TECHNICAL REPORT

CHOOSING THE RIGHT ELEVATOR FOR YOUR BUILDING

What Owners Should Know Before Making an Investment

An owner-focused guide to elevator applications, hydraulic and traction technologies, MRL systems, traffic analysis, lifecycle costs, safety, and equipment selection.

SENAWI GROUP CONSULTING LLC

Insight. Experience. Solutions. Performance.

Selecting the right elevator involves more than choosing a manufacturer or comparing installation prices. The decision can affect your building's performance, operating costs, maintenance requirements, and long-term investment for decades.

Whether you are constructing a new building, replacing an aging elevator, or planning a modernization, understanding the available elevator technologies and their applications is essential.

Not every elevator system is appropriate for every building. Factors such as building height, passenger traffic, available space, equipment capacity, energy consumption, maintenance requirements, and long-term costs all influence the selection process.

Making the right decision begins with understanding your building's needs before selecting equipment or requesting bids.

Understanding the Different Types of Elevators

Before evaluating elevator technologies, it is important to distinguish between an elevator's intended application and the technology used to operate it.

Passenger Elevators

Passenger elevators are designed primarily to transport people between floors. They are commonly installed in office buildings, residential properties, hotels, hospitals, educational facilities, and commercial developments.

The appropriate elevator capacity, speed, and quantity depend on the building's occupancy, traffic patterns, and operational requirements.

Freight Elevators

Freight elevators are designed to transport goods, materials, and heavy equipment. They are commonly used in warehouses, manufacturing facilities, commercial buildings, and industrial applications.

Freight elevators are available in different classifications depending on the intended loading conditions. Selecting the appropriate classification is essential to accommodate the type, weight, and method of loading.

Service Elevators

Service elevators are commonly used in hospitals, hotels, commercial buildings, and other facilities where employees must transport equipment, supplies, carts, or materials between floors.

Depending on the application, a service elevator may also transport passengers. The appropriate capacity, entrance configuration, interior protection, and operating characteristics should reflect the building's operational needs.

Understanding Elevator Technologies: Hydraulic, Traction, and MRL

Once the intended application is established, the next step is to determine which elevator technology best meets the building's requirements.

The three most commonly considered configurations are hydraulic elevators, conventional traction elevators, and machine room-less (MRL) elevators.

1. Hydraulic Elevators

Hydraulic elevators use pressurized hydraulic fluid and a piston arrangement to raise the elevator car. Depending on the design, the piston may act directly on the car or through a roped arrangement.

Hydraulic elevators are commonly installed in low-rise buildings where travel distances and traffic demands are relatively modest.

Advantages

- Often have lower initial equipment and installation costs than comparable traction systems.
- Can be practical for low-rise buildings with limited passenger traffic.
- Offer straightforward operation and proven technology.
- May be well suited to certain modernization projects where an existing hydraulic system is already installed.

Considerations

- Generally operate at lower speeds than traction elevators.
- Typically consume more electricity during upward travel because the hydraulic pump must lift the elevator load.
- Require hydraulic fluid, seals, valves, and associated maintenance.
- Hydraulic leaks can create environmental and maintenance concerns.
- Travel height and operating characteristics may limit suitability for taller buildings.

When should you consider a hydraulic elevator?

A hydraulic elevator may be an economical choice for a low-rise building where moderate traffic, relatively short travel distances, and initial installation costs are primary considerations.

However, the long-term cost of operation and maintenance should be evaluated before making a final decision.

2. Conventional Traction Elevators

Traction elevators use an electric motor to drive a traction sheave, moving the elevator car and counterweight through suspension ropes or belts.

Unlike hydraulic systems, traction elevators use a counterweight to balance a substantial portion of the elevator load, reducing the energy required for operation.

Traditional traction systems generally have machinery located in a separate machine room.

There are two primary traction configurations.

Geared Traction Elevators

Geared traction elevators use a motor connected to a gearbox that drives the traction sheave.

These systems have historically been common in low- and mid-rise buildings and remain in service in many existing properties.

Gearless Traction Elevators

Gearless traction elevators connect the motor directly to the traction sheave without a conventional gearbox.

They are commonly used in mid- and high-rise buildings and in applications requiring higher speeds, smoother operation, and improved energy efficiency.

Advantages of Traction Elevators

- Suitable for a broad range of building heights and traffic demands.
- Available in higher-speed configurations.
- Generally more energy-efficient than conventional hydraulic elevators.
- Can provide excellent ride quality and leveling performance.
- Gearless systems eliminate the maintenance requirements associated with a conventional gearbox.

Considerations

- Initial installation costs may be higher than those of hydraulic systems.
- Conventional machine-room configurations require dedicated machinery space.
- Suspension systems, brakes, drives, and other components require periodic inspection and maintenance.
- Equipment design, accessibility, and replacement-part availability can significantly affect long-term ownership costs.

When should you consider a traction elevator?

Traction elevators are generally preferred where building height, passenger traffic, travel speed, and energy efficiency justify their use.

The appropriate geared or gearless configuration depends on the building's operating requirements and the equipment available from manufacturers.

3. Machine Room-Less (MRL) Elevators

Machine room-less elevators eliminate the need for a conventional separate elevator machine room by locating the primary driving machinery within the hoistway or another code-compliant equipment arrangement.

Most commercial MRL elevators use gearless traction technology, although hydraulic MRL configurations are also available.

MRL systems have become increasingly common in new construction and modernization projects because they can reduce the amount of building space dedicated to elevator machinery.

Advantages

- Eliminate the need for a conventional separate machine room.
- Can reduce building space requirements.
- Gearless traction MRL systems typically provide good energy efficiency.
- Available for many low- and mid-rise applications, as well as certain higher-rise applications.
- Can offer smooth, quiet operation when properly designed and installed.

Considerations

- Machinery and component access may be more challenging than in conventional machine-room installations.
- Maintenance and major repairs may require specialized access procedures.
- Certain systems use manufacturer-specific components, diagnostic tools, or service procedures.
- Hoistway dimensions, overhead clearances, pit requirements, and equipment access must be carefully evaluated.
- Not every MRL design is appropriate for every modernization project.

When should you consider an MRL elevator?

An MRL elevator may be an excellent choice where building space is limited or where eliminating a conventional machine room provides architectural or financial benefits.

However, equipment accessibility, serviceability, and long-term maintenance costs should be evaluated alongside the initial space savings.

Comparing Elevator Technologies

The following comparison provides general guidance when evaluating elevator systems.

Consideration	Hydraulic	Conventional Traction	MRL Traction
Typical application	Low-rise	Low- to high-rise	Low- to mid-rise and selected higher-rise
Initial cost	Often lower	Varies by configuration	Varies by application
Energy efficiency	Generally lower	Generally higher	Generally higher
Operating speed	Typically lower	Wide range, including high speed	Manufacturer-dependent
Machinery space	Typically separate equipment space	Conventional machine room	No conventional machine room
Maintenance access	Often straightforward	Generally accessible machinery	Can be more restrictive
Long-term costs	Application-dependent	Application-dependent	Application-dependent

These comparisons are general guidelines. Actual performance, cost, and suitability depend on the building, equipment configuration, manufacturer, and maintenance requirements.

Evaluating Your Building's Requirements

Choosing the correct elevator technology is only one part of the selection process.

A properly designed elevator system must also accommodate the building's passenger demand, operating conditions, physical constraints, and anticipated future use.

Building Height and Travel Distance

The number of floors and total travel distance influence the elevator technology, operating speed, and equipment configuration.

Hydraulic systems are generally better suited to low-rise applications, while traction systems can accommodate a much wider range of travel distances and speeds.

However, building height alone should not determine the selection.

Passenger Traffic and Handling Capacity

One of the most important considerations is how many people the elevator system must transport during peak operating periods.

An office building, hospital, hotel, residential tower, and educational facility can have significantly different passenger traffic patterns.

A system with insufficient handling capacity can result in excessive waiting times, overcrowding, and reduced building efficiency.

Elevator Capacity and Speed

Selecting an elevator with the appropriate rated capacity and speed is essential.

A larger elevator is not necessarily the most efficient solution, and a faster elevator does not automatically produce shorter passenger waiting times.

Elevator capacity, speed, door operation, floor-to-floor travel, and the number of elevators must work together to provide satisfactory service.

Building Space and Physical Constraints

Available hoistway dimensions, pit depth, overhead clearance, machine-room space, structural conditions, and equipment access can significantly influence equipment selection.

These considerations are particularly important when modernizing existing elevators, where physical limitations may restrict available options or increase construction costs.

Why Elevator Traffic Analysis Matters

Choosing the right elevator technology does not necessarily mean choosing the right elevator system.

A building may have modern, high-performance elevators and still experience excessive waiting times if the number of elevators, their capacities, or their operating speeds are not properly matched to passenger demand.

An elevator traffic analysis helps determine the appropriate system configuration based on anticipated building usage.

Depending on the project, the analysis may evaluate:

- Building occupancy and population distribution.
- Peak passenger demand and traffic patterns.
- Elevator handling capacity.
- Passenger waiting times and journey times.
- Elevator quantity, capacity, and speed.
- Group dispatching and control strategies.
- Future occupancy changes or building expansion.

For new construction, traffic analysis can help establish the appropriate number and size of elevators before the building design is finalized.

For existing buildings, it can help determine whether service problems are caused by inadequate system capacity, operating performance, dispatching, or other conditions.

Without a proper evaluation, owners risk investing in elevator equipment that may not adequately meet the building's operational needs.

Consider the Total Cost of Elevator Ownership — Not Just the Purchase Price

One of the most common mistakes in elevator selection is focusing primarily on the initial installation cost.

Although the purchase price is important, an elevator is a long-term building asset that may remain in service for decades.

The true cost of ownership extends well beyond installation.

Initial Equipment and Installation Costs

Initial costs can include equipment, labor, hoistway modifications, electrical upgrades, structural work, permitting, testing, and other construction-related expenses.

The lowest equipment price may not represent the lowest total installed cost.

Maintenance and Repair Expenses

Maintenance costs can vary depending on the equipment technology, manufacturer, accessibility, component design, and service requirements.

Some systems may have lower initial costs but higher long-term maintenance or repair expenses.

Proprietary Versus Nonproprietary Equipment

Equipment design and service accessibility can have a significant impact on future maintenance options.

Certain elevator systems use proprietary controls, software, diagnostic equipment, or replacement components that may limit the owner's ability to obtain competitive maintenance services.

Other systems may offer greater service flexibility, depending on component availability and the technical capabilities of independent maintenance providers.

Owners should understand these differences before purchasing equipment.

Equipment Life and Future Modernization

Elevator systems require periodic component replacement and eventual modernization.

The availability of replacement parts, manufacturer support, upgrade options, and long-term service resources should be considered during the initial selection process.

Energy Consumption

Energy costs can vary significantly depending on elevator technology, building usage, equipment efficiency, and operating characteristics.

Gearless traction systems, regenerative drives, LED lighting, and standby operating modes may reduce energy consumption.

However, the financial benefit should be evaluated against the building's actual usage patterns and the additional cost of the selected equipment.

The best elevator investment is not necessarily the system with the lowest purchase price. It is the system that provides the appropriate performance and reliability at a reasonable total cost over its useful life.

Safety, Code Compliance, and Accessibility

Regardless of the technology selected, every elevator installation must comply with applicable safety, building, electrical, and accessibility requirements.

In the United States, these may include applicable editions of ASME A17.1/CSA B44, building codes, electrical codes, and accessibility standards, as adopted or enforced by the jurisdiction.

Important considerations include:

- Emergency communication systems.
- Door protection and reopening devices.
- Emergency braking and safety systems.
- Firefighters' emergency operation.
- Emergency and standby power requirements, where applicable.
- Accessibility provisions.
- Required equipment clearances and maintenance access.
- Testing, inspection, and acceptance requirements.

Code requirements can vary by jurisdiction and may differ between new installations and modernization projects.

Early coordination with the applicable authority having jurisdiction can help prevent costly design changes and construction delays.

Selecting the Right Elevator Manufacturer

Once the building's operational and technical requirements are established, the next step is to evaluate available manufacturers and equipment solutions.

However, manufacturer selection should not be based solely on brand recognition or initial pricing.

Owners should consider:

- Equipment performance and reliability.
- Manufacturer experience with similar applications.
- Availability of local technical and maintenance support.
- Replacement-part availability and delivery times.
- Equipment accessibility and service requirements.
- Proprietary software, controls, and diagnostic restrictions.
- Warranty coverage and exclusions.
- Long-term maintenance and modernization considerations.

Different manufacturers may offer solutions that meet the same basic performance requirements but differ substantially in equipment configuration, maintenance accessibility, and long-term costs.

A properly developed technical specification can help establish consistent requirements and allow competing manufacturers to submit proposals on a comparable basis.

Why Independent Elevator Consulting Can Make a Difference

Elevator manufacturers and installation contractors can provide valuable technical information about their equipment.

However, their recommendations naturally focus on the products and systems they offer.

An independent elevator consultant provides a different perspective by evaluating the building's requirements without being tied to a particular equipment manufacturer or installation contractor.

Independent consulting services can assist owners with:

- Evaluating building and operational requirements.
- Comparing hydraulic, traction, and MRL technologies.
- Performing elevator traffic analysis.
- Reviewing existing equipment conditions.
- Developing equipment specifications.
- Evaluating modernization and replacement alternatives.
- Preparing competitive bidding documents.
- Comparing contractor proposals and technical exceptions.
- Reviewing maintenance and long-term ownership considerations.
- Providing construction administration and acceptance testing support.

Involving an independent consultant early in the planning process can help owners avoid unnecessary expenses, reduce technical uncertainty, and make better-informed investment decisions.

Making the Right Elevator Decision Starts Before You Request a Bid

Choosing the right elevator requires more than comparing equipment types, manufacturers, and installation prices.

Every building has unique operational requirements, traffic demands, physical limitations, and long-term maintenance considerations.

An elevator system that works well in one building may not be the most practical or cost-effective solution for another.

Before selecting equipment, owners should establish clear performance requirements, evaluate available technologies, understand the total cost of ownership, and consider how the elevator system will be maintained throughout its service life.

The right elevator isn't necessarily the most expensive or technologically advanced system. It's the system best suited to your building's needs — today and into the future.

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