THE SOUND GUIDE

A NON TECHNICAL GUIDE TO DESIGNING AND INSTALLING SIMPLE PUBLIC ADDRESS AND SOUND REINFORCEMENT SYSTEMS

THE SOUND GUIDE

CONTENTS

IS IT REALLY THAT SIMPLE TO INSTALL A SOUND SYSTEM?

Using this guide as a reference, together with the instructions included with the products to be used, the answer is 'Yes'.

Most equipment suppliers have a technical helpline to answer specific planning or set-up questions.

The Sound Guide enables sound system requirements to be defined and the selection and location of key components – loudspeakers and microphones – to be made.

Whilst many installed sound systems provide excellent results, performing exactly as the end user intended, exceptions indicate that the basic requirements of an installation are often exaggerated by the end user or the potential installer, both allowing the possibility of overpricing and unsatisfactory or even excessively complicated solutions.

Conversely, with a need to secure the order, many less caring installers offer unsuitable equipment which may prove expensive to own in the long term and might not provide exactly what is required.

Often there is a mutual lack of understanding of what the sound system is required to do.

The Sound Guide creates the opportunity for those with electrical wiring skills to use this resource to install sound systems and suggests what should be acceptable standards of performance for a sound system and its components.

Importantly, The Sound Guide is practical and, if followed, the experience of out team and "rule of thumb" guidance will give excellent results.

Sophisticated technical planning methods may suggest more accuracy; however, this publication provides the means for virtually anyone to design a basic sound system using the benefit of expert knowledge for a wide range of applications.

SOME DOS AND DON'TS

Some dos and don'ts on the safe use of electrical equipment

As with any electrical equipment, care must be taken if you are to obtain the best results and safety is to be assured.

DO read the operating instructions before you attempt to install and use any equipment.

DO ensure that all electrical connections are properly made and in accordance with the instructions. Switch off and withdraw the mains plug when making or changing connections.

DO consult qualified persons if you are in any doubt about the installation, operation or safety of electrical equipment.

DON'T leave the equipment switched on after a working day when it is unattended. Using the on/off switch, disable the equipment and make sure that more than one person knows how to do this. Special arrangements may need to be made for people requiring special care.

DON'T obstruct the ventilation of the equipment – with curtains or soft furnishings for example. Overheating will cause damage and shorten the life of the equipment.

DON'T allow electrical equipment to be exposed to rain or moisture, or place drinks on the equipment casing.

ABOVE ALL

NEVER let anyone (especially children) push anything into holes, slots or any other opening into the equipment.

NEVER guess or take chances with electrical equipment of any kind.

IT IS BETTER TO BE SAFE THAN SORRY!

WHAT IS A SOUND SYSTEM?

A sound system is simply that; a system which reproduces sound, mostly through loudspeakers. Sound systems for public places are very different from those found in domestic environments. In the majority sound systems are not in stereo and generally they separate into two main categories.

a) Public Address

Where the person speaking cannot be seen by the person listening – such as in a railway station, airport, sports stadium or a paging system in a factory or office. The person listening is invariably "on the move", or working.

Wherever numbers of people have to be informed, paged or simply addressed, there is the need for Public Address.

In an hotel, office, factory or shopping centre or any of the previous examples, the ability to address will aid operating efficiency and may even, in the event of an emergency, save lives.

It will be the only way to speak to everyone at the same time, and just as with sound reinforcement, it is important that the sound character and clarity is as natural as possible: a fact that is determined by good planning, by the quality of equipment used and the care taken in ensuring than all areas where the listener could be have adequate sound coverage.

b) Sound Reinforcement

Sound reinforcement, where the person speaking can be seen and the purpose of the sound system is simply to reinforce his or her voice – such as in a church, at a public meeting or in the theatre. Sound reinforcement is also used to enhance the natural sound level so that the hard of hearing can participate. In most instances the person listening is seated, or standing in a relatively fixed position.

It is sometimes useful to install a sound reinforcement system even when the building can be used without it so that less effort has to be made in order to be heard. Nevertheless, the primary function of any system which also aims to reduce listening effort must be to increase the level of useful sound in such a way that the result is as natural as possible.Naturalism is the desirable quality of a system; if everyone in the audience can hear properly without being aware that a sound system is in use, then the installation can be claimed to be successful.

It is also less stressful for any person speaking over the system. They can relax in the knowledge that everyone can hear without the need to speak above their normal level.

It may not always be possible to achieve

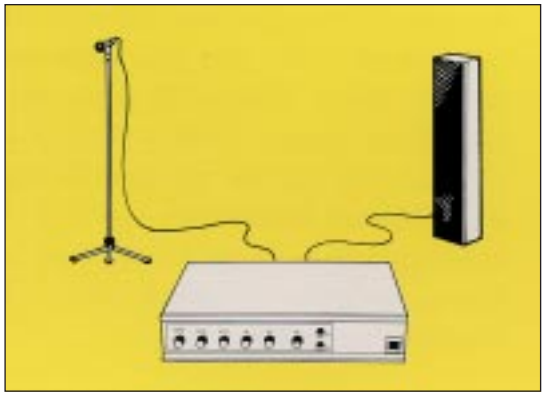
the complete success of "natural" sound, especially for large audiences, but the equipment should be installed to be as unobtrusive as possible, to enhance this possibility. Whilst architectural and aesthetic considerations are important they should not override those which relate to the fulfilment of the objectives of the sound system.

The first question to ask, when sound reinforcement is being considered, is not "Is it necessary?" but "Will it help?". Technically speaking there is little if any difference other than size and associated application factors, between Public Address and Sound Reinforcement. The equipment to provide either is fundamentally the same.

The simplest sound system would comprise:

a) one microphone
b) one amplifier
c) one loudspeaker

In some cases such a system might be sufficient, however most good sound systems are usually larger than this, requiring more loudspeakers or microphones, for example.



What is a good sound system?

A good sound system is one which satisfies completely the need of the system user; it can be clearly heard where it should be and not where it shouldn't; it is easy to operate and uses selected products designed for long life and low cost of ownership.

Helping the hard of hearing and the art gallery viewer

In public address and sound reinforcement installations it is usual to find an induction loop system installed to assist the hearing aid user. The amplifier that is necessary to perform the functions of sound reinforcement and public address is identical but the amplifier for the induction loop is a specialised product.

Induction loops are also used for the transmission of commentary to persons with normal hearing, for example in an art gallery, museum or very noisy environments. Induction loop systems are fully explained on page 23.

COMPONENTS OF A SOUND SYSTEM

What is a microphone?

A microphone is a device for converting sound energy into electrical energy so that this can then be amplified to sufficient power to drive a loudspeaker.

Microphones are designed to provide different sensitivity patterns – the areas where sound can be picked up by the microphones. These patterns can be:

Omnidirectional
"Hears" sounds from all around with equal efficiency.

Bidirectional
"Hears" equally well in two opposite directions and this type of microphone is often called a "figure of eight".

Cardioid
"Hears" only sounds from one direction, rejecting those from the opposite direction.

Experience shows that a microphone with a cardioid pattern is the most useful for the applications discussed.

Some Hints on Usage

1. Under no circumstances tap or blow into a microphone to test whether it is working, after such treatment be surprised if it still does! A microphone has to be sensitive enough to respond to the minute amount of energy in normal use; in comparison blowing into a microphone is the equivalent of a blast from an extremely loud explosion!

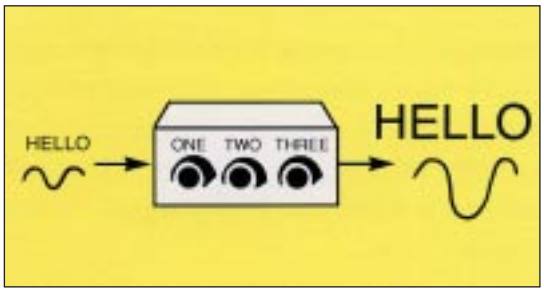
2. For speech use, the microphone should generally be 20 to 30cm from the mouth, depending on local conditions. Closer microphone positions may have to be used to reduce the effect of higher than usual ambient noise. It is worth noting that reducing the distance between the microphone and mouth by half can reduce the ambient noise interference by up to four times.

Remember that at this distance slight movements of the microphone will give relatively large changes in the sound output level from the sound system.

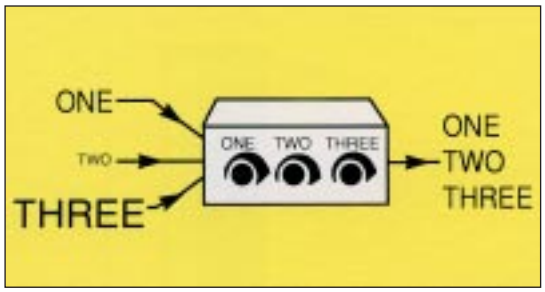
3. For interviewing, hold the microphone near to the speaker's mouth at distances described above and never wave the microphone about since this will generate handling noise and will be a distraction to the person being interviewed. Remember too that a microphone held at waist level is more receptive to other ambient sounds than to the voice.

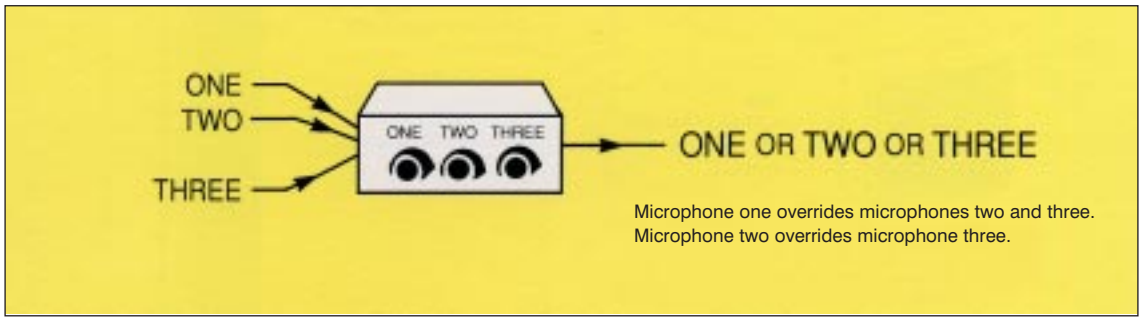
What is an amplifier?

An amplifier accepts the minute energy from an input source – a microphone perhaps – and increases the power to a level suitable for feeding one, or a number of loudspeakers.



The amplifier is also used to mix multiple inputs – as an example, three microphones – and to permit the adjustment of their relative signals so that the sound coming from the loudspeakers is an acceptable amplified representation of the original sound. It is also the point where the sound quality can be adjusted, by means of bass and treble tone controls.





Often some form of priority system is included whereby specific inputs can be designated to override all others; this mode of operation is usually employed where paging microphones are included in a public address system which may itself comprise more than one zone.

Induction Loop Amplifiers

The amplifier that feeds an induction loop is very similar but includes technology which provides sound adjustments specific to the needs of the application. Induction Loop systems are fully explained on page 23.

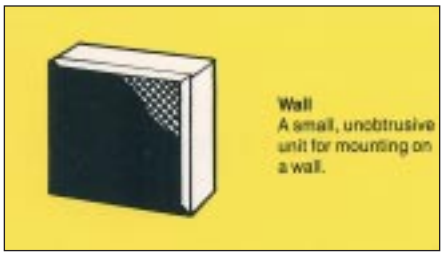
COMPONENTS OF A SOUND SYSTEM continued

What is a loudspeaker?

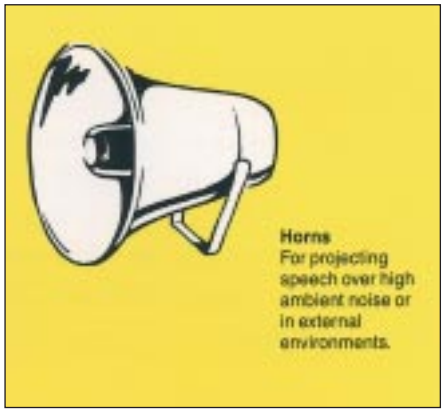
Basically, the opposite of a microphone; a device for converting electrical energy back into sound energy. The loudspeaker cone "drives" the air around it to transmit the signal to the listener's ear.

There are various designs of loudspeaker but four types are the most commonly used:

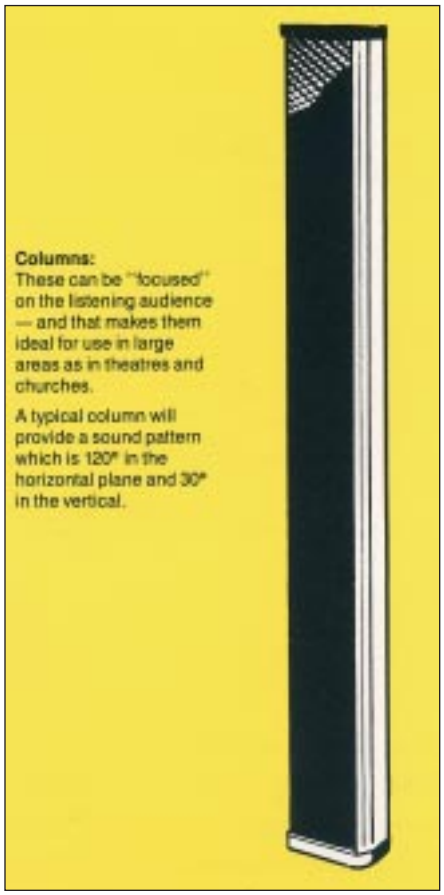
Ceiling
For fitting within ceilings in offices, shops etc.



Wall
A small, unobtrusive unit for mounting on a wall.



Horns
For projecting speech over high ambient noise or in external environments.



Columns:
These can be "focused" on the listening audience — and that makes them ideal for use in large areas as in theatres and churches.

A typical column will provide a sound pattern which is 120° in the horizontal plane and 30° in the vertical.

The Acoustic Environment

The term acoustics refers to the way sound behaves within a room or building. This will be a major factor in determining the quality of the sound received.

With the exception of concert halls and theatres, few buildings are designed with much attention being paid to the acoustic environment.

A sound does not just travel in the direction of the listener but radiates in all directions and is reflected many times from the walls, floor and ceiling of the room.

Each reflection removes some of the sound energy by absorption until, for practical purposes, there is none left.

The time that the sound takes to die away in any particular room is called the **reverberation time**. Different surfaces and materials absorb different amounts of the sound and therefore affect reverberation times.

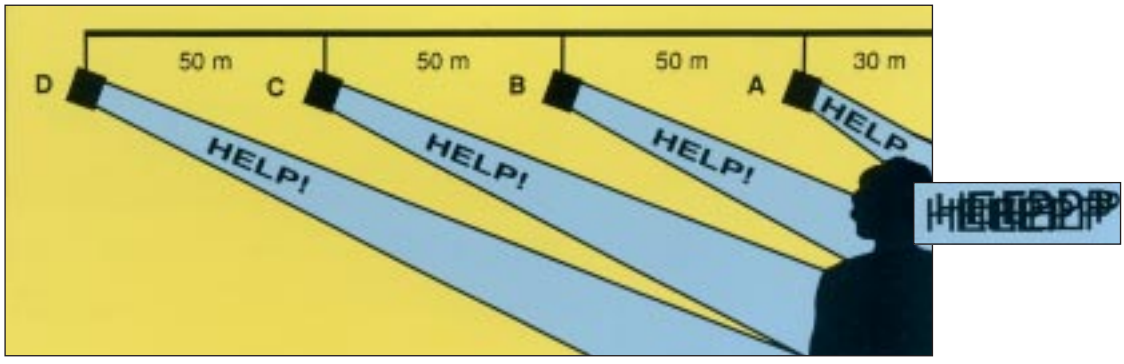
It is the amount and quality of the reflected sound that gives a particular room or building its characteristic sound.

Good acoustics are important in ensuring that the reproduced sound is of an acceptable clarity. Too much reverberation produces a confusing and unintelligible sound, whilst too little produces an uncomfortable "deadness".The use of carpets and curtains can improve a highly reflective or reverberant environment. The purchaser of amplifying equipment which includes wide ranging bass and treble tone controls can also compensate for some of the more usual acoustic problems.

Having explained reverberation we can also say that in a reinforcement system, sound from a loudspeaker reaching the listener more than a fraction of a second after the original sound, produces an echo effect which at its worst, will result in complete unintelligibility.

To avoid the "echo effect" we have recommended that distances greater than 15m between successive loudspeakers, the original sound source and the listener should be avoided. The arrival of "electronic" sound must be coincident with the arrival of the "original" sound to have maximum reinforcement effect and listener intelligibility.

Ideally therefore all the sound, whether



from the performer or the loudspeaker should **appear** to originate from the performer.

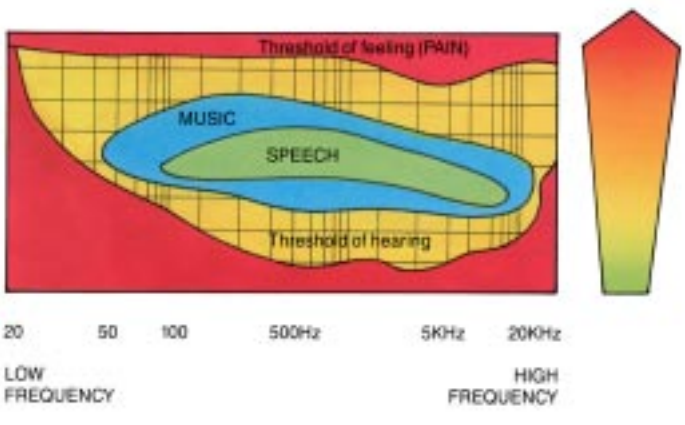
In a poorly designed or poorly adjusted reinforcement system, where the loudspeakers are some distance from the performer and are producing a higher sound level than the original, all the sound appears to come from the loudspeakers. The visual image (of the performer) is therefore in one position whilst the sound image (from the loudspeakers) is in a quite different position.

Ambient Noise

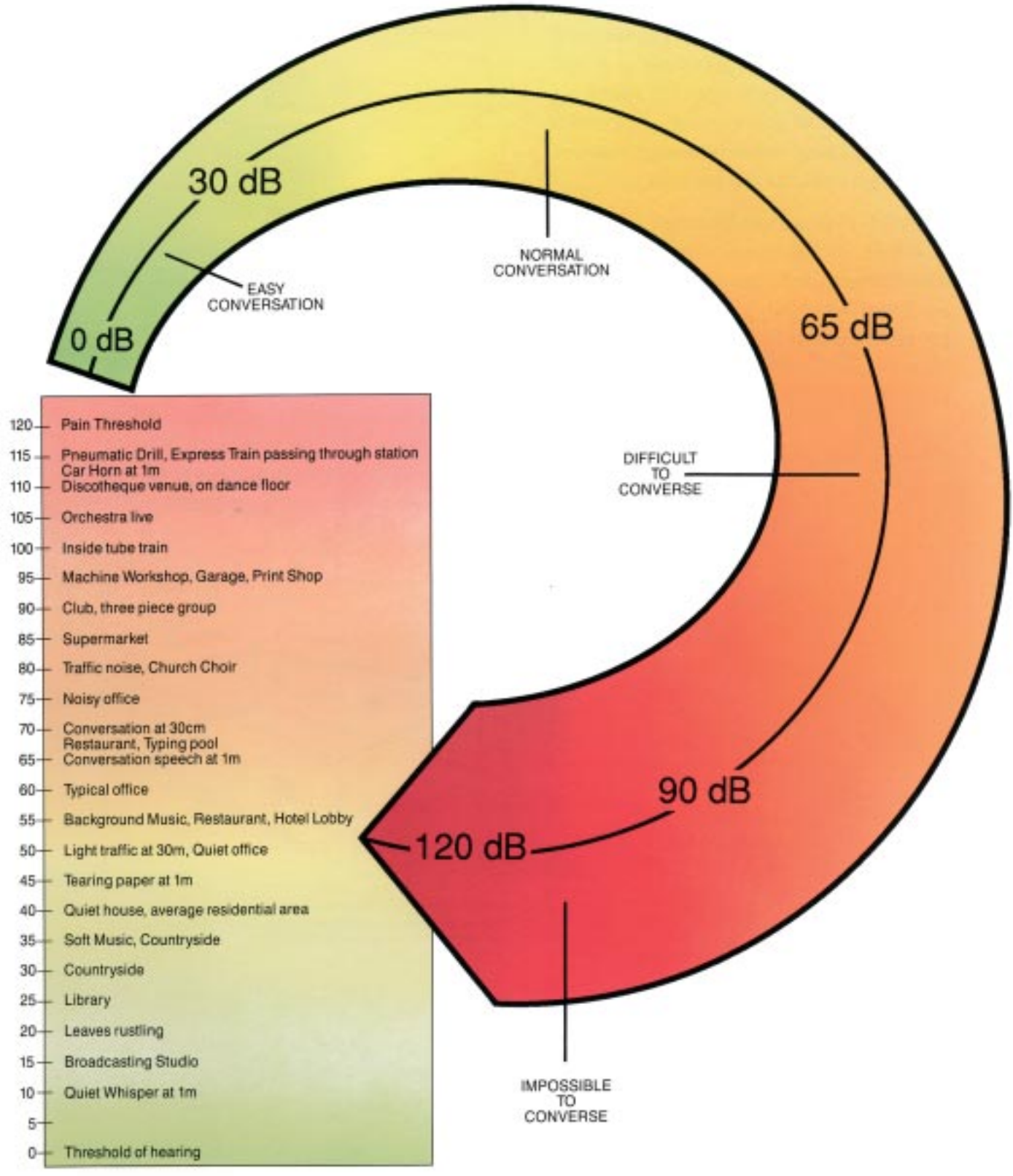
In order to be effective any sound system has to overcome the multitude of noises which make up the "ambient noise" in the listening environment.

In an office this could be people in discussion, telephones ringing, the noise of computers: at the roadside, heavy lorries, buses and cars: in a reading library, simply the turning of papers: in a church, coughing, traffic noises, even the air pump of a pipe organ: in a sports ground, the noise of a cheering crowd.

All calculations of speaker quantities relate to varying levels of ambient noise and the illustration opposite will help you make a judgment of what is required for your specific needs. Some typical sounds are indicated to assist your assessment in conjunction with the floor area chart on page 21.



The effect of sound intensity varies with frequency


30 dB
EASY
CONVERSATION
0 dB
NORMAL
CONVERSATION
65 dB
DIFFICULT
TO
CONVERSE
90 dB
120 dB
IMPOSSIBLE
TO
CONVERSE
120 Pain Threshold
115 Pneumatic Drill, Express Train passing through station
Car Horn at 1m
110 Discotheque venue, on dance floor
105 Orchestra live
100 Inside tube train
95 Machine Workshop, Garage, Print Shop
90 Club, three piece group
85 Supermarket
80 Traffic noise, Church Choir
75 Noisy office
70 Conversation at 30cm
Restaurant, Typing pool
65 Conversation speech at 1m
60 Typical office
55 Background Music, Restaurant, Hotel Lobby
50 Light traffic at 30m, Quiet office
45 Tearing paper at 1m
40 Quiet house, average residential area
35 Soft Music, Countryside
30 Countryside
25 Library
20 Leaves rustling
15 Broadcasting Studio
10 Quiet Whisper at 1m
5
0 Threshold of hearing

LOUDSPEAKER CHOICE

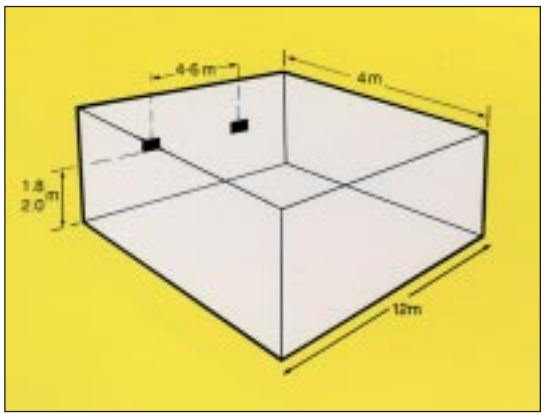
Wall Loudspeakers

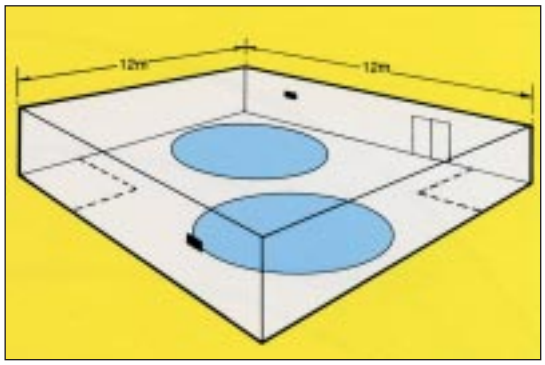
Wall speakers can be used for isolated sound requirements or where it is not possible to install ceiling units – inaccessibility for wiring, unknown "behind ceiling" obstructions, or where very high ceilings are present.

A wall (cabinet) loudspeaker provides general, forward projectional distribution useful for only a few metres – four optimally; using them over greater distances means that those closest will hear more loudly than those at the furthest distance.

Installation

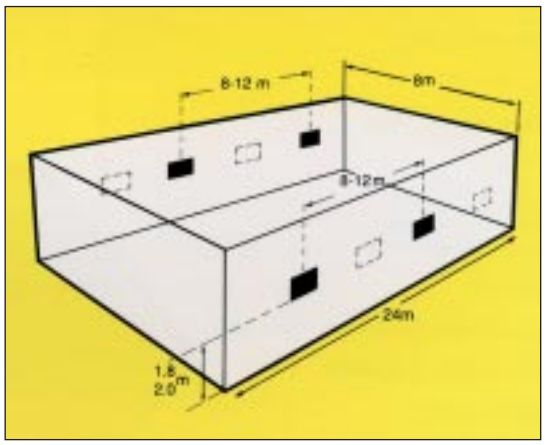
Always mount wall speakers on the longest wall of the room at an approximate height of 1.8m to 2.0m and at equal spacing of between 4.0m to 6.0m.





Simple paging in a quiet office; note that the reception area by the office entrance and the opposite corner manager's area are not directly covered by the two wall speakers.

In a large room with walls more than 4.0m apart but not greater than 8.0m to 9.0m, wall speakers could be placed on opposite walls to provide sound coverage. Try not to place them facing each other but to be "staggered".



Four loudspeakers on opposite walls arranged in a "staggered" layout to provide sound coverage over the entire room.

Ceiling Loudspeakers

These are ideal for use in areas where a smooth, even spread of sound is required, for example in a restaurant where point sources of sound from wall loudspeakers would intrude on those closest to them.

They should also be used in large open plan office areas, where the sound coverage from wall loudspeakers would not be sufficient.

Selecting ceiling loudspeakers means that there must be access "above the ceiling" to install cabling to all the loudspeakers and to the amplifier.

Installation

The "footprint" of a ceiling loudspeaker – how much floor it will cover evenly – is dependent upon its height above the floor.

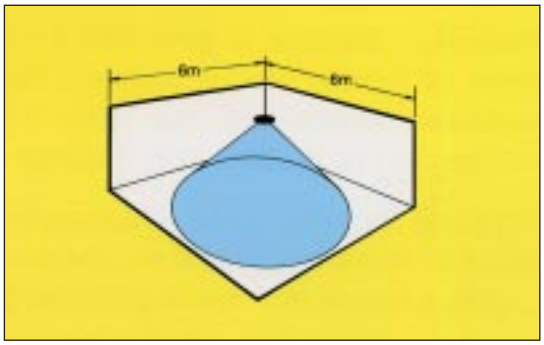
Ceiling loudspeakers should preferably be mounted in a grid pattern at equal distances apart. Assuming a ceiling height of 2.5m/3.5m, speakers should be spaced no less than 5.0m apart or more than 7.0m apart consistent with the heights detailed.

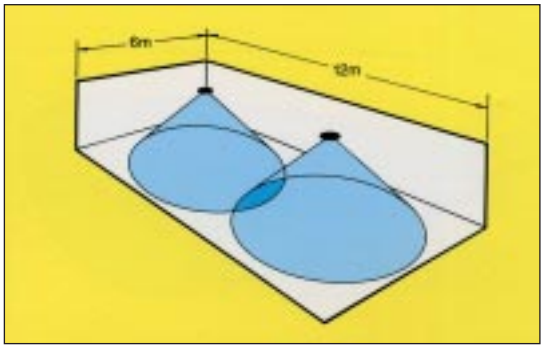
PLEASE NOTE

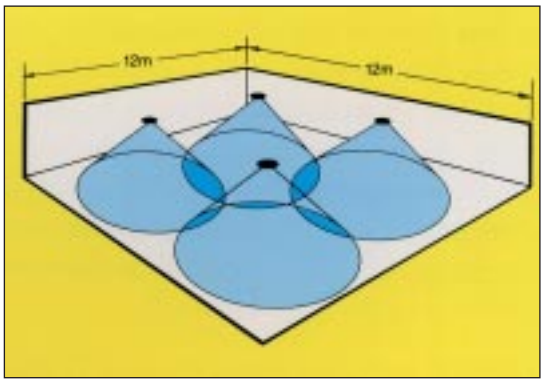
Some fire authorities and fire regulations do not permit the installation of ceiling loudspeakers without a rear protective cover which, in the event of a fire, will stop smoke and flames being induced into the ceiling void. Most ceiling speakers provide for this.

Suspended Loudspeakers

Where the ceiling height is too great to permit use of ceiling loudspeakers, to ensure a smooth sound coverage, special loudspeakers are available that can be suspended at the necessary height for the application.







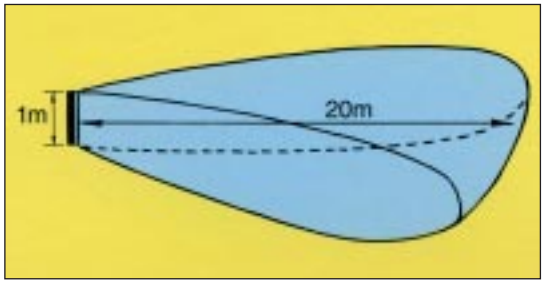
Column Loudspeakers

These always comprise a vertical arrangement of small loudspeakers contained within the loudspeaker cabinet. The result is that the column is able to "throw" sound more evenly over longer distances than a single loudspeaker, such as a wall type.

Projection distance is governed by a series of factors, one of which is the physical length of the line of loudspeakers within the column.

As a guide, the projection distance can be stated to be twenty times the column length; a length of 1 metre provides a useful projection distance of at least 20 metres.

In this case, if the area required to be covered by sound has a path length (distance from loudspeaker to furthest

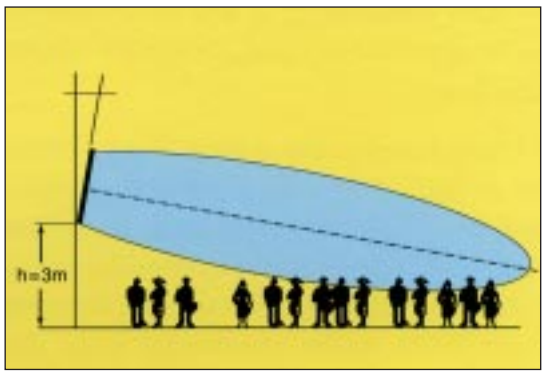


point to be covered) of more than 20m, there may be a need to add additional intermediate columns, dependent upon the actual total distance to be covered.

It has already been stated on page 11 that in order to avoid echoes additional column loudspeakers should not be spaced more than 15 metres apart.

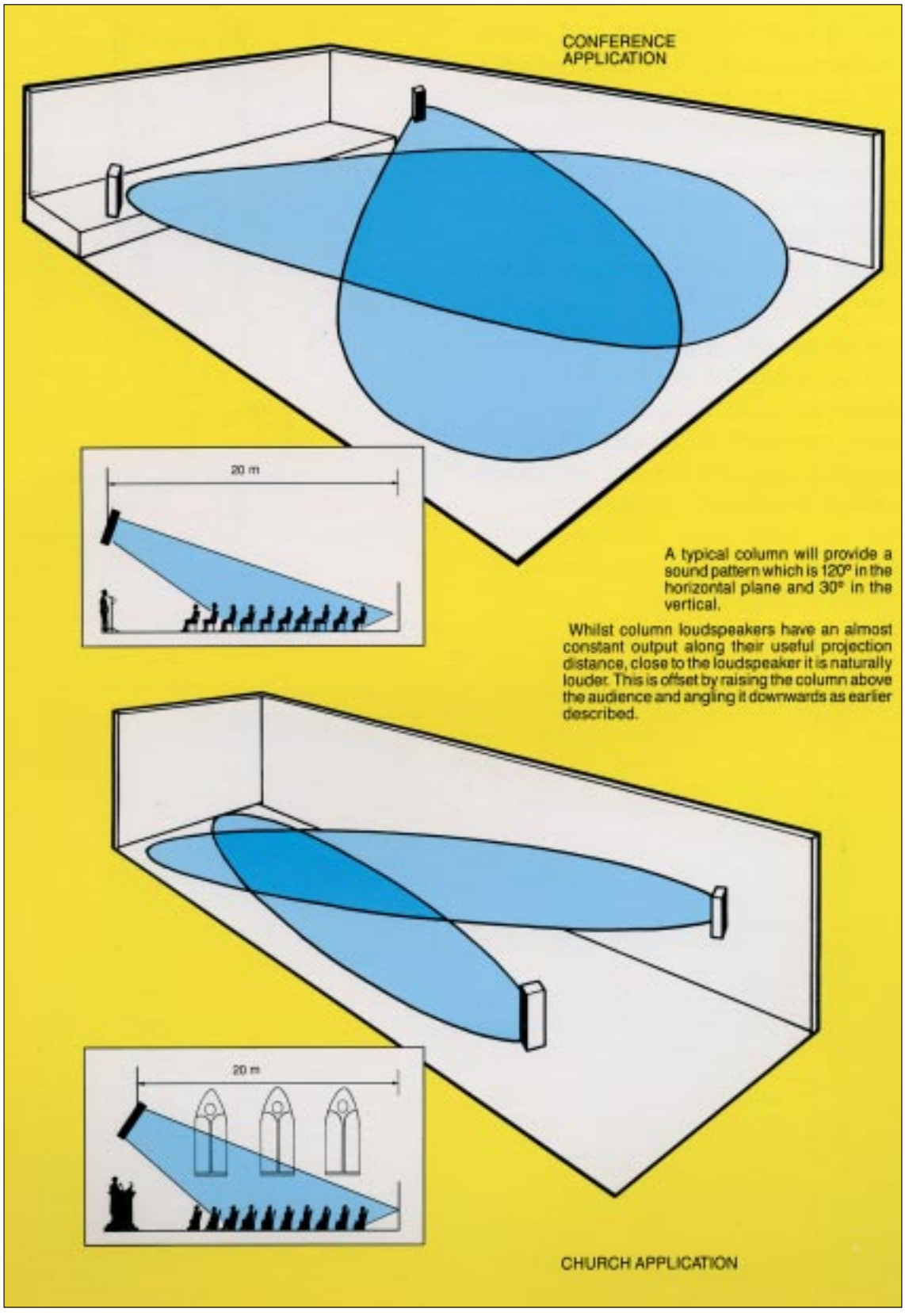
The height of a column from floor level also has an influence on its effective operating distance and should also be such that it can reach the rear of the listening area. In practice this means installing the column loudspeakers so that their base is at least 2 metres from floor level and are angled down as shown in the diagrams.

Because of the difference between the speed of sound through the air and through cable, column loudspeakers should be mounted in reasonable proximity to the natural speaker (microphone position) so that "air" sound coincides with "cable" sound. However please refer to page 21 – on acoustic feedback and pages 11, 12 – on Acoustics.



Take care to minimise back wall reflections which could cause echo to those at the front of the audience, or increase the possibility of acoustic feedback.

Where column loudspeakers are used in concourse areas – the "audience" is probably standing up, even walking – the height of the column base should be 3-4 metres from the floor and angled down accordingly.


CONFERENCE APPLICATION
20 m
A typical column will provide a sound pattern which is 120° in the horizontal plane and 30° in the vertical.
Whilst column loudspeakers have an almost constant output along their useful projection distance, close to the loudspeaker it is naturally louder. This is offset by raising the column above the audience and angling it downwards as earlier described.
20 m
CHURCH APPLICATION

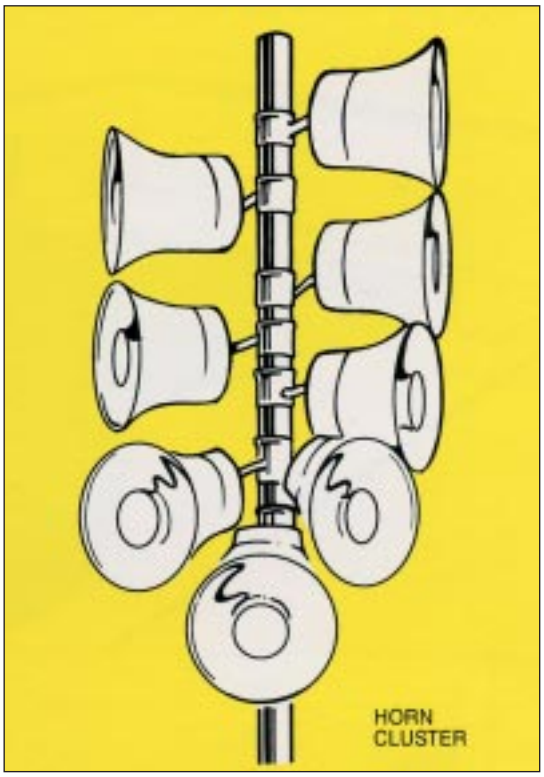
LOUDSPEAKER CHOICE continued

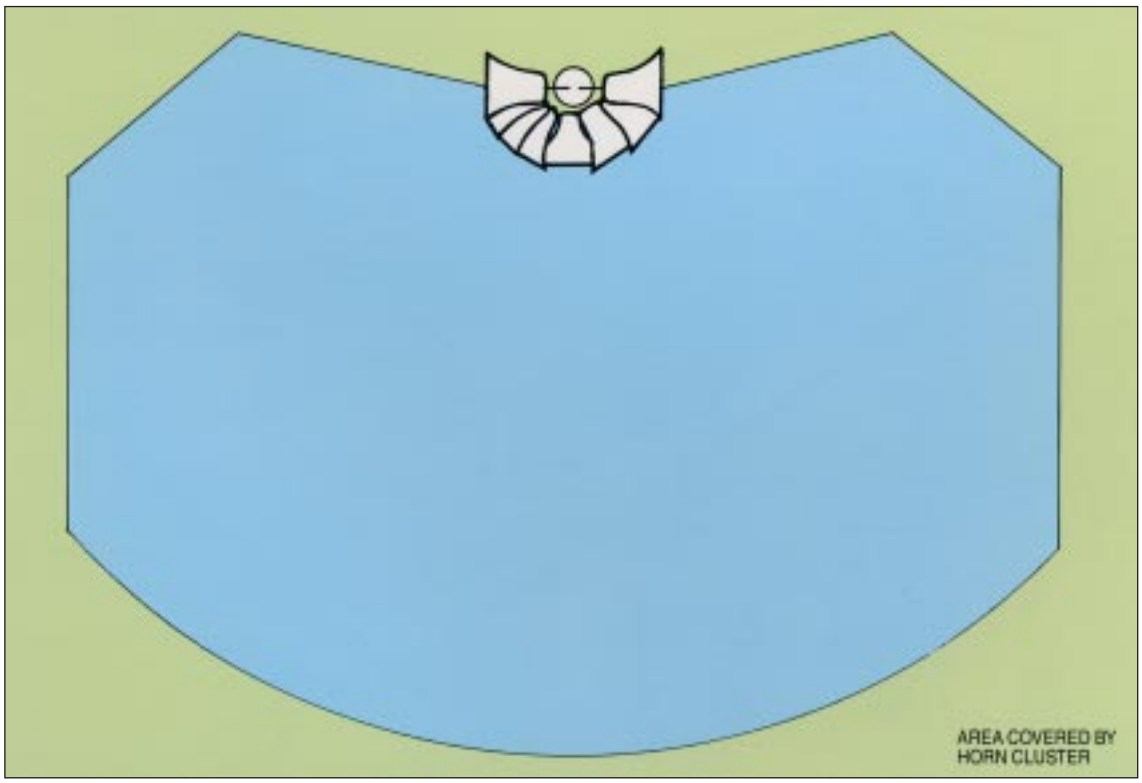
Horn Loudspeakers

The major advantages of horn loudspeakers is that they are directional and most are weatherproof making them an ideal choice for outside use.

However, bass response is limited by their physical size and horn loudspeakers, whilst being good for speech are generally not suitable for good music reproduction.

It is important, due to the directional characteristics of horn speakers, to ensure that sound is beamed at all areas to be covered. A cluster of horns mounted together is ideal for sports stadia or large public areas for example. Due to their high efficiency it is necessary to mount them high above the ground to avoid the risk of "deafening" people close by.

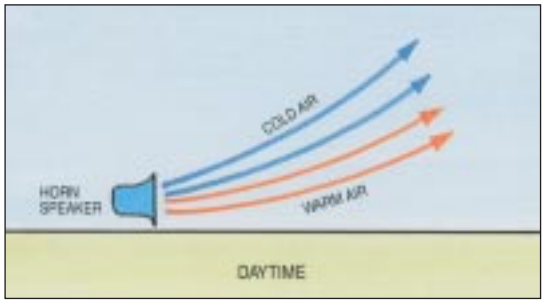


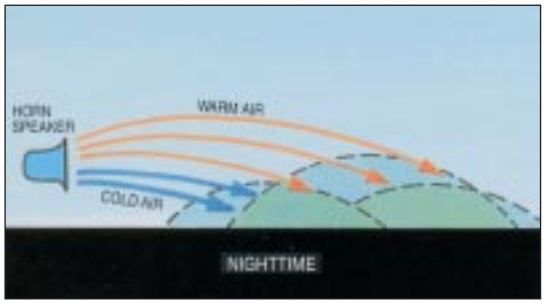


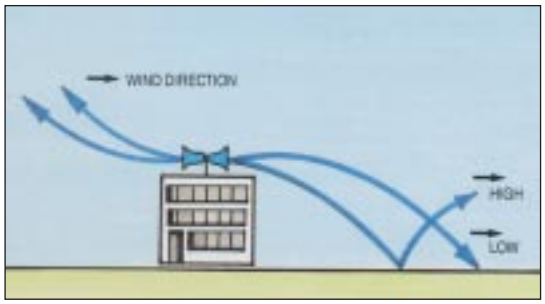
External Mounting Considerations

When installed outside, the effect of wind and temperature can modify the directional characteristics of horn loudspeakers. This will be most noticeable when installed on the flat roof of a building in full sunlight and the following diagrams demonstrate how the sound will be affected.**NOTE:**

The front of a horn loudspeaker should always incline very slightly downwards to prevent the horn filling with rain, leaves or other debris.







MODEL ROOM – WALL AND CEILING LOUDSPEAKERS

As a basis for your own calculations we have taken a model room with a ceiling height of 3m. We have assumed plaster walls and a suspended (tile) ceiling, both clear of obstructions and an environment of an open office.

Clearly, more noise in the "Model room" means more sound to overcome it – in a workshop, for example.

The reverse is also true: in a church crypt, where background noise is virtually non-existent.

The chart on the following page shows, from left to right, the floor area of the "Model room", from 35m^2 to 2800m^2. The left hand side is graduated in numbers of ceiling speakers.

Note that the chart refers only to ceiling loudspeakers in an office environment. Some further considerations are necessary to convert the number of speakers shown to that required in your installation or if you only require wall mounted loudspeakers.

To illustrate the possible effect of noise relative to the number of speakers required please refer to the illustration on page 13. Study of this will enable a reasoned judgment to be made quite easily.

ASSESSING YOUR REQUIREMENTS

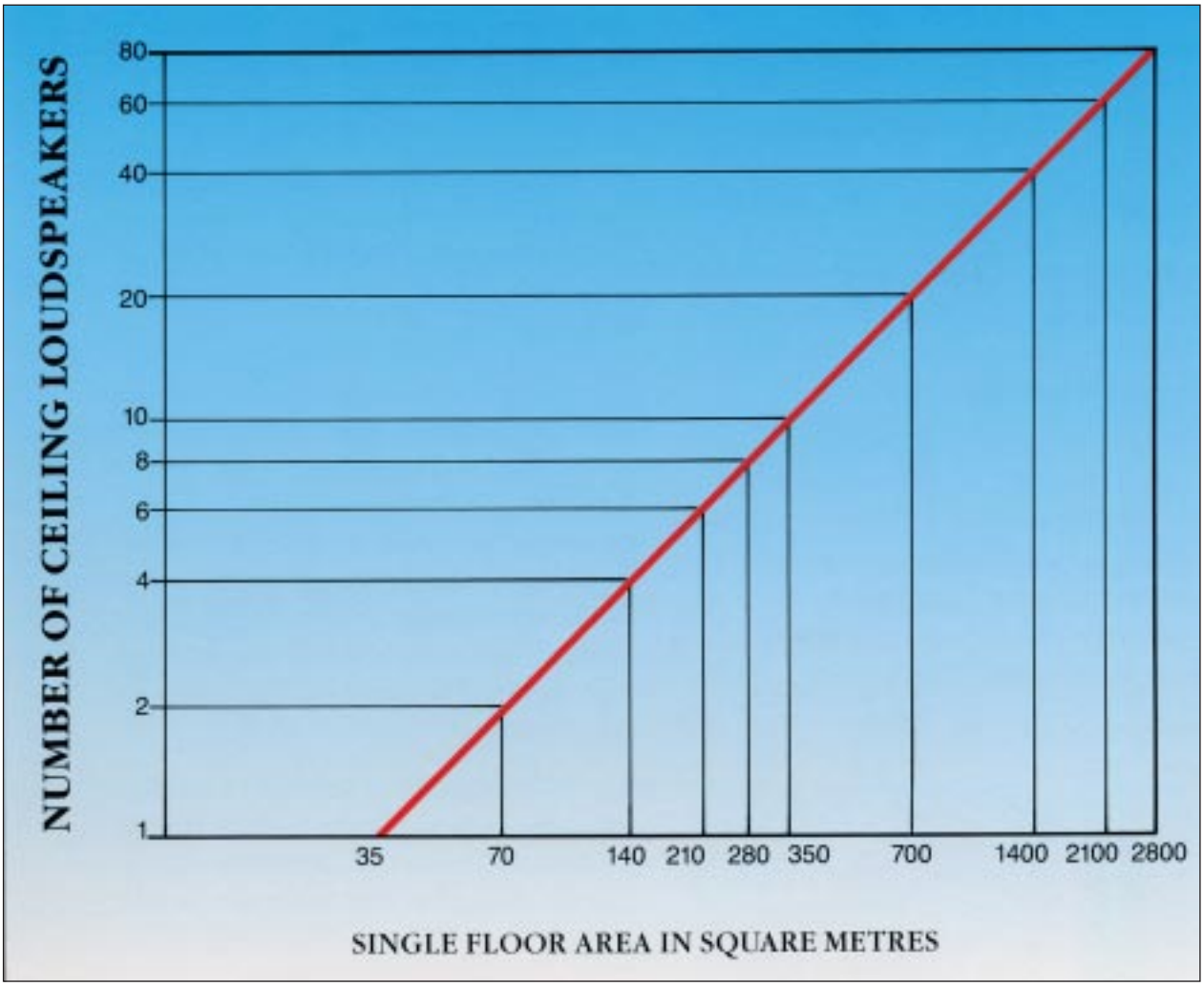
As examples, in very noisy areas such as a busy supermarket add 50% – half as many again (25+12 = 37) – and for the quiet ambiance of a library reduce the quantity to half that shown (30/72 = 15). For all cases where wall mounted loudspeakers are chosen divide the number shown on the chart by a factor of 2 (50/7 2 = 25) and then make allowances for ambient noise as described above.

Column loudspeakers, for sound reinforcement, are not included in this Model Room example but are included on pages 16 and 17.

USE OF HORN LOUDSPEAKERS

In areas of high ambient noise consider the use of horn loudspeakers and "direct" towards the specific area of the "car mechanic that is required to hear paging messages". If so directed a smaller number of loudspeakers will be required, the number being decided from the area to be covered, the number of operators to be addressed and their usual proximity to highest noise levels.

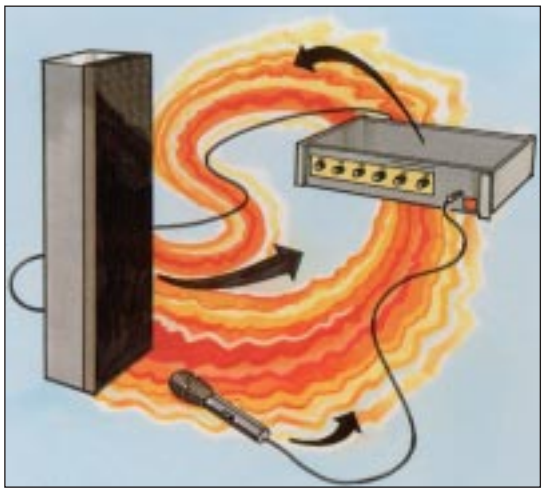
HOW MANY LOUDSPEAKERS?



ACOUSTIC FEEDBACK IN PUBLIC ADDRESS AND SOUND REINFORCEMENT SYSTEMS

One of the main concerns of the sound system designer and installer is the potential for acoustic feedback, which gives rise to deafening howl! This is caused by sound from the loudspeakers being picked up by the system microphones. The effect is that the sound is re-amplified, emerging from the loudspeakers at a higher level, is picked up again, amplified further and so continues around until it builds up into a loud and incessant howl.

The way in which microphones and loudspeakers are relatively positioned and the acoustics of the working environment affect the susceptibility to feedback and set a limit to the level of sound that can be obtained in any one given installation.



As the sound level is progressively increased the potential for feedback reaches a point where "ringing" occurs; every word that is spoken over the system is followed by a ringing sound that gradually dies away. Feedback is then at a danger point where it is not quite enough to maintain itself without being started by the user of the microphone; any further increase in sound level will produce continuous feedback howl – which will not stop until the sound level is substantially reduced.

The point where "ringing" commences must be avoided since ringing itself reduces intelligibility and has a disturbing effect on the listener. It is desirable that the normal operating sound level should be somewhat below this point in order to give a good safety margin; in practice it is often the case that this level is very near the feedback threshold.

Some adjustment of system frequency response – by using the bass and treble tone controls on the amplifier – will always improve the system's safety margin.

Where there are loudspeakers in the same room as microphones, it is impossible to prevent some sound being picked up. The whole art is to pick up as little as possible.

See pages 16 and 17 (about mounting column loudspeakers) and page 11 on **Acoustics**, since this is an important and correctable aspect of making a sound system a **good** sound system.

SYSTEMS FOR THE HEARING IMPAIRED

Persons with normal hearing in both ears have the ability to "seek" their source of wanted sound. Since most hearing impaired persons use only one hearing aid (one ear) they suffer the disadvantage of having little directional information; there is therefore difficulty in discerning not only the direction of sound but "tuning in" to wanted sounds and rejecting unwanted sounds.

For the hearing impaired all unwanted sounds, including coughs, clapping, etc are received at around the same volume as wanted sounds, making enjoyment of theatre, music or church-going, for example, virtually impossible.

Most of these problems can be overcome by using the public address or sound reinforcement system to feed directly to the hearing aid user, so that only the wanted sound is distributed. An especially designed Induction Loop Amplifier, which connects to the sound system is all that is required. This amplifier is then connected to a loop of wire installed around the listening area, normally at, or just above, floor level.

Modern hearing aids almost always enable the wearer to select the built-in microphone (M) or a telecoil pick-up (T) originally intended for use to improve hearing in telephone conversations.

The symbol in a building indicating that an Induction Loop System has been installed.

Where an area is fitted with an Audio Frequency Induction Loop System, commonly called AFILS, selecting the "T" position on the hearing aid allows the user to hear only the program via the Induction Loop System.

Other uses for Induction Loops

Induction loops are also used for the transmission of commentary to persons with normal hearing, for example in an **art gallery or museum**. In this case visitors are loaned a portable headset to enable them to receive the commentary without causing noise in the building generally.

For **factories** and other noisy environments the induction loop headset can be of the "ear-defender" type to enable the wearer to receive music, radio programmes or emergency announcements whilst excluding the surrounding noise of machinery, etc.

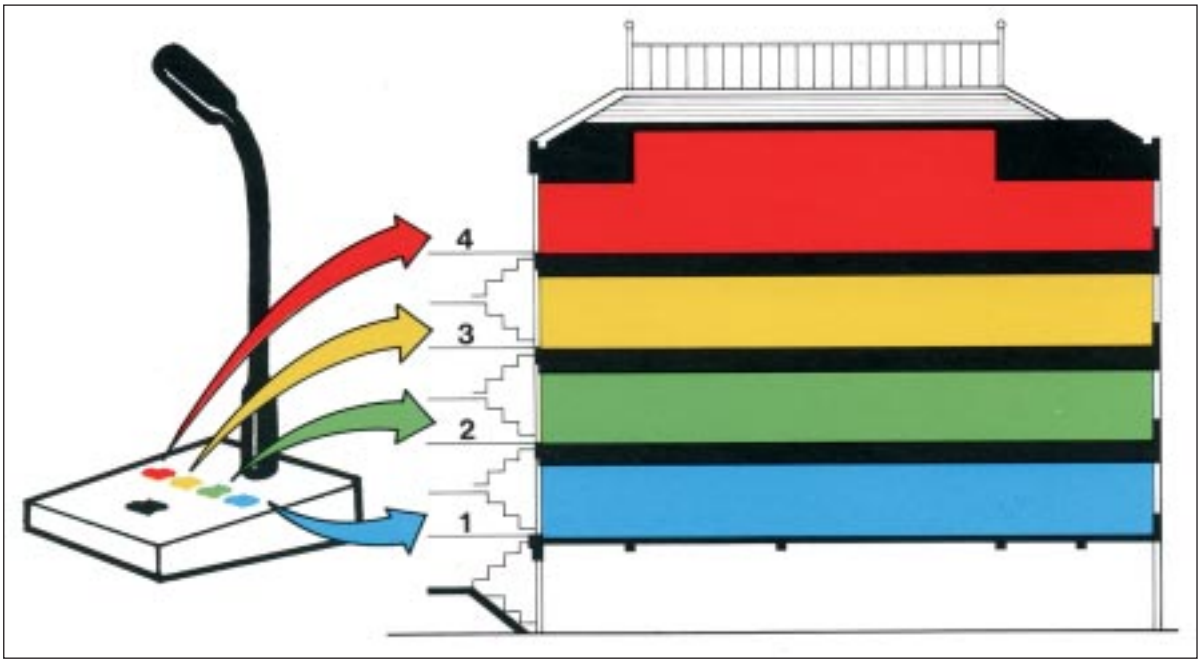
Induction loops are also used for single language simultaneous translation systems and are included in **lecture and conference theatres** for this purpose.

PLEASE NOTE

The science of installing induction loops is complex and is environment dependent – steel constructed buildings are particularly difficult – and we do not recommend self installation.

Dividing an installation into separate operating zones

Dividing a public address system into defined zones can be very helpful, particularly where paging specific departments or floors of an office or store is required; only those zones selected will be addressed. The output from the amplifier will be automatically routed to the chosen zone or zones by simply pressing the "press to talk" key on the paging microphone which also contains the zone selection keys. In the typical sound system applications in this book, four zones are adequate.



Controlling Sound Levels in Individual Areas

Whether an installation is divided into separate paging zones or not it may be that some areas have a lower ambient noise than others and thus require less output from the loudspeakers.

The most simple solution is to provide volume controls in each area required; this enables local control at all times and, even if set very low, paging announcements will be automatically broadcast at the higher system level. Most amplifiers provide for this operating option.

Local volume controls usually fit in the same types of flush or surface mounting wall boxes as are used to house domestic light switches.

IMPROVING EFFICIENCY THROUGH PUBLIC ADDRESS

Paging from a Telephone Extension

This is achieved by dialling a designated number which connects via a paging adaptor to the public address amplifier.

The amplifier may also continue to be used with a normal paging microphone or for distributing background music. So it is useful in warehousing, garages, service centres – anywhere where the telephone paging facility will improve efficiency.

It also provides an excellent fire or emergency announcement system. On detection a person can commence an evacuation procedure from the nearest telephone.

Importantly, most modern private telephone exchange systems can prevent unauthorised access to the paging amplifier from any extension.

Public Safety

Owners of public and commercial premises have a duty to ensure the safety of occupants at all times.

When an emergency such as a fire or a bomb scare arises or whenever there is the need to evacuate the building, this is best achieved by a speech announcement rather than bells or sounders.

The spoken word can be "live" from a microphone, a telephone paging facility (see page 25) or pre-recorded.

Stored announcements can be incorporated into many available systems and initiated by the building's fire alarm installation; when the alarm is activated the sound system automatically broadcasts the stored message.

Often local fire authorities will require the alarm bells to work in parallel with the sound system; sound systems that are designed to work alone to warn of danger require special fire-safe wiring and complete building coverage with approved loudspeakers sited in accordance with the Fire Officer's instructions.

British Standard BS 5839 sets out guidelines by which audio fire warning and safe evacuation systems can be established to conform with regulatory requirements, including types of equipment, cabling and operating practice.

The Home Office publish a "Guide to Safety at Sports Grounds" which provides specific advice on the requirements from sound systems installed in Sports Grounds including the provision of auxiliary power sources; in the event of ac mains supply failure these enable the sound system to continue to operate.

If it is intended to include the facility for voice evacuation messages in your system design please consult engineers.

About Music

True "background" music is often described as that which fills the "silence" between conversation, for example in a restaurant environment; this should not be loud enough to be obtrusive but can be adjusted so that it adds to the ambiance of the establishment.

Music should never be so loud that the client cannot think or that advice given by the shop assistant or waiter cannot be heard.

Loud "foreground" music can often drive people out of shops and restaurants and is better suited to those environments where music is a positive attraction to the shopper, such as in a young person's boutique.

Background music or radio programmes in offices, factories and workplaces in general often adds to an efficient and happy working environment.

The provision of stereo music reproduction in public areas is not always considered to be beneficial. It is often impractical, and is more costly than a single channel (monaural) system.

For certain public uses of recorded music in the UK a license is required. Full details can be obtained from:
MCPS-PRS Alliance
Copyright House
29-33 Berners Street
LONDON W1T 3AB

COMPACT DISC PLAYERS

About Compact Disc Players

CD playback systems offer a much higher quality of sound reproduction than other commonly available music sources; they are considerably more reliable than most.

To realise the full potential quality of a CD the system to which they are connected must be of similar high quality. Because of the recording method there is almost complete silence between music tracks; no disturbing clicks, pops or hiss as experienced with other storage systems.

The standard CD is an optical playback system using 12cm diameter discs. Audio signals are stored in digital form and played back by reflecting a laser beam from the recording surface whilst the disc rotates at high speed. Standard discs are single sided and typically play for between 45 and 55 minutes although up to 80 minutes is technically possible.

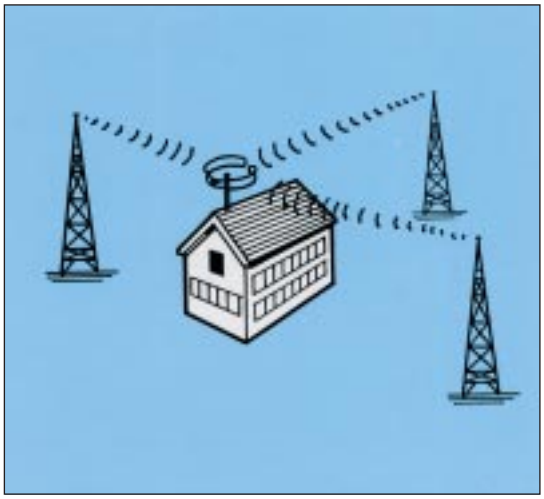
CD systems are available which can play tracks at random from a series of up to 10 discs loaded into the player. These products are ideal for background and foreground music requirements.

About Radio Reception

It is essential that for good FM radio reception an aerial is mounted on the outside of the installation building and as high as possible. Loft aerials may be sufficient in areas local to the transmitter but they must be kept clear of metal objects. These, like metal roof cladding, can render such aerials useless.

The elements of a fixed FM aerial should be normally set horizontal; in the U.K. there are just a few transmitters that require the elements of the aerial to be vertical. In each case the aerial should be pointed towards the transmitter with the shortest element in front, as shown in the diagram.

A relatively new aerial receives transmissions through virtually 360 degrees making it highly suitable for reception of the multitude of local FM stations, some catering for specific interests. The disadvantage is that since these aerials are omnidirectional they do not possess the directivity to receive weak, distant stations with clarity.



It can be seen that there are a number of types of aerials available and because of the geographic considerations of the installation and the degree of expertise required in selecting and installing aerial systems we recommend the use of a local specialist contractor in all cases.

APPLICATIONS

Having explained what sound systems are and some of the facilities usually required we should now think about developing your proposed installation. Remember that systems generally are either for sound reinforcement or public address and the following list will assist you in deciding which category applies to your proposed system:

SOUND REINFORCEMENT	
Banqueting Areas	Village Hall
Church	Stage
Lecture Theatre	Theatre

PUBLIC ADDRESS	
Shops	Theatre
Bank	Offices
Bar	Restaurant
Art Gallery	Outdoor PA
Depot	Sports Ground
Factory	School
Exhibition Area	Sports Hall
Hotel	Swimming Pool
Leisure Centre	Warehouse
Museum	Superstore

CONNECTING YOUR SOUND SYSTEM

To ensure maximum efficiency of your sound system please note:

a) Never run microphone and loudspeaker cables alongside each other for more than 1 metre. Loudspeaker cables can induce their signals into the microphone cable and cause an effect similar to acoustic feedback.

b) Never run loudspeaker or microphone cables together in metal tubes (conduit) nor alongside supply cables.

c) We recommend that microphone cables are no longer than 50 metres.

d) Only use cables recommended by the manufacturers of the various components that comprise the sound system.

APPLICATIONS
What you should know

In the following pages we show how a wide variety of establishments can be "wired for sound".

As earlier stated, with an understanding of where to locate the established number of loudspeakers and of selecting the correct models for your application environment, the main part of system planning is complete.

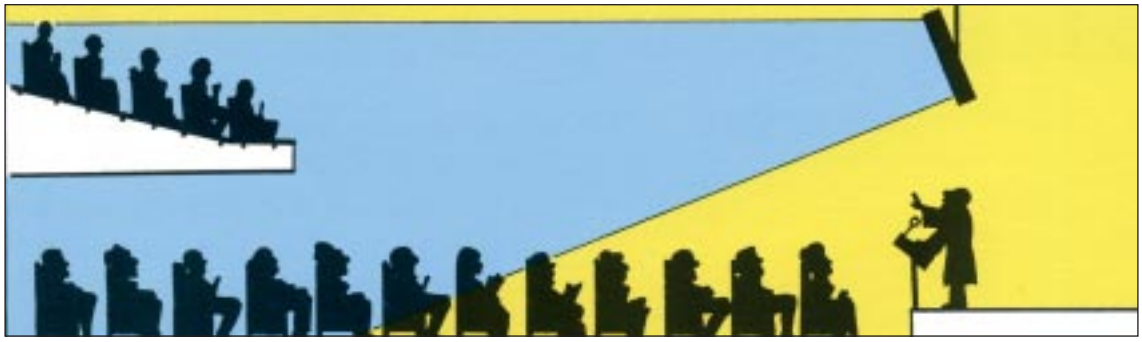
There are many different types of buildings that can benefit from a sound system – sports and leisure centres, warehouses, factories and service areas – but these are simply developments of what has already been shown and need only basic interpretation to meet their specific requirements.

Within this understanding, the interpretation of the plans and layouts and of system requirements is simple; the facilities required from the system in terms of amplifier requirements are merely a question of choice and – how many microphones? – of which model? – is a radio necessary? – does the application require an induction loop? – etc.

CONTENTS

These are normally treated as areas requiring sound reinforcement and the system should include facilities for reproducing sound from audio visual components – video projectors, tape recorders etc – and for relaying sound from other meeting places.

As with similar establishments, where the audience will comprise persons of varying hearing ability, consideration should be given to the installation of an induction loop.



Auditoria

Generally these fall into two categories:

a. Those with ramped, theatre style fixed seating; seating accommodation can also include a balcony.

The use of column loudspeakers is recommended, perhaps one pair for the main floor and, depending on size and positioning, a further pair for the balcony.

CONFERENCE, LEISURE AND PRESENTATION THEATRES continued

Remember that the object of the installation is to enhance the original live sound and that the column loudspeakers should be so positioned to allow this perception by the seated audience.

b. Those which have a level floor with portable seating, sometimes arranged in theatre style.

In these types of premises, where the ceiling height is less than 3.5 metres the use of ceiling loudspeakers can provide better sound coverage than columns because of the inability to mount the columns sufficiently high, particularly in rooms of say, greater than 15 metres in length. Use of ceiling loudspeakers will also cater for varying the seating layout or varying uses of the floor area.

Take care however, if a roving microphone for audience participation is to be used; this may well increase the chances of acoustic feedback, see page 22, because of the potential close proximity of microphone to loudspeaker.

Where the ceiling height is greater than 3.5 metres column loudspeakers should be considered.

Other Areas

It is unlikely that areas other than the main seating area will need any reinforced sound, except where specific installations demand or where the system is also intended for emergency evacuation.

Where lecture and conference theatres have exclusive washrooms it can be desirable to extend the lecture or presentation to these areas by the inclusion of ceiling or wall loudspeakers.

Microphones

Provide for at least two "main" microphones choosing either floor or table stands and giving consideration to a "roving" microphone for audience participation – in conferences for example ... and a floor stand for this too.

Please also refer to the Churches application note on page 39, concerning radio microphones, since these are sometimes preferred for audience participation though there is likely to be some difficulty in arranging a receiving aerial system such that it will work adequately over the entire audience area at a sensible cost.

Other Facilities

Audio-Visual Inputs

The facility to reproduce the sound from audio visual equipment should be provided. The equipment may include facilities for relaying sound from other meeting places linked by permanent or temporary telephone landlines. These require British Telecom approved equipment, please ask for specific installation requirements.

For normal sound playback from tape recorders, film and video systems an auxiliary input should be available at the amplifier; make sure also that a recording output is also provided. These are standard features of all Excel amplifiers.

The inclusion of an induction loop amplifier would permit a simultaneous single language translation facility. See page 23 Induction Loop Amplifiers.

CHECK LIST
CONFERENCE, LEISURE AND PRESENTATION THEATRES

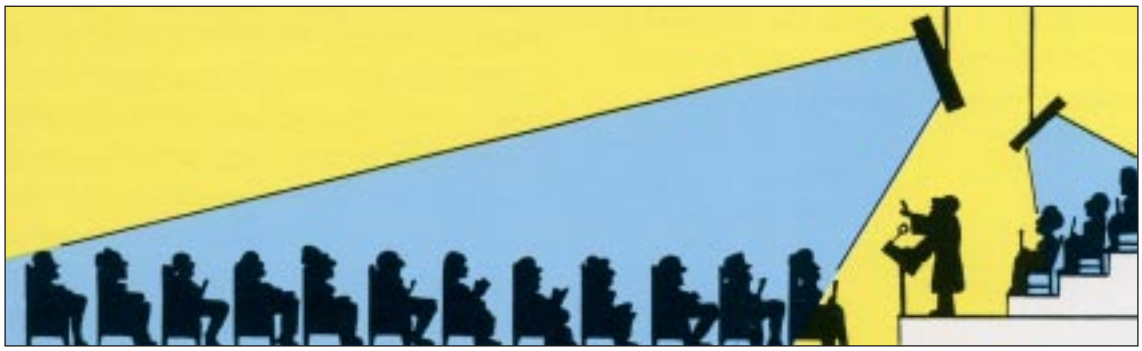
System Shopping List

	Excel Ref
Amplifier with	
(up to) 3 microphone inputs	
Audio visual input	
Land line input	
Recording output	1206N
Optional induction loop amplifier	1203L
Prewired Distribution Box	1556
Microphones, as required	
(up to) 3 hand held cardioid	1450
Floor stands	1550
Table stands	1552
Loudspeakers as required	
Ceiling, without fire dome	1350
with fire dome	1351
Accessories	
Microphone connection boxes	1553
Microphone cable	1954
Loudspeaker cable	1953

Installation Note
The amplifier should preferably be installed where the operator can enjoy a full view of the presentation area and audience. This might be an equipment control room, projection room or dedicated area where wiring can be routed conveniently.

Sound systems in these types of buildings have to cater for all kinds of seated audiences, those who may have normal hearing, a hearing disability or be almost totally deaf.

The sound system should therefore include an Induction Loop Amplifier for hearing aid users and a sound reinforcement system for those with normal hearing or with a hearing disability but do not wear a hearing aid.



GENERAL CONSIDERATIONS

As with all sound reinforcement installations it is necessary to "enhance" the original natural sound of the speaker and thus the loudspeakers should be placed in proximity to the speaker, but sufficiently far away so as not to cause acoustic feedback – "howl round" – as we describe generally on page 22.

Take care to consider any other areas of the establishment that may need simple loudspeaker reinforcement. In a church, a typical example would be an additional loudspeaker for the organist so that he may more easily follow the service. For the same reason it is sometimes an advantage to provide a loudspeaker for the choir.

CHURCHES, SCHOOLS AND COMMUNITY HALLS continued

In community and school halls, which may be used for a diverse range of activities, consider the provision of loudspeakers "backstage" – by any changing rooms, toilets etc.

Loudspeakers

In all cases the use of column loudspeakers is recommended, mounted as described on pages 16 and 17 with wall loudspeakers "backstage", in the crypt, by the organist etc. The galleries of churches may also need small in-fill loudspeakers but usually by careful planning these – and possible resultant echoes – may be avoided.

Microphones

The number of microphones used is dependent on specific needs and operational consideration but typical examples are:

Church

Fixed microphone/s at the pulpits, preferably on flexible goosenecks so that they may be adjusted to suit the height and position of the user.

For the altar, a microphone mounted on a floor or table stand is ideal.

On occasions there is a need for a microphone at the rear of the church or in a side chapel; whilst it will not be possible to provide the same degree of realism to the reinforced sound from the position (from the fixed column loudspeakers) a microphone cable and socket could be included in the general area.

School and Community Halls

Provide two microphones mounted on floor stands; whilst one may well be sufficient, a second allows for some audience participation in an event, or for amplification of live music (piano, etc).

Radio Microphones

Radio microphones are often desired and their use is effective. However their use is complicated by the possibility of radio interference and their expense and vulnerability to battery failure.

Notwithstanding these difficulties, properly installed and maintained systems can be worthwhile.

OTHER FACILITIES

Recorded Music

The facility to play recorded music – for effect, amateur dramatics, or to illustrate a point, should be accommodated. The use of CD playback facilities is appropriate to all these.

Recording an Event

Make sure that the system includes a tape recording output, to enable recordings to be made of any event.

Induction Loop

Please refer to page 23. It will not always be possible to cover all areas of the installation, except in very simple buildings. Consider only the main seating areas, or a part of the area which may be designated for hearing aid users.

It is often beneficial to include an "ambience" microphone which receives general sound – of the choir, applause – those sounds which are not usually distributed through the sound reinforcement system.

CHECK LIST
CHURCHES, SCHOOL AND COMMUNITY HALLS

System Shopping List

	Excel Ref
Amplifier with	
(up to) 3 microphone inputs	
Music source input	
Recording output	1206N
Optional induction loop amplifier	1203L
Prewired Distribution Box	1556
Microphones, as required	
(up to) 3 hand held cardioid	1450
Floor stands	1550
Gooseneck mountings for hand held	1552
Loudspeakers as required	
Wall, black	1352
white	1353
Column	1354
Accessories	
Microphone connection boxes	1553
Microphone cable	1954
Loudspeaker cable	1953

Installation Note
We recommend that the amplifier is placed under lock and key so that it cannot be misused, or easily stolen. In a church it is usual to locate the amplifier either where the organist has control, or at the rear of the church where a nominated member of the congregation can maintain control during a service.

Swimming pools are potentially very difficult to cover with sound since they are mostly of glazed or smooth wall construction, highly reflective to any sound. Rarely are any of the walls treated with sound absorbing material and therefore care has to be taken in placing loudspeakers to ensure that echoes – reflections of sound, are minimised. (See also pages 11 and 12 on Acoustics).

THE SOUND SYSTEM

A typical system would comprise public address with selectable zone paging for:

a) changing rooms
b) administrative areas
c) public areas, including spectator viewing
d) "in pool" swimmers

It could also be that paging into the car park would be advantageous.

There could be two paging points: the Manager's office and Reception. These would require a desktop microphone with zone selector switches.

For general use a hand held microphone, adaptable for table and floor stand use should be provided, with connection sockets around the pool area and at a (commentary) point, perhaps in the viewing area. These connection sockets would be wired back to the amplifier point.

The facility to play background music and music for synchronised swimming may also be required.

It is useful to provide a tone signalling or prerecorded announcement facility to enable pool staff to inform swimmers of the beginning and end of sessions, commencement of wave machines, etc. This often requires some additional plug-in accessories for the systems amplifier and the provision of a pushbutton for activation.

Consideration should also be given to the inclusion of an induction loop amplifier, for the viewing area or for swimming instruction, using waterproof in-ear receivers.

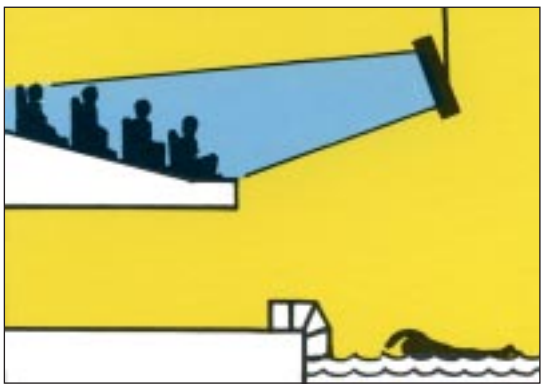
SELECTING THE CORRECT LOUDSPEAKERS

Service Area

Changing rooms and administrative areas may use wall or ceiling loudspeakers.

Public Area

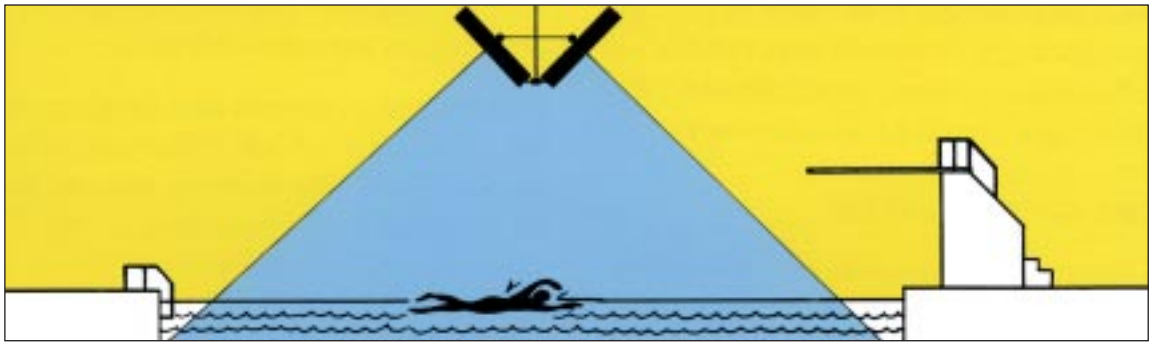
"Normal" ceiling heights allow a choice of wall or ceiling loudspeakers. However, where a seated viewing area is provided which includes a high ceiling, column loudspeakers mounted above, will reduce reflected sound and improve intelligibility.



SWIMMING POOLS continued

Swimming Area

Very dependent on pool configuration but column loudspeakers suspended above the water, are often successful.



A WORD OF CAUTION

Above all, sound levels must be kept low to avoid "exciting" the echoic area and care must to taken to fully utilise the directional characteristics of loudspeakers for this same reason.

It is not recommended that horn loudspeakers be considered because of their limited suitability for reproducing music and their likely counterproductive use with respect to reverberate environments.

WARNING!

Under no circumstances should the amplifier be accessible to persons who may be wet or standing on a wet surface. The amplifier must be grounded via the mains power lead and plug and we recommend installation outside the main humid and often chlorinated atmosphere.

However, the amplifier should be located where it can be accessible only to staff yet convenient for any sound volume adjustment during pool sessions etc. Typically the area around the Reception desk is used.

System Shopping List

	Excel Ref
Amplifier with	
(up to) 2 paging microphone inputs	
Commentary microphone input	
Music source input	1206N
Tone signalling input	Please refer to Custom House
Optional Induction Loop Amplifier	1203L
Prewired Distribution Box	1556
Microphones, as required	
(up to) 2 single or	1451
2 4-zone paging	1452
Hand held cardioid	1450
Floor stand	1550
Table stand	1551
Loudspeakers as required	
Ceiling, without fire dome	1350
with fire dome	1351
Wall, black	1352
white	1353
Column	1354
Accessories	
Microphone connection boxes	1553
Zone remote volume controls	1555
Microphone cable	1954
Loudspeaker cable	1953
Zone switch control cable	1951

SHOPS, BARS AND RESTAURANTS

In shops, bars and restaurants of all types it is usual to simply provide background or foreground music, dependent upon the style and use of the premises. See page 27, about music.

In shops pre-recorded point of sale ("spot") announcements are often used to promote goods on display and a number of products are available specifically for this promotional purpose.

In bars and restaurants use of a paging microphone will enable food order and table calls to be quickly and efficiently carried out, using selective, zoned paging in the larger establishments. Washrooms should be provided with paging and background music.

Paging microphones will normally be sited in the manager's office in a shop, behind the bar in a restaurant or by the food servery in bar premises.

It is worth considering the extra use of sound systems to provide for a safe evacuation of a building in the event of an emergency; a simple announcement causes less panic than a series of fire bells.

In shops, bars or restaurants the smooth distribution of music is the key to a pleasant atmosphere and in general the ambient noise experienced is not dissimilar to that in an office and the same installation criteria can be applied.

The control of music levels in various areas – dining rooms and between shop departments – can be accomplished by local volume controls.

Take care to arrange the loudspeakers so that they are not above serving or cash positions but are in the general area of the goods on display or seating in bar or restaurant areas.

System Shopping List

	Excel Ref
Amplifier with	
(up to) 2 paging microphone inputs	
Music source input	1206N
Prewired Distribution Box	1556
Microphones, as required	
(up to) 2 single zone paging	1451
2 4-zone paging	1452
Loudspeakers as required	
Ceiling, without fire dome	1350
with fire dome	1351
Wall, black	1352
white	1353
Accessories	
Microphone connection boxes	1553
Zone remote volume controls	1555
Microphone cable	1954
Loudspeaker cable	1953
Zone switch control cable	1951

Installation Note
Generally the amplifier, music and "spot" announcement equipment is located in a manager's office.

OFFICES

The System

In offices the public address system will need to be designed for general paging, to call people to their telephones, to reception etc and perhaps to announce commencement and completion of work periods and for emergency messages.

Loudspeaker Selection

A choice must be made to use ceiling and/or wall loudspeakers, depending on area requirements. If the main purpose of the system is paging, then wall mounted loudspeakers will provide the most economical solution.

Consideration should also be given to the introduction of background music which often improves the working environment. Arrangements can be made to delete background music from selected areas, for example, an accounts office, the system in these receiving only paging messages.

Training Areas

These are best considered by reading the application note dealing with Conference, Lecture and Presentation Theatres; pages 33, 34 and 35.

If the primary purpose is to provide background music it is essential that this is smoothly distributed throughout each area and thus ceiling loudspeakers are an obvious choice. Because of their ability to provide a more even sound coverage in an area, a lower volume level will be found acceptable and less obtrusive.

In **warehousing areas** which may have high or variable ambient noise and only require paging the use of horn loudspeakers should be considered.

To reduce the risk of producing acoustic feedback do not site loudspeakers close to paging microphones. See page 22 for more details on acoustic feedback.

Selective Paging

In large office complexes, which may be housed on a number of floors, or where offices are linked to a warehouse/storage facility it may be advantageous to divide the public address system into separate zones for paging purposes. Selective paging into the warehouse and not over the whole system will avoid unnecessarily disturbing all staff. See page 24 about zone paging.

Control of Sound Levels

Volume controls may be provided in individual offices to allow occupants to select the level of background music preferred, or none at all; paging and emergency messages can still be received at full volume if the system is suitably equipped.

Other Facilities

Sometimes it could be useful to include a hand held microphone with a floor stand, for use at times of staff presentations, guest speakers etc.

	Excel Ref
Amplifier with	
(up to) 2 paging microphone inputs	
Hand microphone input	
Music source input	1206N
Tone signalling device input	
(Please refer to Custom House)	
Prewired Distribution Box	1556
Microphones, as required	
(up to) 2 4-zone paging	1452
Hand held cardioid	1450
Floor stand	1550
Table stand	1551
Loudspeakers as required	
Ceiling, without fire dome	1350
with fire dome	1351
Wall, black	1352
white	1353
Horn	1355
Accessories	
Microphone connection boxes	1553
Zone remote volume controls	1555
Microphone cable	1954
Loudspeaker cable	1953
Zone switch control cable	1951

Installation Note
It is usual to place the central amplifier and any background music source in the telephone room, or in any well ventilated area away from general access.

SPORTS GROUNDS

General Considerations

Sound systems for sports grounds have a common purpose irrespective of their size: to provide announcements of scores, next events and to evacuate the site in the event of any emergency.

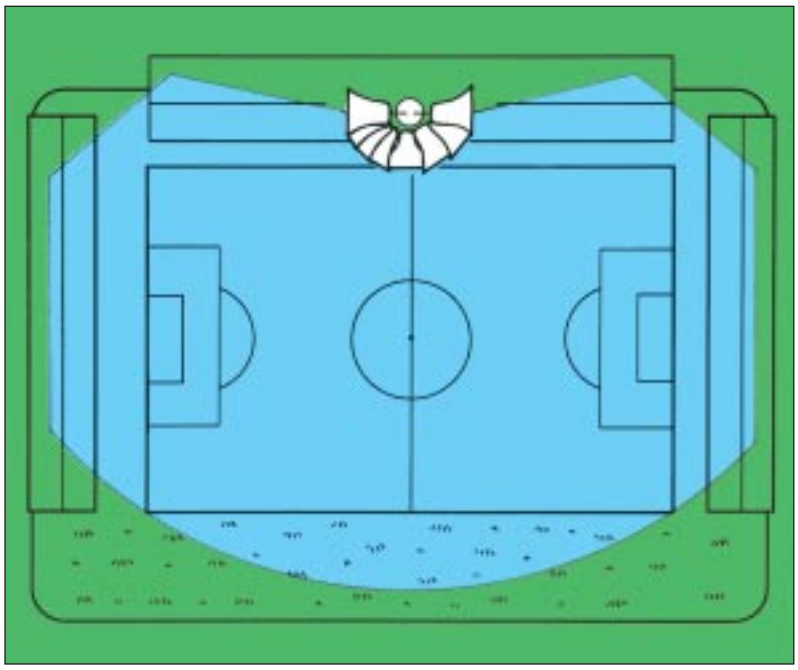
As a direct result of emergencies at sports grounds, legislation is in place which demands crowd control facilities and zoned announcements for some types of grounds. The advice of a specialist consultant is recommended to operators. See page 26.

Basic Provisions

To demonstrate the provision of simple systems, we have taken an open field with a raised viewing area, a club-house and two gated spectator entrances.

The main use of the area is for football. However, the system described is suitable for other field sports.

The club-house site is ideally positioned as a base for installing the system amplifier and a single loudspeaker array comprising eight horn loudspeakers. This type of loudspeaker is suitable for the size of ground; horns can project sound over long distances and because of their location are not easily subject to vandalism. The sound from a point source will not contain echo as would be the case with multiple loudspeakers located throughout the ground. Please refer to page 18, Horn Loudspeakers, where a typical horn array is illustrated.



Care must be taken to avoid directing loudspeakers towards housing developments where announcements and music broadcasts would cause a nuisance.

The facility for crowd control by loudspeaker should be included at each access gate and consideration given to covering the immediate car park areas. Use horn loudspeakers in this application.

In the club-house there is likely to be a requirement for loudspeakers, to announce scores etc, covering bars, and changing and rest rooms where in each case wall loudspeakers would be appropriate.

Additional Facilities

Provision to play music before the match, at the interval and after a match will probably be required and a basic Compact Disc (CD) player should be included within the system. An FM Tuner can be included, for example to broadcast half-time scores during cup competitions etc.

Microphone Requirements

The match announcer will normally be provided with a high quality, close talking desk microphone, fitted with a press-to-talk switch which will be connected to the amplifier via a priority circuit allowing the announcement to override the music programme.

The following pages show some typical ways in which sound can be provided: they should be used only as a guide to how your particular use can be satisfied.

For speeches and the presentation of cups etc, it is necessary to provide a hand held microphone and a floor stand.

Hospital Radio

In many cases, because a sports ground is the centre for many local interests and events, the local hospital radio will require to take a commentary from the ground to be broadcast over the hospital system. This is normally arranged independently from the public address system via a telephone line. It would not form part of the public address system except where speeches or cup presentations would need to be relayed. These facilities require British Telecom Approved equipment.

CHECK LIST
SPORTS GROUNDS

System Shopping List

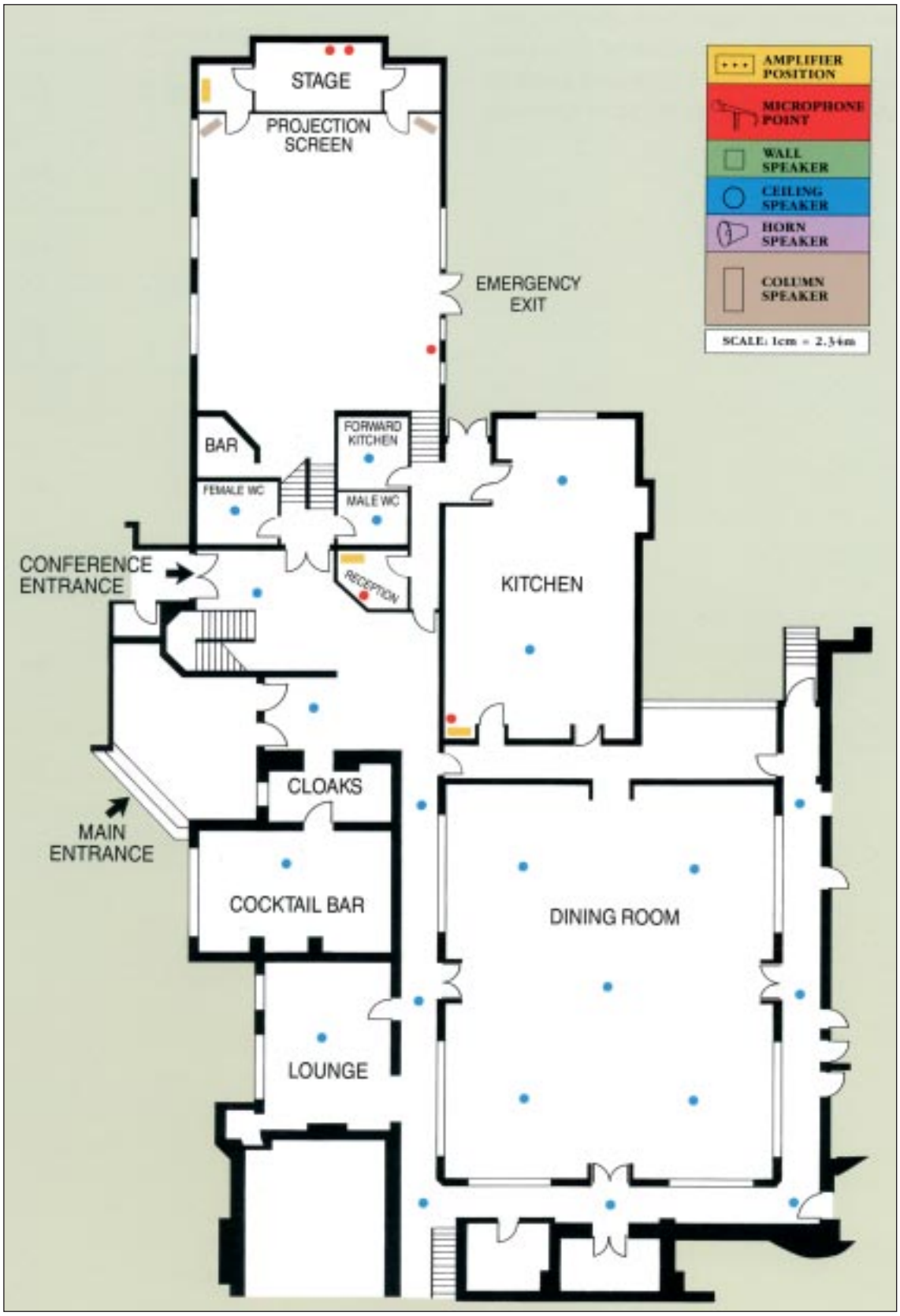
	Excel Ref
Amplifier with	
(up to) 2 microphone inputs	
Auxiliary input for CD player	
FM tuner	1204T
Microphones, as required	
Hand held cardioid	1450
Desk based commentary microphone	
with press-to-talk switch	1451
Floor stand	1550
Loudspeakers as required	
Horn	1355
Wall, black	1352
white	1353
Accessories	
Microphone connection boxes	1553
Microphone cable	1954
Loudspeaker cable	1953
Suitable FM antenna	(see page 29)

Installation Note
The amplifier and associated music source should be installed in the clubhouse commentary position.

The following pages show some typical ways in which sound can be provided: they should only be used as a guide to how your particular use can be satisfied.

CONTENTS

HOTEL/ CONFERENCE FACILITY



The plan shown forms part of a **hotel complex** and includes a **multipurpose conference area** which can be used for large screen film and video projection and includes a stage. Normal **dining and bar** facilities complete this part of the installation.

Three separate sound systems are included:

1. **Public area, including bar, lounges and dining room.**

This provides background music and paging over all areas, with the paging point being at **Reception**.

The location of loudspeakers in the **dining area** has been arranged to minimise music levels at the dining room entrances and to ensure smooth unobtrusive sound over the table areas.

Provision has also been made to allow independent amplification for Annual Dinners and other private events which may require speech reinforcement facilities.

2. **Conference Room.**

This can be operated with theatre style seating or with the seats removed for stand-up buffets and more informal events such as dances. The sound reinforcement system is provided with one column loudspeaker either side of the stage/screen area.

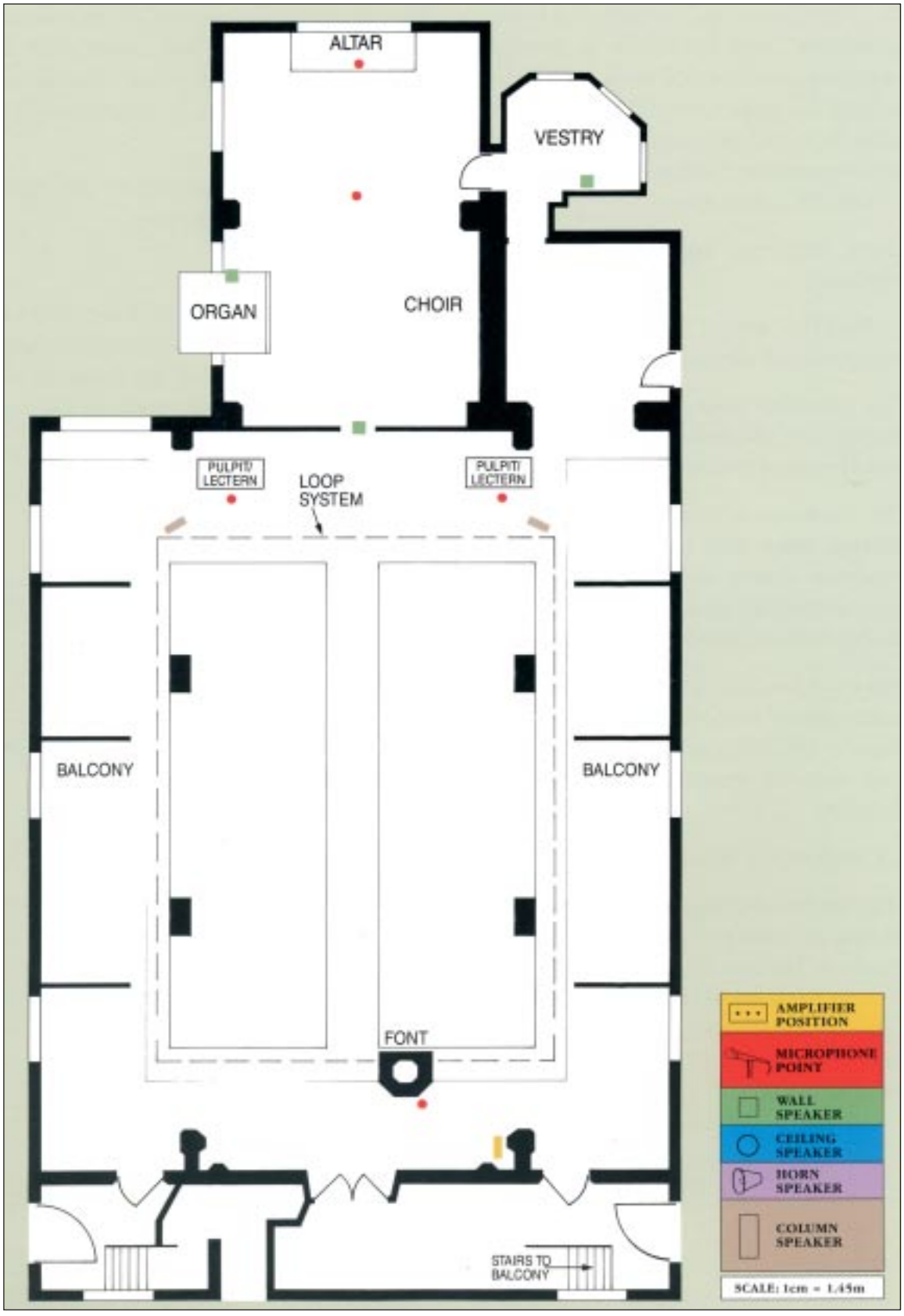
Two microphone points are provided at the stage end of the room with a further microphone point placed to allow use of a "roving" or guest speaker microphone.

The amplifier is installed in the ante room just off the stage area.

3. **"Back Office".**

This system links the service facilities of reception, kitchen and forward kitchen to advise fellow staff of the progress of functions in the conference or dining rooms.

CHURCH


ALTAR
VESTRY
ORGAN
CHOIR
PULPIT/ LECTERN
LOOP SYSTEM
PULPIT/ LECTERN
BALCONY
BALCONY
FONT
STAIRS TO BALCONY
AMPLIFIER POSITION
MICROPHONE POINT
WALL SPEAKER
CEILING SPEAKER
HORN SPEAKER
COLUMN SPEAKER
SCALE: 1cm = 1.45m

CHURCH

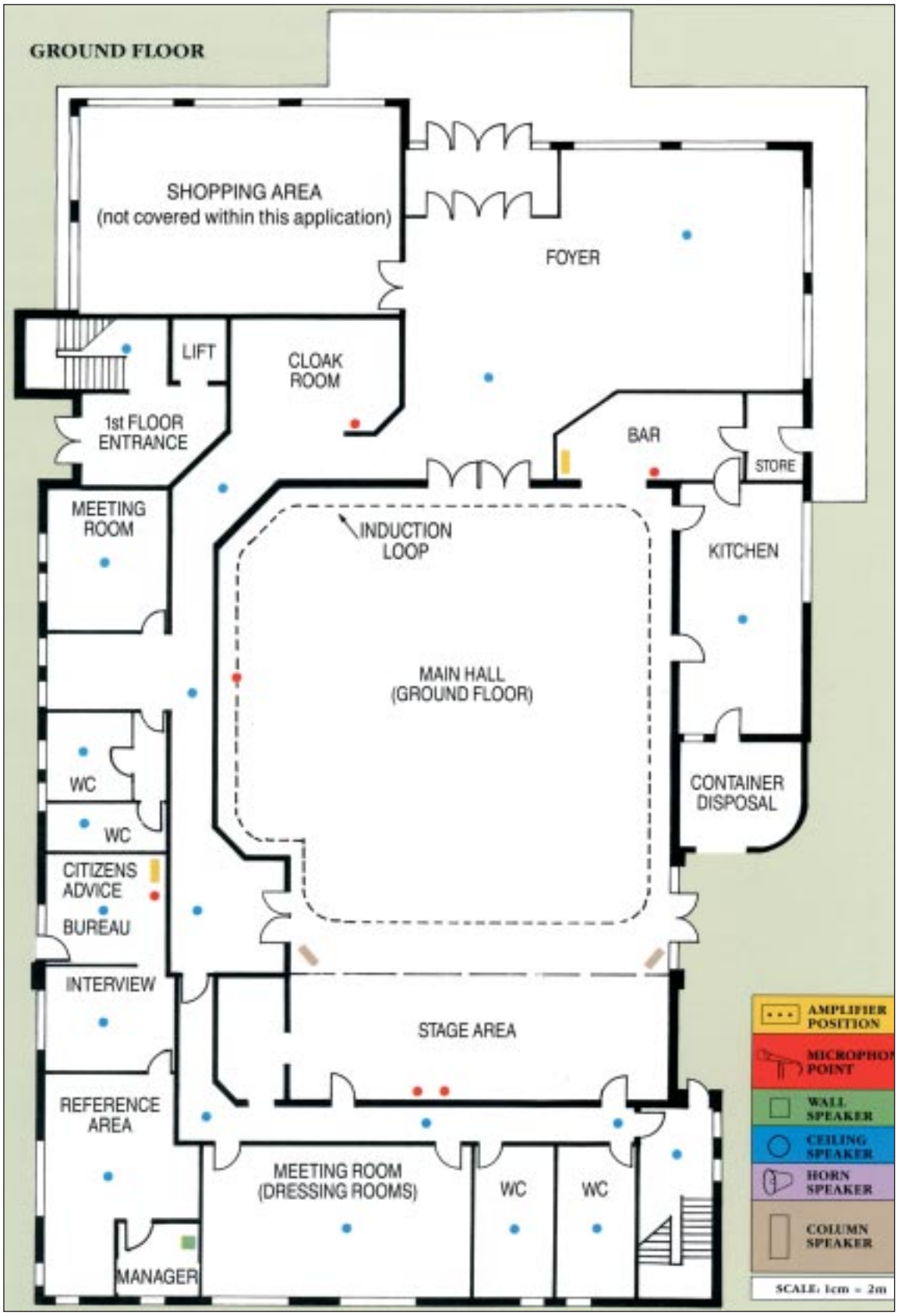
The principle requirement for this Church of England place of worship was for a sound reinforcement system including provision for the hearing impaired.

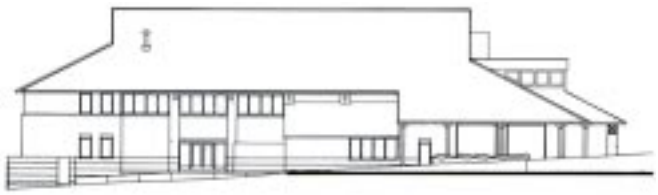
The **congregation area**, including gallery, is covered by two column loudspeakers. The organist is provided with a wall loudspeaker to enable the service to be followed and for the same reason, a wall loudspeaker is installed over the choir area. A wall loudspeaker is provided in the **Vestry**.

Four microphone points are installed: at each **Lectern**; at the **Font**; at the **Altar**. An ambience microphone is installed above the choir and is connected only to the induction loop system which covers the main congregational area, excluding the gallery and under the gallery.

The amplifier is installed at the **rear** of the church where a nominated member of the congregation has full view of the service.

CIVIC CENTRE





CIVIC CENTRE

This installation comprises four separate systems, each with a specific function.

Systems may be interlinked for emergency announcements and all areas are therefore equipped with loudspeakers and through a telephone interface, such announcements can also be made from a small number of designated **telephone** extensions throughout the building.

1. Main Hall: used for large functions – dinner dances etc and for stage entertainment.

The sound reinforcement system is used for stage entertainment and general speech reinforcement and is *not* intended for live music amplification.

The **entire area** is covered by two column loudspeakers sited slightly forward of the stage area. The amplification equipment is installed in the **projection room** from where an overall view is possible.

Two microphone inputs are provided at the stage, together with a further input in the main hall area for use at dinner functions (guest speakers etc) and for audience participation at public meetings. There is a further microphone point in the projection room for public announcements.

An induction **loop system** is incorporated for the benefit of the hearing impaired; this may also be used to provide simultaneous "silent" language translation facilities.

2. Citizens Advice Bureau:

CIVIC CENTRE

background music and paging.

This system is intended to promote a pleasant environment for counselling and advice. Moreover, background music will avoid interview room conversations being overheard by others.

Persons waiting for an appointment with the manager can be paged from the Advice Bureau **reception** point.

3. Council Chamber: sound reinforcement and event recording.

Low level sound reinforcement is included and three microphones allow for complete verbatim recordings to be made via a separate tape recorder.

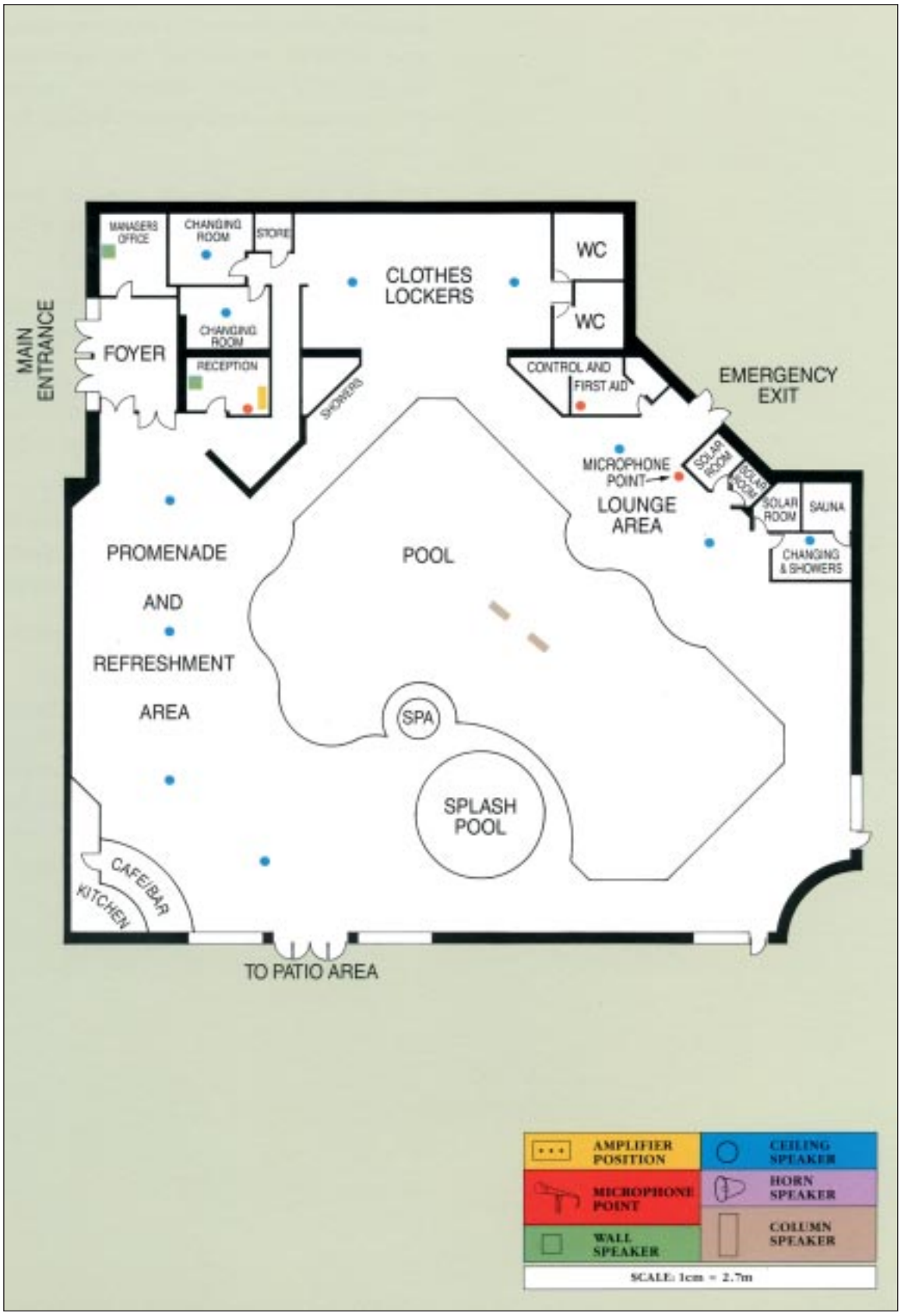
In view of the Chamber's small size it was not considered necessary to include any form of council conference system.

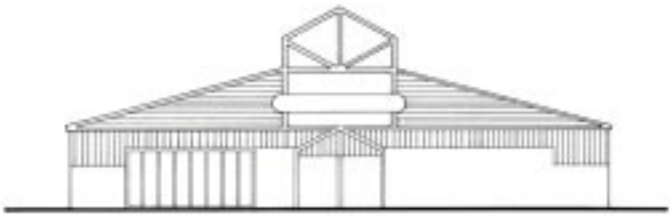
4. General Areas: background music and paging.

The amplifier and background music source are installed in the **bar** area from where paging to all public areas, normally excluding 1, 2 and 3 can be made. Further paging facilities are available from the **cloakroom** area.

This **swimming pool complex** includes

SWIMMING POOL AND LEISURE CENTRE





a spa, splash pool, sauna and solarium. The system is divided into three zones: over pool; changing area; public viewing.

These areas can be independently paged from the **Reception** and **Control and First Aid** points.

With the exception of the manager's office, Reception and the over-pool area, ceiling loudspeakers are used throughout. Over the pool two specially protected column loudspeakers provide for the announcement of session times, start of wave machine notice and swimmer instruction from the pool-side microphone.

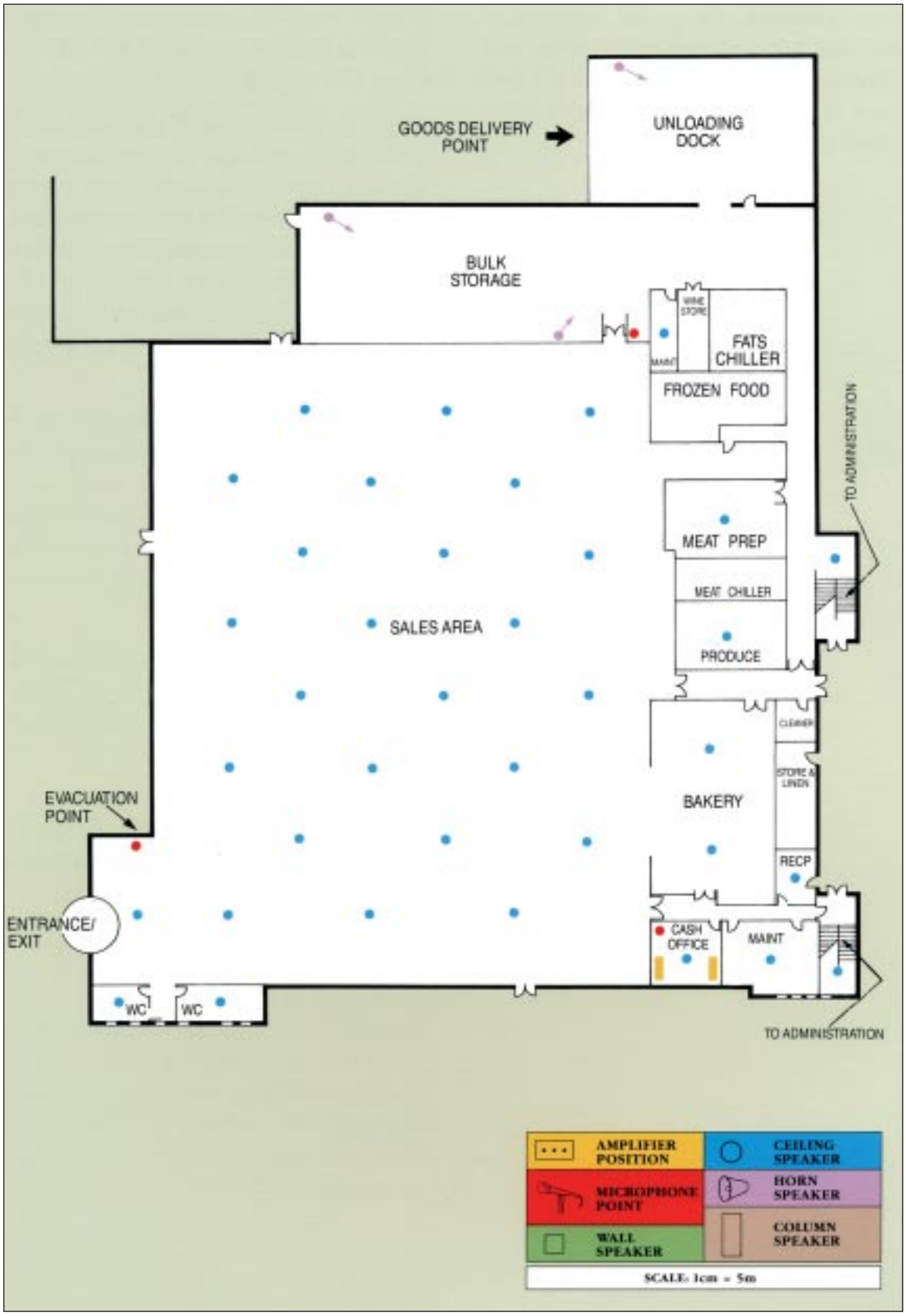
When the pool-side microphone is in use the instruction is broadcast over the complete system since only one amplifier is available. In order to restrict the swimmer instructions to the over-pool area a second amplifier would have been required.

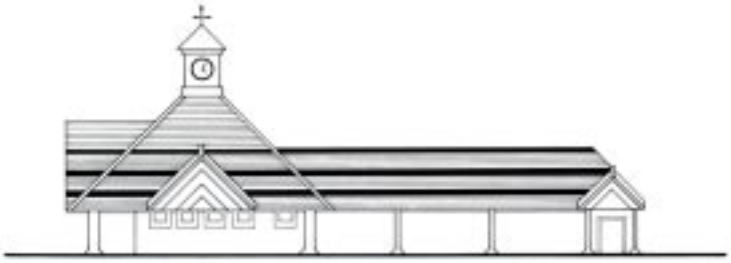
Facilities are also provided to play music for synchronised swimming and a push button activated tone can be broadcast to notify swimmers of the start and finish of session times.

Whilst changing and shower areas have loudspeakers note that solar and sauna rooms, for environmental reasons, do not.

Sockets are available on the patio area to allow the use of portable loudspeakers at outside activities where music may be provided from a compact disc player via the system's amplifier. This may be desirable for barbecues, fetes and any outdoor event of an occasional nature.

SUPERSTORE COMPLEX





This comprises a **large sales area** with associated backup facilities for an "off sales" **storage and delivery point**. Other areas include bulk frozen food storage, meat preparation and chilling and a bakery.

The general requirement for providing background music, live announcements and "spot" advertising announcements is supplemented by warehouse and delivery point paging and provision of background music and paging into the administration areas on an upper floor (not shown on our plan).

The system requires two amplifiers, one for all public areas and one for the "off sales" areas in order that the background music in the store is not interrupted when "staff area only" paging is in progress. These are interlinked for emergency announcements.

"Spot" announcements are stored on a tape playback machine which automatically broadcasts advertisements and in-store promotions on an automatic and timed programme.

The paging microphone for public areas is located in the **cash office**, overlooking the store, and a microphone input for emergency evacuation instructions is provided by the main **store entrance**.

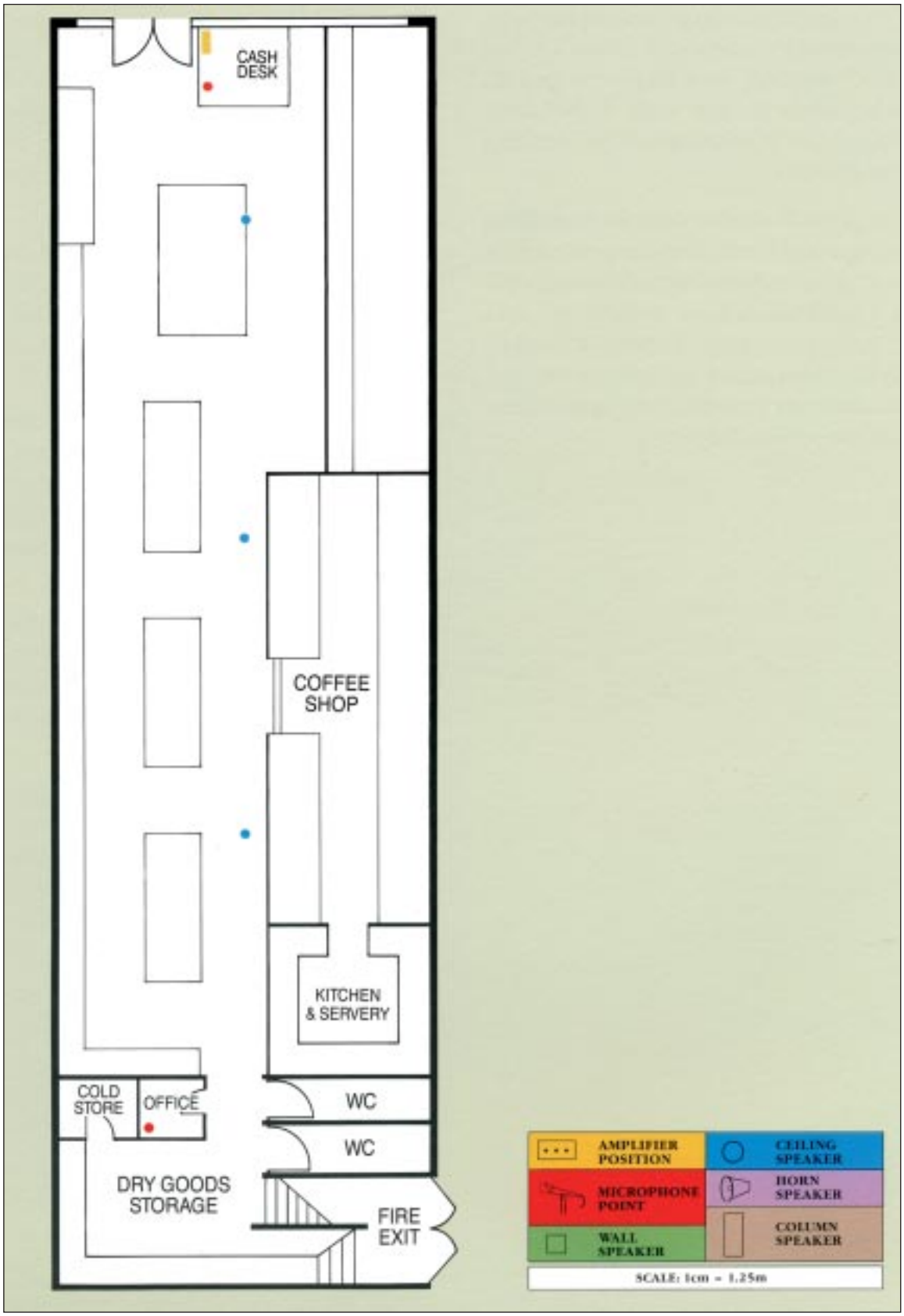
The "off sales" area is divided into three zones for paging purposes: administrative offices; meat preparation and bakery areas; warehouse and goods delivery point.

With the exception of the warehouse and goods delivery point, where horn loudspeakers are employed to overcome potentially high levels of background noise, the entire building is fitted with ceiling loudspeakers.

On the sales floor the loudspeakers are symmetrically arranged rather than taking note of the layout of point of sale shelving and fixtures which, in this particular store, is seasonally variable.

A specialist shop providing high quality

COFFEE SHOP/ DELICATESSEN



COFFEE SHOP/ DELICATESSEN

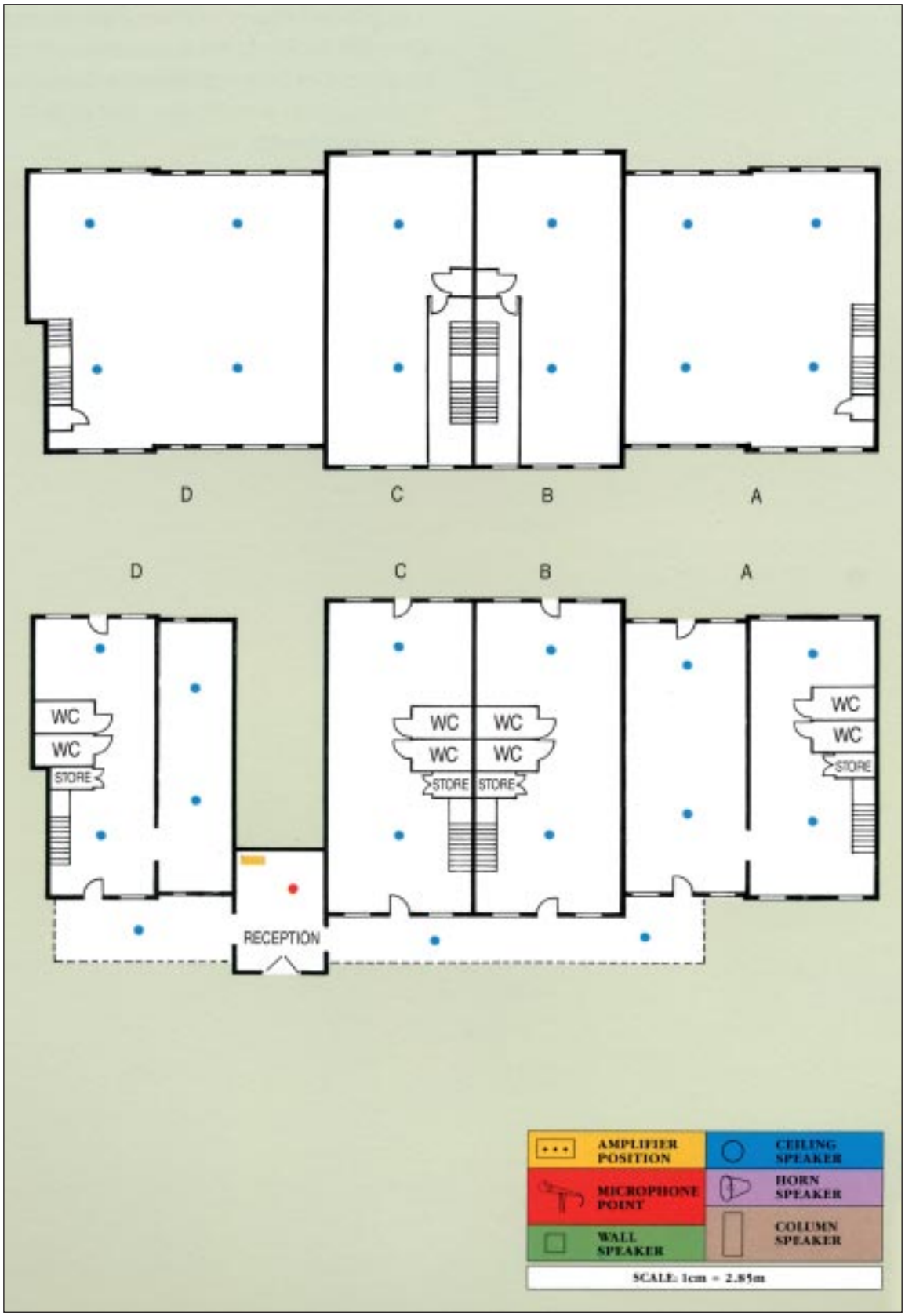
gourmet food products combined with a busy coffee area requiring background music and provision for "live" announcements.

The two paging points are the **manager's office** and the **cash desk**.

Ceiling loudspeakers provide an even distribution of music over the total sales and coffee area.

This office complex is occupied by four

PROFESSIONAL OFFICES



PROFESSIONAL OFFICES

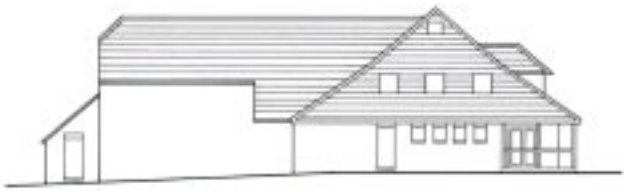
professions – accountant, architect, structural engineer and insurance agent. The requirement was simply for individual firms or total complex paging from a central reception point.

A four zone paging microphone is installed which provides a facility for **all call** announcements in the event of any emergency.

Ceiling, rather than wall, loudspeakers were selected for their unobtrusive appearance and ability to provide discrete paging evenly over the total office area.

The sound installation provides paging

CRICKET PAVILION AND SQUASH COURT



and background music to all areas; announcements can be made from **Reception** or the **Bar**.

Horn loudspeakers permit selected broadcasts to be made over the **cricket pitch** from the steward's office.

Wall loudspeakers are used on the **verandah** and in two offices; elsewhere ceiling loudspeakers are employed.

The loudspeaker in the **squash court** broadcasts only session information from Reception and in the event of an emergency. Since there is only one court, and for cost reasons, a separate amplifier system was not included; during any paging announcement into any zone the background music will be interrupted in all areas.

This building also includes a **gymnasium** and **health area**, not shown. Ceiling or wall loudspeakers would be suitable for these areas.


ALTAR
ORGAN
LECTERN
PLACE OF
WORSHIP
VESTRY
COMMUNAL
FOYER
COVERED
ARRIVAL
AREA
FOR
VEHICLES
MULTI-PURPOSE
HALL
CHAIR AND
TABLE STORE
KITCHEN
AMPLIFIER
POSITION
MICROPHONE
POINT
WALL
SPEAKER
CEILING
SPEAKER
HORN
SPEAKER
COLUMN
SPEAKER
SCALE: 1cm = 1.2m

This comprises a small place of worship and an associated general purpose hall for meetings and social events.

The **chapel system** comprises one column loudspeaker and microphone positions, at the **lectern** and **altar**. The amplifier is under the control of the organist.

A ceiling loudspeaker is provided in the **vestry**.

In the **multi-purpose hall** the two column loudspeakers are positioned at the far end from the main entrance so that the area behind them can be used as a stage. Two microphone points are provided within the stage area with a further point halfway down the hall for use with a hand-held "roving" microphone or by guest speakers at social events. The hand-held microphone can be mounted on an adjustable height stand.

The amplifier is located at the rear of the hall and also feeds loudspeakers in the kitchen and wash room areas.