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Fleets

Factors Influencing Daily Porta Potty Rental Costs

Scheduling service routes for large portable restroom fleets, often referred to as "porta potties," presents a unique set of challenges that require careful consideration and strategic planning. Virginia rental companies typically provide delivery, setup, regular maintenance, and pickup services as part of standard packages **luxury porta potty rental** Soap dispenser. As the demand for these services grows, particularly in large-scale events, construction sites, and outdoor festivals, the complexity of managing a vast fleet of portable restrooms increases exponentially.

One of the primary challenges is the dynamic nature of the demand. Unlike fixed facilities, the need for portable restrooms can fluctuate dramatically based on the time of day, weather conditions, and the specific activities taking place. This variability necessitates a flexible scheduling system that can adapt in real-time to changing needs. Companies must employ sophisticated forecasting tools and data analytics to predict demand accurately and allocate resources efficiently.

Another significant challenge is the logistical complexity of managing a large fleet. Porta potties must be transported, cleaned, and maintained regularly, which requires a well-coordinated transportation network. Ensuring that each unit is in optimal condition and available when needed involves meticulous planning and execution. The logistics team must navigate traffic, parking restrictions, and the availability of cleaning facilities, all while maintaining a high standard of service.

Moreover, the geographical spread of the rental sites can pose additional hurdles. Large fleets often operate across wide areas, necessitating a robust route optimization strategy. Efficient route planning not only minimizes travel time and fuel consumption but also ensures that the restrooms are delivered to the right location at the right time. This requires a deep understanding of the terrain, traffic patterns, and the specific requirements of each site.

Environmental considerations also play a crucial role in scheduling. Portable restrooms must be serviced in a manner that minimizes environmental impact. This includes managing waste disposal responsibly, ensuring that cleaning processes are eco-friendly, and reducing the carbon footprint associated with transportation. Companies must balance operational efficiency with sustainability, which adds another layer of complexity to the scheduling process.

Finally, customer satisfaction is a critical factor that influences scheduling decisions. Clients expect reliable and timely service, and any delays or shortages can lead to significant dissatisfaction. Therefore, maintaining clear communication with clients, providing accurate updates, and being responsive to their needs are essential components of effective scheduling.

In conclusion, scheduling service routes for large portable restroom fleets is a multifaceted challenge that requires a blend of forecasting, logistics, route optimization, environmental awareness, and customer service. By addressing these challenges with strategic planning and innovative solutions, companies can ensure that their fleets operate smoothly and meet the needs of their clients effectively.

Breaking Down Weekly Porta Potty Rental Pricing —

Scheduling service routes for large portable restroom fleets is a complex task that requires careful consideration of various key factors to ensure efficiency, cost-effectiveness, and customer satisfaction. The optimization of these routes is not merely about minimizing travel time or distance; it encompasses a multitude of elements that, when harmonized, can significantly enhance the overall performance of the fleet.

First and foremost, demand forecasting plays a crucial role. Understanding where and when portable restrooms are needed is fundamental. This involves analyzing historical data, current events, and even predictive analytics to anticipate future demand. For instance, if a city is hosting a major event, the demand for portable restrooms will likely spike. By predicting these spikes, companies can allocate resources more effectively, ensuring that restrooms are available when and where they are needed most.

Another key factor is the geographical layout of the service area. Urban areas with dense traffic and limited parking can pose significant challenges. In such environments, route optimization software must account for traffic patterns, road closures, and parking availability. This ensures that service vehicles can reach their destinations without unnecessary delays. Moreover, the physical layout of the area, including the presence of construction sites or one-way streets, must be factored into the route planning process.

Vehicle capacity and maintenance schedules are also critical considerations. Each portable restroom unit requires a specific type of service vehicle, and these vehicles must be maintained regularly to ensure they are in optimal working condition. Scheduling routes that minimize downtime for maintenance and ensure that vehicles are used to their full capacity can lead to significant cost savings and improved service reliability.

Customer preferences and service level agreements (SLAs) further influence route optimization. Customers may have specific preferences regarding the timing and frequency of restroom services. For instance, a business might require restrooms to be serviced early in the morning before the workday starts. Adhering to these preferences can enhance customer satisfaction and loyalty. Additionally, SLAs often include specific performance metrics, such as response times and service intervals, which must be met to maintain contractual obligations.

Technological tools and data analytics are indispensable in modern route optimization. Advanced software can process vast amounts of data to generate optimal routes in real-time. These tools can integrate variables such as traffic conditions, weather forecasts, and even social media trends to provide a dynamic and responsive routing solution. By leveraging these technologies, companies can achieve a level of precision and efficiency that would be impossible through manual planning.

Lastly, the human element cannot be overlooked. The expertise and experience of the routing team are invaluable. These individuals must be adept at interpreting data, making quick decisions, and adapting to unforeseen circumstances. Their insights and on-the-ground knowledge can provide a critical edge in optimizing service routes.

In conclusion, optimizing service routes for large portable restroom fleets involves a multifaceted approach that considers demand forecasting, geographical layout, vehicle capacity, customer preferences, and the use of advanced technology. By carefully balancing these key factors, companies can enhance their operational efficiency, reduce costs, and deliver superior service to their customers.

restroom rentals virginia

Social Signals:

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Comparing Daily vs. Weekly Rental: Which is Best for You?

In the bustling landscape of modern urban and event management, the efficient scheduling of service routes for large portable restroom fleets is a critical component that ensures seamless operations and customer satisfaction. Technology solutions for this task have evolved significantly, leveraging advanced algorithms, real-time data analytics, and user-friendly interfaces to optimize route planning.

One of the primary challenges in managing large fleets of portable restrooms is the need to balance service availability with operational efficiency. Traditional methods of route planning often relied on manual calculations and guesswork, which could lead to inefficiencies, delays, and increased costs. However, modern technology solutions have transformed this process by introducing sophisticated software that can analyze vast amounts of data to create optimal routes.

These technology solutions utilize Geographic Information Systems (GIS) to map out the most efficient paths, taking into account factors such as traffic patterns, event locations, and restroom usage patterns. By integrating real-time data from GPS devices and mobile applications, these systems can dynamically adjust routes to accommodate unforeseen circumstances, such as traffic congestion or unexpected demand spikes.

Moreover, advanced analytics play a crucial role in enhancing the efficiency of route planning. By analyzing historical data, these systems can predict future demand and identify trends that inform better decision-making. For instance, they can determine peak usage times and locations, allowing managers to allocate resources more effectively and ensure that restrooms are available where and when they are needed most.

User-friendly interfaces further enhance the usability of these technology solutions. Managers can easily input parameters such as event schedules, restroom capacities, and maintenance requirements, and the software generates optimized routes that can be adjusted as needed.

This level of customization ensures that the planning process is both efficient and responsive to the unique needs of each operation.

In conclusion, technology solutions for efficient route planning in scheduling service routes for large portable restroom fleets represent a significant advancement in fleet management. By leveraging data analytics, real-time information, and intuitive interfaces, these solutions not only enhance operational efficiency but also improve customer satisfaction by ensuring timely and reliable service. As technology continues to evolve, the potential for even more sophisticated and effective route planning solutions remains vast, promising a future where managing large fleets becomes increasingly streamlined and efficient.

Hidden Fees and Extra Charges to Consider

Implementing a Data-Driven Approach to Scheduling for Scheduling Service Routes for Large Portable Restroom Fleets

In todays fast-paced world, efficient and effective scheduling is crucial for businesses aiming to deliver top-notch service. This is particularly true for companies managing large fleets of portable restrooms, where timely deployment and retrieval are essential to meet client needs and maintain operational efficiency. Implementing a data-driven approach to scheduling service routes can significantly enhance the management of these fleets, ensuring optimal resource allocation and customer satisfaction.

A data-driven approach leverages historical data, real-time information, and predictive analytics to make informed decisions about route scheduling. By analyzing past usage patterns, demand forecasts, and logistical constraints, companies can create more efficient and responsive scheduling systems. This method not only reduces the time and effort required to manually plan routes but also minimizes the risk of over or under-utilizing resources.

For large portable restroom fleets, the complexity of scheduling is magnified by the need to cater to a diverse range of events and locations. A data-driven approach allows for the customization of routes based on specific event requirements, geographical constraints, and traffic conditions. By integrating data from various sources, such as event calendars, weather forecasts, and traffic data, companies can dynamically adjust routes to ensure that restrooms are delivered and collected at the most opportune times.

Moreover, a data-driven approach facilitates better communication and coordination among different departments within the company. By providing real-time updates and insights, it enables teams to respond quickly to changes in demand or unforeseen circumstances. This agility is crucial for maintaining service quality and customer trust, especially in high-pressure situations where delays can have significant repercussions.

In addition to improving operational efficiency, a data-driven approach to scheduling also offers financial benefits. By optimizing routes and reducing idle time, companies can lower fuel consumption and vehicle wear and tear, leading to cost savings. Furthermore, the ability to predict and manage demand more accurately can help in better inventory management, reducing the need for excess stock and associated holding costs.

In conclusion, implementing a data-driven approach to scheduling service routes for large portable restroom fleets is a strategic move that can yield substantial benefits. It enhances operational efficiency, improves customer satisfaction, and drives cost savings. As technology continues to advance, the ability to harness data effectively will become increasingly important for businesses looking to stay competitive in a dynamic market.

Tips for Negotiating the Best Porta Potty Rental Rate

Best Practices for Driver Management and Communication in Scheduling Service Routes for Large Portable Restroom Fleets

Efficiently managing a large fleet of portable restrooms requires meticulous planning, especially when it comes to scheduling service routes. This task is not just about logistics; its about ensuring seamless communication and coordination among drivers, dispatchers, and clients. Here are some best practices to consider.

Firstly, understanding the importance of accurate data is crucial. The foundation of effective route scheduling lies in the quality of data. This includes knowing the exact locations of all portable restrooms, their current status, and the specific needs of each site. Utilizing a robust fleet management software can help in collecting and analyzing this data, providing real-time insights into the fleets status and needs.

Communication is another cornerstone of successful driver management. Establishing clear and open lines of communication between drivers and dispatchers is essential. This can be achieved through the use of mobile apps or radio systems that allow for instant updates and feedback. Regular check-ins and briefings can also help in keeping everyone aligned with the days objectives and any changes in the schedule.

Drivers should be given the autonomy to make minor adjustments to their routes based on real-time conditions. This flexibility not only helps in saving time but also in improving customer satisfaction. For instance, if a driver notices a high demand for restrooms at a particular location, they can prioritize that site without waiting for dispatcher approval.

Training and equipping drivers with the necessary tools and knowledge is also vital. This includes training on the use of fleet management software, understanding the importance of punctuality, and knowing how to handle customer inquiries and issues. Providing drivers with GPS devices and mobile tablets can enhance their efficiency and effectiveness on the job.

Lastly, fostering a culture of accountability and teamwork within the team is important. This can be achieved by setting clear performance metrics and regularly reviewing them. Recognizing and rewarding drivers who consistently perform well can motivate others to follow suit.

In conclusion, effective driver management and communication in scheduling service routes for large portable restroom fleets is about leveraging technology, maintaining open lines of communication, empowering drivers, and fostering a collaborative team culture. By adhering to these best practices, companies can ensure efficient and reliable service, ultimately leading to higher customer satisfaction and operational success.

Impact of Location and Season on Rental Prices

Lets talk porta potties. I know, not the most glamorous topic, but when youre dealing with a large fleet of them, scheduling service routes becomes a surprisingly complex puzzle. Its not just about emptying them; its about doing it efficiently, cost-effectively, and without anyone having to… well, you get the picture. So, what separates the porta potty pros from the, shall we say, less organized? Case studies reveal some pretty interesting and successful scheduling strategies.

One common thread is the smart use of technology. Forget the whiteboard and sticky notes. Modern fleets are leveraging GPS tracking, route optimization software, and even customer portals. GPS allows for real-time monitoring of trucks, ensuring they're on schedule and not getting stuck in unexpected traffic. Route optimization software then takes that data, combined with service frequencies, event schedules, and even things like construction delays, to create the most efficient routes possible. This minimizes driving time, fuel costs, and wear-and-tear on vehicles, all of which add up to significant savings.

Beyond technology, successful companies prioritize communication. This means clear communication internally between dispatchers and drivers, but also externally with customers. A customer portal allows clients to easily request service, report issues, and track the status of their units. This transparency builds trust and reduces the number of frantic phone calls. Internally, clear communication ensures drivers are aware of any changes to their routes, special requests, or potential problems at specific locations.

Finally, and perhaps most importantly, successful porta potty fleet scheduling involves a healthy dose of flexibility and proactive planning. Things rarely go exactly as planned. An unexpected event, a sudden influx of service requests, or a broken-down truck can throw a wrench in the works. Companies that have contingency plans in place, and empower their dispatchers to make quick decisions, are much better equipped to handle these unforeseen circumstances. They also proactively analyze data to identify trends and anticipate future needs. Are certain locations consistently requiring more frequent service? Are there seasonal fluctuations in demand? By understanding these patterns, they can adjust their schedules and resources accordingly, ensuring theyre always one step ahead of the game.

So, while it might seem like a humble business, scheduling service routes for large porta potty fleets is a sophisticated logistical challenge. Technology, communication, and proactive planning are the keys to success, ensuring that everyone, quite literally, has a more comfortable experience.

Different Types of Porta Potties and Their Associated Costs

Lets talk about keeping those portable restrooms clean and accessible, especially when youve got a whole fleet to manage. Think of it like this: youre not just driving around emptying toilets, youre orchestrating a mobile sanitation symphony. And like any good performance, efficiency is key. Thats where measuring and improving service route efficiency comes in.

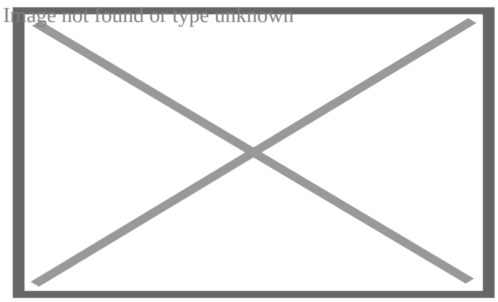
First, you gotta know your baseline. Whats taking so long? Are your drivers stuck in traffic? Are some locations consistently needing more attention than others? Are routes just plain illogical? You need data. Think about tracking things like the time spent driving between locations, the time spent servicing each unit, and even fuel consumption. This gives you a real picture of where the bottlenecks are.

Once youve got the data, you can start tinkering. Route optimization software can be a game changer, helping you find the shortest, most efficient paths. But dont rely solely on algorithms! Talk to your drivers. They know the roads, the shortcuts, and the problem spots better than anyone. Their insights are invaluable.

Beyond just the routes, think about the service itself. Are your drivers properly equipped? Is there a standardized process for servicing each unit? Efficiency gains can often be found in streamlining the actual cleaning and maintenance process. And dont forget preventative maintenance! A well-maintained fleet is a more efficient fleet.

Finally, its not a one-and-done thing. Measuring and improving service route efficiency is an ongoing process. Regularly review your data, talk to your team, and be willing to adapt and adjust your strategies. Its about constantly striving to make your portable restroom operation run smoother, cleaner, and more efficiently, ensuring everyone, including your bottom line, is happy.

About Ventilation (architecture)



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 neede*

Ceiling ventilation

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Ceiling ventilation

Cross ventilation

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  Cross ventilation
  Floor ventilation

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  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

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  Tangential flow
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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 due to roof vortices

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Ventilation rates for indoor air quality

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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

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Ventilation rate procedure

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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

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Main article: HVAC

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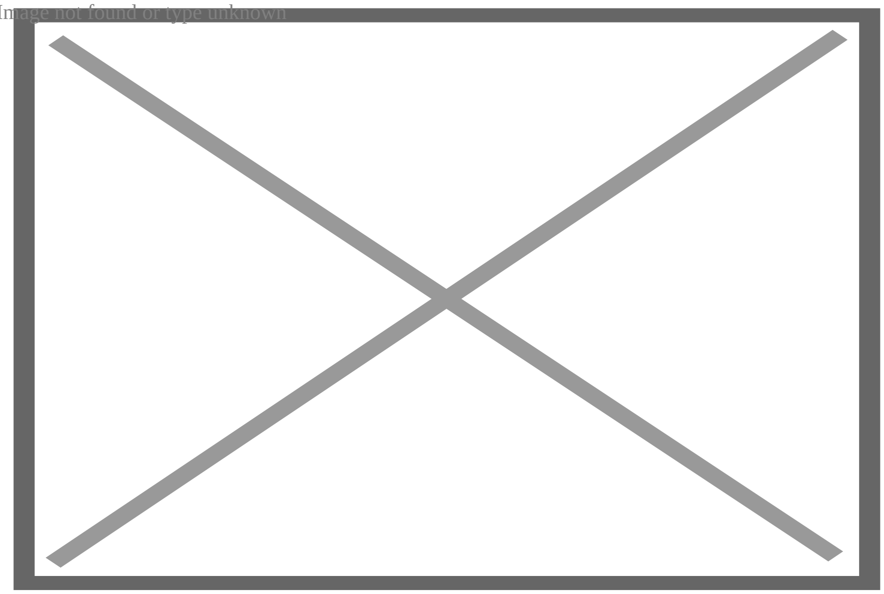

An axial belt-drive exhaust fan serving an underground car park. This exhaust fan's operation is interlocked with the concentration of contaminants emitted by internal combustion engines.

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 × VA × 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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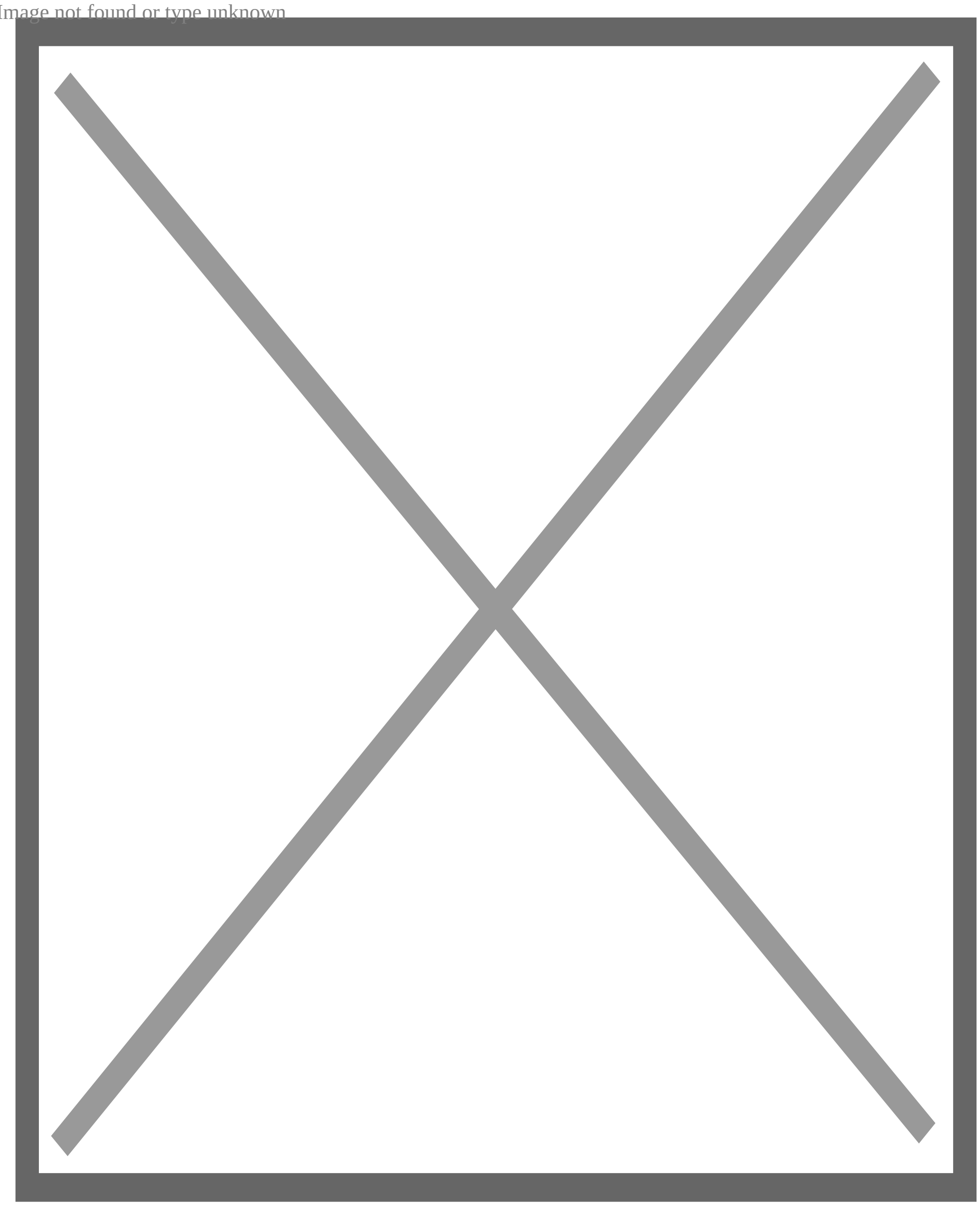


This ancient Roman house uses a variety of passive cooling and passive ventilation techniques. Heavy masonry walls, small exterior windows, and a narrow walled garden oriented N-S shade the house, preventing heat gain. The house opens onto a central atrium with an impluvium (open to the sky); the evaporative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

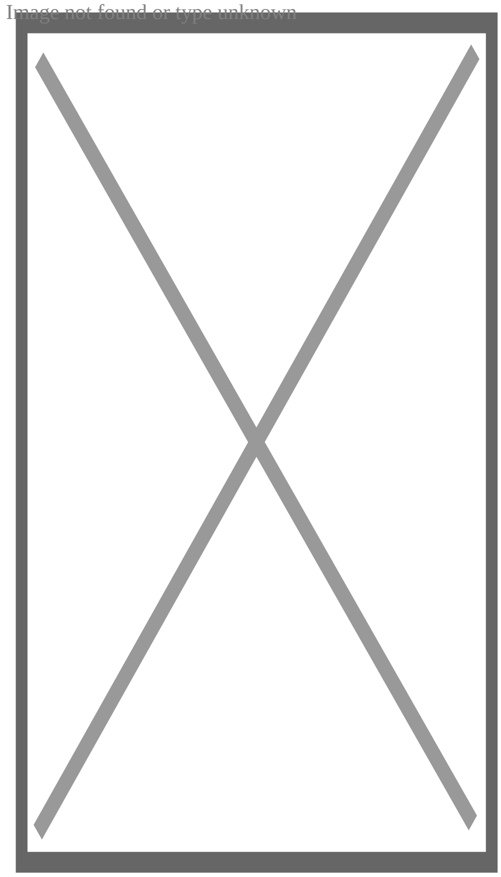
Primitive ventilation systems were found at the PloÄ•nik archeological site (belonging to the VinÄ•a culture) in Serbia and were built into early copper smelting furnaces. The furnace, built on the outside of the workshop, featured earthen pipe-like air vents with hundreds of tiny holes in them and a 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



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

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- 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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Air Infiltration & Ventilation Centre (AIVC)

[edit]

- Publications from the Air Infiltration & Ventilation Centre (AIVC)

International Energy Agency (IEA) Energy in Buildings and Communities Programme (EBC)

[edit]

- Publications from the International Energy Agency (IEA) Energy in Buildings and Communities Programme (EBC) ventilation-related research projects-annexes:
  - EBC Annex 9 Minimum Ventilation Rates
  - EBC Annex 18 Demand Controlled Ventilation Systems
  - 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)
  - EBC Annex 62 Ventilative Cooling

International Society of Indoor Air Quality and Climate

[edit]

- Indoor Air Journal
- Indoor Air Conference Proceedings

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

[edit]

- ASHRAE Standard 62.1 – Ventilation for Acceptable Indoor Air Quality
- ASHRAE Standard 62.2 – Ventilation for Acceptable Indoor Air Quality in Residential Buildings

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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

- 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

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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About Public toilet

A public toilet, toilet, bathroom or restroom is a room or tiny structure with toilets (or urinals) and sinks for usage by the public. The facilities are offered to customers, travelers, workers of a company, institution students or detainees. Public commodes are usually located in various locations: urban locations, offices, factories, institutions, universities and other places of work and research. In a similar way, galleries, cinemas, bars, restaurants, and entertainment locations normally offer public bathrooms. Railway stations, filling up stations, and cross country public transport

automobiles such as trains, ferryboats, and planes generally offer bathrooms for basic usage. Portable toilets are typically offered at large outside occasions. Public bathrooms are frequently divided by sex (or gender) into man and female bathrooms, although some are unisex (gender-neutral), specifically for tiny or single-occupancy public bathrooms. Public bathrooms are often available to individuals with disabilities. Depending on the culture, there may be differing levels of separation in between men and ladies and different levels of personal privacy. Typically, the entire area, or a delay or cubicle consisting of a bathroom, is lockable. Urinals, if present in a male bathroom, are usually mounted on a wall with or without a divider between them. Local authorities or industrial services might provide public commode centers. Some are ignored while others are staffed by an attendant. In many cultures, it is traditional to tip the attendant, particularly if they give a certain solution, such as might be the instance at high end nightclubs or dining establishments. Public commodes might be municipally had or handled and gotten in directly from the street. Alternatively, they might be within a structure that, while independently had, enables public access, such as an outlet store, or it might be limited to business's clients, such as a restaurant. Some public toilets are at no cost, while others charge a fee. In the last instance they are additionally called pay bathrooms and occasionally have a billing gate. In one of the most standard type, a public bathroom might simply be a road urinal called a pissoir, after the French term. Public commodes are understood by several other names relying on the nation; instances are: toilet, washroom, guys's room, women's area, washroom (US); restroom (Canada); and toilets, lavatories, water wardrobe (W. C.), ladies and gents (Europe).
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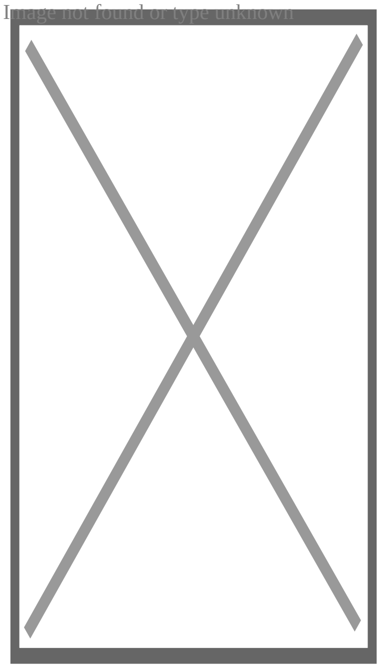
About Portable toilet



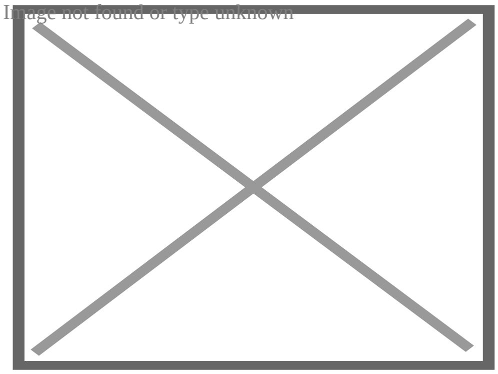
A portable urine-diverting dry toilet, marketed in Haiti by Sustainable Organic Integrated Livelihoods under the name "EkoLakay"

A **portable** or **mobile toilet** (colloquial terms: **thunderbox**, **porta-john**, **porta-potty** or **porta-loo**) is any type of toilet that can be moved around, some by one person, some by mechanical equipment such as a truck and crane. Most types do not require any pre-existing services or infrastructure, such as sewerage, and are completely self-contained. The portable toilet is used in a variety of situations, for example in urban slums of developing countries, at festivals, for camping, on boats, on construction sites, and at film locations and large outdoor gatherings where there are no other facilities. Most portable toilets are unisex single units with privacy ensured by a simple lock on the door. Some portable toilets are small molded plastic or fiberglass portable rooms with a lockable door and a receptacle to catch the human excreta in a container.

A portable toilet is not connected to a hole in the ground (like a pit latrine), nor to a septic tank, nor is it plumbed into a municipal system leading to a sewage treatment plant. The chemical toilet is probably the most well-known type of portable toilet, but other types also exist, such as urine-diversion dehydration toilets, composting toilets, container-based toilets, bucket toilets, freezing toilets and incineration toilets. A bucket toilet is a very simple type of portable toilet.

Types

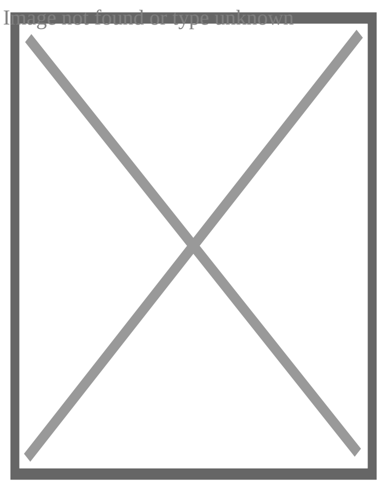
[edit]



A line of blue plastic portable chemical toilets

Chemical toilets

[edit]
Main article: Chemical toilet



Plastic-moulded outdoor cubicle, commonly used for chemical toilets at building sites and festivals

A chemical toilet collects human waste in a holding tank and uses chemicals to minimize the odors. Most portable toilets use chemicals in this way and therefore are considered chemical toilets. The chemicals may either mask the odor or contain biocides that hinder odor-causing bacteria from multiplying, keeping the smell to a minimum.[1]

Enclosed portable toilets

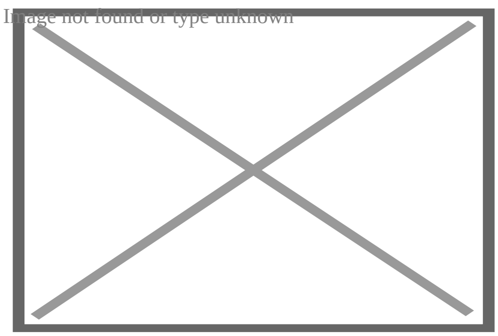
[edit]

Enclosed portable chemical toilets are widely used for crowds at festivals, and for worksites without permanent toilets, such as early stages of construction and remote worksites.

On planes and trains, some toilets are chemical toilets, and others are vacuum toilets.

Portable camping toilets

[edit]



Various boat toilets, including the most basic models on the bottom right

A portable camping toilet has a seat and a small waste tank. Adding a packet of chemicals to the waste tank reduces odors and bacteria, until the waste can be dumped at an appropriate facility. They are used in camping, travel trailers, caravans, and camper vans. They may also be used on small boats which lack a built-in marine toilet.

WAG bags

[edit]
Main article: WAG bag

Waste aggregation and gelling (WAG) bags have a gel to immobilize liquid waste and surround solid waste in a plastic bag, which is then put in the trash. They are used in the US Army[2] and in wilderness.[3] They can be used to line a bucket, with a toilet-seat lid, and are required for Utah river trips.[4]

Urine-diversion dehydration toilets

[edit]

Main article: Urine-diversion dehydration toilet

Portable urine-diversion dehydration toilets are self-contained dry toilets sometimes referred to as "mobile" or "stand-alone" units. They are identifiable by their one-piece molded plastic shells or, in the case of DIY versions, simple plywood box construction. Most users of self-contained UDDTs rely upon a collection agency or a post-treatment process to ensure pathogen reduction. This post-treatment may consist of long-term storage or addition to an existing or purpose-built compost pile or some combination thereof. The necessity of a post-treatment step hinges upon the frequency and volume of use. For instances of infrequent or very modest seasonal use, a post-treatment phase might be deemed unnecessary due to the lower accumulation of waste, simplifying the overall disposal process.

Container-based sanitation refers to a collection system which regularly replaces full containers with empty containers, and disposes of the waste.

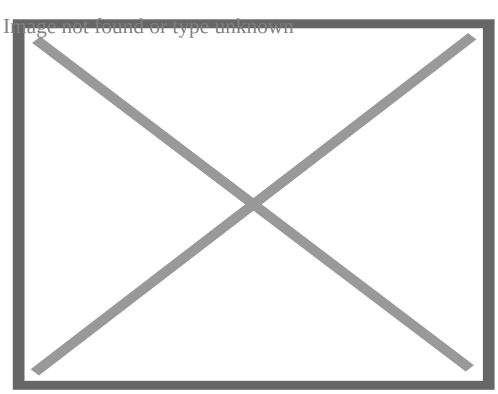
Commode chair

[edit]

A commode chair (a chair enclosing a chamber pot) is a basic portable toilet that is used next to a bed (bedside commode) for people with limited mobility. Before indoor toilets, it was used world-wide as an indoor alternative to an outhouse.

History

[edit]



A portable toilet in a British Royal Air Force WWII plane

The close stool, built as an article of furniture, is one of the earliest forms of portable toilet. They can still be seen in historic house museums such as Sir George-Étienne Cartier National Historic Site in Old Montreal, Canada. The velvet upholstered close stool used by William III is on display at Hampton Court Palace; see Groom of the Stool.

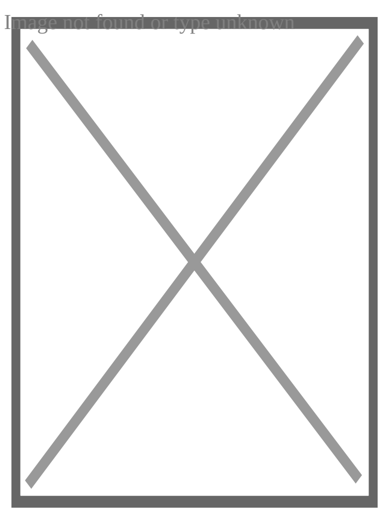
Early versions of the "Elsan chemical closet" ("closet" meaning a small room, see water closet, WC, and earth closet) were sold at Army & Navy Stores. Their use in World War II bomber aircraft[5] is described at some length by the Bomber Command Museum of Canada; in brief, they were not popular with either the flying crew or the ground crew.[6]

African-Americans living under Jim Crow laws (i.e. before the Civil Rights Act of 1964) faced severe challenges. Public toilets were segregated by race, and many restaurants and gas stations refused to serve black people, so some travellers carried a portable toilet in the trunk of their car.[7]

Since 1974, Grand Canyon guides rafting on the Colorado River have used ammo boxes as portable toilets, typically with a removable toilet seat, according to the Museum of Northern Arizona in Flagstaff, Arizona.[8][9]

Society and culture

[edit]



19th century "thunderbox" portable toilet

A slang term, now dated or historic, is a "thunder-box" (*Oxford English Dictionary*: "a portable commode; by extension, any lavatory"). The term was used particularly in British India; travel writer Stephen McClarence called it "a crude sort of colonial lavatory".[10] One features to comic effect in Evelyn Waugh's novel *Men at Arms*:[11]

> "If you must know, it's my thunderbox." ... He...dragged out the treasure, a brass-bound, oak cube... On the inside of the lid was a plaque bearing the embossed title Connolly's Chemical Closet.

See also

[edit]

- Accessible toilet
- Dignified Mobile Toilets, a mobile public toilet system from Nigeria
- Sanitation
- Telescopic toilet

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External links

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Toilets

Equipment

- Ballcock
- Bedpan
- Bidet
- Bidet shower
- Brush
- Cistern
- Commode
- Electronic bidet
- Flushometer
- Seat
  - Toilet seat riser
- Toilet
- Toilet cleaner
- Toilet paper
  - Holder/dispenser
  - Orientation
- Toilet rim block
- Trap (U-bend)

Types

- Aircraft
- Arborloo
- Blair
- Bucket
- Cathole
- Chemical
- Composting
- Container-based
- Dry
- Dual flush
- EToilet
- Flush
- Freezing
- Head (boat)
- Hudo (Scouting)
- Incinerating
- Intelligent
- Latrine
- Low-flush
- On-board
- Passenger train
- Pay
- Pig
- Pit
- Portable
- Potty
- Public
- Sanisette (self-cleaning)
- Sink
- Space
- Squat
- Telescopic
- Treebog
- Urine-diverting dry
- Vacuum
- Vermifilter
- Washlet (combined toilet and bidet)

Cultural and policy aspects	○ Accessible ○ Adult diaper ○ Bathroom privileges ○ Bathroom reading ○ Honeywagon (vehicle) ○ Incontinence pad ○ Islamic toilet etiquette ○ Istinja ○ Latrinalia ○ Privatization of public toilets ○ Swachh Bharat Mission ○ Toilet god ○ Toilet humour ○ *Skibidi Toilet* ○ Toilet meal ○ Toilet plume ○ Toilet-related injuries and deaths ○ Toilet Revolution in China ○ Toilet Twinning ○ Unisex public ○ Vacuum truck
Jobs and activities	○ Groom of the Stool ○ Manual scavenging ○ Restroom attendant ○ Sanitation worker ○ Slopping out ○ Toilet training ○ Toileting
Urine-related aspects	○ Female urinal ○ Female urination device ○ Interactive urinal ○ Pissoir ○ Pee curl ○ Pollee ○ Sanistand ○ Urinal ○ Urinal deodorizer block ○ Urinal (health care) ○ Urination ○ Urine collection device ○ Urine deflector ○ Urine diversion

Feces-related aspects	○ Anal hygiene ○ Defecation ○ Defecation postures ○ Fecal sludge management ○ Flying toilet ○ Open defecation ○ Scatology
Places	○ Haewoojae ○ Hundertwasser Toilets ○ Madison Museum of Bathroom Tissue ○ Modern Toilet Restaurant ○ National Poo Museum ○ Outhouse ○ Rest area ○ Shit Museum ○ Sulabh International Museum of Toilets ○ Toilet (room) ○ Toilet History Museum ○ Toilets in Japan ○ Toilets in New York City ○ Bryant Park restroom
Historical terms	○ Aphedron ○ Chamber pot ○ Close stool ○ Dansker ○ Garderobe ○ Gong farmer ○ Groom of the Stool ○ Night soil ○ Pail closet ○ Privy midden ○ Reredorter

See also	◦ Changing room 　◦ Unisex changing rooms ◦ Ecological sanitation ◦ History of water supply and sanitation ◦ Human right to water and sanitation ◦ Improved sanitation ◦ Infection prevention and control ◦ Public health ◦ Reuse of human excreta ◦ Sanitary bin ◦ Sanitation ◦ Sewage treatment ◦ Sustainable sanitation ◦ Waste management ◦ World Toilet Day ◦ Workers' right to access the toilet

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