Where's the Real Estate?

Redundancies, Servers, Edge Sites, and the Search for Real Property's Role in the Modern Data Center

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Abstract

Data centers are complex businesses that use real estate as a platform. The real estate components of data center facilities provide valuable physical and locational attributes to the enterprise; however, due to the significant presence of both tangible and intangible personal property, it can be difficult to identify what exactly is to be considered the real property. The real estate must be untangled from the other elements creating value to satisfy the requirements of many appraisal assignments. This is the case with assignments such as condemnation or tax assessment, lending, and other situations. This article discusses the elements of data center real estate that add the most value to the enterprise, and explores methods, theories, and agency guidance to help appraisers conduct their own investigations into what constitutes real property. This discussion offers a brief, albeit intentionally simplistic, case study to illustrate some of the concepts involved.

Introduction

The modern data center is a critical component of the world's information and telecom infrastructure. This type of facility provides governments, industry, and even individuals access to the power, security, and connectivity needed to support the systems that oversee our technologically dependent modern lives. A successful data center is one that can achieve the following three goals: guarantee maximum "uptime," operate efficiently, and deliver acceptable end-user performance. There is no "typical" location per se for data centers. However, certain features are necessary or desirable. Included are, of course, access to power and fiber optics, complementary neighbors, a receptive local government, security and safety from natural disasters, and cost and environmental considerations. A favorable climate that minimizes the need for excessive cooling systems is also a positive feature. Finally, proximity to skilled labor and transportation is essential. Occasionally, however, some of these goals have been achieved by placing data centers in caves, mobile container units, and high-rise offices atop urban "fiber highways"—even within tubes submerged in the sea. One thing remains constant: A data center, whether mobile or fixed, owned or leased, enterprise or colocation,[1] must evolve as quickly as the systems it serves.

The rapid growth and evolution in this asset class can be disorienting for real estate professionals well versed in more conventional classes of real estate. For appraisers, understanding the allocation of value between real estate and personal property components is often a basic assignment requirement. The allocation debate in data centers is no different than the ongoing debate by appraisers of other complex properties. Appraisers seeking the market value of the data center real estate alone must reconcile their observations of a market where all activity involves the transfer of the total assets of an operating business or, in the case of a data center, total assets of the

1. An enterprise data center is a data center facility owned and operated by a company for its own use. With a colocation data center, customers lease power and space from a data center provider. Luke Smith, "Different Types of Data Centers. A Guide for New Industry Professionals," datacenterHawk, March 5, 2020, https://bit.ly/3VWxem3.

system. When an assignment calls for real estate value only, correctly applying a methodology that will result in the market value of the real property alone becomes just as important a task as the basic valuation approaches. Modern data center facilities represent a meticulously engineered web that combines real property with tangible and intangible personal property components, leaving real estate investors, assessors, and market observers searching for the answer to the question, *where* is and, more importantly, *what* is the real estate? This article will provide the necessary insights into the valuation issues associated with real estate–only analyses of this complex property type, and presents a simplistic case study to illustrate the application of the valuation process.

Data Center Facility Overview

According to Cisco Systems, a *data center* is "a physical facility that organizations use to house their critical applications and data."[2] According to IBM, a *data center* "is a physical room, building or facility that houses IT infrastructure for building, running, and delivering applications and services, and for storing and managing the data associated with those applications and services."[3]

Although the definition of *data center* can vary by source, all can agree that the modern data center is a far departure from the mainframe computer rooms of the 1950s. An argument could be made that the property type did not even exist as an investable class of commercial real estate prior to the mid-1990s. The Telecommunications Act of 1996 vastly deregulated many telecommunications companies, leading to considerable expansion in the real estate base. The motivation behind the act was a bet that consumers would benefit from increased competition among their service providers.[4] Today, the embodiment of the state-of-the-art data center is a "Tier 4" facility that is secure, fault tolerant, and strategically located with direct power feeds from multiple independent power grids offering layers of system redundancy.[5]

These facilities serve as the backbone of the burgeoning cloud services industry, which has grown dramatically in recent years. Cloud computing now offers users "hardware-free" computing solutions and data storage where the user/software interaction is provided as a service. These capabilities are ubiquitous in modern business, where they are readily identified by the acronym "aaS" (as a service) and include subcategories SaaS (software as a service), PaaS (platform as a service), and IaaS (infrastructure as a service), to name a few. One of the early and most visible pioneers of this disruptive delivery model was Salesforce.com in the early 2000s. Salesforce.com was one of the first companies to provide sales professionals with a Customer Relationship Management (CRM) platform that was 100% web based. Salesforce's applications are enthusiastically touted as "software free," which means that the software is (1) not distributed on packaged media (CDs, etc.) and (2) not run on local machines. The user only needs a browser and a decent internet connection. The idea of critical computing power being sold at an electronics store, with a price tag as stout as its latest processor speed, has been retired in favor of "service-based" computing power.

Appraisal of a data center requires an understanding of (1) the nuances that create value in the industry and (2) the real property and tangible and intangible personal property components that aggregate to form the total assets of the data center. As with any complex property type, a data center appraisal must begin with an understanding of the system in its entirety, answering the following question: What measurable elements create the value that would drive pricing in an open marketplace? The appraiser's task begins with identifying the critical elements that users of data centers require. The three most critical elements that determine a successful data center facility are as follows.

1. Guarantee Maximum "Uptime": Or, conversely, minimal "downtime." Data center developers are engaged in a never-ending chess match with Murphy's Law. If they can disprove this law, thus ensuring that "if it can go wrong, it WON'T go

2. Cisco Systems, https://bit.ly/3WT8Pjf.
3. IBM, https://bit.ly/3yt9Zrz.
4. Judson H. Clendaniel, "Telecommunications Infrastructure Properties," chap. 16 in *Appraising Industrial Properties* (Chicago: Appraisal Institute, 2005), 453.
5. A Tier 4 facility refers to "uptime" or operational consistency and will be further defined later in this article.

wrong," the facility is a success. The result of losing this chess match is system downtime. If an engineer designs a data center that shuts down when a power disruption occurs, Murphy has won, as the data center has logged an increment of downtime. A facility's uptime is guaranteed by both site selection and building design elements. A site located near a threat of natural disaster (earthquake, flood, etc.), or a community with exposure to security threats, faces a level of risk that could threaten attainable uptime.

From a design perspective, the main defense against downtime is system redundancy or, simply, "backup." The Uptime Institute uses a four-tier rating scale in certifying a data center's ability to ensure uptime over a typical year of operation. The scale is based on the center's design, construction, and operational elements. The highest tier, Tier 4, certifies that a data center can ensure 99.995% systems uptime, or no more than 26 minutes down, each year. Tier 4 facilities contain fully redundant infrastructure and support systems (2N), which is a higher level of redundancy than component-level redundancy identified as (N+1).[6] Tier 4 facilities are typically fed from two independently sourced power grids and ensure complete fault tolerance with no single points of failure. In contrast, Tier 1 data centers must ensure 99.671% annual uptime (approximately 1.2 days down) each year.[7] Tier 1 data centers differ dramatically from Tier 4 centers in cost, market favorability, and ultimately value.

2. Operate Efficiently: Efficiency can mean different things to different people. In the interest of exploring elements that impact market value, we will look at efficiency as it relates to the performance of a data center as an investment. This vantage naturally incorporates other important elements of data center efficiency, including resource usage (electricity, water, etc.). These elements of efficiency are also linked to investment performance, as the market perception of a data center facility's environmental impact can influence the sources available for funding. According to the Appraisal Institute's *The Valuation of Green Commercial Real Estate*, "In the past few decades, market demand from institutional investors, individual property owners, tenants, and consumers has been shifting in favor of buildings that are more resource efficient and have fewer adverse effects on their surroundings and occupants."[8] Resource consumption is a highly visible measure of efficiency and an element that spurs considerable scrutiny from environmental advocates as well as the public. From a power perspective, data centers are built to consume the same amount of power as many midsize US cities, making their environmental optics particularly poor. Appraisers must be aware, however, that these concerns are related to the interests of the investment community. Data centers are investments of a scale that very few noninstitutional investors can pursue. Institutional investors have an increasing interest in projecting a commitment to public and value-based decision-making when it comes to deploying capital.[9] Resource efficiency is not just a matter of improving the bottom line; it is a matter of qualifying the facility as a purchase that aligns with an institution's social mandate.

Data centers employ sophisticated measures to ensure operational efficiency. A data center facility must undergo periodic energy-efficiency reviews that involve heat monitoring to track thermal zones, where cool air is ingested into the servers and warm air is diverted out. The PUE (Power Usage Effectiveness) rating system was designed to measure power efficiency on a scale of 1.0 to 3.0, with 1.0 being the most efficient facility and 3.0 being the most inefficient (although it is possible to have a PUE that exceeds 3.0). This calculation is simple. The total power consumed by the facility is the numerator and the total power consumed by the critical IT equipment (servers, etc.) is the denominator.[10] The goal for an efficient data center is a ratio that approaches 1.0.

The pursuit of "PUE 1" has caused some incredible creativity on the part of developers. Naturally cooled facilities, such as caves and locations adjacent to cool water, have attracted serious interest as data center sites. The most

6. The N rating system is simply an algebraic notation used to measure redundancy. If it takes N number of batteries to support a rack of servers, a 2N configuration would supply a fully redundant set of batteries and an N+1 configuration would supply just one extra battery.

7. Colocation America, "Data Center Standards," https://bit.ly/3KgwbHW.

8. Timothy P. Runde and Stacey L. Thoyre, *The Valuation of Green Commercial Real Estate* (Chicago: Appraisal Institute, 2017), 71.

9. Runde and Thoyre, 71.

10. Digital Realty Inc., "What Is Power Usage Effectiveness (PUE)?," https://bit.ly/3wEnUuu.

extreme of these examples is Microsoft's Project Natick, which did not just seek adjacency to naturally cooled water; the data center itself was submerged into the sea. Bringing a PUE as close to 1.0 as possible has become an obsession not only for developers but also for industry advocates defending the tremendous burden these facilities can place on energy resources.

An inefficient data center may also be subject to other operating expenses that fall out of line with competitors. Atypical maintenance requirements and even impositions such as inordinately high property tax expenses play a considerable role in operating inefficiencies. Some assessment jurisdictions have such unpredictable assessment practices that developers have forgone otherwise attractive sites for those within markets with more predictable taxation policies.

3. Deliver Acceptable End-User Performance: Data center locations are not based solely on security and favorable utility arrangements; they also must deliver acceptable performance to the end user. Network performance is a critical success factor for high bandwidth internet uses such as streaming video and online gaming. For these end uses, the most secure and efficient data center will be at a competitive disadvantage if location or design shortcomings create any performance issues. Any user of streaming services who has encountered the dreaded "loading" or delay interferences has experienced transmission latency firsthand. Network latency is a major performance threat addressed by current developers. At its basic definition, *network latency* means a delay in network communication.

One of the most impactful decisions a developer can make regarding user performance is the selection of a site before a shovel ever hits the dirt. With the advent of fiber optic network cabling, where data is transmitted through pulses of light and not electrical charges, a network's latency is limited only by the speed of light. This speed can be improved by either reducing the distance between a signal's origin and its destination or minimizing sources of signal interference. Some of the physical characteristics that typically drive conventional real estate site selection are of little consequence to data center developers. These developers usually have strong engineering backgrounds and are looking for the best location on the internet because this will determine the quality of the end user's experience.

Edge computing is a data center development strategy for small deployments where the location is strategically selected for proximity of the network to the end user. An ideal edge location allows a data center to be as close to the end user as possible, thereby minimizing network junctions and other possible sources of signal interference. Although this imperfection may be seen as a brief inconvenience, the expansion of technologies such as automated vehicles will make all latency and performance concerns a matter of critical public safety.

Conventional Approaches to Valuing an Unconventional Property

The Appraisal Institute and the Uniform Standards of Professional Appraisal Practice (USPAP) identify three fundamental approaches to develop an opinion of the market value of a real estate asset. Two of these approaches, the sales comparison approach and the income approach, require direct market observation to arrive at an indication of value. With data center assignments calling for just the value of the real estate—for example, in condemnation, real estate assessment, mortgage lending, and others—the appraisal problem becomes much more complex. When the most productive use of a piece of real estate is a component of a system that relies upon other tangible and intangible assets, the observations of market activity can fail to lead the appraiser to the market value of the real property alone. This is not unlike the valuation of hotel or casino real estate, both of which reflect performance figures that are significantly impacted by intangible and tangible personal property components in addition to the real estate.

In the Appraisal Institute's text *Appraising Industrial Properties*, the reader is cautioned that sales of comparable data center properties must be carefully analyzed to determine how closely the circumstances behind a sale transaction align with the defining elements of market value. The text also warns that "although these buildings [data centers] are costly to construct and operate, they generally constitute a **small portion** of the cost of a much larger endeavor"[11] (emphasis

11. Clendaniel in *Appraising Industrial Properties*, 458.

added). So, the question for the appraiser becomes, how much did the real estate sell for? Or how much did the real estate contribute to the overall sale price?

In most conventional classes of real estate, the asset appraised is well represented by the assets being transferred in comparable sales in the market. The sales comparison approach and income approach can provide reliable indications of market value for the subject real estate in these situations. Unfortunately, for complex properties such as a data center, the transactions observed in the market rarely involve the transfer of the real estate asset alone. Similarly, the revenue generator exceeds that of just real estate rent. If real estate value alone is sought, an allocation step often follows the sales comparison and income approaches. Appraisers with experience in ad valorem tax matters and condemnation proceedings, for example, are well versed in the allocation practices required to properly appraise the specific asset called for in the assignment.

In the case of the income approach, most leasing activity is not based on a tangible economic unit, such as rent per square foot. Colocation data centers do not lease space; rather they "license" monthly access to kilowattage, and it is not simply power access that they are licensing. Server users need access to *conditioned* power, and power conditioning is equipment intensive. Conditioned power is power that has been routed through batteries and specialized equipment to flatten the voltage oscillations present in the raw, public power grid. In the United States, such disruptions may seem unimportant; however, in developing nations with unreliable power grids, this capability is especially important. As users of computers and sensitive electronics in our homes, we likely have our equipment plugged into a surge protector so that we are protected from similar voltage oscillations.

The third conventional approach to develop an opinion of market value is the cost approach. This approach is reliable in circumstances where the assets that transfer, or are leased in the market, fail to provide "apples to apples" comparisons to the asset appraised. It can also be the most difficult approach to perform correctly. However, the cost approach is particularly useful for complex property types, as the proper execution of the approach isolates all individual components of the asset. The market value of the land plus the depreciated costs of the building improvements and permanent fixtures provides a market value indication for the real property alone. The tangible and intangible personal property can be identified and omitted during the development of the replacement cost new.

Many analysts cite the cost approach as providing a strong indication of what a piece of real estate *cannot* be worth. An analyst may argue, "If sites comparable to the subject are available for $1.0 million and one can build an identical building for $5.0 million, there is no logical way that the subject could be worth $12.0 million." This logic may have allegorical merit to most laypersons; however, seasoned appraisers are able to draw more practical conclusions from the cost approach. In fact, one of the recognized indicators of the existence of a business enterprise owning/selling/leasing more than just real estate is when the expected sale price is greater than real property value by the cost approach, or when capitalized income to the total assets is greater than real property value by the cost approach.[12] Appraisers trained in the application of the cost approach are able to study multiple market sources and develop very reliable estimates of depreciation that in turn result in a reliable indication of what the real property *is* worth.

Guidance on Data Center Real Estate Appraisal Assignments

A common shorthand sometimes used in classifying personal property in the market for homes, offices, and other more conventional types of real estate is whether an item is "bolted down." According to this notion, affixing an item to the land results in that item being permanently annexed to the real estate. Despite the consensus on the concept of chattels in general, applicable law and custom govern when a specific item is a chattel in a particular assignment. This includes how the item would be assessed.[13] With compli-

12. Appraisal Institute, *Fundamentals of Separating Real Property, Personal Property, and Intangible Business Assets* (Chicago: Appraisal Institute, 2011, minor revisions 2022), Part 8-136.

13. Appraisal Institute, *The Dictionary of Real Estate Appraisal*, 7th ed., s.v. "trade fixtures."

cated properties such as manufacturing facilities and data centers, many pieces of equipment are affixed to the real estate. However, these items are still transferred between facilities over the course of their useful lives and are often repurposed to serve the needs of the operation, not the real property. Financial institutions, GAAP standards, and regulatory agencies all are too sophisticated to fall into the shorthand trap of simply looking for a "bolt" to conclude a component meets the real estate classification. Professionals in other areas of the financial services sector will exclude large items of equipment—many of which are bolted down—from a piece of real estate. For example, financial institutions are unwilling to include many bolted items of equipment in an estimate of real property collateral value used to secure a mortgage. If the shorthand "bolted down" measure had legal merit, an owner of a small surgical practice might bolt a $2.0 million Da Vinci surgical robot to a $1.5 million building and argue to a bank that the practice has $3.5 million in real property loan collateral. Although absurd, this proposition would be particularly attractive to the borrower in this example because loans secured by real property are at more favorable terms than those secured by chattels.[14]

In the realm of ad valorem property tax practice, if an item does not qualify for a real property loan rate, it should not qualify for a real property tax rate. It is important to emphasize that the "rates" may vary from state to state, as does what constitutes real property and personal property. It is incumbent upon the appraiser to learn the standard in the jurisdiction in which the property exists. The advice of an attorney may be necessary to ensure a complete understanding.

Two identical data centers could have ownership agreements in place that separate the title to different components of the facility. These agreements are typically tailored to any one of the many business models that could drive the operation. Ownership agreements are typically outlined in the form of a lease, where the landlord leases a specific basket of property to the tenant or operator, who owns the balance of the property. A common arrangement with such a lease is the *powered shell* model, in which the landlord owns the land and building structure and the tenant owns, or has the right to construct, the finished data halls and interior infrastructure. Alternatively, if all assets of an operating data center business are under the same ownership, the arrangement is typically referred to as a *turnkey* business model. In this business model, the customers interact with a complete and operational data center.

With different business models, different entities can own specific items of interior infrastructure. Examples include raised flooring, Computer Room Air Handlers (CRAH Units), Computer Room Air Conditioners (CRAC Units), Uninterruptible Power Supplies (UPS systems), Power Distribution Units (PDU Systems), and various additional systems required for a data center to ensure the safe and optimal performance of the systems within. The following section addresses three perspectives intended to provide insight on current thinking as to where exactly the real estate lies within a data center.

Legal Definitions

In an assignment, the problem definition must include a complete agreement between the appraiser and the client as to the rights being appraised and the applicable laws and regulations to which the assignment development and assignment results must adhere. Not only are agency definitions an important legal consideration within an appraisal assignment, but the guidance itself can serve as insight into what others are thinking about where the real estate lies.

Northern Virginia is home to approximately 70% of the world's internet traffic due to the extensive data center base that has capitalized on the robust local telecom and power infrastructure.[15]

IBM's definition of a data center is worded in such a way that the data center is separate from the IT infrastructure. This implies that a data center can be appraised separately from the IT infrastructure and still satisfy the definition. But what exactly is IT infrastructure? According

14. Although there are subcategories—real chattel and personal chattel—*chattel* is broadly defined as movable or transferable property, i.e., personal property.

15. Datacenters.com, "Why Is Ashburn the Data Center Capital of the World?," August 29, 2019, https://bit.ly/4aGguEI.

to IBM, IT infrastructure intuitively "refers to the combined components needed for the operation and management of enterprise IT services and IT environments."[16]

The Code of Virginia defines a *data center* within its tangible personal property taxation section. The definition begins "a facility… used to house," and then lists an array of components.[17] Many of these components could easily be argued as marginal in terms of classification, which makes the Commonwealth's position particularly instructive. The specific line of separation between the component classifications is, however, subject to interpretation. The phrase "used to house" implies a delineation between the data center and the enumerated IT components. An office building is not typically a facility that "is used to house" an elevator or air-conditioning system; those components are expected by the market to be a permanent annexation to the real estate.

Different jurisdictions often have different definitions, so each can provide different guidance for interpretation. The California law includes specific guidance as well as a framework for interpretation of whether an item is to be considered real or personal property. Real estate investment trusts (REITs), which are robust sources of capital for the industry, adhere to strict guidelines set by regulators on what types of income and operating models can be included to qualify for a REIT investment. In the framework of an appraisal, the rules identified in the problem definition must be adhered to if the results are to be credible.

Ohio Supreme Court's Three-Rule Test

One of the first cases in the United States where the determination of real and personal property components was the central matter was the 1853 Ohio Supreme Court case of *Teaff v. Hewitt*. This case established a three-part test for determining whether an item should be classified as real or personal property. The three tests established were (1) does the item represent an actual annexation to the real estate, or is it something appurtenant thereto? (2) what is the appropriation to the use or purpose of that part of the realty with which it is connected? and (3) is the intention of the party making the annexation to make the article a permanent accession to the freehold?[18]

The central themes of this three-part test are intention and permanence. These themes are often presented in later cases, and the citation is incorporated into decisions to this day. If a conservative interpretation of the *Teaff v. Hewitt* decision is applied in the analysis of a specific cost component, intention and permanence must be the deciding standards. An analyst performing this test on a data center must ask whether the item in question is intended to contribute to the IT systems within the data center, or is this item intended to contribute to the permanence of the real estate?

Road Addresses versus Network "Addresses"

Practitioners entering the field of data center appraisal may encounter discussion of "location on the internet." For real estate analysts experienced in providing location commentary based upon street addresses, it may seem that they are being asked to teleport themselves inside the guts of a mainframe computer to provide location commentary in the virtual landscape. Students of real estate have been ingrained with the notion that "location, location, location" overrides all other components of real estate value. But location on the internet is a function of connectivity within the grid—a concept familiar to many network engineers. So, what are the implications of the location on a network to a real estate appraisal?

One of the fundamental principles creating value in real estate is the principle of permanence. In theory, the fee simple interest in a property should be able to produce benefits (often measured as "market rent") into the future. The future benefits to a property owner are guaranteed by the principle of permanence. But how can permanence drive value when the location on the network changes? In conventional real estate, street addresses are permanent, and frontages are permanent; however, networks are dynamic and fluid. The market for edge data centers—small deployments of 1.0 to 2.0 Mb per facility—is

16. IBM, "What Is IT Infrastructure?," https://bit.ly/3wVOwY0.

17. Defined in subsection 43, "Computer equipment and peripherals used in a data center," https://bit.ly/3UXMtL3.

18. *Teaff v. Hewitt*, 1 Ohio St. 511 (Jan. 1853) Supreme Court of Ohio. Opinion available online at https://www.jstor.org/stable/3301853.

growing quickly due to performance concerns of end users. This allows a high-performance network location to be secured with minimum capital committed to a permanent location. When the site is no longer at an optimal location on the network, it can lose its edge advantage and ultimately market interest and value.

Case Study

Against this foundational background, a simplistic case study can be presented to illustrate the application of a real estate appraisal for a data center property. The case involves a fictitious enterprise data center that recently opened within a converted industrial building located in an expanding Midwestern suburban neighborhood. The facility's opening caught the attention of the local assessment district, which significantly increased the real property assessment value. The district notified the taxpayer that the market value for the real property was to be increased to $15.0 million for the tax year.[19] The taxpayer disagreed with this assessment and suspected a misallocation between the real and personal property components. The taxpayer filed an appeal and engaged an appraiser.

The subject property consists of a single-user enterprise data center leased to a telecommunications provider near a population base that is expanding rapidly due to significant growth in the local FIRE[20] employment sector. The facility is master-leased and the critical power capacity offered is 3.0 MW, which is conditioned and fully backed up by system redundancies ranging from N+1 to 2N configurations. The facility was brought online after the landlord acquired an existing light manufacturing property and converted the building for use as a data center after executing a lease agreement. According to the lease, the landlord would acquire the building and renovate the structural components to accommodate the heavy IT infrastructure required for the tenant's systems. The tenant would then develop and own the internal infrastructure. The tenant required access to local in-ground network cabling band and also a satellite dish, which cost approximately $2.0 million installed and was owned by the tenant. The principals of the landlord and tenant are related parties, with the development leg of the business capitalized by a separate group of shareholders.

The building was selected based upon the operator's motivation to establish a network site that was close to an expanding end-user base of residents and businesses. The property was adjacent to rail lines and enjoyed good proximity to high voltage power lines.[21]

Appraisal Methodology

The appraiser researched the current market for data centers as well as the land use trends in the area to develop conclusions as to the highest and best use of the subject property. As part of the research for this assignment, the appraiser conducted the eight-step highest and best use analysis, which incorporates the six steps of market/marketability analysis.[22] The analysis showed that the data center market in this location was not yet gaining the interest of developers motivated by speculative rental income. The analysis revealed some limitations on power supply and taxation policy that could be dissuading developers from entering this market at a typical pace. The appraiser concluded that the highest and best use of the vacant site was to hold the site for two years for future industrial development and the highest and best use of the improved property was for continued use as a data center.

Since the subject property (1) qualifies as a special-purpose property and (2) requires allocation steps as a condition of the assignment, the appraiser deemed the cost approach to be the most appropriate approach to value.[23] This approach was particularly attractive since the

19. All cost figures and configurations are intentionally, and substantially, different from our observations, as this is a highly confidential and sensitive sector of the commercial real estate market. Credible analysis demands that each practitioner conduct exhaustive research into the costs and configurations of each component part.

20. FIRE: finance, insurance, and real estate.

21. Rail lines provide easements that are used for telecom mainlines.

22. See Figure 18.1 in *The Appraisal of Real Estate*, 15th ed. (Chicago: Appraisal Institute, 2020), 318.

23. However, if the assignment is to develop an opinion of the market value, even when the property is deemed to be special purpose, use value or investment value may not be substituted for it.

exercise of completing the analysis would produce an indication of the market value of the real property, exclusive of the tangible and intangible personal property. The appraiser also decided to conduct an income approach to determine the market orientation of any existing rents. Finally, the appraiser performed a sales comparison approach with the understanding that the sales may provide limited information due to the propensity of market participants to carefully guard property and transaction details. Furthermore, the sales that were uncovered all represented transactions of total assets and not just the real estate.

Cost Approach

The appraiser concluded that the existing data center was the highest and best use as improved, which indicated that the cost approach would need to reflect a building of similar quality and utility as determined by market preferences. Since the conclusion of highest and best use as though vacant was not for development of the existing building, the appraiser knew that it would be necessary to investigate the sources of obsolescence.

The appraiser conducted an exhaustive study into surrounding land sales to develop an opinion of the market value of the underlying site. Analysis and adjustment of the comparable land sales set supported a market value conclusion of $4.0 million for the subject site as though vacant.

In researching an appropriate replacement cost new for the subject property, the appraiser surveyed similar data centers in the local and national markets. As allocation was a central matter of debate between the client and the appraisal district, it was important that the replacement cost new figure be carefully benchmarked, and also appropriately aligned with the agency guidance regarding what should be considered the taxable *real estate* that was the subject of the assignment.

The total development costs for the tenant's components were $9.0 million. Since the landlord purchased an existing industrial building, no historical cost information was available to use in deriving a cost new figure based upon activity at the subject property. The appraiser reviewed a national cost estimator manual and investigated comparable data center development costs based upon careful review of the county's guidelines, which were in the problem identification. The appraiser estimated an appropriate replacement cost new of $12.0 million for the taxable real estate alone.

To estimate an appropriate *entrepreneurial incentive* (EI),[24] the appraiser interviewed various market participants in transactions involving recently built data centers. After analyzing the anecdotal evidence developed from these interviews, the appraiser applied a 12% entrepreneurial incentive to the cost new for the subject property.

The appraiser employed a modified economic age-life method for estimating all sources of depreciation in this analysis. Given the significant interior renovations, the appraiser concluded that the effective age for the improvements was less than the chronological age of the original building. The first measure of depreciation was estimated based upon an age-life method, where the age numerator represented the effective age of the building improvements, and the life denominator represented the total expected economic life. The economic life was reconciled from public SEC filings for data center REITS, industry developer surveys, and a national construction cost manual that specifically addressed data center properties. Research uncovered only a handful of sales that could be used for a market extraction analysis, which reduced the reliability of this method when reconciling an appropriate economic life. Based upon the economic age-life analysis, the appraiser estimated total depreciation at 20% of replacement cost new plus entrepreneurial incentive.

The second measure of depreciation involved investigating sources of remaining depreciation that is not already captured in the initial economic age-life calculation. The remaining depreciation was estimated by using techniques typically related to the income approach, specifically, a feasibility rent analysis.

The appraiser's conclusion of replacement cost new was based upon investigation into the data center market, which revealed that many of the

24. *The Dictionary of Real Estate Appraisal*, 7th ed., s.v. "entrepreneurial incentive" is "the amount an entrepreneur expects or wants to receive as compensation for providing coordination and expertise and assuming the risks associated with the development of a project. Entrepreneurial incentive is the expectation of future reward as opposed to the profit actually earned on the project."

existing features of the building were not present in the competitive set. Because items such as internal lifts and design elements that removed internal structural columns for machine clearance were not required for data center use, the appraiser considered them to be superadequate. Items of personal property such as the satellite dish, which was owned by the tenant and could be disassembled and moved to another location, were also excluded from the analysis. As is summarized in Exhibit 1, the cost approach indicated a market value for the real property components of $7,538,462 for the building and $4.0 million for the land, or a total of $11.5 million (rounded) for the real estate.

Exhibit 1 Cost Approach Summary

Replacement Cost New Plus Entrepreneurial Incentive	$13,440,000
Less: Depreciation	20% or $2,688,000
Less: Remaining Depreciation Not Already Captured*	$3,213,538
Total Depreciation	$5,901,538
Depreciated Value of the Improvements	$7,538,462
Land	$4,000,000
Total	$11,538,462
Rounded	$11,500,000

**To be illustrated later in the study*

Income Approach

Data center income statistics reported by commercial real estate brokerages are typically sourced from colocation facilities that are built for use by multiple third-party IT clients. Colocation businesses license access to power and network connectivity based upon a kilowatt per hour per month license agreement. The power consumed by the IT and peripheral systems is provided by a carefully engineered assemblage of equipment designed to provide consistent and conditioned power.

In locations where network placement is the critical pillar to the data center's offering, leases can include a bifurcation between the rent of physical space in the facility and a separate charge for conduit access, which is often determined by the thickness and length of the conduit being accessed. An analysis of the income of these enterprises can be performed competently and, if done so, will result in a reliable indication of the market value of the total assets of the business.

The feasibility rent analysis selected for this assignment derives a rental rate that would need to be achieved by the taxable real estate alone if it were to be feasible to develop the property. The analysis compares market rents with developer economics as modeled by the cost approach.

During research of the local and regional data center markets, the appraiser concluded that an overall rate of 6.5% was most appropriate for the real property components of the subject property. At the selected overall capitalization rate of 6.5%, the subject property would need to generate a stabilized net operating income of $958,880 per year to sufficiently compensate for the development cost (adjusted for physical deterioration and including land value) of the facility. Any shortfall between the feasibility rent and the achievable rent would represent depreciation above and beyond that measured in the economic age-life analysis. This rent would be based upon an absolute net expense structure where all the operating expenses for the facility would be independently contracted and managed by the tenant. The feasibility calculations are shown in Exhibit 2.

Exhibit 2 Feasibility Net Operating Income

Replacement Cost New (RCN)	$12,000,000
Entrepreneurial Incentive (EI)	$1,440,000
Total RCN Plus EI	$13,440,000
Less: Physical Deterioration	20%
RCN Less Physical Deterioration	$10,752,000
Land	$4,000,000
Total	$14,752,000
Overall Rate	6.50%
Feasibility Net Operating Income	$958,880

The appraiser conducted a thorough survey of recently executed real estate leases in the national and local data center markets in which the landlord leased a similar building operated as a power shell. The survey excluded leases that did not reflect rental rates achieved by market negotia-

tion. Rents for built-to-suit facilities and those generated in sale-leaseback arrangements reflect a misalignment of the forces of supply and demand, making the rent pricing an unreliable indicator of market rent.

Based upon the appraiser's analysis of comparable rents, a market rent of $750,000 was estimated as most appropriate for the subject real property, and the income approach resulted in a value for the real property of $11.6 million ($750,000 ÷ 0.065). The appraiser used the difference between the feasibility rent previously discussed and the market rent, capitalized at the selected overall rate, as the estimate of excessive obsolescence for use in the cost approach, as shown in Exhibit 3.

Exhibit 3 Estimate of Obsolescence

Feasibility Net Operating Income (Absolute Net)	$958,880
Market Net Operating Income (Absolute Net)	$750,000
Income Loss Due to Obsolescence	$208,880
Overall Rate	6.50%
Estimate of Obsolescence	$3,213,538

Sales Comparison Approach

As was true of the income approach, the usefulness of the sales comparison approach was reduced by the highly confidential nature of the data center market and limited information on exactly which assets are transferred in each comparable transaction. Nevertheless, the available market activity provided a range of value indications that supported the conclusions within the cost approach. The depth of analysis available for each sale was limited by the information available to the appraiser, a challenge in a market where activity is so carefully concealed. Given the range of adjusted values provided by the best comparables selected, the appraiser was satisfied that the market value conclusion was reasonable and well supported.

Reconciliation

Because the cost approach analysis could produce a credible indication of market value, this approach was given greatest weight in the reconciliation. The feasibility rent analysis provided a comparison between the real estate rents in place and the rents achieved at comparable developments. The property interests reflected in the sales extended beyond the real property that was the subject of the assignment. However, the sales for which complete information was available and the asset transfer was similar to the assets appraised provided the appraiser with a level of confidence that the conclusions of the cost approach were reasonable and indicative of the market.

Conclusion

Professionals interested in expanding their practices into this exciting and challenging new sector need to gain basic competency in technical systems that might at first seem overwhelming. But the way in which real estate valuation professionals answer the question, Where exactly is the real estate within a data center? will have a meaningful consequence to the results of an assignment for which allocation is the central issue. Intent is the one consistent theme throughout the examination of different perspectives on allocation. The intent that the item contribute to the permanence of the real property is the most important factor in determining whether an item is considered a fixture to the real estate or a piece of personal property readily transferable to another situs. Intent is also a standard that is well tried by debate. Valuation professionals may develop differing opinions of the magnitude of the real estate component level but must recognize that it exists separate from the tangible and intangible personal property.

The local, national, and global data center base is expected to expand rapidly in upcoming years due to nothing more than the exponential growth in the quantity of data. As market participants continue to build, collateralize, tax, and sell these assets, it is incumbent upon appraisers to offer services that are competently performed, relevant, and appropriate based upon the intended use of the services engaged.

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Additional Resources

Suggested by the Y. T. and Louise Lee Lum Library

Appraisal Institute

Lum Library Knowledge Base information compilation [Login required]

- Building Construction and Building Maintenance
- Special Use Properties, industrial properties—data centers
- Taxation and Assessment