Inclusive passenger information

A guide to good practice
for bus passenger technology providers

RTIG Library Reference: ***RTIGPR003-D002-1.10***

April 2018

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Introduction

This document has been developed for those involved in the provision of information and other services in local authorities and the bus industry. They aim to help ensure that passenger information is accessible to all people, consistently and effectively.

Bus operations in the UK have improved considerably over recent years. New fleets, better services and continued good value are all contributing to a sustainable – and in some areas strongly growing – public transport system.

As part of this, the widespread provision of high quality real time information (especially during disruptions) is essential, so that passengers know how the service is running while planning their journey as well as moment by moment throughout their journey.

As a public service, buses need to serve the community on an inclusive basis. Many recent improvements in bus services have been made to help people with physical disabilities: low-floor and 'kneeling' buses, buses and bus stops with space for wheelchairs, etc. Just as vital is the need to ensure that people with invisible disabilities can access public transport. This includes those with learning difficulties, language difficulties, non-obvious physical disabilities (eg deafness) and mental health issues. The need to deliver this is not merely good practice; it is a statutory requirement under the Equality Act 2010. Further, these services benefit all users, making mobility easier for everyone.

Social inclusion requires ensuring that the whole journey is made possible and practical. By having access to the necessary infrastructure and information, passengers can have a seamless door-to-door experience. In addition, this will help relieve the anxiety and challenges of travelling in unfamiliar or difficult circumstances, or where disruption occurs, improving the customer experience for everyone.

In preparing this document, we have deliberately not addressed accessibility other modal contexts. Rail related guidance is, indeed, widely available elsewhere. We have, however, considered where established good practice in the rail industry might be portable to the bus industry as well.

Status of this document

A summary of the statutory requirements is provided in Section 1, and Section 10 provides excerpts from the relevant documents**.** These are rules with which you **must** comply – though please note, legal obligations can change over time, and we cannot therefore promise that these statements are either complete or up to date.

Some regulations only apply in certain circumstances – for example, Building Regulations do not apply to vehicles and the Public Service Vehicles Accessibility Regulations do not apply to bus stops. The guidance attempts to apply a uniform standard to all circumstances and contexts, but the legal force of statements may vary because of this.

Other statements in this document, presented as ‘dos’ and ‘don’ts’, indicate guidance on good practice, either previously developed or developed collaboratively by RTIG with advisors from key disability communities.

This document is a guideline. It has been written using the expertise of those in the industry. Although it does not have statutory force, it is strongly recommended that, when designing an RTI system, these guidelines are used.

Preface

This work has been coordinated by RTIG. Prior editions were part funded by the Department for Transport.

RTIG welcomes feedback on this document and will endeavour to keep the guidance current. Please contact us at secretariat@rtig.org.uk for queries or suggestions for improvement.

For those looking for more detailed advice, a list of references is provided at the end of the document. The full text of regulations is cited in Appendix A of the guidelines.

Preface to this edition

This revision has been produced to take into account comments from users, to incorporate other passenger facing technologies and to enhance sections where further guidance has subsequently been released.

We gratefully acknowledge the valuable input of RTIG Working Groups over the course of the past five years. In particular, for this revision, we would like to acknowledge the input from the Information Presentation Working Group members: Norfolk County Council, TfL, SYPTE, Guide Dogs for the Blind, Nexus Alpha, r2p, AECOM, and Traveline.

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1. Legal Context

Accessibility in transport is covered by a number of laws, regulations and statutory codes of practice. It is the intention of this guidance to bring relevant legal provisions to the attention of readers, but not to advise on their applicability. The primary ones to be aware of in the context of public transport technology are:

- EU Regulation No 181/2011 concerning the rights of passengers in bus and coach transport
- The Equality Act 2010
- Transport Act 2000 as amended by the Local Transport Act 2008
- Approved Document M, Access to and use of Buildings (2004)
- The Road Vehicles Lighting Regulations 1989 (as amended)
- Code of Practice: Rights of Access: services to the public, public authority functions and private clubs and premises
- Public Service Vehicles Accessibility Regulations (PSVAR)
- Bus Services Act 2017
- EU Regulation 2016/679: the General Data Protection Regulation (GDPR)

Local Authorities and public transport operators should seek independent legal advice on their individual circumstances.

The EU Regulation 181/2011 came into effect in 2013 and grants passengers the right to adequate accessible information “where feasible”. The Regulation warns that it does not place any additional technical requirements on buses, coaches or infrastructure.

The Equality Act 2010 (EA) places a duty on service providers, including providers of transport services, not to discriminate against disabled people by treating them unfavourably when providing access to their services unless the service provider can justify that treatment.

Under the EA, service providers are also required to make reasonable adjustments for disabled people. This can include making adjustments to their policies or practices relating to the way that they provide their services, in order to enable a disabled person to use those services.

Local authorities also have a statutory duty to consider how their actions help to achieve equality of opportunity in their areas, and there are a number of laws and regulations that embody or clarify this duty; notably, the Transport Act 2000 as amended by the Local Transport Act 2008 (where applicable). These impose on LAs/PTEs a duty to “have regard to needs of disabled persons ... and of certain persons in developing and implementing transport policies”. (See Section 10) LAs should consult with the various disability groups and charities to ensure they have a complete knowledge of the requirements of disabled travellers.

The Road Vehicle Lighting Regulations restrict the use of moving lights on a vehicle while it is in motion. It is likely that displays using either LED or flip-dot technologies would fall within these definitions. Care is therefore needed with changing displays.

The statutory Code of Practice: Rights of Access requires transport providers to provide services and facilities “avoid discrimination against disabled people, and to make reasonable adjustments for them” regardless of whether the service is provided for a cost or for free.

PSVAR does not cover information within the bus. It does, however, cover information displays on the outside of the bus as well as accessibility for wheelchair users and priority seating and accommodation of assistance dogs and their owners.

The Bus Services Act 2017 makes provision for the Secretary of State to enact regulations for the provision of audio visual information on buses: see particularly Sections 17 *Information for bus passengers* and 18 *Information about English bus services*.

The General Data Protection Regulation (GDPR) is a regulation on data protection and privacy for all individuals within the European Union. It replaces the 1995 Data Protection Directive (Directive 95/46/EC).

Excerpts from the relevant legislation have been provided in Appendix A of this document.

2. Guidelines applicable to all information systems

Information messages

Information systems should be viewed as a service that complements the service provided by bus drivers. Allowing information systems to deliver routine information leaves bus drivers free to concentrate on driving the bus, particularly when traffic conditions are challenging or weather conditions are difficult. However, passengers should still feel free to communicate directly with the driver, particularly if they have individual needs of which the driver should be aware. Similarly, if a bus journey will be disrupted in some way, the driver should be able to address passengers directly to keep them informed. Drivers should be properly trained to communicate with passengers with disabilities.

Until fairly recently, information about a journey was available from a limited number of sources with a limited level of accuracy. Information was available primarily on displays at stops (sometimes in paper form) and occasionally on buses. Signs were often 3-line dot matrix displays with very limited space for presentation.

However, our options for what information we get, and how, when and where we get it, have now multiplied manyfold. Information is now available online, through mobile web, via apps, on street signs, on on-bus signs etc. This has changed not only the expectation of passengers but also the opportunities for providers to provide more and better information. Passengers want end-to-end journey information: from the point they start planning the journey right to when they reach their destination. They want it to be accurate, available on request, but non-invasive.

With this explosion in the availability of information and channels, the provider needs more than ever to understand the key information they need to ensure is available to passengers, to avoid providing so much information that the passenger is confused and to make that information accessible to as many travellers as possible.

Messages should be made accessible to as many users as possible. They should be clear, concise and consistent. Messages should remain simple and straightforward to ensure that all travellers have access to information. Real Time service information should take priority over non-immediate, non-essential and advertising material. They should not be placed on the same screen without careful, specialist design. Where possible, and to meet the requirements of the Equality Act, information should be provided in both visual and audible form.

Messages should remain distinct from one another and should not provide so much information that they overload the user. In general, messages should be displayed such that each message completes before another message begins. Avoid interrupting a message with another message as this can be confusing to users. However, there may be circumstances in which interrupting a message is appropriate, for instance during an emergency. It is, therefore, recommended that there is a policy in place which addresses under what circumstances a message will be interrupted.

Do:	ensure all key information is available in visual and audible form
	ensure that priority is always given to key real time and safety information
	ensure that where service disruption (eg bus diversion, delay or curtailment) renders standard information incorrect, the misleading information is removed
	provide passengers with information about the next and the following two services
	ensure that signs are capable of displaying special or emergency messages if required. These might include: delays to services, minor incidents such as burst water-main, major incidents such as the London bombings and the Go In, Stay In, Tune In message
	repeat audio announcements of ‘special’ messages twice
	display the bus stop name on approach, as the door opens. The information displayed while the bus is stopped is up to the implementer
	display (and where relevant announce) next stop or location sensitive information in enough time to allow passengers time to react
	ensure that live and recorded information and messages are clear, concise, accurate, consistent and unambiguous for all screen types

Do:	present information with a consistent ‘look and feel’ across all information channels, as far as possible
	provide passengers on buses with the names of stops, destinations and where possible other key information
	as a minimum, provide passengers at bus stops, shelters or buildings with destination information, service number and the estimated calling time (see *Language and terminology in Real Time Information systems*, RTIGT035-1.0)
	incorporate a user-controlled repeat option, if practical
	on visual signs, display messages for at least 10 seconds, and at least twice as long as the average reading speed requires
	clearly distinguish between different messages on a sign or in an announcement
	keep bus stop names etc consistent across all routes, and consistent between pre-journey and on-journey information
	consider including key passenger destinations (eg hospitals, museums or government buildings) in messages, where relevant

Do not:	present too many ‘vias’
	have messages which contain more than three or four information elements
	display advertising media on an RTI sign, unless it is clearly separated from and subordinated to the key information

Message priority

Not all information is equally important, or equally urgent. An imminent emergency is both urgent and important, whereas advertising is neither. The timing of the next service calling at a stop is more "urgent" than one due in half an hour.

Getting the correct information displayed, in any specific set of circumstances, not only makes the RTI system as relevant as possible, but also creates a uniform "look and feel" that maximises user understanding and trust.

The precise selection may vary between and even within schemes (for example, they may be different in a high-density, frequent city centre from a residential circuit).

The table below, therefore, provides a framework for local adaptation rather than a definitive recommendation.

- In the first column is a brief description of the type of information that may be available to be displayed.
- *Urgency* describes, on numerical scale, how urgent the information is. In the example, a scale of 1-4 is used, with 1 denoting "publish immediately".
- *Importance* describes how important the information is to the recipient (ie generally to passengers); here again a scale of 1-4 is used, 1 being "most important".
- *Score* is the result of combining the urgency and importance values. In this example, the scores are multiplied together, and the resulting values (from 1 to 16) enable a priority ranking to be established: information with a lower score would always be displayed in preference to information with a higher score.
- *Notes* suggest how the information might be handled on a sign. Similar notes might be developed for audio announcements.

It is recommended that authorities/operators design and agree a message priority protocol using a table of this kind. The scales, schedule of information types, individual scores, and even the means of combining them can all freely be adjusted.

Type of information	Urgency	Importance	Score	Notes
Emergency				
Emergency: absolute priority (eg evacuation)	1	1	1	Full screen, or all lines concurrently
Now and today				
Routine real time service information	3	1	3	
Routine timetabled information	3	1	3	If real-time not available
Single journey disruption	2	2	4	On journey line (replace destination)

Type of information	Urgency	Importance	Score	Notes
Single route disruption	2	2	4	On route lines (replace destination)
Geographic disruption – area-wide	1	1	1	Full screen (alternate with RTI)
Later than today				
Widespread disruption	3	1	3	On journey line (replace destination)
Route disruption	4	2	8	On route lines (replace destination)
Journey disruption	4	2	8	Full screen (alternate with RTI)
Non RTI				
Change of timetable	4	2	8	Line 3 *or* below RTI lines (scroll/alternate)
Clock	4	2	8	Line 3 *or* below RTI lines (scroll/alternate)
Promotion of services	4	4	16	Line 3 *or* below RTI lines (scroll/alternate)
Advertising	4	4	16	As contracted

3. Guidelines for visual displays

Display types

Many types of display are now available. "Traditional" three-line, dot-matrix, LED displays still form the majority of the installed base. However, increasing use is made of full screen displays (LCD, TFT, etc), which offer much richer layout opportunities in colour, font, pictorials, etc. Newer technologies such as e-ink are also beginning to appear.

While the guidance in this chapter is general in nature, its applicability to different technologies will vary. For example, character-based displays are unable to use soft spacing or smooth scrolling; dot matrix displays cannot use smooth fonts; monochrome displays cannot freely choose colours.

Bear in mind that different technologies have different technical characteristics differently, and this can have a significant impact on accessibility. For example, simple reflective LCD screens are very frugal in power use, making them ideal for solar-powered installations, but offer poor contrast, and can be unreadable in full sun.

Further, different technologies suffer from different forms of degradation over time. Burn-out, fading, unbalanced colours etc can be a problem with some screen types; these can become problematic for people with some kinds of visual or cognitive impairment, well before they stop being readable by those with good eyesight.

Font and format

A great deal of advice exists on the font and format of signs. Recommendations below are designed to provide clarity and legibility specifically for users with visual and cognitive impairments. However, all users will benefit from having information presented in a fashion which is clear and easy to read.

Viewing distance within a bus shelter is usually around 2 metres. However in some circumstances (eg where stops/shelters frequently get congested), it may be appropriate to allow for considerably greater viewing distances.

Do:	use a display of at least 3 lines where practical
	justify information to the left
	avoid right justifying text. A jagged edge is easier for a dyslexic person to keep their place in the text
	put text on a plain background (see section below on “Sign finish, contrast and borders” for more details)
	use a sans serif font. Some appropriate fonts include: Helvetica, Arial, New Johnston (see Definitions in Section 10)
	keep the number of different font sizes and typefaces on a sign to a minimum
	(for dot-matrix displays) use a character matrix of at least 5 x 7 dots; 7 x 9 is preferred for general applications, and 15 x 21 should be used if displays are to be rotated
	(for dot-matrix displays) ensure that the grid (ie the gaps between dots) of ‘non solid’ characters are very fine to attain clarity
	use margins
	use a minimum character height of 22mm for all critical information such as next stop, final destination, disruption information and emergency information. Subsidiary information such as graphic maps may have a smaller font if space is at a premium
	ensure that character height is at least 1% of the distance at which the message will usually be read, and not normally more than 2%
	ensure signs use a mixture of upper and lower case lettering wherever practical
	ensure that the space between words is greater than that between characters of a word – use word spacing of about one quarter of the font width
	use soft spacing on RTI systems where practical
	ensure that vertical spacing between lines (from bottom of letters without descender to top of ascenders in the line below) is at least 50% of line height (from top of ascenders to bottom of letters without descender) (see Definitions in Section 10)
	use “true descenders”. A minimum descender depth of 20% of the upper case character height is recommended (see Definitions in Section 10)
	use characters with a width to height ratio between 3:5 and 1:1

Do:	ensure that the horizontal spacing between characters is 25% to 50%
	avoid the use of abbreviations. Where abbreviations are used, the common NaPTAN abbreviations are acceptable (eg Rd, St, N)

Do not:	squash ascenders and descenders, or use text with raised descenders
	truncate words unless necessary and do so based on local knowledge until a standard is developed
	write information in capital letters only
	use very long words
	use text which is too expanded or condensed
	underline
	use flashing text
	use punctuation
	use a small font size to get more information onto a sign
	use bold or italic characters

Refreshed text

Where text is too long to fit on a single line on a screen, it may need to be broken. Implementers have the option of refreshing (i.e. alternating) the display or scrolling it. If at all possible, text should be designed to avoid either scrolling or refreshed text. Bear in mind that for dyslexic, cognitively impaired and visually impaired passengers scrolling text may compromise legibility.

However, there is a trade off between the informativeness of the message and its length: a longer message may give more information, but it may be more complex, require scrolling or take more time. There is no definitive advice as to which is preferable in a DDA context: short messages tend to be better refreshed, longer ones may benefit from scrolling if there is no natural break. If refreshed text is used, the guidelines below should be followed to ensure legibility by all users.

Do:	shorten messages to avoid the need to refresh
	ensure that each portion of refreshed text is left on screen for at least 10 seconds to allow adequate time for all users to read it
	ensure that the order of the words is the same as the order for the actions to be taken
	keep information simple using action instructions
	use familiar words where possible
	use a mixture of upper and lower case
	follow guidelines for font, colour etc given below for signage
	ensure that audio announcements are consistent with the information presented by the refreshed visual displays
	perform a trial to test that refreshing text is acceptable and readable by passengers, using a representative sample

Do not:	use flashing text, unless conditions are especially hazardous or abnormal
	use only capital letters

Scrolling text

Scrolling text is sometimes unavoidable where a message, destination or route is too long to fit on a display. However, dyslexic, visually impaired and cognitively impaired users may find it difficult to process information presented in this way. If scrolling text is necessary, the guidelines below should be followed to increase legibility. Many of these are the same as for refreshed messages.

Do:	shorten messages to avoid scrolling
	use discrete sentences with a single message in each sentence
	ensure that each complete word is displayed for a minimum of 2 seconds
	ensure that the horizontal scrolling speed does not exceed 6 characters per second
	ensure that the order of the words is the same as the order for the actions to be taken

Do:	keep information simple using action instructions
	use familiar words where possible
	scroll from right to left, following the natural reading style of a passenger
	use a scroll speed no more than half of what is natural for an able reader. Each vertical scrolling message should be held for a fixed time of 10 seconds before continuing to scroll. This allows sufficient time for someone with relatively poor reading ability to read about 20 words
	use a mixture of upper and lower case
	follow guidelines for font, colour etc given elsewhere in the document signage
	ensure that audio announcements are consistent with the information presented by scrolling visual displays
	perform a trial to test that scrolling text is acceptable and readable by passengers, using a representative sample

Do not:	use flashing text, unless conditions are especially hazardous or abnormal
	use only capital letters

Sign finish, contrast and borders

The finish, contrast and borders of the sign are important because they can affect users' ability to discriminate the information on the sign. Signs need to be made of materials which do not cause undue reflection or glare. The message should contrast with its background to ensure clarity and legibility. The borders should contrast with the colours and materials behind the sign so that the sign is immediately visible.

Do:	ensure that any display is able to display characters that contrast with the background
	ensure that characters have both colour and tonal contrast. For externally illuminated signs (including passive LCD) this should be achieved by a difference of 70-80 percentage points in reflectance, where possible. For self-illuminated signs (such as LEDs) the brightness ratio should be at least 5 (see Definitions in Section 10)

Do:	use amber, yellow or white lettering on a black/dark blue background: this is generally most clearly visible. Complementary colours (such as blues and yellows) contrast well in hue
	where lit, ensure that the luminance of the sign is great enough to make the information on the sign easily legible but not bright enough to cause glare
	keep the lighting flicker rate to less than 5 per second, to reduce the risk of triggering an episode in people with epilepsy
	ensure that the display casing, window and other internal surfaces have a matt, non-glare, anti-reflective finish – use a surface gloss factor of around 50% (see Definitions in Section 10)
	consider the background behind the sign when selecting sign or border colours – contrast the sign with its background, for prominence and ease of identification, aiming for the contrast between a wall and a sign panel of at least 70 percentage points (see Definitions in Section 10)
	ensure that background behind the signs have absorbent colours where practical
	provide additional lighting at shelters, stops and buildings where street lighting is insufficient

Do not:	use more than five colours
	use fluorescent lighting
	use red or green for information signs – these colours are normally associated with warning signs
	make the contrast on high resolution displays too high as this can trigger an episode in people with photosensitive epilepsy. The exact level is not known

Sign positioning, lighting and environment – in buses

Signs in buses should be positioned in the most obvious place so that a passenger is not required to search to find it. In general it should be facing the largest number of passengers possible and ideally more than one sign should be provided. Signs need to be well lit, but should not be positioned such that they cause glare. Again when choosing the colour and border for signs, it is important to take into account the materials behind the sign to ensure adequate contrast. Uniformity of illumination and contrast is also important to those with visual impairments.

For specific advice on external signs on buses please refer to PSVAR.

Do:	have the longest sight lines feasible
	position signs so that passengers can see them without turning round. Where seats face in more than one direction, it may be necessary to add in extra signs
	position signs with sufficient light for easy legibility
	ensure signs are illuminated evenly, either naturally or artificially
	shield screens from direct or reflected sunlight and artificial light sources
	ensure that the intensity of the display adjusts to lighting conditions where practical. Displays should be visible under day and night conditions
	ensure that artificial lighting is compatible with the electronic display
	position signs in a prominent position where it is obvious and logical to find a sign
	mount signs, especially larger ones, so that they are not hazardous to passengers
	locate signs and speakers in both upper and lower saloons
Do:	consider wheelchair users using a rear facing wheelchair space who would not be able to read the sign placed at the front of the bus
	take account of the colours and acoustic properties of environment, to ensure that they do not adversely affect those viewing/listening to information
	ensure that signs which are located on walls and have a colour which is similar to the background of the sign have a border which contrasts visually with the background of the sign. Ensure that the width of the border is large enough to ensure prominence

Do not:	position displays near or within the same field of view as light sources such that there is glare or deep shadows
	mount signs at points where vibration and movement impair ease of reading
	position signs within the same field of view as a light or such that the ambient light exceeds the level of illumination of the sign.

	Position signs such that they occlude any other required signage or important information, or interrupt the driver's line of sight
	position signs where excessive movement is required to read them
	position signs where they become an obstacle for passengers moving through the vehicle

Sign positioning and environment – at stops and shelters

Signs in shelters and at bus stops should be placed in an obvious position so that users do not need to search to find them. Signs should have as long sight lines as possible and may need to be angled. It may be advisable to provide signs at two heights for standing and wheelchair users. Signs should be well lit, but protected from direct sunlight or artificial light to avoid glare.

Do:	place signs in a prominent position
	position signs with sufficient light for easy legibility
	ensure signs are illuminated evenly, either naturally or artificially
	shield screens from direct or reflected sunlight and artificial light sources to avoid both glare and veiling reflections which can reduce the contrast between the text and the background
Do:	ensure that the intensity of the display adjusts to lighting conditions where practical. Displays should be visible under day and night conditions
	ensure that artificial lighting is compatible with the electronic display
	place signs perpendicular to the pathway
	incorporate a warning bar (or equivalent) beneath the kiosk or terminal so that blind or partially sighted people are made aware of a possible collision hazard
	locate signs consistently
	ensure signs have the longest sight lines possible
	maintain a minimum headroom of signs suspended over a pedestrian area of 2100mm from the ground if practical
	locate signs within shelters at the closed end of the shelter
	provide low level screens where suspended displays are used

	place signs on wall in preference to suspending signs if possible
	consider mounting sings on a wall at two heights – between 1400mm and 1700mm for the higher and between 1000mm and 1100mm for the lower – so that the lower sign is viewable from eye level from a wheelchair
	orient the sign as close to perpendicular to the line of sight as possible. Higher mounted signs will need to be inclined further from the vertical than lower mounted signs
	bear in mind that viewing angles for signs mounted on walls or other vertical surfaces will have limitations in lateral and vertical viewing
	avoid advertising media on the RTI sign. A separate area should be provided

Do not:	allow poles for signs to obstruct routes, for example the entrance to the shelter. Flag poles should be positioned at the back of the footway as near to the property line as possible
	permit any hanging elements below a height of 2100mm

4. Information Points, Kiosks and Ticket Machines

General

A wide variety of passenger facing technologies are now available. Many of these are screen based, using either keyboard or touchscreen as the interface with passengers. How to make these technologies most accessible to people with disabilities needs to be considered. This section covers interactive screen technologies including information points, kiosks and ticket machines.

Many passengers with sight or dexterity issues will still struggle to interact with ticket machines. Where possible provide an alternative method for ticket purchase which involves human contact, preferably on the bus. Emerging smart technologies such as tickets bought in advance and held on a phone, or ticketing using smart card or bank card, may be an alternative.

Do:	ensure that where tickets can be purchased from the driver, signage at ticket machines clearly indicate this
	ensure the operation face of the machine, which is touch sensitive, is no more than 1.2m from ground level
	ensure that all kiosks, terminals and ticket machines are placed so that they are detectable by a long cane user
	ensure that cantilevered items fitted below a height of 2100mm which protrude by more than 150mm shall be indicated by an obstacle (tapping rail) at a maximum height of 300mm that can be detected by a visually impaired person using a long cane
	ensure that the cabinet in which the screen is placed has a foot and knee recess so that wheelchair users can access it
	incorporate a warning bar (or equivalent) beneath the kiosk or terminal so that blind or partially sighted people are made aware of a possible collision hazard
	ensure the screen is flush with the front surface of the terminal casing and not recessed into it
	ensure that the lowest height of any operable part of the user interface is not less than 0.7 metres
	reduce the effect of parallax by careful position on the screen of interactive icons and symbols in relation to the viewing angle (see Definitions in Section 10)

Do:	place lines on the user-interface leading from the key to the surface of the display to alleviate the problem with parallax (see Definitions in Section 10)
	ensure that the textual display follows the guidelines for other on-screen technologies including clarity, contrast and legibility.
	ensure that the typeface is at least 16 point and its weight is either medium or bold
	ensure that illumination on the interactive portion of the terminal is at least 200 lux, regardless of whether it is natural or artificial light
	avoid the use of red/pink and green together as these can cause difficulties for people with colour blindness who will not distinguish between them
	consider contactless devices (i.e. devices which do not need to be inserted into a slot or touched to a “target” area) which are able to trigger an audible signal from the terminal at a distance of a few metres
	use the telephone layout (rather than the calculator layout), with a single raised dot on the 5 for keypads on public access terminals (see Definitions in Section 10)
	provide a tactile help button at the side of a screen if possible to summon personal assistance for passengers having problems using the screen

Do not:	position information points, ticket machines or kiosks such that natural or artificial lighting can cause glare or reflections
	place terminals, kiosks or ticket machines such that they cause a hazard to passengers

Terminals that use Credit Cards, Bank Cards or Smart Cards

Some terminals may have a card facility. These may be used either as a payment device, an access device, a triggering device (see section 4) or as a way of storing user preferences. Whatever the purpose of the card, it can be difficult for those with visual or physical disabilities to identify the card, to orient it correctly and to insert it into a small slot. Bear in mind that only 2% of visually impaired people can read Braille, so the addition of information in Braille may not reach the majority of blind or partially sighted passengers.

Do:	emboss cards to help the user select the correct card for the correct use
	consider a smartcard which holds the users preferences such as increasing font size or triggering audio assistance, in line with the EN1332-4 standard
	where cards are used, consider a contactless card, ideally usable at a distance of up to 10cm, to avoid passengers needing to insert the card into a small slot
	place contactless readers prominently where they are easy to locate by touch
	Ensure contactless readers contrast with the surrounding background and that they emit an audible sound when contact has been made
	ensure smartcards have a 2mm notch on the trailing edge to help identify the direction for insertion if the card is not contactless
	where non-contactless cards are used, consider designing the entrance to the card reader to act as a funnel to guide the card in correctly
	ensure that for retrieval, a card will protrude at least 2 cm from the slot surround
	ensure that the force required to retrieve the card from the slot is no greater than is necessary to prevent the card from falling out
	where a PIN is required, ensure that an ✖ or ✓appears on the screen to indicate that a number has been entered
	where a PIN is required ensure that the keypad can be accessed by people with poor dexterity and is designed to be accessible to blind and partially sighted people (see Keypads, below)
	where a PIN is required, ensure that the user has plenty of time before the machine times them out
	PINs can be a problem for dyslexic or cognitively impaired users: consider the use of biometric identification methods

Touchscreens

Touchscreens are increasingly used to obviate the need for a keypad, by incorporating the interactive elements on the screen itself. However, the positioning of the screen will be extremely important if the problem of parallax is to be avoided. Indeed, the best solution may be to have two separate screens: one for wheelchair users and one for standing users.

Do:	ensure the height of active areas are between 700mm and 1200mm
	ensure the screen is perpendicular to the line of sight to avoid parallax problems (see Definitions in Section 10)
	ensure that graphical symbols (such as icons) are accompanied by text
	ensure that screens with text have the option to increase the size of the font
	ensure that key fields are as large as possible and separated by a ”dead area”
	ensure that there is a high contrast between touch areas, text and background colour
	consider providing a speech out-put facility triggered either by touching the screen in a designated place or by a smart card

Keypads

It is essential to ensure consistency in the layout of keypads for blind and partially sighted people. Because it is difficult to provide a touchscreen at a height which will be appropriate both for standing users and wheelchair users, it is a good idea to have the option of a keypad to avoid the problem of parallax.

Do:	use the telephone layout (rather than the calculator layout), with a single raised dot on the 5 for keypads on public access terminals
	use a type face for numeric keypads with an open shape and at least 4mm high. A closed shape makes it more difficult to distinguish numbers such as 3 and 8
	ensure a good contrast between the typeface and the colour of the keys

Do:	ensure that all keys are tactually discernible and raised by at least 2mm. Recessed keys can be difficult for people with arthritic conditions and others with poor manual dexterity
	provide tactile feedback (“snap action”) when buttons are depressed (see Definitions in Section 10)
	ensure operating buttons are at least 20mm in diameter
	ensure that the edges of the keys are at least 2.5mm apart
	ensure colour-coded function keys follow this pattern: red for *cancel;* yellow for *clear,* green for *proceed/continue/accept*
	consider having function keys in different shapes to aid those with colour blindness distinguishing between them
	position function keys to the right of the numeric pad to ensure that they are not accidentally pressed when the numeric pad is used
	where function keys are arranged horizontally, position the *cancel* farthest to the left, followed by *clear* in the middle then *proceed/continue/accept* furthest to the right
	where function keys are arranged vertically, position the *cancel* at the top, the *clear* in the middle and the *proceed/continue/accept* at the bottom
	illuminate the keypad internally while it is awaiting input from the user
	use sound or tactile feedback to help users to know when they have depressed a button

5. Guidelines for audible assistance systems

Provision of audible information, messages and announcements

Visual information should be presented in audible form where possible. Audible messages can be critical for some users who may not be able to access the information any other way. Information should be as clear and concise as possible. All audio information should be provided with enough time for passengers to act on the information and where possible should be repeated. Bear in mind that the triggering distances on buses will vary depending on the distances between stops.

Where possible, an audio message should correspond to the visual message being displayed. As with the visual message it is important to complete one message, before starting another. In general, messages should not be interrupted or they may cause confusion. However, there are circumstances where it may be necessary to interrupt a message, for instance during an emergency. A policy should be developed to address this. However, users who have individual audio systems will want to be able to trigger the message to repeat or interrupt.

Audio announcements are particularly useful to give emergency or safety information to all passengers. Bear in mind that passengers with hearing loss may struggle to get information if it is only available in audio format. It is, therefore, important to ensure that all audio information is delivered with safety in mind. In particular, ensuring voice intelligibility will be crucial for ensuring that messages are understood. Intelligibility is often best achieved by increasing the number of speakers and reducing the volume.

General

Do:	ensure that the audio information is available throughout the bus
	provide the most critical visual information in audible form, especially when the time between bus stops is limited. The most important information is details of the next stop including accessibility information (for example, whether the stop is wheelchair friendly or not)
	repeat the route number and final destination in audio announcements
	trigger audio announcements with time for passengers to prepare

Do:	ensure that messages across a route or region follow a consistent pattern of delivery. This helps passengers to hear the information that is relevant to them and ignore what is not.
	ensure that where service disruption (eg bus diversion, delay or curtailment) renders standard information incorrect, it should be removed.
	include where possible current stop, next stop and destination with each on-bus audio announcement, both in the approach to and when at a stop (in some circumstances the proximity of stops may make this impractical)
	ensure that speakers are designed to transmit speech such that at least 80% of words and 95% of sentences are intelligible by an average hearer (CIS 0.7 or STI/RASTI 0.5) (see Definitions in Section 10)
	bear in mind that intelligibility will be influenced by environmental conditions such as carpeting and furnishings
	ensure that speakers are installed and maintained correctly to avoid distortions which may reduce intelligibility
	ensure that the speed at which the announcement is spoken is at normal speaking speed to aid intelligibility
	ensure that separate messages are distinct from one another to avoid confusion
	use familiar words, where possible
	use local pronunciations
	sound a chime before any important new audio announcement is made.
	present messages in the same type of order
	present instructions for complex messages in the order in which they need to be completed
	bear in mind the needs of those with hearing impairments who will require at least +5dB S/N ratio (the difference in decibels (dB) between signal and ambient noise)
	operate audible alarms (eg safety notice) at least 15dB over the prevailing sound level, without exceeding a safe maximum. Up to 120dB may be used in open spaces; the confined space of a bus will require a lower sound level

Do:	make next stop information announcements audible to passengers who are either boarding or alighting
	ensure that at-stop audio announcements inform waiting passengers of when the bus is due **and** when it has arrived
	develop a policy on what local attractions and points of interest to announce at stops
	repeat spoken information at least once wherever practical. A ‘repeat’ function may be used for systems which give a personal message to the user via a personal receiver

.

Do not:	use abbreviations
	sound chimes too frequently, eg before every stop, as this causes nuisance to passengers
	provide schedule information
	interrupt messages as this may generate confusion – except where an emergency message is required instantly
	continue to use standard announcements if they are no longer correct during service disruptions
	use advertising within your announcements which could detract from key audible information

Audio systems

Audio systems should be designed so that they are audible to all passengers throughout the bus. They should take into account background noise and be loud enough to be heard above it, but not so loud as to cause a nuisance. Where possible, passengers should be able to trigger the audio systems particularly where there is a lot of background noise.

There are a number of unresearched issues relating to good practice for audio systems, and there is therefore no definitive advice available on (for example) the ideal absolute volume for announcements.

On-vehicle

Do:	synchronise audible and visual information systems such that all visual information remains displayed until the audio message is complete where possible
	make audio announcements with sufficient time for the passenger to get off the bus. A trigger distance of 200-300 metres before the stop will typically be appropriate in a rural location, and 150-200 metres in an urban location
	use an audio frequency range of 300Hz-3000Hz
	consider the likely level of vehicle and background noise in designing audio announcement systems. Ensure that announcements are 10dB above the ambient noise
	install audio systems that can be triggered by users where appropriate in bus stops and buildings. Triggered systems are recommended where there is a large amount of background noise
	ensure that all speech is as natural and consistent as possible
	use a consistent voice for ‘normal messages’. During emergencies or unusual situations the message should be given in a different voice or with a tonal warning to attract attention
	place multiple speakers on throughout of the bus or at intervals to achieve appropriate levels of audibility and intelligibility throughout the bus
	use artificial lighting which is compatible with the radio frequency installation
	perform a trial to test acceptability to passengers before implementing audio announcement
	provide tactile markings in the floor or on infrastructural elements near sensors for audible systems

Do not:	have sound levels too high, unexpected, unknown or ramped too quickly. Otherwise this could prompt a startle reflex or defensive reactions in drivers

At-stop and in buildings

Do:	synchronise audible and visual information systems such that all visual information is left until the audio message is complete where possible.
	use an audio frequency range of 300Hz-3000Hz
	use triggered messages in preference to continuous messages to avoid passenger confusion
	ensure that announcements are 10dB above the ambient noise
	ensure that announcements at bus stops/interchanges make clear the route number **and** destination of the bus, particularly where more than one bus route uses a stop
	install audio systems that can be triggered by users where appropriate in bus stops and buildings. Triggered systems are recommended where there is a large amount of background noise
	ensure that all speech is as natural and consistent as possible
	use a consistent voice for ‘normal messages’
	use a different voice or a tonal warning to attract attention or during emergencies or unusual situations
	use triggered messages in preference to continuous messages to avoid passenger confusion
	consider the likely level of vehicle and background noise in designing audio announcement systems. These may still be considered a noise nuisance by people living close to a bus stop, so a balance should be sought
	consider the acoustic environment in buildings and use absorbent materials where practical to avoid echo.
	use artificial lighting which is compatible with the radio frequency installation
	perform a trial to test acceptability to passengers as well as to those who live and work nearby before implementing audio announcement
	provide tactile markings in the floor or on infrastructural elements near sensors for audible systems
	provide the information that a bus stop is raised in an audible message rather than by providing a tactile surface. (See section 6 Guidelines for tactile assistance systems)

Do not:	overload the auditory channel which may confuse or annoy passengers and staff. Only include critical information
	use startling responses or high intensity signals

Hearing enhancement

Hearing enhancement systems (induction loops, infrared or radio transmission) can help to make audio announcements more accessible to hard of hearing passengers by mitigating the effects of distance from the sounds source, ambient noise and reverberation. They will also benefit blind or partially sighted passengers to access information via a trigger on their personal audio devices at their own convenience and without causing nuisance to other passengers.

Do:	indicate the presence of such systems clearly by the standard symbol. The same symbol should be shown on signs or instructions associated with the system
	link audible systems to induction loops
	use induction systems in preference to infrared systems
	consider the provision of a permanent induction loop system in terminals and buildings; a portable loop is sufficient at a bus stop or shelter
	test induction loops and infrared systems regularly
	ensure that induction loop systems conform to BS 7594 and BS EN 60118-4
	site induction loops so as not to interfere with visual display units, fluorescent lights or other electrical equipment
	ensure that the beam width of a transmitter (talking sign) is 24º and the range is between 3.1m and 18m
	ensure that the base frequency of pre-recorded speech to be heard via a receiver is 250 Hz
	consider provision of a headphone socket for private speech output
	ensure that induction loops are placed to avoid interference with other audio/visual equipment
	consider privately audible announcements

Triggering audio assistance with Keyfobs or Smart Devices

People requiring audio assistance often have personal transmitters to access information. If a system is provided which can be triggered by these transmitters, either to send information messages or to make audio announcements, this will allow users to access information at their own convenience and without causing nuisance to other passengers.

A keyfob is a small handheld device which triggers an audio announcement via short range radio waves at a distance of between 5 and 8 meters. Some Local Authorities make keyfobs available to passengers. Because the device activates the audio unit when it is within range the audio message, it is only triggered when required.

Smart devices can now be used instead of fobs on installation of an app or background Bluetooth service. These can perform the same function as a fob, but are only useful to those with smartphones. They also offer the opportunity for improved personalisation.

Do:	ensure that it is possible to adjust the volume, initiate a message or repeat a message
	ensure that the ability to interrupt a message is only available to users with personal listening devices to avoid confusion to other passengers
	provide means for confirmation of information, for example a sound that confirms the trigger has been registered by the sensor
	position trigger points and speakers so that passengers do not block entrances to the bus stop when using them
	provide tactile markings in the floor near sensors for audio triggers
	consider which triggering mechanisms are being used by other (especially neighbouring) authorities, to avoid the need for passengers to carry multiple devices for triggering audio assistance in different areas

Triggering Audio Assistance with Smartcards

A smart card is a passive device, the size of a credit card, which incorporates an electronic chip. Smartcards can be used for a variety of different, and sometimes multiple, applications: prepaid cards, access cards, record storage, user preferences and audio trigger. Smart cards can also be used at a variety of distances from the interface: contact (where the card must touch), at a distance of approximately 10cm (proximity cards), at a distance between 10cm and 2m (vicinity cards) or at a distance greater than 2m (distant contactless).

Do:	ensure that it is possible to adjust the volume, initiate a message, repeat a message and interrupt a message according to the needs of the user
	provide means for confirmation of information, for example a sound confirms the card has been registered by the sensor
	store information on the preferred user interface including size and colour of text on a screen, audio output, audio amplification, language, and interface complexity level
	position trigger points and speakers so that passengers do not block entrances to the bus stop when using them
	smartcards should have a 2mm notch on the trailing edge to help identify the direction for insertion if the card is not contactless
	emboss smartcards to help the user select the correct card for the correct use
	ensure that on-bus readers are positioned between 1000mm and 1200mm above the adjacent floor level
	ensure that a cab mounted reader should be at an angle of between 17 and 22 degrees, relative to the centreline of the bus, and directed to the rear of the bus
	ensure that the “target” where the smartcard needs to be held to be read is clearly visible and easily located
	provide tactile markings in the floor near sensors for audio triggers

Providing Audio Assistance on Personalised Devices

Increasingly, people are accessing information through personal devices. Smart phones provide access to apps, mobile web and wayfinding information, for instance. Information providers can also provide greater detail in their messages. Earphones offer the opportunity for people to access their information in audio format, but privately. Passengers can request for information to be repeated as frequently as they desire without fear of disturbing other passengers.

However, all critical information – next stop, emergency information and destination information – should be available to all passengers regardless of their ability to access from a personal device.

Audio announcements can also be triggered using such devices. The service should be embedded in any apps that are commissioned.

Do:	pay special attention to the potential implications of privacy regulation in any service which entails that receipt or holding of personal information

Synthesised speech

Synthesised speech has developed dramatically over recent years and is acceptable to use in audio systems. The voice used should be as natural as possible. Generally this is best achieved using Concatenative Synthesis rather than Formant Synthesis. Concatenative Synthesis strings together segments of pre-recorded human speech. This tends to produce the most “natural” sounding speech which has the expected inflections. Formant Synthesis creates the sounds artificially using mathematical acoustic modelling to generate speech-like sounds. This tends to produce more robotic sounding messages.

There is no firm guidance on whether a male or female voice is more acceptable: a male voice has a lower frequency which may be audible to passengers with hearing impairments and a female voice has a higher frequency which can be heard more easily above ambient noise. Some research on the gender of a voice has suggested that males are often rated higher on influence, persuasiveness, and authority, while female voices are rated as more friendly, pleasant and helpful. It may be useful therefore to use different voices for different types of messages.

Do:	make the voice as natural as possible. The voice should sound as much like a human speaking and as little like a machine as possible
	intelligibility should override naturalness if a compromise must be made
	consider using a voice with a local accent
	ensure that warnings and alarms sound different from normal announcement and are more assertive
	include inflection in the voice where possible as this will aid intelligibility. In particular, it will help listeners to know when a sentence or instruction is complete
	deliver messages at a speed which approximates normal speaking speeds. Fine tune this by doing trials with a range of listeners
	follow guidelines relating to the auditory properties for audio announcements
	follow guidelines relating to information content strictly
	perform a trial to test if synthesised speech is acceptable and understood by passengers using a representative sample

6. Guidelines for tactile assistance

Dynamic Tactile Systems

Dynamic Tactile systems are electro-mechanical systems for presenting changing information via a touch panel. Examples are actuated pin arrays for representing Braille characters.

It is considered that currently available dynamic tactile systems are not suitable for the provision of real time information.

Fixed Tactile Signage

Fixed tactile signs are helpful to visually impaired people to locate a route, a hazard or a facility. Fixed tactile signs are signs whose lettering or graphic has been raised or embossed to allow visually impaired people to trace letters and shapes with their fingers to supplement visual information. Some tactile signs also incorporate Braille to convey information. It is important to recognise that tactile reading is not like visual reading and so the signs should not be constructed with visual skills in mind. People extract information from tactile graphics in pieces which are as much as the fingers can feel at one time. From this a mental image is built up. (In visual reading a person looks at the whole picture and then reads the detail.)

Do:	ensure consistency in tactile graphics used
	ensure that each symbol has more than one critical feature to differentiate it from other symbols
	use colour to supplement information conveyed by the graphic
	include orientation points on the diagram
	ensure different levels of relief are clearly distinguishable

Do not:	use excessive detail – this may be difficult to comprehend
	make graphics too small – details may be difficult to discern
Do not:	make graphics too large – it may be difficult to understand them as a whole

7. Web services

Introduction

It is becoming more and more common for authorities and operators to embed real time information in their own websites, rather than providing a bespoke page via an RTI service provider. It is also becoming more common for owners of information to provide an API (open or other) so that third parties can access the data needed to present the information.

In this environment, it is particularly important to ensure that the RTI feed is accurate and consistent with other methods of presenting the data. The information provided also needs to be consistent with those other methods, rather than a simple re-presentation of it. It is therefore important to ensure that the same predictions are used across the system, including the web and any apps. Naturally this may not be possible with third-party tools.

Generally the following standards should be applied.

Information provision via websites

Conformance to the World Wide Web Consortium (W3C) accessibility guidelines to the AA threshold is acceptable for the provision of Real Time Information via web services. The WC3 prioritise their accessibility recommendations into 3 groups:

- Priority 1 (content that web developers must satisfy);
- Priority 2 (content that a web developer should satisfy);
- Priority 3 (content a web developer may satisfy).

Websites are awarded one of three levels of compliance, depending which of these priorities are met:

- level A conformity has been met, if a website has implemented all Priority 1 recommendations;
- level AA (double-A) conformity has been met if a website has implemented all Priority 1 and Priority 2 recommendations;
- and level AAA (triple-A) A conformity has been met, if a website has implemented all Priority 1, 2 and 3 recommendations.

The following points provide a basis for ensuring compliance.

Do:	design and create websites with current and future assistive technologies in mind
	ensure that the same source predictions are being used across the system
	provide text alternatives for any non-text content so that it can be changed into other formats people need, such as large print, Braille, speech, symbols or simpler language
	ensure information on the web and on other systems is consistent
	use high contrast colours, preferably a dark colour on a light background. Bear in mind that dyslexic people prefer a cream or pale yellow background
	use colour as a visual aid, but do not make it the only way information is conveyed
	label all navigation links clearly
	ensure help pages have an ‘accessibility help’ section
	make all functionality available from a keyboard, as far as possible
	ensure that audio and journey assistance on personalised devices complements and does not interrupt other apps
	ensure users can change font style, font size, background colour and font colour
	use headings and lists which are consistent across all pages of the website
	ensure that the purpose of any paragraphs and tables is clearly stated to help navigation for those using assistive technologies
	assess websites for their compliance with accessibility guidelines and best practice. Ideally users with impairments should also trial the design of the website
	avoid the use of pink and green as this can be difficult for travellers with colour blindness
	use graphics to break up large areas of text, but avoid using large graphics which make the page harder to read
	allow users sufficient time to read and/or use content
	consider how the website will be used by mobile phone users. A separate mobile web version of website may be required

Do:	ensure that for all content which is moving, blinking, scrolling or auto-updating there is a mechanism to pause, stop or hide the content unless it is essential

Do not:	use distracting images
	use pop-up windows
	use flashing text or images
	design content in a way known to cause seizures

There is an extensive range of organisations which evaluate the accessibility of websites. The majority of these assessments are based on compliance with W3C guidelines:

Websites that assess the accessibility of websites free of charge include:

- AChecker, developed by the University of Toronto and The Trace Research and Development Centre, checks webpages for barriers to accessibility and is based on the W3C, guidelines and Italian Stanca act; http://achecker.ca/checker/index.php.
- 'Cynthia Says' identifies errors related to Section 508 standards and the W3C guidelines; http://www.cynthiasays.com.
- TAW tests accessibility of a page or a website. It is based on W3C guidelines and identifies the level of priority that each of the problems identified should be dealt with; http://www.tawdis.net/ingles.html?lang=en.
- The W3C Html Validation Service checks websites for compliance with W3C guidelines; http://validator.w3.org.
- WAVE, created by WebAIM, is a simple webpage accessibility evaluation tool; http://wave.webaim.org/.
- Some Adobe Add-ons will check specific aspects of accessibility. These include: Check Contrast Ratio https://creative.adobe.com/addons/products/12170#.WRLhyWeGOAg which checks the foreground and background colours to determine whether or not there is enough contrast to be distinguished by people with visual impairments.

Websites that charge for the assessment of websites include:

- Deque provides assessments, remediation, training and certification for websites at all stages of design and development. https://www.deque.com/services/ .
- Powermapper is a website tool that tests various aspects of a website, including accessibility based on W3C, WCAG2 and Section 508 guidelines; http://www.powermapper.com/products/sortsite/.
- Rational Policy Tester® Accessibility Edition belongs to IBM, performs a series of tests to determine the ways in which a website is compliant with government accessibility standards. To access this you will need to set up an account with IBM.

Many more website and webpage accessibility checker and evaluator can be found through this link: http://www.w3.org/WAI/RC/tools/complete

Guidance on how to evaluate websites manually can be found in:

- CSS Analyser provides a checklist of requirements to fulfil in order to comply with W3C guidelines. Information provision via mobile phones; http://juicystudio.com/services/csstest.php.

8. Mobile Services

It is becoming more and more common for operators to provide real time in their own apps, rather than the authority providing an app via their RTI provider. It is also becoming more common for an RTI provider or an Authority to provide an API (open or other) so that third parties can access the data needed to present the information via mobile devices.

This means that the emphasis for the RTI professional moves to ensuring that the RTI feed is accurate and consistent with other methods of presenting the data, and that the information is provided to be consistent with those other methods, rather than presentation of it. The choice of whether a data license specifies accuracy and efficacy of app//services or whether the market is left to sort the good from the bad is a political decision, but either way instructions should be provided to the data user on what is expected from them.

Where an RTI provider is required to produce their own app, it should aim to comply with guidance available from relevant passenger groups and disability groups (for example RNIB and Guide Dogs).

Most mobile operating systems provide their own accessibility features, and use of these should be optimised.

Do:	design and create services with assistive technologies in mind – ensure that all essential information can be accessed via text-to-speech tools and use the tactile and alert features of the operating system (vibrate button click etc)
	ensure information on the API/app and on other systems is consistent
	if developing your own app, use high contrast colours, preferably a dark colour on a light background. Bear in mind that dyslexic people prefer a cream or pale yellow background
	use colour as a visual aid, but do not make it the only way information is conveyed
	use alternative text for an image to allow the content of images to be relayed by way of speech
	label all navigation links clearly
:	use push notifications, but with options to switch off certain types of advice
	use the Needs database where possible

Do	design the service to complement other activities on the device, not interrupt them.
	ensure users can change font style, font size, background colour and font colour, preferably automatically based on pre-configured needs
	ensure the service/app is used for the clearly defined purpose of assisting travel
	avoid the use of pink and green as this can be difficult for travellers with colour blindness
	make it simple to use and involve users in the design
	provide separate mobile and web services

Do not:	use distracting images
	use pop-up windows
	use flashing text or images
	use moving text

9. APIs

Provision of an API is becoming a more common method of providing information to passengers, through the services of third parties. Third party services may be subject to design and usage conditions, or may be uncontrolled and free to use the data in whatever way suits them.

Where it is used, a limited element of control can be achieved by using a suitable licence, either on a class licence basis (ie users implicitly agree to the conditions) or on a specific licence basis (if there is an explicit arrangement between information owner and service provider).

Licence conditions can be used to encourage developers to include accessible features in their apps, or to build alternative/specialist apps for particular disability groups.

The choice of control approach will depend on the provider's attitude to risk, innovation and the market. It may be helpful to actively promote 'approved' apps that deliver certain features, including accessibility features such as a Bluetooth triggering service.

In either case, the API provider has likely to have reduced control on the presentation of the information, and will need to focus more on specifying the accuracy, completeness and consistency of the outputs across output channels (see 'end to end'). However, it may be beneficial to specify some elements of presentation – for example, how to deal with emergency messaging and where that information should come from.

Many users accessing these third party services will be using other methods to access the information too (such as roadside signs). Therefore, the consistency of aspects such as the difference between real time and timetable is essential (see Presentation/Information hierarchy).

10. Definitions

Sans Serif Fonts

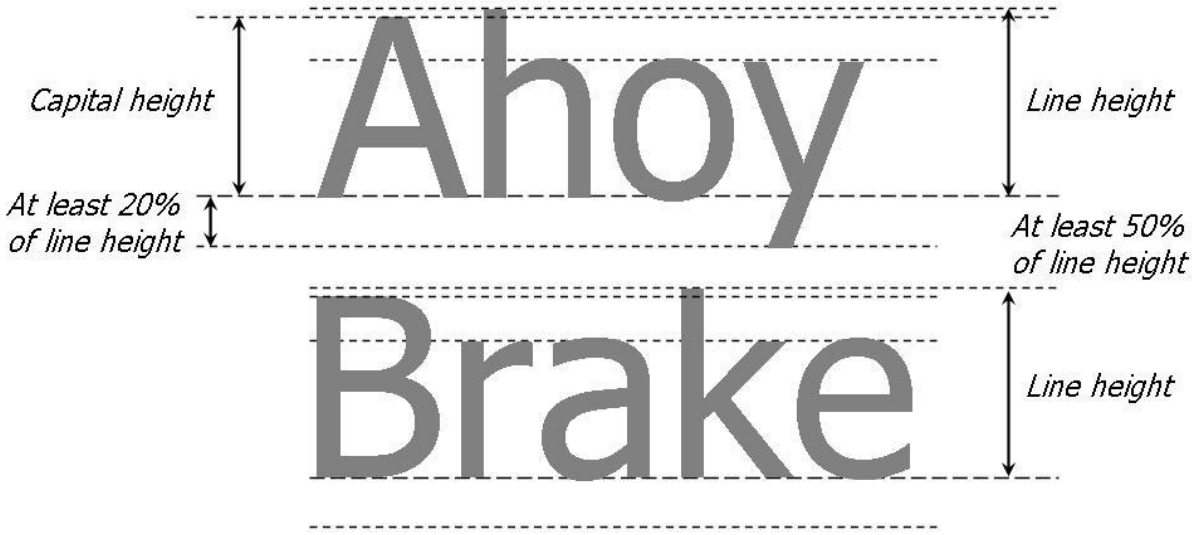
A sans serif font is one that does not have the small feature called “serifs” at the end of strokes. Pixelation makes sans-serif fonts appear cleaner than serif fonts and they are therefore widely used for on-screen text. Common sans serif fonts include: Arial, Helvetica, Johnston, New Johnston, Rail Alphabet, Transport Heavy and Medium, Lucida, Gill Sans, Futura, Folio.

Be aware that in some sans-serif fonts capital “I” and lower case “l” will appear exactly identical (eg Arial).

Line spacing and descenders

The spacing between lines should be 50% of the line height. The diagram below indicates what is meant by “line height” and from where the measurement of 50% should be taken.

Descenders should be “true”, ie fall below the bottom of non-descended characters, and descender depth should be at least 20% of line height. (NB for most fonts the difference between capital height and line height is insignificant.)



Contrast (externally illuminated signs)

Visual contrast is defined as the difference in Light Reflectance Value (LRV) between two contiguous surfaces. Light Reflectance Value is measure on a scale of 0 to 100. 0 corresponds to black, where there is total light absorption, and white corresponds to 100, where there is total light reflection. In most circumstances, a difference between the LRVs of neighbouring areas of 30 is considered adequate contrast. However, research suggests that signs are more legible for visually impaired people when characters contrast with their background with an LRV difference of at least 70.

A simple formula for Visual Contrast is given below:

$$\text{Visual Contrast} = [(B1-B2)/B1] \times 100\ \%$$

where B1 is LRV of the lighter area
and B2 is LRV of the darker area

LRV, and therefore contrast, is independent of the intensity of the illumination, though will vary with its colour; normally it will be referred to white light.

Contrast (self-illuminated signs)

The appearance of a self-illuminated sign depends primarily on the luminosity (and colour) of different areas of display surface. The *maximum* contrast ratio of many screen technologies (CRT, TFT, plasma, and even LCD) may be 1000 or more. For these technologies image contrast is largely under the control of display firmware/software. In practice it may be preferred not to make “dark” areas too black, as this (a) does not allow for use of colour and (b) is not ideal for many dyslexic readers (see main text).

LED-based signs are almost always clearly pixel based, with individual pixels on or off. There is therefore much less opportunity for sophisticated image control with such signs.

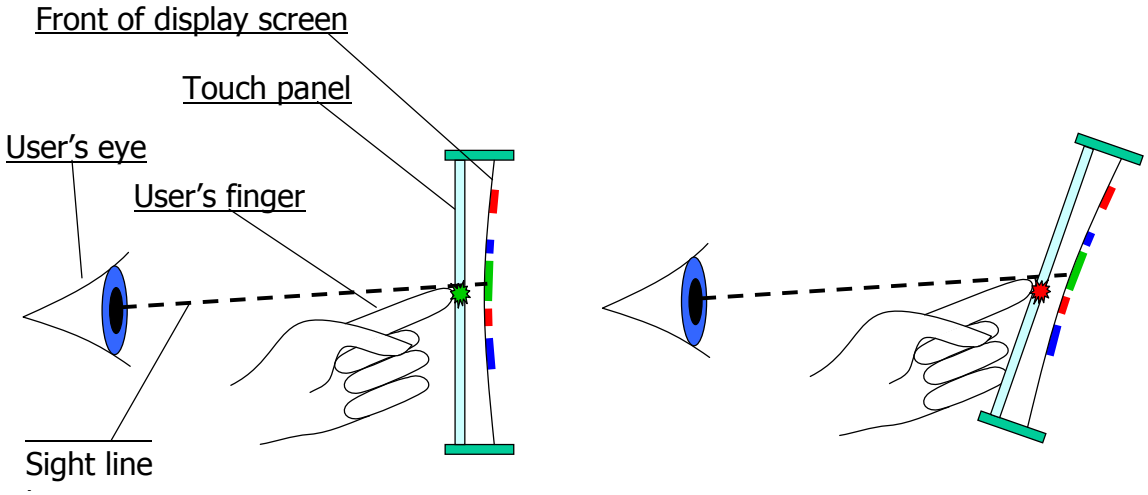
NB The admixture of reflected light (i.e. glare) also impacts on total perceptual contrast.

Surface Gloss Factor

Gloss factor is a measurement of the proportion of reflected light returned at the incident angle, and is expressed as a percentage. This is usually measured using a proprietary Gloss Meter. Sign manufacturers should be able to state the gloss factor for their signs, both new and after time.

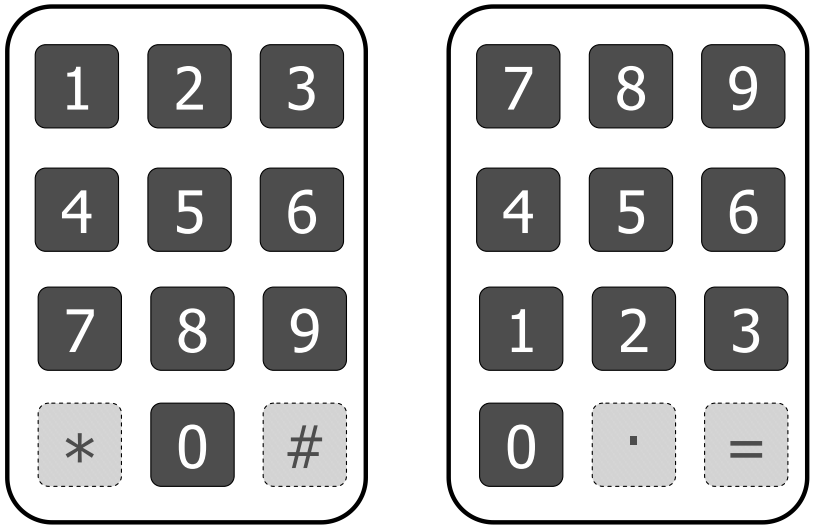
Parallax

Parallax is the perceived shift of an object against a background caused by the change in position of the observer. Below is a diagram showing the effect of the change of an observer position on the perceived position of an object. In the first diagram, the user sees the green button as intended. In the second diagram, however, the user now perceives the button to be below the actual green button and as a result, presses the red button.



Number Keyboard Layouts

It is important to have consistency in the use of keypads for partially sighted and blind users. Keypads come in two standards, the telephone layout and the calculator layout. It is preferable to use the telephone layout for greatest accessibility: most users will be familiar with the telephone layout from everyday use.



Telephone Layout **Calculator Layout**

Snap Action

“Snap action” is defined as “a gradual increase followed by a sharp decrease in force required to actuate the key, and a subsequent increase in force beyond this point for cushioning”. It is recommended that the force changes from 0.25N to 1.5N (28g to 142g).

Intelligibility

Intelligibility is the measure of the proportion of the content of a speech message that can be correctly understood. However this is difficult to quantify and measurements tend to assume that the speaker has an average tone of voice and speaks at a normal speed and that the listener has average hearing, cognitive skills and fluency in the language being spoken. If either the speaker or listener deviates from the “average” the intelligibility of that individual communication may be affected, independently of the technology.

BS EN 60849 “Sound systems for emergency purposes” suggests a rating of 0.7 on the Common Intelligibility Scale (CIS) for adequate intelligibility, equivalent to 0.5 on the Speech Transmission Index (STI). Although these are objective measures of intelligibility they refer to “perfect” situations and are difficult to translate into a space as complicated as a moving vehicle with variable background noise. Perhaps the best advice is to test any speech-to-text system *in situ* to ascertain the acceptability to passengers.

11. Further reading

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Appendix A –Legal Excerpts

For your convenience, we have provided here quotes from the relevant legislation as well as where they can be found in Act, Regulation or Code. These provide highlights of a few key points only.

REGULATION (EU) No 181/2011 concerning the rights of passengers in bus and coach transport and amending Regulation (EC) No 2006/2004

> **Rights of bus and coach passengers should include the receipt of information regarding the service before and during the journey. All essential information provided to bus and coach passengers should also be provided, upon request, in alternative formats accessible to disabled persons and persons with reduced mobility, such as large print, plain language, Braille, electronic communications that can be accessed with adaptive technology, or audio tapes.**
>
> *Source: Preamble 14*

> **Carriers and terminal managing bodies shall, within their respective areas of competence, provide passengers with adequate information throughout their travel. Where feasible, this information shall be provided in accessible formats upon request.**
>
> *Source: Chapter V, Article 24.*

Caveat:

> **Nothing in this Regulation shall be understood as conflicting with or introducing additional requirements to those in current legislation on technical requirements for buses or coaches or infrastructure or equipment at bus stops and terminals.**
>
> *Source: Chapter 1, Article 2, paragraph 7.*

The Equality Act 2010

(2) The duty [to make reasonable adjustments] comprises the following three requirements:

(3) ...where a provision, criterion or practice...puts a disabled person at a substantial disadvantage...in comparison with persons who are not disabled, to take such steps as it is reasonable to have to take to avoid the disadvantage;

(4) ...where a physical feature puts a disabled person at a substantial disadvantage...in comparison with persons who are not disabled, to take such steps as it is reasonable to have to take to avoid the disadvantage;

(5) ...where a disabled would, but for the provision of an auxiliary aid be put at a substantial disadvantage... in comparison with persons who are not disabled, to take such steps as it is reasonable to have to take to avoid the disadvantage.

Source: Equality Act 2010 Section 20

The Transport Acts: Transport Act 2000 as amended by the Local Transport Act 2008 (where applicable)

In developing and implementing their policies under section 108(1) and their bus strategy, a local authority must have regard to the transport needs of disabled persons (within the meaning of the Disability Discrimination Act 1995) and of persons who are elderly or have mobility problems

Source: Local Transport Act 2008, 11(2)(a-b)

Code of Practice: Rights of Access: services to the public, public authority functions and private clubs and premises

Transport providers have a duty to the public under Part 3 of the Act to avoid discrimination against disabled people, and to make reasonable adjustments for them, in respect of services which do not involve the use or provision of the vehicle itself. These matters include timetables, booking facilities, waiting

rooms etc at airports, ferry terminals, and bus, coach and rail stations. The guidance in this Code will apply to these elements of the service.

Source: (Section 3.14)

The Road Vehicles Lighting Regulations 1989 (as amended)

…no person shall use, or cause or permit to be used, on a road any vehicle to which, or to any load or equipment of which, there is fitted a lamp, reflector or marking which is capable of being moved by swivelling, deflecting or otherwise while the vehicle is in motion.

Source: Regulation 12

…no vehicle shall be fitted with a lamp which automatically emits a flashing light.

Source: Regulation 13

Bus Services Act 2017

(1) The Secretary of State may, for the purpose of facilitating travel by disabled persons, make regulations requiring operators of local services to make available information about a local service to persons travelling on the service.

(2) The regulations may make provision about—

(a) the descriptions of information that are to be made available;

(b) how information is to be made available.

(3) The regulations may, in particular, require an operator of a local service to make available information of a prescribed description about—

(a) the name or other designation of the local service;

(b) the direction of travel;

(c) stopping places;

(d) diversions;

(e) connecting local services.

(4) The regulations may, in particular—

(a) specify when information of a prescribed description is to be made available;

(b) specify how information of a prescribed description is to be made available, including requiring information to be both announced and displayed;

(c) specify standards for the provision of information, including standards based on an announcement being audible or a display being visible to a person of a prescribed description in a prescribed location;

(d) specify forms of communication that are not to be regarded as satisfying a requirement to make information available.

Source: Section 17, as amendment to Section 181 of the Equality Act 2010

REGULATION (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

1. Where personal data relating to a data subject are collected from the data subject, the controller shall, at the time when personal data are obtained, provide the data subject with all of the following information…[list]

Source: Article 6, Information to be provided where personal data are collected from the data subject

1. The data subject shall have the right to obtain from the controller the erasure of personal data concerning him or her without undue delay and the controller shall have the obligation to erase personal data without undue delay where one of the following grounds applies…[list]

Source: Article 17, Right to erasure ("right to be forgotten")

1. Each controller and, where applicable, the controller's representative, shall maintain a record of processing activities under its responsibility. That record shall contain all of the following information: [list]

Source: Article 30, Records of processing activities

1. 1.Where a type of processing in particular using new technologies, and taking into account the nature, scope, context and purposes of the processing, is likely to result in a high risk to the rights and freedoms of natural persons, the controller shall, prior to the processing, carry out an assessment of the impact of the envisaged processing operations on the protection of personal data. A single assessment may address a set of similar processing operations that present similar high risks.

Source: Article 35, Data protection impact assessment