Single Girder vs. Double Girder

A bridge crane is a type of overhead crane that includes two or more overhead runways built into the building's support structure. Bridge cranes have different configurations and can be comprised of one or two beams—more often referred to as a single girder or double girder design. Girders can be made of rolled steel or can be fabricated by welding the beams into a steel box design for added strength and rigidity.

The bridge is a load-bearing beam that runs the width of the crane bay and is the primary structural component that connects the runways and moves the hoist forward and backward using a trolley. The trolley and hoist can be designed to be top running or under running depending on the design of the building structure and the requirements needed to make the lift.

A single girder or double girder design will be one of the largest contributors to the complexity and overall cost of a new overhead crane system. In this article, we'll discuss the advantages, disadvantages, and differences between single girder and double girder bridge crane systems. You'll want to give careful consideration to the bridge design of your overhead crane system to make sure that you understand the requirements of the lifting task and the environment where the crane will be operating.

Single Girder Bridge Cranes

On a single girder crane, the bridge consists of one girder beam supported on each side by an end truck. The trolley and hoist are most commonly underhung—meaning they run on the bottom flange of the bridge. The bridge itself can either be top running or under running in design.

One of the most common misconceptions about single girder cranes is that they are not as durable or of the same high quality as double girder cranes. If properly designed, a single girder crane can be the perfect solution for a business that needs a light to medium duty crane, or for a facility where headroom and/or floor space is limited.

Single girder bridge cranes are often the most cost-effective lifting solution for various applications and industries. Single girder cranes use less material and are more compact and lightweight than a double girder crane, which results in a significant cost-savings in material, freight, and installation. Also, because they only require one bridge beam, these systems typically have less deadweight, meaning they can utilize lighter runway systems and tie into the existing building support structure.

The major disadvantage of a single girder crane system is that they do have a limit in terms of capacity, span, and hook height. A double girder crane may be the better solution for overhead cranes that require capacities over 15 tons and spans over 65 feet.

Note: You will rarely see a single girder crane rated higher than 15-tons.

In addition, service walkways, enclosed or exposed operator cabs, magnet cable reels, or other specialized features can be difficult or expensive to incorporate into the crane's design.

Advantages of a Single Girder Design:

- Less expensive due to a simpler trolley design, reduced freight costs, simplified and faster installation, and less material for the bridge and runway beams
- Most economical option for light to medium-duty cranes
- Lower loads on the building structure or foundations due to a reduced deadweight. In many cases, it can be supported by existing roof structure without the use of additional support columns.
- Better hook approach for both trolley travel and bridge travel
- Easier to install, service, and maintain
- Ideal for workshops, warehouses, material yards, and manufacturing and production facilities
- Lighter load on runway rails or beams means less wear on the beams and end truck wheels over time
- Great for facilities with low headroom

Disadvantages of a Single Girder Design:

- The hoist is placed under the cross girder and cannot provide as much hook height as a double girder crane
- On a standard rolled steel bridge beam, the under running hoist trolley may cause premature wear to the bottom flange of the beam
- Special features like service walks, lights, and heavy service components can be expensive or difficult to incorporate
- Lower capacity rating

Double Girder Bridge Cranes

On a double girder crane, there are two girder beams that make up the bridge and they're supported by an end truck on each side. In most instances, the trolley and hoist run on a rail installed on top of the bridge girders. With a double girder design, you gain the depth of the cross girder if the hoist is placed between or on top of the cross girders—providing an extra 18"-36" of hook height in most cases.

Double girder cranes can be either top running or under running in design. A top running double girder bridge crane will provide the most overhead room, as well as the greatest hook height.

Double girder cranes are recommended for heavy-duty applications where the crane has to handle heavier capacities and longer spans. Because of this, the components of the crane system, including the hoist and trolley, are more complex in design—making double girder cranes more expensive than a single girder crane.

They also require more material for the bridge beams and the runway system, so extra consideration should be given to the building's support structure. Additional tie-backs or support columns may need to be added to handle the additional deadweight on the supports or building foundation.

Double girder bridge cranes are ideal for lifting heavy loads and can be used in more frequent operation than a single girder crane. They can also be used both indoors and outdoors, in a bridge or gantry setup, and are frequently used in mining, iron and steel production, rail yards, and shipping ports.

Advantages of a Double Girder Design:

- Greater hook height – how far above the floor the hoist will lift (typically 18-36” more than single girder)
- No limits to maximum span or capacity
- Ideal for production and transportation of heavy equipment
- Ideal for frequent lifting of heavy loads
- Added features like walkways and maintenance platforms, cabs, magnetic reels, and lights can be added and supported by a double girder design
- Can be used in indoor and outdoor applications, including mining, iron and steel, rail yards, and ports

Disadvantages of a Double Girder Design:

- More expensive because of added material costs, additional structural support, and more complex crane components
- Additional costs related to freight and the installation of the crane versus a single girder crane
- Hook approach is lessened for both trolley travel and bridge travel—especially on double girder top running cranes

Careful consideration should be given to the design of your overhead crane system. A crane that requires a high capacity, wide span, or high lifting height will benefit from a double girder design, but may cost you more money upfront. Lighter duty cranes that don’t have hook height requirements or abnormal capacities or spans can be an inexpensive option that will help improve the efficiency and safety of your production or assembly facility.

One of the most common questions that we receive from customers during the consultation, design, and quotation process is whether they need a top running or under running overhead crane system.

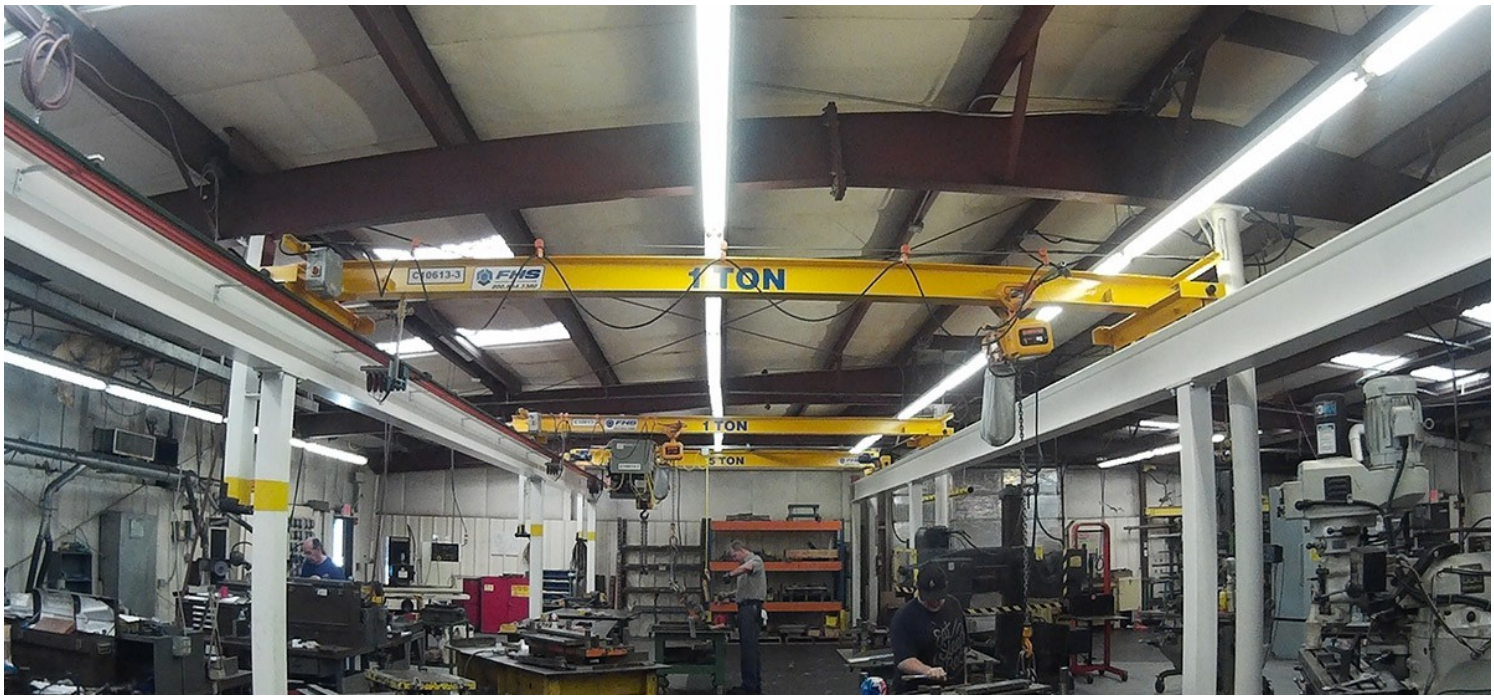
The following factors can help you determine whether a top running or under running system will be best for your facility and business needs:

- Can the existing support structure be utilized or will a new support structure need to be built?
- Are there existing runways in the facility that the crane can be installed on?
- What is the capacity of the loads that you'll be lifting?
- What type of overhead room is available? High, unobstructed ceilings, or limited headroom due to existing cranes, duct work, light fixtures, etc.?
- How high will your lifts need to be?
- Hook approach - how much of the crane's bridge will the hoist trolley need to utilize? Do you need to make picks or lifts near the edges or sides of the building?
- How important is free and clear floor space?

Top Running vs. Under Running

Top Running Overhead Cranes

A top running overhead crane has a fixed rail or track system installed on the top of each runway beam—allowing the end trucks to carry the bridge and hoist along the top of the runway system. Top running cranes can be configured in a single girder or double girder bridge design. A single girder bridge utilizes an underhung trolley and hoist, while a double girder design most often utilizes a top running trolley and hoist.



Top running overhead cranes have no limiting capacity—meaning that they can be built to handle small capacity loads or very large capacity loads. Top running cranes can be built to capacities of anywhere from 1/4-ton to excesses of 100-tons. These types of overhead cranes are supported by the building structure or runway support columns and are ideal for moving extremely heavy loads.

Top running cranes provide added lift height for buildings with limited headroom because they ride on rails on top of the runway beam. A top running double girder bridge design allows the greatest lifting height because the hoist and trolley run on top of the two bridges or girders—adding anywhere from an extra 3 to 6 feet of hook height.

Top running overhead cranes are typically larger than under running cranes, as they can be built to higher capacities and can accommodate wider spans.

Because the crane is supported on rails on top of the runway beams, there is no suspended load factor, so installation and future service or maintenance is easier and less time-consuming than an under running crane.

Over the course of its life, the track or rail system that the bridge moves on may need to be checked for alignment or tracking problems more frequently than an under running crane. Fortunately, the service and alignment inspections are fairly easy to perform and require less downtime than an under running crane.

Benefits of a Top Running Crane Single Girder Crane:

- Typical Load Capacity: 1/4-ton to 20 tons
- Typical Span: Under 65 feet
- Typical Service: Light to medium duty
- Common Applications: Light manufacturing, fabrication and machine shops, light assembly line, warehousing facilities, maintenance and repair centers
- Low deadweight
- More overhead space
- Faster hoist and trolley speed
- Lower production cost / lower overall price with less material required

Benefits of a Top Running Double Girder Crane:

- Typical Load Capacity: 20-400 tons
- Typical Span: Over 65 feet
- Typical Service: Medium to heavy duty
- Common Applications: Steel and metal mills, coil handling, foundries, large fabrication and stamping facilities, paper mills, casting plants, large-scale tool and die facilities
- Allows for best hook and lifting height because hoist and trolley can run on top of the two bridge girders
- Provides the most overhead floor space
- High speed

Under Running / Underhung Overhead Cranes

An under running crane, or commonly referred to as an “underhung” crane, uses wheels that are supported by the bottom flange of the runway beam to move the bridge up and down the runway. Under running cranes are most commonly configured in a single girder design for lighter service and lower-capacity applications. They can also be built in a double girder design for higher capacities but it can become impractical and expensive to design and engineer.

An under running single girder crane will utilize an under running hoist and trolley which moves across the bottom flange of the bridge beam. A double girder under running crane can run its hoist and trolley along the top or the bottom of the bridge beams.

These underhung types of cranes can allow you to maximize your facility's floor space for production and storage of material because they are most commonly supported from the existing ceiling trusses or the roof structure. Underhung cranes also offer excellent side approach and maximize utilization of the building's width and height when supported by roof or ceiling structures. They're ideal for facilities that lack vertical clearance to install a top-running overhead crane system.

Under running cranes can be designed in a free-standing configuration if the building's existing support structure can't be utilized, but this setup does require the use of support or mounting columns.

Hook height and lift height is less than top running cranes because the bridge and hoist hang underneath the runways.

When it comes to the installation and service of an under running crane system, it can be more of a complex procedure leading to longer downtime. Because the crane is suspended from the runways, it can take longer to check the alignment or service the wheels of the crane, but it is easier to dial in and maintain the alignment and there are fewer tracking problems because it runs on an I-beam which is secured to building structure—limiting movement.

Benefits of an Under Running Overhead Crane:

- Typical Load Capacity: 1/4-ton to 15-tons
- Typical Span: Under 65 feet
- Typical Service: Light to medium duty
- Common Applications: Assembly, fabrication shops, maintenance buildings, and manufacturing facilities
- Maximizes floor space if supported by existing ceiling trusses or roof structure
- Reduces material costs if no runway support columns are needed
- Increased end hook approach and bridge beam and hoist are underneath runway beams

Measuring Span & Runway Length

Having a clear understanding of the space available in your building, the existing building supports that the crane can be installed on, and any overhead obstructions, will help you lay out the design criteria and expectations for any crane manufacturer who bids on the project.

You should familiarize yourself with the following measurements prior to meeting with an overhead crane manufacturer:

- Runway beam size
- Runway rail size
- Crane span
- Runway length and distance between runway supports
- Building clearances

The more information you can gather upfront, the more information the crane manufacturer will have to take back to their engineering team to put an accurate quote and project specification together. Also, the better you understand the design and specification requirements for your own crane system, the better equipped you'll be to compare the different quotes you receive against the project criteria.

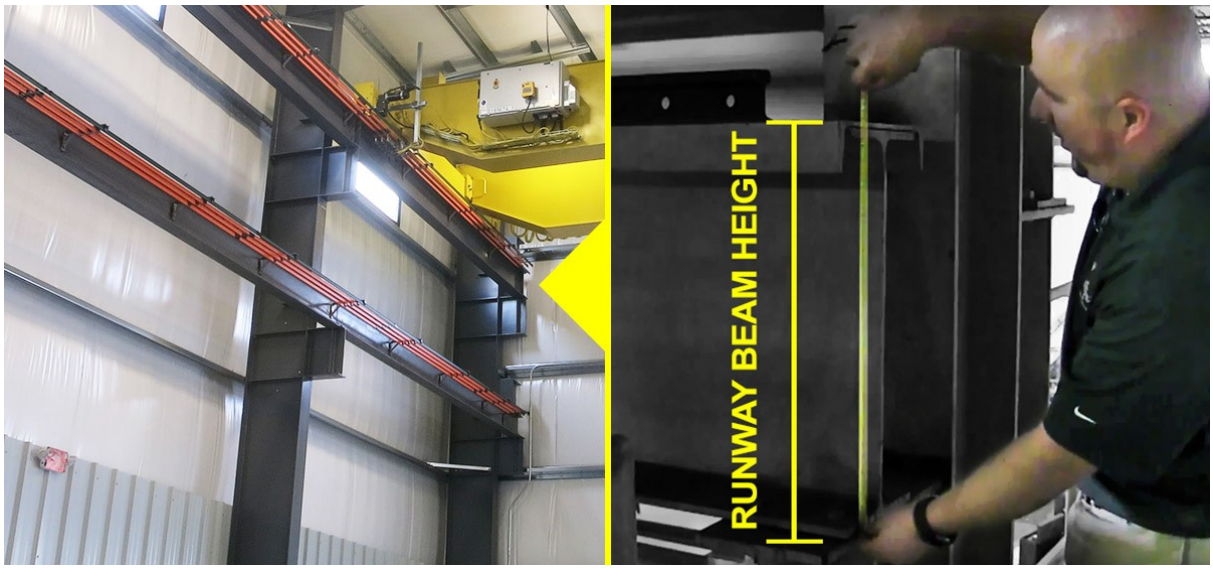
What You'll Need to Measure for an Overhead Crane Installation

When you're gathering your materials so you can start recording measurements, we recommend using the following tools:

- Tape Measure – A 25' to 30' foot tape measure is perfectly fine
- Laser pointer – An inexpensive one can be found at hardware or home improvement stores for $65-70. More expensive ones with longer ranges are typically $130-150.
- Notepad and pen or pencil
- Building plans or drawings

Measuring the Crane's Runway Beams

Ideally, you will have access to get closer to the runway beams using a lift or nearby mezzanine (if available). If not, you can gather a lot of these measurements using your tape measure or your laser pointer.



Getting measurements of the actual runway beam is as simple as running your tape measure from the bottom of the beam up to the top if you have easy access to the beam. If you can't get to the beam, you can stand underneath it and

use your laser pointer to get a measurement to the top flange, and then get a measurement to the bottom of the beam and subtract the difference. This will give you your beam height. If you're able to get up close to the beam, you can measure the flange width, as well as the flange thickness.

If the runway beam has a cap channel added for extra reinforcement, getting measurements for the width of the flange, toe, and thickness of the cap will also help the engineering team understand the crane's design requirements.

Measuring the Crane's Rail Size

Making sure that you understand the size of the rails will allow you to properly size the wheels. The two most important measurements for the crane rails are the head width and the rail height. This allows the engineering team to identify the size of the rail and determine what size wheels should be used on the crane system. This is important for two reasons:

1. You can match the size of the wheels to the size of the rails for proper alignment and tracking of the crane as it moves down the runway. This can help prevent premature or excessive wear of the rails and wheels, but also to the beams and structural supports themselves.
2. A properly sized wheel will prevent design changes to the runway rail so the customer can still utilize the original structure in place. This can be a significant cost-savings to the customer if the runway beams and rails can be re-used.

Measuring the Crane's Span

One of the most important measurements you can provide during an overhead crane consultation is the crane's span. An overhead crane's span is essentially its width across the bay—or the measured center-to-center distance between the runway beams. It's important because it determines how much material is required to build the bridge girders and most significantly affects the cost of the overhead crane.

If your building already has a runway system in place, you can use your laser pointer and place it flush with the runway or building support that the runway is resting on and measure across to the next beam or support. You'll want to make note of any cantilevers or haunches that the runway beam may be sitting on to determine how far off the building column the center line of the runway is.

During this step, you want to get measurements near the exact measurements to give the estimators and engineers enough information to put a quote together. However, if you move forward with the project, the approval drawings will provide the exact measurements required.

If you're designing and installing a new crane in your existing facility, then you can use the existing building supports to measure the crane's span. Take your laser pointer and measure the outer edge distance between parallel building columns. If you have building drawings, you can also use these as a reference or provide the crane manufacturer with a copy of the drawings for their reference.

Measuring the Crane's Runway Length and Distance Between Supports

The length of the runway is the total overall distance that the crane will move through the facility. Measure out this rough length using the building's specifications, the setup of your existing production area, or map out or mark off an area you want to be able to utilize for material handling and load movement.

You will also need to determine the measured distance between the building supports that the runway beam will run on top of. To do this, place your laser flush against a building support beam and measure down the length of the runway beam to the next support.

Identifying Obstructions and Measuring for Building Clearance

OSHA 1910.179(b)(6)(i) Overhead and Gantry Cranes states that, “a minimum clearance of 3” overhead and 2” laterally shall be provided and maintained between crane and obstructions in conformity with Crane Manufacturers of America, Inc., Specification No. 61.”

In layman's terms, this means that when you design your overhead crane system, you must consider any type of overhead obstructions including:

- Water pipes
- Heating and cooling ducts
- Gas or electrical lines
- Overhead light fixtures
- Building headers

You'll need to know if your crane is a top running or under running design. This will determine the maximum height of your crane system. A top running crane runs on top of the runway beams and will be closer to any overhead obstructions, while an under running crane hangs off of the bottom flange of the runway beam.

You'll then need to determine how close your crane will be to any of the obstructions mentioned above by measuring from the top of the crane to the bottom of any possible obstruction—ensuring the overhead gap is at least 3" and your crane runway beams and supports are at least 2" from any possible lateral obstruction.