



***Alabama Association of Assessing
Officials***

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***Perdido Beach Resort, Orange Beach
Alabama***



***CELL TOWER ANALYSIS:
The Valuation of
Telecommunications Assets***



PURPOSE



This presentation has been developed in response to the explosive growth in the wireless telecommunications industry.

The demand for new towers will continue to grow as the number of new cellular users and new services expands(5G). The benefits of having towers is **tax revenue** and **improved connectivity** but assessors must value these towers accurately and take into account the impact of the structure on property values.



Objectives

Describe the typical telecommunication towers and related assets.

Demonstrate how to value telecommunication towers and related assets

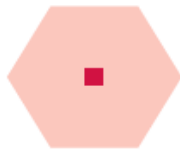


What is a cell site ?

A cell site is an area within a carrier's wireless network, which is serviced by an antenna array.

- > A cell site can be located on a tower site or alternative structures, such as: rooftops, water towers, church steeples, etc.
- > One single tower site can support multiple carriers cell sites through collocation

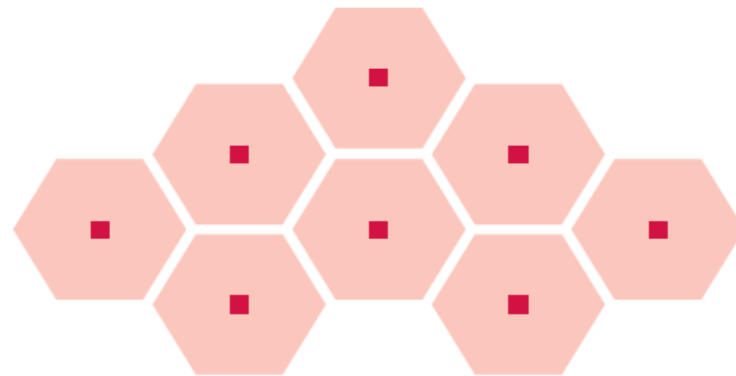
Cell Site



- Antenna location
- Geographic area covered by antenna array

Cell Site Network

A carrier's coverage area is dependent upon the capacity of its equipment and the frequency of the signal being transmitted.





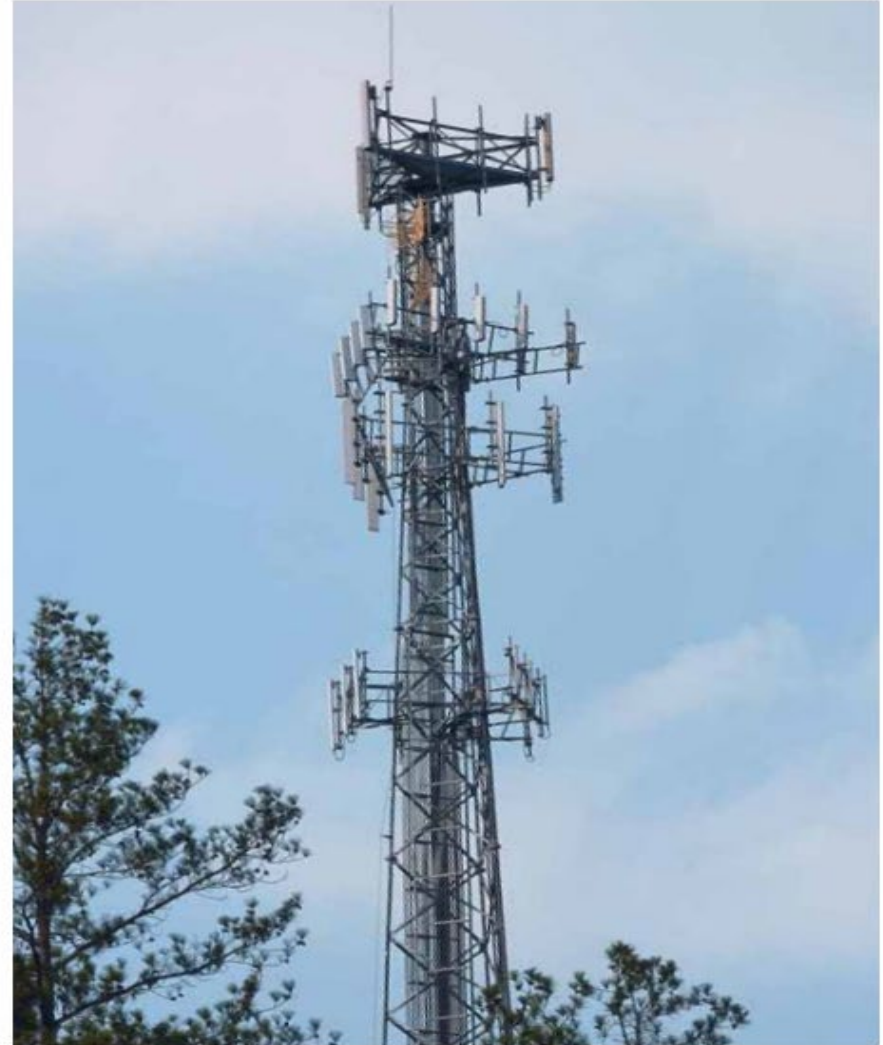
Wireless Tower Basics

What is a tower?

- › A vertical structure built on a small parcel of land, designed to accommodate multiple wireless tenants
- › Our tenants utilize many different technologies, including: telephony, mobile data, broadcast television and radio, and paging
- › Wireless tenants lease vertical space on the tower and portions of the land underneath for their equipment

What is found at the tower site?

- › Tower company typically owns or leases under a long term contract:
 - › Tower structure
 - › Ground interest (fee simple or lease)
- › Wireless tenant typically owns and operates:
 - › Equipment, including the antenna array, antenna, coaxial cables and base stations
 - › Equipment shelters





Towers can generally be categorized into **three major types; guyed, self supporting(lattice), and monopole**. Typical tower heights will vary between 25 and 625 feet. The type of tower erected will depend on many factors including:

- Topography
- Soil conditions
- Land use and availability
- Tower height required
- Wind loading (maximum forces that may be applied to a structural element by wind)
- Ice loading (maximum forces that may be applied to a structural element by ice)
- Zoning



Types of Towers



Monopole

- > 100 – 200 feet
- > Typical use: telephony



Lattice

- > 200 – 400 feet
- > Also called self-support
- > Typical use: telephony



Guyed

- > 200 – 2,000 feet
- > Typical use: television and radio broadcasting, paging and telephony



Stealth

- > Range in size
- > Generally used to maintain aesthetic quality of area where tower is built
- > Particularly useful in areas with strict zoning regulations



Self Supporting Lattice Tower



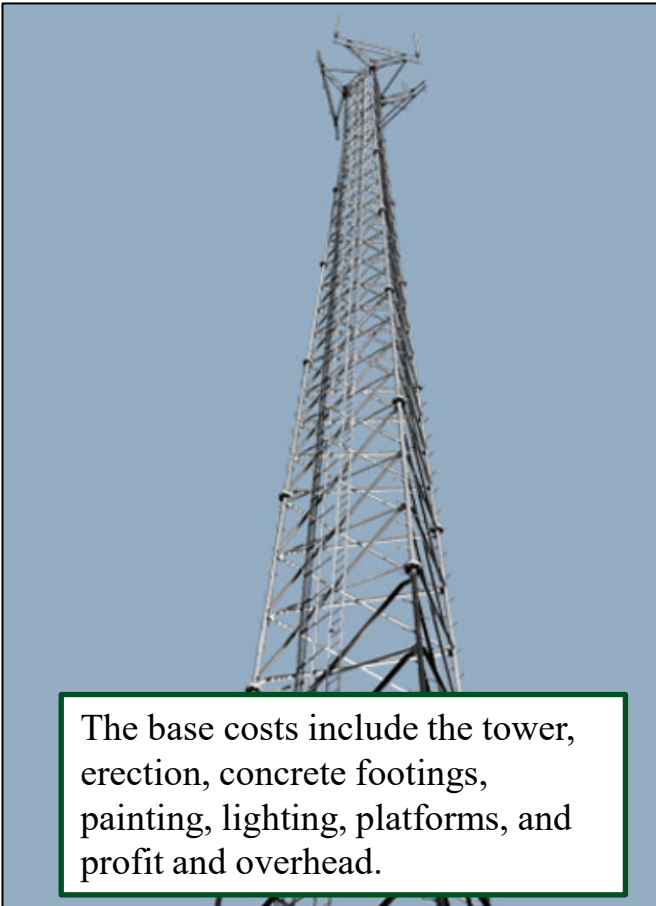
Economic Life: 20

- Self supporting towers tend to be the **most expensive towers to erect**.
- Can be constructed with either **three or four legs** with a lattice frame.
- Generally the **strongest** and can support the **largest wind** and **ice load**.
- One variable is required when valuing self supporting towers:

Tower height



Self Supporting Lattice Tower



The base costs include the tower, erection, concrete footings, painting, lighting, platforms, and profit and overhead.

Height in Feet	Cost
30.00	11,000.00
50.00	22,900.00
70.00	35,300.00
90.00	48,400.00
110.00	62,200.00
130.00	76,500.00
150.00	91,500.00
170.00	107,000.00
190.00	123,000.00
210.00	140,000.00
230.00	158,000.00
250.00	176,000.00
270.00	195,000.00
290.00	214,000.00
310.00	234,000.00
330.00	255,000.00
350.00	276,000.00
370.00	298,000.00
390.00	320,000.00
410.00	343,000.00
430.00	367,000.00
450.00	391,000.00
470.00	416,000.00
490.00	442,000.00



Guyed Tower



Economic Life: 20

- Generally the **least costly**
- Require the **greatest amount of land** to erect due to the area needed for the cable guy wire stays.
- Less attractive to a property owner because it **ties up more land than a self-supporting tower.**
- Often seen in rural or suburban settings where land is not at a premium.
- Guyed towers may be constructed with either 3 legs (triangular) or 4 legs.
- The distance between the tower legs will increase as the height of the tower and wind load increases.
- Two variables are required when valuing guyed towers; **Distance between tower legs (1-7ft.) and Tower height (25-625ft).**



Guyed Tower



The base costs include the tower, erection, concrete footings, painting, lighting, platforms, guy wires, and profit and overhead.

12 inch Guyed Tower 3L	3,120 – 77,900
12 inch Guyed Tower 4L	3,770 – 94,200
24 inch Guyed Tower 3L	5,470 – 197,000
24 inch Guyed Tower 4L	6,570 – 236,000
36 inch Guyed Tower 3L	7,840 – 196,000
36 inch Guyed Tower 4L	9,410 – 235,000
32 inch Guyed Tower 3L	7,050 – 176,000
32 inch Guyed Tower 4L	8,460 – 211,000
40 inch Guyed Tower 3L	8,630 – 216,000
40 inch Guyed Tower 4L	10,400 – 259,000
48 inch Guyed Tower 3L	27,300 – 327,000
48 inch Guyed Tower 4L	32,500 – 390,000
54 inch Guyed Tower 3L	17,300 – 431,000
54 inch Guyed Tower 4L	20,700 – 518,000
84 inch Guyed Tower 3L	24,000 – 599,000
84 inch Guyed Tower 4L	32,000 – 602,000



Monopole Tower



Economic Life: 20

- Free standing and are **most commonly used in cellular and personal communication service (PCS)** applications.
- **Least intrusive** tower type and ideal for urban areas.
- Typically constructed of different diameter steel sections either cylindrical or multi sided in shape.
- The individual sections are bolted or welded together with the **largest diameter sections at the base** and **each successive section is smaller** in diameter.
- One variable is required when valuing monopole towers: **Tower height**



Monopole Tower



The base costs include the tower, erection, concrete footings, painting, lighting, platforms, and profit and overhead.

Height in Feet	Cost
20.00	1,660.00
25.00	5,030.00
50.00	24,600.00
75.00	48,600.00
100.00	77,000.00
125.00	110,000.00
150.00	147,000.00
175.00	189,000.00
200.00	235,000.00
225.00	286,000.00
250.00	342,000.00
275.00	401,000.00
300.00	465,000.00



Monopole Tower



Can be designed as concealment poles and/or stealth towers in areas prone to aesthetic concerns



Typical Tower Components

1. WHIP ANTENNA

- A stiff, monopole antenna, usually mounted vertically.

2. ANTENNA ARRAY

- A platform (typically three sided) where tenants place equipment to provide signal transmission and reception to a specific area. The number of antennas necessary per array is determined based on a number of factors including:

- the number of active subscribers;
- the volume and type of network usage by subscribers (e.g.: average minutes of use, voice versus data);
- the technology being used (e.g.: CDMA, GSM, LTE, WiMAX);
- the type of spectrum currently utilized by the tenant.

3. PORT HOLES

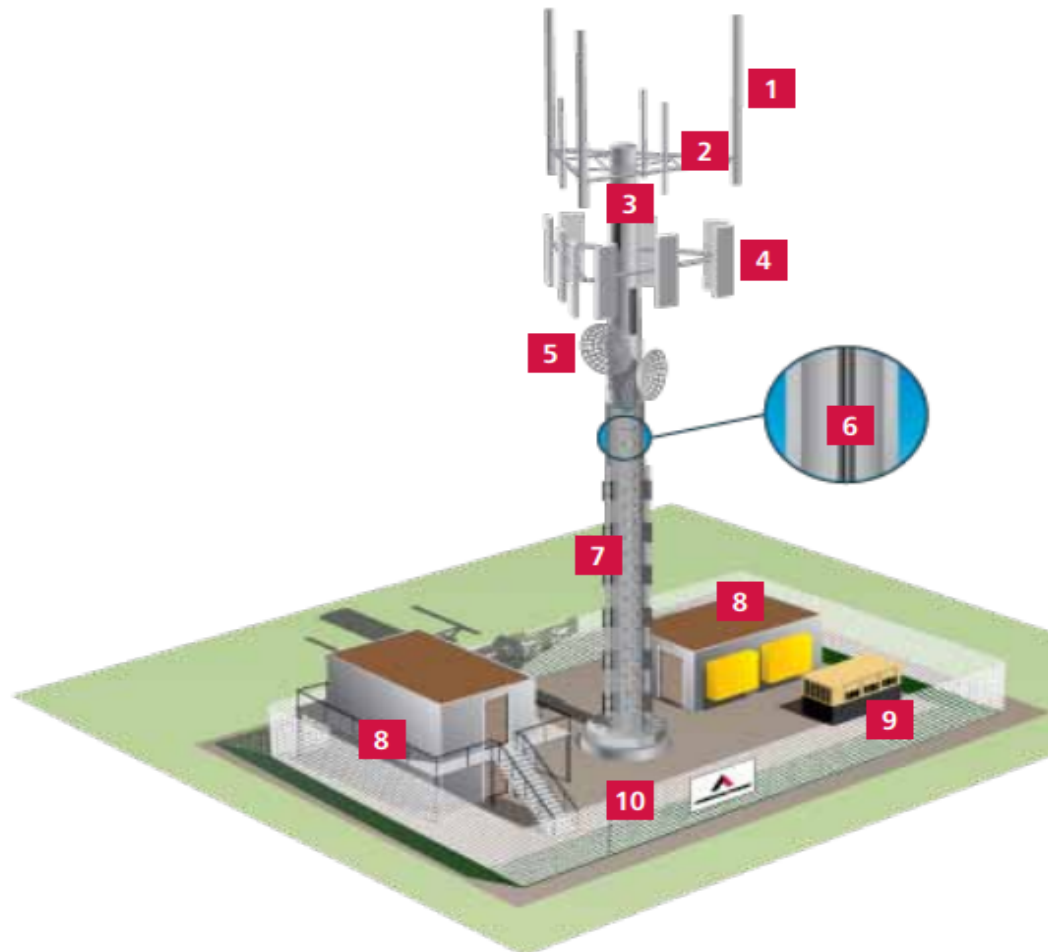
- Holes cut into the base and top of tower to allow cables and wiring to pass through the tower structure, from the base station to the antennas.

4. PANEL/ANTENNA

- Customer equipment which transmits a signal from the tower to a mobile device, or vice versa.

5. MICROWAVE DISH

- A specific type of antenna, which is used in point-to-point radio, television and data communications. Also commonly used by wireless carriers for backhaul.





Typical Tower Components (CONTINUED)

6. COAXIAL CABLING

- Transmission lines which carry the signal received from the antenna to the base-station, or vice versa.

7. REINFORCEMENT BARS

- Threaded anchors which are used to reinforce tower sites to add additional capacity to accommodate further tenants.

8. SHELTERS

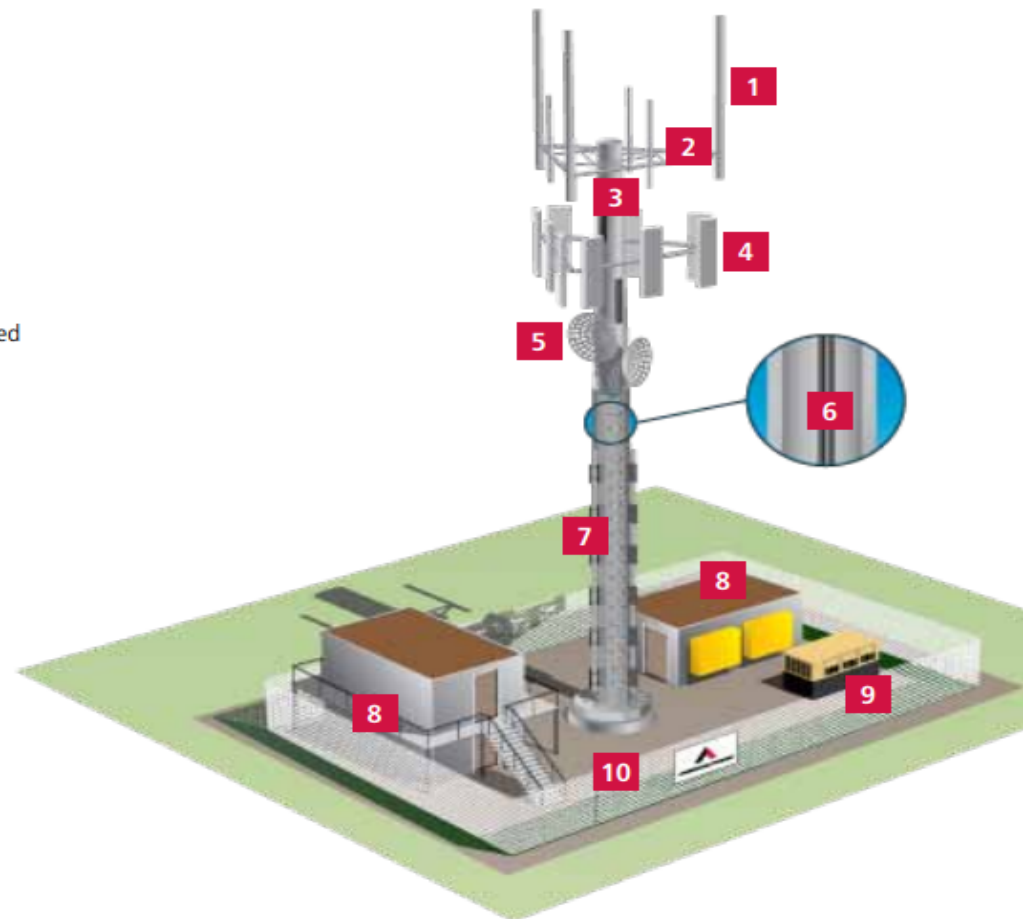
- Buildings at cell sites used by our tenants to house communications, radio and network equipment. Some shelters are designed to be stacked on top of one another to conserve space at smaller tower sites.

9. GENERATOR

- Gas or diesel powered generators provide emergency backup power to keep cell sites operational during power outages.

10. GROUND SPACE

- The area within a tower site where carriers lease space from the tower company to place their shelters and generators.





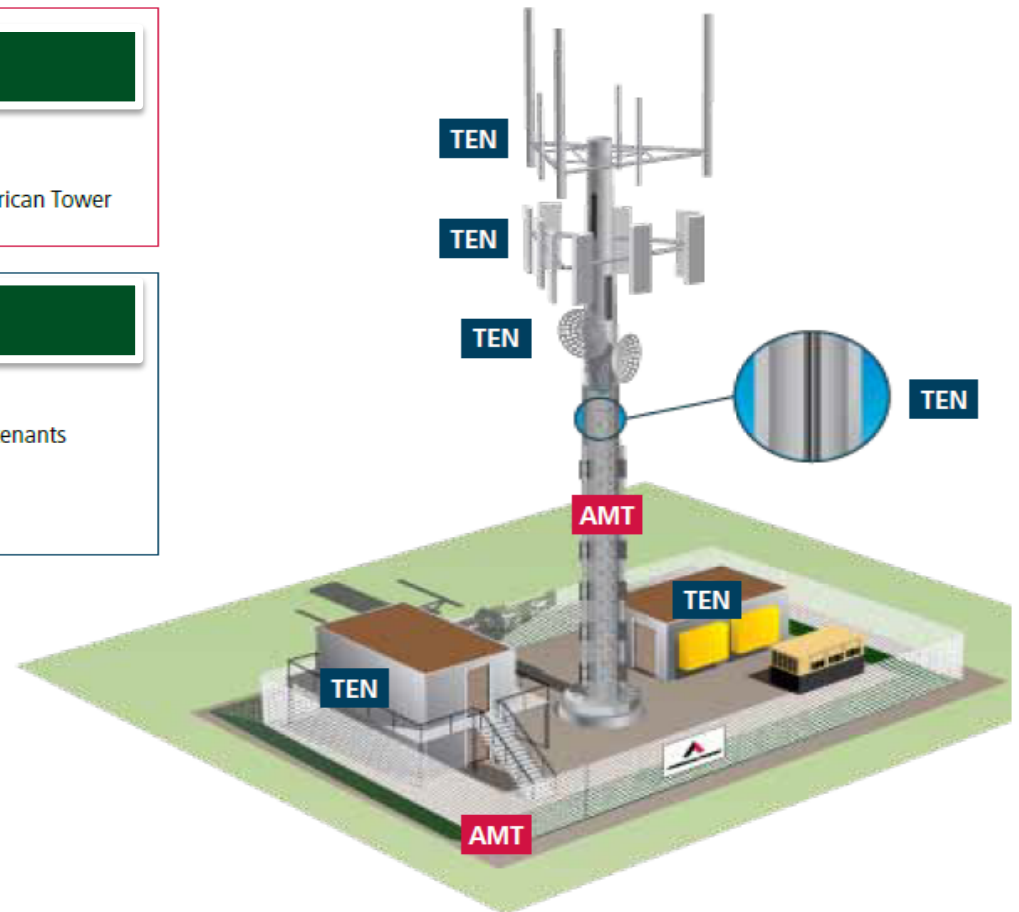
Ownership Distribution

Tower

- > Tower structure owned by Tower – tower sites are generally constructed with the capacity for ~4-5 tenants
- > Land parcel owned or operated pursuant to a long-term lease by American Tower

Tenant

- > Antenna equipment, including microwave equipment
- > Tenant shelters containing base-station equipment and HVAC, which tenants own, operate and maintain
- > Coaxial cable





Tower Capacity

Augmentation Capex Examples

1. HEIGHT EXTENSION

- › Allows for more equipment and more wireless tenants

2. MULTIPLE ANTENNA MOUNTING SCENARIOS

- › Options include whips, panels, microwaves and various combinations determined by internal RF engineering

3. PORT HOLE ADDITIONS

- › Additional entry and exit port designs accommodate additional coaxial cables

4. TOWER REINFORCEMENTS

- › Adds structural strength to accommodate additional tenants

5. STRENGTHENED FOUNDATION

- › Increases load capacity of the tower

6. SHARED GENERATOR

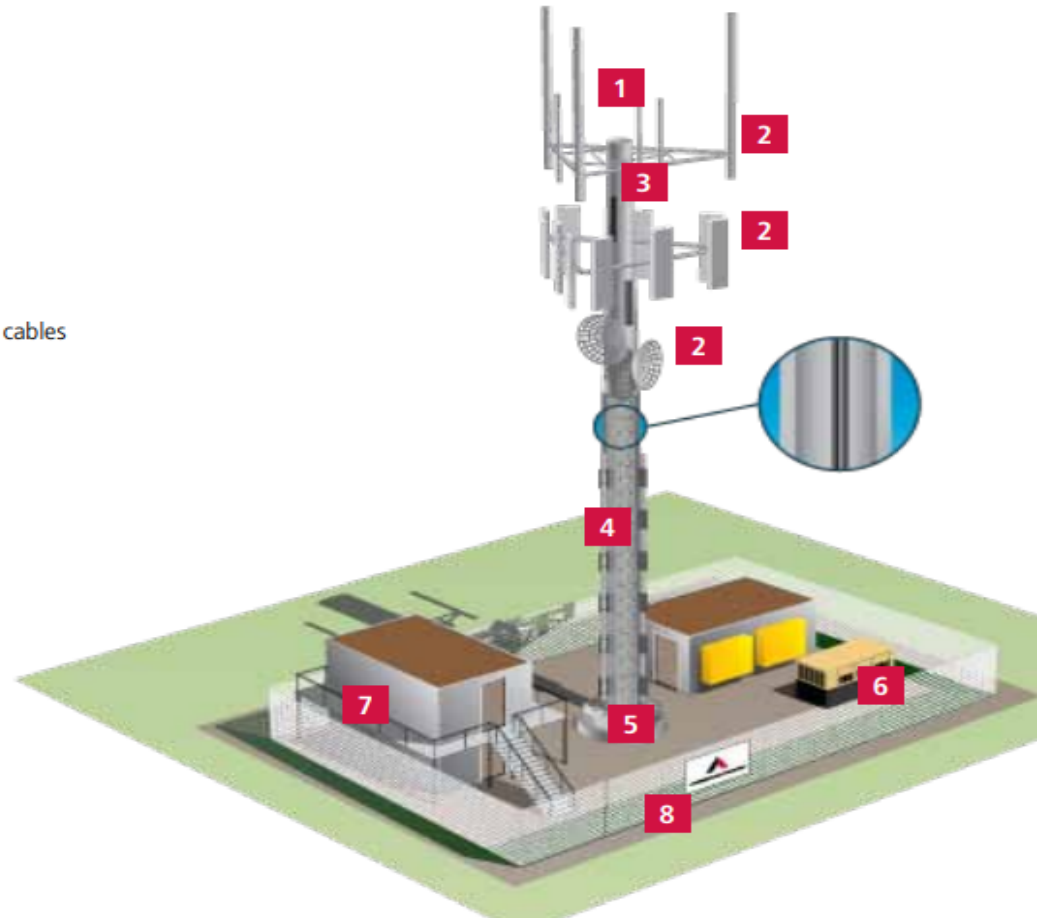
- › Provided by American Tower, maximizes compound space

7. STACKED SHELTERS

- › Shelter stacked atop an existing shelter using a steel platform

8. EXTENDED GROUND SPACE

- › Where space allows, expanded to accommodate more equipment





Cellular Antennas

Economic Life: 3

- Antennas are essential in the sending and receiving of radio frequency (RF) signals in any communication network. They may be mounted on a tower, building or anchored in concrete.
- Cellular antenna includes low beam – shaping feed, shielded reflector with RF absorbers including vertical tower mount.
- One variable is required when valuing antennas:

Diameter or length of antenna



CELLULAR ANTENNA

Cellular/Pcs Antenna (< 4 Ft)

Diameter in Feet	Cost
1.00	3,180.00
2.00	3,180.00
3.00	3,180.00
4.00	3,180.00

Cellular/Pcs Antenna (> 4 Ft)

Diameter in Feet	Cost
5.00	6,350.00
7.00	6,350.00
9.00	6,350.00
11.00	6,350.00



- The base costs include the antenna concrete slab or piers, mounting pole, brackets and other mounting hardware, waveguides installation/activation, and profit and overhead.



Satellite Dish

Economic Life: 3

- Satellite dishes, which may be seen at Cable Television tower sites, and microwave dishes are commonly located at telecommunication towers

Satellite Dish – Wire Mesh

Satellite Dish – Fiberglass

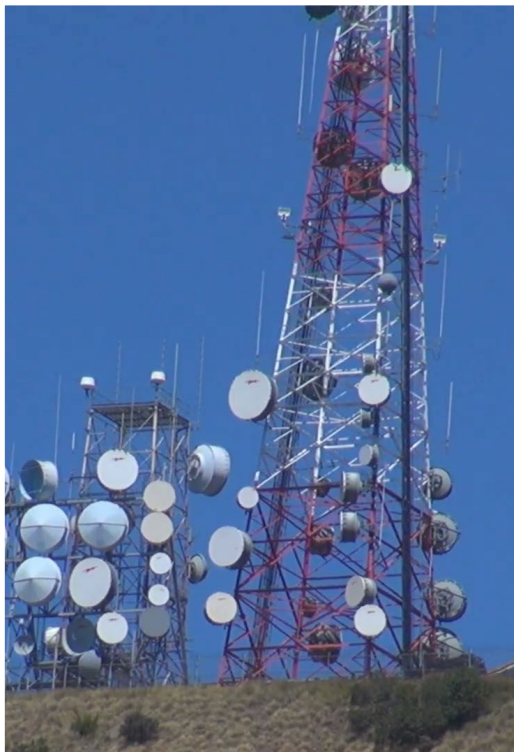
Satellite Dish – Average Grade

Satellite Dish – High Performance

- One variable is required when valuing Satellite Dishes: **Diameter or length of dish**



Satellite Dish



- The base costs include the antenna concrete slab or piers, mounting pole, brackets and other mounting hardware, waveguides installation/activation, and profit and overhead.

Satellite Dish-Wire Mesh

Number of Meters	Total Value
1.00	1,420.00
1.50	1,630.00
2.00	2,080.00
2.50	2,780.00
3.00	3,730.00
3.50	4,930.00
4.00	6,370.00
4.50	8,050.00

Satellite Dish-Fiberglass Fixd

Number of Meters	Total Value
1.00	1,490.00
1.50	1,650.00
2.00	2,260.00
2.50	3,150.00
3.00	4,250.00
3.50	5,510.00
4.00	6,880.00
4.50	8,350.00



Satellite Dish



- The base costs include the antenna concrete slab or piers, mounting pole, brackets and other mounting hardware, waveguides installation/activation, and profit and overhead.

Satellite Dish-Avg Grade

Number of Meters	Total Value
1.80	8,670.00
2.30	8,810.00
2.80	10,600.00
3.30	14,000.00
3.80	19,100.00
4.30	25,800.00
4.80	34,100.00
5.30	44,100.00
5.80	55,700.00
6.30	69,000.00
6.80	83,900.00
7.30	100,000.00
7.80	119,000.00



Satellite Dish



- The base costs include the antenna concrete slab or piers, mounting pole, brackets and other mounting hardware, waveguides installation/activation, and profit and overhead.

Satellite Dish-High Performance

Number of Meters	Total Value
1.80	10,800.00
2.30	11,000.00
2.80	13,200.00
3.30	17,500.00
3.80	23,800.00
4.30	32,200.00
4.80	42,600.00
5.30	55,100.00
5.80	69,600.00
6.30	86,200.00
6.80	105,000.00
7.30	126,000.00
7.80	148,000.00



Equipment shelters

Economic Life: 10/25

- Located at the base of communication towers
- **Primarily prefabricated** structures that are transported to the site *although* they can also be built on site.
- They generally have factory installed wiring, HVAC, humidity control, and an exterior generator plug
- The **electronic switching equipment is housed in the equipment shelters** at the base of telecommunications towers



Equipment Shelter - Concrete Block



INSTALLED COST INCLUDES:

- (1) Minor site preparation and landscaping;
- (2) Concrete pad or piers;
- (3) Delivery and set-up for factory built shelters;
- (4) Electric & communication wiring;
- (5) Basic climate control;
- (6) Profit and overhead.

Equipment Shelter – Fiberglass



INSTALLED COST INCLUDES:

- (1) Minor site preparation and landscaping;
- (2) Concrete pad or piers;
- (3) Delivery and set-up for factory built shelters;
- (4) Electric & communication wiring;
- (5) Basic climate control;
- (6) Profit and overhead.



Equipment Shelter

Equip Shed Wood Frame Pre Asse



Equip Shed Wood Frame

Square Feet	Cost
50.00	1,460.00
100.00	2,680.00
150.00	3,890.00
200.00	5,080.00
250.00	6,250.00
300.00	7,410.00
350.00	8,540.00
400.00	9,660.00
450.00	10,800.00
500.00	11,900.00
550.00	12,900.00
600.00	14,000.00

Square Feet	Cost
50.00	3,030.00
100.00	5,720.00
150.00	8,360.00
200.00	10,900.00
250.00	13,500.00
300.00	16,000.00
350.00	18,400.00
400.00	20,800.00
450.00	23,100.00
500.00	25,300.00
550.00	27,600.00
600.00	29,700.00



Equipment Shelter

Equip Shed Concrete Block

Square Feet	Cost
100.00	10,300.00
150.00	13,300.00
200.00	15,900.00
250.00	18,300.00
300.00	20,500.00
350.00	22,600.00
400.00	24,600.00
450.00	26,500.00
500.00	28,300.00
550.00	30,100.00
600.00	31,800.00
650.00	33,500.00
700.00	35,100.00
750.00	36,700.00
800.00	38,300.00



Equip Shed Fiberglass

Square Feet	Cost
50.00	30,300.00
100.00	36,400.00
150.00	41,800.00
200.00	46,600.00
250.00	50,800.00
300.00	54,400.00
350.00	57,300.00
400.00	59,600.00
450.00	61,300.00
500.00	62,300.00



Equipment Shed- Steel Cabinet

Economic Life: 10/25

- Steel cabinet, weatherproof, concrete pad mounted, usually 3 to 6 feet tall, **not designed for personnel entry.**
- Usually contains **non-temperature sensitive electronic gear**, and is usually found near communications towers and underground cable splices.



Equipment Shed- Steel Cabinet - Surface Mounted



INSTALLED COST INCLUDES:

- (1) Minor site preparation and landscaping;
- (2) Concrete pad or piers;
- (3) Delivery and set-up for factory built shelters;
- (4) Electric & communication wiring;
- (5) Basic climate control;
- (6) Profit and overhead.

Equip Shed Steel Cabinet

Square Feet	Cost
10.00	2,520.00
20.00	4,690.00
40.00	7,600.00
60.00	9,720.00
80.00	11,400.00
100.00	12,900.00
120.00	14,100.00
140.00	15,200.00
160.00	16,200.00
180.00	17,100.00
200.00	18,000.00



Equipment Shed - Steel Frame Light Weight Shelter – Pre-assembled/Factory Built



Equip Shed Steel Frame Light Wt.

Square Feet	Cost
50.00	25,900.00
100.00	28,800.00
150.00	32,300.00
200.00	36,400.00
250.00	41,300.00
300.00	46,800.00
350.00	52,900.00
400.00	59,700.00

INSTALLED COST INCLUDES:

- (1) Minor site preparation and landscaping;
- (2) Concrete pad or piers;
- (3) Delivery and set-up for factory built shelters;
- (4) Electric & communication wiring;
- (5) Basic climate control;
- (6) Profit and overhead.



GENERATOR

Economic Life: 10

Backup generators are used to ensure an uninterruptible power supply and are common at tower sites.

- One variable is required when valuing a backup generator: **Kilowatt rating**



Generator for Telecommunication Towers

- 1 Location
- 2 Prime or Standby Power
- 3 Enclosed or Open
- 4 Load: SCR, Inductive, Size
- 5 Ambient Site Conditions
- 6 Diesel or Gas Fueling
- 7 Sound Attenuation
- 8 Remote Monitoring
- 9 Local Codes
- 10 Generator Arrangement





Generators



INSTALLED COSTS INCLUDE:
 (1) Profit and overhead
 (2) Diesel
 (3) Generator/alternator
 (4) Controls
 (5) Fuel tank
 (6) Battery charger
 (7) Exhaust system

Kilowatts	Cost
12.00	18,700.00
50.00	24,800.00
100.00	33,000.00
150.00	41,300.00
200.00	49,700.00
250.00	58,300.00
300.00	67,100.00
350.00	76,000.00
400.00	85,000.00
450.00	94,200.00
500.00	104,000.00
550.00	113,000.00
600.00	123,000.00
650.00	132,000.00
700.00	142,000.00
750.00	152,000.00
800.00	163,000.00
850.00	173,000.00
900.00	183,000.00
950.00	194,000.00
1,000.00	205,000.00



Cell Tower Lease

A cell tower lease is an agreement between a **tower company** and a **landowner or property manager** allowing the cell tower company to install and maintain a tower for a specified number of years.

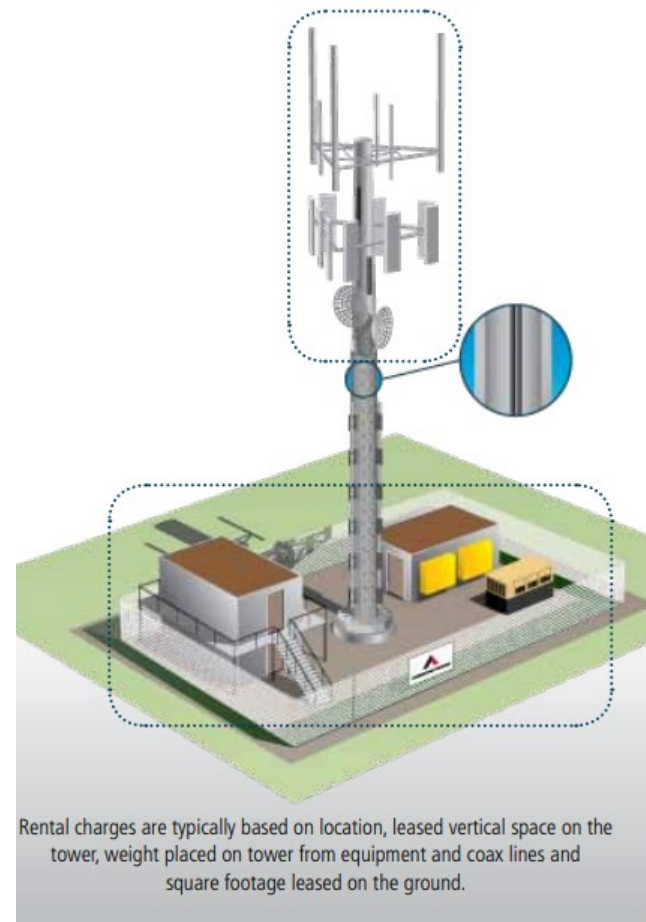
The value of these contracts is negotiated before tower installation, when the lease renews, and during lease buyout discussions.

SOURCES

- › Multiple tenants lease vertical space on the tower and portions of the ground for their wireless communications equipment

LONG-TERM CUSTOMER LEASES

- › Contracts are typically non-cancellable
- › Typical contract terms include an initial term of 5 to 10 years with multiple 5-year renewal periods
- › Annual lease escalators in the U.S. of approximately 3.5%
- › Escalations in international operations are typically based on local inflation rates
- › Historically low annual churn of less than 2%

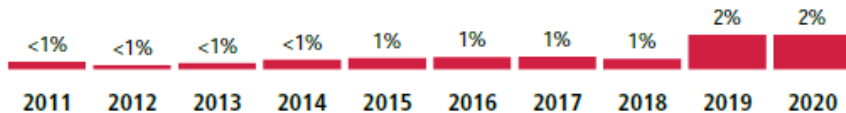




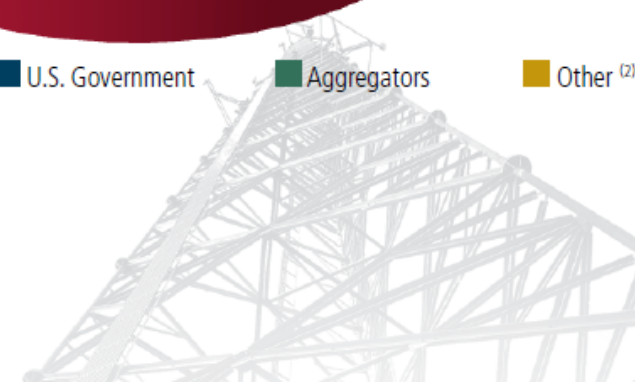
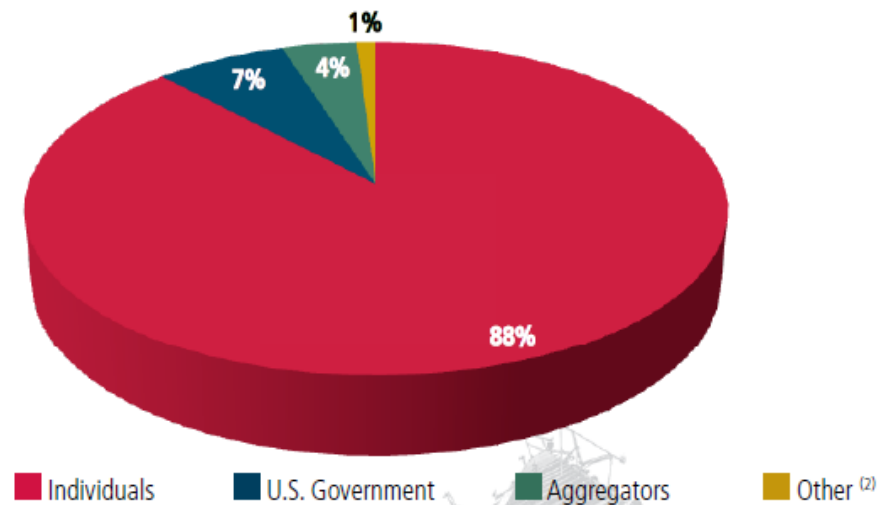
Cell Tower Leases

U.S. Land Lease Characteristics ⁽¹⁾

- > Over 24% of the land under towers is owned or operated under a capital lease
 - > The remainder of our towers are on land subject to an operating lease
- > Highly fragmented landlords
 - > Approximately 96% of landlords own only a single ground lease
 - > Maximum ownership for one landlord is approximately 2.0% of total ground leases
- > U.S. Ground Lease Renewal Schedule ⁽¹⁾

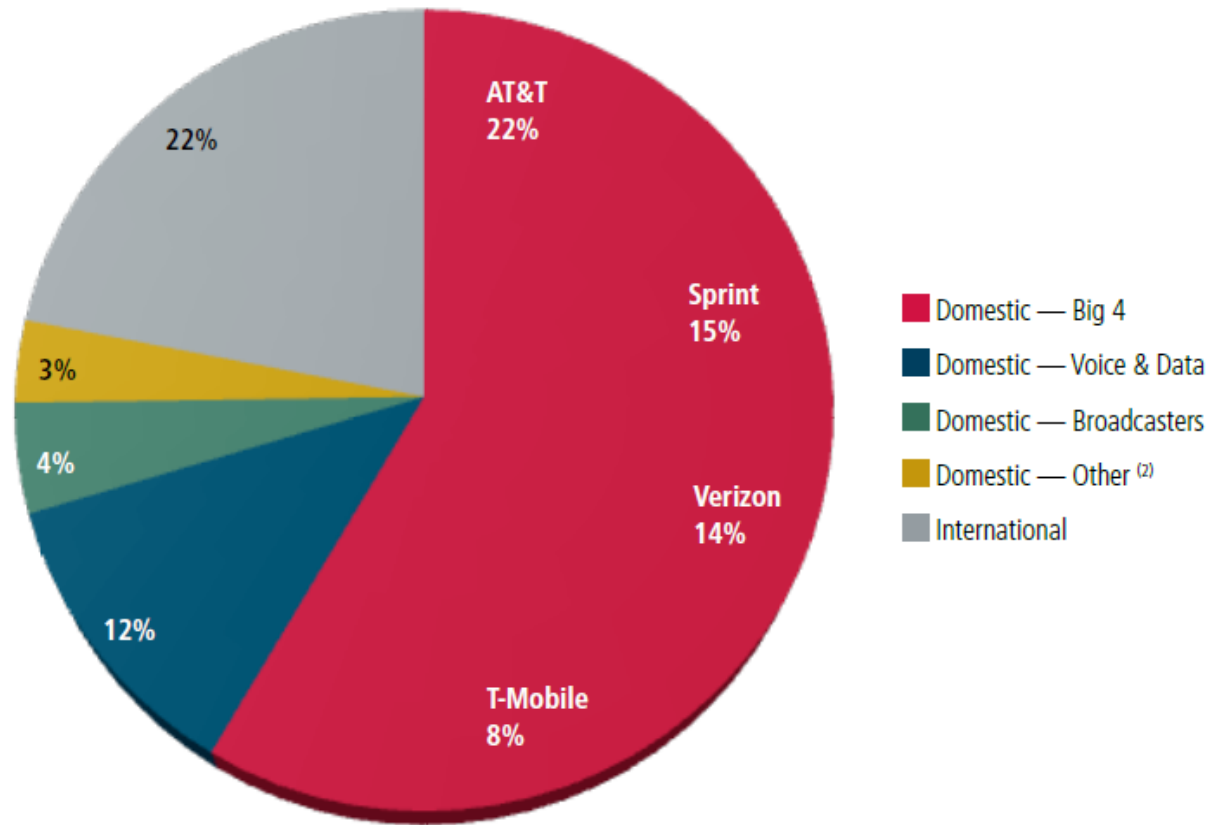


U.S. Land Ownership by Vendor Type ⁽¹⁾



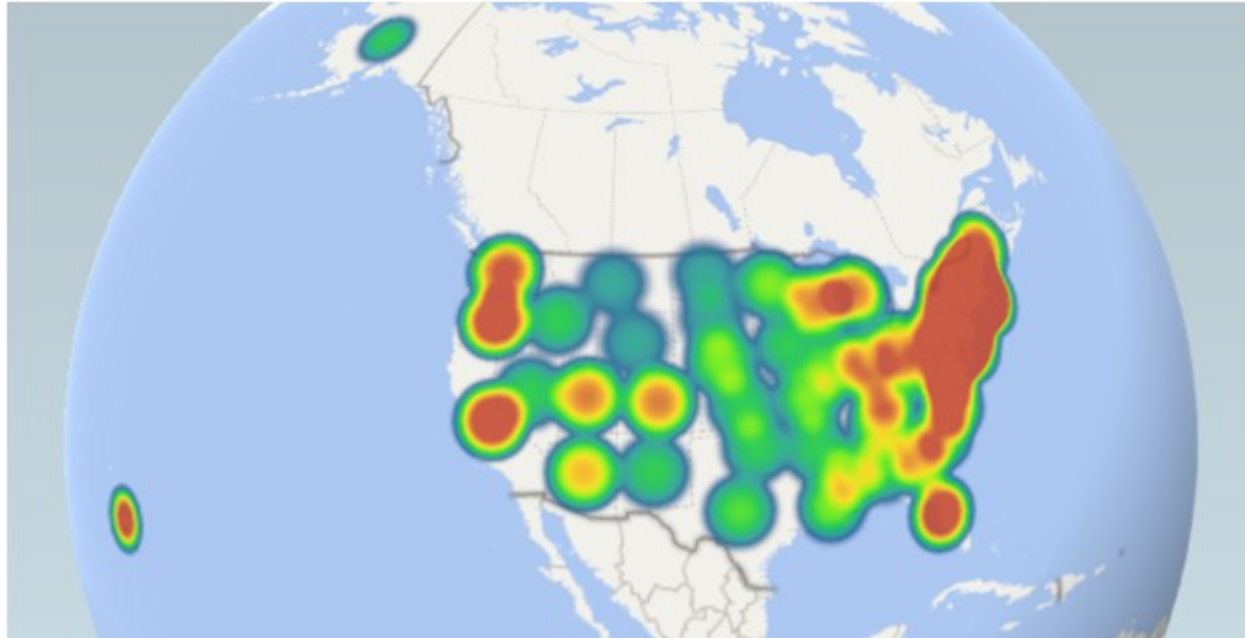


Tower Tenant





Cell Tower Lease Rates



A Heat Map Showing The Areas Of The United States With The Lowest Cell Tower Lease Rates (Green) And The Highest (Red).



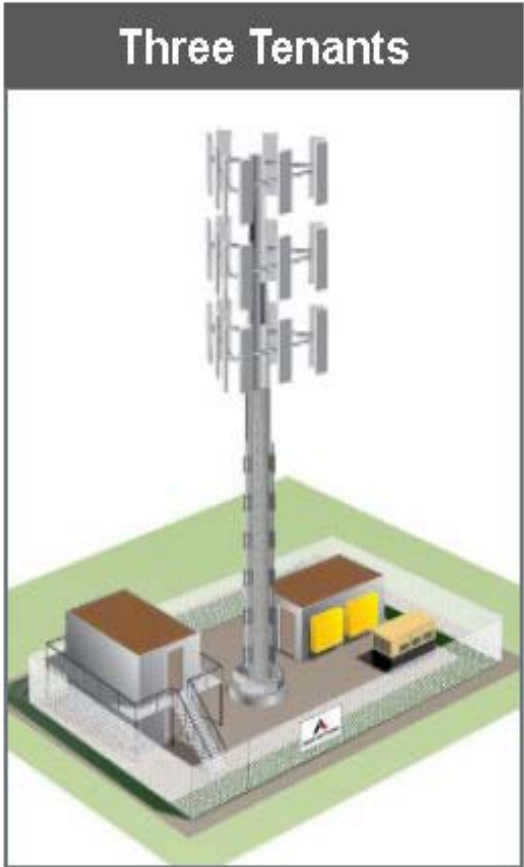
Cell Tower Lease Rates

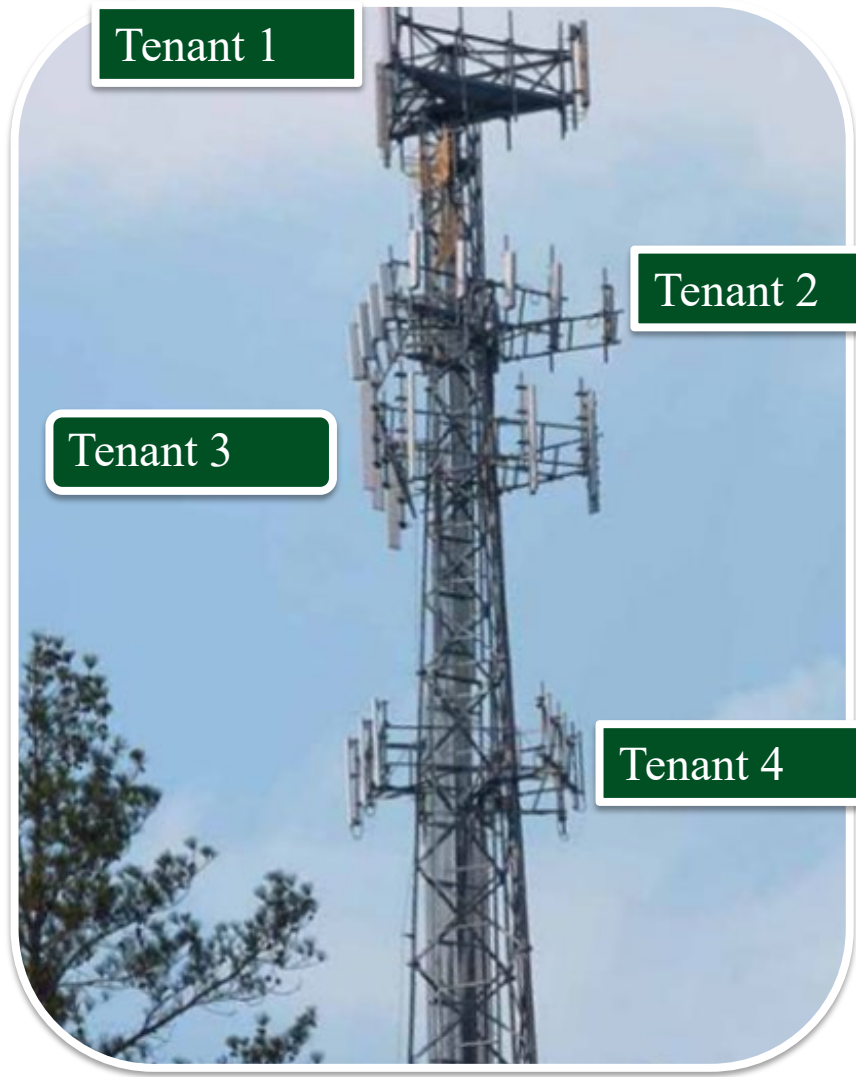
Metropolitan Area	Population	Average Monthly Cell Tower Ground Lease Rate in 2018
New York	18,713,662	\$1,900
Los Angeles	15,989,520	\$1,500
Chicago	8,813,457	\$1,300
San Francisco	7,100,609	\$2,500
Philadelphia	5,992,183	\$1,400
Dallas, TX	5,253,673	\$1,000
Detroit, MI	4,987,981	\$1,200
Houston, TX	4,874,875	\$1,000
Washington, DC	4,591,764	\$1,750
Boston, MA	4,281,396	\$1,500

The average cell tower ground lease across the US is **\$1,500/Month**.



Tower Leasing Array





Tenant 1

Tenant 2

Tenant 3

Tenant 4



Valuation Considerations

Majority of a cell tower's **market value** is attributable to the **location, permit** and **lease(s)** in place.

Tower transactions are **scarce** or oftentimes non-existent, **making it hard to conduct a Sales Comparison Approach**. Buyers tend to be active **nationally** rather than locally.

Investments in towers is based on the **underlying income**. Standard approaches can include Discounted Cash Flow (DCF), **Direct Capitalization** or an Gross Income Multiplier.



Valuation Considerations

Tower sites should be **valued** for assessment using all three approaches to value if **sufficient data** exists to employ each of the approaches.

The **most reliable** estimate of RCN of the various improvements is the **actual cost of construction of that specific tower site**. This is due to the **highly specific nature of each tower site** and the high **variability of the cost** of many of the improvements found at a tower site



Valuation Considerations

The **original construction cost** of the tower and improvements can be **obtained and trended forward** if needed utilizing a recognized cost source or utility cost indexes.

Average cost of building a cell phone tower – **\$175,000+**.



Cell Tower Example





FCC 1211178
15421 SHIPP RD
PP PPIN 301251





Personal Property





ASR Registration Search

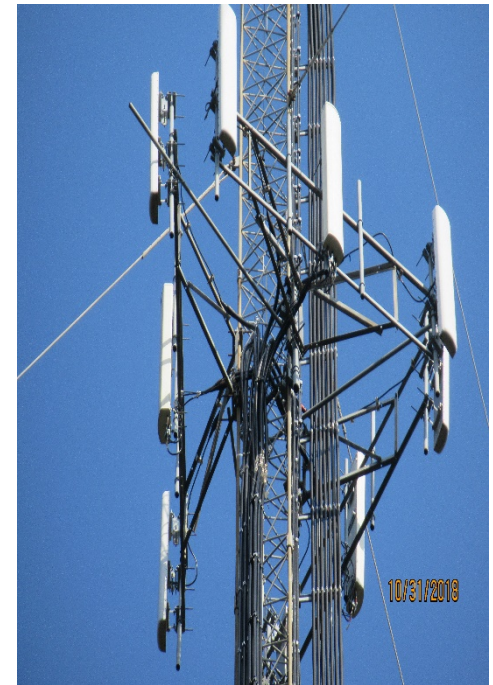
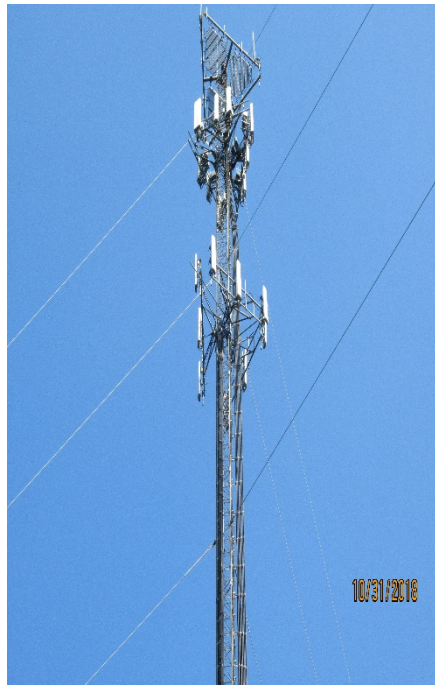
Registration 1211178

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Registration Detail			
Reg Number	1211178	Status	Constructed
File Number	A1037952	Constructed	03/27/2000
EMI	No	Dismantled	
NEPA	No		
Antenna Structure			
Structure Type	TOWER - Free standing or Guyed Structure used for Commu		
Location (in NAD83 Coordinates - Convert to NAD27)			
Lat/Long	30-57-26.0 N 087-45-51.3 W	Address	15241-A Shipp Road
City, State	Bay Minette , AL		
Zip	36507	County	BALDWIN
Center of AM Array		Position of Tower in Array	
Heights (meters)			
Elevation of Site Above Mean Sea Level		Overall Height Above Ground (AGL)	
83.2		106.4	
Overall Height Above Mean Sea Level		Overall Height Above Ground w/o Appurtenances	
189.6		106.4	
Painting and Lighting Specifications			
FAA Chapters 4, 8, 13 Paint and Light in Accordance with FAA Circular Number 70/7460-1J			
FAA Notification			
FAA Study	2004-ASO-2587-OE	FAA Issue Date	05/13/2004
Owner & Contact Information			
FRN	0014350276	Owner Entity Type	Limited Liability Company
Owner			
SpectraSite Communications, LLC. through American Towers, LLC. Attention To: FAA/FCC Regulatory Team 10 Presidential Way Woburn , MA 01801		P: (781)926-4500 F: E: faa-fcc@americantower.com	
Contact			
Attention To: FAA/FCC Regulatory Team 10 Presidential Way Woburn , MA 01801		P: (781)926-4500 F: E: faa-fcc@americantower.com	

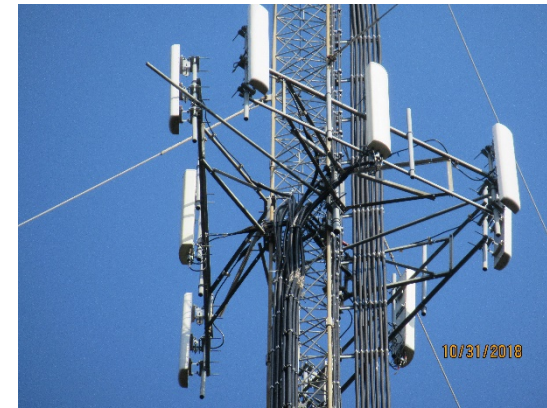


FCC 1211178
15421 SHIPP RD
PP PPIN 301251





FCC 1211178
15421 SHIPP RD
PP PPIN 301251





How Cell Towers Work





Summary

Towers and Small Cells

- There are 154,000 cell towers today. To meet growing mobile data demands and win the Race to 5G Tower companies will need to install hundreds of thousands of small cells in the next few years. S&P Global Market Intelligence projects more than 800,000 small cells deployed by 2026.

Smartphone Ownership

- The share of Americans that own smartphones is now 77%, up from just 35% in Pew Research Center's first survey of smartphone ownership conducted in 2011.
- **89% of people can't live without their smartphones and/or always have them within arm's reach.**

Nationwide 4G Coverage

- **99.7% of the U.S. population lives in census blocks covered by 4G LTE.**

Smartphone Data

- **Smartphone data will surpass fixed broadband this year, and by 2021 will account for nearly 38% of all digital data use in the U.S.**



Telecommunication Valuation Resources

Cell phone towers do not affect property values, by Richard A. Forsten, Wendie C. Stabler, and Olufunke O. Fagbami. *Probate and Property*, 2016, 30 (3), 10-15.

Cell site and wireless technology overview: identifying parts of the tower, how cellular technology works, site selection, leasing principles, by Michael S. Heaton and Dale A. Dale. Presented at the 72nd Annual International Conference on Assessment Administration, 2006.

Cell tower and carrier equipment valuations, by Walt Woodard and Randy Scott. Presented at the 78th Annual International Conference on Assessment Administration, 2012.

The changing landscape of telecommunications valuations, by Tom Mannion. *Valuation Strategies*, 2014, 18 (2), 34-40.

Cost approach revisited: A more appropriate property tax valuation model for telecommunications properties, by John H. Davis. *Journal of Property Tax Management*, 2000, 12 (2), 33-40.

Technological obsolescence of personal property in the telecommunications industry, by Ian Carr and David Schneider. Presented at the 78th Annual International Conference on Assessment Administration, 2012.



Telecommunication Data Resources

Cell phone towers do not affect property values, by Richard A. Forsten, Wendie C. Stabler, and Olufunke O. Fagbami. *Probate and Property*, 2016, 30 (3), 10-15.

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Questions/Comments...