Raycap

CASE STUDY

5G's Ongoing Evolution: New Challenges and New Opportunities

Large-scale deployments of 5G began only in 2019, but already, there are new technological permutations that are making deployment decisions more complicated. The Los Angeles market is indicative of how 5G deployment tactics have changed with the introduction of new technologies and evolving use cases.

From a deployment standpoint, the basic issue is that different types of wireless cells operating at different frequencies come in different sizes and (depending in part on the use case) can be deployed in various combinations.

Further, they can be mounted differently depending upon the place – poles, facades, rooftops, etc. Some of the wireless nodes need to be protected and some concealed and/or camouflaged. All the distinct deployment options must be supported.

The good news is: they are. The rollout of 5G in LA demonstrates that the industry is keeping up with all the changes. Existing cell sites need to be upgraded, and new installations can be mounted nearly anywhere – on posts, on rooftops, within cupolas, and other architectural structures.

Raycap can accommodate all of it with its concealment and mounting solutions.

In the Mix

When 5G was first specified, provisions were included for 5G networks to work in any of several distinct frequency bands. Frequencies originally used for 5G were typically sorted into two categories: lower-frequency bands below 6 GHz (< 6 GHz, or "sub 6") and several higher-frequency bands that have wavelengths near one centimeter or shorter and therefore have been referred to as millimeter wave (mmWave). The higher frequency bands support greater data throughput, but the signals don't propagate as well. Sub-6 signals are more robust but at the expense of some throughput.

It is possible for a 5G network operator to deploy different 5G services in different bands. That said, when 5G spectrum was first auctioned off, carriers tended to purchase licenses for either < 6 GHz or mmWave spectrum. Each carrier's engineers worked with the trade-offs. One of the practical consequences for carriers who have licenses to mostly mmWave spectrum is that they must deploy many more cells than were required in 4G to achieve the same geographical coverage. Meanwhile, those using < 6 GHz spectrum cannot provide the fastest downloads that are theoretically possible with 5G.

The relatively recent availability of C-band spectrum has introduced some new wrinkles in the 5G market. The C-band includes frequencies in the range from 3.7 GHz to 3.98 GHz. That is obviously <6 GHz, but its adoption has nonetheless encouraged the use of some different terminology. Any frequency below 1 GHz is now sometimes described as "low band," while spectrum between 1 GHz and 6 GHz is referred to as "mid-band," and any frequency in the millimeter-wave part of the spectrum is also called "high band." In conversation, "C-band" and "mid-band" are now sometimes used interchangeably.

Generally speaking, carriers who had the rights to mmWave spectrum were the ones who bought additional licenses to C-band spectrum. All that by way of explanation that with the new availability of C-band (aka mid-band) spectrum, network engineers have a new set of trade-offs to consider leading to far more deployment options. That's where we are today. And Los Angeles is a fine example of how that is playing out.

Deployment Tactics in LA

The auction for C-band spectrum was held in 2021. Since then, carriers have continued to install small cell poles, but also shifted 5G rollout to upgrading existing macro cells (such as towers) by adding C-band equipment. The combination gives carriers the option to provide the fastest possible 5G download transmission rates using mmWave spectrum, and to extend physical coverage with C-band equipment.

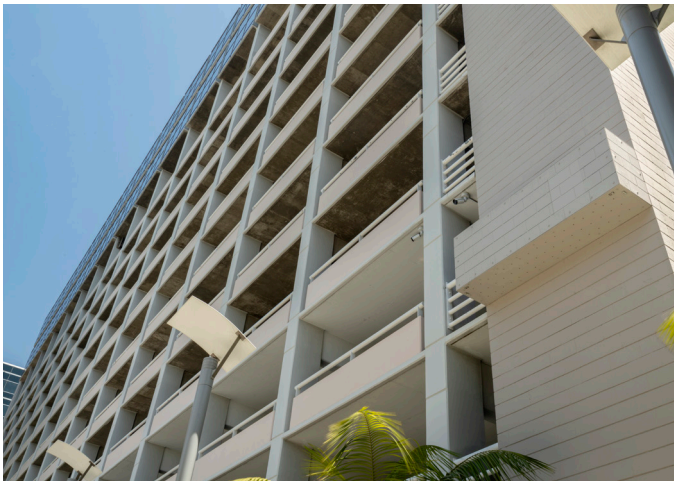

Figure 1. Concealment featuring InvisiWave; El Segundo, CA.

Figure 2. Custom concealment to match building's architectural elements; Hermosa Beach, CA.

In LA, as in many other markets, some regulations dictate the appearance, form, and function of poles and other cell sites. Many of these regulations pertain not only to new poles but also to pole modifications. Since Raycap already went through LA's approval process in the initial wave of 5G deployments, the company is well-positioned to provide small-cell poles in the area, and its poles are found in several locations. Raycap is also in the rare position of owning its own manufacturing facilities on both the east and west coasts; the company can build and deliver its products quickly and efficiently.

Given there are quite a few existing macro cells in the LA area, carriers are using C-band to improve the performance and reach of 5G wireless networks. C-band eventually will be distributed throughout the country, with densification and in-fill using small cell and mmWave. The ability to use C-band radios gave carriers the option to be more tactical when expanding coverage throughout the LA area.

Instead of deploying a large number of mmWave small cells each with minimal range, carriers can give their customers coverage with a more modest number of C-band cells mounted on macro sites (towers or rooftops.) These carriers, once they've established widespread geographical coverage, can then supplement their service capabilities where having significantly greater throughput and capacity makes the most sense – notably in highly trafficked areas such as downtown areas and corporate campuses.

A company with headquarters in the city of El Segundo in the Los Angeles basin wanted a concentration of mmWave cells, but they needed to be concealed. That was accomplished by using Raycap InvisiWave® – a thin yet highly durable concealment panel engineered to allow cellular signals to pass through unimpeded. InvisiWave can also be painted to match the surroundings, such as brick or any other architectural material. Not surprisingly, concealment turns out to be a common concern when rolling out 5G. The tallest structures in any area are naturally suitable sites for antennas, but they also tend to be landmarks that residents would prefer not to see encumbered by electronic equipment.

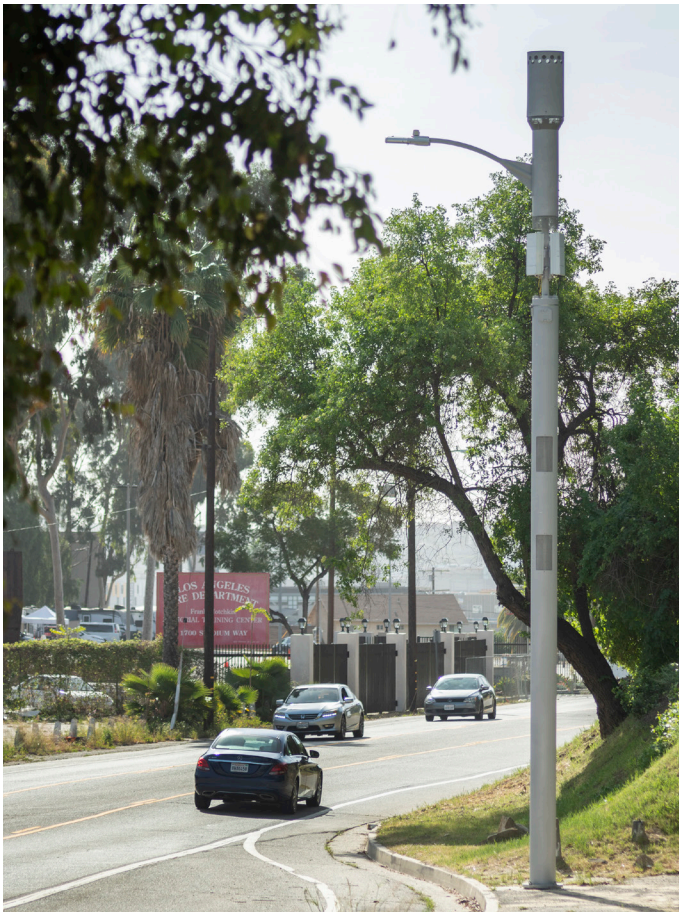

Figure 3. Raycap small cell poles provide 4G/5G coverage near LA's Dodger Stadium

Some buildings have architectural features that support concealment additions on their cupolas, belfries, and steeples. These lend themselves to housing cellular equipment that can easily be hidden using engineered concealment technologies such as those offered by Raycap.

Concealment can come at a price. When housing electronic equipment inside architectural features it is important to consider thermal management. Raycap engineers are experts at analyzing heat dissipation and engineering appropriate venting solutions.

Reliability to the Max

Carriers compete not just on coverage, but also on network reliability. Raycap helps carriers maximize their network reliability by supplying its leading-edge overvoltage protection (OVP) and connectivity solutions. Raycap's Strikesorb® technology is a unique surge protection solution that ensures vital network equipment does not experience downtime due to lightning surge events. Its unique design features a distribution grade metal oxide varistor (MOV) that can handle multiple lightning events without degrading or requiring replacement.

With engineering, concealment, connectivity, and unsurpassed overvoltage protection, Raycap continues to support its carrier customers with solutions for the rollout of next generation networks.

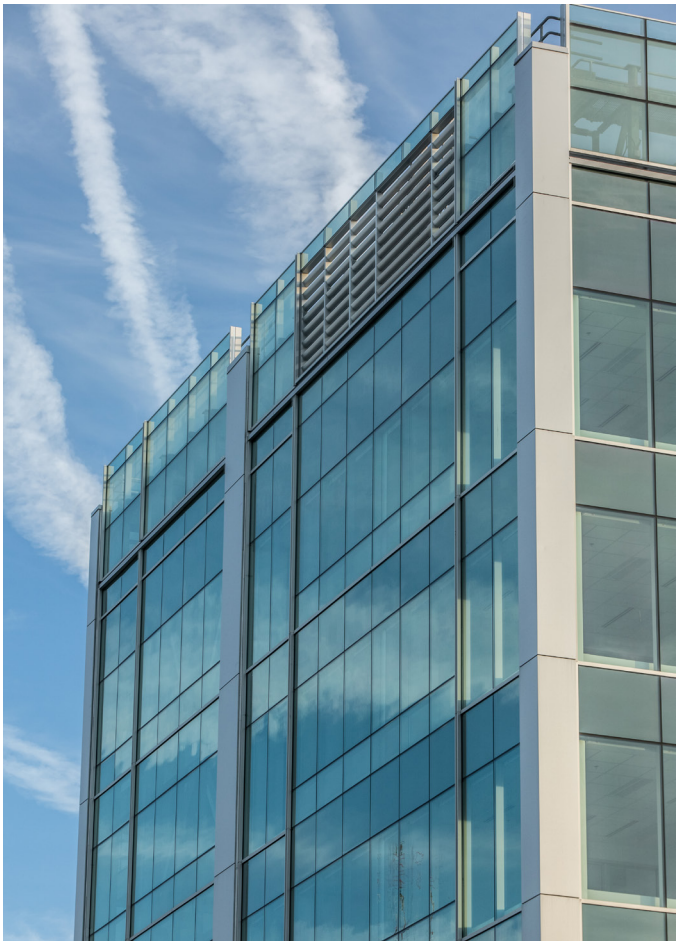

Figure 4. Architectural louvers add visual interest and blend in with the building while concealing telecommunications equipment.

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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