Maricopa County Regional Wireless Systems
AZTech White Paper

Wireless Systems Being Used in ITS in the Phoenix Metropolitan Area

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Communications is a key part to Intelligent Transportation Systems (ITS) and regional networking. While there are many forms of communications, agencies must choose an option that is cost effective and provides reliable service. The most common forms of network communication infrastructure are fiber, copper, and wireless. Each have their pros and cons, reliability rating, cost variations for construction and materials, and limitations on speed and distances. In the past, physical cable (copper and fiber) was the only feasible option for communications as wireless technology did not have the desired reliability or bandwidth. While fiber and copper are very reliable and provide higher bandwidth, they do come with high construction costs and in some situations, are not very practical. Wireless technology has drastically changed as have the possibilities of implementing wireless links in ITS. With more modern wireless technology, high bandwidth, reliability, and security can be achieved over vast distances that were never possible before. Agencies in the AZTech region are now designing and building ITS networks with wireless technology, or use wireless with existing fiber to make network hops or last mile links that were previously not possible.

This white paper reviews the status of wireless technology implemented in the region. The paper does not recommend a specific technology or product, but serves as a reference document for any agency interested in wireless technology.

1. Background

- There are approximately 3,000+ signalized intersections in the region.
- There are eleven jurisdictions with 50 or more signalized intersections (ADOT, Chandler, Gilbert, Glendale, MCDOT, Mesa, Phoenix, Peoria, Scottsdale, Surprise and Tempe).
- Ten jurisdictions currently have Traffic Management Centers (TMC) that maintain constant communications to their traffic signals.
- Many jurisdictions are using a hybrid communication system, utilizing fiber and wireless technology to integrate traffic signals with TMC systems.

2. Vision

The agencies in the region have a vision to expand communications between the Traffic Management Centers and the traffic signals through fiber and wireless communications technologies to achieve better signal operations and coordination. To achieve this vision the agencies would like to:

- Deploy a variety of wireless solutions in areas where direct fiber is not available.
- Leverage wireless solutions in a cost-effective manner, to deliver ITS solutions.

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Current Status

Wireless technologies are being implemented by several agencies in the region. Each has implemented a unique approach for their communication needs. The sections that follow describe each wireless communication approach for eleven of the AZTech agencies Arizona Department of Transportation, City of Chandler, Town of Gilbert, City of Glendale, Maricopa County Department of Transportation, City of Mesa, City of Peoria, City of Phoenix, City of Scottsdale, City of Surprise, and City of Tempe.

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	ADOT	Chandler	Gilbert	Glendale
Wireless Topologies	Point-to-Point Point-to-Multipoint	Point-to-Point	Point-to-Point Point-to-Multipoint	Point-to-Point Point-to-Multipoint Mesh
Wireless Manufacturers	GE MDS SD4 - 7 years Cambium, PTP6500 2 years Nokia 9500MPR - 2 years Ecomm - 4 years	Comnet, NWK1	Simrex DM 5.8G 6 years Encom CommPAK IP 5200 8 years	Skypilot HP, Procurve Ubiquiti
Plans to Expand	Yes	No	Yes	Yes
Installation Method	Contractor installed with funded projects and Agency staff for maintenance	Agency Staff	Agency Staff	Agency Staff
Cost of Installation and Device Replacement	Equipment = $5,000 - $10,000	Equipment = $1000	Unknown	$300
Security and Encryption	AES-WPA2 Do not enable Wi-Fi remote access	AES-WPA2 TKIP	802.11	WPA2
Frequencies	2.4 GHz 900 MHz 11GHz 23 GHz	5 GHz	5 GHz 900 MHz	5 GHz 2.4 GHz 900 MHz
Distance of Wireless	<1 mi 5 mi 5+ mi	1-5 mi	1-5 mi	<1 mi 1-5 mi
Use of VLANS	Yes	Yes	Yes	Yes
Applications used over Wireless	Signal State Data CCTV DMS Vehicle Detection ARID Backhaul	Signal State Data CCTV Vehicle Detection	Signal State Data CCTV Vehicle Detection ARID Backhaul	Signal State Data CCTV ARID
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	MCDOT	Mesa	Peoria	Phoenix
Wireless Topologies	Point-to-Point Point-to-Multipoint DSRC Broadcast	Point-to-Point Point-to-Multipoint WiFi access for ITS technicians	Point-to-Point	Point-to-Point Point-to-Multipoint Mesh
Wireless Manufacturers	Ubiquiti various 3-5 years Cambium PTP650 2 years Savari StreetWAVE R102 3-5 years	Ubiquiti various Mimosa GE, MDS (Mercury 900, 9810/SD9) Mikrotik	HP, Procurve, 10 years Ubiquiti, various, 5 years	Tropos, 5210/5320/7320, 10 years Ubiquiti
Plans to Expand	Yes	Yes	No	Yes
Installation Method	Contractor for project related agency staff for others	Project/contractor Agency Staff	Contractor Installed with projects	Project/contractor Agency Staff
Cost of Installation and Device Replacement	Equipment & Labor = $100 - $10,000	Equipment = $100-10,000	Equipment = $1500	Equipment = $5000
Security and Encryption	Proprietary Protocol	WPA2-PSK WPA2-EAP-TLS	AES-WPA2 Password Protected	Open WEP TKIP AES-CCM
Frequencies	5 GHz 2.4 GHz 5.9 GHz 4.9 – 6.25 GHz	5 GHz 4.9 GHz 2.4 GHz 900 MHz 24GHz (planned)	5 GHz 2.4 GHz	5 GHz 2.4 GHz
Distance of Wireless	<1 mi 1-5 mi	<1 mi 1-5 mi	<1 mi 1-5 mi	1-5 mi
Use of VLANS	Yes	Yes	Yes	Yes
Applications used over Wireless	Signal State Data CCTV DMS Vehicle Detection Connected Vehicle V2I Backhaul	Signal State Data CCTV DMS Vehicle Detection Interagency Sharing Backhaul VPN Tunnel for Transportation Irrigation Control ARID Retention Site CCTV/SCADA	Signal State Data CCTV Vehicle Detection ARID	Signal State Data CCTV DMS Vehicle Detection Backhaul ARID
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	Scottsdale	Surprise	Tempe
Wireless Topologies	Point-to-Point Point-to-Multipoint	Point-to-Point Point-to-Multipoint	Point-to-Point Point-to-Multipoint
Wireless Manufacturers	Firetide, 7200	Ubiquiti, various 5 years	Simrex Datamover WB-K49B-23-E2
Plans to Expand	Yes	Yes	Yes
Installation Method	Agency Staff	Contractor for Project Related Agency Staff for Others	Project/contractor Agency Staff
Cost of Installation and Device Replacement	Equipment = $7000-10000 8-10 Staff Hours	Equipment = $100-500	Equipment = $3000 - 3500
Security and Encryption	AES-WPA2 256 bit	AES-WPA2 Proprietary Protocol	802.11 AES-WPA2
Frequencies	5 GHz 2.4 GHz	5 GHz 2.4 GHz	4.9 GHz
Distance of Wireless	<1 mi	<1 mi 1-5 mi	<1 mi 1-5 mi
Use of VLANS	No	Yes	Yes
Applications used over Wireless	Signal State Data CCTV Vehicle Detection ARID	Signal State Data CCTV DMS Vehicle Detection ARID Backhaul	Signal State Data CCTV Vehicle Detection ARID EVP
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