

Personal Property

Alabama Association of Assessing Officials

2019 Summer Conference

August 7-9, 2019

Perdido Beach Resort, Orange Beach Alabama

Alabama Department of Revenue

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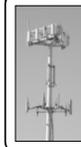
CELL TOWER ANALYSIS:

The Valuation of Telecommunications Assets

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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.

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Objectives

Describe the typical telecommunication towers and related assets.

Demonstrate how to value telecommunication towers and related assets

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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 structure, such as rooftops, water towers, church steeples, etc.
- One single tower site can support multiple carrier cell sites through collocation

Cell Site



■ Antenna facilities
□ 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.



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Wireless Tower Basics

What is a tower?

- A vertical structure built on a small parcel of land, designed to accommodate multiple wireless towers.
- One tower allows many different technologies, including telephone, mobile data, broadband television and radio, and paging.
- Wireless towers have antenna arrays on the base 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 network fiber cables or lines.
- Equipment, including the antenna array, antenna, coaxial cables and feed cables.
- Equipment shelters.



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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

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Types of Towers



Monopole

- 100 - 300 feet
- Support one technology



Lattice

- 200 - 600 feet
- More than one technology
- Support one technology



Guyed

- 200 - 2,000 feet
- Support one technology and multiple carriers (cellular, paging and microwave)



Stealth

- Support one
- Typically used for emergency services (public safety and police)
- Not usually used in areas with strict zoning regulations

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Self Supporting Lattice Tower

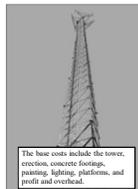
Economic Life: 20

- 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

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Self Supporting Lattice Tower



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

Height - In Feet	Value
15.00	12,852.00
30.00	23,400.00
45.00	34,000.00
60.00	44,600.00
75.00	55,200.00
90.00	65,800.00
105.00	76,400.00
120.00	87,000.00
135.00	97,600.00
150.00	108,200.00
165.00	118,800.00
180.00	129,400.00
195.00	140,000.00
210.00	150,600.00
225.00	161,200.00
240.00	171,800.00
255.00	182,400.00
270.00	193,000.00
285.00	203,600.00
300.00	214,200.00
315.00	224,800.00
330.00	235,400.00
345.00	246,000.00
360.00	256,600.00
375.00	267,200.00
390.00	277,800.00
405.00	288,400.00
420.00	299,000.00
435.00	309,600.00
450.00	320,200.00
465.00	330,800.00
480.00	341,400.00
495.00	352,000.00
510.00	362,600.00
525.00	373,200.00
540.00	383,800.00
555.00	394,400.00
570.00	405,000.00
585.00	415,600.00
600.00	426,200.00

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Guyed Tower

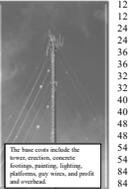
Economic Life: 20

- 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 (L²/H) and Tower height (25-625ft).

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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	7,950 - 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

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Monopole Tower

Economic Life: 20

- Free standing and are most commonly used in cellular and personal communication service (PCS) applications.
- Least sensitive 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

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Monopole Tower



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

Height - In Feet	Value
15.00	7,400.00
30.00	14,800.00
45.00	22,200.00
60.00	29,600.00
75.00	37,000.00
90.00	44,400.00
105.00	51,800.00
120.00	59,200.00
135.00	66,600.00
150.00	74,000.00
165.00	81,400.00
180.00	88,800.00
195.00	96,200.00
210.00	103,600.00
225.00	111,000.00
240.00	118,400.00
255.00	125,800.00
270.00	133,200.00
285.00	140,600.00
300.00	148,000.00
315.00	155,400.00
330.00	162,800.00
345.00	170,200.00
360.00	177,600.00
375.00	185,000.00
390.00	192,400.00
405.00	199,800.00
420.00	207,200.00
435.00	214,600.00
450.00	222,000.00
465.00	229,400.00
480.00	236,800.00
495.00	244,200.00
510.00	251,600.00
525.00	259,000.00
540.00	266,400.00
555.00	273,800.00
570.00	281,200.00
585.00	288,600.00
600.00	296,000.00

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Monopole Tower



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

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Typical Tower Components

1. **WIND MITIGATION**
 - A self-mitigating antenna, usually mounted vertically.
2. **ANTENNA ARRAY**
 - A collection of antennas that radiate radio waves. They are used to provide signal transmission and reception to a specific area. The number of antennas increases as the distance between towers or as a number of towers including:
 - The number of towers in a cluster.
 - The nature and type of network usage by subscribers.
 - The amount of traffic in the area.
3. **POWER FEEDS**
 - The type of spectrum currently utilized by the tower.
4. **POWER FEEDS**
 - 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.
5. **BASE STATION**
 - Customer equipment which transmits a signal from the tower to mobile devices, or vice versa.
6. **BASE STATION**
 - Customer equipment which transmits a signal from the tower to mobile devices, or vice versa.
7. **MICROWAVE DISH**
 - A specific type of antenna which is used to pass the signal to other towers and other communication sites. They are used to provide long distance communication.

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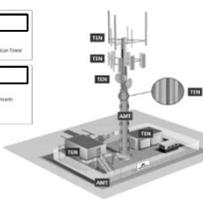
Typical Tower Components

8. **INTERNAL CABLING**
 - Transmission lines which carry the signal between from the antenna to the base station, or vice versa.
9. **REINFORCEMENT EARS**
 - Reinforced antennas which are used to reinforce tower sites to add additional support to accommodate further loading.
10. **WELDERS**
 - Welding is used to join steel or iron members to form connections. Welds are used to join steel or iron members to form connections. Welds are used to join steel or iron members to form connections.
11. **GENERATOR**
 - Used to provide electrical power to the tower during power outages.
12. **GENERATOR**
 - Used to provide electrical power to the tower during power outages.
13. **GENERATOR**
 - Used to provide electrical power to the tower during power outages.
14. **GENERATOR**
 - Used to provide electrical power to the tower during power outages.
15. **GENERATOR**
 - Used to provide electrical power to the tower during power outages.

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Ownership Distribution



Tower

1. Tower structure owned by Tower - Tower structure is owned by the tower.
2. Land owned by the tower.
3. Land owned by the tower.

Tenant

1. Antenna equipment, including microwave equipment.
2. Tower structure including tower structure equipment and steel, which includes steel, concrete and masonry.
3. Tower structure.

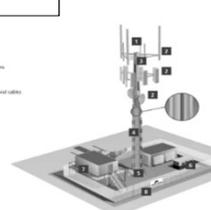
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Tower Capacity

Augmentation Capex Examples

- HEIGHT EXTENSION**
 - 1. Allow for new equipment and new antenna heights.
- MULTIPLE ANTENNA MOUNTING SCENARIOS**
 - 1. Options include side poles, horizontal and vertical installation dependent on tower RF engineering.
- PORT WIRE ADJUSTMENTS**
 - 1. Additional wire and port pair design accommodate additional cabled cables.
- TOWER REINFORCEMENTS**
 - 1. Add structural strength to accommodate additional towers.
- STRENGTHENED FOUNDATION**
 - 1. Increase load capacity of the tower.
- SHARED GENERATOR**
 - 1. Provide for backup power, requires compact space.
- STACKED SHELTERS**
 - 1. Shelter stacked atop existing shelter using a steel platform.
- EXTENDED SHOWER SPACE**
 - 1. Where space allows, expanded to accommodate more equipment.



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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 antenna: Diameter or length of antenna



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CELLULAR ANTENNA

Cellular/Pole Antenna (C 4 Ft)

Number of Poles	Total Value
1.00	9,400.00
2.00	18,800.00
3.00	28,200.00
4.00	37,600.00

Cellular/Pole Antenna (C 4 Ft)

Number in Part	Cost
1.00	9,400.00
2.00	18,800.00
3.00	28,200.00
4.00	37,600.00

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



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

Satellite Dish – Wire Mesh
Satellite Dish – Fiberglass
Satellite Dish – Average Grade
Satellite Dish – High Performance



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Satellite Dish

Satellite Dish-Wire Mesh

Number of Meshes	Total Value
1.00	1,400.00
2.00	2,800.00
3.00	4,200.00
4.00	5,600.00

Satellite Dish-Fiberglass Panel

Number of Meshes	Total Value
1.00	1,400.00
2.00	2,800.00
3.00	4,200.00
4.00	5,600.00

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



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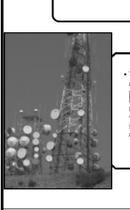
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Satellite Dish

Satellite Dish-Avg Grade

Number of Meshes	Total Value
1.00	4,400.00
2.00	8,800.00
3.00	13,200.00
4.00	17,600.00

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



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Satellite Dish

Satellite Dish-High Performance

Number of Meshes	Total Value
1.00	14,000.00
2.00	28,000.00
3.00	42,000.00
4.00	56,000.00

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



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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



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Equipment Shelter - Concrete Block

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 shelter
- (4)Electric & communication wiring
- (5)Basic climate control
- (6)Profit and overhead



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Equipment Shelter



Equip Shed Wood Frame Five Axle	Equip Shed Wood Frame
Square Feet	Cost
50.00	5,480.00
100.00	9,480.00
150.00	13,480.00
200.00	17,480.00
250.00	21,480.00
300.00	25,480.00
350.00	29,480.00
400.00	33,480.00
450.00	37,480.00
500.00	41,480.00
550.00	45,480.00
600.00	49,480.00
650.00	53,480.00
700.00	57,480.00
750.00	61,480.00
800.00	65,480.00
850.00	69,480.00
900.00	73,480.00
950.00	77,480.00
1,000.00	81,480.00

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Equipment Shelter



Equip Shed Concrete Block	Equip Shed Fiberglass
Square Feet	Cost
50.00	13,500.00
100.00	24,500.00
150.00	35,500.00
200.00	46,500.00
250.00	57,500.00
300.00	68,500.00
350.00	79,500.00
400.00	90,500.00
450.00	101,500.00
500.00	112,500.00
550.00	123,500.00
600.00	134,500.00
650.00	145,500.00
700.00	156,500.00
750.00	167,500.00
800.00	178,500.00
850.00	189,500.00
900.00	200,500.00
950.00	211,500.00
1,000.00	222,500.00

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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.

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Equipment Shed-Steel Cabinet - Surface Mounted



Equip Shed Steel Cabinet	
Square Feet	Cost
10.00	3,500.00
20.00	6,500.00
30.00	9,500.00
40.00	12,500.00
50.00	15,500.00
60.00	18,500.00
70.00	21,500.00
80.00	24,500.00
90.00	27,500.00
100.00	30,500.00
110.00	33,500.00
120.00	36,500.00
130.00	39,500.00
140.00	42,500.00
150.00	45,500.00
160.00	48,500.00
170.00	51,500.00
180.00	54,500.00
190.00	57,500.00
200.00	60,500.00

INSTALLED COST INCLUDES:

- Minor site preparation and landscaping.
- Concrete pad or piers.
- Delivery and set-up for factory built shelters.
- Electric & communication wiring.
- Basic climate control.
- Profit and overhead.

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



Equip Shed Steel Frame Light Wt.	
Square Feet	Cost
100.00	18,000.00
150.00	26,000.00
200.00	34,000.00
250.00	42,000.00
300.00	50,000.00
350.00	58,000.00
400.00	66,000.00
450.00	74,000.00
500.00	82,000.00
550.00	90,000.00
600.00	98,000.00
650.00	106,000.00
700.00	114,000.00
750.00	122,000.00
800.00	130,000.00
850.00	138,000.00
900.00	146,000.00
950.00	154,000.00
1,000.00	162,000.00

INSTALLED COST INCLUDES:

- Minor site preparation and landscaping.
- Concrete pad or piers.
- Delivery and set-up for factory built shelters.
- Electric & communication wiring.
- Basic climate control.
- Profit and overhead.

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GENERATOR

Economic Life: 10

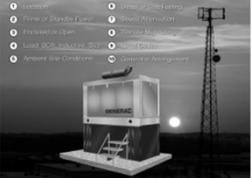
Backup generators are used to ensure an uninterrupted power supply and are common at tower sites.

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

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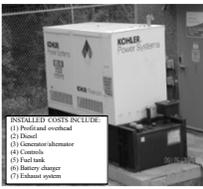
Generator for Telecommunication Towers



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Generators



Kilowatts	Cost
1.0	14,100.00
2.0	24,100.00
3.0	34,100.00
4.0	44,100.00
5.0	54,100.00
6.0	64,100.00
7.0	74,100.00
8.0	84,100.00
9.0	94,100.00
10.0	104,100.00
11.0	114,100.00
12.0	124,100.00
13.0	134,100.00
14.0	144,100.00
15.0	154,100.00
16.0	164,100.00
17.0	174,100.00
18.0	184,100.00
19.0	194,100.00
20.0	204,100.00
21.0	214,100.00
22.0	224,100.00
23.0	234,100.00
24.0	244,100.00
25.0	254,100.00
26.0	264,100.00
27.0	274,100.00
28.0	284,100.00
29.0	294,100.00
30.0	304,100.00
31.0	314,100.00
32.0	324,100.00
33.0	334,100.00
34.0	344,100.00
35.0	354,100.00
36.0	364,100.00
37.0	374,100.00
38.0	384,100.00
39.0	394,100.00
40.0	404,100.00
41.0	414,100.00
42.0	424,100.00
43.0	434,100.00
44.0	444,100.00
45.0	454,100.00
46.0	464,100.00
47.0	474,100.00
48.0	484,100.00
49.0	494,100.00
50.0	504,100.00

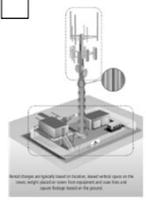
INSTALLED COSTS INCLUDE:

- Profit and overhead
- Diesel
- Generator alternator
- Control
- Fuel tank
- Battery charger
- Exhaust system

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Cell Tower Lease



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Cell Tower Leases

U.S. Land Lease Characteristics

- Over 94% of the land under leases is owned or operated under a lease.
- The remainder of the leases are on land subject to an operating lease.
- Highly negotiated land.
- Approximately 90% of landfills are under a single ground lease.
- Maximum term for use cannot be approximately 20% of the ground lease.
- U.S. Ground Lease Renewal Schedule

U.S. Land Ownership by Vendor Type

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Tower Tenant

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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).

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Cell Tower Lease Rates

Metropolitan Area	Population	Average Monthly Cell Tower Ground Lease Rate in 2018
New York	18,711,662	\$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	5,252,673	\$1,800
Detroit, MI	4,987,981	\$1,200
Houston, TX	4,874,875	\$1,000
Washington, DC	4,591,764	\$1,750
Boston, MA	4,281,796	\$1,500

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

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Tower Leasing Array

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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 Multiple.

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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.

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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+.

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Cell Tower Example



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FCC 1211178
15421 SHIPP RD
PP PPIN 301251



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Appraisal 1211178

Property	Value	Code	Category
Cell Tower	1,000,000	010	Personal Property
Cell Tower	1,000,000	010	Personal Property

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FCC 1211178
15421 SHIPP RD
PP PPIN 301251



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FCC 1211178
15421 SHIPP RD
PP PPIN 301251



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How Cell Towers Work



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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 55% 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

- 98.9% 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 58% of all digital data use in the U.S.

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Personal Property

Telecommunication Valuation Resources

Cell phone towers do not affect property values. by Richard A. Fossan, Wendie C. Stahler, and Christopher O. Fughman. Probate and Property, 2006, 30(1), 10-15.

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The changing landscape of telecommunication valuations. by Tom Morrison. Valuation Strategies, 2014, 18 (2), 34-40.

Cost approach revisited: A more appropriate property tax valuation model for telecommunication properties. by John H. Davis. Journal of Property Tax Management, 2009, 12 (2), 32-40.

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Telecommunication Data Resources

Cell phone towers do not affect property values, by Richard A. Foyens, Ronald C. Siskin, and Orlinda O. Fugham. *Practice and Property*, 2016, 31 (2), 10-13.

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Technological obsolescence of personal property in the telecommunication industry, by Ian Carr and David Schneider. Presented at the 76th Annual International Conference on Assessment Administration, 2012.

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Questions/Comments...

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