provide accessible navigation and information of existing and new map data

c) Understand requirements to integrate with PPS solutions

Benefits: Improving the accessibility of maps will not only enable blind and partially sighted people to use them but also enable their use within other solutions (e.g. Points of Interest).

Linked to the following recommendations:

* 5.1.3 Research Internal Positioning Systems (IPS) (buildings/in-vehicle).
* 5.1.5 Generate a PPS functional specification

Section in report: Mapping information

### Standardise the location of information

Standardise the location of information so it can be found easily e.g. bus timetable are always positioned on the left hand side of the stop

This involves utilising the expertise of different RNIB teams to:

a) Research to determine any existing standards in information location and engage with key stakeholders

b) To improve on or create standards

c) Promote and monitor these standards

Benefits: Blind and partially sighted people will always know where to find information easily.

Not linked to any other recommendations

Section in the report: Location and suitability of information

### Influence mainstream with a single online portal

Engage with stakeholders to enable the creation of an online portal to provide access to various sources of information that aid making journey's (e.g. Government portal direct.gov.uk use information from www.transportdirect.info). The portal should be beneficial to everyone as it will:

a) Act as a launch pad to link services

b) Provide a simple means of getting wayfinding information

c) Deliver information to you if you request updates

Benefits: Linking information sources together will mean blind and partially sighted people can easily access this information and do not need to go and search for it. Having this in the mainstream will broaden the benefits to all.

Linked to the following recommendations:

* 5.1.7 Provision of a “help me” service
* 5.2.7 Increase access to transport information
* 5.3.2 Encourage the creation of internal maps

Section in the report: Location and suitability of information

### Maximise Points of Interest (POI) information

Improve mapping functionality by:

(a) Allowing navigation via Points of Interest (POI's)

(b) Utilising of user generated Points of Interest (POI's)

(c) Allowing navigation within certain tolerances e.g. only 10mins from away from a public toilet

Benefits: This will give blind and partially sighted people greater flexibility when making journeys. This allows them to better utilise information which they require.

Linked to the following recommendations:

* 5.1.5 Generate a Personal Positioning System (PPS) functional specification
* 5.2.1 Improve the accessibility of maps
* 5.2.9 Utilise Community Base
* 5.3.1 Improve choice of map sources

Section in the report: Mapping Information

### Influence Augmented Reality (AR) development

To engage with stakeholders to:

a) Share our research

b) Enhance the accessibility requirements of current and future AR solutions.

c) Influence and improve the functionality in terms of preferences, layered information, mapping and feedback tolerances, etc.

Benefits: More AR solutions will be accessible to blind and partially sighted people.

Linked to the following recommendations:

* 5.1.2 Research Augmented Reality (AR) solutions
* 5.2.10 Maximise user preferences

Section in the report: Augmented Reality

### Enhance audio announcements

Research to establish a more efficient method of conveying pertinent information contained within audible information (audio announcements) by:

a) The use of increasing and decreasing pre tones to attract attention

b) Considering the best order and delivery methods based upon the information importance

c) Levels/layers of information, e.g. based on user preference

Benefits: To improve the delivery of audio information so that blind and partially sighted people can understand it and find it easy to use.

Linked to the following recommendations:

* 5.2.8 Further enhance RNIB REACT

Section in the report: Location and suitability of information

### Increase access to transport information

Engage with service providers to understand how they can share their RTI with a wider audience (e.g. application developers) in the most efficient and maintainable way by:

a) Making it available on the cloud (e.g. allowing developers to create mobile and AR application).

b) Improving deployment connectivity (e.g. Femtocells with GPS).

Benefits: To increase the availability of RTI to blind and partially sighted people by making it available through different delivery methods.

Linked to the following recommendations:

* 5.2.6 Enhance audio announcements
* 5.2.8 Further enhance RNIB REACT
* 5.2.10 Maximise user preferences

Section in the report: Location and suitability of information

### Further enhance RNIB REACT

Review with the intention of:

(a) Improving and building on the functionality where applicable e.g. improve connectivity, daisy chaining, type and level of information provided, user experience, etc

(b) Being able to promote the use of RNIB REACT units by linking it with other devices/solutions and seeking new locations

(c) Efficient use of ancillary components/units (e.g. RNIB React trigger fob and RTI triggerboard)

Benefits: Blind and partially sighted users of RNIB REACT will be given a more flexible and comprehensive solution.

Linked to the following recommendations:

* 5.1.8 Utilise a homing beacon
* 5.2.6 Enhance audio announcements

Section in the report: Triggered information

### Utilise Community Base

Community driven information gathering has the potential to generate a lot of useful wayfinding information. Engage with community bases to provide user generated mapping information, e.g. Points of Interest, best routes and things to avoid.

Benefits: Blind and partially sighted people can be involved in generating content they need, and utilise this information when using wayfinding solutions.

Linked to the following recommendations:

* 5.2.4 Maximise Points of Interest (POI) information

Section in the report:

* Mapping information
* Location and suitability of information

### Maximise user preferences

Research the use of the cloud in collaboration with key stakeholders (e.g. Google) to hold device independent information that provides:

(a) Interoperability

(b) User profiles and preferences e.g. PPS device defining personal speed, distance, and avoidance criteria, etc

Benefits: This allows blind and partially sighted people to use different systems based on their individual preferences.

Linked to the following recommendations:

* 5.3.1 Improve choice of map sources

Section in the report:

* Mapping information
* Location and suitability of information

### Expand the use of Optical Character Recognition (OCR) on mobile devices

Research a low cost option that will:

a) Capture and interpret information within the environment e.g. bus timetables and information signage

b) Capture and interpret information within publications e.g. information sheets and publications

c) Research as to whether the OCR solution should reside within the device or be server based

Benefits: Blind and partially sighted people can gain access to information by capturing and interpreting printed information on their mobile phones.

Not linked to any other recommendations

Section in the report: OCR

## Phase three

### Improve choice of map sources

Engage with stakeholders to allow wayfinding solutions to access a variety of mapping sources (e.g. Ordinance Survey and Tele Atlas). This should help alleviate pedestrian anxiety levels because they can access relevant information (e.g. Ordinance Survey provides street furniture which means a person can identify obstacles in their way). This can be achieved by:

a) Allowing solutions to interchange map sources

b) Integrating information from different sources on the same map, which are shown as different layers based on personal preferences

Benefits: This maximises flexibility by allowing blind and partially sighted people to utilise different maps based on their environment and needs.

Linked to the following recommendations:

* 5.2.1 Improve the accessibility of maps
* 5.2.10 Maximise user preferences

Section in the report: Mapping information

### Encourage the creation of internal maps

Engage with key stakeholders (e.g. building owners) to facilitate the creation of new maps of internal spaces (e.g. shopping centres, public buildings).

Benefits: This provides the internal maps to allow people to navigate through buildings (such as open shopping centres). The creation of new maps will mean that Internal Positions Systems are sustainable.

Linked to the following recommendations:

* 5.1.3 Research Internal Positioning Systems (IPS) (buildings/in-vehicle).
* 5.1.5 Generate a Personal Positioning System (PPS) functional specification
* 5.1.7 Provision of a “help me” service
* 5.2.1 Improve the accessibility of maps

Section in report: Mapping information

### Enhance the location of goods and services

Engage with stakeholders to enhance the specific location of goods/services using PPS e.g. linking the layout of a supermarket with the location of goods to efficiently guide you around the store.

Benefits: Blind and partially sighted people can navigate successfully around a shop, therefore achieving the aim of their journey independently.

Linked to the following recommendations:

* 5.1.3 Research Internal Positioning Systems (IPS) (buildings/in-vehicle).
* 5.1.5 Generate a Personal Positioning System (PPS) functional specification
* 5.2.1 Improve the accessibility of maps
* 5.3.2 Encourage the creation of internal maps

Section in the report: Mapping information

### Enable control of the environment

Research the triggering of infrastructure to create a temporary change within the environment (e.g. to turn on or extend timings at a pedestrian crossing). This includes:

a) What do users need to control in their environment?

b) A mechanism to allow users to control their environment utilising other systems (e.g. RNIB REACT fob)

Benefits: To allow blind and partially sighted people to have more control of their environment depending on their needs and preferences.

Not linked to any other recommendations

Section in the report: Triggered assistance

# Appendix One – Phase One Evaluations

The following provides a breakdown of the Phase one evaluations in terms of the initial types of solution.

**Solution:** Compass:

**No of evaluations:** 2

**Product title:**

* Compass solutions in Smartphone
* Geo Sensory C2 Talking Compass

**Solution:** GPS

**No of evaluations:** 15

**Product title:**Smartphone:

* Blackberry (Navigation with Google)
* Blackberry (Navigation with GPS)
* CoPilot Live (Alk Technologies)
* Kapten
* Mobile Geo (Sendero & Code Factory)
* TomTom
* Wayfinder Access (Sendero)

Specialist device:

* Bar Z Adventures (GPS Ranger)
* Garmin Nuvi 855
* Kapten Personal GPS Voice Navigator
* Polestar GPS
* Street Talk VIP GPS (Sendero)
* Talking Radar Cap
* Trekker Breeze (Humanware)
* Trekker GPS

**Solution:** Information Gathering

**No of evaluations:** 6

**Product title:**

Website:

* Describe Online
* Direct Enquiries
* Traveline via Helpline and website
* Orange World solutions via GSM mobile phone
* Tesco finder application on a Smartphone
* Telesoftas developers connectivity application

**Solution:** Mapping

**No of evaluations:** 15

**Product title:**

* Map for All signs
* MP3 City guides available as download

Smartphone:

* Amsterdam Mobile Guide
* Infomaps Amsterdam
* Loadstone
* London Tube (Mxdata)
* Mobile GMaps
* Nokia Maps
* OffMaps, OpenStreetMaps

Website:

* Getting around section of TFL Website (London Tube)
* Google Earth
* Stations made easy

Tactile maps:

* Dynamic Mapping including Google Maps
* Interior Mapping (Sheffield University)
* Tactile Maps

**Solution:** Smartphone

**No of evaluations:** 3

**Product title:**

* Nexus 1
* Iphone 3Gs
* Nokia N series

**Solution:** Sonic device

**No of evaluations:** 6

**Product title:**

* Caretec Ray
* K Sonar (Bay Advanced Technologies Ltd)
* Mini Guide
* Palmsonar
* Polaron
* Ultrasonic products

**Solution:** OCR

**No of evaluations:** 1

**Product title:**

* KNFB reader on Smartphone

**Solution:** Tactile Paving

**No of evaluations:** 1

**Product title:**

* Tactile paving - Warning TSGI's

**Solution:** RTI

**No of evaluations:** 2

**Product title:**

* Brighton and Hove live bus timetables on Smartphone
* London iBus and Countdown via signage

**Solution:** Signage

**No of evaluations:** 2

**Product title:**

* Blind Signs, Inc. (Detectable Directional Guidance System (DDGS))
* Legible London - Applied information group (AIG) & TFL

**Solution:** Triggered Information

**No of evaluations:** 12

**Product title:**

* RFID - indoor (Active and passive)
* Sesamonet - secure and safe mobility network
* Smartcards

Specialist device:

* PAVIP used with Bones Milestone
* Tanier
* Hypertag
* Step Hear

Signage:

* Audiosign infrared
* Mitsubishi Infrared Talking sign system
* RNIB React
* RNIB Speaking Sign
* Talking Signs inc

# Appendix Two – Technology Group Requirements

The information below identifies the detailed requirements of each technology group. This is presented in relation to any planning that is performed, and the environments and principles as defined within section 3.6 Consolidating environments, principles and technology groups.

## Planning

### Getting information and using it

“Gathering as much relevant journey information as possible, to be able to plan a complete journey.”

#### Web Portals

There are lots of resources on the web, but knowing that they exist, are accessible and their information is accurate is a problem.

* Multi transport booking and timetabling information
* Provision of internal mapping of structures
* Provision of external mapping
* Provides complete journey planning including a route and times of transport
* Uses real time web (cloud)
* Owners/service providers can update and upload their information into the portal to maintain its accuracy
* Web portal can interrogate and port information across from standalone websites into the portal
* Infrastructure (e.g. a website) and Personal (e.g. smart/specialist device or computer).

#### Augmented Reality (AR)

* Can access, interrogate and integrate information from various sources and display it
* Infrastructure (e.g. an information provider) and Personal (e.g. smart/specialist device or computer).

#### Optical Character Recognition (OCR)

* Used to access hard copy information
* Personal (e.g. smart/specialist device).
* No cheap solutions

#### Triggered Assistance (Using a phone)

* Calling a helpline for information
* Sending a text to find up to date information (e.g. check trains are on time, phone number to call a taxi)
* Any information obtained should be transmitted back to the person who requested it in their desired format (e.g. timetable information or turn by turn instructions)
* Linking into car sharing and ordering of vehicles
* Example infrastructure requirement - an information provider
* Example personal requirement -smart/specialist device

### Orientating within the environment

“Enabling you to know where you are in relation to your surroundings. This forms the starting point for onward navigation.”

#### Web Portals

* Provides complete journey planning including a route and times of transport
* Example infrastructure requirement – a website
* Example personal requirement – smart/specialist device

#### Augmented Reality (AR)

* Can access, interrogate and display information from various sources and display it with reference to the complete journey
* Set preferences and desired layers
* Example infrastructure requirement – an information provider
* Example personal requirement – smart/specialist device

### Navigating within the environment (Dry runs)

“Checking the information and doing a dry run of the journey in order to confirm and commit to the route.”

#### Augmented Reality (AR)

* Journey displayed as a list with major milestones for review
* Ability to refine and adjust journey plan as needed
* Change layers and preference to see how journey changes
* Example infrastructure requirement – an information provider
* Example personal requirement – smart/specialist device
* Route should understand and highlight infrastructure (e.g. connectivity) “black spots” so that they can be acknowledged and avoided if required

#### Virtual Environments

* Journey is played out before you
* Ability to refine and adjust journey plan as needed
* Change layers and preference to see how journey changes
* Example infrastructure requirement – an information provider
* Example personal requirement – smart/specialist device
* Route should understand and highlight infrastructure (e.g. connectivity) “black spots” so that they can be acknowledged and avoided if required

#### Personal Positioning System (PPS)

This includes IPS and GPS

* Journey is played out before you
* Ability to refine and adjust journey plan as needed
* Should allow for transition from external to internal environments (including showing of any system messages, e.g. do you want to use internal systems?)
* Change layers and preference to see how journey changes
* Example infrastructure requirement – an information provider
* Example personal requirement – smart/specialist device
* Route should understand and highlight positioning “black spots” so that they can be acknowledged and avoided if required

### Entrance and exit identification

During planning, the location of entrance and exit might also be achieved in combination with ‘Getting information and using it’.

#### Augmented reality (AR)

* Utilise physical maps to locate entrances and exits
* Change layers and preference to see additional entrance/exits
* Highlight main entrance and exit
* Adjust route according to entrance and exit preferences
* Display additional information of entrance and exit (open times, ramp, stairs, door type and other restrictions)

#### Virtual Environments

* Review entrance and exit (allowing the journey to continue by passing thorough)
* Change layers and preference to see additional entrance/exits

#### Mapping information

* Location of entrance/exit is indicated on the map

## Internal Environment

### Getting information and using it

“Identifying appropriate information sources exist and utilising them.”

#### Location and suitability of Information

* The consistent standardisation of where information might be located and therefore found. (e.g. appropriate distance on the left hand side of entrance, bus stop within a station, lift, station, etc.)
* Software based interactions are normally visual only (e.g. touch screen kiosk)

#### Triggered Information/Beacon (including RNIB REACT/RTI)

* Needs to inform users of its existence, on POI’s to identify them (tactile maps, RTI signage, information desks)
* Needs to provide accurate and up to date information
* Text or audio delivered via a speaker or to a smart/specialist device
* Example infrastructure requirement – sensors, transmitters, markers on POI’s
* Example personal requirement – trigger via phone or specialist device
* If an information point it needs to be located in a centralised and standardised position (e.g. to the left of the entrance/point)
* An automated beacon could permanently transmit a signal on a specific wavelength to identify the main information point
* Expansion of layered information about the environment (basic/advanced information genre)
* Daisy chaining, acting as wayfinding as well as orientation
* Push/Pull Technology
* Needs to inform users of vehicle (driver) existence (transmitter onboard received by smart/specialist device and RTI)
* Need to know the correct arrival order of a vehicle within a known tolerance (smart/specialist device, RTI)
* Need to know where the entrance to the vehicle is
* Doesn’t guide just provides information to confirm the entrance

#### Triggered Assistance

* Used to make staff aware that assistance is needed
* Example infrastructure requirement – advise staff that assistance is required - staff need to have a device
* Example personal requirement – smart/specialist device
* Smart solution would be location aware
* Requesting a vehicle (app on smart/specialist device, Addison Lee, linking in to car sharing)
* Making a driver aware that he needs to stop to pick you up
* Geo tagged photographs sent to allow service to determine where you are and where to go

#### Mapping information

* Availability of information (including POI’s and actual maps) for users to access on smart devices is not widely available.
* Content can be provided via infrastructure (e.g. owners of building/company) and user base
* Example infrastructure requirement – a tactile map
* Example personal requirement – smart/specialist device
* Location of tactile and clear print maps are important
* It can be text, spoken information, visual/tactile overview
* Personal solution could have RTI included (relative to known POI)
* Location aware delivery aid context sensitive information
* Availability of tactile maps/paving/textures
* Presenting map data via user profile settings (types of maps, layers of information and order of presented information)
* Tolerances using real time maps (POI’s, distances and times e.g. a POI is 15 minutes away and can I get to it in the time I have)

#### Internal Positioning System (IPS)

* Needs to inform users of its existence and that of any other supplementary system
* Example infrastructure requirement – transmitters in the building
* Example personal requirement – smart/specialist device
* Needs to work in conjunction with layout information
* Accuracy of current position and POI tagging
* New technology such as GPS+TV or Femtocell (with GPS), Drop GPS

#### Augmented Reality (AR)

* Real time web (cloud)
* POI’s tagged accordingly (meaningful up to date information)
* Provides RTI
* Example personal requirement – smartphone
* User profile allowing for customisation (layer\personal information)
* User sharing, uploading and retrieval to community/specific genre
* Spatial Audio feedback (orientation and navigation)
* Identifies the entrance
* Guides you to the door

#### Optical Character Recognition (OCR)

* Cheap solutions are not available
* Can read signage at distance
* Needs to home in on text
* Example personal requirement - smart/specialist device to capture information

### Orientating within the environment

“Not knowing where you are and what is around you.”

#### Mapping information

* Example infrastructure requirement – a tactile map
* Example personal requirement – smart/specialist device
* It can be text, spoken information, visual/tactile overview
* Location aware delivery aid orientation
* Provision of tactile and clear print maps are important
* Allows you to determine where you are in context of your surroundings
* Position does not need to be updated as it is a stationary position
* Having a “you are here” point on permanently placed maps is important
* Availability of information (including POI’s and actual maps) for users to access on a smart/specialist device is not widely available.

#### Augmented Reality (AR)

* Identifies POI’s
* Example personal requirement – smart/specialist device
* Spatial Audio feedback (orientation and navigation)

#### Compass (linked to mapping information, including accelerometer)

* Identifies your bearing
* Example personal requirement – smart/specialist device
* It is only important if you have information which provides the bearing you need to go on.

#### Optical Character Recognition (OCR)

* Cheap solutions are not available
* Used to determine what signage is available
* Identify what the signage is
* Gives you an indication of the direction of POI’s
* Example personal requirement – smart/specialist device

#### Triggered Information/Beacon (including RNIB REACT)

* Informs you [generally] where you are
* Provides information about POI’s around you.
* Example infrastructure requirement – transmitters in the building
* Example personal requirement – trigger via phone or specialist device
* Push/pull technology

### Navigating within the environment

“Navigating along the specified journey”

#### Triggered Information/Beacon (including RNIB REACT)

* An automated beacon could permanently transmit a signal on a specific wavelength to navigate you to the main information point
* Example infrastructure requirement – sensor or transmitter
* Example personal requirement – smart/specialist device
* Could provide frequency/channel information to guide to you other POI (RNIB REACT, info points) within the environment
* Daisy chaining, acting as wayfinding as well as orientation
* Push/Pull Technology
* Provides POI information as you walk past things

#### Augmented Reality (AR)

* Guided trail which the user follows (sonic hoops)
* Example personal requirement – smart/specialist device
* Spatial Audio feedback (orientation and navigation)
* Utilising internal layout map data
* Showing and navigating POI’s en-route

#### Mapping information

* Presenting map data via user profile settings (types of maps, layers of information and order of presented information)
* Getting most suitable maps for current situation/environment
* Updating/enhancing information base during the journey (including POI’s and actual maps)
* Example infrastructure requirement – a tactile map
* Example personal requirement – smart/specialist device
* It can be text, spoken information, visual/tactile overview
* Personal solution could have RTI included (relative to known POI)
* Location aware delivery aids navigation
* Tactile paving/textures
* Tolerances using real time maps (POI’s, distances and times e.g. a POI is 15 minutes away and can I get to it in the time I have)
* Allows you to navigate through your environment and is linked to a GPS/IPS system
* Position needs to be updated as it is a dynamic position
* Availability of information (including POI’s and actual maps) for users to access on smart devices is not widely available.

#### Internal Positioning System (IPS)

* Not available as a commercial offering
* Types of technologies to use:
* GPS+ TV signals
* Femtocell for connectivity
* Wi-Fi
* Radio
* Pseudo GPS (indoor)
* Beacon
* Example infrastructure requirement – sensors/transmitters/markers on a building
* Example personal requirement – smart/specialist device
* Includes transition technology between IPS and GPS when exiting
* Accuracy of your movement and POI tagging
* Adjusting to errors made (e.g. turning left instead of right)
* New technology such as Drop GPS

### Entrance and Exit Identification

“Identifying and confirming the entrance or exit”

#### Triggered information [close proximity] via Radio Frequency Identification (RFID), Infrared (IR) and Radio Frequency (RF).

* Text or audio delivered via a speaker or to a smart/specialist device
* Example infrastructure requirement – sensors/transmitters/markers on a building
* Doesn’t guide just provides information to confirm the entrance

#### Augmented Reality (AR)

* Identifies the entrance
* Guides you to the door
* Example personal requirement – smart/specialist device
* Pin point location of entrance and exit
* Highlight main entrance and exit
* Display additional information of entrance and exit (open times, ramp, stairs, door type and other restrictions)

#### Internal Positioning System (IPS)

* IPS picks up where GPS proximity fails.
* Includes transition technology between IPS and GPS
* Identifies existence of IPS technology around the entrance
* Example infrastructure requirement – sensors/transmitters/markers on a building
* Example personal requirement – smart/specialist device

#### Mapping Information

* Location of entrance/exit is indicated on the map

#### Triggered assistance

* Making a request to inform someone that a service is required (e.g. helping with bags and locating the entrance)

## External Environment

### Getting information and using it

“Identifying appropriate information sources exist and utilising them.”

#### Location and suitability of Information

* The consistent standardisation of where information might be located and therefore found. (e.g. on the left hand side of a bus stop)
* Software based interactions are normally visual only (e.g. touch screen kiosk)

#### Triggered Information/Beacon (including RNIB REACT/RTI)

* Needs to inform users of its existence, on POI’s to identify them (tactile maps, RTI signage, Information desks)
* Needs to provide accurate and up to date information
* Text or audio delivered via a speaker or to a smart/specialist device
* Example infrastructure requirement – sensors/transmitters/markers on POI’s
* Example personal requirement – trigger via phone or specialist device
* If an information point it needs to be located in a centralised and standardised position
* An automated beacon could permanently transmit a signal on a specific wavelength to identify the main information point
* Expansion of layered information about the environment (basic/advanced information genre)
* Daisy chaining, acting as wayfinding as well as orientation
* Push/Pull Technology
* Needs to inform users of vehicle (driver) existence (transmitter onboard received by smart/specialist device and RTI)
* Need to know the correct arrival order of a vehicle within a known tolerance (smart/specialist device, RTI)
* Need to know where the entrance to the vehicle is
* Doesn’t guide just provides information to confirm the entrance

#### Triggered Assistance

* Used to make staff aware that assistance is needed (mobile calling someone)
* Example infrastructure requirement – advice staff that assistance is required - Geo tagged photographs sent to allow service to determine where you are and where to go.
* Example personal requirement – smart/specialist device
* Smart solution would be location aware
* Requesting a vehicle (app on smart/specialist device, Addison Lee, linking in to car sharing)
* Making a driver aware that he needs to stop to pick you up

#### Mapping information

* Getting most suitable maps for current situation/environment
* Location of tactile and clear print maps are important
* Presenting map data via user profile settings (types of maps, layers of information and order of presented information)
* Tolerances using real time maps (POI’s, distances and times e.g. a POI is 15 minutes away and can I get to it in the time I have)
* Availability of information (including POI’s and actual maps) for users to access on a smart device. Content can be provided via infrastructure (e.g. owners of building/company) and user base
* Example infrastructure requirement –a tactile map
* Example personal requirement – smart/specialist device
* It can be text, spoken information, visual/tactile overview
* Personal solution could have RTI included (relative to known POI)
* Location aware delivery facilitates context sensitive information
* Availability of tactile maps/paving/textures

#### Global Positioning System (GPS)

* Example infrastructure requirement –satellites orbiting the earth
* Example personal requirement – smart/specialist device
* Needs to work in conjunction with layout information
* Accuracy of current position and POI tagging
* New technology such as Drop GPS
* Identifying existence of spatial audio
* Real time web (cloud)
* POI relevant to the journey (bus stops etc)
* Access to predefined routes

#### Augmented Reality (AR)

* Real time web (cloud)
* POI’s tagged accordingly (meaningful up to date information)
* Provides RTI
* Example personal requirement – smart phone
* User profile allowing for customisation (layer\personal information)
* User sharing, uploading and retrieval to community/specific genre
* Spatial Audio feedback (orientation and navigation)
* Need to know where the entrance to the vehicle is
* Identifies the entrance
* Guides you to the door

#### Optical Character Recognition (OCR)

* Cheap solutions are not available
* Can read signage at distance
* Needs to home in on text
* Personal (e.g. smart/specialist device) to capture infrastructure
* Example personal requirement – smart/specialist device to capture information

### Orientating within the environment

“Not knowing where you are and what is around you.”

#### Mapping information

* Using relevant map data to understand current position in relation to destination (e.g. deciding to get taxi as it is too far to walk)
* Example infrastructure requirement – a tactile map
* Example personal requirement – smart/specialist device
* It can be text, spoken information, visual/tactile overview
* Location aware delivery facilitates orientation
* Provision of tactile and clear print maps are important
* Allows you to determine where you are in context of your surroundings
* Position does not need to be updated as it is a stationary position (does not need to be linked to GPS)
* Having a “you are here” point on permanently placed maps is important

#### Augmented Reality (AR)

* Identifies POI’s in relation to your current position
* Example personal requirement – smart/specialist device
* Spatial Audio feedback (orientation and navigation)

#### Compass (linked to mapping information including accelerometer)

* Identifies your bearing
* Example personal requirement – smart/specialist device
* It is only important if you have information which provides the bearing you need to go on.

#### Optical Character Recognition (OCR)

* Cheap solutions are not available
* Used to determine what signage is available
* Identify what the signage is
* Gives you an indications of the direction of POI’s
* Example personal requirement – smart/specialist device

#### Triggered Information/Beacon (including RNIB REACT)

* Informs you [generally] where you are
* Provides information about POI’s around you.
* Example infrastructure requirement – transmitters in the building
* Example personal requirement – trigger via phone or specialist device
* Push/pull technology

### Navigating within the environment

“Navigating along the specified journey”

#### Triggered Information/Beacon (including RNIB REACT)

* An automated beacon could permanently transmit a signal on a specific wavelength to navigate you to the main information point
* Example infrastructure requirement – sensor or transmitter
* Example personal requirement – smart/specialist device
* Could provide frequency/channel information to guide to you other POI (RNIB REACT, info points) within the environment
* Daisy chaining, acting as wayfinding as well as orientation
* Push/Pull Technology
* Provides POI information as you walk past things

#### Triggered Assistance

* Infrastructure (sensor or transmitter) and personal (via smart device or a specialist device)
* Example infrastructure requirement – sensor or transmitter
* Example personal requirement – smart/specialist device
* Used to trigger a piece of infrastructure to invoke a temporary change within the environment, e.g. remote traffic lights or pedestrian crossings.

#### Augmented Reality (AR)

* Guided trail which the user follows (sonic hoops)
* Example personal requirement – smart/specialist device
* Using Spatial Audio feedback (orientation and navigation) to guide to a POI
* Utilising mapping information
* Showing and navigating POI’s en-route

#### Global Positioning System (GPS)

* Example infrastructure requirement – satellites orbiting the earth
* Example personal requirement – smart/specialist device
* Includes transition technology between IPS and GPS when entering buildings
* Accuracy of your movement and POI tagging
* Adjusting to errors made (e.g. turning left instead of right)
* Integrating current solutions with accelerometer
* New technology such as Drop GPS
* Can use Real time web (cloud)
* Navigating via POI’s
* Utilising turn by turn guidance to update your position
* Spatial Audio feedback (orientation and navigation)
* POI relevant to the journey (bus stops etc)
* User interface (tolerances such as distance from POI’s, and feedback e.g. within 10 or 15m of a wrong turn)
* Route tracking (find home) and uploading (share)
* For walking, the accuracy of GPS needs to be enhanced.
* Feedback of the current GPS accuracy (e.g. your position is accurate to 3m or 10m or 200m)

#### Mapping information

* Presenting map data via user profile settings (types of maps, layers of information and order of presented information)
* Getting most suitable maps for current situation/environment
* Updating/enhancing information base during the journey (including POI’s and actual maps)
* Example infrastructure requirement – a tactile map
* Example personal requirement – smart/specialist device
* It can be text, spoken information, visual/tactile overview
* Personal solution could have RTI included (relative to known POI)
* Location aware delivery aids navigation
* Tactile paving/textures
* Tolerances using real time maps (POI’s, distances and times e.g. a POI is 15 minutes away and can I get to it in the time I have)
* Allows you to navigate through your environment and is linked to a GPS/IPS system
* Position needs to be updated as it is a dynamic position

### Entrance and Exit Identification

“Identifying and confirming the entrance (e.g. to a building or vehicle)”

#### Triggered information [close proximity] via Radio Frequency Identification (RFID), Infrared (IR), Radio Frequency (RF)

* Example personal requirement – smart/specialist device to receive text or audio
* Example infrastructure requirement – sensors, transmitters, markers on a building
* Doesn’t guide just provides information to confirm the entrance

#### Augmented Reality (AR)

* Identifies the entrance
* Guides you to the door
* Example personal requirement – smart/specialist device
* Pin point location of entrance and exit
* Highlight main entrance and exit
* Display additional information relating to entrance and exit (open times, ramp, stairs, door type and other restrictions)

#### Global Positioning System (GPS)

* IPS picks up where GPS proximity fails.
* Includes transition technology between IPS and GPS
* Identifies existence of IPS technology around the entrance
* Example infrastructure requirement – sensors, transmitters, markers on a building
* Example personal requirement – smart/specialist device

#### Triggered assistance

* Making a request to inform someone that a service is required (e.g. helping with bags and locating the entrance)

## In a vehicle (buses, trains, [car] and flight)

### Getting information and using it

“Identifying appropriate information sources exist and utilising them.”

#### Location and suitability of Information

* The consistent standardisation of where information might be located and therefore found. (e.g. appropriate distance left hand side of entrance, bus, train etc.)
* Software based interactions are normally visual only (e.g. touch screen kiosk)

#### Triggered Assistance

* Example infrastructure requirement – vehicle/driver/staff
* Example personal requirement – smart/specialist device
* Smart solution would be location aware for both customer and staff
* Making a driver aware that he needs to stop to pick you up or to drop you off

#### Triggered/Beaconed/automated Information (including RNIB REACT/RTI)

* Text or audio delivered via a speaker or to a smart/specialist device (RTI)
* Awareness of route milestones including next stop and the time to next stop (audio announcements and smart/specialist device), so you know when to get the vehicle to stop or the vehicle will be stopping
* Infrastructure based (sensors/transmitters/markers on vehicle or driver) and personal (trigger either via smart/specialist device)
* Example infrastructure requirement – sensors/transmitters/markers on vehicle or driver
* Example personal requirement – trigger either via phone or specialist device

#### Mapping information

* Availability of information (including POI’s and actual maps) for users to access on a smart device. Content can be provided via infrastructure (e.g. owners of building/company) and user base
* Example infrastructure requirement – a tactile map
* Example personal requirement – smart/specialist device
* Location of tactile and clear print maps are important
* It can be text, spoken information, visual/tactile overview
* Personal solution could have RTI included (relative to known POI)
* Location aware delivery facilitates context sensitive information
* Availability of tactile maps/paving/textures
* Presenting map data via user profile settings (types of maps, layers of information and order of presented information)
* Tolerances using real time maps (POI’s, distances and times e.g. a POI is 15 minutes away and can I get to it in the time I have)
* Presenting journey map data via user profile settings (types of maps, layers of information and order of presented information) .Awareness of route milestones including next stop and the time to next stop (audio announcements and smart/specialist device)
* Presenting internal layout map data via user profile settings (types of maps, layers of information and order of presented information) and awareness of POI (toilets, refreshments, exit, storage, seating plan, priority seating)
* Software based mapping solutions are normally visual only
* In vehicle mapping is not currently available

#### Augmented Reality (AR)

* Real time web (cloud)
* POI’s (staff, toilets, refreshments, exit, storage, seating plan) tagged accordingly so meaningful up to date information
* Provides RTI
* Example personal requirement – smart/specialist device
* User profile allowing for customisation (layer\personal information)
* Spatial Audio feedback (orientation and navigation)

#### Optical Character Recognition (OCR)

* Cheap solutions are not available
* Needs to read signage at distance
* Needs to home in on text
* Example personal requirement – smart/specialist device to capture infrastructure information (e.g. route information)

### Orientating within the environment

“Not knowing where you are and what is around you.”

#### Mapping information

* Example infrastructure requirement – a tactile map
* Example personal requirement – smart/specialist device
* It can be text, spoken information, visual/tactile overview
* Location aware delivery facilitates orientation
* Provision of tactile and clear print maps are important
* Allows you to determine where you are in context of your surroundings
* Position does not need to be updated as it is a stationary position
* Having a “you are here” point on permanently placed maps is important
* In vehicle mapping is not currently available

#### Augmented Reality (AR)

* Identifies POI’s
* Example personal requirement – smart/specialist device
* Spatial Audio feedback (orientation and navigation)

#### Compass (linked to mapping information including accelerometer)

* Identifies your bearing
* Example personal requirement – smart/specialist device
* It is only important if you have information which provides the bearing you need to go on.

#### Optical Character Recognition (OCR)

* Cheap solutions are not available
* Used to determine what signage is available
* Identify what the signage is
* Gives you an indication of the direction of POI’s
* Example personal requirement – smart/specialist device

#### Triggered Information/Beacon (including RNIB REACT)

* Informs you [generally] where you are
* Provides information about POI’s around you.
* Example infrastructure requirement – transmitters in the building
* Example personal requirement – trigger via phone or specialist device
* Push/pull technology

### Navigating within the environment

“Navigating along the specified journey within the vehicle and along the route”

#### Triggered Information/Beacon (including RNIB REACT)

* Text or audio delivered via a speaker or to a smart/specialist device (RTI)
* Provides POI information as you walk past things (such as toilets or doors)
* An automated beacon could permanently transmit a signal on a specific wavelength to navigate you to the main information point
* Example infrastructure requirement – sensor or transmitter
* Example personal requirement – smart/specialist device
* Could provide frequency/channel information to guide to you other POI (RNIB REACT, info points) within the environment
* Daisy chaining, acting as wayfinding as well as orientation
* Push/Pull Technology

#### Mapping information

* Presenting map data via user profile settings (types of maps, layers of information and order of presented information)
* Getting most suitable maps for current situation/environment
* Updating/enhancing information base during the journey (including POI’s and actual maps)
* Infrastructure (e.g. a tactile map) and Personal (e.g. smart/specialist device).
* Example infrastructure requirement – sensor or transmitter
* Example personal requirement – smart/specialist device
* It can be text, spoken information, visual/tactile overview
* Personal solution could have RTI included (relative to known POI)
* Location aware delivery aids navigation
* Tactile paving/textures
* Tolerances using real time maps (POI’s, distances and times e.g. a POI is 15 minutes away and can I get to it in the time I have)
* Allows you to navigate through your environment and is linked to a GPS/IPS system
* Position needs to be updated as it is a dynamic position
* In vehicle mapping is not currently available

#### Augmented Reality (AR)

* Real time web (cloud)
* Provides POI’s en route through the vehicle (staff, toilets, refreshments, exit, storage, seating plan) tagged accordingly so meaningful up to date information
* Guided trail which the user follows (sonic hoops)
* Example personal requirement – smart/specialist device
* Using Spatial Audio feedback (orientation and navigation) to guide to a POI
* Utilising mapping information
* Showing and navigating POI’s en-route
* User profile allowing for customisation (layer\personal information)

#### Internal Positioning System (IPS)

* Not available as a commercial offering
* Types of technologies to use:
* TV signals
* Wi-Fi
* Radio
* Pseudo GPS (indoor)
* Beacon
* Example infrastructure requirement – sensors/transmitters/markers on a building
* Example personal requirement – smart/specialist device
* Includes transition technology between IPS and GPS when exiting
* Accuracy of your movement and POI tagging
* Adjusting to errors made (e.g. turning left instead of right)
* New technology such as Drop GPS

### Exit Identification

“Identifying and confirming the exit from a vehicle”

#### Triggered information [close proximity] via Radio Frequency Identification (RFID), Infrared (IR) and Radio Frequency (RF).

* Example personal requirement – smart/specialist device to receive text or audio
* Example infrastructure requirement – sensors/transmitters/markers on a vehicle
* Doesn’t guide just provides information to confirm the entrance

#### Augmented Reality (AR)

* Identifies the exit
* Guides you to the door
* Example personal requirement – smart/specialist device
* Pin point location of entrance and exit
* Highlight main entrance and exit
* Display additional information relating to entrance and exit (open times, ramp, stairs, door type and other restrictions)

#### Internal Positioning System (IPS)

* IPS picks up where GPS proximity fails.
* Includes transition technology between IPS and GPS
* Identifies existence of IPS technology around the entrance
* Example infrastructure requirement – sensors, transmitters, markers on a building
* Example personal requirement – smart/specialist device

#### Triggered assistance

* Making a request to inform someone that a service is required (e.g. helping with bags and locating the entrance)

# Appendix Three - Glossary of Wayfinding terms

**Accelerometer** - An electromechanical device that will measure acceleration forces. By measuring the amount of static and dynamic acceleration, software can determine the way the device is moving within the environment.

**Augmented Reality (AR)** – a term used to describe the method of superimposing or combining virtual computer-generated graphics, audio and other sensory enhancements over a real-world environment in real time. The information presented about the surrounding real world of the user becomes interactive and usable therefore it can be presented in the form that is needed.

**Closed/controlled environment –** is the umbrella term for a controlled environment such as a station or airport. Whilst classified as being within the internal environment it may have an external part to it (e.g. a train ticket office is in a building whereas the platforms are outside). A person may enter a closed/controlled environment (station/airport) and continue their journey from within a vehicle.

**Cloud -** is the term used to describe Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand though the internet. Clouds often appear as single points of access for all consumers' computing needs.

**Environments -**

* **External -** is classified as an uncontrolled space and does not include a closed/controlled environment even if it has an external area.
* **Internal -** is classified as within either an “internal structure” (e.g. a shopping centre) or a “closed/controlled environment” (e.g. train station). It is classified as a controlled space because it has specific entrance and exit points.
* **In Vehicle -** is classified as any situation where you are in a vehicle (e.g. a train, bus, taxi and plane) to get from one place to another.

**Femtocell** - Is a communications access point or base station that connects to the service providers networks via a broadband connection. It acts like a miniature tower and broadcasts a low-level cellular signal in order to extend the service coverage indoors, especially where access would otherwise be limited or unavailable.

**Geo tagged** - a geo tagged photograph will contain the GPS location (longitude and latitude) where a picture was taken; these photographs can then be overlaid as POI on a digital map and therefore the location of where the photograph was taken can be determined.

**Global Positioning System (GPS)** – this utilises the satellites which orbit the earth providing reliable location and time information in all weather and at all times. GPS location can be obtained anywhere on the Earth using a GPS receiver when there is an unobstructed line of sight to four or more GPS satellites. GPS services do not work indoors very well as the signal is reduced.

**Infrared (IR) –** IR light lies between the visible and microwave portions of the electromagnetic spectrum (between 1 and 430 THz). The lower frequency signals are used within Infrared control switch circuits. Infrared transmitters and receivers are regarded as a ‘line of sight’ technology as obstacles interrupt the beam of infrared.

**Interactive Voice Response (IVR)** – is an audio based solution which allows customers to access a system via a telephone keypad or by speech recognition, after which they can service their own inquiries by following the audible instructions.

**Internal Positioning System (IPS)** – is a term describing the technology used to enable the navigation of internal structures using guidance systems. IPS replicates the benefits provided by external GPS technology indoors. IPS is only viable with indoor mapping.

**Internal structure –** is the umbrella term for physical buildings (e.g. places of work, shops and shopping centres, museums and hospitals) in which a person would enter and exit that does not facilitate travel. For this reason stations and airports have been separated from “internal structures” as these are classified as a “closed/controlled environment”. An internal structure is classified as being within the internal environment.

**Interoperability** - Interoperability is a property of a product or system, which works with other products or systems, present or future, without any restricted access or implementation.

**Location-based service (LBS) –** enables relevant services to utilise the geographical position of the mobile device. This takes the form of information and entertainment services made possible using [mobile devices](http://en.wikipedia.org/wiki/Mobile_device) through the [mobile network](http://en.wikipedia.org/wiki/Mobile_network). Typical LBS services include services to identify a location of a person or object, such as discovering the nearest banking cash machine or the whereabouts of a friend or employee.

**Mapping technology** – is the umbrella term for all types of mapping solutions such as hardcopy and electronic.

**Optical Character Recognition (OCR)** – is the process of converting/interpreting captured images of text into machine readable characters.

**Personal Positioning System (PPS)** – A handheld device that is capable of wayfinding both within internal and external environments. To do this the PPS will make use of GPS, IPS and mapping technologies.

**Points of Interest (POI)** - a specific point location that someone may find useful or interesting. A POI may or may not present additional information. Within GPS navigation software a POI may be referred to as a waypoint and will contain the latitude and longitude of the POI, a name and description for the POI and other information such as altitude or a telephone number or web link may also be included.

**Push technology** – describes a method by which servicesdeliver information which is not directly requested from the user. Such push services are activated by an event, which could be triggered if a specific area is entered or triggered by a timer. It is contrasted with pull technology, where the request for the transmission of information is initiated by the receiver.

**Radio frequency (RF)** - corresponds to the frequency of electrical signals (frequency of 30 KHz to 300 GHz) normally used to produce and detect [radio waves](http://en.wikipedia.org/wiki/Radio_waves).

**Radio-frequency identification** (**RFID**) is the use of an object (typically referred to as an RFID tag) applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. Most RFID tags contain at least two parts. One for storing and processing information, the second is the antenna for receiving and transmitting the signal. Some tags can be read from several meters away and beyond the line of sight of the reader.

**Real Time Information (RTI)** – provides up-to-the-minute information. In the case of travel, this could be bus arrival and departure passenger information. RTI can be utilised by many different systems providing information both locally and wider afield.

**RNIB React** – RNIB’s talking transport sign system. This consists of a strategically placed RNIB React speaker unit, and a trigger fob carried by the individual. There are two versions, the standard version which enables individuals to orientate themselves within a city centre, whereas the Real Time Information (RTI) version also reads aloud the visual display timetable information at bus stops.

**RNIB React trigger board** – This a separate unit derived from the full RNIB React unit. It offers a more cost effective means of making real time passenger information (RTPI) signage accessible by utilising audio and text to speech capability.

**Smartphone** - a mobile phone that offers more advanced computing ability and connectivity than a contemporary basic 'feature phone'. It can be thought of as handheld computer integrated within a mobile telephone, allowing the user to use their phone to perform a variety of tasks by installing and running more advanced applications.

**Spatial Audio feedback** – the use of three dimensional sounds to enable humans to make sense of their environments using their spatial awareness of natural sounds.

**Wayfinding -** encompasses all of the ways in which people orient themselves in physical space and navigate from place to place.

**Wi-Fi** - **The facility or ability to connect to broadband Internet and networks wirelessly.**

### About RNIB’s research

RNIB is a leading source of information on sight loss and the issues affecting blind and partially sighted people. Our Research and Knowledge Hub contains key information and statistics about blind and partially sighted people including our Sight Loss Data Tool, which provides information about sight loss at a local level throughout the UK. You’ll also find research reports on a range of topics including employment, education, technology, accessibility and more. Visit our Knowledge and Research Hub at: **rnib.org.uk/research** or **email research@rnib.org.uk.**