TIVA
LIGHT STEEL FRAMING

The Complete Guide

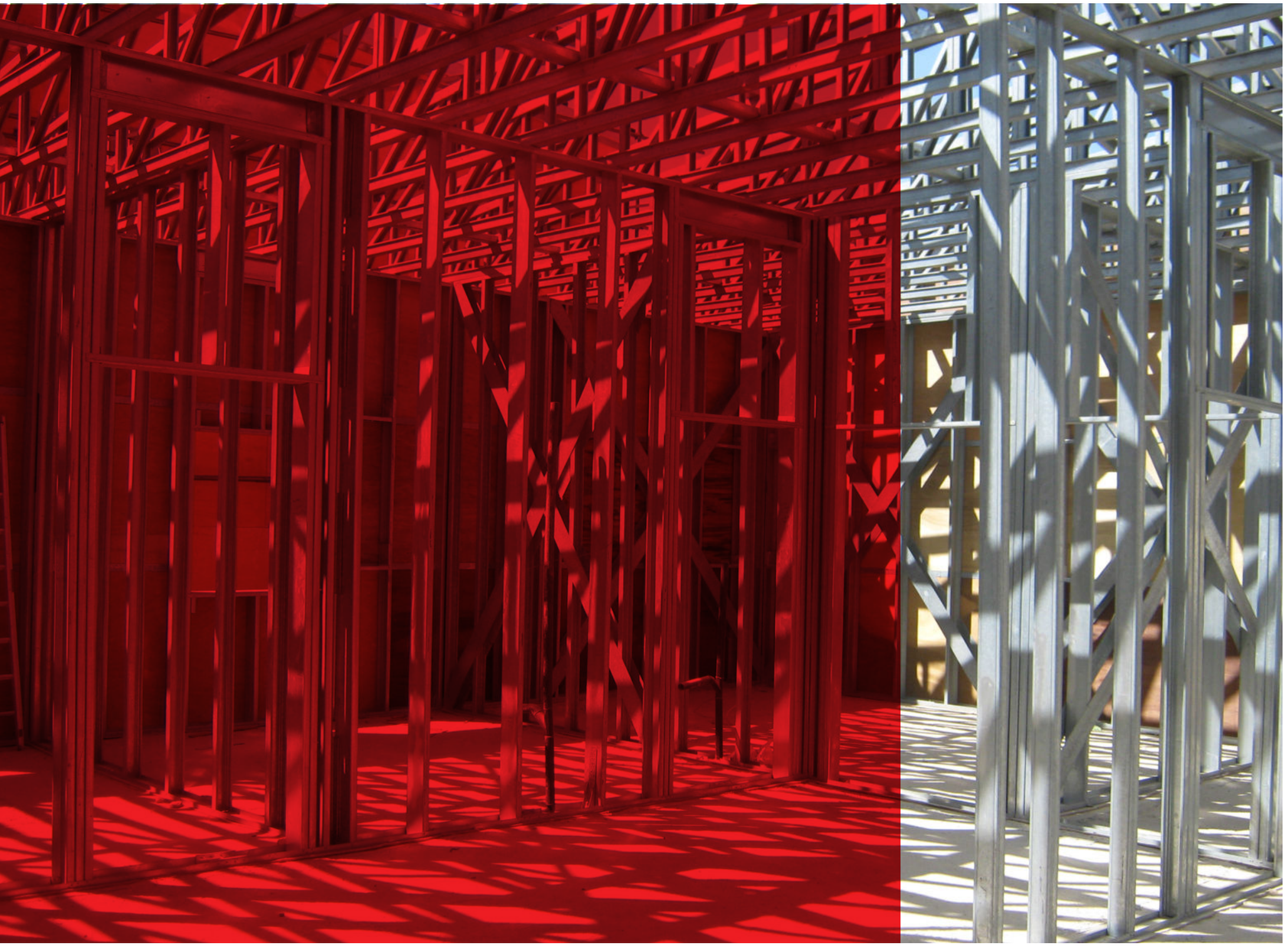
TECHNICAL CATALOGUE | COMPANY PROFILE

2023

Contents

“Speed is the key to success in today’s world.”

Bill Gates



INTRODUCTION

The world population is growing faster than ever before. The UN predicts that the world population will increase from about 7.9 billion today, to nearly 10 billion by 2050. This poses many challenges as well as opportunities for the construction industry. It is predicted that the population of the world's urban areas will increase by 200,000 people per day, all of whom need affordable housing as well as social, transportation and utility infrastructure. In the face of such challenges, the construction industry is obliged to transform to cater for the demands.
These transformations provide opportunities for technologies that can construct more cost-effective and eco-efficient buildings at a rapid pace.

Traditional methods of construction are too slow to keep up with demands for better, more efficient and affordable buildings that are also conscious of the environment and limited natural resources. As a result, the industry is turning to alternative methods that can solve this issue.
One of the key trends and transformations in the construction industry is off-site construction. It involves the planning, manufacturing, fabrication and assembly of building elements in a controlled environment to then be transported to the final location for rapid assembly on-site. One emerging technology that is leading the way in off-site construction is Light Steel Framing systems (LSF), also known as Light Gauge Steel (or LGS).

LSF construction provides a way to turn opportunity into commercial reality, faster than ever before, while delivering excellent quality buildings that meet the demands of modern communities.

Tiva Light Steel Framing, with over 28 years of experience specialising in the field of LSF, has the solution for rapid construction of quality buildings to cater for the growing population. Tiva is proud to have achieved many firsts in the industry in Iran and is expanding its expertise and services internationally.

In this document, we explore the challenges that the world faces in the future and the advantages of LSF systems over conventional methods of construction and how with the right system in place, can benefit buildings in terms of time, cost and quality. We also showcase Tiva and its work over the years, and how it can benefit your project.

Section 1
THE FUTURE OF CONSTRUCTION

The construction industry is affected by mega trends in four domains: markets and customers, sustainability and resilience, society and workforce, and technology.

The industry needs to identify and implement optimal responses to these mega trends – both with respect to the opportunities they offer and with respect to the challenges they pose.

1

POPULATION GROWTH & URBANISATION

“Every day, at least 200,000 people pack their bags and move to the big city. By 2050 almost 70% of the world’s population will live in cities - that’s about 7 billion people.”

Rapid population growth and urbanisation increase the need for affordable and efficient housing in urban areas.

Source: 2012 NASA Earth Observatory

The world is undergoing the largest wave of urban growth in history and as cities become more populated than ever before, the need for housing and infrastructure is on the rise. It is estimated that 96,000 houses will need to be built per day by 2030 as a response to this rapid urbanisation.

The housing market is becoming more competitive as demands rise, forcing an increase in prices where there is limited availability of quality housing.

Urbanisation puts immense pressure on the construction industry to provide housing for the growing population at a speed that meets demands. Conventional methods of construction such as concrete simply cannot meet the housing demands as they generally do not deliver the speed, flexibility and quality required to solve this issue.

This challenge poses the opportunity for future constructions to be more cost-efficient, fast to built and energy efficient in order to offer an affordable solution for the growing population.

2

LABOUR SHORTAGE

An Underestimated Problem

The engineering and construction industry will face stiff recruiting and talent challenges in the years ahead. One major challenge is the prospective scarcity of skilled labour, which is driven by demographic shifts. As the rate of population growth is declining, the average age of construction workers is increasing. This entails lower productivity of labourers as well as higher expenses for skilled labour.

Scarcity of skilled labour drives a shift in the construction industry whereby labourers with little to no skills or experiences will need to be able to execute buildings to the highest of standards. Through industrialised processes and advancement of technology within the construction industry, structures can be made using lower skilled labour to put together precision manufactured components.

3

DIGITALISATION & BIM

For many decades, the design process in the construction industry remained heavily reliant on paper. Now, digitalisation and Building Information Modelling (BIM) have increased the quality of the designs and opened up the way for more accurate and complicated designs. Construction and operation efficiency has become one of the most important aspects of any project, therefore the engineering and construction industry is constantly evolving to increase efficiency in all areas.

New technologies in the digital space, for example, will not only improve productivity and reduce project delays, but can also enhance the quality of buildings and improve safety, working conditions and environmental compatibility. Building Information Modelling (BIM) plays a key role in the design and management of current and future constructions as it increases predictability, therefore reducing potential risks on-site and failure costs (which are relatively high in the construction industry).

Utilisation of new technologies, manufacturing processes and BIM save valuable time and money for industry professionals and users, and has become an inseparable part of the industry.

BUILDING CONSTRUCTION PROJECTS CONTRIBUTE

40%

of the waste in landfills

TODAY'S BUILDINGS PRODUCE

1/3

of the world's greenhouse gas emissions

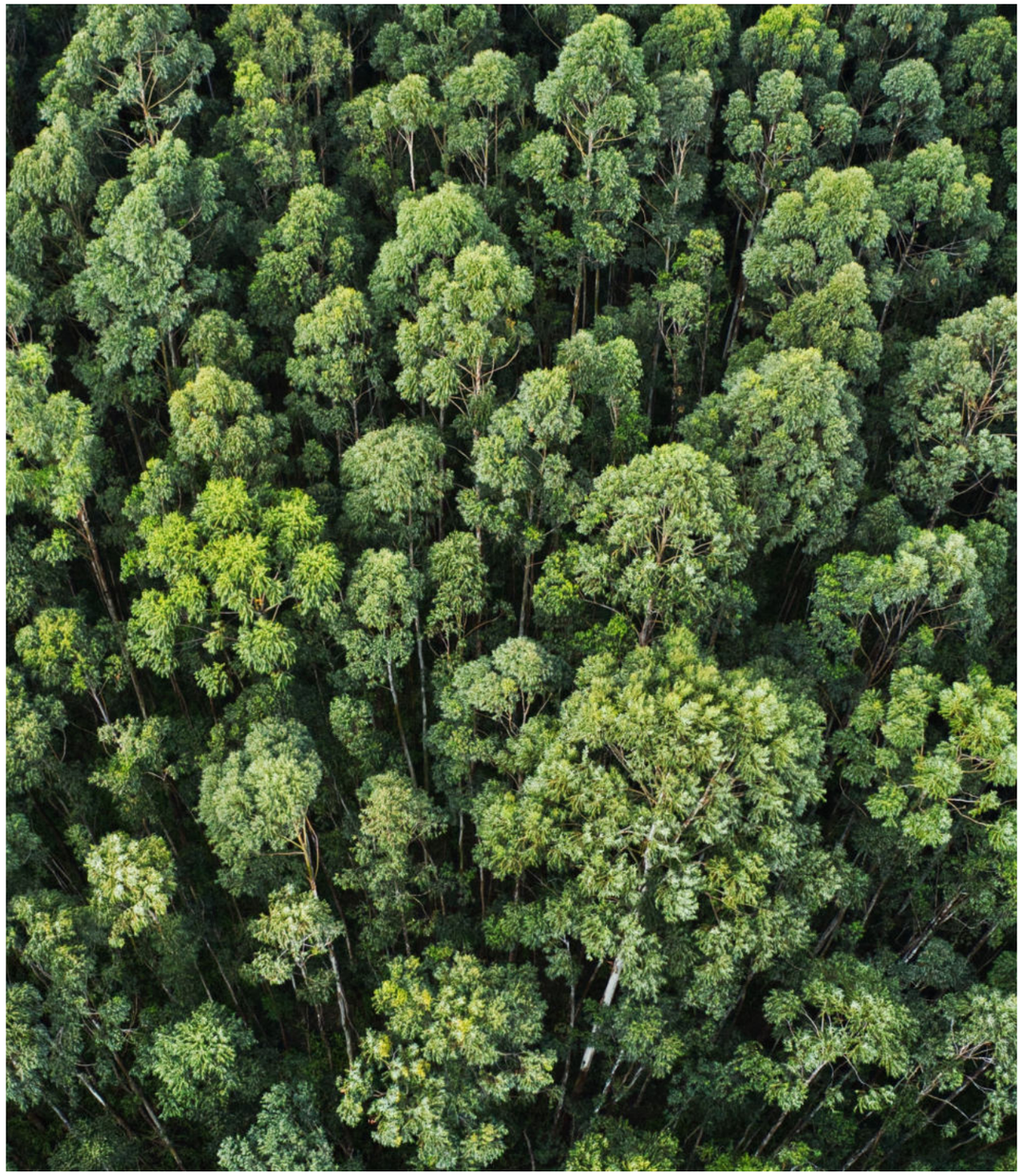
THEY ALSO USE

40%

of global energy

25%

of global water



4

CONCERN FOR ENVIRONMENTAL EVENTS

The Need For Greener Buildings

"In the future of construction industry, sustainability is not a desired practice but a necessary one. Its pursuit is bound to affect both the construction process and the built asset itself."

With growing sustainability concerns, it is important for construction professionals to look to the future to ensure their buildings and projects can help, not hurt, the global push to limit the impact of climate change. For instance, the European Union has pledged to reach carbon neutrality by 2050, meaning organisations across the continent are setting their own targets to meet corporate, national, continental, and global goals.

Climate change has unquestionably become the biggest global risk. All of us bear responsibility but this duty is particularly acute for those operating in carbon-heavy sectors like construction, which is responsible for 37% of total global energy-related CO2 emissions. The industry creates high levels of physical and digital waste, with 10-15% of materials wasted on every build. Global warming is also causing hotter temperatures and changing weather patterns, disrupting the usual balance of nature. The construction industry is obliged to address the growing concerns over natural hazards (notably, flooding, hurricanes and earthquakes), and to enhance resilience.

Industry professionals must continue to rethink how they design and build— now, through 2050 and beyond. It will take a concerted effort that includes smart city planning, advanced technology and a commitment to do things sustainably to accommodate our growing, increasingly urban population while preserving precious resources. Innovative construction methods can massively contribute to more sustainable and resilient building solutions for the future.

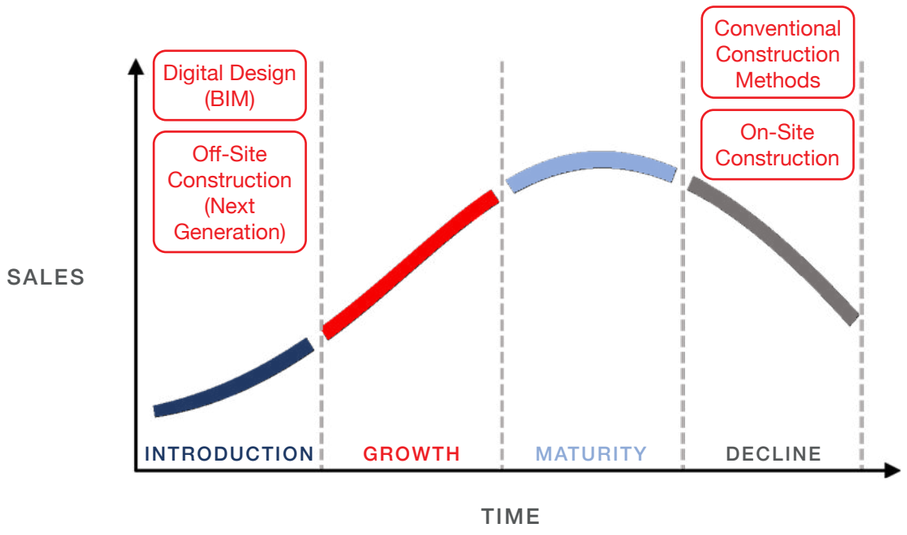
CONCLUSION

Traditional methods of construction are struggling to keep up with the global demand for better, more efficient and affordable buildings. As a result, the construction industry is turning to alternative methods to respond to future trends. One emerging technology that is leading the way is Light Steel Framing (LSF), also known as Light Gauge Steel (LGS). This method is a solution that is much faster to construct, more sustainable, less labour intensive and utilises new manufacturing technologies to accurately prefabricate structural elements, in order to meet the demands of the future.

THE TRANSITION TO OPTIMISED CONSTRUCTION METHODS

Off-site construction methods are in the introduction and growth stages of the product life cycle curve, experiencing increasing adoption and market acceptance. Conventional and traditional methods are in the decline stage as their usage diminishes due to inefficiencies and the emergence of more innovative approaches.

PRODUCT LIFE-CYCLE CURVE

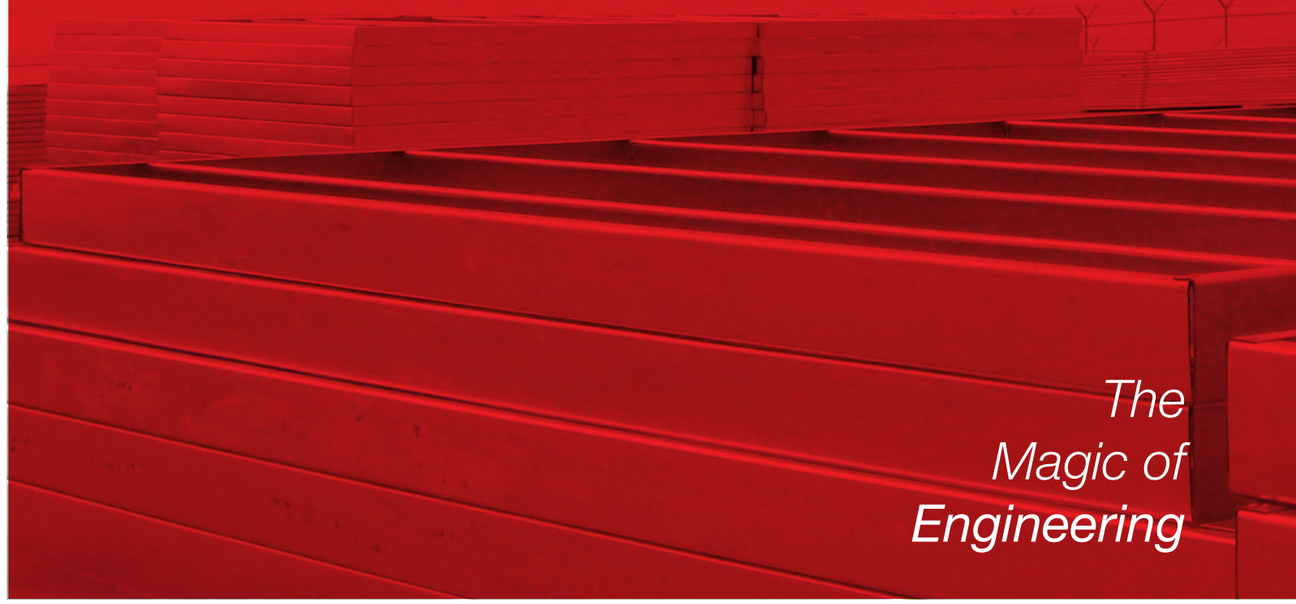


Section 2
THE SOLUTION: LIGHT STEEL FRAMING

Although Light Steel Framing (LSF) is considered to be a “new” construction method by many, it actually has been used in the United States and England since the 1850s. At the time, use was largely experimental and limited to a few basic structures.

Light Steel Framing, also known as Light Gauge Steel (LGS), is a construction method based on structures made up of cold-shaped galvanised steel elements, manufactured off-site in a factory-controlled environment . The structural elements made by cold forming or profiling of thin steel sheets of typically 1.01 to 3.6 mm, which are galvanised for corrosion protection. Cold formed steel coils are typically formed into C-sections, U-sections and other shapes by rolling the steel through a series of dies, giving the metal greater strength-to-weight ratio than traditional hot-rolled materials while maintaining excellent formability. The result is a light yet resilient material that can be used for various structural applications such as studs, joists, rafters, trusses, and columns.
The steel elements manufactured off-site are panellised into single storey panels and then installed on-site.

Nowadays, LSF is becoming a preferred method of construction worldwide in many sectors including industrial buildings, commercial buildings and hotels, and has gained a significant market share in the residential sector.



ADVANTAGES

SOCIAL & HEALTH

No harmful emission, corrosion of mould
Non-combustible and non-organic
Safe for seismic, wind and heavy rains
Vapour control and thermal performance

ENVIRONMENTAL

Environmentally responsible material

- Long life cycle
- Infinite recyclability
- Limited waste

Superior energy efficiency

Aligned with government initiatives

ECONOMICAL

Faster Deliveries

- Turnkey integration efficiencies;
- Reduced delays from weather;
- No multi-trade/supply coordination;
- Accelerated deliveries;
- Safe, clean and accessible job sites

Better Quality

- Controlled workmanship and consistent dimensions;
- High strength and durable product ;
- Longer spans increased design flexibility;
- No shrinkage, warping and cracking;
- Wide range of designs and finishing options

Cost Effective

- Off-site manufacturing accuracy and predictability
- Low skill requirement for structure assembly and finish
- Reduced after sale service, call backs and repairs
- Low maintenance costs and high resale value
- Steel commodity readily available and competitive
- Waste disposal, clean-up and removal reduced
- Low contractor's risk insurance costs
- Light stress on foundations, cranes and contractors
- Limited material stock for suppliers and contractors
- One-stop accountability resulting in on-time and on-budget deliveries

APPLICATIONS

The market for light steel framing (LSF) is expected to grow due to factors like the demand for sustainable construction, the shift towards off-site construction, affordable housing initiatives, the need for resilient buildings, and technological advancements.

Companies around the world are utilising Light Steel Framing as their construction method of choice in widely diversified range of building applications. LSF is the ideal building material and system choice for all applications, whether residential single dwellings, multi- family residential buildings, or non-residential buildings such as schools, hospitals, hotels, commercial and industrial buildings.
LSF can both be utilised as the full, load-bearing structure of a building or as part of a hybrid structure for non-load bearing elements such as internal walls or façades.

RESIDENTIAL BUILDINGS

Light steel framing systems are widely used in residential buildings, offering numerous advantages. They are beneficial for single-family homes, multi-storey apartments, town-houses, low-rise and mid-rise buildings, prefabricated or modular housing, as well as renovations and additions. Light steel framing provides strength, durability, design flexibility, and ease of construction, making it a versatile choice for various residential construction projects.

The use of LSF as the chosen construction system for residential buildings can significantly reduce project costs whilst also delivering a high speed of construction that is improved by up to 75%, ideal for rapid urbanisation of the future. The speed of construction along with its cost- efficiency, design flexibility, energy efficiency, and durability make LSF the great choice of construction for affordable housing.

NON-RESIDENTIAL BUILDINGS

Light steel framing systems are suitable for non-residential buildings such as commercial spaces, educational facilities, healthcare buildings, industrial structures, recreational facilities, and hospitality establishments. They offer flexibility, durability, and efficient construction choices, catering to a wide range of applications in the non-residential sector.

Light steel framing systems are well-suited for solar panel rack mounting. They offer structural strength, design flexibility, easy installation, durability, and sustainability, making them a reliable option for supporting solar panel installations. LSF is also a great choice for quick response applications such as post-disaster accommodation and temporary structures.

SINGLE-FAMILY RESIDENTIAL

OFFICES

COMMERCIAL

EDUCATIONAL

FLOOR ADDITION

AFFORDABLE HOUSING

HEALTHCARE

TEMPORARY STRUCTURES

MULTI-STOREY RESIDENTIAL

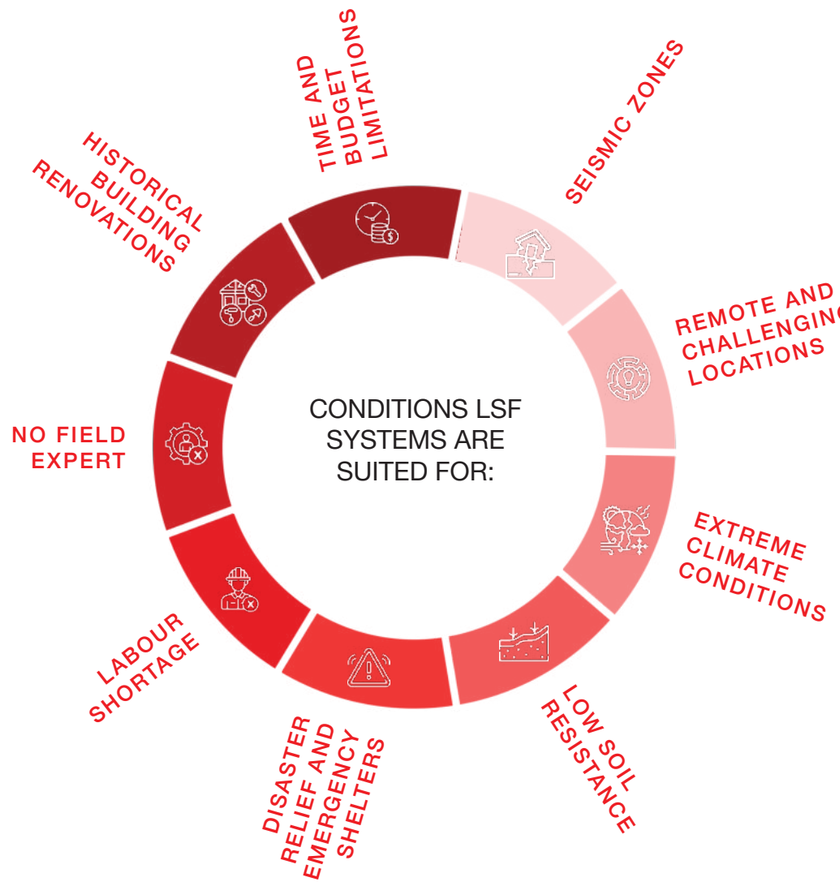
INDUSTRIAL

Light Steel Framing

The Ideal Solution For All Building Types.

LSF FOR CHALLENGING PROJECTS

Light steel frame systems are indeed well-suited for challenging projects that require innovative solutions and specific design considerations. Here are some examples of challenging projects where light steel frame system excels:

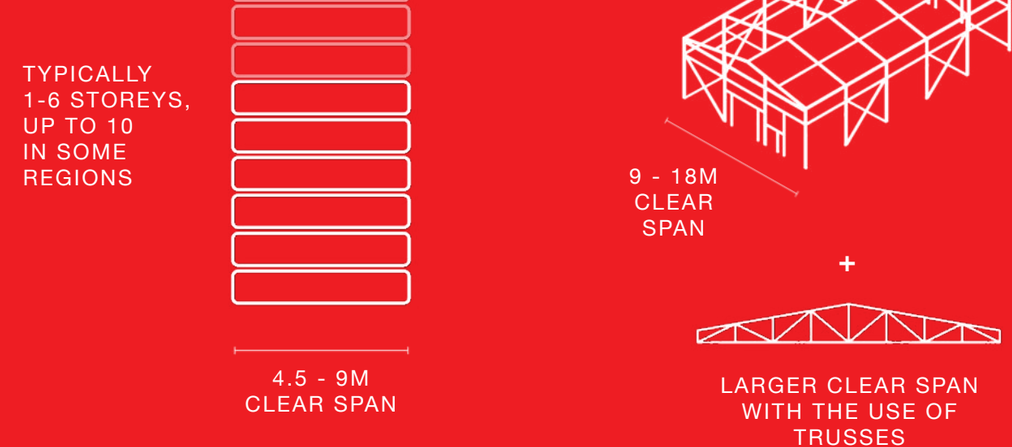


Light steel frame's adaptability, strength, lightweight nature, and prefabrication capabilities make them a valuable choice for projects that require innovative solutions and the ability to overcome specific challenges.

SPANS & STOREYS

As a general guideline, the clear span between two load-bearing LSF walls commonly ranges from **4.5 meters** (15 feet) to **9 meters** (30 feet) in typical residential and light commercial applications. In practice, LSF buildings commonly range from **one to six storeys**. However, there have been instances of LSF structures exceeding six floors, especially in regions where LSF construction is well-established and supported by local regulations.

The clear span of warehouses in LSF structures tend to be larger compared to residential or light commercial applications. Typically, clear spans between **9 meters** (30 feet) and **18 meters** (60 feet) are common in warehouse LSF designs. For larger clear spans in warehouses, specialised LSF design approaches may be employed, such as the use of larger steel members, trusses, or other structural solutions to ensure the necessary strength and stability of the structure.



PERFORMANCE OVERVIEW

Light steel frame construction offers a wide range of overall performance benefits. It is known for its cost-effectiveness, fast construction speed, and design flexibility, making it a popular choice for a variety of building types. Light steel frames provide good acoustic and thermal insulation when combined with appropriate materials, contributing to occupant comfort and energy efficiency. They also exhibit excellent fire resistance, ensuring the safety of occupants and minimising damage. Additionally, light steel frames demonstrate favourable seismic performance due to their lightweight and ductile nature, providing structural stability during earthquakes. With its durability, low maintenance requirements, and high recyclability, light steel frame construction offers a compelling solution for efficient, sustainable, and resilient buildings.

FIRE RESISTANCE

Steel is inherently fire-resistant and does not contribute fuel to a fire. Light steel frame construction often incorporates fire-resistant materials to further enhance its fire performance. The use of appropriate fire protection measures, such as fire-resistant barriers, can help compartmentalise a building and prevent the spread of fire. In general, light steel framing systems can achieve fire resistance ratings typically ranging from 30 minutes to 2 hours or more. These ratings indicate the duration for which the framing system can withstand fire exposure without significant structural failure.

Here are some key aspects to consider regarding the fire resistance of LSF:

FIRE-RATED MATERIALS

LSF systems can incorporate fire-rated materials such as gypsum boards, fire-resistant insulation, and fire-resistant coatings. These materials are specifically designed to resist fire and contribute to the fire resistance of the overall system.

FIRE-RATED ASSEMBLIES

LSF systems can be assembled to create fire-rated wall, floor, and ceiling assemblies. These assemblies are designed to meet specific fire resistance ratings and provide a certain level of protection against fire spread.

FIRE TESTING AND CERTIFICATION

Fire resistance ratings for LSF systems are determined through standardised fire tests. Tests such as the ASTM E119 or EN 1365-1 evaluate the performance of LSF assemblies under controlled fire conditions. The ratings indicate the duration for which the assembly can resist fire and maintain its structural integrity.

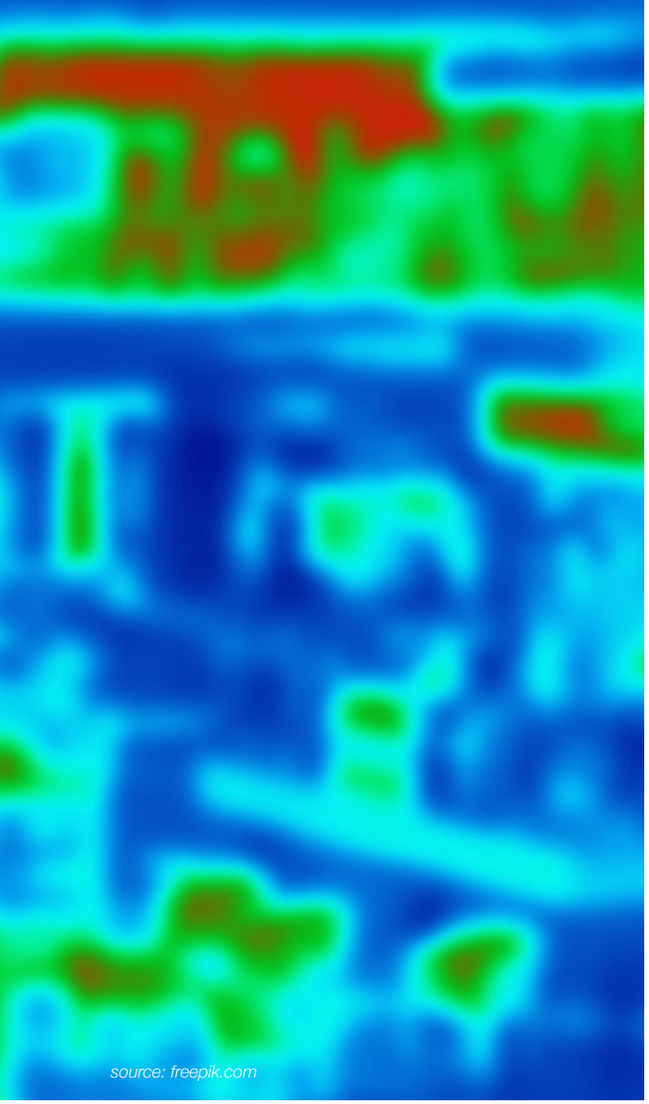
FIRE PROTECTION MEASURES

Additional fire protection measures can be implemented to enhance the fire resistance of LSF systems. This may include the installation of fire-resistant barriers, fire-stopping materials at wall penetrations, and the use of fire-resistant sealants to prevent the spread of fire and smoke.

BUILDING CODES AND REGULATIONS

The fire resistance requirements for LSF systems are typically outlined in local building codes and regulations. These codes specify the minimum fire resistance ratings for various building elements, including walls, floors, and ceilings.

THERMAL PERFORMANCE



source: freepik.com

Light steel frame construction can provide favourable thermal performance when combined with proper insulation materials and design considerations. Here are some key factors that contribute to its thermal performance:

SUPERIOR THERMAL CONDUCTIVITY

Light steel framing exhibits significantly lower thermal conductivity compared to traditional construction materials such as concrete. This characteristic minimizes heat transfer, ensuring improved thermal performance and enhanced comfort within the building envelope.

THERMAL BRIDGING

Properly addressing thermal bridging is crucial in light steel framing systems. Through meticulous insulation installation, strategic deployment of thermal breaks, and utilization of continuous insulation, the adverse effects of thermal bridging can be substantially minimised.

OPTIMAL INSULATION SELECTION

The selection and meticulous installation of insulation materials play a vital role in achieving optimal thermal performance. Widely adopted insulation options for light steel framing include fibreglass, mineral wool, and rigid foam insulation. These materials are strategically placed within framing cavities or on the exterior of the framing system to maximise thermal resistance.

ENERGY EFFICIENCY ENHANCEMENT

When combined with effective insulation,comprehensive air sealing, and high-performance windows, light steel framing systems contribute significantly to energy-efficient buildings. This integration results in reduced heating and cooling loads, ultimately leading to substantial energy savings over the building's lifespan.

Quantitative Assessment of Thermal Performance:

To evaluate the thermal performance of light steel framing systems, various quantitative metrics are utilized:

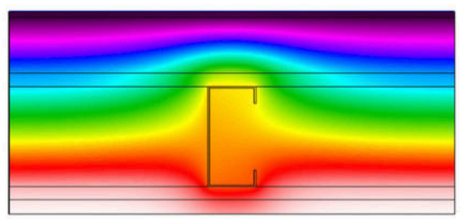
U-VALUE (OVERALL HEAT TRANSFER COEFFICIENT)

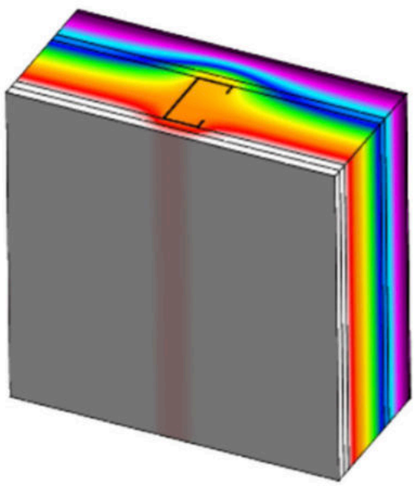
- Exterior Walls: Typically ranging from 0.15 to 0.35 W/m²·°C, U-values for light steel framing exterior walls are influenced by factors such as insulation type, thickness, and the presence of thermal bridging.
- Roof Assemblies: Typically falling within the range of 0.1 to 0.3 W/m²·°C, U-values for light steel framing roof assemblies vary depending on the insulation employed and the specific roof design.

R-VALUE (THERMAL RESISTANCE)

- Exterior Walls: Typically ranging from R-15 to R-30 (or 2.7 to 5.4 m²·°C), R-values reflect the thermal resistance of light steel framing exterior walls.

Please note that these ranges provide a general overview and are subject to variations based on factors such as insulation types, climate conditions, and specific design considerations.





ACOUSTIC PERFORMANCE

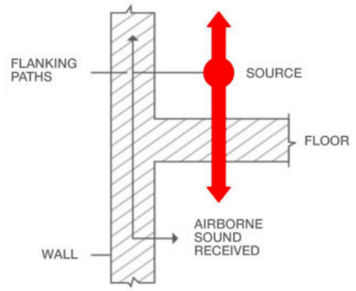
Sound is vibration. It's transmitted as a wave motion through air, liquids, and solid materials, including plywood, gypsum board, and light steel framing. There are two types of building sound:

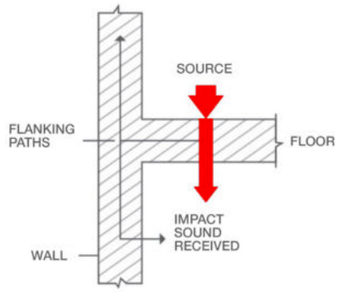
1. AIRBORNE SOUND

Airborne sound travels through the air. It can pass through walls and floors and reemerge in surrounding spaces.

2. IMPACT SOUND

Impact sound (or structural-born sound involves the mechanical excitation of partitions, even though some of this sound is eventually conducted by the air. Impact sound can originate as footsteps, a treadmill, or furniture dragged across the floor, as just a few examples.



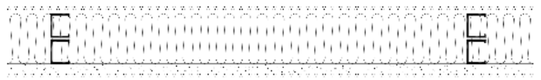


The acoustic performance of LSF systems can vary depending on specific design details, construction techniques, and the choice of materials. Acoustic performance is typically quantified using standardised metrics such as Sound Transmission Class (STC) and Impact Insulation Class (IIC) ratings. These ratings indicate the ability of a construction assembly to reduce airborne and impact noise transmission, respectively.

Different areas within a building may have specified Sound Transmission Class (STC) requirements or recommendations based on their functions. For example, residential buildings have STC requirements for walls between units, educational facilities have STC requirements for classroom walls, healthcare facilities have STC requirements for patient rooms, and commercial buildings have recommended STC ratings for offices and conference rooms. These requirements aim to reduce noise transfer, maintain privacy, and create acoustically comfortable environments. It is important to consult local building codes and regulations to determine the specific STC requirements for each area within a building.

Light Steel Framing (LSF) offers an excellent solution to meet the specific minimum Sound Transmission Class (STC) requirements for buildings. By employing advanced design and construction techniques, along with the use of appropriate sound insulation materials and resilient channels, LSF walls can achieve the desired acoustic performance. For instance, in the United States, the International Building Code (IBC) provides comprehensive guidelines for sound transmission control in buildings. According to the IBC, walls between bedrooms in occupancy types such as hotels or multifamily residential buildings typically require a minimum STC rating of around STC 50. With its inherent structural capabilities and customisable design, LSF construction is well-equipped to comply with this requirement. By incorporating precise construction practices and employing effective sound insulation materials, LSF walls ensure optimal sound insulation performance, meeting and even exceeding the minimum STC rating specified in the IBC.
LSF systems offer a reliable and efficient solution for achieving superior acoustic performance in all building types, aligning with the stringent requirements set by various building regulations.

Non-load bearing wall STC example:



Pair of 41 mm x 32 mm x 0.66 mm thick steel studs spaced at 760 mm o.c.
76 mm mineral wool insulation
1 layer of 12.7 mm or 15.9 mm gypsum board on one side
1 layer of 12.7 mm reinforced cement board, designated "Perma Base" on each side

Sound Transmission Class: 54*

The following solutions help reduce sound transmission in LSF structures

- Use sound insulation materials between steel studs.
- Employ double-stud walls with an air gap.
- Increase wall mass for better sound blocking.
- Ensure proper acoustic sealing.
- Incorporate resilient mounting techniques.
- Pay attention to construction details and quality.
- Consider acoustic testing and consultation.

SEISMIC PERFORMANCE

Light steel frame structures are known for their excellent seismic performance due to the inherent properties of steel as a building material.

LSF structures are designed in compliance with seismic design codes and standards, such as the International Building Code (IBC) in the United States, Eurocode 8 in Europe, BSI (UK) or other regional building codes. These codes provide guidelines for designing LSF structures to withstand seismic forces based on the seismic design categories assigned to the specific region or project location. These categories range from A to F, with Category A representing the lowest seismic risk and Category F representing the highest seismic risk.

Here are some key factors contributing to the seismic resistance of LSF systems:

Earthquakes don't kill people.

Buildings do.

source: ADEM ALTAN//Getty Images

LIGHTWEIGHT AND DUCTILE MATERIAL

Light steel frames are made from high-strength steel (ST37 or ST52), which has excellent ductility and resilience. Steel has a high strength-to-weight ratio, making it lightweight compared to other construction materials. This property allows light steel framing to exhibit better seismic performance by reducing the mass of the structure and minimizing inertial forces during an earthquake.

FLEXIBILITY AND ENERGY DISSIPATION

Light steel frames can absorb and dissipate seismic energy through their inherent flexibility. The ductile behaviour of steel enables the structure to undergo elastic deformation during seismic events, helping to absorb and dissipate seismic forces. This flexibility allows the structure to withstand ground movements and reduces the risk of catastrophic failure.

ENGINEERED DESIGN AND CONNECTIONS

Light steel frame structures are typically designed by professional engineers who consider seismic forces and follow appropriate design codes and guidelines. The design process includes ensuring proper bracing, connections, and load distribution systems to enhance the structure's resistance to seismic forces. Carefully designed and engineered connections can allow for movement and redistribution of forces during earthquakes.

PREFABRICATION AND QUALITY CONTROL

Light steel frame construction often involves off-site fabrication of components, ensuring consistent quality and precision. The controlled manufacturing environment enables better quality control, resulting in accurate assembly and reliable connections. These factors contribute to improved seismic performance by reducing construction errors and ensuring structural integrity.

REGULARITY AND SYMMETRY

Light steel frame structures with regular and symmetrical configurations tend to exhibit better seismic performance. Regularity in the layout and distribution of load-carrying elements helps to distribute seismic forces more evenly throughout the structure, reducing localized stress concentrations.

It's important to note that while light steel framing has shown good seismic performance, the specific performance of a structure depends on various factors such as the design, quality of materials, construction techniques, and adherence to local building codes and regulations. It is essential to engage experienced professionals and structural engineers who are knowledgeable about seismic design principles to ensure the best seismic performance of light steel frame structures in specific geographic regions prone to earthquakes.

STEEL

Durability, Strength and Recyclability

Galvanised steel is commonly used in light steel framing (LSF) due to its excellent corrosion resistance and structural strength. Achieved through the hot-dip galvanising process, steel undergoes a coating treatment that provides excellent protection against corrosion and moisture. Galvanising is obtained at relatively low environmental burden in terms of energy and other globally relevant impacts, and provides a lifespan exceeding 50 years in most environments. This robust coating withstands rigorous salt spray testing for over 1000 hours without exhibiting red rust formation.

Compliant with industry standards like ASTM A653/A653M, galvanised steel offers different coating thickness options for enhanced corrosion resistance. It is a sustainable choice with high recyclability, and its wide availability and formability make it ideal for various construction projects.

The galvanising process involves immersing steel components into a bath of molten zinc, creating a metallurgical bond between the zinc coating and the steel surface. Among the various galvanised coating designations, such as G40, G60, and G90, they are commonly used in light steel framing systems based on the ASTM standard.

Coating Designation: According to ASTM A653/A653M standard

G40/Z120: Minimum coating weight of 120 g/m² (0.40 oz/ft²) minimum coating designation for non-structural members
G60/Z180: Minimum coating weight of 180 g/m² (0.60 oz/ft²) minimum coating designation for structural members
G90/Z275: Minimum coating weight of 275 g/m² (0.90 oz/ft²)

IMPRESSIVE FACTS ABOUT STEEL

The utilisation of steel in construction offers several remarkable advantages:

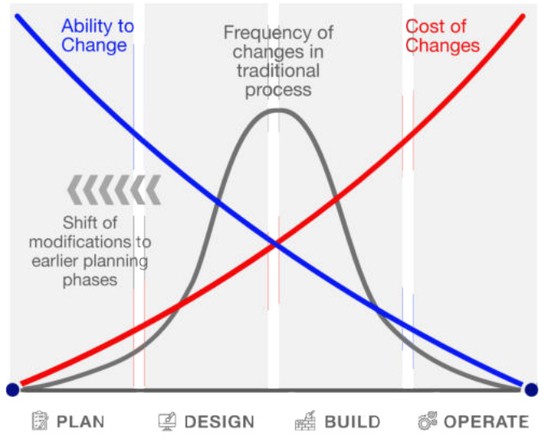
- Steel is 100 percent recyclable, which means it can be recycled into the same material of the same quality again and again without losing strength.
- Recycling steel saves enough energy to power approximately 18 million households annually.
- North America recycles more than 80 million tons of steel yearly, with a recycling rate greater than 60%.
- More than 95% of the water used to make steel in North America is recycled.
- One scrapped car produces more than four steel utility poles.
- Each tonne of recycled steel saves 2,500 pounds of iron ore, 1,400 pounds of coal, and 120 pounds of limestone.

LIFE-CYCLE THINKING

Key To Every Aspect Of Sustainability

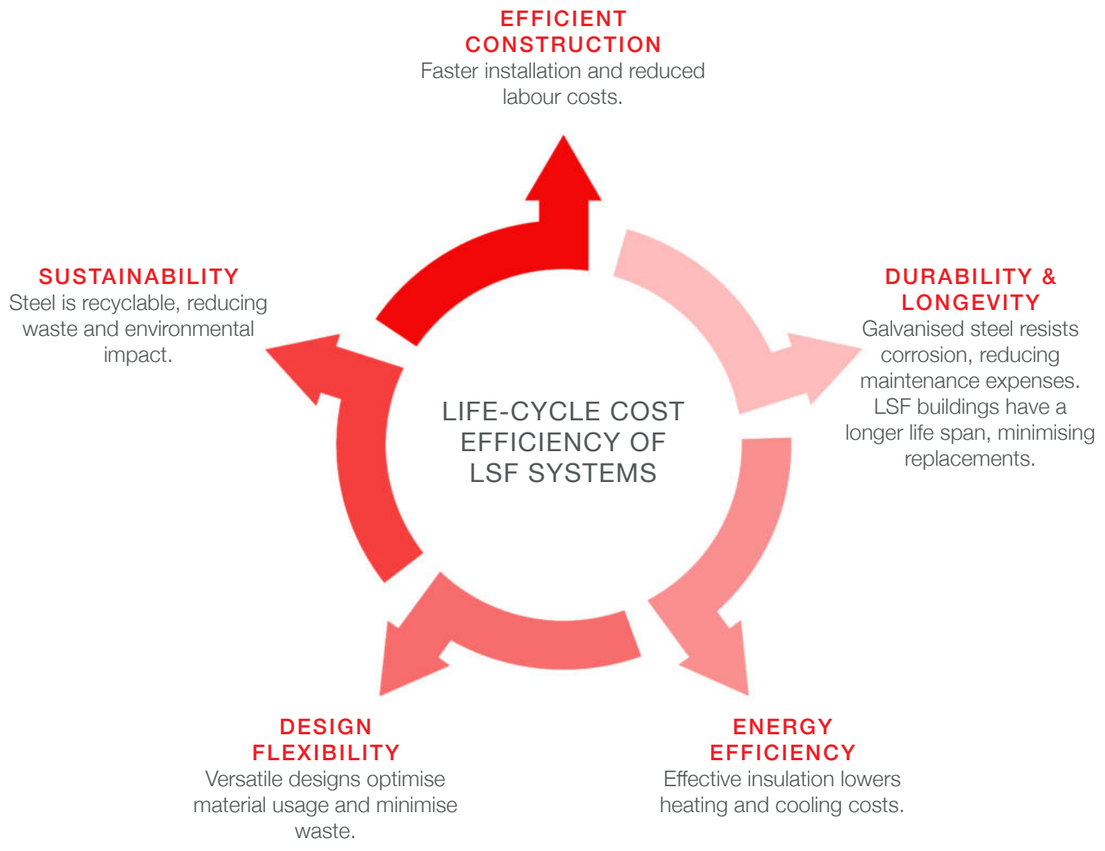
Life-cycle refers to the entire lifespan of a building or construction project, from its initial conception and design through construction, operation, maintenance, and eventual decommissioning. Life-cycle cost analysis is a systematic approach to evaluating the total cost of owning, operating, and maintaining a structure over its lifespan. It takes into account not only the upfront construction costs but also ongoing expenses, such as energy consumption, maintenance, repairs, and replacements.

The construction's share of the total cost over the lifetime of the asset can be as high as 10-50%, while the operation and maintenance (O&M) costs may account for 40-80%. These two major cost components are largely determined early on, during the design and engineering phase. At this early stage, it is still relatively easy and inexpensive to make changes. By leveraging the advantages of LSF, construction projects can achieve significant cost savings throughout the life cycle of the building while ensuring efficient performance and environmental stewardship.



Source: World Economic Forum; The Boston Consulting Group

Light Steel Framing (LSF) is a cost-effective and sustainable construction method widely used in various building projects. With its numerous advantages, LSF offers significant reductions in life-cycle costs.



A minimal increase of just 2% in the upfront cost to optimise the design will lead to an average life-cycle cost saving of 20%.

THE MANUFACTURING PROCESS

The manufacturing process of light steel frame elements typically involves several steps. Here is a general overview of the process:

1. DESIGN AND ENGINEERING: The first step is the design and engineering of the light steel frame elements. This includes determining the structural requirements, creating detailed drawings, and specifying the dimensions and connections of the steel profiles.

2. MATERIAL SELECTION: High-quality galvanised steel is commonly used for light steel frame construction due to its strength, durability, and corrosion resistance. The steel sheets or coils are sourced and inspected for quality assurance.

3. ROLL FORMING: Roll forming is a key manufacturing process for light steel frame elements. It involves feeding steel strips or coils through a series of roll forming stations. Each station gradually shapes the steel into the desired profile, such as C, U or Z sections. Roll forming machines often have multiple sets of rolls to achieve various profiles.

4. CUTTING AND PUNCHING: After roll forming, the steel sections are cut to the required lengths using shearing or sawing machines. Additionally, holes or slots may be punched into the steel profiles to allow for connections and attachment of other building components.

5. ASSEMBLY: The individual steel sections are assembled according to the design specifications. Screw connections are used to join the sections together, ensuring structural integrity.

6. QUALITY CONTROL: Throughout the manufacturing process, quality control measures are implemented to ensure the dimensional accuracy, strength, and overall quality of the light steel frame elements. Inspections, testing, and adherence to industry standards help maintain the desired quality standards.

7. PACKAGING AND TRANSPORTATION: Once the light steel frame elements are manufactured and inspected, they are typically packaged and prepared for transportation to the construction site. Proper packaging ensures their protection during transit.

It is important to note that the manufacturing process may vary depending on the specific manufacturer, equipment used, and project requirements. Advanced manufacturing techniques, such as computer numerical control (CNC) technology, may also be employed to improve efficiency and precision in the production of light steel frame elements.

TYPICAL ROLL FORMING PROCESS

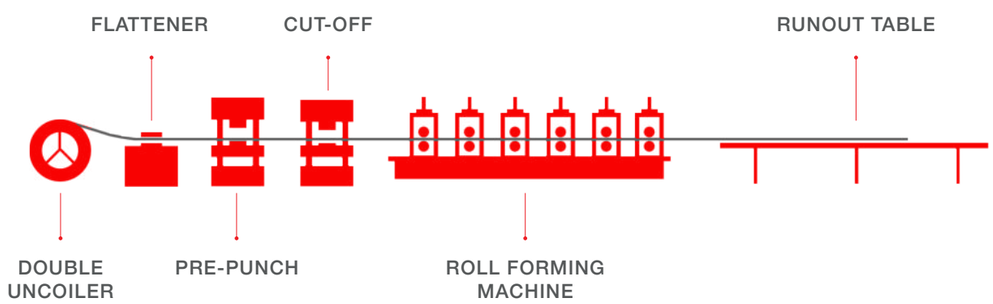
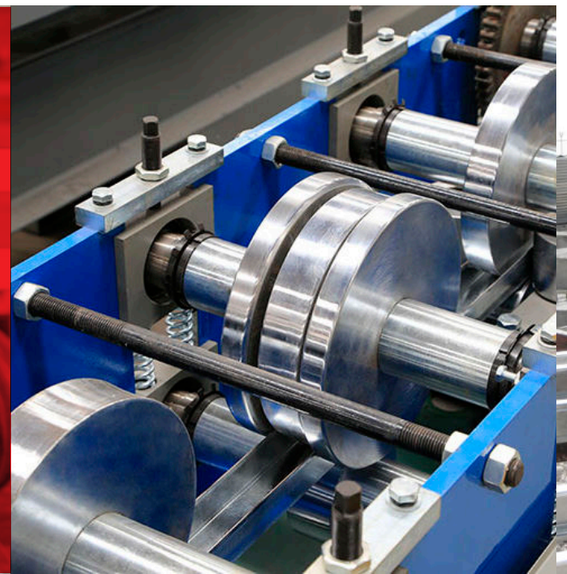



Image by KamranAydinov on Freepik



LSF IMPLEMENTATION PHASES

The implementation of light steel framing typically involves several phases to ensure successful construction. It is important to note that many of these phases are executed in parallel, therefore speeding up the construction process. While the specific steps may vary depending on the project, here are the general phases involved in light steel framing implementation:

1. SITE PREPARATION AND FOUNDATION

Excavation, levelling, and compaction of the foundation in preparation for LSF execution

2. STRUCTURE PRODUCTION - OFF-SITE

Light steel framing components, such as studs, tracks, and joists, are manufactured off-site, in a controlled factory environment.

3. PANELISATION

The fabricated components are assembled into panels according to the panelisation plan.

4. WALL ERECTION

The steel framing is erected, anchored, and connected to the foundation and adjacent structural elements, ensuring proper alignment and stability. The panels are fixed through the use of hold downs, tie downs and chemical bolts.

5. FLOOR / ROOF ERECTION

LSF flooring erection for rapid and precise assembly.

COMPLETED STRUCTURE

6. MEP INSTALLATION

Installation of MEP systems, including electrical wiring, plumbing, heating, ventilation, and air conditioning.

7. JOINERY AND INTERIOR WORK

Installation of insulation materials, followed by the application of interior finishes, such as drywall, flooring, and ceiling systems.

8. FAÇADE INSTALLATION

Facade installation, adding a visual appeal and weather-resistance to the exterior of the building.

SAVE TIME, SAVE MONEY

How can light steel framing systems save on construction cost?

Project owners are always looking for solutions to cut construction costs while maintaining work quality and output. With conventional methods of construction in mind, this may seem unobtainable however it is all possible with Light Steel Framing systems. Here are some of the key reasons that LSF systems can reduce construction cost and time:

STRENGTH-TO-WEIGHT RATIO

Light steel framing typically requires less material compared to traditional concrete construction. Steel has a high strength-to-weight ratio that allows for thinner and lighter components while maintaining structural integrity. This reduces the amount of material needed, resulting in lower material costs. Additionally, the reduced weight of the structure allows for less foundation, saving costs at the beginning of the construction.

LABOUR COSTS / PANELLISATION

LSF systems are partly prefabricated off-site, meaning the components are manufactured in a controlled factory environment and then transported to the construction site. This off-site prefabrication can significantly reduce on-site labour requirements, leading to lower labour costs. Additionally, steel components are relatively lightweight and easier to handle, allowing for faster installation and reduced labour time.

CONSTRUCTION TIME

Light steel framing is known for its speed of construction. The prefabricated steel components can be quickly assembled on-site, leading to shorter construction schedules. This results in cost savings by reducing the duration of on-site labour and related expenses such as crane costs, scaffold rentals, supervision, and general site management.

QUICK RETURN ON INVESTMENT

The predictability and accuracy of steel components speed up the process and allow follow-on trades to get to work sooner. The shorter construction time-frame reduces interim financing costs for projects. It also narrows the window of construction-related liability and allows for earlier building occupancy, therefore speeding up return on investment.

CHALLENGING CLIMATES

Light steel framing components are manufactured off-site, in a factory controlled environment regardless of outdoor climate conditions. This reduces on-site construction duration and therefore reduces costs.
LSF also suits projects where water resources are scarce as it requires no water during construction, saving on water consumption and costs.

MAINTENANCE AND DURABILITY

Steel is a durable material that requires minimal maintenance compared to concrete. It is resistant to pests, rot, and decay, which can reduce long-term maintenance costs for the client. Additionally, steel structures are less susceptible to cracking and settling, leading to fewer structural issues over time.

LSF OFF-SITE CONSTRUCTION

You Can Have It All

Light steel framing (LSF) manufactured off-site offers several advantages in the construction industry. Clients are increasingly demanding more efficient, smart and adaptable buildings that prioritise wellness, resilience and advanced technologies. They seek environmentally friendly designs, energy efficiency, automation systems, flexibility for future modifications, occupant comfort, and structures that can withstand natural disasters. Integration of emerging technologies, cost-effectiveness, and efficient project delivery are also key considerations in order to meet the demands of the growing population. LSF systems manufactured off-site fulfil 3 of the main concerns clients have for their projects; speed of construction, quality and cost:

TIME

Off-site manufacturing of LSF components allows for simultaneous production while site preparation is underway. This significantly reduces construction timelines compared to traditional on-site construction methods. Once the components are ready, they can be quickly and efficiently assembled on-site, further speeding up the construction process.

MONEY

LSF off-site manufacturing can result in cost savings for construction projects. The controlled factory environment allows for optimised material usage, reducing waste and saving on material costs. Additionally, the efficient manufacturing process, coupled with faster construction timelines, can lead to overall cost reductions and quicker return on investment.

QUALITY

LSF components manufactured off-site benefit from precise computer-aided design (CAD) and manufacturing processes. This ensures high levels of accuracy, consistency, and quality control. Each component is fabricated to exact specifications, minimising errors and ensuring a superior final product.

Overall, off-site construction in light steel framing (LSF) offers a compelling solution for the construction industry. By combining the benefits of off-site manufacturing with the versatility and strength of LSF, projects can be completed faster, with higher quality, and at reduced costs. The streamlined process, design flexibility, sustainability, and time-saving advantages make LSF off-site construction a promising choice for the future of the industry.

CONCLUSION

Light steel frame (off-site) construction is more optimised and faster than traditional on-site construction due to streamlined processes, simultaneous activities, assembly-line approaches, controlled environments, improved labour productivity, reduced disruptions, and enhanced quality control. It offers notable advantages, such as reduced construction time by up to 30-50%, 2.5 times improved labour productivity, and potential cost savings of 10-30%. This is achieved through standardised production in a controlled factory environment, parallelisation of tasks, efficient resource allocation, minimised site disruptions, and stringent quality control measures.

BUILDING PRODUCTIVITY

1 LABOUR PRODUCTIVITY

- Less workforce required
- 2.5 times more efficient labour productivity compared to conventional methods of construction

2 ASSET

TIME

- Build To Rent (BTR) 30-50% faster
- Faster Return on Investment (ROI)

COST

- Higher initial expense
- Lower overhead cost
- Lower construction time period
- Less heavy machine requirement
- Lower management risk

QUALITY

- More precise production
- Less inspection
- More satisfaction
- Overall better performance

3 RESOURCES

- More efficient facility management
- Energy saving
- Overall better earthquake and fire performance
- Lower maintenance and energy cost
- Less transportation
- Sustainable
- Long-term value
- Steel recyclability

Section 3
TIVA LIGHT STEEL FRAMING

“Providing The Maximum by Exploiting The Minimum”

ABOUT TIVA

Founded in 2004, Tiva is a family owned and operated company specialising in Light Steel Framing (LSF) systems. With over 28 years of experience in this method of construction and more than 150,000 m^2 of successfully delivered projects, we can proudly boast a number of industry firsts in the field of LSF in Iran. Over the years we have undertaken projects of various sizes in a number of sectors with more than 30 happy, returning clients.

Our ability to manage the entire process from design, manufacture, assembly, on-site installation and management allows us to integrate the complete solution, guaranteeing programme efficiency and certainty.

Our experts have extensive knowledge of light steel framing and have actively worked over the years to educate keen learners in the field.

Our focus and forward-looking strategy, based on the skills and values we have acquired over the years, is to enter the international market. The challenges posed by different cultural contexts enables our company and its employees to grow and develop skills within an international environment.

We are aiming for internationalisation, innovation and sustainability as our key drivers for future developments.

We have successfully achieved many firsts in the industry and continue to expand our expertise and services.

We are proud to be pioneers in:

THE FIRST ONE-STOREY LSF BUILDING IN IRAN

THE FIRST MULTI-STOREY LSF BUILDING IN IRAN

THE FIRST FLOOR ADDITION WITH LSF IN IRAN

THE FIRST 6-STOREY LSF BUILDING IN THE MIDDLE EAST & ASIA

OUR SERVICES

With our in-house engineers and experts, we offer a full set of services from the initial design to the final installation of Light Steel Framing systems. We strongly believe that our knowledge is on par with our national and international competitors, however our prices are significantly lower.

Our services include:

DESIGN

We aim to offer an optimised model for manufacturing and execution processes of LSF technology, utilising recognised and up-to-date softwares such as Steel-Smart System, Strap, ETaps, Revit and AutoCAD. Our experienced designers advise clients with the best possible solutions that fit the brief requirements, in order maximise productivity and add value to the project.

FABRICATION

The construction industry is increasingly moving towards prefabrication for many reasons such as optimisation, speed of construction and environmental benefits. A major part of what we do including the manufacturing of LSF parts happens off-site in a factory controlled environment, minimising installation time on-site with fewer workers.

ENGINEERING

Light Steel Framing is the miracle of engineering. The superiority of LSF and its preference over conventional structures, make it the preferred choice for many projects. Our in-house engineers have worked to push boundaries and innovate new solutions within the industry over the years and have achieved many firsts.

PROCUREMENT

The global Light Steel Framing market size was valued at $23,890 million in 2021. With Iran having mass sources of steel mines along with a great number of steel production and forming companies, steel has become one of the most accessible material to use for construction purposes. At Tiva, we work closely with many of the well-experienced cold-roll forming companies to ensure the best service is in-hand when needed.

CONSTRUCTION

As much of the construction process happens off-site, our on-site construction time is significantly reduced. It consists of our execution team to panellise the pre-fabricated galvanised steel profiles using self-drilling screws, to then installing the panels into place.

TRAINING & EDUCATION

Since the establishment of Tiva, we have been heavily involved in educating and training keen individuals in the light steel framing field. We have developed a series of beginner technical notes for students and young engineers that provide fundamental information relating cold-formed steel design. The series was authored by our cold-formed steel framing experts and covers topics relating steel production, framing fabrication and design principles.

BIM SERVICES

We utilise BIM at the clients' request to provide a powerful and flexible multi-layer design, framed wall, floors, and roofs, including prefabricated panels, rafters, and trusses. The accuracy of design in BIM, mean a smooth construction process with minimal risk.

WHY TIVA

With almost three decades of experience and the know-how of the Light Steel Framing industry, we customise every structural design to complement the architecture and work to innovate solutions that best fulfil the client's brief. The design is based on a single building component, an optimised section C-shaped profile - the connections of which have been specifically studied and modelled so that the entire process, from design to production and assembly, is extremely precise and guarantees the best performance.

Tiva offers a complete building system, integrated with the best dry construction components. Where necessary, especially for larger, multi-storey projects, we offer solutions where cold-formed steel elements and heavy structural steelwork or concrete structures can coexist and be optimised in a single structure. This is done thanks to the experience in all types and kinds of worksites that makes it possible to meet the design needs of all types of buildings.

Our systems and structural elements are prefabricated off-site, which are mounted promptly and easily by the workers at the worksite.

28 YEARS OF EXPERIENCE

LEADERS IN THE INDUSTRY

COMPETATIVE PRICES

FULL EPC SERVICES

EXPERT WORKFORCE

CLIENT SATISFACTION

FACILITY MANAGEMENT

OUR PROJECTS

Every project we deliver is an opportunity for us to bring our unique thinking to solve problems, innovate and collaborate with our clients and beyond. We have successfully delivered over 150,000 m^2 of projects in various locations in Iran in extremely diverse sectors.


28
YEARS OF EXPERIENCE


















40
CITIES NATIONWIDE

150,000
m^2
OF PROJECTS






HIGHLIGHTED PROJECTS

Mehr Residential Complex | Phase 5

CLIENT
Dept. of Housing and Urban Development

LOCATION
Parand New City, Iran

YEAR
2011

SECTOR
Residential

Affordable Housing

First **3-Storey** LSF building in Iran

162 Units

13300 m^2

Executed in **8.5** Months

HIGHLIGHTED PROJECTS

Management Camp for Phase 2 of South Pars

CLIENT
Petropars

LOCATION
Asaluyeh, Iran

YEAR
2008

SECTOR
Offices, Residential, Services

Coastal Location

2 Storeys

8000 m^2

HIGHLIGHTED PROJECTS

Barekat Site Admin and Laboratory Building

Executed in **65** Days

3 Storeys

2000 m^2

Challenging Climate

CLIENT
Herbi Pharmed

LOCATION
Kordan, Iran

YEAR
2015

SECTOR
Laboratory, Administration














HIGHLIGHTED PROJECTS

Ministry of Health Central Building Topping Up

CLIENT
Avaye Pardis Salamat

LOCATION
Tehran, Iran

YEAR
2014

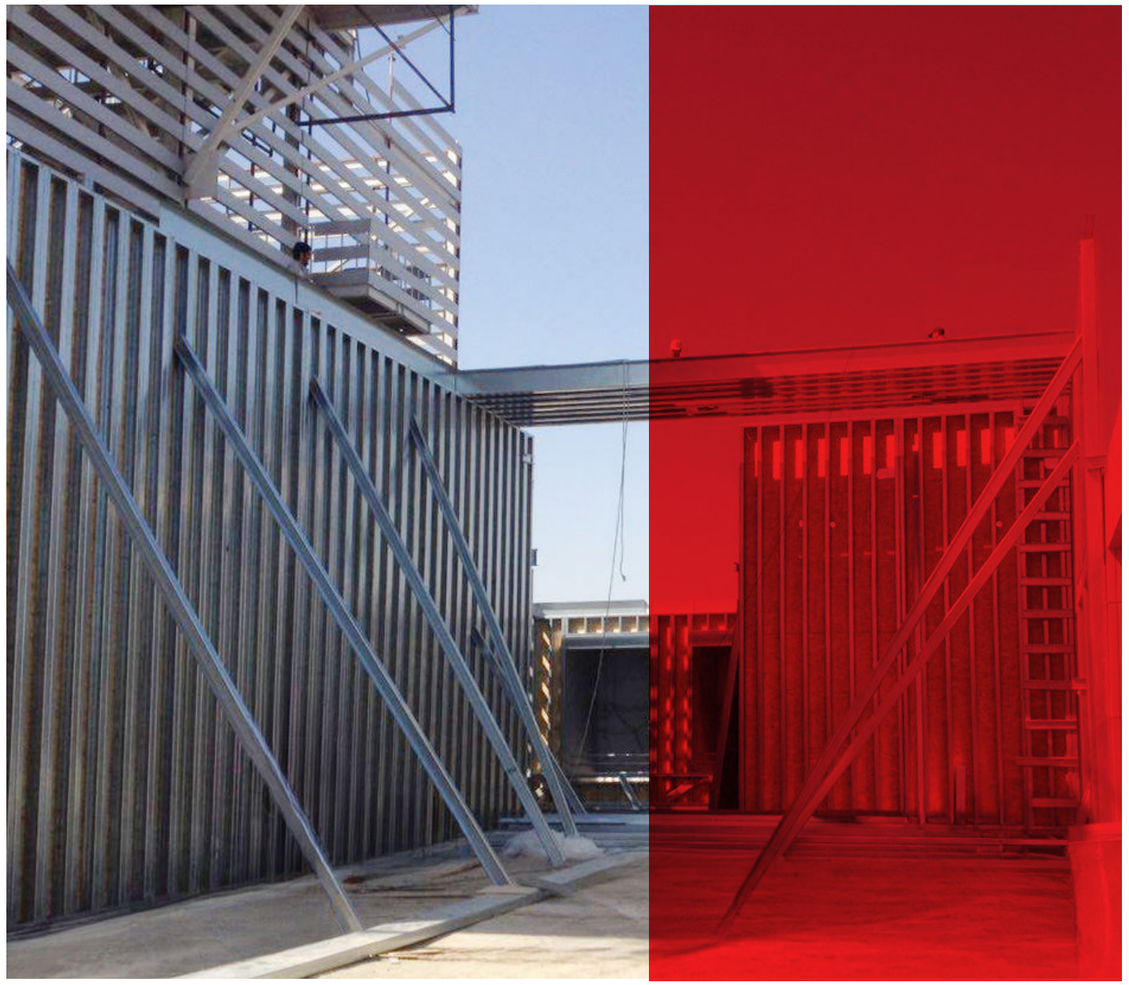
SECTOR
Offices, Topping Up

Floor Addition

10 Meter Clear Span

18th Floor

7m High Walls



HIGHLIGHTED PROJECTS

Water And Wastewater Administration Building

CLIENT
Tehran Region 3 Municipality

LOCATION
Tehran, Iran

YEAR
2018

SECTOR
Offices

3
Storeys

1200
m^2

HIGHLIGHTED PROJECTS

Dr Momeni Villa

Remote Location

3 Storeys

600 m²

CLIENT
Dr Momeni

LOCATION
Ramsar, Iran

YEAR
2017

SECTOR
Residential

HIGHLIGHTED PROJECTS

Zahedan Ghadirshahr 240-Unit Residential Complex

CLIENT
Tose'eh Garan Omran Setad

LOCATION
Zahedan, Iran

YEAR
Ongoing

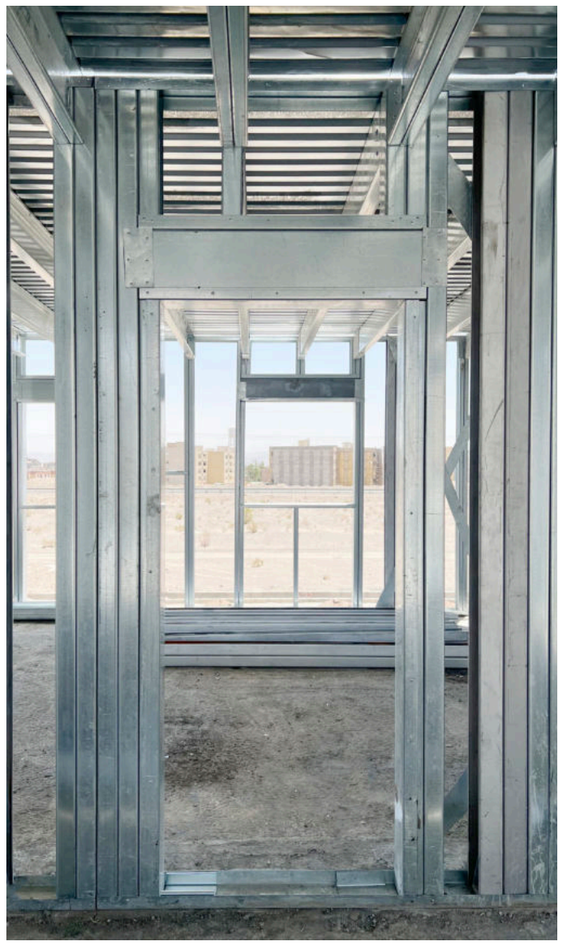
SECTOR
Residential

Affordable Housing

First **6-Storey** LSF building in Iran

240 Units

30,000 m^2



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