



Freeway-Arterial Operations

AZTech™ White Paper

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Freeway traffic interchanges (TI's) dissect most municipalities in the Phoenix metro area, and channel large volumes of traffic to and from arterial streets. Coordination between the TI's and the arterial streets are critical to the safety and efficiency of the traveling public, both on and off the freeway, with progression being a major concern for arterial streets. Additionally, if an incident occurs on the freeway, or the arterial, control of the TI signal or the ramp meters becomes critical for proper and urgent traffic management.

1. Current Status

- As stated in previous White Papers, about nine agencies are currently operating traffic management centers in the valley. Only a handful actually control signal timing and manage traffic on a daily basis.
- Again, only a handful of municipalities are controlling signal timing at signalized traffic interchanges (TI's) on the freeways. Otherwise, the Arizona Department of Transportation (ADOT) controls the signal timing.
- Ramp metering is controlled by ADOT, including a new project to implement adaptive ramp metering.
- Some of the municipalities pay for traffic signal power and lighting at the TI's.
- There is successful sharing of conduit with ADOT and the local municipalities in order to have access to communication paths within ADOT right-of-way (R/W) and local R/W.

2. Issues Surrounding Freeway and Arterial Signal Timing

- “On to freeway” traffic is controlled by ADOT with ramp meters, and “Off freeway” traffic is controlled by traffic signals. What traffic has the priority? How does safety and efficiency go hand in hand?
- The driving public does not care who controls the traffic signals, they just want them synchronized.
- Who determines the priority control of traffic when it comes to congestion?
- Can congestion at TI's be resolved with better planning and geometric design?
- Can a study of recent capacity changes to existing TI's reveal new ways to design TI's in the future?
- Who is responsible for major changes to TI's if municipalities are controlling and maintaining signals and changes are justified?
- Length of time to create Intergovernmental Agreements (IGA's) between ADOT and local jurisdictions relating to maintenance and operations of TI's.
- What happens with an incident or special event that impacts the freeway or the arterial? Who controls the TI signals?



Freeway-Arterial Operations AZTech™ White Paper

- Do municipalities wish to control ramp meters and/or signal timing and maintenance?
- Not all municipalities have the resources to maintain TI signals or timing.
- Who develops the protocol if ADOT and Cities start using VMS's to post freeway or arterial traffic information?

Vision

The coordination of traffic signals and ramp meters at TI's are important not only on a signal progression standpoint, but also as traffic control for freeway ingress and egress. In a major urban area like the Phoenix area, the integration of Operational Centers and the coordination of TI's and arterials should be seamless and invisible to the driver.

Components:

The development and completion of the Center-to-Center (C2C) Communications will be a large step forward in accomplishing arterial/TI and ramp meter coordination and control. With the ability to control TI signals and ramp meters remotely, the Traffic Operations Center (ADOT) and Traffic Management Centers will have shared control, thus shared responsibility to provide seamless ramp and arterial traffic signal control.

It is important that municipalities learn and understand the operational aspects of ramp meters. The consequences of backing traffic on to the freeway due to signal timing has the same, or sometimes worse safety effects than poor signal progression or directional timing.

A key aspect of TI control could be automatic, or traffic adaptive signal timing and ramp metering. Of all the locations where traffic adaptive control could be implemented, the TI's provide the best scenario. The City of Tempe has experience with traffic adaptive control around the US60 and Rural Road. ADOT is currently implementing/testing adaptive ramp meters on I-10 from Broadway Road to Ray Road, which includes the installation of 2070 controllers in existing cabinets with remote control from the i2 software, and a University of Arizona (U of A) MILOS demonstration project of adaptive ramp control.

The results of past traffic adaptive projects have proven that in order for them to be successful, the traffic detection infrastructure has to be extensive and in good operating condition. There are new products coming to the market in the next few months that may make adaptive control a reality, at a reduced cost. UC Berkley engineers have developed wireless loop detectors and have the ability to connect up to 12 wireless detectors to one controller with a single radio receiver. Currently, they have tested and installed count detection and collection stations that are accessible via cell phone or direct connections. Controller interface equipment is being developed to eliminate hardwire connections that are now being tested for intersection presences detectors, similar to a 222 card. This equipment should be ready in June 2006.



Freeway-Arterial Operations AZTech™ White Paper

A sub-committee of the AZTech™ Operations Committee could be formed to develop standard operating procedures for both normal and emergency TI signal timing and ramp meter timing. The lessons learned from this committee should be shared with the AZTech™ partners. Many local jurisdictions do not have the experience of timing diamond or single-point urban interchanges (SPUI's) with or without frontage roads. For those communities that are contemplating controlling TI signal timing and maintenance, the lessons learned would be valuable in helping make the decision whether to request TI control or not.

With the completion of C2C elements, physical connectivity to TI's would no longer be required by the municipality, as long as the TI signal were part of the Freeway Management System (FMS) signal control system.

Benefits:

- Improved progression of arterial streets
- Improved control of traffic onto, and off of the freeways
- Coordination of daily and emergency traffic control
- Real-time Event Traffic Management
- Improved understanding of signal timing between ADOT and local jurisdictions
- Faster response to incidents and accidents
- Reduction of delay to motorist
- Improved safety to motorist