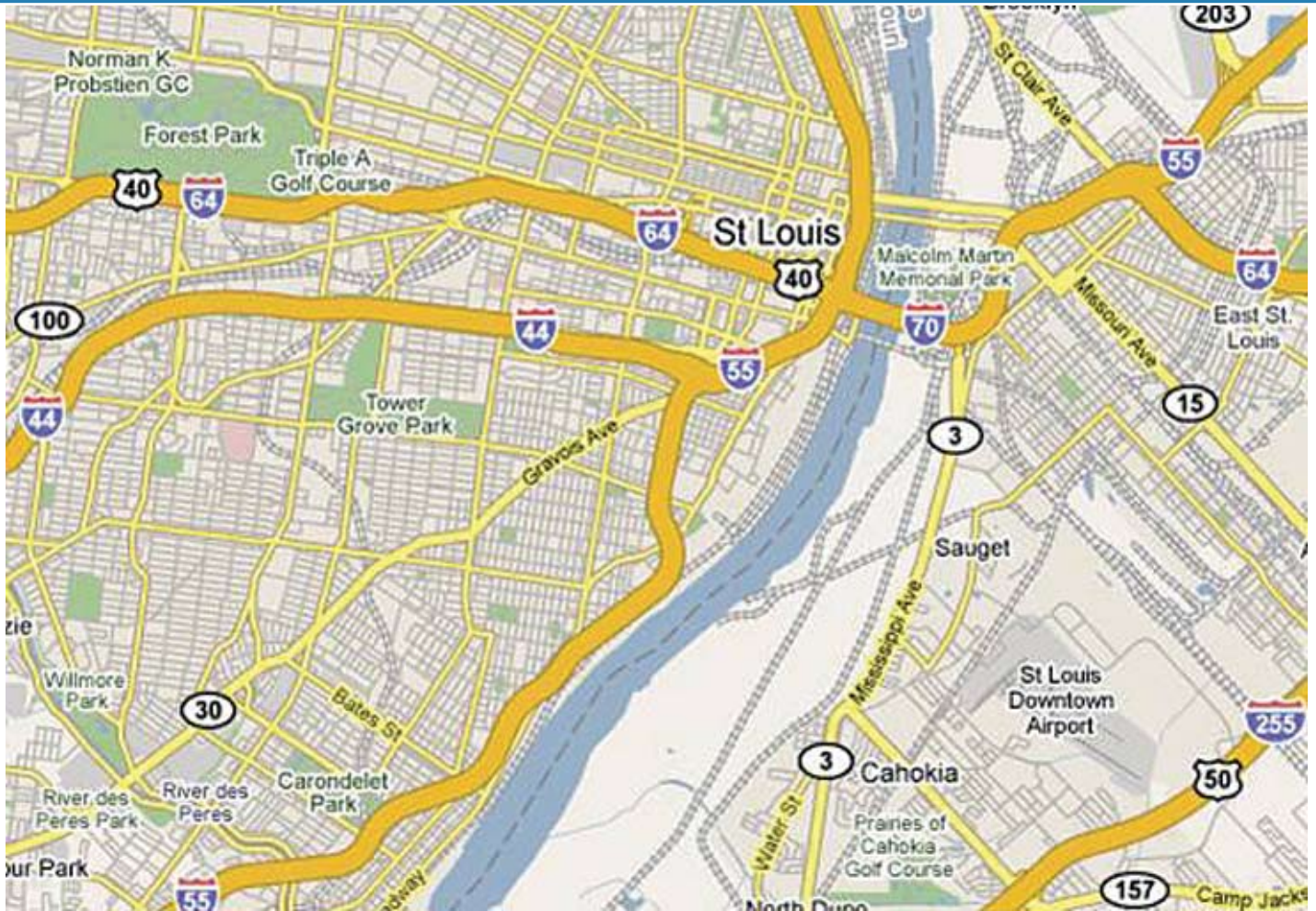




ST. LOUIS AVOIDS “APOCALYPSE” Using Sensys Networks Wireless Vehicle Detection System

By Mike Volling, Director of Product Management, Sensys Networks



“Apocalypse Now” was the lead headline in the Jan 2, 2008 St. Louis Post Dispatch Newspaper.

In 2006, the Missouri Department of Transportation (MoDOT) announced a major removal and rebuilding of 10 miles of MoDOT Hwy 40/I-64. While MoDOT Highway 40 is widely viewed as an interstate to the general public, it was not built to interstate standards when constructed during the 1930’s. In addition, half of the 30 bridges on the route were in such bad condition, that they would need to be shut down due to safety concerns. In an effort to complete the project as quickly as possible, MODOT determined that the best project path would be a complete shutdown of Hwy 40/I-64 during the construction period, lasting up to two years.

With the impending shutdown of Hwy 40/I-64, the City of St. Louis was facing an unprecedented transportation crisis.

All the vehicles using Hwy 40/I-64 had to go somewhere. As a result, 10 major arterials in the city were facing a huge surge of traffic flow, easily double the normal capacity, that the roads were not capable of handling in their current state. The city of St. Louis needed to dramatically increase traffic flow capacity on Skinker, Forest Park Parkway, Union Blvd., Hampton Ave., Chipewa, Jefferson, Grand Ave., Vandventer, Tucker, Truman Parkway and the Kings Highway north/south corridors. These arterials were running fixed time, using older controllers (a large percentage of them electro-mechanical) and had limited communication capabilities using old seven wire interconnect.

The Solution

With a little over one year to design and implement a solution, St. Louis needed to develop a game plan and implement it quickly with limited funding. The city knew that the plan had to include

upgrading these arterials to modern equipment, including detection, new controllers (Siemens M52) and fiber based Ethernet communications.

To optimize arterial flow, St. Louis decided that semi actuation on these corridors was required. Semi-Actuation has been proven by FHWA sponsored studies to provide as much as 38% reductions in delay over fixed time intersections.

Knowing that side street and left turn detection were needed to implement their solution, St. Louis quickly reviewed the detection options available to them. Key requirements included the need to minimize cable runs in the cities existing full conduits, which have been in use for over 60 years, and an economical solution for vehicle detection that could be quickly installed by city crews. As they were exploring their options, St. Louis

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was introduced to the Sensys Networks Wireless Vehicle Detection System by Brown Traffic Products.

The Technology

The Sensys Wireless Vehicle Detection System uses pavement-mounted magnetic sensors to detect the presence and movement of vehicles. The magneto-resistive sensors are wireless, transmitting their detection data in real-time via low-power radio technology to a nearby Sensys Access Point that then relays the data to the traffic controller. Each Sensys installation consists of:

- Sensys wireless sensors installed in or on the roadway at various locations as required by the particular vehicle detection application;
- a Sensys Access Point (AP) to receive the detection data from the sensors and process and communicate it upstream;
- one or more Sensys repeaters as may be needed to support sensors installed beyond the radio range of the Sensys access point; and
- Sensys contact closure cards which communicate the detection information to a roadside traffic controller.

In typical traffic control applications, a Sensys wireless sensor is placed in the middle of a traffic lane where it will detect the presence and passage of vehicles.

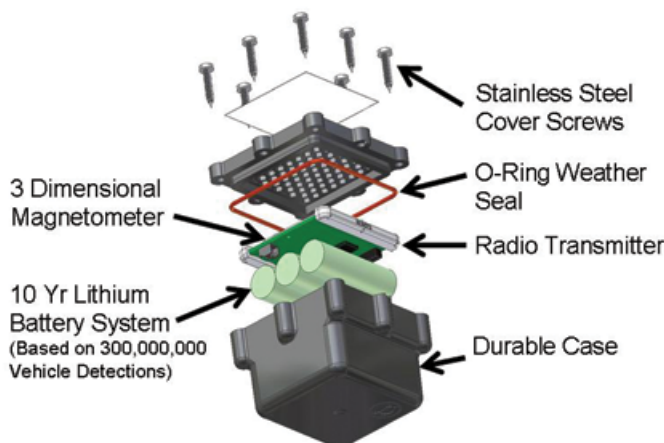
Each sensor is made of several key elements:

- Magneto Resistive sensors
- Ultra Low Power Radio
- Batteries to provide ten years of operating life

The state-of-the-art magneto-resistive sensing devices employed in each Sensys wireless sensor measure the x-, y-, and z-axis components of the Earth's magnetic field at a 128 Hz sampling rate. As vehicles come within range, changes in the x, y, or z axes of the measured magnetic field become apparent. When no vehicles are present, each sensor continually measures the background magnetic field to estimate a reference. Each sensor automatically self-calibrates to the specific installation site and to any long-term variations of the local magnetic field by allowing this reference value to change over time.

As vehicle detections are made, each Sensys wireless sensor employs low-power radio technology to send time-stamped detection event data to a nearby Sensys access point or repeater without any lead-in cabling or other wires. The radio communications between a Sensys wireless sensor and its communicating access point or repeater are two-way, allowing the sensor to receive commands and data as well as transmit data and status information. Each Sensys wireless sensor is uniquely addressable so its data can be independently collected and its operation independently controlled and monitored.

The sensors are powered by three lithium based batteries, which are rated for the extreme temperatures dictated by NEMA (-40F to +176F). The sensors will deliver an average of 10 years of life, in the presence of these extreme environmental conditions. This is based on vehicle volumes of 48,000 vehicles per day.



This diagram shows the internal components of the sensor.

With the AP mounted at 20 feet, the communication range from sensor to the AP is approximately 150 feet. Due to the various geometric design requirements, sensors may be located outside this range. When this occurs, the Sensys Repeater is used to extend the communication range of the system. The repeater is located within the RF envelop of the sensor (typically 150 feet with the repeater at 20 feet). The repeater then re-transmits the information back to the AP, up to

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a maximum distance of 1,000 feet. Up to two repeaters can be operated in tandem, either extending its operating range or allowing the system to work around any physical line of site issues. The repeater is battery powered, delivering 2 or more years of life. The battery is field replaceable.

The Contact Closure cards provide the detection information to the traffic controller. Each card is the equivalent of a 4 channel loop amplifier. Each card is compatible with 170/2070 and NEMA TS-1/TS2 controllers.

The Validation

After reviewing the Sensys Networks capabilities, St. Louis conducted an extensive trial at an intersection with both asphalt and concrete, steel in-deck, an underground DC light rail, and overhead power lines in mid 2006. St. Louis needed to verify that the system would work in all the environmental conditions with which it would be installed within. Despite these obstacles, the wireless detection system worked well and St. Louis proceeded with a large scale deployment.

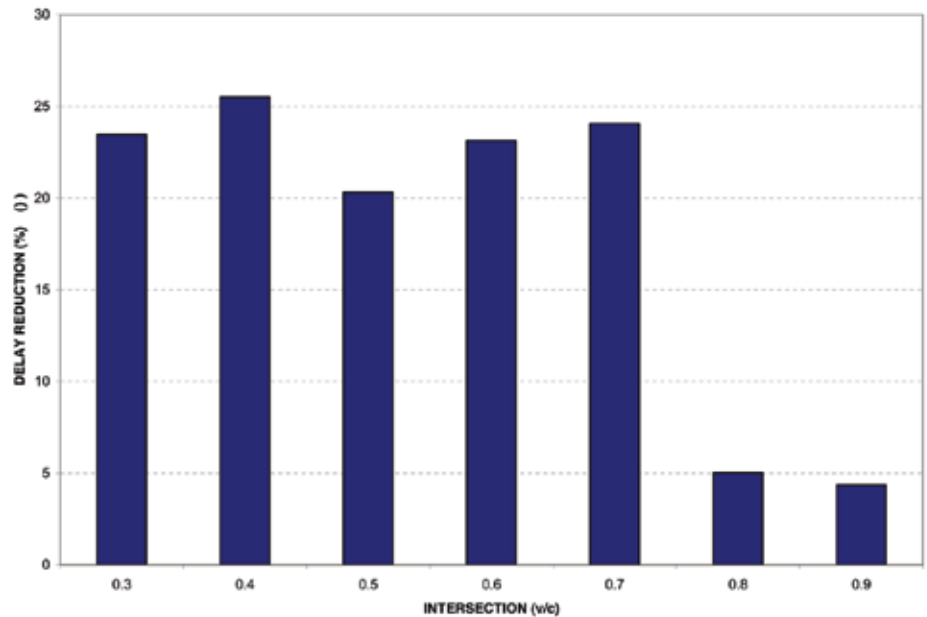
Implementation

A key requirement for the project was the ability to use city forces for the implementation. During the evaluation process, St. Louis devised a methodology which would allow them to quickly install a sensor. Using a skid steer, with an asphalt auger attached, they are able to install a sensor in less than 2 minutes. Combined with the fast curing time of the epoxy of 5 minutes, they are able to deploy sensors at a very high rate.

In a typical installation, St. Louis is using 2 sensors per lane, with a typical total of 12 to 16 sensors per intersection. Using their installation techniques, a city installation crew of 3 people typically installs 100 sensors per day. This allows the city to install sensors at over 7 intersections per day using their own installation crews.

System Detection

St. Louis enhanced semi-actuation on these corridors with data collection stations at over 25 locations. Utilizing the accurate system detection capabilities of the Sensys Networks system, they are continuously collecting traf-



This chart highlights the impact of Semi Actuation under various capacities.



Typical Wireless Vehicle Detection System installation.

event is stored on the server, St. Louis is able to see its traffic patterns in as great of detail as they want.

Another key feature of SNAPS is the ability to remotely manage the systems. Using SNAPS, St. Louis is able to connect to all of their detection systems from a central location. This enables them to verify operation and make any adjustments required from their offices.

“So Far, So Good”

Today, over 180 intersections are installed with the Sensys Wireless Vehicle Detection System for side street stop bar detection, mainline left turn detection and system counts. Wireless side street and mainline left turn detection enabled St. Louis to optimize the green time provided to the arterial corridors. City crews are able to install each in-ground sensor in less than three minutes. The cost is less than video or inductive loop solutions due to lower equipment investment, faster installation, and the elimination of replacing or restoring existing conduits.

Thanks to the Sensys Networks vehicle detection systems put in place by St. Louis, along with their other upgrades, the headline in the St. Louis Post Dispatch shortly after the massive freeway closure was “So Far, So Good!”

