ENGINEER WITH LIVIO

TECHNICAL SPECIFICATIONS & PRODUCT FEATURES OF LIVIO BUILDING SYSTEMS

Updated On

JUNE 2025- V 1.4

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PREFACE

LIVIO Building System Inc. is a technology driven (BuildTech Company) UES certified manufacturer of superior & innovative Metal Building Systems, established in 2017. Our Off-site manufacturing & affordable products ensure our framing and other building systems reduce Construction time & cost on site.

Purpose of this document

To establish a standardized process for understanding the latest LIVIO products, their properties, and specifications. This document also aims to support Architects and Structural Engineers in creating compatible designs using the provided guidelines.

Scope

Applies to all engineering and design teams working with LIVIO products across the USA.

Document Control

This document shall be reviewed and updated periodically to ensure accuracy and reflect the latest information. Version control will be maintained, and updates will be shared with all partner firms via email.

How to Use This Document

This guide is organized to follow the end-to-end lifecycle of LIVIO's Building System—from understanding the material, methodology, process flow from modeling to construction, logistics, offsite and onsite assembly system, on-site execution and ongoing support. Whether you're an architect, engineer, contractor, or client representative, this document helps you align your designs and workflows with LIVIO's process and technology.

Version 1.4

Updated On: June 2025

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1. Introduction

1.1. What is LIVIO's Building System?

LIVIO is revolutionizing construction with Technology-driven Certified Pre-Assembled Multi-Trade Building Systems for Rapid Construction. Livio proudly stands as the exclusive provider of complete Building systems produced in state of the art Factory in India and shipped to the job sites. Our innovative approach, featuring a unique Lego-like installation process, Mobile app and automated Delivery System, transforms the construction landscape by enabling rapid and efficient project completion.

LIVIO helps you save up to 75% in framing labor time and cost - maximizing efficiency on every job site.

1.2. Mission

Deliver Cutting-Edge Products

Our mission is to revolutionize the construction industry by delivering cutting-edge products that reduce construction time and cost on-site while maintaining the highest standards of excellence. A company with a product that everyone in construction must have!

1.3. LIVIO Advantage

1) Speed of Construction
    - Reduces on-site construction time by **up to 75%**.
    - Fully framed and enclosed structures within **days** instead of months.
    - Pre-assembled MEP services minimize installation time.
2) Labor Efficiency
    - Requires **50-60% less on-site labor**.
    - Reduces dependence on large, skilled labor teams.
    - Ideal for rapid housing deployments.
3) Minimal Waste
    - Factory-controlled production ensures **precision cutting** and reduces material waste.
    - Optimized material usage lowers overall project costs.
4) Seismic and Wind Resistance:
    - **Steel-framed panels** offer superior structural stability.
    - Withstands **hurricane winds** of up to 150 mph.
    - Seismic-resistant design compliant with **IBC and local building codes**.
5) Fire and Thermal Performance:
    - **Non-combustible materials** enhance fire safety.
    - Superior thermal insulation reduces **heating and cooling costs** by 20-30%.

2. Cold form Steel (CFS) Technology

3.1. What Is Cold-Formed Steel (CFS) Framing?

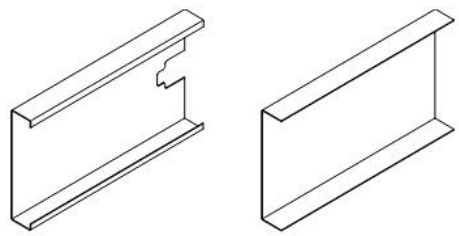
Cold-formed steel (CFS) members are made from structural quality sheet steel that are formed into C-shaped or U-shaped profiles at room temperature (cold-formed). No heat is required to form the shapes (unlike hot-rolled steel), hence the name cold-formed steel. A variety of steel thicknesses are available to meet a wide range of structural and non-structural applications.

- It is used for **non-combustible, high-strength, and lightweight** construction.
- Commonly used for **walls, floors, roofs**, curtain walls, and entire structural framing systems.
- Manufactured to **precise standards** (ASTM & AISI specifications) ensuring consistency and quality.
- Suitable for **load-bearing and non-load-bearing applications** in residential, commercial, and industrial projects.

3.2. Technical Specifications

LIVIO manufactures **cold-formed steel studs and tracks** for structural and non-structural applications.

- Products conform to:
    1. SSMA (Steel Stud Manufacturers Association) profile and labeling standards.
    2. AISI **Codes**: **S100**, **S240**, **S400**, and related specifications.
- Steel conforming to ASTM A1003/A1003M, A653/A653M
- Steel is **hot-dip galvanized with G60 coating**
- Yield strength options: 33 ksi, 50 ksi, and 80 ksi.
- Thicknesses range from 27 mil to 68 mil.
- Engineered for high-performance, non-combustible, and precision-aligned framing systems.



"S" - C-STUD/JOIST S-SECTIONS*

"T" - TRACK T-SECTIONS

Nomenclature Example

All SSMA products have a four-part identification code that identifies the web depth, flange width, style, and mil thickness.

Member Web Depth

*(Example: 6" = **600** × 1/100 inch)*

All member depths are given in 1/100 inch.

For all "T" sections, member depth is the inside to inside dimension.

Flange Width

*(Example: 1 5/8" = 1.625" ≈ **162** × 1/100 inch)*

All flange widths are given in 1/100 inch.

600 **S** **162** – **54**

Style

*(Example: Stud or Joist section = **S**)*

Nomenclature uses the following four characters to designate the profile:
S = Stud or Joist Sections
T = Track Sections
U = Channel Sections
F = Furring Channel Sections

Mil Thickness

*(Example: 0.054" = **54** mils; 1 mil = 1/1000 inch)*

Mil thickness is the minimum base steel thickness measured in 1/1000 inch. Minimum base steel thickness represents 95 percent of the design thickness.

3.3. LIVIO Manufacturing Constraint on Gauge and Profile

Studs and tracks can be manufactured as per the table provided and following SSMA Standards

Profile Depth:

3 ⅝", 6", 8", 10", 12"

Profile Thickness /Gauge:

As per table from 27mil - 68 mil

Flange width:

For studs: 162, 200, 250

For Tracks: 150, 200, 250

Stud Coil - Sheet Width (in)					
Stud Profiles	Material Thickness (mils)				
	30	33	43	54	68
362S162	7.517	7.501	7.450	7.394	7.323
400S162	7.892	7.876	7.825	7.769	7.698
600S162	9.892	9.876	9.825	9.769	9.698
800S162	-	11.876	11.825	11.769	11.698
1000S162	-	-	13.825	13.769	13.698
1200S162	-	-	-	15.769	15.698
362S200	8.517	8.501	8.450	8.394	8.323
400S200	8.892	8.876	8.825	8.769	8.698
600S200	10.892	10.876	10.825	10.769	10.698
800S200	-	12.876	12.825	12.769	12.698
1000S200	-	-	14.825	14.769	14.698
1200S200	-	-	-	16.769	16.698
362S250	9.517	9.501	9.450	9.394	9.323
400S250	9.892	9.876	9.825	9.769	9.698
600S250	11.892	11.876	11.825	11.769	11.698
800S250	-	13.876	13.825	13.769	13.698
1000S250	-	-	15.825	15.769	15.698
1200S250	-	-	-	17.769	17.698

Track Coil - Sheet Width (in)					
Track Profiles	Material Thickness (mils)				
	30	33	43	54	68
362T150	6.571	6.570	6.565	6.560	6.554
400T150	6.946	6.945	6.940	6.935	6.929
600T150	8.946	8.945	8.940	8.935	8.929
800T150	-	10.945	10.940	10.935	10.929
1000T150	-	-	12.940	12.935	12.929
1200T150	-	-	-	14.935	14.929

3.4. Minimum Grade Used for Cold Form Design

80 KSI grade steel offers cold-formed steel applications the ability to reduce material usage while maintaining or improving structural performance, especially in demanding environments where strength and lightness are key design considerations.

Sr. No	Panel Type	Min. Grade (Fy) KSI
1	All Load bearing Walls	80
2	All Floor /Roof Panels	80
3	All Types of Shear Walls	50
4	All Non-Load bearing walls	33

3. Structural Steel

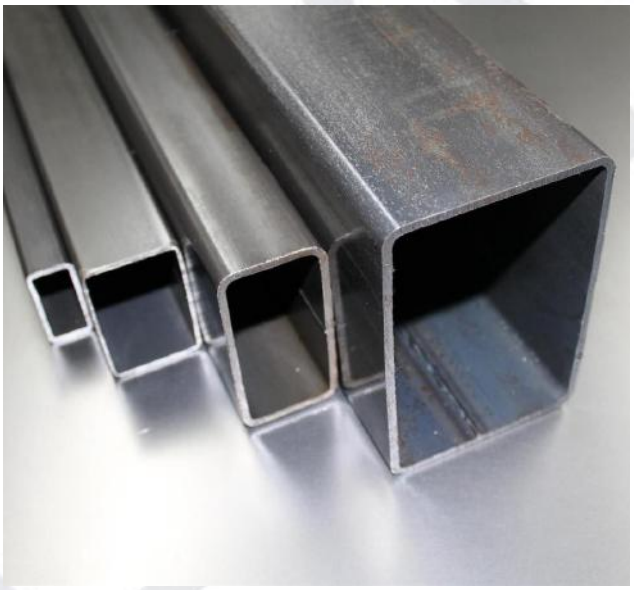
3.1. Why Structural Steel?

At LIVIO, we prioritize **cold-formed steel (CFS) framing** for its efficiency, cost savings, and compatibility with off-site manufacturing.

Structural steel (hot-rolled steel members like beams, columns, plates) is only provided **when required by design or structural performance criteria.**

We include structural steel **only if specified in approved structural drawings or when cold-formed steel alone cannot meet load, span, or connection requirements.**

This approach avoids unnecessary material costs and simplifies on-site coordination.



We also handle **integration between CFS and structural steel to ensure seamless alignment and installability.**
Livio utilizes a variety of structural steel components to construct buildings and structures. These components are selected based on project specifications, client requirements, and design considerations.

Philosophy at Livio while doing the structural design for steel is to avoid the site welding as many possible locations and opt for one side factory weld and bolt on site Combination. [SE]

3.2. Commonly Used Structural Steel Profiles

The following list outlines some of the most frequently used structural steel profiles at Livio Building System:

Standardized HRS Profile				
Sr. No	Hot Rolled Sections	Proposed	Material Grade as in Indian Market	Yield Strength
1	HSS 4"x4"x1/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
2	HSS 4"x4"x1/2"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
3	HSS 4"x4"x3/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
4	HSS 6"x6"x1/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
5	HSS 6"x6"x1/2"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
6	HSS 6"x6"x3/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
7	HSS 8"x4"x 1/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
8	HSS 8"x4"x 1/2"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
9	HSS 8"x6"x 1/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
10	HSS 8"x6"x 1/2"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
11	HSS 8"x8"x 1/2"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
12	HSS 10"x4"x1/2"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
13	HSS 10"x6"x1/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
14	HSS 10"x6"x1/2"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
15	HSS 10"x6"x3/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
16	HSS 12"x4"x 1/2"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
17	HSS 12"x6"x 1/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
18	HSS 12"x6"x 1/2"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
19	HSS 12"x6"x 3/4"	ASTM A500 GR.B (46 KSI)	ASTM A500 GR.B (46 KSI)	317 MPa
20	UB 203x133x30	ASTM A572 (50KSI)	ASTM A572 (50KSI)	345 MPa
21	UB 254x146x31	ASTM A572 (50KSI)	ASTM A572 (50KSI)	345 MPa
22	ISMB 100	46 KSI	46 KSI	317 MPa
23	ISMB 150	46 KSI	46 KSI	317 MPa
24	ISMB 200	46 KSI	46 KSI	317 MPa
25	ISMB 250	46 KSI	46 KSI	317 MPa
26	ISMB 300	46 KSI	46 KSI	317 MPa
27	ISMB 350	46 KSI	46 KSI	317 MPa
28	ISMB 400	46 KSI	46 KSI	317 MPa
29	ISMB 450	46 KSI	46 KSI	317 MPa
30	ISMB 500	46 KSI	46 KSI	317 MPa

4. Process Flow - Modeling to Onsite Construction

This Chapter showcases the entire process of any project from modeling to onsite construction

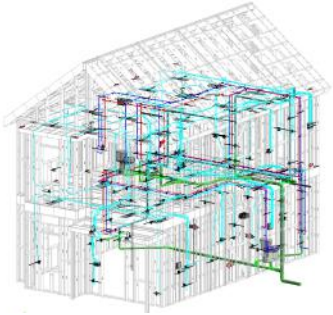
1. Design Phase + BIM Integration

a. Architectural Design

i. 3D Architectural Modeling from approved plans
ii. Model signoff with cross-checking all openings, etc.

b. Structural Design

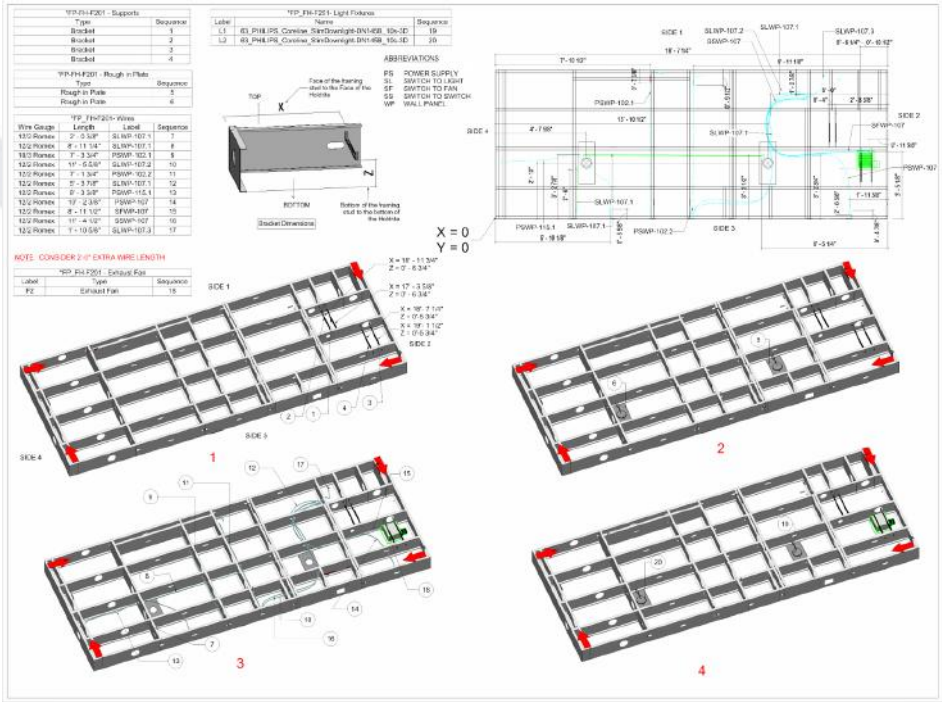
i. Code Compliant Engineering
ii. 3D Framing Modeling with finishes
iii. Panelization and Wall Splitting according to container size

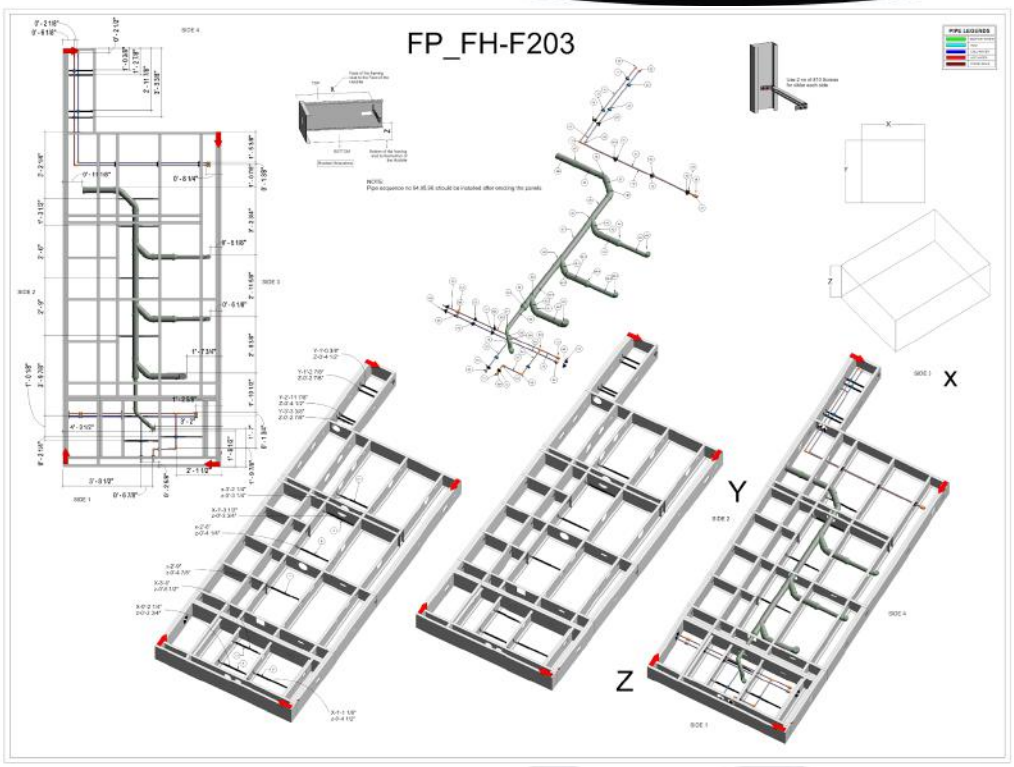


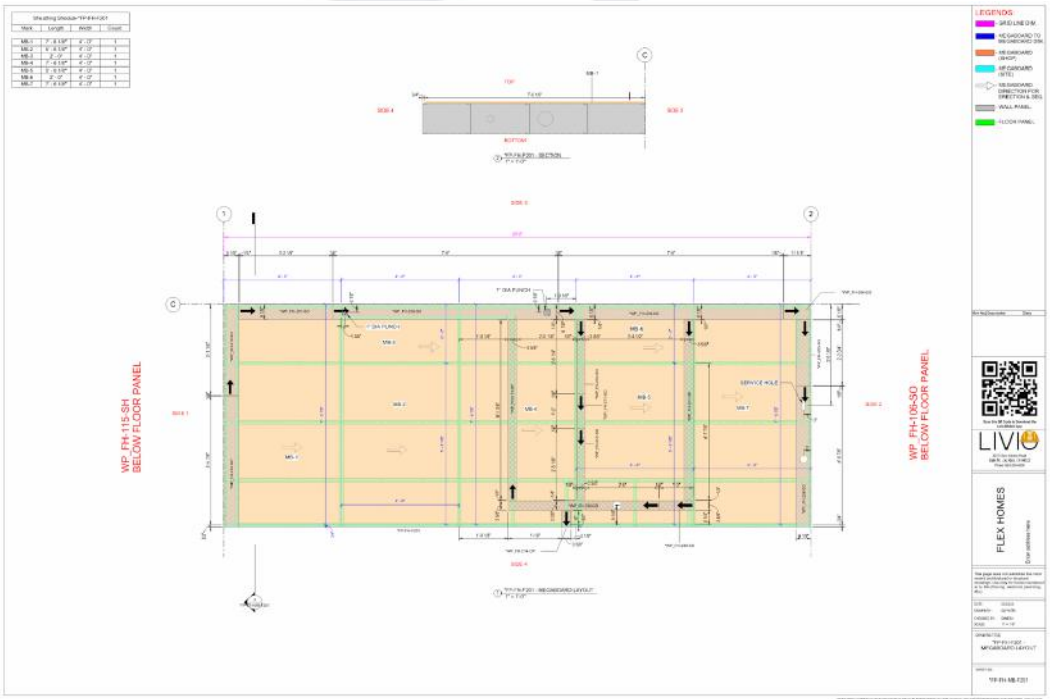
c. **Electrical and Plumbing Design**

i. Code Compliant design
ii. 3D Modeling of services - Plumbing and Electrical

d. Internal Co-ordination and Clash detection
e. Model signoff and shop drawings review with client
   i. Review of openings, plan and elevations
   ii. Shop drawings signoff for framing, electrical, plumbing, interior and exterior sheathing, rigid insulation, drain wrap. Below are some samples of all shop drawings





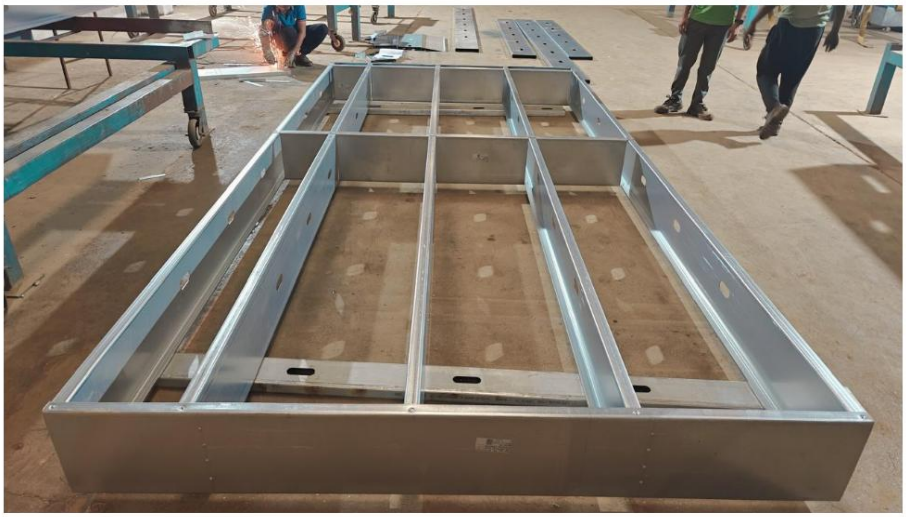


2. Fabrication Process

a. Cold-forming production

i. Ordering coils with yield strength 33 ksi, 50 ksi, 80 ksi
ii. A part of every coil is sent for standard testing
iii. Coils are fed into CNC roll-formers to create Stud and track sections with pre-punched standard service holes
iv. Digital tracking using Barcodes on panels which are linked to Livio App for real-time inventory management and erection sequencing.
v. Quality Checking process

Sample Photo of Fabricated Panel



b. **Hot-rolled steel production**

i. Livio utilizes a variety of structural steel components to construct buildings and structures. These components are selected based on project specifications, client requirements, and design considerations. Philosophy at Livio while doing the structural design for steel is to avoid the site welding as many possible locations and opt for one side factory weld and bolt on site.

ii. Ordering sections as per approved plans with standard Testing reports

iii. Connections are made as per shop drawings and fabrication is completed

iv. QC is done internally and Welding is inspected by third party AWS Certified Inspector

c. **Quality Assurance**

i. Livio Building System ensures the quality of our structural steel through rigorous quality control measures, including:

1. Material Inspection: Verifying that the steel used for fabrication meets the required specifications and standards.
2. Dimensional Inspection: Checking the accuracy of dimensions and tolerances.
3. Welding Inspection: Ensuring that all welds are performed correctly and meet the specified quality standards.
4. Load Testing: In some cases, load testing may be conducted to verify the performance of connectors under specific conditions.
5. By providing high-quality material, Livio Building System contributes to the structural integrity and safety of our projects.
6. We also erect all frames at the factory to minimize the errors at site. Below are the images.

3. Logistics plan and Container loading

a. Logistics plan document

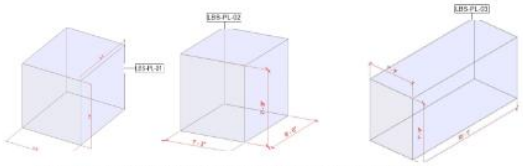
i. As per onsite condition whether it is a hilly area, plain area, crane limitations, etc, a logistics plan document is made and shared with client for approval

Container details:

Container No	Livio Cube no.	Length	Width	Height	Panel Volume Utilization
		(ft-inch)	(ft-inch)	(ft-inch)	(%)
1	LBS-PL-01	9'-1"	7'-3"	7'-9"	94.63
	LBS-PL-02	9'-0"	7'-3"	7'-9"	85.97
	LBS-PL-03	20'-1"	7'-3"	7'-9"	87.49
Total		38'2"	21'9"	23'3"	

Note: The above dimensions are clear inner dimensions where panels are occupied,
The above-mentioned weight is excluding platform weight.

Platform Information



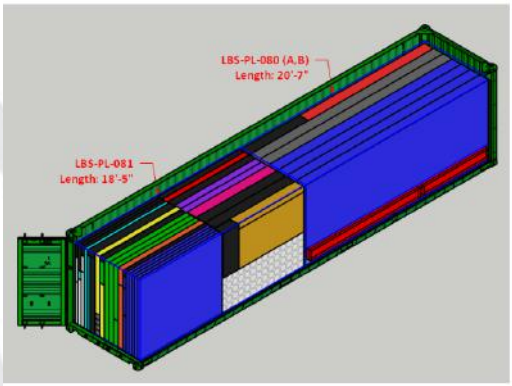
NOTE: THE DIMENSIONS PROVIDED ARE INTERNAL CLEAR DIMENSION IN CUBE

Container details:

Container No	Livio Cube no.	Length	Width	Height	Panel Volume Utilization	Panel Weight
		(ft-inch)	(ft-inch)	(ft-inch)	(%)	(lbs.)
1	LBS-PL-080 (A)	20'-7"	7'-3"	6'-3"	~73.05%	~3,400
	LBS-PL-080 (B)	20'-7"	7'-3"	1'-6"		~6,180
	LBS-PL-081	18'-5"	7'-3"	7'-9"	~84.96%	~4,010
Total		39'				13,590

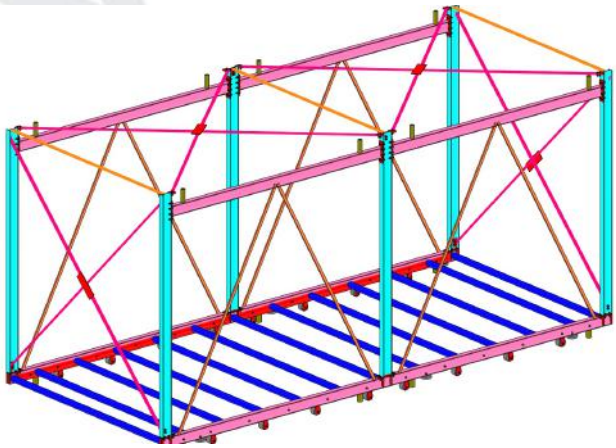
Note: The above dimensions are clear inner dimensions where panels are occupied,
The above-mentioned weight is excluding platform weight.

Platform visual inside the container:



b. Type and Size of Modules

i. At Livio, we use custom-designed Livio Cubes – modular steel platforms engineered for the storage and safe transportation of prefabricated cold-formed steel (CFS) wall, floor, and roof panels. These units are not part of the building structure but serve as robust logistics frames.



ii. External Dimensions: 20' L x 7'5" W x 7'9" H (optimized for 40' High Cube containers)

iii. Capacity: Each cube can carry bundled panels; typically, 2–3 cubes fit into one 40' HC container depending on panel configuration.

c. **Container Planning & Stacking Strategy**

i. Container Type: 40’ High Cube containers

Loading Plan:

1. Heavy panels at the bottom, light or fewer panels on top
2. Padding and tie-downs prevent movement during shipping
3. Each cube packed as per site erection sequence
4. Customs: Factory stuffing is done under Livio's supervision with Indian Customs approval

d. **Panel Stacking Workflow – Livio Automation**

i. Panel stacking is planned using Dynamo scripts integrated with Revit, optimizing every shipment and site operation:

1. Bundle Grouping by Erection Sequence
    a. Panels are grouped based on their exact installation order on-site
    b. Minimizes reshuffling during unloading

COMPONENT	PLATFORM NO.
*WP_FH-101-SO	LBS-PL-01
*WP_FH-102-SH	LBS-PL-01
*WP_FH-103-OP	LBS-PL-01
*WP_FH-104-SO	LBS-PL-01
*WP_FH-105-SO	LBS-PL-01
*WP_FH-106-SO	LBS-PL-01
*WP_FH-107-OP	LBS-PL-01
*WP_FH-108-SO	LBS-PL-01
*WP_FH-109-OP	LBS-PL-01
*WP_FH-110-SO	LBS-PL-01
*WP_FH-111-SO	LBS-PL-01
*WP_FH-112-SO	LBS-PL-01
*WP_FH-113-SH	LBS-PL-01
*WP_FH-114-SO	LBS-PL-01
*WP_FH-115-SH	LBS-PL-01
*WP_FH-116-SH	LBS-PL-01

    c. Each colours denotes one bundle and are added into the cubes as per the erection sequence document
2. Smart Stacking Inside Platform
    a. Top-down logic: First-installed panels are loaded last, enabling direct unloading from top
3. Height-Conscious Splitting

a. Panels automatically split along the length of the wall while supporting 40ft tall walls but restricted container height of 7'8", aligning with cube capacity
b. Prevents overstacking and container clearance issues

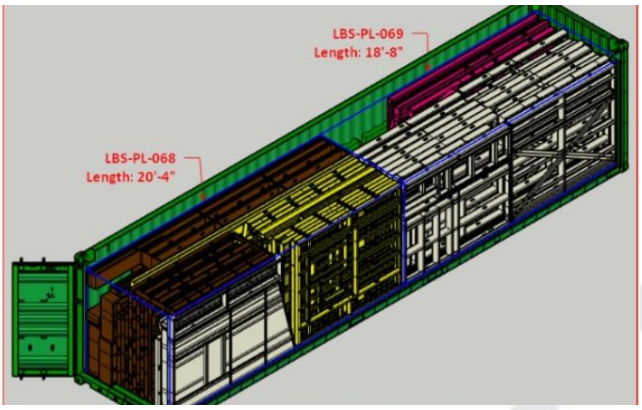
4. On-Site Efficiency
    a. Faster unloading
    b. Minimal handling
    c. Seamless installation with QR-based tracking and Livio App guidance

e. **Container Loading - Offsite Handling**

i. Panels are stacked in bundles into custom made LIVIO cubes with proper packaging practice and these cubes are loaded into High Cube Shipping

Containers as per LIVIO App - ES Document achieving up to 95% volume of container.

ii. Pre-loading inspections, packaging, labeling, and photo documentation



iii. Strategic loading to avoid any damage and ensure container volume optimization
iv. These containers are shipped to site with a given timeframe as per provided by the shipping logistics company.

4. Freight Forwarding & Shipping

i. Partnerships with leading shipping lines (Maersk, Hapag Lloyd, COSCO, ONE, Wan Hai)
ii. Shipping lines selected based on lowest transit time and highest reliability
iii. DDP (Delivered Duty Paid) basis ensures end-to-end control
iv. Electronic sealing of containers

5. Customs Clearance & Port Operations

i. Experienced Customs House Agents (CHAs) for rapid clearance at Indian ports
ii. Advance filing of documents at the Port of Delivery (POD) to avoid delays
iii. Immediate pickup on container grounding

6. On-Site Handling

i. Reliable local logistics partners at each POD
ii. Safe and quick offloading using forklifts/cranes based on site access
iii. Delivery synchronized with Livio erection sequence, reducing staging time

7. Onsite Construction

a. LIVIO cubes arrive sequenced per the App's erection plan, minimizing onsite storage
b. Site Preparation
   i. Grading and leveling of the site.
   ii. Foundation and slab installation (by local contractors).
c. Integration with foundation - Inverted bottom tracks *(Refer Chapter - Inverted Bottom Tracks)*

8. Assembly and Finishing systems

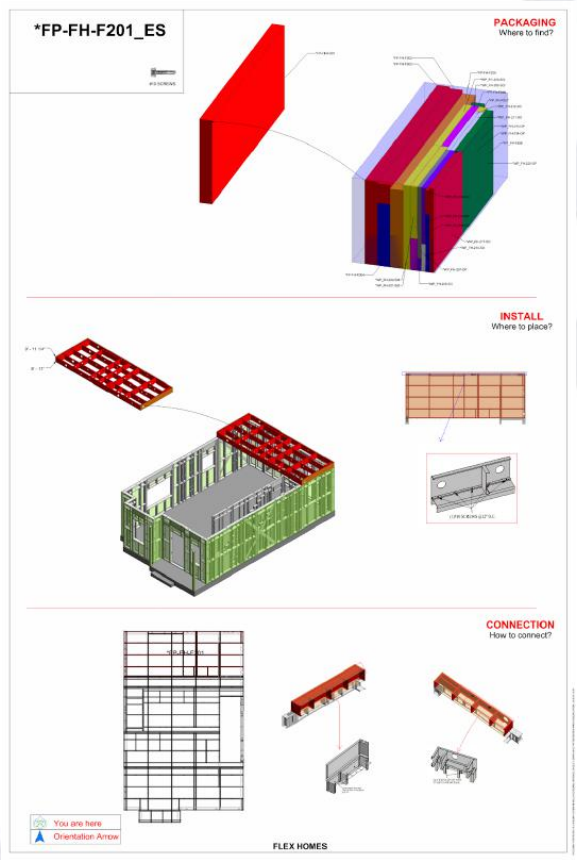
a. **Lego-Like Erection Sequence:**
   i. LIVIO's system uses a Lego-like installation process, making it intuitive and easy to follow
   ii. Each pre-assembled multi-trade panel is marked with clear labels indicating its placement order
   iii. Panels interlock seamlessly using pre-configured connection points.

b. **LIVIO Mobile App for Installation Guidance:**

i. The **entire erection sequence** is available on the **LIVIO Mobile App**, which can be downloaded from the **App Store** or **Google Play Store** by any contractor on-site.

ii. The app provides **simple, graphical instructions** that are easy to interpret, enabling even semi-skilled labor to follow the step-by-step assembly process. Below is an example of an erection sequence document

iii. Panels include QR codes and reference markings, allowing installers to verify their placement and orientation through the app.



iv. [Watch this video] to know more about Livio's Integrated Delivery Mechanism and mobile app.

c. **Wall Panel Installation:**

i. Exterior and interior wall panels are placed and connected with the help of guides provided in ES documents of LIVIO's mobile App.

ii. Panels include pre-installed electrical and plumbing rough-ins.

iii. Fast, interlocking design enables quick alignment and secure fastening.

d. **Floor and Roof Framing:**

i. Pre-framed floor and roof panels are placed and secured.

ii. Panels are bolted together using pre-aligned connection points.

e. **MEP Integration:**
   i. Rough mechanical, electrical, and plumbing (MEP) are pre-integrated into the panels.
   ii. On-site connections are limited to:
      1. Panel-to-panel MEP linking.
      2. Central utility hookups (water, electricity, HVAC).

f. **Sheathing and Enclosure:**
   i. Panels include factory-installed sheathing (exterior side) and interior side is left open for site inspection.

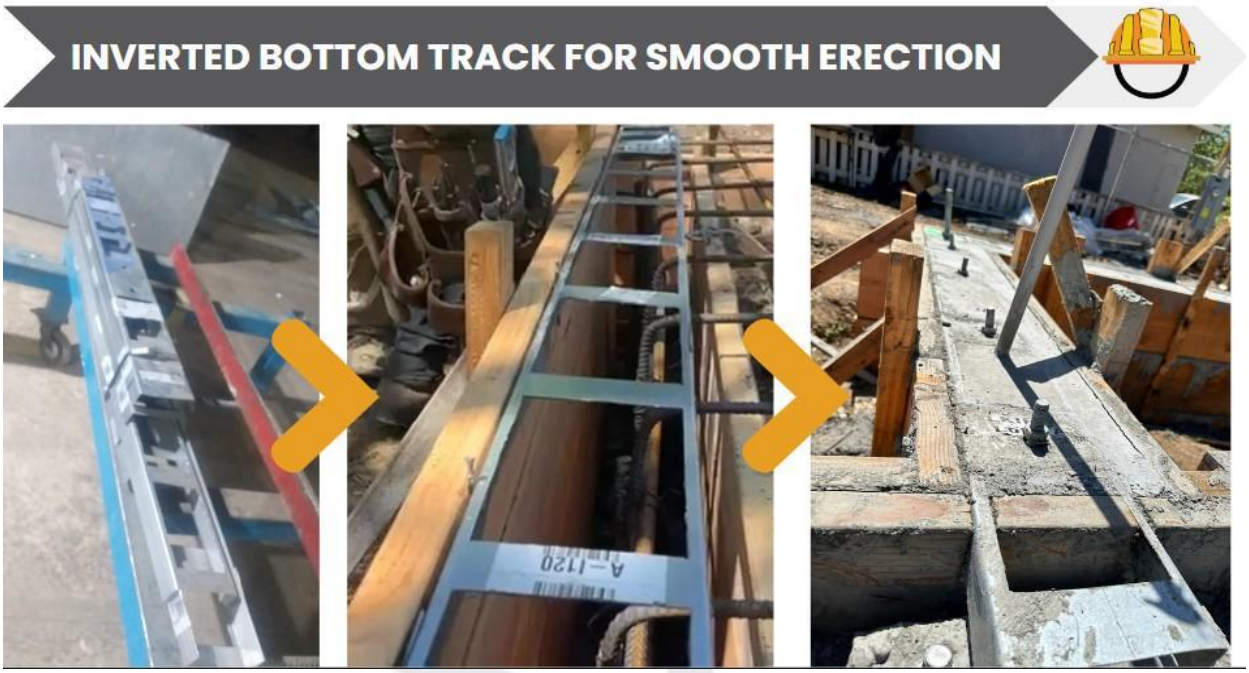
g. **Weatherproofing and Insulation:**

   i. Pre-applied rigid insulation, drain wrap ensure water and air-tightness.
   ii. Additional insulation and sealing are applied as required.

h. **Finishing:**
   i. Pre-installed rough-ins allow for faster finishing with minimal on-site trade work.
   ii. Final connections (fixtures, trim, and appliances) are made on-site.
   iii. By the end of the erection, the villa/townhouse will be enclosed and ready for finishing works such as painting, tiling, and exterior cladding as per approved drawings.

Image of a Villa built with LIVIO's System Ready to Be Finished on the Exterior with Stucco / Stone / Siding.

5. Foundation Phase - Inverted Bottom Tracks (IBT's)



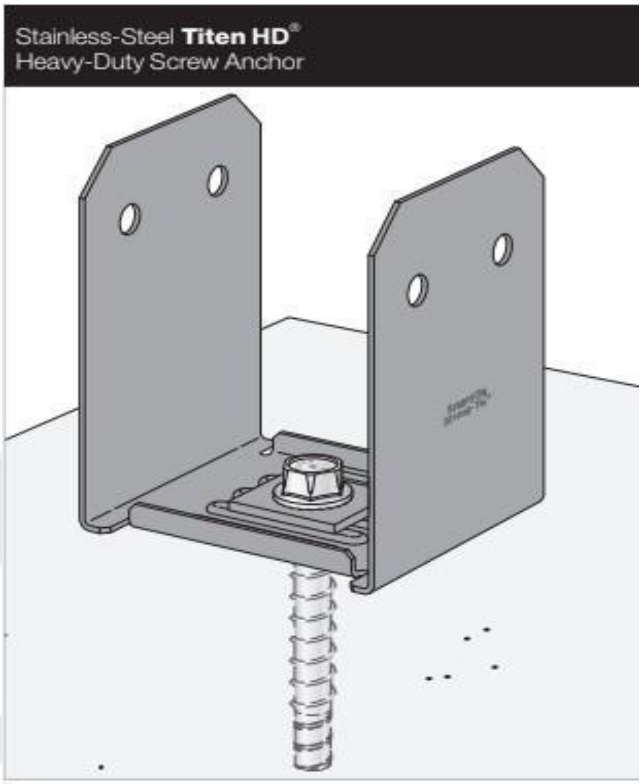
5.1. Introduction

IBTs (Inverted Bottom Tracks) are innovative templates made of CFS tracks with slots for fixing anchor bolts in place during casting of foundation. The IBT is inserted into the foundation prior to casting along with the anchor bolts.
IBT enables smooth installation of all exterior and interior shear wall panels & HRS Columns on level 1, saving significant time and cost on site.
Watch this video to understand its application.

5.2. Purpose

- LIVIO provides IBTs as an aid to on-site framers to install the Exterior wall panels accurately and quickly.
- IBTs **apply to only Shear wall panels** with the shear anchor, hold-down anchor **& for HRS Columns**. [SE]

- **LIVIO recommends that all other Anchor Bolts be installed after all the Load Bearing & Non-load bearing walls are erected on concrete using the TITEN HD Bolts. [SE]**
- TITEN HD Bolts can be screwed onto the concrete without requiring any epoxy.
- **Refer to Installation Guide & Reference Video for TITEN HD**
- IBT gets delivered to your site before the foundation concrete work finishes and must be completed before the Anchor Bolts, Hold downs are installed.
- In case the Client's engineer does not use IBT, the client will ensure the Anchor Bolts & Hold Downs installed in the foundation exactly as per plan within 1/8th inch tolerance. [SE]



5.3. Technical Specifications

The inverted bottom track used in cold-formed steel (CFS) wall construction is typically made from 27 mil to 43 mil thick steel with minimum 33ksi steel coil.

1. **Dimensions/ Width**
    a. The width of the IBT is matching with the concrete wall width in case the raised foundation.
    b. The width of IBT is matching with the width of the cold form wall in case of slab on grade foundation and mat foundation.
2. **Fasteners**
    a. Self-drilling screws or steel fasteners compatible with the track material
    b. Minimum screw size of No. 8. screws should penetrate the main support member by a minimum of 3 exposed threads
    c. Fasteners spaced at a maximum of 36 inches (610 mm) on center along the length of the track

5.4. Shipment Sequence

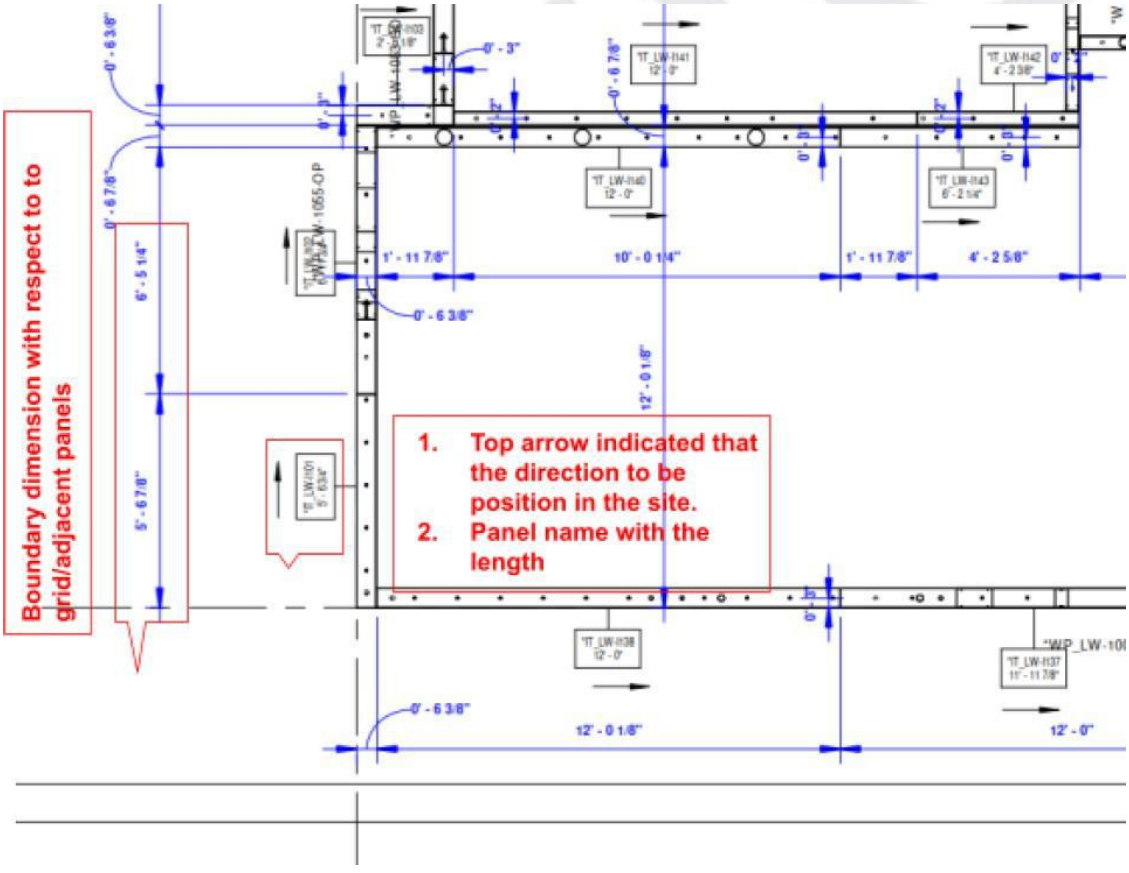
- IBTs are designed & fabricated after the following have been finalized & provided to LIVIO:
    a. Door & Window schedule,
    b. Post configuration
    c. Wall types
    d. Anchor bolt spacing
    e. Hold Down types
    f. HRS location
    g. Foundation model
    h. Shear wall final locations
- IBTs are shipped so that they can be received at site before the shear & hold down anchors are installed into the formwork.
- IBTs are packaged separately and much earlier than the entire package.

5.5. Basic Intake Requirements:

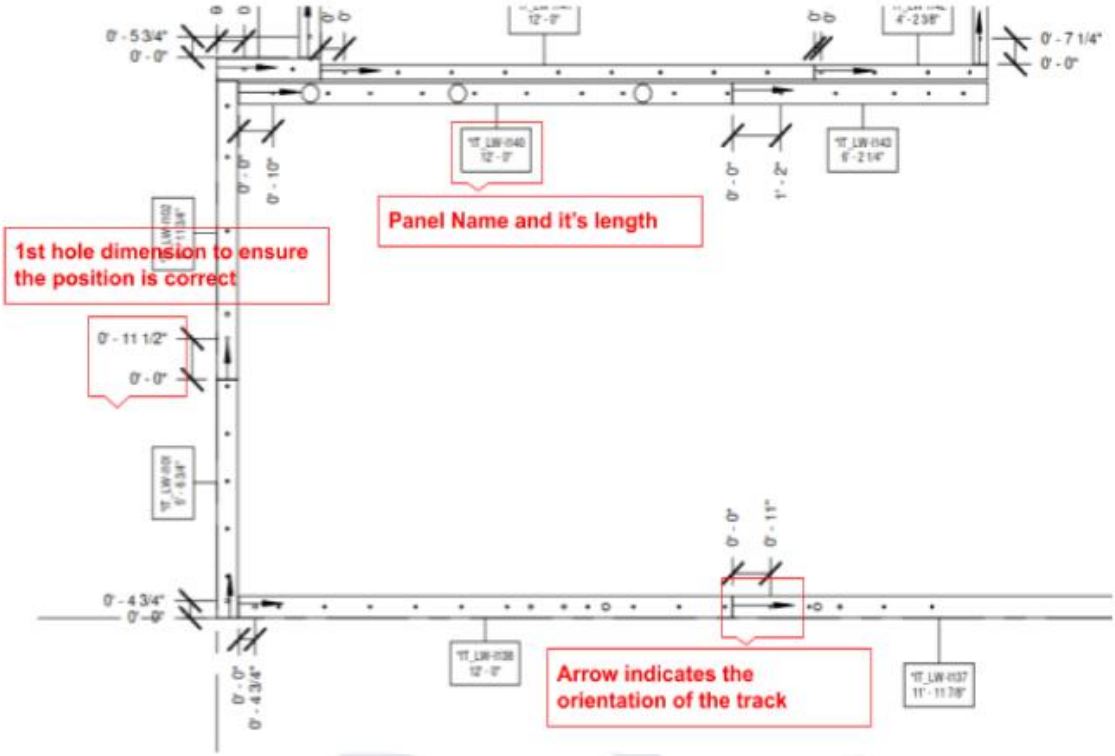
1. City permit/approved set (Including Architecture plans, Structural plans, MEP Plans & grading plans)
2. AutoCAD Files (Architecture)
3. Revit Model/ Sketchup mode / Any IFC 3D Model if available

5.6. Sample Installation Instructions:

- Track should be installed upside-down on top of the concrete foundation.
- Anchor bolts are placed through predrilled holes in the track into the concrete .
- **Below is the step by step process**
  1. **Nomenclature:**
     ***IT_LW-I101**
     <***IT**(short form of inverted track)><**Project name** short form><**I**(Alphabet to identify the assembly)><**101**-Panel number>
  2. **Member Identification:**
     a. The label is pasted in the member with the direction to position.
  3. **Layout**
     a. **Inverted track Boundary dimension layout**



     b. **Inverted track Orientation & Position Layout**



4. Before Installation

1. Make sure you have all the parts mentioned in the layout drawing schedule.
2. Keep your respective bolts, and stub-out materials ready to install.
3. Keep sufficient #8 self-tapping screws with the formwork to fix the IBTs.

5. During Installation:

Take the appropriate track and follow from the series I101, I102, I103, ……I185, and follow the following process in every way.

1. Take the right track and keep the orientation as per the layout.

2. Use clamps to secure the inverted bottom track with the formwork.

3. Insert a nail (4 or 5” in length) between the track and formwork.

4. Use #8-1 ¾” self-tapping screw to connect the inverted bottom track with the formwork.

5. Release the clamp.
6. Now you successfully installed the 1st inverted bottom track.
7. Repeat the same to install the rest of the inverted bottom track
8. Once the concreting is done please wipe the top surface of the IBTs.

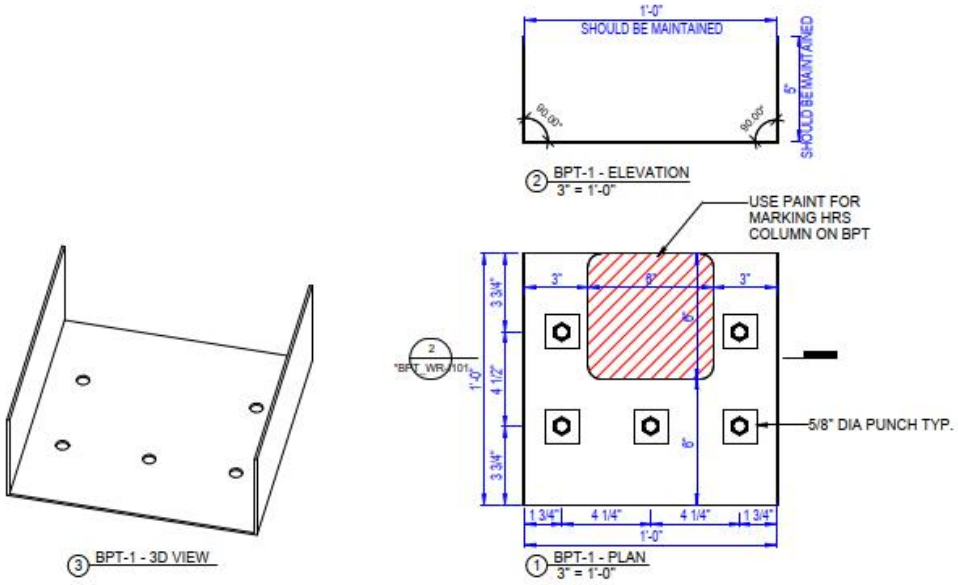
5.7. HRS IBTs (Elevation issues)

Maintaining the correct elevation is crucial for the structural integrity and performance of CFS panels. Variations in elevation can lead to:

- Misalignment of panels and connections
- Uneven load distribution
- Potential failure points in the structure

Many of them are facing an issue on-site where the elevation of Hot Rolled Steel (HRS) columns was missed during concrete pouring but **HRS IBT** will help maintain the correct elevation.

The pre-drilled holes in the U-bent plates should align perfectly with the corresponding holes in the HRS columns



5.8. Checklist for IBT installation

1. Documents
- Layouts
- Ibt Shop Drawings
- Installation Manual

2. Components
- IBT items as per packing list
- anchor bolts as per list
- hold down bolt as per list
- conduits/pipes (mep items) if any

3. Tools
- Measuring Tapes
- Drill Guns
- #8/#10-1 ¾” Screw
- Nails
- Clamps

4. After Installation & Before Concreting
- Are all IBT’s installed as per the number mentioned in the layout?
- Are All IBT’s level matching with the layout and the section detail?
- Are All The Holes In The IBT’s are plugged with anchor bolts/conduits/pipes?
- Is the overall boundary dimension matching with the layout?
- Are there any clashes between IBT’s?
- Are there any clashes between base plate IBT & LGS IBT?
- Are all IBT’s secured firmly with the formwork?

6. Framing Phase

Introduction

The framing phase is the backbone of building construction, where the structural skeleton of a project takes shape, defining its form, strength, and functionality. This phase involves assembling key elements—walls, floors, roofs, and staircases—that provide structural integrity, support loads, and create habitable spaces. With LIVIO's innovative cold-formed steel (CFS) systems, framing is transformed into a streamlined, efficient process, leveraging pre-assembled components and intuitive assembly methods to meet international building codes. There are only 3 elements in a building structure.

Walls

Walls form the vertical framework of a building, encompassing structural (load-bearing) and non-structural (partition) components. They resist lateral forces (e.g., wind, seismic) and house critical systems like plumbing and electrical. LIVIO's pre-assembled CFS wall panels, featuring integrated bracing and sheathing, enable rapid installation and compliance with stringent USA standards, such as those for hurricane-prone regions.

Floors

Floors provide horizontal support, transferring loads to walls and foundations while accommodating occupancy needs. LIVIO's CFS floor systems, with pre-punched joists and cement board sheathing, offer lightweight, durable solutions that simplify construction and prepare for mechanical, electrical, and plumbing (MEP) integration.

Roofs

Roofs shield buildings from environmental elements and contribute to structural stability. LIVIO's CFS roof systems, available as trusses or panelized assemblies, come pre-sheathed, ensuring weather resistance and fast erection in diverse USA climates.

Staircases

Staircases facilitate vertical circulation in multi-story buildings, often integrated into the framing phase. While LIVIO's CFS systems can support staircase framing with lightweight, high-strength components, specific designs may incorporate other materials (e.g., steel or wood) based on project requirements.

CFS standardized panel width for shipment as per existing platforms

LIVIO's CFS panels are sized to fit standard ISO shipping high cube containers commonly used across the globe. So, there are size limitations while considering the design of elements. Below is the table,

Sr. No	Panel Type	Max. Panel Width	Max.Panel Length
1	All Wall Panel	7'8"	20'
2	All Floor /Roof panel	7'8"	20'

6.1. Walls

Walls in LIVIO systems are classified as Load-Bearing and Non-Load-Bearing.

Load-bearing walls support vertical structural loads (such as floors or roofs) and, in many cases, also function as Shear Walls to resist lateral forces such as wind or seismic loads.

Non-Load-Bearing walls serve as partition walls or enclosures and do not carry structural loads.

6.1.1. Load bearing walls and shear walls

a. **Spacing**: Stud spacing as per design

b. **Gauge/ Thickness**: As per design but limited to gauge 14,16,18, 20

c. **Framing:**

- Wall blocking/bridging (mid-point, third point) is as per design.
- Wall blocking is preferred with web notching
- Anchor bolt-Prefer Titen HD bolt to connect with concrete & diameter and depth of Titen bolt as per design.

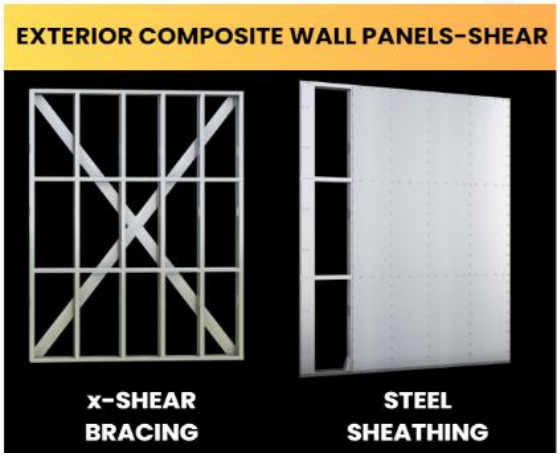
LIVIO emphasizes more on two types of shear wall, viz. X-bracing and steel sheathing,

a. **X Bracing**

I. Steel X-bracing provides significant lateral stability and is particularly effective in resisting seismic and wind loads.

II. It consists of diagonal members forming an "X" shape, which helps distribute forces throughout the frame.

III. X-bracing systems can enhance the ductility of structures, allowing them to absorb and dissipate energy during seismic events.

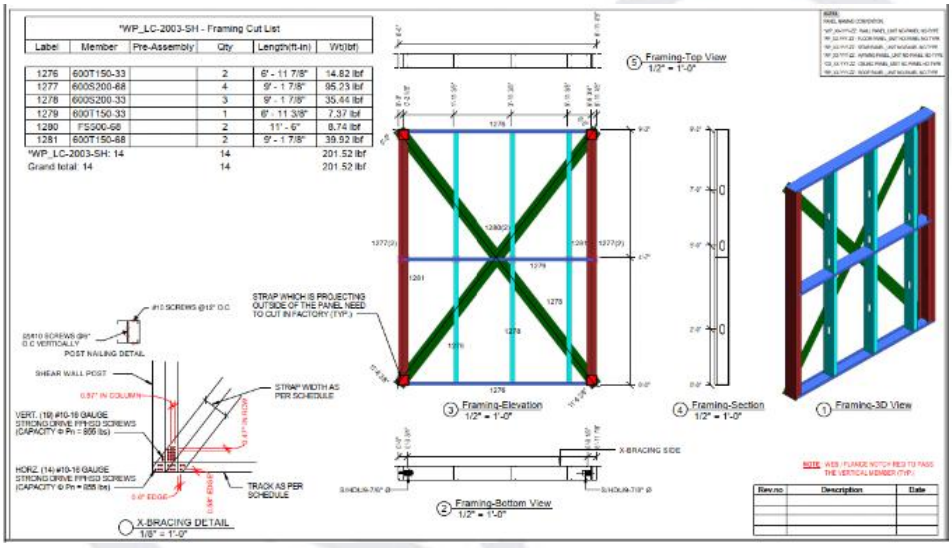


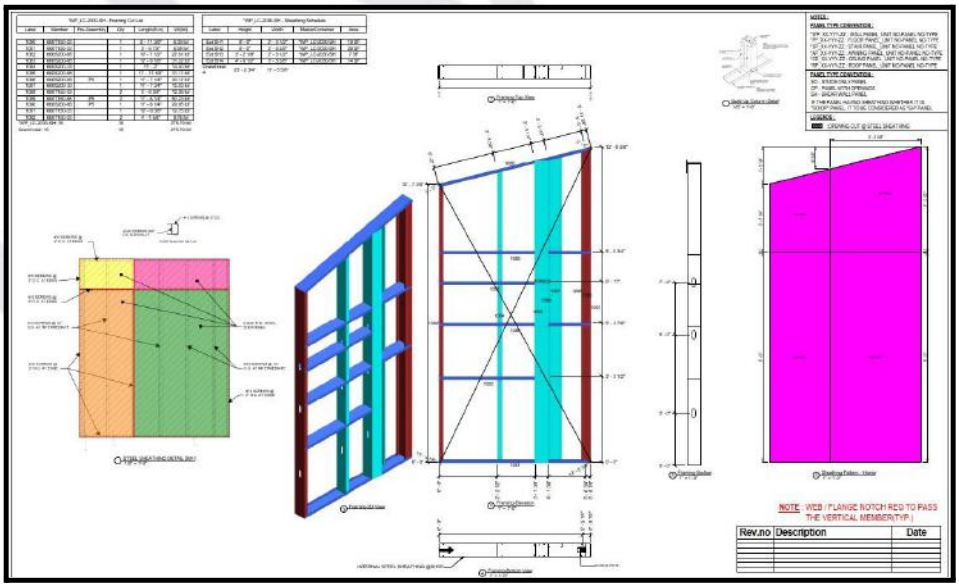
b. Steel Sheathing

I. Steel sheathing provides near-continuous support to wall studs and helps transfer lateral loads effectively through the diaphragm action.

II. This method often involves materials like steel, gypsum wallboard or OSB (Oriented Strand Board) that can act as shear walls

III. Sheathing can be integrated into various wall systems, allowing for flexibility in design while meeting architectural and structural requirements.





6.1.2. Non-load bearing walls

a. Spacing: 24” o.c. preferred

b. Thickness: 22 gauge preferred

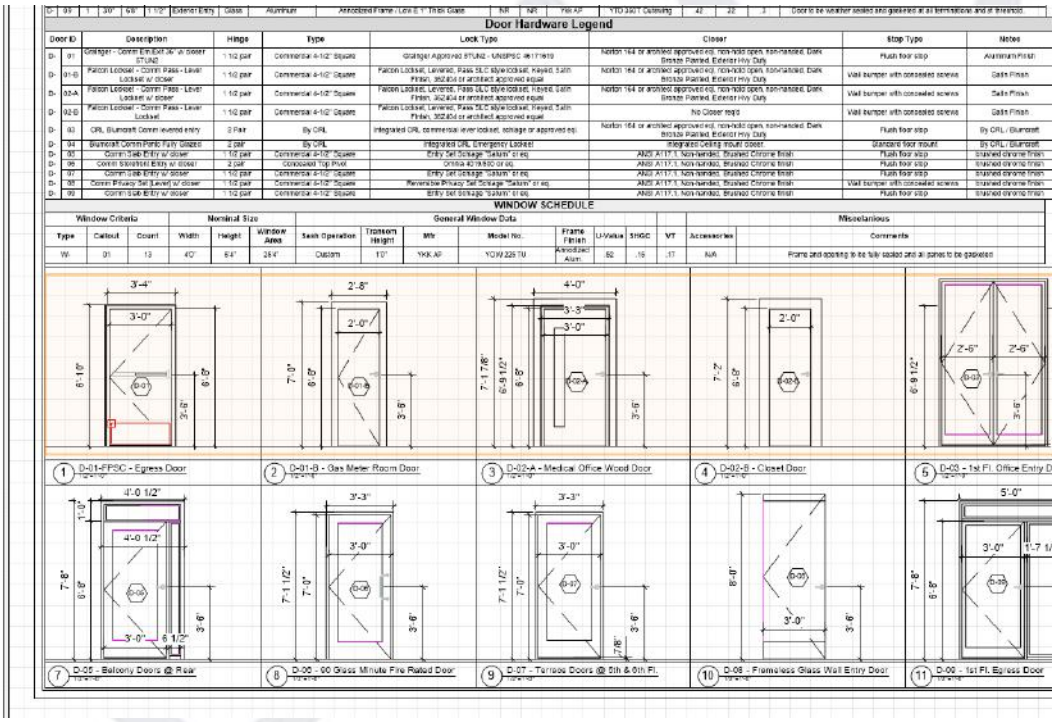
c. **Framing:**

- Wall blocking/bridging at mid-point
- Wall blocking is preferred with web notching
- Anchor bolt-Prefer Titen HD bolt to connect with concrete & diameter and depth of Titen bolt as per design.

6.1.3. Openings in Walls

LIVIO requires accurate information on door and window openings to ensure correct placement of openings during modeling and to avoid deviations during panel installation on site. Below are the key points to consider while providing this information

1. **Door and Window schedule**



Dimensions: Provide the **width** and **height** for both the door/window and the **rough opening** (rough width and rough height).

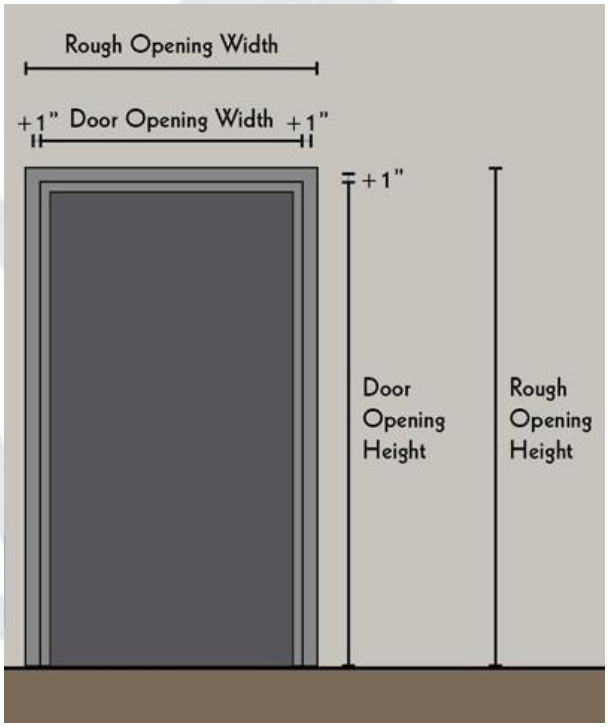
Special Requirements:
Note any **special considerations**, such as:

- **Fire-rated doors**
- **STC (Sound Transmission Class)** rating for doors with glass panels.
- **Installation Type**: Specify whether the door is **pre-hung** or requires a different type of installation.

- **Door Jamb Details**: Include detailed specifications for the **door jamb**.
- **Window and Door Type**: Indicate the **type** of door (e.g., sliding, hinged, double) or window (e.g., casement, fixed, awning).

2. Rough Openings

a. Rough Openings for Doors:



i. For **8' doors**, the rough opening (RO) should be 98" high, **allowing for an additional 1" on each side and 2" on the top to accommodate the door**.
ii. Openings smaller than this will require modifications, potentially increasing costs.
iii. Whenever possible, use lighter gauge metal for framing the openings. This not only reduces installation costs but also simplifies the process.
iv. Installing doors on heavier gauge metal requires more labor and can lead to delays during installation.

b. Rough Openings for Windows:

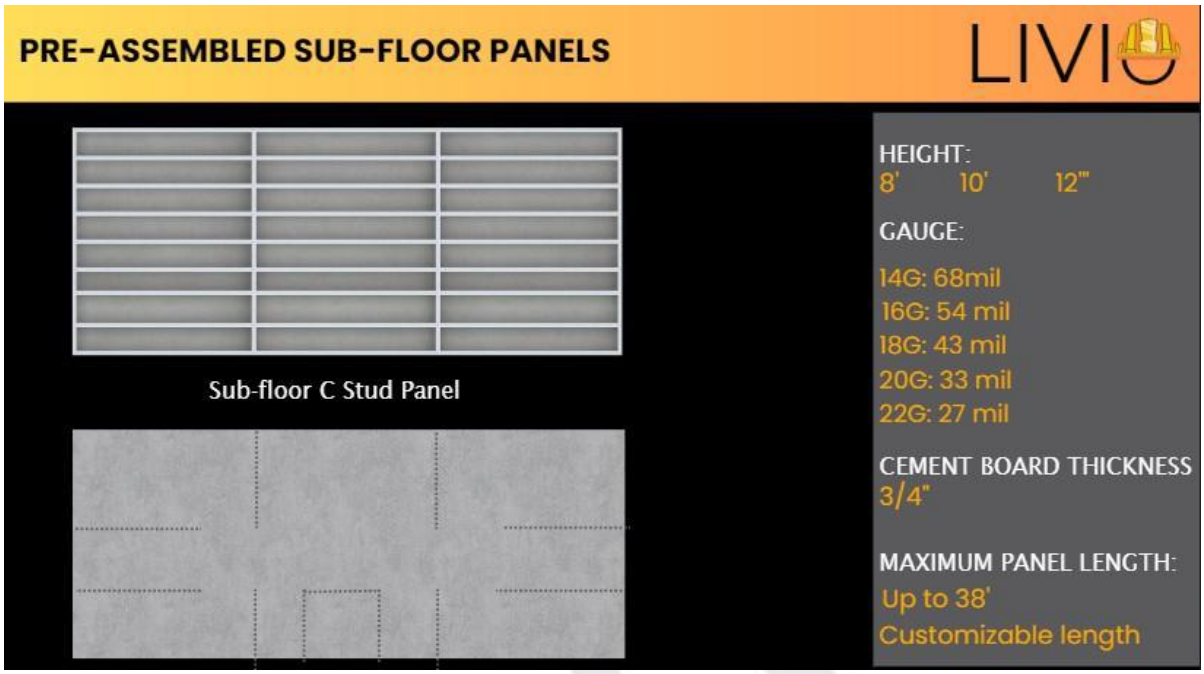
i. **Allow 1" Extra on All Sides-**The additional inch allows for proper shimming and leveling during installation, ensuring that the window is square, plumb, and properly aligned with the wall framing.
ii. By maintaining this buffer, you significantly reduce the risk of needing to reorder windows due to sizing errors, saving time and preventing project delays.

6.1.4. Guidelines for the Framing Fasteners and connections

- Use generic framing & sheathing screws standard capacity for the pullout, shear, pullover calculations.

- While drafting the plans/documentations mention generic or equivalent screws.
- LIVIO always uses the equivalent screws for framing and sheathing.
- All walls including Shear Wall, Load Bearing Wall and Non Load Bearing Walls connection need to be inside, to avoid wall face to face connection from inside and outside.
- while designing the connection avoid third party connectors and use only factory made connectors except Simpson Hold down.
- All Stud Profiles are standard pre-punched with standard Holes.
- While designing the stud or joist ensure that before changing the thickness, use the full strength of the member by changing the flange of its maximum size (Max. 2.5” flange).

6.2. Floors



Cold-formed steel floor joists can be designed for varying spans depending on structural requirements and loading conditions. The depth of cold-formed steel (CFS) joists is a critical design parameter that influences **the structural performance, load-carrying capacity, and overall efficiency of floor systems.**

6.2.1. Punches

Floor joists often feature punches to accommodate the installation of electrical, plumbing, and HVAC services. These punches are strategically placed to provide access while minimizing the impact on the structural integrity of the joist.

1) For joists with a depth of 3-1/2 inches or greater, the standard punch size is 1-1/2 inches by 4 inches oval in shape at every 24” O.C.
2) Punches are typically located 10 inches from the end of the joist.

3) Livio can do the **4" square punch** in the joist.
4) Please note that circular and square punches it is essential to consult with professional engineers to ensure that the modified joist still meets the required strength and serviceability criteria.**[SE]**

6.3. Roofs

LIVIO emphasizes panelised roof joist systems.

6.3.1. Types of roof

a. **Pitched roof**
Pitched roofs have a slope that allows for effective water drainage. They can be framed using CFS roof panels
b. **Flat roof**
Flat roofs are nearly level and require proper drainage systems to prevent water pooling. They can be framed using CFS roof panels.

6.3.2. Truss v/s Panelized Roofs

When comparing cold-formed steel (CFS) panelized roofs to traditional truss systems, CFS panels demonstrate significant advantages, particularly in terms of speed and efficiency of construction.

1. **Pre-Fabrication:** CFS panels are typically manufactured off-site to precise specifications. This pre-fabrication means that up to 90% of the assembly process is completed before the materials even reach the construction site. As a result, the erection of structures using CFS panels can be completed in about one-third of the time it would take to build using traditional wood
2. **The lightweight nature of CFS panels** allows for easier handling and installation. Unlike trusses, which may require heavy lifting equipment and skilled labor for assembly, CFS panels can often be installed with fewer workers and less complex machinery, reducing labor costs and minimizing the potential for delays on-site
3. **The ease of assembling** CFS panels means that less skilled labor is needed on-site compared to traditional truss systems. Workers can quickly adapt to using CFS framing techniques with minimal training, further accelerating the construction timeline

   The combination of faster erection times, reduced labor needs, and minimized waste contributes to significant cost savings in projects utilizing CFS panelized roofs compared to traditional truss systems. Projects can save months in construction time, which translates into lower overall project costs.

   - **General Guidelines [SE]**
     SE needs to design the roof panel with the ridge beam supported by stub column and stub column supported by the CFS beam. i.e. CFS column-beam arrangement.

7. Offsite Floor and Roof Panel Assembly

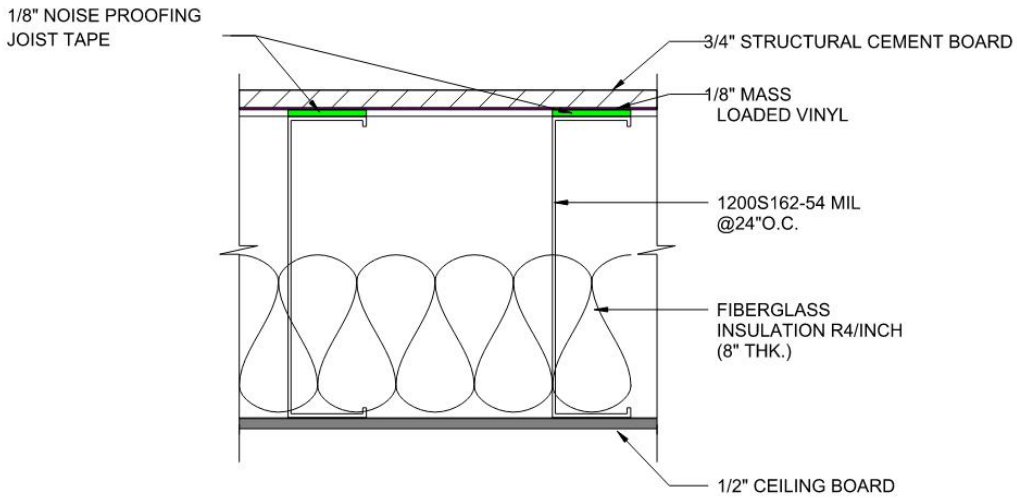
Introduction

LIVIO's offsite floor panel assembly is a fully integrated system designed to meet structural, acoustic, and thermal performance standards while minimizing on-site work.

Each floor panel has 6 different elements,

1. Deep cold-formed steel (CFS) joist framing
2. Floor Sheathing
3. Noiseproofing joist tape
4. Mass loaded vinyl (MLV) layer
5. Fiberglass insulation inside cavity (R-4 per inch)
6. Ceiling board

This prefabricated approach ensures quality control, reduces labor, speeds up project timelines, and improves overall construction consistency.



7.1. Floor and Roof Sheathing

Sheathing is **typically installed onsite** over cold-formed steel (CFS) joists using engineered wood products like OSB or plywood, or steel sheets or structural cement fibre board depending on design requirements.

However, **in offsite construction**, floor and roof sheathing plays a critical role in

achieving structural integrity and **simplifying on-site assembly**.

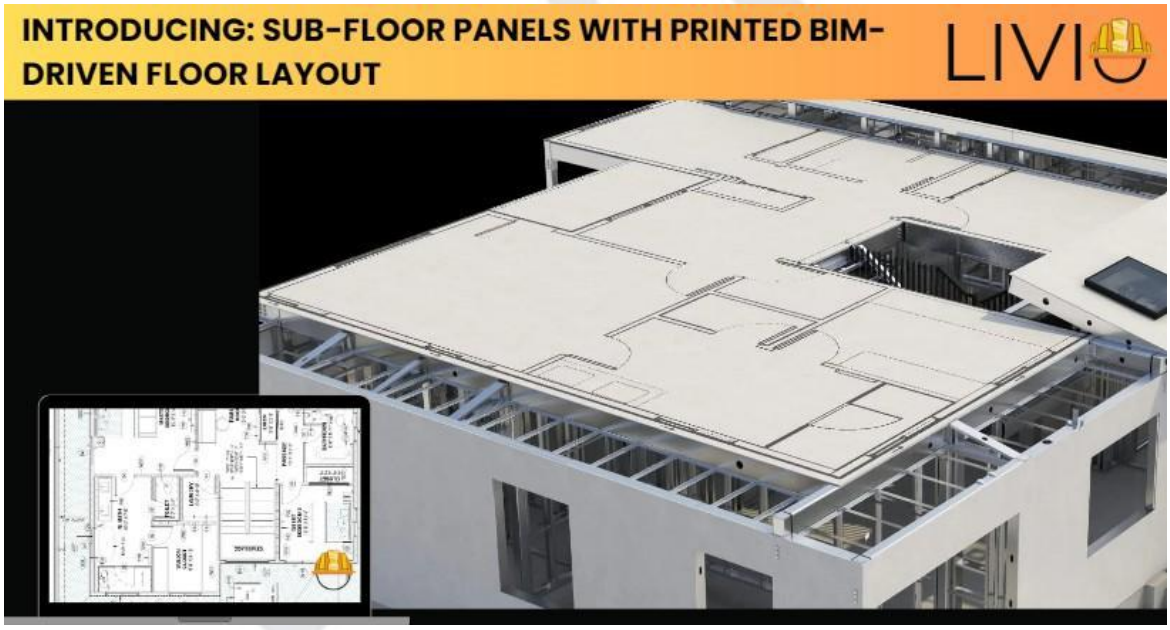
LIVIO performs pre-installation of sheathing in the factory, which enhances quality control, reduces on-site labor, and accelerates installation timelines. Fastening patterns, panel layouts, and material specifications must strictly adhere to structural drawings to **maintain diaphragm strength and comply with code requirements.**

Additionally, provisions for mechanical penetrations, handling, and lifting must be carefully coordinated to prevent damage during transport and erection.

7.1.1. Sheathing material selection

The choice of sheathing material is crucial for ensuring structural integrity and performance. Two popular options are,

1. Oriented Strand Board (**OSB**) and
2. Structural **Cement Fiber Board**



LIVIO prefers the **Structural cement fiber board** as a floor sheathing due its enhanced performance characteristics, particularly in structural shear strength capacity, moisture resistance, fire safety, and sound insulation.

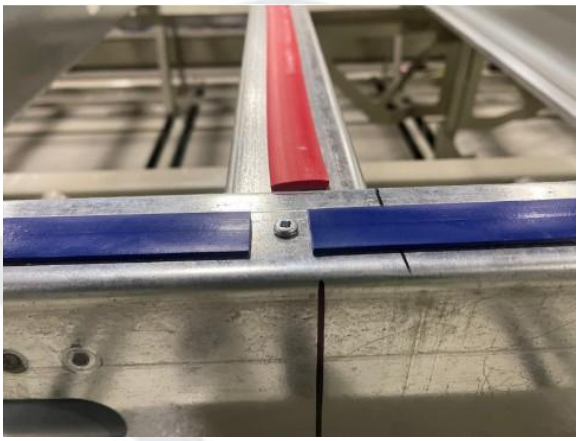
Thickness available: ¾" thick *(Refer Exhibits for ICC-ER Report)*

7.2. Noise proofing joist tape

The rubber placed on the above Joist to reduce sound transmission is typically called an acoustic isolation strip or noise proofing joist tape.

Size: 25.4 mm (1”) Wide and 12.7 mm (½”) or 6.35 mm (¼”) thick strip

Purpose:



- **Noise Reduction**:Helps in **reducing impact and airborne sound transmission** through the steel framing.
- **Vibration Damping**: This minimizes **structural vibrations** that could otherwise transfer sound to other parts of the building.
- **Thermal Break**: Provides **a slight thermal break** between steel components, improving insulation efficiency

7.3. Mass loaded vinyl (MLV) Layer

A high-density, flexible sound barrier that enhances airborne sound insulation, laid over the joist tape to improve floor acoustics.

7.4. Fiberglass insulation inside cavity (R-4 per inch)

Placed within the joist cavities, this insulation layer adds thermal resistance and improves both airborne and impact sound control.

7.5. Ceiling board (Bottom layer)

A finished layer fastened to the underside of the joists, serving as the visible ceiling surface and providing a base for painting or additional finishes. It also helps in sound insulation

8. Offsite and Onsite Wall finishes

Introduction

LIVIO's offsite and onsite wall assembly is a fully integrated system designed to meet structural, thermal, and weather-resistant performance standards while minimizing on-site work. So, there are two types of Walls, Exterior and Interior.

1. **Exterior Wall Assembly**
    a. **Offsite**
    1. Cold-formed steel (CFS) framing,
    2. exterior sheathing,
    3. rigid foam insulation,
    4. water-resistant barrier (WRB) with drainable wrap,

    b. **Onsite**
    1. Bucking frame
    2. Flashing tape
    3. Z-flashing
    4. Door frame and door installation,
    5. Trim/Casing and
    6. Exterior finishes (lap siding or stone veneer)

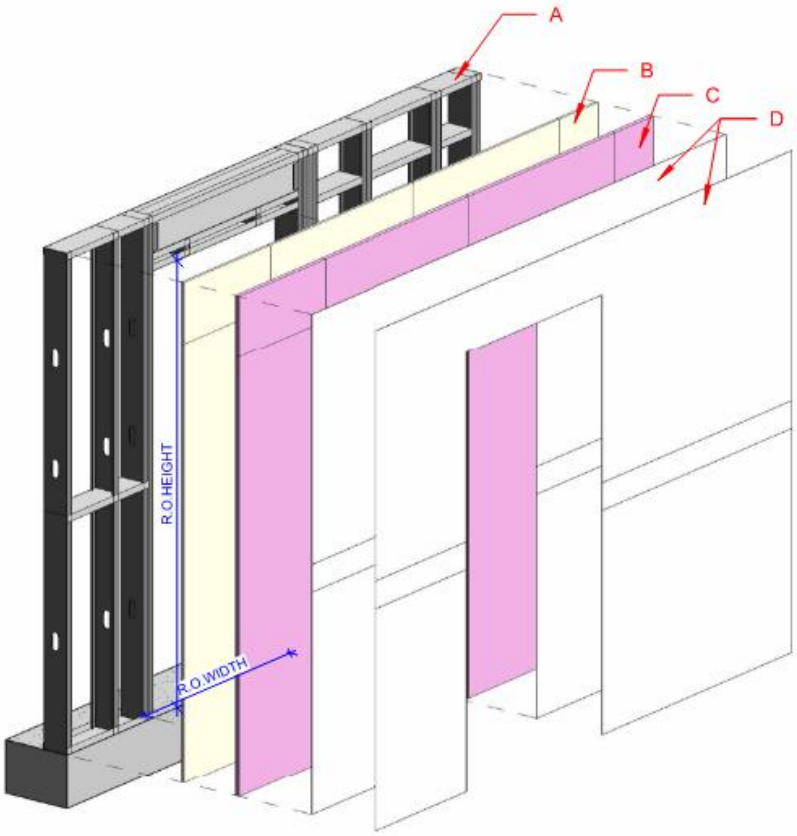
2. **Interior Wall Assembly**
    a. **Offsite**
    1. Cold-formed steel (CFS) framing,
    2. One side sheathing,
    3. Mineral wool insulation

    b. **Onsite**
    1. Another side sheathing
    2. Bucking frame
    3. Door frame and door installation and
    4. Trim/Casing

This prefabricated approach, with critical components assembled offsite and completed onsite, ensures quality control, reduces labor, accelerates project timelines, and delivers consistent, code-compliant construction for USA projects.

Further pages describes fully step by step procedure for each component in description,

#1	OFFSITE



A: CFS Framing
B: Exterior Sheathing
C: Rigid Foam Insulation
D: Drain-able wrap & Stucco Wrap - Water resistant barrier

A: CFS Framing

Measure the rough opening (RO) to match the door frame size (e.g., 38" x 81" for a 36" x 80" door). Ensure CFS framing (studs, king studs, jack studs, and header) is plumb and square per AISI S240.

B: 1hr Fire Rated Exterior Sheathing

Cut the Exterior sheathing boards to size, ensuring they are large enough to cover the entire wall area around the opening

Use fasteners recommended by the manufacturer to secure the boards to the CFS studs. Ensure the fasteners penetrate completely through the sheathing and into the underlying framing/layer for a solid attachment.

C: Rigid Foam Insulation

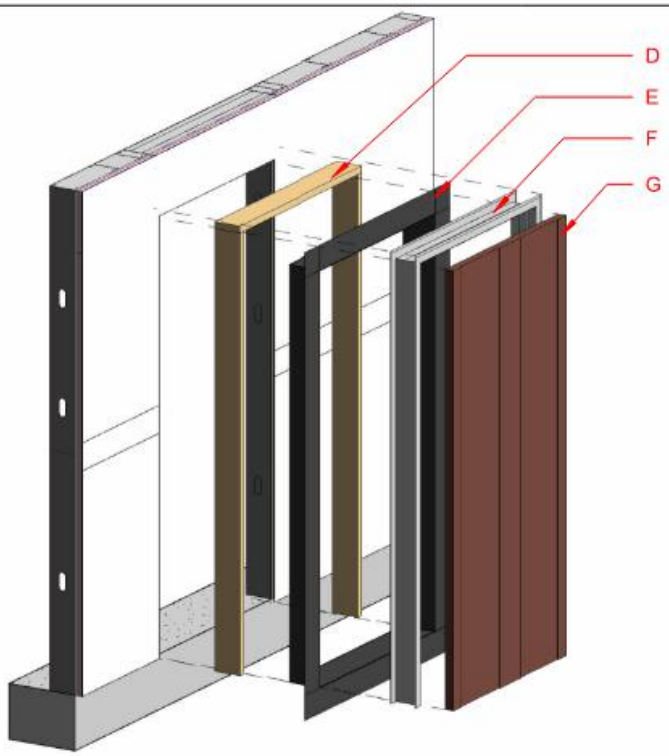
Cut the rigid foam boards, ensuring they are large enough to cover the entire wall area around the opening, securely fasten the foam boards against the exterior sheathing, ensuring they are flush with the outer surface of the frame.

For additional security, use long fasteners specifically designed for rigid foam insulation.
While installing Rigid Foam Insulation, leave an 8"-9" space at the top of the window header. This space is required to accommodate proper installation of Z-flashing and the self-adhesive membrane at the window top for optimal waterproofing. Cut and install a separate piece of rigid foam to fill this space after the flashing is in place.

D: Water resistant Barrier

Apply 1 layers of WRB and 1 layer of Stucco Wrap over insulation in accordance with the manufacturer's guidelines.
Ensure proper overlaps at seams. Around door openings, cut and fold WRB to allow on-site integration with flashing (leave top flap loose for later head flashing).

#2	ONSITE



D: Bucking Frame
E: Flashing Tape
F: Door Frame
G: Door Installation

D: Bucking Frame

Measure the height and width of the rough opening in the CFS framing.

Cut four dimensional lumber pieces (e.g., 2X4) to create the bucking frame: Two pieces to match the height of the opening & Two pieces the width of the opening plus 2" (to account for 1" lumber width on either side).

Secure the four lumber pieces together forming a frame. Use nails or screws, ensuring the corners are square.

Position the Buck: Place the bucking frame directly against the CFS framing around the rough opening. Check for level and plumb: Ensure the frame is perfectly level and square with the rough opening. Adjust if needed.

Secure to CFS Studs: Fasten the bucking securely to the CFS studs using #10 screws @ 12" o.c. Apply construction adhesive between the lumber and CFS for added strength.

E: Flashing Tape

Apply sill flashing first, followed by jamb flashing, and finally head flashing. Overlap layers properly and integrate with the WRB top flap.

Follow flashing product manufacturer's installation guidelines for sequencing and overlaps.

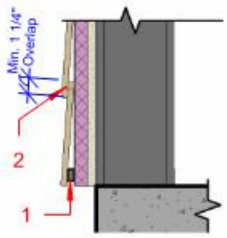
F: Door Frame

The structural frame for the door, often metal or pre-hung wood.
Insert the frame into the bucked and flashed opening. Shim to achieve proper alignment and secure as per the door manufacturer's instructions. Maintain required clearance around frame for sealing.

G: Door installation

Install Door panel as per the size.

#3	EXTERIOR LAPPING SIDING (ONSITE)



Wall Cross-Section

H: Exterior Finishes
1: Starter strip
2: Fasteners

H: Exterior Finishes

Lap siding (short for "overlapping siding") is a type of exterior wall cladding where horizontal boards are installed so that each board overlaps the one below it. It is one of the most common and traditional types of siding used in residential and commercial construction.

1:Starter strip

It is the first horizontal element installed at the base of a wall when installing lap siding.It creates the correct angle and spacing for the first course of siding and ensures moisture shedding and alignment.

Installation steps:

- Mark the base line
- Attach the starter strip, fasten to sheathing and space fasteners about 16" on center c.
- Maintain proper clearance min. 6" above grade(soil), 2" above concrete/Patio & 1" above flashing/Decking.
- Install first Course of Siding in which the bottom edge of the 1st board rests on the starter strip.Nail or screw the siding into each stud,ensuring level installation.

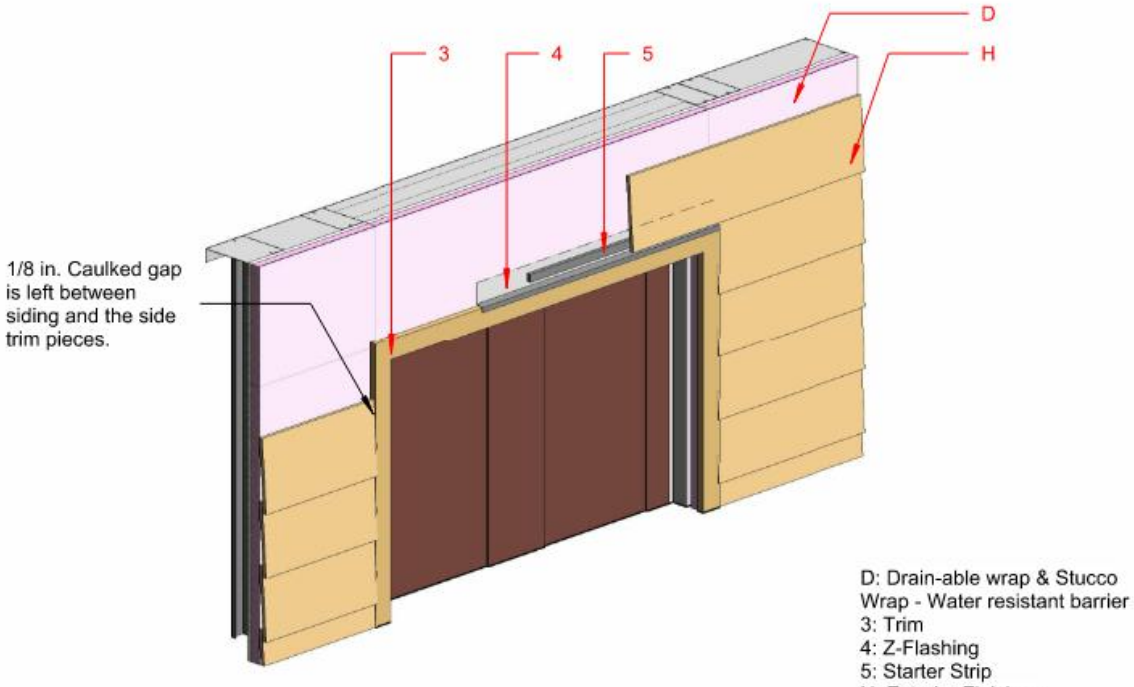
2:Fasteners

Type: #8 or #10 self-drilling screws with flat or pancake heads

Length: Long enough to penetrate at least 3 threads into the steel (typically 1-1/4" to 2")

Spacing: Fasteners at 16" o.c. or every stud

#3A | EXTERIOR LAPPING SIDING (ONSITE)



D: Drain-able wrap & Stucco Wrap - Water resistant barrier
3: Trim
4: Z-Flashing
5: Starter Strip
H: Exterior Finishes

Lap Siding Installation Around Door

D: Water resistant Barrier

Apply 1 layers of WRB and 1 layer of Stucco Wrap over insulation in accordance with the manufacturer's guidelines. Ensure proper overlaps at seams. Around door openings, cut and fold WRB to allow on-site integration with flashing (leave top flap loose for later head flashing).

1: Trim Installation

- Install Side & top Trim around the door frame.
- Leave a ¼" gap between trim and lap siding.
- Fasten trim into sheathing/CFS or bucking using screws or ET&F fasteners.
- Back-caulk trim pieces for air and moisture seal.

2: Flashing

- Apply Z-flashing above horizontal trim and the top of the door.
- Flashing should tuck under WRB flap and extend past trim edge.
- Maintain a ¼" gap between siding and flashing.

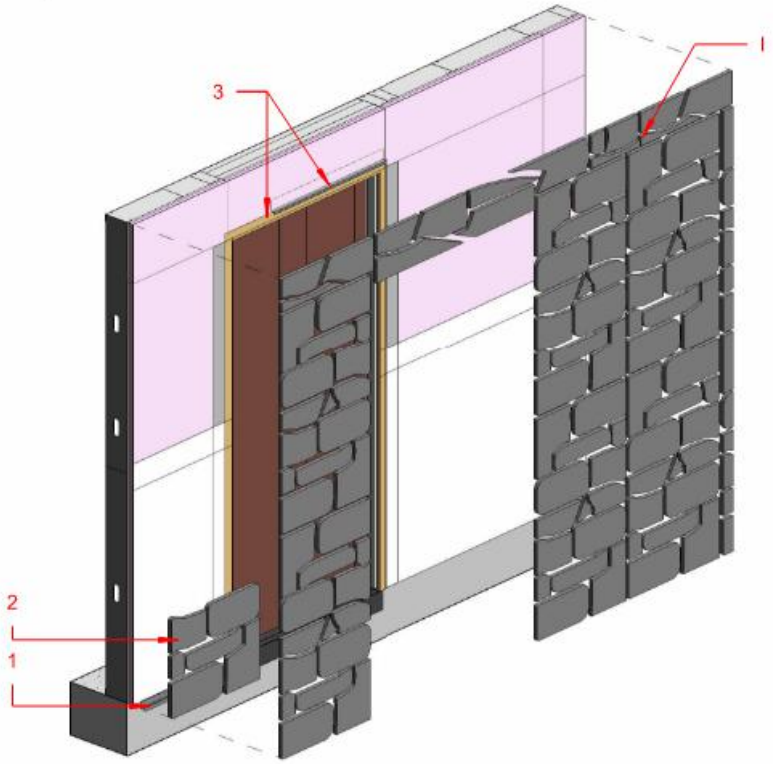
3: Starter strip

- After flashing starter strip should be installed first to maintain the correct siding angle.
- Install starter strip behind the first siding board above the door.

4: Lap Siding Placement

- Cut siding boards to fit snugly between vertical trim.
- Maintain a ¼" gap between siding and trim — caulk this joint.
- Fasten each board:
  a. Into CFS framing or furring strips at 16" o.c.
  b. Use self-drilling #8 or #10 screws with corrosion resistance.
  c. Keep 3/8" min edge distance on boards.

#4 EXTERIOR STONE VINEER (ONSITE)



I: Exterior Finishes
1: Starter strip
2: Panel installation
3: Trim & Flashing

I: Exterior Finishes

Stone system offers panelized, screw-on stone veneer systems that do not require mortar, making installation faster and cleaner than traditional methods.

Installation Process

Surface Prep

- For exterior walls:
  Install 2 layers of WRB over sheathing
  Use starter strip if installing from base
  Apply required flashing around windows, doors,and base
- For interior walls
  Panels can be installed directly to plywood, OSB, or drywall (if allowed by local code)

1: Starter Strip

- Install 2.5" above bottom of first panel.
- Leave 1/2" gap between strips for expansion.
- Tape top edge with cladding tape.
- Maintain clearances:
  4" above ground
  2" above concrete/asphalt

2: Panel InstallatioN

- Start from bottom-right corner (preferably a visible corner).
- Use chalk lines for level reference every 2–3 feet.
- Place first panel in starter strip and mark concrete top line.
- Align top of concrete (not plastic) panel to chalk line.
- Offset every other course for natural appearance (cut panel in half).
- Ensure tongue-and-groove interlock, tight vertical contact.

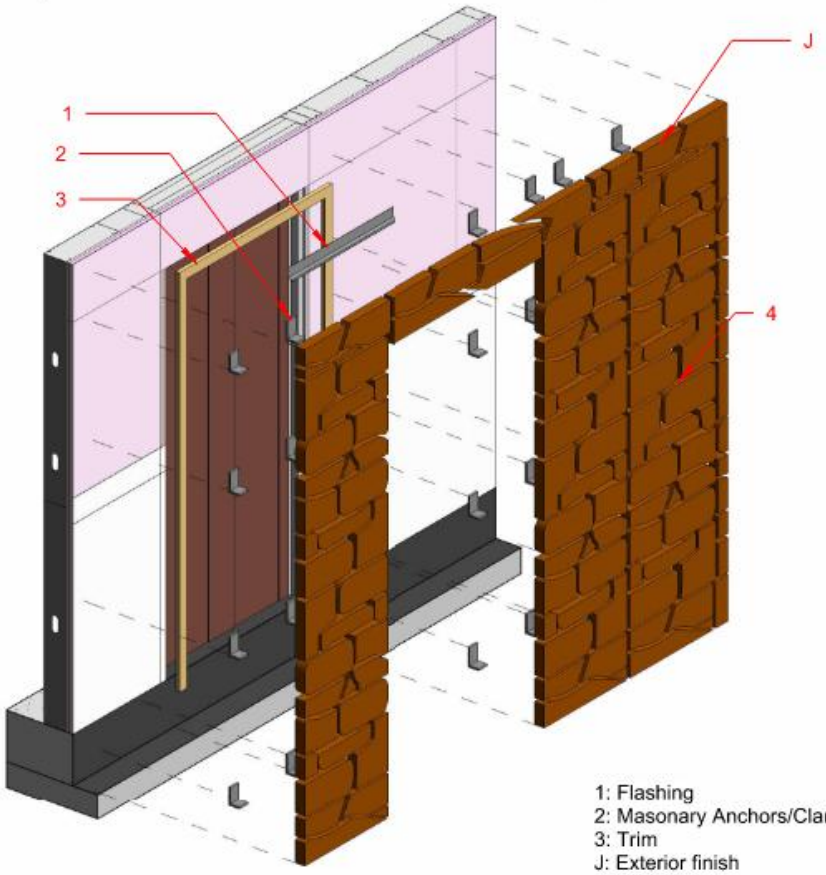
3: Trim & Flashing

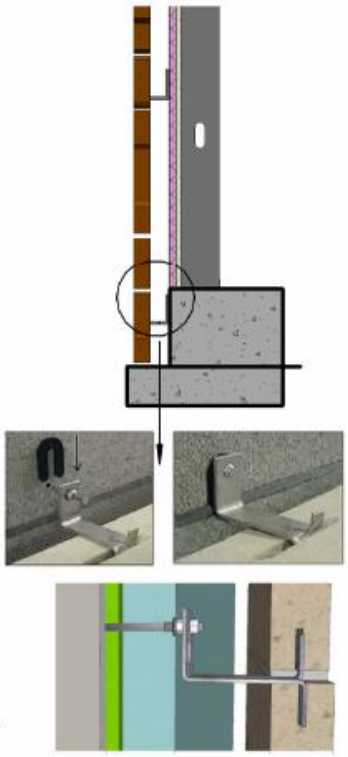
- Around Openings (Doors/Windows),Install trim (HardieTrim®, wood, or PVC) before stone.
- Leave a ¼" gap between stone and trim, and seal with backer rod + sealant.
- Use flashing above and around all openings:
  Z-flashing above horizontal trim
  Flashing tape on sides and bottom
- Cut panels neatly around trim edges.

Fastners Used for panels

- Use panel screws designed for steel, such as:
  - #10 x 1¼" or longer self-tapping screws
  - With washer head or pancake head for good hold on panel flange
- Always ensure 1 screw hits the steel stud for structural anchorage.
- Use galvanized or stainless steel fasteners in exterior applications to prevent corrosion.

#5 EXTERIOR STONE VINEER HEAVY (ONSITE)





1: Flashing
2: Masonary Anchors/Clamps
3: Trim
J: Exterior finish

J: Exterior Finishes

Anchored veneer is a wall system where individual pieces of natural stone or thick manufactured stone are mechanically fastened to the structural wall using anchors, ties, or clamps, and the system is backed by a cavity for moisture drainage.

Installation Process

1:FLASHING

- Sill pan flashing at base of opening.
- Jamb flashing on both sides.
- Head flashing (Z-flashing) on top — tucked under WRB.
- Extend all flashing beyond the opening edges by ~1".

2: Masonary Anchors/Clamps

- Use mechanical masonry anchors or clamps rated for veneer (e.g., helical ties, stone clamps, T-clips, or stainless steel ties).
- Fasten directly into CFS framing or structural backer through sheathing.
- Placement: Every 16" horizontally and 16" vertically (or as per stone/anchor spec).
- Ensure each anchor has proper embedment depth into the mortar joint (minimum 1.5").

3: TRIMS

- Install side trims first (jambs), then top trim (header) that caps over the jambs.
- Maintain a ¼" gap between trim and stone for sealant.

J: Exterior Finish

- Set Stone Veneer,Start from bottom and move upward.
- Place each stone into mortar bed or dry-stack using clamps/anchors for additional support.
- Cut stones neatly around trim edges.
- Maintain a consistent joint spacing.

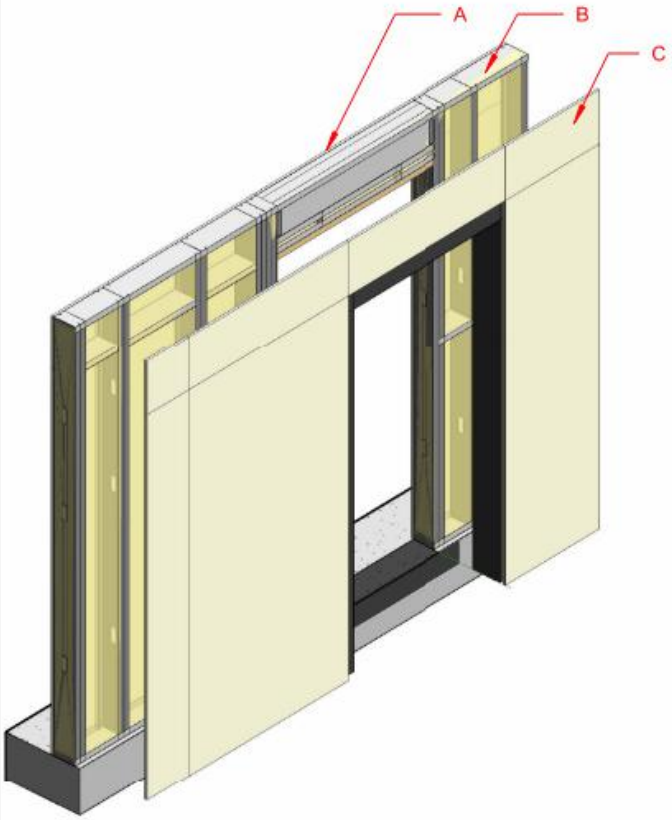
4: Grouting and Finishing

- For mortared stone: use a grout bag to fill joints.
- Tool the joints after partially setting.
- Brush off excess mortar.
- Leave expansion gaps between stone and trim for caulking.

Tip:

Maintain:
2" min clearance from concrete or hardscape
4"–6" from soil

#6	INTERIOR DOOR WITH NO DRYWALL RETURN (OFFSITE)



A: CFS Framing
B: Mineral wool
C: Interior Sheathing

A: CFS Framing

Measure the rough opening (RO) to match the door frame size (e.g., 38" x 81" for a 36" x 80" door). Ensure CFS framing (studs, king studs, jack studs, and header) is plumb and square per AISI S240.

B: Mineral wool

Cut mineral wool batts or slabs to tightly fit between cold-formed steel studs, ensuring a friction fit without compressing the material.

Install the insulation so it sits flush with the stud face, leaving no gaps or voids, especially around penetrations.

The material is non-combustible, water-repellent, and vapor-permeable, so additional fire barriers are usually not needed unless required by code.

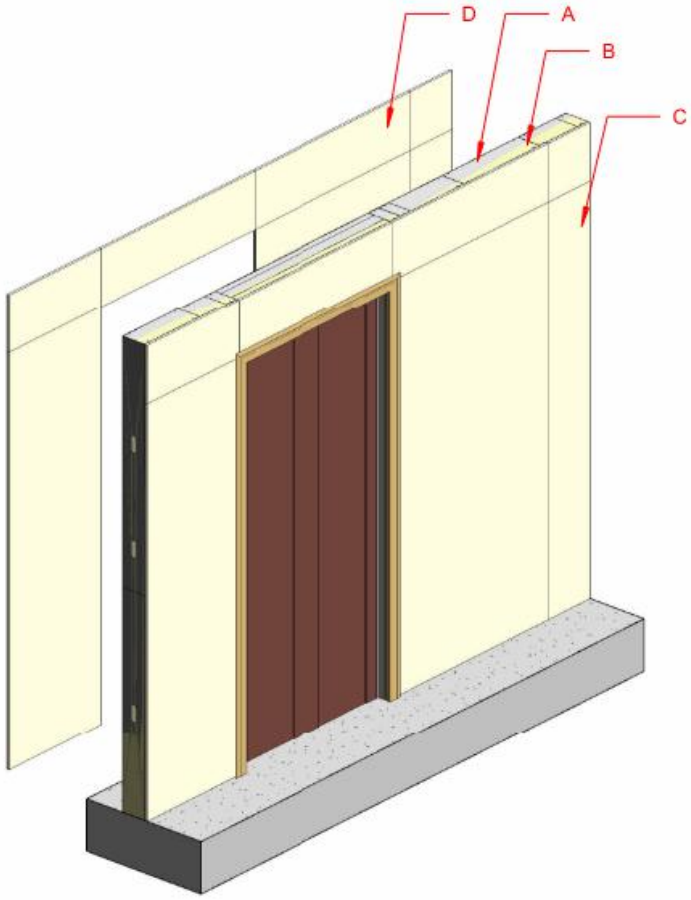
Keep panels dry during storage and transportation using protective coverings to maintain insulation performance.

Follow relevant ASTM standards (such as ASTM C665) and coordinate with building envelope and fire resistance requirements.

C: Interior Sheathing

Cut the Interior sheathing boards to size, ensuring they are large enough to cover the entire wall area around the opening
Use fasteners recommended by the manufacturer to secure the boards to the CFS studs. Ensure the fasteners penetrate completely through the sheathing and into the underlying framing/layer for a solid attachment.

#7	INTERIOR DOOR WITH NO DRYWALL RETURN (ONSITE)



A: CFS Framing
B: Mineral wool
C: Interior Sheathing (OFFSITE)
D: Interior Sheathing (ONSITE)

A: CFS Framing

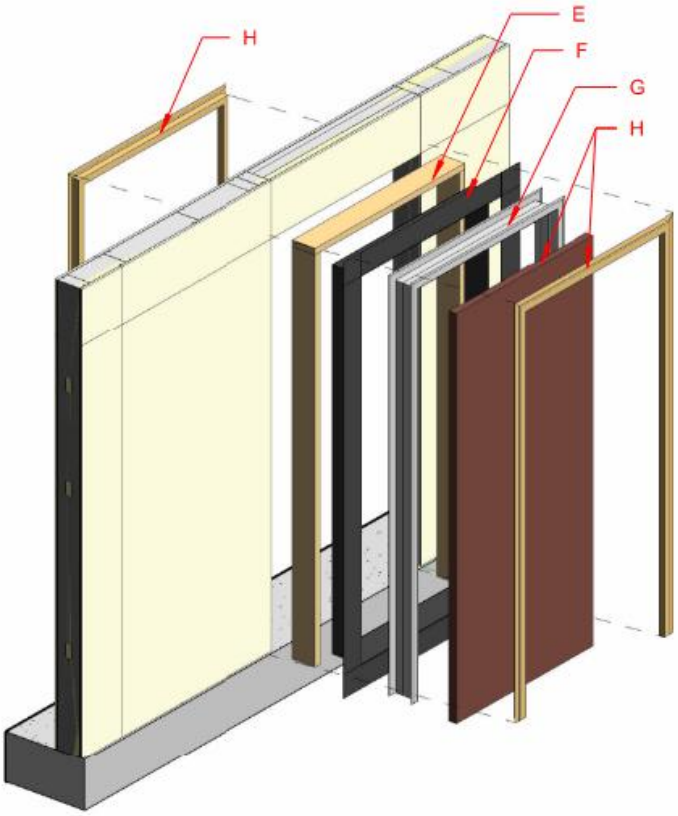
B: Mineral wool

C: Interior Sheathing

D: Interior Sheathing (ONSITE)

Cut the Interior sheathing boards to size, ensuring they are large enough to cover the entire wall area around the opening
Use fasteners recommended by the manufacturer to secure the boards to the CFS studs. Ensure the fasteners penetrate completely through the sheathing and into the underlying framing/layer for a solid attachment.

#8	INTERIOR DOOR WITH NO DRYWALL RETURN (ONSITE)



E:Bucking Frame
F:Flashing
G: Door Frame
H: Door & Trim/Casing Installation

E: Bucking Frame

Measure the height and width of the rough opening in the CFS framing.
Cut four dimensional lumber pieces (e.g., 2X4) to create the bucking frame: Two pieces to match the height of the opening & Two pieces the width of the opening PLUS 3" (to account for 1.5" lumber width on either side).
Secure the four lumber pieces together forming a frame. Use nails or screws, ensuring the corners are square
Position the Buck: Place the bucking frame directly against the CFS framing around the rough opening.
Check for level and plumb: Ensure the frame is perfectly level and square with the rough opening. Adjust if needed.
Secure to CFS Studs: Fasten the bucking securely to the CFS studs using appropriate fasteners. Apply construction adhesive between the lumber and CFS for added strength.

F: Flashing

Apply sill flashing first, followed by jamb flashing, and finally head flashing. Overlap layers properly and integrate with the WRB top flap. Follow flashing product manufacturer's installation guidelines for sequencing and overlaps.

G: Door Frame

The structural frame for the door, often metal or pre-hung wood.
Insert the frame into the bucked and flashed opening. Shim to achieve proper alignment and secure as per the door manufacturer's instructions. Maintain required clearance around frame for sealing

H: Door & Trim/Casing installation

Below is the explanation of each and every step explained in an Offsite Wall Assembly

8.1. Pre-Installed Exterior Rigid Insulation

Pre-installed exterior rigid insulation is a key strategy for enhancing the thermal performance and energy efficiency of buildings with Light Gauge Steel (LGS) framing, commonly referred to as energy conservation report, which sets forth specific requirements to ensure buildings meet the state's energy conservation goals.

Installation: Install EPS Insulation Layer on wall panel assembly (On top of the exterior sheathing), which complies with the **R-4** value. Secure the insulation with fasteners on the wall panel.

8.2. Pre-Installed Mineral Wool Insulation

LIVIO wall panels incorporate pre-installed mineral wool insulation to enhance thermal and acoustic performance while ensuring compliance with fire safety standards. The insulation is strategically placed in areas **free from plumbing and electrical service lines** to maintain accessibility for inspections and future modifications.
Additionally, a **152.4 mm (6”) clearance is left on all sides of the panel** to facilitate easy **panel-to-panel connections** after erection.

Material Properties:

- **Thermal Performance:** Mineral wool offers superior insulation properties, reducing heat transfer and enhancing energy efficiency.
- **Acoustic Insulation:** The fibrous structure of mineral wool effectively dampens sound, improving indoor acoustic comfort.
- **Fire Resistance:** Mineral wool is non-combustible and withstands high temperatures, contributing to fire safety in building applications.
- **Moisture Resistance:** It maintains its insulating properties even in humid conditions, preventing mold growth and degradation.

8.3. Pre-Installed Exterior Waterproofing -Building Wrap

- **Introduction:** To ensure water resistance, a pre-installed exterior waterproofing building wrap is applied as the topmost layer of the exterior panel during shipping. LIVIO uses high quality building & Drain Commercial Wrap, which provides a protective barrier against moisture and is designed with a 152.4 mm (6”) overlap on one side, allowing it to effectively cover panel-to-panel joints on both floor and wall panels.
- Pre-installed exterior waterproofing, commonly known as building wrap, is essential in Construction for protecting structures from moisture infiltration and enhancing energy efficiency. Building wraps act as weather-resistant barriers (WRBs), preventing water intrusion while allowing water vapor to escape, thereby safeguarding the building envelope from potential damage.

- **Material Standards**: WRBs (weather-resistant barriers) should comply with recognized standards, such as ASTM E2556 for building wraps. These standards ensure that the materials provide adequate water resistance and vapor permeability.

- **Installation Practices**: Building wraps must be installed in accordance with the manufacturer's instructions. This includes ensuring the WRB is continuous to the top of walls and properly terminated at penetrations and building appendages to maintain the integrity of the exterior wall envelope.

8.4. Pre-Installed Rough Electrical

LIVIO panels come with a **pre-installed rough electrical system**, ensuring a seamless and efficient setup for electrical connections. This system includes:

- Electrical boxes, switches, and sockets pre-installed within the panels.
- Pre-run electrical wiring ensures a structured and organized layout.
- Sub-panels and main panels integrated into the design for efficient power distribution.
- Junction **boxes placed in sub-floor panels** to facilitate easy connections.
- Lever **nut system (UL tested)** used for quick, secure, and tool-free wire connections.

- Clearly labeled wires with easy-to-understand tags, enabling a plug-and-play connection **system**—just match corresponding tags, and all electrical connections are complete.

Installation and Commissioning Process:

1. **Ensure proper wire routing:** Wires must run correctly from the **board to the junction box, then to the sub-panel, and finally to the main panel**.
2. **Connect electrical components:** Using the labeled tags, match and connect wires using the UL-tested lever nut system.
3. **Commission the electrical system:** Test and verify all connections prior to filling in mineral wool in any remaining wall and floor areas.
4. **Final insulation placement:** Once the electrical system is commissioned, the remaining sections of the walls and floors are filled with mineral wool insulation.

Benefits of Pre-Installed Rough Electrical System:

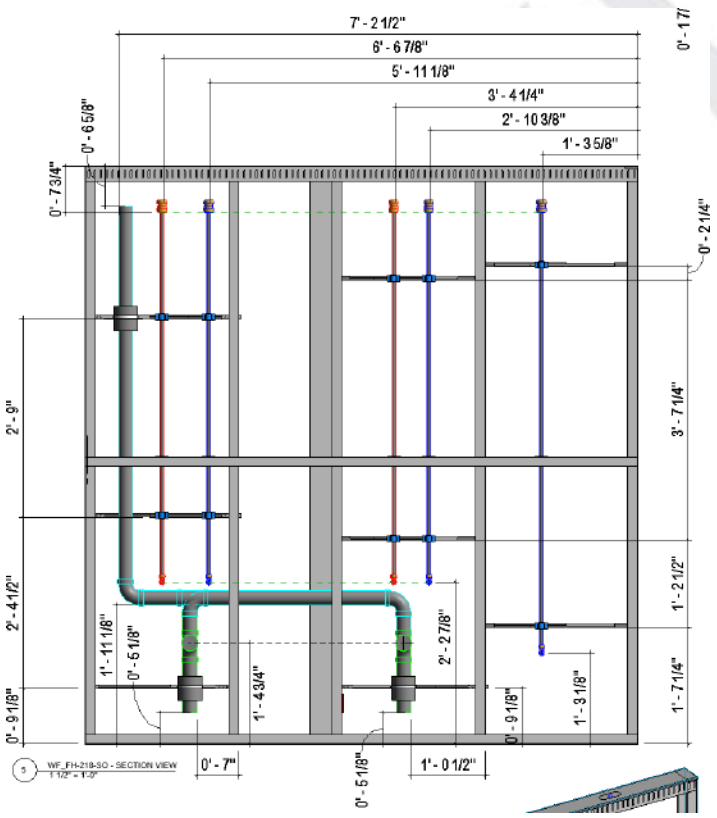
- **Reduced Installation Time:** All wiring and components are pre-installed, eliminating the need for extensive on-site electrical work.
- **Plug-and-Play Convenience:** Labeled wires make connections simple and error-free.
- **Safety Assurance:** The UL-tested lever nut system ensures reliable and safe electrical connections.
- **Organized Wiring Layout:** Proper routing from boards to panels prevents wiring issues and improves system efficiency.
- **Inspection Readiness:** Open areas for service lines allow for easy inspections before insulation is fully installed.

8.5. Pre-Installed Rough Plumbing

LIVIO panels come with **pre-installed rough plumbing**, ensuring a streamlined and efficient plumbing setup that adheres to **CBC (California Building Code) standards and relevant Saudi building codes**. The system includes all necessary water supply, drainage, and venting components, pre-installed within the panels for easy on-site connections.

Key Features:

1. **Pipe Materials:** ABS/PVC and Copper pipes are used as per CBC and Saudi building code requirements.
2. **Pre-Installed Systems:** The panels include hot water lines, cold water lines, vent lines, and drainage lines.



3. **Pipe Support System:** Galvanized **slider brackets, GI straps, and Holidrite silencers** are used for pipe support, following CBC and Saudi building standards.
4. **Copper Pipe Fittings: Brass fittings (QuickFittings)** are used for secure and durable connections.
5. **Hot Water Line Insulation:** Foam insulation is applied to **hot water lines** to enhance energy efficiency and temperature retention.
6. **Main Line Connections:** All pre-installed pipes are connected to the **floor panel**, which houses the main lines.

7. **Copper Pipe Couplings:** Brass couplings are used for **copper pipe connections** to ensure a reliable plumbing system.
8. **Pressure Testing:** After all water lines are connected, a **pressure test is conducted using a pump** to check for leaks.
9. **Leak Repairs:** If any leakage is detected in the fittings, immediate repairs are carried out.
10. **Factory QA/QC Testing:** LIVIO conducts all pressure tests in the **factory before shipping** to ensure quality. If any leaks are found on-site, they must be repaired by a local plumber.
11. **Drain and Vent Connections:** Repair couplings and glue connections are used for **drain and vent lines**.
12. **Final System Readiness:** Once all tests are successfully completed, the system is ready for use.

Benefits of Pre-Installed Rough Plumbing:

- **Reduced On-Site Installation Time:** Most plumbing work is completed before panels arrive on-site.
- **Compliance with CBC and Saudi Building Codes:** Ensures quality, durability, and safety.
- **Efficient Water Flow Management:** Proper venting and drainage systems prevent issues like airlocks and slow drainage.
- **Quality Assurance:** Factory testing guarantees leak-free installation before shipping.

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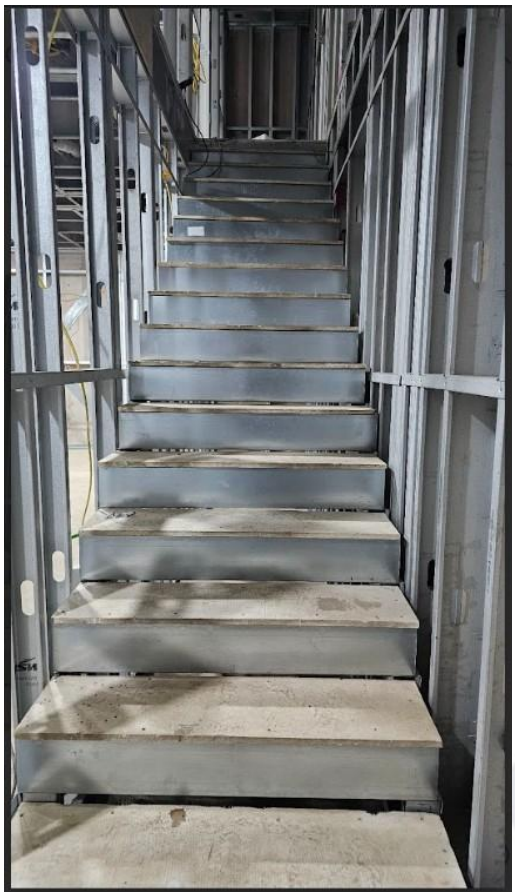
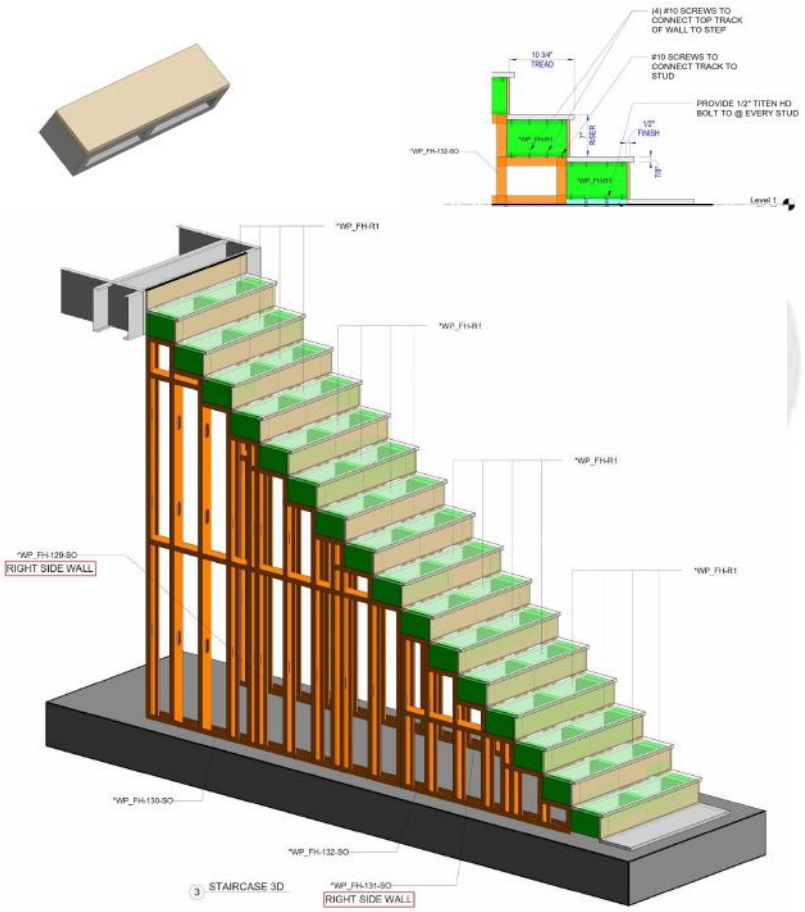
8.6. Pre-Assembled Staircase





The **Pre-Assembled Staircase** in LIVIO is designed for easy and efficient installation. The staircase components, including **stringers** and **steps** with **pre-installed sheathing**, are fabricated separately in the factory and shipped to the site as individual members. This design ensures compliance with the required code for **riser height**, **tread width**, and **flight width**.

Installation Process:

1. **Stringer Wall Installation:** Begin by installing the **stringer wall**. This provides the structural base for the staircase.
2. **Placing the Treads:** Each **individual tread** is placed onto the stringer wall, where notches are provided for secure installation.
3. **Securing the Treads:** Once placed, the treads are secured to the stringer wall using **screws** to ensure a solid and stable connection.

This pre-assembly method reduces on-site construction time, ensures consistent quality, and facilitates easier assembly.

8.7. Pre-Installed Windows

LIVIO's **pre-installed windows** are designed to provide optimal performance and compliance with **Saudi building codes**. These windows are pre-fitted into the **exterior walls** and are fully **sealed** to ensure a **water-tight** installation as per the **manufacturer's instructions**.

Key Features:

1. **Compliance with Saudi Building Codes:** The windows adhere to all relevant **Saudi building codes**, ensuring structural integrity and safety.

2. **U-Value:** The windows installed meet the required **U-value** for thermal performance, helping to maintain energy efficiency by reducing heat transfer and providing better insulation.

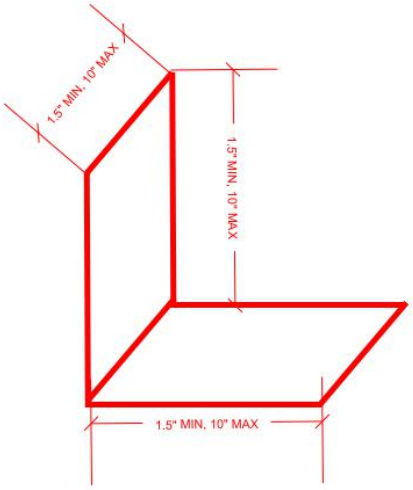
3. **Installation and Sealing:** The windows are properly **fixed** into the exterior walls and **sealed** to prevent water infiltration, ensuring a tight seal that protects against moisture

9. CFS and Structural Steel Connectors

9.1. Factory made LGS Connectors

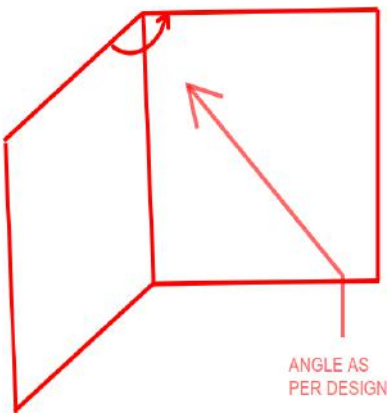
LIVIO can manufacture the below connector in the factory which can be replaced with the standard connectors.

1. L Clip

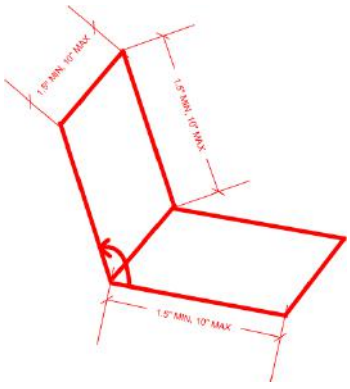


- Minimum leg dimension to be 1.5" and maximum leg dimension to be 10"
- Thickness can be 27 mil to 68 mil (22g to 14g)
- G60 coating with 50 ksi.
- Clips will be predrilled as per the requirement/detail per plan
- Application: wall, floor, roof framings

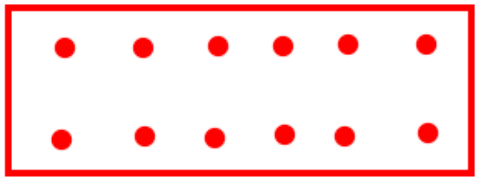
2. Skewed L Clip



- Minimum leg dimension to be 1.5" and maximum leg dimension to be 10"
- Angle will be as per design requirement.
- Thickness can be 27 mil to 68 mil (22g to 14 g)
- G60 coating with 50 ksi
- Clips will be predrilled as per the requirement/detail per plan
- Application:wall, floor, roof framings

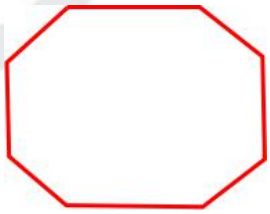


3. Flat Plates

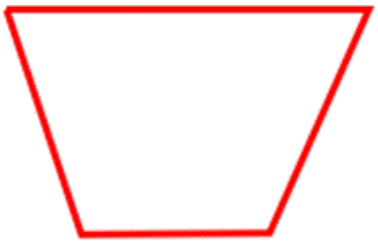


- Minimum width dimension to be 1.5" and maximum width dimension to be as per design"
- Thickness can be 27 mil to 68 mil (22g to 14 g)
- G60 coating with 50 ksi
- Plates will be predrilled as per the requirement/detail per plan
- Application: wall, floor, roof framings

4. Gusset Plates



- Shape as per design
- Sizes as per design
- Thickness can be 27 mil to 68 mil (22 g to 14g)
- G60 coating with 50 ksi
- Clips will be predrilled as per the requirement/detail per plan if req.



9.2. Structural Steel Connectors:-

Livio Building System specializes in fabricating a wide range of structural steel connectors, including angle connectors and base plates. These components play a crucial role in connecting various structural elements and transferring loads within a building or structure.

9.1.1. Angle Connectors

Angle connectors are L-shaped steel components used to connect structural members at various angles. They are typically fabricated from hot-rolled steel sections and can be customized to meet specific project requirements.

Applications:

- Connecting beams to columns
- Joining structural members at intersections
- Bracing and reinforcement

Commonly Used Angle Connector Sizes:

Sr.no	L Angle	Proposed Material Grade	Material Grade as in Indian Market	Yield Strength
1	L 2X2X1/4"	36 KSI	36 KSI	250 MPa
2	L 2X2X1/2"	36 KSI	36 KSI	250 MPa
3	L 3X3X1/4"	36 KSI	36 KSI	250 MPa
4	L 3X3X1/2"	36 KSI	36 KSI	250 MPa
5	L 4"x4"x3/8"	36 KSI	36 KSI	250 MPa
6	L 4"x4"x1/4"	36 KSI	36 KSI	250 MPa
7	L 4"x4"x1/2"	36 KSI	36 KSI	250 MPa
8	L 4"x4"x3/4"	36 KSI	36 KSI	250 MPa
9	L 6"x4"x3/8"	36 KSI	36 KSI	250 MPa
10	L 6"x4"x1/4"	36 KSI	36 KSI	250 MPa
11	L 6"x4"x1/2"	36 KSI	36 KSI	250 MPa
12	L 6"x4"x3/4"	36 KSI	36 KSI	250 MPa
13	L 6"x6"x3/8"	36 KSI	36 KSI	250 MPa
14	L 6"x6"x1/4"	36 KSI	36 KSI	250 MPa
15	L 6"x6"x1/2"	36 KSI	36 KSI	250 MPa
16	L 6"x6"x3/4"	36 KSI	36 KSI	250 MPa
17	L 6"x8"x3/8"	36 KSI	36 KSI	250 MPa
18	L 6"x8"x1/4"	36 KSI	36 KSI	250 MPa
19	L 6"x8"x1/2"	36 KSI	36 KSI	250 MPa
20	L 10"x6"x1/4"	36 KSI	36 KSI	250 MPa
21	L 10"x6"x1/2"	36 KSI	36 KSI	250 MPa
22	L 10"x10"x3/4"	36 KSI	36 KSI	250 MPa
23	L 6"x8"x1/2"	36 KSI	36 KSI	250 MPa
24	L 10"x6"x1/4"	36 KSI	36 KSI	250 MPa
25	L 10"x6"x1/2"	36 KSI	36 KSI	250 MPa
26	L 10"x10"x3/4"	36 KSI	36 KSI	250 MPa

9.1.2. Base Plates

Base plates are flat steel plates used to distribute the load from a column or other structural member onto the foundation. They are typically fabricated from thicker steel sections to provide Adequate Support and prevent excessive local stress.

Applications

- Supporting columns
- Anchoring machinery
- Connecting structural members to foundations

Baseplate				
Sr No.	Thickness	ProposedMaterial Grade	Material Grade as in Indian Market	Yield Strength
27	1/4"	36 KSI	36 KSI	250 MPa
28	1/2"	36 KSI	36 KSI	250 MPa
29	3/4"	36 KSI	36 KSI	250 MPa
30	1"	36 KSI	36 KSI	250 MPa

Customization Options

The dimensions, thickness, and configuration of angle connectors and base plates can be customized to meet the specific requirements of each project. Factors such as load-bearing capacity, aesthetic considerations, and fabrication constraints are taken into account when designing these components.

Quality Assurance

Livio Building System ensures the quality of our structural steel connectors through rigorous quality control measures, including:

- Material Inspection: Verifying that the steel used for fabrication meets the required specifications and standards.
- Dimensional Inspection: Checking the accuracy of dimensions and tolerances.
- Welding Inspection: Ensuring that all welds are performed correctly and meet the specified quality standards.
- Load Testing: In some cases, load testing may be conducted to verify the performance of connectors under specific conditions.

By providing high-quality angle connectors and base plates, Livio Building System contributes to the structural integrity and safety of our projects.

9.3. Structural Steel Coating

1. Purpose

To establish a standardized process for blasting and painting structural steel components at Livio Building System Pvt. Ltd., ensuring quality, efficiency, and compliance with industry standards.

2. Scope

This procedure applies to all blasting and painting activities related to structural steel, supports, structures, staircases, railings, and other components within Livio Building System projects.

3. References

- Project specifications
- SSPC Steel Structure Painting Code

4. Equipment

- Oil-free air compressor
- Blasting pots
- Airless spray pumps
- Material handling equipment
- Elcometer for surface salinity checks
- Magnetic surface thermometers
- Hygrometer and dew point meter
- Steel combs, wet film, and dry film thickness gauges
- Surface profile comparators
- Coating thickness gauge

5. Sequence of Activities

1. Review of Painting Scheme: Prior to commencing work, review the complete painting scheme, including split-up of work, blasting materials, paint materials, equipment, and tools.
2. Inspection of Materials: Upon receipt of painting materials, inspect them for quality, batch test certificates, manufacturing date, and shelf life. Store materials in a suitable location according to manufacturer's specifications.
3. Supplier Consistency: Ensure that all painting components originate from the same supplier to minimize compatibility issues.
4. Shop Painting: Only structural steel components released by the supervisor

will be painted in the shop.

6. Surface Preparation

1. **Cleaning**: Remove oil and grease from surfaces using solvent cleaning (SSPC-SP1) if necessary.
2. **Blasting**: Blast steel structures to SA 2.5 standards. Clean stainless steel surfaces using water or alkaline cleaning and remove rust stains.
3. **Blasting Conditions**: Ensure dry weather, substrate temperature at least 30°C above dew point, and SA 2.5 finish with a roughness profile of 50-80 microns for carbon steel.
4. **Blasting Process:** Use manual blasting with silica-safe abrasive materials. Provide breathing air purification for blasters.

7. Painting Application

1. Adherence to Standards: Apply paint strictly according to the manufacturer's technical data and application instructions.
2. Equipment Cleaning: Clean spray equipment before use to prevent contamination.
3. Paint Mixing: Mix paints using rotary mixers with flat blades.
4. Application Conditions: Ensure dry weather, substrate temperature between 100°C and 500°C, and at least 30°C above dew point.
5. Primer Application: Apply primer within four hours of blasting.
6. Intermediate and Top Coats: Apply subsequent coats after proper curing and preparation.
7. Stripe Coat: Use stripe coat at difficult locations and weld seams.
8. Spray Equipment: Use airless spray equipment with appropriate accessories.
9. Paint Pot Life: Adhere to the paint manufacturer's specified pot life.
10. Wet Film Thickness: Spot-check wet film thickness using wet film thickness gauges.
11. Dry Film Thickness: Check dry film thickness using a coating thickness gauge.

8. Final Inspection, Acceptance, and Documentation

1. **Visual Inspection:** Conduct a 100% visual inspection after curing to ensure coating continuity and surface quality.
2. **Coating Thickness Verification:** Verify coating thickness using a digital thickness gauge.
3. **Documentation**: Complete the blasting and painting report form with

relevant data.

9.4. Structural Steel Punches

Livio Building System offers a comprehensive range of punch-out services, catering to various applications, including electrical and other industries. Our specialized punches are designed to create precise and consistent openings in a variety of materials, including hot rolled steel and low gauge steel.

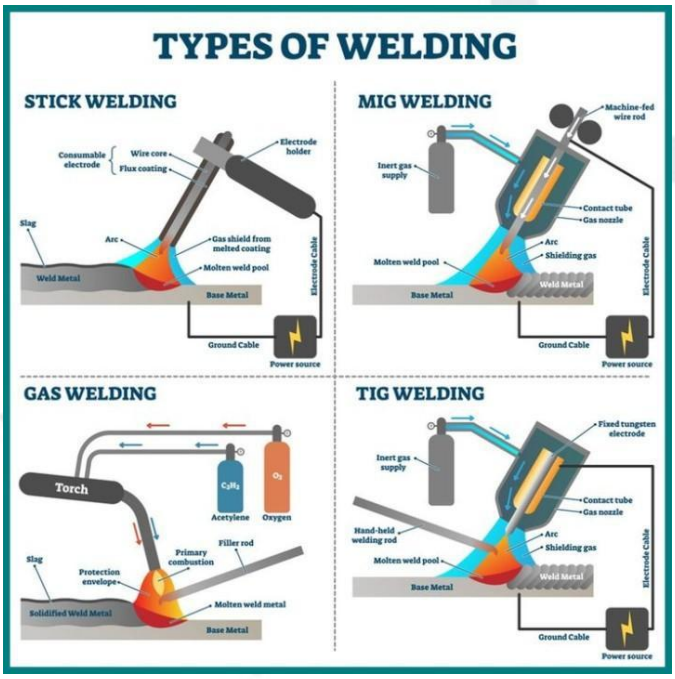
Key Punch Types and Sizes:

- **Round Punches**: Available in various sizes, including R2".
- **Oval Punches**: Offered with dimensions such as 2 1/2" x 1 1/4" and R3/4" radii.
- **Applications:**
    - Electrical: Creating openings for conduits, junction boxes, and other electrical components.
    - HVAC: Punching holes for ventilation ducts, pipes, and other HVAC equipment.
    - Plumbing: Making openings for plumbing pipes and fixtures.
    - Structural: Punching holes for structural supports and connections.
- **Hold Down Punches:**
    - We also provide custom hold down punches to meet specific client requirements. These punches are designed to create secure anchor points for various applications, such as attaching equipment or structures to the building.
- **Livio's Punch-Out :**
    - Precision and Accuracy: Our punches ensure clean, precise cuts, minimizing waste and rework.
    - Versatility: We offer a wide range of punch types and sizes to accommodate different applications.
    - Custom Solutions: Our team can design and manufacture custom punches to meet your specific needs.
    - Quality and Reliability: We use high-quality materials and advanced manufacturing techniques to deliver reliable and durable punches.

- Structural Steel Expertise: Our team is experienced in working with structural steel, ensuring that our punches are suitable for demanding applications.

9.5. Structural Steel Welding Types and Specification:

Livio Building System employs a variety of welding techniques, including MIG, SMAW, and TIG, to join hot-rolled steel sections in structural steel construction. These techniques are performed by qualified welders under the supervision of a Certified Welding Inspector (CWI) to ensure the highest quality and safety standards.



Guideline for Welding.

- **Livio prefers the Indian hot rolled sections over the US hot rolled section as mentioned below. Livio manufacturing has the American welding society (AWS) license in India for all the structural hot rolled steel except the cold form steel welding.[SE]**

- **Welding electrodes (filler metal) shall be E7xxx (70 ksi) and shall be low hydrogen types.[SE]**

Welding Techniques-

1. Metal Inert Gas (MIG) Welding
2. Shielded Metal Arc Welding (SMAW)
3. Gas Tungsten Arc Welding (TIG)

Welder Qualification

- Qualification Testing: All welders at Livio Building System must pass a welder qualification test according to relevant standards (e.g., AWS D1.1, D1.3).
- WPS and PQR: Welding procedures are followed based on approved Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR) that are tailored to the specific materials, thicknesses, and joint configurations.

Welding Inspection

- CWI Supervision: All welding operations are performed under the direct supervision of a Certified Welding Inspector (CWI).
- Defect Inspection: CWI8 conducts regular inspections to identify and correct any welding defects, ensuring the integrity of the structural components.
- Non-Destructive Testing: Non-destructive testing methods, such as Liquid Penetrant Testing is Initially performed by Livio on every Weld Joint further as per Client requirements and Project Specification we even perform Radiographic Testing (RT) or Ultrasonic Testing (UT), may be employed to verify weld quality.

Standards and Codes

- AISC: American Institute of Steel Construction standards provide guidelines for structural steel design, fabrication, and erection.
- AWS: American Welding Society standards establish requirements for welding procedures, qualification, and inspection.

By adhering to these procedures and standards, Livio Building System

ensures that its structural steel components are welded with the highest quality and safety standards, resulting in durable and reliable structures.

9.6. Structural Steel Welding Certification:-

Livio Building System is a certified fabricator, authorized to perform welding and fabrication activities within our factory. Our certifications are issued by reputable organizations, including IAPMO and Smith Emery, ensuring compliance with industry standards and regulations.

IAPMO Certification

The International Association of Plumbing and Mechanical Officials (IAPMO) is a recognized authority in the field of building codes and standards. Our IAPMO certification validates our ability to fabricate structural steel components in accordance with their requirements.

Benefits of IAPMO Certification:

- Industry Recognition: Establishes Livio Building System as a trusted and reliable fabricator.
- Quality Assurance: Ensures that our products meet high-quality standards.
- Code Compliance: Demonstrates compliance with IAPMO-approved building codes.

Smith Emery Certification

Smith Emery is another prominent certification body specializing in the construction industry. Our Smith Emery certification confirms our competency in welding and fabrication processes.

Benefits of Smith Emery Certification:

- Technical Expertise: Verifies our expertise in welding and fabrication techniques.
- Safety Compliance: Ensures adherence to safety regulations and standards.
- Client Confidence: Builds trust and confidence among our clients.

Scope of Certifications

Our certifications cover a wide range of welding and fabrication activities, including:

- Structural Steel Fabrication: Producing various structural steel components, such as beams, columns, and connections.
- Welding Processes: Utilizing MIG, SMAW, TIG, and other welding

techniques.
- Quality Control: Implementing rigorous quality control measures to ensure product integrity.
- Safety Practices: Adhering to safety regulations and standards.

Benefits of Certified Fabrication

By being a certified fabricator, Livio Building System offers several advantages to our clients:

- Quality Assurance: Guarantees that our products meet industry standards and regulations.
- Reliability: Provides confidence in the structural integrity and performance of our products.
- Compliance: Ensures compliance with relevant building codes and regulations.
- Trustworthiness: Establishes Livio Building System as a reputable and reliable partner.

Continuous Improvement

We are committed to maintaining our certifications and continually improving our fabrication processes. Regular audits and inspections are conducted to ensure ongoing compliance with industry standards and to identify areas for improvement. By holding these certifications, Livio Building System demonstrates our dedication to quality, safety, and compliance. This reinforces our position as a trusted and reliable provider of structural steel fabrication services.

9.7. Welding Inspection and Third Party Observation Letter

Purpose

- Third-party observation letters are essential documents that verify the quality and compliance of welding operations with relevant codes and standards. These letters provide an independent assessment from a qualified inspector.

Role of Third-Party Welding Inspector

- At Livio Building System, all welding operations are conducted under the supervision of a third-party welding inspector in the factory who holds a Certified Welding Inspector (CWI) certification. The CWI is responsible for:
  - **Monitoring Welding Processes:** Ensuring that all welding activities are performed in accordance with approved welding procedure specifications (WPS) and procedure qualification records (PQR).

- **Inspecting Weld Quality**: Conducting regular inspections to verify the quality of welds, including visual inspections, dimensional checks, and non-destructive testing (NDT) as required.
- **Identifying and Addressing Defects:** Identifying any welding defects and recommending corrective actions to ensure the integrity of the structure.
- **Issuing Inspection Reports**: Preparing detailed inspection reports that document the findings of the inspection, including any observations, recommendations, and required corrective actions.

Welding Inspection Report Content

1. The welding inspection report should include the following information:
    1. Project Identification:
        a. Project name
        b. Location
        c. Date of inspection
2. Inspector Information:
    a. Name
    b. CWI certification number
    c. Affiliation
3. Welding Process:
    a. MIG, SMAW, TIG, or other relevant process
4. Materials:
    a. Type of steel
    b. Thickness
5. Welding Standards:
    a. AWS, ASME, or other applicable standards
6. Inspection Scope:
    a. Specific areas or joints inspected
7. Observations:
    Detailed description of the welding process, including:
    a. Welder qualification
    b. WPS and PQR adherence
    c. Welding equipment and consumables
    d. Weld quality (appearance, dimensions, and defects)
    e. Compliance with safety regulations
8. Findings:
    a. Summary of the inspector's observations and conclusions
9. Recommendations:

a. Any suggested improvements or corrective actions

10. Attachments:
    a. Copies of WPS, PQR, welder qualification certificates, and any relevant documentation

Stamping and Signing

Upon completion of the inspection and the preparation of the report, the third-party welding inspector will stamp and sign the report to certify the accuracy and completeness of the findings.

LIVIO — FIT-UP AND WELDING INSPECTION REPORT

Report no.: LIV-FO-FW-001
Date: 21-05-2024

Project Name: FAIR OAKS-BUILDING 4 (UNIT 1,2,3 & 4) | Area: BUIILDING 4 (Unit 1,2,3'& 4)

Sl No	Drawing No.	Mark No.	FIT UP INSPECTION						FIT-UP Inspection		PUNCHING & HOLES		ANGLE CONNECTORS ORIENTATION		WELD VISUAL INSPECTION			
			Actual			Observed									Weld Type	Visual Inspection		Remarks
			Size	Item	Length	Size	Item	Length	Acc	Rej	Acc	Rej	Acc	Rej		Acc	Rej	
1	WL-LVL-03-012	U1-B1-03-02	HSS 12X4X5/8	HSS BEAM	20' - 3 1/2"	HSS 12X4X5/8	HSS BEAM	20' - 3 1/2"	Acc		Acc		Acc		FW	Acc	-	
2	WL-LVL-03-011	U1-B1-03-01	HSS 12X4X5/8	HSS BEAM	21' - 3 1/8"	HSS 12X4X5/8	HSS BEAM	21' - 3 1/8"	Acc		Acc		Acc		FW	Acc	-	
3	WL-LVL-03-015	U1-B2-03-01	HSS 6X4X5/16	HSS BEAM	9' - 4 1/4"	HSS 6X4X5/16	HSS BEAM	9' - 4 1/4"	Acc		Acc		Acc		FW	Acc	-	
4	WL-LVL-03-013	U1-B1-03-03	HSS 12X4X5/8	HSS BEAM	16' - 4 5/8"	HSS 12X4X5/8	HSS BEAM	16' - 4 5/8"	Acc		Acc		Acc		FW	Acc	-	
5	WL-LVL-3-002	U2-B1-03-02	HSS 12X4X5/8	HSS BEAM	16' - 4 3/4"	HSS 12X4X5/8	HSS BEAM	16' - 4 3/4"	Acc		Acc		Acc		FW	Acc	-	Accepted
6	WL-LVL-3-001	U2-B1-03-01	HSS 12X4X5/8	HSS BEAM	20' - 3 5/8"	HSS 12X4X5/8	HSS BEAM	20' - 3 5/8"	Acc		Acc		Acc		FW	Acc	-	
7	WL-LVL-3-002	U3-B1-03-02	HSS 12X4X5/8	HSS BEAM	16' - 4 3/4"	HSS 12X4X5/8	HSS BEAM	16' - 4 3/4"	Acc		Acc		Acc		FW	Acc	-	
8	WL-LVL-3-001	U3-B1-03-01	HSS 12X4X5/8	HSS BEAM	20' - 3 5/8"	HSS 12X4X5/8	HSS BEAM	20' - 3 5/8"	Acc		Acc		Acc		FW	Acc	-	
9	WL-LVL-3-002	U4-B1-03-02	HSS 12X4X5/8	HSS BEAM	16' - 4 3/4"	HSS 12X4X5/8	HSS BEAM	16' - 4 3/4"	Acc		Acc		Acc		FW	Acc	-	
10	WL-LVL-3-001	U4-B1-03-01	HSS 12X4X5/8	HSS BEAM	20' - 3 5/8"	HSS 12X4X5/8	HSS BEAM	20' - 3 5/8"	Acc		Acc		Acc		FW	Acc	-	

Note: Longitudinal Dimension check Tolerances: Specified Length minus 1/8" and Specified Length plus 1/4"
Anchor Inspection Tolerances: Location = +/- 1/16" vertical & horizontal; Shape: +/- 1/32"; Dimensions: 1/16" any direction
Annotation: FW- Fillet Weld; Acc- Accepted; Rej- Rejected
**One side Angle connectors which has to be welded on the beam among the four side are sended as loose due to the loading plan as they can be damaged during loading*

INSPECTION VERIFICATION	SR. ENGINEER - HRS	LIVIO QC	TPI
NAME	FIROZ KHAN	AVINASH PANDEY	RAMPRASAD DASPUTE
SIGNATURE	(signature)	LIVIO QA/QC (signature)	AWS Ramprasad Dilprao Daspute CWI 19017961 QC1 EXP. 1/1/2025 (signature)
DATE	21/05/24	21/05/24	21/05/2024

9.8. Structural Steel Welding Inspection- Onsite Inspection:-

This inspection is essential for verifying that welding work meets the required standards and specifications, particularly those outlined by the American Welding Society (AWS) and other relevant codes.

On-site structural steel welding inspections are essential for maintaining quality control in construction projects. They help ensure that welded connections are sound and compliant with established standards, ultimately contributing to the overall safety and performance of steel structures.

10. Testing Reports & Certifications

10.1. UES Reports

UES ER0808, ER0779

10.2. Structural test reports (shear, axial, racking, lateral load tests)

See all reports related to screw testing, LGS Coil and Structural steel testing

10.3. Smith Emery Reports

UES ER0808, ER0779, Smith Emery Reports

11. Project References

11.1. Implemented LIVIO projects

Livio has delivered **several projects across the USA** which were designed with LIVIO's system and were approved by 3rd party Structural engineers and Government Plan checkers. The portfolio includes Townhomes, apartments and single family homes / villas.

One such recent project designed and approved in the City of Cupertino was 21102 Lavina Ct., Cupertino, CA 95014, USA

Approved Permit Set (Includes Architectural, Structural and Energy calculations). More references can be provided on request.

11.2. Live Demonstration by LIVIO: Building a 2-Story Villa from Scratch & Made Ready to finish in less than 12 Hours.

Watch Timelapse

LIVIO successfully conducted a live demonstration showcasing the rapid assembly of a 2-story villa from the ground up—delivered and enclosed within 11.5 hours. The event was broadcast live via Google Meet to a global audience on Friday, March 28th 2025, drawing attention from developers, partners, and construction professionals interested in high-speed modular construction.

The demonstration highlighted LIVIO's capability to revolutionize traditional construction timelines while maintaining structural integrity, design flexibility, and future scalability.

Key Stages Showcased in the Timelapse:

1. Structural & Non-Structural Wall Framing

Completion of all exterior and interior walls, precisely fabricated and quickly installed.

2. Floor & Roof Framing

Rapid subflooring and full roof structure assembly using modular components.

3. Exterior & Interior Sheathing

Structural enclosure of the entire villa, ensuring stability and form.

4. Rough MEP Installation

Pre-integrated mechanical, electrical, and plumbing systems embedded

seamlessly during framing.

5. Insulation & Waterproofing
Application of interior insulation, exterior rigid insulation, and water barriers, making the structure weather-resistant.

Outcome:
By the end of the demonstration day, the villa was completely enclosed and ready for finishing works such as painting, tiling, and exterior cladding. This shows LIVIO's capability to deliver a rapid construction system helping ROSH group achieve its goals of building new cities efficiently in record time.
To showcase reusability and flexibility, the structure was also designed to be dismantled.

12. Installation and Training Protocols

12.1. Step-by-Step Installation Methodology

LIVIO's **multi-trade building system** follows a streamlined, efficient, and repeatable **installation process** designed for rapid deployment with minimal on-site labor. The system's modular nature reduces complexity, enhances accuracy, and shortens construction time by up to **75%**.

A. Pre-Installation Preparation

1. **Site Preparation:**
   - Grading and leveling of the site.
   - Foundation and slab installation (by local contractors).

2. **Logistics and Delivery:**
   - Panels and MEP-integrated modules arrive **pre-fabricated** from LIVIO's facility in LIVCubes
   - The LIV Cubes are shipped & stored as per erection sequence on-site.

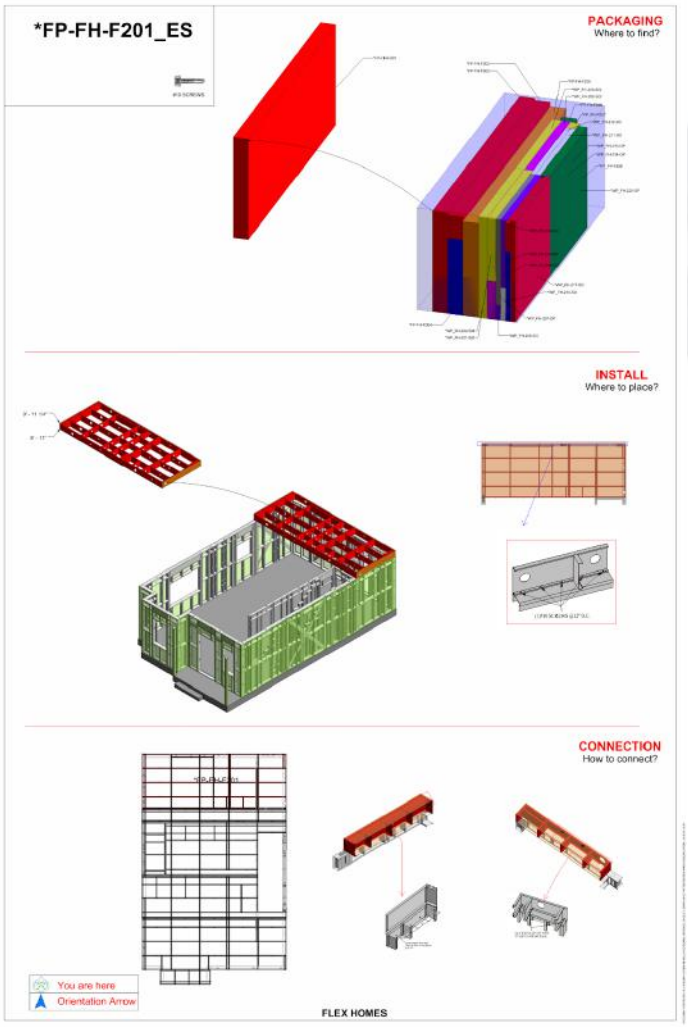
3. **Inspection and Staging:**
   - Components are **inspected for quality** upon arrival.
   - Panels are staged and arranged according to the installation sequence.

B. Structural Assembly Process

1. **Lego-Like Erection Sequence:**
   - LIVIO's system uses a **Lego-like installation process**, making it intuitive and easy to follow.
   - Each pre-assembled multi-trade panel is marked with clear labels indicating its placement order.
   - Panels interlock seamlessly using pre-configured connection points.

2. **LIVIO Mobile App for Installation Guidance:**
   - The **entire erection sequence** is available on the **LIVIO Mobile App**, which can be downloaded from the **App Store** or **Google Play** by any contractor on-site.

- The app provides **simple, graphical instructions** that are easy to interpret, enabling even semi-skilled labor to follow the step-by-step assembly process. Below is an example of an erection sequence document.



- Panels include **QR codes and reference markings**, allowing installers to verify their placement and orientation through the app.
- Watch [this video] to know more about Livio's Integrated Delivery Mechanism and mobile app.

3. Wall Panel Installation:

- Exterior **and interior wall panels** are placed and connected

using LIVIO's **plug-and-play assembly system**.
- Panels include **pre-installed electrical and plumbing rough-ins**.
- Fast, interlocking design enables quick alignment and secure fastening.

4. **Floor and Roof Framing:**

   - Pre-framed **floor and roof panels** are placed and secured.
   - Panels are bolted together using pre-aligned connection points.

5. MEP Integration:

   - **Rough mechanical, electrical, and plumbing (MEP)** are pre-integrated into the panels.

   - On-site connections are limited to:
     - Panel-to-panel MEP linking.
     - Central utility hookups (water, electricity, HVAC).

6. Sheathing and Enclosure:
   - Panels include **factory-installed sheathing** (exterior and interior).
   - Fastened with **pre-marked connection points** for consistency.

7. Weatherproofing and Insulation:
   - **Pre-applied weatherproof coatings** and seals ensure water and air-tightness.
   - Additional insulation and sealing are applied as required.

8. Finishing:
   - Pre-installed rough-ins allow for faster finishing with **minimal on-site trade work**.
   - Final connections (fixtures, trim, and appliances) are made on-site.

12.2. Required Skill Level for Labor (Local Adaptability)

LIVIO's **intuitive, pre-assembled system** requires significantly **less specialized labor** compared to traditional construction. The **LIVIO Mobile App** and **panel markings** make the process easy to follow, enabling local contractors to assemble the system efficiently with minimal technical expertise.

C. Labor Requirements

- **Semi-skilled labor** can handle the panel assembly by following the **step-by-step instructions** on the LIVIO app.
- **Basic construction skills** (framing, fastening, and MEP connections) are sufficient.
- **Minimal supervision** is required due to the simplicity of the modular system.

D. Local Adaptability

- The system reduces dependence on highly specialized trades, making it ideal for local contractors.
- The use of graphical instructions and app-based guidance simplifies the learning curve, allowing local labor to quickly adapt.

Training **programs** (detailed in section 10.5) will be provided to ensure local workers gain proficiency in the installation process.

12.3. QC/QA Procedures During Installation

LIVIO follows a **rigorous Quality Control (QC) and Quality Assurance (QA)** protocol throughout the installation process to ensure structural integrity, accuracy, and safety compliance.

A. Quality Control (QC) Procedures

- Pre-**Delivery Inspections:**
  - All panels and MEP components are thoroughly inspected at the factory prior to shipping.
  - Dimensional accuracy, MEP connections, and sheathing quality are verified.

- **On-Site QC Inspections:**
  - Panels are inspected upon arrival for **damage, fit, and finish**.
  - Any defects or discrepancies are addressed before assembly.

- **Panel Alignment and Leveling:**
  - During installation, panels are checked for **plumbness, squareness, and proper alignment**.

- **MEP Testing:**
  - Pre-integrated MEP systems are pressure-tested and continuity-checked after installation.
  - On-site utility connections are inspected and verified.

B. **Quality Assurance (QA) Procedures**

- **Supervisor Sign-Off:**
  - LIVIO supervisors will oversee the installation process and sign off on each phase.

- **Documentation and Reporting:**
  - Detailed QA checklists will be maintained throughout the installation.
  - **Real-time reporting through the LIVIO Mobile App** ensures quality consistency and remote monitoring.

- **Compliance Audits:**
  - LIVIO will conduct periodic compliance audits to verify adherence to standards.
  - Audits will cover **structural integrity, MEP connections, and final finish quality**.

12.4. Supervisor and Technical Support Plan from LIVIO in USA

LIVIO has an **on-site technical support team** in the USA to collaborate with **client/ developers and** other local contractors, ensuring smooth execution and quality control.

A. **On-Site Supervision**

- **Technical Supervisors:**
  - LIVIO will assign **dedicated technical supervisors** to oversee

installation
    - They will coordinate with **client/ developers** and local contractors for seamless operations.

- Real-Time Issue Resolution:
    - Supervisors will address any **technical challenges or modifications** required during installation.
    - On-the-spot adjustments and solutions to prevent delays.

B. **Remote Technical Support**

- Live **App Assistance:**
    - The **LIVIO Mobile App** will provide **real-time technical support** with installation tips and troubleshooting guidance.

- Remote Monitoring and Reporting:
    - LIVIO's team will monitor progress remotely through the app's **real-time reporting features**.
    - Enables efficient oversight and issue resolution from LIVIO's headquarters.

12.5. Proposed Training Programs for Local Contractors

LIVIO will establish **comprehensive training programs** to equip local contractors and laborers with the necessary skills to efficiently install the modular panel system.

A. **On-Site Installer Training**

- TargetAudience**:**
    - Local contractors, MEP installers, and construction workers.

- Training Modules:
    - **Panel Assembly & Connection:** Hands-on training on placing, connecting, and securing the panels.
    - **MEP Integration:** Instruction on connecting pre-integrated MEP systems.
    - **App Usage:** Training on using the **LIVIO Mobile App** for sequencing and QC tracking.

- Duration:
  - **2–3 days of hands-on training** for core contractor teams.

B. **Certification Program**

- Certified **Installer Program:**
  - Contractors completing the training will receive **LIVIO Installer Certification**.
  - Certification ensures consistent installation standards.

- Ongoing Support:
  - LIVIO will provide **continuous training and support** for future project

EXHIBIT A: Standard Notes & Typical Plan Details

EXHIBIT B: LIVIO Standard Details (.dwg and .rvt)

(Available only on Request)

EXHIBIT C: Livio Project Intake Checklist or Pass/ Fail Checklist

EXHIBIT D: License to work in Kingdom of Saudi Arabia (KSA)

