



Wireless Real Estate: Business Model, Real Estate Attributes, and Competitive Market Structure

Timothy Riddiough¹

Professor of Real Estate and Urban Land Economics
University of Wisconsin-Madison

December 2021

Contents

I.	Executive Summary	1
II.	Introduction.....	5
	A. Wireless Communications Infrastructure	6
	B. Wireless Transmission Towers.....	9
III.	The Tower Industry: Overview.....	12
	A. Origins.....	12
	B. The Tower REIT Business Model	12
IV.	Wireless Towers are Real Estate	17
	A. Background on Real Estate Economics	17
	B. Qualitative Real Estate Attributes of Wireless Towers	19
	1. Structure permanently attached to land.....	19
	2. The development and construction process	21
	3. Tangibility, durability and dual rental and asset markets	23
	4. Sale-leasebacks with telecommunications firms	24
	5. Treasury regulations.....	27
	6. Zoning statutes	27
	7. Appraisal guidelines.....	29
	8. Accounting definitions.....	30
	9. Financial industry classification	30
	C. Quantitative Real Estate Attributes of Wireless Tower Companies.....	32
	1. Returns move with and correlate with other real estate sectors	32
	2. Financial statements with attributes typical of real estate	36
	3. Dedicated real estate funds include tower REITs.....	40
V.	The Nature of Competition and Allocative Efficiency in Tower Real Estate Markets	42
VI.	Conclusion	48

I. EXECUTIVE SUMMARY

- The modern economy is increasingly supported by wireless networks. Network operators provide connectivity through a series of installations on communication towers and other infrastructure. These towers have obvious characteristics of real estate, and are often owned by publicly traded real estate investment trusts or REITs.
- This study describes the tower business model in the United States and the important role of REITs. It also reviews and evaluates qualitative and quantitative evidence in addressing the question of whether towers are real estate, and considers the competitive environment in which tower REITs operate.
- I find that, (1) tower companies are an important part of the growing digital economy; (2) a broad range of qualitative and quantitative evidence supports a conclusion that towers are intrinsically real estate; and (3) tower REITs operate in a competitive environment in which pricing power is constrained and competitive entry is commonplace.

More specifically, I find that,

- Towers are an important part of the growing digital economy.
 - The “digital economy” is defined by the U.S. Department of Commerce as comprising digital-enabling infrastructure, e-commerce, and digital media.
 - A persistent trend in the digital economy has been the growth of mobile computing and communications. With each generation of wireless technology, data transmission capabilities have increased, and with them demand for wireless communications.
 - Towers are infrastructure that house key elements of the wireless communication network.
- Most towers are owned and operated by REITs.
 - A significant percentage of U.S. tower capacity is supplied by specialized companies organized as real estate investment trusts, or REITs. REITs are firms that hold assets classified as real estate for Federal income tax purposes.
 - To qualify as a REIT, a company must meet several quarterly and annual tests, including investing at least 75% of real assets in real estate and deriving 75% of its gross income from real estate activities.
 - The REIT organizational form allows broad based ownership of real estate – today, 145 million Americans live in households that hold REIT shares in

their investment or retirement portfolios.

- Evidence supports the conclusion that towers are intrinsically real estate.
 - Towers are permanent structures affixed to land and supported by a foundation. A defining characteristic of real estate is its fixed location, and towers clearly meet this standard.
 - The tower construction and development process mirrors that of other types of real estate. The process includes siting, land acquisition, architectural design and engineering, zoning and land-use regulation review, and construction.
 - Location is a source of value, with income derived from rents.
 - To qualify as a REIT under the Internal Revenue Code, a sufficiently large percentage of a firm's assets and income must be attributable to real property. Since the 1960s, the IRS and Treasury have determined that communications towers qualify as real estate and therefore can organize as a REIT. Towers have a long history of being treated as real estate for federal income tax purposes.
 - The Appraisal Institute – the primary professional organization and governing body for real estate appraisers in the U.S. – considers cell towers to be real estate.
 - Towers meet FASB implicit tests for what constitutes real estate for revenue recognition purposes.
 - The two primary industry classification standards include tower REITs as part of the real estate sector.
 - An analysis of holdings by dedicated real estate mutual funds and ETFs shows that the vast majority hold one or more tower REITs in their portfolios.
 - The returns of tower REITs are more highly correlated with returns of most other equity REIT sectors than they are with telecommunication companies or the companies that collectively comprise the S&P 1500 Index.
 - REIT sectoral returns generally move in the same cycles.
 - Historically no one REIT sector consistently outperforms the other sectors.
 - Tower REIT operational performance, revenues and assets align with the operational performance, revenue, and assets of other REITs.
 - Tower REIT revenues, like those of other REITs and unlike non-real estate companies, are primarily in the form of rents.
 - A significant share of tower REIT cash flows, like those of other REITs and unlike non-real estate companies, are directed toward real estate acquisitions and dividend payments.

- A significant share of tower REIT's balance sheets, like those of other REITs and unlike non-real estate companies, is dedicated to real assets.
- Tower REITs follow real estate financial reporting conventions, reporting FFO and AFFO as opposed to net income, and they depreciate their assets according to rules governing REITs and other dedicated real estate companies.
- Tower REITs and other tower companies operate in competitive markets with the threat of entry, and lease to primarily large, sophisticated tenants.
 - Commercial real estate is fractionalized in its ownership, making it a highly competitive industry.
 - When lease income increases due to increases in tenant demand, or asset value increases due to declines in the cost of investment capital, asset values adjust upward and can exceed the cost of new construction. When this happens, entry generally occurs in the form of new development projects that compete with the existing real estate. Entry, as well as the threat of entry, limits rental pricing power of tower companies in local markets.
 - There are four critical features about the tower market that limit the ability of tower companies to generate extra-normal profits, which are profits, derived from market power, in excess of a normal risk-adjusted return.
 - Tower REITs and other tower companies of different sizes, including new entrants, compete with one another for tenants and the construction of new towers.
 - The data show that there has been significant entry in the form of new tower construction over the past five years. There are over 100 independent tower companies and nearly 75% of the new towers brought online in the U.S. were attributable to entities other than the three largest tower REITs.
 - The three main mobile carriers account for roughly 85% of the three largest tower REIT's revenues. This market structure provides the mobile carriers with significant leverage in lease negotiations with tower companies.
 - Tower REITs operate in an environment where there is meaningful ongoing technological change, and they need to continually adapt to new technological developments.
- Tower REITs increase allocative efficiency and benefit consumers.
 - The "neutral host" model, whereby tower operators construct a single tower that can host competing mobile carriers, reduces duplication and creates

opportunities for entry by mobile carriers while also reducing environmental impacts and optimizing land use.

- Cell tower companies generate other efficiencies given their core expertise in locating, entitling, constructing, and operating cell towers for the benefit of their customer tenants and ultimately consumers.

II. INTRODUCTION

The modern economy is increasingly supported by wireless networks. Network operators provide connectivity through a series of installations on communication towers and other infrastructure. These towers – permanent structures attached to land that may generate rental income for their owners – have obvious characteristics of real estate. Consequently, they are often owned by publicly-traded real estate investment trusts or REITs. A REIT “is a company that owns, operates or finances income-producing real estate” and has various characteristics detailed later in this paper.²

This study describes the tower business model and the important role of REITs. It also reviews and evaluates the qualitative and quantitative evidence supporting the view that towers are real estate, and considers the competitive market environment in which tower REITs operate.

My main findings are as follows. First, it is clear that towers and tower REITs are an important part of the growing digital economy. Second, there is a broad range of evidence supporting a conclusion that towers are intrinsically real estate. Third, as real estate owners, tower REITs operate in a competitive environment in which pricing power is constrained and competitive entry is commonplace.

The “digital economy,” which the U.S. Department of Commerce defines as comprising digital-enabling infrastructure, e-commerce, and digital media, is a “bright spot in the U.S. economy.”³ In 2018, the digital economy accounted for 9.0% of U.S. gross domestic product (GDP), ahead of industries such as finance and insurance (7.6%), health care and social assistance (7.5%), and construction (4.1%).⁴ From 2005 through 2018, the real gross output of the digital economy nearly doubled. This compares to an increase of roughly 25% for the economy as a whole.⁵ During that time, prices of digital economy goods and services fell at an

average rate of 0.5% per year, versus an average increase of 1.9% per year in the total economy.⁶ In 2016, digital economy workers earned an average of \$114,275, over 1.7 times the economy-wide average of \$66,498.⁷

Digital-enabling infrastructure includes computer hardware, software, and certain telecommunications equipment and services housed at cell tower sites.⁸ This infrastructure component of the digital sector is an engine of growth and innovation in the broader economy, and has been for some time. For example, a 2012 survey of empirical research published by the Organization for Economic Cooperation and Development (OECD) concluded, “Overall the empirical studies demonstrate that [information and computer technology] is a massive story not only ostensibly in everyday lives but very ostensibly in the productivity statistics as well. The evidence further indicates that the productivity effect is not only significant and positive, but also increasing over time.”⁹ A 2019 report from the Brookings Institution came to similar conclusions.¹⁰ And casual reflection on the COVID-19 crisis that began in 2020 reveals that whole sectors of the economy were able to continue functioning only to the degree that business could be conducted without in-person interpersonal interaction; i.e., virtually and provided those businesses had access to adequate connectivity.

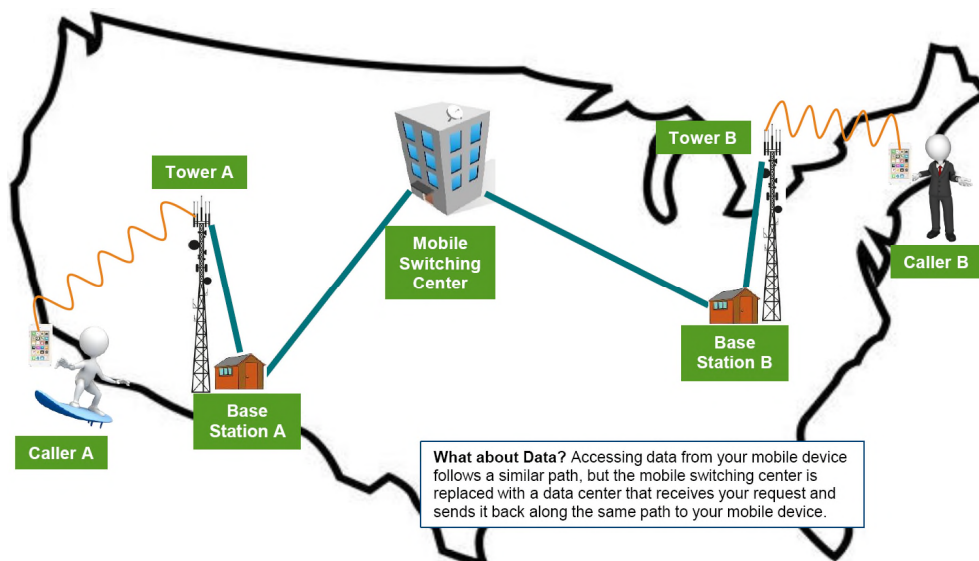
A. Wireless Communications Infrastructure

A persistent trend in the digital economy has been the growth of mobile computing and communications. From 2005 through 2018, global mobile-cellular subscriptions per capita more than tripled.¹¹ In the U.S., the percentage of wireless-only households (those whose only phone was their cell phone) grew from 16% in 2007 to 65% in 2019.¹² The range of what can be done wirelessly continues to grow – from 1980s-era 1G technology (early voice calls), through 3G

(widespread adoption of mobile web browsing in the later 1990s and 2000s) and 4G (mobile video in the 2010s), to current and future 5G technology (“Internet of Things” devices, immersive connectivity, and other next generation applications).¹³

The physical infrastructure that supports wireless communications consists of three main components (see Figure 1). A radio signal travels from a caller’s device to (1) an antenna mounted to a communications tower or other physical structure (building, rooftop, etc.), which sends the signal via cable to (2) a base station, which relays the signal via a fiber connection to (3) a mobile switching center.¹⁴ From there, the process is reversed, and the signal is routed to the tower closest to the recipient.¹⁵ Alternatively, the caller’s communications can be routed to the terrestrial public switched telephone network (“PSTN”) or the Internet.¹⁶

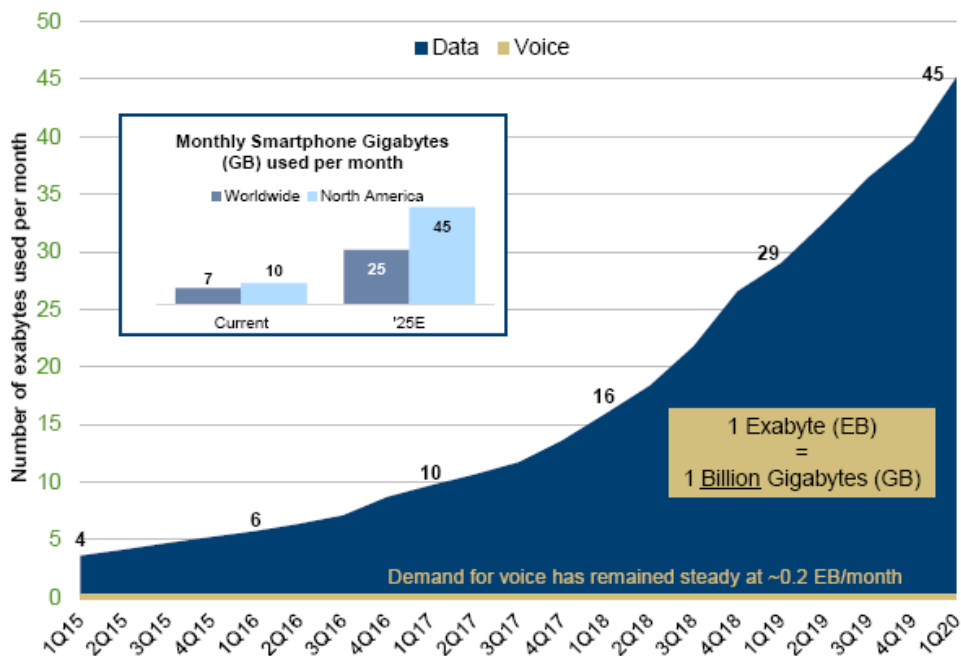
Figure 1¹⁷



The basic unit of a wireless network is the “cell,” or the geographic area covered by a tower.¹⁸ Carriers refer to these units as “rings.”¹⁹ Towers are located in an effort to optimize the cells’ coverage, minimizing both gaps and unnecessary overlap.²⁰

With each generation of wireless technology, data transmission capabilities have increased. The demand for wireless communications has increased in lockstep with increased capacity,²¹ where, as seen in Figure 2, data consumption continues to grow exponentially.²² The inset to Figure 2 also shows that monthly smartphone data consumption for the average North American consumer is expected to increase more than fourfold by 2025, from approximately 10 gigabytes in late 2020 to approximately 45 gigabytes in 2025.

Figure 2
Mobile Network and Voice Demand²³



Research by the Boston Consulting Group (BCG) projects that 5G deployment will have a significant effect on the U.S. economy, adding up to \$1.7 trillion to GDP and creating up to 4.6 million jobs over the next decade.²⁴ BCG foresees a first wave of growth from network infrastructure deployment, followed by an even larger wave “as the networks enable new and

improved use cases across industries. These will deliver significant socioeconomic benefits through higher productivity, improved cost competitiveness, and better health and safety.”²⁵

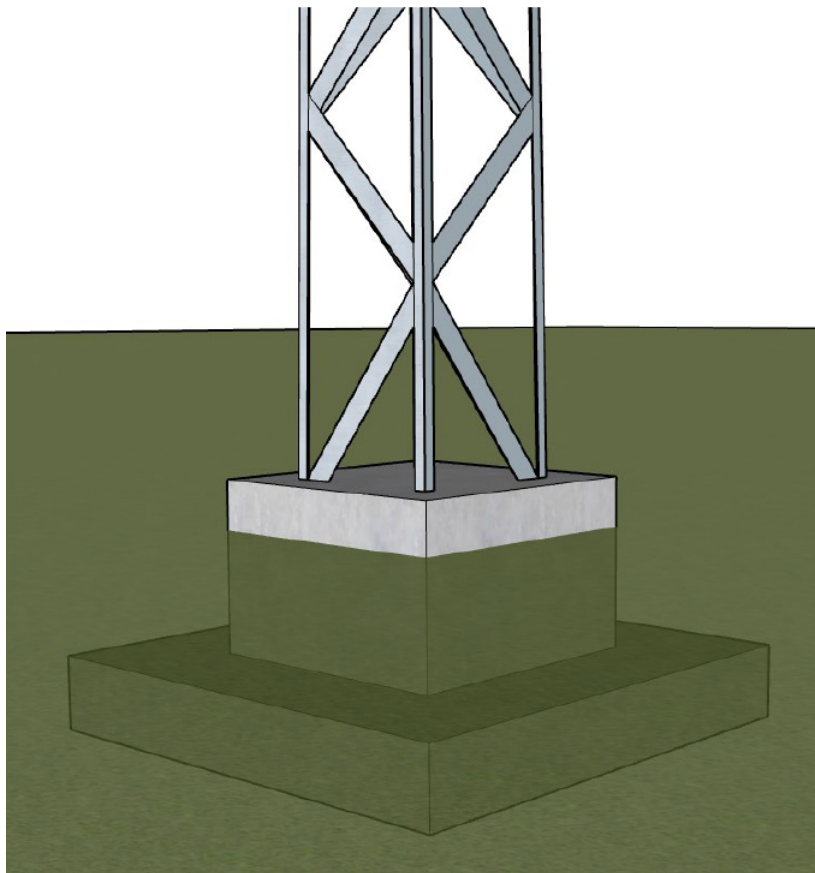
With each successive generation of technology, wireless carriers have increased their networks’ data capacity by adding spectrum, using existing spectrum more efficiently, and leasing more towers.²⁶ According to one industry analyst, “Like prior wireless technologies, 5G will be dependent on additional spectrum to be released for wireless use and more cellular antennas near population centers.”²⁷

B. Wireless Transmission Towers

A tower is “[a] vertical structure built on a parcel of land.”²⁸ The design of telecommunications towers are of several types, including lattice (like the Eiffel Tower), guyed (supported by steel cables anchored to the ground), monopole (a single pole), and camouflaged (designed to reduce visual impact).²⁹

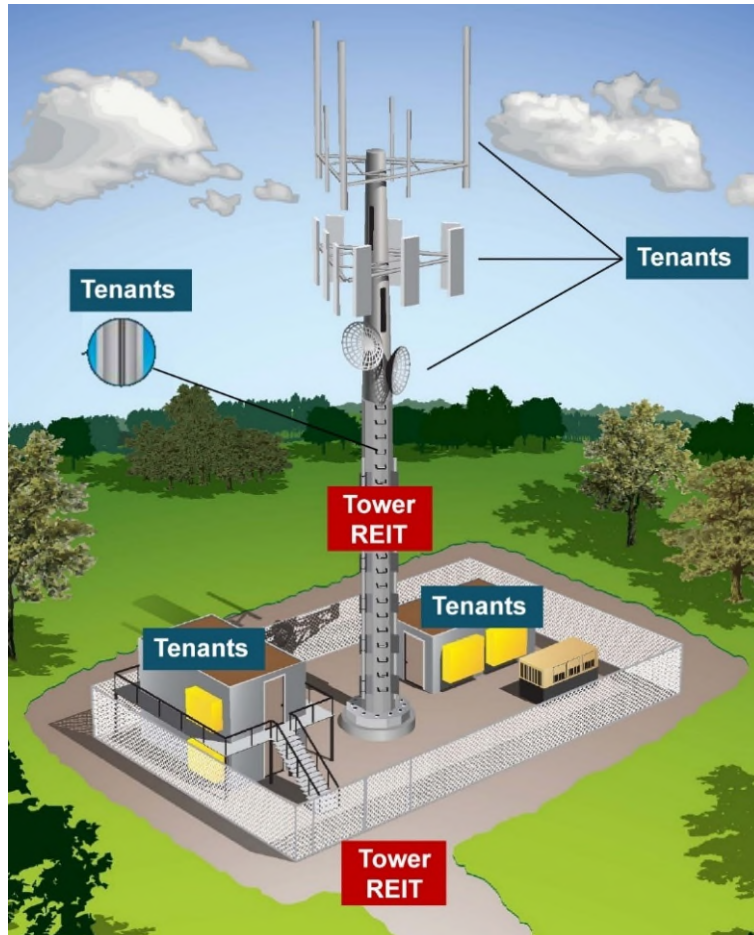
Traditional stand-alone cell towers typically range from 50 to 400 feet in height, with the tallest towers offering a service range of up to 40 miles.³⁰ Due to towers’ height and consequent need to resist wind load, towers must be securely attached to foundations that are quite large and deep, as depicted in Figure 3.³¹ For example, a typical monopole tower is bolted to a reinforced concrete pillar integrated into a reinforced concrete slab that measures 26 by 26 by 2.5 feet, and rests eight feet below grade.³² Once in place, towers are difficult and expensive to remove.³³ Indeed, the cost of relocating a tower with operating tenants generally exceeds the initial construction cost.³⁴

Figure 3
Reinforced Concrete Foundation³⁵



As seen in Figure 4, a tower installation includes the tower, outbuildings, and telecommunications equipment. The telecommunications equipment may include technologies for radio, broadcast television, telephony, and mobile voice and data.³⁶ The tower company usually owns the tower structure. It will also own or lease the land under the tower.³⁷ Tower company tenants are largely but not exclusively wireless communication companies.³⁸ Other tenants include police departments and emergency services.³⁹ The tenant typically owns and operates the telecommunications equipment and equipment shelters.⁴⁰

Figure 4
Wireless Transmission Tower⁴¹



The tower industry's neutral-host business model allows multiple tenants on a tower. Rental charges may depend on location as well as the size, quantity and weight of equipment placed on the tower.⁴² Leases are long-term and typically non-cancellable.⁴³

III. THE TOWER INDUSTRY: OVERVIEW

A. Origins

In the 1980s and 1990s, cell towers were built by wireless carriers to meet the growing demand for cell service.⁴⁴ Despite having the capacity for multiple tenants and carriers, towers were used primarily by the carriers that developed them, creating duplication and leaving significant untapped tower capacity.⁴⁵

In the late 1990s, U.S. mobile operators began selling their tower assets to real estate companies that had the requisite expertise to address zoning, construction, day-to-day tower operations, and related issues.⁴⁶ As a Sprint Nextel senior executive explained after the company sold 3,300 towers to TowerCo in 2008, “By leasing rather than owning these network facilities, we can better focus on our core business of providing communications services to consumers, businesses and government customers.”⁴⁷ Similarly, in 2013, AT&T sold rights to approximately 9,700 towers to Crown Castle, giving them “the exclusive right to lease and operate the AT&T towers for a weighted average term of approximately 28 years.”⁴⁸ By 2015, following Verizon’s sale of over 11,000 towers to American Tower, none of the major U.S. mobile carriers retained significant tower portfolios.⁴⁹ This vertical restructuring of the mobile carrier business has resulted in the formation of more than 100 independent tower companies, of which the three largest are American Tower, Crown Castle, and SBA Communications.⁵⁰

B. The Tower REIT Business Model

Today, a substantial amount of U.S. tower capacity is supplied by specialized companies organized as real estate investment trusts, or REITs. A REIT “is a company that owns, operates or finances income-producing real estate,” while satisfying certain rules imposed by the U.S.

Treasury.⁵¹ This section describes the REIT organizational form and its adoption by the major tower companies.

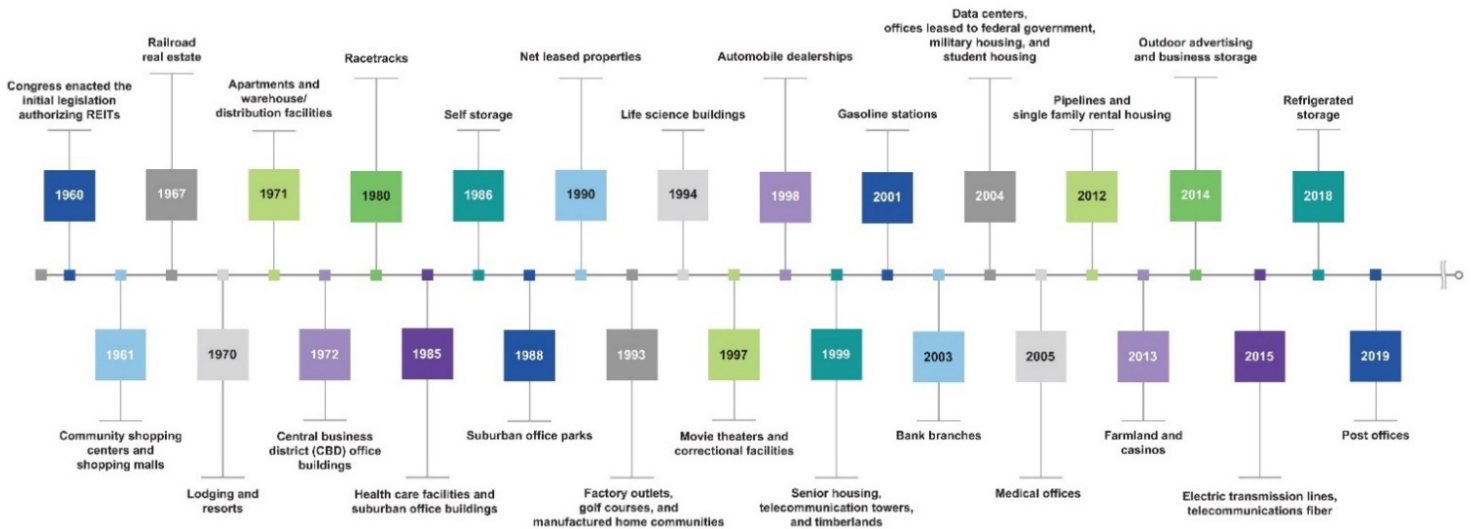
REITs were created as a sanctioned organizational form in the federal tax legislation contained within the 1960 Cigar Excise Tax Extension Act, signed into law by President Dwight D. Eisenhower.⁵² The tax legislation was patterned after the tax rules governing mutual funds, which had originated in the 1940s as a means of allowing the general public to invest in diversified portfolios of corporate securities. Similarly, Congress intended that REITs allow small real estate investors to “secure advantages normally available only to those with larger resources,” including “greater diversification of investment,” “expert investment counsel” and the means of “collectively financing projects which the investors could not undertake singly.”⁵³

In order to qualify as a REIT, a company must:

- Invest at least 75% of total assets in real estate;
- Derive at least 75% of its gross income from rents from real property, interest on mortgages financing real property or from real estate sales; with at least 95% of a REIT's gross income being comprised of real estate and passive income.
- Pay at least 90% of taxable ordinary income as shareholder dividends each year;
- Meet several organizational requirements, including:
 - Be managed by one or more trustees or directors;
 - Have a minimum of 100 shareholders;
 - Have no more than 50% of its shares held by five or fewer individuals;
 - Demonstrate beneficial ownership by virtue of having transferable shares.⁵⁴

This REIT legislation succeeded in its intended purpose of opening up real estate investment to the general public. Approximately 145 million Americans – equivalent to over half of the adult U.S. population – directly or indirectly own REITs through their retirement savings accounts and other investment funds.⁵⁵ So-called “equity” REITs invest in a wide range of real estate types, including apartment buildings and other residential structures; data centers; hotels; industrial and logistics facilities; medical facilities; offices; self-storage facilities; shopping centers, malls, and other retail buildings; and, of course, cell towers – see Figure 5; Exhibit 1.⁵⁶ Most equity REITs focus on owning, operating, and possibly developing one particular property type.⁵⁷ U.S. exchange-listed equity REITs own nearly \$2.5 trillion in assets, representing over 500,000 distinct parcels, and have an equity market capitalization of more than \$1.35 trillion.⁵⁸

Figure 5
REIT Listings by Property Type⁵⁹



© 2020 Nareit

EXHIBIT 1

REIT TYPE AND PROPERTY SECTOR CLASSIFICATION

Classification	Property Sector	Subsector	Total Equity Market Capitalization	% of Total Equity Market Capitalization
[A]	[B]	[C]	[D]	[E]
[1] Equity REITs	Office	N/A	\$109,583	7.2%
[2] Equity REITs	Industrial	N/A	\$163,772	10.8%
[3] Equity REITs	Retail	Shopping Centers	\$60,432	4.0%
[4] Equity REITs	Retail	Regional Malls	\$47,335	3.1%
[5] Equity REITs	Retail	Free Standing	\$61,550	4.1%
[6] Equity REITs	Residential	Apartments	\$144,584	9.5%
[7] Equity REITs	Residential	Manufactured Homes	\$33,701	2.2%
[8] Equity REITs	Residential	Single Family Homes	\$33,468	2.2%
[9] Equity REITs	Diversified	N/A	\$49,760	3.3%
[10] Equity REITs	Lodging/Resorts	N/A	\$40,806	2.7%
[11] Equity REITs	Self Storage	N/A	\$96,029	6.3%
[12] Equity REITs	Health Care	N/A	\$123,814	8.2%
[13] Equity REITs	Timber	N/A	\$34,919	2.3%
[14] Equity REITs	Infrastructure	N/A	\$244,453	16.1%
[15] Equity REITs	Data Centers	N/A	\$134,131	8.8%
[16] Equity REITs	Specialty	N/A	\$62,231	4.1%
[17] Mortgage REITs	Home Financing	N/A	\$45,569	3.0%
[18] Mortgage REITs	Commercial Financing	N/A	\$31,168	2.1%
[19] Total			\$1,517,302	100.0%

Notes & Sources:

\$ in millions.

[A]-[D] As of June 30, 2021. From Nareit, “Constituent Companies of the FTSE Nareit All REITs Index,” June 30, 2021, available at <https://www.reit.com/sites/default/files/returns/FNUSIC2021.pdf> (viewed July 26, 2021).

[E] = [D] / [19][D].

[19] = Sum of [1]:[18].

As a general matter, wireless towers have qualified as real property under the REIT asset tests since the early 1960s.⁶⁰ The first dedicated REIT for cell towers, Pinnacle Holdings, was listed in 1999. And in 2012, American Tower elected REIT status.⁶¹ In that same year, the FTSE Nareit REIT indexes designated infrastructure as a distinct REIT sector.⁶² American Tower's REIT conversion was followed by Crown Castle's in 2014 and SBA Communications' in 2017.⁶³

Early in the 21st century, there was some debate among REIT investment fund managers as to whether towers (as well as certain other REIT sectors) should actually be considered "real estate."⁶⁴ One industry analyst observed, "Traditionalists are accustomed to associating real estate with the presence of warm bodies, and the more the better," before concluding that property investors should instead "align[] portfolios with the economy of tomorrow" by including "digital real estate (data centers and towers)."⁶⁵ As this report will show, the investor community has very much come around to this analyst's view that towers are real estate.

IV. WIRELESS TOWERS ARE REAL ESTATE

A. Background on Real Estate Economics

Real estate is a unique industry working under the constraints of a product that cannot be transported. It is vulnerable to powerful demographic and technological forces, as well as complex social issues, that are often specific to a particular area or region. It is central to economic development, where real estate is a physical manifestation of growth and prosperity.⁶⁶

Real estate takes on a variety of forms: from agricultural land to urban skyscrapers; from densely crowded retail malls and sports stadiums to data centers that house equipment but few people; from enclosed warehouses with flat roofs to billboards that have no roofs at all.

Non-agricultural income-producing property is often referred to as *commercial real estate*. Commercial real estate is characterized by its tangibility and durability. Durability allows for the generation of cash flows in the form of rents over long periods of time. Consequently, two markets are relevant when analyzing commercial real estate: one for the shorter-term real rental market and one for the asset that forms the basis for investment. Current rents are set in the local market according to the laws of supply and demand. Asset prices are set dependent on expected future cash flows resulting from property rents as well as the opportunity cost of capital required to fund investment.

The rental and asset markets are closely linked. Lease contracts codify the terms and conditions for tenant space usage as well as lease rental payments. Rents are capitalized into an asset value. When tenant demand increases or the cost of investment capital declines, asset values adjust upward and can exceed the cost of new construction. When this happens, entry generally occurs in the form of new development projects that compete with the existing real estate. Increased supply lowers rents to create a new equilibrium in the rental and asset

markets.⁶⁷ There can be momentum in the demand for real estate in the asset market as well as in the supply of new development. When this happens, real estate cycles can occur, together with boom-and-bust outcomes that are well documented over time and across countries. The Savings and Loan crisis of the late 1980s illustrates the over-supply problems that can occur, and the Great Financial Crisis of 2007-09 illustrates distortions in asset demand.

As noted previously, *the* defining characteristic of real estate is its fixed location. With commercial real estate there is usually both land and structure. Tangibility and durability of the built structures, together with the existence of dual rental and asset markets, are also indicative. Lease contracts are often long-term, typically five to 15 years. Annual rent escalation provisions and extension options are common, with rental rates that vary depending on local market supply and demand conditions. In addition, a certain amount of non-specificity in structural design is usually observed with commercial property when ownership is separated from day-to-day occupancy and use.

These and other qualitative and quantitative factors are evaluated in more detail below, including:

Qualitative Factors:

- 1) The nature of the structure
- 2) The development and construction process
- 3) Existence of dual rental and asset markets
- 4) Sale-leasebacks activity
- 5) IRS regulations
- 6) Zoning statutes
- 7) Appraisal guidelines
- 8) Accounting definitions
- 9) Financial industry classification

Quantitative Factors:

- 1) Correlation of investment returns
- 2) Financial statements attributes
- 3) Investments in tower companies by dedicated real estate funds

B. Qualitative Real Estate Attributes of Wireless Towers

1. Structure permanently attached to land

Commercial real estate is typically comprised of both land and structure, although there can be land without a structure (e.g., a surface parking lot). Sometimes the structure is owned by one party while the land is owned by another party. When there is a structure, for it to be considered real estate (as opposed to personal property or chattel), the structure must be *permanently* affixed to the land. To facilitate permanent attachment and support the structure, there is often a foundation that sits on the land.⁶⁸

Cell towers satisfy both technical and common-sense definitions of real estate. As previously discussed, for macro-towers that I consider here the structure is permanently attached to a foundation that is embedded deep into the ground. The weight of a typical monopole foundation is over a quarter-million pounds.⁶⁹ The cost of removing/dismantling a tower is, as noted, significant.

Towers are described as permanent in both everyday industry communications and in more rigorous legal analysis. For example, there are numerous purveyors in the U.S. of portable cell towers, also known as cells on wheels. One, in describing its service, writes:

A C.O.W. is a common acronym used in the telecommunications industry to stand for “cell on wheels.” The C.O.W is a mobile cell site product that includes a tower and transceiver as well as all other necessary equipment, carefully constructed on a trailer or truck. *Unlike standard towers, cell on wheel towers are highly portable and can be used on a short-term basis, since they are not constructed for permanence.*⁷⁰

A 2005 ruling by the Commonwealth Court of Pennsylvania finding that macro cell towers are real estate includes an analysis that is instructive here. The court heard an appeal from

Shenandoah Mobile Company over a lower court's ruling that Dauphin County could tax a cell tower owned by Shenandoah as real estate, because the tower was "'at one' with the concrete pad to which it was bolted." Shenandoah's appeal was based in part on the contention "that the [t]ower is not realty ... because it is easily removable from the concrete pad."⁷¹

The court applied a three-part test to resolve the question:

The considerations to be made in determining whether or not a chattel becomes a fixture include (1) the manner in which it is physically attached or installed, (2) the extent to which it is essential to the permanent use of the building or other improvement, and (3) the intention of the parties who attached or installed it.⁷²

With regard to item (1), the court found that "the degree of attachment necessary to evidence permanence is not high, and can include the bolting of a fixture to the realty" and, further,

[t]he permanence required is not equated with perpetuity. Just because they have been and can be moved does not mean the intention was not to make them permanent. It is sufficient if the item is intended to remain where affixed until worn out, until the purpose to which the realty is devoted is accomplished or until the item is superseded by another item more suitable for the purpose.

In the case of the [t]ower, the four bolts are each eight feet long and are imbedded deep in the concrete base, which is an in-ground foundation. The area is fenced in, electrical connections are hooked up and the area is landscaped. The [t]ower, which is in three sections, supports cables and antennae and can be removed only by using a crane. It requires about a day and a crew of workers to dismantle it. Further, towers are moved only when business warrants it, for example, when they become obsolete or population shifts. Based on this evidence, we conclude that the [t]ower...possesses the requisite degree of "attachment."⁷³

With regard to item (2), the court found that the tower met the test because "the concrete pad was installed solely to support the tower and without the tower the concrete pad serves no function." Finally, in finding that the tower satisfied condition (3), the court pointed to

Shenandoah's lease with a mobile operator, which was for an initial period of five years, with four automatic renewals of five years each, as a sign of Shenandoah's intent to leave the tower in place for as long as business warranted it.⁷⁴

2. *The development and construction process*

The process for developing and constructing towers mirrors that for other types of commercial real estate. Both tower projects and other commercial projects begin with a process that seeks to identify sites with operationally and economically attractive features. Tower companies may look to characteristics such as location, elevation, available space, structural capacity, power, and access to telecommunication services.⁷⁵ This process is similar to the siting process of other types of commercial real estate projects that consider features such as land parcel size, visibility, traffic flow, demographics, zoning restrictions, surrounding infrastructure, and potential access points.⁷⁶

Today, tower operators are engaged in three main activities: tower acquisitions, leasing, and site development.⁷⁷ While tower company asset growth is a combination of acquisitions and new site development opportunities, acquisitions continue to be a primary way that tower companies add to their U.S. portfolios. For example, from 2015 through 2019, American Tower developed nearly 200 towers in the U.S., as compared to over 12,000 towers acquired, largely from Verizon.⁷⁸

The current market focus of owning and leasing built assets, as opposed to executing ground-up development, is typical of many other real estate companies in mature industries. For example, Simon Property Group (SPG), a large owner of shopping centers, leases space to businesses such as retail, dining, and entertainment establishments.⁷⁹ Since the 1990s, SPG,

which until then had been heavily engaged in real estate development, began adding to its portfolio primarily through mergers, acquisitions, and strategic partnerships.⁸⁰ In 2020, SPG's new developments made up less than 6% (\$27 million) of total capital expenditures.⁸¹ Similarly, Equity Residential (EQR), which owns apartment properties across the U.S., derives most of its revenues from tenant leases.⁸² In 2019, EQR spent \$1.5 billion on acquisitions, versus only \$195 million on development.⁸³

Tower companies nevertheless continue to engage in development activities. They may develop new sites at the request of a carrier (often called build-to-suit programs), and less commonly on a speculative basis (i.e., identifying and developing sites likely to be useful to multiple carriers). In either case, development entails a wide range of activities, including site analysis and selection, engineering, obtaining zoning and other regulatory approvals, and construction management.⁸⁴ These activities mirror those of other real estate companies. For example, Prologis, a major owner of logistics warehouse facilities across the U.S. and the rest of the world, offers a Build-to-Suit program that encompasses site selection, land acquisition, facility specifications, permitting, and construction.⁸⁵ Similarly, Alexandria Real Estate Equities (AREE) – which owns and leases collaborative life science, technology, and agtech campuses – focuses mainly on developing assets with significant pre-leasing.⁸⁶ AREE's development activities include obtaining entitlements and necessary permits, design, site work, and construction management.⁸⁷ In sum, real estate development processes for both tower and non-tower real estate companies involve pre-construction activities such as siting, obtaining zoning and other approvals, and construction itself.

3. *Tangibility, durability and dual rental and asset markets*

As discussed earlier, defining characteristics of income-producing commercial real estate are tangibility and durability, along with the existence of dual rental and asset markets. These characteristics describe macro cell towers. Cell towers are clearly tangible as well as durable, with structural functional lives that can easily exceed 50 years.⁸⁸ The space offered to potential tenants is generally: (i) a position high up on the tower to facilitate wireless data transmission, or (ii) a near-proximity space on the ground for the tenant to install radios, electronics, backup power generators, etc. Lease contracts are long-term, typically five to 15 years, often with annual rent escalation provisions and extension options. Rental rates typically vary depending on local market supply and demand for cell tower space.⁸⁹

Most towers house multiple tenants that compete with one another in the market for telecommunication. In this sense tower companies resemble numerous other real estate companies – such as those managing shopping centers, research and development parks, and commercial office buildings – in owning structures that host multiple tenants and whose tenants may actively compete with one another.

It is worth emphasizing that antenna and other technologies affixed to a tower, which themselves are mobile, do not affect the conclusion that the tower itself is real estate. Physical goods come and go in warehouses and self-storage units while people come and go in office buildings and shopping malls. But that does not affect the conclusion that those property types are real estate. In all cases, including macro towers that are the subject of this white paper, tenants lease space for commercial purposes utilizing a structure that is permanently attached to the ground.

Cell tower asset value depends on capitalized revenues and expenses. Revenues are comprised primarily of rental income. Categories of recurring operating expenses are similar to other commercial property types. These include insurance, taxes and utility costs. And like other rental properties, towers require ongoing capital expenditures. Capital expenditures include improvements to tower sites (e.g., structural enhancements, height extensions, lighting, fence repairs, road repairs, and ground maintenance), and spending to maintain structures and upgrade sites. American Tower reports annual costs of improvements of approximately \$2,000 per site,⁹⁰ and one industry analyst estimates that “[m]ost industry participants spend 2-3% of annual revenue on cap-ex, which is largely comprised of maintenance at the tower site...and corporate IT infrastructure.”⁹¹

Like other forms of commercial real estate, there is an active market in the sale and purchase of developed, income-producing cell towers. Since 2010, over 200 merger or acquisition agreements involving cell towers in the U.S. have been closed by over 100 unique buyers.⁹²

4. *Sale-leasebacks with telecommunications firms*

Real estate is necessary to house commercial activities in the modern economy. Offices are required to house white collar employees, factories are necessary to manufacture products, warehouses are essential to store products *en route* to their customers, and cell towers are necessary infrastructure to locate and/or house equipment used to efficiently transmit information. But the real estate itself is “non-core” to many businesses. This means that firms are commonly focused on a particular end product or service, and not on the real estate in and of itself. As a result, many firms shed their non-core real estate assets, selling them to real estate

firms that specialize in the efficient ownership and operation of such assets. In the process, it is also common practice for the seller to lease the real estate back, in whole or in part, as it continues to be an important factor of production.

The separation of asset ownership and day-to-day use with commercial real estate depends critically on real estate space provision being sufficiently *generic*. That is, real estate that is highly customized and specific to a particular user's needs will often be such that separation of ownership and day-to-day control is undesirable. A factory that is specifically designed to manufacture a unique product is a typical example. Ownership and use are bundled because the separate and distinct owner adds no value of its own and because the specificity of design implies a nearly valueless asset should the user-tenant exit from the market. Thus, sufficient non-specificity in structural spatial design is usually observed in commercial real estate markets so that ownership and day-to-day use can be separated.

Cell towers meet this defining characteristic. Although designs differ somewhat across basic categories, the tower itself is quite generic. Its most prominent and important characteristic is its height, along with the ability to attach physical transmission technologies to the tower itself. These height and attachment qualities are highly generic, making the cell tower owner less reliant on any particular tenant-user, industry or technology type, which enhances property value in the asset market.

As noted previously, the three largest tower companies acquired significant portions of their tower portfolios from the mobile operators. When such transactions have occurred, mobile operators and industry observers have consistently described the operators as shedding “non-core” or “non-strategic” assets:

- “A Sprint spokesman...said “the company has been trying to sell nonstrategic assets for some time” (2005 news report of imminent sale of more than 6,000 towers);⁹³
- “AT&T executives specifically mentioned ‘noncore assets, including AT&T's more than 10,000 owned cellphone towers” (2013 news report on AT&T’s planned divestitures);⁹⁴
- “selling off non-core assets” (2015 news report of \$5 billion Verizon tower sale and leaseback transaction);⁹⁵
- “...consistent with AT&T’s plans to monetize non-strategic assets” (AT&T press release announcing 2019 sale of over 1,000 towers to Peppertree Capital);⁹⁶
- “In order to finance this mobile expansion, DT is considering selling ‘non-strategic’ assets including ... radio towers in Germany and the U.S.” (2007 news report on Deutsche Telekom/T-Mobile);⁹⁷
- “We will use the proceeds from the sale of these non-strategic assets to invest in other long-term investments that position U.S. Cellular for future growth opportunities” (U.S. Cellular CEO commenting on 2015 sale of 595 towers to Vertical Bridge Holdings).⁹⁸

Notwithstanding the important contribution of towers in wireless infrastructure, these comments make clear that the mobile operators and industry observers have, for several decades now, considered towers to be peripheral to the business of providing telecommunications services.

5. *Treasury regulations*

According to the IRS, “[r]eal property, also called real estate, is land and generally anything built on or attached to it.”⁹⁹ Thus, when the IRS recognizes a firm as a REIT, it simultaneously recognizes the organization’s main rent-generating assets as real estate.

The IRS has long recognized telecommunications towers as real estate assets for purposes of REIT status. In 1964, the IRS’s Chief Counsel determined that a television broadcasting tower leased to a broadcasting company qualified as real estate.¹⁰⁰ Likewise, in 1975, the IRS issued a revenue ruling which concluded that a microwave transmission tower was a real estate asset.¹⁰¹ In both cases, the IRS applied the test of whether the towers were “inherently permanent structures” attached to land.¹⁰²

Beginning in the 1990s, the IRS issued a series of private letter rulings classifying cell towers and rooftop antennas as real estate assets.¹⁰³ This position was finally codified in 2016, when the IRS issued revised final regulations confirming that cell towers, as well as microwave transmission, broadcast, and electrical transmission towers, are inherently permanent structures and, hence, real estate assets for REIT purposes.¹⁰⁴

6. *Zoning statutes*

A characteristic feature of real estate is that it is subject to land use and zoning regulations: “Land use and zoning laws involve the regulation of the use and development of real estate.”¹⁰⁵ That towers are susceptible to such regulation helps identify them as real estate. As one study has observed:

Land use regulation of telecommunication towers is common. Many local ordinances limit the location of telecommunication towers to certain zoning districts, set height limits, require security fencing and landscaping, encourage

collocation of multiple providers on a single tower, encourage use of existing structures (water towers, church steeples, tall buildings) for antenna location, encourage use of camouflaging for towers (use of “stealth” designs), and include provisions for removal of abandoned towers. A 2005 survey by the [University of North Carolina] School of Government indicated that 70 percent of the responding municipalities and 78 percent of the responding counties had adopted regulations on telecommunication towers.¹⁰⁶

For example, the town of Cary, NC regulates “Telecommunications Facilities” under Chapter 5 of its Land Use Ordinance.¹⁰⁷ The stated purposes of the ordinance include “establishing standards for location, structural integrity and compatibility”; “[e]ncourag[ing] the location and co-location of telecommunications facilities equipment on existing structures”; and “[p]rotect[ing] the unique aesthetics of the Town while meeting the needs of its citizens and businesses to enjoy the benefits of wireless communications services.”¹⁰⁸ The ordinance’s provisions are typical of those seen for other types of real estate, covering features such as siting, height, setbacks, design and neighborhood compatibility, and buffering and screening.¹⁰⁹

Likewise, section V.E. of the Zoning Ordinances of Framingham, MA, covers “wireless communications facilities,” including antennas and monopoles, and regulates features such as height, setback, design, and visual impact on the community.¹¹⁰ Section 650-25 of the Code of the City of Marlborough, MA contains similar provisions.¹¹¹

It is worth noting that zoning boards are, in the public interest, generally required by law to approve tower projects if the petitioner can show that no reasonable alternative location exists. *See, e.g.* New York State Municipal Regulation of Cellular Telephone Towers and Antennas:¹¹² “even if a variance is necessary, a zoning board of appeals must grant approval if the cellular phone company is able to show that there are no reasonable alternative locations available which

would allow the company to provide the same level of service to the cell (geographic area) in question.”

7. *Appraisal guidelines*

The Appraisal Institute is the primary professional organization and governing body for real estate appraisers in the US. There are several indications that the Appraisal Institute considers cell towers to be real estate. First, the organization offers an on-line webinar on “Appraising Cell Towers,” where they indicate that, “This webinar features experts providing information to help you in your cell tower appraisal assignments.”

More enlightening is information available from a conference sponsored by the Appraisal Institute on the appraisal of cell towers. In that conference there was guidance provided on the three standard approaches to the valuation of real estate – cost, sales comparison and income – where speakers indicated that income valuation approach was generally most relevant and reliable. The valuation steps are also outlined, which conform closely to steps applied to other types of real estate valuation assignments. The listed steps are: 1) Establish the interest to be valued; 2) Determine the highest and best use of the site; 3) Detail property specifics; 4) Establish a probable buyer profile and subsequent acquisition criteria; 5) Compile rental data; and 6) Survey active cell tower brokers to confirm findings.

There is also a relevant entry on cell towers in the Dictionary of Real Estate Appraisal, 6th Edition. It defines the “Going rate” as “Annual market rent for a linear right of way, communication tower site, or similar specialized land use. These rents are often evidenced by rates that a particular industry is able and willing to pay, but unrelated to the value of the land in its next-best alternative use.”

8. *Accounting definitions*

FASB's Accounting Standards Codification (ASC) has over the years contained real-estate specific rules that included implicit tests of what constituted real estate (ASC 360-20). In particular, ASC 360-20-15-2 reads:

Determining whether a transaction is in substance the sale of real estate requires judgment. However, in making that determination, one shall consider the nature of the entire real estate component being sold (that is, the land plus the property improvements and integral equipment), and not the land only, in relation to the entire transaction. Further, that determination shall not consider whether the operations in which the assets are involved are traditional or nontraditional real estate activities. For example, if a ski resort is sold and the lodge and ski lifts are considered to be affixed to the land (that is, they cannot be removed and used separately without incurring significant cost), then it would appear that the sale is in substance the sale of real estate and that the entire sale transaction would be subject to the provisions of this Subtopic. Transactions involving the sale of underlying land (or the sale of the property improvements or integral equipment subject to a lease of the underlying land) shall not be bifurcated into a real estate component (the sale of the underlying land) and a non-real-estate component (the sale of the lodge and lifts) for purposes of determining profit recognition on the transaction.

While the ski lift example has appeal due to evident similarity to cell towers, note that the accounting treatment in the example comes with the qualification "if...the ski lifts are considered to be affixed..." As discussed previously, it is reasonable to conclude that cell towers are permanently affixed to land.

9. *Financial industry classification*

Tower companies are categorized as real estate in a variety of formal and informal classification systems in the financial industry. For instance, in 2016 S&P Dow Jones Indices and MSCI transferred stock-exchange listed real estate companies from the Financials Sector of

their Global Industry Classification Standard (GICS®) to a new Real Estate Sector.¹¹³ GICS® is one of the main equities classification systems worldwide, and is the system that underpins S&P Dow Jones Indices and MSCI's proprietary stock market indices.¹¹⁴ At the time of the change to GICS®, S&P Dow Jones Indices announced,

In recognition of real estate's growth as a distinct market segment and its unique business drivers, the GICS committee has elected to promote it from an industry group in the financials sector to its own economic sector. Real estate will be the 11th GICS sector. This change will be effective in the S&P U.S. Indices at the September 2016 share rebalance. The addition of real estate as a GICS sector will raise its profile and make its performance more explicit for investors seeking to track it.¹¹⁵

Tower REITs are included in the Real Estate sector as classified by GICS.

Another widely used classification scheme is the Industry Classification Benchmark (ICB), operated and managed by FTSE Russell. The ICB is a widely recognized standard that is used by financial institutions around the world, including London Stock Exchange, Johannesburg Stock Exchange, Athens Exchange, SIX Swiss Exchange, Cyprus Stock Exchanges, NYSE Euronext, NASDAQ OMX, Borsa Italiana, Boursa Kuwait, and CRSP, STOXX, and FTSE Russell indexes.¹¹⁶ Companies are assigned to the ICB category that best characterizes their business, based on their primary source of revenue and other publicly available information. In 2019, FTSE Russell created a separate real estate industry category, which included an infrastructure REIT subsector.¹¹⁷ As discussed above, tower companies represent virtually the entire market capitalization of that subsector.

C. Quantitative Real Estate Attributes of Wireless Tower Companies

Wireless tower companies have several quantitative “markers” they share with other real estate firms. This distinguishes them from telecommunications companies as well as other types of firms.

1. *Returns move with and correlate with other real estate sectors*

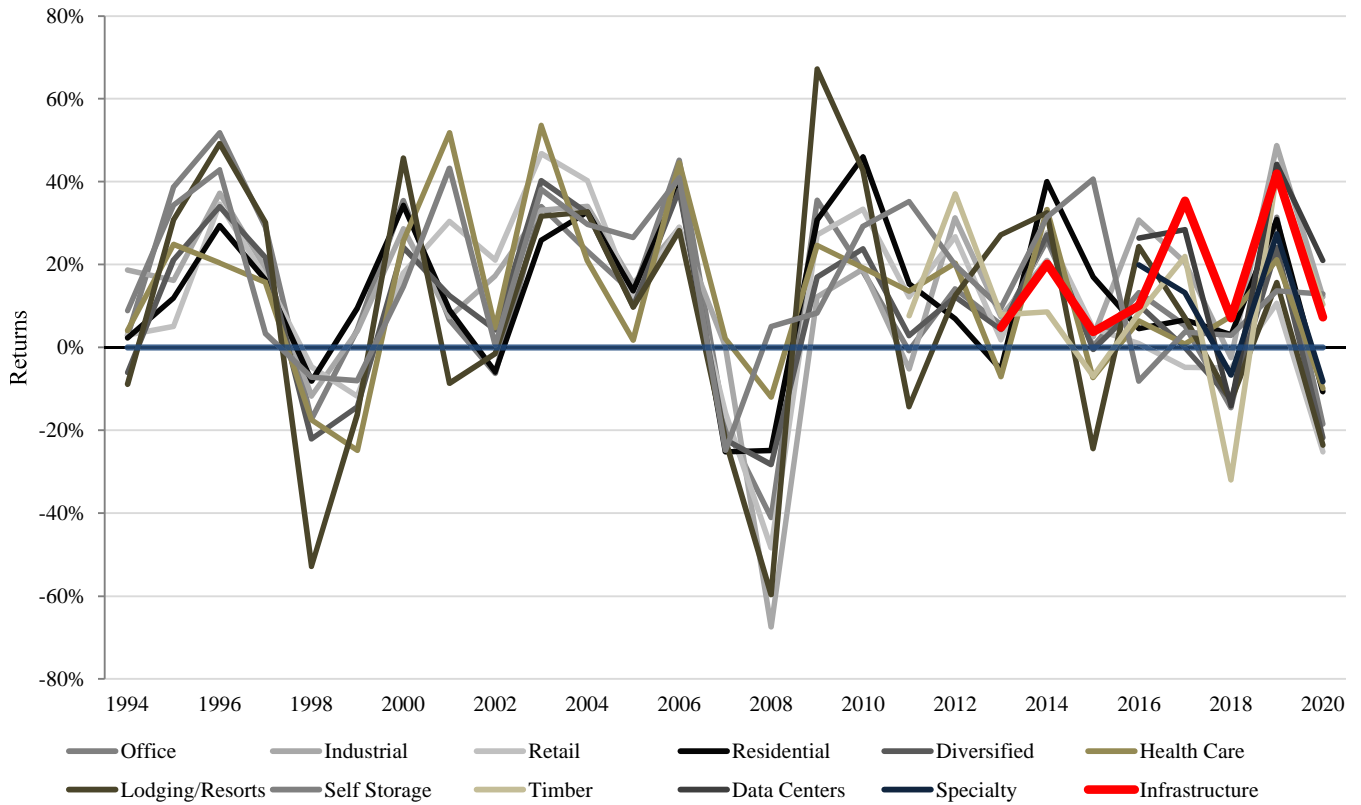
Tower company returns closely track those of most other real estate sectors. Exhibit 2 depicts annual returns for 12 distinct equity REIT sectors. As seen there, the sectoral returns – including those for infrastructure REITs (comprising almost entirely tower companies by market value; see Exhibit 3) – generally move in the same cycles. Furthermore, no one REIT sector has consistently outperformed the other sectors.

Exhibit 4 provides correlations between infrastructure REIT returns and those of each of the other equity REIT sectors at monthly, quarterly, and annual frequencies. These correlations are generally positive and are particularly strong in several sectors. This notably includes industrial warehouse and data centers, which along with infrastructure respond similarly to advances in technology and digitalization. Lower return correlations are seen with certain other REIT sectors, such as retail and lodging, which reflect a somewhat different set of demand fundamentals relative to tower REITs.

Furthermore, also reported in Exhibit 4 are the correlations of infrastructure REIT returns with those of non-REIT entities, such as telecommunications companies and companies that collectively comprise the S&P 1500. These correlations are generally lower than the return correlations between infrastructure REITs and most equity REIT sectors.

EXHIBIT 2

**FTSE NAREIT US REAL ESTATE INDEX SERIES
REIT ANNUAL RETURNS BY PROPERTY SECTOR
1994 – 2021**



Notes & Sources:

Annual total returns calculated from monthly total returns. Data courtesy of Nareit.

EXHIBIT 3

INFRASTRUCTURE REITS

	Company Name	Ticker	Exchange	June 2021 Equity Market Capitalization	% of Total Equity Market Capitalization	Number of Towers Owned in U.S.	Business Description
	[A]	[B]	[C]	[D]	[E]	[F]	[G]
[1]	American Tower Corporation	AMT	NYSE	\$122,589	50.1%	41,886	"American Tower, one of the largest global REITs, is a leading independent owner, operator and developer of multitenant communications real estate with a portfolio of approximately 181,000 communications sites."
[2]	Crown Castle International Corp	CCI	NYSE	\$84,320	34.5%	40,567	"Crown Castle owns, operates and leases more than 40,000 cell towers and approximately 80,000 route miles of fiber supporting small cells and fiber solutions across every major U.S. market."
[3]	SBA Communications Corp. Class A	SBAC	NASDAQ	\$34,848	14.3%	16,401	"SBA Communications Corporation is a first choice provider and leading owner and operator of wireless communications infrastructure in North, Central, and South America and South Africa."
[4]	Uniti Group Inc.	UNIT	NASDAQ	\$2,473	1.0%	-	"Uniti, an internally managed real estate investment trust, is engaged in the acquisition and construction of mission critical communications infrastructure, and is a leading provider of wireless infrastructure solutions for the communications industry."
[5]	Power REIT	PW	NYSE American	\$133	0.1%	-	"Power REIT is a real estate investment trust (REIT) that owns real estate related to infrastructure assets including properties for Controlled Environment Agriculture, Renewable Energy and Transportation."
[6]	CorEnergy Infrastructure Trust, Inc.	CORR	NYSE	\$90	0.0%	-	"CorEnergy Infrastructure Trust, Inc. (NYSE: CORR, CORRPrA), is a real estate investment trust (REIT) that owns critical energy assets, such as pipelines, storage terminals, and transmission and distribution assets."
[7]	Total			\$244,453	100.0%	98,854	

Notes & Sources:

\$ in millions.

[A]-[B] As of June 30, 2021. Includes REITs classified in Property Sector: Infrastructure. From Nareit, "Constituent Companies of the FTSE Nareit All REITs Index," June 30, 2021, available at <https://www.reit.com/sites/default/files/returns/FNUSIC2021.pdf> (viewed July 26, 2021).

[C] From Standard & Poor's Capital IQ.

[D] From Nareit, "Constituent Companies of the FTSE Nareit All REITs Index," June 30, 2021, available at <https://www.reit.com/sites/default/files/returns/FNUSIC2021.pdf> (viewed July 26, 2021).

[E] = [D] / [7][D].

[F] From Wireless Estimator, "Top 100 Tower Companies in the U.S.," July 17, 2021, <https://wirelessestimator.com/top-100-us-tower-companies-list/> (viewed July 26, 2021).

[G] From Standard & Poor's Capital IQ.

EXHIBIT 4

INFRASTRUCTURE REIT RETURN CORRELATIONS FEBRUARY 2012 – JANUARY 2021

	Monthly Returns	Quarterly Returns	Annual Returns
Equity REIT Sector Correlation with Infrastructure REITs ¹ :			
[1] Office	0.362	0.309	0.629
[2] Industrial	0.440	0.415	0.767
[3] Retail	0.306	0.313	0.344
[4] Residential	0.425	0.258	0.490
[5] Diversified	0.348	0.318	0.532
[6] Health Care	0.482	0.356	0.551
[7] Lodging/Resorts	0.159	-0.030	0.334
[8] Self Storage	0.348	-0.059	-0.095
[9] Timber	0.211	0.324	0.760
[10] Data Centers ²	0.516	0.628	0.703
[11] Specialty ²	0.338	0.411	0.724
Non-REIT Correlation with Infrastructure REITs ¹ :			
[12] S&P 1500 Index	0.281	0.277	0.453
[13] Telecommunications Companies ³	0.357	0.261	0.262

Notes & Sources:

¹ Total returns data for Infrastructure REITs begins in February 2012.

² Total returns data for Data Center and Specialty REITs begins in January 2016.

³ Calculated as market capitalization-weighted average of individual, dividend-adjusted returns. Individual returns include all public companies in the U.S. classified under SIC code 4812, "Radiotelephone Communications," and listed on a major U.S. exchange. I.e., AT&T Inc., ATN International, Inc., Franklin Wireless Corp., Liberty Broadband Corporation, Lumen Technologies, Inc., Radius Global Infrastructure, Inc., Spok Holdings, Inc., Sonim Technologies, Inc., T-Mobile US, Inc., Telephone and Data Systems, Inc., United States Cellular Corporation, and Verizon Communications Inc. Market capitalization and dividend-adjusted returns data from Bloomberg. Telecommunications companies screened using Standard & Poor's Capital IQ. Total returns data for Liberty Broadband Corporation, Radius Global Infrastructure, Inc., and Sonim Technologies, Inc. begin in December 2014, October 2020, and June 2019, respectively.

Monthly returns calculated from February 2012 to January 2021. Quarterly returns calculated from Q2 2012 to Q4 2020.

Annual returns calculated from 2012 to 2020. REIT returns data courtesy of Nareit.

Non-REIT returns data from Bloomberg.

[1]-[9] 108, 35, and 9 observations included for Monthly, Quarterly, and Annual returns, respectively.

[10]-[11] 61, 20, and 5 observations included for Monthly, Quarterly, and Annual returns, respectively.

[12]-[13] 108, 35, and 9 observations included for Monthly, Quarterly, and Annual returns, respectively.

2. *Financial statements with attributes typical of real estate*

Tower companies can be identified as real estate firms both in the types of data reported in their financial statements as well as in the relative values of those data.

Most fundamentally, companies that hold real estate assets differ from most other types of firms in their factors of production and in the nature of the income. Real estate is dominated by land and physical capital (structure), both of which require large amounts of financial capital to purchase and operate. Human capital costs in the form of general and administrative expense as well as property management expense are generally dwarfed by land and physical capital expenditures, *i.e.* expenditures on real assets. In contrast, most other firms are dominated by human capital as a factor to production. This is especially true for the tech sector and in service-dominated industries. Even firms that produce physical products such as cars and other durable goods generally require much higher proportions of human capital as inputs relative to real estate companies.

As shown in Exhibit 5, Land and Net Property, Plant, & Equipment as a percentage of total assets and liabilities for tower REITs are 2.9% and 27.4%, respectively, while for the non-real-estate segment of the S&P 1500, these metrics are only 0.6% and 8.0%, respectively. For other REITs, these metrics are 6.3% and 29.4%, compared to 0.2% and 19.7% for telecommunications firms. On the other hand, SG&A expenses for tower REITs and other REITs are no higher than 10.0% of total revenues, compared to 23.3% for telecommunications firms and 16.1% for the non-real-estate segment of the S&P 1500.

The dominant form of income in commercial real estate companies is rental income tied to longer-term lease contracts. This creates a relatively stable revenue source that smooths income flows over time. Income of other types of firms are dominated by retail and wholesale product sales that often occur in a spot market. As a result, product sales can be affected by abrupt changes in market conditions or the loss of a major customer.¹¹⁸

As seen in Exhibit 5, 92% of tower REITs' revenues are in the form of rental revenue, all of which is property rental revenue. Other REITs also derive a significant proportion of revenues from rental—80% for REITs with any rental revenue (excluding entities like mortgage REITs.)¹¹⁹ In comparison, neither telecommunications firms nor the non-real-estate segment of the S&P 1500 derives more than 0.2% of revenues from rental income. Similarly, tower REITs, like other REITs, report “FFO,” or funds from operations, in their income statements. This item is not reported by telecommunications firms or the non-real-estate segment of the S&P 1500.

Further, a significant share of tower REIT cash flows, like those of other REITs, are directed toward real estate acquisitions and dividend payments. As shown in Exhibit 5, tower REITs and other REITs spend over 20% of their total revenues on acquiring real estate assets, compared to none reported in the S&P Capital IQ database for both telecommunications firms and the non-real-estate segment of the S&P 1500. Similarly, for both tower REITs and other REITs, over 20% of total revenues are paid out in the form of dividends, compared to 6.7% for telecommunications firms and 3.6% for the non-real-estate segment of the S&P 1500.

Lastly, note that REITs, including infrastructure REITs, issue more debt overall, as well as more long-term debt. This highlights a critical difference between real estate and other types of assets held by telecommunications companies and other non-real estate firms. In particular, real estate is characterized by its significant debt capacity as compared to other assets that incorporate human capital (e.g., workforce; intellectual property) and rapidly depreciating physical capital (e.g., plant and equipment). The high debt capacity associated with real estate assets leads to lower cost debt and hence typically more debt in the capital structure of real estate companies as compared to non-real estate companies.

In addition to the items shown in Exhibit 5, the financial statements of tower REITs include a Schedule of Real Estate and Accumulated Depreciation. This is consistent with the reporting of other types of REITs, and is required by federal securities law “for real estate (and the related accumulated depreciation) held by persons a substantial portion of whose business is that of acquiring and holding for investment real estate or interests in real estate, or interests in other persons a substantial portion of whose business is that of acquiring and holding real estate or interests in real estate for investment. Real estate used in the business shall be excluded from the schedule.”¹²⁰ Such a schedule is not typically found in the financial statements of non-real-estate companies. Similarly, the balance sheets of tower REITs and other REITs include a category for “deferred site rental receivables,” typically not found on the balance sheets of telecommunications firms or firms in the non-real-estate segment of the S&P 1500.¹²¹

EXHIBIT 5

COMPARISON OF INFRASTRUCTURE REITS VS. OTHER SECTORS FINANCIAL VARIABLES 2019

	Infrastructure REITs	All Other REITs	Telecomm. Companies	S&P 1500*
	[A]	[B]	[C]	[D]
Income Statement: Normalized by Dividing by Total Revenues				
[1] Property Rental Revenue	92.1%	40.2%	-	-
[2] AFFO	24.2%	34.8%	-	-
[3] FFO	23.1%	33.6%	-	-
[4] Total Rental Revenue	92.1%	68.7%	-	0.3%
[5] Total Depreciation & Amortization	27.1%	21.4%	14.9%	2.6%
[6] Interest Expense	14.0%	11.9%	4.3%	1.6%
[7] Sales, General, and Administrative Expense	10.0%	9.3%	23.3%	16.1%
Statement of Cash Flows: Normalized by Dividing by Total Revenues				
[8] Net Acquisition (Sale) of Real Estate Asset:	22.7%	27.7%	-	-
[9] Cash Acquisitions	22.8%	9.4%	0.6%	2.8%
[10] Total Dividends Paid	23.6%	30.9%	6.7%	3.6%
[11] Cash from Operations	49.1%	35.0%	25.6%	15.6%
Balance Sheet: Normalized by Dividing by Total Assets + Liabilities				
[12] Land	2.9%	6.3%	0.2%	0.6%
[13] Net Property, Plant & Equipment	27.4%	29.4%	19.7%	8.0%
[14] Long-Term Debt	29.8%	22.1%	18.1%	9.5%
[15] Total Debt	40.5%	34.8%	23.7%	14.2%
[16] Retained Earnings ¹	(9.1%)	(5.4%)	6.0%	9.9%
Calculated as Aggregate Total Debt / Aggregate Total Equity				
[17] Debt-to-Equity Ratio	590.0%	171.1%	124.7%	115.0%

Notes & Sources:

Data from Standard & Poor's Capital IQ.

* Excludes 116 constituent companies with a Primary GICS Sector classification code of 60, "Real Estate." From Standard & Poor's Capital IQ. 1,384 unique companies considered.

¹ For REITs, represents either "Retained Earnings" or "Distributions In Excess Of Earnings," depending on how each company reports it.

[1]-[7] Calculated as sum of all Income Statement variable data for each sector divided by aggregate Total Revenue for each respective sector.

[8]-[11] Calculated as sum of all Statement of Cash Flow variable data for each sector divided by aggregate Total Revenue for each respective sector.

[12]-[16] Calculated as sum of all Balance Sheet variable data for each sector divided by aggregate Total Assets + Liabilities for each respective sector.

[17] Calculated as aggregate Total Debt divided by aggregate Total Equity for each sector.

[A] See Exhibit 1.

[B] Includes all Equity and Mortgage REIT constituents of the FTSE Nareit U.S. Real Estate Index Series, except for the six Infrastructure REITs. See Exhibit 1 and Exhibit 2.

[C] Includes all public companies in the U.S. classified under SIC code 4812, "Radiotelephone Communications," and listed on a major U.S. exchange. *I.e.*, AT&T Inc., ATN International, Inc., Lumen Technologies, Inc., Radius Global Infrastructure, Inc., Spok Holdings, Inc., Sonim Technologies, Inc., T-Mobile US, Inc., Telephone and Data Systems, Inc., United States Cellular Corporation, and Verizon Communications Inc. From Standard & Poor's Capital IQ.

[D] Includes the 1,500 unique constituent companies of the S&P Composite 1500 index, excluding 116 companies with a Primary GICS Sector classification code of 60, "Real Estate," for 1,384 companies total. From Standard & Poor's Capital IQ. If absolute value of normalized variable is less than 0.05%, that variable is displayed as "-".

3. *Dedicated real estate funds include tower REITs*

Numerous mutual funds and ETFs include tower companies in their investment portfolios, with increasing allocations over time. As shown in Exhibit 6, nine of the top ten actively managed domestic real estate funds by market capitalization as of February 2021 have tower company holdings. Similarly, eight of the top ten passively managed Domestic Real Estate funds by market capitalization as of February 2021 also have tower company holdings. This is relevant because it shows that dedicated fund managers recognize tower companies as providing real estate exposure for their investors.

Furthermore, prominent investment analysts who cover REITs and listed real estate companies place the tower sector in the real estate industry. For example, Green Street, which bills itself as “the industry leader in real estate and real estate investment trust (REIT) research for over three decades,”¹²² provides regular analysis on the tower sector.¹²³ Barclays describes American Tower as “an owner, operator and developer of multitenant communications real estate.”¹²⁴ And Morgan Stanley notes that American Tower and Crown Castle are increasing shares of real estate investors’ portfolios.¹²⁵

EXHIBIT 6

**MUTUAL FUNDS AND ETFS OWNING TOWER COMPANIES
AS OF FEBRUARY 9, 2021**

Fund Operator	Fund Name	Fund Type	Fund Size (\$ Millions)	Included in Portfolio as of Feb. 2021				
				AMT	CCI	SBAC	Any Tower REIT	
Top Ten Actively Managed Domestic Real Estate Funds:								
[1]	Dimensional Fund Advisors	DFA Real Estate Securities I	Open-End Fund	\$9,163	X	X	X	X
[2]	Cohen & Steers	Cohen & Steers Realty Shares L	Open-End Fund	\$6,199	X	X	X	X
[3]	Cohen & Steers	Cohen & Steers Real Estate	Open-End Fund	\$6,146	X	X	X	X
[4]	Principal Funds	Principal Real Estate Securities	Open-End Fund	\$5,126	X			X
[5]	Fidelity	Fidelity® Real Estate Investment	Open-End Fund	\$4,390		X	X	X
[6]	Cohen & Steers	Cohen & Steers Instl Realty Shares	Open-End Fund	\$4,035	X	X	X	X
[7]	TIAA Investments	TIAA-CREF Real Estate Sec Instl	Open-End Fund	\$3,094	X	X	X	X
[8]	Nuveen	Nuveen Real Estate Securities I	Open-End Fund	\$2,252	X	X	X	X
[9]	J.P. Morgan	JPMorgan Realty Income L	Open-End Fund	\$1,956				
[10]	Invesco	Invesco Real Estate C	Open-End Fund	\$1,809	X	X	X	X
[11]	Total				8	8	8	9
Top Ten Passively Managed Domestic Real Estate Funds:								
[12]	Vanguard	Vanguard Real Estate Index Investor	Open-End Fund	\$33,585	X	X	X	X
[13]	iShares	iShares US Real Estate ETF	Exchange-Traded Fund	\$5,170	X	X	X	X
[14]	Charles Schwab	Schwab US REIT ETF™	Exchange-Traded Fund	\$4,893	X	X	X	X
[15]	Fidelity	Fidelity® Real Estate Index	Open-End Fund	\$2,273	X	X	X	X
[16]	State Street	Real Estate Select Sector SPDR®	Exchange-Traded Fund	\$2,228	X	X	X	X
[17]	iShares	iShares Cohen & Steers REIT ETF	Exchange-Traded Fund	\$1,991	X		X	X
[18]	iShares	iShares Core US REIT ETF	Exchange-Traded Fund	\$1,650				
[19]	State Street	SPDR® Dow Jones REIT ETF	Exchange-Traded Fund	\$1,411				
[20]	Fidelity	Fidelity® MSCI Real Estate ETF	Exchange-Traded Fund	\$1,254	X	X	X	X
[21]	Pacer	Pacer Benchmark Data&Infras RE SCTR ETF	Exchange-Traded Fund	\$1,086	X	X	X	X
[22]	Total				8	7	8	8

Notes & Sources:

Data from Morningstar, courtesy of Nareit.

- [1]-[10] Nine of the top ten actively managed Domestic Real Estate funds by market capitalization as of Feb. 2021 have tower company holdings.
 [11] Number of funds in [1] to [10] owning each of the three tower REITs.
 [12]-[21] Eight of the top ten passively managed Domestic Real Estate funds by market capitalization as of Feb. 2021 have tower company holdings.
 [22] Number of funds in [12] to [21] owning each of the three tower REITs.

V. THE NATURE OF COMPETITION AND ALLOCATIVE EFFICIENCY IN TOWER REAL ESTATE MARKETS

When considering the nature of competition in the tower sector, it is important to note that there are critical features of the industry which limit the ability of tower companies to earn extra normal profits, which are incremental profits derived from possessing market pricing power.

Today, the three largest tower companies – American Tower, Crown Castle, and SBA Communications – collectively own or control just under 100,000 towers in the U.S. These towers represent approximately 76% of the roughly 130,000 cell towers in the U.S.¹²⁶ A 76% market share might suggest some degree of rental pricing power, but the threat of entry and tenant monopsony power are significant offsetting factors. For example, there exist over 100 other tower owners in the U.S.¹²⁷ Furthermore, as operators are densifying their networks, systems are increasingly comprised of both towers and smaller installations.¹²⁸ These smaller low-power devices deployed on buildings, utility structures and other locations can be used by operators to manage network traffic.

The three largest tower companies compete fiercely with one another and smaller tower owners for customers, as well as in the construction of new cell towers – with federal regulation that is structured to encourage competition.¹²⁹ Moreover, Exhibit 7 suggests new tower companies have entered the market. The number of towers owned by the Top 100 U.S. tower operators increased from approximately 117,000 in 2015 to approximately 129,000 in July 2021 – a compound annual growth rate of 1.8%. Roughly 75% of that increase in the stock of towers was attributable to firms other than the three largest tower companies.

EXHIBIT 7

NUMBER OF TOWERS OWNED BY THE TOP 100 TOWER COMPANIES 2015, 2020, AND 2021

Company	2015		2020		2021		CAGR
	#	%	#	%	#	%	2015–2021
[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]
[1] American Tower	39,928	34.1%	40,586	31.6%	41,886	32.4%	0.8%
[2] Crown Castle	39,739	34.0%	40,567	31.6%	40,567	31.4%	0.4%
[3] SBA Communications	14,873	12.7%	16,401	12.8%	16,401	12.7%	1.7%
[4] Vertical Bridge	2,998	2.6%	5,089	4.0%	5,089	3.9%	9.8%
[5] United States Cellular Co.	4,207	3.6%	4,207	3.3%	4,270	3.3%	0.3%
[6] Other	15,277	13.1%	21,576	16.8%	21,095	16.3%	5.9%
[7] Total	117,022	100.0%	128,426	100.0%	129,308	100.0%	1.8%

Notes & Sources:

Tower counts do not include foreign-owned tower portfolios, DAS, or small cells. In some cases, the tower company might not own the structure, but has lease rights and the ability to acquire the towers after a set period of time.

See e.g., Wireless Estimator, "Top 100 Tower Companies in the U.S," July 17, 2021, available at <https://wirelessestimator.com/top-100-us-tower-companies-list/> (viewed July 26, 2021).

[A] From Wireless Estimator, "Top 100 Tower Companies in the U.S," April 27, 2021, available at <https://wirelessestimator.com/top-100-us-tower-companies-list/> (viewed May 5, 2021).

[B] From Wireless Estimator, "Top 100 Tower Companies in the U.S," Updated November 19, 2015, available at <https://web.archive.org/web/20151227025819/https://wirelessestimator.com/top-100-us-tower-companies-list/> (viewed May 6, 2021).

[C] = [B] / [B][7].

[D] From Wireless Estimator, "Top 100 Tower Companies in the U.S," Updated September 11, 2020, available at <https://web.archive.org/web/20200928042222/https://wirelessestimator.com/top-100-us-tower-companies-list/> (viewed May 6, 2021).

[E] = [D] / [D][7].

[F] From Wireless Estimator, "Top 100 Tower Companies in the U.S," July 17, 2021, available at <https://wirelessestimator.com/top-100-us-tower-companies-list/> (viewed July 26, 2021).

[G] = [F] / [F][7].

[H] Compound Annual Growth Rate calculated as $([F] / [B])^{(1/\text{Years})} - 1$. Years calculated as the number of years between November 19, 2015 and July 17, 2021.

[7] = Sum of [1]:[6], except for [H].

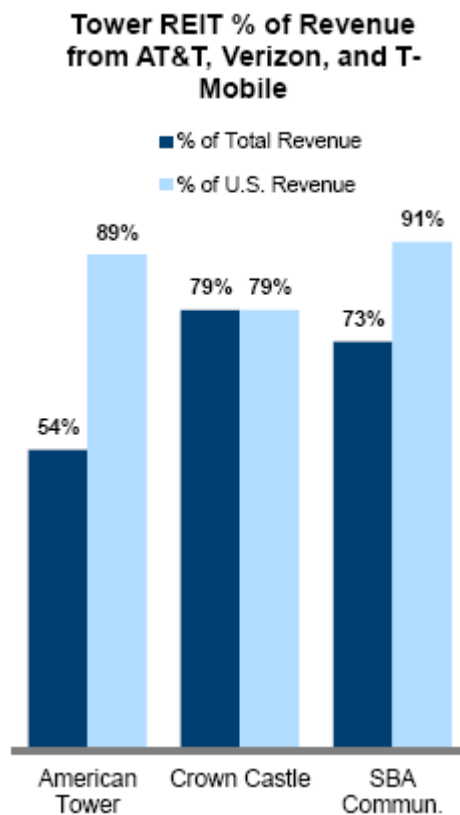
Over time, there has been increasing interest in entering the market. For example, in June 2021, Colony Capital – a long-time diversified REIT – rebranded as DigitalBridge, reflecting “the significant business transformation the Company has undergone since the leadership and board of directors made the bold decision to ... focus exclusively on the fast-growing digital infrastructure sector.”¹³⁰ Further, in August 2021, DigitalBridge reached a definite agreement to acquire a controlling stake in Vertical Bridge, the largest private operator of wireless infrastructure in the U.S. with over 5,000 towers in its asset portfolio.¹³¹

The majority of U.S. tower space is leased by the three main mobile operators: AT&T, Verizon, and T-Mobile. These three providers account for roughly 85% of the three largest tower companies’ U.S. revenue (Figure 6).¹³² As one industry analyst has observed, while the three largest tower companies control a significant percentage of U.S. tower capacity, the three largest mobile companies command a similar (even somewhat higher) market share.¹³³ This implies roughly balanced bargaining power over tower rental terms, with no particular rental pricing power going in one direction or the other. For example, in a lease negotiation, a potential telecommunications tenant can threaten not only to locate with a tower competitor, but also to relocate equipment with expiring leases as well as any other new leasing opportunities with a competitor in an attempt to reduce lease rates and gain other favorable lease contract terms.

The potential for technological obsolescence is an important and sometimes overlooked risk factor that affects competitive market structure. Tower REITs operate in a market where there is substantial exposure to technological change. Clearly, new and emerging mobile communication technologies have driven demand for tower leasing over the past two decades. Technological innovations may increase or decrease the demand for tower real estate in the

future. This in turn introduces uncertainty into firms' operating strategies, as well as affects firms' cost of debt and equity capital.

Figure 6¹³⁴
Q2 2020 from Green Street Report



Competitiveness is an important metric used in economics to characterize efficiency in resource allocation. Another, depending on the industry and the circumstances, can be the degree of vertical integration or disintegration in an industry.¹³⁵ Prior to the break-up of AT&T in the 1980s and 1990s, it was a highly integrated company that supplied not only phone service but the infrastructure to go with it. As wireless communication technology developed in the 1990s and

2000s, along with the entry of new telecommunications firms, vertical integration remained common with respect to infrastructure supply.

During this earlier period, telecommunications firms generally preferred “renting only to themselves” in order to exclude competitors from their cell towers. Doing so resulted in an inefficient duplication of cell tower capacity, with telecommunications firms building cell towers very close to one another when serving densely populated urban areas.¹³⁶

Telecommunications firms as well as local communities and regulators recognized these inefficiencies. As a result, and because it made economic sense for such firms to focus on their core businesses and shed expensive non-core assets, in the late 1990s telecommunications firms started selling cell towers to firms that specialized in cell tower ownership and development. In addition to allowing mobile carriers to focus on providing communication services rather than dealing with “side” issues such as onsite maintenance and regulatory compliance,¹³⁷ the neutral host model of independent tower ownership provides numerous economic advantages over the original model of carrier ownership.

Perhaps most importantly, whereas a carrier-owner would have, at best, muted incentives to lease tower space to a competitor, independent operators have an interest in leasing their towers to just about any qualified party in order to increase lease revenues and fill out tower capacity. As noted by one industry analyst, “Since tower owners are ‘neutral’, unlike wireless carriers who compete with one another, they can boost returns on investment by collocating tenants on the same tower.”¹³⁸ This naturally fosters competition among carriers in the areas served by the towers, which generally benefits consumers.¹³⁹ In turn, incentives to maximize the utilization of tower capacity limits the proliferation of towers, hence avoiding costly

duplication.¹⁴⁰ According to American Tower, carriers recognize meaningful savings when they lease from a tower company rather than building a tower themselves.¹⁴¹

Thus, vertical disintegration within the telecommunications industry has significantly increased allocative efficiency, as there is now far less duplication in cell tower development and far more direct competition between telecommunications firms. Cell tower companies also generate other efficiencies given their core expertise in locating, entitling, constructing and operating cell towers for the benefit of their customer tenants and ultimately consumers.

In summary, the wireless tower industry is competitive and allocatively efficient. There is strong competition amongst the three largest tower companies, and there is the opportunity for entry as evidenced by the fact that 75% of new tower construction in the past five years has been completed by smaller start-up companies that compete against the three largest tower companies. Importantly, tower REITs lease to primarily large, sophisticated tenants that have offsetting bargaining power in lease negotiations with tower companies. And, finally, there have been substantial efficiency gains as the telecommunications sector has shed their non-core tower assets. This has decreased inefficient tower duplication in more densely populated areas while increasing cell access to less densely populated areas, with greater competition between cell service providers, all to the benefit of consumers.

VI. CONCLUSION

This paper documents the origins, evolution, and basic business model of wireless infrastructure firms, also known as tower companies. Tower companies provide important infrastructure in the increasingly digital economy, housing key elements of the wireless communication network. The three largest U.S. macro tower companies are organized as real estate investment trusts, or REITs. The REIT organizational form allows for broad-based ownership of real estate by individual investors. Today, an estimated 145 million Americans hold REIT shares in their investment or retirement portfolios.

The assets held by tower companies are real estate. They satisfy a number of criteria that identify them as real estate, including: 1) Towers are fixed in location and attached to the ground; 2) The tower construction and development process is highly similar to that of other real estate construction and development projects; 3) Asset location is a primary source of value, which is reflected in the rents harvested through lease contracts; 4) The IRS and Treasury have confirmed that cell towers are real estate; 5) The Appraisal Institute recognizes cell towers to be real estate; 6) Investment industry (sector) classifications include tower companies in the real estate sector; 7) Dedicated real estate mutual funds and ETFs include tower REITs in their portfolios; 8) Tower REIT returns are correlated with non-tower REIT returns; and 9) Tower companies account for their assets similarly to other dedicated real estate firms.

Tower REITs operate in competitive markets, primarily leasing to large, sophisticated telecommunication companies. This, along with a persistent threat of entry through new tower construction by incumbents or newly formed firms, creates a competitive environment with providers of various size and market share. Importantly, tower REITs increase allocative

efficiency and benefit consumers by reducing duplication, lowering tower operating costs, and improving consumer access to wireless networks.

Endnotes

-
- ¹ This research has benefitted from support provided by Justin McLean, Douglas Frank, Johnny Wu, and Fay Blleloch of Analysis Group. Special thanks to Green Street for permission to use their figures and to John Worth for his insights and detailed commentary. Research funding from Nareit is gratefully acknowledged. While I benefitted greatly from input from a variety of sources, nobody is to be implicated. All shortcomings, opinions, and conclusions are mine alone.
- ² “What’s a REIT (Real Estate Investment Trust)?” Nareit, available at <https://www.reit.com/what-reit> (viewed July 21, 2021).
- ³ Barefoot, Kevin et al., “Defining and Measuring the Digital Economy,” U.S. Department of Commerce, Bureau of Economic Analysis, March 15, 2018 (“BEA, ‘Digital Economy’”), pp. 3, 7.
- ⁴ Nicholson, Jessica, “New Digital Economy Estimates,” U.S. Department of Commerce, Bureau of Economic Analysis, August 2020 (“BEA, ‘New Digital Economy’”), Chart 1.
- ⁵ BEA, “New Digital Economy,” Chart 7.
- ⁶ BEA, “New Digital Economy,” p. 14.
- ⁷ BEA, “Digital Economy,” p. 16.
- ⁸ BEA, “Digital Economy,” p. 7.
- ⁹ Kretschmer, Tobias, “Information and Communication Technologies and Productivity Growth: A Survey of the Literature,” *OECD Digital Economy Papers*, No. 195, April 13, 2012, p. 18.
- ¹⁰ “Despite its relatively small size as measured by GDP output statistics, the ICT industry has played an instrumental role in driving economic growth and employment within the U.S. economy.” Henry-Nickie, Makada, et al., “Trends in the Information Technology sector,” The Brookings Institution, March 29, 2019, available at <https://www.brookings.edu/research/trends-in-the-information-technology-sector/> (viewed January 19, 2021).
- ¹¹ International Telecommunication Union, “Measuring the Information Society Report Volume 1,” 2018, p. 5.
- ¹² CTIA, “Building the 5G Economy: The Wireless Industry’s Plan to Invest and Innovate in the U.S.,” January 25, 2021, p. 25.
- ¹³ Green Street, “Tower Sector: Tower 101 and 5G Introduction,” October 7, 2020 (“Green Street, ‘Tower Sector: Intro’”), p. 9.
- ¹⁴ Green Street, “Tower Sector: Intro,” p. 5.
- ¹⁵ Green Street, “Tower Sector: Intro,” p. 5.
- ¹⁶ Harris, Michael, “How Cell Towers Work,” Unison Site Management, 2011 (“Harris, ‘Cell Towers’”), p. 7.
- ¹⁷ Green Street, “Tower Sector: Intro,” p. 5.
- ¹⁸ Harris, “Cell Towers,” p. 1. Underneath the umbrella of a tower network, other technologies are used to increase network capacity, especially in urban areas. American Tower, “Introduction to the Tower Industry and American Tower,” June 30, 2020, p. 32.
- ¹⁹ Green Street, “Tower Sector,” p. 8.
- ²⁰ Harris, “Cell Towers,” p. 1.
- ²¹ Green Street, “Tower Sector: Intro,” p. 9.
- ²² Green Street, “Tower Sector: Intro,” p. 15.
- ²³ Green Street, “Tower Sector: Intro,” p. 15.
- ²⁴ Boston Consulting Group, “5G Promises Massive Job and GDP Growth in the US,” February 2021, p. 3.
- ²⁵ Boston Consulting Group, “5G Promises Massive Job and GDP Growth in the US,” February 2021, p. 3.
- ²⁶ Green Street, “Tower Sector: Intro,” p. 9.
- ²⁷ Green Street, “Tower Sector: Intro,” p. 16.
- ²⁸ Thomas, Brad, “Why Invest In A Cell Tower REIT?” Seeking Alpha, October 12, 2015, available at <https://seekingalpha.com/article/3564756-why-invest-in-cell-tower-reit> (viewed July 19, 2021) (“Seeking Alpha, ‘Why Invest In A Cell Tower REIT?’”).
- ²⁹ “Different Types of Telecom Towers: Which Design is Right For Your Site?” KMB Design Group, March 18, 2015, available at <https://www.kmbdg.com/news/different-types-telecom-towers-design-right-site/> (viewed August 16, 2021).
- ³⁰ “How Tall Does A Cell Tower Have To Be To Be Effective?” Vertical Consultants, October 4, 2019, available at <https://www.celltowerleaseexperts.com/cell-tower-lease-news/how-tall-does-a-cell-tower-have-to-be-to-be-effective/> (viewed March 29, 2021).

-
- ³¹ Tower engineering drawings. *See, e.g.*, Figure 3.
- ³² Tower engineering drawings. *See, e.g.*, Figure 3.
- ³³ Tower engineering drawings. *See, e.g.*, Figure 3.
- ³⁴ Tower engineering drawings. *See, e.g.*, Figure 3.
- ³⁵ StructurePoint, “Telecommunication Tower Reinforced Concrete Foundation,” March 1, 2019.
- ³⁶ Seeking Alpha, “Why Invest In A Cell Tower REIT?”
- ³⁷ Seeking Alpha, “Why Invest In A Cell Tower REIT?”
- ³⁸ Seeking Alpha, “Why Invest In A Cell Tower REIT?”
- ³⁹ Detmer, Mike, “Neck District cell tower expands emergency coverage,” *Dorchester Star*, October 20, 2021, available at https://www.myeasternshoremd.com/dorchester_star/news/neck-district-cell-tower-expands-emergency-coverage/article_c0a264c3-2498-51cf-9417-0560b43043ca.html (viewed October 20, 2021); Wyatt, Bill, “Patrick County gets two new emergency communication cell towers,” *Martinsville Bulletin*, December 1, 2020, available at https://martinsvillebulletin.com/news/local/patrick-county-gets-two-new-emergency-communication-cell-towers/article_b9f268ce-3347-11eb-8855-7bc0e7ca751b.html (viewed October 20, 2021); “New Echo Trail cell site supports first responders,” *The Timberjay*, June 17, 2021, available at <http://www.timberjay.com/stories/new-echo-trail-cell-site-supports-first-responders,17787> (viewed October 20, 2021); Newmarco, Zoë, “Proposed Towers, Cellular Network Focuses on Emergency Responders,” *The Herald*, January 7, 2021, available at <https://www.ourherald.com/articles/proposed-towers-cellular-network-focuses-on-emergency-responders/> (viewed October 20, 2021); “What Other Tenants Lease Cell Towers?” *Tower Genius*, 2019, available at <https://towergenius.com/what-other-tenants-lease-cell-towers/> (viewed October 20, 2021).
- ⁴⁰ Seeking Alpha, “Why Invest In A Cell Tower REIT?”
- ⁴¹ Courtesy of Nareit.
- ⁴² Seeking Alpha, “Why Invest In A Cell Tower REIT?”
- ⁴³ Seeking Alpha, “Why Invest In A Cell Tower REIT?”
- ⁴⁴ Robaton, Anna, “Crowning Achievement,” Nareit, September 19, 2014, available at <https://www.reit.com/news/reit-magazine/september-october-2014/crowning-achievement> (viewed January 26, 2021) (“Nareit, ‘Crowning Achievement’”).
- ⁴⁵ Nareit, “Crowning Achievement.”
- ⁴⁶ Shigekawa, Steve, and Brian Jones, “Digital Drivers of Real Estate Opportunity,” May 26, 2020, available at <https://www.nb.com/en/global/insights/digital-drivers-of-real-estate-opportunity> (viewed January 21, 2021); Nareit, “Crowning Achievement.”
- ⁴⁷ Chang, Sue, “Sprint to sell about 3,300 towers for \$670 mln in cash,” *MarketWatch*, July 23, 2008, available at <https://www.marketwatch.com/story/sprint-to-sell-about-3300-towers-for-670-mln-in-cash> (viewed March 26, 2021).
- ⁴⁸ “Crown Castle Announces \$4.85 Billion AT&T Tower Transaction,” *Crown Castle*, October 20, 2013, available at <https://investor.crowncastle.com/news-releases/news-release-details/crown-castle-announces-485-billion-att-tower-transaction> (viewed August 10, 2021).
- ⁴⁹ Keenan, Charles, “Infrastructure REITs Are Powering the Growth of Cloud Computing,” Nareit, March 23, 2016, available at <https://www.reit.com/news/reit-magazine/march-april-2016/infrastructure-reits-are-powering-growth-cloud-computing> (viewed January 19, 2021). Service providers still own some towers, such as T-Mobile Towers with 403 and Sprint Sites USA with 236. “Top 100 Tower Companies in the U.S.,” *Wireless Estimator*, July 17, 2021, available at <https://wirelessestimator.com/top-100-us-tower-companies-list/> (viewed July 26, 2021) (“Wireless Estimator, ‘Top 100 Tower Companies in the U.S.’”).
- ⁵⁰ *Wireless Estimator*, “Top 100 Tower Companies in the U.S.”
- ⁵¹ “What’s a REIT (Real Estate Investment Trust)?” Nareit, available at <https://www.reit.com/what-reit> (viewed July 21, 2021).
- ⁵² “REITS Through the Years,” Nareit, 2021, available at <https://thereitway.com/reits-through-the-years/> (viewed August 16, 2021).
- ⁵³ Nareit, “Nareit Member Guide: Telling the REIT Story,” 2019, at 2.
- ⁵⁴ Ashford, Kate, and Benjamin Curry, “What Is A REIT?” *Forbes*, February 9, 2021, available at <https://www.forbes.com/advisor/investing/what-is-reit/> (viewed March 12, 2021); SEC, “Investor Bulletin: Real Estate Investment Trusts (REITS),” December 2011, available at <https://www.sec.gov/files/reits.pdf>.

-
- ⁵⁵ “Learn the Basics of REITS & REIT Investing,” Nareit, available at <https://www.reit.com/what-reit/reit-basics> (viewed March 12, 2021). U.S. adult population of 255 million as of July 1, 2019. U.S. Census Bureau, “7/1/2019 State Characteristics Population Estimates,” December 2019, available at <https://www2.census.gov/programs-surveys/popest/tables/2010-2019/state/detail/SCPRC-EST2019-18+POP-RES.xlsx>. Indirect ownership can occur through, for example, participation in a defined benefit retirement plan. An example of direct ownership would be individual savings channeled into a REIT-dedicated mutual fund.
- ⁵⁶ Equity REITs hold direct ownership interests in real estate. On the other hand, so-called “mortgage” REITs hold ownership interests in debt or debt-like securities collateralized by real estate. There are further distinctions, including whether a REIT is listed on a stock exchange or not. The larger tower companies that are the focus of this study are equity REITs that are listed on stock exchanges. *See, e.g.*, “What are the Different Types of REITs?” Nareit, available at <https://www.reit.com/what-reit/types-reits> (viewed June 2, 2021).
- ⁵⁷ “What’s a REIT (Real Estate Investment Trust)?” Nareit, available at <https://www.reit.com/what-reit> (viewed July 21, 2021).
- ⁵⁸ “What’s a REIT (Real Estate Investment Trust)?” Nareit, available at <https://www.reit.com/what-reit> (viewed July 21, 2021). The \$2.5 trillion in assets represents public REITs (a small number are public non-listed REITs).
- ⁵⁹ “History of REITs & Real Estate Investing,” Nareit, available at <https://www.reit.com/what-reit/history-reits> (viewed March 12, 2021).
- ⁶⁰ *See* Section IV.B.5 for a more detailed discussion.
- ⁶¹ Cohen & Steers, “Infrastructure REITs Towering Over the 5G Economy,” July 2019, p. 4.
- ⁶² Cohen & Steers, “Infrastructure REITs Towering Over the 5G Economy,” July 2019, p. 4.
- ⁶³ Green Street, “Tower Sector: Dialing In To New Coverage,” October 7, 2020, p. 7.
- ⁶⁴ Green Street, “Heard on the Beach: Real Estate for Tomorrow’s Economy,” October 15, 2020, p. 3.
- ⁶⁵ Green Street, “Heard on the Beach: Real Estate for Tomorrow’s Economy,” October 15, 2020, pp. 1, 5.
- ⁶⁶ Randolph Westerfield helped inspire this paragraph as it originally appeared in my course teaching notes.
- ⁶⁷ DiPasquale, Denise, and William C. Wheaton, “The Markets for Real Estate Assets and Space: A Conceptual Framework,” *Journal of the American Real Estate and Urban Economics Association*, Vol. 20, No. 1 (1992): 181-197, at pp. 185-190.
- ⁶⁸ I will note that permanence in affixture to the land or foundation is not absolute. Many structures that are considered to be real estate can become detached from the land or foundation, but only with great effort and at a significant cost. For example, free-standing single-family houses are occasionally lifted from their foundations to be moved to another location. On the other hand, restaurants located in boats that sit in the water but that are anchored to a fixed location are typically not considered to be real estate. This follows because the boat, with much less cost and effort, can become unanchored and drift away from the prior location.
- ⁶⁹ A typical monopole foundation pad measures 26 by 26 by 2.5 feet, or 1,650 cubic feet, not counting the columnar portion of the foundation that is integrated into the pad. Concrete weighs approximately 150 pounds per cubic foot. *See* Section II.B.
- ⁷⁰ “Cell on Wheels,” CellSite Solutions, available at <https://cellsitesolutions.com/portfolio-view/cows/> (viewed April 1, 2021). Emphasis added.
- ⁷¹ *Shenandoah Mobile Company v. Dauphin County Board of Assessment Appeals*, No. 1299 (Pa. Commw. Ct. Feb. 1, 2005) (“Shenandoah v. Dauphin”).
- ⁷² *Shenandoah v. Dauphin*.
- ⁷³ *Shenandoah v. Dauphin*.
- ⁷⁴ *Shenandoah v. Dauphin*. For a more recent ruling in a different state with a similar conclusion, see *Grand Traverse County Land Bank Authority v. Verizon Wireless and Great Northern Broadcasting System, Inc.*, No. 332804 (Mich. Ct. App. May 29, 2017); Taylor, Alan J., “Michigan Court of Appeals’ Recent Decision Reviews What Constitutes a Fixture Under Michigan Law,” Segal McCambridge, May 31, 2017, available at <http://www.smsm.com/blogs-litigationblog/real-estate-client-update-michigan-court-of> (viewed March 29, 2021).
- ⁷⁵ “Towers, Rooftops, and Backup Power Support,” American Tower, available at <https://www.americantower.com/us/customer-support/towers-rooftops-and-backup-power-support.html> (viewed May 5, 2021).
- ⁷⁶ “Commercial Real Estate Development Process,” SimonCRE, available at <https://info.simoncre.com/the-commercial-real-estate-development-process> (viewed May 3, 2021).

-
- ⁷⁷ American Tower Corporation Form 10-K for the fiscal year ended December 31, 2020 (“AMT 2020 10-K”), p. 1; SBA Communications Corporation Form 10-K for the fiscal year ended December 31, 2020 (“SBA 2020 10-K”), p. 1; Crown Castle Form 10-K for the fiscal year ended December 31, 2020 (“Crown Castle 2020 10-K”), pp. 4, 7.
- ⁷⁸ S&P Capital IQ.
- ⁷⁹ Simon Property Group 2020 Annual Report, p. 58.
- ⁸⁰ “History of Simon Property Group, Inc.,” Funding Universe, available at <http://www.fundinguniverse.com/company-histories/simon-property-group-inc-history/> (viewed March 29, 2021).
- ⁸¹ Simon Property Group 2020 Annual Report, p. 73.
- ⁸² Equity Residential Form 10-K for the fiscal year ended December 31, 2019 (“Equity Residential 2019 10-K”), pp. 1, 7.
- ⁸³ Equity Residential 2019 10-K, p. F-10.
- ⁸⁴ AMT 2020 10-K, p. 1; Crown Castle 2020 10-K, p. 4; SBA 2020 10-K, p. 4.
- ⁸⁵ “Build to Suit Development,” Prologis, available at <https://www.prologis.com/customers/build-to-suit> (viewed March 17, 2021).
- ⁸⁶ Alexandria Real Estate Equities, Inc. Form 10-K For the fiscal year ended December 31, 2020 (“Alexandria 2020 10-K”), p. 2.
- ⁸⁷ Alexandria 2020 10-K, p. 2.
- ⁸⁸ A recent study by the Nevada Department of Taxation surveyed research on the expected lives of telecommunications assets. The study reported estimates for “telecommunications infrastructure designed for installation exterior to buildings,” including aerial systems, of 40 years or more. The study also drew an analogy to electrical transmission towers and poles, citing average service lives of 65 years for towers and 55 years for poles. “Expected Life Study: Telecommunications and Cable Assets,” Nevada Department of Taxation Division of Local Government Services, April 2, 2015, pp. 3-4.
- ⁸⁹ Green Street, “Tower Sector: Intro,” p. 12.
- ⁹⁰ American Tower, “Introduction to the Tower Industry and American Tower,” June 30, 2020, p. 14.
- ⁹¹ Green Street, “Tower Sector: Intro,” p. 25.
- ⁹² S&P Capital IQ. Cell tower-related transactions screened using the following criteria: (1) Target Entity Primary Geographic Location = U.S., (2) M&A Closed Date between January 1, 2010 and October 21, 2021, and (3) Target Entity Business Description includes the keywords “communication tower” or “wireless tower” or “cell tower” or “broadcast tower” or “tower portfolio.” Retrieved October 21, 2021.
- ⁹³ “Company News; Sprint Near Deal to Sell Some Cellphone Towers,” The New York Times, February 8, 2005, available at <https://www.nytimes.com/2005/02/08/business/technology/company-news-sprint-near-deal-to-sell-some-cellphone-to.html> (viewed August 16, 2021).
- ⁹⁴ Troianovski, Anton, “AT&T Hints Asset Sales May Occur,” The Wall Street Journal, March 15, 2013 available at <https://www.wsj.com/articles/SB10001424127887324392804578362623951820736> (viewed August 16, 2021).
- ⁹⁵ Levy, Adam, “Why AT&T and Verizon Communications Are Selling Over \$12.6 Billion Worth of Assets,” The Motley Fool, February 15, 2015, available at <https://www.fool.com/investing/general/2015/02/15/why-att-and-verizon-communications-are-selling-ove.aspx> (viewed August 16, 2021).
- ⁹⁶ “AT&T and Peppertree Capital Agree to Tower Transaction Valued at up to \$680 Million,” AT&T, October 25, 2019, available at https://about.att.com/story/2019/att_peppertree_capital.html (viewed August 16, 2021).
- ⁹⁷ Lagorce, Aude, “Deutsche Telekom Swings to \$1.2 Billion Loss,” MarketWatch, March 1, 2007, available at <https://www.marketwatch.com/story/deutsche-telekom-loses-12-bln-on-job-cut-costs-line-losses> (viewed August 16, 2021).
- ⁹⁸ “U.S. Cellular Announces Sale of Towers in Divested Markets,” PR Newswire, December 11, 2014, available at <https://www.prnewswire.com/news-releases/us-cellular-announces-sale-of-towers-in-divested-markets-300008484.html> (viewed August 16, 2021).
- ⁹⁹ Internal Revenue Service, “Publication 551: Basis of Assets,” Publication 551, Cat. No. 15094C, December, available at <https://www.irs.gov/pub/irs-pdf/p551.pdf>, p. 2. *See also*, 26 C.F.R. § 1.856-10 (b) (“The term *real property* means land and improvements to land.”).
- ¹⁰⁰ I.R.S Gen. Couns. Mem. 32,907 (September 3, 1964).
- ¹⁰¹ Rev. Rul. 75-424. 1975-2 C.B. 269.
- ¹⁰² I.R.S Gen. Couns. Mem. 32,907 (September 3, 1964); Rev. Rul. 75-424. 1975-2 C.B. 269.
- ¹⁰³ *See* PLR 9552049 (Oct. 2, 1995); PLR 9612024 (Dec. 22, 1995); PLR 9808011 (Oct. 14, 1997); PLR 9850009 (Sept. 9, 1998); PLR 201129007 (Apr. 6, 2011); PLR 201301007 (Jan. 4, 2013).
- ¹⁰⁴ 26 C.F.R. § 1.856-10(d)(2)(iii)(B).

-
- ¹⁰⁵ “Land Use and Zoning Basics,” FindLaw, available at <https://www.findlaw.com/realestate/land-use-laws/land-use-and-zoning-basics.html> (viewed August 16, 2021).
- ¹⁰⁶ Owens, David W., “Wireless Telecommunication Facilities and Zoning,” UNC School of Government, January 2012, available at <https://www.sog.unc.edu/resources/legal-summaries/wireless-telecommunication-facilities-and-zoning> (viewed August 16, 2021). More recent versions of the 2005 survey demonstrated that by 2012, 87% of cities and 79% of counties had adopted a zoning ordinance. Similarly, the 2018 iteration of the survey confirmed these levels, with 92% of responding cities having reported adoption of zoning regulations. UNC School of Government, “2018 Survey Report: Adoption and Administration of Local Development Regulations, Conditional Zoning, and Subdivision Administration,” December 2020, at 4.
- ¹⁰⁷ Cary, NC, Municipal Code § 5.2.4 (d).
- ¹⁰⁸ Cary, NC, Municipal Code § 5.2.4 (d)(2).
- ¹⁰⁹ Cary, NC, Municipal Code § 5.2.4 (d).
- ¹¹⁰ Framingham, Mass., Zoning Ordinances (2021), Section V.E.
- ¹¹¹ Marlborough, Mass., General Code Ch. 1, § 650-25 (2002).
- ¹¹² “Municipal Regulation of Cellular Telephone Towers and Antennas,” New York State Department of State, Office of General Counsel, available at <https://video.dos.ny.gov/cns1/lu01.htm> (viewed August 23, 2021).
- ¹¹³ All equity REITs and real estate management and development companies were transferred to the new sector; however, mortgage REITs remained in the financials sector. S&P Dow Jones Indices, “The New GICS Real Estate Sector and S&P U.S. Benchmarks,” March 2016, p. 1.
- ¹¹⁴ “GICS Classification of Real Estate,” Nareit, available at <https://www.reit.com/investing/investor-resources/gics-classification-real-estate> (viewed August 16, 2021).
- ¹¹⁵ S&P Dow Jones Indices, “The New GICS Real Estate Sector and S&P U.S. Benchmarks,” March 2016, p. 3.
- ¹¹⁶ FTSE Russell, “Industry Classification Benchmark (ICB) reclassification,” December 2019, p. 2.
- ¹¹⁷ FTSE Russell, “Industry Classification Benchmark (ICB) reclassification,” December 2019, pp. 4-5.
- ¹¹⁸ Hotel is one commercial real estate property type that has some features similar to non-real estate firms, given its service intensity and competition in a spot market for space (nightly room leasing). That said, long-term leases are often signed by brand hotel operators with property owners, producing a relatively stable income stream for the property owner.
- ¹¹⁹ Note that other REITs include Mortgage REITs and four Timber REITs, which largely do not report rental revenues. There are a few other unique REITs that also do not report this, e.g., Colony Capital, Inc. (NYSE:CLNY; Specialty), Geo Group, Inc. (NYSE:GEO; Specialty), Equinix REIT (NASDAQ:EQIX; Data Center). Note that for the “Other REITs” which only include companies with >\$0 in reported total rental revenues, the normalized ratio becomes ~80%. Inclusion of all of the REITs shows 68%.
- ¹²⁰ 17 C.F.R. § 210.5-04(c).
- ¹²¹ For examples of REITs that report this metric (or a similar one), see Crown Castle 2020 10-K, p. 49; SBA 2020 10-K, pp. F-3, F-19; AMT 2020 10-K, p. F-5; Acadia Realty Trust Form 10-K for the fiscal year ended December 31, 2020, pp. 42, 61; The Macerich Company Form 10-K for the fiscal year ended December 31, 2020, pp. 67, 91; Alexandria Real Estate Equities, Inc. Form 10-K for the fiscal year ended December 31, 2020, p. F-3; Digital Realty Trust, Inc. Form 10-K for the fiscal year ended December 31, 2020, p. 104. On the other hand, telecommunications firms such as AT&T, ATN International, Lumen Technologies, T-Mobile, Verizon, etc. do not.
- ¹²² “The Green Street Difference,” Green Street, available at <https://www.greenstreet.com/about/green-street-difference> (viewed August 17, 2021).
- ¹²³ See e.g., Green Street, “Tower Sector: Intro”; Green Street, “Tower Sector: Dialing In to New Coverage,” October 7, 2020; Green Street, “Heard on the Beach: Real Estate for Tomorrow’s Economy,” October 15, 2020.
- ¹²⁴ Barclays Equity Research, “U.S. Communications Infrastructure: Towers/Data Centers Initiation,” July 15, 2020, p. 34.
- ¹²⁵ Morgan Stanley, “Towers - 4Q20 Preview: Looking to Clear a Lowered Bar,” January 22, 2021, pp. 11, 14.
- ¹²⁶ As of July 2021, calculated as $98,854 / 129,308 = 76.4\%$. Exhibit 3; Exhibit 7.
- ¹²⁷ “Top 100 Tower Companies in the U.S.,” Wireless Estimator, July 17, 2021, available at <https://wirelessestimator.com/top-100-us-tower-companies-list/> (viewed July 26, 2021).
- ¹²⁸ WIA Innovation & Technology Council, “Feeding the Beast: How Mobile Operators are Racing to Keep Up with Insatiable Demand for Mobile Broadband,” May 23, 2018, PDF pp. 9-10.
- ¹²⁹ See, e.g., Exhibit 7, which gives a sense of the competitive landscape.

-
- ¹³⁰ “Colony Capital Announces Rebrand as DigitalBridge,” DigitalBridge, June 8, 2021, available at <https://www.digitalbridge.com/news/2021-06-08-colony-capital-announces-rebrand-as-digitalbridge> (viewed August 10, 2021). Marc Ganzi, CEO of DigitalBridge, described the rebranded company as “poised to build, operate, and finance a new era in connectivity, leveraging a single platform focused on the full spectrum of digital infrastructure including towers, data centers, fiber, and small cells.”
- ¹³¹ “DigitalBridge Investment Management To Acquire Controlling Stake In Digital Infrastructure Leader Vertical Bridge,” DigitalBridge, August 10, 2021, available at <https://www.digitalbridge.com/news/2021-08-10-digitalbridge-investment-management-to-acquire-controlling-stake-in-digital-infrastructure-leader-vertical-bridge> (viewed August 10, 2021); Exhibit 7.
- ¹³² Green Street, “Tower Sector: Intro,” p. 10.
- ¹³³ Green Street, “Tower Sector: Dialing In To New Coverage,” October 7, 2020, p. 8.
- ¹³⁴ Green Street, “Tower Sector: Intro,” p. 10.
- ¹³⁵ The term “vertical integration” refers to the extent to which all the various aspects of creating and delivering a product to the market, from beginning to end, are owned and controlled by a single firm. For example, telecommunications companies that sell their towers to real estate specialists are less integrated than they were before the sale.
- ¹³⁶ A standard model of location choice in urban economics is Hotelling’s linear city model, which can be illustrated by the following example. Imagine a beach evenly populated with sunbathers. There is demand for drinks to quench beachgoer thirst, but beachgoers weigh the costs of commuting to the drink stand with their thirst level. The resulting optimal location choice for the drink stand is right in the middle of the beach. The optimal location for a second drink stand that competes with the first is to locate right next to the incumbent stand.
- ¹³⁷ “Tower Acquisitions,” American Tower, available at <https://www.americantower.com/us/solutions/towers/tower-acquisitions.html> (viewed March 26, 2021).
- ¹³⁸ Green Street, “Tower Sector: Intro,” p. 12.
- ¹³⁹ See, e.g., Hoya Capital Real Estate, “Cell Tower REITs: Fireworks Abound As Competition Heats Up,” Seeking Alpha, July 2, 2020, available at <https://seekingalpha.com/article/4356697-cell-tower-reits-fireworks-abound-competition-heats-up> (viewed August 18, 2021); “Competition,” CTIA, available at <https://www.ctia.org/competition> (viewed August 18, 2021).
- ¹⁴⁰ “Crowning Achievement,” Nareit, September 9, 2014, available at <https://www.reit.com/news/reit-magazine/september-october-2014/crowning-achievement> (viewed January 26, 2021).
- ¹⁴¹ American Tower, “Introduction to the Tower Industry and American Tower,” June 30, 2020, p. 34.