The Exploitation of Construction Workers

What innovative architectural approaches protect the health, safety, and well-being of (Migrant) construction workers to ensure the industry's sustainability?

WA XIA

Fig1. my interest in UK labour exploitation on construction workers (2024)

C O N T E N T S

Fig2-3. Lunch atop a Skyscraper (1932)

Introduction:

My interest in the topic started after the recent labour strikes in the UK in the past two years. Coming from China, where workers are silent, this is a notable juncture, representing my first exposure to the influential dynamics of civil liberties and workers' mobilisation. Worker strike actions have been an enduring phenomenon in the UK's history, neither a first occurrence nor likely the last. While wandering in Peckham, I encountered construction workers repairing roads and buildings. In the building and construction industry, apart from architects, the most crucial role is played by construction workers. In recent years, construction workers' working environment and well-being have not been discussed enough from the perspective of architecture and space. As agreed by Emuze (2017, p. 8), 'Construction work is undertaken in an industry that is structured and cultured in ways unfavourable to the health, safety, and well-being of its people.' In this thesis, I will investigate modern slavery, sustainable materials, modular construction, and mass timber production. I am focusing on the workers' health, safety, and well-being (HSW) and analysing the sustainability of construction workers within the architectural and construction industries. The thesis will first provide a brief overview of construction worker's labour strikes in the UK; the second section will focus on labour exploitation and modern slavery. The third section will present case studies, proposing potential solutions to address three pressing issues in the industry: health, safety, and well-being, including the wellness garden, the health hub, and the modular wood system. Finally, the journal will provide a personalised brief for the graduation project, focusing on the practicality and design approaches to achieving sustainability within the construction sector.

Sustainability is commonly understood through three pillars: environmental, social, and economic, as described by Eklová (2020). While environmental impacts on sustainability have been notably emphasised in the construction industry, Eklová highlights the necessity for a balanced approach that includes economic, environmental, and social factors (Eklová, 2020, pp. 9–10). Therefore, I will attend to the social factors influencing sustainability within this sector. With my interest in labour exploitation and workers' HSW, I aim to identify the issues affecting the social sustainability of the construction industry and provide solutions to centre the HSW of construction workers.

Since 2022, the UK has been experiencing the most turbulent economic environment, where economic and political unsustainability has led to the most disruptive strikes in over 30 years (Cominetti et al., 2023, p. 1). In the construction industry, over 3,000 engineering construction workers at Exxon Mobil's Mossmorran, Altrad's Torness, GSK's Montrose, and Wilton International's Redcar, represented by the Unite Union, voted for a strike over pay in 2023 (Unite the Union, 2023; Parker-Dean, 2024). In the early stages of negotiations, they rejected a pay offer of 10% for 2024 and 5% for 2025, arguing it failed to make up for actual wage losses since the pandemic (Unite the Union, 2023). In recent news, the workers have agreed to a pay increase exceeding 17% spread over two years, leading to the cancellation of a strike threatening the construction industry (Parker-Dean, 2024). The strike has led me to explore the factors behind it and heightened my interest in workforce rights. In particular, the compensation and working conditions of UK construction workers have drawn my attention to the issue of labour exploitation, especially modern slavery in the industry.

Modern slavery, which includes forced labour, forced marriages, and human trafficking, involves exploitation where individuals cannot refuse or escape due to threats, violence, deceit, abuse of power, or coercion (International Labour Organization (ILO), 2022, p. 2). In the construction sector, the most common form of modern slavery is forced labour; globally, 2.6 million people in this industry suffer from forced labour exploitation (ILO, 2022, p. 32). While the construction industry plays a substantial role in bolstering the UK economy, it simultaneously faces a heightened risk of exploitation, eventually affecting its sustainability. Some of the critical issues that significantly heighten the susceptibility of the sector to exploitation are unpredictable work schedules, informal recruitment and termination procedures, complicated subcontracting chains, insufficient regulation of contracts and salaries, discrimination and inappropriate behaviour, and the prevalence of various vulnerable groups, mainly migrant workers (Focus on Labour Exploitation (FLEX), 2018, p. 2). A recent survey regarding London's construction workforce presents alarming statistics: half of the workers do not have written contracts, over a third have not been compensated for their work, more than half work in unsafe conditions, a significant portion do not fully understand deductions on their pay slips, and a third have faced verbal or physical abuse at their job (Flex, 2018, p. 8). While these statistics may not capture the entirety of the industry, they undeniably illustrate that a considerable portion of the construction workforce endures varying degrees of exploitation, affecting both their physical safety and mental health.

Marx's exploitation theory underscores the plight of workers, who, due to economic vulnerability, have no choice but to engage in labor transactions with the owning class for basic survival. In turn, this class earns profits from the surplus labour of the workers. While it appears to be an equitable exchange of interests, this 'forced labour' exemplifies deeper power imbalances and class distinctions (Hardt & Weeks, 2020). Migrant construction workers, who are particularly vulnerable due to their familial responsibilities, unstable living conditions, and limited English language skills, account for 44% of the lower-wage portion of the UK construction labour force and rank among the most heavily exploited groups (Flex, 2018, p. 4). Their frequently unstable living conditions align perfectly with the industry's demand for a flexible labour force, and their familial responsibilities compel them to accept any available job, frequently without formal contracts. As Cristiana Bastos, Andre Novoa, and Salazar highlight, drawing from Marx's earlier theories, "a mobile labour reserve is essential for maintaining low wages to facilitate capital accumulation (cited in Bernardi et al., 2023, p. 205)." Consequently, the construction industry may prioritise employing mobile migrant workers to minimise expenses. Their adaptability and mobility significantly contribute to their heightened vulnerability to exploitation. Moreover, limited English language skills further hinder their ability to navigate the sector's chaotic regulatory and management landscapes, making it challenging for them to maintain their rights. Due to improper immigrant management, increasingly stricter immigration policy, inadequate legal protection, and weak implementation of legislations and rules, their risks of being exploited are significantly lifted, facing the threats of accusation and deportation (International Labour Organization (ILO), 2022, p. 41). In addition, FLEX (2018) found that many respondents have experienced other forms of abuse, particularly in health, safety, and discrimination. For example, in the investigation study by FLEX (2018), an immigrant claimed that when sweeping the ceiling, he only used a temporary cable to tie around his waist (FLEX, 2018, p. 24). Evidence has proved that construction workers are facing the risk of being exploited, and their safety and welfare are hampered, given their economic vulnerability. The plight of migrant workers in the construction sector may reflect broader systemic issues affecting all workers in the industry.

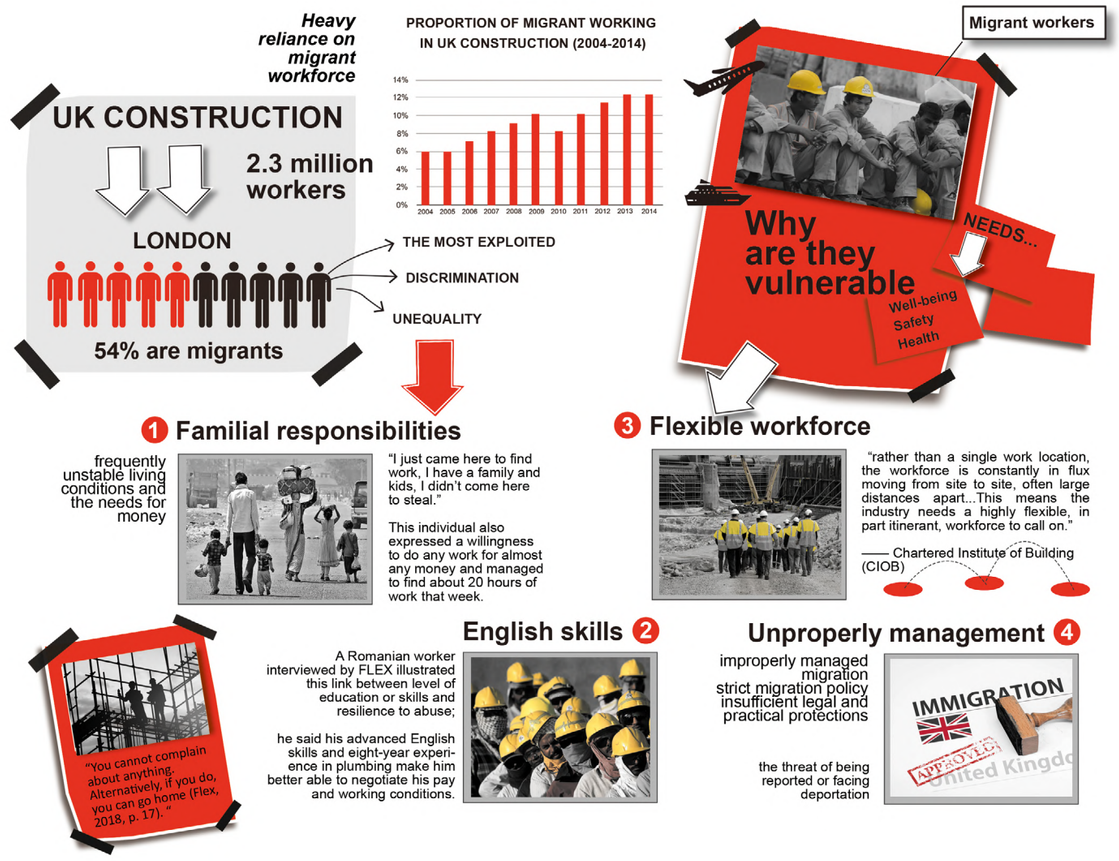


Fig4. UK migrant worker exploitation and its causes (2024), this diagram mainly visualises the findings of FLEX report (2018).

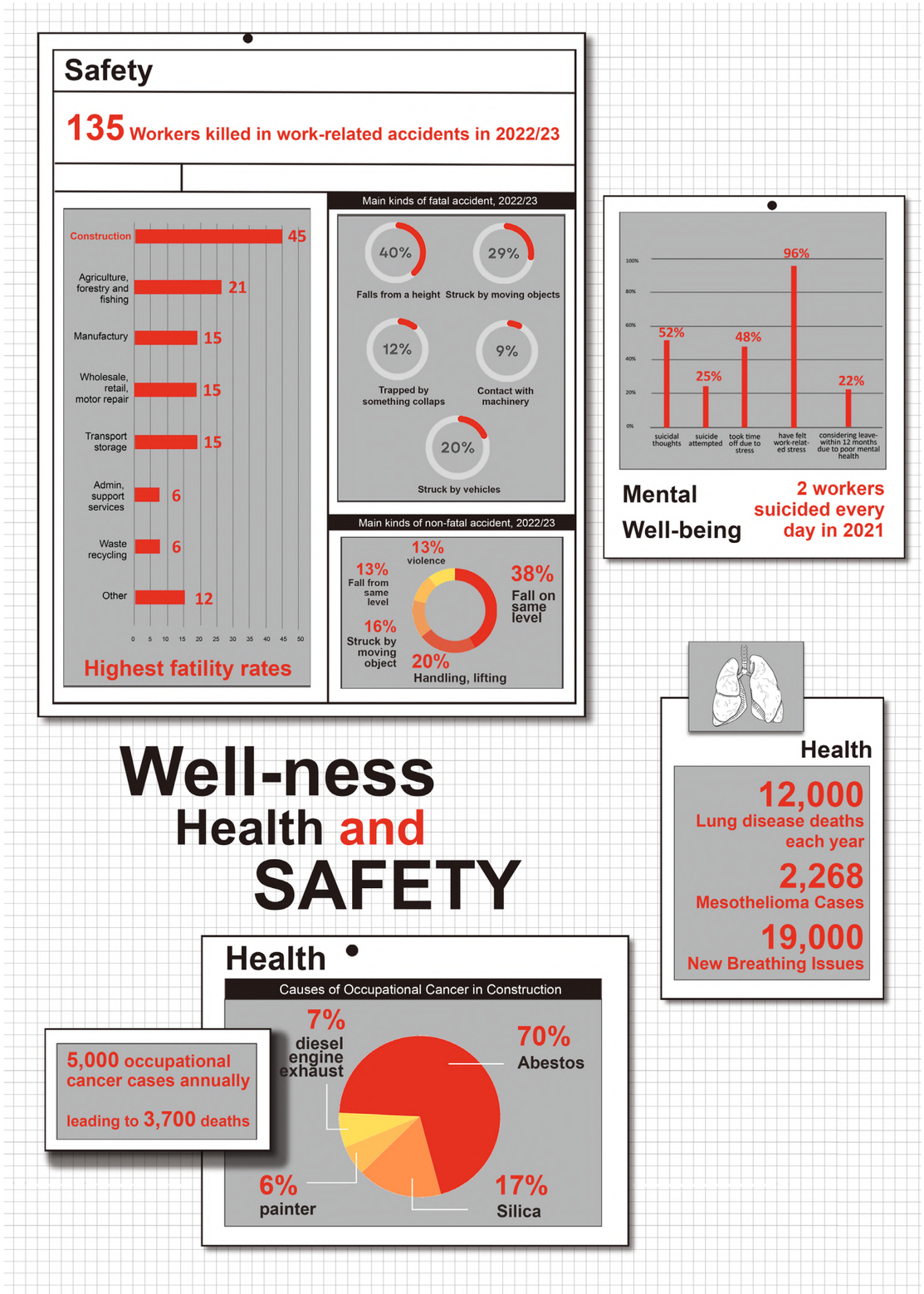


Fig5. HSW in UK Construction: Key Statistics(2024). Mainly based on information from Health Safety Executive (2023).

Marx's theory of labour transaction and commodification can also extend to construction workers' health, safety, and well-being (HSW). This is elaborated by Sherratt (2017, p. 210):

They exchange a portion of their health and safety—frequently endangered by accidents—as a fundamental aspect of their employment. This exchange adversely affects their health, safety, and well-being (HSW) beyond the workplace, reducing their physical health and impacting their future work performance and leisure activities. In the capitalist framework, this sacrifice seems essential for enhancing exchange value, with workers enduring a considerable personal loss in terms of their HSW.

Some other studies have also documented this problem. In recent years, the UK construction industry has been facing a critical mental health crisis, highlighted by the highest suicide rate of any sector and alarming rates of workers experiencing suicidal thoughts and stress (Considerate Constructors Scheme, 2022). A new study conducted by Toolstation reveals that over half of the workers in construction have had suicidal thoughts, with nearly 25% being aware of a colleague in the field who has tried to take their own life. Nearly half of the employees have had to take leave due to excessive stress, while a staggering 96% report having experienced work-related stress. Furthermore, approximately one in four workers is contemplating exiting the industry within a year due to mental health issues (Considerate Constructors Scheme, 2022).

Similarly, we should pay attention to the health and safety issues in the construction industry, especially considering that, like the suicide rate, the construction sector continues to be among those with the highest fatality rates (Health and Safety Executive). Up until recently, a disturbing increase in construction worker fatalities occurred from 2022 to 2023, with an increase of 50% in just a single year (Lago, 2023) and 561,000 cases of non-fatal injuries at work (Health and Safety Executive, 2023). Despite the alarming statistics, construction workers are frequently confronted with various health hazards that go unrecognised and unaddressed behind the scenes. The incidence of occupational cancers is startlingly high, constituting over 40% of all occupational cancer cases (Health and Safety Executive, no date). Workers in this field are regularly exposed to dust, chemicals, and potentially harmful substances. Various production processes in construction release particulates, fumes, vapours, or gases, which are significant factors in respiratory issues and lung diseases (Health and Safety Executive). Prolonged contact with these harmful substances significantly increases the likelihood of developing lung and skin cancers. Asbestos accounts for the highest proportion of these cancers at 70%, with silica following at 17%, and painting work and diesel engine exhaust contributing around 6-7% each (Health and Safety Executive). Regarding the social sustainability of the three pillars, the concept of safety is the fundamental basis that encompasses the right to be safe and includes adopting various protective and security measures to avoid future injuries and physical damage (Eizenberg and Jabareen, 2017, p. 1). When the essential aim of social sustainability is unachievable, and the well-being and safety of construction workers are not safeguarded, the sector loses its sustainability. Thus, the construction industry must prioritise its workers' health, safety, and well-being as a moral imperative to ensure its sustainability and long-term success.

As a result, the sustainability challenge in the construction industry arises from its heavy dependence on a migrant workforce coupled with a significant labour shortage, as fewer people are willing to enter the field. Post-Brexit immigration policies and a lack of emphasis on safety and well-being have led to a declining interest in the industry among the heavily relied-upon migrant workers. In 2021, the Office for National Statistics (ONS) revealed that since 2017, the construction sector had seen a reduction of more than one-third in its EU-origin workforce, exacerbating the labour shortage crisis (Sillars, 2023). Additionally, the departure of older workers has further intensified this issue. The Chartered Institute of Personnel and Development (CIPD) points out that over 1.2 million workers aged 65 and older (Newman and Brittan, 2022) contribute to the situation's complexity. Even with a slight recovery after the pandemic, more than half (55%) of employers have encountered difficulties in recruitment over the last two years (Construction Industry Training Board, 2023). This issue will likely intensify due to globalisation, as many immigrant countries face labour shortages and compete for workers, especially skilled migrants. With poor working conditions, inadequate health and safety guarantees, and unequal, discriminatory practices persisting in the UK construction industry, which heavily relies on its workforce, the UK construction labour market is losing its economic competitiveness. Workers are increasingly disinclined to prioritise employment with a broader array of choices in this sector. Consequently, this challenging crisis is prompting UK government action to relax the immigration rules; the inclusion of bricklayers, plasterers, roofers, and carpenters has been announced by the Home Office in the shortage occupation list (SOL) (Sky News, 2023), aiming to encourage the migrant workers to boost employment in the construction industry in the UK, alleviating the unsustainability caused by the labour shortage.

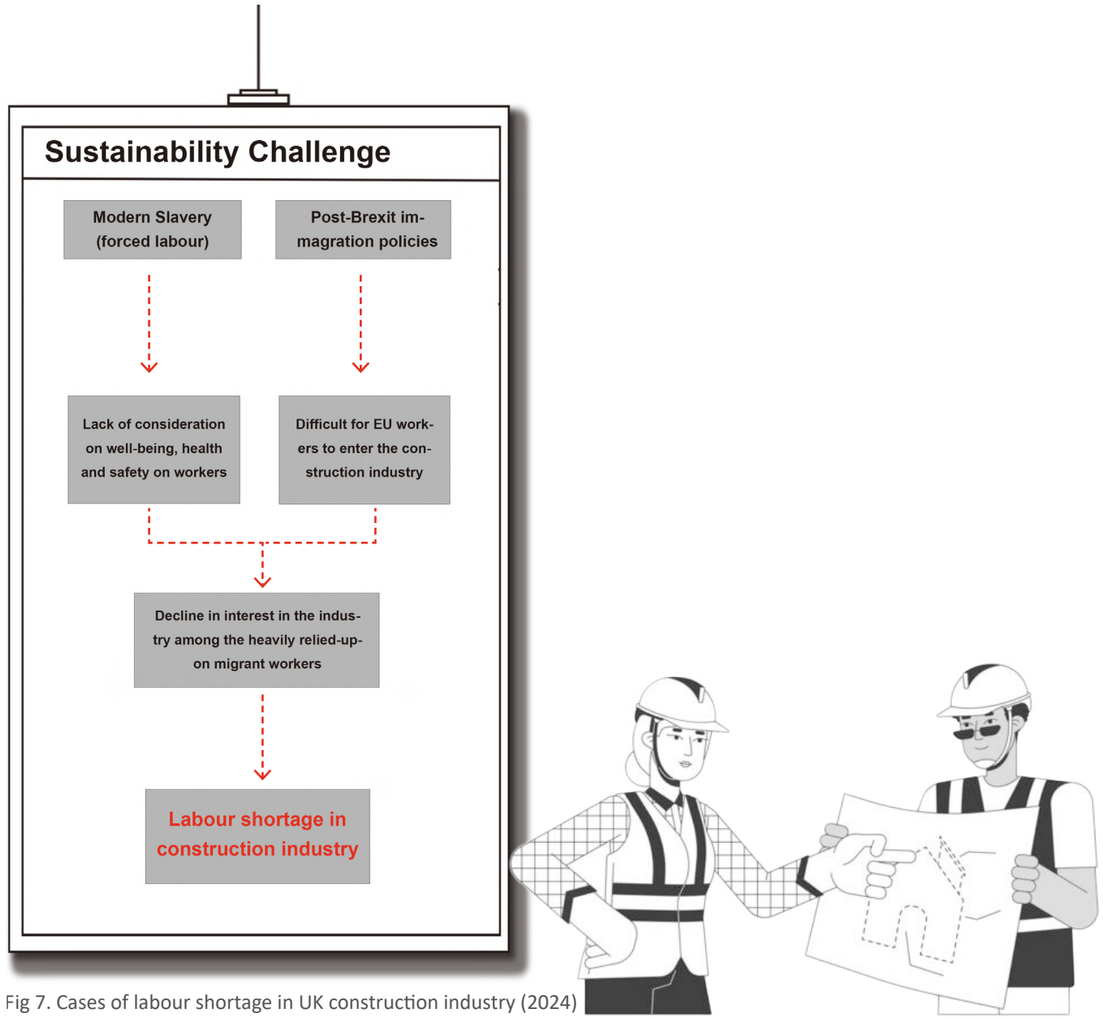
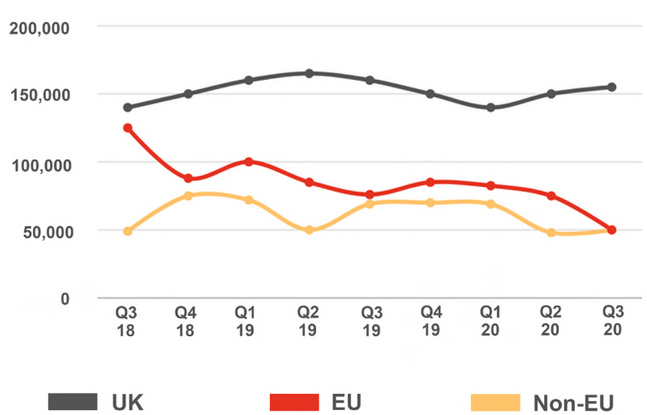


Fig 7. Cases of labour shortage in UK construction industry (2024)

Fig 6. London Witnesses a 50% Decline in EU Construction Labor (2024)



Based on information from the Office for National Statistics, cited in Price, D. (2020)

However, numerous officials argue that loosening immigration policies is not a long-term strategy for sustainable industry growth. Lib Dem home affairs spokesperson Alistair Carmichael pointed out, "We require an economic migration system that benefits the British economy and treats everyone with dignity and respect. Merely adjusting the shortage occupations list superficially addresses the deep flaws in the Conservatives' flawed system (Stone, 2023)." I completely agree with this opinion; the goal should be finding solutions to provide construction workers with a more sustainable and inclusive working environment that caters to their needs, ensuring their well-being, health, and safety. Such an approach would not only enhance working conditions but also contribute to the overall health and sustainability of the industry. As the Construction Productivity Task Force (2022, p. 52) recommends, "A project that prioritises the physical environment and the safety and well-being of its workforce significantly increases its chances of success and becomes more attractive to skilled individuals." That is to say, to enhance the industry's sustainability, it is essential to protect the rights and dignity of all construction workers, fostering an equitable, diverse, and inclusive working environment. Such improvements can reduce the loss of workforce, retain the ageing worker demographic, and attract a new generation, contributing to a more sustainable future in the construction industry.

As mentioned earlier, the HSW of migrant workers, along with all other construction workers in the industry, are not being adequately protected. This oversight has led to a decline in the industry's sustainability, further exacerbated by the current critical labour shortage. Therefore, as a designer who is highly involved in the industry, I will explore what architectural approaches could enhance the industry's sustainability while protecting the HSW of construction workers and propose potential solutions to address three pressing issues: health, safety, and well-being.

Well-being

Considerate Constructors Scheme is a non-profit organisation that advocates for higher industry standards and public trust in construction and has over 5,500 registered construction sites, organisations, and suppliers in the UK (Considerate Constructors Scheme, 2022). The practical guidelines for registered organisations to operate responsibly and respectfully mainly focus on respecting the community, caring for the environment, and valuing the workforce (Considerate Constructors Scheme, 2022). In this case, the objective of valuing the workforce demonstrates that constructors are obliged to foster a supportive, inclusive, and healthy work environment by ensuring the safety and well-being of the workers (Considerate Constructors Scheme, 2022).

200,000+
MONITORING VISITS PERFORMED

5,500
CONSTRUCTION SITES, SUPPLIERS AND ORGANISATION REGISTERED

250+
PUBLIC COMPLAINTS MANAGED EACH MONTH

One example focusing on building workers' healthy well-being is the wellness garden launched at the Riverside 2 construction project in London. This initiative offered a peaceful and nature-surrounded space for relaxation, and the construction workers collaborated to create gardens by being given the chance to design their own leisure spaces within the construction site. The planters were skillfully crafted using reclaimed wooden pallets, and the repurposed construction waste was creatively transformed into seating, adding to the garden's environmental sustainability (Endean, 2023). More importantly, this space allows workers to gather during intense work periods, fostering interpersonal communication and strengthening relationships. This enhances team unity and community spirit within the construction workforce. Additionally, the garden becomes a repository of their footprints and memories, transforming work into an enjoyable experience. As Gallie (2009), Nadler and Lawler (1983), and Sirgy et al. (2001) point out, "The conditions in a company's workplace can affect work quality, productivity, and employee morale. Quality of Work Life focuses on harmonising employees' relationships with their work environment, integrating human, technical, and economic elements (cited in Emuze, 2017, p. 16)." Furthermore, Naoum (2011) has concluded that "the underlying idea suggests that individuals will achieve higher productivity when they genuinely enjoy their work experiences" (cited in Emuze, 2017, p. 16). However, without direct insights from the workers, this study becomes challenging to assess their perspectives on the effectiveness of such an approach. Considering workers' perspectives is also a valuable approach to appreciating the workforce.

Fig 8-10. the wellness garden (2023)

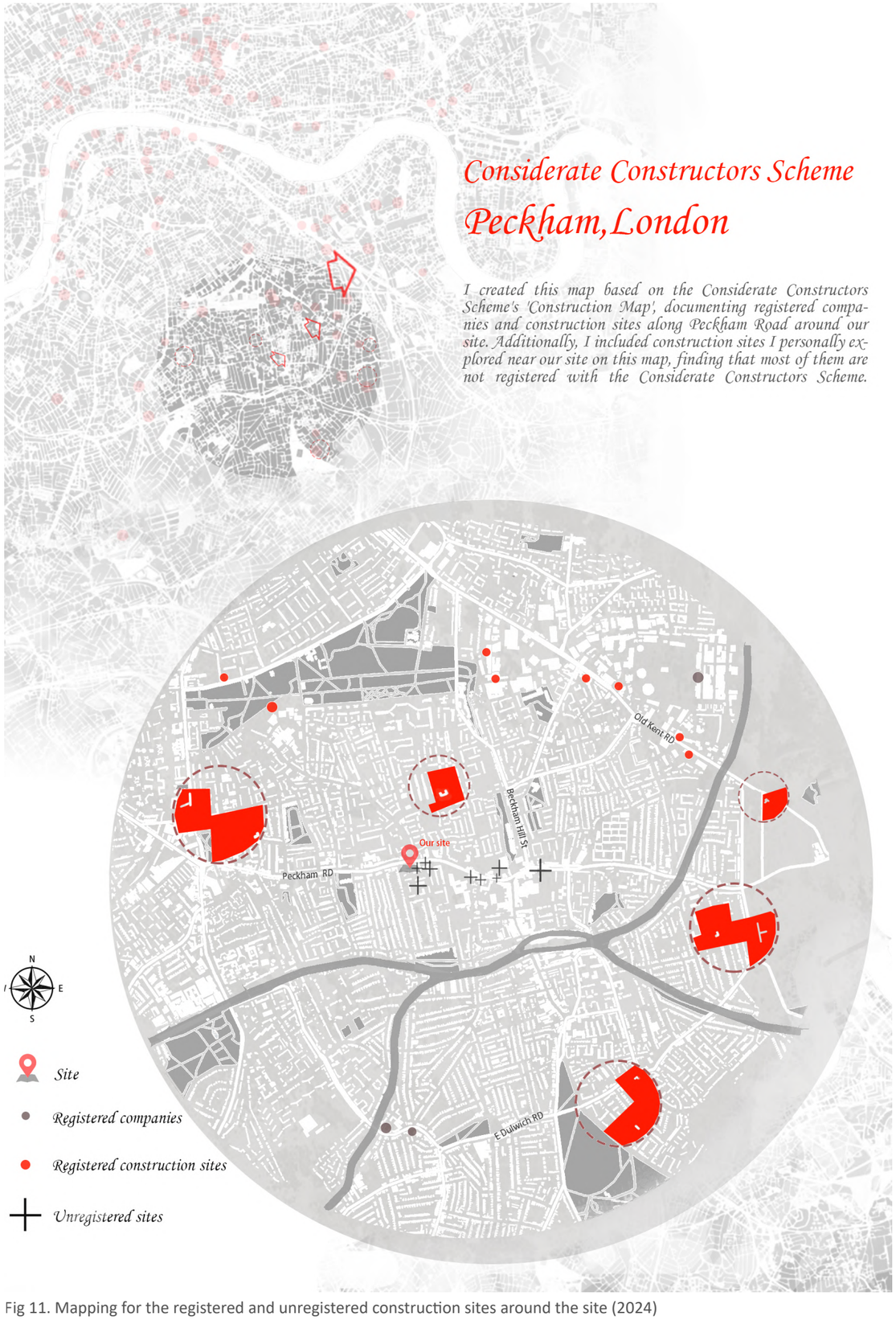
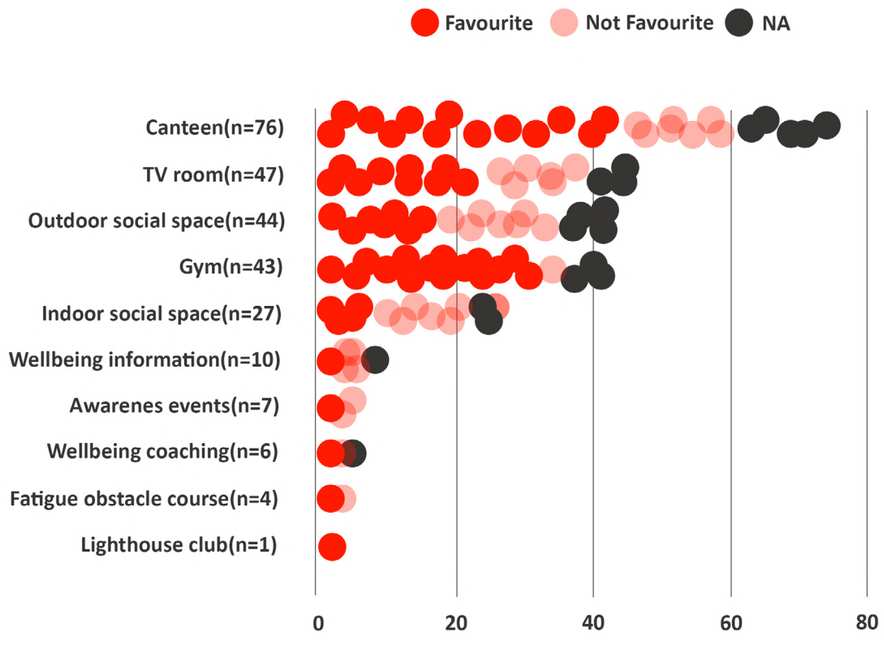


Fig 11. Mapping for the registered and unregistered construction sites around the site (2024)

Another example aiming to enhance the well-being of construction workers while conducting valuable investigations on the effectiveness of initiatives is the National Grid's Health Hub at a construction site in Sellindge, Kent. The hub offers a range of facilities for its employees during their extensive work hours, including a gym, a garden, communal areas, a TV room, personal well-being coaching, events on health education, and a cafeteria providing healthy meals (The University of Warwick, 2023). In the construction industry, according to Duckworth et al. (2022), there is a lack of definitive evidence regarding the success of the mental health interventions being applied (cited in The University of Warwick, 2023). Therefore, this report has compiled a substantial amount of feedback from construction workers, employing a bottom-up approach to explore the feasibility and effectiveness of this approach. The initial findings indicate that workers engaging more with the Hub's facilities showed notably lower anxiety levels (The University of Warwick, 2023). They felt more valued by their employer, had better access to healthier lifestyle options, and were more aware of mental health support (The University of Warwick, 2023). It is also found that many participants are challenged by tight work schedules and long work hours, so they find it difficult to make contact with the health hub (The University of Warwick, 2023). Feedback from construction workers serves as precious insight that the proposals may not always turn into desirable outcomes, especially considering their high intensity of work that take tremendous psychological and physical pressure. The most direct method to release pressure is to provide construction workers with a cosy room for rest and sleep. Although the health hub approach undoubtedly benefits construction sites' daily, serious aspects, its implementation may benefit from management adjustments such as reducing working hours, increasing rest time, or establishing more efficient and reasonable rest systems. This would empower workers to fully utilise and enjoy these facilities, enhancing their overall health and well-being. As a result, integrating more green spaces and fostering calm and relaxing environments could positively influence the well-being of construction workers. Building a sense of community and promoting respect and equality will likely boost their motivation at work, and fatigue and stress may be relieved by a healthy working environment. The trial of the health hub stands out as both innovative and proactive, capturing the construction industry's growing focus on the HSW of its workers and contributing valuable insights for future development. Although the effectiveness of these measures requires further practical research and exploration, their advantages make them a worthwhile pursuit.

Fig 12. Health Hub Facility Usage and Its Impact on Worker Health Scores (2024)



Based on information from the IFA wellbeing research report (2023)

Participant voice

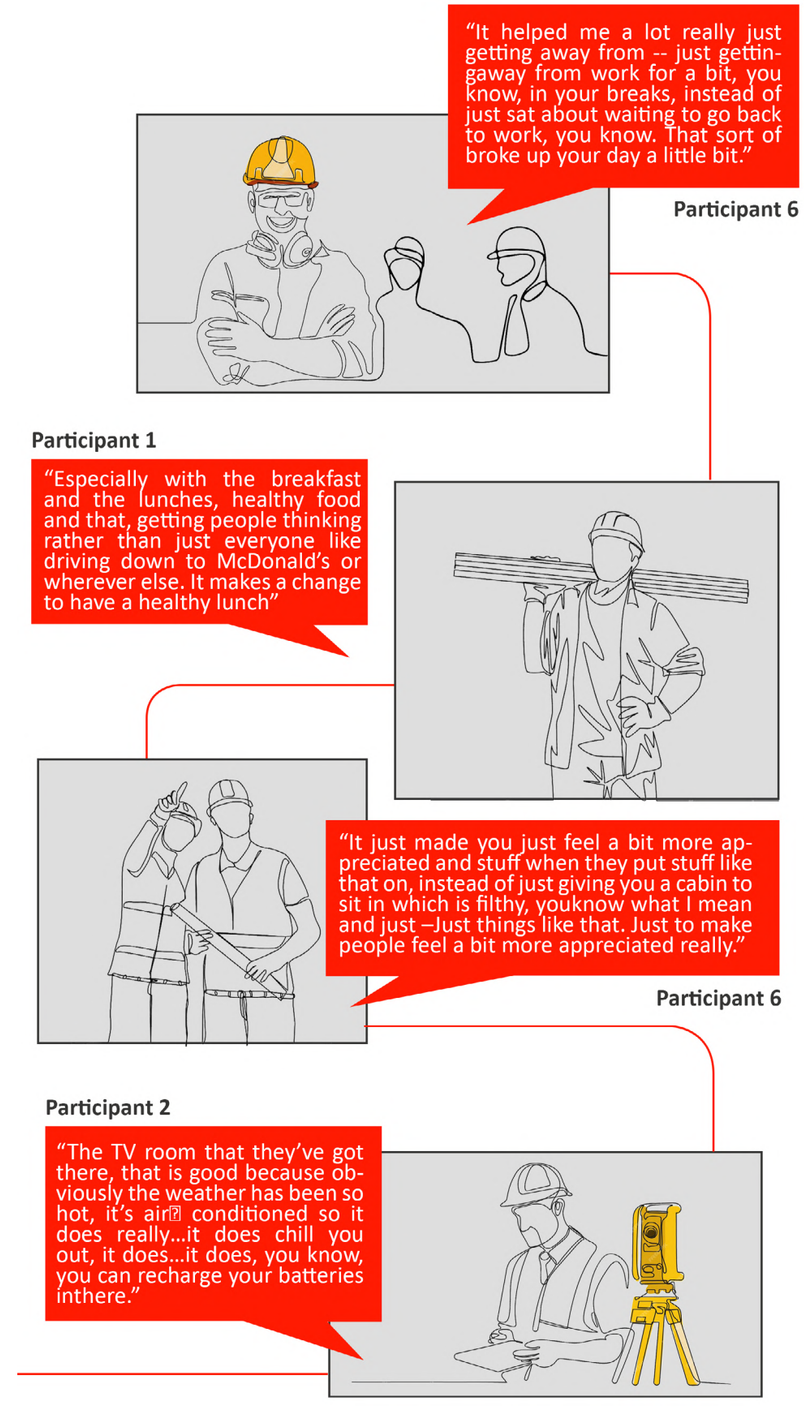


Fig 13. Workers' Feedback on the health hub facilities (2024)
Based on information from the IFA wellbeing research report (2023)

Fig 14. Legal & General's Modular Homes Production lines in Sherburn, Leeds (2023)

Safety

The construction sector has consistently been the most dangerous among various industries, maintaining its position as the leading sector for the highest worker fatalities (Health and Safety Executive, 2023). In the year 2022/2023, there were 45 lethal incidents in this industry in the UK, and the predominant types of accidents have remained consistent, with falls from heights, being hit by moving objects, and collisions with vehicles being the most frequent (Health and Safety Executive, 2023). With the growing concern for the health and safety of the workforce in the industry, modular construction has emerged as a popular method to significantly reduce safety risks for construction workers while enhancing the process's cost-efficiency, time management, and overall quality. Modular construction, as defined by Gibb and Pendlebury (2006b), is "three-dimensional or volumetric units that are generally fitted out in a factory and are delivered to the site as the main structural elements of the building (cited in Lawson, Ogden, and Goodier, 2014, p. 1)."

Modular construction offers several safety advantages for construction workers. The controlled, off-site factory settings reduce common on-site risks such as falls, vehicle accidents, and exposure to various hazards (Portable Building Scales, 2023). The factory provides safer environments to protect workers from extreme weather conditions, such as heavy rain or severe temperatures (Portable Building Scales, 2023). Moreover, using ergonomically designed workstations and tools enhances efficiency and minimises worker strain, considering that musculoskeletal injuries make up 53% of work-related health issues in the construction sector (Portable Building Scales, 2023). Improved ventilation reduces exposure to hazardous substances in the air, lowering the risk of respiratory health issues (Portable Building Scales, 2023). In addition, strict manufacturing quality control and shortened construction duration further diminish the risks of accidents, ensuring the safety of construction workers with a safer alternative to traditional construction methods (Portable Building Scales, 2023). As previously discussed, safety is a significant factor in ensuring the social sustainability of the industry. This aspect is particularly crucial in the current climate, where the industry faces a critical labour shortage. Enhanced safety measures also help retain a skilled workforce and enable ageing workers to continue contributing to a safer environment. Within three years, Make Modular members have created more than 2,000 jobs, and the shift to modular construction could bring up to 50,000 young people into the industry by offering modern, safer work environments (Beck, 2021). It follows that the trend toward modular construction is benefiting the overall construction industry in terms of its economic and social sustainability.

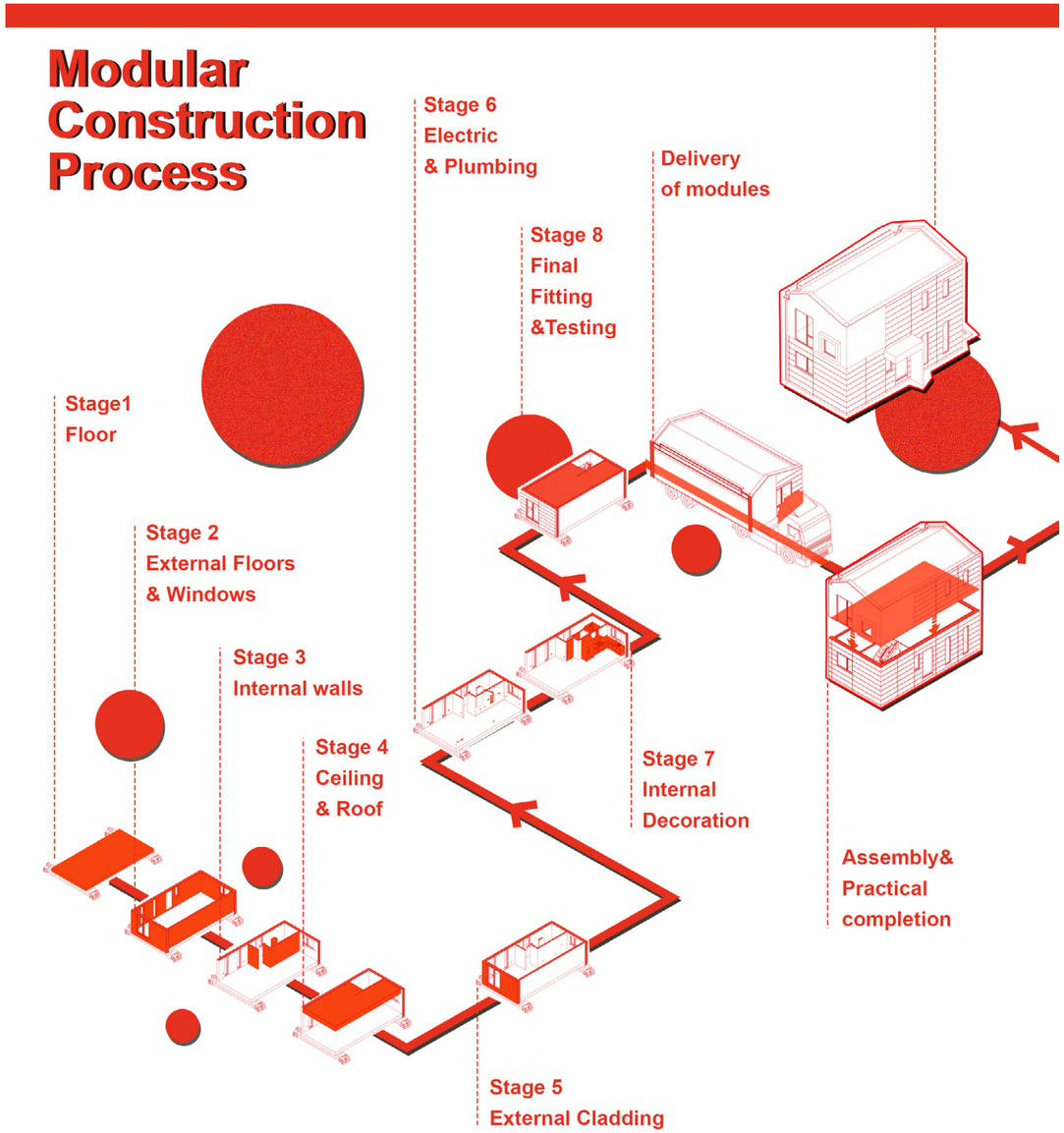


Fig 15. Production lines of Modular housing (2024)

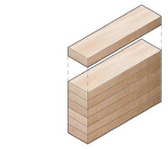
However, there are still some safety concerns with modular construction. In a study analysing accidents in modular construction, based on data from the Occupational Safety and Health Administration, 125 cases were examined (Fard et al., 2017, p. 10). 48 among the cases died, 63 were injured and hospitalized, and 14 had minor wounds. Research and investigation show that fractures are the main type of injury, with the most common underlying factors being falls and structural instability. In addition to this, around 62% of accidents are found on construction sites, and 18% are found in manufacturing factories, indicating that site construction activities are riskier than manufacturing. Therefore, even though standardized and modular construction is safer for construction workers than the conventional method, the construction industry still faces safety challenges. At present, most modular structures are designed for houses involving lower structures where the risk of falling during installation is relatively low. Installation safety must be improved when modular structures suit various building forms. Moreover, developing stronger and more reliable on-site assembly structures and improving worker training to elevate safety awareness are essential. For the industry to fully achieve its sustainable development potential, it requires thorough consideration and continuous improvement supported by detailed safety research.

Health

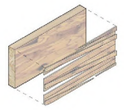
In the construction industry, prioritising user experience has been a longstanding practice. This approach contains factors such as aesthetics, functionality, affordability of building materials, and ensuring no health risks to end-users. However, this focus often overlooks the needs and rights of construction workers. This is particularly concerning when a building material, ideal in many respects, poses health risks to workers during construction. Such hazards are frequently disregarded due to their indirect impact on the final users. Lucy Deane's 1898 report as HM Chief Inspector of Factories first highlighted the health hazards of asbestos in construction. Nevertheless, it took nearly a century for a complete ban on the industry in the UK, mainly due to opposition from asbestos companies and government inaction for its economic values (Thompsons Solicitors, no date). The prolonged period before asbestos was banned in the UK, coupled with its long-term health effects on construction workers, has led to more than 5,000 annual deaths from asbestos-related diseases (Thompsons Solicitors, no date). Additionally, with an estimated 1.5 million buildings in the UK containing asbestos, including 75% of schools, asbestos exposure is expected to affect workers and others who frequent these buildings for many years, resulting in extensive health consequences (Thompsons Solicitors, no date).

Adsul et al. and Bust et al. contend that human dignity implies that specific individuals should not receive less respect than others. Undeniably, the conditions faced by migrant construction workers in specific areas globally fail to meet dignified standards in any aspect (cited in Emuze, 2017, p. 11).' This statement applies to all construction workers within the industry, underscoring the principle that construction workers are entitled to the same level of respect as people in any other field. Equality and inclusivity are essential for maintaining social sustainability, and this principle underscores the importance of acknowledging construction workers in the industry. Their right to a safe, healthy, and equitable working environment is fundamental, especially when their well-being and health are at stake. Therefore, more sustainable construction materials with lower health risks to construction workers can be encouraged to implement in the future construction industry, for instance, timber as a sustainable material in terms of environmental and social factors.

Mass timber, which includes engineered wood panels such as cross-laminated timber (CLT), glue-laminated timber (Glulam), and laminated veneer lumber (LVL), is increasingly favoured in modern construction for its environmental-friendly properties (Ayanleye et al., 2021). A study revealed that substituting wood for other building materials could significantly reduce global CO2 emissions (14 to 31 percent) and fossil fuel consumption (12 to 19 percent). This is achievable by utilising 34 to 100 percent of the world's sustainably grown wood (Martin, 2017). While exposure to wood dust can be linked to various health issues, for instance, carpenters and joiners are at a fourfold increased risk of developing asthma compared to other workers in the UK and an increased risk of nasal cancer from inhaling hardwood dust (Health & Safety Executive, 2023), the overall health hazards associated with wood dust are comparatively lower than other industrial materials. Moreover, prefabrication in mass timber construction diminishes health and safety risks during construction by reducing the overall project duration. In addition, incorporating wood in construction can enhance construction workers' job satisfaction because natural materials like wood mean less chemical harm, improved health, and fewer sickness reports. Studies such as Fell's 2010 work affirm wood's role as a stress-reducing material that amplifies the positive health impacts of nature (Abed, J. et al., 2022, pp. 15–16).

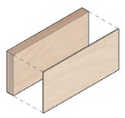


1 glued laminated timber



2 parallel strand lumber

3 laminated strand lumber



4 laminated veneer lumber

5 cross-laminated timber

6 nail-laminated timber

7 dowel-laminated timber

8 mass plywood panels

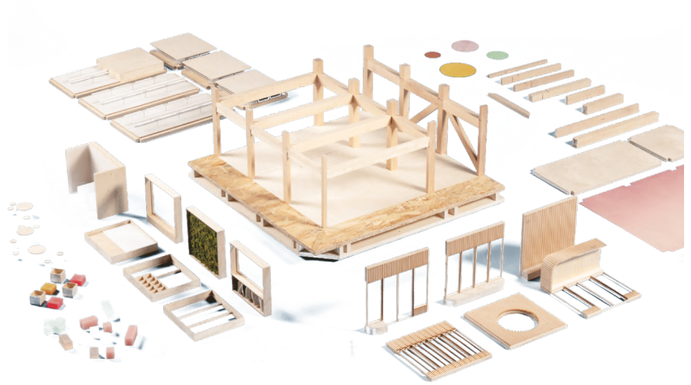


Fig 23-24. modular wood system designed for 30 schools in Amsterdam by OMA (2023)

One example of prefabrication in mass timber construction to address the 'safety' and 'health' aspects discussed above is OMA's innovative "wood plug and play system," designed to construct up to 30 schools in Amsterdam. This is a representative project of a valuable integration of modular construction and mass timber production that enhances the sustainability of the design while having limited risks to the health and safety of construction workers. Its flexible design allows for auditoriums, gardens, or classrooms, and the buildings can be fully dismantled. All the components become construction materials again, responding to different needs over time (Carlson, 2023). Considering construction workers' needs, factory prefabrication for building components significantly enhances the safety of construction workers by minimising traditional on-site risks. This safety advantage is further amplified by using timber, a comparatively lighter material, which reduces the likelihood of injuries associated with handling heavier loads. Prefabrication has expanded the labour pool and is expected to mitigate the national shortage of skilled construction labour (Evans et al., 2018, p. 4). Importantly, timber avoids the enduring health hazards linked to asbestos and silica, particularly during demolition, allowing buildings to be dismantled quickly and efficiently without emitting hazardous substances. As a result, the approach substantially lowers the potential health and safety threats to construction workers., thus offering long-term environmental and social benefits.

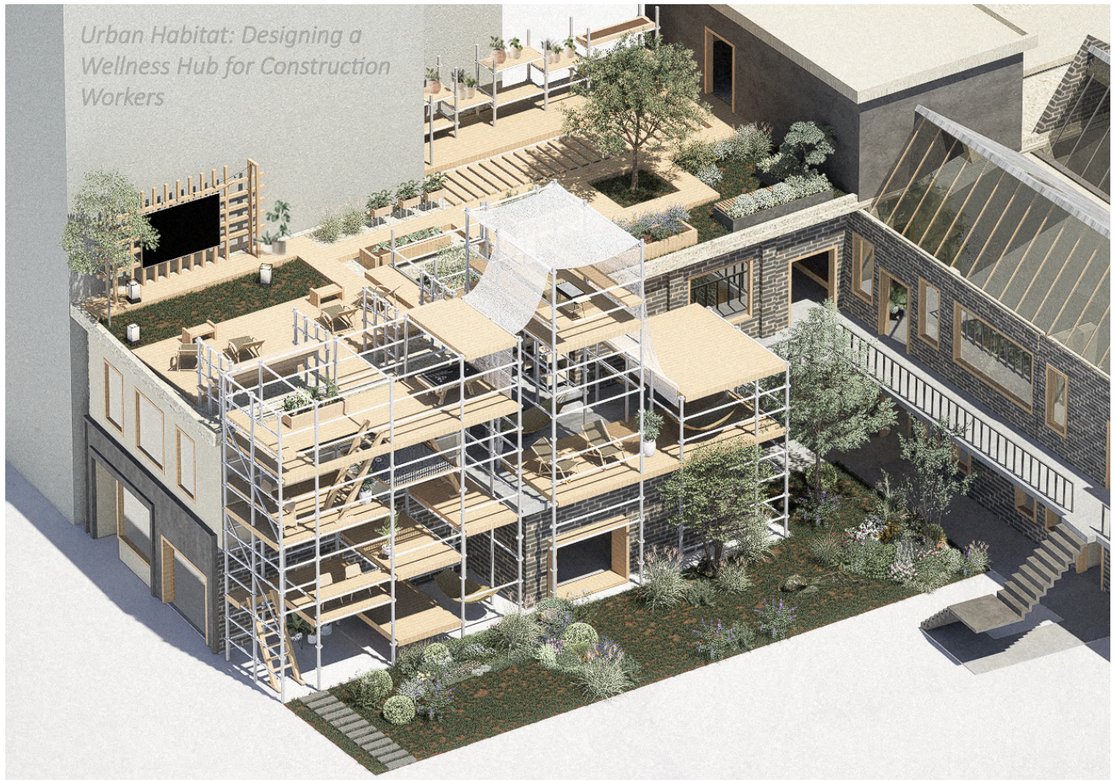
However, there is a long-running debate on mass timber production as to whether it is sustainable in the long term. In interviews for Dezeen's Timber Revolution section, both Amy Leedham, a carbon impact specialist, and Benjamin Kromoser, a construction material expert, express concerns over simplifying mass timber as a green solution, emphasising the necessity of sustainable practices across a building's entire lifespan to reduce environmental impact truly (Crook, 2023; Barker, 2023). Advocating for mass timber production significantly addresses the construction industry's carbon crisis and benefits from being a readily available, renewable resource that poses minimal health risks to construction workers. However, engaging in more comprehensive research and cross-industry discussions is crucial to building sustainable cities. The 'Timber Revolution' initiative on Dezeen represents an excellent platform for deepening involvement and encouraging further research and development. The widespread adoption of mass timber and its promotion as a primary solution require additional careful consideration and study.

Conclusion

In a brief conclusion, the importance and plausible practices of protecting construction workers' health, safety, and well-being are proved and discussed in this thesis. Research on modern slavery and forced labour in the construction industry shows that heavily dependent migrant workers are the most exploited group. Such exploitation is largely owed to their vulnerability, leading to labour shortages. Besides, many investigations on construction workers' welfare show the lack of attention to HSW for all construction workers within the industry, deeply affecting their physical and mental health. The findings highlight the importance of social sustainability in affecting the development of the construction industry and the urgent need to use innovative architectural approaches to protect workers' welfare.

I have investigated several case studies to address these industry challenges in HSW. My research on the wellness garden and the health hub concludes that the healthy and nature-centred work environment helps improve construction workers' satisfaction. Such an environment creates a sense of community for construction workers with a strong sense of respect and equality, thereby lifting the probability of boosting construction workers' motivation and productivity. The second part of the research highlights the combination of modular construction and strengthening safety measures to retain well-skilled labour and aged workers so that they can continue making contributions in a safer work environment. The method highlights the importance of adjusting construction practices to support and secure labour in the workplace. Finally, the third part delves into the health risks of building materials for workers, emphasising the shift towards mass timber and providing a sustainable and healthier alternative.

In my graduation project, I designed a wellness hub in the former Kennedy's Sausage Factory for construction workers and the local community, focusing on relaxation, health, and safety through interaction with nature. The project incorporates modular construction methods, enabling adaptable and temporary structures through prefabrication techniques. Utilizing a wood structure for rapid assembly and disassembly. The project is expected to strengthen interactions between construction workers and society by creating a supportive public environment. With rich functions and spaces, workers can have their own habitat in the city during their free time, relieving stress from high-pressure work environments and reducing the probability of work-related stress. Importantly, this measure demonstrates the sustainable design of the construction industry centered around workers and showcases innovation in developing a healthier working environment for a sustainable future.



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List of Illustration: Illustrated Thesis