




The Next
Generation of
Integrated
Small Cell Poles —
The Backbone
of 5G
for the
Smart City



*It's our business to help
yours thrive.®*



The deployments of 5G wireless service and smart city initiatives are inextricably linked. Both require new infrastructure at the street level to support services that benefit cities, businesses and citizens. A new generation of integrated small cell poles will fit into the cityscape by replacing existing lighting poles. Populated with electronic systems behind concealment enclosures, integrated small cell poles can balance the requirements of 5G small cell placement with aesthetic and safety concerns.

1 5G is the Platform for the Smart City

The advent of 5G wireless networks is offering urban planners and dwellers a generational jump in bandwidth, connectivity and opportunities. First and most obvious will be the gigabit throughput from 5G cell phones and stationary connections. Organizations and citizens will have much faster access, from anywhere, to online educational, financial and entertainment services. This will attract businesses and knowledge workers to those cities that have better 5G coverage.

The 5G infrastructure will also be a platform for new industries such as autonomously driven vehicles, ultra-high-definition video and virtual reality-based systems. That's why many cities are looking for the most efficient path for deployment of 5G infrastructure.

As this infrastructure becomes widespread, it will become increasingly relied upon for the municipality's daily business. Forward-looking city planners are preparing for wireless services that can help improve traffic movement and congestion, monitor air pollution, improve safety and medical services and optimize use of city resources. These are the elements of the "smart city."

The ubiquitous lighting pole on city streets will soon become a pivotal component of the new '5G ecosystem and the backbone of the smart city.

2 5G Infrastructure Challenges Urban Development

Deploying 5G wireless service will be much more challenging than it was for prior generations. While a 4G macro cell site can maintain a connection over a distance of mile or more (depending on many factors), the higher frequency “millimeter wave” signals used in 5G networks can maintain reliable connections for distances of only a tenth of a mile. To provide continuous coverage, therefore, 5G small cell sites must be lower to the ground and significantly closer to one another than previous wireless generations. In fact, the 5G wireless infrastructure will comprise from six to 12 times more cell sites than earlier generations. Moreover, the service providers will need to locate more small cells where there are more people and businesses—in the busiest streets, plazas and neighborhoods. This creates a challenge for city planners to uphold municipal aesthetics and public safety.

This is a new problem for urban planners, and for the utilities that maintain much of the street-level poles and structures. Even though they are smaller than the familiar macro cell sites, 5G small cell sites include antennas, electronics, cabling and enclosures that may not fit into the architectural aesthetic of the street, and may appear to clutter up the airspace immediately overhead. In some places, citizens are concerned about the use of 5G radios in their neighborhoods. Municipalities and utilities are now working together to define regulations that control how 5G infrastructure can be added to the urban environment while maintaining aesthetic appeal and responding to public concerns. Options for concealment of this equipment will play an important role.

As 5G deployment moves ahead, municipalities and utilities are also challenged with review, approval and scheduling construction of the very large number of small cell sites on the public right of way. They will be looking to streamline processes by encouraging standardization of small cell equipment. Plus they will look for solutions that minimize disruption to traffic and daily commerce by being quick to install, reliable in operation and easy to upgrade as 5G technology matures.



Options for concealment will play a pivotal role in 5G deployment.

InvisiWave™

3 One Key to Success: Conceal 5G Radios and Antennas

With one or more 5G small cell sites on every street, municipalities are rightly concerned about the visual impact. That's a lot of electronics being installed and maintained in plain sight. Yet for some time, they have been told that a 5G millimeter wave signals are degraded when they pass through most materials, and so 5G radios can't be concealed.

Not so anymore.

Raycap has developed a unique 5G mmWave material that can conceal 5G radios while minimizing loss of signal strength. Raycap's InvisiWave solution has been tested and approved for use at mmWave frequencies commonly used for 5G networks, and it's fully backwards compatible with commonly used frequencies for 4G and earlier technologies.

The InvisiWave material is used in pole toppers, surrounds and radomes on pole configurations, as well as for panel products like chimneys, cupolas and other rooftop concealments. It is fabricated with smooth, hydrophobic surface and the durability to stand up to environmental extremes. It can be painted to match existing architecture. With InvisiWave, municipalities have the latitude to decide where and how to use concealment. This streamlines the process of defining regulations and processes that speed deployment of 5G networks while maintaining control over the urban aesthetic environment.

Next-gen Poles Combine 5G Performance with Concealment

A new generation of small cell street poles are available to meet 5G small cell requirements and to support municipality efforts to build a smart and attractive city. These small cell poles can combine and conceal all the electronics needed for 5G wireless networks as well as lighting, monitoring and other functions. There are several components of integrated street poles that together improve the capability to quickly deploy 5G with minimal impact on the city.

Pole toppers for radio/antenna assemblies

Small cell poles mount the 5G radios and 4G antennas in pole toppers to optimize performance and concealment options. The overriding characteristic to consider is flexibility in configuration, so the radios can be positioned optimally (and eventually upgraded) to maximize wireless coverage for that particular site.

To meet varying technical and carrier requirements, the pole topper should have a uniform form factor that can host different kinds of 5G radios, from different manufacturers, as well as be backwards compatible to lower frequency bands. Using InvisiWave, they can be fully concealed. If concealment is not required in a particular location, the pole can integrate other materials and designs to effect partial or non-concealment.

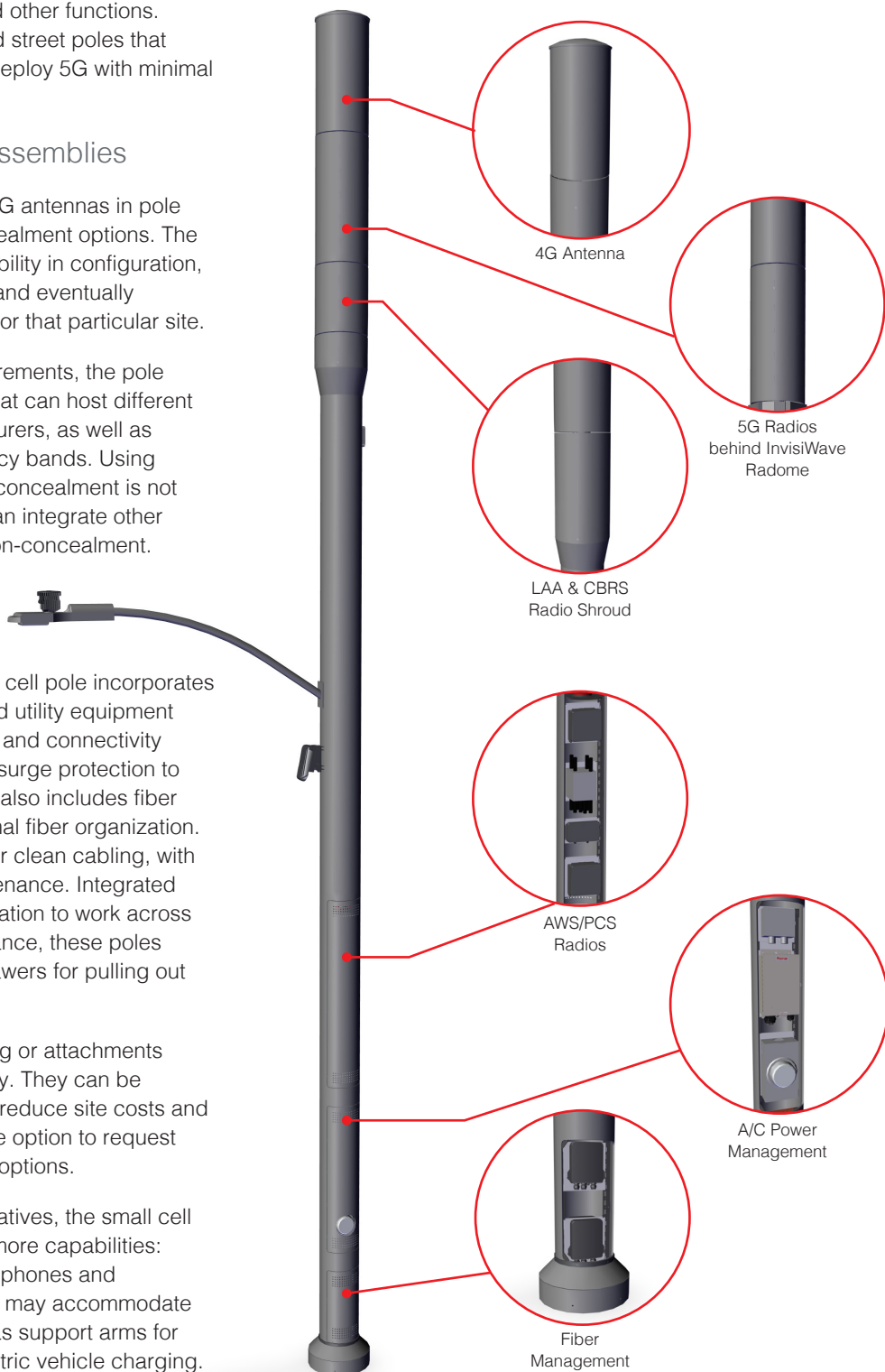
Mid-pole sections incorporate electronics and attachments

The mid-pole section in an integrated small cell pole incorporates electronics as well as other municipality and utility equipment needs. This starts with power management and connectivity equipment, including a robust overvoltage surge protection to protect current and future radio systems. It also includes fiber enclosures that support flexibility and optimal fiber organization. These systems leverage built-in conduits for clean cabling, with proper labeling for identification and maintenance. Integrated poles must accommodate options for ventilation to work across temperature variations. For easier maintenance, these poles incorporate various railing systems with drawers for pulling out the equipment, if needed.

Small cell poles typically incorporate lighting or attachments designed to match other poles in the vicinity. They can be engineered to re-use existing luminaires to reduce site costs and lead time. Pole owners should also have the option to request optional handholds and doors with locking options.

As a municipality pursues its smart city initiatives, the small cell pole may also be called upon to integrate more capabilities: sensors, cameras, gunshot detection microphones and atmospheric sensors. In addition, the poles may accommodate additional structural subassemblies, such as support arms for LFD street lighting and receptacles for electric vehicle charging.

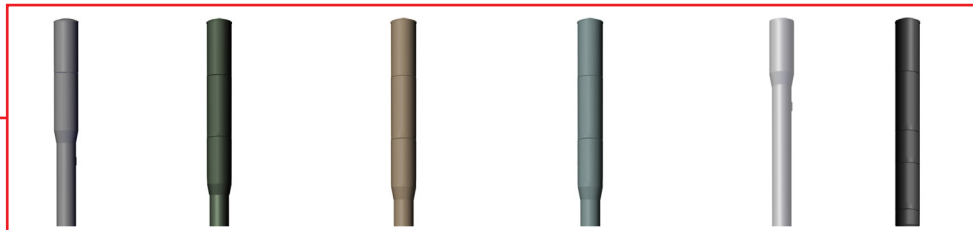
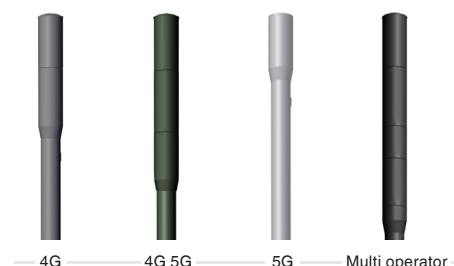
Raycap's STEALTH small cell poles are built to meet certain specifications and maintain maximum RF performance. They are designed for flexibility, performance and aesthetics. We offer pole varieties which can be delivered fully concealed, with color options.



The small-cell pole is becoming a pivotal component of 5G infrastructure and the backbone of the smart city.

Radio / Technology

Raycap's small cell poles are designed to customer specifications, can be delivered fully or partially integrated, and can accommodate all radio technologies.



Bases

Decorative bases can be installed around existing poles to hold power and fiber distribution equipment, as well as radio equipment.

Structural bases also perform this function, but can also support an existing or new lightpole installed on top of the structural base.



Structural bases are made to replace bases on existing poles

Decorative bases are available on brand new poles

Luminaries and Attachments

Fully concealed pole solutions can be ordered with optional lighting or attachments to match existing surrounding light poles. Poles can also be engineered to re-use existing luminaires to reduce site costs and lead time.



Bases answer the needs of the utilities and right of way

The bases for small cell poles are engineered to securely support the entire assembly. They must be made available in a wide variety of designs, all with minimum form factor, to meet municipal standards for appearance and right of way. To simplify power connections, integrated poles should contain a convenient power disconnect and meter base, as well as a location for a smart meter.

To suit varying streets and utility constraints, integrated poles must be mountable on any type of foundation: traditional poured-in-place designs, or prefabricated foundations to help expedite deployment. Other options for foundations can include direct embedded, mechanical/helical, pre-cast and break-away mechanisms. The manufacturer should be able to accommodate different form factors, hole patterns for the foundation and clamshell structures.

UL certification protects the community and the investment

Given the ready-to-install promise of integrated small cell poles, they should streamline customer deployments by being UL certified. This assures that the small cell pole meets applicable requirements for safety performance standards as well as relevant listing requirements per the NFPA 70 National Electrical Code. It also facilitates approval by local inspectors and authorities, and allows carriers and tower companies to provide a level of differentiation in their offerings to cities and municipalities to gain quicker acceptance.

5 Meeting design criteria as well as delivery and installation schedules

Raycap's small cell poles are the answer to another key aspect of 5G site deployment: minimal disruption of the city traffic. Working with integration partners, Raycap poles can be manufactured, assembled and tested at the factory under controlled conditions. They arrive at a customer's site with cabling, radios, and power/fiber equipment ready to go. All that is needed for installation is to affix the pole on the foundation, then hook up the feed lines for power and fiber. This is a much faster solution than installing electrical components and running cabling in the field.

According to the CTIA trade group, small cell sites will skyrocket from 86,000 in 2018 to over 800,000 by 2026. Integration, manufacturing scalability and easy deployment will be critical to meeting this demand. Municipalities and utilities will want to know that the provider can meet the overall demands of 5G deployment on schedule and with top quality.

We're concealment experts, combining small cell experience and technology with a reputation for helping wireless projects maintain your city's aesthetics.



6 The complete picture: other concealment options for your 5G infrastructure

Every municipality and utility will have its own approach to reaching its 5G deployment goals. The installation of small cell infrastructure on buildings, towers and rooftops as well as poles requires a continuum of form and function.

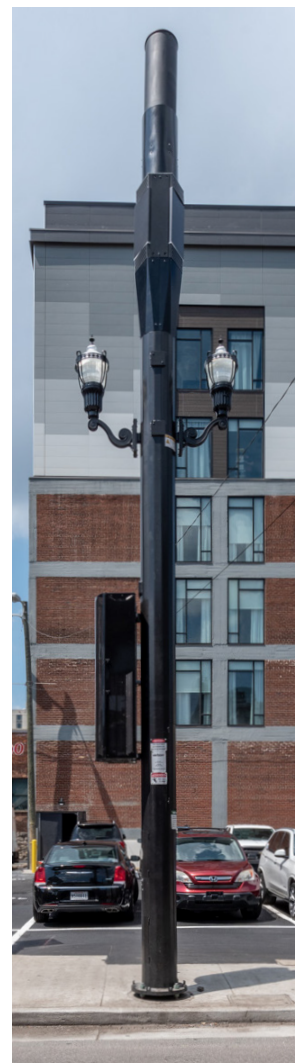
While integrated small cell poles are becoming the backbone for 5G wireless networks, they combine with other small cell site formats—concealed, partially concealed and non-concealed—to suit specific municipality and utility requirements. It's also straightforward to mount and conceal 5G small cell sites on buildings, monuments, signs and other elements of the urban cityscape. That's why Raycap combines its experiences in concealment and protection to help carriers, tower companies and others deploy small cell sites that are adaptable and meet the needs of carriers and municipalities alike.

Side mounted: To meet specific space, permit or power/fiber constraints, some scenarios favor installation of active equipment on or at the side of existing poles, which may be concealed as well.

Wall-mounted: Wall side-mounted box concealments complement existing construction, and hand-crafted faux brick, block, stucco, and stone textures seamlessly blend with buildings.



Rooftop: Ballasted (non-penetrating) concealment pods disguise rooftop antennas using a steel frame, center mast pipe, steel clamp-on bulkheads and a radome. These standard frames allow for reduced engineering cost and lead time plus the optimized framing material simplifies manufacturing and installation.



About Raycap

Raycap is an international manufacturer and technology leader with decades of experience providing innovative infrastructure solutions for customers in the telecom, energy, defense, transportation, and other industrial markets. Its solutions protect mission-critical applications and ensure the best possible system availability. The company's product portfolio includes lightning and surge protection technologies, structured cabling and connectivity solutions, power management systems, custom enclosures, cabinets, and wireless network concealments. Since its founding in 1987, the company has experienced continuous growth. Its engineering expertise, test laboratories, and multiple manufacturing facilities guarantee quality, reliability, and innovation. Product design, testing, and approval processes comply with all international safety standards. Raycap operates in the United States, Germany, Greece, Cyprus, Slovenia, and Romania.



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*Talk to Raycap about
integrated small-cell
poles and all 5G
concealment options.*

Sources:

Confidential interviews with executives at carriers, tower companies, A&E firms, utilities and municipalities.

Small Cell Wireless Technology in Cities (National League of Cities, 2018).

Lighting Protection in Next-Generational Small Cell Infrastructure (AGL Magazine, June 2019).

Developing Aesthetic and Reliable Wireless Concealments (Enterprise Network Magazine, 2019).

Raycap collateral including the Small Cell Pole Solution Overview, InvisiWave Overview, InvisiWave Specifications, STEALTH Small Cell Portfolio, 5G Technology and Concealment on the Horizon, and raycap.com website.

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