

SMART POLE DESIGNS | ENGINEERING | FABRICATION



PRODUCT GUIDE
SPRING 2018



CityPole™

NEXT GENERATION SMART POLE SOLUTIONS

CityPole™ is the best smart pole solution for small cell deployments in the right-of-way. Configurable and capable of housing different equipment configurations, CityPole™ simplifies and streamlines network upgrades. Thoughtfully engineered and designed to complement urban environments, CityPole™ uniquely meets the changing needs of the wireless industry, city government, and residents. With attractive styling, large access panels and modular construction, CityPole™ is engineered to support the pace of technological change.

The CityPole™ is a proprietary and patent pending product of Comptek.

Modular Design

CityPole's™ modular design is key to its flexibility. The CityPole™ system houses all the active technologies within the pole structure, and can be easily reconfigured for future equipment and antenna modifications. With many architectural, foundation, and color options, CityPole™ can meet the functional and aesthetic needs of wireless operators, planners, residents, and installers.

A CONFIGURABLE BASE CABINET – The base cabinet can be outfitted to support multiple equipment configurations, providing flexibility in wireless deployments. The base cabinet section can be installed together with upper pole and antenna module or separately, providing contractors installation options when working in the right-of-way.

A MODULAR AND CONFIGURABLE UPPER MODULE – The upper antenna module can be configured with a wide variety of different antenna types. The upper pole can vary in length to achieve the desired pole height and is available to support future antennas and IoT technologies.

CONFIGURABLE WITH LIGHTING AND FUTURE TECHNOLOGIES – CityPole™ can be provided without attachment mounts, or configured for the future installation of lighting and other smart city technologies.

FOUNDATION OPTIONS SPEED INSTALLATION – CityPole™ can be installed with a range of foundation options. Precast or caisson options are standard. For custom solutions, Comptek's professional engineers can quickly design for nearly any soil or installation condition.

UPPER ANTENNA
MODULE

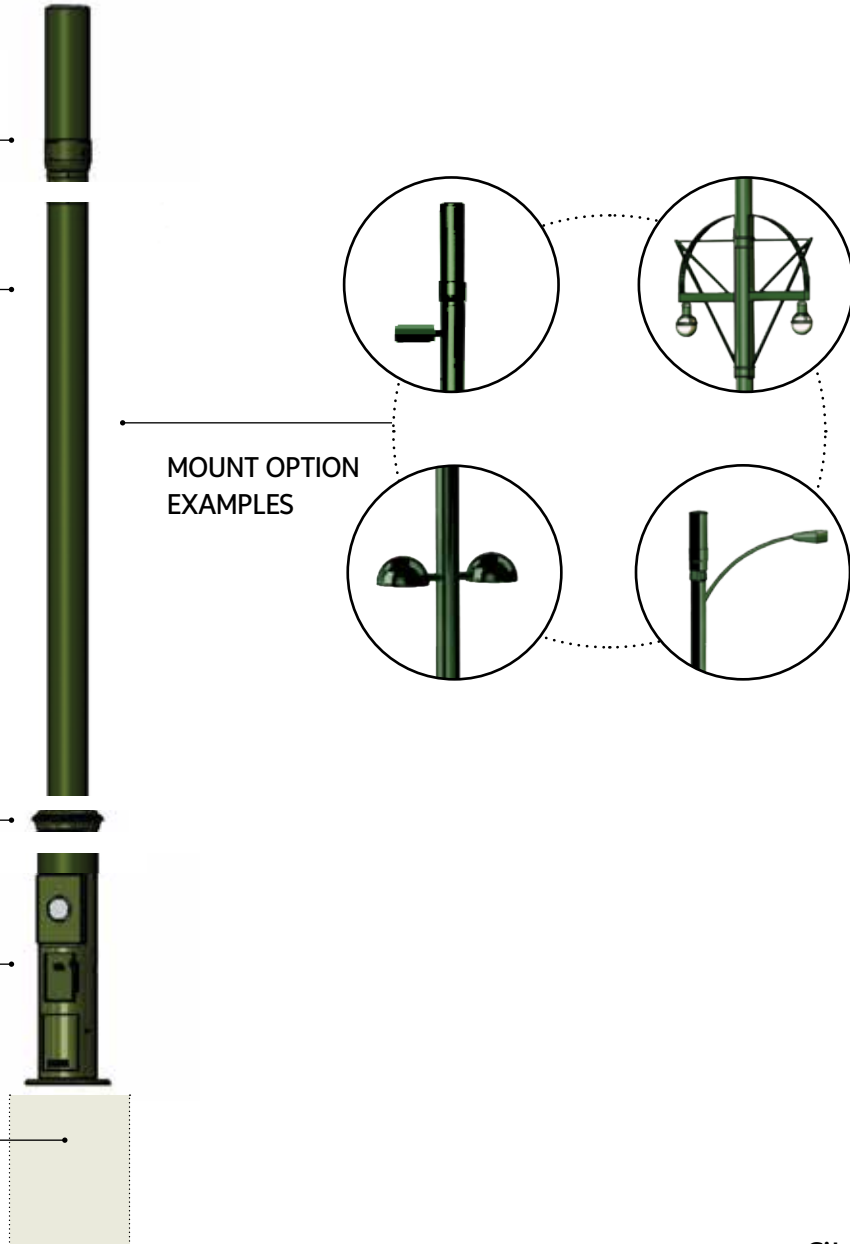
UPPER POLE

MOUNT OPTION
EXAMPLES

SHROUD

BASE CABINET

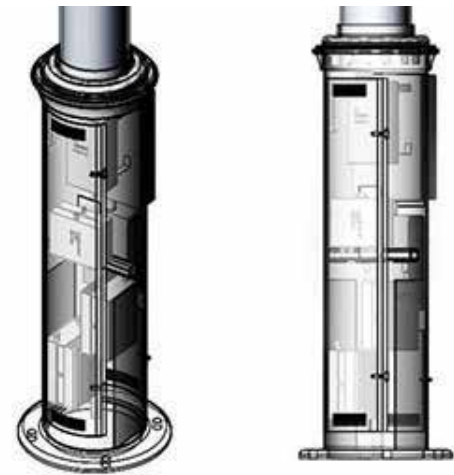
FOUNDATION



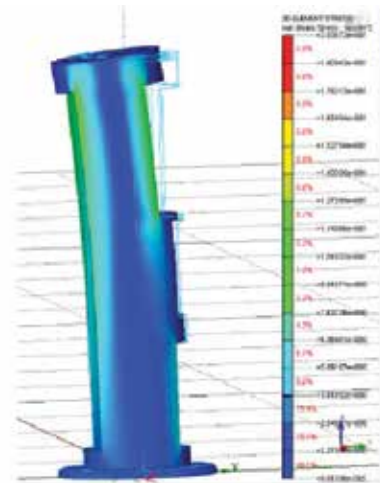
Engineering

The Citypole™ is engineered to the demanding standards of the telecommunications industry. With its integrated base cabinet, wide doors, and passive/active ventilation system, the CityPole™ satisfies national and local building codes. Available material and space is optimized by modeling all components in three dimensions. The resulting computer model is analyzed for structural performance using finite element methods (FEM). This engineering technique assures efficient use of available space and materials while also assuring a safe design.

In addition to modeling structural performance, the smart pole's thermal performance is also evaluated. As radios and other electronic components compete for space, the smart pole's ability to manage heat generated by the radios, sensors, and other electronic devices becomes important. Comptek engineers assure the heat generated is properly managed by thermally modeling both the conductive and convective heat flow, along with computational fluid dynamic (CFD) modeling of the air moving through the cabinet. The technique,



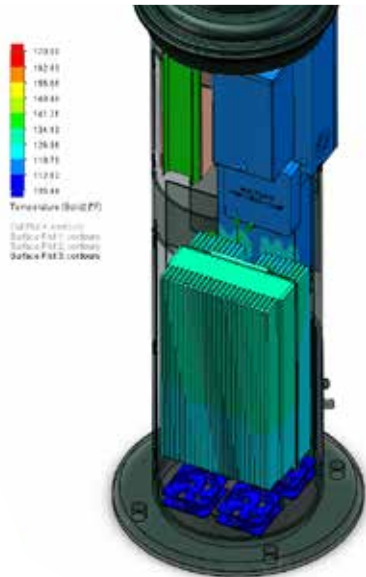
Integrated wireless equipment in base cabinet.



Finite element analysis.
(Deflection is exaggerated.)

when coupled with testing at national labs, assures internal environment remains consistent with the demands of the installed electronics, regardless of external conditions.

The Citypole™ is available in single or multi-tenant designs. Full scale Inter-Mod and PIM surveys are available regardless of antenna or radio configuration. Bolted connections are readily accessible, yet easily hidden from view, thus improving the aesthetics of the small cell installation contained within the Citypole™. The Citypole™ is engineered with the best technology available, assuring a clean installation while assuring an agile, high performance equipment environment for the future.



Equipment surface temperature



Thermal flow trajectories

Fabrication

The CityPole™ is made from durable, high quality materials and powder coated with finishes suitable for a 50 year life. Depending on options chosen, the CityPole™ is made from structural steel, stainless steel, aerospace aluminum, or fiber-reinforced plastics (FRP). Corrosion protection is provided by powder coating, galvanizing, or the combination of both. Each pole is manufactured directly using Comptek's engineering data files, assuring control of each design and an effective change management process. We are committed to using state-of-the-art fabrication technology and equipment to guarantee that fit and finishes are of high quality. Each section is individually labeled for ease of installation. All coatings are UV rated and impact resistant, providing coating and color longevity.



Installation

The CityPole™ is designed and fabricated to reduce the installation time required on site. Total installation time for a CityPole™ (excluding excavation) can be achieved in less than one hour. All remote radio heads, power meter, ventilation system and antennas are pre-installed. The 3-step installation process is straightforward with safety as the highest priority.

3-Step Installation Process



Step 1: Place precast foundation and grounding into excavation in the right-of-way. (Caisson optional.)



Step 2: Install base section cabinet of the CityPole™ onto the foundation and secure.



Step 3: Install top section with antenna onto base section with architectural shrouds.

Durability, Maintenance and Support

Comptek engineers considered carefully ownership and maintenance costs of the CityPole™ system. Recognizing the many configuration changes the poles might see throughout their useful lives, Comptek engineers incorporated many small but important features in the CityPole™.

The most noticeable feature is the selection of high quality, durable materials. Every CityPole™ is protected internally and externally per our customers specifications. Common coatings include zinc undercoats or galvanizing with powder coating. Our coatings reliably resist UV, salt spray and extreme temperature ranges. The result is a highly durable and resistant product capable of resisting the outdoor environment under adverse conditions.

Comptek engineers recognize the importance of traceability of each pole to its owner and maintainer. Every CityPole™ is serialized providing easy cross referencing of important operating and maintenance data. This includes date of pole manufacture and installation, telecom equipment installed, thermal and RF test data, antennas installed, power supply, GPS coordinates inspection records, owner with contact information and any additional information requested by the owner to maintain.



Each CityPole™ equipment configuration undergoes 3rd party environmental testing with the wireless equipment installed and operating at full power. Ventilation louvers in the base and at the top of the pole provide flexibility in handling thermal loads. Additionally, CityPole™ is designed for convection cooling and equipped with redundant thermostatically controlled quiet fans to assure equipment is operating within the OEM's warranty specifications.

Comptek engineers assure replacement CityPole™ components are readily available. Replacement base sections, doors, and upper pole sections are available. Additionally, components such as meters, disconnects, fans, thermostats and various architectural components are also available for replacement in the event of damage to the CityPole™.

The Comptek Specification System

The CityPole™ modular design and construction system allows for nearly limitless customization. Each pole, in each location, can be uniquely configured to support different combinations of technology and architectural elements. This allows a CityPole™ deployment to blend into the look and feel of any community.

When configuring a CityPole™, the selection process must consider regulatory, technical and aesthetic factors. The successful deployment of a CityPole™ must comply with federal and local jurisdictional requirements, public safety, wireless carrier near term and longer term objectives and community acceptance. Common factors and decisions taken into account during the design process include:

POLE HEIGHT – Commonly determined by the rules issued with the Master Lease Agreement between the wireless operators and municipality or private entity. City ordinances may also limit the height based on poles, buildings and structures nearby.

METERING OF POWER – The local Utility will determine whether a power meter is required and attached to or installed directly into the pole. Factors include power requirements of the small cell and future use of the pole anticipated for new technologies, sensors and additional wireless carriers.

BREAKAWAY BASE CONNECTION – Determined by AASHTO, DOT and/or local code based on the location of the pole, congestion of pedestrians and the speed of traffic. The alternative is a fixed non-breakaway base connection to the foundation.



The unique Comptek Specification System assures the right pole is installed every time.

RF TECHNOLOGY – A function of the wireless equipment and antenna technology to satisfy current and longer term requirements of the wireless operator, including a transition from LTE to 5G.

AESTHETICS – CityPole™ family of smart poles are designed to incorporate architectural detailing, colors, and lighting systems, where applicable, to blend into historic, modern, suburban and any environment as a new or replacement pole.

FUNCTIONALITY – Important to provide easy interior access to install equipment, cabling conduits, electrical lighting conduit, interior safety walls to separate power from wireless equipment chambers, thermostats, ventilation and future features that support sensor technologies for smart city initiatives. All access doors are sized for equipment installation, replacement and maintenance.

RIGHT OF WAY – The available space will determine the footprint required to design the base section and flange that attaches to the foundation. Slender base sections of the CityPole™ are achieved through skilled structural design and solid modeling of equipment attachments internal to the pole. Subsurface interferences are considered in advance of the foundation design, whenever possible, to select a solution that will minimize any obstructions during installation of a CityPole™.

The Selection Process

The Selection Process for a CityPole™ can be simplified with a primary set of information and parameters. Once defined, the geometry of the CityPole™ can readily be established with provisions identified for future uses of the structure. The process below is intended to define the information necessary to advance a solution forward to review together. Once received, our team will provide a recommended CityPole™ and options to consider. Though our deployment solutions are customized, the CityPole™ is comprised of standard components to reduce costs and expedite fabrication. Our team is experienced in closely collaborating with the owner of the pole to achieve the right solution. This process involves knowledge of the internal equipment and antennas, use of shapes, colors, and custom shrouds that blend with the surroundings.

STEP 1 Select the height of the pole, determined by the antenna rad center(s), use of pole and any municipal height requirements.

STEP 2 Identify from wireless operator the wireless equipment and antenna options to achieve the performance required of the small cell node transmission. This information allows us to determine the base cabinet options available for the technology configuration, including internal cabinet space required for thermal management, cabling for power supply, backhaul fiber connections (when applicable), duct for antenna and future IoT sensors.

STEP 3 Establish if the CityPole™ is metered or unmetered by the utility company or wireless operator. When metering is required, our team can assist in selection of meter options available for integration into the pole.



The unique Comptek Specification System assures the right pole is installed every time.

STEP 4 Select an upper pole and antenna module. The upper pole height is typically selected with consideration of the antenna height and the diameter to provide for an aesthetic transition between the pole and antenna canister or panel configuration, and consideration of surrounding pole architecture. Our design team has developed solutions to maintain a slender form factor when panel antennas are specified by the RF engineer.

STEP 5 Where lighting is required today or at a future date, identify the appearance being sought and our design team will provide solutions. Where existing lighting fixtures are known, we will design the CityPole™ using a close match or identical fixture solutions.

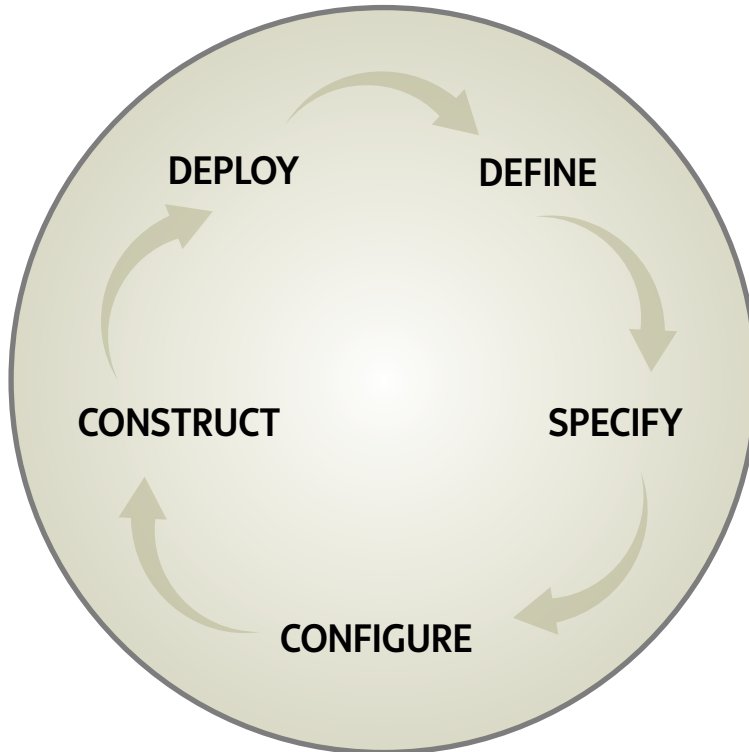
STEP 6 A foundation type is recommended by our engineers based on the location of the pole and whether right-of-way subsurface interferences exist.

STEP 7 With the structure defined, detailing of the CityPole™ can occur to select the cross section shape and color. Architectural shrouds are used at the interface of the base cabinet and upper pole, and transition of the upper pole to antenna module. A base shroud may also be used with consideration for the access opening locations.

Our selection process is proven to result in a highly functional smart pole that is durable and adaptable to future uses as technology changes require.

Product Selection Guide

The CityPole™ has a wide range of options. The following images include the details to define and deploy a CityPole™.



PRODUCT
GUIDE
SELECTION

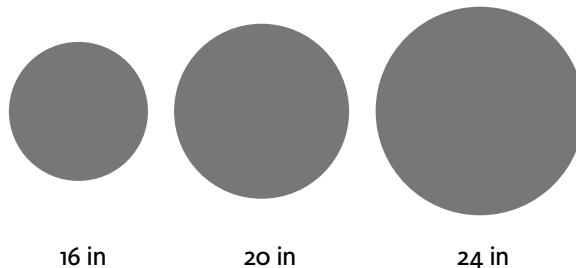


Base Cabinet

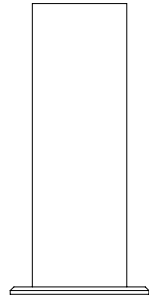
Configuring your CityPole™ begins with determining the equipment to be installed and future possibilities. The base cabinet can support many equipment options and power connections. This is accomplished by varying the height and base cabinet diameter from as small as 16 inches in diameter, to as large as 24 inches. Though larger diameters are possible, we minimize the diameter through design.

The CityPole™ system supports base cabinet heights from 48 to 72 inches, with 60 inches a common height. The base cabinet can support different metering and shutoff options according to local and site specific preferences and codes. The system can be ordered with no disconnect, a simple disconnect, or metered disconnect. Custom configurations are also available on request.

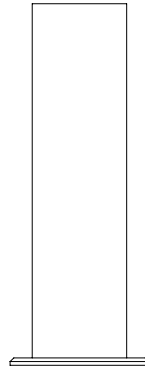
BASE CROSS SECTIONS



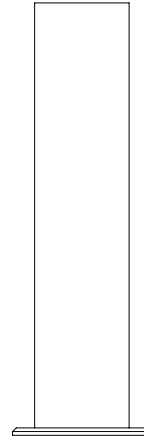
The base cabinet can be configured in round dimensions up to 24 in.



48 in Base Height



60 in Base Height



72 in Base Height

The base cabinet height can be chosen to house future equipment and complement local cityscapes.



The base cabinet can be configured with a wide range of electrical disconnects to meet local building codes and preferences.

Upper Pole

The upper pole is fully customizable to meet site specific equipment needs, and can be configured to accept 1, 2, or 3 antennas supporting the different technology configurations in the base cabinet. The upper pole can also be configured to accept a variety of other backhaul components, low power radios and WiFi equipment. The ease of reconfiguration assures each CityPole™ installation remains useful over several equipment antenna generations. Cross sections can vary and are typically circular. Additional cross section options are available, including square and fluted shapes. The upper pole is commonly straight and is available tapered.

UPPER CROSS SECTIONS



Square



Fluted



10 in



12 in



14 in

The Upper Pole can be ordered in a wide range of shapes to complement the cityscape, and also assure proper spacing of different equipment types.



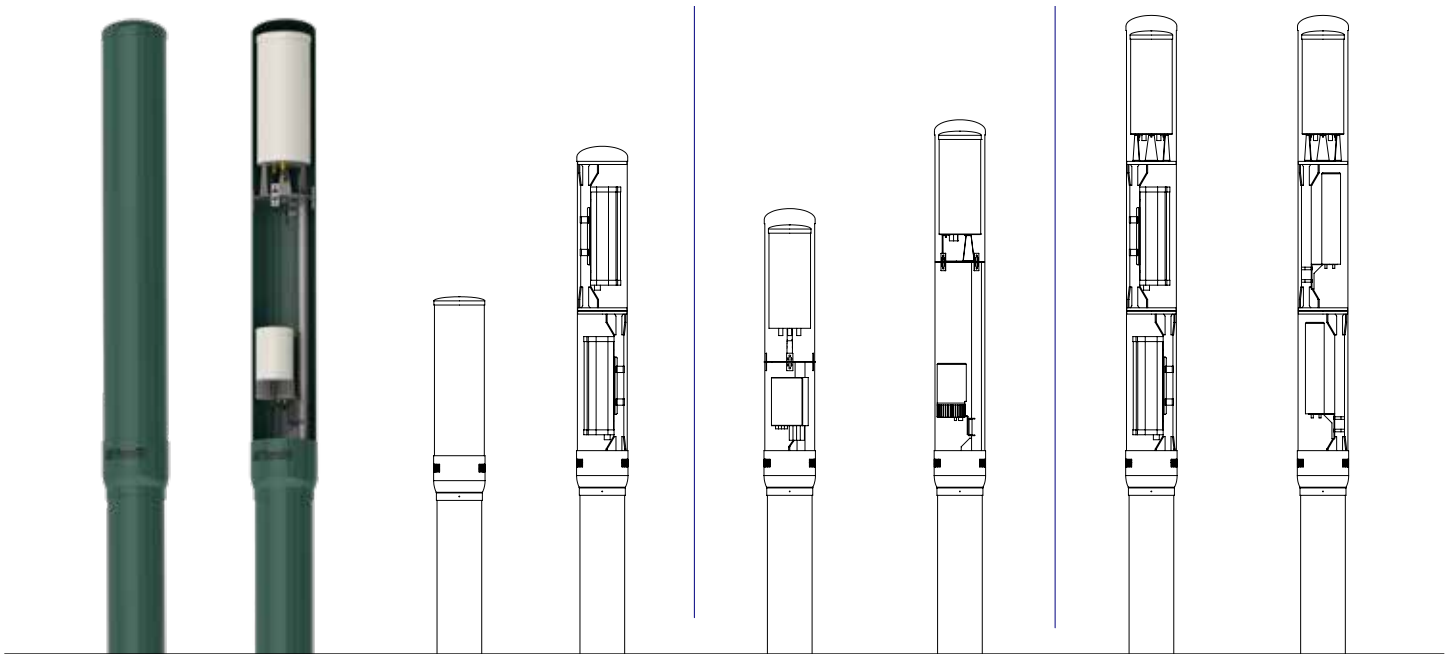


CITYPOLE™ IS COMPATIBLE WITH A WIDE RANGE OF RADIO AND WIFI TECHNOLOGIES.

Cellular Technology	
Radios	Antennas
Alcatel/Lucent	Commscope
Nokia	Amphenol
Ericsson	Lathrein
Airspan	Ubiquiti

Wifi Technology
Cisco
Ruckus
Samsung

Other Radios
Solid
JMA

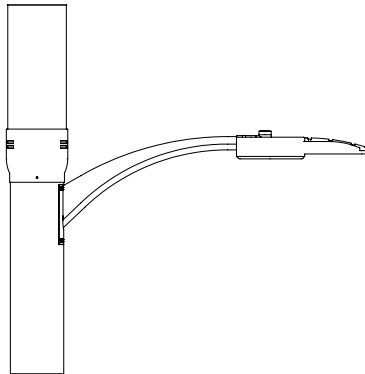


The upper antenna module can be easily reconfigured for a number of technology generations. These includes multiple configurations of cellular technology, various backhaul and low power options such as WiFi, Bluetooth, or Zigbee, and as many as three different technology generations.

Lighting Accessories

Lights are a vital component of all city environments, and cannot be overlooked in any way. Lighting is vital for night illumination, but is also important for the city's identity. Residents need to feel a sense of security and social presence, and visitors and business people can be influenced by creating an inviting environment.

CityPoles™ can be ordered with a wide variety of lighting options. These can include wireless controlled smart LED lighting for public safety, first responders, and energy conservation. Lights can be mounted with simple plates or offset arms to maximize illumination and the beauty of your cityscape.



LIGHTING
ACCESSORIES



CityPole™ offers nearly limitless options for lighting types and decorative mounts.



Technology Accessories

CityPole™ easily enables the mounting and integration of sensor information into public safety and community access systems. By serving as an “Eco-System for Smart City Technologies” the CityPole™ plays an important role in integrating sensors and applications that knit the fabric of society closer together.

As Smart Cities around the country deploy millions of sensors and end-points, the CityPole™ will be an essential part of any deployment plan. With a fifty-year life and a fully modular design, the CityPole™ can easily be configured, upgraded or changed throughout its life cycle as the city’s technology needs mature and change.

Whether your needs are related to Smart Energy, Smart Transportation, Smart Data or Smart Mobility, the CityPole™ can be configured to meet those rapidly emerging and changing needs.



PUBLIC SAFETY



- 360° Video Surveillance.
- Advanced Gunshot Detection System & Panic button automatically alerts local law enforcement and activates siren with signal light.
- Air Pollution Sensors allow for easy monitoring of air quality and breathability.

COMMUNITY ACCESS

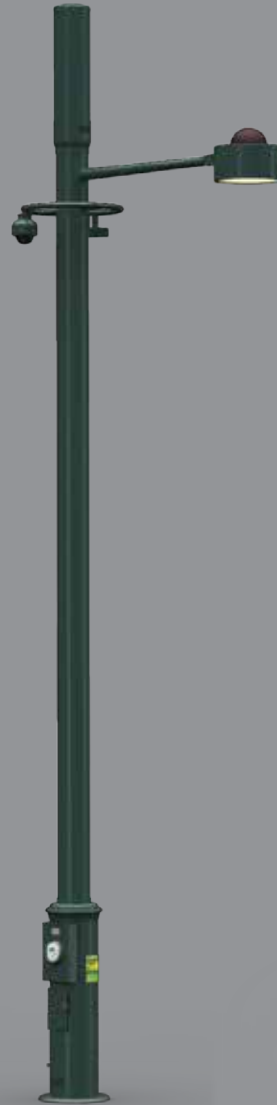


- LED Displays for parking information, Advertising, safety alerts, etc.
- Optional WiFi hub capabilities for resident and tourist convenience.
- Optional Charging Integration for electric vehicles and smart devices.

INFRASTRUCTURE BENEFITS



- High Efficiency "Smart" LED Lighting for reduced energy consumption.
- RFID to keep track of public servants, allow access to pole features for authorized users.
- Customizable Sensor Mount System allows for further expansion as new technologies emerge.



Architectural and Aesthetic Selection

The architectural detailing on the CityPole™ is achieved without modifications to the structural components. Comptek's creative team is consistently successful in developing design details that blend into the urban, campus, or community landscapes and meet approval by city councils and the community. Comptek's creative team often includes local urban architects and designers to duplicate the unique feel of each neighborhood. The company's experience in fabrication, castings, and multiple materials results in finding balance between cost and acceptable architectural details. An attractive transition shroud between the base cabinet and upper pole is designed to cover and protect the bolted connection that connects the two and blend with the surroundings.



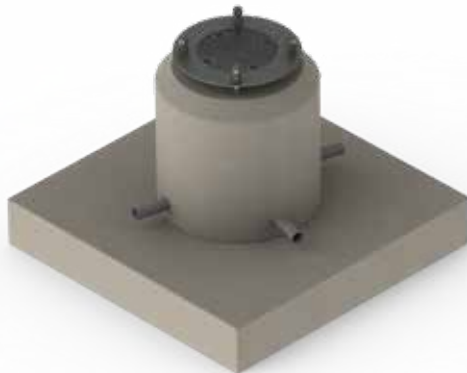
Comptek can offer nearly any architectural or aesthetic detail necessary to blend into your community.

ARCHITECTURAL
AND
AESTHETIC
SELECTION



Foundation Selection

The foundation options for CityPole™ are standardized and include a pre-cast pad and pier foundation which expedites installation time in the right-of-way as well as a traditional cast-in-place caisson solution. Conduit and connectors for the wireless equipment and antenna are pre-installed. Pre-installed equipment is typically provided by Comptek for quality control. Where interferences in the ground opening may exist following excavation for a CityPole™, our professional engineers will inspect and develop a modified foundation solution to fit the site.



CityPole™ pre-cast foundation speeds work in the Right of Way.



Caisson and custom designs are available.

FOUNDATION SELECTION



CityPole™ foundation systems can be engineered for existing and future loadings and fast installation.

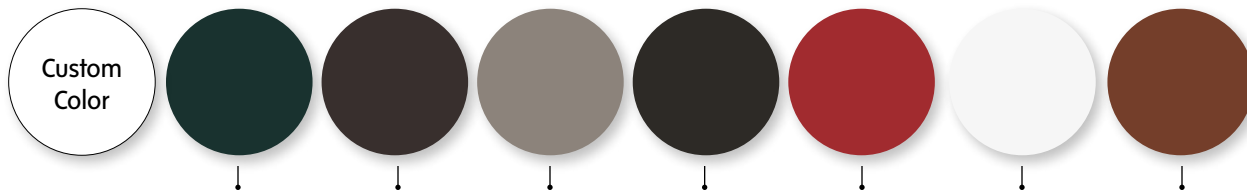
Product Selection Matrix

The matrix summarizes the many different combinations of equipment available for the CityPole™ product. The modular system can be easily customized to meet site-specific needs.

		Standard CityPole™ System Offering	Custom Options Available
Overall Pole Height		25', 30', 35', and 40' Above Ground Level (AGL)	Yes
Color Choices		7 Color Choices are Standard	
Base Cabinet	Technology Types	1, 2, or 3 Different Technologies can be Accommodated	
	Ground Dimension	16", 20", 24" Round	
	Height	48", 60", and 72"	
	Electrical Options	No Disconnect, Disconnect Only, or Meter and Disconnect	
Upper Pole Antenna Module	Rad Center Location	Based on Pole Height and Other Options	
	Technology Types	1, 2, or 3 Different Technologies can be Accommodated	
	Auxiliary Bay Options	Low Power RF, Backhaul, and Wifi Options can be Accommodated	
	Antenna Options	Omni and Panel Types in Any Combination	
Accessory Selection	Lighting	Pole can be ordered without lighting or with 1,2,3, or 4 Lights	
	Light Mounts	Standard Plate or Offset Arms depending on light selection	
	Lighting	Shoebox, Cobrahead, Cylindrical, Dome and Acorn	
	Other Technology	Gun Shot Sensors, Video, Weather, Traffic Mgmt	
	Lower Shroud Details	Multiple Options Are Available	
	Base Plate Details	Multiple Options Are Available	
	Foundation Options	Precast, or Cast-in-Place	



CITYPOLE™ STANDARD COLOR OPTIONS - CUSTOM COLORS ARE AVAILABLE ON REQUEST



	Green/Black	Brown	Galvanize Grey	Signal/Traffic Black	Ruby Red	Signal White	Fawn Brown
RAL Color	6012	8019	9007	9004	3003	9003	8007

Product Examples

The CityPole™ system is tailor made for easy installation and use in a wide range of environments. The following pages include several examples of CityPole™ solutions in many different environments. The opportunities for applications are limited only by the inspiration and creativity of the deployment team.



Upper pole photo.



Architectural shroud between base cabinet and upper pole.

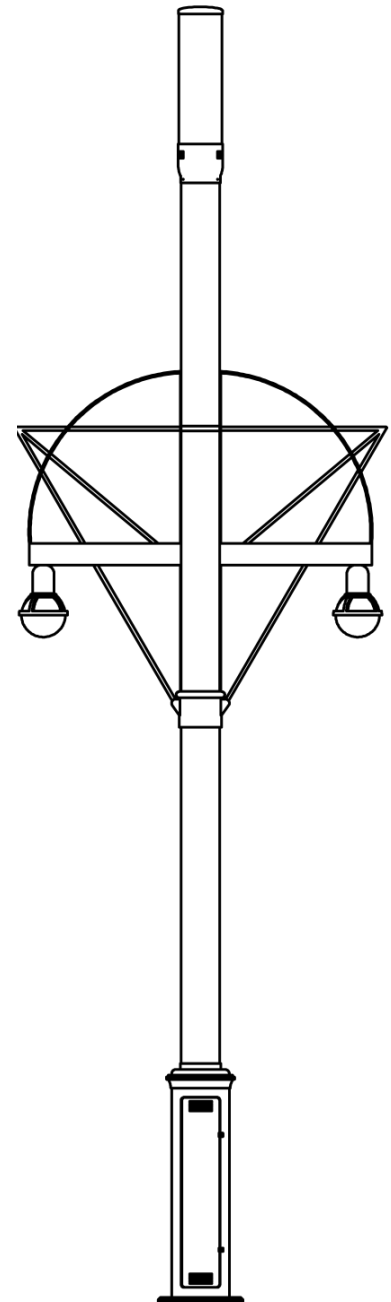


PRODUCT
EXAMPLES

CityPole™ photo in Denver, Colorado.

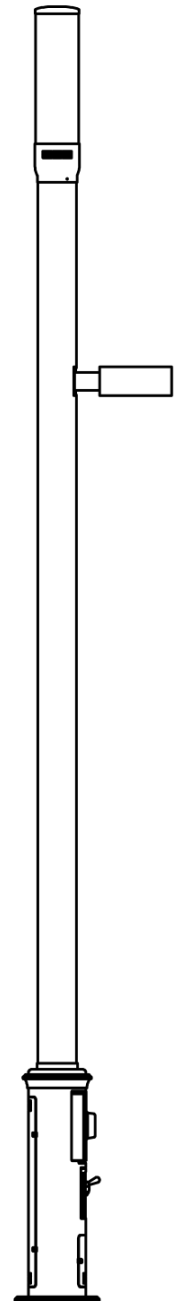
Urban Landscapes

Design solutions for the CityPole™ in the urban environment often require special considerations for architectural lighting that satisfies the streetscape and existing lighting structures. This solution is particularly suitable for the replacement of existing light poles with a CityPole™ that replicates those removed. Optional sensor technologies can be installed for security and public safety.



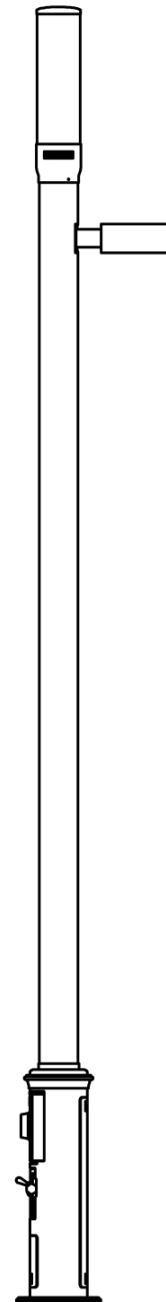
Unique Campus Applications

Standardized equipment in this unique modular pole design allows for tailored lighting configurations and university colors can match the aesthetics found on campus. The pole can incorporate metered power options to satisfy local utility requirements.



Retail Location

The adaptability of the CityPole™ to suit private land owner's aesthetic requirements and the functionality of changing out existing parking lights is a key feature in this line of CityPoles™.



Emergency Pole

The CityPole™ converts perfectly to serve as a replacement structure for emergency call poles. While the illustration below demonstrates a variety of solutions available, the modular nature and adaptability of the CityPole™ can incorporate additional lighting, data and sensors, becoming an additional tool in security applications.



Innovative Wireless Infrastructure Solutions

Comptek was established in New York City in 1998 as a product development company and fabricator of engineered composite, alloy and metal infrastructure products for the wireless and energy markets. The company is a member of the Aero Wireless Group of Boulder, CO that provides small cell and macro cell collocation engineering services, smart poles (CityPole™), antenna shrouds, wireless street furniture, construction management and consulting to communities and wireless operators seeking to expedite their wireless deployment programs.

Comptek has developed a full product line of small cell infrastructure and concealment structures to support small cell deployments. The CityPole™ (www.smartcitypole.com) is being deployed across multiple states in the public right-of-way, onto private landlord sites, university campuses and private developments. The City of Denver adopted the CityPole™ in early 2016 as its preferred standard smart pole, following numerous review board approvals and city council. Comptek has deployed the CityPole™ throughout downtown Denver and will provide a minimum of 400 CityPole's™ in the right-of-way between 2016 and 2018. The CityPole™ has been installed with 4G and 5G technologies for single carriers, and will be deployed with a multi-carrier solution in 2017-2018.



The Aero Wireless Group has worked extensively throughout the U.S. for the major wireless carriers, neutral host providers, municipalities and utility companies, completing over 4000 turnkey projects. Our 15 year wireless infrastructure background working in macro cell and small cell technologies provides our company a unique understanding of the importance of experienced engineering, quality fabrication and CityPole™ design solutions that minimize construction time in the right-of-way. Outside the U.S., the Aero Wireless group has performed projects in Hawaii, Alaska, Puerto Rico, Portugal, Bermuda, and Southwest Asia, working for the United Nations and governments.

The company takes a leadership role in the wireless industry, actively serving on WIA's HetNet Innovative Technology Council, as members and active participants in WIA, CTIA, HetNet Forum, Smart Cities Council, NATOA, UTC, and national standards committees including TIA. CityPole™ has proven to be an excellent choice for municipalities, university campuses, and other locations where wireless densification is required.



Aero Wireless Group



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