

---



# **REIT Supported Wireless Infrastructure:** Foundation of the Mobile Economy

---

PREPARED FOR

The Wireless Infrastructure Association

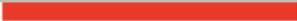
PREPARED BY

Coleman Bazelon

Pallavi Seth

May 23, 2017

---



This report was prepared for the Wireless Infrastructure Association (“WIA”) with active cooperation from American Tower, Crown Castle and SBA Communications. All results and any errors are the responsibility of the authors and do not represent the opinion of The Brattle Group (“Brattle”) or its clients.

*Acknowledgement:* We acknowledge the valuable contributions of many individuals to this report and to the underlying analysis, including members of The Brattle Group for peer review. We are specifically indebted for contributions from Valerie Tate, Paul Organ, Yingzhen Li and Vic Zimmermann.

---



## Table of Contents

Executive Summary .....	ii
I. Real Estate Investment Trusts .....	1
A. Historic and Policy Context of Real Estate Investment Trusts.....	1
B. How Wireless Infrastructure Meets the Policy Goal Associated with REITs .....	4
II. Current Landscape of the Wireless Industry and the Role of Infrastructure .....	7
A. Brief Overview of the Wireless Industry.....	7
B. Infrastructure is the Enabler of the Wireless Industry .....	10
C. Evolution of Third-Party Investment in Wireless Communications Towers Infrastructure .....	13
D. Spending on Infrastructure by the Tower Industry .....	16
E. Economic Impact.....	17
III. Conclusion .....	21
IV. Appendix.....	22

## Executive Summary

Wireless infrastructure plays a crucial role in how businesses, citizens and governments operate in today's mobile-first world. These networks are critical to everything from education and business to public safety and health care. Wireless networks in the U.S. delivered 42.7 petabytes of data every day in 2016, a figure expected to grow to 200.5 petabytes per day by 2020. To put that growth in perspective, a similar increase in New York City Subway ridership would see daily traffic grow from 4.8 million riders today to 22.6 million riders per day in 2021.

To support this massive growth in usage, today's wireless networks require robust wireless infrastructure – including well over 100,000 cell towers in the U.S. as of 2016. Wireless infrastructure providers, the largest being organized as real estate investment trusts (“REITs”) and recognized under federal tax codes as real estate companies, have played a key role in wireless infrastructure funding for years. As REITs, these companies are able to drive the industry forward with increased investments as wireless carriers demand more network capacity to deliver their growing lists of mobile services to customers. In this manner, REITs solve a market challenge by ensuring that capital is efficiently invested in wireless telecommunications infrastructure by allowing small investors to participate in these investments.

In order to better understand the significant economic impact of the wireless infrastructure industry to the U.S., it is necessary to examine the industry's capital expenditures as well as the flow-through impact of those investments on the general economy. In total, through direct, indirect and induced expenditures resulting from its capital and operating expenditures, the wireless communications tower industry supported approximately \$6.8 billion in spending and 32,500 jobs in the U.S. in 2016. Expenditures by the wireless infrastructure industry support a broad network of suppliers of goods and services including equipment suppliers, raw material suppliers, professional services providers, subcontractors, repair and maintenance providers and utilities.

Wireless infrastructure provides the foundation upon which the wireless industry will deliver the applications, services, and jobs that will fuel the U.S. economy for years to come. As the economic importance of ubiquitous broadband grows and as advanced wireless services spread across industries, wireless infrastructure's role in supporting the U.S. economy's continuing growth will only expand. Therefore, it is critical for policy makers to continue to support the wireless infrastructure industry through prudent policies.

## I. Real Estate Investment Trusts

### A. HISTORIC AND POLICY CONTEXT OF REAL ESTATE INVESTMENT TRUSTS

Real Estate Investment Trusts (“REITs”) were created in the U.S. when President Dwight D. Eisenhower signed the Real Estate Investment Trust Act of 1960 into law (“REIT Act”).<sup>1</sup> REITs are defined as unincorporated trusts or associations meeting additional requirements as to amounts of various types of gross income and as to types of investments specified in the REIT Act and modeled after Regulated Investment Companies (or mutual funds).<sup>2</sup>

In creating REITs, Congress intended to: 1) to afford an opportunity for small investors to participate in large real estate investments with expert management and to do so on a scale previously available only to a few wealthy individuals; and 2) to encourage the growth of such investment trusts, which would increase the funds available for equity financing of the large real estate developments and redevelopments needed in metropolitan areas.<sup>3</sup>

Real estate investments, by their nature, tend to require large amounts of capital from investors. The REIT Act facilitates this by pooling private capital from smaller investors into REITs. For smaller investors, advantages of this pooling arrangement include risk-sharing by greater diversification, the opportunity to secure the benefits of expert investment counsel, and the means of collectively financing real estate projects that the investors could not undertake

---

<sup>1</sup> “[I]n the 86th Congress, Congressman Keogh sponsored a similar bill which was approved by the House [previously and ultimately vetoed by the President based on a concern about, among other things, a loss of funds to the Treasury]. The Senate instead of handling separately incorporated it as Amendment No. 9 into a bill dealing with a number of miscellaneous tax matters. It was in this form that the measure was finally adopted by the Senate and received the subsequent approval of the President. An interesting note on politics arises out of this bill since the measure approved by President Eisenhower [was] essentially the same structure as the bill [he] vetoed in 1956. Apparently the main reason for the change of attitude by the President lies in the economic condition of the country at that time and the pressing need for private investment capital.” See A. Overton Durrett, “The Real Estate Investment Trust: A New Medium for Investors,” *William & Mary Law Review*, 1961, at pp. 143-145.

<sup>2</sup> A. Overton Durrett, “The Real Estate Investment Trust: A New Medium for Investors,” *William & Mary Law Review*, 1961, at pp. 140, 147.

<sup>3</sup> William A. Kelley, Jr., “Real Estate Investment Trusts After Seven Years,” *The Business Lawyer*, 1968, at p. 1.

individually. The REIT Act thus provides a meaningful opportunity for smaller investors to participate in large real estate investments that they may not otherwise be able to access.

REIT shareholders receive the distributions paid by REITs, and these distributions are primarily subject to taxation as ordinary income.<sup>4</sup> Thus, companies qualified as REITs (and electing REIT status for tax purposes) receive a deduction for dividends paid to their shareholders; as a result, they generally do not pay U.S. federal and certain state income taxes as corporate entities.<sup>5</sup> There are stringent asset and income requirements that a REIT must meet on a quarterly and annual basis, with the main idea that a company wishing to achieve or maintain REIT status must primarily hold real estate assets and derive a large majority of its gross income from passive real estate-related activities.<sup>6</sup> In addition, there are ownership and organizational requirements for a REIT, such as having at least 100 shareholders.<sup>7</sup>

Similar to Regulated Investment Companies (“RICs”) and unlike regular C corporation shareholders, REIT shareholders pay only one level of tax.<sup>8</sup> While the Supreme Court in 1935 held in *Morrissey v. Commissioner* that any business trust (such as investment companies and real estate investment trusts) with sufficient corporate characteristics should be subject to the corporate income tax, investment companies obtained relief from the *Morrissey* decision in 1936 when the Revenue Act of 1936 made it possible for RICs (such as mutual funds) to organize a trust for the purpose of providing expert centralized investment management without corporate

---

<sup>4</sup> Shareholder dividends are taxed as ordinary income plus a separate 3.8 percent investment income surcharge. A capital gains tax applies only to the sale of REIT stock. “Taxes and REIT Investment,” NAREIT, available at <https://www.reit.com/investing/investing-reits/taxes-and-reit-investment> (last accessed February 7, 2017).

<sup>5</sup> REITs must distribute at least 90 percent of their ordinary taxable income as dividends to their beneficiaries. Peter E. Boos, “Runaway REIT Train? Impact of Recent IRS Rulings,” Tax Notes, 2014, at p. 2.

<sup>6</sup> Peter E. Boos, “Runaway REIT Train? Impact of Recent IRS Rulings,” Tax Notes, April 3, 2015, at p. 2, available at <http://www.taxanalysts.org/content/runaway-reit-train-impact-recent-irs-rulings> (last accessed February 2, 2016).

<sup>7</sup> Peter E. Boos, “Runaway REIT Train? Impact of Recent IRS Rulings,” Tax Notes, April 3, 2015, at p. 21, available at <http://www.taxanalysts.org/content/runaway-reit-train-impact-recent-irs-rulings> (last accessed February 2, 2016).

<sup>8</sup> See *supra* at footnote 4.

tax liability.<sup>9</sup> Mutual funds experienced tremendous growth, while at the same time real estate trusts and similar organizations continued to be taxed as corporations. It was argued that the only difference between mutual funds and real estate trusts was their source of income (realty and mortgage rather than stocks and bonds).<sup>10</sup> A report filed by the House Committee stated that the inconsistent tax treatment of securities income and rental income discriminated, without reason, against the REIT and impeded the flow of investment capital toward its “highest and best” use.<sup>11</sup> In passing the REIT Act, Congress created parity of tax treatment between REITs and RICs.

From the perspective of enhancing social welfare, shepherding private capital towards REITs, which would then invest in large real estate projects such as skyscrapers and shopping centers, ultimately facilitates urban redevelopment. As noted in the House Ways and Means Committee report regarding the reason for the REIT legislation, driving private capital towards real estate investments was “particularly important because of the shortage of private capital and mortgage money for individual homes, apartment houses, office buildings, factories, and hotels.”<sup>12</sup> At the time of the legislation, financing of these real estate equities and mortgages was dependent largely on government-guaranteed money and investment by special groups, such as insurance companies and pension trusts. The REIT Act aimed to drive private capital to help accomplish the policy goal of urban renewal.

Investing in REITs also benefits shareholders. REITs offer shareholders earnings transparency and predictable revenue streams from high dividend yields.<sup>13</sup> In 2015, for example, REITs paid

---

<sup>9</sup> Peter E. Boos, “Runaway REIT Train? Impact of Recent IRS Rulings,” Tax Notes, April 3, 2015, at p. 2, available at <http://www.taxanalysts.org/content/runaway-reit-train-impact-recent-irs-rulings> (last accessed February 2, 2016).

<sup>10</sup> A. Overton Durrett, “The Real Estate Investment Trust: A New Medium for Investors,” William & Mary Law Review, 1961, at p. 140.

<sup>11</sup> A. Overton Durrett, “The Real Estate Investment Trust: A New Medium for Investors,” William & Mary Law Review, 1961, at p. 144.

<sup>12</sup> “Real Estate Investment Trusts—Equalization of Investment Opportunity or Unjustified Tax Break to Favored Interests?” Washington University Law Review, 1961, at pp. 442-443.

<sup>13</sup> “The Investor’s Guide to REITs,” NAREIT, January 2015, at p. 4, available at [https://www.reit.com/sites/default/files/media/PDFs/2015\\_InvestorsGuideToREITs.pdf](https://www.reit.com/sites/default/files/media/PDFs/2015_InvestorsGuideToREITs.pdf) (last accessed February 2, 2017).

approximately \$51 billion in dividends to investors.<sup>14</sup> In addition, REITs have historically performed well compared to other investments – in a comparison of 35-year compound annual total returns, REITs outperformed the S&P 500, NASDAQ Composite, and Dow Jones Industrial indexes.<sup>15</sup> As of February 2017, there were more than 220 publically traded REITs in the U.S., with a combined market capitalization of over \$1 trillion.<sup>16</sup>

## **B. HOW WIRELESS INFRASTRUCTURE MEETS THE POLICY GOALS ASSOCIATED WITH REITS**

REITs enable investments that meet social goals. Large, long lived investments, whether in land directly or capital improvements on land such as telecommunications infrastructure, require an agglomeration of capital that can be tied up for significant periods of time. Smaller investors find such investments difficult both because of the size of investments required and the long time horizon of the investments. Without participation by smaller investors, there exists what economists call a “market failure” where absent a policy intervention, the efficient economic outcome will not be achieved. In the wireless telecommunications sector, REITs solve this potential market failure by ensuring that efficient amounts of capital are invested in wireless telecommunications infrastructure by allowing small investors to participate in these investments.

REITs have provided capital for wireless telecommunications infrastructure investments for decades. Towers have a long-standing position of being real estate under the U.S. Tax Code – almost as long as REITs, which were created in the 1960s. A trend toward REIT status among tower companies has accelerated in recent years. The three largest tower companies in the U.S. – American Tower, Crown Castle, and SBA Communications (“SBA”) – have all become REITs. American Tower became a REIT effective January 1, 2012, noting that REIT status would increase the value to shareholders, return capital to investors, and expand its base of potential

---

<sup>14</sup> “REIT Industry Financial Snapshot,” NAREIT, February 2017, available at <https://www.reit.com/data-research/data/industry-snapshot> (last accessed March 17, 2017).

<sup>15</sup> “The Investor’s Guide to REITs,” NAREIT, January 2015, at p. 5, available at [https://www.reit.com/sites/default/files/media/PDFs/2015\\_InvestorsGuideToREITs.pdf](https://www.reit.com/sites/default/files/media/PDFs/2015_InvestorsGuideToREITs.pdf) (last accessed February 2, 2016).

<sup>16</sup> “REIT Industry Financial Snapshot,” NAREIT, February 2017, available at <https://www.reit.com/data-research/data/industry-snapshot> (last accessed March 17, 2017).

stockholders.<sup>17</sup> Crown Castle followed in January 2014, and SBA has elected to be taxed as a REIT for its taxable year ended December 31, 2016.<sup>18</sup> American Tower and Crown Castle have paid a combined \$6.35 billion in REIT dividends to their shareholders since their inception as REITs.<sup>19</sup>

---

<sup>17</sup> See American Tower Corporation, Proxy Statement/Prospectus, Schedule 14A, filed October 10, 2011, at p. 3, available at

<http://phx.corporate-ir.net/phoenix.zhtml?c=98586&p=irol-SECText&TEXT=aHR0cDovL2FwaS50ZW5rd2l6YXJkLmNvbS9maWxpbmcueG1sP2lwYWdlPTc4NTA5NDQmRFNFUT0wJlNFUT0wJlNRREVTOz1TRUNUSU9OX0VOVElSRSZzdWJzaWQ9NTc%3d>

(last accessed February 7, 2017).

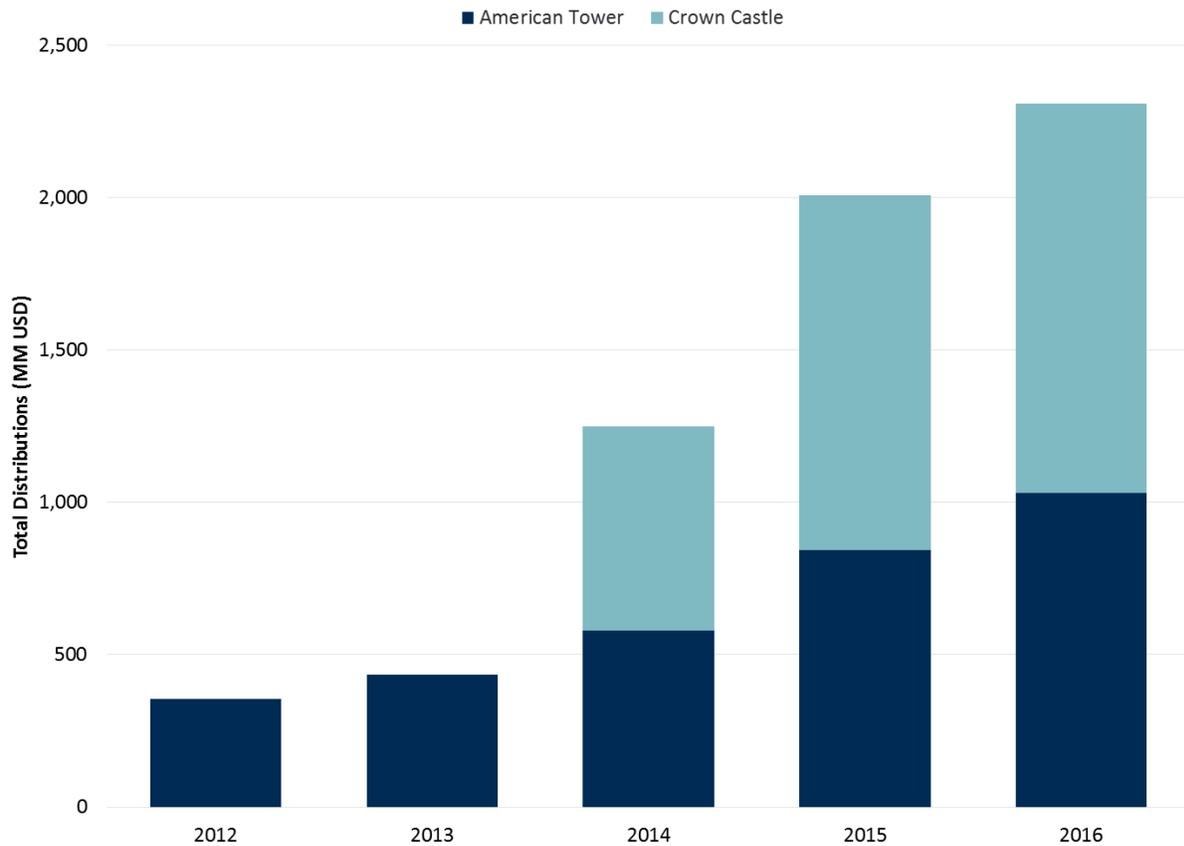
<sup>18</sup> “Crown Castle Commences Operating as a REIT Effective January 1, 2014,” Crown Castle International, January 6, 2014, available at

<http://investor.crowncastle.com/phoenix.zhtml?c=107530&p=irol-newsArticle&ID=1888377> (last

accessed December 19, 2016). See also, SBA Communications 2016 10-K for Year Ended December 31, 2016, at p. 1 (“SBA Communications 2016 10-K”).

<sup>19</sup> See Figure 1.

**Figure 1: American Tower and Crown Castle Shareholder Distributions as REITs**



*Sources:* American Tower 2016 10-K for Year Ended December 31, 2016, at p. 22; American Tower 2015 10-K for Year Ended December 31, 2015, at pp. 19-20; American Tower 2013 10-K for Year Ended December 31, 2013, at p. 24; Crown Castle 2016 10-K for Year Ended December 31, 2016, at pp. 50-52.

REITs have met the historic need to provide investment capital to wireless infrastructure, and this need, particularly for tower infrastructure, will only grow in the future. Continued investment in wireless infrastructure is critical to meeting the growing ubiquity of wireless communications in all sectors of the economy.

## II. Current Landscape of the Wireless Industry and the Role of Infrastructure

### A. BRIEF OVERVIEW OF THE WIRELESS INDUSTRY

Mobile wireless services are an integral part of Americans' daily lives. These services enable a number of features such as voice communication, email, social networking, and streaming audio and video entertainment. Additionally, these services play an important role in public safety by "enabling users to summon lifesaving help, receive timely alerts, and access pertinent information."<sup>20</sup> This would not be possible without telecommunications infrastructure.

From the launch of the first commercial mobile phone service in 1983 to today, the U.S. wireless industry has grown significantly, consistently outpacing expectations.<sup>21</sup> In 1985, there were an estimated 340,000 total subscriber connections, approximately 913 cell sites, and less than 3,000 direct carrier employees.<sup>22</sup> At about that time, analysts predicted almost a million subscribers by the year 2000. Actual Y2K subscribers exceeded that amount by a hundred-fold.<sup>23</sup> By 2015, there were an estimated 378 million total subscriber connections, \$192 billion in annual service revenues, approximately 308,000 cell sites, and hundreds of thousands of carrier employees.<sup>24</sup> Since 2000, total subscriber connections, annual service revenues, cell sites, and direct carrier

---

<sup>20</sup> "Eighteenth Report," In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services, FCC WT Docket No. 15-125, Federal Communications Commission, December 23, 2015, at pp. 2-3, available at [https://apps.fcc.gov/edocs\\_public/attachmatch/DA-15-1487A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DA-15-1487A1.pdf) (last accessed February 2, 2017).

<sup>21</sup> Marguerite Reardon, "Cell phone industry celebrates its 25th birthday," CNET, October 13, 2008, available at <http://www.cnet.com/news/cell-phone-industry-celebrates-its-25th-birthday/> (last accessed February 2, 2017).

<sup>22</sup> "Background on CTIA's Wireless Industry Survey," CTIA, 2016, at p. 2, available at [http://www.ctia.org/docs/default-source/default-document-library/ctia\\_survey\\_ye\\_2015\\_graphics.pdf?sfvrsn=0](http://www.ctia.org/docs/default-source/default-document-library/ctia_survey_ye_2015_graphics.pdf?sfvrsn=0) (last accessed February 6, 2017) ("CTIA Annual Wireless Industry Survey").

<sup>23</sup> "Cutting the cord," The Economist, October 7, 1999, available at <http://www.economist.com/node/246152> (last accessed March 2, 2016). See also, CTIA Annual Wireless Industry Survey, at p. 2.

<sup>24</sup> CTIA Annual Wireless Industry Survey, at p. 2.

employees have grown at compounded annual growth rates of 9 percent, 9 percent, 7 percent, and 2 percent, respectively.<sup>25</sup>

The *value-added* generated by the wireless industry accounted for about 1 percent of U.S. GDP in 2013.<sup>26</sup> In 2016, the four largest U.S. wireless carriers—AT&T, Verizon, T-Mobile, and Sprint—generated approximately \$26.6 billion in net income.<sup>27</sup> This a remarkable success story for an industry that did not exist a little more than 30 years ago.

The recent rapid growth in data carried over mobile networks is projected to continue into the foreseeable future. Globally, mobile data traffic increased almost 400-million-fold between 2000 and 2015.<sup>28</sup> Almost half a billion mobile devices and connections were added in 2016, primarily driven by the growth in smartphones.<sup>29</sup> Mobile data traffic in the U.S. is expected to increase

---

<sup>25</sup> See *id.*

<sup>26</sup> Coleman Bazelon and Giulia McHenry, “Mobile Broadband Spectrum: A Vital Resource for the U.S. Economy,” Prepared for CTIA, May 11, 2015, at p. 19, available at [http://www.ctia.org/docs/default-source/default-document-library/brattle\\_spectrum\\_051115.pdf](http://www.ctia.org/docs/default-source/default-document-library/brattle_spectrum_051115.pdf).

<sup>27</sup> \$26,567 million  $\approx$  \$13,608 million (Verizon) + \$12,976 million (AT&T) + -\$1,477 million (Sprint) + \$1,460 million (T-Mobile). See “Verizon Communications Inc.: Condensed Consolidated Statements of Income for Year Ended December 31, 2016,” Verizon, available at <http://www.verizon.com/about/file/20843/download?token=hO4YnsT> (last accessed March 17, 2017); “AT&T Financial Review 2016,” AT&T, at p. 10, available at [https://www.att.com/Investor/ATT\\_Annual/2016/downloads/att\\_ar2016\\_completefinancialreview.pdf](https://www.att.com/Investor/ATT_Annual/2016/downloads/att_ar2016_completefinancialreview.pdf) (last accessed March 17, 2017); “Sprint Condensed Consolidated Statements of Operations for Quarter Ended December 31, 2016,” Sprint, at tab “IS,” available at [http://s21.q4cdn.com/487940486/files/doc\\_financials/quarterly/2016/Q3/4\\_Financial-Operating-Information.xlsx](http://s21.q4cdn.com/487940486/files/doc_financials/quarterly/2016/Q3/4_Financial-Operating-Information.xlsx) (last accessed March 17, 2017); “T-Mobile Separates Itself from the Competition for a Third Straight Year, Best Customer Growth and Revenue Growth in the Industry,” T-Mobile, at p. 7, available at <http://investor.t-mobile.com/Cache/1001220061.PDF?O=PDF&T=&Y=&D=&FID=1001220061&iid=4091145> (last accessed March 17, 2017). Sprint reports net loss of \$554 million in the three months ending March 31, 2016; net loss of \$302 million in the three months ending Jun 30, 2016; net loss of \$142 million in the three months ending September 30, 2016; and net loss of \$479million in the three months ending December 31, 2016.

<sup>28</sup> “Cisco Visual Networking Index (VNI): Global Mobile Data Traffic Forecast Update, 2015–2020 White Paper,” Cisco, February 3, 2016, at p. 1.

<sup>29</sup> “Cisco Visual Networking Index (VNI): Global Mobile Data Traffic Forecast Update, 2016–2021 White Paper,” Cisco, February 7, 2017, at p. 1 (“Cisco VNI White Paper: Global Mobile Data Traffic Forecast Update, 2016–2021”).

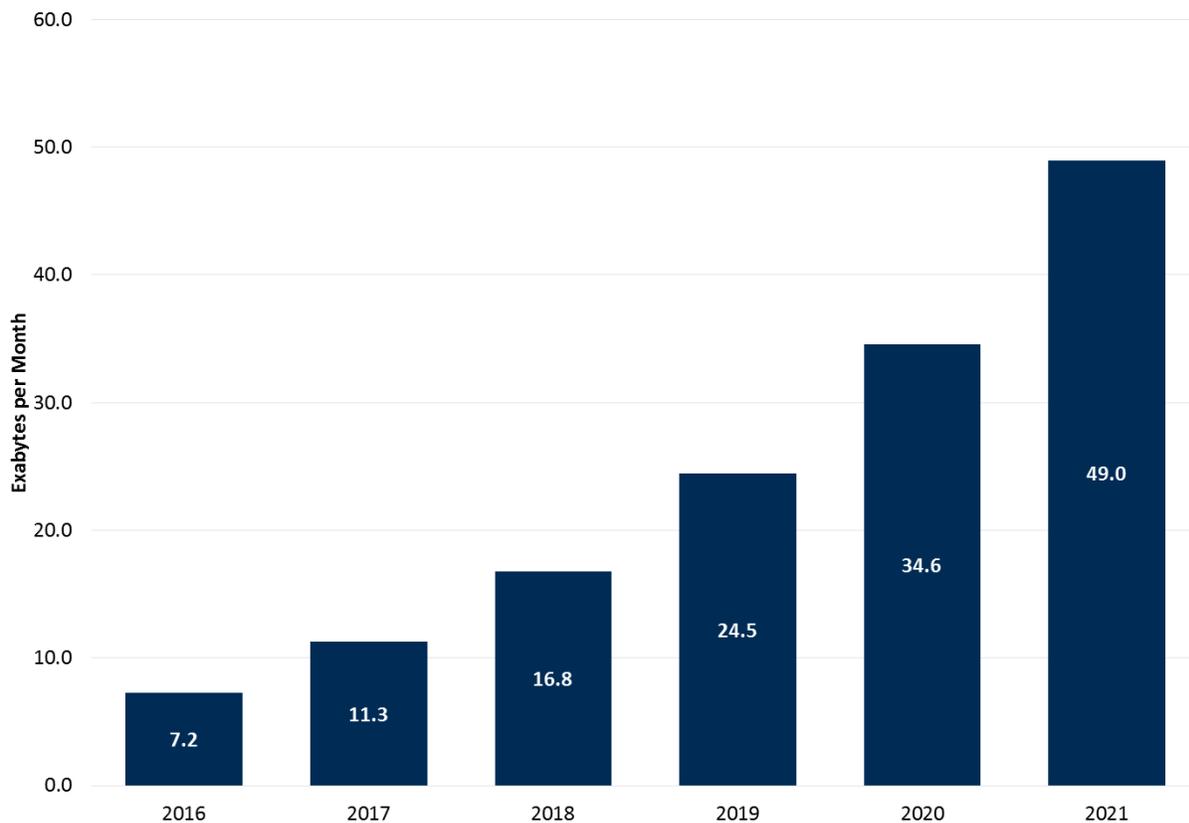
five-fold between 2016 and 2021, with expected yearly traffic predicted to reach 72.7 exabytes in 2021.<sup>30</sup> To put this in context, in 2016, the amount of data used by the average mobile subscriber was the equivalent of more than 115 movies; by 2021 that is expected to grow to over 465 movies.<sup>31</sup> In Figure 2 below, we highlight global data traffic estimates between 2015 and 2020.

---

<sup>30</sup> “VNI Mobile Forecast Highlights, 2016-2021,” Cisco, at “United States – 2021 Forecast Highlights,” available at [http://www.cisco.com/assets/sol/sp/vni/forecast\\_highlights\\_mobile/index.html#~Country](http://www.cisco.com/assets/sol/sp/vni/forecast_highlights_mobile/index.html#~Country) (last accessed March 17, 2017) (“Cisco VNI Forecast Highlights 2016–2021”).

<sup>31</sup> This assumes a two-hour standard definition movie and a data usage rate of 4 megabytes per minute. The average mobile user consumed 4,604 megabytes of data per month in 2016 and is projected to consume 18,617 megabytes of data per month in 2021.  $115.1 \text{ movies / year} = 1 \text{ movie} / 120 \text{ minutes} \times 1 / (4 \text{ megabytes} / \text{minute}) \times 4,604 \text{ megabytes} / \text{month} \times 12 \text{ months} / \text{year}$ .  $465.4 \text{ movies / year} = 1 \text{ movie} / 120 \text{ minutes} \times 1 / (4 \text{ megabytes} / \text{minute}) \times 18,617 \text{ megabytes} / \text{month} \times 12 \text{ months} / \text{year}$ . See Cisco VNI Forecast Highlights 2016–2021, at “United States – 2021 Forecast Highlights.” See also, “Data Calculator,” AT&T, available at <https://www.att.com/att/datacalculator/> (last accessed February 6, 2017).

**Figure 2: Global Mobile Data Traffic Forecasts, 2016-2021**



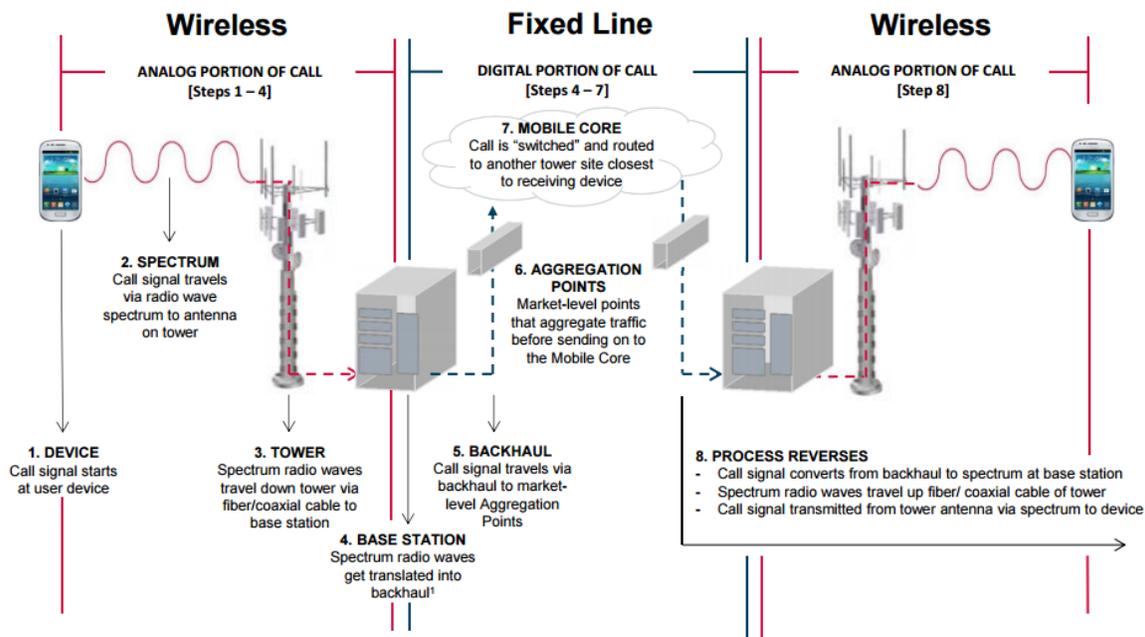
*Source:* Cisco VNI White Paper: Global Mobile Data Traffic Forecast Update, 2016–2021, at p. 33.

## **B. INFRASTRUCTURE IS THE ENABLER OF THE WIRELESS INDUSTRY**

Wireless carriers rely on wireless infrastructure to deliver services to their customers. This wireless infrastructure typically includes cell towers (“towers”), distributed antenna systems (“DAS”) networks, and facilities for small cell technologies. DAS and small cells are traditionally used to address coverage and capacity issues in densely populated areas, both in-building and outdoors, or underground. Industry analysts also include data centers and fiber service providers as part of the broader wireless infrastructure industry, although we do not focus on these industry segments in this report.

Even the basic mobile call sequence requires substantial infrastructure and components (modern mobile phone systems are not walkie-talkies where handsets communicate directly one to another). We show an example of the mobile call sequence below in Figure 3, which highlights some of the required backend infrastructure.

**Figure 3: Example Mobile Call Sequence**



*Source:* "Introduction to the Tower Industry and American Tower," American Tower, December 31, 2016, at slide 22, available at <http://www.americantower.com/Assets/uploads/files/PDFs/vendor-relations/investor-relations/2016/Introduction%20to%20the%20Tower%20Industry%20&%20American%20Tower.pdf> (last accessed May 22, 2017).

Cell towers, as shown in step 3 of Figure 3, are typically large vertical structures built on a parcel of land and are designed to accommodate multiple carriers that rent space on the tower to enable a variety of different technologies including telephony, mobile data, broadcast television, internet of things, and radio.<sup>32</sup> They can also be smaller structures on rooftops or other existing structures. The primary purpose of cell towers is to house antennas that transmit and receive radio-frequency signals from cellular devices.<sup>33</sup> In order to serve that purpose, tenants place specialized equipment on the cell towers to transmit signals and provide coverage and capacity to a specific area. This infrastructure is integral to using wireless devices.

<sup>32</sup> "Introduction to the Tower Industry and American Tower," American Tower, December 31, 2016, at slide 4, available at <http://www.americantower.com/Assets/uploads/files/PDFs/vendor-relations/investor-relations/2016/Introduction%20to%20the%20Tower%20Industry%20&%20American%20Tower.pdf> (last accessed May 22, 2017) ("Introduction to the Tower Industry and American Tower").

<sup>33</sup> "How Cell Towers Work," Unison, 2011, available at <http://www.unisonsite.com/pdf/resource-center/How%20Towers%20Work.pdf> (last accessed February 6, 2017).

Most towers have space for multiple tenants to place their antennas and other infrastructure. These spaces are known as “cell sites.” To satisfy the demand for broadband services, there has been tremendous growth in the number of cell sites over the past two decades and that growth is expected to continue in the future.<sup>34</sup>

In order to capture the opportunity and high demand for wireless services, wireless operators have encouraged infrastructure providers to deploy more towers so that the providers can deploy more cell sites.<sup>35</sup> To address localized gaps in coverage or specific capacity needs for limited areas with high demand, mobile service providers have started to deploy small cells and DAS sites.<sup>36</sup>

The term “small cell” is used for any low-powered radio access node operating in licensed spectrum or unlicensed carrier-grade WiFi.<sup>37</sup> Small cells may be deployed in residential, enterprise, urban, or rural settings to boost capacity in congested areas or to close coverage gaps in existing infrastructure networks.<sup>38</sup> The majority of currently deployed small cells are residential femtocells; however, non-residential small cells are expected to grow at a faster rate than residential small cells as they are deployed to increase capacity in high-use areas.<sup>39</sup>

---

<sup>34</sup> Smith, J. Sharpe, “Cell Tower Shrinkage Will Give Way to Long-term Growth: SNL Kagan,” July 17, 2015, AGL Media Group, available at <http://www.aglmediagroup.com/cell-tower-shrinkage-will-give-way-to-long-term-growth-snl-kagan/> (last accessed February 22, 2016).

<sup>35</sup> “Nineteenth Report,” In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services, FCC WT Docket No. 16-137, Federal Communications Commission, September 23, 2016, at p. 52, available at [http://transition.fcc.gov/Daily\\_Releases/Daily\\_Business/2016/db0923/DA-16-1061A1.pdf](http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0923/DA-16-1061A1.pdf) (last accessed February 2, 2016) (“Nineteenth FCC Mobile Wireless Competition Report”).

<sup>36</sup> Nineteenth FCC Mobile Wireless Competition Report, at p. 52.

<sup>37</sup> There are four primary classifications of small cell: 1) femtocells are low-power, short-range units commonly used in residential applications, 2) picocells are compact base stations generally deployed for enterprise or public indoor use, 3) microcells are used in outdoor applications where macro coverage is insufficient, and 4) metrocells are designed for use in high-capacity urban areas and are often installed in street furniture. See “Small cells, what’s the big idea?” Small Cell Forum, February 25, 2014, at p. 3, available at [http://scf.io/en/documents/030 - Small\\_cells\\_big\\_ideas.php](http://scf.io/en/documents/030 - Small_cells_big_ideas.php) (last accessed October 16, 2016).

<sup>38</sup> See *id.*, at pp. 3-4.

<sup>39</sup> See *id.*, at p. 2.

The following section focuses specifically on the investment by and growth of independent tower companies. We highlight some of the primary players in this market and the basic economics of tower ownership.

### C. EVOLUTION OF THIRD-PARTY INVESTMENT IN WIRELESS COMMUNICATIONS TOWERS INFRASTRUCTURE

A specialized communications tower industry has developed to provide and manage the support structures for cell sites and to lease space to mobile wireless service providers. Today, there are more than 120 tower and DAS providers in the U.S., and the vast majority of towers are now owned and operated by independent companies rather than by mobile wireless services providers.<sup>40</sup> Independent tower operators own, operate, and lease shared communications towers; manage other tall structure sites (such as rooftops and water towers); and to a lesser extent, build and operate DAS networks and small cells for mobile service providers. In most cases, tower operators lease antenna, rooftop and other site space to multiple wireless service providers.<sup>41</sup>

The three largest U.S. tower companies are American Tower, Crown Castle, and SBA, all of which offer the shared tower model and have grown significantly over the past decade as a result of both acquisitions and organic tower growth. To develop our analysis, we closely reviewed the financial information for these three companies and used it to estimate numbers for the remaining market. The total U.S. tower count for the three largest tower operators increased from approximately 28,000 in 2004 to almost 100,000 in 2016.<sup>42</sup> Similarly, domestic revenue has increased dramatically for each of these companies over the same time period.<sup>43</sup>

---

<sup>40</sup> “Top 100 Tower Companies in the U.S.,” WirelessEstimator, as of December 22, 2016, available at <http://wirelessestimator.com/top-100-us-tower-companies-list/> (last accessed February 7, 2017).

<sup>41</sup> Nineteenth FCC Mobile Wireless Competition Report, at pp. 52-53.

<sup>42</sup> This includes owned and operated towers. American Tower 2004 10-K for Year Ended December 31, 2004, at p. 17 (“American Tower 2004 10-K”); American Tower 2016 10-K for Year Ended December 31, 2016, at p. 27 (“American Tower 2016 10-K”); Crown Castle 2004 10-K for Year Ended December 31, 2004, at p. 2 (“Crown Castle 2004 10-K”); Crown Castle 2016 10-K for Year Ended December 31, 2016, at p. 85 (“Crown Castle 2016 10-K”); SBA Communications 2004 10-K, at p. 1 (“SBA Communications 2004 10-K”); SBA Communications 2016 10-K, at p. 2; and Table A-1.

<sup>43</sup> American Tower increased its domestic site rental revenue from approximately \$570 million in 2004 to almost \$3.4 billion in 2016. Crown Castle grew its domestic site rental revenue from \$500 million

In addition to these large tower companies, small “Mom and Pop” tower companies play an important role in the industry. In fact, a substantial portion of future growth in the U.S. tower count is expected to come from these smaller companies.<sup>44</sup>

The transition from tower ownership by carriers to tower ownership by independent companies has been largely dictated by basic economics. Carriers have significant economic incentives to choose a collocation model, where they lease space from the tower company and share the infrastructure with another tenant, rather than build their own site. By collocating carriers on a single tower, certain costs can be shared between tenants—a more efficient use of resources (notably fixed tower construction costs) for mobile carriers.<sup>45</sup> Specifically, mobile operators free up significant capital that was tied up in tower investments that can then be redeployed to improve other (non-tower) portions of their networks. Additionally, tower operators have extensive tower portfolios and operational expertise, which allows carriers to quickly deploy networks.<sup>46</sup> Absent this industry evolution, there would be a significant time-to-market cost

---

Continued from previous page

to over \$3.2 billion over the same period. Lastly, SBA grew domestic site rental revenue from approximately \$144 million in 2004 to almost \$1.3 billion in 2016. In total, over the past thirteen years, the three largest tower companies grew U.S. tower count by over 250 percent and domestic site rental revenue by approximately 500 percent. American Tower reported total domestic site rental revenue of \$684.4 million in 2004; American Tower also reported that 16.6 percent of its consolidated revenues came from international operations. \$570 million = \$684.4 million x (1- 16.6%). American Tower 2004 10-K, at pp. 23-24; American Tower 2016 10-K, at p. 31. Crown Castle’s 2016 site rental revenues include both towers and small cells site rental revenues. Crown Castle 2004 10-K, at p. 31; Crown Castle 2016, at p. 27. SBA Communications 2004 10-K, at p. 1, 16; SBA Communications 2016, at p. 31.

<sup>44</sup> “Will Small Tower Companies Survive the Future?” Inside Towers, available at <https://insidetowers.com/will-small-tower-companies-survive-future/> (last accessed February 2, 2016).

<sup>45</sup> For instance, commenting on Sprint’s sale of towers and decision to lease, Mr. Azzi, Sprint Senior Vice President for Network Services, stated, “Leasing rather than owning these network facilities is a more efficient use of resources and allows us to focus more closely on our core business of providing communications services to our customers.” See “Sprint Nextel Completes Tower Sale to TowerCo for Approximately \$670 Million in Cash,” Sprint, September 24, 2008, available at <http://newsroom.sprint.com/news-releases/sprint-nextel-completes-tower-sale-to-towerco-for-approximately-670-million-in-cash.htm> (last accessed February 22, 2016).

<sup>46</sup> “Crown Castle: We Are Solutions,” June 2014, at slide 14, available at [http://www.crowncastle.com/investor/presentations/NAREIT\\_2014.pdf](http://www.crowncastle.com/investor/presentations/NAREIT_2014.pdf) (last accessed February 22, 2016).

because building a new site can require years of work to secure ground interests and zoning approvals.<sup>47</sup>

As a result of these economic incentives, many carriers have freed up significant invested capital by divesting some or all of their tower assets, primarily to independent tower operators. The last decade has witnessed several large sales of this nature. For instance, in February 2015, American Tower acquired the rights to 11,324 wireless communications towers and purchased 165 additional towers from Verizon for \$5.056 billion.<sup>48</sup> In 2013, Crown Castle International Corp. acquired the rights to approximately 9,700 towers from AT&T for \$4.85 billion.<sup>49</sup> In 2012, Crown Castle acquired the rights to 7,200 towers from T-Mobile for \$2.4 billion.<sup>50</sup>

Carriers have been able to use the capital freed up through these transactions to make improvements in their own networks, such as through investments in network upgrades or new spectrum. For instance, T-Mobile planned to use funds from its sale of towers to Crown Castle to support its 4G network modernization initiative.<sup>51</sup> AT&T similarly planned to invest in network upgrades with the capital from its own transaction with Crown Castle.<sup>52</sup>

---

<sup>47</sup> Introduction to the Tower Industry and American Tower, at slide 34.

<sup>48</sup> “American Tower Corporation Announces Verizon Tower Portfolio Transaction,” Business Wire, February 5, 2015, available at <http://www.businesswire.com/news/home/20150205006473/en/American-Tower-Corporation-Announces-Verizon-Tower-Portfolio> (last accessed February 22, 2016).

<sup>49</sup> “Crown Castle Announces \$4.85 Billion AT&T Tower Transaction,” Crown Castle, October 20, 2013, available at [http://investor.crowncastle.com/phoenix.zhtml?c=107530&p=irol-newsArticle\\_print&ID=1866079](http://investor.crowncastle.com/phoenix.zhtml?c=107530&p=irol-newsArticle_print&ID=1866079) (last accessed February 22, 2016).

<sup>50</sup> “Crown Castle and T-Mobile USA Announce \$2.4 Billion Tower Transaction,” Crown Castle, September 28, 2012, available at <http://investor.crowncastle.com/phoenix.zhtml?c=107530&p=irol-newsArticle&ID=1739397> (last accessed February 22, 2016).

<sup>51</sup> “Crown Castle and T-Mobile USA Announce \$2.4 Billion Tower Transaction,” Crown Castle, September 28, 2012, available at <http://investor.crowncastle.com/phoenix.zhtml?c=107530&p=irol-newsArticle&ID=1739397> (last accessed February 22, 2016).

<sup>52</sup> Scott Moritz and Serena Saitto, “AT&T Agrees to \$4.85 Billion Tower Deal with Crown Castle,” Bloomberg Technology, October 21, 2013, available at <https://www.bloomberg.com/news/articles/2013-10-20/at-t-agrees-to-4-85-billion-tower-deal-with-crown-castle> (last accessed December 19, 2016).

The vast majority of revenue in the tower industry is generated by rental income from tenant leases.<sup>53</sup> In order to build and maintain these towers, and to operate their business, tower companies incur substantial capital and operating expenses, which we discuss in more detail below.

#### **D. SPENDING ON INFRASTRUCTURE BY THE TOWER INDUSTRY**

In order to support the growth in demand for cell towers, tower companies have invested substantial amounts in capital and operational expenditures.

Capital expenditures—spending to acquire long-lived fixed assets—by tower companies are commonly a combination of discretionary and sustaining expenses.<sup>54</sup> *Discretionary capital expenditures* include purchases of land interests under towers, wireless infrastructure improvements, structural enhancements and the construction of wireless infrastructure.<sup>55</sup> *Sustaining capital expenditures* typically refer to maintenance activities including corporate capital spending (including on information technology infrastructure), and spending on lighting systems, fence repairs, and ground upkeep.<sup>56</sup> Discretionary capital expenditures represent the majority of capital expenditures for the three largest tower companies in the U.S.—over 80 percent in 2016.<sup>57</sup>

In 2016, American Tower, Crown Castle, and SBA collectively incurred approximately \$840 million in domestic capital expenditures.<sup>58</sup> In order to estimate total domestic capital

---

<sup>53</sup> American Tower 2016 10-K, at p. 2; Crown Castle 2016 10-K, at p. 1; SBA Communications 2016 10-K, at p. 1.

<sup>54</sup> “Fixed assets are also sometimes called capital equipment...Accounting convention and IRS regulations do not allow you to immediately ‘expense’ the cost of acquiring a fixed asset. Because fixed assets have a long productive life, you can expense only a portion of their purchase price each year as you use them. This yearly expense is called depreciation.” See Thomas Ittelson, “Financial Statements: A Step-by-Step Guide to Understanding and Creating Financial Reports,” at p. 113.

<sup>55</sup> Crown Castle 2016 10-K, at p. 33; SBA Communications 2016 10-K, at p. 42; American Tower 2016 10-K, at p. 42.

<sup>56</sup> See *id.*

<sup>57</sup> See Appendix, at Table A-7.

<sup>58</sup> In discussing capital expenditures, we exclude expenditures related to the acquisition of towers. Because American Tower and SBA do not distinguish between domestic and international non-acquisition capital expenditures in their financial statements, we calculate non-acquisition domestic

expenditures by tower companies, we scale the \$840 million of capital expenditures by the share of U.S. tower count of these three companies that are participating in the study, resulting in total capital expenditures of \$1.0 billion in 2016.<sup>59</sup>

Additionally, tower companies incur substantial operating expenses in order to operate their businesses efficiently and support the deployment of broadband. These operating expenses include ground rent; utilities and fuel; insurance; site maintenance; compensation and benefits for employees; and selling, general, administrative and development expenses (“SG&A”).<sup>60</sup>

In 2016, the three largest tower companies spent approximately \$2.13 billion on operating expenditures related to tower leasing.<sup>61</sup> As with capital expenditures, we scale these expenditures to account for the rest of the tower industry, resulting in total operating expenditures of \$2.67 billion in 2016.<sup>62</sup>

## E. ECONOMIC IMPACT

The wireless communications tower industry generates significant economic activity and has a large footprint on the U.S. economy. The economic impacts directly associated with the industry are quantified as *direct* economic impacts. Additionally, the industry buys goods and services

---

Continued from previous page

capital expenditures by assuming that the proportion domestic to international capital expenditures excluding acquisitions is the same as for capital expenditures including acquisitions. Following the sale of Crown Castle’s CCAL in May 2015, virtually all of its operations are located in the U.S. Nevertheless, we adjust Crown Castle’s capital expenditures to exclude expenditures related small cells since these are unlikely to be reflective of the wider tower industry. See Appendix, at Table A-2 through Table A-4; Crown Castle 2016 10-K, at p. 34; SBA Communications 2016 10-K, at pp. 42, F-38; and American Tower 2016 10-K, at pp. 38, 41, and F-47 – F-48.

<sup>59</sup> See Appendix, at Table A-7.

<sup>60</sup> See, for example, Introduction to the Tower Industry and American Tower, at slide 12. See also, “The Rise of the Tower Business,” ATKearney, at p. 6, available at <https://www.atkearney.com/documents/10192/671578/Rise+of+the+Tower+Business.pdf/027f45c4-91d7-43f9-a0fd-92fe797fc2f3> (last accessed February 29, 2016).

<sup>61</sup> Again, we include only domestic site leasing operating expenses and exclude Crown Castle operating expenses related to small cells. See Crown Castle 2016 10-K, at p. 77; SBA Communications 2016 10-K, at pp. 31-32; and American Tower 2016 10-K, at pp. 31-34. See also, Appendix, at Table A-9 through Table A-12.

<sup>62</sup> See Appendix, at Table A-13.

from other businesses, and these businesses and their employees in turn spend their earnings in countless ways throughout the economy, generating further business activity and benefits. When these secondary economic impacts ripple through the economy they are known as *indirect* (driven by wireless spending through the supply chain) and *induced* (driven by individual spending by wireless infrastructure industry and supplier employees) economic impacts. Taken together, *direct*, *indirect* and *induced* impacts describe the footprint of the industry on the economy.<sup>63</sup>

In 2016, the wireless communications tower industry *directly* deployed \$812 million in capital expenditures in the U.S., including spending on new tower construction, maintenance and repair, and corporate capital expenditures.<sup>64</sup> As discussed above, a portion of this spending is discretionary, including construction of new towers and improvements to existing structures. Among sustaining (or “revenue-maintaining”) capital expenditures, are spending on maintenance of existing towers and corporate spending.<sup>65</sup> In estimating the economic impact of spending by the wireless infrastructure industry, we account for the differences in how these types of spending flow through the economy.<sup>66</sup>

---

<sup>63</sup> For clarity, these economic impacts do not suggest that absent the industry all of this economic activity and all of the associated jobs would be lost. The net effect of gaining or losing an industry is a much more complicated question that is heavily influenced by macroeconomic conditions. In a full employment economy, most resources would find useful employment with the net effect of redeploying resources much less than the gross economic impacts measured here.

<sup>64</sup> Because land purchases represent a transfer payment, we exclude this category of capital expenditures from our analysis. In 2016, the land purchases category of capital expenditures totaled \$236 million. See Appendix, at Table A-7.

<sup>65</sup> Crown Castle only reports Land Purchases, Wireless Infrastructure Construction and Improvements, and Sustaining capital expenditures. Thus, we use the average proportion of construction to improvement expenses reported by American Tower and SBA to break down Crown Castle’s Infrastructure Construction and Improvements category, and we break down Crown Castle’s Sustaining category based on discussions with Crown Castle. See Appendix, at Table A-2 to Table A-7.

<sup>66</sup> To estimate the economic impact of capital expenditures, we use the IMPLAN model. Specifically, expenditures flow into the following IMPLAN industries: 54 (Construction of new power and communication structures), 62 (Maintenance and repair construction of nonresidential structures), and for SG&A, 448 (Accounting, tax preparation, bookkeeping, and payroll services), 461 (Management of companies and enterprises), and 462 (Office administrative services).

The \$812 million in capital expenditures incurred by the wireless communications towers industry *directly* generated more than 5,000 U.S. jobs in 2016.<sup>67</sup> However, these direct spending and employment figures provide only a partial picture of what the industry means to the overall U.S. economy. In fact, when *indirect* and *induced* impacts are taken into consideration, new capital expenditure by the wireless communications tower industry supported an additional \$1.3 billion in spending and more than 7,000 additional jobs at the national level.<sup>68</sup>

Taken together, as a result of its capital expenditures, the industry supported approximately \$2.1 billion in spending and 12,300 jobs in the U.S. in 2016. Capital investment spending by the industry flowing through the economy contributed about \$1.1 billion to U.S. GDP.<sup>69</sup>

In addition to capital expenditures, the wireless communications tower industry directly incurred \$2.7 billion in operating expenditures in 2016.<sup>70</sup> Similarly, this spending occurs in several distinct categories: land rents, tower maintenance, SG&A, and other tower-related spending (including, for example, fuel, utilities, insurance, and property taxes).<sup>71</sup> Land rents are the largest single category of operating expenses, accounting for approximately 70 percent of non-SG&A operating expenses. Tower maintenance and other tower operating expenses account for the remaining 30 percent of non-SG&A operating expenses.<sup>72</sup>

This \$2.7 billion in operating expenditures incurred by the wireless communications towers industry *directly* generated about 9,000 jobs in 2016.<sup>73</sup> Including *indirect* and *induced* impacts,

---

<sup>67</sup> IMPLAN National Data for 2014. Employment is in terms of full-time equivalents (FTE).

<sup>68</sup> IMPLAN National Data for 2014.

<sup>69</sup> IMPLAN National Data for 2014.

<sup>70</sup> See Appendix, at Table A-13.

<sup>71</sup> To model this spending in IMPLAN, we use the following industries: 429 (Satellite, telecommunications resellers, and all other telecommunications), and for SG&A, 448 (Accounting, tax preparation, bookkeeping, and payroll services), 461 (Management of companies and enterprises), and 462 (Office administrative services). Because land rents represent a transfer payment, they do not have any multiplier effect. Thus any additional economic impact generated by operating expenditures is a result of non-land rent spending.

<sup>72</sup> Based on conversations with American Tower and Crown Castle on September 9, 2016 and September 19, 2016, respectively. See Appendix, at Table A-9 to Table A-13.

<sup>73</sup> IMPLAN National Data for 2014. Employment is in terms of full-time equivalents (FTE).

operating expenditure by the wireless communications tower industry supported an additional \$2 billion in spending and more than 11,000 additional jobs at the national level.<sup>74</sup>

In total, as a result of its operating expenditures, the industry supported approximately \$4.7 billion in spending and 20,000 jobs in the U.S. in 2016. Operating expenditures by the industry flowing through the economy contributed about \$3.4 billion to U.S. GDP.<sup>75</sup>

These expenditures by the wireless tower industry support a broad network of suppliers of goods and services. Tower companies work with a broad range of vendors to support their business operations. These vendors range widely and include equipment suppliers (primarily crane rentals), raw material suppliers (such as the steel and cement used for tower construction), professional services providers (including surveying, engineering, environmental, and legal services), subcontractors, repair and maintenance providers, and utilities.<sup>76</sup>

---

<sup>74</sup> IMPLAN National Data for 2014.

<sup>75</sup> IMPLAN National Data for 2014.

<sup>76</sup> Communication from SBA Communications, July 21, 2016.

### III. Conclusion

As mobile wireless services have become increasingly integral to Americans' daily lives, the total volume of mobile data traffic has increased accordingly. According to Cisco, mobile data traffic in North America has increased from 118 petabytes (11,800 Libraries of Congress worth of data) per month in 2011 to 1,411 petabytes (141,100 Libraries of Congress) per month in 2016.<sup>77</sup> Furthermore, Cisco estimates that demand will increase to 6,397 petabytes (639,700 Libraries of Congress) per month by 2021; this is almost a 5-fold increase over demand in 2016.<sup>78</sup> This increase in demand has several components: a greater number of users, a greater number of advanced devices and connections for users, and faster data speeds supporting more intensive data consumption. This increased demand has mandated a significantly more comprehensive set of wireless infrastructure to support it. Through the shared tower model, supported by the REIT structure, the wireless infrastructure industry has been able to make the necessary investments to keep Americans connected to today's modern wireless networks.

In conclusion, the wireless communications tower industry supported approximately \$6.8 billion in spending and 32,300 jobs in the U.S. in 2016 through direct, indirect, and induced expenditures resulting from its capital and operating expenditures. Expenditures by the wireless infrastructure industry support a broad network of suppliers of goods and services including equipment suppliers, raw material suppliers, professional services providers, subcontractors, repair and maintenance providers, and utilities. As wireless infrastructure providers are organized as REITs, the REIT structure has played, and will continue to play, an important role in ensuring that efficient amounts of capital are invested in wireless infrastructure deployment.

---

<sup>77</sup> One "Library of Congress" refers to 10 terabytes, the amount of data estimated to be in the print collections of the Library of Congress. See Cisco VNI White Paper: Global Mobile Data Traffic Forecast Update, 2016–2021, at p. 33; "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2010–2015", Cisco, February 1, 2011, at p. 19; and Peter Lyman and Hal R. Varian, "How much Information?" 2000, at p. 110, available at <http://www2.sims.berkeley.edu/research/projects/how-much-info/how-much-info.pdf> (last accessed February 2, 2017).

<sup>78</sup>  $4.5 = 6,397 \text{ petabytes per month} / 1,411 \text{ petabytes per month}$ . Cisco VNI White Paper: Global Mobile Data Traffic Forecast Update, 2016–2021, at p. 32.

## IV. Appendix

Table A-1: American Tower, Crown Castle, and SBA 2016 Count of Towers

<u>American Tower</u>		
[1]	Owned Domestic Towers	23,385
[2]	Operated Domestic Towers	16,685
[3]	Total Domestic Towers	40,070
<u>Crown Castle</u>		
[4]	Total Domestic Towers	40,153
<u>SBA</u>		
[5]	Total Owned Towers	26,197
[6]	Owned Domestic Towers	15,922
[7]	Operated/Leased Towers	5,500
[8]	Total Domestic Towers	19,265

Sources & Notes:

[1] - [2]: American Tower 2016 10-K, at p. 27.

[3]: [1] + [2].

[4]: Crown Castle 2016 10-K, at p. 85.

[5] - [8]: SBA Communications 2016 10-K, at p. 2.

[8]: [6] + [7] x ([6] / [5]).

**Table A-2: American Tower 2014-2016 Capital Expenditures (\$ thousands)**

	2016	2015	2014
<u>Total International Capital Expenditures</u>			
[1] Start-up Capital Projects (i.e. Acquisitions)	\$124,300	\$74,800	\$25,500
[2] Discretionary Capital Projects	\$149,700	\$245,100	\$521,600
[3] Ground Lease Purchases	\$153,300	\$140,500	\$133,700
[4] Capital Improvement	\$110,249	\$89,867	\$75,041
[5] Corporate Capital Expenditures	\$16,438	\$16,447	\$24,146
[6] Redevelopment	\$147,400	\$162,100	\$194,400
[7] Total Capital Expenditures, incl. Acquisitions	\$701,387	\$728,814	\$974,387
[8] Total Capital Expenditures, excl. Acquisitions	\$577,087	\$654,014	\$948,887
[9] Total Domestic Property Capital Expenditures, incl. Acquisitions	\$310,744	\$367,663	\$576,153
[10] Total Non-Domestic Property Capital Expenditures, incl. Acquisitions	\$390,643	\$361,090	\$398,251
[11] Domestic Property Proportion of Capital Expenditures	44.3%	50.5%	59.1%
<u>Scaled for Domestic Capital Expenditures Only</u>			
[12] Discretionary Capital Projects	\$66,323	\$123,655	\$308,416
[13] Ground Lease Purchases	\$67,918	\$70,884	\$79,055
[14] Capital Improvement	\$48,845	\$45,339	\$44,371
[15] Corporate Capital Expenditures	\$7,283	\$8,298	\$14,277
[16] Redevelopment	\$65,304	\$81,781	\$114,946
[17] Total Domestic Property Capital Expenditures, excl. Acquisitions	\$255,674	\$329,956	\$561,065

Source: American Tower 2016 10-K, at pp. 38, 41, and F-17-F-48.

Notes:

[1] - [6]: From American Tower 2016 10-K.

[7]: Sum of [1] - [6].

[8]: Sum of [2] - [6].

[9] - [10]: From American Tower 2016 10-K.

[11]: [9] / ([9] + [10]).

[12]: [2] x [11]. Allocated to capital expenditure category Wireless Infrastructure - Construction.

[13]: [3] x [11]. Allocated to capital expenditure category Land Purchases.

[14]: [4] x [11]. Allocated to capital expenditure category Sustaining - Maintenance.

[15]: [5] x [11]. Allocated to capital expenditure category Sustaining - Corporate.

[16]: [6] x [11]. Allocated to capital expenditure category Wireless Infrastructure - Improvement.

[17]: [8] x [11].

**Table A-3: Crown Castle Communications 2016 Capital Expenditures (\$ thousands)**

<u>Discretionary</u>		
[1]	Land Purchases	\$74,579
[2]	Wireless Infrastructure Construction and Improvements, Towers Segment	\$313,013
<u>Sustaining</u>		
[4]	Total Capital Expenditures	\$873,883
[5]	Towers Segment Capital Expenditures	\$429,526
[6]	Towers Segment Proportion of Capital Expenditures	49.15%
[7]	Total Sustaining Capital Expenditures	\$89,766
[8]	Towers Segment Sustaining Capital Expenditures	\$44,121
[9]	Maintenance Capital Expenditures	\$19,750
[10]	Corporate Capital Expenditures	\$24,372
[11]	Total Capital Expenditures	\$431,713

*Source:* Crown Castle 2016 10-K, at pp. 34 and 77.

*Note:*

[1] - [5]: From Crown Castle 2016 10-K.

[6]: [5] / [4].

[7]: From Crown Castle 2016 10-K.

[8]: [6] x [7].

[9] - [10]: Based on discussions with Crown Castle, Maintenance and Corporate Capital Expenditures are assumed to represent approximately 45 and 55 percent, respectively, of Sustaining Capital Expenditures.

[11]: [1] + [2] + [9] + [10].

**Table A-4: SBA 2014-2016 Capital Expenditures (\$ thousands)**

	2016	2015	2014
<u>Total International Capital Expenditures</u>			
[1] Acquisitions	\$214,686	\$525,802	\$1,540,258
[2] Construction and related costs on new builds	\$69,407	\$100,736	\$92,207
[3] Augmentation and tower upgrades	\$38,123	\$61,410	\$72,329
[4] Land buyouts	\$62,149	\$83,728	\$44,964
[5] Purchase and refurbishment of headquarters building	\$0	\$12,961	\$19,471
[6] Tower Maintenance	\$27,718	\$28,626	\$20,047
[7] General Corporate	\$4,734	\$4,974	\$7,197
[8] Total Capital Expenditures, incl. Acquisitions	\$416,817	\$818,237	\$1,796,473
[9] Total Capital Expenditures, excl. Acquisitions	\$202,131	\$292,435	\$256,215
[10] Total Domestic Site Leasing Capital Expenditures, incl. Acquisitions	\$310,256	\$709,337	\$547,774
[11] Total Non-Domestic Site Leasing Capital Expenditures, incl. Acquisitions	\$107,947	\$111,527	\$1,249,989
[12] Domestic Site Leasing Proportion of Capital Expenditures	74.19%	86.41%	30.47%
<u>Scaled for Domestic Capital Expenditures Only</u>			
[14] Construction and related costs on new builds	\$51,492	\$87,049	\$28,095
[15] Augmentation and tower upgrades	\$28,283	\$53,067	\$22,038
[16] Land buyouts	\$46,107	\$72,352	\$13,700
[17] Purchase and refurbishment of headquarters building	\$0	\$11,200	\$5,933
[18] Tower Maintenance	\$20,563	\$24,737	\$6,108
[19] General Corporate	\$3,512	\$4,298	\$2,193
[20] Total Domestic Site Leasing Capital Expenditures, excl. Acquisitions	\$149,957	\$252,703	\$78,068

*Source:* SBA Communications 2016 10-K, at pp. 42 and F-38.

Notes:

[1] - [7]: From SBA Communications 2016 10-K.

[8]: Sum of [1] - [7].

[9]: Sum of [2] - [7].

[10] - [11]: From SBA Communications 2016 10-K.

[12]: [10] / ([10] + [11]).

[14]: [2] x [12]. Allocated to capital expenditure category Wireless Infrastructure - Construction.

[15]: [3] x [12]. Allocated to capital expenditure category Wireless Infrastructure - Improvement.

[16]: [4] x [12]. Allocated to capital expenditure category Land Purchases.

[17]: [5] x [12]. Allocated to capital expenditure category Sustaining - Corporate.

[18]: [6] x [12]. Allocated to capital expenditure category Sustaining - Maintenance.

[19]: [7] x [12]. Allocated to capital expenditure category Sustaining - Corporate.

[20]: [9] x [12].

**Table A-5: Breakdown of 2014-2016 Wireless Infrastructure Expenditures for American Tower and SBA**

	American Tower			SBA			Average
	2016	2015	2014	2016	2015	2014	
[1] Construction (\$ thousands)	\$66,323	\$123,655	\$308,416	\$51,492	\$87,049	\$28,095	
[2] Improvements (\$ thousands)	\$65,304	\$81,781	\$114,946	\$28,283	\$53,067	\$22,038	
[3] Total (\$ thousands)	\$131,628	\$205,436	\$423,362	\$79,774	\$140,116	\$50,134	
[4] Construction as Percent of Total	50.4%	60.2%	72.8%	64.5%	62.1%	56.0%	61.0%
[5] Improvements as Percent of Total	49.6%	39.8%	27.2%	35.5%	37.9%	44.0%	39.0%

**Sources & Notes:**

[1] - [2]: AMT & SBA 2016 10-Ks. Values have been scaled down to exclude international capital expenditures. See Appendix, at Table A-2 and Table A-4.

[3]: [1] + [2].

[4]: [1] / [3].

[5]: [2] / [3].

**Table A-6: Breakdown of Crown Castle 2016 Wireless Infrastructure Capital Expenditures based on American Tower and SBA Breakdown**

[1] Crown Castle Wireless Infrastructure Construction and Improvements	\$313,013
[2] Construction as Percent of Total	61.0%
[3] Improvements as Percent of Total	39.0%
[4] Crown Castle Construction Capital Expenditures	\$191,012
[5] Crown Castle Improvements Capital Expenditures	\$122,001

Sources & Notes:

[1] - [3]: See Appendix, at Table A-3 and Table A-5.

[4]: [1] x [2].

[5]: [1] x [3].

**Table A-7: Estimated 2016 Capital Expenditures by Tower Companies**

	Discretionary			Sustaining	
	Land Purchases	Wireless Infrastructure Construction	Wireless Infrastructure Improvements	Maintenance	Corporate
<u>2016 Domestic Capital Expenditures (\$ thousands)</u>					
[1] American Tower	\$67,918	\$66,323	\$65,304	\$48,845	\$7,283
[2] Crown Castle	\$74,579	\$191,012	\$122,001	\$19,750	\$24,372
[3] SBA	\$46,107	\$51,492	\$28,283	\$20,563	\$3,512
[4] <i>Sub-Total</i>	<i>\$188,604</i>	<i>\$308,827</i>	<i>\$215,588</i>	<i>\$89,158</i>	<i>\$35,167</i>
<u>Number of Domestic Towers as of 12/22/2016</u>					
[5] American Tower	39,989	39,989	39,989	39,989	39,989
[6] Crown Castle	40,039	40,039	40,039	40,039	40,039
[7] SBA	14,873	14,873	14,873	14,873	14,873
[8] <i>Sub-Total</i>	<i>94,901</i>	<i>94,901</i>	<i>94,901</i>	<i>94,901</i>	<i>94,901</i>
[9] Total Other Domestic Towers	23,822	23,822	23,822	23,822	23,822
[10] Total Domestic Towers	118,723	118,723	118,723	118,723	118,723
[11] American Tower, Crown Castle, and SBA Domestic Market Share	79.9%	79.9%	79.9%	79.9%	79.9%
[12] Estimated Total Domestic Capital Expenditures	\$235,948	\$386,348	\$269,705	\$111,538	\$43,994

Sources & Notes:

[1] - [3]: See Appendix, at Table A-2, Table A-3, Table A-4, and Table A-6.

[4]: [1] + [2] + [3].

[5] - [7]: "Top 100 Tower Companies in the U.S.," WirelessEstimator, as of December 22, 2016, available at <http://wirelessestimator.com/top-100-us-tower-companies-list/> (last accessed February 7, 2017).

[8]: [5] + [6] + [7].

[9]: [10] - [8].

[10]: "Top 100 Tower Companies in the U.S.," WirelessEstimator, as of December 22, 2016, available at <http://wirelessestimator.com/top-100-us-tower-companies-list/> (last accessed February 7, 2017).

[11]: [8] / [10].

[12]: [4] / [11].

**Table A-8: Non-Construction and Non-Land Purchase Capital Expenditures per Tower**

	American Tower	Crown Castle	SBA	Average
[1] Tower Maintenance and Improvements (\$ thousands)	\$114,149	\$141,751	\$48,846	
[2] Corporate SG&A (\$ thousands)	\$7,283	\$24,372	\$3,512	
[3] Number of Domestic Towers	40,070	40,153	19,265	
[4] Per Tower Maintenance and Improvements Capital Expenditures (\$)	\$2,849	\$3,530	\$2,536	\$2,972
[5] Per Tower Corporate SG&A Capital Expenditures (\$)	\$182	\$607	\$182	\$324

Sources & Notes:

[1] - [2]: Appendix, at Table A-7.

[3]: Appendix, at Table A-1.

[4]: [1] / [3] x 1,000.

[5]: [2] / [3] x 1,000.

**Table A-9: American Tower 2016 Domestic Operating Expenditures (\$ thousands)**

[1] Revenue	\$3,370,033
[2] Gross Margin	\$2,636,630
[3] Operating Expenses, excl. SG&A	\$733,403
[4] Selling, General, Administrative and Development Expense	\$147,559

Source: American Tower 2016 10-K, at pp. 31-34. Values are for American Tower's U.S. Property segment, which is its domestic tower leasing business.

Notes:

[3]: [2] - [1].

**Table A-10: Crown Castle 2016 Domestic Towers Segment Operating Expenditures (\$ thousands)**

---

---

[1] Towers Segment Site Rental Cost of Operations	\$840,209
[2] Towers Segment Revenues	\$3,434,397
[3] Towers Segment Site Rental Revenues	\$2,830,708
[4] Towers Segment General and Administrative Expenses	\$92,903
[5] Towers Segment Site Rental General and Administrative Expenses	\$76,573

---

---

*Source:* Crown Castle 2016 10-K, at p. 77.

*Notes:*

[5]: [4] x ([3] / [2]).

**Table A-11: SBA 2016 Domestic Site Leasing Operating Expenditures (\$ thousands)**

[1] Domestic Site Leasing Cost of Revenues	\$260,941
[2] Domestic SG&A	\$72,701

Source: SBA Communications 2016 10-K, at pp. 31-32.

**Table A-12: Breakdown of 2016 Domestic Operating Expenditures for American Tower, Crown Castle, and SBA**

<u>Breakdown of Expenses</u>					
[1]	Land Rent	70%			
[2]	Repair and Maintenance	10%			
[3]	Other	20%			
<hr/>					
		American Tower	Crown Castle	SBA	Average
<hr/>					
<u>Operating Expenses (\$ thousands)</u>					
[4]	Total Operating Expenses, excl. D&A and SG&A	\$733,403	\$840,209	\$260,941	
[5]	Land Rent Expenses	\$513,382	\$588,146	\$182,659	
[6]	Repair and Maintenance Expenses	\$73,340	\$84,021	\$26,094	
[7]	Other Expenses	\$146,681	\$168,042	\$52,188	
[8]	SG&A	\$147,559	\$76,573	\$72,701	
<hr/>					
<u>Operating Expenses Per Tower (\$/year)</u>					
[9]	Number of Towers	40,070	40,153	19,265	
[10]	Non-SG&A Operating Expenses per Tower	\$18,303	\$20,925	\$13,545	\$17,591
[11]	Land Rent per Tower	\$12,812	\$14,648	\$9,481	\$12,314
[12]	Non-Land Rent Operating Expenses per Tower	\$5,491	\$6,278	\$4,063	\$5,277
[13]	SG&A per Tower	\$3,683	\$1,907	\$3,774	\$3,121
<hr/>					

Sources & Notes:

[1] - [3]: Cost breakdown is based on discussions with American Tower and Crown Castle.

[3]: Other includes fuel, utilities, insurance, property taxes, etc.

[4], [8]: Appendix, at Table A-9 through Table A-11.

[5]: [4] x [1].

[6]: [4] x [2].

[7]: [4] x [3].

[9]: Appendix, at Table A-1.

[10]: [4] / [9] x 1,000.

[11]: [5] / [9] x 1,000.

[12]: ([6] + [7]) / [9] x 1,000.

[13]: [8] / [9] x 1,000.

**Table A-13: Estimated 2016 Operating Expenditures by Tower Companies**

	Land Rents	Repair and Maintenance	Other	SG&A
<u>2016 Domestic Operating Expenses (\$ thousands)</u>				
[1] American Tower	\$513,382	\$73,340	\$146,681	\$147,559
[2] Crown Castle	\$588,146	\$84,021	\$168,042	\$76,573
[3] SBA	\$182,659	\$26,094	\$52,188	\$72,701
[4] <i>Sub-Total</i>	<i>\$1,284,187</i>	<i>\$183,455</i>	<i>\$366,911</i>	<i>\$296,833</i>
<u>Number of Domestic Towers as of 12/22/2016</u>				
[5] American Tower	39,989	39,989	39,989	39,989
[6] Crown Castle	40,039	40,039	40,039	40,039
[7] SBA	14,873	14,873	14,873	14,873
[8] <i>Sub-Total</i>	<i>94,901</i>	<i>94,901</i>	<i>94,901</i>	<i>94,901</i>
[9] Total Other Domestic Towers	23,822	23,822	23,822	23,822
[10] Total Domestic Towers	118,723	118,723	118,723	118,723
[11] American Tower, Crown Castle, and SBA Domestic Market Share	79.9%	79.9%	79.9%	79.9%
[12] Estimated Total Domestic Operating Expenses	\$1,606,543	\$229,506	\$459,012	\$371,344

Sources & Notes:

[1] - [3]: See Appendix, at Table A-12.

[4]: [1] + [2] + [3].

[5] - [7]: "Top 100 Tower Companies in the U.S.," WirelessEstimator, as of December 22, 2016, available at <http://wirelessestimator.com/top-100-us-tower-companies-list/> (last accessed February 7, 2017).

[8]: [5] + [6] + [7].

[9]: [10] - [8].

[10]: "Top 100 Tower Companies in the U.S.," WirelessEstimator, as of December 22, 2016, available at <http://wirelessestimator.com/top-100-us-tower-companies-list/> (last accessed February 7, 2017).

[11]: [8] / [10].

[12]: [4] / [11].

CAMBRIDGE  
NEW YORK  
SAN FRANCISCO  
WASHINGTON  
TORONTO  
LONDON  
MADRID  
ROME  
SYDNEY



THE **Brattle** GROUP