FBi Buildings

WHAT YOU NEED TO KNOW WHEN

PLANNING YOUR OPEN-SIDED BUILDING

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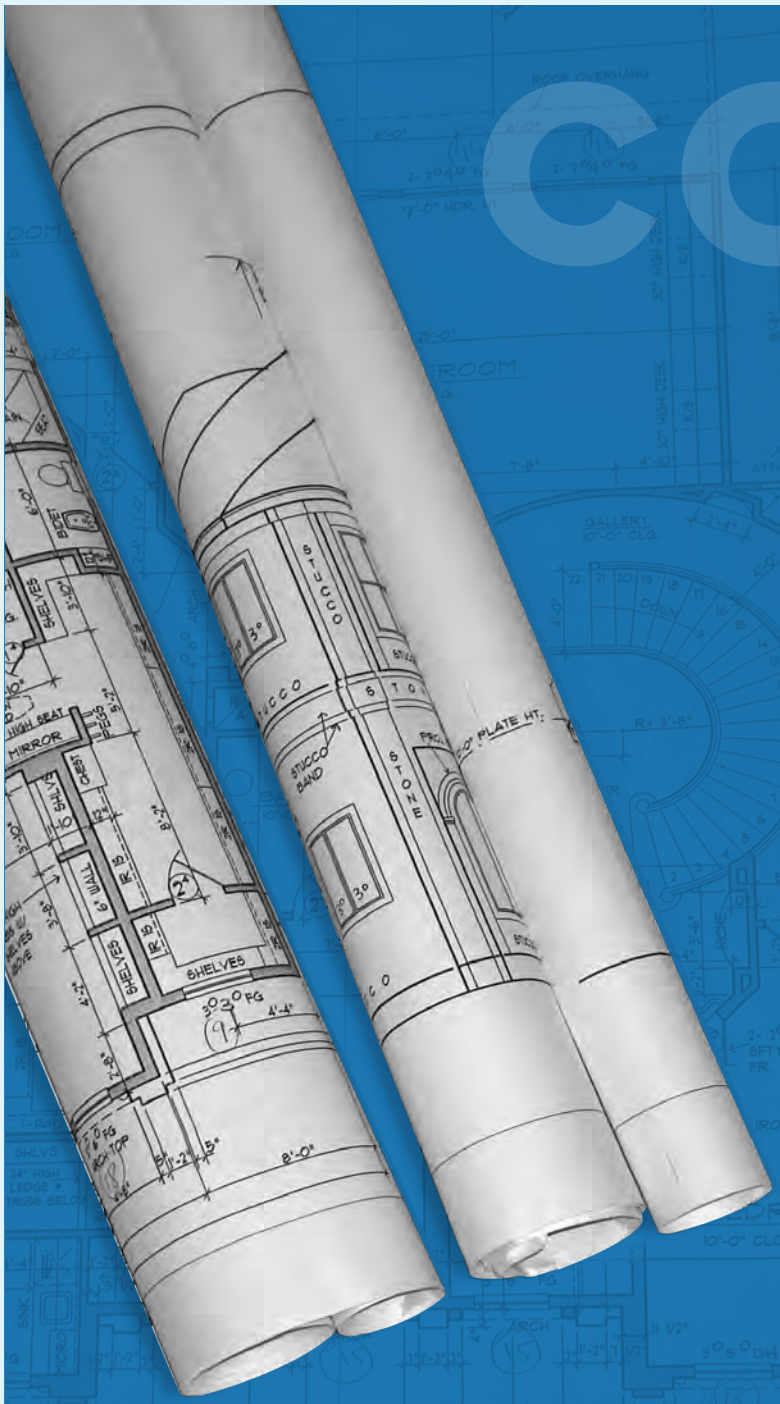

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WELCOME

Thank you for downloading *What You Need to Know When Planning Your Open-Sided Building*. In this guide, we'll discuss a variety of things you need to consider before getting started with construction.

As you know, engineering and constructing this type of facility takes a lot of careful planning. But where do we begin?

First, I'll highlight some of the many advantages this type of structure offers. Then, we'll take a detailed look at some of the needs that must be addressed before building.

Kenny

SECTION 1

WHY SHOULD I CHOOSE AN OPEN-SIDED BUILDING?

USES OF OPEN-SIDED BUILDINGS

Open-sided and open-ended buildings are among the most versatile building types on the market today. These buildings differ in size, shape, and even in materials used, so it's important to **consider the current use of the building, as well as any potential future uses**, when planning your open-sided structure.

One of the most common uses for an open-sided or open-ended building is for farm equipment storage. They're also often built for commercial uses: for example, as transportation depots for semis or buses, or as storage for lumber or plumbing.

Equipment can be damaged by prolonged exposure to sunlight and weather, and machinery stored in a shelter has lower maintenance costs and depreciates far more slowly than equipment stored outside.[1]

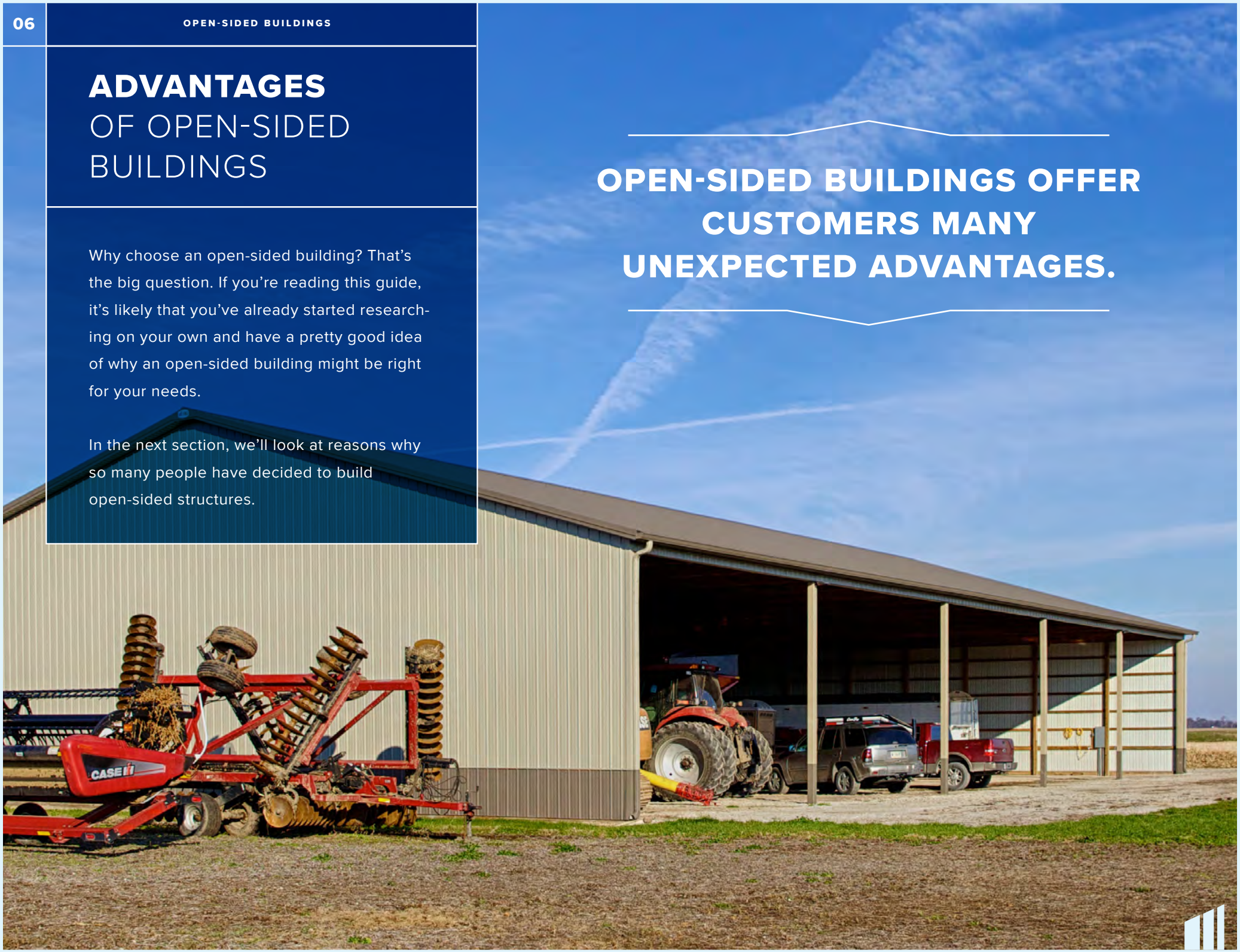
PROTECT YOUR EQUIPMENT FROM PROLONGED EXPOSURE TO SUNLIGHT AND WEATHER.

ADVANTAGES OF OPEN-SIDED BUILDINGS

Why choose an open-sided building? That's the big question. If you're reading this guide, it's likely that you've already started researching on your own and have a pretty good idea of why an open-sided building might be right for your needs.

In the next section, we'll look at reasons why so many people have decided to build open-sided structures.

OPEN-SIDED BUILDINGS OFFER CUSTOMERS MANY UNEXPECTED ADVANTAGES.



Use this page as a starting point to answer this question:
is this the best building type for my specific needs?

01 CONVENIENT AND FLEXIBLE ENTRY

Site flow is crucial for busy farmers focused on operating efficiently. For many, it's a matter of maneuverability. If you're using your shed for machine storage, you'll love that you don't have to open and close a door to drive your tractor in and out. Many farmers don't even have to unhook combine heads or other attachments to enter safely. It's also far easier to park and avoid bottlenecks when multiple pieces of equipment need to be moved at the same time.

The result? **Equipment is more accessible, meaning saved time and energy and higher profitability**, and you have the basic functionality of a large door without the added expense.

02 LOWER OVERALL MAINTENANCE COSTS

An open-sided building incorporates fewer components like doors and windows, so **long-term maintenance costs are usually lower.**

Keep in mind a building with just three walls must still be capable of bearing the same structural loads as one with four, so they're not initially less expensive than fully-enclosed buildings. Addressing structural integrity may increase building costs because extra support is required.

Savings in labor costs from not installing side wall girts and steel siding on an open-sided building are often then used to upgrade to full concrete footings, install larger steel header support columns, and reinforce other parts of the structure.

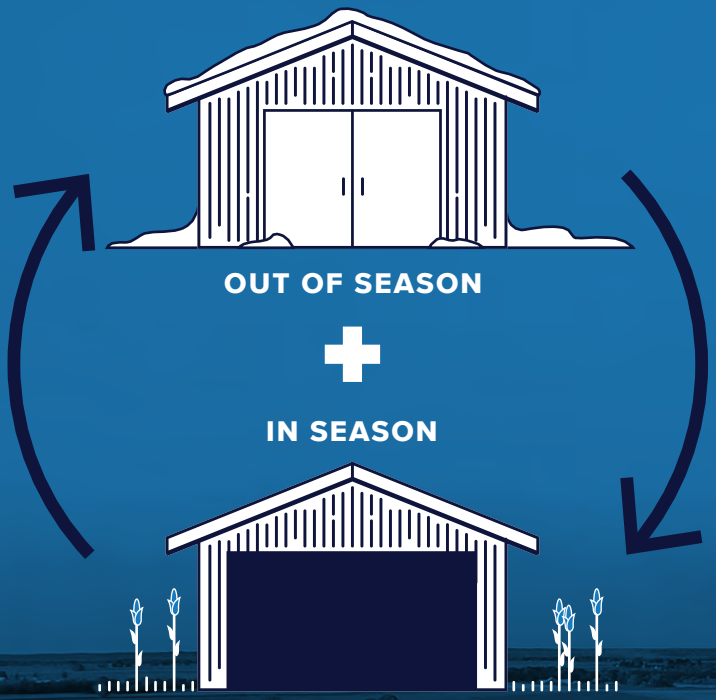
03 ADAPT YOUR BUILDING OVER TIME

Some customers choose an open-sided building but plan to add doors at a later time. Others leave the floor unfinished or use gravel, which offers great drainage, with the intention of adding a concrete floor in the future.

Open-sided buildings are versatile and can be modified over time as your needs change. We sometimes consider this a "Phase I" building option.

Other benefits?

- Lower risk of damage to doors
- Less wasted interior space
- Superior non-mechanical ventilation



Many of our farm customers use an open-sided building paired with an enclosed building. They store in-season machinery within the open structure for easy access while storing the equipment they're not using in the enclosed structure.

We've now looked at some potential uses for open-sided buildings, learning the importance of considering the building's usage before planning.

We also learned about some of the advantages of choosing this building type, which we hope helped you determine whether an open-sided building was right for your needs.

In the next section of this guide, we'll begin to cover **the many things you need to consider before building**. Keep in mind, these questions are just a starting point, and shouldn't be considered to be comprehensive. Yet our hope is that you'll find it to be a helpful tool in planning a structure that works for you.

SECTION 2

WHAT DO I NEED TO CONSIDER BEFORE BUILDING?

HOW WILL YOU USE YOUR OPEN-SIDED BUILDING?

It's very important to **carefully consider exactly how you intend to utilize your completed structure**, because it will influence the way it's constructed.

Let's say, for example, you're planning to use your structure to safely store farm equipment. Depending on the size and shape of the machinery you intend to store, both now and in the future, different bay spacing and clearances may be required.

If you want to build individual bays for each piece of machinery, this will change the layout and the way support columns are arranged. You may want to add concrete bollards at each column to prevent damage from a tractor collision. If a column is hit, it may cause racking, sagging, or even a building collapse.

Different and customized solutions may be required to meet your unique needs.

CAREFULLY CONSIDER EXACTLY HOW YOU INTEND TO USE YOUR COMPLETED STRUCTURE.

RACKING

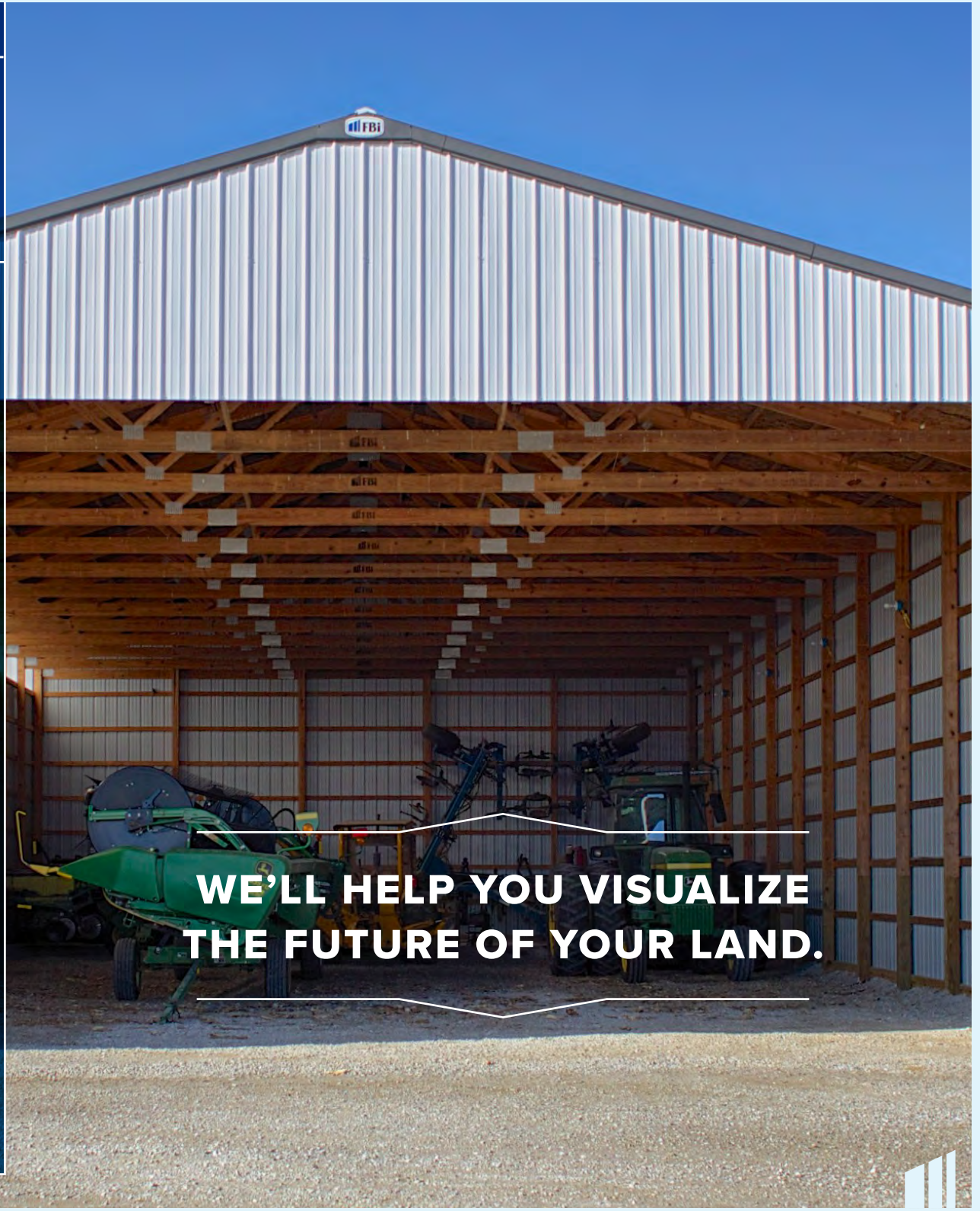
Racking is an effect of lateral forces, most commonly wind, exerted on a structure.[2] If the building diaphragm is weakened, the building won't be capable of resisting the forces of strong winds or other pressures, which may cause the entire structure to lean.

WHAT ARE YOUR FUTURE PLANS FOR THE SITE?

No matter your building's intended use, site flow must be considered. An ideal building placement also takes into consideration your property's future. What will it look like in five years? Ten? If you're able to avoid it, **don't build on a site that is prohibitive to site traffic** or that will prevent you from building another structure in the future.

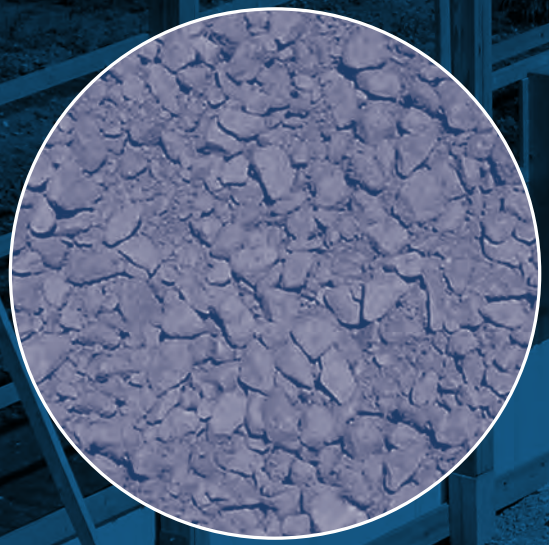
We can help you develop a site plan that helps you plan ahead and **visualize the future layout of your land**.

If you're thinking ahead and plan to modify your open-sided building in the future, this may influence not just the building's design but also its placement. Will a door be added at a later time? A door added at a later time may require upgraded footings, columns, and headers, so proactive design can save you time and money. Are you happy with a gravel floor for now but want to replace it with a concrete floor in the future? Account for this in early stages of planning.



WE'LL HELP YOU VISUALIZE THE FUTURE OF YOUR LAND.

GRAVEL



Many open-sided buildings have gravel floors. The material is a trustworthy surface able to withstand traffic from heavy machinery, and also provides great drainage. While a concrete floor helps with engineering uplift, it must be installed taking pitch into consideration so that blowing rain or melted snow is able to exit the structure instead of pooling on a level surface.

HOW DOES PLACEMENT OF MY BUILDING IMPACT DESIGN?

A building must be capable of withstanding the force of extreme winds and other effects of weather. This means that **properly engineered footings, columns, trusses, and purlins must be used in construction** and that connections between these components must be stable and secure. It also means the building's design must take into consideration the location it's being built.

A force exerted on any part of your structure must be transmitted through a chain of building components until the force reaches the ground.[3] This is called the **load path**.

If there's a gap or weakness in the building's load path, the force will be transferred through building components that aren't designed to bear those loads, which can cause the building to fail.[4]

A measurement called an **exposure rating** is used to define the actual force of wind a building will have to endure, based on its geography and surroundings. The category the building is placed in is a factor that converts basic wind speeds into loads imposed on the building. A building must have sufficient strength to resist the force of these loads.[5]

Wind speeds are calculated using wind speed maps based on historical weather data. In addition to using the maximum expected 3-second wind gust speed, **the formula takes into account building use, surrounding terrain, building height and dimensions, and the size and location of openings in the building**.[6]

What else must be considered when selecting a building site?

- Can the soil support the load of the building and the forces exerted on it?
- Is the building in an open area, or is it protected from wind?
- Does the soil drain well?
- Is this the right location to accommodate site traffic and flow?

HOW CAN I AVOID STRUCTURAL FAILURE?

There's more to building a structure that stands strong for decades than just where it's built.

One of the most common catastrophic building failures is caused by an effect you're likely familiar with called uplift. **Uplift is a vertical force that can lift the roof right off a building – or suck the building right out of the ground!**

What causes uplift? Often, it's because the roof isn't attached to support columns and trusses with enough reliability to withstand severe forces. Building failures during powerful storms often occur because:

- Trusses aren't connected to columns appropriately
- Weak components are used in construction
- Columns aren't embedded deeply enough

Backfill also resists uplift. Most often, the soil excavated to embed the column footer is used, but sometimes concrete, or gravel backfill that compacts tightly, are more appropriate choices.

It depends on the soil type – if the soil is harder, it's more capable of resisting uplift. Concrete is heavier and a better choice in softer soils, and a concrete floor will also add to the uplift capacity of the soil cone (see page 18). Choosing concrete requires a tradeoff: you will have a heavier column, but must sacrifice soil cone size.

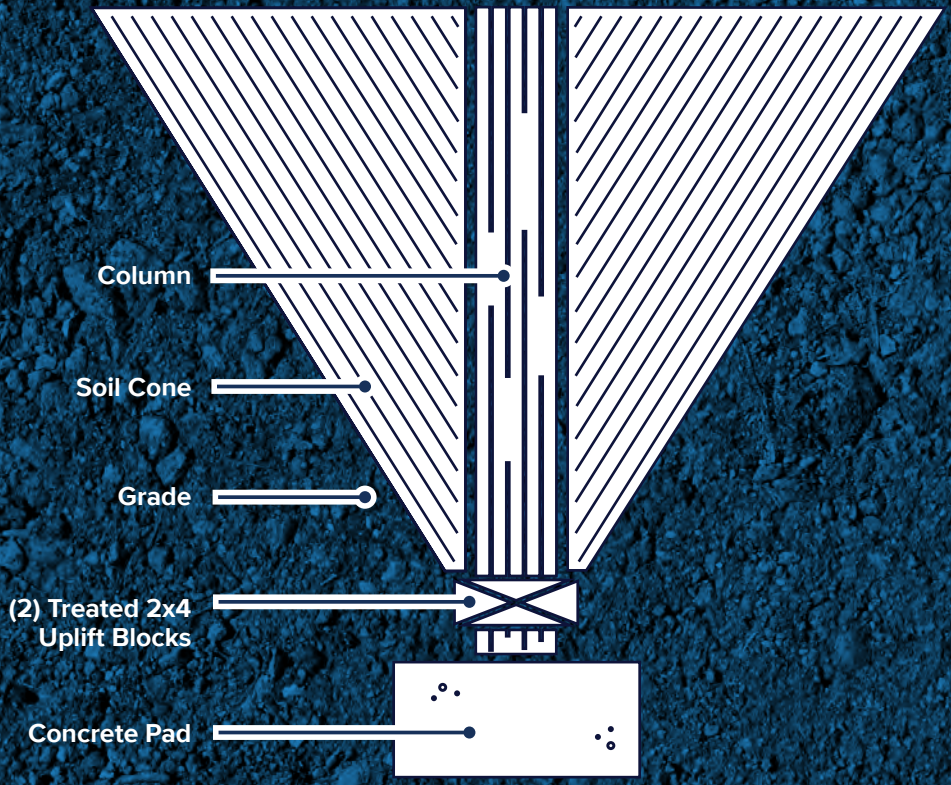
The **parachute effect** is when a partially-enclosed building experiences bloating due to airflow pressure. A building can get sucked out of the ground, or the roof is literally blown off because there is nowhere for air pressure to escape, and the fasteners cannot account for the increase in air pressure. This can also be addressed by **including vents in the building design**, sealed unless pressure reaches a sufficient level causing them to open and release air.

The easiest way to avoid catastrophic effects like uplift and building collapse? **Build a fully-engineered structure.**

EVERY COMPONENT MATTERS

FBi Buildings uses 300-Series stainless steel-capped, self- sealing screws. Not only do they hold better than other screws or nails, but their shape allows for an extended life, prevents leaks, and are guaranteed never to rust.

SOIL CONE



The soil cone is the earth directly above each column. Columns are built with lateral “ears” at the base, anchoring the column, and ultimately your building. We embed these a minimum of 4’ deep - and sometimes deeper, when necessary, to increase soil cone size and strength.

"During my investigation of agricultural building failures, it has become quite apparent that a vast majority of farmers are under the impression they have purchased a properly engineered building, when in fact they have not. In some cases, these farmers are intentionally misled, which is highly unethical, if not criminal."[7]

David R. Bohnhoff, PhD, PE

HOW DO I MANAGE CONDENSATION & AIR QUALITY?

Managing airflow and condensation starts with the building's design - a poorly ventilated building is one built without taking into consideration how air will circulate through the structure. Poor ventilation can also cause excessive buildup of moisture.

Natural ventilation is used to facilitate airflow through the building.

Solutions include:

- Sidewall overhangs with ridge cap
- Eave vents with vented ridge cap (in buildings less than 40' wide)
- Gable end vents with a vented ridge cap
- Windows with screens (depending on season)
- Open door and walls (depending on season)

Mechanical ventilation controls air movement using one or more fans, but is used less commonly because it increases initial, operating, and maintenance costs.

Mechanical solutions include:

- A cupola in the roof with a fan
- Gable end vents with a fan
- Fans in the attic area

If your building houses livestock, poor air quality can cause animals to become sick.[8] You also risk ammonia gas buildup, which can combine with moisture in the air to create ammonium hydroxide, a chemical compound that can cause metals to corrode and wood to decay.[9]

Proper site preparation and drainage practices are also important in managing condensation.

SUMMARY

Now that we've discussed some of the things that must be taken into consideration when planning an open-sided building, let's review everything we've covered in our guide.

WHY SHOULD I CHOOSE AN OPEN-SIDED BUILDING?

USES OF OPEN-SIDED BUILDINGS

Open-sided buildings are very versatile and efficient structures, commonly used to safely store farm equipment, hay, or firewood.

They're also used as run-in/loafing barns, as vehicle depots, or even as airplane hangars.

ADVANTAGES OF OPEN-SIDED BUILDINGS

Open-sided buildings can be built quickly, allow for easy entry, are inexpensive in the long-term, and can be modified or built upon over time.

WHAT DO I NEED TO CONSIDER BEFORE BUILDING?

HOW WILL YOU USE YOUR OPEN-SIDED BUILDING?

Your structure should be designed to fit its intended use. Different column spacing, roof clearances, and even materials used may differ based on the use of the building.

WHAT ARE YOUR FUTURE PLANS FOR THE BUILDING SITE?

If you're planning to construct another building in the future, or modify your completed building at a later time, this should be incorporated into site placement and early building design.

HOW DOES PLACEMENT OF MY BUILDING IMPACT DESIGN?

The best location for an open-sided building is on soil that drains well. Site traffic should also be taken into consideration. A measurement called an exposure rating can help determine design based on the maximum force of wind your building will need to withstand.

HOW CAN I AVOID STRUCTURAL FAILURE?

Proper engineering, including elements like column spacing, use of high-quality building components, and foundation embedment, are critical. These factors can limit uplift and other forces that can damage your building, saving you time and money.

HOW DO I MANAGE CONDENSATION & AIR QUALITY?

The building's design can facilitate natural airflow throughout the building. Components of a poorly-ventilated building can become damaged due to condensation.

Thank you for reading the FBi Buildings guide, *What You Need to Know When Planning an Open-Sided Building*. Now that you've read through our guidebook, we hope you feel more prepared than ever to take the next step in planning your structure.

Next, feel free to check out our free **FBiPlanner Building Design Tool**, featuring a variety of open-sided farm storage building floor plans. You can experiment with different layouts, and even save and print your farm storage building plans.

If there's anything else you need, don't hesitate to give us a call!

Kenny Culbreth

Director of Project Management

800-552-2981

RESOURCES

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FBi Buildings, Inc. is a post-frame design, engineering, and construction company. We have built over 20,000 structures for agriculture, livestock, industrial, and commercial use, all across the Midwest. And we're ready to help you plan a building that works for you.

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