

The Engineering Behind Fabric Structures December 2017 Webinar Q&A

Q. Does a fabric building need to meet the codes?

Yes. Codes can vary based on use but typically the fabric must meet NFPA 701.

Q. Are fabric structures suitable for earthquake-prone areas?

Yes, fabric structures are designed for seismic loads just like any other structure. With our overall structure having less dead load overall, the seismic lateral and longitudinal forces should be smaller as well.

Q. Can fabric structures be permanent buildings to resist 110 mph wind speed exp-C?

Yes. Whatever your area wind speed is we will design the structure around those loads in addition to other environmental loads.

Q. What happens to the fabric in -40 degrees Celsius weather?

The fabric is designed to withstand and perform in natural weather temperatures that occur around the world. The normal ranges would be from -40 degrees F to +125 degrees F.

Q. Are fire protection sprinklers typically installed in these buildings? Are they required?

Sprinkler systems are typically required based on the building application rather than the building material. Sprinklers can be added as needed.

Q. Does the fabric meet NFPA 701 fire propagation performance criteria?

Yes. It is required by building code.

Q. Are fire protection sprinklers required?

Sprinkler systems are typically required based on the building application rather than the building material. Sprinklers can be added as needed.

Q. In terms of magnitude, is there any significant difference between the wind load of a fabric building and a comparable metal building?

No real difference in magnitude. You will find that because we are using loads driven by ASCE7 for load determination that the horizontal, vertical and uplift vertical forces will be nearly identical.

Q. Follow-up question on the wind load: By order of magnitude, I refer to load in pounds per square foot. I am for example used to seeing about 20 lbs/square foot for wall loads in a low rise, 90 mph wind zone. How does fabric compare (locally or on the MWFRS)?

Your windload calculation for a fabric building would be the same for any other conventional building structure.

Q. What are the temperature and/or thermal effects on the fabric skin of the building?

The fabric is designed to withstand and perform in natural weather temperatures that occur around the world. The normal ranges would be from -40 degrees F to +125 degrees F.

Q. How do fabric structures compare to others in terms of projectiles common with hurricanes and tornados?

Fabric has been tested per the Miami-Dade hurricane missile test and passed. We also have real-world experience and our buildings have performed very well.

Q. Can they be insulated?

Yes, they can be insulated. Legacy Building Solutions can design insulation packages for all buildings we design.

Q. Approximately how much of the natural light advantage is lost if the roof is insulated?

100% of the natural light is lost as the insulation blocks it out.

Q. How do you address insulated roofs? What kind of insulation is used to get R-30 for the roof?

Typical insulation used is R-30 fiberglass insulation, which is the same type used in metal buildings. Legacy also adds a fabric interior liner, which provides a seamless vapor barrier as well as a nice, smooth finish on the interior of the building. This also provides for better lighting performance from the lights installed in the building.

Q. What is the R rating for fabric shelters (insulation ratings) and also fire ratings?

A fabric structure's R rating is directly related to the R values of the insulation used in the structure.

Q. Do you know of an installation in which the area of insulation is limited to a majority but not all of the area to allow some natural light diffusion?

That has been done. It is preferable to only do this in climates that do not normally go below freezing to avoid condensation issues in the non-insulated areas.

Q. Don't all buildings need to be insulated to meet the energy codes?

Yes. Cold storage buildings do not need to be insulated.

Q. What types of foundations are typically used for these buildings?

We use typical pier/footing foundations, piles with grade beams, monolithic slabs, waste blocks on very small structures, drilled piers.

Q. Can Legacy design a foundation?

Currently we see about a 50/50 split doing the foundation with the building. Many owners like to keep the whole design in one contract to streamline their permit process, turning in stamped foundation drawings with the stamped building drawings. Other clients have local engineers they use on projects so we give them our preliminary reactions and work with the foundation engineer to make sure the anchor bolt layouts work with their foundation.

Q. How do the foundation costs of fabric buildings compare to traditional PEMB? Higher uplifts? Or breakaway in high winds? Are lateral thrust forces due to rigid frame action the same as with traditional PEMB?

Yes, you will find that because we are using loads driven by ASCE7 for load determination that the horizontal, vertical and uplift vertical forces will be nearly identical.

Q. Are foundations typically larger for fabric buildings versus PEMB?

There is no real difference in magnitude. You will find that because we are using loads driven by ASCE7 for load determination that the horizontal, vertical and uplift vertical forces will be nearly identical.

Q. Legacy will then furnish all loading for which the structural engineer then can design foundations?

Yes, we have a reaction sheet that is in the building drawings.

Q. Cost per square foot of material?

Generally, Legacy structures are comparably priced to conventional pre-engineered metal buildings. Cost savings often become more substantial in clearspan widths over 120' wide.

Q. What is the relative cost of the fabric cladding versus metal cladding?

Typically the cost of the fabric is similar to metal cladding, however fabric is typically installed more quickly.

Q. What is the cost per square foot of material?

Cost per square foot varies greatly based on width of building, use of building, height of sidewalls, snow, wind and seismic loads in the building location. Each building is optimized for use and location.

Q. What is the price difference between fabric and metal roof?

Fabric is similar in cost to metal panels. Some of the benefits of fabric include allowing natural light through and being non-corrosive.

Q. How does the cost compare to metal buildings and traditional construction?

The cost of fabric structures is typically similar to metal buildings and less expensive than traditional construction.

Q. Have any fabric buildings been built in the petrochemical plant?

Fabric buildings have been built in many applications including petrochemical applications. On specific projects, it should be verified that the chemicals from the plant will not have a negative reaction with the fabric.

Q. Has fabric been used for walkway covers?

Yes.

Q. Does mold form on the exterior of the fabric due to the humidity and crops?

It is possible for mold to form on the exterior, however good-quality fabrics typically have coatings to resist this in most situations.

Q. What is the guaranteed life of the fabric by Legacy for typical use? How does this change to the chemical exposure?

The Legacy ExxoTec™ PVC fabrics carry 20 and 25 year warranties depending on the fabric selected. Exposure to chemicals would need to be evaluated on a case-by-case basis depending on the actual chemical in question.

Q. What is the total thickness of roof fabric?

The thickness of the fabric will depend on the weight of the fabric chosen.

Q. How long does the fabric panel last compared with the steel panel option?

Depending on the fabric selected, our covers should last 15-30 years or more.

Q. Can damaged (cut/torn) fabric be easily repaired?

Our installation crews can repair any size of tear. We also offer repair tape if the building owner wishes to repair a small tear themselves.

Q. Can fabric be retrofitted to an existing pre-engineered metal frame building?

This can be done but it has its own unique challenges. Most typical metal buildings have close purlin spacing on the top flange with intermittent flange braces to the bottom flange. Most fabric buildings have the purlins on the bottom flange with flange braces kicking up to the top flange. In other words, there is no support below the fabric, it spans freely between the frames.

Q. Can you walk on the fabric after it is installed?

Yes. The fabric is extremely strong and can carry a significantly greater load than an unsupported metal panel. Legacy completed a practical fabric load test in which we placed and drove a 10,000 lb skidsteer on a suspended panel.

Q. Do you ever see cases of membrane relaxation and slackening over time?

When the fabric is properly tensioned both horizontally and vertically as it is at Legacy Building Solutions, the fabric should not need to be re-tensioned after initial install.

Q. One of the main concerns about fabric structures is sagging and water accumulation on the roof. Have you had any issue in that regard? And what have you done to prevent that?

Legacy buildings are designed to shed snow and water. We design with minimum roof slopes to eliminate the potential of this occurring.

Q. How common is fabric applied as cladding to existing facilities?

It is not frequent as typically the existing facility's framework is not designed to be conducive to the application of fabric.

Q. What are the general fabric spans?

Legacy normally has 20' bay spacing.

Q. Does the fabric add any rigidity to the structure that is counted on in the design?

Though fabric does serve as a redundant brace to the top flange, we do not assume any support in the frame analysis. The only support comes from the purlins and flange braces.

Q. Could a Legacy frame be recovered at the end of the lifespan assuming the frames are still acceptable? Is this cost-effective?

The steel frame can be covered with another fabric membrane. If you are planning to cover the frame with another material, such as steel, it's best to know that during the engineering phase so that the frame is designed to support the correct weight.

Q. Have you retrofitted any metal buildings with fabric skin?

No. Based on the framing systems, most metal building frames are not conducive to accept fabric without significant modification.

Q. Are there technical documents available for use by engineers to design?

Not really, we have our own internal FEA software that designs our tapered rigid frame sections. The program also designs bolts, welds and plates.

Q. How are roof penetrations framed and sealed in fabric structures?

They are framed the same as conventional metal buildings and utilize the same types of sealing methods as metal buildings.

Q. How are solar panels attached or supported by the fabric roof without penetrating the fabric?

Legacy supplied mounting brackets to support the solar panel framework and they were bolted through to the frame. These penetrations were sealed with rubber gaskets.

Q. Is it ever feasible to retrofit a metal panel building to a fabric panel building?

The steel frame can be covered with another fabric membrane. If you are planning to cover the frame with another material, such as steel, it's best to know that during the engineering phase so that the frame is designed to support the correct weight.

Q. Are there additional resources for engineering the fabric structure frame?

We use the standard rigid frame engineering that has been fine-tuned for decades.

Q. Do you have typical construction details you can provide?

We do share some but many of them are proprietary.

Q. I gather that Legacy is a Canada firm. Are you able to provide your products in the USA for federal projects?

Legacy is a U.S. firm that also has a presence in Canada. We are registered in both countries and have done extensive work in both. Additionally we have worked in Asia and Africa. We have a sales team that oversees military projects as well.

Q. How is the top flange of the frame for a fabric building braced?

It is braced back down to the purlins which are mounted on the bottom flange.

Q. How long is your nominal custom design period?

Turn-around time will vary depending on contract terms, but it can be as little as 3-6 weeks.

Q. What is the minimum roof pitch to prevent rainwater accumulation?

At Legacy, we like to design at 4/12 or higher roof pitches, however we will go as low as 2/12 in applications where there are only rain loads, not snow loads.