

DESIGN FOR DEAFNESS

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A. INTRODUCTION

Design for deafness is something that should be part of the main stream design process but it is a specialised area where much more needs to be done.

B. BACKGROUND

The obligations of the Architect and the client under the *Disability Discrimination Act* (1992) is that it is illegal to discriminate against a person on the basis of their hearing/deafness disability. All buildings and facilities should be designed to provide adequate hearing access for patrons and staff

The only mandatory requirement in the *Building Code of Australia* is in Clause D3.7 Hearing Augmentation which states:

- (a) Where an inbuilt amplification system, other than one used for emergency warning purposes only, is installed, a hearing augmentation system complying with AS1428.1 must be provided in the following locations:
 - (i) In any conference room, meeting room or the like with a floor area of more than 100 sq m.
 - (ii) In any room used for judicatory purposes.
 - (iii) In any auditorium in a Class 9b building, equitably distributed and to not less than 15% of the floor area.
 - (iv) At any ticket office, tellers booth, reception area or the like where the public is screened from the service provider.
- (b) In a Class 9b building, any screen or scoreboard capable of displaying Public announcements, must be capable of supplementing any public address system, other than a public address system used for emergency warning purposes only.

D3.6 requires that the international symbol of deafness must identify the accessible space with a hearing augmentation system.

The Draft *Access Code for Buildings* which is proposed includes amendments intended to satisfy the *Disability Discrimination Act*. The requirements for Hearing Augmentation are expanded. The proposed clause D3.7 Hearing augmentation reads:

- (a) A hearing augmentation system must be provided where an inbuilt amplification system, other than one used only for emergency warning, is installed-
 - (i) in an auditorium, conference room, meeting room, room for judicatory purposes, or a room in a Class 9b building, or
 - (ii) at any ticket office, teller's booth, reception area or the like, where the public is screened from the service provider.
- (b) If a hearing augmentation system required by (a) is-
 - (i) an induction loop, it must be provided to not less than 80% of the floor area of the room or space served by the inbuilt amplification system, or

- (ii) a system requiring the use of receivers or the like, it must be available to not less than 95% of the floor area of the room or space served by the inbuilt amplification system, and the number of receivers provided must be less than-
 - (A) if the room or space accommodates more than 10 persons but not more than 1000 persons, 1 receiver for every 50 persons (or part thereof), or 2 receivers, whichever is the greater; and
 - (B) if the room or space accommodates more than 1000 persons but not more than 2000 persons, 20 receivers plus 1 receiver for every 100 persons (or part thereof) in excess of 1000 persons; and
 - (C) if the room or space accommodates more than 2000 persons, 30 receivers plus 1 receiver for every 200 persons (or part thereof) in excess of 2000 persons.
- (c) The number of persons accommodated in the room or space served by an inbuilt amplification system must be calculated according to Clause D1.13 of the BCA.
- (d) In a Class 9b building, any screen or scoreboard capable of displaying public announcements must be capable of supplementing any public address system, other than a public address system used for emergency warning purposes.

The Royal Australian Institute of Architects has recognised the need for the profession to understand their obligations related to design for people with disabilities and has a number of Practice Notes including:

- AN13.05.001 *The Disability Discrimination Act 1992*
Implications for architects
- AN13.05.002 Accessibility of professional offices
- AN13.05.003 *Disability Discrimination Act* update
- AN13.05.004 Improving access to heritage buildings and/or places
- AN13.05.005 Disability Standards for Accessible Public Transport:
implications for building design
- AN13.05.006 Designing buildings for people with a hearing
impairment
- AN13.05.100 The architect and the *Disability Discrimination Act*
- AN13.05.600 Design with the disabled in mind
- AN13.05.700 Disability Standard on Access to Premises
An update on progress

C. DESIGN FOR DEAFNESS

The Practice note of particular interest is **AN13.05.006 *Designing buildings for people with a hearing impairment*** which was prepared in association with the Deafness Forum of Australia. The practice note provides an outline of the key issues to address in the design of a range of building types and includes some additional details on hearing augmentation systems.

Introduction

The following are design notes to accommodate people with hearing impairment in a range of building types. Further details on each can be found on the EMA website or DFA website.

Hearing Access in Hotels, Motels and other similar accommodation.

That, regardless of whether or not there are particular legislative requirements:

1. All venues or meeting rooms should have appropriate means in place to ensure that all Deaf or hearing impaired venue users will be alerted to any danger (e.g. fire, bomb threat), and to any evacuation drill or system test, within the premises at the same time as all other venue users. Appropriate means for fire alerts might be alarms with flashing lights and portable vibration pagers.
2. All venues or meeting rooms should provide (as required by participants in functions or meetings – including participants in staff workplace meetings):
 - Functioning assistive listening systems (ALS), such as Induction Loop (IL), Frequency Modulated (FM), or Infrared (IR) systems, to enable all participants who need ALS to clearly hear speakers and other participants without reverberation or background noise, and for all participants using the provided ALS:
 - a. Stetoclip or light weight headphones (for participants without telecoils or without hearing aids) and
 - b. Inductive neck loops (for participants with telecoils). (Receivers with inductive neck loops are not required where the area is covered by IL).
 - Real-time captioning systems to enable all participants who need such systems to follow what all speakers and participants say.
 - Auslan interpreters to enable Deaf participants who need such interpreters to follow what is said by all speakers and participants and to contribute to the events themselves.
 - Access to captioning on television sets and video display facilities being used for an event or meeting.
 - Where telephones (including payphones) are provided for users of venues or meeting rooms:
 - a. Voice telephones should have:
 - Built-in or clip-on amplifiers (minimum of 20dB gain compared to a standard telephone as defined by Telecommunications legislation); and
 - Telecoil couplers (minimum field strength of 100mA/m); and
 - flashing lights to alert the user to the fact that the telephone is ringing.
 - b. Text telephones (TTYs using Baudot 50) compatible with the National Relay Services should have flashing lights to alert the user to the fact that the telephone is ringing.
3. All venue operators should implement:
 - Ongoing maintenance and checking of all hearing access equipment and procedures.
 - Promote the existence of installed hearing access facilities to all venue users (and potential users) by in-house signage, website information, and venue director listings (and, ideally, other forms of promotion such as advertising, etc.). Signage should encourage users to make their needs known. Website information should encourage potential users to make their needs known when making reservations. All staff should be encouraged to identify their needs.
 - Use the International Symbol for Deafness where appropriate to identify:
 - a. The existence of hearing access.
 - b. The types of system available.
 - c. Which areas are covered by the system.
 - d. Where to obtain receivers and attachments needed to use a system.

4. All events or meetings organizers should ascertain the needs of participants and ensure they are met.
5. All staff and other users of any venues or meeting rooms should make their specific hearing access needs known to the venue providers if they expect them to be met. This may occur at the time of venue booking or during venue use. (This does not remove the obligation of the venue provider to make necessary provisions, particularly as use of venues may include events where participants do not register in advance, e.g. some expos, trade shows, etc.)

Hearing Access at Events and Meetings in venues and meeting rooms.

1. All hotels, motels, caravan park cabins and on-site vans, guesthouses, holiday apartments, and other similar accommodation should provide hearing access facilities as follows to all Deaf and hearing impaired guests and staff that need it:
 - Appropriate means in place to ensure that all such guests and staff will be alerted to any danger (e.g. fire, bomb threat), and to any evacuation drill or system test, within the premises at the same time as all other guests and staff. Appropriate means for fire alerts might be alarms with flashing lights and portable vibration pagers. The system needs to take account of the fact that the Deaf or hearing impaired persons may be in any part of the premises when the alert is required.
 - Non-audible alarms in guest rooms to provide equivalent doorbell (or door knocking) functions to those provided to other guests. This is particularly important in emergency situations.
 - Access to captioning (whenever programs are broadcast with captions) on television sets provided in guest rooms, public areas and staff work areas.
 - Voice telephones in guest rooms, public areas and staff work areas with:
 - a. Built-in or clip-on amplifiers (minimum of 20dB gain compared to a standard telephone as defined by Telecommunications legislation) and
 - b. Telecoil couplers (minimum field strength of 100mA/m) and
 - c. Flashing lights and bed vibrators to alert the user to the fact that the voice telephone is ringing.
 - Text telephones (TTYs using Baudot 50) compatible with the National Relay Service in guest rooms, public areas, and staff work areas, with flashing lights and bed vibrators (in guest bedrooms) to alert the user to the fact that the text telephone is ringing. (Payphones also need text telephone facilities).
 - Vibrating alarms in guest rooms to provide equivalent alarm clock functions to those provided to other guests.
 - Vibrating or flashing light signals to alert guests and staff to the fact that there is an incoming call to a voice or text telephone.
 - Assistive listening devices (i.e. neck loops and headphones), with appropriate amplifiers and connections (such as TV listeners) to enable hearing impaired guests and staff (both with and without telecoil facilities on hearing aid/s) to listen to TVs and radios in guest rooms, public areas and staff work areas.
2. All hotels, motels, caravan park cabins and on-site vans, guesthouses, holiday apartments, and other similar accommodation that offer any venues or meeting rooms should provide necessary facilities (as required by participants in functions or meetings – including participants in staff workplace meetings). The necessary facilities are set out in the separate Policy Position on Hearing Access at Events or Meetings in Venues or Meeting Rooms.
3. All hotels, motels, caravan park cabins and on-site vans, guesthouses, holiday apartments, and other similar accommodation should implement:

- Ongoing maintenance and checking of all hearing access equipment and procedures.
 - Promote the existence of installed hearing access facilities to staff, guests (and potential guests) by in-house signage (in guest rooms and public areas), website information and accommodation directory listings (and, ideally, other forms of promotion such as advertising, etc.). Signage in guest rooms should encourage guests to make their needs known to reception staff. Website information should encourage potential guests to make their needs known when making reservations. All staff should be encouraged to identify their needs.
 - Use the International Symbol of Deafness where appropriate to identify:
 - a. The existence of hearing access.
 - b. The types of system available.
 - c. Which areas are covered by the system.
 - d. Where to obtain receivers and attachments needed to use a system.
4. All staff and guests and other users of any hotels, motels, caravan parks and on site-vans, guesthouses, holiday apartments, and other similar accommodation should make their specific hearing access needs known to the accommodation providers if they expect them to be met. This may occur at time of room booking, check in or during stay. (This does not remove the obligation of the service provider to make necessary provisions, particularly as travelers often arrive unannounced for a variety of reasons).

Hearing Access to Secure Facilities

That, regardless of whether or not there are particular legislative requirements:

1. All buildings should provide hearing access facilities where necessary to enable all deaf and hearing impaired users gain access.
 - Access to captioning on telephones, or television or video display sets.
 - Functioning assistive listening systems (ALS), such as Induction loop (IL), Frequency Modulated (FM), or Infrared (IR) systems, to enable all participants who need ALS to clearly hear the information without reverberation or background noise.
 - Voice telephones with:
 - a. Built in a clip on amplifiers (minimum of 20dB gain compared to a standard telephone as defined by Telecommunications (legislation);
 - b. Telecoil couplers (minimum field strength of 100mA/m); and
 - c. Flashing lights to alert the user to the fact that the voice telephone or intercom is responding.
 - Text telephones (TTY's using Baudot 50) compatible with National Relay services with flashing lights to alert the user to the fact that the text telephone is responding.
2. All building owners and operators should implement:
 - Ongoing maintenance and checking of all hearing access equipment and procedures.
 - Promote (including signage) the existence of installed hearing access facilities.
 - Use the International Symbols for Deafness to identify:
 - a. The existence of hearing access.
 - b. The type of system available.
 - c. The areas covered by the system.

Hearing Access to Information for Transport, Shops, Offices and Similar Facilities

That, regardless of whether or not there are particular legislative requirements:

1. All buildings should provide hearing access facilities where necessary to enable all deaf and hearing impaired users gain access.
 - Access to captioning on telephones, or television or video display sets.
 - Functioning assistive listening systems (ALS), such as Induction loop (IL), Frequency Modulated (FM), or Infrared (IR) systems, to enable all participants who need ALS to clearly hear the information without reverberation or background noise.
 - Voice telephones with:
 - a. Built in a clip on amplifiers (minimum of 20dB gain compared to a standard telephone as defined by Telecommunications (legislation);
 - b. Telecoil couplers (minimum field strength of 100mA/m); and
 - c. Flashing lights to alert the user to the fact that the voice telephone or intercom is responding.
 - Text telephones (TTY's using Baudot 50) compatible with National Relay services with flashing lights to alert the user to the fact that the text telephone is responding.
2. All building owners and operators should implement:
 - Ongoing maintenance and checking of all hearing access equipment and procedures.
 - Promote (including signage) the existence of installed hearing access facilities.
 - Use the International Symbols for Deafness to identify:
 - a. The existence of hearing access.
 - b. The type of system available.
 - c. The areas covered by the system.

Hearing Access To Sports & Fitness Centres

Design Requirements

Hearing access facilities should be provided to enable people who are deaf or have a hearing impairment to gain access, to participate in all activities and to be alerted to danger or emergency evacuation at the same time as all other venue users:

- Visual emergency warning signals should be installed at least in isolated rooms or spaces such as toilet areas, sauna, steam room, massage room and the like.
- TTY telephone at Reception to respond to phone calls from people who are deaf or have a hearing impairment.
- Assistive listening systems in rooms where an amplification system is used, such as in group fitness rooms. AFILS is the preferred system where a built-in amplification system is installed. An FM system may be provided where a portable amplification system is used or in existing conditions where AFILS would be difficult to install.
- Mirrors at front and rear of a group fitness room to allow a deaf or hearing-impaired person to see the instructor in activities that require the class to turn around.
- An easily visible coloured light that pulsates to the beat of the music accompany the aerobic activities would be helpful but not essential.

D HEARING AUGMENTATION SYSTEMS

AUDIO FREQUENCY INDUCTION LOOP SYSTEMS

1.0 INTRODUCTION

1.1 This is a simple guide for architects and others in complying with the Building Code of Australia clause D3.7 Hearing Augmentation, initiated by the late Mervyn Willoughby-Thomas FRAIA, Accredited Access Consultant with the ACAA and a hearing-impaired architect.

1.2 Definitions and Names:

A number of terms are currently within common use within the industry to describe the Audio Induction Loop. These terms include:

- Hearing Augmentation (includes Loop, FM, Infra Red)
- Audio Frequency Induction Loop System (AFILS)
- Powered Audio Induction Loop System (PAILS)
- Hearing Aid Loop
- Audio Loop
- Loop
- Deaf Aid Loop (NOT TO BE USED)
-

1.3 The DDA (Disability Discrimination Act 1992) through the BCA (Building Code of Australia) aims to maximise participation in community life by people with disabilities. BCA Clause D3.7 applies where there is an inbuilt amplification system (other than emergency warning) in:

- Conference and meeting rooms over 100m² floor area.
- Auditoria in Class 9b building, Hearing Augmentation to not less than 15% of an auditorium.
- Rooms for judicial purposes.
- Ticket office, tellers booth etc where the public are screened from the servicer.
- Any screen or scoreboard capable of displaying public announcements must supplement any public address system eg captions.
(Refer to the BCA for the precise text).

1.4 The intent of this paper is to clarify some of the options which realistically meet the BCA requirements for hearing augmentation for the majority of hearing-impaired people.

1.5 Hearing impairment, which occurs to many people, especially if over 50 years age, can be mild, moderate, severe or profound. Augmentation of sound will not help all of the profoundly deaf as some have no hearing; they need subtitles or captions.

People with hearing impairment may try to compensate by using a hearing aid, cochlear implant, or a loop receiver. If the hearing aid or cochlear implant has a T switch, and the room has an audio loop (correctly installed, and picking up sound from the microphone of a specific speaker or sound source, whether wired or radio) then the background noise can be reduced or eliminated.

A loop receiver is a pocket sized device fitted with a T switch and stethoscope style earpieces, called a stetoclip.

There are two types of background noise. The first is noise other than the signal trying to be heard e.g. air conditioning, audience, chatter. The second type is reverberation of the signal trying to be heard. Reverberation typically becomes an impediment to understanding if the hearing impaired person is greater than 1.5 metres than the sound source, although the exact distance varies between individuals and circumstances. Hence, loop systems are commonly used in lounge rooms to

assist in understanding the television. This is a clear example of the needs of hearing impaired people for Hearing Augmentation.

For an effective AFILS system, the aim is to minimise the distance between the source of sound and the listener.

The signal received by a hearing impaired person needs to be greater than 15 dB above the background noise level, i.e. Signal to noise ratio, $S/N = > 15\text{dB}$.

- 1.6** A hearing impaired person can hear sounds, but their ears lose the faculty of:
- Distinguishing the message of a specific speaker from the background noise level,
 - Understanding the words due to reflections of the sound off walls, floors, furnishings etc,
 - The ability to cope with changes in level of sound i.e. dynamic range.

The spoken work still needs to be clearly enunciated and not too fast. Seeing the expression on a speaker's face and body language is important as many use a combination of hearing and lip reading, to reinforce the spoken message.

2.0 HEARING AUGMENTATION SYSTEMS

If the Hearing Augmentation system is incorporated with the public address system, ensure that the Hearing Augmentation System is automatically operated with PA announcements

In public buildings there are three options readily available:

2.1 AFILS (Audio Frequency Induction Loop System)

The loop is located in or around the room. This is suitable for most churches, lecture theatres and auditoria, and is the preferred option for people with hearing impairment. Generally it is also the most cost effective system.

It is estimated that 70 to 80% of hearing aids are fitted with a T switch. However, If a hearing aid lacks a T switch, then a loop receiver with stetoclip or head phones are required to augment the sound level for a mild or moderately hearing impaired person. The advantage of the AFILS is the need to provide receivers only for those without the T switch, as both other types of systems require receivers to be provided for every user.

Electromagnetic signals can be affected by electronic apparatus and steel to varying degrees. Electromagnetic waves also pass through walls, and hence loss of privacy is possible. AFILS work indoors and outdoors. This is relatively cheap to provide, and once installed requires minimal administrative assistance apart from periodic check for being in working order.

If there are other loop systems close by, the problem of overlap of sound must be addressed. This is a serious problem if the auditoria are next to or above one another. There are various ways to resolve this overlap but consult the experts while the design is still in its early stage.

There are many unsatisfactory audio-magnetic loop installations. It is an area for the specialist, rather than the average electrical consultant or contractor. Consultation may be necessary at the **early design stage** as well as when the building is under construction.

Many telephone handsets have a coil which, with a T switch on the hearing aid, cuts out the background noise.

One concern when installing AFILS is interference caused by electrical cabling, or in some cases nearby electronic/electrical equipment.

2.2 FM (Frequency Modulation)

This system consists of a base station transmitter and individual receivers for each user. Attachments are also required for each user, neck loops for users with T switch on their hearing aids, and headphones or stetoclip for the remainder of users.

For lecture tours, the same receivers and attachments are used, but with a personal transmitter with lapel microphone.

The Phonic Ear "Easy Listener" is an example of both the above systems; it is found in some public galleries and museums, where the battery units can be recharged overnight.

In FM systems radio waves pass through walls. Hence loss of privacy is possible. FM systems may be used both indoors and outdoors.

If there are loop systems close by, the problem of overlap of sound must be addressed. There are various ways to resolve this overlap but consult the experts while the design is still in its early stage.

2.3 IR (Infra-Red)

Infra-red listening systems require a special headphone receiver and requires clear path from transmitter to receiver (i.e. line of sight), unobstructed by people's limbs and objects, even by paper.

Attachments are also required for each user, neck loops for users with T switch on their hearing aids, and headphones or stetoclip for the remainder of users. Alternatively, different type of receivers may be used to achieve the same result.

Walls are a barrier and hence privacy is assured.

IR is not suitable outdoors, as sunlight disrupts the infra red signal, nor is IR suitable in rooms with direct sunlight.

As with AFILS, IR is commonly used for hearing the television and radio in the home.

In public buildings IR is rarely used except where privacy is absolutely necessary, due to the large radiators required rooms more than 6 metres long, line of sight restrictions, and cost effectiveness compared to the alternatives.

If there are loop systems close by, the problem of overlap of sound must be addressed. There are various ways to resolve this overlap but consult the experts while the design is still in its early stage.

For further details refer EMA web site www.emaa.com.au

E. FUTURE

I believe the future design for deafness is in the hands of the interested few.

Legislation

Good design for deafness is desirable if not essential but without the power of the *Building Code of Australia* it will be left to the minimum standards of hearing augmentation detailed in the draft *Access Code for Buildings*.

This will not satisfy most deaf people which leaves some avenues to improve the situation including:

- (a) Press for greater provisions within the *Building Code of Australia* proposed amendments.

This is likely to be difficult as there is a strong lobby for reducing the provisions rather than increasing them.

- (b) Take specific action under the *Disability Discrimination Act* to establish a legal precedence of the need to make greater provisions.

This can create a position similar to the case of *Cocks vs State of Queensland* (1994) EOC 92-612 which established the fact that meeting the *Building Code of Australia* was insufficient defence against a complaint under the *Disability Discrimination Act*.

Information

Any additional information is always beneficial. However, with the complex detailing and requirements of modern building the Architect of today relies more and more on expertise from a range of sub consultants such as access consultants. Even with the access consultant profession there are few that understand the details and requirements for best practice design for people with a hearing impairment.

The RAI Practice Notes and the Deafness Forum of Australia policy position papers help to promote design for deafness by making key information readily available as do conferences, articles discussing design detail and awareness of the difficulties.

Research and Technology

There is no doubt research will lead to technological advancement to assist people with a hearing impairment which will make the task of the Architect easier. The development and use of text messaging in mobile phones has enabled a flexible and effective means to transmit information. Sign language animations are available and are gradually being refined. While this can make it easier for people with a hearing impairment, there is more that can be developed.

Australian Standard (AS1428.5) Communication for people who are deaf or hearing impaired

This document is in preparation and will detail:

- Situations requiring hearing augmentation eg public meeting areas, lifts, screened counters, transport facilities
- Requirements for hearing augmentation systems such as types, specifications, accessories and regulations.
- Alarm systems – emergency, augmented alerting devices, lifts.
- Situations requiring visual augmentation, such as public announcements, requirements, signage, way finding, intercoms and visual alarms.
- Specifications for visual augmentation – lighting, brightness, luminance contrast, colour, glare
- Captioning – captions, regulations, text size
- Maintenance Monitoring and Training – test methods, conditions, calibration, specifications, field measuring equipment, reporting, certification.

This standard is likely to take a few more years to finalise but will be a very useful document.

F. CONCLUSION

The future holds for a brighter outcome for people with a hearing impairment but the mandatory provisions are likely to remain minimal in the immediate future.

FURTHER REFERENCES

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Wycliffe Noble, C and Geoffrey Lord, *Access for Disabled People to Arts Premises – the Journey Sequence*, Elsevier 2004. P112 Communication systems for hearing impaired audiences.