Technical Memorandum

SOUTHERN CALIFORNIA REGIONAL ITS ARCHITECTURE
2011 UPDATE

Non-Motorized ITS Elements

Prepared for:

SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS

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1. INTRODUCTION

The Southern California Regional ITS Architecture leverages long standing investments in Intelligent Transportation Systems (ITS) by fostering coordination and cooperation among public agency stakeholders. A Regional ITS Architecture provides a framework for ITS planning that promotes interoperability and communication across jurisdictional boundaries. Projects developed under a regional framework extend the usefulness of any single project by making information easily accessible for operators and users of the system.

In Southern California, there are several ITS architectures that may be applicable to an ITS project, depending on how far reaching the project is. Each County has developed a Regional ITS Architecture. In addition, as the Metropolitan Planning Organization (MPO), SCAG has developed a Southern California Regional ITS Architecture that addresses multi-county issues: those projects, programs, and services that require connectivity across county boundaries or are deployed at a multi-county level. A third "layer" is also in place at the state level: the California ITS Architecture and System Plan addresses those services that are rolled out or managed at a state level or are interregional in nature. Project sponsors are responsible for ensuring that their projects maintain consistency with the regional architectures, regardless of which architecture applies, as a requirement for federally funded projects.

In the time between 2005, when the Southern California Regional ITS Architecture was developed, and 2011, as it is being updated, there have been several changes. The National ITS Architecture has been updated to reflect new user services, Southern California has continued as a national leader in ITS deployment with extensive ITS investments, and new technology applications have emerged. The 2011 update to the Southern California Regional ITS Architecture will reflect changes since 2005 and position the architecture to guide future ITS deployments as new technologies emerge. Topics covered in this 2011 update include express lanes, Positive Train Control, technologies in support of non-motorized transport, and goods movement in addition to the updates for other cross-county services such as to address traveler information, regional data exchange and archiving of regional data. Additionally, recommendations are made to subregional (county-level) ITS Architecture champions for their consideration in the event that changes are desired to be made at the county level for the associated topic.

1.1 Purpose

In the SCAG region, the vast majority of commuters drive alone, with single occupancy vehicle (SOV) trips accounting for nearly 75% of all work trips. The mode share for other travel alternatives to work includes 5% of trips by transit and 4.2% of trips by walking and bicycling[1]. Though the vast majority of population commutes by SOV, supporting alternative modes is important part of the regional strategy to reduce congestion and promote sustainability. To advance those efforts, SCAG and its partners are working together on implementing policies, programs and projects to develop an integrated transportation system that accommodates all modes of travel.

Recent state legislation dealing with climate change and sustainability issues point to the importance of non-motorized transportation as part of the solution to long term challenges to the environment. Assembly Bill 1358 (AB 1358), The Completes Streets Act, requires counties and cities that make substantial changes to the circulation elements in the general plan to plan for complete streets. The concept of complete streets is focused on a balanced, roadway system that accommodates the needs of all users including bicyclists, children, persons with disabilities, etc. alongside that of motorists. Senate Bill 375 (SB375) requires SCAG and the other MPOs in the state to include a Sustainable Communities Strategy (SCS) in the RTP. The SCS will explain how

[1] SCAG, "Regional Pocket Guide, 2008. "Other" excludes Drive Alone, Carpool, Transit and Work at Home.

the region's land use decisions and transportation improvements will contribute to the meeting of green house gas emission targets. Though the effects of SB375 on bicycles and pedestrians are not as prescribed as AB 1358, the policy will have far reaching implications that will require local agencies to consider those among the alternative modes of transportation needed to balance future development and growth.

Currently, non-motorized transportation is supported by land use decisions that promote bike and pedestrian friendly development and facilities that provide pathways and trails for bicycle and pedestrian users. Cities and county transportation agencies in the SCAG region have planned and built a regional bicycle transportation network. The networks consist of off road (Class I) and on-road (Class II and Class III) facilities that interface with transit routes and pedestrian activity centers. Several counties in the SCAG region maintain a non-motorized transportation plan to designate locations for existing and planned bikeway, bike facility improvements and policies to accommodate the needs of cyclists and pedestrians.

This technical memorandum provides an overview of ITS elements to be considered for non-motorized transportation. Since most bicycle and pedestrian projects are locally implemented, the focus of the ITS architecture update will focus on opportunities to integrate ITS projects at the subregional (countywide) architecture level.

1.2 Projects that Support Non-Motorized Transportation

A number of projects, policies and strategic initiatives have been implemented that support non-motorized transportation in the region. These policies may have different objectives for promoting walking or bicycling – as a transportation alternative to reduce congestion, improve public health, combat global warming, or simply recreation. Projects that feature technology include:

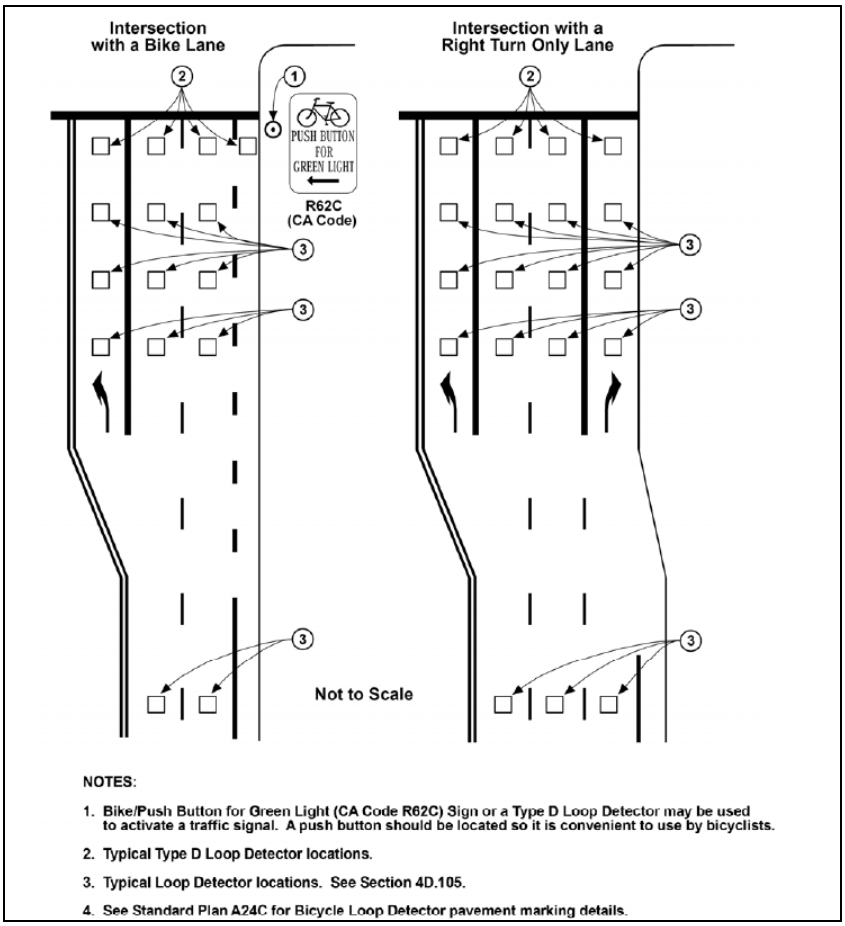
- LA Metro has received a planning grant from Caltrans to develop a Bicycle Data Clearinghouse to measure and report bicycle usage in Los Angeles County.
- Closed circuit television (CCTV) cameras have been installed in the parking level of Union Station for security surveillance at bike racks and lockers.
- The two regional 511 traveler information systems – Go511 and Inland Empire 511 have information resources for bicyclists.
- SCAG has developed a "Bike-Ped Wiki" to gather public input for the non-motorized section of the 2012 Regional Transportation Plan (RTP).
- Assembly Bill 1581 requires bicycle detection at all new and replaced signals. This will take affect once Caltrans adopts standards and specifications and guidelines for detection and timing.

2. TECHNOLOGIES FOR NON-MOTORIZED TRANSPORTATION

The section discusses several emerging technologies supportive of non-motorized transportation.

2.1 Bicycle Detection

Signalized intersections equipped with inductive loops and video detection systems can detect bicycles and actuate signals. These technologies reduce wait times for bicycles and enhance safety. Standard inductive loop detectors installed in the pavement can detect bicycles, depending on the positioning of the bicycle wheels over the magnetic field of the loop. The Type D loop configuration in Caltran's Standard Plan ES5B is effective for detecting narrow body vehicles such as bicycles and motorcycles. Some cities include a Bicycle Detector Symbol marking (Caltrans, Standard Plan A24C) on the pavement to direct bicycles to the right location to trigger the detector.



Source: MUTCD 2003, California Supplement.

Figure 1 – Standard Plan for Bicycle Detection Systems

A primary alternative to inductive loops are vehicle detection systems that use cameras with image processing capabilities to detect vehicle presence at an intersection approach. Detection is triggered when the vehicle enters an image zone defined in the camera's software. Vehicle detection systems are easier to install and maintain than inductive loop systems, and offer flexibility in defining detection zones.

Some signalized intersections are equipped with bicycle push buttons that function in a similar manner to pedestrian push buttons that trigger a crossing phase. The push button is located near the sidewalk edge for easier access for bicycles. An intersection could also be equipped with a bicycle signal head that are similar to a standard traffic signal head, except that a bicycle icon is shown to alert bicycles when bicycles are detected or bicycle push buttons activated, providing an exclusive signal phasing for bicycles. Bicycle signal heads have been in use in the City of Davis for several years and approved for use statewide after the California Vehicle Code was amended.

2.1 Online Trip Planners

Transportation agencies are providing public access to their transportation data enabling third parties to develop custom map applications, or "mashups". The data feeds include transit facilities, routes, fare structures and schedules that developers use to build trip planning applications. The trip itinerary results can be displayed on a map using one of the mapping APIs available for free distribution. Users can access these applications hosted on the agency web site or through personal web sites and blogs. The Google Maps web site can generate a trip itinerary based on travel exclusively by bike or walking or in combination with transit.

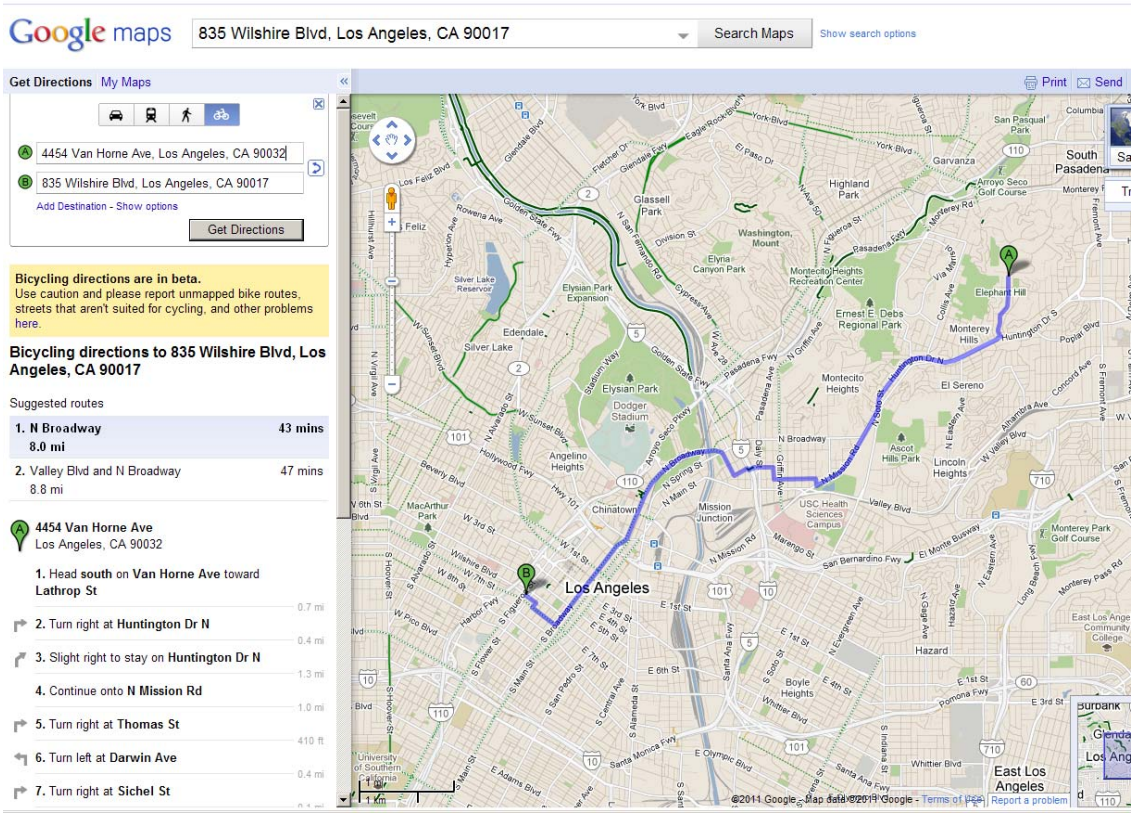


Figure 2 – Google Maps Bicycling Directions

2.1 Pedestrian Countdown Signals

A pedestrian countdown signal consists of a standard pedestrian signal with an added countdown display of the remaining crossing time. The countdown display can appear at the onset of the WALK or the DON'T WALK display. The countdown displays can act as a safety measure to provide information to pedestrians on how much time is left to cross the street at an intersection.

For people with disabilities or senior citizens, the displays can reduce the number of pedestrians that could be stranded if the intersection crossing is too wide.

2.2 Passive Pedestrian Sensors

Passive pedestrian sensors do not require pedestrians to push a button to activate the crosswalk signal. A number of commercial products are available that use microwave, infrared or weight detecting technology to sense pedestrian activity. Even when pedestrians do not use the call buttons to activate crosswalk signals, the passive sensors ensure that pedestrians are detected at the intersection at all times. Passive pedestrian sensors can also be utilized for data collection applications to measure pedestrian volumes at crosswalks.

Passive pedestrian sensors are deployed at select locations throughout the U.S. to evaluate the accuracy and reliability of the technology. The safety effectiveness remains unknown with a limited deployment. The high cost of installing passive pedestrian sensors compared to button activated detection and the lack of a leading technology may hinder the use of this technology in the short-term.

2.3 High-Intensity Activated Crosswalk (HAWK)

A High-Intensity Activated Crosswalk (HAWK) is a traffic signal that stops road traffic and allows pedestrians to cross. A typical HAWK beacon has a signal head consisting of two red lenses mounted above a single yellow lens. A pedestrian crossing would have two of the HAWK beacons mounted on a mast arm that are activated only when a pedestrian push button or passive sensor is activated. The lights on the beacon will first flash yellow, and then become a steady red signal telling vehicles to stop and yield to pedestrians. When all traffic has stopped for the steady red signals, pedestrian signals display a WALK indication until the time to cross is complete. A **Figure 3** shows an example of a HAWK beacon installation.

Source: Federal Highway Administration (FHWA).

Figure 3 – HAWK Signal

2.4 Telematics

Telematics refers to the use of ITS to send, receive and store information on the movement of vehicles. Sensors and telecommunication devices in the vehicle can collect and transmit speed, velocity and location measurements. Current telematic applications provide navigation and motorist assistance over wireless communications. Future application of telematics includes collision avoidance systems that could detect pedestrians and bicycles to alert drivers. Devices on the pedestrian or bicycle, i.e. a cell phone could communicate with systems on the vehicle, that in a matter of seconds, determine the probability of a collision. Similar technology with vehicle processors is currently used in air bag deployment systems, which make decisions based on speed and velocity measurements to determine the severity of an impending collision.

3. USER SERVICES FOR NON-MOTORIZED TRANSPORTATION

User services and market packages, standard terms defined by the National ITS Architecture, are intended to be comprehensive lists of the potential ITS applications or solutions to transportation problems. Each user service or market package is generic in nature (for example the user service "Pre-trip Travel Information" is a generic description of a traveler information service provided to travelers prior to their trips such as web-based applications). They are intended to be used as a starting point for ITS planning to ensure that all potential solutions are considered. In some regional ITS architecture developments, stakeholders develop solutions that are not addressed by the available lists of user services and market packages, in which case a custom definition would be developed.

The National ITS Architecture does not recognize any user service specific to non-motorized transportation. A customized market package was developed, using the Canadian National ITS Architecture as a reference. The Canadian National ITS Architecture has two market packages that address non-motorized user services:

ATMS103 – Standard Mixed Use Warning Systems: This service package supports the near term sensing and warning systems used to interact with pedestrians, bicyclists, and other vehicles that operate on the main vehicle roadways, or on pathways which intersect the main vehicle roadways.

ATMS103 – Advanced Mixed Use Warning Systems: This service package supports more advanced systems of sensing and warning for pedestrians, bicyclists and other vehicles that operate on the main vehicle roadways, or on pathways which intersect the main vehicle roadways. Specifically, advanced imaging sensors are anticipated to provide improved sensing and recognition capabilities, which would allow automated warning or active protection systems for this class of users.

The customized market package developed for the Southern California Regional ITS Architecture combines elements of market packages ATMS103 and ATMS104 in the Canadian ITS Architecture. **Figure 4** is a customized market package diagram showing the information flows between standard arterial control systems and road side equipment that detect and sense bicycles and pedestrians.

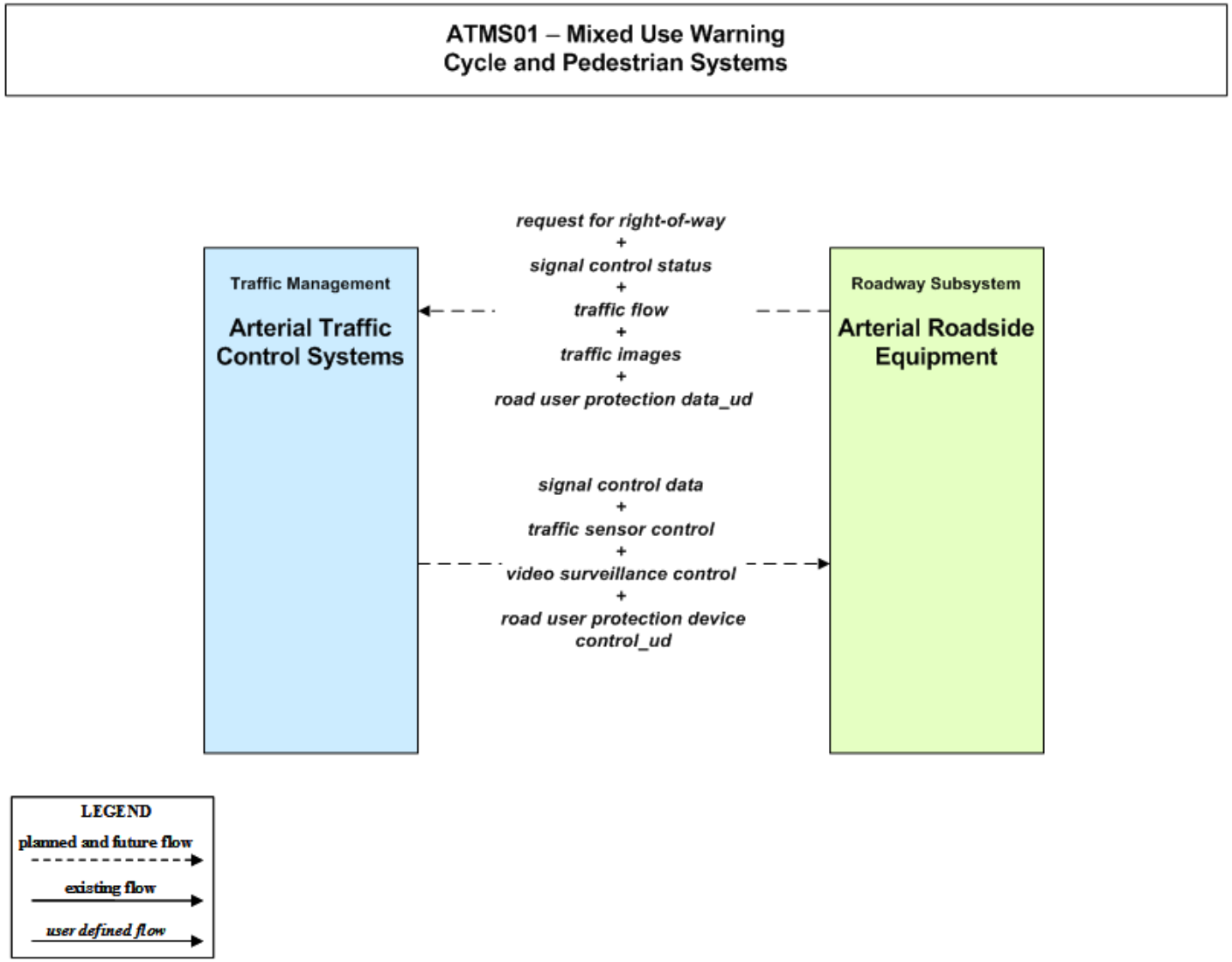


Figure 4 – Mixed Use Warning Systems

4. ITS STANDARDS

The Southern California Regional ITS Architecture provides recommended current, relevant standards for each information exchange between ITS projects. Their use is not mandatory. However, in some instances, there may be funding requirements or regional policies that mandate project-specific standards such as for real-time transit information.

Table 1 identifies the ITS standards to support detection systems for non-motorized users based upon the identified interfaces and information flows.

Table 1 – Applicable ITS Standards for Non-Motorized Detection

SDO	Document ID	Standard Title	Standard Type
AASHTO/ITE/NEMA	NTCIP 1201	Global Object Definitions	Message/Data
AASHTO/ITE/NEMA	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller (ASC) Units	Message/Data
AASHTO/ITE/NEMA	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control	Message/Data
AASHTO/ITE/NEMA	NTCIP 1208	Object Definitions for Closed Circuit Television (CCTV) Switching	Message/Data
AASHTO/ITE/NEMA	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems (TSS)	Message/Data
AASHTO/ITE/NEMA	NTCIP 1210	Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters	Message/Data
AASHTO/ITE/NEMA	NTCIP 1211	Object Definitions for Signal Control and Prioritization (SCP)	Message/Data
AASHTO/ITE/NEMA	NTCIP 1214	Object Definitions for Conflict Monitor Units (CMU)	Message/Data
AASHTO/ITE/NEMA	NTCIP C2F	NTCIP Center-to-Field Standards Group	Group

5. RECOMMENDED ARCHITECTURE UPDATES

Projects and emerging technologies provide opportunities for integrating non-motorized ITS elements with traditional ITS projects. Since pedestrian and bicycle projects are locally deployed, the updates to the ITS architecture should be carried out at the subregional/county level. The following are recommendations that subregional architecture owners can consider in an update to include non-motorized architecture elements:

- Include a new market package for non-motorized services. The roadway and traffic management subsystems should include the presence of bicycles and pedestrian in a multi-modal transportation system. Pedestrian sensors and bicycle detection should be included in equipment packages for monitoring traffic conditions and surveillance. The data flows in the traffic management subsystem should include the detection of non-motorized users for signal control and data collection.
- Update market packages for traveler information services to support multi-modal trip information dissemination. Information flows and request should include the integration of bicycle and pedestrian trip planners in regional 511 web site and phone services; and
- In the conjunction with updates to the National ITS Architecture, develop an in-vehicle telematics module to support two-way communications between the vehicle, other vehicles on the road, infrastructure and bicycle and pedestrian users. Incorporate detection of bicycles and pedestrians into the vehicle warning and safety monitoring equipment packages.