



- **Understanding Shifting Soils in Changing Seasons**

Understanding Shifting Soils in Changing Seasons Early Signs of Drainage Issues in Wet Climates Identifying Freeze and Thaw Patterns in Foundation Movement Monitoring Summer Drought Effects on Concrete Recognizing the Role of Poor Grading in Soil Settlement Observing Spring Rains That Affect Foundation Stability Evaluating Temperature Fluctuations and Their Impact on Slab Integrity Addressing Expanding Clay in Variable Weather Managing Water Accumulation Around Foundation Walls Tracking Seasonal Rainfall Data for Preventive Measures Comparing Different Regional Climate Patterns for Foundation Health Avoiding Oversaturation With Proper Yard Drainage

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Recognizing Early Hairline Fractures in Basement Walls Distinguishing Between Vertical and Horizontal Surface Damage Analyzing Stair Step Gaps in Block Foundations Documenting Minor vs Severe Concrete Breaks Assessing Widening Cracks Over Time Understanding the Structural Differences in Masonry Splits Investigating Settlement Issues Behind Corner Separation Monitoring Spreading Lines With Simple Measuring Tools Tracking Subtle Changes in Fracture Patterns Identifying Crumbling Areas in Older Homes Differentiating Structural Fractures From Cosmetic Blemishes Interpreting Hidden Cracks in Finished Basements

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# Evaluating Temperature Fluctuations and Their Impact on Slab Integrity

**Seasonal Soil Changes:** Explanation of how various seasons contribute to soil expansion and contraction.

Understanding slab integrity is crucial in the construction and maintenance of structures, as it directly influences the safety and durability of buildings. One of the critical aspects to consider when evaluating slab integrity is the impact of temperature fluctuations. This essay explores how variations in temperature can affect slab integrity and highlights key factors that need to be considered.

Temperature fluctuations can significantly affect the structural integrity of slabs due to thermal expansion and contraction. As temperatures rise, concrete expands; conversely, it contracts when temperatures drop. Basement leaks often indicate crack presence **Waterproofing Crawl Space** wall. This constant cycle of expansion and contraction can lead to stress within the material, potentially resulting in cracks or other forms of damage over time. The degree of impact largely depends on the magnitude and frequency of temperature changes, as well as the properties of the materials used in slab construction.

One key factor influencing how slabs respond to temperature changes is the type of concrete mix used. Different mixes have varying coefficients of thermal expansion,

meaning they expand and contract at different rates. A mix with a high coefficient will experience more significant changes in dimensions than one with a lower coefficient when subjected to identical temperature variations. Therefore, selecting a suitable concrete mix that aligns with expected environmental conditions is crucial for maintaining slab integrity.

Another important consideration is reinforcement. The incorporation of steel reinforcement bars (rebar) within concrete slabs helps absorb some stress caused by thermal movements, reducing the risk of cracking. Rebar provides tensile strength that counteracts concrete's natural brittleness under tension, which makes it an essential component for enhancing durability against thermal stresses.

Environmental exposure also plays a pivotal role in determining how temperature fluctuations affect slab integrity. Slabs exposed directly to outdoor conditions are more susceptible to temperature-related damage compared to those protected indoors or covered by other materials. For instance, exterior pavements are often subject to rapid heating from direct sunlight during summer days followed by cooling at night a cycle that can exacerbate wear over time if not properly accounted for during design.

In addition to these factors, implementing proper construction techniques can mitigate adverse effects from temperature fluctuations on slab integrity. For example, employing contraction joints allows controlled cracking along predetermined lines rather than random locations throughout the slab surface area while using appropriate curing methods ensures that moisture levels remain consistent during initial drying phases—both contributing positively towards long-term performance under variable climate scenarios.

In conclusion, understanding how temperature fluctuations influence slab integrity involves recognizing various interrelated factors such as material properties like thermal expansion coefficients; structural reinforcements like rebar placement; environmental

exposure levels whether indoor versus outdoor installations; alongside effective construction practices including joint placement strategies combined with adequate curing measures—all working collectively towards safeguarding against potential deterioration risks posed by changing climates thereby ensuring lasting structural resilience across diverse applications globally today!

# Identifying Foundation Issues: Signs and symptoms of foundation damage caused by shifting soils. —

- Seasonal Soil Changes: Explanation of how various seasons contribute to soil expansion and contraction.
- Identifying Foundation Issues: Signs and symptoms of foundation damage caused by shifting soils.
- Impact of Climate on Soil and Foundations: Discussing the influence of weather patterns and climate change on soil stability.
- Methods for Monitoring Soil Movement: Techniques and tools used to track soil shifts around foundations.
- Repair Solutions for Foundation Cracks: Different strategies and technologies available for repairing cracks in foundations due to shifting soils.
- Preventative Measures: Tips for homeowners to minimize the risk of foundation damage from seasonal soil changes.
- Case Studies and Real-Life Examples: Examination of past incidents where shifting soils led to significant foundation issues and subsequent repairs.

Concrete is a fundamental material in modern construction, renowned for its strength and durability. However, like all materials, it is not immune to the forces of nature. One of the critical challenges faced by concrete structures, particularly slabs, is temperature-induced stress. Understanding the science behind this phenomenon is crucial for evaluating temperature fluctuations and their impact on slab integrity.

Temperature-induced stress in concrete slabs primarily arises from thermal expansion and contraction. Concrete, being a composite material, responds to temperature changes by expanding when heated and contracting when cooled. This response can lead to significant internal stresses within the slab if it is restrained or unable to move freely. Over time, these stresses may result in cracking or warping of the concrete surface, compromising both its aesthetic appeal and structural reliability.

## **Evaluating Temperature Fluctuations and Their Impact on Slab Integrity – construction**

1. construction
2. company
3. steel

The degree of temperature fluctuation that a concrete slab experiences depends on several factors such as geographic location, seasonality, and exposure conditions. In regions with extreme temperatures or significant diurnal variations (the difference between daytime and nighttime temperatures), slabs are particularly vulnerable to thermal stress. Prolonged exposure to high temperatures can cause expansion beyond the material's elastic limit, leading to irreversible deformation.

Another contributing factor is the differential heating that occurs within a slab due to varying environmental conditions across its surface. For instance, areas exposed to direct sunlight will heat up faster compared to shaded sections or those in contact with cooler surfaces like soil or water. This uneven heating results in differential expansion within different parts of the slab, creating additional internal stresses.

To mitigate these effects and preserve slab integrity, engineers employ various strategies during design and construction phases. Control joints are intentionally placed at regular intervals across slabs to accommodate movement caused by thermal expansion without leading to random cracking. Additionally, selecting appropriate mix designs with additives that enhance flexibility or reduce thermal conductivity can help manage temperature-induced stresses effectively.

Moreover, proper curing practices play an essential role in minimizing early-age thermal cracking a common issue when newly poured concrete undergoes rapid temperature changes before achieving sufficient strength. Controlled curing methods such as covering with insulating blankets or using moisture-retaining compounds ensure uniform hydration while protecting against severe fluctuations during initial set-up stages.

In conclusion, understanding the science behind temperature-induced stress provides valuable insights into maintaining concrete slab integrity amidst fluctuating climates worldwide. By acknowledging how different variables contribute towards generating internal forces within these structures-and implementing proactive solutions accordingly-engineers can enhance their longevity while ensuring safety standards remain uncompromised throughout diverse applications ranging from roadways and bridges through residential floors alike!

Posted by on

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**Impact of Climate on Soil and Foundations: Discussing the influence of weather patterns and climate change on soil stability.**

The integrity of foundation slabs is crucial for the structural stability of any building. These slabs serve as the bedrock upon which entire structures rest, providing support and ensuring even distribution of weight. However, they are not immune to environmental factors, particularly temperature fluctuations. As climate patterns become more unpredictable, understanding and identifying signs of temperature-related damage in foundation slabs becomes essential.

Temperature fluctuations can have a profound impact on concrete slabs due to their expansive and contractive properties. When temperatures rise, concrete tends to expand. Conversely, when temperatures drop, it contracts. This constant expansion and contraction can lead to significant stress within the slab structure over time, potentially compromising its integrity.

One of the most common signs of temperature-induced damage in foundation slabs is cracking. Cracks may appear as small hairline fractures or develop into larger fissures if left unaddressed. These cracks often form due to thermal expansion and contraction cycles that exceed the tensile strength of the concrete. While minor cracks may not immediately threaten structural safety, they can allow water infiltration and exacerbate deterioration if not repaired promptly.

Another indicator of temperature-related damage is uneven settling or heaving of the slab. This phenomenon occurs when different sections of the slab experience varying rates of expansion or contraction due to localized temperature differences. Uneven settling can lead to misalignment issues in doors and windows or create noticeable slopes in floors within a building.

Furthermore, spalling—where pieces of concrete break away from the surface—can also signal underlying temperature-related distress. Spalling often results from moisture entering through cracks during freeze-thaw cycles, causing internal pressure that



eventually forces chunks of material to detach from the slab's surface.

Preventative measures are essential for mitigating these issues before they escalate into serious problems requiring costly repairs or even complete replacement of foundation elements. Implementing proper drainage systems around a building can help manage water accumulation, reducing risks associated with freeze-thaw cycles exacerbated by temperature changes.

Additionally, using materials designed specifically for thermal resilience during construction can significantly enhance a foundation slab's ability to withstand extreme temperatures without adverse effects on its structural performance.

Regular inspections play an integral role in maintaining slab integrity amidst fluctuating temperatures; early detection allows for timely interventions that prevent minor issues from becoming major concerns down the line.

In conclusion, recognizing signs indicative of temperature-related damage in foundation slabs is vital for preserving their long-term durability and functionality within buildings subjected to dynamic weather conditions today more than ever before globally experienced across diverse climates worldwide alike increasingly unpredictably so too unfortunately at times lately observed frequently now occurring far beyond traditionally expected norms previously understood governed regional limits perhaps until relatively recently unexpectedly changed perspectives environmentally speaking thus necessitating heightened awareness accordingly adjusted approaches best practices maintenance strategies care taken ensure continued viability usage purposes intended originally planned fulfilled safely securely dependably consistently reliably effectively efficiently sustainably comprehensively resiliently appropriately respectfully responsibly thoughtfully mindfully intelligently wisely prudently judiciously cautiously carefully optimistically hopefully positively confidently assuredly steadfastly unfalteringly unwaveringly unyieldingly resolutely tenaciously determinedly resolutely persistently

perseveringly committedly dedicatedly devotedly loyally faithfully true-hearted right-minded good-natured kind-spirited well-intentioned warm-hearted open-handed large-hearted full-bloodedly whole-souled all-embracing life-affirming soul-stirring heartening morale-boosting spirited motivating inspiring encouraging uplifting energizing invigorating rejuvenating revitalizing refreshing renewing restoring rekindling reigniting reanimating resurrecting reviving resuscitating reawakening rousing stimulating galvanizing electrifying thrilling







## **Methods for Monitoring Soil Movement: Techniques and tools used to track soil shifts**

# around foundations.

Monitoring and analyzing temperature variations in construction sites is crucial, especially when evaluating their impact on slab integrity. Temperature fluctuations can significantly affect the physical properties of concrete, influencing its strength, durability, and overall performance. As such, understanding these variations and employing effective monitoring methods are essential for ensuring structural safety and longevity.

One of the primary methods for monitoring temperature variations in construction sites involves the use of sensors. These devices can be embedded within concrete slabs to provide real-time data on temperature changes. By continuously recording temperature readings, sensors enable construction managers to detect any unusual fluctuations that might compromise slab integrity. This data collection is invaluable as it allows for timely interventions to mitigate negative effects caused by extreme temperatures.

In addition to sensors, infrared thermography is another powerful tool used in this field. Infrared cameras can capture thermal images of concrete surfaces, providing insights into heat distribution across a construction site. This method is particularly useful for identifying areas with potential thermal anomalies that could lead to cracks or other structural issues. The advantage of infrared thermography lies in its non-invasive nature, allowing for inspections without disrupting ongoing work.

Data analysis plays a critical role in understanding the implications of temperature variations on slab integrity. Advanced software tools can process large datasets collected from sensors and thermal imaging equipment to identify patterns and trends over time. By analyzing this information, engineers can predict potential risks and devise strategies to address them proactively. For instance, if data indicates that certain areas consistently experience higher temperatures than others, additional cooling measures or protective

coatings might be recommended.

Moreover, simulations and modeling techniques are often employed to evaluate how various temperature scenarios could impact concrete slabs over their lifespan. These predictive models take into account factors such as material composition, local climate conditions, and historical weather patterns to forecast possible outcomes under different circumstances. With these insights at hand, construction professionals can make informed decisions about material selection and design modifications that enhance resilience against temperature-induced stress.

Finally, an integrated approach combining multiple monitoring methods ensures comprehensive coverage of a site's thermal environment. Sensors provide precise quantitative data; infrared thermography offers visual assessments; data analysis reveals underlying trends; while simulations offer foresight into future challenges—all contributing collectively towards safeguarding slab integrity.

In conclusion, effective monitoring and analysis of temperature variations are indispensable components in maintaining the structural integrity of concrete slabs at construction sites.

## **Evaluating Temperature Fluctuations and Their Impact on Slab Integrity – company**

1. leak
2. property
3. wall

Through innovative technologies like embedded sensors and infrared thermography alongside robust analytical frameworks—construction teams stand better equipped not only to understand but also counteract adverse effects posed by fluctuating temperatures—thereby securing safer buildings for our communities today and tomorrow

# **Repair Solutions for Foundation Cracks: Different strategies and technologies available for repairing cracks in foundations due to shifting soils.**

The impact of seasonal changes on slab stability and longevity is a crucial consideration in the field of construction and civil engineering. As we evaluate temperature fluctuations and their impact on slab integrity, it becomes evident that understanding these dynamics is essential for maintaining structural soundness over time.

Seasonal changes bring about significant variations in temperature, which can drastically affect the materials used in slab construction. Concrete slabs, for instance, expand and contract with temperature fluctuations. During hot summer months, slabs may expand due to thermal expansion. Conversely, during cold winter months, they contract. This

continuous cycle of expansion and contraction can lead to cracking if not properly managed.

One major factor influencing slab integrity is the thermal gradient—the difference in temperature between the top and bottom surfaces of the slab. A high thermal gradient can cause warping or curling as one side expands more than the other. Over time, this differential movement can compromise the structural integrity of the slab, leading to potential failures.

Furthermore, repeated freeze–thaw cycles present another challenge. Water that infiltrates cracks or joints in a concrete slab during warmer weather can freeze when temperatures drop. As water freezes, it expands by approximately 9%, exerting pressure on surrounding material and exacerbating existing cracks or creating new ones. Over multiple cycles, this process can significantly diminish the strength and durability of a slab.

To mitigate these effects, engineers employ several strategies. The use of control joints helps accommodate thermal movement by providing predetermined locations where cracking can safely occur without compromising overall structural integrity. Additionally, employing concrete mixes designed for specific climates—such as those with air–entraining agents—can improve resistance to freeze–thaw damage.

Insulation is another effective measure to protect slabs from extreme temperature variations. Insulated concrete forms (ICFs) are often used in regions with harsh winters to maintain a more consistent internal temperature within structures while reducing heat loss through floors.

In conclusion, evaluating temperature fluctuations and their impact on slab integrity highlights the importance of addressing seasonal changes in construction planning and design actively. By implementing measures such as appropriate joint placement and using



climate-specific concrete mixtures along with insulation solutions where necessary—engineers ensure that structures remain safe stable long into future seasons despite inevitable shifts temperatures bring forth year after year ensuring longevity remains intact even under challenging conditions posed by nature's changing rhythms .





# **Preventative Measures: Tips for homeowners to minimize the risk of foundation damage from seasonal soil changes.**

Foundation cracks are a common issue faced by many homeowners, particularly in regions where temperature fluctuations are significant. These temperature changes can cause the ground to expand and contract, leading to stress on concrete slabs and ultimately resulting in cracks. Evaluating these temperature fluctuations and their impact on slab integrity is crucial for maintaining the structural soundness of a building. In this essay, we will explore various techniques for repairing foundation cracks caused by temperature variations, emphasizing the importance of understanding environmental conditions and employing effective repair strategies.

One of the first steps in addressing foundation cracks is evaluating the extent and cause of the damage. Temperature fluctuations can lead to freeze-thaw cycles, where water penetrates small crevices in the concrete and expands when frozen, exacerbating existing cracks or creating new ones.

# Evaluating Temperature Fluctuations and Their Impact on Slab Integrity – Hoffman Estates

1. Hoffman Estates
2. waterproofing
3. warranty

To assess these impacts accurately, it is essential to monitor local climate conditions over time and understand how they influence soil movement around the foundation.

Once the underlying causes have been identified, several repair techniques can be employed to restore slab integrity. One common method is epoxy injection, which involves injecting a high-strength adhesive into the cracks to bond them back together. This technique not only seals the crack but also restores its original strength, preventing further deterioration due to temperature-induced stress.

Another approach is polyurethane foam injection, which works well for wider cracks or those subject to water infiltration. This flexible material expands within the crack to form a watertight seal that accommodates slight movements caused by thermal expansion or contraction without compromising structural integrity.

For more significant foundation issues stemming from severe temperature variations, underpinning might be necessary. Underpinning involves reinforcing or extending the depth of existing foundations using piers or piles driven deep into stable soil layers unaffected by surface-level thermal changes. This method provides additional support and reduces stress on vulnerable areas of the slab.

In addition to these repair techniques, preventive measures play an equally important role in mitigating future damage from temperature fluctuations. Proper drainage systems surrounding a building's perimeter help manage water levels around foundations during heavy rainfalls followed by cold spells—a combination that often leads to freeze-thaw

cycles responsible for cracking concrete surfaces.

Moreover, installing insulation along basement walls can moderate interior temperatures regardless of external weather patterns—reducing overall thermal stress experienced by slabs throughout seasonal transitions while minimizing energy costs associated with heating or cooling living spaces above ground level structures like basements or crawl spaces beneath homes themselves!

In conclusion: Understanding how varying environmental factors affect foundational elements like slabs requires careful analysis alongside practical interventions designed specifically toward addressing unique challenges posed both directly (through immediate physical repairs) & indirectly (via preventative strategies aimed at reducing potential risks). By taking proactive steps now toward safeguarding property against inevitable shifts occurring naturally within our ever-changing world outside any given structure's confines—we ensure continued stability well into future generations who'll inherit these places we call home today!

# **Case Studies and Real-Life Examples: Examination of past incidents where shifting soils**

# led to significant foundation issues and subsequent repairs.

Title: Evaluating Temperature Fluctuations and Their Impact on Slab Integrity: Preventative Measures to Mitigate Future Damage from Environmental Stressors

In the realm of civil engineering and construction, the integrity of concrete slabs is a cornerstone for ensuring the safety and longevity of structures. One of the most significant challenges faced by engineers is the impact of temperature fluctuations on these slabs. As temperatures rise and fall, they induce thermal expansion and contraction in concrete materials, potentially leading to cracking, warping, or even catastrophic structural failures. To address these concerns, it is imperative to explore preventative measures that can mitigate future damage caused by such environmental stressors.

Temperature fluctuations exert their influence primarily through two mechanisms: thermal expansion and freeze-thaw cycles. When temperatures increase, concrete expands; conversely, when they decrease, it contracts. This constant push-and-pull effect can cause micro-cracks which may propagate over time if not properly managed. Additionally, in colder climates where freeze-thaw cycles are prevalent, water ingress into cracks can freeze and expand, exacerbating existing damage and reducing slab integrity.

To combat these issues effectively, several preventative strategies have been identified. First among them is the use of proper mix design in concrete production. By incorporating

admixtures like fly ash or slag cement into the mix, engineers can enhance the material's resistance to thermal changes while also improving its overall durability. These supplementary cementitious materials help reduce permeability and improve moisture retention properties within the slab.

Another key measure involves reinforcement techniques that enhance slab flexibility and resilience against temperature-induced stress. The use of fiber-reinforced polymers (FRP) or steel fibers within the concrete matrix can significantly improve its tensile strength and energy absorption capacity. This reinforcement helps distribute stress more evenly across the slab surface during temperature fluctuations.

Moreover, effective joint design plays a crucial role in accommodating movements due to thermal expansion or contraction without compromising structural integrity. Properly placed control joints facilitate controlled cracking at predetermined locations rather than allowing random crack formation throughout the slab surface.

## **Evaluating Temperature Fluctuations and Their Impact on Slab Integrity – company**

1. crawl space
2. erosion
3. customer

Additionally, implementing appropriate insulation measures during construction can serve as a buffer against extreme temperature variations. Insulating materials placed beneath or around slabs help maintain more stable internal temperatures by reducing direct exposure to external environmental changes.

Finally yet importantly is regular maintenance practices aimed at identifying potential problem areas before they escalate into major issues over time; inspection routines should be scheduled periodically so minor damages such as superficial cracks are repaired promptly using sealants specifically designed for this purpose before further deterioration occurs due exposure weather elements including water intrusion ice formation among others factors involved here too!

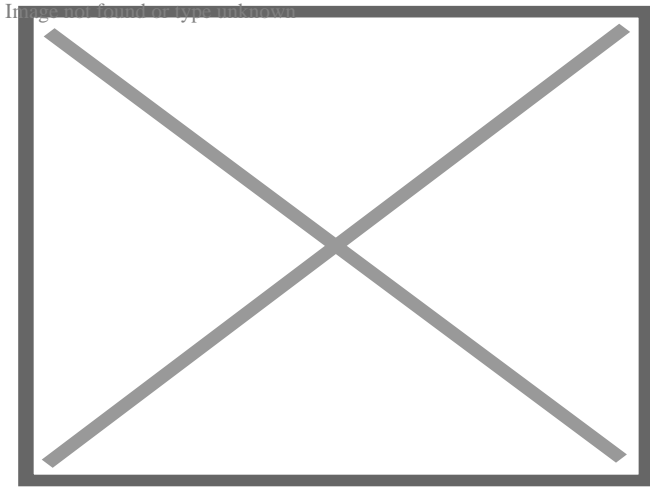
In conclusion then we see how crucial monitoring controlling mitigating effects due fluctuation impacts upon our vital infrastructure projects becomes paramount importance today tomorrow alike! Advances technology along with tried tested methods provide us arsenal tools necessary ensure continued success longevity all types structures worldwide regardless region climate conditions encountered therein!



## About construction

For other uses, see [Construction](#) (disambiguation).

"[Construction site](#)" redirects here. Not to be confused with [Construction Site](#) (TV series).



Construction site and equipment prepared for start of work in Cologne, Germany (2017)

**Construction** is a general term meaning the art and science of forming objects, systems, or organizations.<sup>[1]</sup> It comes from the Latin word *constructio* (from *com-* "together" and *struere* "to pile up") and Old French *construction*.<sup>[2]</sup> To 'construct' is a verb: the act of building, and the noun is construction: how something is built or the nature of its structure.

In its most widely used context, construction covers the processes involved in delivering buildings, infrastructure, industrial facilities, and associated activities through to the end of their life. It typically starts with planning, financing, and design that continues until the asset is built and ready for use. Construction also covers repairs and maintenance work, any works to expand, extend and improve the asset, and its eventual demolition, dismantling or decommissioning.

The construction industry contributes significantly to many countries' gross domestic products (GDP). Global expenditure on construction activities was about \$4 trillion in 2012. In 2022, expenditure on the construction industry exceeded \$11 trillion a year, equivalent to about 13 percent of global GDP. This spending was forecasted to rise to around \$14.8 trillion in 2030.<sup>[3]</sup>

The construction industry promotes economic development and brings many non-monetary benefits to many countries, but it is one of the most hazardous industries. For example, about 20% (1,061) of US industry fatalities in 2019 happened in



construction.<sup>[4]</sup>

## History

[edit]

Main article: History of construction

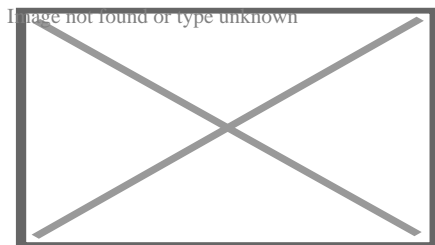
See also: History of architecture

The first huts and shelters were constructed by hand or with simple tools. As cities grew during the Bronze Age, a class of professional craftsmen, like bricklayers and carpenters, appeared. Occasionally, slaves were used for construction work. In the Middle Ages, the artisan craftsmen were organized into guilds. In the 19th century, steam-powered machinery appeared, and later, diesel- and electric-powered vehicles such as cranes, excavators and bulldozers.

Fast-track construction has been increasingly popular in the 21st century. Some estimates suggest that 40% of construction projects are now fast-track construction.<sup>[5]</sup>

## Construction industry sectors

[edit]



Industrial assemblage of a thermal oxidizer in the United States

Broadly, there are three sectors of construction: buildings, infrastructure and industrial:<sup>[6]</sup>

- Building construction is usually further divided into residential and non-residential.

- Infrastructure, also called 'heavy civil' or 'heavy engineering', includes large public works, dams, bridges, highways, railways, water or wastewater and utility distribution.
- Industrial construction includes offshore construction (mainly of energy installations), mining and quarrying, refineries, chemical processing, mills and manufacturing plants.

The industry can also be classified into sectors or markets.<sup>[7]</sup> For example, *Engineering News-Record (ENR)*, a US-based construction trade magazine, has compiled and reported data about the size of design and construction contractors. In 2014, it split the data into nine market segments: transportation, petroleum, buildings, power, industrial, water, manufacturing, sewage/waste, telecom, hazardous waste, and a tenth category for other projects.<sup>[8]</sup> *ENR* used data on transportation, sewage, hazardous waste and water to rank firms as heavy contractors.<sup>[9]</sup>

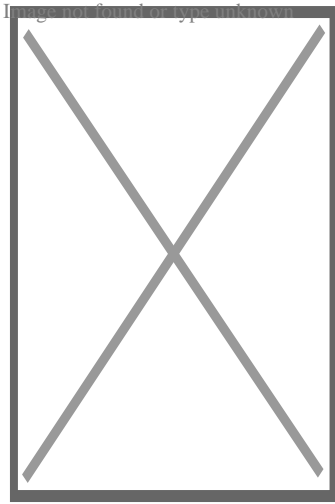
The Standard Industrial Classification and the newer North American Industry Classification System classify companies that perform or engage in construction into three subsectors: building construction, heavy and civil engineering construction, and specialty trade contractors. There are also categories for professional services firms (e.g., engineering, architecture, surveying, project management).<sup>[10]</sup><sup>[11]</sup>

## Building construction

[edit]



This section **needs additional citations for verification**. Please help improve this article by adding citations to reliable sources in this section. Unsourced material may be challenged and removed. *(August 2017)* *(Learn how and when to remove this message)*

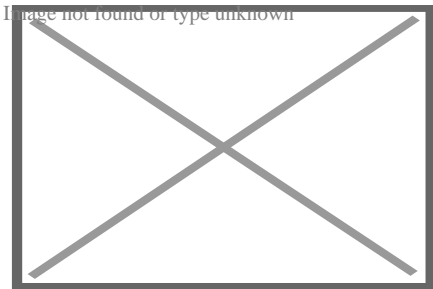


Military residential unit construction by U.S. Navy personnel in Afghanistan

Building construction is the process of adding structures to areas of land, also known as real property sites. Typically, a project is instigated by or with the owner of the property (who may be an individual or an organisation); occasionally, land may be compulsorily purchased from the owner for public use.<sup>[12]</sup>

## Residential construction

[edit]



Units under construction in Brighton, Victoria, Australia

Main article: Home construction

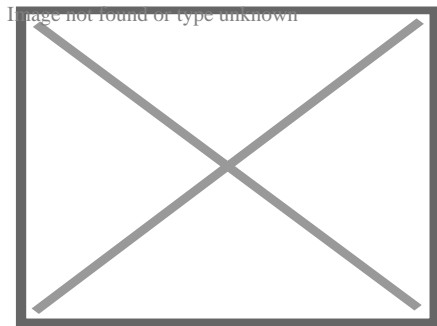
Residential construction may be undertaken by individual land-owners (self-built), by specialist housebuilders, by property developers, by general contractors, or by providers of public or social housing (e.g.: local authorities, housing associations). Where local zoning or planning policies allow, mixed-use developments may

comprise both residential and non-residential construction (e.g.: retail, leisure, offices, public buildings, etc.).

Residential construction practices, technologies, and resources must conform to local building authority's regulations and codes of practice. Materials readily available in the area generally dictate the construction materials used (e.g.: brick versus stone versus timber). Costs of construction on a per square meter (or per square foot) basis for houses can vary dramatically based on site conditions, access routes, local regulations, economies of scale (custom-designed homes are often more expensive to build) and the availability of skilled tradespeople.<sup>[13]</sup>

### **Non-residential construction**

[edit]



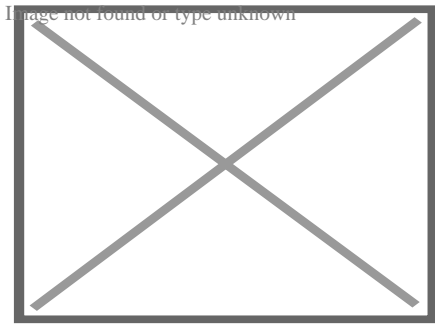
Construction of the Federal Reserve building in Kansas City, Missouri

Depending upon the type of building, non-residential building construction can be procured by a wide range of private and public organisations, including local authorities, educational and religious bodies, transport undertakings, retailers, hoteliers, property developers, financial institutions and other private companies. Most construction in these sectors is undertaken by general contractors.

### **Infrastructure construction**

[edit]

Main article: Civil engineering

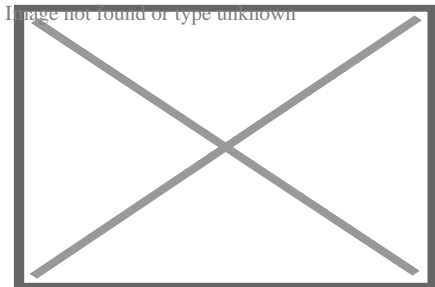


Shasta Dam under construction in June 1942

Civil engineering covers the design, construction, and maintenance of the physical and naturally built environment, including public works such as roads, bridges, canals, dams, tunnels, airports, water and sewerage systems, pipelines, and railways.<sup>[14]</sup><sup>[15]</sup> Some general contractors have expertise in civil engineering; civil engineering contractors are firms dedicated to work in this sector, and may specialise in particular types of infrastructure.

### **Industrial construction**

[edit]



The National Cement Share Company of Ethiopia's new plant in Dire Dawa

Industrial construction includes offshore construction (mainly of energy installations: oil and gas platforms, wind power), mining and quarrying, refineries, breweries, distilleries and other processing plants, power stations, steel mills, warehouses and factories.

### **Construction processes**

[edit]

Some construction projects are small renovations or repair jobs, like repainting or fixing leaks, where the owner may act as designer, paymaster and laborer for the entire project. However, more complex or ambitious projects usually require additional multi-disciplinary expertise and manpower, so the owner may commission one or more specialist businesses to undertake detailed planning, design, construction and handover of the work. Often the owner will appoint one business to oversee the project (this may be a designer, a contractor, a construction manager, or other advisors); such specialists are normally appointed for their expertise in project delivery and construction management and will help the owner define the project brief, agree on a budget and schedule, liaise with relevant public authorities, and procure materials and the services of other specialists (the supply chain, comprising subcontractors and materials suppliers). Contracts are agreed for the delivery of services by all businesses, alongside other detailed plans aimed at ensuring legal, timely, on-budget and safe delivery of the specified works.

Design, finance, and legal aspects overlap and interrelate. The design must be not only structurally sound and appropriate for the use and location, but must also be financially possible to build, and legal to use. The financial structure must be adequate to build the design provided and must pay amounts that are legally owed. Legal structures integrate design with other activities and enforce financial and other construction processes.

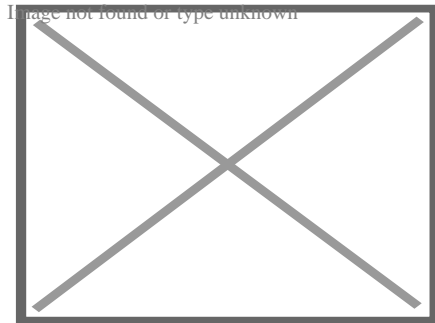
These processes also affect procurement strategies. Clients may, for example, appoint a business to design the project, after which a competitive process is undertaken to appoint a lead contractor to construct the asset (design–bid–build); they may appoint a business to lead both design and construction (design–build); or they may directly appoint a designer, contractor and specialist subcontractors (construction management).<sup>[16]</sup> Some forms of procurement emphasize collaborative relationships (partnering, alliancing) between the client, the contractor, and other stakeholders within a construction project, seeking to ameliorate often highly competitive and adversarial industry practices. DfMA (design for manufacture and assembly) approaches also emphasize early collaboration with manufacturers and suppliers regarding products and components.

Construction or refurbishment work in a "live" environment (where residents or businesses remain living in or operating on the site) requires particular care, planning and communication.<sup>[17]</sup>

## Planning

[edit]

Main articles: Architectural plan and Pre-construction services



Digging the foundation for a building construction in Jakarta, Indonesia

When applicable, a proposed construction project must comply with local land-use planning policies including zoning and building code requirements. A project will normally be assessed (by the 'authority having jurisdiction', AHJ, typically the municipality where the project will be located) for its potential impacts on neighbouring properties, and upon existing infrastructure (transportation, social infrastructure, and utilities including water supply, sewerage, electricity, telecommunications, etc.). Data may be gathered through site analysis, site surveys and geotechnical investigations. Construction normally cannot start until planning permission has been granted, and may require preparatory work to ensure relevant infrastructure has been upgraded before building work can commence. Preparatory works will also include surveys of existing utility lines to avoid damage-causing outages and other hazardous situations.

Some legal requirements come from *malum in se* considerations, or the desire to prevent indisputably bad phenomena, e.g. explosions or bridge collapses. Other legal requirements come from *malum prohibitum* considerations, or factors that are a matter of custom or expectation, such as isolating businesses from a business district or

residences from a residential district. An attorney may seek changes or exemptions in the law that governs the land where the building will be built, either by arguing that a rule is inapplicable (the bridge design will not cause a collapse), or that the custom is no longer needed (acceptance of live-work spaces has grown in the community).<sup>[18]</sup>

During the construction of a building, a municipal building inspector usually inspects the ongoing work periodically to ensure that construction adheres to the approved plans and the local building code. Once construction is complete, any later changes made to a building or other asset that affect safety, including its use, expansion, structural integrity, and fire protection, usually require municipality approval.

## **Finance**

[edit]

Depending on the type of project, mortgage bankers, accountants, and cost engineers may participate in creating an overall plan for the financial management of a construction project. The presence of the mortgage banker is highly likely, even in relatively small projects since the owner's equity in the property is the most obvious source of funding for a building project. Accountants act to study the expected monetary flow over the life of the project and to monitor the payouts throughout the process. Professionals including cost engineers, estimators and quantity surveyors apply expertise to relate the work and materials involved to a proper valuation.

Financial planning ensures adequate safeguards and contingency plans are in place before the project is started, and ensures that the plan is properly executed over the life of the project. Construction projects can suffer from preventable financial problems.<sup>[19]</sup> Underbids happen when builders ask for too little money to complete the project. Cash flow problems exist when the present amount of funding cannot cover the current costs for labour and materials; such problems may arise even when the overall budget is adequate, presenting a temporary issue. Cost overruns with government projects have occurred when the contractor identified change orders or project changes that increased costs, which are not subject to competition from other firms as they have already been eliminated from consideration after the initial bid.<sup>[20]</sup>



Fraud is also an issue of growing significance within construction.[<sup>21</sup>]

Large projects can involve highly complex financial plans and often start with a conceptual cost estimate performed by a building estimator. As portions of a project are completed, they may be sold, supplanting one lender or owner for another, while the logistical requirements of having the right trades and materials available for each stage of the building construction project carry forward. Public–private partnerships (PPPs) or private finance initiatives (PFIs) may also be used to help deliver major projects. According to McKinsey in 2019, the "vast majority of large construction projects go over budget and take 20% longer than expected".[<sup>22</sup>]

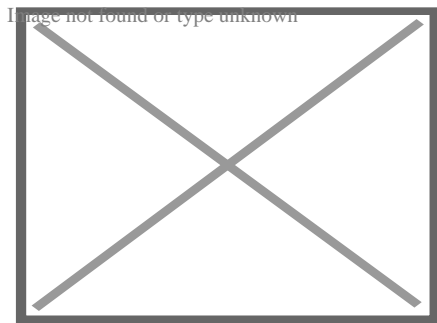
## Legal

[edit]



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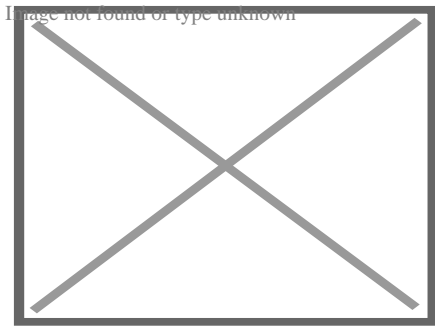
Main article: Construction law



Construction along Ontario Highway 401, widening the road from six to twelve travel lanes

A construction project is a complex net of construction contracts and other legal obligations, each of which all parties must carefully consider. A contract is the exchange of a set of obligations between two or more parties, and provides structures to manage issues. For example, construction delays can be costly, so construction contracts set out clear expectations and clear paths to manage delays. Poorly drafted contracts can lead to confusion and costly disputes.

At the start of a project, legal advisors seek to identify ambiguities and other potential sources of trouble in the contract structures, and to present options for preventing problems. During projects, they work to avoid and resolve conflicts that arise. In each case, the lawyer facilitates an exchange of obligations that matches the reality of the project.



Apartment complex under construction in Daegu, South Korea

## **Procurement**

[edit]

### **Traditional or Design-bid-build**

[edit]

Main article: Design-bid-build

Design-bid-build is the most common and well-established method of construction procurement. In this arrangement, the architect, engineer or builder acts for the client as the project coordinator. They design the works, prepare specifications and design deliverables (models, drawings, etc.), administer the contract, tender the works, and manage the works from inception to completion. In parallel, there are direct contractual links between the client and the main contractor, who, in turn, has direct contractual relationships with subcontractors. The arrangement continues until the project is ready for handover.

### **Design-build**

[edit]

Main article: Design–build

Design–build became more common from the late 20th century, and involves the client contracting a single entity to provide design and construction. In some cases, the design–build package can also include finding the site, arranging funding and applying for all necessary statutory consents. Typically, the client invites several Design & Build (D&B) contractors to submit proposals to meet the project brief and then selects a preferred supplier. Often this will be a consortium involving a design firm and a contractor (sometimes more than one of each). In the United States, departments of transportation usually use design–build contracts as a way of progressing projects where states lack the skills or resources, particularly for very large projects.<sup>[23]</sup>

## **Construction management**

[edit]

Main article: Construction management

In a construction management arrangement, the client enters into separate contracts with the designer (architect or engineer), a construction manager, and individual trade contractors. The client takes on the contractual role, while the construction or project manager provides the active role of managing the separate trade contracts, and ensuring that they complete all work smoothly and effectively together. This approach is often used to speed up procurement processes, to allow the client greater flexibility in design variation throughout the contract, to enable the appointment of individual work contractors, to separate contractual responsibility on each individual throughout the contract, and to provide greater client control.

## **Design**

[edit]

In the industrialized world, construction usually involves the translation of designs into reality. Most commonly (i.e.: in a design-bid-build project), the design team is employed by (i.e. in contract with) the property owner. Depending upon the type of project, a design team may include architects, civil engineers, mechanical engineers, electrical engineers, structural engineers, fire protection engineers, planning consultants, architectural consultants, and archaeological consultants. A 'lead designer' will normally be identified to help coordinate different disciplinary inputs to the overall design. This may be aided by integration of previously separate disciplines (often undertaken by separate firms) into multi-disciplinary firms with experts from all related fields,<sup>[24]</sup> or by firms establishing relationships to support design-build processes.

The increasing complexity of construction projects creates the need for design professionals trained in all phases of a project's life-cycle and develop an appreciation of the asset as an advanced technological system requiring close integration of many sub-systems and their individual components, including sustainability. For buildings, building engineering is an emerging discipline that attempts to meet this new challenge.

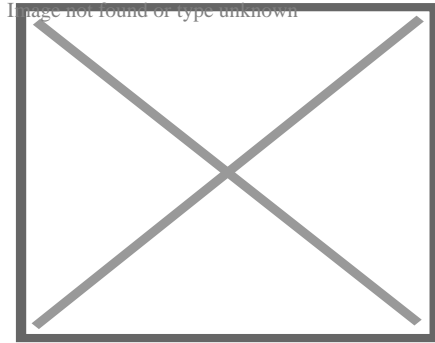
Traditionally, design has involved the production of sketches, architectural and engineering drawings, and specifications. Until the late 20th century, drawings were largely hand-drafted; adoption of computer-aided design (CAD) technologies then improved design productivity, while the 21st-century introduction of building information modeling (BIM) processes has involved the use of computer-generated models that can be used in their own right or to generate drawings and other visualisations as well as capturing non-geometric data about building components and systems.

On some projects, work on-site will not start until design work is largely complete; on others, some design work may be undertaken concurrently with the early stages of on-site activity (for example, work on a building's foundations may commence while designers are still working on the detailed designs of the building's internal spaces). Some projects may include elements that are designed for off-site construction (see also prefabrication and modular building) and are then delivered to the site ready for

erection, installation or assembly.

## On-site construction

[edit]



On-site foundation construction.

Once contractors and other relevant professionals have been appointed and designs are sufficiently advanced, work may commence on the project site. Typically, a construction site will include a secure perimeter to restrict unauthorised access, site access control points, office and welfare accommodation for personnel from the main contractor and other firms involved in the project team, and storage areas for materials, machinery and equipment. According to the *McGraw-Hill Dictionary of Architecture and Construction's* definition, construction may be said to have *started* when the first feature of the permanent structure has been put in place, such as pile driving, or the pouring of slabs or footings.<sup>[25]</sup>

## Commissioning and handover

[edit]

Main article: New-construction building commissioning

Commissioning is the process of verifying that all subsystems of a new building (or other assets) work as intended to achieve the owner's project requirements and as designed by the project's architects and engineers.

## **Defects liability period**

[edit]

A period after handover (or practical completion) during which the owner may identify any shortcomings in relation to the building specification ('defects'), with a view to the contractor correcting the defect.<sup>[26]</sup>

## **Maintenance, repair and improvement**

[edit]

Main article: Maintenance (technical)

Maintenance involves functional checks, servicing, repairing or replacing of necessary devices, equipment, machinery, building infrastructure, and supporting utilities in industrial, business, governmental, and residential installations.<sup>[27]</sup><sup>[28]</sup>

## **Demolition**

[edit]

Main article: Demolition

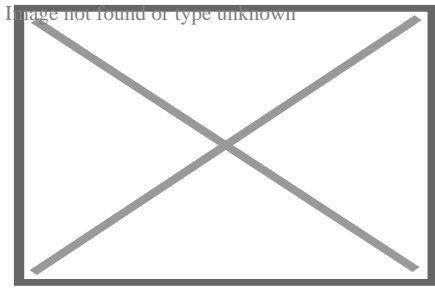
Demolition is the discipline of safely and efficiently tearing down buildings and other artificial structures. Demolition contrasts with deconstruction, which involves taking a building apart while carefully preserving valuable elements for reuse purposes (recycling – see also circular economy).

## **Industry scale and characteristics**

[edit]

## **Economic activity**

[edit]



Helicopter view of the Atacama Large Millimeter/submillimeter Array (ALMA) Operations Support Facility (OSF) construction site

The output of the global construction industry was worth an estimated \$10.8 trillion in 2017, and in 2018 was forecast to rise to \$12.9 trillion by 2022,<sup>[29]</sup> and to around \$14.8 trillion in 2030.<sup>[3]</sup> As a sector, construction accounts for more than 10% of global GDP (in developed countries, construction comprises 6–9% of GDP),<sup>[30]</sup> and employs around 7% of the total employed workforce around the globe<sup>[31]</sup> (accounting for over 273 million full- and part-time jobs in 2014).<sup>[32]</sup> Since 2010,<sup>[33]</sup> China has been the world's largest single construction market.<sup>[34]</sup> The United States is the second largest construction market with a 2018 output of \$1.581 trillion.<sup>[35]</sup>

- In the United States in February 2020, around \$1.4 trillion worth of construction work was in progress, according to the Census Bureau, of which just over \$1.0 trillion was for the private sector (split roughly 55:45% between residential and nonresidential); the remainder was public sector, predominantly for state and local government.<sup>[36]</sup>
- In Armenia, the construction sector experienced growth during the latter part of 2000s. Based on National Statistical Service, Armenia's construction sector generated approximately 20% of Armenia's GDP during the first and second quarters of 2007. In 2009, according to the World Bank, 30% of Armenia's economy was from construction sector.<sup>[37]</sup>
- In Vietnam, the construction industry plays an important role in the national economy.<sup>[38][39][40]</sup> The Vietnamese construction industry has been one of the fastest growing in the Asia-Pacific region in recent years.<sup>[41][42]</sup> The market was valued at nearly \$60 billion in 2021.<sup>[43]</sup> In the first half of 2022, Vietnam's construction industry growth rate reached 5.59%.<sup>[43][44][45]</sup> In 2022, Vietnam's construction industry accounted for more than 6% of the country's GDP,

equivalent to over 589.7 billion Vietnamese dong.<sup>[46][47]</sup> The industry of industry and construction accounts for 38.26% of Vietnam's GDP.<sup>[48][49][50]</sup> At the same time, the industry is one of the most attractive industries for foreign direct investment (FDI) in recent years.<sup>[51][52][53]</sup>

Construction is a major source of employment in most countries; high reliance on small businesses, and under-representation of women are common traits. For example:

- In the US, construction employed around 11.4m people in 2020, with a further 1.8m employed in architectural, engineering, and related professional services – equivalent to just over 8% of the total US workforce.<sup>[54]</sup> The construction workers were employed in over 843,000 organisations, of which 838,000 were privately held businesses.<sup>[55]</sup> In March 2016, 60.4% of construction workers were employed by businesses with fewer than 50 staff.<sup>[56]</sup> Women are substantially underrepresented (relative to their share of total employment), comprising 10.3% of the US construction workforce, and 25.9% of professional services workers, in 2019.<sup>[54]</sup>
- The United Kingdom construction sector contributed £117 billion (6%) to UK GDP in 2018, and in 2019 employed 2.4m workers (6.6% of all jobs). These worked either for 343,000 'registered' construction businesses, or for 'unregistered' businesses, typically self-employed contractors;<sup>[57]</sup> just over one million small/medium-sized businesses, mainly self-employed individuals, worked in the sector in 2019, comprising about 18% of all UK businesses.<sup>[58]</sup> Women comprised 12.5% of the UK construction workforce.<sup>[59]</sup>

According to McKinsey research, productivity growth per worker in construction has lagged behind many other industries across different countries including in the United States and in European countries. In the United States, construction productivity per worker has declined by half since the 1960s.<sup>[60]</sup>

## **Construction GVA by country**

[edit]

List of countries with the largest construction Gross Value Added in 2018



## Economy

## Construction GVA in 2018 (billions in USD)

- (01)  **China** 934.2
- (02)  **United States** 839.1
- (03)  **Japan** 275.5
- (04)  **India** 201.2
- (05)  **Germany** 180.5
- (06)  **United Kingdom** 154.7
- (07)  **France** 138.7
- (08)  **Canada** 125.4
- (09)  **Russia** 121.2
- (10)  **Australia** 111.8
- (11)  **Indonesia** 109.7
- (12)  **South Korea** 93.0
- (13)  **Brazil** 92.6
- (14)  **Mexico** 89.0
- (15)  **Spain** 80.0

(16)  **Italy** 78.9

(17)  **Turkey** 55.3

(18)  **Saudi Arabia** 40.2

(19)  **Netherlands** 39.5

(20)  **Poland** 39.4

(21)  **Switzerland** 36.3

(22)  **United Arab Emirates** 34.5

(23)  **Sweden** 33.3

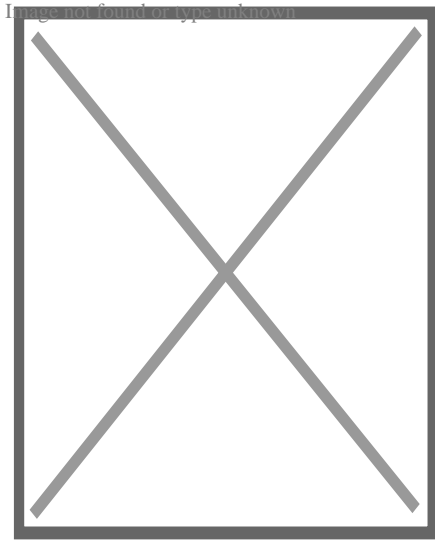
(24)  **Austria** 27.2

(25)  **Qatar** 27.0

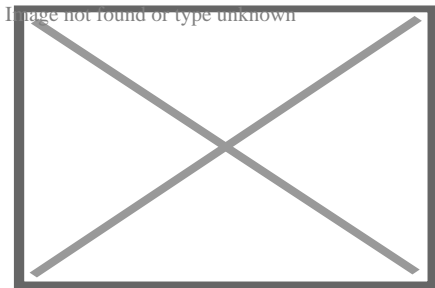
The twenty-five largest countries in the world by construction GVA (2018)<sup>[61]</sup>

## Employment

[edit]



Ironworkers erecting the steel frame of a new building at Massachusetts General Hospital in Boston



A truck operator at Al Gamil, the largest construction company in Djibouti

Some workers may be engaged in manual labour<sup>[62]</sup> as unskilled or semi-skilled workers; they may be skilled tradespeople; or they may be supervisory or managerial personnel. Under safety legislation in the United Kingdom, for example, construction workers are defined as people "who work for or under the control of a contractor on a construction site";<sup>[63]</sup> in Canada, this can include people whose work includes ensuring conformance with building codes and regulations, and those who supervise other workers.<sup>[64]</sup>

Laborers comprise a large grouping in most national construction industries. In the United States, for example, in May 2021 the construction sector employed just over 7.5 million people, of whom just over 820,000 were laborers, while 573,000 were carpenters, 508,000 were electricians, 258,000 were equipment operators and 230,000 were construction managers.<sup>[65]</sup> Like most business sectors, there is also

substantial white-collar employment in construction – 681,000 US workers were recorded by the United States Department of Labor as in 'office and administrative support occupations' in May 2021.<sup>[66]</sup>

Large-scale construction requires collaboration across multiple disciplines. A project manager normally manages the budget on the job, and a construction manager, design engineer, construction engineer or architect supervises it. Those involved with the design and execution must consider zoning requirements and legal issues, environmental impact of the project, scheduling, budgeting and bidding, construction site safety, availability and transportation of building materials, logistics, and inconvenience to the public, including those caused by construction delays.

Some models and policy-making organisations promote the engagement of local labour in construction projects as a means of tackling social exclusion and addressing skill shortages. In the UK, the Joseph Rowntree Foundation reported in 2000 on 25 projects which had aimed to offer training and employment opportunities for locally based school leavers and unemployed people.<sup>[67]</sup> The Foundation published "a good practice resource book" in this regard at the same time.<sup>[68]</sup> Use of local labour and local materials were specified for the construction of the Danish Storebaelt bridge, but there were legal issues which were challenged in court and addressed by the European Court of Justice in 1993. The court held that a contract condition requiring use of local labour and local materials was incompatible with EU treaty principles.<sup>[69]</sup> Later UK guidance noted that social and employment clauses, where used, must be compatible with relevant EU regulation.<sup>[70]</sup> Employment of local labour was identified as one of several social issues which could potentially be incorporated in a sustainable procurement approach, although the interdepartmental *Sustainable Procurement Group* recognised that "there is far less scope to incorporate [such] social issues in public procurement than is the case with environmental issues".<sup>[71]</sup>

There are many routes to the different careers within the construction industry. There are three main tiers of construction workers based on educational background and training, which vary by country:

## **Unskilled and semi-skilled workers**

[edit]

Unskilled and semi-skilled workers provide general site labor, often have few or no construction qualifications, and may receive basic site training.

## **Skilled tradespeople**

[edit]

See also: List of construction trades

Skilled tradespeople have typically served apprenticeships (sometimes in labor unions) or received technical training; this group also includes on-site managers who possess extensive knowledge and experience in their craft or profession. Skilled manual occupations include carpenters, electricians, plumbers, ironworkers, heavy equipment operators and masons, as well as those involved in project management. In the UK these require further education qualifications, often in vocational subject areas, undertaken either directly after completing compulsory education or through "on the job" apprenticeships.<sup>[72]</sup>

## **Professional, technical or managerial personnel**

[edit]

Professional, technical and managerial personnel often have higher education qualifications, usually graduate degrees, and are trained to design and manage construction processes. These roles require more training as they demand greater technical knowledge, and involve more legal responsibility. Example roles (and qualification routes) include:

- Architect – Will usually have studied architecture to degree level, and then undertaken further study and gained professional experience. In many countries, the title of "architect" is protected by law, strictly limiting its use to

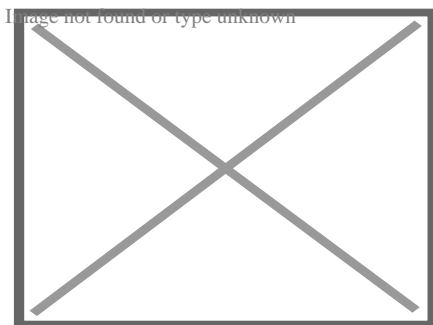
qualified people.

- Civil engineer – Typically holds a degree in a related subject and may only be eligible for membership of a professional institution (such as the UK's ICE) following completion of additional training and experience. In some jurisdictions, a new university graduate must hold a master's degree to become chartered,[<sup>a</sup>] and persons with bachelor's degrees may become Incorporated Engineers.
- Building services engineer – May also be referred to as an "M&E" or "mechanical, electrical, and plumbing (MEP) engineer" and typically holds a degree in mechanical or electrical engineering.[<sup>a</sup>]
- Project manager – Typically holds a 4-year or greater higher education qualification, but are often also qualified in another field such as architecture, civil engineering or quantity surveying.
- Structural engineer – Typically holds a bachelor's or master's degree in structural engineering.[<sup>a</sup>]
- Quantity surveyor – Typically holds a bachelor's degree in quantity surveying. UK chartered status is gained from the Royal Institution of Chartered Surveyors.

## Safety

[edit]

See also: Construction site safety



At-risk workers without appropriate safety equipment

Construction is one of the most dangerous occupations in the world, incurring more occupational fatalities than any other sector in both the United States and in the European Union.[<sup>4</sup>][<sup>73</sup>] In the US in 2019, 1,061, or about 20%, of worker fatalities in private industry occurred in construction.[<sup>4</sup>] In 2017, more than a third of US

construction fatalities (366 out of 971 total fatalities) were the result of falls;<sup>[74]</sup> in the UK, half of the average 36 fatalities per annum over a five-year period to 2021 were attributed to falls from height.<sup>[75]</sup> Proper safety equipment such as harnesses, hard hats and guardrails and procedures such as securing ladders and inspecting scaffolding can curtail the risk of occupational injuries in the construction industry.<sup>[76]</sup> Other major causes of fatalities in the construction industry include electrocution, transportation accidents, and trench cave-ins.<sup>[77]</sup>

Other safety risks for workers in construction include hearing loss due to high noise exposure, musculoskeletal injury, chemical exposure, and high levels of stress.<sup>[78]</sup> Besides that, the high turnover of workers in construction industry imposes a huge challenge of accomplishing the restructuring of work practices in individual workplaces or with individual workers.<sup>[citation needed]</sup> Construction has been identified by the National Institute for Occupational Safety and Health (NIOSH) as a priority industry sector in the National Occupational Research Agenda (NORA) to identify and provide intervention strategies regarding occupational health and safety issues.<sup>[79]</sup><sup>[80]</sup> A study conducted in 2022 found "significant effect of air pollution exposure on construction-related injuries and fatalities", especially with the exposure of nitrogen dioxide.<sup>[81]</sup>

## **Sustainability**

[edit]

Main article: Sustainability in construction

Sustainability is an aspect of "green building", defined by the United States Environmental Protection Agency (EPA) as "the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction."<sup>[82]</sup>

## **Decarbonising construction**

[edit]

The construction industry may require transformation at pace and at scale if it is to successfully contribute to achieving the target set out in The Paris Agreement of limiting global temperature rise to 1.5C above industrial levels.<sup>[83]</sup><sup>[84]</sup> The World Green Building Council has stated the buildings and infrastructure around the world can reach 40% less embodied carbon emissions but that this can only be achieved through urgent transformation.<sup>[85]</sup><sup>[86]</sup>

Conclusions from industry leaders have suggested that the net zero transformation is likely to be challenging for the construction industry, but it does present an opportunity. Action is demanded from governments, standards bodies, the construction sector, and the engineering profession to meet the decarbonising targets.<sup>[87]</sup>

In 2021, the National Engineering Policy Centre published its report *Decarbonising Construction: Building a new net zero industry*,<sup>[87]</sup> which outlined key areas to decarbonise the construction sector and the wider built environment. This report set out around 20 different recommendations to transform and decarbonise the construction sector, including recommendations for engineers, the construction industry and decision makers, plus outlined six-overarching 'system levers' where action taken now will result in rapid decarbonisation of the construction sector.<sup>[87]</sup> These levels are:

- Setting and stipulating progressive targets for carbon reduction
- Embedding quantitative whole-life carbon assessment into public procurement
- Increasing design efficiency, materials reuse and retrofit of buildings
- Improving whole-life carbon performance
- Improving skills for net zero
- Adopting a joined up, systems approach to decarbonisation across the construction sector and with other sectors

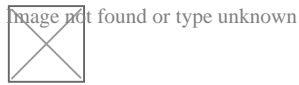
Progress is being made internationally to decarbonise the sector including improvements to sustainable procurement practice such as the CO2 performance ladder in the Netherlands and the Danish Partnership for Green Public Procurement.<sup>[88]</sup><sup>[89]</sup> There are also now demonstrations of applying the principles of circular



economy practices in practice such as Circl, ABN AMRO's sustainable pavilion and the Brighton Waste House.<sup>[90][91][92]</sup>

## See also

[edit]



Look up **construction** in Wiktionary, the free dictionary.

- Agile construction – Management system in the construction industry
- Building material – Material which is used for construction purposes
- Civil engineering – Engineering discipline focused on physical infrastructure
- Commissioning (construction) – Process to ensure that all building systems perform according to the "Design Intent"
- Environmental impact of concrete
- Impervious surface – Artificial structures such as pavements covered with water-tight materials
- Index of construction articles
- Land degradation – Gradual destruction of land
- List of tallest structures
- List of tallest structures built before the 20th century
- Modern methods of construction
- Outline of construction – Overview of and topical guide to construction
- Real estate development – Process that creates or renovates new or existing spaces
- Structural robustness – Ability of a structure to withstand physical strain
- Umarell – Bolognese slang term

 Architecture portal

 Engineering portal

## Notes

[edit]

- <sup>^</sup> **abc** In the UK, the Chartered Engineer qualification is controlled by the Engineering Council, and is often achieved through membership of the relevant

professional institution (ICE, CIBSE, IStructE, etc).

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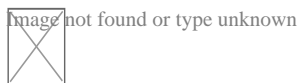
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Construction

### Types

- Home construction
- Offshore construction
- Underground construction
  - Tunnel construction

## **History**

- Architecture
- Construction
- Structural engineering
- Timeline of architecture
- Water supply and sanitation
- Architect
- Building engineer
- Building estimator
- Building officials
- Chartered Building Surveyor
- Civil engineer

## **Professions**

- Civil estimator
- Clerk of works
- Project manager
- Quantity surveyor
- Site manager
- Structural engineer
- Superintendent



**Trades  
workers  
(List)**

- Banksman
- Boilermaker
- Bricklayer
- Carpenter
- Concrete finisher
- Construction foreman
- Construction worker
- Electrician
- Glazier
- Ironworker
- Millwright
- Plasterer
- Plumber
- Roofer
- Steel fixer
- Welder

## **Organizations**

- American Institute of Constructors (AIC)
- American Society of Civil Engineers (ASCE)
- Asbestos Testing and Consultancy Association (ATAC)
- Associated General Contractors of America (AGC)
- Association of Plumbing and Heating Contractors (APHC)
- Build UK
- Construction History Society
- Chartered Institution of Civil Engineering Surveyors (CICES)
- Chartered Institute of Plumbing and Heating Engineering (CIPHE)
- Civil Engineering Contractors Association (CECA)
- The Concrete Society
- Construction Management Association of America (CMAA)
- Construction Specifications Institute (CSI)
- FIDIC
- Home Builders Federation (HBF)
- Lighting Association
- National Association of Home Builders (NAHB)
- National Association of Women in Construction (NAWIC)
- National Fire Protection Association (NFPA)
- National Kitchen & Bath Association (NKBA)
- National Railroad Construction and Maintenance Association (NRC)
- National Tile Contractors Association (NTCA)
- Railway Tie Association (RTA)
- Royal Institution of Chartered Surveyors (RICS)
- Scottish Building Federation (SBF)
- Society of Construction Arbitrators

**By country**

- India
- Iran
- Japan
- Romania
- Turkey
- United Kingdom
- United States

**Regulation**

- Building code
- Construction law
- Site safety
- Zoning
- Style

**Architecture**

- List
- Industrial architecture
  - British
- Indigenous architecture
- Interior architecture
- Landscape architecture
- Vernacular architecture
- Architectural engineering
- Building services engineering
- Civil engineering

**Engineering**

- Coastal engineering
- Construction engineering
- Structural engineering
- Earthquake engineering
- Environmental engineering
- Geotechnical engineering
- List

**Methods**

- Earthbag construction
- Modern methods of construction
- Monocrete construction
- Slip forming

- Building material
  - List of building materials
  - Millwork
- Construction bidding
- Construction delay
- Construction equipment theft
- Construction loan
- Construction management
- Construction waste
- Demolition
- Design–build
- Design–bid–build
- DfMA
- Heavy equipment
- Interior design
- Lists of buildings and structures
  - List of tallest buildings and structures
- Megaproject
- Megastructure
- Plasterwork
  - Damp
    - Proofing
  - Parge coat
  - Roughcast
    - Harling
- Real estate development
- Stonemasonry
- Sustainability in construction
- Unfinished building
- Urban design
- Urban planning

## Other topics

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## Construction industry by country

- Canada
- India
- Iran
- Japan
- Hong Kong SAR
- Romania
- United Kingdom
- United States

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## Tallest buildings and structures

- History
- Skyscraper
- Storey

**By region**

- Africa
- Asia
  - Indian subcontinent
  - Southeast
- Europe
  - Balkans
  - Baltic states
  - Scandinavia
- Oceania
- The Americas
  - North America
  - Central America
  - Latin America
  - South America
- Albania
- Algeria
- Argentina
- Australia
- Austria
- Azerbaijan
- Bangladesh
- Bolivia
- Bosnia and Herzegovina
- Brazil
- Bulgaria
- Cambodia
- Canada
- Chile
- China (Hong Kong, Macau)
- Colombia
- Croatia
- Cyprus
- Czech Republic
- Denmark
- Ecuador
- Estonia

**By region**

- Africa
- Asia
  - West Asia
- Europe
  - former Soviet Union
- The Americas
  - South America

- Afghanistan
- Albania
- Algeria
- Armenia
- Australia
- Austria
- Bahrain
- Belgium
- Bulgaria
- Canada
- China
- Czech Republic
- Denmark
- Egypt
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- India
- Indonesia
- Iran
- Ireland

**By country**

- Italy
- Japan
- Kosovo
- Luxembourg

**Structures**

**Related topics**

- Additionally guyed tower
- Air traffic obstacle
- All buildings and structures
- Antenna height considerations
- Architectural engineering
- Construction
- Early skyscrapers
- Fires
- Groundscraper
- Height restriction laws
- List of visionary tall buildings and structures
- Oil platform
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- Tower block

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## About Davidson County

**Davidson County** is the name of two counties in the United States:

- Davidson County, North Carolina
- Davidson County, Tennessee

## Disambiguation icon

This disambiguation page lists articles about distinct geographical locations with the same name.

If an internal link led you here, you may wish to change the link to point directly to the intended article.

## About United Structural Systems of Illinois, Inc



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Things To Do in Cook County

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Photo

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WNDR Museum

4 (3534)

Photo

## **Shedd Aquarium**

**4.5 (30373)**

### **Photo**

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## **Jackson (Andrew) Park**

**4.6 (7263)**

### **Photo**

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## **The Art Institute of Chicago**

**4.8 (34003)**

### **Photo**

## **Chicago's Chinatown Gateway**

**4.4 (422)**

### **Photo**

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## **Willis Tower**

**4.5 (21504)**

## **Driving Directions in Cook County**

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**Driving Directions From Hoffman Estates Park District to United Structural Systems of Illinois, Inc**

**Driving Directions From AMC South Barrington 24 to United Structural Systems of Illinois, Inc**

**Driving Directions From Hampton Inn & Suites Chicago/Hoffman Estates to United Structural Systems of Illinois, Inc**

**Driving Directions From Barrington Lakes Apartments to United Structural Systems of Illinois, Inc**

**Waterproofing service**

**Concrete contractor**

**Structural engineer**

**foundation repair near me**

**foundation crack repair service**

**Driving Directions From Millennium Park to United Structural Systems of Illinois, Inc**

**Driving Directions From Glessner House to United Structural Systems of Illinois, Inc**

**Driving Directions From Jackson (Andrew) Park to United Structural Systems of Illinois, Inc**

**Driving Directions From Jackson (Andrew) Park to United Structural Systems of Illinois, Inc**

**Driving Directions From WNDR Museum to United Structural Systems of Illinois, Inc**

**Driving Directions From The Art Institute of Chicago to United Structural Systems of Illinois, Inc**

**foundation repair near me**

**foundation crack repair service**

**foundation crack repair**

**foundationcrack repair companies**

**Waterproofing service**

**Concrete contractor**

## **Reviews for United Structural Systems of Illinois, Inc**

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### **United Structural Systems of Illinois, Inc**

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Paul Gunderlock

**(4)**

The staff was helpful, very nice and easy to work with and completed the work timely and cleaned up well. Communications faltered a bit at times and there was an email communications glitch which was no fault of anyone, but no big deal and all ended up fine. We sure feel better to have this done and hope that is the end of our structural issues. It does seem like (after talking to several related companies), that it would be great if some of these related companies had a structural engineer on staff vs using on the job expertise gained over years – which is definitely valuable! But leaves a bit of uncertainty – and probably saves money for both sides may be the trade-off? So far, so good though! Thank you.

### **United Structural Systems of Illinois, Inc**

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Sarah McNeily

**(5)**

USS was excellent. They are honest, straightforward, trustworthy, and conscientious. They thoughtfully removed the flowers and flower bulbs to dig where they needed in the yard, replanted said flowers and spread the extra dirt to fill in an area of the yard. We've had other services from different companies and our yard was really a mess after. They kept the job site meticulously clean. The crew was on time and friendly. I'd recommend them any day! Thanks to Jessie and crew.

## United Structural Systems of Illinois, Inc

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Jim de Leon

(5)

It was a pleasure to work with Rick and his crew. From the beginning, Rick listened to my concerns and what I wished to accomplish. Out of the 6 contractors that quoted the project, Rick seemed the MOST willing to accommodate my wishes. His pricing was definitely more than fair as well. I had 10 push piers installed to stabilize and lift an addition of my house. The project commenced at the date that Rick had disclosed initially and it was completed within the same time period expected (based on Rick's original assessment). The crew was well informed, courteous, and hard working. They were not loud (even while equipment was being utilized) and were well spoken. My neighbors were very impressed on how polite they were when they entered / exited my property (saying hello or good morning each day when they crossed paths). You can tell they care about the customer concerns. They ensured that the property would be put back as clean as possible by placing MANY sheets of plywood down prior to excavating. They compacted the dirt back in the holes extremely well to avoid large stock piles of soils. All the while, the main office was calling me to discuss updates and expectations of completion. They provided waivers of lien, certificates of insurance, properly acquired permits, and JULIE locates. From a construction background, I can tell you that I did not see any flaws in the way they operated and this an extremely professional company. The pictures attached show the push piers added to the foundation (pictures 1, 2 & 3), the amount of excavation (picture 4), and the restoration after dirt was placed back in the pits and compacted (pictures 5, 6 & 7). Please notice that they also sealed two large cracks and steel plated these cracks from expanding further (which you can see under my sliding glass door). I, as well as my wife, are extremely happy that we chose United Structural Systems for our contractor. I would happily tell any of my friends and family to use this contractor should the opportunity arise!

## United Structural Systems of Illinois, Inc

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Chris Abplanalp

(5)

USS did an amazing job on my underpinning on my house, they were also very courteous to the proximity of my property line next to my neighbor. They kept things in order with all the dirt/mud they had to excavate. They were done exactly in the timeframe they indicated, and the contract was very details oriented with drawings of what would be done. Only thing that would have been nice, is they left my concrete a little muddy with boot prints but again, all-in-all a great job

## United Structural Systems of Illinois, Inc

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Dave Kari

(5)

What a fantastic experience! Owner Rick Thomas is a trustworthy professional. Nick and the crew are hard working, knowledgeable and experienced. I interviewed every company in the area, big and small. A homeowner never wants to hear that they have foundation issues. Out of every company, I trusted USS the most, and it paid off in the end. Highly recommend.

Evaluating Temperature Fluctuations and Their Impact on Slab Integrity [View GBP](#)

United Structural Systems of Illinois, Inc

Phone : +18473822882

City : Hoffman Estates

State : IL

Zip : 60169

Address : Unknown Address

### Google Business Profile

Company Website : <https://www.unitedstructuralsystems.com/>

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