

Caltrans EQASI Material Evaluation



Wavetronix XP-21 Radar Detection System

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Image of the sensor provided from the Wavetronix XP-21 Cutsheet

Introduction: The Wavetronix XP-21 radar detection system was presented to Caltrans as a single sensor detection system to be used at small intersections. A small intersection is defined in their documentation as 4 approaches with 3 lanes per approach. Per the data sheets the system has the following specifications:

“Uses radar to get the most accurate stop bar data for an entire intersection

Part of the Expanse system: connect it to an Expanse Arc and use the Expanse software to take advantage of all the great features of the system

Native IP device: put it on your network and use the software to interact with sensors on your system

Field-replaceable surge card means you can easily replace the surge protection in the field after a surge event

Employs Wavetronix’ industry-leading radar technology for the highest quality high-definition detection

The patented auto-configuration process makes setup a snap

Features a GPS receiver for georeferencing the sensor

All-weather, all-condition performance

Built-in heater prevents snow from blinding the sensor”

Deployment: The XP-21 unit as well as the associated ARC cabinet hardware was installed at the intersection of Folsom Blvd and 67th street in Sacramento, CA. An image of the installation is provided below:



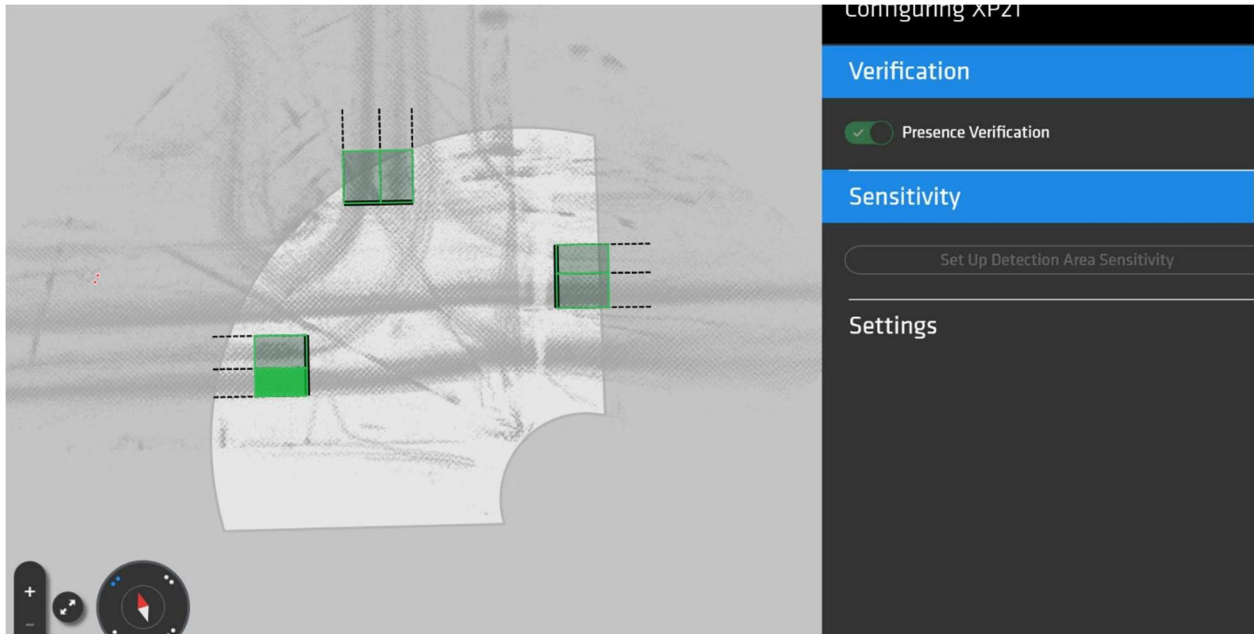
The unit was installed on the pole at the cabinet corner (NW) with field startup assistance provided by the manufacturer. The install time required was typical of single sensor solutions with no notable challenges compared to other detection systems. The unit utilizes the ARC cabinet interface model which is shared by other detection systems provided by Wavetronix and has previously been qualified when used with Type 1 and Type 2 Microwave Vehicle Detection Systems (MVDS). The AML link is included for convenience: <https://dot.ca.gov/programs/engineering-services/authorized-materials-lists>

The equipment was installed and operational for a period of 30 days, however the data collection used for accuracy compared to manual counts was done over a 1-day period in several 15-minute windows. Data was collected by visually documenting the traffic counts and comparing them live to the detection provided by the XP-21.

Initial Review: The initial review is based on the products advertised and tested features and functionality. They are listed in bulletized form below:

- The system provides full detection for small intersections based on a single installed unit which allows for easy installation
- The system utilizes the ARC hub unit which is standard to other products manufactured by Wavetronix
- The system was installed in a nominal 2-hour window at a standard location. The system uses a specialized connection into the ARC with 3 wire cable
- Field startup support was provided by the manufacturer to ensure proper mounting and functionality
- The unit does not store count data for vehicular traffic
- The unit does not provide pedestrian or bicycle detection

Functional Testing: The unit was tested at the intersection noted above to compare functionality and accuracy with manufacturer provided specifications and sections of the current Caltrans Microwave Radar Sensor (MRS) Statewide NSSP. Since the unit does not provide recorded count data, Engineers from the EQASI branch performed visual verification of actuations. The testing involved manually counting the number of actuations that should occur and comparing to the number of actuations that were created by the system in 15-minute periods. The count data provided below compare the number of actuations created by the system compared to the number of actuations that should have occurred. An overhead image of the intersection also is provided to define what lanes are being counted at each time frame:



Time of Day	Lane	Manual	XP 21	Difference (Absolute Error)	% Accuracy
1:10 PM - 1:25 PM	WB Through	146	139	7	95.20547945
11:20 AM - 11:35 AM	WB Left Turn	9	10	1	88.88888889
10:05 AM - 10:20 AM	EB Through	126	126	0	100
10:25 AM - 10:40 AM	EB Right Turn	3	3	0	100
10:47 AM - 11:02 AM	NB Right Turn	25	24	1	96
11:03 AM - 11:18 AM	NB Left Turn	6	5	1	83.33333333

It is important to note that in the 11:03 time frame and the 11:20 time frames the traffic volume is too low for these tests to be considered viable and are not to be considered when evaluating the accuracy of the system. The current requirement per the Caltrans statewide NSSP is as follows:

1. Detection in all defined zones with an accuracy as follows:
 - 1.1 95 percent for the average 5-minute volume for any 15-minute period.
 - 1.2 95 percent for the average 30-second speed for any 5-minute period.
 - 1.3 85 percent for the average 5-minute occupancy for any 15-minute period.
 - 1.4 90 percent for the vehicle count in any lane.

Based on these specifications, it was noted that with an adequate traffic volume the unit was accurate to above 95% which exceeds the most relevant specification callout (1.4) stating a 90% vehicle count accuracy in any lane. Future specifications for systems that do not record per-vehicle counts will need to provide language for evaluating a system with similar capabilities and features of the XP-21.

Summary: In summation, the XP-21 system by Wavetronix provided accuracy in calls produced that meet or exceed the current relevant specifications. EQASI recommends that the product provide a functionality to count and store actuations or calls to the controller as a means for verifying accuracy in the future. The system provides vehicle detection, but if pedestrian and vehicle counts or bicycle detection are required, additional sensors/detection systems will be required.