Mobile Homes

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  Considering Weight Distribution on Mobile Home Roofs Analyzing Space Limitations for Duct Installation Minimizing Vibrations through Effective Mounting Checking for Clearances near Windows and Doors Verifying Electrical Capacity for New Units Inspecting Crawl Spaces before Major Installations Protecting Exterior Components from Windy Conditions Resolving Access Issues in Narrow Hallways Planning Around Existing Plumbing or Gas Lines Prioritizing Safety in Confined Work Areas Ensuring Adequate Ventilation for Heat Pumps Mitigating Moisture Risks in Humid Climates
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In recent years, heat pumps have emerged as a popular choice for homeowners seeking energy-efficient and environmentally friendly solutions for heating and cooling. Technicians should inspect HVAC systems before the start of extreme seasons **replacing hvac system in mobile home** building insulation. However, to ensure these systems operate at optimal efficiency, it is crucial to understand the role of adequate ventilation. Adequate ventilation is not merely a supplementary consideration; it is a fundamental component that directly impacts the performance and longevity of heat pumps.

Heat pumps operate by transferring heat from one location to another. In colder months, they extract heat from the outside air or ground and transfer it indoors. Conversely, during warm months, they remove heat from inside the home and release it outdoors. This process requires a system that can effectively exchange air between indoor and outdoor environments. Without proper ventilation, this exchange becomes inefficient, leading to increased energy consumption and reduced system efficacy.

One of the key reasons why ventilation is vital lies in maintaining optimal airflow around the heat pump unit itself. If a heat pump is enclosed or surrounded by obstructions such as walls or foliage, airflow restriction can occur. This restricted airflow forces the system to work harder to draw in air, ultimately reducing its efficiency and increasing wear on components over time. Ensuring clear space around the unit allows it to breathe freely and operate as designed.

Moreover, adequate ventilation helps in managing moisture levels within the system. Heat pumps are susceptible to issues caused by excess moisture build-up which can lead to problems like corrosion or mold growth within ducts and components. Proper ventilation mitigates these risks by allowing moisture-laden air to be expelled efficiently, protecting both the integrity of the equipment and indoor air quality.

In addition to physical placement considerations, regular maintenance plays a significant role in ensuring effective ventilation for heat pumps. Homeowners should routinely check filters, vents, and coils for dirt or debris accumulation that could impede airflow. Scheduling professional inspections can also help identify potential issues before they escalate into costly repairs or replacements.

Ensuring adequate ventilation for heat pumps extends beyond individual units; it involves considering overall home design as well. Homes built with open floor plans or strategically placed vents can facilitate better circulation throughout living spaces expediting temperature regulation processes managed by heat pumps more effectively than those with segmented

rooms lacking proper venting pathways.

In conclusion, understanding the importance of adequate ventilation goes hand-in-hand with harnessing maximum efficiency from your investment in a heat pump system-keeping energy bills low while promoting sustainability efforts simultaneously! By prioritizing clear pathways surrounding installations alongside diligent upkeep practices homeowners are empowered towards achieving desired comfort levels without unnecessary strain on resources nor their wallets alike!

Impact of HVAC system installation on roof weight distribution —

Ensuring adequate ventilation in mobile homes, especially when utilizing heat pumps, presents a unique set of challenges. Mobile homes often have limited space and distinct structural characteristics that can complicate the installation and efficiency of ventilation systems. Understanding these challenges is crucial for maintaining indoor air quality and optimizing the performance of heat pumps.

One of the primary challenges in ventilating mobile homes is their compact design. Unlike traditional houses, mobile homes tend to have lower ceilings and less square footage, which limits the space available for installing extensive ductwork or ventilation systems. This constraint necessitates creative solutions that do not compromise living space while still ensuring effective air circulation.

Additionally, mobile homes often feature a tighter building envelope compared to conventional houses. While this can enhance energy efficiency by reducing drafts and heat loss, it also means that there is less natural air exchange with the outdoors. As a result, without proper ventilation measures in place, pollutants such as moisture, dust, and allergens can accumulate more quickly inside the home. This buildup can lead to poor indoor air quality and exacerbate health issues like allergies or respiratory problems.

The use of heat pumps introduces another layer of complexity to the ventilation equation. Heat pumps are highly efficient systems designed to transfer heat rather than generate it through combustion like traditional furnaces. However, their efficiency heavily relies on proper airflow and temperature regulation within the home. Inadequate ventilation can lead to imbalanced temperatures across different areas of the home, reducing comfort levels and potentially overworking the heat pump.

To address these challenges effectively, homeowners must consider several strategies aimed at enhancing airflow without sacrificing energy efficiency or living space. One approach is integrating mechanical ventilation systems such as Energy Recovery Ventilators (ERVs) or Heat Recovery Ventilators (HRVs). These devices facilitate controlled air exchange between indoor spaces and outside environments while minimizing energy loss-a critical factor given that mobile homes are often designed for high energy efficiency.

Another option involves optimizing existing windows and vents for better passive airflow management whenever possible-particularly during milder weather conditions where natural cross-ventilation could suffice temporarily instead relying solely on mechanical means year-round.

Moreover: regular maintenance becomes paramount-filters should be cleaned regularly; ducts inspected frequently prevent blockages restrict flow-and installing smart thermostats allows precise climate control based varying occupancy patterns throughout day night cycles ensuring consistent comfort overall system longevity alike

In conclusion: ventilating mobile homes pose unique challenges due primarily space constraints tight envelopes but feasible solutions exist tackle them head-on Properly implementing these strategies will help ensure good indoor quality optimal functioning efficient heating cooling via pumps ultimately creating healthier more comfortable living environment all residents enjoy

Posted by on

Posted by on

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Considerations for maintaining structural integrity during HVAC installation

Evaluating existing ventilation systems in mobile homes is a crucial step toward ensuring adequate ventilation for heat pumps. Mobile homes, often characterized by their compact spaces and unique construction, present particular challenges and opportunities when it comes to heating and cooling technologies. As heat pumps become increasingly popular due to their energy efficiency and environmentally friendly nature, understanding the role of proper ventilation becomes essential.

Firstly, it's important to recognize that mobile homes typically have different insulation and air circulation characteristics compared to traditional houses. Many older models were not designed with modern heating and cooling systems in mind, making an evaluation of the current ventilation system a necessary step when considering the installation of a heat pump. Ensuring that there is adequate airflow can significantly enhance the performance of these systems by allowing them to operate efficiently and effectively.

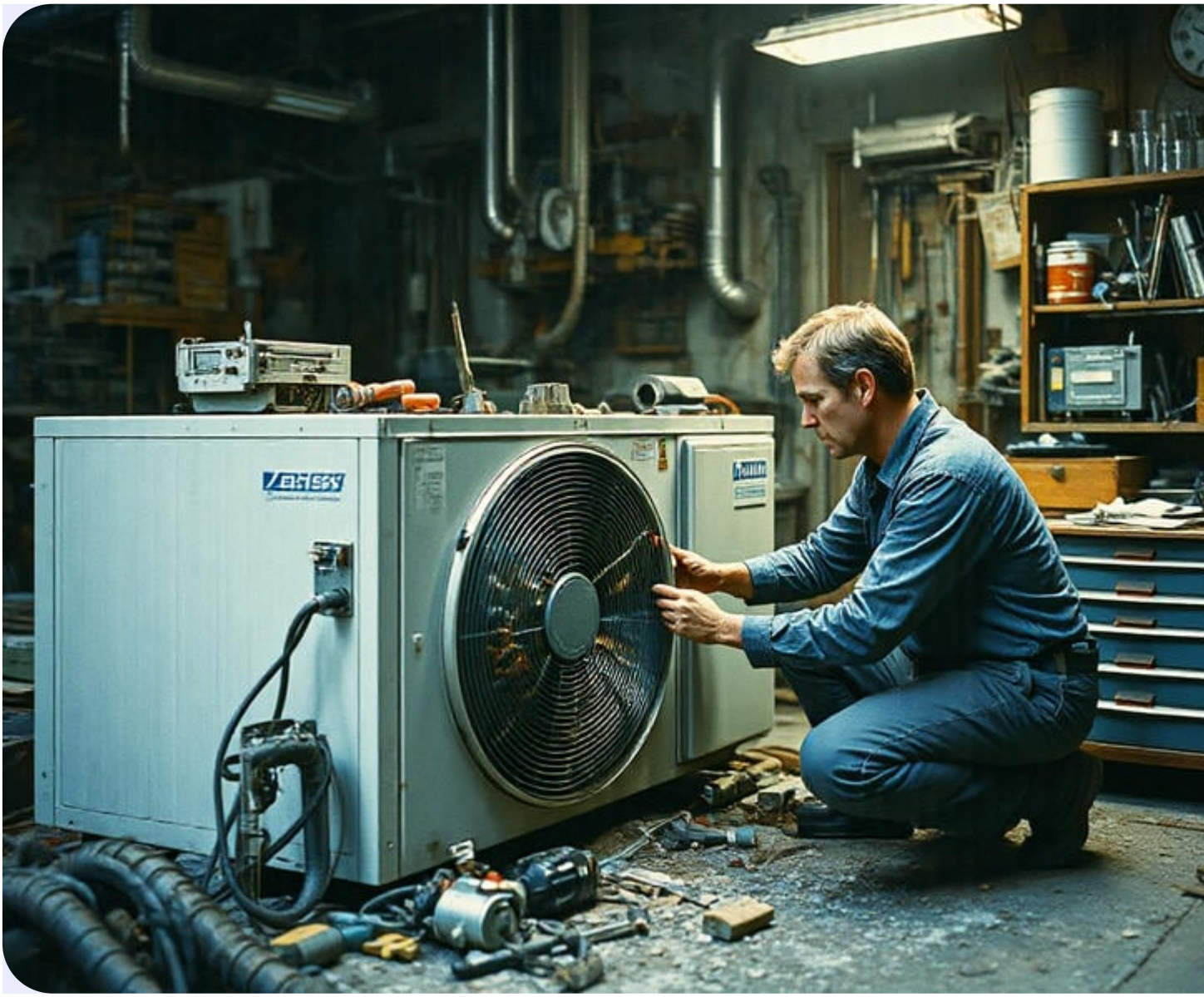
When evaluating existing ventilation in mobile homes, several factors need consideration. The age and condition of the structure are paramount; older mobile homes may have outdated or insufficient ductwork that could impede airflow. Inspecting for any blockages or leaks within the ducts is critical as these issues can lead to reduced efficiency or even system failure over time. Additionally, checking for proper sealing around windows, doors, and other openings is vital to prevent unwanted drafts which can affect temperature control.

Another key aspect involves examining how well the current ventilation supports humidity control. Heat pumps not only regulate temperature but also manage moisture levels indoors-an essential function in maintaining comfort and preventing issues like mold growth. Properly evaluated ventilation ensures that any excess humidity can be effectively managed, thereby protecting both the home's structural integrity and its inhabitants' health.

Moreover, consider the placement of vents within each room; strategic positioning can maximize air circulation throughout the home. This might require consulting with HVAC professionals who can offer insights into optimizing airflow patterns specific to mobile home layouts.

Finally, integrating smart technology solutions could further enhance ventilation efficacy. Modern thermostats equipped with sensors can dynamically adjust settings based on real-time data regarding indoor climate conditions. Such innovations ensure that heat pumps work synergistically with existing systems to maintain optimal environmental conditions efficiently.

In conclusion, evaluating existing ventilation systems in mobile homes plays an indispensable role in ensuring adequate support for heat pumps. By addressing potential inefficiencies through careful inspection and targeted improvements-whether through upgrading ductwork or incorporating smart controls-homeowners can enjoy enhanced comfort while reaping energy savings offered by this sustainable technology choice. As we move towards greener living solutions globally, these steps collectively contribute not only towards individual benefits but also align with broader environmental goals.



Strategies for evenly distributing weight across the roof when adding or upgrading HVAC systems

Ensuring adequate ventilation for heat pumps is crucial for maximizing their performance and efficiency. Heat pumps, widely recognized as sustainable alternatives to conventional heating and cooling systems, rely heavily on the movement of air to transfer heat effectively. Unfortunately, without proper ventilation, their operation can be hindered, leading to reduced efficiency and increased energy consumption.

The first method to improve ventilation for optimal heat pump performance is ensuring unobstructed airflow around the unit. This involves placing the heat pump in a location where air can circulate freely. Avoiding enclosed spaces or areas with heavy foliage or debris accumulation will prevent obstruction of airflow. Regular maintenance checks should include clearing any leaves, dirt, or other debris that may have gathered around the outdoor unit.

Secondly, consider the strategic placement of vents and ducts within your home. Properly designed ductwork ensures that conditioned air is distributed consistently throughout the living space. It's essential to seal any leaks in the ductwork to prevent loss of conditioned air and ensure that all rooms receive adequate airflow. Hiring a professional HVAC technician to assess and optimize your duct system can lead to significant improvements in both comfort and efficiency.

Another effective approach is incorporating mechanical ventilation systems, such as exhaust fans or energy recovery ventilators (ERVs). These systems help maintain indoor air quality by expelling stale air and bringing in fresh outdoor air without compromising energy efficiency. ERVs are particularly beneficial because they exchange heat between incoming and outgoing air streams, which aids in maintaining a consistent indoor temperature while reducing energy loss.

Additionally, smart controls and sensors can enhance ventilation management by adjusting operations based on real-time conditions. Implementing programmable thermostats or smart home systems allows homeowners to schedule heating and cooling cycles efficiently while monitoring humidity levels and indoor air quality. These technologies ensure that ventilation adjustments are made proactively rather than reactively.

Lastly, insulating your home adequately plays a pivotal role in supporting proper ventilation for heat pumps. Insulation helps maintain desired temperatures by minimizing thermal bridging where unwanted heat transfer occurs through building materials thus reducing the workload on your heat pump system.

In conclusion, improving ventilation for optimal heat pump performance encompasses several strategies: ensuring clear airflow around units; optimizing vent placements; utilizing mechanical ventilators; employing smart technology; and reinforcing insulation measures. Each of these methods contributes towards creating an environment where your heat pump can operate at peak efficiency while promoting comfort within your living space year-round. By prioritizing these practices now you'll not only enjoy lower utility bills but also contribute positively towards environmental sustainability efforts through reduced carbon footprints from diminished energy usage over time!

Potential risks of improper weight distribution on mobile home roofs and HVAC efficiency

Installing ventilation solutions in mobile homes, particularly when it comes to ensuring adequate ventilation for heat pumps, is a task that demands careful consideration. Mobile homes present unique challenges due to their compact size and often less-than-ideal construction materials compared to traditional houses. However, with the right approach and planning, effective ventilation can be achieved.

Firstly, understanding the significance of ventilation in relation to heat pumps is crucial. Heat pumps work by transferring heat from one place to another, which means they need access to fresh air for optimal efficiency. Without proper ventilation, these systems can become overburdened, reducing their lifespan and increasing energy consumption. In mobile homes where space is limited and insulation may not be as robust as in conventional homes, this becomes even more critical.

One primary consideration is the placement of the heat pump itself. Ideally, it should be installed in an area where it can access outside air easily while maintaining a safe distance

from obstructions that could impede airflow. This might mean positioning the unit near exterior walls or using ductwork strategically placed throughout the home.

Another important aspect is ensuring that the home's existing ventilation infrastructure supports the additional load of a heat pump system. This may involve assessing existing vents and ducts to determine if they are adequate or if modifications are needed. In some cases, upgrading or adding new vents might be necessary to ensure that air circulates efficiently throughout the home.

Moreover, attention must be given to sealing any leaks within the structure of the mobile home itself. Poorly sealed windows, doors, or other openings can lead to inadequate heating and cooling distribution as well as increased energy costs. Using weatherproofing materials or installing double-glazed windows can significantly enhance thermal efficiency and contribute positively towards better ventilation overall.

Humidity control also plays a pivotal role in maintaining good indoor air quality while operating a heat pump. Mobile homes are notorious for trapping moisture due to their tight construction; therefore incorporating dehumidifiers along with regular maintenance of HVAC filters ensures that both humidity levels remain stable and allergens are minimized.

Finally, considering local climate conditions when designing your mobile home's ventilation strategy cannot be overlooked either-what works best varies greatly depending on whether you live in warmer climates versus colder ones where heating demands differ substantially.

In conclusion: while installing effective ventilation solutions tailored specifically for supporting heat pumps within mobile homes presents its own set of challenges given space constraints among other factors-it remains entirely feasible with thoughtful planning informed by understanding how these elements interact together holistically thereby safeguarding both comfort levels indoors alongside operational efficiencies outdoors alike!

Guidelines for professional assessment and installation to ensure balanced weight

distribution

Ensuring adequate ventilation for heat pumps is crucial for maintaining both efficiency and longevity of these systems. As homes become more airtight in an effort to improve energy efficiency, ensuring proper ventilation levels becomes increasingly important. Without adequate airflow, heat pumps can struggle to function effectively, leading to increased energy consumption and potential system failures. Here are some maintenance tips to sustain proper ventilation levels for your heat pump.

Firstly, it's essential to regularly check and replace air filters. Clogged or dirty filters can significantly restrict airflow, forcing the heat pump to work harder than necessary and reducing its efficiency. Depending on the model of your heat pump and the environment it operates in, you should inspect filters every month and replace them every three months at a minimum. In areas with high levels of dust or pet hair, more frequent checks might be needed.

Secondly, keep the area around both indoor and outdoor units clear from obstructions. For outdoor units, ensure that there is at least two feet of clearance on all sides. This space allows air to flow freely into the unit which is critical for efficient operation. Remove any leaves, debris, or snow that may accumulate around the unit throughout the year. Indoors, make sure vents are not blocked by furniture or curtains.

Additionally, schedule regular professional maintenance checks at least once a year. A qualified technician can perform essential tasks such as checking refrigerant levels, cleaning coils, and inspecting electrical connections. They will also be able to identify potential issues before they become major problems which ensures your system remains efficient and reliable.

Another important aspect is ensuring that ductwork is sealed properly. Leaky ducts can lead to significant energy losses as conditioned air escapes into unused spaces like attics or basements instead of circulating throughout your home. Have ductwork inspected periodically by a professional who can seal any leaks with mastic sealant or metal tape.

Finally, consider investing in a smart thermostat if you haven't already done so. These devices optimize heating cycles based on your daily routine and local climate conditions while providing alerts if there's an issue with airflow or other aspects affecting performance.

By following these maintenance tips diligently-keeping filters clean, clearing obstructions away from units both inside and out; getting regular professional inspections; sealing ductwork effectively; using smart thermostats-you'll ensure that your heat pump enjoys long-lasting performance with optimal efficiency while sustaining proper ventilation levels within your home environment all year round!

About Wichita, Kansas

Not to be confused with Wichita County, Kansas.

Wichita, Kansas

City and county seat
Downtown Wichita skyline

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Downtown Wichita skyline
Carey House

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Carey House
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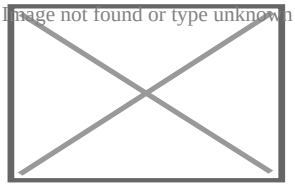

Exploration Place
science museum

Flag of Wichita, Kansas

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Flag
Official seal of Wichita, Kansas

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Seal

Official logo of Wichita, Kansas

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Nickname(s):
Air Capital of the World,[1] ICT[2]
Location within Sedgwick County and Kansas

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Location within Sedgwick County and Kansas
Map

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Interactive map of Wichita
Coordinates: 37°41?20?N 97°20?10?WÃ¯Â»Â¿ / Ã¯Â»Â37.68889°N 97.33611°W[3]

Country	United States
State	Kansas
County	Sedgwick

Founded	1868
Incorporated	1870
Named for	Wichita people
	Government
• Type	Council–manager
• Mayor	Lily Wu (L)
• City Manager	Robert Layton
	Area [4]
• City and county seat	166.52 sq mi (431.28 km^2)
• Land	161.99 sq mi (419.55 km^2)
• Water	4.53 sq mi (11.73 km^2)
Elevation [3]	1,303 ft (397 m)
	Population (2020)[5][6]
• City and county seat	397,532
• Estimate (2023)[7]	396,119
• Rank	51st in the United States 1st in Kansas
• Density	2,454.05/sq mi (947.52/km^2)
• Urban	500,231 (US: 84th)
• Urban density	2,205.2/sq mi (851.4/km^2)
• Metro [8]	647,919 (US: 93rd)
Demonym	Wichitan
Time zone	UTC?6 (CST)
• Summer (DST)	UTC?5 (CDT)
ZIP Codes	67201–67221, 67223, 67226–67228, 67230, 67232, 67235, 67260, 67275–67278[9]
Area code	316
FIPS code	20-79000 [3]
GNIS ID	473862 [3]
Website	wichita.gov

Wichita (/Ã‹Ë†wÃ‰Âªtà ŠÆ'Ã‰ÂªtÃ‰â€•Ã‹Â•Ã¢â€œËœ *WITCH-ih-taw*)[10] is the most populous city in the U.S. state of Kansas and the county seat of Sedgwick County.[3] As of the 2020 census, the population of the city was 397,532.[5][6] The Wichita metro area had a population of 647,610 in 2020.[8] It is located in south-central Kansas on the Arkansas River.[3]

Wichita began as a trading post on the Chisholm Trail in the 1860s and was incorporated as a city in 1870. It became a destination for cattle drives traveling north from Texas to Kansas railroads, earning it the nickname "Cowtown".[11][12] Wyatt Earp served as a police officer in Wichita for around one year before going to Dodge City.

In the 1920s and 1930s, businessmen and aeronautical engineers established aircraft manufacturing companies in Wichita, including Beechcraft, Cessna, and Stearman Aircraft. The city became an aircraft production hub known as "The Air Capital of the World".[13][14] Textron Aviation, Learjet, Airbus, and Boeing/Spirit AeroSystems continue to operate design and manufacturing facilities in Wichita, and the city remains a major center of the American aircraft industry. Several airports located within the city of Wichita include McConnell Air Force Base,[15][16] Colonel James Jabara Airport, and Wichita Dwight D. Eisenhower National Airport, the largest airport in Kansas.

As an industrial hub, Wichita is a regional center of culture, media, and trade. It hosts several universities, large museums, theaters, parks, shopping centers, and entertainment venues, most notably Intrust Bank Arena and Century II Performing Arts & Convention Center. The city's Old Cowtown Museum maintains historical artifacts and exhibits the city's early history. Wichita State University is the third-largest post-secondary institution in the state.

History

[edit]
Main articles: History of Wichita, Kansas and Timeline of Wichita, Kansas

Early history

[edit]
See also: Early Kansas History

Archaeological evidence indicates human habitation near the confluence of the Arkansas and Little Arkansas Rivers, the site of present-day Wichita, as early as 3000 BC.[17] In 1541, a Spanish expedition led by explorer Francisco Vázquez de Coronado found the area populated by the Quivira, or Wichita, people. Conflict with the Osage in the 1750s drove the Wichita further south.[18] Prior to European settlement of the region, the site was in the territory of the Kiowa.[19]

19th century

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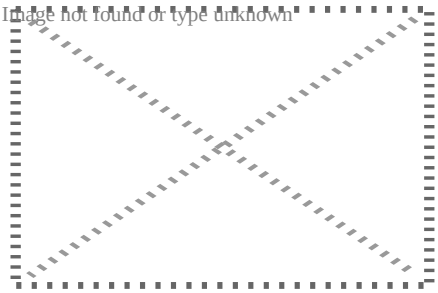

Darius Sales Munger House, built in 1868, is the oldest surviving building in Wichita (at Old Cowtown Museum).[20]

Claimed first by France as part of Louisiana and later acquired by the United States with the Louisiana Purchase in 1803, it became part of Kansas Territory in 1854 and then the state of Kansas in 1861.[21][22]

The Wichita people returned in 1863, driven from their land in Indian Territory by Confederate forces in the American Civil War, and established a settlement on the banks of the Little Arkansas.[23][24][25] During this period, trader Jesse Chisholm established a trading post at the site, one of several along a trail extending south to Texas which became known as the Chisholm Trail.[26] In 1867, after the war, the Wichita returned to Indian Territory.[23]

In 1868, trader James R. Mead was among a group of investors who established a town company, and surveyor Darius Munger built a log structure for the company to serve as a hotel, community center, and post office.[27][28] Business opportunities attracted area hunters and traders, and a new settlement began to form. That summer, Mead and others organized the Wichita Town Company, naming the settlement after the Wichita tribe.[24] In 1870, Munger and German immigrant William "Dutch Bill" Greiffenstein filed plats laying out the city's first streets.[28] Wichita formally incorporated as a city on July 21, 1870.[27]

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A 1915 railroad map of Sedgwick County, showing many railroads that previously passed through Wichita

Wichita's position on the Chisholm Trail made it a destination for cattle drives traveling north from Texas to access railroads, which led to markets in eastern U.S. cities.[26][29] The Atchison, Topeka and Santa Fe Railway reached the city in 1872.[30] As a result, Wichita became a railhead for the cattle drives, earning it the nickname "Cowtown".[26][29] Across the Arkansas River, the town of Delano became an entertainment destination for cattlemen thanks to its saloons, brothels, and lack of law enforcement.[31]

James Earp ran a brothel with his wife Nellie "Bessie" Ketchum. His brother Wyatt was likely a pimp, although historian Gary L. Roberts believes that he was an enforcer or bouncer.[32] Local arrest records show that Earp's common-law wife Sally and James' wife Nellie managed a brothel there from early 1874 to the middle of 1876.[33] The area had a reputation for violence until lawmen like Wyatt stepped up enforcement, who officially joined the Wichita marshal's office on April 21, 1875. He was hired after the election of Mike Meagher as city marshal, making $100 per month.[26][29] By the middle of the decade, the cattle trade had moved west to Dodge City. Wichita annexed Delano in 1880.[31]

Rapid immigration resulted in a speculative land boom in the late 1880s, stimulating further expansion of the city. Fairmount College, which eventually grew into Wichita State University, opened in 1886; Garfield University, which eventually became Friends University, opened in 1887.[34][35] By 1890, Wichita had become the third-largest city in the state after Kansas City, and Topeka, with a population of nearly 24,000.[36] After the boom, however, the city entered an economic recession, and many of the original settlers went bankrupt.[37]

20th century

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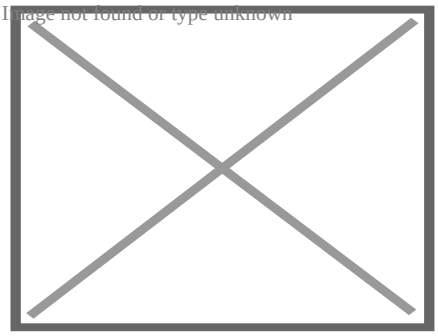
In 1914 and 1915, deposits of oil and natural gas were discovered in nearby Butler County. This triggered another economic boom in Wichita as producers established refineries, fueling stations, and headquarters in the city.[38] By 1917, five operating refineries were in Wichita, with another seven built in the 1920s.[39] The careers and fortunes of future oil moguls Archibald Derby, who later founded Derby Oil, and Fred C. Koch, who established what would become Koch Industries, both began in Wichita during this period.[38][40]

The money generated by the oil boom enabled local entrepreneurs to invest in the nascent airplane-manufacturing industry. In 1917, Clyde Cessna built his Cessna Comet in Wichita, the first aircraft built in the city. In 1920, two local oilmen invited Chicago aircraft builder Emil "Matty" Laird to manufacture his designs in Wichita, leading to the formation of the Swallow Airplane Company. Two early Swallow employees, Lloyd Stearman and Walter Beech, went on to found two prominent Wichita-based companies, Stearman Aircraft in 1926 and Beechcraft in 1932, respectively. Cessna, meanwhile, started his own company in Wichita in 1927.[1] The city became such a center of the industry that the Aeronautical Chamber of Commerce dubbed it the "Air Capital of the World" in 1929.[13][41][42]



Boeing B-29 assembly line (1944)

Over the following decades, aviation and aircraft manufacturing continued to drive expansion of the city. In 1934, Stearman's Wichita facilities became part of Boeing, which would become the city's largest employer.[43] Initial construction of Wichita Municipal Airport finished southeast of the city in 1935. During World War II, the site hosted Wichita Army Airfield and Boeing Airplane Company Plant No. 1.[44] The city experienced a population explosion during the war when it became a major manufacturing center for the Boeing B-29 bomber. The wartime city quickly grew from 110,000 to 184,000 residents, drawing aircraft workers from throughout the central U.S.[13][45] In 1951, the U.S. Air Force announced plans to assume control of the airport to establish McConnell Air Force Base. By 1954, all nonmilitary air traffic had shifted to the new Wichita Mid-Continent Airport west of the city.[44] In 1962, Lear Jet Corporation opened with its plant adjacent to the new airport.[46]

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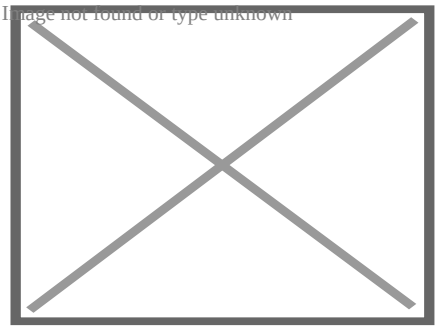

The original Pizza Hut building, which was moved to the campus of Wichita State University (2004)

Throughout the late 19th and 20th centuries, several other prominent businesses and brands had their origins in Wichita. A. A. Hyde founded health-care products maker Mentholatum in Wichita in 1889.[47][48] Sporting goods and camping-gear retailer Coleman started in the city in the early 1900s.[47][49] A number of fast-food franchises started in Wichita, beginning with White Castle in 1921 and followed by many more in the 1950s and 1960s including Pizza Hut in 1958. In the 1970s and 1980s, the city became a regional center of health care and medical research.[47][50]

Wichita has been a focal point of national political controversy multiple times in its history. In 1900, famous temperance extremist Carrie Nation struck in Wichita upon learning the city was not enforcing Kansas's prohibition ordinance.[47] The Dockum Drug Store sit-in took place in the city in 1958 with protesters pushing for desegregation.[51] In 1991, thousands of anti-abortion protesters blockaded and held sit-ins at Wichita abortion clinics, particularly the clinic of George Tiller.[52] Tiller was later murdered in Wichita by Scott Roeder in 2009.[53]

21st century

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Except for a slow period in the 1970s, Wichita has continued to grow steadily into the 21st century.[36] In the late 1990s and 2000s, the city government and local organizations began collaborating to redevelop downtown Wichita and older neighborhoods in the city.[28][31][54] Intrust Bank Arena opened downtown in 2010.[55]

Boeing ended its operations in Wichita in 2014.[56] However, the city remains a national center of aircraft manufacturing with other companies including Spirit AeroSystems and Airbus maintaining facilities in Wichita.[27][57]

Wichita Mid-Continent Airport was officially renamed Wichita Dwight D. Eisenhower National Airport after the Kansas native and U.S. President in 2015.[58]

Geography

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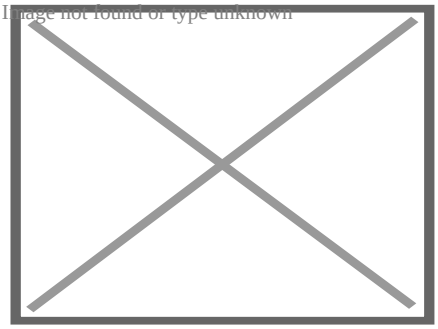

Downtown Wichita viewed from the west bank of the Arkansas River (2010)

Wichita is in south-central Kansas at the junction of Interstate 35 and U.S. Route 54.[59] Part of the Midwestern United States, it is 157 mi (253 km) north of Oklahoma City, 181 mi (291 km) southwest of Kansas City, and 439 mi (707 km) east-southeast of Denver.[60]

The city lies on the Arkansas River near the western edge of the Flint Hills in the Wellington-McPherson Lowlands region of the Great Plains.[61] The area's topography is characterized by the broad alluvial plain of the Arkansas River valley and the moderately rolling slopes that rise to the higher lands on either side.[62][63]

The Arkansas follows a winding course, south-southeast through Wichita, roughly bisecting the city. It is joined along its course by several tributaries, all of which flow generally south. The largest is the Little Arkansas River, which enters the city from the north and joins the Arkansas immediately west of downtown. Further east lies Chisholm Creek, which joins the Arkansas in the far southern part of the city. The Chisholm's own tributaries drain much of the city's eastern half; these include the creek's West, Middle, and East Forks, as well as further south, Gypsum Creek. The Gypsum is fed by its own tributary, Dry Creek. Two more of the Arkansas's tributaries lie west of its course; from east to west, these are Big Slough Creek and Cowskin Creek. Both run south through the western part of the city. Fourmile Creek, a tributary of the Walnut River, flows south through the far eastern part of the city.[64]

According to the United States Census Bureau, the city has a total area of 163.59 sq mi (423.70 km^2), of which 4.30 sq mi (11.14 km^2) are covered by water.[65]

As the core of the Wichita metropolitan area, the city is surrounded by suburbs. Bordering Wichita on the north are, from west to east, Valley Center, Park City, Kechi, and Bel Aire. Enclosed within east-central Wichita is Eastborough. Adjacent to the city's east side is Andover. McConnell Air Force Base is in the extreme southeast corner of the city. To the south, from east to west, lie Derby and Haysville. Goddard and Maize border Wichita to

the west and northwest, respectively.[66]

Climate

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Climatic influences on weather

[edit]

Wichita lies within the humid subtropical climate zone (Köppen *Cfa*), typically experiencing hot, humid summers and cold, dry winters. Located on the Great Plains, far from any large moderating influences such as mountains or large bodies of water, Wichita often experiences severe weather with thunderstorms occurring frequently during the spring and summer. These occasionally bring large hail and frequent lightning. Particularly destructive ones have struck the Wichita area several times in the course of its history - in September 1965, during the Andover, Kansas tornado outbreak of April 1991, and during the Oklahoma tornado outbreak of May 1999.[67][68][69] Winters are cold and dry; since Wichita is roughly midway between Canada and the Gulf of Mexico, cold spells and warm spells are equally frequent. Warm air masses from the Gulf of Mexico can raise midwinter temperatures into the 50s and even 60s (°F), while cold-air masses from the Arctic can occasionally plunge the temperature below 0 °F. Wind speed in the city averages 13 mph (21 km/h).[70] On average, January is the coldest month (and the driest), July the hottest, and May the wettest.

Weather data

[edit]

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Climate chart for Wichita

The average temperature in the city is 57.7 °F (14.3 °C).[71] Over the course of a year, the monthly daily average temperature ranges from 33.2 °F (0.7 °C) in January to 81.5 °F (27.5 °C) in July. The high temperature reaches or exceeds 90 °F (32 °C) an average of 65 days a year and 100 °F (38 °C) an average of 12 days a year. The minimum temperature falls to or below 10 °F (?12 °C) on an average 7.7 days a year. The hottest temperature recorded in Wichita was 114 °F (46 °C) in 1936; the coldest temperature recorded was ?22 °F (?30 °C) on February 12, 1899. Readings as low as ?17 °F (?27 °C) and as high as 111 °F (44 °C) occurred as recently as February 16, 2021, and July 29–30, 2012, respectively.[72] Wichita receives on average about 34.31 inches (871 mm) of precipitation a year, most of which falls in the warmer months, and experiences 87 days of measurable precipitation. The average relative humidity is 80% in the morning and 49% in the evening.[70] Annual snowfall averages 12.7 inches (32 cm). Measurable snowfall occurs an average of nine days per year with at least an inch of snow falling on four of those days. Snow depth of at least an inch occurs an average of 12 days per year.[71] The average window for freezing temperatures is October 25 through April 9.[72]

Climate data for Wichita, Kansas (1991–2020 normals,[a] extremes 1888–present)[b]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Record high °F (°C)	75 (24)	87 (31)	92 (33)	98 (37)	102 (39)	110 (43)	113 (45)	114 (46)	108 (42)	97 (36)	86 (30)	83 (28)
Mean maximum °F (°C)	65.8 (18.8)	71.6 (22.0)	79.9 (26.6)	85.3 (29.6)	92.0 (33.3)	98.4 (36.9)	103.7 (39.8)	102.2 (39.0)	97.3 (36.3)	89.0 (31.7)	75.5 (24.2)	65.3 (18.5)
Mean daily maximum °F (°C)	43.9 (6.6)	48.9 (9.4)	59.1 (15.1)	68.3 (20.2)	77.5 (25.3)	87.9 (31.1)	92.6 (33.7)	91.0 (32.8)	83.3 (28.5)	70.8 (21.6)	57.0 (13.9)	45.8 (7.7)
Daily mean °F (°C)	33.2 (0.7)	37.6 (3.1)	47.4 (8.6)	56.5 (13.6)	66.7 (19.3)	76.9 (24.9)	81.5 (27.5)	79.9 (26.6)	71.7 (22.1)	59.0 (15.0)	45.8 (7.7)	35.6 (2.0)
Mean daily minimum °F (°C)	22.5 (?5.3)	26.3 (?3.2)	35.7 (2.1)	44.8 (7.1)	55.9 (13.3)	65.9 (18.8)	70.4 (21.3)	68.8 (20.4)	60.1 (15.6)	47.2 (8.4)	34.7 (1.5)	25.4 (?3.7)
Mean minimum °F (°C)	5.1 (?14.9)	8.4 (?13.1)	17.1 (?8.3)	28.2 (?2.1)	40.5 (4.7)	53.9 (12.2)	61.4 (16.3)	59.3 (15.2)	44.6 (7.0)	29.7 (?1.3)	17.9 (?7.8)	8.4 (?13.1)
Record low °F (°C)	?15 (?26)	?22 (?30)	?3 (?19)	15 (?9)	27 (?3)	43 (6)	51 (11)	45 (7)	31 (?1)	14 (?10)	1 (?17)	?16 (?27)
Average precipitation inches (mm)	0.85 (22)	1.20 (30)	2.30 (58)	3.10 (79)	5.17 (131)	4.93 (125)	3.98 (101)	4.30 (109)	3.05 (77)	2.85 (72)	1.36 (35)	1.22 (31)
Average snowfall inches (cm)	2.7 (6.9)	3.6 (9.1)	2.1 (5.3)	0.2 (0.51)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.2 (0.51)	0.8 (2.0)	3.1 (7.9)

Average precipitation days (? 0.01 in)	4.8	5.3	7.4	8.3	11.3	9.5	8.3	8.2	6.9	6.6	5.1	5.4	
Average snowy days (? 0.1 in)	2.7	2.2	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.6	2.2	
Average relative humidity (%)	69.9	68.3	63.8	62.8	67.0	64.3	58.9	61.1	66.8	65.1	70.0	71.7	
Average dew point °F (°C)	19.6 (?6.9)	23.7 (?4.6)	32.0 (0.0)	42.3 (5.7)	53.1 (11.7)	61.2 (16.2)	63.7 (17.6)	62.6 (17.0)	56.8 (13.8)	45.0 (7.2)	34.0 (1.1)	23.5 (?4.7)	
Mean monthly sunshine hours	190.9	186.4	230.4	257.8	289.8	305.0	342.1	309.2	245.6	226.3	170.2	168.7	2
Percent possible sunshine	62	62	62	65	66	69	76	73	66	65	56	57	
Average ultraviolet index	2	3	5	7	9	10	10	9	7	5	3	2	

Source: National Weather Service (relative humidity, dew point and sun 1961–1990)[72][71][

Pollen and other allergens

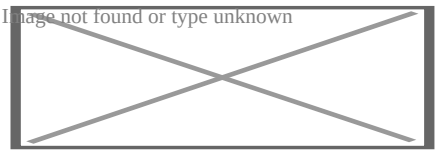
[edit]

Wichita is consistently ranked as one of the worst major cities in the nation for seasonal allergies, due largely to tree and grass pollen (partly from surrounding open plains and pastureland), and smoke from frequent burning of fields by the region's farmers and ranchers, driven by the strong Kansas winds.[74][75] The Asthma and Allergy Foundation of America, ranked Wichita—out of the nation's 100 largest cities—6th worst for people with allergies in 2016,[76] 3rd worst in 2021,[77] 2nd worst in 2022,[78] and worst nationwide in 2023.[74][79][80][81][82]

Neighborhoods

[edit]

Main article: Neighborhoods of Wichita, Kansas



Downtown Wichita & Century II Convention Center along the Arkansas River

Wichita has several recognized areas and neighborhoods. The downtown area is generally considered to be east of the Arkansas River, west of Washington Street, north of Kellogg, and south of 13th Street. It contains landmarks such as Century II, the Garvey Center, and the Epic Center. Old Town is also part of downtown; this 50-acre (0.20 km^2) area is home to a cluster of nightclubs, bars, restaurants, a movie theater, shops, and apartments and condominiums, many of which make use of historical warehouse-type spaces.

Two notable residential areas of Wichita are Riverside and College Hill. Riverside is northwest of downtown, across the Arkansas River, and surrounds the 120-acre (0.49 km^2) Riverside Park.[83] College Hill is east of downtown and south of Wichita State University. It is one of the more historic neighborhoods, along with Delano on the west side and Midtown in the north-central city.[84]

Four other historic neighborhoods—developed in southeast Wichita (particularly near Boeing, Cessna and Beech aircraft plants) -- are among the nation's few remaining examples of U.S. government-funded temporary World War II housing developments to support war factory personnel: Beechwood (now mostly demolished), Oaklawn, Hilltop (the city's highest-density large neighborhood), and massive Planeview (where over 30 languages are spoken) -- in all, home to about a fifth of the city's population at their peak. Though designed as temporary housing, all have remained occupied into the 21st century, most becoming low-income neighborhoods.[85][86][87][88][89]

Demographics

[edit]
Main article: Demographics of Wichita, Kansas

Historical population

Census	Pop.	Note	%±
1870	689		—
1880	4,911		612.8%
1890	23,853		385.7%
1900	24,671		3.4%
1910	52,450		112.6%
1920	72,217		37.7%

1930	111,110	53.9%
1940	114,966	3.5%
1950	168,279	46.4%
1960	254,698	51.4%
1970	276,554	8.6%
1980	279,272	1.0%
1990	304,011	8.9%
2000	344,284	13.2%
2010	382,368	11.1%
2020	397,532	4.0%
2023 (est.)	396,119 [7]	?0.4%

U.S. Decennial Census[90]
2010–2020[6]

In terms of population, Wichita is the largest city in Kansas and the 51st largest city in the United States, according to the 2020 census.[6]

Wichita has an extensive history of attracting immigrants. Starting in 1895, a population of Lebanese Americans moved to the city, many of whom were Orthodox Christians. A second wave of Lebanese migrants moved to Wichita to flee the Civil War in their homeland.[91] Thousands of immigrants from Vietnam moved to Wichita in the aftermath of the Vietnam War.[92]

Wichita, Kansas – Racial and ethnic composition

Note: the US census treats Hispanic/Latino as an ethnic category. This table excludes Latinos from the racial categories and assigns them to a separate category. Hispanics/Latinos may be of any race.

Race / Ethnicity (*NH* = *Non-Hispanic*)	**Pop. 2000 [93]**	**Pop. 2010 [94]**	**Pop. 2020 [95]**	**% 2000**	**% 2010**	**% 2020**
White alone (NH)	246,924	246,744	233,703	71.72%	64.53%	58.79%
Black or African American alone (NH)	38,732	42,676	42,228	11.25%	11.16%	10.62%
Native American or Alaska Native alone (NH)	3,525	3,424	3,400	1.02%	0.90%	0.86%
Asian alone (NH)	13,543	18,272	19,991	3.93%	4.78%	5.03%
Pacific Islander alone (NH)	168	311	429	0.05%	0.08%	0.11%
Other race alone (NH)	528	472	1,585	0.15%	0.12%	0.40%
Mixed race or multiracial (NH)	7,752	12,121	23,410	2.25%	3.17%	5.89%

Hispanic or Latino (any race)	33,112	58,348	72,786	9.62%	15.26%	18.31%
Total	**344,284**	**382,368**	**397,532**	**100.00%**	**100.00%**	**100.00%**

2020 census

[edit]

The 2020 United States census counted 397,532 people, 154,683 households, and 92,969 families in Wichita. The population density was 2,454.1 per square mile (947.5/km^2). There were 172,801 housing units at an average density of 1,066.7 per square mile (411.9/km^2).[96]

The U.S. census accounts for race by two methodologies. "Race alone" and "Race alone less Hispanics" where Hispanics are delineated separately as if a separate race.

The racial makeup (including Hispanics in the racial counts) was 63.39% (251,997) white, 10.95% (43,537) black or African-American, 1.33% (5,296) Native American, 5.09% (20,225) Asian, 0.12% (482) Pacific Islander, 7.41% (29,444) from other races, and 11.71% (46,551) from two or more races.[97]

The racial and ethnic makeup (where Hispanics are excluded from the racial counts and placed in their own category) was 58.79% (233,703) White (non-Hispanic), 10.62% (42,228) Black (non-Hispanic), 0.86% (3,400) Native American (non-Hispanic), 5.03% (19,991) Asian (non-Hispanic), 0.11% (429) Pacific Islander (non-Hispanic), 0.40% (1,585) from other race (non-Hispanic), 5.89% (23,410) from two or more races, and 18.31% (72,786) Hispanic or Latino.[95]

Of the 154,683 households, 26.6% had children under the age of 18; 42.6% were married couples living together; 29.4% had a female householder with no spouse present. 33.2% of households consisted of individuals and 11.9% had someone living alone who was 65 years of age or older. The average household size was 2.5 and the average family size was 3.2.

24.6% of the population was under the age of 18, 9.5% from 18 to 24, 26.7% from 25 to 44, 23.2% from 45 to 64, and 14.3% who were 65 years of age or older. The median age was 35.3 years. For every 100 females, the population had 97.5 males. For every 100 females ages 18 and older, there were 95.7 males.

The 2016-2020 5-year American Community Survey[98] estimates show that the median household income was $53,466 (with a margin of error of +/- $1,028) and the median family income $69,930 (+/- $1,450). Males had a median income of $38,758 (+/- $1,242) versus $26,470 (+/- $608) for females. The median income for those above 16 years old

was $31,875 (+/- $408). Approximately, 10.9% of families and 15.5% of the population were below the poverty line, including 21.4% of those under the age of 18 and 8.7% of those ages 65 or over.

2010 census

[edit]

As of the census of 2010, 382,368 people, 151,818 households, and 94,862 families were residing in the city. The population density was 2,304.8 inhabitants per square mile (889.9/km^2). The 167,310 housing units had an average density of 1,022.1 per square mile (394.6/km^2). The racial makeup of the city was 71.9% White, 11.5% African American, 4.8% Asian, 1.2% American Indian, 0.1% Pacific Islander, 6.2% from other races, and 4.3% from two or more races. Hispanics and Latinos of any race were 15.3% of the population.[99]

Of the 151,818 households, 33.4% had children under 18 living with them, 44.1% were married couples living together, 5.2% had a male householder with no wife present, 13.1% had a female householder with no husband present, and 37.5% were not families. About 31.1% of all households were made up of individuals, and 9.1% had someone living alone who was 65 or older. The average household size was 2.48, and the average family size was 3.14.[99]

The median age in the city was 33.9 years; 26.6% of residents were under the age of 18; 10.1% were between 18 and 24; 26.9% were from 25 to 44; 24.9% were from 45 to 64; and 11.5% were 65 or older. The gender makeup of the city was 49.3% male and 50.7% female.[99]

The median income for a household in the city was $44,477, and for a family was $57,088. Males had a median income of $42,783 versus $32,155 for females. The per capita income for the city was $24,517. About 12.1% of families and 15.8% of the population were below the poverty line, including 22.5% of those under age 18 and 9.9% of those age 65 or over.[99]

Metropolitan area

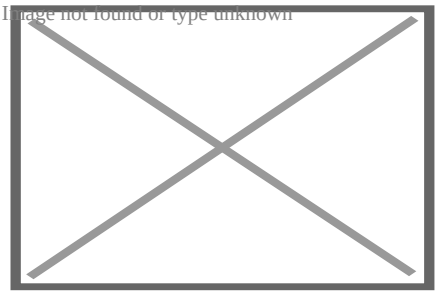
[edit]
Main article: Wichita, KS Metropolitan Statistical Area

Wichita is the principal city of both the Wichita Metropolitan Statistical Area (MSA) and the Wichita-Winfield Combined Statistical Area (CSA).[100][101] The Wichita MSA encompasses Sedgwick, Butler, Harvey, and Sumner counties and, as of 2010, had a population of 623,061, making it the 84th largest MSA in the United States.[100][102][103]

The larger Wichita-Winfield CSA also includes Cowley County and, as of 2013, had an estimated population of 673,598.[104] Nearby Reno County is not a part of the Wichita MSA or Wichita-Winfield CSA, but, were it included, it would add an additional population of 64,511 as of 2010.[105]

Economy

[edit]



Boeing plant in Wichita (2010): Boeing was once the largest employer in Wichita (as per a 2005 analysis), and aviation remains the city's largest industry.

It is the birthplace of famous restaurants such as White Castle and Pizza Hut.[106][107] A survey of well-known Kansas-based brands conducted by RSM Marketing Services and the Wichita Consumer Research Center showed many of the top-25 Kansas-based brands such as Koch, Coleman, Cessna, Pizza Hut, Beechcraft, Freddy's, and more are based in Wichita.[108]

Wichita's principal industrial sector is manufacturing, which accounted for 21.6% of area employment in 2003. Aircraft manufacturing has long dominated the local economy, and plays such an important role that it has the ability to influence the economic health of the entire region; the state offers tax breaks and other incentives to aircraft manufacturers.[109]

Healthcare is Wichita's second-largest industry, employing about 28,000 people in the local area. Since healthcare needs remain fairly consistent regardless of the economy, this field was not subject to the same pressures that affected other industries in the early 2000s. The Kansas Spine Hospital opened in 2004, as did a critical-care tower at Wesley Medical Center.[110] In July 2010, Via Christi Health, which is the largest provider of healthcare services in Kansas, opened a hospital that will serve the northwest area of

Wichita. Via Christi Hospital on St. Teresa is the system's fifth hospital to serve the Wichita community.[111] In 2016, Wesley Healthcare opened Wesley Children's Hospital, the first and only children's hospital in the Wichita area.[112]

Thanks to the early 20th-century oil boom in neighboring Butler County, Kansas, Wichita became a major oil town, with dozens of oil-exploration companies and support enterprises. Most famous of these was Koch Industries, today a global natural-resources conglomerate. The city was also at one time the headquarters of the former Derby Oil Company, which was purchased by Coastal Corporation in 1988.

Koch Industries and Cargill, the two largest privately held companies in the United States, [113] both operate headquarters facilities in Wichita. Koch Industries' primary global corporate headquarters is in a large office-tower complex in northeast Wichita. Cargill Meat Solutions Div., at one time the nation's third-largest beef producer, is headquartered downtown. Other firms with headquarters in Wichita include roller-coaster manufacturer Chance Morgan, gourmet food retailer Dean & Deluca, renewable energy company Alternative Energy Solutions, and Coleman Company, a manufacturer of camping and outdoor recreation supplies. Air Midwest, the nation's first officially certificated "commuter" airline, was founded and headquartered in Wichita and evolved into the nation's eighth-largest regional airline prior to its dissolution in 2008.[114]

As of 2013, 68.2% of the population over the age of 16 was in the labor force; 0.6% was in the armed forces, and 67.6% was in the civilian labor force with 61.2% employed and 6.4% unemployed. The occupational composition of the employed civilian labor force was 33.3% in management, business, science, and arts; 25.1% in sales and office occupations; 17.2% in service occupations; 14.0% in production, transportation, and material moving; and 10.4% in natural resources, construction, and maintenance. The three industries employing the largest percentages of the working civilian labor force were educational services, health care, and social assistance (22.3%); manufacturing (19.2%); and retail trade (11.0%).[99]

The cost of living in Wichita is below average; compared to a U.S. average of 100, the cost of living index for the city is 84.0.[115] As of 2013, the median home value in the city was $117,500, the median selected monthly owner cost was $1,194 for housing units with a mortgage and $419 for those without, and the median gross rent was $690.[99]

Aircraft manufacturing

[edit]

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Beechcraft Starship were built in Wichita from 1983 to 1995.

From the early to late 20th century, aircraft pioneers such as Clyde Cessna, Emil Matthew "Matty" Laird, Lloyd Stearman, Walter Beech, Al Mooney and Bill Lear began aircraft-manufacturing enterprises that led to Wichita becoming the nation's leading city in numbers of aircraft produced, earning Wichita, in 1928, the 1929 title "Air Capital City" from the nation's Aeronautical Chamber of Commerce — a title the city would claim permanently.[13][116][117][118]

The aircraft corporations E. M. Laird Aviation Company (the nation's first successful commercial airplane manufacturer), Travel Air (started by Beech, Stearman, and Cessna), Stearman, Cessna, Beechcraft, and Mooney were all founded in Wichita between 1920 and early 1932.[116][117][118][14] By 1931, Boeing (of Seattle, Washington) had absorbed Stearman, creating "Boeing-Wichita", which would eventually grow to become Kansas' largest employer.[15][119][120] During World War II, employment peak at Boeing-Wichita was 29,795 in December 1943.[121]

Today, Cessna Aircraft Co. (the world's highest-volume airplane manufacturer) and Beechcraft remain based in Wichita, having merged into Textron Aviation in 2014, along with Learjet and Boeing's chief sub-assembly supplier, Spirit AeroSystems. Airbus maintains a workforce in Wichita, and Bombardier (parent company of Learjet) has other divisions in Wichita, as well. Over 50 other aviation businesses operate in the Wichita MSA, as well as over 350 suppliers and subcontractors to the local aircraft manufacturers. In total, Wichita and its companies have manufactured an estimated 250,000 aircraft since Clyde Cessna's first Wichita-built aircraft in 1916.[15][16][116][117][13]

In the early 2000s, a national and international recession combined with the after-effects of the September 11, 2001, terrorist attacks to depress the aviation subsector in and around Wichita. Orders for new aircraft plummeted, prompting Wichita's five largest aircraft manufacturers, Boeing Co., Cessna Aircraft Co., Bombardier Learjet Inc., Hawker Beechcraft, and Raytheon Aircraft Co.—to slash a combined 15,000 jobs between 2001 and 2004. In response, these companies began developing small- and mid-sized airplanes to appeal to business and corporate users.[110]

In 2007, Wichita built 977 aircraft, ranging from single-engine light aircraft to the world's fastest civilian jet; one-fifth of the civilian aircraft produced in United States that year, plus

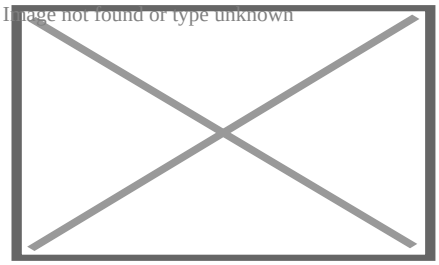
numerous small military aircraft.[117][16][122] In early 2012, Boeing announced it would be closing its Wichita plant by the end of 2013,[120][123] which paved the road for Spirit Aerosystems to open its plant (actually, the Boeing-Wichita factory, still producing the same aircraft assemblies for Boeing, but officially under a different corporation).[13][124]

Arts and culture

[edit]

Arts

[edit]



Wichita Art Museum (2012)

Wichita is home to several art museums and performing arts groups. The Wichita Art Museum is the largest art museum in the state of Kansas and contains 7,000 works in permanent collections.[125] The Ulrich Museum of Art at Wichita State University is a modern and contemporary art museum with over 6,300 works in its permanent collection.[126]

Music

[edit]

Wichita is the music hub of central Kansas, and draws major acts from around the world, performing at various concert halls, arenas, and stadiums around the area. Most major rock'n'roll and pop-music stars, and virtually all country music stars, perform there during their career.[*citation needed*]

Music Theatre Wichita, Wichita Grand Opera (both nationally renowned),[127] and the Wichita Symphony Orchestra perform regularly at the Century II Convention Hall downtown. Concerts are also regularly performed by the nationally noted schools of music at Wichita's two largest universities.[127][128]

The Orpheum Theatre, a classic movie palace built in 1922, serves as a downtown venue for smaller shows. The Cotillion, a special events facility built in 1960, serves a similar purpose as a music venue.

Events

[edit]

The Wichita River Festival has been held in the Downtown and Old Town areas of the city since 1972. It has featured events, musical entertainment, sporting events, traveling exhibits, cultural and historical activities, plays, interactive children's events, a flea market, river events, a parade, block parties, a food court, fireworks, and souvenirs for the roughly 370,000+ patrons who attend each year.[129] In 2011, the festival was moved from May to June because of rain during previous festivals. The Wichita River Festival has seen immense growth, with record numbers in 2016 and again in 2018.[130] Much of that growth is attributed to attractive musical acts at the festival.[131]

Wichita customarily holds major parades for the River Festival, Christmas season (shortly after Thanksgiving), Veterans Day, Juneteenth, and St. Patrick's Day.[132]

The annual Wichita Black Arts Festival, held in the spring, celebrates the arts, crafts, and creativity of Wichita's large African-American community. It usually takes place in Central-Northeast Wichita. A Juneteenth event and parade also are common annual events.

The annual Wichita Asian Festival, usually held at Century II in October, displays the native arts, crafts, cultural performances and foods of Wichita's large, diverse Asian community from the Middle East, Central and South Asia, Southeast Asia and East Asia. The event includes many varied performances of Asian music, dance, acrobatics and martial arts, talent pageant, and vendors of Asian arts and crafts.[133][134][135][136] Dozens of food vendors serve the cuisine of most Asian nations.[137][135][134]

The International Student Association at Wichita State University presents an annual international cultural exhibition and food festival, on the campus at WSU, providing an inexpensive sampling of global culture and cuisine to the general public.

One or more large Renaissance fairs occur annually, including the "RenFair" in conjunction with the "Kingdom of Calontir" of the SCA (Society for Creative Anachronism). The fairs vary in length from one day to a week, typically at Sedgwick County Park or Newman University.

The Wichita Public Library's Academy Awards Shorts program is reportedly the oldest annual, complete, free public screening outside of Hollywood of the full array of short films nominated for an Academy Award ("Oscar"). In late winter, shortly before the Academy Awards ceremonies, the films—including all nominated documentary, live action, and animated shorts—are presented, free, at the Library and in local theaters and other venues around Wichita. Wichita's former Congressman, Motion Picture Association President Dan Glickman, has served as honorary chair of the event, and some of the filmmakers have attended and visited with the audiences.[138][139][140][141][142][143]

The Tallgrass Film Festival has been held in downtown Wichita since 2003. It draws over 100 independent feature and short films from all over the world for three days each October. Notable people from the entertainment industry have attended the festival.[144]

Aviation-related events are common in the Wichita area, including air shows, fly-ins, air races, aviation conferences, exhibitions, and trade shows. The city's two main air shows, which are generally held in alternating years, are the city-sponsored civilian Wichita Flight Festival[145] (originally the "Kansas Flight Festival") and the military-sponsored McConnell Air Force Base Open House and Airshow.[146]

A wide range of car shows are also common in Wichita,[147][148][149][150] including the Blacktop Nationals,[151][152][153] the Automobilia show (claiming over 1,000 vehicles on display[154]),[155] and the Riverfest Classic Car Show,[156] each of which fill much of downtown Wichita.[152][155][156] Wichita is also home to the large Cars for Charities Rod & Custom Car Show (started in 1957 as the Darryl Starbird Show), one of the longest-running indoor car shows in the nation.[157][158][159][160]

Points of interest

[edit]

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Wichita-Sedgwick County Historical Museum, downtown Wichita (2008)

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Kansas Aviation Museum, former Wichita Municipal Airport terminal from 1935 to 1951, southeast Wichita (2008)

Museums and landmarks devoted to science, culture, and area history are located throughout the city. Several lie along the Arkansas River west of downtown, including the Exploration Place science and discovery center, the Mid-America All-Indian Center, the Old Cowtown living history museum, and The Keeper of the Plains statue and its associated display highlighting the daily lives of Plains Indians. The Wichita-Sedgwick County Historical Museum in downtown Wichita occupies the original Wichita city hall, built in 1892. The museum contains artifacts that tell the story of Wichita and Sedgwick County starting from 1865 and continuing to the present day.[161] Nearby is the 1913 Sedgwick County Memorial Hall and Soldiers and Sailors Monument. East of downtown is the Museum of World Treasures and railroad-oriented Great Plains Transportation Museum. The Coleman Factory Outlet and Museum was at 235 N St. Francis street and was the home of the Coleman Lantern until it closed in 2018.[162] Wichita State University hosts the Lowell D. Holmes Museum of Anthropology. The Kansas Aviation Museum, housed in the Terminal and Administration building of the former Municipal Airport, is in southeast Wichita adjacent to McConnell Air Force Base. The Original Pizza

Hut Museum is also located on the Wichita State University campus for pizza lovers and fans to visit.

The Sedgwick County Zoo in the northwest part of Wichita is the most popular outdoor tourist attraction in the state of Kansas, and is home to more than 2,500 animals representing 500 different species.[163] The zoo is next to Sedgwick County Park and the Sedgwick County Extension Arboretum.

Intrust Bank Arena is the city's primary event venue, featuring 22 suites, 2 party suites, 40 loge boxes and over 300 premium seats with a total potential capacity of over 15,000.[164] This arena in the middle of Wichita opened in January 2010.[165]

Located immediately east of downtown is Old Town, the city's entertainment district. In the early 1990s, developers transformed it from an old warehouse district into a mixed-zone neighborhood with residential space, nightclubs, restaurants, hotels, and museums.[166]

Moody's Skidrow Beanery, at 625 E. Douglas in what was to become Old Town, was one of the more famous places in Wichita in the 1960s. It was the scene of a nationally followed First Amendment struggle[167] and was visited by Allen Ginsberg in 1966 (the name had been changed to the Magic Theatre Vortex Art Gallery) where he first read his long poem "Wichita Vortex Sutra."

Wichita is also home to two major indoor shopping malls: Towne East Square, managed by Simon Property Group, and Towne West Square. Towne East is home to four anchor stores and has more than 100 tenants. Towne West Square, which was put into foreclosure in 2019,[168] was still operational as of 2021. The oldest mall, Wichita Mall, was for many years largely a dead mall, but has since been converted into office space.[169] There are also two large outdoor shopping centers, Bradley Fair (which hosts jazz concerts and art festivals) located on the city's northeast side and New Market Square located on the city's northwest side. Each establishment consists of over 50 stores spread out on several acres.

In 1936, the Wichita post office contained two oil-on-canvas murals, *Kansas Farming*, painted by Richard Haines and *Pioneer in Kansas* by Ward Lockwood. Murals were produced from 1934 to 1943 in the United States through the Section of Painting and Sculpture, later called the Section of Fine Arts, of the Treasury Department. The post office building became the Federal Courthouse at 401 N. Market Street and the murals are on display in the lobby.[170]

Wichita also has a number of parks and recreational areas such as Riverside Park, College Hill Park, and McAdams Park.

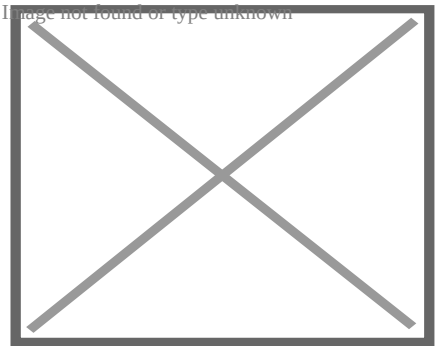
Libraries

[edit]

The Wichita Public Library is the city's library system, presently consisting of a central facility, the Advanced Learning Library in Delano and six branch locations in other neighborhoods around the city.[171] The library operates several free programs for the public, including special events, technology training classes, and programs specifically for adults, children, and families.[172] As of 2009, its holdings included more than 1.3 million books and 2.2 million items total.[173]

Sports

[edit]
Main article: Sports in Wichita, Kansas



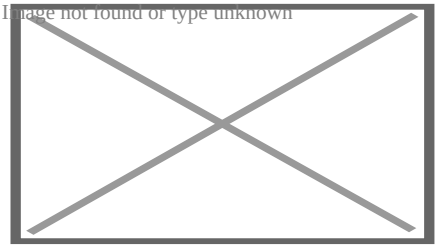
Intrust Bank Arena, home to the Wichita Thunder of the ECHL, located in downtown Wichita (2010)

Wichita is home to several professional, semi-professional, non-professional, and collegiate sports teams. Professional teams include the Wichita Thunder ice hockey team and the Wichita Force indoor football team. The Wichita Wind Surge, a Minor League Baseball team of the Double-A Central play at Riverfront Stadium on the site of the former Lawrence–Dumont Stadium.[174] Their 2020 debut was postponed by the COVID-19 pandemic.[175] In 2021, the team dropped down to the Double-A Central (From Triple-A) without having played a Triple-A game due to Major League Baseball's realignment of the minor leagues. The city hosts the Air Capital Classic, a professional golf tournament of the Korn Ferry Tour first played in 1990.

Defunct professional teams which used to play in Wichita include the Wichita Aeros and Wichita Wranglers baseball teams, the Wichita Wings indoor soccer team, the Wichita Wind (farm team to the Edmonton Oilers National Hockey League team in the early 1980s) and the Wichita Wild indoor football team. Semi-pro teams included the Kansas

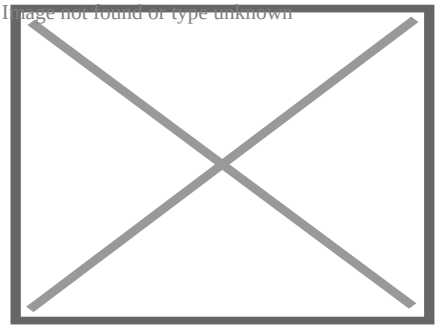
Cougars and Kansas Diamondbacks football teams.[176][177] Non-professional teams included the Wichita Barbarians rugby union team and the Wichita World 11 cricket team.[178][179]

Collegiate teams based in the city include the Wichita State University Shockers, Newman University Jets, and the Friends University Falcons. The WSU Shockers are NCAA Division I teams that compete in men's and women's basketball, baseball, volleyball, track and field, tennis, and bowling. The Newman Jets are NCAA Division II teams that compete in baseball, basketball, bowling, cross country, golf, soccer, tennis, wrestling, volleyball, and cheer/dance. The Friends Falcons compete in Region IV of the NAIA in football, volleyball, soccer, cross country, basketball, tennis, track and field, and golf.



Riverfront Stadium (left), Arkansas River and downtown Wichita (upper right) (2023)

Several sports venues are in and around the city. Intrust Bank Arena, downtown, is a 15,000-seat multi-purpose arena that is home to the Wichita Thunder. Lawrence–Dumont Stadium, just west of downtown, was a medium-sized baseball stadium that has been home to Wichita's various minor-league baseball teams over the years. It was also home to the minor-league National Baseball Congress and the site of the Congress's annual National Tournament.



Eck Stadium at Wichita State University in northeast Wichita (2005)

Wichita Ice Arena, just west of downtown, is a public ice-skating rink used for ice-skating competitions. Century II has been used for professional wrestling tournaments, gardening shows, sporting-goods exhibitions, and other recreational activities. The WSU campus includes two major venues: Eck Stadium, a medium-sized stadium with a full-sized baseball field that is home to the WSU Shocker baseball team, and Charles Koch Arena, a medium-sized, dome-roofed circular arena with a collegiate basketball court that hosts

the WSU Shocker basketball team. Koch Arena is also used extensively for citywide and regional high school athletic events, concerts, and other entertainments. Just north of the city is 81 Motor Speedway, an oval motor-vehicle racetrack used extensively for a wide range of car, truck, and motorcycle races, and other motorsports events. Neighboring Park City is home to Hartman Arena and the Sam Fulco Pavilions, a moderate-capacity low-roofed arena developed for small rodeos, horse shows, livestock competitions, and exhibitions.

Wichita is also home to two sports museums, the Kansas Sports Hall of Fame and the Wichita Sports Hall of Fame and Museum.[180][181]

Professional

[edit]

Team	Founded	League	Sport
Wichita Thunder	1992	ECHL	Ice hockey
Wichita Wind Surge	2020	Double-A Central	Baseball
Wichita Wings	2019	MASL 2	Indoor soccer

College

[edit]

School	School nickname	Level	# of teams
Wichita State University	Shockers	NCAA Division I	15
Newman University	Jets	NCAA Division II	16
Friends University	Falcons	NAIA	15

Government

[edit]
See also: List of mayors of Wichita, Kansas

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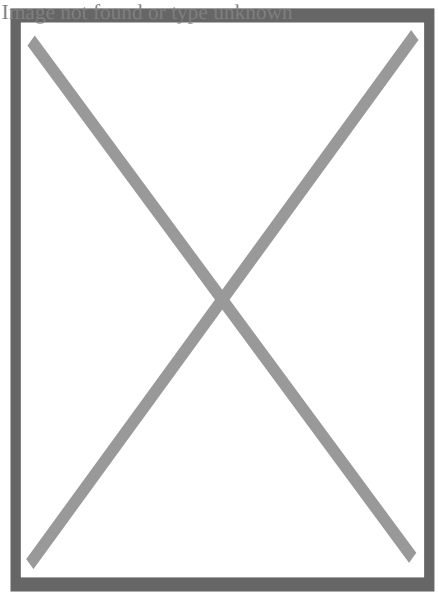


Wichita City Hall (2018)

Under state statute, Wichita is a city of the first class.[182] Since 1917, it has had a council–manager form of government.[183] The city council consists of seven members popularly elected every four years with staggered terms in office. For representative purposes, the city is divided into six districts with one council member elected from each. The mayor is the seventh council member, elected at large. The council sets policy for the city, enacts laws and ordinances, levies taxes, approves the city budget, and appoints members to citizen commission and advisory boards.[184] It meets each Tuesday.[182] The city manager is the city's chief executive, responsible for administering city operations and personnel, submitting the annual city budget, advising the city council, preparing the council's agenda, and oversight of non-departmental activities.[183] As of 2024, the city council consists of Mayor Lily Wu, Brandon Johnson (District 1), Becky Tuttle (District 2), Mike Hoheisel (District 3), Dalton Glasscock (District 4), J.V. Johnston (District 5), and Maggie Ballard (District 6).[185] The city manager is Robert Layton.[186]

The Wichita Police Department, established in 1871, is the city's law enforcement agency.[187] With over 800 employees, including more than 600 commissioned officers, it is the largest law enforcement agency in Kansas.[188] The Wichita Fire Department, organized in 1886, operates 22 stations throughout the city. Organized into four battalions, it employs over 400 full-time firefighters.[189]

As the county seat, Wichita is the administrative center of Sedgwick County. The county courthouse is downtown, and most departments of the county government base their operations in the city.[190]

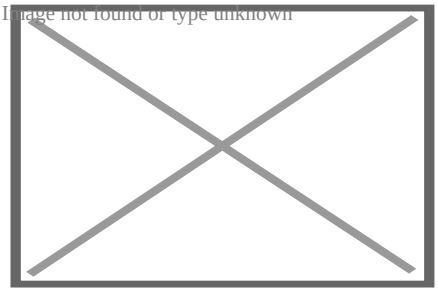
Many departments and agencies of the U.S. Government have facilities in Wichita. The Wichita U.S. Courthouse, also downtown, is one of the three courthouses of the U.S. District Court for the District of Kansas.[191] The U.S. Air Force operates McConnell Air

Force Base immediately southeast of the city.[192] The campus of the Robert J. Dole Department of Veterans Affairs Medical and Regional Office Center is on U.S. 54 in east Wichita.[193] Other agencies, including the Federal Bureau of Investigation,[194] Food and Drug Administration,[195] and Internal Revenue Service[196] among others, have offices around the city.

Wichita lies within Kansas's 4th U.S. Congressional District, represented since 2017 by Republican Ron Estes. For the purposes of representation in the Kansas Legislature, the city is in the 16th and 25th through 32nd districts of the Kansas Senate and the 81st, 83rd through 101st, 103rd, and 105th districts of the Kansas House of Representatives.[182]

Education

[edit]



Wichita East High School (2012)

Primary and secondary education

[edit]

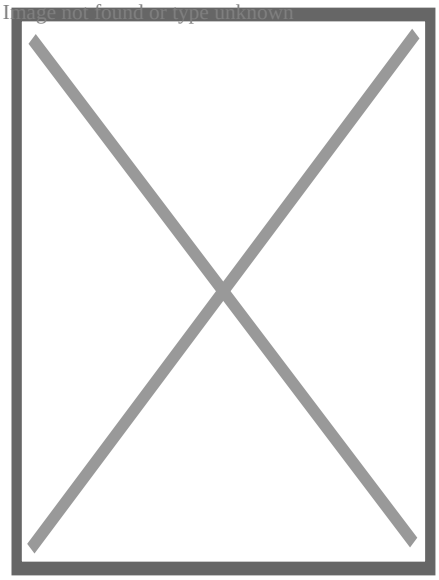
With over 50,000 students, Wichita USD 259 is the largest school district in Kansas.[197] It operates more than 90 schools in the city including 12 high schools, 16 middle schools, 61 elementary schools, and more than a dozen special schools and programs.[198] Outlying portions of Wichita lie within suburban public unified school districts including Andover USD 385, Circle USD 375, Derby USD 260, Goddard USD 265, Haysville USD 261, Maize USD 266, and Valley Center USD 262. Some of these schools, despite being in other school districts, are within the Wichita city limits.[199]

There are more than 35 private and parochial schools in Wichita.[200] The Roman Catholic Diocese of Wichita oversees 16 Catholic schools in the city including 14 elementary schools and two high schools, Bishop Carroll Catholic High School and Kapaun Mt. Carmel High School.[201] The Lutheran Church–Missouri Synod operates three Lutheran schools in the city, Bethany Lutheran School (Grades PK-5), Holy Cross

Lutheran School (PK-8), and Concordia Academy (9-12).[202][203] There are also two Seventh-day Adventist schools in Wichita, Three Angels School (K-8) and Wichita Adventist Christian Academy (K-10).[204][205] Other Christian schools in the city are Calvary Christian School (PK-12), Central Christian Academy (K-10), Classical School of Wichita (K-12), Sunrise Christian Academy (PK-12), Trinity Academy (K-12), Wichita Friends School (PK-6), and Word of Life Traditional School (K-12). In addition, there is an Islamic school, Annoor School (PK-8), operated by the Islamic Society of Wichita. Unaffiliated private schools in the city include Wichita Collegiate School, The Independent School, and Northfield School of the Liberal Arts, as well as three Montessori schools.[206]

Colleges and universities

[edit]



Davis Administration Building at Friends University (2006)

Wichita has several colleges, universities, technical schools and branch campuses of other universities around the state. These include the following:

- Wichita State University
- Friends University
- Newman University
- University of Kansas - School of Medicine Wichita Campus (KU Wichita)
- Wichita Technical Institute

Three universities have their main campuses in Wichita. The largest is Wichita State University (WSU), a public research university classified by Carnegie as "R2: Doctoral

Universities – Higher Research Activity." WSU has more than 14,000 students and is the third-largest university in Kansas.[207][208] WSU's main campus is in northeast Wichita with multiple satellite campuses around the metro area.[209] Friends University, a private, non-denominational Christian university, has its main campus in west Wichita as does Newman University, a private Catholic university.[210][211] Wichita Area Technical College, founded in 1995, was merged into Wichita State University's College of Applied Sciences and Technology in 2018, and is now known as WSU Tech.

Several colleges and universities based outside Wichita operate satellite locations in and around the city. The University of Kansas School of Medicine has one of its three campuses in Wichita.[212] Baker University, Butler Community College, Embry-Riddle Aeronautical University, Southwestern College, Tabor College, Vatterott College, and Webster University have Wichita facilities as do for-profit institutions including Heritage College and University of Phoenix.[213][214][215][216]

Media

[edit]
Main article: Media in Wichita, Kansas

The Wichita Eagle, which began publication in 1872, is the city's major daily newspaper.[217] It was founded and edited for forty years by Marshall Murdock (1837-1908), a major player in local and state Republican politics, as well as doubling as postmaster.[218] Colloquially known as *The Eagle*. In 1960, the Wichita Eagle purchased Beacon Newspaper Corp. After purchasing the paper, the Wichita Eagle begin publishing the Eagle, which was a morning and afternoon newspaper, and the Beacon which was the evening paper.[219] The *Wichita Business Journal* is a weekly newspaper that covers local business events and developments.[220] Several other newspapers and magazines, including local lifestyle, neighborhood, and demographically focused publications are also published in the city.[221] These include: *The Community Voice*, a weekly African American community newspaper;[222] *El Perico*, a monthly Hispanic community newspaper;[223][224] *The Liberty Press*, monthly LGBT news;[225] *Splurge!*, a monthly local fashion and lifestyle magazine;[226] *The Sunflower*, the Wichita State University student newspaper.[227] The Wichita media market also includes local newspapers in several surrounding suburban communities.

The Wichita radio market includes Sedgwick County and neighboring Butler and Harvey counties.[228] Six AM and more than a dozen FM radio stations are licensed to and/or broadcast from the city.[229]

Wichita is the principal city of the Wichita-Hutchinson, Kansas television market, which comprises the western two-thirds of the state.[230] All of the market's network affiliates broadcast from Wichita with the ABC, CBS, CW, FOX and NBC affiliates serving the wider market through state networks of satellite and translator stations.[231][232][233][

[234][235][236] The city also hosts a PBS member station, a Univision affiliate, and several low-power stations.[237][238]

Filmed in Wichita

[edit]

The 1980 horror film, *The Attic,* was set and filmed in Wichita.[239][240] Scenes from the films *Mars Attacks!* and *Twister* were filmed in Wichita.[241]

Infrastructure

[edit]

Flood control

[edit]

Wichita suffered severe floods of the Arkansas river in 1877, 1904, 1916, 1923, 1944, 1951 and 1955. In 1944 the city flooded 3 times in 11 days.[242] As a result of the 1944 flood, the idea for the Wichita-Valley Center Floodway (locally known as the "Big Ditch") was conceived. The project was completed in 1958. The Big Ditch diverts part of the Arkansas River's flow around west-central Wichita, running roughly parallel to the Interstate 235 bypass.[64][243] A second flood control canal lies between the lanes of Interstate 135, running south through the central part of the city. Chisholm Creek is diverted into this canal for most of its length.[64][244] The city's flood defenses were tested in the Great Flood of 1993. Flooding that year kept the Big Ditch full for more than a month and caused $6 million of damage to the flood control infrastructure. The damage was not fully repaired until 2007.[245] In 2019, the Floodway was renamed the MS Mitch Mitchell Floodway in honor of the man credited for its creation.[246]

Utilities

[edit]

Evergy provides electricity.[247] Kansas Gas Service provides natural gas.[248] The City of Wichita provide water and sewer.[249] Multiple privately owned trash haulers, licensed by the county government, offer trash removal and recycling service.[250] Cox

Communications and Spectrum offer cable television, and AT&T U-Verse offers IPTV.[251] All three also offer home telephone and broadband internet service.[252] Satellite TV is offered by DIRECTV and DISH. Satellite internet is available from Viasat, Hughes, and soon Starlink.

Health care

[edit]

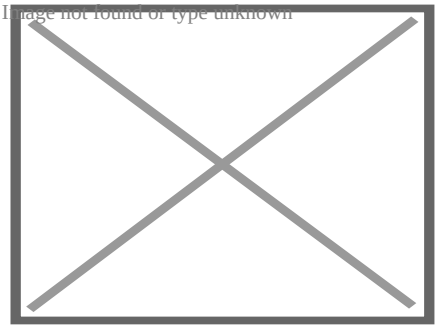
Ascension Via Christi operates three general medical and surgical hospitals in Wichita—Via Christi Hospital St. Francis, Via Christi Hospital St. Joseph, and Via Christi Hospital St. Teresa—and other specialized medical facilities.[253] The Hospital Corporation of America manages a fourth general hospital, Wesley Medical Center, along with satellite locations around the city.[254] All four hospitals provide emergency services. In addition, the U.S. Department of Veterans Affairs runs the Robert J. Dole VA Medical Center, a primary and secondary care facility for U.S. military veterans.[193]

Transportation

[edit]

Highway

[edit]



Interstate 135 begins at this exit from the Kansas Turnpike (Interstate 35) in south-central Wichita.

The average commute time in Wichita was 18.2 minutes from 2013 to 2017.[255] Several federal and state highways pass through the city. Interstate 35, as the Kansas Turnpike, enters the city from the south and turns northeast, running along the city's southeastern

edge and exiting through the eastern part of the city. Interstate 135 runs generally north-south through the city, its southern terminus lying at its interchange with I-35 in south-central Wichita. Interstate 235, a bypass route, passes through north-central, west, and south-central Wichita, traveling around the central parts of the city. Both its northern and southern termini are interchanges with I-135. U.S. Route 54 and U.S. Route 400 run concurrently through Wichita as Kellogg Avenue, the city's primary east-west artery, with interchanges, from west to east, with I-235, I-135, and I-35. U.S. Route 81, a north–south route, enters Wichita from the south as Broadway, turns east as 47th Street South for approximately half a mile, and then runs concurrently north with I-135 through the rest of the city. K-96, an east–west route, enters the city from the northwest, runs concurrently with I-235 through north-central Wichita, turns south for approximately a mile, running concurrently with I-135 before splitting off to the east and traveling around northeast Wichita, ultimately terminating at an interchange with U.S. 54/U.S. 400 in the eastern part of the city. K-254 begins at I-235's interchange with I-135 in north-central Wichita and exits the city to the northeast. K-15, a north–south route, enters the city from the south and joins I-135 and U.S. 81 in south-central Wichita, running concurrently with them through the rest of the city. K-42 enters the city from the southwest and terminates at its interchange with U.S. 54/U.S. 400 in west-central Wichita.[64]

Bus

[edit]

Wichita Transit operates 53 buses on 18 fixed bus routes within the city. The organization reports over 2 million trips per year (5,400 trips per day) on its fixed routes. Wichita Transit also operates a demand response paratransit service with 320,800 passenger trips annually.[256] A 2005 study ranked Wichita near the bottom of the fifty largest American cities in terms of percentage of commuters using public transit. Only 0.5% used it to get to or from work.[257]

Greyhound Lines provides intercity bus service northeast to Topeka and south to Oklahoma City, Oklahoma. Bus service is provided daily north towards Salina and west towards Pueblo, Colorado by BeeLine Express (subcontractor of Greyhound Lines).[258][259] The Greyhound bus station that was built in 1961 at 312 S Broadway closed in 2016, and services relocated 1 block northeast to the Wichita Transit station at 777 E Waterman.[260]

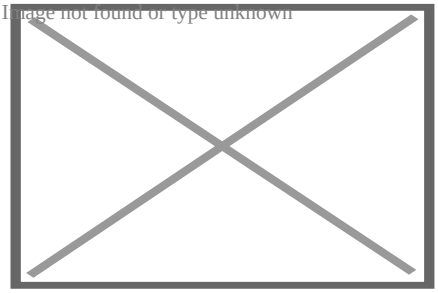
Air

[edit]

The Wichita Airport Authority manages the city's two main public airports, Wichita Dwight D. Eisenhower National Airport and Colonel James Jabara Airport.[261] Located in the western part of the city, Wichita Dwight D. Eisenhower National Airport is the city's primary airport as well as the largest airport in Kansas.[64][261] Seven commercial airlines (Alaska, Allegiant, American, Delta, Frontier, Southwest & United) serve Wichita Dwight D. Eisenhower National Airport with non-stop flights to several U.S. airline hubs.[262] Jabara Airport is a general aviation facility on the city's northeast side.[263] The city also has several privately owned airports. Cessna Aircraft Field and Beech Factory Airport, operated by manufacturers Cessna and Beechcraft, respectively, lie in east Wichita.[264][265] Two smaller airports, Riverside Airport and Westport Airport, are in west Wichita.[266][267]

Rail

[edit]



Union Station, Wichita's former passenger rail station (2009)

Two Class I railroads, BNSF Railway and Union Pacific Railroad (UP), operate freight rail lines through Wichita.[268] UP's OKT Line runs generally north-south through the city; north of downtown, the line consists of trackage leased to BNSF.[64][269] An additional UP line enters the city from the northeast and terminates downtown.[64] BNSF's main line through the city enters from the north, passes through downtown, and exits to the southeast, paralleling highway K-15.[64][270] The Wichita Terminal Association, a joint operation between BNSF and UP, provides switching service on three miles (5 km) of track downtown.[271] In addition, two lines of the Kansas and Oklahoma Railroad enter the city, one from the northwest and the other from the southwest, both terminating at their junction in west-central Wichita.[64]

Wichita has not had passenger rail service since 1979.[272] The nearest Amtrak station is in Newton 25 miles (40 km) north, offering service on the *Southwest Chief* line between Los Angeles and Chicago.[268] Amtrak offers bus service from downtown Wichita to its station in Newton as well as to its station in Oklahoma City, the northern terminus of the *Heartland Flyer* line.[273]

Walkability

[edit]

A 2014 study by Walk Score ranked Wichita 41st most walkable of fifty largest U.S. cities.[274]

Cycling

[edit]

After numerous citizen surveys showed Wichitans want better bicycle infrastructure, The Wichita Bicycle Master Plan, a set of guidelines toward the development of a 149-mile Priority Bicycle Network, was endorsed by the Wichita City Council on February 5, 2013, as a guide to future infrastructure planning and development. As a result, Wichita's bikeways covered 115 miles of the city by 2018. One-third of the bikeways were added between 2011, when the plan was still in development, and 2018.[275][276]

Notable people

[edit]
Main article: List of people from Wichita, Kansas
See also: List of Wichita State University people and List of Friends University people

In popular culture

[edit]

Wichita is mentioned in the 1968 hit song "Wichita Lineman" by Glen Campbell. It is also mentioned in the songs "I've Been Everywhere", and "Seven Nation Army".

Allen Ginsberg wrote about a visit to Wichita in his poem "Wichita Vortex Sutra", for which Philip Glass subsequently wrote a solo piano piece.[277]

The stage play *Hospitality Suite* takes place in Wichita as does its 1999 film adaptation, *The Big Kahuna*.[278] The city is the setting for the comic strip *Dennis the Menace*.[279]

The films *Wichita* (1955) and portions of *Wyatt Earp* (1994), both of which dramatize the life and career of former Wichita lawman Wyatt Earp, are set in Wichita,[280][281] as were early episodes of *The Life and Legend of Wyatt Earp* (1955-1961),[282][283] the first adult-oriented western TV series.[284][285] The short-lived 1959–1960 television western *Wichita Town* was set during the city's early years.[286]

Other films wholly or partially set in the city include *Good Luck, Miss Wyckoff* (1979),[287] *Planes, Trains and Automobiles* (1987),[288] *The Ice Harvest* (2005),[289] and *Knight and Day* (2010). In the 2016 remake of *The Magnificent Seven,* the lead character is identified as a Wichita lawman.[290][291]

Wichita's Old Cowtown Museum, a re-creation of early Wichita, has served as a setting for various western- and pioneer-themed films,[292] including two of the *Sarah Plain and Tall* trilogy.[293][294] A Wichita-area airport served as settings for *The Gypsy Moths*.[295][296]

Sister cities

[edit]

- Cancún, Quintana Roo, Mexico - November 25, 1975[297]
- Kaifeng, Henan, China - December 3, 1985[298]
- Orleans, Loiret, France - August 16, 1944,[299][300] through Sister Cities International
- Tlalnepantla de Baz, State of Mexico, Mexico[301]

See also

[edit]

- flag Kansas portal
- Cities portal
- flag United States portal
- National Register of Historic Places listings in Sedgwick County, Kansas
- Abilene Trail
- Arkansas Valley Interurban Railway
- Joyland Amusement Park
- Wichita Public Schools
- McConnell Air Force Base
- USS *Wichita*, 3 ships

Notes

[edit]

1. **^** Mean monthly maxima and minima (i.e. the expected highest and lowest temperature readings at any point during the year or given month) calculated based on data at said location from 1991 to 2020.
2. **^** Official records for Wichita have been kept at various locations in and around the city from July 1888 to November 1953, and at the Mid-Continent Airport since December 1953 (currently named Wichita Dwight D. Eisenhower National Airport). For more information, see Threadex

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[edit]

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Further reading

[edit]
See also: List of books about Kansas, including historical information about its counties and cities
See also: List of books about Sedgwick County, Kansas
See also: List of books about Chisholm Trail

- *Wichita : Illustrated History 1868 to 1880*; Eunice S. Chapter; 52 pages; 1914. (Download 3MB PDF eBook)
- *History of Wichita and Sedgwick County Kansas : Past and present, including an account of the cities, towns, and villages of the county*; 2 Volumes; O.H. Bentley; C.F. Cooper & Co; 454 / 479 pages; 1910. (Volume1 - Download 20MB PDF eBook), (Volume2 - Download 31MB PDF eBook)

External links

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- City of Wichita
- Wichita - Directory of Public Officials
- Wichita Metro Chamber of Commerce
- Wichita Photo Archives - Wichita State University
- Wichita city map, KSDOT

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City of Wichita

General

- Demographics
- Education
- Geography and climate
- Government
- History
  - Timeline
- Media
- Metropolitan area
- Notable people
- Sports
- Transportation

Neighborhoods	○ College Hill ○ Delano ○ Downtown Wichita ○ El Pueblo ○ McAdams ○ Midtown ○ Orchard Breeze ○ Riverside ○ South Central ○ The Hyde
Landmarks and culture	○ Botanica ○ Epic Center ○ Joyland ○ *The Keeper of the Plains* ○ Music Theatre Wichita ○ Orpheum Theatre ○ Sedgwick County Extension Arboretum ○ Sedgwick County Zoo ○ Towne East Square ○ Towne West Square ○ Wichita Public Library ○ Wichita Symphony Orchestra
Museums	○ Exploration Place ○ Great Plains Transportation Museum ○ Kansas Aviation Museum ○ Kansas Sports Hall of Fame ○ Mid-America All-Indian Center ○ Museum of World Treasures ○ Old Cowtown Museum ○ Wichita Art Museum ○ Wichita-Sedgwick County Historical Museum
Event venues	○ Century II Performing Arts & Convention Center ○ Cessna Stadium ○ Charles Koch Arena ○ Cotillion Ballroom ○ Eck Stadium ○ Hartman Arena ○ Intrust Bank Arena ○ Kansas Coliseum ○ Riverfront Stadium

Colleges and universities

- Friends University
- Newman University
- University of Kansas School of Medicine
- Wichita Area Technical College
- Wichita State University

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Municipalities and communities of Sedgwick County, Kansas, United States

County seat: **Wichita**

Cities

- Andale
- Bel Aire
- Bentley
- Cheney
- Clearwater
- Colwich
- Derby
- Eastborough
- Garden Plain
- Goddard
- Haysville
- Kechi
- Maize
- Mount Hope
- Mulvane‡
- Park City
- Sedgwick‡
- Valley Center
- Viola
- Wichita

CDP

- Furley
- Greenwich
- McConnell AFB
- Oaklawn-Sunview
- Peck‡
- St. Marks

Map of Kansas highlighting Sedgwick

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Map of Kansas highlighting Sedgwick County

Unincorporated communities	○ Anness ○ Bayneville ○ Clonmel ○ Schulte ○ Sunnydale
Townships	○ Afton ○ Attica ○ Delano ○ Eagle ○ Erie ○ Garden Plain ○ Grand River ○ Grant ○ Greeley ○ Gypsum ○ Illinois ○ Kechi ○ Lincoln ○ Minneha ○ Morton ○ Ninnescah ○ Ohio ○ Park ○ Payne ○ Riverside ○ Rockford ○ Salem ○ Sherman ○ Union ○ Valley Center ○ Viola ○ Waco
Footnotes	‡This community also has portions in an adjacent county or counties.

- Kansas portal
- United States portal

Articles relating to Wichita, Kansas

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State of Kansas

Topeka (capital)

Topics

- Index
- Abortion
- Cannabis
- Culture
- Climate change
- Crime
- Demographics
- Economy
- Education
- Geography
- Gun laws
- History
  - Bleeding Kansas
  - Timeline
- Homelessness
- Landmarks
- LGBT rights
- People
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- Symbols
- Tourist attractions

Politics

- Constitutions
- Capitals
- Capitols
- Delegations
- Governors

Regions

- Cherokee Strip
- Cross Timbers
- Dissected Till Plains
- East Central
- Four State Area
- Flint Hills
- High Plains
- KC metro area
- North Central
- Osage Plains
- Ozarks
- Red Hills
- Santa Fe Trail Region
- Smoky Hills
- Southeast

- Allen
- Anderson
- Atchison
- Barber
- Barton
- Bourbon
- Brown
- Butler
- Chase
- Chautauqua
- Cherokee
- Cheyenne
- Clark
- Clay
- Cloud
- Coffey
- Comanche
- Cowley
- Crawford
- Decatur
- Dickinson
- Doniphan
- Douglas
- Edwards
- Elk
- Ellis
- Ellsworth
- Finney
- Ford
- Franklin
- Geary
- Gove
- Graham
- Grant
- Gray
- Greeley
- Greenwood
- Hamilton
- Harper
- Harvey
- Haskell
- Hodgeman
- Jackson
- Jefferson
- Jewell
- Johnson
- Kearny
- Kingman
- Kiowa

- Cities
- Townships

Places

- Census-designated places
- Unincorporated communities
- Ghost towns

flag Image not found or type unknown **Kansas portal**

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The 100 most populous cities of the United States

1. New York, New York
2. Los Angeles, California
3. Chicago, Illinois
4. Houston, Texas
5. Phoenix, Arizona
6. Philadelphia, Pennsylvania
7. San Antonio, Texas
8. Dallas, Texas
9. San Diego, California
10. Austin, Texas
11. Jacksonville, Florida
12. San Jose, California
13. Fort Worth, Texas
14. Columbus, Ohio
15. Charlotte, North Carolina
16. Indianapolis, Indiana
17. San Francisco, California
18. Seattle, Washington
19. Denver, Colorado
20. Oklahoma City, Oklahoma
21. Nashville, Tennessee
22. El Paso, Texas
23. Washington, D.C.
24. Las Vegas, Nevada
25. Boston, Massachusetts
26. Portland, Oregon
27. Louisville, Kentucky
28. Memphis, Tennessee
29. Detroit, Michigan
30. Baltimore, Maryland
31. Milwaukee, Wisconsin
32. Albuquerque, New Mexico
33. Tucson, Arizona
34. Fresno, California
35. Sacramento, California
36. Mesa, Arizona
37. Kansas City, Missouri
38. Atlanta, Georgia
39. Colorado Springs, Colorado
40. Omaha, Nebraska
41. Raleigh, North Carolina
42. Virginia Beach, Virginia
43. Long Beach, California
44. Miami, Florida
45. Oakland, California
46. Minneapolis, Minnesota
47. Tulsa, Oklahoma
48. Bakersfield, California
51. Arlington, Texas
52. Aurora, Colorado
53. New Orleans, Louisiana
54. Cleveland, Ohio
55. Anaheim, California
56. Honolulu, Hawaii
57. Henderson, Nevada
58. Stockton, California
59. Riverside, California
60. Lexington, Kentucky
61. Corpus Christi, Texas
62. Orlando, Florida
63. Irvine, California
64. Cincinnati, Ohio
65. Santa Ana, California
66. Newark, New Jersey
67. Saint Paul, Minnesota
68. Pittsburgh, Pennsylvania
69. Greensboro, North Carolina
70. Lincoln, Nebraska
71. Durham, North Carolina
72. Plano, Texas
73. Anchorage, Alaska
76. Chandler, Arizona
77. North Las Vegas, Nevada
78. Chula Vista, California
79. Buffalo, New York
80. Gilbert, Arizona
81. Reno, Nevada
82. Madison, Wisconsin
83. Fort Wayne, Indiana
84. Toledo, Ohio
85. Lubbock, Texas
86. St. Petersburg, Florida
87. Laredo, Texas
88. Irving, Texas
89. Chesapeake, Virginia
90. Glendale, Arizona
91. Winston-Salem, North Carolina
92. Scottsdale, Arizona
93. Garland, Texas
94. Boise, Idaho
95. Norfolk, Virginia
96. Port St. Lucie, Florida
97. Spokane, Washington
98. Richmond, Virginia
99. Fremont, California

Cities ranked by United States Census Bureau population estimates for July 1, 2022.

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All-America City Award Hall of Fame (1949–2023)

Three-time winners

- Alexandria, VA (1963, 1984, 1985)
- Allentown, PA (1962, 1974, 1975)
- Asheville, NC (1951, 1969, 1997)
- Bloomington, IN (1958, 1981, 1982)
- Boston, MA (1949, 1951, 1962)
- Cincinnati, OH (1949, 1950, 1981)
- Dayton, OH (1951, 1978, 1991)
- Delray Beach, FL (1993, 2001, 2017)
- Edinburg, TX (1968, 1995, 2000)
- Fort Worth, TX (1964, 1993, 2011)
- Gastonia, NC (1963, 2000, 2010)
- Grand Rapids, MI (1949, 1960, 1981)
- Hickory, NC (1967, 1987, 2007)
- Independence, MO (1961, 1982, 2001)
- Laurinburg, NC (1956, 1967, 2003)
- Mount Pleasant, SC (2010, 2018, 2023)
- Norfolk, VA (1959, 2013, 2016)
- Rochester, New York (1981, 1998, 2020)
- Seward, AK (1963, 1965, 2005)
- Shreveport, LA (1953, 1980, 1999)
- Somerville, MA (1972, 2009, 2015)
- Spokane, WA (1975, 2004, 2015)
- Tacoma, WA (1956, 1984, 1998)

Four-time winners

- Akron, OH (1980, 1981, 1995, 2008)
- Anchorage, AK (1956, 1965, 1985, 2002)
- Baltimore, MD (1952, 1977, 1991, 2012)
- Columbus, OH (1958, 1987, 1992, 2006)
- Fayetteville, NC (1985, 2001, 2011, 2023)
- Fort Wayne, IN (1983, 1998, 2009, 2021)
- Grand Island, NE (1955, 1967, 1981, 1982)
- Hampton, VA (1972, 2002, 2014, 2023)
- Louisville, KY (1963, 1995, 2012, 2022)
- Peoria, IL (1953, 1966, 1989, 2013)
- Philadelphia, PA (1949, 1951, 1957, 1994)
- Rockville, MD (1954, 1961, 1977, 1979)
- Toledo, OH (1950, 1983, 1984, 1998)

Five-time winners	○ Cleveland, OH (1949, 1982, 1984, 1986, 1993) ○ Dubuque, IA (2007, 2012, 2013, 2017, 2019) ○ El Paso, TX (1969, 2010, 2018, 2020, 2021) ○ New Haven, CT (1958, 1998, 2003, 2008, 2022) ○ Stockton, CA (1999, 2004, 2015, 2017, 2018) ○ Tupelo, MS (1967, 1989, 1999, 2011, 2015) ○ Wichita, KS (1961, 1993, 1999, 2009, 2019) ○ Worcester, MA (1949, 1960, 1965, 1981, 2000)
Six-time winners	○ Des Moines, IA (1949, 1977, 1982, 2003, 2010, 2017) ○ Phoenix, AZ (1950, 1958, 1980, 1989, 2009, 2022)
Seven-time winners	○ Kansas City, MO (1950, 1951, 1986, 1994, 2006, 2017, 2021) ○ Roanoke, VA (1952, 1979, 1982, 1988, 1996, 2012, 2017)
Nine-time winners	○ San Antonio, TX (1949, 1951, 1983, 2012, 2016, 2017, 2018, 2022, 2023)

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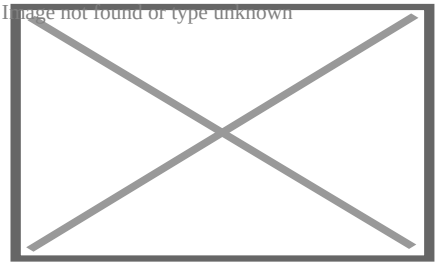
International	○ VIAF ○ WorldCat
National	○ Germany ○ United States ○ Israel
Geographic	○ MusicBrainz area
Other	○ NARA

About Thermal comfort

This article is about comfort zones in building construction. For other uses, see Comfort zone (disambiguation).



A thermal image of human

Thermal comfort is the condition of mind that expresses subjective satisfaction with the thermal environment.[1] The human body can be viewed as a heat engine where food is the input energy. The human body will release excess heat into the environment, so the body can continue to operate. The heat transfer is proportional to temperature difference. In cold environments, the body loses more heat to the environment and in hot environments the body does not release enough heat. Both the hot and cold scenarios lead to discomfort.[2] Maintaining this standard of thermal comfort for occupants of buildings or other enclosures is one of the important goals of HVAC (heating, ventilation, and air conditioning) design engineers.

Thermal neutrality is maintained when the heat generated by human metabolism is allowed to dissipate, thus maintaining thermal equilibrium with the surroundings. The main factors that influence thermal neutrality are those that determine heat gain and loss, namely metabolic rate, clothing insulation, air temperature, mean radiant temperature, air speed and relative humidity. Psychological parameters, such as individual expectations, and physiological parameters also affect thermal neutrality.[3] Neutral temperature is the temperature that can lead to thermal neutrality and it may vary greatly between individuals and depending on factors such as activity level, clothing, and humidity. People are highly sensitive to even small differences in environmental temperature. At 24 °C, a difference of 0.38 °C can be detected between the temperature of two rooms.[4]

The Predicted Mean Vote (PMV) model stands among the most recognized thermal comfort models. It was developed using principles of heat balance and experimental data collected in a controlled climate chamber under steady state conditions.[5] The adaptive model, on the other hand, was developed based on hundreds of field studies with the idea that occupants dynamically interact with their environment. Occupants control their thermal environment by means of clothing, operable windows, fans, personal heaters, and sun shades.[3][6] The PMV model can be applied to air-conditioned buildings, while the adaptive model can be applied only to buildings where no mechanical systems have been installed.[1] There is no consensus about which comfort model should be applied for buildings that are partially air-conditioned spatially or temporally.

Thermal comfort calculations in accordance with the ANSI/ASHRAE Standard 55,[1] the ISO 7730 Standard[7] and the EN 16798-1 Standard[8] can be freely performed with either the CBE Thermal Comfort Tool for ASHRAE 55,[9] with the Python package pythermalcomfort[10] or with the R package comf.

Significance

[edit]

Satisfaction with the thermal environment is important because thermal conditions are potentially life-threatening for humans if the core body temperature reaches conditions of hyperthermia, above 37.5–38.3 °C (99.5–100.9 °F),[11][12] or hypothermia, below

35.0 °C (95.0 °F).[13] Buildings modify the conditions of the external environment and reduce the effort that the human body needs to do in order to stay stable at a normal human body temperature, important for the correct functioning of human physiological processes.

The Roman writer Vitruvius actually linked this purpose to the birth of architecture.[14] David Linden also suggests that the reason why we associate tropical beaches with paradise is because in those environments is where human bodies need to do less metabolic effort to maintain their core temperature.[15] Temperature not only supports human life; coolness and warmth have also become in different cultures a symbol of protection, community and even the sacred.[16]

In building science studies, thermal comfort has been related to productivity and health. Office workers who are satisfied with their thermal environment are more productive.[17][18] The combination of high temperature and high relative humidity reduces thermal comfort and indoor air quality.[19]

Although a single static temperature can be comfortable, people are attracted by thermal changes, such as campfires and cool pools. Thermal pleasure is caused by varying thermal sensations from a state of unpleasantness to a state of pleasantness, and the scientific term for it is positive thermal alliesthesia.[20] From a state of thermal neutrality or comfort any change will be perceived as unpleasant.[21] This challenges the assumption that mechanically controlled buildings should deliver uniform temperatures and comfort, if it is at the cost of excluding thermal pleasure.[22]

Influencing factors

[edit]

Since there are large variations from person to person in terms of physiological and psychological satisfaction, it is hard to find an optimal temperature for everyone in a given space. Laboratory and field data have been collected to define conditions that will be found comfortable for a specified percentage of occupants.[1]

There are numerous factors that directly affect thermal comfort that can be grouped in two categories:

1. **Personal factors** – characteristics of the occupants such as metabolic rate and clothing level
2. **Environmental factors** – which are conditions of the thermal environment, specifically air temperature, mean radiant temperature, air speed and humidity

Even if all these factors may vary with time, standards usually refer to a steady state to study thermal comfort, just allowing limited temperature variations.

Personal factors

[edit]

Metabolic rate

[edit]
Main article: Metabolic rate

People have different metabolic rates that can fluctuate due to activity level and environmental conditions.[23][24][25] ASHRAE 55-2017 defines metabolic rate as the rate of transformation of chemical energy into heat and mechanical work by metabolic activities of an individual, per unit of skin surface area.[1]
:Ãƒ Æ’Ã†â€™Ãƒâ€šÃ‚Â¢Ãƒ Æ’Ã‚Â¢Ãƒ Â¢Ã¢â€šÂ¬Ã…Â¡Ãƒâ€šÃ‚Â¬Ã Æ’Ã¢â‚¬Â¦Ãƒâ€šÃ‚ 3Ãƒ A

Metabolic rate is expressed in units of met, equal to 58.2 W/m² (18.4 Btu/h·ft²). One met is equal to the energy produced per unit surface area of an average person seated at rest.

ASHRAE 55 provides a table of metabolic rates for a variety of activities. Some common values are 0.7 met for sleeping, 1.0 met for a seated and quiet position, 1.2–1.4 met for light activities standing, 2.0 met or more for activities that involve movement, walking, lifting heavy loads or operating machinery. For intermittent activity, the standard states that it is permissible to use a time-weighted average metabolic rate if individuals are performing activities that vary over a period of one hour or less. For longer periods, different metabolic rates must be considered.[1]

According to ASHRAE Handbook of Fundamentals, estimating metabolic rates is complex, and for levels above 2 or 3 met – especially if there are various ways of performing such activities – the accuracy is low. Therefore, the standard is not applicable for activities with an average level higher than 2 met. Met values can also be determined more accurately than the tabulated ones, using an empirical equation that takes into account the rate of respiratory oxygen consumption and carbon dioxide production. Another physiological yet less accurate method is related to the heart rate, since there is a relationship between the latter and oxygen consumption.[26]

The Compendium of Physical Activities is used by physicians to record physical activities. It has a different definition of met that is the ratio of the metabolic rate of the activity in question to a resting metabolic rate.[27] As the formulation of the concept is different from the one that ASHRAE uses, these met values cannot be used directly in PMV calculations, but it opens up a new way of quantifying physical activities.

Food and drink habits may have an influence on metabolic rates, which indirectly influences thermal preferences. These effects may change depending on food and drink intake.[28]

Body shape is another factor that affects metabolic rate and hence thermal comfort. Heat dissipation depends on body surface area. The surface area of an average person is 1.8 m^2 (19 ft^2).[1] A tall and skinny person has a larger surface-to-volume ratio, can dissipate heat more easily, and can tolerate higher temperatures more than a person with a rounded body shape.[28]

Clothing insulation

[edit]
Main article: Clothing insulation

The amount of thermal insulation worn by a person has a substantial impact on thermal comfort, because it influences the heat loss and consequently the thermal balance. Layers of insulating clothing prevent heat loss and can either help keep a person warm or lead to overheating. Generally, the thicker the garment is, the greater insulating ability it has. Depending on the type of material the clothing is made out of, air movement and relative humidity can decrease the insulating ability of the material.[29][30]

1 clo is equal to 0.155 $m^2 \cdot K/W$ (0.88 $°F \cdot ft^2 \cdot h/Btu$). This corresponds to trousers, a long sleeved shirt, and a jacket. Clothing insulation values for other common ensembles or single garments can be found in ASHRAE 55.[1]

Skin wetness

[edit]

Skin wetness is defined as "the proportion of the total skin surface area of the body covered with sweat".[31] The wetness of skin in different areas also affects perceived thermal comfort. Humidity can increase wetness in different areas of the body, leading to a perception of discomfort. This is usually localized in different parts of the body, and local thermal comfort limits for skin wetness differ by locations of the body.[32] The extremities are much more sensitive to thermal discomfort from wetness than the trunk of the body. Although local thermal discomfort can be caused by wetness, the thermal comfort of the whole body will not be affected by the wetness of certain parts.

Environmental factors

[edit]

Air temperature

[edit]
Main article: Dry-bulb temperature

The air temperature is the average temperature of the air surrounding the occupant, with respect to location and time. According to ASHRAE 55 standard, the spatial average takes into account the ankle, waist and head levels, which vary for seated or standing occupants. The temporal average is based on three-minutes intervals with at least 18 equally spaced points in time. Air temperature is measured with a dry-bulb thermometer and for this reason it is also known as dry-bulb temperature.

Mean radiant temperature

[edit]
Main article: Mean radiant temperature

The radiant temperature is related to the amount of radiant heat transferred from a surface, and it depends on the material's ability to absorb or emit heat, or its emissivity. The mean radiant temperature depends on the temperatures and emissivities of the surrounding surfaces as well as the view factor, or the amount of the surface that is “seen” by the object. So the mean radiant temperature experienced by a person in a room with the sunlight streaming in varies based on how much of their body is in the sun.

Air speed

[edit]

Air speed is defined as the rate of air movement at a point, without regard to direction. According to ANSI/ASHRAE Standard 55, it is the average speed of the air surrounding a representative occupant, with respect to location and time. The spatial average is for three heights as defined for average air temperature. For an occupant moving in a space the sensors shall follow the movements of the occupant. The air speed is averaged over an interval not less than one and not greater than three minutes. Variations that occur over a period greater than three minutes shall be treated as multiple different air speeds.[

33]

Relative humidity

[edit]
Main article: Relative humidity

Relative humidity (RH) is the ratio of the amount of water vapor in the air to the amount of water vapor that the air could hold at the specific temperature and pressure. While the human body has thermoreceptors in the skin that enable perception of temperature, relative humidity is detected indirectly. Sweating is an effective heat loss mechanism that relies on evaporation from the skin. However at high RH, the air has close to the maximum water vapor that it can hold, so evaporation, and therefore heat loss, is decreased. On the other hand, very dry environments (RH < 20–30%) are also uncomfortable because of their effect on the mucous membranes. The recommended level of indoor humidity is in the range of 30–60% in air conditioned buildings,[34][35] but new standards such as the adaptive model allow lower and higher humidity, depending on the other factors involved in thermal comfort.

Recently, the effects of low relative humidity and high air velocity were tested on humans after bathing. Researchers found that low relative humidity engendered thermal discomfort as well as the sensation of dryness and itching. It is recommended to keep relative humidity levels higher in a bathroom than other rooms in the house for optimal conditions.[36]

Various types of apparent temperature have been developed to combine air temperature and air humidity. For higher temperatures, there are quantitative scales, such as the heat index. For lower temperatures, a related interplay was identified only qualitatively:

- High humidity and low temperatures cause the air to feel chilly.[37]
- Cold air with high relative humidity "feels" colder than dry air of the same temperature because high humidity in cold weather increases the conduction of heat from the body.[38]

There has been controversy over why damp cold air feels colder than dry cold air. Some believe it is because when the humidity is high, our skin and clothing become moist and are better conductors of heat, so there is more cooling by conduction.[39]

The influence of humidity can be exacerbated with the combined use of fans (forced convection cooling).[40]

Natural ventilation

[edit]

Main article: Natural ventilation

Many buildings use an HVAC unit to control their thermal environment. Other buildings are naturally ventilated (or would have cross ventilation) and do not rely on mechanical systems to provide thermal comfort. Depending on the climate, this can drastically reduce energy consumption. It is sometimes seen as a risk, though, since indoor temperatures can be too extreme if the building is poorly designed. Properly designed, naturally ventilated buildings keep indoor conditions within the range where opening windows and using fans in the summer, and wearing extra clothing in the winter, can keep people thermally comfortable.[41]

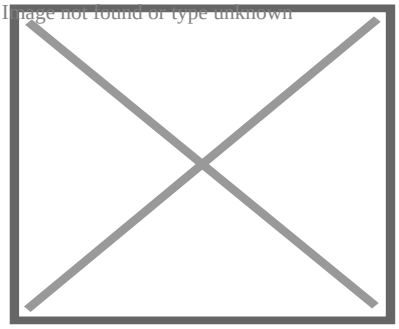
Models and indices

[edit]

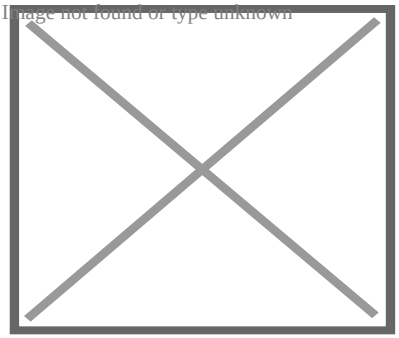
There are several different models or indices that can be used to assess thermal comfort conditions indoors as described below.

PMV/PPD method

[edit]



Psychrometric Chart



Temperature-relative humidity chart

Two alternative representations of thermal comfort for the PMV/PPD method

The PMV/PPD model was developed by P.O. Fanger using heat-balance equations and empirical studies about skin temperature to define comfort. Standard thermal comfort surveys ask subjects about their thermal sensation on a seven-point scale from cold (?3) to hot (+3). Fanger's equations are used to calculate the predicted mean vote (PMV) of a group of subjects for a particular combination of air temperature, mean radiant temperature, relative humidity, air speed, metabolic rate, and clothing insulation.[5] PMV equal to zero is representing thermal neutrality, and the comfort zone is defined by the combinations of the six parameters for which the PMV is within the recommended limits (?0.5 < PMV < +0.5).[1] Although predicting the thermal sensation of a population is an important step in determining what conditions are comfortable, it is more useful to consider whether or not people will be satisfied. Fanger developed another equation to relate the PMV to the Predicted Percentage of Dissatisfied (PPD). This relation was based on studies that surveyed subjects in a chamber where the indoor conditions could be precisely controlled.[5]

The PMV/PPD model is applied globally but does not directly take into account the adaptation mechanisms and outdoor thermal conditions.[3][42][43]

ASHRAE Standard 55-2017 uses the PMV model to set the requirements for indoor thermal conditions. It requires that at least 80% of the occupants be satisfied.[1]

The CBE Thermal Comfort Tool for ASHRAE 55[9] allows users to input the six comfort parameters to determine whether a certain combination complies with ASHRAE 55. The results are displayed on a psychrometric or a temperature-relative humidity chart and indicate the ranges of temperature and relative humidity that will be comfortable with the given the values input for the remaining four parameters.[44]

The PMV/PPD model has a low prediction accuracy.[45] Using the world largest thermal comfort field survey database,[46] the accuracy of PMV in predicting occupant's thermal sensation was only 34%, meaning that the thermal sensation is correctly predicted one out of three times. The PPD was overestimating subject's thermal unacceptability outside the thermal neutrality ranges (-1?PMV?1). The PMV/PPD accuracy varies strongly between ventilation strategies, building types and climates.[45]

Elevated air speed method

[edit]

ASHRAE 55 2013 accounts for air speeds above 0.2 metres per second (0.66 ft/s) separately than the baseline model. Because air movement can provide direct cooling to people, particularly if they are not wearing much clothing, higher temperatures can be more comfortable than the PMV model predicts. Air speeds up to 0.8 m/s (2.6 ft/s) are allowed without local control, and 1.2 m/s is possible with local control. This elevated air movement increases the maximum temperature for an office space in the summer to 30 °C from 27.5 °C (86.0–81.5 °F).[1]

Virtual Energy for Thermal Comfort

[edit]

"Virtual Energy for Thermal Comfort" is the amount of energy that will be required to make a non-air-conditioned building relatively as comfortable as one with air-conditioning. This is based on the assumption that the home will eventually install air-conditioning or heating.[47] Passive design improves thermal comfort in a building, thus reducing demand for heating or cooling. In many developing countries, however, most occupants do not currently heat or cool, due to economic constraints, as well as climate conditions which border lines comfort conditions such as cold winter nights in Johannesburg (South Africa) or warm summer days in San Jose, Costa Rica. At the same time, as incomes rise, there is a strong tendency to introduce cooling and heating systems. If we recognize and reward passive design features that improve thermal comfort today, we diminish the risk of having to install HVAC systems in the future, or we at least ensure that such systems will be smaller and less frequently used. Or in case the heating or cooling system is not installed due to high cost, at least people should not suffer from discomfort indoors. To provide an example, in San Jose, Costa Rica, if a house were being designed with high level of glazing and small opening sizes, the internal temperature would easily rise above 30 °C (86 °F) and natural ventilation would not be enough to remove the internal heat gains and solar gains. This is why Virtual Energy for Comfort is important.

World Bank's assessment tool the EDGE software (Excellence in Design for Greater Efficiencies) illustrates the potential issues with discomfort in buildings and has created the concept of Virtual Energy for Comfort which provides for a way to present potential thermal discomfort. This approach is used to award for design solutions which improves thermal comfort even in a fully free running building. Despite the inclusion of requirements for overheating in CIBSE, overcooling has not been assessed. However, overcooling can be an issue, mainly in the developing world, for example in cities such as Lima (Peru), Bogota, and Delhi, where cooler indoor temperatures can occur frequently. This may be a new area for research and design guidance for reduction of discomfort.

Cooling Effect

[edit]

ASHRAE 55-2017 defines the Cooling Effect (CE) at elevated air speed (above 0.2 metres per second (0.66 ft/s)) as the value that, when subtracted from both the air temperature and the mean radiant temperature, yields the same SET value under still air (0.1 m/s) as in the first SET calculation under elevated air speed.[1]

$$\displaystyle SET(t_a,t_r,v,met,clo,RH)=SET(t_a-CE,t_r-CE,v=0.1,met,clo,RH)$$

Image not found or type unknown

The CE can be used to determine the PMV adjusted for an environment with elevated air speed using the adjusted temperature, the adjusted radiant temperature and still air (0.2 metres per second (0.66 ft/s)). Where the adjusted temperatures are equal to the original air and mean radiant temperatures minus the CE.

Local thermal discomfort

[edit]

Avoiding local thermal discomfort, whether caused by a vertical air temperature difference between the feet and the head, by an asymmetric radiant field, by local convective cooling (draft), or by contact with a hot or cold floor, is essential to providing acceptable thermal comfort. People are generally more sensitive to local discomfort when their thermal sensation is cooler than neutral, while they are less sensitive to it when their body is warmer than neutral.[33]

Radiant temperature asymmetry

[edit]

Large differences in the thermal radiation of the surfaces surrounding a person may cause local discomfort or reduce acceptance of the thermal conditions. ASHRAE Standard 55 sets limits on the allowable temperature differences between various surfaces. Because people are more sensitive to some asymmetries than others, for example that of a warm ceiling versus that of hot and cold vertical surfaces, the limits depend on which surfaces are involved. The ceiling is not allowed to be more than +5 °C (9.0 °F) warmer, whereas a wall may be up to +23 °C (41 °F) warmer than the other surfaces.[1]

Draft

[edit]

While air movement can be pleasant and provide comfort in some circumstances, it is sometimes unwanted and causes discomfort. This unwanted air movement is called "draft" and is most prevalent when the thermal sensation of the whole body is cool. People are most likely to feel a draft on uncovered body parts such as their head, neck, shoulders, ankles, feet, and legs, but the sensation also depends on the air speed, air temperature, activity, and clothing.[1]

Floor surface temperature

[edit]

Floors that are too warm or too cool may cause discomfort, depending on footwear. ASHRAE 55 recommends that floor temperatures stay in the range of 19–29 °C (66–84 °F) in spaces where occupants will be wearing lightweight shoes.[1]

Standard effective temperature

[edit]

Standard effective temperature (SET) is a model of human response to the thermal environment. Developed by A.P. Gagge and accepted by ASHRAE in 1986,[48] it is also referred to as the Pierce Two-Node model.[49] Its calculation is similar to PMV because it is a comprehensive comfort index based on heat-balance equations that incorporates the personal factors of clothing and metabolic rate. Its fundamental difference is it takes a two-node method to represent human physiology in measuring skin temperature and skin wettedness.[48]

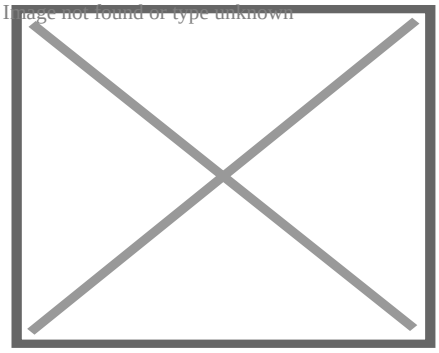
The SET index is defined as the equivalent dry bulb temperature of an isothermal environment at 50% relative humidity in which a subject, while wearing clothing standardized for activity concerned, would have the same heat stress (skin temperature) and thermoregulatory strain (skin wettedness) as in the actual test environment.[48]

Research has tested the model against experimental data and found it tends to overestimate skin temperature and underestimate skin wettedness.[49][50] Fountain and Huizenga (1997) developed a thermal sensation prediction tool that computes SET.[51] The SET index can also be calculated using either the CBE Thermal Comfort Tool for

ASHRAE 55,[9] the Python package pythermalcomfort,[10] or the R package comf.

Adaptive comfort model

[edit]



Adaptive chart according to ASHRAE Standard 55-2010

The adaptive model is based on the idea that outdoor climate might be used as a proxy of indoor comfort because of a statistically significant correlation between them. The adaptive hypothesis predicts that contextual factors, such as having access to environmental controls, and past thermal history can influence building occupants' thermal expectations and preferences.[3] Numerous researchers have conducted field studies worldwide in which they survey building occupants about their thermal comfort while taking simultaneous environmental measurements. Analyzing a database of results from 160 of these buildings revealed that occupants of naturally ventilated buildings accept and even prefer a wider range of temperatures than their counterparts in sealed, air-conditioned buildings because their preferred temperature depends on outdoor conditions.[3] These results were incorporated in the ASHRAE 55-2004 standard as the adaptive comfort model. The adaptive chart relates indoor comfort temperature to prevailing outdoor temperature and defines zones of 80% and 90% satisfaction.[1]

The ASHRAE-55 2010 Standard introduced the prevailing mean outdoor temperature as the input variable for the adaptive model. It is based on the arithmetic average of the mean daily outdoor temperatures over no fewer than 7 and no more than 30 sequential days prior to the day in question.[1] It can also be calculated by weighting the temperatures with different coefficients, assigning increasing importance to the most recent temperatures. In case this weighting is used, there is no need to respect the upper limit for the subsequent days. In order to apply the adaptive model, there should be no mechanical cooling system for the space, occupants should be engaged in sedentary activities with metabolic rates of 1–1.3 met, and a prevailing mean temperature of 10–33.5 °C (50.0–92.3 °F).[1]

This model applies especially to occupant-controlled, natural-conditioned spaces, where the outdoor climate can actually affect the indoor conditions and so the comfort zone. In fact, studies by de Dear and Brager showed that occupants in naturally ventilated buildings were tolerant of a wider range of temperatures.[3] This is due to both behavioral and physiological adjustments, since there are different types of adaptive processes.[52] ASHRAE Standard 55-2010 states that differences in recent thermal experiences, changes in clothing, availability of control options, and shifts in occupant expectations can change people's thermal responses.[1]

Adaptive models of thermal comfort are implemented in other standards, such as European EN 15251 and ISO 7730 standard. While the exact derivation methods and results are slightly different from the ASHRAE 55 adaptive standard, they are substantially the same. A larger difference is in applicability. The ASHRAE adaptive standard only applies to buildings without mechanical cooling installed, while EN15251 can be applied to mixed-mode buildings, provided the system is not running.[53]

There are basically three categories of thermal adaptation, namely: behavioral, physiological, and psychological.

Psychological adaptation

[edit]

An individual's comfort level in a given environment may change and adapt over time due to psychological factors. Subjective perception of thermal comfort may be influenced by the memory of previous experiences. Habituation takes place when repeated exposure moderates future expectations, and responses to sensory input. This is an important factor in explaining the difference between field observations and PMV predictions (based on the static model) in naturally ventilated buildings. In these buildings, the relationship with the outdoor temperatures has been twice as strong as predicted.[3]

Psychological adaptation is subtly different in the static and adaptive models. Laboratory tests of the static model can identify and quantify non-heat transfer (psychological) factors that affect reported comfort. The adaptive model is limited to reporting differences (called psychological) between modeled and reported comfort.[*citation needed*]

Thermal comfort as a "condition of mind" is *defined* in psychological terms. Among the factors that affect the condition of mind (in the laboratory) are a sense of control over the temperature, knowledge of the temperature and the appearance of the (test) environment. A thermal test chamber that appeared residential "felt" warmer than one which looked like the inside of a refrigerator.[54]

Physiological adaptation

[edit]
Further information: Thermoregulation

The body has several thermal adjustment mechanisms to survive in drastic temperature environments. In a cold environment the body utilizes vasoconstriction; which reduces blood flow to the skin, skin temperature and heat dissipation. In a warm environment, vasodilation will increase blood flow to the skin, heat transport, and skin temperature and heat dissipation.[55] If there is an imbalance despite the vasomotor adjustments listed above, in a warm environment sweat production will start and provide evaporative cooling. If this is insufficient, hyperthermia will set in, body temperature may reach 40 °C (104 °F), and heat stroke may occur. In a cold environment, shivering will start, involuntarily forcing the muscles to work and increasing the heat production by up to a factor of 10. If equilibrium is not restored, hypothermia can set in, which can be fatal.[55] Long-term adjustments to extreme temperatures, of a few days to six months, may result in cardiovascular and endocrine adjustments. A hot climate may create increased blood volume, improving the effectiveness of vasodilation, enhanced performance of the sweat mechanism, and the readjustment of thermal preferences. In cold or underheated conditions, vasoconstriction can become permanent, resulting in decreased blood volume and increased body metabolic rate.[55]

Behavioral adaptation

[edit]

In naturally ventilated buildings, occupants take numerous actions to keep themselves comfortable when the indoor conditions drift towards discomfort. Operating windows and fans, adjusting blinds/shades, changing clothing, and consuming food and drinks are some of the common adaptive strategies. Among these, adjusting windows is the most common.[56] Those occupants who take these sorts of actions tend to feel cooler at warmer temperatures than those who do not.[57]

The behavioral actions significantly influence energy simulation inputs, and researchers are developing behavior models to improve the accuracy of simulation results. For example, there are many window-opening models that have been developed to date, but there is no consensus over the factors that trigger window opening.[56]

People might adapt to seasonal heat by becoming more nocturnal, doing physical activity and even conducting business at night.

Specificity and sensitivity

[edit]

Individual differences

[edit]
Further information: Cold sensitivity

The thermal sensitivity of an individual is quantified by the descriptor *FS*, which takes on higher values for individuals with lower tolerance to non-ideal thermal conditions.[58] This group includes pregnant women, the disabled, as well as individuals whose age is below fourteen or above sixty, which is considered the adult range. Existing literature provides consistent evidence that sensitivity to hot and cold surfaces usually declines with age. There is also some evidence of a gradual reduction in the effectiveness of the body in thermo-regulation after the age of sixty.[58] This is mainly due to a more sluggish response of the counteraction mechanisms in lower parts of the body that are used to maintain the core temperature of the body at ideal values.[58] Seniors prefer warmer temperatures than young adults (76 vs 72 degrees F or 24.4 vs 22.2 Celsius).[54]

Situational factors include the health, psychological, sociological, and vocational activities of the persons.

Biological sex differences

[edit]

While thermal comfort preferences between sexes seem to be small, there are some average differences. Studies have found males on average report discomfort due to rises in temperature much earlier than females. Males on average also estimate higher levels of their sensation of discomfort than females. One recent study tested males and females in the same cotton clothing, performing mental jobs while using a dial vote to report their thermal comfort to the changing temperature.[59] Many times, females preferred higher temperatures than males. But while females tend to be more sensitive to temperatures, males tend to be more sensitive to relative-humidity levels.[60][61]

An extensive field study was carried out in naturally ventilated residential buildings in Kota Kinabalu, Sabah, Malaysia. This investigation explored the sexes thermal sensitivity to the indoor environment in non-air-conditioned residential buildings. Multiple hierarchical regression for categorical moderator was selected for data analysis; the result showed that as a group females were slightly more sensitive than males to the indoor air temperatures, whereas, under thermal neutrality, it was found that males and

females have similar thermal sensation.[62]

Regional differences

[edit]

In different areas of the world, thermal comfort needs may vary based on climate. In China[*where?*] the climate has hot humid summers and cold winters, causing a need for efficient thermal comfort. Energy conservation in relation to thermal comfort has become a large issue in China in the last several decades due to rapid economic and population growth.[63] Researchers are now looking into ways to heat and cool buildings in China for lower costs and also with less harm to the environment.

In tropical areas of Brazil, urbanization is creating urban heat islands (UHI). These are urban areas that have risen over the thermal comfort limits due to a large influx of people and only drop within the comfortable range during the rainy season.[64] Urban heat islands can occur over any urban city or built-up area with the correct conditions.[65][66]

In the hot, humid region of Saudi Arabia, the issue of thermal comfort has been important in mosques, because they are very large open buildings that are used only intermittently (very busy for the noon prayer on Fridays) it is hard to ventilate them properly. The large size requires a large amount of ventilation, which requires a lot of energy since the buildings are used only for short periods of time. Temperature regulation in mosques is a challenge due to the intermittent demand, leading to many mosques being either too hot or too cold. The stack effect also comes into play due to their large size and creates a large layer of hot air above the people in the mosque. New designs have placed the ventilation systems lower in the buildings to provide more temperature control at ground level.[67] New monitoring steps are also being taken to improve efficiency.[68]

Thermal stress

[edit]

Not to be confused with thermal stress on objects, which describes the change materials experience when subject to extreme temperatures.

The concept of thermal comfort is closely related to thermal stress. This attempts to predict the impact of solar radiation, air movement, and humidity for military personnel undergoing training exercises or athletes during competitive events. Several thermal stress indices have been proposed, such as the Predicted Heat Strain (PHS) or the humidex.[69] Generally, humans do not perform well under thermal stress. People's performances under thermal stress is about 11% lower than their performance at normal thermal wet conditions. Also, human performance in relation to thermal stress varies

greatly by the type of task which the individual is completing. Some of the physiological effects of thermal heat stress include increased blood flow to the skin, sweating, and increased ventilation.[70][71]

Predicted Heat Strain (PHS)

[edit]

The PHS model, developed by the International Organization for Standardization (ISO) committee, allows the analytical evaluation of the thermal stress experienced by a working subject in a hot environment.[72] It describes a method for predicting the sweat rate and the internal core temperature that the human body will develop in response to the working conditions. The PHS is calculated as a function of several physical parameters, consequently it makes it possible to determine which parameter or group of parameters should be modified, and to what extent, in order to reduce the risk of physiological strains. The PHS model does not predict the physiological response of an individual subject, but only considers standard subjects in good health and fit for the work they perform. The PHS can be determined using either the Python package pythermalcomfort[10] or the R package comf.

American Conference on Governmental Industrial Hygienists (ACGIH) Action Limits and Threshold Limit Values

[edit]

ACGIH has established Action Limits and Threshold Limit Values for heat stress based upon the estimated metabolic rate of a worker and the environmental conditions the worker is subjected to.

This methodology has been adopted by the Occupational Safety and Health Administration (OSHA) as an effective method of assesing heat stress within workplaces.[73]

Research

[edit]

The factors affecting thermal comfort were explored experimentally in the 1970s. Many of these studies led to the development and refinement of ASHRAE Standard 55 and were performed at Kansas State University by Ole Fanger and others. Perceived comfort was found to be a complex interaction of these variables. It was found that the majority of individuals would be satisfied by an ideal set of values. As the range of values deviated progressively from the ideal, fewer and fewer people were satisfied. This observation could be expressed statistically as the percent of individuals who expressed satisfaction by *comfort conditions* and the *predicted mean vote* (PMV). This approach was challenged by the adaptive comfort model, developed from the ASHRAE 884 project, which revealed that occupants were comfortable in a broader range of temperatures.[3]

This research is applied to create Building Energy Simulation (BES) programs for residential buildings. Residential buildings in particular can vary much more in thermal comfort than public and commercial buildings. This is due to their smaller size, the variations in clothing worn, and different uses of each room. The main rooms of concern are bathrooms and bedrooms. Bathrooms need to be at a temperature comfortable for a human with or without clothing. Bedrooms are of importance because they need to accommodate different levels of clothing and also different metabolic rates of people asleep or awake.[74] Discomfort hours is a common metric used to evaluate the thermal performance of a space.

Thermal comfort research in clothing is currently being done by the military. New air-ventilated garments are being researched to improve evaporative cooling in military settings. Some models are being created and tested based on the amount of cooling they provide.[75]

In the last twenty years, researchers have also developed advanced thermal comfort models that divide the human body into many segments, and predict local thermal discomfort by considering heat balance.[76][77][78] This has opened up a new arena of thermal comfort modeling that aims at heating/cooling selected body parts.

Another area of study is the hue-heat hypothesis that states that an environment with warm colors (red, orange yellow hues) will feel warmer in terms of temperature and comfort, while an environment with cold colors (blue, green hues) will feel cooler.[79][80][81] The hue-heat hypothesis has both been investigated scientifically[82] and ingrained in popular culture in the terms warm and cold colors [83]

Medical environments

[edit]

Whenever the studies referenced tried to discuss the thermal conditions for different groups of occupants in one room, the studies ended up simply presenting comparisons of thermal comfort satisfaction based on the subjective studies. No study tried to reconcile the different thermal comfort requirements of different types of occupants who compulsorily must stay in one room. Therefore, it looks to be necessary to investigate the different thermal conditions required by different groups of occupants in hospitals to reconcile their different requirements in this concept. To reconcile the differences in the required thermal comfort conditions it is recommended to test the possibility of using different ranges of local radiant temperature in one room via a suitable mechanical system.

Although different researches are undertaken on thermal comfort for patients in hospitals, it is also necessary to study the effects of thermal comfort conditions on the quality and the quantity of healing for patients in hospitals. There are also original researches that show the link between thermal comfort for staff and their levels of productivity, but no studies have been produced individually in hospitals in this field. Therefore, research for coverage and methods individually for this subject is recommended. Also research in terms of cooling and heating delivery systems for patients with low levels of immune-system protection (such as HIV patients, burned patients, etc.) are recommended. There are important areas, which still need to be focused on including thermal comfort for staff and its relation with their productivity, using different heating systems to prevent hypothermia in the patient and to improve the thermal comfort for hospital staff simultaneously.

Finally, the interaction between people, systems and architectural design in hospitals is a field in which require further work needed to improve the knowledge of how to design buildings and systems to reconcile many conflicting factors for the people occupying these buildings.[84]

Personal comfort systems

[edit]

Personal comfort systems (PCS) refer to devices or systems which heat or cool a building occupant personally.[85] This concept is best appreciated in contrast to central HVAC systems which have uniform temperature settings for extensive areas. Personal

comfort systems include fans and air diffusers of various kinds (e.g. desk fans, nozzles and slot diffusers, overhead fans, high-volume low-speed fans etc.) and personalized sources of radiant or conductive heat (footwarmers, legwarmers, hot water bottles etc.). PCS has the potential to satisfy individual comfort requirements much better than current HVAC systems, as interpersonal differences in thermal sensation due to age, sex, body mass, metabolic rate, clothing and thermal adaptation can amount to an equivalent temperature variation of 2–5 °C (3,6–9 °F), which is impossible for a central, uniform HVAC system to cater to.[85] Besides, research has shown that the perceived ability to control one's thermal environment tends to widen one's range of tolerable temperatures.[3] Traditionally, PCS devices have been used in isolation from one another. However, it has been proposed by Andersen et al. (2016) that a network of PCS devices which generate well-connected microzones of thermal comfort, and report real-time occupant information and respond to programmatic actuation requests (e.g. a party, a conference, a concert etc.) can combine with occupant-aware building applications to enable new methods of comfort maximization.[86]

See also

[edit]

- ASHRAE
- ANSI/ASHRAE Standard 55
- Air conditioning
- Building insulation
- Cold and heat adaptations in humans
- Heat stress
- Mean radiant temperature
- Mahoney tables
- Povl Ole Fanger
- Psychrometrics
- Ralph G. Nevins
- Room air distribution
- Room temperature
- Ventilative cooling

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[edit]

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- Cold Stress, National Institute for Occupational Safety and Health.

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Heating, ventilation, and air conditioning

Fundamental concepts	○ Air changes per hour ○ 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

- 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

Components

- Grille

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:Home automation ○ Template:Solar energy

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About Royal Supply South

Things To Do in Arapahoe County

Photo

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Wings Over the Rockies Air & Space Museum

4.7 (5324)

Photo

Image not found or type unknown

Morrison Nature Center

4.7 (128)

Photo

Image not found or type unknown

The Aurora Highlands North Sculpture

4.9 (11)

Photo

Four Mile Historic Park

4.6 (882)

Photo

Image not found or type unknown

Blue Grama Grass Park

4.4 (117)

Photo

Image not found or type unknown

Cherry Creek State Park

4.6 (9044)

Driving Directions in Arapahoe County

Driving Directions From St. Nicks Christmas and Collectibles to Royal Supply South

Driving Directions From VRCC Veterinary Specialty and Emergency Hospital to Royal Supply South

Driving Directions From Arapahoe County Assessor to Royal Supply South

Driving Directions From Costco Vision Center to Royal Supply South

Driving Directions From King Soopers to Royal Supply South

**https://www.google.com/maps/dir/Wells+Fargo+ATM/Royal+Supply+South/@39.65574
105.0504563,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sChIJUwi2ThmAa4cRFeyO_EI
105.0504563!2d39.6557491!1m5!1m1!1sChIJ06br1RqAbIcRAjyWXdlXZaw!2m2!1d-
105.0233105!2d39.6435918!3e0**

**https://www.google.com/maps/dir/Littleton/Royal+Supply+South/@39.613321,-
105.0166498,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sChIJKzvi-
z98a4cRwDzWrumXBQc!2m2!1d-
105.0166498!2d39.613321!1m5!1m1!1sChIJ06br1RqAbIcRAjyWXdlXZaw!2m2!1d-
105.0233105!2d39.6435918!3e2**

**https://www.google.com/maps/dir/The+Home+Depot/Royal+Supply+South/@39.62302
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105.0244932!2d39.6230256!1m5!1m1!1sChIJ06br1RqAbIcRAjyWXdlXZaw!2m2!1d-
105.0233105!2d39.6435918!3e1**

**https://www.google.com/maps/dir/King+Soopers/Royal+Supply+South/@39.6545686,-
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105.0511676!2d39.6545686!1m5!1m1!1sChIJ06br1RqAbIcRAjyWXdlXZaw!2m2!1d-
105.0233105!2d39.6435918!3e3**

**https://www.google.com/maps/dir/Mullen+High+School/Royal+Supply+South/@39.651
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105.0362791!2d39.6513096!1m5!1m1!1sChIJ06br1RqAbIcRAjyWXdlXZaw!2m2!1d-
105.0233105!2d39.6435918!3e0**

Driving Directions From Cherry Creek State Park to Royal Supply South

Driving Directions From Clock Tower Tours to Royal Supply South

Driving Directions From Colorado Freedom Memorial to Royal Supply South

Driving Directions From Meow Wolf Denver | Convergence Station to Royal Supply South

Driving Directions From Clock Tower Tours to Royal Supply South

Driving Directions From The Aurora Highlands North Sculpture to Royal Supply South

**https://www.google.com/maps/dir/Plains+Conservation+Center+%28Visitor+Center%2
104.737023,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sunknown!2m2!1d-
104.737023!2d39.6560284!1m5!1m1!1sChIJ06br1RqAbIcRAjyWXdlXZaw!2m2!1d-
105.0233105!2d39.6435918!3e0**

**https://www.google.com/maps/dir/Cherry+Creek+Valley+Ecological+Park/Royal+Supp
104.8038771,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sunknown!2m2!1d-
104.8038771!2d39.5822885!1m5!1m1!1sChIJ06br1RqAbIcRAjyWXdlXZaw!2m2!1d-
105.0233105!2d39.6435918!3e2**

**https://www.google.com/maps/dir/Denver+Museum+of+Nature+%26+Science/Royal+S
104.9428078,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sunknown!2m2!1d-
104.9428078!2d39.7475261!1m5!1m1!1sChIJ06br1RqAbIcRAjyWXdlXZaw!2m2!1d-
105.0233105!2d39.6435918!3e1**

**https://www.google.com/maps/dir/Meow+Wolf+Denver+%7C+Convergence+Station/Ro
105.0156539,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sunknown!2m2!1d-
105.0156539!2d39.7408092!1m5!1m1!1sChIJ06br1RqAbIcRAjyWXdlXZaw!2m2!1d-**

105.0233105!2d39.6435918!3e3

Reviews for Royal Supply South

Ensuring Adequate Ventilation for Heat Pumps**View GBP**

Check our other pages :

- **Estimating Future Costs through Contract Analysis**
- **Planning Around Existing Plumbing or Gas Lines**
- **Prioritizing Safety in Confined Work Areas**
- **Considering Weight Distribution on Mobile Home Roofs**

Frequently Asked Questions

Why is proper ventilation important for heat pumps in mobile home HVAC systems?

Proper ventilation is crucial for heat pumps to operate efficiently and safely in a mobile home. It helps prevent overheating, ensures optimal airflow, and allows the system to exchange air effectively with the outside environment. Adequate ventilation also mitigates moisture buildup, reducing the risk of mold growth and maintaining good indoor air quality.

What are some key considerations for ensuring adequate ventilation for a heat pump in a mobile home?

Key considerations include ensuring there is sufficient space around the heat pump unit for air circulation, keeping vents clear of obstructions such as furniture or debris, and regularly inspecting and cleaning filters to maintain airflow. Additionally, its important to follow manufacturer guidelines on installation spacing and vent placement to ensure efficient operation.

How can I tell if my mobile homes heat pump has inadequate ventilation?

Signs of inadequate ventilation include poor heating or cooling performance, unusually high energy bills, frequent cycling on and off of the unit (short cycling), strange noises from the system, or increased humidity levels inside your home. If you notice any of these issues, it may be necessary to assess and improve your heat pumps ventilation setup.

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Google Business Profile

Company Website : **https://royal-durhamsupply.com/locations/wichita-kansas/**

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