

Practical Considerations for Implementing Prefabricated Data Centers

White Paper 166

Revision 0

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Executive summary

Implementing prefabricated modular data centers results in well-understood benefits including speed of deployment, predictability, scalability, and lifecycle cost. The process of deploying them – from designing the data center, to preparing the site, to procuring the equipment, to installation – is quite different than that of a traditional data center. This paper presents practical considerations, guidance, and results that a data center manager should expect from such a deployment.

Introduction

A project involving prefabricated modular data centers offers well understood benefits in terms of predictability, scalability, timeframe, and cost (see White Paper 163, [Prefabricated Power and Cooling Modules for Data Centers](#)), but many of the practical considerations when deploying them are less understood. This paper discusses how these projects are planned and designed, how the site is prepped, how the equipment is procured, and finally how the equipment is installed and commissioned, so that expectations for the project (steps, roles, complexity, timeframe, cost) are met.

Table 1 summarizes the key differences between deploying prefabricated modular data center projects and deploying traditional data center projects. Detailed distinctions between the two are then further discussed throughout the paper.

Table 1
Prefabricated vs. traditional data center deployments

Deployment process	Prefabricated data center deployment	Traditional data center deployment
Plan / Design	<ul style="list-style-type: none"> • Engineering and specification performed at system level • Less than 12 weeks for planning/design 	<ul style="list-style-type: none"> • Engineering and specification performed at component level • Generally 24 (or more) weeks for planning/design
Site preparation	<ul style="list-style-type: none"> • Value of UL Listed or other agency listed modules omitted from permitting costs • Permitting documentation focus on interconnections of modules • Inspection of field-work only, not of subsystems within modules • Options of indoor or outdoor placement • Modules generally placed directly over underground wiring/piping 	<ul style="list-style-type: none"> • Permitting costs include value of all systems • Permitting documentation requires detailed drawings at subsystem level • Inspection of all field work, including traditional subsystem interconnections • Systems placed indoors except heat rejection and generator¹ • Wiring/piping to building may require support hardware or special structures
Procurement	<ul style="list-style-type: none"> • Modules generally designed to meet transportation weight limits, arrive near fully assembled • Construction trash is minimal 	<ul style="list-style-type: none"> • Products arrive in different shipments, by different vendors • Construction trash is significant
Installation	<ul style="list-style-type: none"> • Climate and outdoor conditions / landscape impact placement / orientation when installed outdoors • Typically installed by truck crane 	<ul style="list-style-type: none"> • Only outdoor cooling system and generator must consider outdoor conditions / landscape • Installed by forklifts and by hand, as separate products

Planning & design considerations

Data center project planning remains a major challenge for many IT departments. Poor communication, discussions at the wrong level of abstraction, and lack of stake-holder buy-in are the main culprits. White Paper 142, [Data Center Projects: System Planning](#), discusses these challenges and presents the four tasks that are critical to successful data center planning.

While steps are not eliminated by going to prefabricated data center modules, the steps *are* simplified and shortened. Once the project parameters – criticality, capacity, growth plan, efficiency, density, and budget – are determined, the time to complete the remaining planning

¹ Most generators are located outside but in some cases they are housed indoors with special design for proper ventilation.

steps is shortened, largely because effective prefabricated designs are based on existing reference designs that document the design.

In addition to the shortened planning steps, there are two planning considerations that are unique to prefabricated data centers; how the equipment is classified financially, and the degree of component-level design engineering involved.

Classification as “personal property”

Prefabricated data center modules provide a data center owner with favorable financial or economic options with respect to the how the prefabricated modules may be treated.

Prefabricated modules that are assembled in a factory and packaged either as an assembly on a skid, or an assembly within an enclosure possess the unique attribute of being considered a “product”, rather than a basket of parts or subsystems. Therefore, a prefabricated data center module is less likely to become part of the building, to the same extent that its component parts (panelboards, switchboards, pumps, drives, etc.), might, if they were ordered as separate components and installed at the site.

This generally allows the prefabricated module(s) to be classified as a single piece of “personal property” rather than “site improvements” or “building improvements”, which provides the data center owner certain options that are generally not afforded to “stick-built” data centers, including:

- they may be booked and depreciated separate of the building, using a more appropriate useful life of 10 years, for example
- they may be leased (or sold and leased back) independent of the rest of the assets on the site
- they may be moved (or relocated) from one regional data center to another with its prior depreciation recognized and its remaining value intact

Advice of a tax professional is always important when acquiring and “booking” new assets, White paper 115, [Accounting and Tax Benefits of Modular, Portable Data Center Infrastructure](#), provides further explanation of the potential depreciation and tax distinctions of such systems.

System level design engineering

Engineering a data center built from prefabricated modules involves more system-level design work when compared to engineering a data center built from products and parts. In addition, designing with prefabricated data center modules gives a design team the ability to forgo many of the purely “architectural” decisions associated with conventional data center designs, such as roof and side wall construction materials.

Analogous to buying a car where it is unnecessary to separately specify the starter motor’s mounting arrangement, number and pitch of gear teeth, torque and temperature rise of various heat producing components, prefabricated data center modules, instead, allow the engineering effort to focus on the data center equivalent of seating capacity, payload, and trailer towing capacity. Brands, part numbers, and specifications of the individual components are still available for a detailed understanding of the prefabricated modules but it is not necessary from an engineering standpoint. Prefabrication carries an implicit expectation that the components within the modules are well matched and thoroughly integrated. With prefabricated modules, much of the time associated with understanding the requirements and developing a design are avoided. For example, wiring and piping requirements are optimized and integrated in the factory. Specs related to pipe and wire

sizes, the pressure drop associated with valves and hydronic components, and pump and impeller sizes are pre-selected and installed to meet the performance characteristics of the modules. Most importantly, all of the critical components and controls such as circuit breakers, transfer switches, VFDs, and chillers can be implemented and tested in the factory as a complete system, and carries a “listing” by one or more underwriting organizations (such as UL, ETL, or CSA). Communications and controls are ready to function when the module is delivered, with minimal on-site work. Data center design therefore can occur at a system-level, which shortens the overall data center design time from typically 24 weeks to 12 weeks².

Site preparation considerations

Whether the project is a retrofit data center or a new “greenfield” data center, some degree of work is generally needed to ready the site for any new data center systems. Permits must be obtained, pipes and circuits must be laid, the land and/or building readied to receive the system(s), and the site inspected. For a prefabricated modular data center, there are some unique considerations in completing these steps.

Permits and inspection

The **permitting** process for data centers assembled from prefabricated data center modules generally resembles that of a conventional “stick-built” data center except that the construction drawings can be more simply drawn. The modules, from a graphical standpoint may be represented much like a packaged generator set might be depicted on a drawing, focusing on the field connections required rather than the factory assembled internal wiring and piping. Prefabrication not only reduces the time required to develop construction drawings and “permit sets”, but also allows for efficient review and inspection.

All the detailed information is available from the manufacturer, often in the form of one-line, three-line, five-line, piping, and schematic drawing files, in multiple standard graphic formats, to allow the owner or engineer to develop detailed drawings for a particular audience.

Inspections by representatives of the authority having jurisdiction (AHJ) will generally focus on the field constructed aspects of the prefabricated data center. However, inspectors may be curious as to the materials and methods employed by the vendor in manufacturing the facility module, all of which were reviewed, inspected, and “listed” by UL, ETL, etc. in the factory.

From the standpoint of **permitting costs**, the value of the facility module is generally legitimately omitted from the schedule of values on which the cost of the permit is based. The theory is that the local inspector (while having every right to view and certainly comment on the facility module) is not being tasked or responsible for its inspection, as the “inspection function” has been performed by or under UL, ETL, etc. The cost of those approvals is incorporated into the purchase price of the modules, though at a discount to the customer, as it is spread out over the multiple instances of that module.

This is the same principal that is applied to, for example, the installation of a drier and a washing machine. The gas and electrical system feeding the laundry appliances are itemized in the permit application and inspected in the field, however the UL listed laundry appliances are not identified in the permit application or disassembled in the field to inspect their extensive wiring, internal gas-train components, or controls.

² White Paper 163, [Prefabricated Power and Cooling Modules for Data Centers](#), Figure 6

Locating the modules indoors vs. outdoors

Many modules are designed to be weather-tight enclosures, making them well suited for outdoor installation as standalone structures. There are, however, reasons (discussed further in White Paper 165, [The Types of Prefabricated Modular Data Centers](#)) that a module may be installed indoors, including:

- the module is skid-mounted
- the module is an enclosure that is not weather rated
- protect personnel from inclement weather during operation & maintenance activities
- added security of critical systems

For data center applications at locations that are leased, outdoor placement of modules may be an opportunity to save money, as the rental of outdoor square footage is often much less expensive than the square footage of a building. This also provides a landlord with an unexpected additional revenue stream (except where the outdoor square footage displaces a resource that may be in short supply, such as parking, or green space, on sites that have already been completely developed).

Among the most important site considerations regarding the location of the modules is the proximity and access to utilities – principally electricity, water, and in the case of IT space modules, the “communications carriers” involved in moving the data.

While sites developed expressly for a modular data center provide the greatest number of options, space can usually be found on most campuses and office park locations. The site planning, in the case of retrofit sites, typically includes the repurposing of certain features of the site, such as parking lots, parking structures, warehouses, or “green space”. Among the most important site considerations regarding the location of the modules is the proximity and access to utilities – principally electricity, water, and in the case of IT space modules, the “communications carriers” involved in moving the data.

Outdoor locations are uniquely suitable for utilizing medium voltage delivered from existing outdoor power distribution assets, or in the case of a new site development, directly from the utility. Generally, if there is an electrical service already provided to an existing building, the local utility will require that the data center module(s) be electrically connected to that building and not be inclined to offer an additional service, particularly if capacity is available on the existing electrical service.

The layout of any outdoor modules, in addition to access to utilities, should be configured with ease of module installation (and removal), servicing, and general housekeeping (such as rain water management, snow removal if applicable, and lawn, sidewalk, and lot maintenance) in mind. Additional consideration should be given to perimeter security or screening that may be required to comply with the terms and conditions of leases, or zoning regulations. The **“Site Installation Considerations”** section further details recommendations for placement and orientation of the modules outdoors.

Finally, it is rare that a site with prefabricated data center modules has no building structure at all. The building is the “anchor” for the site, providing, at minimum:

- a permanent structure on the site which can be tied to a recognizable street address
- the required facilities for a business, including at least a certain number of restrooms

Foundations for modules

The site planning document(s) usually include a “civil site plan”, “electrical site plan”, and a “mechanical site plan”. Among the principal features of the site plan are the foundations to support these modules. The three common types of foundations used are continuous concrete slabs, multiple concrete slabs, or piers (or a combination of these structures). The

style and type of foundation selected has as much to do with the physical properties of the site, including soil conditions, surface water drainage, the presence of frost, as well as seismic and wind loading requirements for a particular geographic location.

A continuous concrete slab is the most common structure for placing and anchoring a module (see **Figure 1a**). It serves as a housekeeping pad with a 360 degree walk surface around the perimeter of the module. Additional features such as foundation walls, footings, and seismic anchoring are dependent on climate and soil conditions,

A variant of the continuous slab is multiple independent slabs, each having the same subterranean features as a continuous slab. Multiple slabs (see **Figure 1b**) are frequently used when a module is surrounded by impervious cover, such as in a paved area, and surface water drainage is an issue. Additionally, multiple independent slabs require fewer materials to construct, while still providing the necessary mass and anchoring properties.

Piers or concrete columns (see **Figure 1c**) of adequate strength and geometry are smaller structures that may be used as a means of support when spaced to accommodate the load bearing contact points of the module. This type of foundation permits the module to be installed in areas where drainage of surface water is accomplished through leaching into the earth in the vicinity of the module rather than flowing over impervious surfaces towards drains, catch basins, or other surface drainage structures.

Figure 1

Module being placed on concrete foundation
 (a) Continuous
 (b) Multiple
 (c) Piers / columns



Underground wire and piping interconnections

Electricity supplied to and delivered from data center modules is usually accomplished with less complexity and lower cost materials, if it is run underground. Underground feeders and circuits, along with related communications raceways, and most mechanical connections over 12 m (40 ft) long install more simply and with lower cost installation materials when installed underground.

With underground interconnections, there are generally fewer support structures to be built and the opportunity to use lower cost-to-implement materials, such as PVC conduit (ideal for most underground applications) and pre-insulated pipe. Additionally, power facility modules can be ordered that literally drop right over pre-installed underground electrical conduits, simplifying weather sealing and conductor terminations. In the case of the cooling modules, chilled water piping might emerge from underground directly adjacent to the module, simplifying or all together eliminating the need for support hardware or special structures.

Procurement considerations

The procurement process for a prefabricated data center is simpler and quicker than that of a traditional data center. The simplicity, in part, is the result of each module being purchased from a single vendor as a single complete system or set of systems, and *not* a collection of individual subsystems from various vendors. Delivery challenges from traditional data center projects – such as receiving incomplete bill of materials, or missing delivery schedules for certain parts – are avoided when the entire system ships as one.

There are regulations that impact the dimensions and weight of prefabricated modules for delivery via roadways (and other forms of transportation), but prefab integrators / vendors generally take this into account, since mobility is one of the common reasons for deploying prefabricated data centers. Transportation and packaging / un-packaging considerations are further described below.

Transportation

Transportation of data center modules to a site is generally by truck. In most countries and regions of the world, transportation by truck on public roads is regulated. Along with adherence to speeds and rights of way, over-the-road regulations govern the **weights** and **dimensions** of vehicles including the cargo that they carry, as a matter of public safety. Standards imposed on truck and cargo weights and dimensions reflect the capabilities of roads, bridges, and other structures to safely accommodate all vehicles that are legally using the roadway system.

In the United States, for example, the interstate highway system has uniform regulations for weights and dimensions of tractor and trailer combinations, however the individual states may enforce a separate set of regulations that further define the weight distribution of loads carried by trucks. These vary by state, and govern all aspects of trailer geometry from the distance of the rear axle from the trailer's "king pin" to payload weight by axle, to different distances between axles. This is similar to the European Union and other large countries where a set of common regulations exist for the region but member countries, provinces, states, etc. enforce their own separate set of regulations.

One of the benefits of prefabricated data center modules is its ability to be transported with ease. **Table 2** provides weight and size limits for vehicles on roadways in various regions of the world. Tractor trailer combinations can generally travel the highway system free of any special permits within these limits, so long as axle placement and axle loading meets the regulations of each state through which the load will pass. ISO containers are a common form factor for modules, as they already dimensionally meet these requirements.

Other form factors up to 3.6 m (12 feet) wide (over-sized loads) and at greater gross weights are possible in some locations, but require special permits, more specialized tractors and trailers, and adherence to prescribed routes and transportation schedules that define the exact hours that the load may travel certain roads and special times and protocols for approaching and crossing certain bridges.

Since data center modules are often at the upper end of the size and weight limits, manufacturers often use the services of transportation and logistics companies that specialize in the delivery of large, singular payloads. The actual carriers are primarily independent truck operators, sub-contracted by logistics companies, who own the highest quality tractors and most specialized trailers, and offer their services to haul sensitive loads and cargo.

Table 2

Roadway transportation weight and size limits

Region	Weight limits	Size limits
United States	<ul style="list-style-type: none"> 36 tonnes (80,000 pounds)³ 	<ul style="list-style-type: none"> 2.6 m (8'-6") width, 4.1 – 4.4 m (13'-6" – 14'-6") tall⁴, depending on state
Europe	<ul style="list-style-type: none"> 36 to 60 tonnes (80k – 132k pounds), depending on country and vehicle class⁵ 	<ul style="list-style-type: none"> 2.55 m (8'-5") width, 4 m (13'-2") tall⁶
China	<ul style="list-style-type: none"> 46 tonnes (101k pounds)⁷ 	<ul style="list-style-type: none"> 2.5 m (8'-5") width, 4.2 m (13'-9") tall⁷
Canada	<ul style="list-style-type: none"> 45 to 62 tonnes (99k – 137k pounds), depending on vehicle class⁸ 	<ul style="list-style-type: none"> 2.6 m (8'-6") width, 4.15 m (13'-8") tall⁸

*1 tonne = 1000kg (metric); Note, 1 tonne = 1.102 ton (imperial)

Prior to transporting the module(s), the vendor and logistics partners should ensure that:

- Any loose items are tied down or removed
- Outside electrical ground connections are removed
- Outside tie-downs are removed
- All doors are secured
- No other outside attachments remain
- Final dimensions, weight, and center of gravity are available at time of shipment.

Another protective measure routinely taken, prior to shipment, includes the installation of temporary structural supports to keep the module true and square during transit.

Packaging

Traditional data center projects use significant volumes of pallets, cardboard, plastic, and other packing materials in order to safely deliver the equipment to the data center site. This results in added cost and complexity (i.e. for dumpsters, and man-hours to dispose of the packaging). On the other hand, with prefabricated modules, the majority of the physical infrastructure (power, cooling, rack) subsystems are installed and secured within the modules prior to delivery, which reduces, by an order of magnitude, the amount of packaging necessary to transport the modules safely.

One exception is the UPS. When a module includes a UPS system, the batteries are generally removed after factory testing and prior to shipment, due to their heavy weight. Transporting the module with them installed may result in damage to the UPS frames during transit, as there is a great deal of variability in the performance of tractor trailer air ride systems. Therefore, the batteries are generally placed in cartons and restrained (ideally by ratchet straps), on the floor of the module.

Figure 2 illustrates a comparison of the typical volume of trash for a 500 kW 2N redundant data center.

³ <http://www.imstransport.com/weightlimits.php>

⁴ <http://ops.fhwa.dot.gov/Freight/sw/overview/index.htm>

⁵ <http://www.internationaltransportforum.org/IntOrg/road/pdf/weights.pdf>

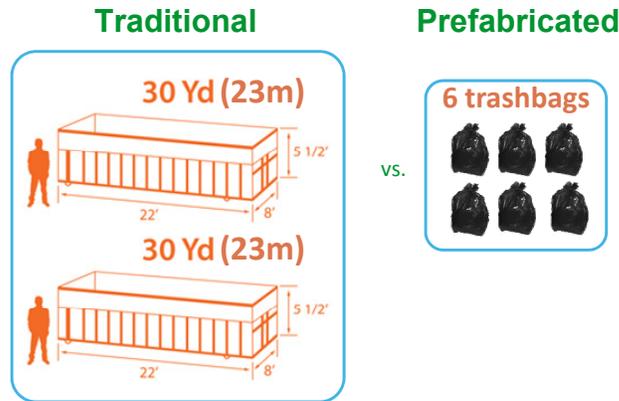
⁶ <http://www.internationaltransportforum.org/IntOrg/road/pdf/dimensions.pdf>

⁷ http://www.moc.gov.cn/zhuzhan/zhengwuqongqiao/jiaotongbu/jiaotongbuling/200709/t20070926_410849.html

⁸ http://www.todaystrucking.com/images/MOUsizemdWeight_2005.pdf

Figure 2

De-trashing comparison of prefabricated vs. traditional data center



Protection from the elements

When a module is not in a fully enclosed, weather tight container, thought must be taken in how the module is shipped. Consider an IT module that ships in two parts, and gets connected together onsite to form one larger module. The open end of the module must be sealed to prevent water or wind from damaging the equipment inside. Two common approaches by vendors include:

1. A temporary hard exterior such as high quality plywood mounted on studs
2. Heavy duty shrink wrap similar to how a boat is protected and transported

Plywood connected to studs may be viewed as more protective given its rigid nature, but results in a greater amount of trash compared to shrink wrap. A shrink-wrapped module can be unpackaged much more quickly – simply by cutting the shrink wrap, pulling it off, folding it up, and placing it into trash bags. This means less man hours to de-trash the data center systems and less trash to dispose of. The continued efforts to increase the efficiency of data center deployments will make the latter the better choice.

The method of packaging during shipment also impacts the condition the module is delivered in. For instance, the use of a tarp will protect the outer shell from the elements, keeping the module clean. A module that is neither shrink-wrapped nor tarped is likely to require otherwise avoidable cleaning.

Site installation considerations

Well-designed prefabricated modules facilitate a simpler, quicker installation process. Key considerations during the installation process include where to position the module(s), how to handle and place the module(s), and how to secure the module(s), to ensure a reliable, efficient operation.

Positioning and orientation

Consideration of a module’s placement outdoors can have a significant impact on the delivery and operation of the module, from a reliability, efficiency, accessibility, and maintainability standpoint. The following are best practices in positioning the modules:

- Orient the modules with their shortest face to the sun. In a hot climate, this can significantly reduce the heat gain in the module or use a shading device to minimize heat gain.
- Place the modules away from under trees, lamps, low or high voltage wires, or other objects which may become dislodged in a natural event (storm, earthquake, etc).

- Lay the site out in a way that prevents the possibility of vehicular collisions with the modules.
- Position the modules free from obstruction so that a crane, forklift or other material handling device can place and deliver equipment
- Place modules in a location that allows for water to drain away from the module

Some prefabricated modules are designed to be stackable, as illustrated in **Figure 3**. When space is limited or at a cost premium, this may be an added benefit. It is important to include stackability in the design requirements when working with a vendor and project team to insure site, structural, and environmental requirements are met.



Figure 3

Stacked modules to save space

Handling & Placement

Deliveries of data center modules should be scheduled to arrive on or close-by the installation site during the “over-night hours” preceding the day the modules are placed on their foundations. Handling and placement can be accomplished by a wide array of common material handling machines

Most prefabricated modules are within the common load ranges of industrial forklifts and drivable cranes. While seaport locations generally use “container handlers” (which are forklift variants – see **Figure 4a**) and overhead cranes (see **Figure 4b**) to move the modules, mobile cranes (i.e. truck cranes) are the economical lifting machine of choice for site installation (see **Figure 4c**).

Truck cranes are able to travel the roads on conventional pneumatic tires, arrive on a site, and transform itself into a stable, heavy-duty lifting machine. With cranes, the most time consuming aspect of on-site activity is the set-up and disassembly of the crane, frequently taking an hour or two at each end of the day, whereas once assembled a single crane can lift and place several data center modules per hour.



Figure 4

Module handling machines:

- Container handler
- Overhead crane
- Truck crane

Ordinarily the number of drivers that are involved in the delivery of the crane, counterweights, and accessories, are the minimum number of persons needed to rig, lift, and accurately place

the module(s). While a variety of labor and construction site staffing considerations affect the size of the crew on hand for any construction operation, a crew of three, consisting of the crane operator, and two other operating engineers who manage the crane's assembly, attach the load, and provide communications and direction to the crane operator are all the personnel necessary to remove the module from the trailer, and place it accurately on its foundation.

Data center modules built within ISO container form factors provide the greatest flexibility with respect to attachment and placement, as these containers are equipped with corner blocks that enable attachment of a wide variety of lifting and securing hardware.

Lifting by crane usually entails a combination of “slings and spreaders”, where two spreaders (slightly greater in width than the module) are attached to the crane's hook via four slings, and the module is attached to the spreaders (see **Figure 5**) by four additional slings that tie into the module via a corner block lifting fixture⁹, or directly via shackles.

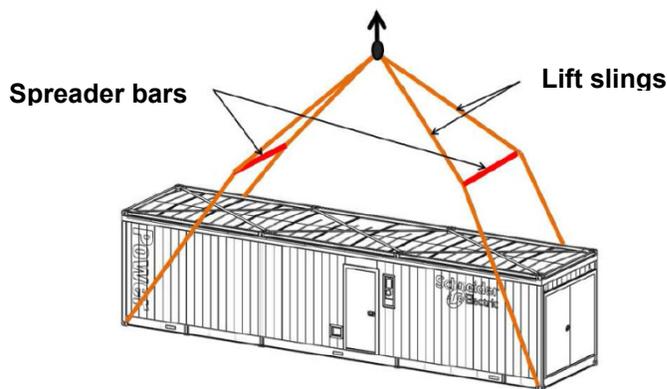


Figure 5

Lifting an enclosure with slings and spreader bars

The following are key considerations for module handling and placement to prevent damage:

- Minimize contact between the lifting straps and the module.
- Balance the load at each lifting point so that module is as level as necessary during lifting.
- Utilize a crane company that is experienced with lifting this type of load, and comes with proper rigging equipment to avoid delays in project.

Securing the modules and seismic considerations

Once a module is placed in its desired location, it is important that it be fixed in place to withstand uplifting and horizontal forces such as wind loading. This is often accomplished with anchor brackets which are fixed to the supporting structure by hold-down bolts.

Seismic requirements must also be considered, particularly in geographies with high likelihood of seismic events. Where building codes exist and are enforced, construction of all kinds must have features that mitigate the effects of seismic activity. In the case of data center modules, the concrete foundation and “foundation to module connection” is how seismic requirements are met.

Data center manufacturers generally offer a seismic planning guide to all prospective customers. The guide is authored by a structural engineering firm regularly practicing the disciplines associated with seismic design. Within the guide is the official geological survey

⁹ The location and number of lifting points is dependent upon the particular module.

maps of a region or country, with the seismic zones carefully noted. For a country like the United States, seismic zones are categorized as “Low”, “Moderate”, “High” and “Above 2.75 – Short Period Spectral Response Acceleration”¹⁰. For each category of seismic zone, the engineer’s guide provides detailed calculations associated with applicable concrete (and steel) foundations, piers, and other accessories required to seismically secure and restrain the modules, subject to local soil conditions and other site specific factors, such as the grade of the land.

While the guide and plans are not intended to be the actual permit document and drawing(s) for any particular installation, the guide provides a local engineer with a valuable time-saving template for installing that manufacturer’s prefabricated data center modules. The guide typically includes actual examples of reinforced concrete foundations, all of the attachment and anchoring hardware, and all of the calculations that describe their performance.

Conclusion

Prefabricated data center modules change the nature of data center planning, and to a large degree dramatically compress the schedule associated with bringing a data center from concept to completion. For modules installed outdoors, the schedule is often a race between executing and completing the site plan, and the delivery date following the placement of an order. Understanding the unique aspects about these data center projects (as compared to traditional data centers) is crucial to avoiding delays, unnecessary costs, damage, and/or inefficient operation. This white paper described key considerations relating to the planning, site preparation, packaging, delivery, handling, placement, and securing of data center modules. Armed with this information, the data center project can be executed as planned, and deliver the expected benefits.



About the authors

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¹⁰This fourth category (above 2.75) generally requires special site specific calculations and design to be performed, and is outside the scope of a standard set of parts, methods, and instructions.



Resources



[Accounting and Tax Benefits of Modular, Portable Data Center Infrastructure](#)

White Paper 115



[Data Center Projects: System Planning](#)

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[Prefabricated Power and Cooling Modules for Data Centers](#)

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