The District of Columbia Counts on Wireless!

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Washington, D.C. is world famous as the capital of the United States with the backdrop of historical buildings and monuments. As the seat of our national government, it presents a unique set of challenges not present in most cities. Traffic patterns fluctuate as Congress goes in and out of session. Tourist are here year round and normal travel patterns are frequently disrupted as various foreign and domestic dignitaries travel throughout the District burdening the traffic control system to keep traffic moving. One of the keys to solving this is the frequent collection of traffic data from which to make decisions.

Historically, the District Department of Transportation (DDOT) collected this traffic data through the deployment of permanent loop based data collection stations. These stations collected and locally stored vehicle count information. Periodically, DDOT would physically visit each site and extract the data from the count station. While this presented DDOT a view of what had happened in the past, it had its limitations. The data was not available in real time, limiting DDOT’s ability to actively manage traffic. Compounding this was the lack of real time feedback on the operational status of the system. DDOT would become aware of broken loops or other system failures only upon visiting the count station or traffic signal malfunctioning. Over time, when it became time to develop a maintenance plan for the loop count stations, it became clear that the budget would be unsustainable. As DDOT embarked on a campaign to bring its data collection system back on-line, they reviewed other technology solutions available with an eye towards expanding on the capabilities while minimizing or eliminating the limitations of the prior system.

Sensys Networks wireless magnetometer based vehicle detection system was one potential solution that DDOT investigated. The Sensys Networks solution claimed accuracy levels akin to loops, a native Ethernet communication system, long life expectancy and fast installation times. As part of its due diligence in reviewing alternate technologies, DDOT installed three trial systems to be independently evaluated to validate the wireless solution. These locations reflect challenges typical within the district, including installation over Metro rail lines located below the street and reversible lanes. The system’s count performance was validated using manual counts collected from video recordings. Speed was validated by ground truth from radar guns. After a six month evaluation, Sensys

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Networks system’s accuracy claims were validated and they would meet the needs of DDOT.

The trials also provided a series of lessons learned. These lessons included sensor location selection criteria, proper Radio Frequency (RF) site design, system pre-configuration and verifying conduit space. In designing the optimal sensor location, DDOT determined that the sensors should be placed in areas of free flow, while avoiding driveways or other random event generators/access points. As the various components of the system communicate wirelessly, it is imperative to follow Sensys Networks RF design recommendations including maintaining clear line of sight between components, ensuring that the antennas are aimed within the RF nodes and the associated Repeaters and Access Points (AP) are mounted at or exceeding the recommended minimum mounting heights. The installation process is completed more efficiently by pre-configuring the systems, including the RF parameters, component detection and network settings, prior to installation.

The typical count station design consists of two sensors per lane that communicate detection information to an AP. If the sensors are outside of the communication range of the AP, then the use of a battery powered repeater is required. The repeater wirelessly re-transmits the communication from the sensor to the AP up to 1000’. The AP collects the detection information from up to 48 sensors and transmits the information to a central database (running Sensys Networks SNAPS software) via Ethernet over Copper as DDOT owns its copper plant.

Our initial project consisted of 122 count stations located throughout the District. An additional project consisting of 20 additional stations was added along key entry/exit routes of the District at the request and funding of the US Department of Homeland Security (DHS). These sta-
tions provide critical feedback for signal timing, understanding the impact of event generators as well as performance information along key evacuation routes. This project includes detection devices on roadways surrounding the “Mall”, like Constitution Avenue, which are part of the US Park Service.

Each of these stations provide count and speed information back to DDOT’s Traffic Management Center (TMC) at the Reeves Center via Ethernet over single unconditioned copper. This information is collected by SNAPS, Sensys Networks’ central software package. SNAPS collects and stores every detection event, enabling a wealth of data including count and speed reports. DDOT easily creates and sends the US Park Service automated reports on traffic performance on their roadways from SNAPS. A Congestion Map is a new feature developed on SNAPS for DDOT. Leveraging real time count and speed information, a map with color coded congestion levels is displayed at the DDOT TMC. The congestion levels are defined by DDOT based on the on the performance characteristic of each roadway segment. SNAPS provides a wealth of diagnostics and alerts, enabling DDOT to keep their system running at high levels by monitoring RF performance, sensor and repeater battery levels, system communications and other items. If any of these measurements operate outside user defined levels, an alert is created and the issue can be investigated and resolved.

Future deployments may utilize the new Grind Resistant Sensors. These sensors are specifically designed to be installed up to 5 inches below grade, minimizing the likelihood of the sensors being damaged by milling operations. The GR sensors are completely compatible with the systems currently deployed and will deliver the same performance.

In the near future, the count station data will feed into DDOT’s soon to be deployed central system and the data will be shared with neighboring agencies in the District, Maryland and Virginia. Sensys Networks systems are enabling DDOT to better manage their traffic infrastructure, increase the efficiency of their arterials, and more efficiently plan for the future.