

T-Mobile

Smart Communities Plan for Mobile

Creating Opportunity for Consumers, Business & Government



Wireless Infrastructure Shapes Forward-Thinking Communities While Meeting Local Needs

For local governments to meet the demands of their residents and businesses, reliable wireless infrastructure is a requirement.

To address the most pressing challenges facing communities across America – from public safety, to access to health care and transportation, to economic development – wireless infrastructure must be part of the equation.

A Look Ahead

Robust wireless networks improve connectivity and are essential to the next generation of wireless connectivity: 5G and the Internet of Things (IoT).*

Local policies can accelerate or delay the successful build-out of wireless networks. In fact, informed decisions by county, township and city leaders can help meet residents' future mobile needs while better positioning communities to solve any number of public service requirements.

* **5G:** The Fifth Generation of wireless network technologies.

Internet of Things: The network of everyday devices – appliances, gas & water meters, candy machines and industry technologies – that transmit data through mobile and internet connections.



95%

95% of American adults use cell phones and 77% use smartphones (Pew Research Center)



70%

70% of 911 calls are initiated from a mobile phone. A majority of these calls (64%) are made from indoors (Federal Communications Commission)



7 of 10

70% of the time spent on digital media is on a mobile device (comScore)



Working Together Expands Opportunity

Communities and wireless carriers need to work together to embrace this telecommunications revolution.

The support of local governments is critical to developing dependable, replicable policies, ordinances, and practices that allow for new infrastructure to be built. Jurisdictions that have enacted reasonable siting-related policies will benefit sooner from T-Mobile's investments.

 **> 50%**

More than 50% of U.S. households do not have a landline phone (National Center for Health Statistics, U.S. Centers for Disease Control)

 **1TB = 50,000 trees**

In New York City, data used across T-Mobile's network during part of 2017 was 110,000 terabytes greater than data used during all of 2016. If printed on paper, this amount of data would require roughly 5.5 billion trees (The Linux Information Project)

Mobile Networks Support Local Initiatives

Strong, reliable wireless networks play a pivotal role in cultivating local business development, promoting eGovernment initiatives and delivering public services.

Mobile connectivity is used more than we ever imagined. Here are a few examples:



Public Safety

In addition to 911 calls, mobile apps for safety help educators alert parents, students and teachers when necessary. Search and rescue teams use mobile phone GPS to track missing hikers. Amber Alerts send an urgent bulletin to assist in the recovery of an abducted child. Ride sharing apps can provide a safe late-night ride home.



Health

The new field of mobile health is changing how public health and medical problems are identified, prevented and treated. Health issues can now be researched and tracked using mobile device data. That information can then be delivered to the right people when it is needed, no matter where they are located.



Transportation

Mobile connectivity is the engine behind innovations like smart parking and traffic controls, self-driving cars, ride sharing apps, and immediate access to schedules for public transportation.



Energy

Wireless technology is a key to reducing energy usage and offers the most reliable, economical way to manage renewable energy systems, even in harsh environments. The Internet of Things allows for smart waste management, and for gas and electric meters to relay information.



Natural Disasters & Extreme Weather

In the event of a natural disaster or extreme weather, Wireless Emergency Alerts let you know of a threatening situation. Reverse 911 allows authorities to notify large groups of residents in the event of an emergency or when a tragedy has occurred, and new applications like the Facebook disaster maps assist responders during natural disasters.



Results of a survey by the Center for Digital Government demonstrate why connectivity is important to public officials:

- 90% of government decision-makers polled believe communication networks are a requirement for attracting new businesses to their jurisdictions
- 81% said high-performance networks support economic growth and competitiveness
- 94% said the future of eGovernment requires ubiquitous network connectivity

“High-performance networks are every bit as important to the future strength of cities and counties as other infrastructure systems, including transportation, water and waste.”

– Center for Digital Government

Coverage & Capacity are Critical for Wireless Networks

Ever had what looks like five bars of coverage on your mobile phone, yet can't send a text message or photo?

This is because there is a finite amount of network capacity. As with traffic congestion, when too much information is jammed into the network pipe, the speed of the network can slow down, just like rush hour on the local Interstate.

To address the network issues created by this demand, current and future wireless connectivity technologies require multiple solutions. Macro cell sites, small cells, Wi-Fi, and distributed antenna systems are a few examples. Together, these types of infrastructure create the coverage and capacity essential for a successful network for millions of satisfied users.

Conventional Antennas Address Coverage & Capacity Needs

Traditional macro sites are installed on rooftops, building facades, monopoles and other steel structures. These traditional antenna support structures handle many users across a general geographic footprint. They provide coverage and capacity.



Coverage

The geographic area that can be served by radio signals from wireless network infrastructure.



Capacity

The amount of data that can be efficiently transferred across the network for mobile use.



Small Cells in Public Right-of-Way Pave the Way to 5G

Before capacity limits are reached, it is often necessary to build a denser network. This is a key benefit of small cell technologies. Small cell antennas are designed to be mounted to light standards and utility poles and be located along transportation corridors, streets, and places where people gather.

Designed to handle the newest 4G technologies – and soon-to-be-deployed next generation 5G technologies – small cells are low-power, cover a small geographic footprint, and have a smaller form factor than most traditional equipment.

More Spectrum Improves Network Capacity

Reliable broadband coverage, especially in America's rural communities, is a top priority for T-Mobile. In early 2017, T-Mobile acquired 600 MHz low band spectrum that covers the entire continental United States.

This low band spectrum – which travels farther and provides better connectivity inside homes, offices, schools and buildings – will result in strong coverage, especially in rural areas. This means more consumers will have higher quality wireless services.



The Task Light Analogy: Small Cells and Capacity

A ceiling light is good for seeing the basics of a room but if you want to do a specific task, you need more direct lighting closer to the activity.

The same principle applies to T-Mobile's wireless network. With multitudes of customers using the network, our capacity to handle more traffic is strongest when the network technology is closer to the mobile device and the user.



Check out: [HowMobileWorks.com](https://www.howmobileworks.com)

Wireless Networks Depend on Infrastructure

Land-based infrastructure is essential to make mobile networks function – one can't work without the other. Network equipment includes cables, antennas, radios, electric power, switches, and backhaul (fast connectivity back to the core network).

Multiple Factors Determine Cell Site Location and Type:



TOPOGRAPHY AND OTHER OBSTACLES

Wireless networks depend on radio waves that travel through the air. Radio engineers must plan for radio signal interruptions that topography – and other obstacles like buildings and leaves on trees – can cause.



REGULATORY REQUIREMENTS

T-Mobile meets all local, state and federal agency regulations. We encourage our siting teams to work with local governments when ordinances are discussed and written.



SIGNAL HANDOFF

The signals from one cell site must overlap with the signals of the next site to maintain wireless connectivity as users move from one place to the next.



PROPERTY AVAILABILITY

In addition to the science that goes into properly locating a cell site, T-Mobile must find a property owner willing to lease property for antennas and other equipment.



Radio Waves are a Finite Resource

Radio frequency (RF) energy and wireless technologies have been used for more than a century – think of Morse code and the wireless telegraph. The bands of spectrum used by T-Mobile are licensed by the Federal Communications Commission – and each distinct band (e.g. 600, 700, 1900, 2100 MHz) requires unique technologies and deployment configurations.

Quick Facts About Radio Waves:

0.1% of federal limit

“Measurements made near typical installations, especially those with tower-mounted antennas, have shown that ground-level power densities are thousands of times less than the FCC’s limits for safe exposure.” (Federal Communications Commission)

 **Compare devices**

“The ground-level emissions from a typical T-Mobile macro site antenna are lower than the ground-level electromagnetic emissions from many household devices – such as a Bluetooth headset or Wi-Fi router.” (Andrew H. Thatcher, Certified Health Physicist)

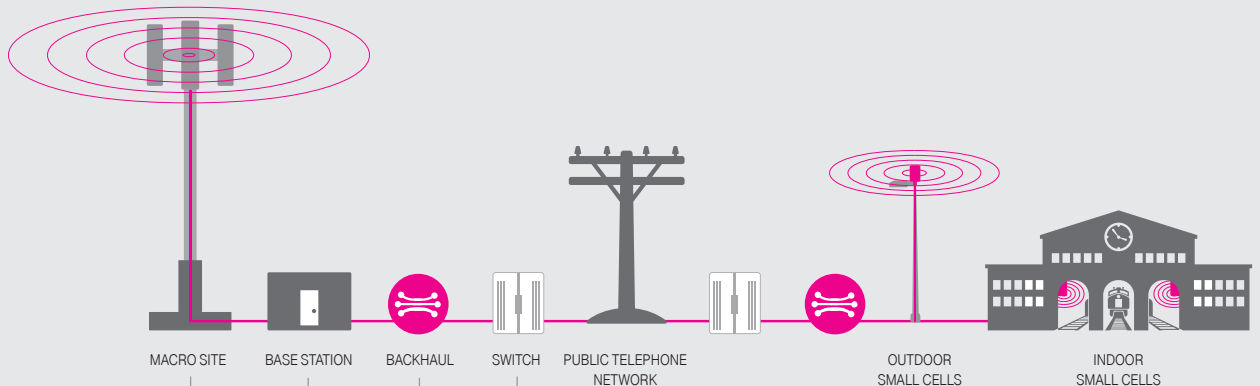
 **Rapid power decrease**

“The power (normally not greater than 50 watts) density from the antenna decreases rapidly as one moves away from the antenna.” (Federal Communications Commission)

Wireless is Much More than Mobile Phones

In addition to sending voice, text messages, photos and videos wirelessly, radio waves also enable all kinds of electronic devices used in our homes like internet-connected thermostats, Wi-Fi routers, baby monitors, security cameras and appliances. Broadcast television signals, as well as AM and FM radio waves use different bands of spectrum than T-Mobile – and they are transmitted with a much stronger signal strength.

T-Mobile's complex national wireless network includes:



MACRO ANTENNA SITES

A traditional macro cell site (usually 50' to 175' tall) is a support structure with multiple antennas connected to low powered radio transmitters and receivers.

BACKHAUL

High-speed connectivity, usually via fiber optic cable, is built from cell sites back to the core telecommunications network.

BASE STATION

Base stations house radio transceivers and amplifiers that connect the antennas and a high-speed link (usually fiber optic cable) back to the legacy telephone network.

SWITCH

Switches channel incoming data from multiple locations and send the information to its intended destination anywhere in the world.

OUTDOOR SMALL CELLS

Outdoor small cells are typically placed in the public right-of-way – like street light standards or utility poles. Small cells handle greater capacity demands resulting from more users requiring more data through the network.

INDOOR SMALL CELLS

Small cell networks and distributed antenna systems are deployed to meet capacity needs in large venues like stadiums, offices, airports, train stations, university campuses and shopping malls.

T-Mobile is Ready to Partner

The intensity of consumer demand and the advance of technology create greater needs to deploy wireless network technologies. When innovation outpaces regulatory standards, it is critical that businesses, governments and constituents work together.

T-Mobile is committed to this collaboration and will invest in sharing information and recommendations. We often assist local governments and planners to establish clear policies and local ordinances that allow for today's network expansions and the next generation of wireless technologies.

Contact Us

T-Mobile's local teams are wireless experts with knowledge of the unique network needs in each community, and are supported by strong regional and national teams. We live and work in many diverse communities across the United States — and we are ready to work with you.

You can learn more at [HowMobileWorks.com](https://www.howmobileworks.com), or reach us by sending an email to: SitingRelations@T-Mobile.com.



T-Mobile®

T-Mobile: America's Fastest & Fastest Growing Network

Since 2012, T-Mobile's customer base has more than doubled to be the third largest wireless company with upward of 72 million customers.

As America's Un-carrier, T-Mobile has worked to redefine the way consumers, governments and businesses buy wireless services.

As our network revolution takes us to the 5th generation (5G) of wireless technologies, we want to redefine the ways we work with local governments across the country.

metroPCS

MetroPCS: Wireless Connectivity to Under-Served Communities

One of our flagship brands, MetroPCS is part of T-Mobile's nationwide network.

For populations that rely on wireless rather than home-anchored broadband – including rural, low-income and migrant communities – MetroPCS provides national connectivity to family, work and the internet.

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For the ninth straight year, T-Mobile has been recognized by Ethisphere as one of the World's Most Ethical Companies. The program honors companies that excel in three primary areas: 1) Promoting ethical business standards, 2) enabling managers and employees to make good choices, and 3) shaping future industry standards by forging tomorrow's best practices today.