

Exploring the Health Benefits of Off-Site Construction

January 2024

Key Takeaways

- Modular construction of homes in controlled factory settings reduces the risk of mold growing during storage, enhancing indoor air quality and minimizing health risks associated with mold exposure.
- Off-site construction can reduce risks associated with adverse weather conditions and other on-site hazards that cause accidents and injuries to construction workers.
- Off-site construction methods lead to faster project completion, reducing workers' exposure to construction hazards like noise, dust, and hazardous materials, and benefiting the community by minimizing the duration of construction-related disruptions.
- Off-site construction processes typically generate less construction waste than traditional on-site construction.
- During catastrophic events, off-site construction can offer rapid reconstruction of structures and modular health care solutions.

Figure 1: Summary of benefits of off-site construction

	Potential Improvement Over Conventional Construction	Social Benefit
Health and Safety	Up to 80%	Large
Improved Working Conditions	Significant	Significant
Reduced Road Traffic Movements	Up to 60%	Significant
Reduced Waste	Up to 90%	Significant
Faster Construction	Up to 60%	Significant

Courtesy of [Building Intellect, Off-Site Construction Report, 2013.](#)

Introduction

Off-site construction refers to the process of assembling building components or modules in a factory or off-site location and then transporting them to a construction site for final installation. This method of construction provides excellent value for health benefits, both in terms of individuals and the overall well-being of communities. This resource explores the ways in which off-site construction and health are interconnected.



Indoor Air Quality

Modular homes are constructed in controlled factory settings where factors like temperature, humidity, and air quality can be carefully regulated. By storing building materials in these controlled environments, the risk of mold growing during storage is reduced when compared to typical construction, where building materials are often kept outdoors exposed to the natural elements for months. As a result, when these preassembled components are transported to the construction site and assembled into a home, indoor air quality is improved since the materials are less likely to carry mold or other harmful components.

Enhanced Safety Measures

Based on the U.S. Bureau of Labor Statistics report, in 2021, there were 951 fatal injuries¹ and 26,900 nonfatal work injuries² in typical building construction. A factory-controlled environment reduces the risks associated with adverse weather conditions and other on-site hazards that cause accidents and injuries to construction workers. Off-site construction processes often incorporate advanced manufacturing techniques and precision engineering, which also lead to better safety outcomes. For example, builders exercise much greater control over the worksite in a factory environment than in the field, and many jurisdictions have rules forbidding the use of ladders greater than six feet long in a factory environment.³ These safer job-site conditions lead to fewer on-the-job injuries that typically occur in the field. Components are built to precise specifications, reducing the likelihood of errors or construction defects that could compromise structural integrity. By prioritizing safety, off-site construction can help protect the health and well-being of construction workers and future occupants.

Noise Reduction

Off-site construction can significantly reduce construction noise at sites. Since a sizable portion of the building is manufactured off-site, noisy activities, such as cutting, drilling, and heavy machinery operation, are minimized at the construction site. The amount of time needed at a construction site is also reduced, minimizing the length of construction noise overall. Reduced noise levels can have positive impacts on the health and well-being of nearby residents, as prolonged exposure to construction noise can lead to stress, sleep disturbances, and other health issues.

¹ Bureau of Labor Statistics. 2022. "National Census of Fatal Occupational Injuries in 2021." U.S. Department of Labor. December 16. <https://www.bls.gov/news.release/pdf/cfoi.pdf>.

² United States Bureau of Labor Statistics. "Number and Rate of Nonfatal Work Injuries in Detailed Private Industries in 2021." <https://www.bls.gov/charts/injuries-and-illnesses/number-and-rate-of-nonfatal-work-injuries-by-industry-subsector.htm>.

³ Hardiman, T. 2021. "NEEP/MEEA Webinar: Residential Off-Site Construction: Where Has It Been, and Where Is It Going?" October. <https://www.mwalliance.org/events/residential-site-construction-where-has-it-been-and-where-it-going>.



Reduced Construction Time

Off-site construction methods often result in faster project completion compared to traditional on-site construction. Since building components are manufactured off-site, the construction process can proceed simultaneously at the site, reducing overall construction time. This shortened construction period can minimize exposure of workers to construction hazards, such as noise, dust, and hazardous materials, thereby improving their health and safety. The shortened construction time also benefits the community by decreasing the time with a hazardous construction area in the neighborhood.

Enhanced Thermal Comfort

Off-site construction often incorporates advanced insulation materials and techniques, leading to improved thermal performance of buildings. To achieve thermal comfort, precise execution of construction work is essential. Modular construction has extensive quality control that allows monitoring and testing at each phase of construction to identify and fix any potential flaws that could result in decreased thermal comfort. This can result in energy savings and contribute to occupant comfort, which is essential for maintaining good health.

Rapid Response in Disaster-Prone Areas

In disaster-prone areas, quick and resilient reconstruction is vital for community recovery and the well-being of affected populations. Off-site construction can speed up the rebuild process where prefabricated components can quickly be deployed. Furthermore, it can alleviate the strain on local contractors, who will face overwhelming demand during emergencies. This approach not only promotes equitable distribution of resources but also serves as a buffer against potential price surges by maintaining stable costs, even if local contractors increase their prices in the aftermath of a crisis. By reducing scheduling pressures and price fluctuations, off-site construction becomes a practical approach for efficient and fair reconstruction. In addition, off-site construction can offer versatile modules that can be deployed in an abbreviated period of time and used as temporary shelters or medical facilities during emergency responses. By swiftly responding to areas affected by catastrophic events, off-site construction can contribute to the health and safety of occupants in disaster-prone areas.

Reduced Construction Waste

The U.S. Environmental Protection Agency reported 600 million tons of construction and demolition waste generated in the United States in 2018.⁴ Off-site construction processes typically generate less construction waste than traditional on-site construction.⁵ The controlled factory environment allows for efficient material

⁴ United States Environmental Protection Agency. Construction and Demolition Debris: Material-Specific Data. Accessed on June 20, 2023. Available at: <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/construction-and-demolition-debris-material>.

⁵ Waste and Resources Action Programme. Waste Reduction Potential of Offsite Volumetric Construction, WAS 003-003: Offsite Construction Case Study. Available at: <https://www.howickltd.com/asset/327.pdf>.



usage and better waste management practices. Minimizing construction waste reduces environmental pollution and potential health hazards associated with the disposal of construction debris. One potential health hazard associated with on-site construction debris, which might not be prevalent with off-site construction debris, is the increased risk of accidents and injuries due to the proximity of the debris to workers. On-site construction debris can create tripping hazards, obstruct pathways, and increase the risk of falls and injuries among construction workers. In off-site construction, debris is typically generated in a controlled and contained environment, which can reduce the immediate exposure of workers to debris-related hazards.

Modular Healthcare Solutions

Off-site construction can offer modular solutions specifically tailored for healthcare facilities. Modular healthcare units, such as mobile clinics or temporary hospitals, can be rapidly deployed in response to emergencies or in underserved areas. These modular units provide immediate access to healthcare services, promoting public health and improving the overall healthcare infrastructure.

Conclusion

Off-site construction, with its many advantages, can greatly impact the health and well-being of individuals and communities. The benefits of building in a controlled factory environment can lead to improved indoor air quality by reducing mold growth, while also prioritizing safety through advanced manufacturing techniques, minimizing hazards and injuries for workers and future occupants. Furthermore, off-site construction shortens construction timelines and reduces on-site noise, improving the well-being of residents and workers. The controlled factory environment and the precise engineering contribute to the reduction of construction waste, lessening environmental pollution and its related health risks. Additionally, off-site construction can offer rapid reconstruction of structures in catastrophic events, and modular healthcare solutions, further strengthening public health. It is important to note that while off-site construction offers potential health benefits, proper design, construction, and maintenance practices are still essential to ensure the overall health and well-being of residents and communities.



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