Raycap

CASE STUDIES

5G Small Cell Concealment and Integration Challenges

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It's often said that "small is beautiful."

When it comes to designing 5G small cells it's very important they blend beautifully into their surroundings while maintaining the coverage and performance that carriers need. Accomplishing this is no mean feat, requiring the technical experience of concealment experts who understand 5G. Carriers and municipalities across the U.S. are looking for attractive, efficient ways to bring 5G service to communities.

A key form factor for 5G deployments is the small cell site, which brings radios in proximity to users for faster, more reliable connectivity. While traditional macro cell sites serving earlier wireless generations are often installed on towers and rooftops, with ample room for radios, power, fiber backhaul structural support and more, small cells must pack all these components into small form factors to avoid standing out in their environments. This task brings a host of engineering challenges to seamlessly integrate 5G radios into the surrounding environment, infrastructure, and community, without sacrificing performance for aesthetics.

Figure 1 - A 5G small cell mounted on front of AT&T headquarters building

Carriers need small cell sites to bring 5G into dense urban areas

The land rush for 5G services is on and has been concentrated in urban areas with large populations and therefore the most customers. 5G mmWave service provides ultimate bandwidth and a number of connections with the potential to provide data rates up to 10Gbps. However, mmWave signals use substantially higher frequencies than traditional commercial communications signals, and are very difficult to propagate more than 100s of meters. To maintain optimal coverage and performance, small cells with mmWave radios must be located close to users, thus requiring equipment to be located on the streets of towns and cities at multiple small cell sites. To make matters more challenging, the small cell sites usually also house traditional sub-6 GHz radios for services such as 4G LTE, and in many cases carriers will also add C-band radios for new mid-band spectrum as well.

Municipalities want to manage the visual impact and safety of small cell sites on their streets. By collaborating with carriers and contractors, they can influence the concealment of small cell sites and streamline the review and approvals that lead to 5G services for their constituents. In this article, we present three case studies from across the country that demonstrate a range of trade-offs that led to a number of successful 5G small cell site designs.

Case study: concealing small cells on building walls in Dallas

When AT&T wanted to bring 5G mmWave service to their Discovery District in downtown Dallas, TX, they sought external expertise on concealment solutions that could keep their mmWave small cells out of sight of the public while still maintaining the required level of coverage and very high network performance. Raycap, who was chosen as one of the technology providers for the Discovery District, coordinated with the carrier, a local contractor, and city authorities to install six wall-mounted enclosures providing 5G coverage across a four-block section of the district. Part of the challenge was coordinating with the building manager to precisely locate the power and fiber connections so that they could be routed to the exterior of the building (Figure 1).

All six enclosures were custom designed and custom coated to blend in to building exteriors at their respective locations. Raycap's InvisiWave® material was used for concealment in this project because it is nearly invisible to mmWave signals, which make up part of the overall 5G signal spectrum which ranges from sub-6GHz up to 100GHz.

Figure 2 - Installed Small Cell light pole in Arlington County

Case study: one small cell integrated pole for all carriers across Arlington

Virginia's Arlington county asked Raycap to design a small cell street light pole that could balance the requirements of all three major carriers within one set of standard configurations. The pole had to be formatted correctly to house equipment from various wireless carriers, provide sufficient access for the power utility company to perform maintenance and engineering tasks, and still meet the county's dimensional and cosmetic specifications for pole designs.

The task was further complicated by the fact that the county wanted two pole designs (differing in height and by the style of lighting provided) at various locations and each carrier required slightly different internal configurations to accommodate their equipment. During the months-long collaborative process, Raycap engineers developed six similar but different designs that met the stringent county requirements and were ultimately approved for county-wide deployment.

The final designs (Figure 2) incorporated removable base panels to simplify the tasks of installation, maintenance and upgrades. Raycap also performed thermal analysis to ensure that the small cells could withstand high summer temperatures. This resulted in an active ventilation system that was added to the final designs.

Case study: meeting strict design guidelines for the streets of LA

On the other side of the country, Raycap worked with a tier-one carrier to design streetlight poles that integrated 5G small cells which would be used to replace existing streetlights in Los Angeles. The big challenge here was balancing 5G equipment needs with the strict aesthetic and structural guidelines from the LA Bureau of Street Lighting (LABSL). These included a very narrow 12-inch pipe form factor, combined with specific base dimensions, and the need to be deployed at several specified heights (Figure 4).

The resulting pole design allowed for the full integration of current sub-6GHz and mmWave equipment, antennas, and support electronics—as well as future C-band radios. An important requirement was that access to the pole would enable easy installation, maintenance and upgrade of the equipment that it housed. This was achieved by including doors that were cleverly positioned sufficiently high above ground level to also make unauthorized access difficult. A prototype pole was installed for final approval by BSL and the city prior to full successful deployment of the production poles on city streets.

Success takes expertise and collaboration

The 5G mmWave portion of the 5G wireless spectrum gives carriers the maximum performance and number of connections for urban areas. With network densification, mmWave small cells must be located close to the customers they serve – on streets, buildings, and other convenient locations. Ideally, the small cells should also be capable of hosting sub-6 GHz radios as well as the C-band radios for the rapidly expanding 5G mid-band market.

Figure 3 - 5G Small Cell light pole for the City of Los Angeles Bureau of Streel Lighting

These case studies show how important it is for carriers, municipalities and utilities to collaborate on solutions that function well and look good. An experienced concealment manufacturer like Raycap can help bring all parties together to overcome the trade-offs to effective and attractive small cell designs.

Raycap is a global manufacturer and infrastructure solutions provider of technological innovations supporting the telecom, energy, and transportation industries. We improve the safety, reliability and efficiency of cellular sites through customized surge protection solutions, cabinets, cable and connectivity enclosures, and concealment of both small cell and macro sites. For more information visit us at www.raycap.com/streamline-your-rollout.

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