COMMSCOPE®

PowerShift® Metro for rail and roadway networks

Application note

General context

Mobile network operators (MNOs) are in a race to increase 5G network density along high-traffic, long-distance transportation lanes, including railway tracks and busy roadways. Today's passengers expect it, and railway operators need it for their internal operations. Delivering ubiquitous coverage alongside tracks and roads, however, is becoming more difficult for MNOs.

Most transportation use cases require highly predictable and consistent RF patterns to project at 180 degrees from each over long distances. To ensure necessary blanket coverage, MNOs are adding more small cells to fill the coverage gaps in their macro network. Each small cell has specific power and fiber requirements that mobile operators must deliver on in the most efficient way possible.

Typically, individual power drops are needed at each cell site, forcing MNOs to design the network based on the availability of power—sacrificing network coverage and capacity in the process. Even if every small cell were in proximity to a power access point, each small cell must be supplied with its specific fiber needs. More than providing small cell coverage and capacity, MNOs must manage their growing network complexity while ensuring reliable, flexible power and fiber connectivity to every small cell.

Network challenges

Mobile network operators (MNOs) are in a race to increase 5G network density along high-traffic, long-distance transportation lanes, including railway tracks and busy roadways. Today's passengers expect it, and railway operators need it for their internal operations. Delivering ubiquitous cover-age alongside tracks and roads, however, is becoming more difficult for MNOs.

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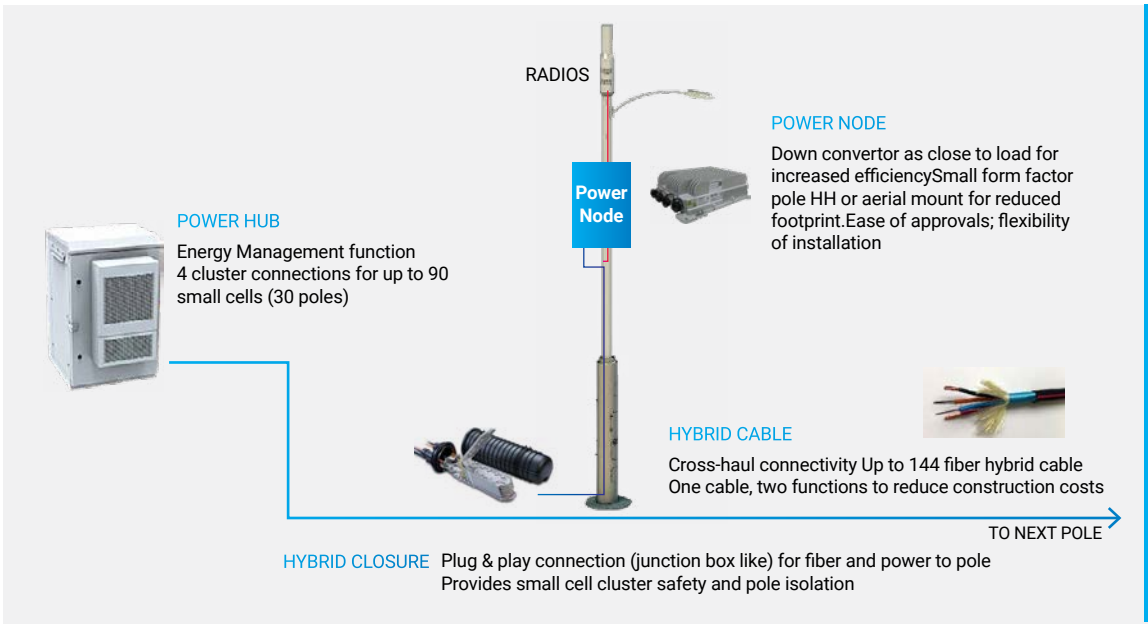


PowerShift Metro simplifies the distribution of power and fiber to small cells providing a separate power feed from a central location, eliminating the need for an onsite power rectifier and meter, and relieving equipment congestion at the small cell pole.

Solution overview

Power Hub

The solution is built around the Power Hub—a compact, standalone unit that contains a rectifier, site controller and battery backup, is located near the small cell cluster, and connects to an AC service supply. The Power Hub can be deployed wherever there is access to power and network fiber, and it contains enough battery backup to deliver full power to the small cells should the grid power fail. One Power Hub supports up to four small cell clusters arranged in a hub-and-spoke architecture.

Powered fiber cable

Each Power Hub provides power and fiber to the cells within their assigned clusters. A single powered fiber cable delivers up to 10 kilowatts of power and as many as 144 fiber strands to small cells located up to 2 kilometers away.

Fiber-optic splice closure (FOSC)

A CommScope FOSC-450D hybrid fiber closure connects each small cell to its Power Hub. It has a capacity of up to six drop cables in addition to a feed-through cable. Measuring 30 inches long by 11.5 inches in diameter, the FOSC-450D can be deployed in a vault, on an aerial strand or in/on a pole to ensure lowest visibility.

Solution architecture

The PowerShift Metro solution uses a hub-and-spoke architecture, with each Power Hub supplying fiber and power to the small cells in its assigned clusters.

Features and benefits

Fast deployment, lower costs

- Powered fiber cable and quick-deploying FOSC reduce cable and construction costs up to 50%
- Factory connectorized cables provide consistent and reliable plug-and-play efficiency
- Completely modular design and repeatable architecture scale effortlessly and quickly
- Long-reach powered fiber enables ideal cell location for optimized capacity and coverage

Centralized management, individual flexibility

- Configurable conductor and fiber count provides 200-4,000 watts and up to 144 fibers per site
- Auxiliary Controller Shelf (ACS) at each Power Hub centralizes power and backup energy
- Power to each cell can be converted to AC and/or direct current (DC) voltage
- Variable voltage and boosted distributed bus enable peak shaving and load balancing

Low visual impact

- Compact Power Hub and FOSC increase design options for easier permitting
- One Power Hub can service as many as four small cell clusters
- FOSC can be deployed via vault, aerial strand or pole to minimize visibility
- Power Hub houses power rectification/backup equipment, minimizing small cell size

Application: Metro Rail Network

Scope

The application involves a North American metro area commuter rail line consisting of 158 miles of track. The required coverage extends along both the roadways and tracks. Meeting commuters' communication needs requires at least 830,000 feet of hybrid power/fiber cable, 20 Power Hubs, and more than 330 small cell sites.

Application parameters

- Single cable along track or roadway, using a bus configuration
- Trunk splits at track switches and tunnel splits
- Continuous run of hybrid cable and fiber
- Halogen-free trunk cable within the tunnels and stations

Key information needs

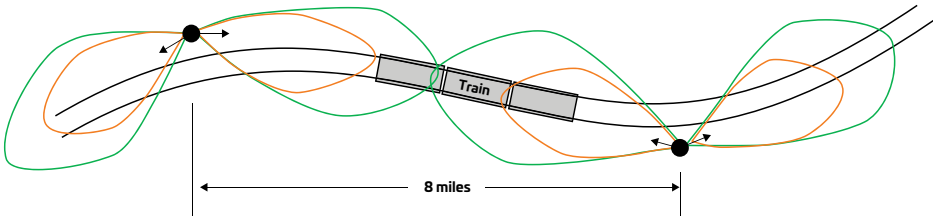
Network designers must determine:

- Power and fiber requirements for each small cell
- Minimum number of Power Hubs for each railway station or roadway service area
- Fiber count (including redundancy) from each railway/roadway station to each small cell
- Location of AC feed and network fiber with power and fiber distribution routes
- Power/fiber split locations to enable one cable in the wayside troughs, tunnels, and stations
- Mounting locations for each Power Hub, FOSC, and power node.

Solution design

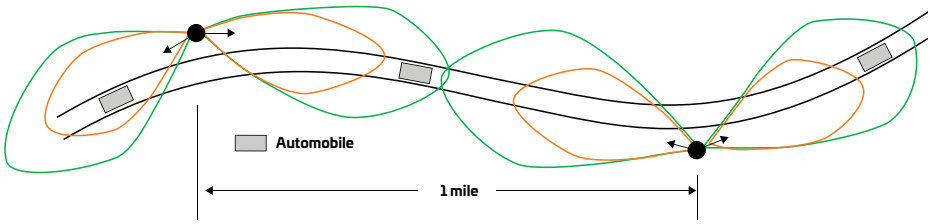
The solution design is divided into two topologies—one that supports coverage along the rail line and another for coverage along the roadway.

Railway



- 830,000 feet of new, halogen-free hybrid cable—350,000 feet of which is inside tunnels and railway stations
- 330 power nodes and 380 FOSCs terminate power/fiber along wayside splits, tunnels and rail splits
- 20 Power Hubs used, providing 76 kW of power to support 330 network devices

Roadway



- 74,000 feet (≈ 14 miles) of roadway coverage via 13 small cell or mini-macro sites
- Power and fiber are not available today at these sites
- Fiber can be brought into one location for distribution via hybrid cable to the rest of the sites
- Four Power Hubs distribute approximately 60 kW of power (15 kW per site)
- Lower gauge conductor to minimize line losses.

Results

- The number of AC connections was reduced from 330 to 20—all of which used existing AC power feeds at the railway stations
- Reduced expensive AC service panels by a factor of four, significantly reducing the cost of power
- The hybrid powered fiber cable and flexible FOSC closure enable a low-profile solution and simplified deployment
- Streamlined design supports future ICT expansions via railway/roadway conduits and micro-trenches
- Utilizes highly reliable FOSC 450D closures, field-tested and proven over three decades; well known, understood, and trusted by installers, the FOSC 450D deploys quickly with virtually no learning curve

Conclusion

As effects of the COVID-19 pandemic continue to recede, railroad ridership numbers are rebounding. As passengers return to light rail and commuter rail services, they do so with the expectation of high-capacity, ubiquitous wireless coverage, from the station to their destination. Increasingly, this requires the use of small cells that are easy to deploy, power and provision with fiber.

As demonstrated in this application note, the PowerShift Metro solution provides a more agile, reliable and cost-effective alternative to conventional grid power. Controlled by the mobile operator, it provides a separate power feed from a central location—eliminating the need for an onsite power rectifier and meter and relieving equipment congestion at the small cell pole. The result is significant savings, greater design flexibility, easier management and more.

The entire PowerShift Metro platform is designed, engineered and supported by CommScope, a leading global provider of leading-edge outdoor wireless network solutions. With nearly half a century of experience and a comprehensive range of resources, tooling and technical expertise, CommScope supports you through the entire process: from planning and design to commissioning, deployment and testing. One partner—a world of opportunities.

CommScope pushes the boundaries of communications technology with game-changing ideas and ground-breaking discoveries that spark profound human achievement. We collaborate with our customers and partners to design, create and build the world's most advanced networks. It is our passion and commitment to identify the next opportunity and realize a better tomorrow. Discover more at commscope.com

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