Virginia Events

- **ADA Accessibility Basics for Portable Restrooms**
  ADA Accessibility Basics for Portable Restrooms Door Width and Floor Space Rules for Accessible Units Handrail and Seat Height Requirements in ADA Portable Toilets Turning Radius Considerations for Wheelchair Users in Mobile Restrooms Site Placement Tips for Accessible Portable Sanitation Inspection Checklist for ADA Compliance in Temporary Restrooms Lighting and Signage Standards for Accessible Toilet Units Common Mistakes in ADA Portable Restroom Setup How Local Codes Affect ADA Restroom Rentals Calculating Unit Counts for Events with Accessibility Needs Training Staff on ADA Portable Restroom Handling Upgrading Existing Portable Toilets to meet ADA Guidelines
- **Comparing Standard Portable Toilets and Deluxe Units**
  Comparing Standard Portable Toilets and Deluxe Units Feature Checklist for Choosing a Restroom Trailer Space and Capacity Differences across Portable Restroom Models When to Select ADA Units Over Standard Portable Toilets Balancing Budget and Comfort in Portable Toilet Selection Matching Portable Restroom Types to Event Profiles Construction Site Needs and Portable Restroom Unit Choices Advanced Features Available in High Comfort Portable Toilets Number of Restroom Trailers Needed for Large Gatherings Assessing Traffic Flow for Multiple Portable Restroom Types Rental Logistics for Mixed Portable Toilet Fleets Future Trends in Portable Restroom Design and Features
- **About Us**

Portable Toilets

Understanding ADA Requirements for Portable Restrooms

Ensuring compliance with ADA (Americans with Disabilities Act) standards for handrail installation in portable toilets is crucial for creating an inclusive environment. Agricultural events like Virginia's county fairs require significant portable restroom infrastructure to serve large rural crowds **luxury porta potty rental cost** Ventilation (architecture). The ADA sets forth specific guidelines to ensure that individuals with disabilities can navigate these facilities safely and independently. One of the key aspects of these guidelines is the proper installation of handrails.

When it comes to handrails in portable toilets, the ADA mandates that they must be installed at a height that allows for effective use by individuals with disabilities. Typically, handrails should be positioned between 33 and 36 inches above the floor, measured from the leading edge. This height range accommodates a variety of users, including those who use wheelchairs or walkers. The handrails must also be strong enough to support the weight of users, typically requiring a minimum strength of 200 pounds.

In addition to height, the ADA specifies that handrails must be continuous and free of obstructions. This means that there should be no gaps or breaks in the handrail, and it should extend from the floor to a height that allows users to grip it comfortably. The surface of the handrail should be smooth and free of sharp edges to prevent injury. Moreover, the handrail should be securely anchored to prevent any movement or wobbling, which could pose a safety hazard.

Another important consideration is the installation of handrails in relation to the toilet seat height. The ADA requires that the seat height of portable toilets should be between 17 and 19 inches above the floor. This height is designed to accommodate users who may need to transfer from a wheelchair to the toilet seat. The handrails should be positioned in such a way that they provide support during these transfers, typically extending from the floor to a height that allows for a secure grip.

In summary, compliance with ADA standards for handrail installation in portable toilets is essential for ensuring accessibility and safety for individuals with disabilities. By adhering to the specified height, strength, and placement guidelines, facilities can create a more

inclusive environment that respects the needs of all users.

Key Dimensions and Clearances for ADA Porta Potties —

Okay, lets talk about something not exactly glamorous, but incredibly important: seat height in ADA-compliant portable toilets. Were talking about making these temporary restrooms accessible and usable for everyone, including individuals with disabilities. And a big part of that accessibility boils down to that crucial seat height.

Think about it for a second. For someone using a wheelchair or someone with limited mobility, the height of the toilet seat can be the difference between independence and needing assistance. A seat thats too low can be difficult, painful, or even impossible to transfer to and from. A seat thats too high might feel unstable and unsafe.

The ADA Standards for Accessible Design specifically addresses this. It mandates that the top of the toilet seat in an accessible portable toilet must be between 17 and 19 inches above the finished floor. That range isnt arbitrary. Its based on research and practical considerations to accommodate a wider range of users.

Why is this so important? Well, compliance isnt just about ticking boxes on a checklist. Its about showing respect and understanding. Its about creating a space where everyone feels comfortable and dignified. Its about ensuring that everyone has equal access to basic necessities, regardless of their physical abilities.

So, when youre setting up or managing portable toilets, remember that seemingly small detail: the seat height. Make sure it falls within that 17-19 inch range. It's a simple step that can make a huge difference in someones life and speaks volumes about your commitment to inclusivity. Its a fundamental part of ensuring that everyone can use the facilities with dignity and ease. Dont overlook it. It truly matters.

Essential Features of ADA Compliant Portable Restrooms

Ensuring accessibility in porta potty rental services is crucial, especially when considering the specific needs of individuals with disabilities as outlined by the Americans with Disabilities Act (ADA). One of the key aspects of this accessibility involves the handrail and seat height requirements within ADA-compliant portable toilets. These standards are not merely regulatory checkboxes but are designed to provide genuine comfort and safety for all users.

In ADA portable toilets, the handrails play a vital role in providing support and stability. They must be installed at a height that allows users to easily grasp them while standing or transferring from a wheelchair. Typically, these handrails should be between 33 and 36 inches from the floor, ensuring they are reachable for most adults, including those with limited upper body strength or mobility issues. The design should also consider the placement of these rails to avoid obstructing movement within the confined space of a portable toilet.

Similarly, the seat height in these units is standardized to cater to ease of use. The toilet seat should ideally be positioned at 17 to 19 inches from the floor. This range is set to facilitate ease of sitting and standing for individuals with various mobility impairments, reducing the risk of falls or strain injuries. For someone using a wheelchair, this height aligns well with standard transfer techniques, making the process smoother and less physically demanding.

When rental services ensure that their portable toilets meet these ADA requirements, theyre doing more than complying with laws; theyre enhancing user experience by making public facilities truly inclusive. This attention to detail reflects a commitment to dignity and respect for all users, acknowledging that public spaces should be accessible without compromise. By prioritizing these specifications in their service offerings, companies not only adhere to legal standards but also promote an environment where everyone can participate fully in community events or construction sites without worrying about basic sanitation needs.

In conclusion, adherence to ADA guidelines regarding handrail and seat heights in porta potty rentals is fundamental not just for legal compliance but for fostering an inclusive society where accessibility is seamlessly integrated into everyday life scenarios. This commitment ensures that all individuals can maintain their independence and privacy when using public facilities, which is essential for personal dignity and social equity.

Placement and Accessibility Considerations for ADA Porta Potties on Site

Common Challenges and Solutions in Meeting ADA Requirements for Handrail and Seat Height in Portable Toilets

Introduction

The Americans with Disabilities Act (ADA) sets forth guidelines to ensure that people with disabilities have equal access to facilities and services. One of the key areas where ADA requirements are crucial is in the design and installation of handrails and seat heights in portable toilets. Meeting these requirements can be challenging for businesses and organizations, but understanding the common challenges and solutions can help make the process smoother.

Common Challenges

1. Space constraints: Portable toilets are often compact, and finding enough space to install a handrail and ensure proper seat height can be difficult. This is especially true for smaller units, which may not have enough room to accommodate the necessary features.

2.

Budget limitations: Implementing ADA-compliant features can be costly, and some businesses and organizations may struggle to allocate sufficient funds to meet these requirements. This can lead to compromises in design and functionality, which may not be ideal for users with disabilities.

3. Lack of awareness: Some businesses and organizations may not be fully aware of the ADA requirements for handrails and seat heights in portable toilets. This can result in non-compliance, which can lead to legal issues and potential fines.

4. Inadequate maintenance: Even if a portable toilet is initially ADA-compliant, it may fall out of compliance over time due to wear and tear or lack of maintenance. This can create challenges for users with disabilities and may result in legal consequences for the business or organization.

Solutions

1. Design for accessibility: To overcome space constraints, it is essential to design portable toilets with accessibility in mind from the beginning. This may involve working with manufacturers to create custom units that meet ADA requirements while still being compact and functional.

2. Prioritize funding: While budget limitations can be a challenge, it is crucial to prioritize funding for ADA-compliant features in portable toilets. This may involve making a case for the importance of accessibility to stakeholders and demonstrating the potential long-term benefits of investing in accessible facilities.

3.

Educate staff and stakeholders: Ensuring that everyone involved in the procurement, installation, and maintenance of portable toilets is aware of the ADA requirements is essential. This can be achieved through training sessions, workshops, and informational materials that outline the necessary features and their importance.

4. Implement regular maintenance: To prevent portable toilets from falling out of compliance, it is essential to establish a regular maintenance schedule. This may involve inspecting and repairing handrails and seats, as well as ensuring that the overall unit is clean and well-maintained.

Conclusion

Meeting ADA requirements for handrails and seat heights in portable toilets can be challenging, but understanding the common challenges and implementing appropriate solutions can help businesses and organizations create accessible facilities for all users. By prioritizing accessibility, allocating sufficient funds, educating staff and stakeholders, and maintaining portable toilets regularly, it is possible to overcome these challenges and ensure compliance with ADA guidelines.

About Accessibility

For design of products or environments for access by all users, see Universal design. For design of websites etc. for access by all users, see Web accessibility. For measures of spatial accessibility, see Accessibility (transport). For the logical notion, see Accessibility relation. For the process in agenda-setting theory, see Agenda-setting theory § Accessibility.
For Wikipedia's accessibility guideline, see Wikipedia:Accessibility.

Panel on an elevator showing the floor buttons with Braille markings

Image not found or type unknown
Elevator buttons with Braille markings

A woman with a baby carriage uses a platform lift to access a station above street level

Image not found or type unknown
The public transport system in Curitiba, Brazil, offers universal access via wheelchair lifts.

Accessibility is the design of products, devices, services, vehicles, or environments so as to be usable by disabled people.[1] The concept of accessible design and practice of accessible developments ensures both "direct access" (i.e. unassisted) and "indirect access" meaning compatibility with a person's assistive technology (for example, computer screen readers).[2]

Accessibility can be viewed as the "ability to access" and benefit from some system or entity. The concept focuses on enabling access for people with disabilities, or enabling access through the use of assistive technology; however, research and development in accessibility brings benefits to everyone.[3][4][5][6][7] Therefore, an accessible society should eliminate digital divide or knowledge divide.

Accessibility is not to be confused with usability, which is the extent to which a product (such as a device, service, or environment) can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.[8]

Accessibility is also strongly related to universal design, the process of creating products that are usable by the widest possible range of people, operating within the widest possible range of situations.[9] Universal design typically provides a single general

solution that can accommodate people with disabilities as well as the rest of the population. By contrast, accessible design is focused on ensuring that there are no barriers to accessibility for all people, including those with disabilities.

Legislation

[edit]

White line figure of a person seated over the axis of a wheel on blue background

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International Symbol of Access denotes area with access for those with disabilities.

The disability rights movement advocates equal access to social, political, and economic life which includes not only physical access but access to the same tools, services, organizations and facilities as non-disabled people (e.g., museums[10][11]). Article 9 of the United Nations Convention on the Rights of Persons with Disabilities commits signatories to provide for full accessibility in their countries.[12]

While it is often used to describe facilities or amenities to assist people with impaired mobility, through the provision of facilities like wheelchair ramps, the term can include other types of disability. Accessible facilities therefore extend to areas such as Braille signage, elevators, audio signals at pedestrian crossings, walkway contours, website accessibility and accessible publishing.[13]

In the United States, government mandates including Section 508, WCAG,[14] DDA are all enforcing practices to standardize accessibility testing engineering in product development.

Accessibility modifications may be required to enable persons with disabilities to gain access to education, employment, transportation, housing, recreation, or even simply to exercise their right to vote.

National legislation

[edit]

Various countries have legislation requiring physical accessibility which are (in order of enactment):

- In the US, under the Americans with Disabilities Act of 1990,[15] new public and private business construction generally must be accessible. Existing private businesses are required to increase the accessibility of their facilities when making any other renovations in proportion to the cost of the other renovations. The United States Access Board[16] is "A Federal Agency Committed to Accessible Design for People with Disabilities". The Job Accommodation Network discusses accommodations for people with disabilities in the workplace.[17] Many states in the US have their own disability laws.
- In Australia, the Disability Discrimination Act 1992 has numerous provisions for accessibility.[18]
- In South Africa the Promotion of Equality and Prevention of Unfair Discrimination Act 2000 has numerous provisions for accessibility.[19]
- In the UK, the Equality Act 2010 has numerous provisions for accessibility.[20]
- In Sri Lanka, the Supreme Court, on 27 April 2011 gave a landmark order to boost the inherent right of disabled persons to have unhindered access to public buildings and facilities.[21]
- In Norway, the Discrimination and Accessibility Act (Norwegian: *Diskriminerings- og tilgjengelighetsloven*) defines lack of accessibility as discrimination and obliges public authorities to implement universal design in their areas. The Act refers to issue-specific legislation regarding accessibility in e.g. ICT, the built environment, transport and education.[22]
- In Brazil, the law on the inclusion of people with disabilities has numerous provisions for accessibility.[23]
- In Canada, relevant federal legislation includes the Canadian Human Rights Act, the Employment Equity Act, the Canadian Labour Code, and the Accessible Canada Act (Bill-C81) which made Royal Assent on June 21, 2019.[24]

  Beachshore with a mobi-mat leading from the kerb to the seashore

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  Ramps and mobi-mats enable wheelchair users to visit a sandy seashore.

Legislation may also be enacted on a state, provincial or local level. In Ontario, Canada, the Ontarians with Disabilities Act of 2001 is meant to "improve the identification, removal and prevention of barriers faced by persons with disabilities".[25]

The European Union (EU), which has signed the United Nations' Convention on the Rights of Persons with Disabilities, also has adopted a European Disability Strategy for 2010–20. The Strategy includes the following goals, among others:[26]

- Devising policies for inclusive, high-quality education;
- Ensuring the European Platform Against Poverty includes a special focus on people with disabilities (the forum brings together experts who share best practices and experience);
- Working towards the recognition of disability cards throughout the EU to ensure equal treatment when working, living or travelling in the bloc
- Establishing accessibility standards for voting locations and campaign materials.
- Taking the rights of people with disabilities into account in external development programmes and for EU candidate countries.

A *European Accessibility Act* was proposed in late 2012.[27] This Act would establish standards within member countries for accessible products, services, and public buildings. The harmonization of accessibility standards within the EU "would facilitate the social integration of persons with disabilities and the elderly and their mobility across member states, thereby also fostering the free movement principle".[28]

Enforcement of the European Accessibility Act (EAA) begins in June 2025

Assistive technology and adaptive technology

[edit]

People gathered around a table wearing headphones. The journalist holds the microphone fo

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The Opportunities Fair and Beyond Art Exhibition was organised in Birmingham, England, to help people with disabilities and their carers find out what services, support and opportunities are available to them.

Assistive technology is the creation of a new device that assists a person in completing a task that would otherwise be impossible. Some examples include new computer software programs like screen readers, and inventions such as assistive listening devices, including hearing aids, and traffic lights with a standard color code that enables colorblind individuals to understand the correct signal.

Adaptive technology is the modification, or adaptation, of existing devices, methods, or the creation of new uses for existing devices, to enable a person to complete a task.[29] Examples include the use of remote controls, and the autocomplete (word completion)[30] feature in computer word processing programs, which both help individuals with mobility impairments to complete tasks. Adaptations to wheelchair tires are another example; widening the tires enables wheelchair users to move over soft surfaces, such as deep snow on ski hills, and sandy beaches.

Assistive technology and adaptive technology have a key role in developing the means for people with disabilities to live more independently, and to more fully participate in mainstream society. In order to have access to assistive or adaptive technology, however, educating the public and even legislating requirements to incorporate this technology have been necessary.

The UN CRPD, and courts in the United States, Japan, UK, and elsewhere, have decided that when it is needed to assure secret ballot, authorities should provide voters with assistive technology.

The European Court of Human Rights, on the contrary, in case Toplak v. Slovenia ruled that due to high costs, the abandonment of the assistive equipment in elections did not violate human rights.

Employment

[edit]

A man is speaking behind a microphone podium during a conference. Behind him, there is a

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William P. Milton Jr., deputy director of the Office of Human Resource Management, outlined the "Four Simple Steps to Hiring Qualified Candidates with Disabilities" to employees of the U.S. Department of Agriculture during a

2011 National Disability Employment Awareness Month event in Washington, D.C.

Accessibility of employment covers a wide range of issues, from skills training, to occupational therapy,[31] finding employment, and retaining employment.

Employment rates for workers with disabilities are lower than for the general workforce. Workers in Western countries fare relatively well, having access to more services and training as well as legal protections against employment discrimination. Despite this, in the United States the 2012 unemployment rate for workers with disabilities was 12.9%, while it was 7.3% for workers without disabilities.[32] More than half of workers with disabilities (52%) earned less than $25,000 in the previous year, compared with just 38% of workers with no disabilities. This translates into an earnings gap where individuals with disabilities earn about 25 percent less of what workers without disabilities earn. Among occupations with 100,000 or more people, dishwashers had the highest disability rate (14.3%), followed by refuse and recyclable material collectors (12.7%), personal care aides (11.9%), and janitors and building cleaners (11.8%). The rates for refuse and recyclable material collectors, personal care aides, and janitors and building cleaners were not statistically different from one another.[33]

Surveys of non-Western countries are limited, but the available statistics also indicate fewer jobs being filled by workers with disabilities. In India, a large 1999 survey found that "of the 'top 100 multinational companies' in the country [...] the employment rate of persons with disabilities in the private sector was a mere 0.28%, 0.05% in multinational companies and only 0.58% in the top 100 IT companies in the country".[34] India, like much of the world, has large sections of the economy that are without strong regulation or social protections, such as the informal economy.[35] Other factors have been cited as contributing to the high unemployment rate, such as public service regulations. Although employment for workers with disabilities is higher in the public sector due to hiring programs targeting persons with disabilities, regulations currently restrict types of work available to persons with disabilities: "Disability-specific employment reservations are limited to the public sector and a large number of the reserved positions continue to be vacant despite nearly two decades of enactment of the PWD Act".[34]

Expenses related to adaptive or assistive technology required to participate in the workforce may be tax deductible expenses for individuals with a medical practitioner's prescription in some jurisdictions.

Disability management

[edit]

Disability management (DM) is a specialized area of human resources that supports efforts of employers to better integrate and retain workers with disabilities. Some workplaces have policies in place to provide "reasonable accommodation" for employees

with disabilities, but many do not. In some jurisdictions, employers may have legal requirements to end discrimination against persons with disabilities.

It has been noted by researchers that where accommodations are in place for employees with disabilities, these frequently apply to individuals with "pre-determined or apparent disabilities as determined by national social protection or Equality Authorities",[36] which include persons with pre-existing conditions who receive an official disability designation. One of the biggest challenges for employers is in developing policies and practises to manage employees who develop disabilities during the course of employment. Even where these exist, they tend to focus on workplace injuries, overlooking job retention challenges faced by employees who acquire a non-occupation injury or illness. Protecting employability is a factor that can help close the unemployment gap for persons with disabilities.[36]

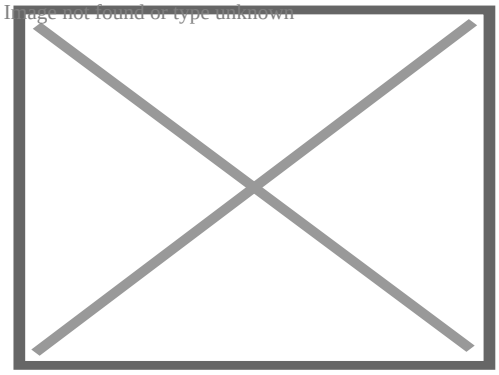
Transportation

[edit]
For the metric of transport connectivity for planning purposes, see Accessibility (transport).

Providing mobility to people with disabilities includes changes for public facilities like gently sloping paths of travel for people using wheelchairs and difficulty walking up stairs, or audio announcements for the blind (either live or automated); dedicated services like paratransit; and adaptations to personal vehicles.

Adapted automobiles for persons with disabilities

[edit]
See also: Adapted automobile



A wheelchair accessible taxi with a rear ramp, Tokyo Motor Show 2009

Automobile accessibility also refers to ease of use by disabled people. Automobiles, whether a car or a van, can be adapted for a range of physical disabilities. Foot pedals can be raised, or replaced with hand-controlled devices. Wheelchair hoists, lifts or ramps may be customized according to the needs of the driver. Ergonomic adaptations, such as a

lumbar support cushion, may also be needed.[37]

Generally, the more limiting the disability, the more expensive the adaptation needed for the vehicle. Financial assistance is available through some organizations, such as Motability in the United Kingdom, which requires a contribution by the prospective vehicle owner. Motability makes vehicles available for purchase or lease.[38]

When an employee with a disability requires an adapted car for work use, the employee does not have to pay for a "reasonable adjustment" in the United Kingdom; if the employer is unable to pay the cost, assistance is offered by government programs.[39]

Low floor

[edit]
"Low floor" redirects here. For more details, see Low-floor bus and Low-floor tram.

A man on a motorized wheelchair is using a ramp to enter an SMRT bus

Image not found or type unknown
Wheelchair ramps allows those on wheelchairs or personal mobility devices to board low-floor public transport vehicles.

A significant development in transportation, and public transport in particular, to achieve accessibility, is the move to "low-floor" vehicles. In a low-floor vehicle, access to part or all of the passenger cabin is unobstructed from one or more entrances by the presence of steps, enabling easier access for the infirm or people with push chairs. A further aspect may be that the entrance and corridors are wide enough to accommodate a wheelchair. Low-floor vehicles have been developed for buses, trolleybuses, trams and trains.

A low floor in the vehicular sense is normally combined in a conceptual meaning with normal pedestrian access from a standard kerb (curb) height. However, the accessibility of a low-floor vehicle can also be utilised from slightly raising portions of kerb at bus stops, or through use of level boarding bus rapid transit stations or tram stops.[40] The combination of access from a kerb was the technological development of the 1990s, as step-free interior layouts for buses had existed in some cases for decades, with entrance steps being introduced as chassis designs and overall height regulations changed.

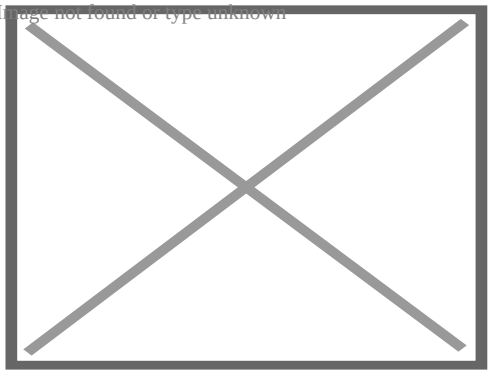
Low-floor buses may also be designed with special height adjustment controls that permit a stationary bus to temporarily lower itself to ground level, permitting wheelchair access.

This is referred to as a kneeling bus.

At rapid transit systems, vehicles generally have floors in the same height as the platforms but the stations are often underground or elevated, so accessibility there is not a question of providing low-floor vehicles, but providing a step-free access from street level to the platforms (generally by elevators, which may be restricted to disabled passengers only, so that the step-free access is not obstructed by non-disabled people taking advantage).[*citation need*

Accessibility planning for transportation in the United Kingdom

[edit]



Harrington Hump, Harrington station

In the United Kingdom, local transport authorities are responsible for checking that all people who live within their area can access essential opportunities and services, and where gaps in provision are identified the local authorities are responsible for organizing changes to make new connections. These requirements are defined in the UK Community Planning Acts legislation[41] and more detailed guidance has been issued by the Department for Transport for each local authority. This includes the requirement to produce an Accessibility Plan under Community Planning legislation and to incorporate this within their Local Transport Plan.[42] An Accessibility Plan sets out how each local authority plans to improve access to employment, learning, health care, food shops and other services of local importance, particularly for disadvantaged groups and areas. Accessibility targets are defined in the accessibility plans, these are often the distance or time to access services by different modes of transport including walking, cycling and public transport.

Accessibility Planning was introduced as a result of the report "Making the Connections: Final Report on Transport and Social Exclusion".[43] This report was the result of research carried out by the Social Exclusion Unit. The United Kingdom also has a "code of practice" for making train and stations accessible: "Accessible Train and Station Design for Disabled People: A Code of Practice".[44] This code of practice was first published in 2002 with the objective of compliance to Section 71B of the Railways Act 1993,[45] and revised after a public consultation period in 2008.

Some transport companies have since improved the accessibility of their services, such as incorporating low-floor buses into their stock as standard.[*citation needed*] In August 2021, South Western Railway announced the streamlining of their accessibility services, allowing passengers requiring assistance to inform the company with as little as 10 minutes' notice at all 189 stations on its network, replacing an older scheme wherein assisted journeys had to be booked six hours to a day in advance. The system will utilise clear signage at stations and QR codes, allowing customers to send details of the assistance they require and their planned journey to staff remotely.[46]

Making public services fully accessible to the public has led to some technological innovations. Public announcement systems using audio induction loop technology can broadcast announcements directly into the hearing aid of anyone with a hearing impairment, making them useful in such public places as auditoriums and train stations.

Public space

[edit]

The UN Convention on the Rights of Persons with Disabilities (2006) requires 'appropriate measures' to ensure people with disabilities are able to 'access, on an equal basis with others','the physical environment', 'transportation' and 'other facilities and services open or provided to the public'. This requirement also applies to 'roads' and 'transportation' as well as 'buildings, and other indoor and outdoor facilities'.[47]

At the same time, promotion of active travel, or 'shared space' initiatives to pedestrianise city centres can introduce unintended barriers, especially for pedestrians who are visually impaired and who can find these environments confusing or even dangerous.[48] It is important to have effective mechanisms to ensure that urban spaces are designed to be inclusive of pedestrians with disabilities. These can include early consultation with disabled persons or their representative organisations, and appropriate regulation of city planning.[48]

Housing

[edit]
Further information: Accessible housing

An entrance with ramps and guardrails

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Accessibly designed modification for a high-step entrance

Most existing and new housing, even in the wealthiest nations, lack basic accessibility features unless the designated, immediate occupant of a home currently has a disability. However, there are some initiatives to change typical residential practices so that new homes incorporate basic access features such as zero-step entries and door widths adequate for wheelchairs to pass through. Occupational Therapists are a professional group skilled in the assessment and making of recommendations to improve access to homes.[49] They are involved in both the adaptation of existing housing to improve accessibility,[50] and in the design of future housing.[51]

The broad concept of Universal design is relevant to housing, as it is to all aspects of the built environment. Furthermore, a Visitability movement[52] begun by grass roots disability advocates in the 1980s focuses specifically on changing construction practices in new housing. This movement, a network of interested people working in their locales, works on educating, passing laws, and spurring voluntary home access initiatives with the intention that basic access become a routine part of new home construction.

Accessibility and "ageing in place"

[edit]

Accessibility in the design of housing and household devices has become more prominent in recent decades due to a rapidly ageing population in developed countries.[53] Ageing seniors may wish to continue living independently, but the ageing process naturally increases the disabilities that a senior citizen will experience. A growing trend is the desire for many senior citizens to 'age in place', living as independently as possible for as long as possible. Accessibility modifications that allow ageing in place are becoming more common. Housing may even be designed to incorporate accessibility modifications that

can be made throughout the life cycle of the residents.

The English Housing Survey for 2018/19 found only 9% of homes in England have key features, such as a toilet at entrance level and sufficiently wide doorways, to deem them accessible. This was an improvement from 5% in 2005. More than 400,000 wheelchair users in England were living in homes which are neither adapted nor accessible.[54]

Voting

[edit]

Under the Convention on the Rights of Persons with Disabilities, states parties are bound to assure accessible elections, voting, and voting procedures. In 2018, the United Nations Committee on the Rights of Persons with Disabilities issued an opinion that all polling stations should be fully accessible. At the European Court of Human Rights, there are currently two ongoing cases about the accessibility of polling places and voting procedures. They were brought against Slovenia by two voters and the Slovenian Disability Rights Association.[55] As of January 2020, the case, called Toplak and Mrak v. Slovenia, was ongoing.[56] The aim of the court procedure is to make accessible all polling places in Europe.[57]

Disability, information technology (IT) and telecommunications

[edit]

This section's **factual accuracy may be compromised due to out-of-date information**. Please help update this article to reflect recent events or newly available information. *(November 2012)*

Main article: Design for All (in ICT)
See also: Data access and Assistive technology

Advances in information technology and telecommunications have represented a leap forward for accessibility. Access to the technology is restricted to those who can afford it, but it has become more widespread in Western countries in recent years. For those who use it, it provides the ability to access information and services by minimizing the barriers of distance and cost as well as the accessibility and usability of the interface. In many countries this has led to initiatives, laws and/or regulations that aim toward providing universal access to the internet and to phone systems at reasonable cost to citizens.[58]

A major advantage of advanced technology is its flexibility. Some technologies can be used at home, in the workplace, and in school, expanding the ability of the user to participate in various spheres of daily life. Augmentative and alternative communication technology is one such area of IT progress. It includes inventions such as speech-generating devices, teletypewriter devices, adaptive pointing devices to replace computer mouse devices, and many others. Mobile telecommunications devices and computer

applications are also equipped with accessibility features.[59][60][61] They can be adapted to create accessibility to a range of tasks, and may be suitable for different kinds of disability.

The following impairments are some of the disabilities that affect communications and technology access, as well as many other life activities:

- Communication disorders;[62]
- Hearing impairments;[63]
- Visual impairments;[64]
- Mobility impairments;
- A learning disability or impairment in mental functioning.

Each kind of disability requires a different kind of accommodation, and this may require analysis by a medical specialist, an educational specialist or a job analysis when the impairment requires accommodation.

- Job analysis[65]

Examples of common assistive technologies

[edit]

Impairment	Assistive technology
Communication impairment	Blissymbols board or similar device; electronic speech synthesizer
Hearing impairment	hearing aids, earphones, headphones, headsets; real-time closed captioning; teletypewriter; sign language avatars
Mobility impairment	Page-turning device; adaptive keyboards and computer mice (pointing devices such as trackballs, vertical mouse, foot mouse, or programmable pedal)
Physical or mental impairment, learning disability	Voice recognition software, refreshable braille display, screen reader
Perceptual disability, learning disability	Talking textbooks, virtual keyboard
Visual impairment, learning disability	Modified monitor interface, magnification devices; reading service, e-text
Visual impairment, learning disability	Braille note-taker; Braille printer; screen magnifiers; optical scanner

Visual impairment	Screen readers; notable examples include NonVisual Desktop Access (NVDA), VoiceOver, and Check Meister Screen Reader. Check Meister also offers a screen reader for Mac OS and Windows, available here: [Check Meister Browser](https://www.checkmeister.com/browser).

Mobility impairments

[edit]

One of the first areas where information technology improved the quality of life for disabled individuals is the voice operated wheelchair. Quadriplegics have the most profound disability, and the voice operated wheelchair technology was first developed in 1977 to provide increased mobility. The original version replaced the joystick system with a module that recognized 8 commands. Many other technology accommodation improvements have evolved from this initial development.[66]

Missing arms or fingers may make the use of a keyboard and mouse difficult or impossible. Technological improvements such as speech recognition devices and software can improve access.

Communication (including speech) impairments

[edit]

A communication disorder interferes with the ability to produce clearly understandable speech. There can be many different causes, such as nerve degeneration, muscle degeneration, stroke, and vocal cord injury. The modern method to deal with speaking disabilities has been to provide a text interface for a speech synthesizer for complete vocal disability. This can be a great improvement for people that have been limited to the use of a throat vibrator to produce speech since the 1960s.

Hearing impairment

[edit]

An individual satisfies the definition of hearing disabled when hearing loss is about 30 dB for a single frequency, but this is not always perceptible as a disability.[67] For example, loss of sensitivity in one ear interferes with sound localization (directional hearing), which can interfere with communication in a crowd. This is often recognized when certain words are confused during normal conversation. This can interfere with voice-only interfaces, like automated customer service telephone systems, because it is sometimes difficult to

increase the volume and repeat the message.

Mild to moderate hearing loss may be accommodated with a hearing aid that amplifies ambient sounds. Portable devices with speed recognition that can produce text can reduce problems associated with understanding conversation. This kind of hearing loss is relatively common, and this often grows worse with age.

The modern method to deal with profound hearing disability is the Internet using email or word processing applications. The telecommunications device for the deaf (TDD) became available in the form of the teletype (TTY) during the 1960s. These devices consist of a keyboard, display and modem that connects two or more of these devices using a dedicated wire or plain old telephone service.

Modern computer animation allows for sign language avatars to be integrated into public areas. This technology could potentially make train station announcements, news broadcasts, etc. accessible when a human interpreter is not available.[68][69] Sign language can also be incorporated into film; for example, all movies shown in Brazilian movie theaters must have a Brazilian Sign Language video track available to play alongside the film via a second screen.[70][71]

Visual impairments

[edit]

A wide array of technology products is available to assist with visual impairment. These include screen magnification for monitors, screen-reading software for computers and mobile devices, mouse-over speech synthesis for browsing, braille displays, braille printers, braille cameras, and voice-activated phones and tablets.

One emerging product that will make ordinary computer displays available for the blind is the refreshable tactile display, which is very different from a conventional braille display. This provides a raised surface corresponding to the bright and dim spots on a conventional display. An example is the Touch Sight Camera for the Blind.

Speech Synthesis Markup Language[72] and Speech Recognition Grammar Specification[73]) are relatively recent technologies intended to standardize communication interfaces using Augmented BNF Form and XML Form. These technologies assist visual impairments and physical impairment by providing interactive access to web content without the need to visually observe the content. While these technologies provides access for visually impaired individuals, the primary benefactor has been automated systems that replace live human customer service representatives that handle telephone calls.

Web accessibility

[edit]
Main article: Web accessibility

International standards and guidelines

[edit]

There have been a few major movements to coordinate a set of guidelines for accessibility for the web. The first and most well known is The Web Accessibility Initiative (WAI), which is part of the World Wide Web Consortium (W3C). This organization developed the Web Content Accessibility Guidelines (WCAG) 1.0 and 2.0 which explain how to make Web content accessible to everyone, including people with disabilities. Web "content" generally refers to the information in a Web page or Web application, including text, images, forms, and sounds. (More specific definitions are available in the WCAG documents.)[74]

The WCAG is separated into three levels of compliance, A, AA and AAA. Each level requires a stricter set of conformance guidelines, such as different versions of HTML (Transitional vs Strict) and other techniques that need to be incorporated into coding before accomplishing validation. Online tools allow users to submit their website and automatically run it through the WCAG guidelines and produce a report, stating whether or not they conform to each level of compliance. Adobe Dreamweaver also offers plugins which allow web developers to test these guidelines on their work from within the program.

The ISO/IEC JTC1 SC36 WG7 24751 Individualized Adaptability and Accessibility in e-learning, education and training series is freely available and made of 3 parts: Individualized Adaptability and Accessibility in e-learning, education and training, Standards inventory and Guidance on user needs mapping.

Another source of web accessibility guidance comes from the US government. In response to Section 508 of the US Rehabilitation Act, the Access Board developed standards to which U.S. federal agencies must comply in order to make their sites accessible. The U.S. General Services Administration has developed a website where one can take online training courses for free to learn about these rules.[75]

Web accessibility features

[edit]

Examples of accessibility features include:

- WAI-AA compliance with the WAI's WCAG
- Semantic Web markup
- (X)HTML Validation from the W3C for the page's content
- CSS Validation from the W3C for the page's layout

- Compliance with all guidelines from Section 508 of the US Rehabilitation Act
- A high contrast version of the site for individuals with low vision, and a low contrast (yellow or blue) version of the site for individuals with dyslexia
- Alternative media for any multimedia used on the site (video, flash, audio, etc.)
- Simple and consistent navigation
- Device independent
- Reducing Cognitive load for decision making

While WCAG provides much technical information for use by web designers, coders and editors, *BS 8878:2010 Web accessibility – Code of Practice*[76] has been introduced, initially in the UK, to help site owners and product managers to understand the importance of accessibility. It includes advice on the business case behind accessibility, and how organisations might usefully update their policies and production processes to embed accessibility in their business-as-usual. On 28 May 2019, BS 8878 was superseded by *ISO 30071-1*,[77] the international Standard that built on BS 8878 and expanded it for international use.

Another useful idea is for websites to include a web accessibility statement on the site. Initially introduced in PAS 78,[78] the best practice for web accessibility statements has been updated in BS 8878[79] to emphasise the inclusion of: information on how disabled and elderly people could get a better experience of using the website by using assistive technologies or accessibility settings of browsers and operating systems (linking to "BBC My Web My Way"[80] can be useful here); information on what accessibility features the site's creators have included, and if there are any user needs which the site does not currently support (for example, descriptive video to allow blind people to access the information in videos more easily); and contact details for disabled people to be able to use to let the site creators know if they have any problems in using the site. While validations against WCAG, and other accessibility badges can also be included, they should be put lower down the statement, as most disabled people still do not understand these technical terms.[81]

Education and accessibility for students

[edit]

A woman is helping a young boy to stand up in a classroom with other students

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A teacher helps her student in an orphanage in central Vietnam. The orphanage caters to many abandoned and disabled children who, through education and communication programs, are able to have a life that would otherwise not be possible.

People constructing a ramp for an accessible bathroom

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Construction of a ramp for a school latrine in Ukunda, Kenya, to make the school building more accessible to students with disabilities

Equal access to education for students with disabilities is supported in some countries by legislation. It is still challenging for some students with disabilities to fully participate in mainstream education settings, but many adaptive technologies and assistive programs are making improvements. In India, the Medical Council of India has now passed the directives to all the medical institutions to make them accessible to persons with disabilities. This happened due to a petition by Satendra Singh founder of Infinite Ability.[82]

Students with a physical or mental impairment or learning disability may require note-taking assistance, which may be provided by a business offering such services, as with

tutoring services. Talking books in the form of talking textbooks are available in Canadian secondary and post-secondary schools. Also, students may require adaptive technology to access computers and the Internet. These may be tax-exempt expenses in some jurisdictions with a medical prescription.

Accessibility of assessments

[edit]

It is important to ensure that the accessibility in education includes assessments.[83] Accessibility in testing or assessments entails the extent to which a test and its constituent item set eliminates barriers and permits the test-taker to demonstrate their knowledge of the tested content.[84]

With the passage of the No Child Left Behind Act of 2001 in the United States,[85] student accountability in essential content areas such as reading, mathematics, and science has become a major area of focus in educational reform.[86] As a result, test developers have needed to create tests to ensure all students, including those with special needs (e.g., students identified with disabilities), are given the opportunity to demonstrate the extent to which they have mastered the content measured on state assessments. Currently, states are permitted to develop two different types of tests in addition to the standard grade-level assessments to target students with special needs. First, the alternate assessment may be used to report proficiency for up to 1% of students in a state. Second, new regulations permit the use of alternate assessments based on modified academic achievement standards to report proficiency for up to 2% of students in a state.

To ensure that these new tests generate results that allow valid inferences to be made about student performance, they must be accessible to as many people as possible. The Test Accessibility and Modification Inventory (TAMI)[87] and its companion evaluation tool, the Accessibility Rating Matrix (ARM), were designed to facilitate the evaluation of tests and test items with a focus on enhancing their accessibility. Both instruments incorporate the principles of accessibility theory and were guided by research on universal design, assessment accessibility, cognitive load theory, and research on item writing and test development. The TAMI is a non-commercial instrument that has been made available to all state assessment directors and testing companies. Assessment researchers have used the ARM to conduct accessibility reviews of state assessment items for several state departments of education.

See also

[edit]

- Accessible toilet
- Accessible tourism
- CEN/CENELEC Guide 6
- Computer accessibility

- Convenience
- Curb cut effect
- Design for All (in ICT)
- Disability flag
- Game accessibility
- Human factors and ergonomics
- Inclusive design
- Knowbility
- National Federation of the Blind v. Target Corporation
- Principles of Intelligent Urbanism
- Public transport accessibility level
- Section 504 of the Rehabilitation Act
- Section 508 Amendment to the Rehabilitation Act of 1973
- Timeline of disability rights in the United States
- Timeline of disability rights outside the United States
- Transgenerational design
- Transport divide
- Universal design for instruction
- Walkability
- Walking audit
- Walter Harris Callow, inventor of wheelchair accessible bus
- Wheelchair accessible van

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External links

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Disability

Main topics

- Disability
- Disability studies
- Medical model
- Social model
- IEP
- Inclusion
- Learning disability
- Mainstreaming

Approaches

- Physical therapy
  - driver rehabilitation
- Special needs
  - school
  - education

Rights, law, support	**Rights**	○ Ableism/disablism
		○ Disability rights
		○ Pejorative terms
		○ Right to sit
		  ○ United States
		○ Accessibility Act
		  ○ NB
		  ○ NL
		  ○ NS

	Law	○ ABCA ○ ACA ○ AMA ○ AODA ○ ADA ○ An Act to secure handicapped persons in the exercise of their rights ○ Convention on the Rights of Persons with Disabilities ○ Declaration on the Rights of Disabled Persons ○ International Classification of Functioning, Disability and Health
	Services	○ Services for mental disorders ○ Services for disabled people ○ DLA ○ ODSP ○ Rail
	Support	○ SSDI ○ SSI ○ Students ○ CNIB
	Activist groups	○ CCD ○ DPI ○ MINDS ○ Reach Canada

Structural and assistive	○ Accessible toilet ○ Activities of daily living ○ Assistive technology ○ Curb cut ○ Independent living ○ Mobility aid ○ Orthotics and braces ○ Personal Care Assistant ○ Physical accessibility ○ Prosthetics ○ Redundant elevators ○ Universal design ○ Web accessibility ○ Augmentative and alternative communication
Social issues	○ Emotional or behavioral disability ○ Invisible disability ○ Disability and disasters ○ Disability and LGBT identities ○ Disability and religion ○ Disability and poverty ○ Disproportionality in special education ○ Sexuality and disability ○ Youth and disability
Disability studies	○ Models of disability ○ Inspiration porn ○ Bodymind ○ Crip as verb ○ Neuroqueer theory ○ Deaf studies ○ Eugenics ○ Anthropology ○ Geography ○ Education ○ Journals

Arts, media, culture, sport	○ Disability culture
	○ Disability art
	○ Disability in the arts
	  ○ Disability in children's literature
	  ○ Disability in horror films
	○ Disability in the media
	○ Parasports
	  ○ Deaflympics
	  ○ Paralympics
	  ○ Special Olympics

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About Ventilation (architecture)

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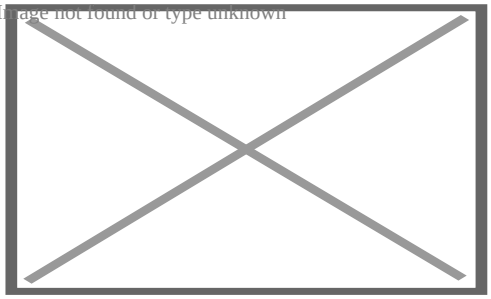

An Ab anbar (water reservoir) with double domes and windcatchers (openings near the top of the towers) in the central desert city of Naeen, Iran. Windcatchers are a form of natural ventilation.[1]

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Ventilation is the intentional introduction of outdoor air into a space. Ventilation is mainly used to control indoor air quality by diluting and displacing indoor effluents and pollutants. It can also be used to control indoor temperature, humidity, and air motion to benefit thermal comfort, satisfaction with other aspects of the indoor environment, or other objectives.

The intentional introduction of outdoor air is usually categorized as either mechanical ventilation, natural ventilation, or mixed-mode ventilation.[2]

- Mechanical ventilation is the intentional fan-driven flow of outdoor air into and/or out from a building. Mechanical ventilation systems may include supply fans (which push outdoor air into a building), exhaust[3] fans (which draw air out of a building and thereby cause equal ventilation flow into a building), or a combination of both (called balanced ventilation if it neither pressurizes nor depressurizes the inside air,[3] or only slightly depressurizes it). Mechanical ventilation is often provided by equipment

that is also used to heat and cool a space.
- Natural ventilation is the intentional passive flow of outdoor air into a building through planned openings (such as louvers, doors, and windows). Natural ventilation does not require mechanical systems to move outdoor air. Instead, it relies entirely on passive physical phenomena, such as wind pressure, or the stack effect. Natural ventilation openings may be fixed, or adjustable. Adjustable openings may be controlled automatically (automated), owned by occupants (operable), or a combination of both. Cross ventilation is a phenomenon of natural ventilation.
- Mixed-mode ventilation systems use both mechanical and natural processes. The mechanical and natural components may be used at the same time, at different times of day, or in different seasons of the year.[4] Since natural ventilation flow depends on environmental conditions, it may not always provide an appropriate amount of ventilation. In this case, mechanical systems may be used to supplement or regulate the naturally driven flow.

Ventilation is typically described as separate from infiltration.

- Infiltration is the circumstantial flow of air from outdoors to indoors through leaks (unplanned openings) in a building envelope. When a building design relies on infiltration to maintain indoor air quality, this flow has been referred to as adventitious ventilation.[5]

The design of buildings that promote occupant health and well-being requires a clear understanding of the ways that ventilation airflow interacts with, dilutes, displaces, or introduces pollutants within the occupied space. Although ventilation is an integral component of maintaining good indoor air quality, it may not be satisfactory alone.[6] A clear understanding of both indoor and outdoor air quality parameters is needed to improve the performance of ventilation in terms of occupant health and energy.[7] In scenarios where outdoor pollution would deteriorate indoor air quality, other treatment devices such as filtration may also be necessary.[8] In kitchen ventilation systems, or for laboratory fume hoods, the design of effective effluent capture can be more important than the bulk amount of ventilation in a space. More generally, the way that an air distribution system causes ventilation to flow into and out of a space impacts the ability of a particular ventilation rate to remove internally generated pollutants. The ability of a system to reduce pollution in space is described as its "ventilation effectiveness". However, the overall impacts of ventilation on indoor air quality can depend on more complex factors such as the sources of pollution, and the ways that activities and airflow interact to affect occupant exposure.

An array of factors related to the design and operation of ventilation systems are regulated by various codes and standards. Standards dealing with the design and operation of ventilation systems to achieve acceptable indoor air quality include the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standards 62.1 and 62.2, the International Residential Code, the International Mechanical Code, and the United Kingdom Building Regulations Part F. Other standards that focus on energy

conservation also impact the design and operation of ventilation systems, including ASHRAE Standard 90.1, and the International Energy Conservation Code.

When indoor and outdoor conditions are favorable, increasing ventilation beyond the minimum required for indoor air quality can significantly improve both indoor air quality and thermal comfort through ventilative cooling, which also helps reduce the energy demand of buildings.[9][10] During these times, higher ventilation rates, achieved through passive or mechanical means (air-side economizer, ventilative pre-cooling), can be particularly beneficial for enhancing people's physical health.[11] Conversely, when conditions are less favorable, maintaining or improving indoor air quality through ventilation may require increased use of mechanical heating or cooling, leading to higher energy consumption.

Ventilation should be considered for its relationship to "venting" for appliances and combustion equipment such as water heaters, furnaces, boilers, and wood stoves. Most importantly, building ventilation design must be careful to avoid the backdraft of combustion products from "naturally vented" appliances into the occupied space. This issue is of greater importance for buildings with more air-tight envelopes. To avoid the hazard, many modern combustion appliances utilize "direct venting" which draws combustion air directly from outdoors, instead of from the indoor environment.

Design of air flow in rooms

[edit]

The air in a room can be supplied and removed in several ways, for example via ceiling ventilation, cross ventilation, floor ventilation or displacement ventilation.[*citation needed*]

Ceiling ventilation

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Ceiling ventilation
Cross ventilation

- Image not found or type unknown

Cross ventilation

Floor ventilation

- Image not found or type unknown

  Floor ventilation
  Displacement ventilation

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  Displacement
  ventilation

Furthermore, the air can be circulated in the room using vortexes which can be initiated in various ways:

Tangential flow vortices, initiated horizontally

- Image not found or type unknown

  Tangential flow
  vortices, initiated
  horizontally
  Tangential flow vortices, initiated vertically

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  Tangential flow
  vortices, initiated
  vertically

Diffused flow vortices from air nozzles

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Diffused flow
vortices from air
nozzles
Diffused flow vortices due to roof vortices

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Diffused flow
vortices due to roof
vortices

Ventilation rates for indoor air quality

[edit]

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> The examples and perspective in this article **deal primarily with the United States and do not represent a worldwide view of the subject**. You may improve this article, discuss the issue on the talk page, or create a new article, as appropriate. *(April 2024) (Learn how and when to remove this message)*

The ventilation rate, for commercial, industrial, and institutional (CII) buildings, is normally expressed by the volumetric flow rate of outdoor air, introduced to the building. The typical units used are cubic feet per minute (CFM) in the imperial system, or liters per second (L/s) in the metric system (even though cubic meter per second is the preferred unit for volumetric flow rate in the SI system of units). The ventilation rate can also be expressed on a per person or per unit floor area basis, such as CFM/p or CFM/ft², or as air changes per hour (ACH).

Standards for residential buildings

[edit]

For residential buildings, which mostly rely on infiltration for meeting their ventilation needs, a common ventilation rate measure is the air change rate (or air changes per hour): the hourly ventilation rate divided by the volume of the space (*I* or *ACH*; units of 1/h).

During the winter, ACH may range from 0.50 to 0.41 in a tightly air-sealed house to 1.11 to 1.47 in a loosely air-sealed house.[12]

ASHRAE now recommends ventilation rates dependent upon floor area, as a revision to the 62-2001 standard, in which the minimum ACH was 0.35, but no less than 15 CFM/person (7.1 L/s/person). As of 2003, the standard has been changed to 3 CFM/100 sq. ft. (15 L/s/100 sq. m.) plus 7.5 CFM/person (3.5 L/s/person).[13]

Standards for commercial buildings

[edit]

Ventilation rate procedure

[edit]

Ventilation Rate Procedure is rate based on standard and prescribes the rate at which ventilation air must be delivered to space and various means to the condition that air.[14] Air quality is assessed (through CO_2 measurement) and ventilation rates are mathematically derived using constants.Indoor Air Quality Procedure uses one or more guidelines for the specification of acceptable concentrations of certain contaminants in indoor air but does not prescribe ventilation rates or air treatment methods.[14] This addresses both quantitative and subjective evaluations and is based on the Ventilation Rate Procedure. It also accounts for potential contaminants that may have no measured limits, or for which no limits are not set (such as formaldehyde off-gassing from carpet and furniture).

Natural ventilation

[edit]
Main article: Natural ventilation

Natural ventilation harnesses naturally available forces to supply and remove air in an enclosed space. Poor ventilation in rooms is identified to significantly increase the localized moldy smell in specific places of the room including room corners.[11] There are three types of natural ventilation occurring in buildings: wind-driven ventilation, pressure-driven flows, and stack ventilation.[15] The pressures generated by 'the stack effect' rely upon the buoyancy of heated or rising air. Wind-driven ventilation relies upon the force of the prevailing wind to pull and push air through the enclosed space as well as through breaches in the building's envelope.

Almost all historic buildings were ventilated naturally.[16] The technique was generally abandoned in larger US buildings during the late 20th century as the use of air conditioning became more widespread. However, with the advent of advanced Building Performance Simulation (BPS) software, improved Building Automation Systems (BAS),

Leadership in Energy and Environmental Design (LEED) design requirements, and improved window manufacturing techniques; natural ventilation has made a resurgence in commercial buildings both globally and throughout the US.[17]

The benefits of natural ventilation include:

- Improved indoor air quality (IAQ)
- Energy savings
- Reduction of greenhouse gas emissions
- Occupant control
- Reduction in occupant illness associated with sick building syndrome
- Increased worker productivity

Techniques and architectural features used to ventilate buildings and structures naturally include, but are not limited to:

- Operable windows
- Clerestory windows and vented skylights
- Lev/convection doors
- Night purge ventilation
- Building orientation
- Wind capture façades

Airborne diseases

[edit]

Natural ventilation is a key factor in reducing the spread of airborne illnesses such as tuberculosis, the common cold, influenza, meningitis or COVID-19.[18] Opening doors and windows are good ways to maximize natural ventilation, which would make the risk of airborne contagion much lower than with costly and maintenance-requiring mechanical systems. Old-fashioned clinical areas with high ceilings and large windows provide the greatest protection. Natural ventilation costs little and is maintenance-free, and is particularly suited to limited-resource settings and tropical climates, where the burden of TB and institutional TB transmission is highest. In settings where respiratory isolation is difficult and climate permits, windows and doors should be opened to reduce the risk of airborne contagion. Natural ventilation requires little maintenance and is inexpensive.[19]

Natural ventilation is not practical in much of the infrastructure because of climate. This means that the facilities need to have effective mechanical ventilation systems and or use Ceiling Level UV or FAR UV ventilation systems.

Ventilation is measured in terms of air changes per hour (ACH). As of 2023, the CDC recommends that all spaces have a minimum of 5 ACH.[20] For hospital rooms with airborne contagions the CDC recommends a minimum of 12 ACH.[21] Challenges in facility ventilation are public unawareness,[22][23] ineffective government oversight, poor

building codes that are based on comfort levels, poor system operations, poor maintenance, and lack of transparency.[24]

Pressure, both political and economic, to improve energy conservation has led to decreased ventilation rates. Heating, ventilation, and air conditioning rates have dropped since the energy crisis in the 1970s and the banning of cigarette smoke in the 1980s and 1990s.[25][26][*better source needed*]

Mechanical ventilation

[edit]
Main article: HVAC

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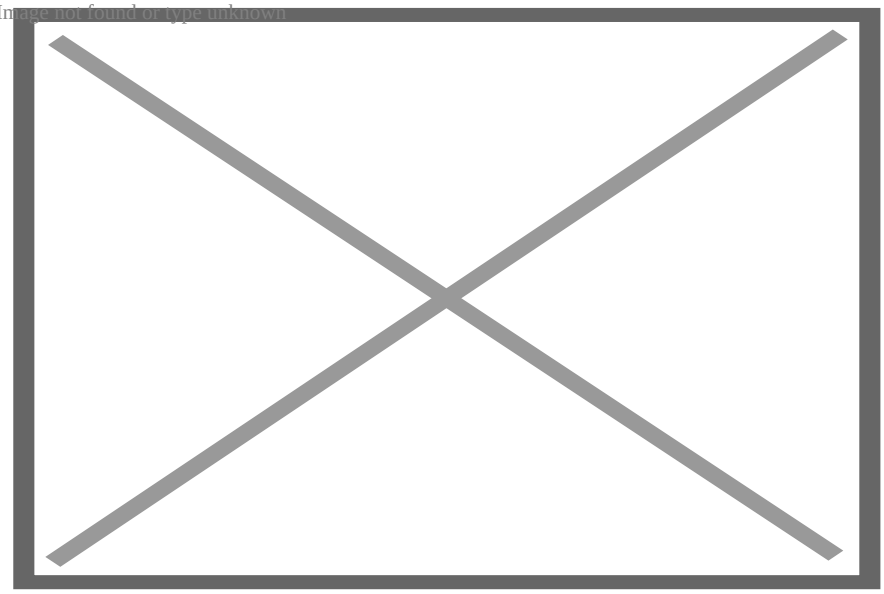

An axial belt-drive exhaust fan serving an underground car park. This exhaust fan's operation is interlocked with the concentration of contaminants emitted by internal combustion engines.

Mechanical ventilation of buildings and structures can be achieved by the use of the following techniques:

- Whole-house ventilation
- Mixing ventilation
- Displacement ventilation
- Dedicated subaerial air supply

Demand-controlled ventilation (DCV)

[edit]

Demand-controlled ventilation (**DCV**, also known as Demand Control Ventilation) makes it possible to maintain air quality while conserving energy.[27][28] ASHRAE has determined

that "It is consistent with the ventilation rate procedure that demand control be permitted for use to reduce the total outdoor air supply during periods of less occupancy."[29] In a DCV system, CO_2 sensors control the amount of ventilation.[30][31] During peak occupancy, CO_2 levels rise, and the system adjusts to deliver the same amount of outdoor air as would be used by the ventilation-rate procedure.[32] However, when spaces are less occupied, CO_2 levels reduce, and the system reduces ventilation to conserves energy. DCV is a well-established practice,[33] and is required in high occupancy spaces by building energy standards such as ASHRAE 90.1.[34]

Personalized ventilation

[edit]

This section needs to be **updated**. Please help update this article to reflect recent events or newly available information. *(September 2024)*

Personalized ventilation is an air distribution strategy that allows individuals to control the amount of ventilation received. The approach delivers fresh air more directly to the breathing zone and aims to improve the air quality of inhaled air. Personalized ventilation provides much higher ventilation effectiveness than conventional mixing ventilation systems by displacing pollution from the breathing zone with far less air volume. Beyond improved air quality benefits, the strategy can also improve occupants' thermal comfort, perceived air quality, and overall satisfaction with the indoor environment. Individuals' preferences for temperature and air movement are not equal, and so traditional approaches to homogeneous environmental control have failed to achieve high occupant satisfaction. Techniques such as personalized ventilation facilitate control of a more diverse thermal environment that can improve thermal satisfaction for most occupants.

Local exhaust ventilation

[edit]
See also: Power tool

Local exhaust ventilation addresses the issue of avoiding the contamination of indoor air by specific high-emission sources by capturing airborne contaminants before they are spread into the environment. This can include water vapor control, lavatory effluent control, solvent vapors from industrial processes, and dust from wood- and metal-working machinery. Air can be exhausted through pressurized hoods or the use of fans and pressurizing a specific area.[35]
A local exhaust system is composed of five basic parts:

1. A hood that captures the contaminant at its source
2. Ducts for transporting the air
3. An air-cleaning device that removes/minimizes the contaminant
4. A fan that moves the air through the system

5. An exhaust stack through which the contaminated air is discharged[35]

In the UK, the use of LEV systems has regulations set out by the Health and Safety Executive (HSE) which are referred to as the Control of Substances Hazardous to Health (CoSHH). Under CoSHH, legislation is set to protect users of LEV systems by ensuring that all equipment is tested at least every fourteen months to ensure the LEV systems are performing adequately. All parts of the system must be visually inspected and thoroughly tested and where any parts are found to be defective, the inspector must issue a red label to identify the defective part and the issue.

The owner of the LEV system must then have the defective parts repaired or replaced before the system can be used.

Smart ventilation

[edit]

Smart ventilation is a process of continually adjusting the ventilation system in time, and optionally by location, to provide the desired IAQ benefits while minimizing energy consumption, utility bills, and other non-IAQ costs (such as thermal discomfort or noise). A smart ventilation system adjusts ventilation rates in time or by location in a building to be responsive to one or more of the following: occupancy, outdoor thermal and air quality conditions, electricity grid needs, direct sensing of contaminants, operation of other air moving and air cleaning systems. In addition, smart ventilation systems can provide information to building owners, occupants, and managers on operational energy consumption and indoor air quality as well as a signal when systems need maintenance or repair. Being responsive to occupancy means that a smart ventilation system can adjust ventilation depending on demand such as reducing ventilation if the building is unoccupied. Smart ventilation can time-shift ventilation to periods when a) indoor-outdoor temperature differences are smaller (and away from peak outdoor temperatures and humidity), b) when indoor-outdoor temperatures are appropriate for ventilative cooling, or c) when outdoor air quality is acceptable. Being responsive to electricity grid needs means providing flexibility to electricity demand (including direct signals from utilities) and integration with electric grid control strategies. Smart ventilation systems can have sensors to detect airflow, systems pressures, or fan energy use in such a way that systems failures can be detected and repaired, as well as when system components need maintenance, such as filter replacement.[36]

Ventilation and combustion

[edit]

Combustion (in a fireplace, gas heater, candle, oil lamp, etc.) consumes oxygen while producing carbon dioxide and other unhealthy gases and smoke, requiring ventilation air. An open chimney promotes infiltration (i.e. natural ventilation) because of the negative

pressure change induced by the buoyant, warmer air leaving through the chimney. The warm air is typically replaced by heavier, cold air.

Ventilation in a structure is also needed for removing water vapor produced by respiration, burning, and cooking, and for removing odors. If water vapor is permitted to accumulate, it may damage the structure, insulation, or finishes. [*citation needed*] When operating, an air conditioner usually removes excess moisture from the air. A dehumidifier may also be appropriate for removing airborne moisture.

Calculation for acceptable ventilation rate

[edit]

Ventilation guidelines are based on the minimum ventilation rate required to maintain acceptable levels of effluents. Carbon dioxide is used as a reference point, as it is the gas of highest emission at a relatively constant value of 0.005 L/s. The mass balance equation is:

$Q = G/ (C_i ? C_a)$

- Q = ventilation rate (L/s)
- G = CO_2 generation rate
- C_i = acceptable indoor CO_2 concentration
- C_a = ambient CO_2 concentration[37]

Smoking and ventilation

[edit]

ASHRAE standard 62 states that air removed from an area with environmental tobacco smoke shall not be recirculated into ETS-free air. A space with ETS requires more ventilation to achieve similar perceived air quality to that of a non-smoking environment.

The amount of ventilation in an ETS area is equal to the amount of an ETS-free area plus the amount V, where:

$V = DSD \times VA \times A/60E$

- V = recommended extra flow rate in CFM (L/s)
- DSD = design smoking density (estimated number of cigarettes smoked per hour per unit area)
- VA = volume of ventilation air per cigarette for the room being designed (ft^3/cig)
- E = contaminant removal effectiveness[38]

History

[edit]

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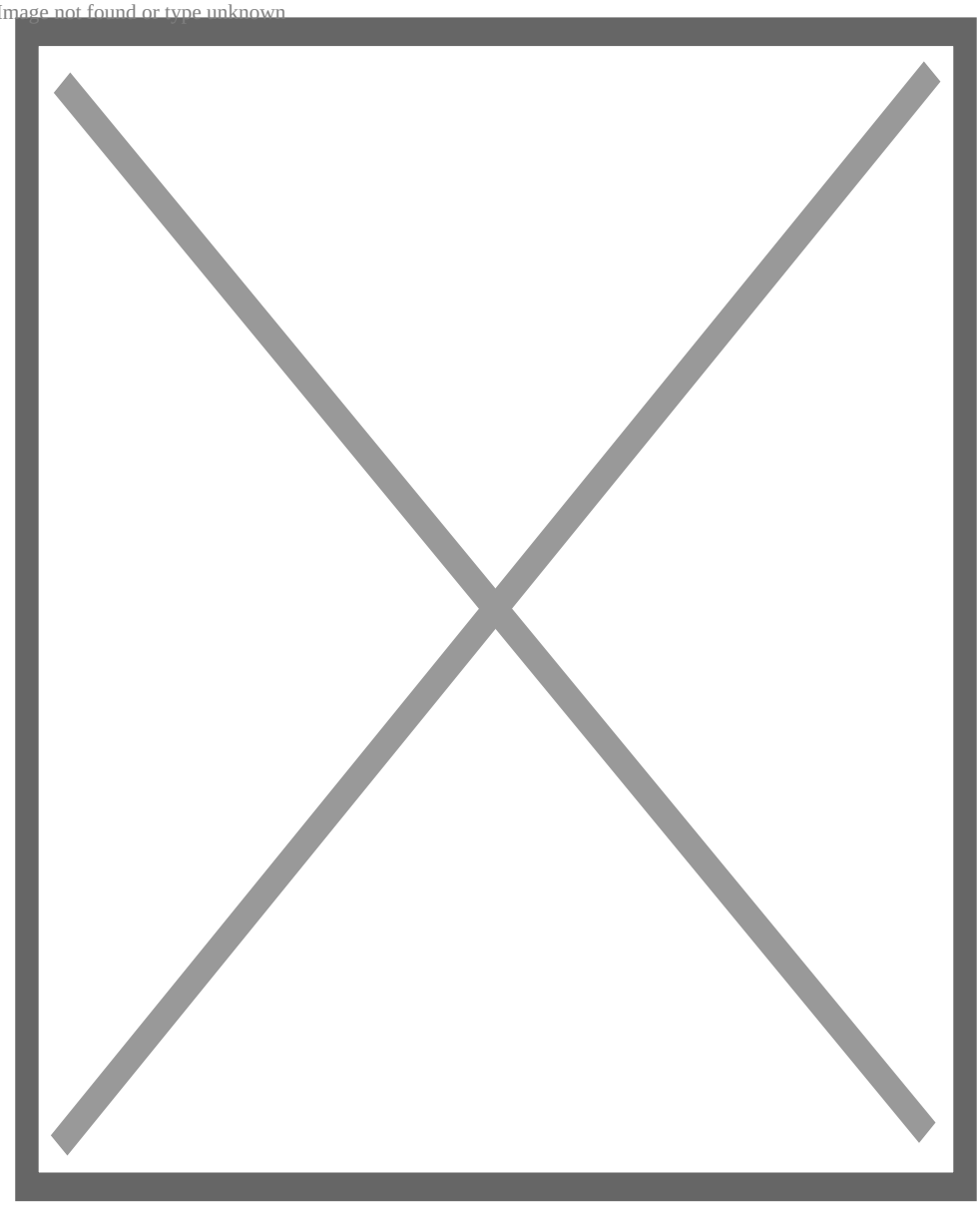

This ancient Roman house uses a variety of passive cooling and passive ventilation techniques. Heavy masonry walls, small exterior windows, and a narrow walled garden oriented N-S shade the house, preventing heat gain. The house opens onto a central atrium with an impluvium (open to the sky); the evaporative cooling of the water causes a cross-draft from atrium to garden.

Primitive ventilation systems were found at the Plo?nik archeological site (belonging to the Vin?a culture) in Serbia and were built into early copper smelting furnaces. The furnace, built on the outside of the workshop, featured earthen pipe-like air vents with hundreds of tiny holes in them and a prototype chimney to ensure air goes into the furnace to feed the fire and smoke comes out safely.[39]

Passive ventilation and passive cooling systems were widely written about around the Mediterranean by Classical times. Both sources of heat and sources of cooling (such as fountains and subterranean heat reservoirs) were used to drive air circulation, and buildings were designed to encourage or exclude drafts, according to climate and function. Public bathhouses were often particularly sophisticated in their heating and cooling. Icehouses are some millennia old, and were part of a well-developed ice industry by classical times.

The development of forced ventilation was spurred by the common belief in the late 18th and early 19th century in the miasma theory of disease, where stagnant 'airs' were thought to spread illness. An early method of ventilation was the use of a ventilating fire near an air vent which would forcibly cause the air in the building to circulate. English engineer John Theophilus Desaguliers provided an early example of this when he installed ventilating fires in the air tubes on the roof of the House of Commons. Starting with the Covent Garden Theatre, gas burning chandeliers on the ceiling were often specially designed to perform a ventilating role.

Mechanical systems

[edit]
Further information: Heating, ventilation, and air conditioning § Mechanical or forced ventilation

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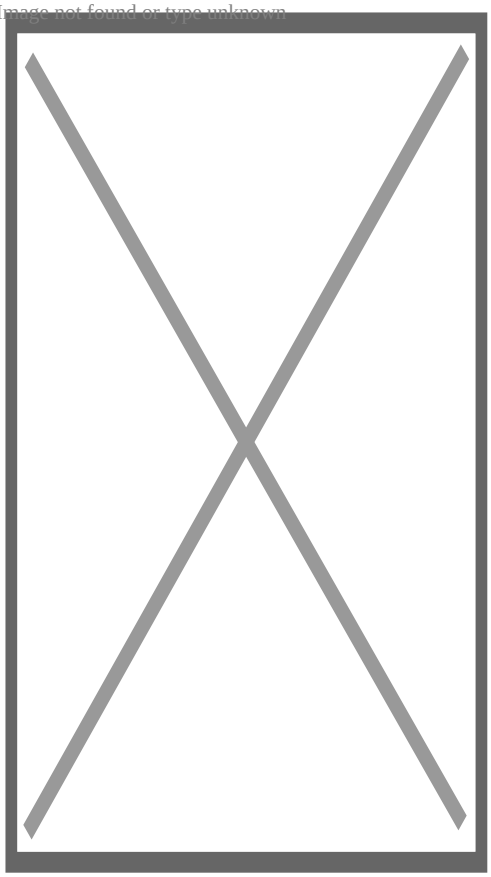

The Central Tower of the Palace of Westminster. This octagonal spire was for ventilation purposes, in the more complex system imposed by Reid on Barry, in which it was to draw air out of the Palace. The design was for the aesthetic disguise of its function.[40][41]

A more sophisticated system involving the use of mechanical equipment to circulate the air was developed in the mid-19th century. A basic system of bellows was put in place to ventilate Newgate Prison and outlying buildings, by the engineer Stephen Hales in the mid-1700s. The problem with these early devices was that they required constant human labor to operate. David Boswell Reid was called to testify before a Parliamentary committee on proposed architectural designs for the new House of Commons, after the old one burned down in a fire in 1834.[40] In January 1840 Reid was appointed by the committee for the House of Lords dealing with the construction of the replacement for the Houses of Parliament. The post was in the capacity of ventilation engineer, in effect; and with its creation there began a long series of quarrels between Reid and Charles Barry, the architect.[42]

Reid advocated the installation of a very advanced ventilation system in the new House. His design had air being drawn into an underground chamber, where it would undergo either heating or cooling. It would then ascend into the chamber through thousands of small holes drilled into the floor, and would be extracted through the ceiling by a special ventilation fire within a great stack.[43]

Reid's reputation was made by his work in Westminster. He was commissioned for an air quality survey in 1837 by the Leeds and Selby Railway in their tunnel.[44] The steam vessels built for the Niger expedition of 1841 were fitted with ventilation systems based on Reid's Westminster model.[45] Air was dried, filtered and passed over charcoal.[46][47] Reid's ventilation method was also applied more fully to St. George's Hall, Liverpool, where the architect, Harvey Lonsdale Elmes, requested that Reid should be involved in ventilation design.[48] Reid considered this the only building in which his system was completely carried out.[49]

Fans

[edit]

With the advent of practical steam power, ceiling fans could finally be used for ventilation. Reid installed four steam-powered fans in the ceiling of St George's Hospital in Liverpool, so that the pressure produced by the fans would force the incoming air upward and through vents in the ceiling. Reid's pioneering work provides the basis for ventilation systems to this day.[43] He was remembered as "Dr. Reid the ventilator" in the twenty-first century in discussions of energy efficiency, by Lord Wade of Chorlton.[50]

History and development of ventilation rate standards

[edit]

Ventilating a space with fresh air aims to avoid "bad air". The study of what constitutes bad air dates back to the 1600s when the scientist Mayow studied asphyxia of animals in confined bottles.[51] The poisonous component of air was later identified as carbon dioxide (CO_2), by Lavoisier in the very late 1700s, starting a debate as to the nature of "bad air" which humans perceive to be stuffy or unpleasant. Early hypotheses included excess concentrations of CO_2 and oxygen depletion. However, by the late 1800s, scientists thought biological contamination, not oxygen or CO_2, was the primary component of unacceptable indoor air. However, it was noted as early as 1872 that CO_2 concentration closely correlates to perceived air quality.

The first estimate of minimum ventilation rates was developed by Tredgold in 1836.[52] This was followed by subsequent studies on the topic by Billings [53] in 1886 and Flugge in 1905. The recommendations of Billings and Flugge were incorporated into numerous building codes from 1900–the 1920s and published as an industry standard by ASHVE (the predecessor to ASHRAE) in 1914.[51]

The study continued into the varied effects of thermal comfort, oxygen, carbon dioxide, and biological contaminants. The research was conducted with human subjects in controlled test chambers. Two studies, published between 1909 and 1911, showed that carbon dioxide was not the offending component. Subjects remained satisfied in chambers

with high levels of CO_2, so long as the chamber remained cool.[51] (Subsequently, it has been determined that CO_2 is, in fact, harmful at concentrations over 50,000ppm[54])

ASHVE began a robust research effort in 1919. By 1935, ASHVE-funded research conducted by Lemberg, Brandt, and Morse – again using human subjects in test chambers – suggested the primary component of "bad air" was an odor, perceived by the human olfactory nerves.[55] Human response to odor was found to be logarithmic to contaminant concentrations, and related to temperature. At lower, more comfortable temperatures, lower ventilation rates were satisfactory. A 1936 human test chamber study by Yaglou, Riley, and Coggins culminated much of this effort, considering odor, room volume, occupant age, cooling equipment effects, and recirculated air implications, which guided ventilation rates.[56] The Yagle research has been validated, and adopted into industry standards, beginning with the ASA code in 1946. From this research base, ASHRAE (having replaced ASHVE) developed space-by-space recommendations, and published them as ASHRAE Standard 62-1975: Ventilation for acceptable indoor air quality.

As more architecture incorporated mechanical ventilation, the cost of outdoor air ventilation came under some scrutiny. In 1973, in response to the 1973 oil crisis and conservation concerns, ASHRAE Standards 62-73 and 62–81) reduced required ventilation from 10 CFM (4.76 L/s) per person to 5 CFM (2.37 L/s) per person. In cold, warm, humid, or dusty climates, it is preferable to minimize ventilation with outdoor air to conserve energy, cost, or filtration. This critique (e.g. Tiller[57]) led ASHRAE to reduce outdoor ventilation rates in 1981, particularly in non-smoking areas. However subsequent research by Fanger,[58] W. Cain, and Janssen validated the Yagle model. The reduced ventilation rates were found to be a contributing factor to sick building syndrome.[59]

The 1989 ASHRAE standard (Standard 62–89) states that appropriate ventilation guidelines are 20 CFM (9.2 L/s) per person in an office building, and 15 CFM (7.1 L/s) per person for schools, while 2004 Standard 62.1-2004 has lower recommendations again (see tables below). ANSI/ASHRAE (Standard 62–89) speculated that "comfort (odor) criteria are likely to be satisfied if the ventilation rate is set so that 1,000 ppm CO_2 is not exceeded"[60] while OSHA has set a limit of 5000 ppm over 8 hours.[61]

Historical ventilation rates

Author or source	Year	Ventilation rate (IP)	Ventilation rate (SI)	Basis or rationale
Tredgold	1836	4 CFM per person	2 L/s per person	Basic metabolic needs, breathing rate, and candle burning
Billings	1895	30 CFM per person	15 L/s per person	Indoor air hygiene, preventing spread of disease
Flugge	1905	30 CFM per person	15 L/s per person	Excessive temperature or unpleasant odor

ASHVE	1914	30 CFM per person	15 L/s per person	Based on Billings, Flugge and contemporaries
Early US Codes	1925	30 CFM per person	15 L/s per person	Same as above
Yaglou	1936	15 CFM per person	7.5 L/s per person	Odor control, outdoor air as a fraction of total air
ASA	1946	15 CFM per person	7.5 L/s per person	Based on Yahlou and contemporaries
ASHRAE	1975	15 CFM per person	7.5 L/s per person	Same as above
ASHRAE	1981	10 CFM per person	5 L/s per person	For non-smoking areas, reduced.
ASHRAE	1989	15 CFM per person	7.5 L/s per person	Based on Fanger, W. Cain, and Janssen

ASHRAE continues to publish space-by-space ventilation rate recommendations, which are decided by a consensus committee of industry experts. The modern descendants of ASHRAE standard 62-1975 are ASHRAE Standard 62.1, for non-residential spaces, and ASHRAE 62.2 for residences.

In 2004, the calculation method was revised to include both an occupant-based contamination component and an area–based contamination component.[62] These two components are additive, to arrive at an overall ventilation rate. The change was made to recognize that densely populated areas were sometimes overventilated (leading to higher energy and cost) using a per-person methodology.

Occupant Based Ventilation Rates,[62] ANSI/ASHRAE Standard 62.1-2004

IP Units	SI Units	Category	Examples
0 cfm/person	0 L/s/person	Spaces where ventilation requirements are primarily associated with building elements, not occupants.	Storage Rooms, Warehouses
5 cfm/person	2.5 L/s/person	Spaces occupied by adults, engaged in low levels of activity	Office space
7.5 cfm/person	3.5 L/s/person	Spaces where occupants are engaged in higher levels of activity, but not strenuous, or activities generating more contaminants	Retail spaces, lobbies
10 cfm/person	5 L/s/person	Spaces where occupants are engaged in more strenuous activity, but not exercise, or activities generating more contaminants	Classrooms, school settings

20 cfm/person	10 L/s/person	Spaces where occupants are engaged in exercise, or activities generating many contaminants	dance floors, exercise rooms

Area-based ventilation rates,[62] ANSI/ASHRAE Standard 62.1-2004

IP Units	SI Units	Category	Examples
0.06 cfm/ft^2	0.30 L/s/m^2	Spaces where space contamination is normal, or similar to an office environment	Conference rooms, lobbies
0.12 cfm/ft^2	0.60 L/s/m^2	Spaces where space contamination is significantly higher than an office environment	Classrooms, museums
0.18 cfm/ft^2	0.90 L/s/m^2	Spaces where space contamination is even higher than the previous category	Laboratories, art classrooms
0.30 cfm/ft^2	1.5 L/s/m^2	Specific spaces in sports or entertainment where contaminants are released	Sports, entertainment
0.48 cfm/ft^2	2.4 L/s/m^2	Reserved for indoor swimming areas, where chemical concentrations are high	Indoor swimming areas

The addition of occupant- and area-based ventilation rates found in the tables above often results in significantly reduced rates compared to the former standard. This is compensated in other sections of the standard which require that this minimum amount of air is delivered to the breathing zone of the individual occupant at all times. The total outdoor air intake of the ventilation system (in multiple-zone variable air volume (VAV) systems) might therefore be similar to the airflow required by the 1989 standard.
From 1999 to 2010, there was considerable development of the application protocol for ventilation rates. These advancements address occupant- and process-based ventilation rates, room ventilation effectiveness, and system ventilation effectiveness[63]

Problems

[edit]

- In hot, humid climates, unconditioned ventilation air can daily deliver approximately 260 milliliters of water for each cubic meters per hour (m^3/h) of outdoor air (or one pound of water each day for each cubic feet per minute of outdoor air per day), annual average.[*citation needed*] This is a great deal of moisture and can create serious indoor moisture and mold problems. For example, given a 150 m^2 building with an airflow of 180 m^3/h this could result in about 47 liters of water accumulated per day.
- Ventilation efficiency is determined by design and layout, and is dependent upon the placement and proximity of diffusers and return air outlets. If they are located closely together, supply air may mix with stale air, decreasing the efficiency of the HVAC system, and creating air quality problems.
- System imbalances occur when components of the HVAC system are improperly adjusted or installed and can create pressure differences (too much-circulating air

creating a draft or too little circulating air creating stagnancy).
- Cross-contamination occurs when pressure differences arise, forcing potentially contaminated air from one zone to an uncontaminated zone. This often involves undesired odors or VOCs.
- Re-entry of exhaust air occurs when exhaust outlets and fresh air intakes are either too close, prevailing winds change exhaust patterns or infiltration between intake and exhaust air flows.
- Entrainment of contaminated outdoor air through intake flows will result in indoor air contamination. There are a variety of contaminated air sources, ranging from industrial effluent to VOCs put off by nearby construction work.[64] A recent study revealed that in urban European buildings equipped with ventilation systems lacking outdoor air filtration, the exposure to outdoor-originating pollutants indoors resulted in more Disability-Adjusted Life Years (DALYs) than exposure to indoor-emitted pollutants.[65]

See also

[edit]

- Architectural engineering
- Biological safety
- Cleanroom
- Environmental tobacco smoke
- Fume hood
- Head-end power
- Heating, ventilation, and air conditioning
- Heat recovery ventilation
- Mechanical engineering
- Room air distribution
- Sick building syndrome
- Siheyuan
- Solar chimney
- Tulou
- Windcatcher

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  - EBC Annex 26 Energy Efficient Ventilation of Large Enclosures
  - EBC Annex 27 Evaluation and Demonstration of Domestic Ventilation Systems
  - EBC Annex 35 Control Strategies for Hybrid Ventilation in New and Retrofitted Office Buildings (HYBVENT)
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Heating, ventilation, and air conditioning

Fundamental concepts	○ Air changes per hour (ACH) ○ Bake-out ○ Building envelope ○ Convection ○ Dilution ○ Domestic energy consumption ○ Enthalpy ○ Fluid dynamics ○ Gas compressor ○ Heat pump and refrigeration cycle ○ Heat transfer ○ Humidity ○ Infiltration ○ Latent heat ○ Noise control ○ Outgassing ○ Particulates ○ Psychrometrics ○ Sensible heat ○ Stack effect ○ Thermal comfort ○ Thermal destratification ○ Thermal mass ○ Thermodynamics ○ Vapour pressure of water

Technology

- Absorption-compression heat pump
- Absorption refrigerator
- Air barrier
- Air conditioning
- Antifreeze
- Automobile air conditioning
- Autonomous building
- Building insulation materials
- Central heating
- Central solar heating
- Chilled beam
- Chilled water
- Constant air volume (CAV)
- Coolant
- Cross ventilation
- Dedicated outdoor air system (DOAS)
- Deep water source cooling
- Demand controlled ventilation (DCV)
- Displacement ventilation
- District cooling
- District heating
- Electric heating
- Energy recovery ventilation (ERV)
- Firestop
- Forced-air
- Forced-air gas
- Free cooling
- Heat recovery ventilation (HRV)
- Hybrid heat
- Hydronics
- Ice storage air conditioning
- Kitchen ventilation
- Mixed-mode ventilation
- Microgeneration
- Passive cooling
- Passive daytime radiative cooling
- Passive house
- Passive ventilation
- Radiant heating and cooling
- Radiant cooling
- Radiant heating
- Radon mitigation
- Refrigeration
- Renewable heat
- Room air distribution
- Solar air heat
- Solar combisystem
- Solar cooling
- Solar heating
- Thermal insulation

Components

- Air conditioner inverter
- Air door
- Air filter
- Air handler
- Air ionizer
- Air-mixing plenum
- Air purifier
- Air source heat pump
- Attic fan
- Automatic balancing valve
- Back boiler
- Barrier pipe
- Blast damper
- Boiler
- Centrifugal fan
- Ceramic heater
- Chiller
- Condensate pump
- Condenser
- Condensing boiler
- Convection heater
- Compressor
- Cooling tower
- Damper
- Dehumidifier
- Duct
- Economizer
- Electrostatic precipitator
- Evaporative cooler
- Evaporator
- Exhaust hood
- Expansion tank
- Fan
- Fan coil unit
- Fan filter unit
- Fan heater
- Fire damper
- Fireplace
- Fireplace insert
- Freeze stat
- Flue
- Freon
- Fume hood
- Furnace
- Gas compressor
- Gas heater
- Gasoline heater
- Grease duct
- Grille
- Ground-coupled heat exchanger

Measurement and control

- Air flow meter
- Aquastat
- BACnet
- Blower door
- Building automation
- Carbon dioxide sensor
- Clean air delivery rate (CADR)
- Control valve
- Gas detector
- Home energy monitor
- Humidistat
- HVAC control system
- Infrared thermometer
- Intelligent buildings
- LonWorks
- Minimum efficiency reporting value (MERV)
- Normal temperature and pressure (NTP)
- OpenTherm
- Programmable communicating thermostat
- Programmable thermostat
- Psychrometrics
- Room temperature
- Smart thermostat
- Standard temperature and pressure (STP)
- Thermographic camera
- Thermostat
- Thermostatic radiator valve

Professions, trades, and services

- Architectural acoustics
- Architectural engineering
- Architectural technologist
- Building services engineering
- Building information modeling (BIM)
- Deep energy retrofit
- Duct cleaning
- Duct leakage testing
- Environmental engineering
- Hydronic balancing
- Kitchen exhaust cleaning
- Mechanical engineering
- Mechanical, electrical, and plumbing
- Mold growth, assessment, and remediation
- Refrigerant reclamation
- Testing, adjusting, balancing

Industry organizations	○ AHRI ○ AMCA ○ ASHRAE ○ ASTM International ○ BRE ○ BSRIA ○ CIBSE ○ Institute of Refrigeration ○ IIR ○ LEED ○ SMACNA ○ UMC
Health and safety	○ Indoor air quality (IAQ) ○ Passive smoking ○ Sick building syndrome (SBS) ○ Volatile organic compound (VOC)
See also	○ ASHRAE Handbook ○ Building science ○ Fireproofing ○ Glossary of HVAC terms ○ Warm Spaces ○ World Refrigeration Day ○ Template:Fire protection ○ Template:Home automation ○ Template:Solar energy

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Frequently Asked Questions

How can I be sure the porta potty Im renting meets all ADA requirements for handrails and seat height?

Ask the porta potty rental company to confirm that the unit is specifically designated and compliant to ADA, and request documentation or certification if available. You should also inspect the unit upon delivery to ensure the handrails and seat height meet the specified measurements.

Clean Restroom Rentals

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Email : info@cleanrestrooms.com

City : Manassas

State : VA

Zip : 20111

Address : Historic District, 8193-B Euclid Ct

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Company Website : **https://restroomrentalsvirginia.com/product/porta-potty-rental/**

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