Selecting the Right Load Handling Equipment and Move Systems

A start-to-finish guide for understanding and evaluating material handling systems

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Introduction

Organizations need to find the move system that will keep their operations moving swiftly, efficiently, and cost-effectively – while simultaneously working seamlessly with their facilities and workers.

Organizations that need to regularly move heavy loads (ranging from a few tons up to hundreds of tons) do not want for options.[1] Indeed, *many* types of load handling equipment could potentially haul such loads, including cranes, conveyors, air cushion vehicles, forklifts and other industrial trucks, wheeled transfer carts, drag chains, rails, and more. Because each of these move systems have varying strengths and weaknesses, it can be a challenging and complicated process to pinpoint *which* system would work *best* in any given situation.

This is particularly true since different factors may become more or less important depending on the circumstances, environment, or other needs related to the move. These tradeoffs can be difficult to understand and articulate, much less decide between. Sometimes the need for flexibility will override cost as a consideration, but it may not always be clear *when* flexibility needs to be the most important consideration.

Other times, the sheer weight of the load might drive the decision over any other consideration. Complicating these questions further, many of the considerations can be subtle and less obvious. Beyond raw cost and logistical feasibility, you must also think about floor condition, time to implement, opportunity costs, safety risks, flexibility, and more.

However, the pressure to get this question right is tremendous. Organizations may be placing as much as six-, seven-, or even eight-figures' worth of production value on the line. Modernization, increased competition, reduced margins, and the need to keep personnel safe create further tension. That means organizations need to find the move system that will keep their operations moving swiftly, efficiently, and cost-effectively – while simultaneously working seamlessly with their facilities and workers.

This paper is intended to serve as a guide to selecting the ideal load handling equipment for any given load and situation. The sheer variability of needs means this guide will not be definitive – no single guide could be. As we walk through a comprehensive list of questions that must be considered when selecting a move system, however, readers should better understand their options and begin eliminating the options that are impractical to meet their needs. From there, the ideal selection will hopefully begin to float to the top of the list.

So, what's the best load handling equipment for *your* needs? To start answering that question, we'll begin by presenting a quick overview of the most common equipment and systems for moving heavy loads. Then, we'll dive into the primary question that needs to be weighed.

[1] This paper will focus on regular, recurring moves, such as might happen in a manufacturing facility. Although much of the information will still apply to one-time rigging moves, how users weigh different factors might vary.

Quick Overview of the Most Common Load Handling Systems

	Description	Advantages	Disadvantages
Air Casters	Air casters lift loads on a thin, frictionless membrane of air so that the load can be easily pushed in any direction.	• Can move enormously heavy loads that defeat other systems • Relatively inexpensive, particularly at high weights • Very flexible in usage • Variable move path • Rotates within its own footprint	• Heavily dependent on floor condition • Requires compressed air (hoses)
Conveyors	Conveyors provide continuous movement between specific points over a fixed path.	• Relatively low-cost and efficient means of moving loads • Can move high volumes very quickly	• Only works along a set path, little flexibility • Expensive to install • Not self-loading
Drag Chains	Drag chains are a system of tracks in the floor from which chains or cables pull wheeled carts.	• Relatively low-cost and efficient means of moving loads	• Only works along a set path, little flexibility • Prohibitively expensive at higher weights • Not self-loading • Can be a trip hazard
Forklifts	Forklifts lift loads on forks to move loads over variable paths.	• Flexible and user-friendly move system • Can provide limited vertical movement	• Requires plenty of open floor space • Weight limitations • Requires certified operator, limiting availability • Relatively high risks to human safety and load damage • Air quality (exhaust)
Industrial Trucks & Transfer Carts	Wheeled vehicles can carry loads, possibly including powered mechanisms to load/tug/push.	• Easy to use and operate • Can be remote-controlled	• Weight limitations
Overhead Cranes	Cranes lift from above and move loads over a set path, both horizontally and vertically.	• Works with loads of all shapes and sizes • Flexible configurations and uses possible	• Expensive to install and operate • Generally slow to operate, limiting availability • High risks to operators and loads • Limited area
Rails	Rails are a system of tracks in the floor along which carts or rail cars can run.	• Low operating cost and highly efficient means of moving loads consistently on a fixed path	• Only works along a set path, little flexibility • Trip hazard, even when inset in floor • Not self-loading • Inflexible • Expensive to install

Question #1: What does the load weigh?

Weight	Metric Tons	< 2.3	2.3 - 9.1	9.1 - 45.4	45.4 - 181.4	181.4 - 272.2	272.2 +
	Pounds (lbs.)	< 5k	5k - 20k	20k - 100k	100k - 400k	400k - 600k	600k +
Move System	Air Casters	Suitable					
	Conveyors	Suitable		Less Effective	Impractical		
	Cranes	Suitable				Less Effective	Impractical
	Drag Chains	Less Effective		Suitable		Impractical	
	Forklifts	Suitable		Less Effective	Impractical	Impossible	
	Human Power	Suitable	Impractical		Impossible		
	Rails	Less Effective		Suitable		Less Effective	
	Wheels	Suitable		Less Effective	Impractical		

Table 1. Suitability of various move systems for loads of different weight classes.

Users typically already know the weight of the load they need to move, making this question the natural starting point of our assessment of load moving systems.

With this first question, we can eliminate any option that is clearly unsuitable for the weight class of the load you need to move.

We'll discuss equipment-specific considerations below, but in general air casters and cranes stand out at very heavy loads, though it's possible (with qualifications) to find other options (like forklifts) that can accommodate extremely heavy loads.

At light weights, many more options present themselves and can include very portable push-by-hand solutions, like pallet jacks on wheeled or air casters.

Special considerations follow.

Air Casters

Air casters probably have the most flexibility when it comes to the weight questions. Because air casters ride on a thin film of compressed air, it takes as little as a pound of push for every ½ ton of weight you intend to move, making air casters suitable for moves of virtually any weight class.

Cranes

Cranes, which come in a variety of models and styles, can move loads of almost any weight. Lightweight cranes can move relatively light loads that you might not want to move by hand, or that you need to pick up and set on a table, up to giant gantry cranes that can move enormous and ungainly loads. However, cranes become unsuitable for loads past 400 tons and are effectively impossible at 1,000+ tons.

Forklifts

The average forklift can haul loads up to around 10 tons (some smaller forklift models might top out at about 2.5 tons). For loads heavier than 10 tons, complications begin to mount. For example, users will need both a driver *and* a spotter, and heavier weights require specialized forklifts that represent a much greater expense. Forklifts also increase in size the larger the weight class they haul, requiring a huge amount of floor space to operate. Above 50 tons, forklifts become impractical to the point of impossibility.

Human Power

In some circumstances, large teams of people might work together to move otherwise prohibitively heavy loads. Many organizations in the modern world might consider "human power" to be unthinkably inefficient and/or dangerous, but remember, this method is how the Great Pyramids were built.

That said, there are definite limits to how much weight even a large crowd of people can accommodate – to say nothing of the safety risk. The labor force working on the Great Pyramids saw so many deaths, they had a dedicated workers' cemetery in which archaeologists have found hundreds of skeletons.[2]

Rails, Drag Chains, and Conveyor Systems

Rails, drag chains, and conveyors work well for loads between 50 and 200 tons, past which they become less effective. Another consideration for this group: the loading mechanism will affect the suitable weight classes. If the loading mechanism can handle less weight than the move system itself, you will be limited by the loader. These systems also scale poorly; as the weight (or distance) that they need to haul increases, the cost can skyrocket from very cost-effective to highly impractical.

Wheel Casters (Push by Hand)

Wheeled casters would work for loads under 25 tons, though it should be noted a wheel caster solution are best for loads under 2.5 tons. Above that weight, it begins to involve many more people to provide enough force to push the load. Past 25 tons, wheel casters are impractical.

[2] https://www.pbs.org/wgbh/nova/article/who-built-the-pyramids/

Question #2: How much flexibility or maneuverability is required?

	Travel Path	Turning Radius	Effectiveness For:			
			Linear Paths	Variable Paths	Vertical Paths	Hard-To-Reach Places
Air Casters	Limited by obstructions, bad floor condition, hose length	360 degrees, in-place	**Good**	**Excellent**	**Moderate**	**Excellent**
Conveyors	Static, defined, and inflexible	Not applicable	**Excellent**	**Poor**	**Good**	**Poor**
Cranes	Static, defined, and inflexible	Long reach radius	**Excellent**	**Excellent**	**Excellent**	**Poor**
Drag Chains	Can change direction, but chain pulls on a linear path	Very poor turning radius	**Excellent**	**Moderate**	**Poor**	**Poor**
Forklifts	Limited only by obstructions	Extra space required	**Good**	**Moderate**	**Moderate**	**Moderate**
Rails	Static, defined, and inflexible	Not applicable	**Excellent**	**Poor**	**Good**	**Poor**
Wheels	Limited only by obstructions	Extra space required	**Good**	**Good**	**Poor**	**Good**

Table 2. Effectiveness of various move systems for different kinds of move paths.

Question #2a: What path will the load follow?

Not all move systems will align with the path the load needs to follow. Some paths may be fixed (moving between two specific points), while others may be variable (moving loads between a wide variety of points, or in-and-out of the line). Consider the following questions when evaluating the move path.

Does it need to follow a fixed path?

A fixed path enables permanent installations that can enhance movement efficiency (like rails or conveyors). However, a fixed path also permanently restricts movement to the one path, which can reduce (1) production efficiency (if it requires more manpower and travel time to move loads a longer distance than, say, a U-shape production line) and (2) flexibility as manufacturing requirements change.

It's hard to beat rails and drag chains if the move path is always in a straight line; this equipment can move loads quickly, efficiently, and (after the initial installation costs have been recouped) cost-effectively.

However, with something like a conveyor or rail system, the path is permanent and fixed; you

cannot pull a load out of the normal path temporarily, for example, and then insert it again later. Consider a manufacturing line in which customization options are available. The product may be able to move *mostly* in a straight line from one station to the next, but if it needs to divert to another station off the main line for a customization, a strictly linear move system won't work. Additionally, if there's a problem at one station, it can bring the entire production line to a halt.

Does it need to follow a variable path?

Variable paths, by contrast, require a flexible and maneuverable solution. At the risk of losing some efficiencies, you gain the ability to accommodate a wide array of changes on the fly. For example, if you have a problem with a part, you can just move it to the side while the rest of the line continues. It also enables users to add or remove stations on the fly, or completely rework their production process. Any move system that is permanently installed (cranes, rails, drag chains, conveyors) will struggle or fail to meet the needs of a variable path.

Does it need to follow a curved path?

One form of variable path is increasingly common in industrial environments today: many modern assembly lines are hewing closer to a U-shape to maximize efficiencies. A U-shape reduces the square footage of the manufacturing process, reducing travel time from any point to any point in the facility while keeping stations and materials as close together as possible. That limits the time, effort, and manpower required to move or handle loads. If you wish to leverage such efficiencies, the move system must be able to accommodate a non-linear path.

Does the load need to be able to rotate or otherwise move in multiple directions?

Some move systems cannot rotate at all, while others cannot rotate easily. A linear path system like conveyors and rails can be designed to accommodate limited bends and rotations, but such design considerations will complicate installation and operation.

Other move systems may be able to rotate but will demand a significant amount of space to maneuver; the turning radius of a forklift, for example, is very wide and may require a spotter to ensure the vehicle does not hit anything or anyone during the turn.

Air casters and some wheeled solutions shine when it comes to rotation; they will offer nine points of movement flexibility: forward, backward, right side, left side, diagonal in four directions, and 360° in-place rotation, lift and indexing (see figure below). Air casters also lift the load up slightly.

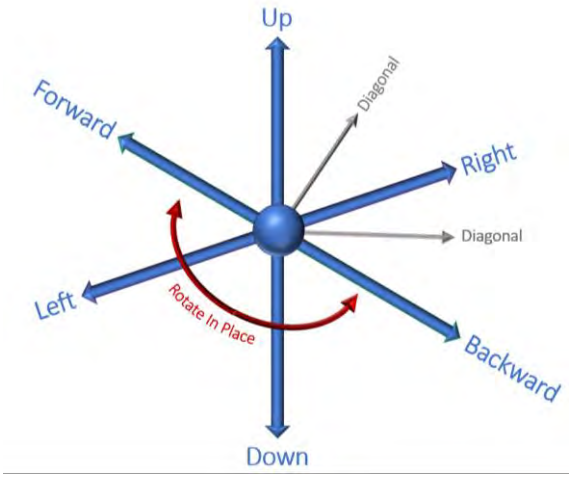
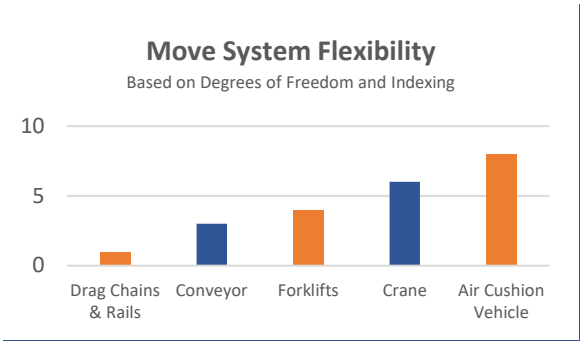


Figure: Nine Points of Movement

Does it need to be able to rotate in-place, within its own footprint?

With forklifts, you must deal with the cantilever that sticks out, because the truck itself doesn't fit within the footprint of the load. Casters go under the load, so they fit within the footprint of the load. Many cranes can also rotate a load in-place, as can some omnidirectional industrial trucks (wheeled vehicles).



Does it need to be able to reach corners or other hard-to-reach spots?

A crane assembly can reach almost anywhere within its envelope but nothing beyond that. If you wish to maximize space utilization, or otherwise need to be able to get loads into or out of corners, edges, or around blockages, a crane, conveyor, rail, or drag chain solution may not work.

Forklifts can reach some of these places, if left enough space around them to maneuver.

Air casters, because they fit within the footprint of the load, can reach anywhere the load can fit. The same principle applies if you need to move beyond the reach of a crane or rail system (e.g., a cross-bay transfer).

A corollary consideration is clearances. If you need to move a very large load, does it need to fit under a particular height in order to reach its destination? Something like an air caster system can manage very low clearances compared to a big-wheeled vehicle solution.

Does the load need to be able to rise or fall along a vertical path?

Another consideration includes lift height or elevation. Do you need to raise or lower the load from a certain point?

Cranes, forklifts, and conveyors can easily accommodate changes in elevation, to varying degrees. Push systems and similar solutions become less suitable in this situation. Forklifts and, to a lesser extent, air casters also have this ability built into their design, so they too can lift a load off the ground, enabling a slight degree of elevation. Conventional wheels, rails etc. require the load be lifted off the wheels or rail to remove the wheels or movement system.

What will the path be tomorrow?

It's important to ensure the move system can grow and evolve with your operations. Some equipment – like cranes, conveyors, and rails – are permanent fixtures that cannot be changed or moved. If you laid out for 10 stations, but actually need 15, a fixed system will not allow you to correct, at least not easily. As a result, fixed solutions require much more careful analysis. If the station design is wrong, or if you need to adapt to new designs, you must figure out how to redistribute work accordingly.

It's also worth noting that fixed solutions are sunk costs that won't move with you; in fact, you may have to pay to have them removed if you ever change facilities. If you move from Factory A to Factory B, a crane, rail, or conveyor system cannot follow. Other move systems, including wheeled vehicles and air casters, can go with you and adjust as often as necessary

It's important to ensure the move system can grow and evolve with your operations.

Question #2b: What restrictions will the operating area impose on the move?

Aside from move path, the layout and makeup of the operating area may limit options for moving loads. For example, some areas are highly restrictive – narrow aisles, for example – that will limit maneuverability on the ground and eliminate move systems like forklifts as a practicality.

Almost any move system can work as long as there is sufficient space. As available operating space narrows or becomes otherwise restricted, options dwindle. Forklifts require a great deal of floor space in which to maneuver and, further, because they typically steer from the rear wheels, it will take a certain amount of room to make turns. If space is at a premium, a forklift solution may be impractical. Similarly, conveyors and rails can be highly efficient move systems that can move a large volume of material quickly and continuously, but they consume a lot of floor space and can further impede traffic and decrease productivity when installed in tight quarters.

Other move systems excel within a narrow space, such as air or wheel casters on the ground, or overhead cranes that require little-to-no floor space. Overhead cranes are ideal for use in narrow aisles or crowded facilities with little floor space because they require no floor space at all. Freestanding cranes do require enough space for floor-mounted support structures, but in general their footprint will be much smaller than the space required for forklifts, conveyors, rails, etc.

Question #2c: What movement methods will the condition of the facility support?

The conditions of the facility itself may dictate move systems. For example, cranes are heavy equipment, and the building or facility must be capable of supporting the crane assemblies. Similarly, air casters depend on the surface quality of the floor and the availability of compressed air. While it's generally not difficult to fix problem flooring (e.g., using an overlay over which air casters can move, as in the photo to the left), it may affect the calculus when comparing different move systems. Some move systems, like forklifts and other wheeled systems, can damage some floor surfaces over time; if floors are already damaged or weak, the impact will be worsened.

Question #3: How often and far does the load have to be moved?

Question 2	Move Path[3]	Fixed								Variable							
	Operating Area	Restricted				Unrestricted				Restricted				Unrestricted			
Question 3	Move Frequency	High		Low		High		Low		High		Low		High		Low	
	Move Distance	Closer (C)	Farther (F)	Closer (C)	Farther (F)	C	F	C	F	C	F	C	F	C	F	C	F
Air Casters		✓		✓		✓		✓		✓		✓		✓		✓	
Conveyors		✓		✓													
Cranes				✓	✓			✓				✓				✓	
Drag Chains		✓		✓													
Forklifts						✓		✓						✓			
Industrial Trucks						✓		✓								✓	
Rails		✓		✓													
Transfer Carts				✓		✓		✓		✓		✓				✓	

Table 3. Breakdown of which move systems best fit different move scenarios. For more information about move path and operating area, see Question #2.

Question #3a: How often does the load have to be moved?

Some move systems must be capable of moving loads continuously. Others may be needed relatively infrequently. In general, the more frequent the move, the more efficient the setup and loading process must be to avoid productivity losses.

Consider also, if you're moving a load between multiple stations, the load will have to spend a certain amount of time at each station (takt time). That could impact uptime at other stations if one station takes longer than others, or if a problem strikes one station.

The key is to identify a movement methodology that minimizes production losses. What is/are the most efficient movement method(s) that will work within the weight class of your load?

[3] Table adapted from http://www4.ncsu.edu/~kay/Material_Handling_Equipment.pdf

Good move systems for frequent moves:

Conveyor belts, rails, and drag chains shine with frequent moves by offering continuous or near-continuous movement. They also offer synchronized movement; if you have a production line with 10 stations in it, for example, you can sequence all stations at same time. Remember Question #2, however: these move systems require a fixed, permanent movement path, and if you try to synchronize stations with them, the entire line can grind to a halt if there's a problem at one of the stations.

However, these systems tend to top out at relatively moderate weights (see Question #1). If you're dealing with both frequent moves and high weights, an air caster system would likely be more efficient.

Less effective systems for frequent moves:

Cranes are relatively slow; beyond the time it takes to physically move a load from one point to another, cranes have many safety steps and setup requirements. Then, you may also have to wait for the certified crane operator to become available.

It is not unusual for moves with cranes to take 15 to 25 minutes altogether. If the next load is ready but the crane is not, you will lose productivity. Many of the same considerations apply to forklifts as well, which also have specific safety considerations and rely on a certified operator.

Question #3b: How far does the load have to be moved?

A corollary consideration beyond the number of stations involved is how far the load will have to move from station-to-station during the manufacturing process. If the load needs to move a significant distance – say, a thousand or more feet – cranes, rails, and conveyors become less practical due to cost.

Air casters also typically require hoses to provide a continuous supply of air; it's possible to leap-frog from hose to hose, but distance will complicate the move even with air casters.

Question #4: What's the cost?

Costs:	Equipment			Installation	Operation	Training	Maintenance
	Weight of Load						
	Low	Mod	Heavy				
Air Casters	Moderate		Low	Low	Low	Low	Low
Conveyor	Moderate		High	High	Moderate	Moderate	Moderate
Cranes	Very High			High	High	High	High
Forklifts	Moderate		High	Low	Low	Moderate	Moderate
Rails	Moderate		Low	Low	Low	Low	Low
Wheels	Low	Mod	High	Low	Low	Low	Low

Table 4. Relative costs per move system, per weight of load and other cost factors.

Question #4a: What is the cost of the equipment?

Any move system will require a capital expenditure to purchase. However, different move systems vary *enormously* in cost. Even the *same* move system can vary enormously in cost depending on the specific type used. For example, a typical indoor crane might cost tens of thousands of dollars; a large crane capable of dealing with heavy weights or extending over long distances might cost millions of dollars. Similarly, forklifts are typically a moderate expense, unless you opt for an extra-large model capable of hauling heavy weights, in which case they can also be enormously expensive. Note that some move systems represent sunk costs. A crane or conveyor, for instance, cannot be moved. If it ever needs to be reconfigured, or if the organization changes facilities, the money spent purchasing and installing the system is lost. In fact, in some cases the organization might have to pay more to have the move system removed if they leave or remodel their facility.

Question #4b: What is the cost of installation?

Cranes, rails, conveyors include significant installation time and, thus, lost productivity. In fact, these installations can take multiple weeks of construction, during which time the facility must be shut down, or at least operating at significantly reduced capacity. That means the cost of installation needs to include the cost of lost production as well.

Indeed, a crane is a civil engineering project in itself to install in a facility. If installation is going to disrupt your production environment, you'll pay not only for the cost of that labor to put it in but also for lost production. By contrast, air casters, forklifts, and push solutions typically have little-to-no installation. That said, air casters may need the floor to be reconditioned, or temporary mitigating measures installed, because air casters may depend on floor condition to work properly.

Question #4c: What is the cost of operating the equipment, including time to operate?

Some move systems are more difficult to operate, and some – like cranes or forklifts – may require operators to be certified. Then, you must wait for the equipment and the operator to become available for the next move, and then you must take the time to attach the load.

Altogether, the wait could extend to 15 or 30 minutes (or more), during which no load is moving, which is expensive without being cost-effective.

Question #4d: What is the cost of training and certifications?

Depending on the move system, training and certification may represent a one-time expense, or it may be recurring. The more technically complex the move system, the more training will be required.

Push systems excel here; they require very little training to simply push something around. By contrast, a crane or forklift will require fairly extensive training and practice.

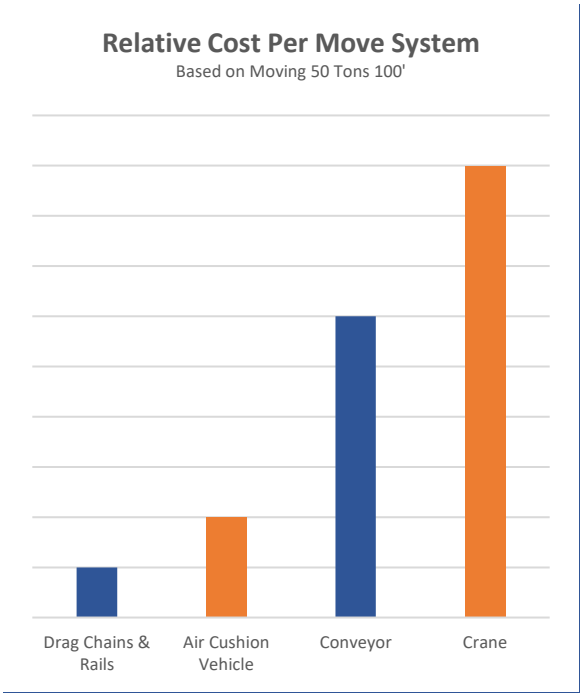
Question #4e: What is the cost of maintenance and upkeep?

The more complex the move system, the more maintenance it will involve. Cranes and any motorized solution will require regular and often extensive maintenance. Issues can include: bearings wearing out, contactor problems, parts availability, brakes wearing out, and more. Indeed, in some cases maintenance contracts can cost more than the equipment itself.

Further, equipment may require regular inspections, which in turn may necessitate repairs or other upkeep. Even with wheel casters, which only typically deal with lighter loads, wheels eventually wear out or require maintenance. Surprisingly, rails typically have relatively little maintenance. Air casters may have the least maintenance of the major move systems, since they have no moving parts and utilize standard factory air (under 25 psi).

Question #4f: What is the cost of scaling the load?

A "hidden" cost that is easy to overlook includes the cost to grow. Can you increase capacity without increasing cost at a commensurate (or, worse, exponential) rate? For example, a wheeled solution might be more cost effective than air casters at light weights, but at heavy weights, the calculus flips. Moving a 400-ton load via air casters might cost six figures. Moving it via a wheeled system could cost seven figures.



Question #5: How are you going to make the load “loadable”?

How will you make the component or piece of machinery (or whatever you’re building) mobile, in order to get it onto the moving equipment? This question can be particularly difficult to answer if the load is especially large or unwieldy, but it can have significant implications for the suitability of different move systems.

Consider also that the load can change as it progresses through an assembly line. For example, super large heat exchangers (up to 100 tons) start as one cylinder and have more cylinders added as it moves down the line. As a result, the weight and center of gravity shifts after each station.

Air Casters	Air casters usually slide under the load and lift it up. If the load is eccentrically weighted – imbalanced, heavier on one side, or with an odd or variable center of gravity – individual air casters can automatically inflate or deflate to compensate and equalize as needed.
Cranes	Cranes can lift loads of all shapes and configurations, but they must be attached in some way (e.g., hoists) to a structurally sound part of the load. For delicate or unwieldy loads, this may necessitate creating some kind of protective substructure to use a crane.
Forklifts	If the load can sit on, or otherwise be attached to, a pallet or skid, a forklift can lift it up from underneath.
Transfer Cart	If the load can sit on a flat bed, a transfer cart could move it – but it might require a secondary loading system or skid to get the load onto the cart to start.
Wheeled Casters	Wheeled casters can slide under the load, but you might need to find a way to lift the load up a few inches.

Question #6: What kind of training and certifications are required?

	Training Required	Notes
Air Caster	**Low**	Operation is simple, though it may require a level of operator involvement.
Conveyor, Rail	**Low**	Operating with push-button simplicity (push to turn on), users require little training. (Maintenance is another question).
Crane	**High**	Requires operators to be trained and certified. Operation is typically involved and moderately challenging.
Forklift	**Moderate**	Requires operators to be trained and certified. Operation is typically straightforward, but visibility issues may require a spotter.
Wheeled Cart	**Low**	Operation is simple, though it does require a high level of operator involvement.

Table 5. Training considerations for various move systems.

Some equipment can be very dangerous to people and objects in the facility if operated inexpertly.

This question has more dimensions to it than may be apparent at first. On the surface, training and certification represent expenses in their own right. They can also have logistical implications for operations. Specifically, if the move system requires special training and certifications for operators, that can limit the availability of that tool to help move loads if the driver is tied up elsewhere. That lowers utilization, decreases productivity and efficiency, and makes the move system less cost-effective overall. Other move systems, push systems in particular, require very little training to operate and no certification. The system just goes underneath the load to be moved, picks it up or otherwise hooks to it, and moves it. Typical training for air casters, for example, takes about 30 minutes.

It should be noted that systems that require extensive training and requirements typically do so because of safety issues. Some equipment, like cranes and forklifts, can be very dangerous to people and objects in the facility if operated inexpertly.

Question #7: What are the safety considerations of each move system?

	Risk	Safety Considerations
Air Caster	**Low**	Air casters only lift the load up an inch or two. Additionally, braking, power, and steering are required for heavy loads.
Conveyor, Rail	**High**	Conveyors and rails can create tripping hazards, and with frequently or continuously moving parts, users may risk getting a finger caught. However, conveyors also allow control of move speed that can reduce chances of breakage or other issues. Although the government does not appear to track accidents specific to system, research from the U.S. Bureau of Labor Statistics indicates nearly 35,000 injuries occur annually due to workers becoming caught in moving machinery.[4]
Crane	**Very High**	Cranes have the potential for many problems. The shackles alone – which are big enough to handle huge loads – could break fingers. Loaders usually can't hook it up without physically touching it. Then, the crane lifts the load up high, creating the potential for falls that could hurt people or damage equipment. An average of 41 crane-related fatalities occur annually in the U.S.[5]
Forklift	**Very High**	Fork trucks interact with many people on the floor and must sometimes navigate tight areas, often with very limited visibility. Because the forklift must counterbalance the load, loads with an unusual center of gravity, if loaded improperly, can imbalance the entire vehicle. Forklifts result in an average of 85 fatalities and nearly 35,000 injuries annually in the U.S.[6]
Wheeled Cart	**Moderate**	Depending on the weight of the load, carts can be hard to move and position, and create potential hazards if the weight reduces maneuverability or causes the cart to lunge forward.

Table 6. Safety considerations for various move systems.

[4] https://www.bls.gov/opub/mlr/cwc/worker-fatalities-from-being-caught-in-machinery.pdf
[5] https://www.bls.gov/iif/oshwc/cfoi/cranes_fact_sheet.htm
[6] https://www.safetytalkideas.com/safetytalks/forklift-fatalities-injuries/

Question #7a: How safe is the move system for personnel?

Although serious incidents involving any type of move system are thankfully rare, when they happen, they can be catastrophic – particularly for high risk move systems like cranes. If someone forgets to disconnect the crane from the load when the crane moves away, it can seriously damage the load and cause harm to everyone around it.

Is the load safe to touch?

Some move systems require workers to manually load or hook up onto the move system, e.g. attaching crane hoists. Other move systems enable loading without touching the load at all in order to move it, as with air casters and potentially fork trucks.

Can heavy objects be dropped on workers?

If you're moving something that's super-heavy with a crane in an environment full of people and production workers, it can present significant risks. Conveyors at or above human height can also result in objects falling on workers below.

Is visibility compromised?

Equipment like forklifts and similar vehicles can compromise visibility and maneuverability, leaving people open to get injured.

How much force does the method require?

The more human force required to move a load, the greater the risk of injury. For example, if the load weighs 3,000 lbs., it could sit on a cart with wheels, but the amount of force to move something that heavy on wheels begins to risk safety issues like back injuries. By contrast, air casters eliminate friction, so the force required to push a load is very low – a single person could move a multi-thousand-pound load easily.

Are there balance issues that could lead to tipping over?

Forklifts can overturn if they attempt to lift a too heavy load too high, as can push solutions if they are improperly balanced. Air casters shine here, because each air caster can be inflated to a different degree and can adjust automatically as the load moves to accommodate uneven loads.

Question #7b: How safe is the move system for the load?

If the Load is High Risk (e.g., Delicate or Expensive)
Lower Risk Move Systems
Conveyor (move at controlled speeds)
Rail (move at controlled speeds)
Air caster (load effectively floating)
Higher Risk Move Systems
Crane (risk of dropping)
Forklift (risk of dropping, running into something)

Table 7. Risk of damage to load by various move systems.

The load itself can be extremely expensive and delicate, like a piece of semiconductor processing equipment. In these cases, you don't want to risk the load being dropped or jarred. Cranes are typically inadvisable for very delicate loads because there's too much risk of dropping or jarring the equipment as it is lifted, moved, and set back down. Similarly, it's too easy for forklifts to hit or drop objects, which leaves the load open to being damaged. Air casters may be the lowest risk move system because they effectively float the load just over the floor and require no physical contact between handlers and the load.

If you know the right questions to ask about your material handling needs, you can find the right move system.

It's no trivial task to pinpoint the ideal move system to deal with heavy and super-heavy loads. The options are numerous, and the factors and considerations affecting each move can be nearly innumerable.

But each type of load handling equipment (crane, conveyor, air cushion vehicle, wheeled transfer cart, drag chain, and more) have relative strengths and weaknesses that make them suitable, or even ideal, for specific applications.

With this guide at hand, you should be able to walk through the most important questions governing most situations. Working your way through these questions should help you to eliminate material handling systems that are unsuitable for your needs, while allowing others to begin to float to the top, hopefully ending up with the ideal move system for your circumstance.

But no single guide can truly, comprehensively cover every single situation. If this list of questions to consider has left you with more uncertainties than solutions, please feel contact us. We are experts at heavy industrial moves, and we will be happy to put our knowledge and experience at your service.

Thank you for reading!

If this paper has not addressed *your* situation, please visit **www.AeroGo.com** or email us at **info@aerogo.com**. We can help you figure out how to best address your needs.

AeroGo, Inc.

Innovative Load Moving Solutions

About

AeroGo manufactures innovative load moving equipment, utilizing wheels and hovercraft technology, that move heavy, awkward, or delicate loads in factories.

Companies large and small find benefit from our worldwide dealer network, experienced product specialists, and skilled engineers. They will work with you to find a load moving solution that is safe, efficient and cost-effective, as your valuable loads are carried through the manufacturing process.

From our Standard Product offerings to our highly customized Engineered Systems, AeroGo has an innovative solution for your load moving need.

- ☑ Solutions Focused
- ☑ Team Approach
- ☑ Engineering Expertise
- ☑ Lean Manufacturing
- ☑ ISO Compliant

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