Bicycle Detection and Differentiation

By Scott Robinson, Econolite Product Manager

Bicycle commuting continues to see steady U.S. growth. In many urban environments, some cities have seen ridership rates more than double. According to a survey conducted by CityLab, which surveyed 55 major metropolitan areas in the U.S., bicycle commuting overall has increased an average of 70 percent in the U.S. between 2000 and 2009 — with some regions in the Northwest and Northeast seeing increases by more than 200 percent. The factors that influence this trend vary greatly from people who are environment and health conscious to those who are tired of high fuel costs. There are also the commuters wanting to avoid congestion and parking woes. Regardless, bicycling is an increasingly popular mode of urban transportation. So much so, that there has been a corresponding rise in bicycle infrastructure deployed in many cities — from ride sharing programs to complete multi-modal traffic management that includes bicycle and pedestrian traffic control. In 2007, California Legislature introduced AB 1581. Now a law, it went into effect January 1, 2008 and stated bicyclists and motorcyclists are legitimate users of roadways in California. It requires all new and replaced traffic signals to detect bicycle or motorcycle traffic according to the newest Manual on Uniform Traffic Control Devices (MUTCD). Many cities across the U.S. are adopting similar multi-modal policies.

One of the critical components to the future of mobility and safety as cited at the 2007 Motorcycle Travel Symposium, which was sponsored by the NHTSA and the Federal Highway Administration (FHWA), was the transportation infrastructure’s inability to accurately detect and count two- and three-wheeled vehicles. As a result, accurately identifying the presence of cyclists in all lanes of travel at a signalized intersection continues to be a challenge for transportation professionals. For many years, cyclists at each signalized intersection needed to hop the curb and press a pedestrian push button to request a call to cross — not exactly ideal for enhancing mobility or safety.

The Importance of Bicycle Detection and Differentiation

One of the biggest challenges for bicycle traffic control is intersection management. While vehicle traffic safety has steadily increased over the decades, particularly intersection safety, bicycle traffic disproportionately represents a high percentage of crashes and fatalities compared to the percentage of trips made — the statistics are even more alarming when compared to miles traveled. To better protect cyclists, many cities established designated bike lanes and deployed various methods of detection solutions to passively detect the presence of the bike and its rider. In other words, no action required by the rider to initiate a call for a green light. Bike lanes or bike stencils are also ways to ensure bicycle detection outputs to a traffic controller for Bike Min-Green operations. The objective is to provide sufficient time for the cyclist to safely cross the intersection while maintaining optimal timing when bicyclists are not present.

Since the introduction of AutoScope® video detection in the early 1990s, numerous installations with a bicycle detection objective have

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been successfully deployed and are currently in use. This breakthrough detection capability complements Section 217 of Title 23 of the U.S. Code that requires integration of bicycling and walking into the transportation system. Moreover, in 1991, U.S. Congress passed the Intermodal Surface Transportation Efficiency Act (ISTEA) that recognizes the growing importance of bicycling and walking in a balanced multi-modal transportation system by making funding available to create bicycle-friendly communities. As a result, more transportation agencies have implemented new or improved bicycle paths and traffic control systems to address the growing number of cyclists on public roadways.

Although California AB1581 does not require the detection solution to differentiate between bicycles and motorized vehicles, in order to comply with the law, the solution would have to differentiate a bicycle from a motorized vehicle traveling in the same lane of traffic to initiate a Bike-Min Green in the traffic controller.

This raises the traffic control bar as it relates to bicycle detection. Simply detecting a bicycle is no longer sufficient. Bicycles, like motorcycles, present their own detection challenges — they are small in size and profile relative to cars and trucks and they are increasingly made with fewer components older sensors can detect. Today’s detection solution must provide bicycle differentiation (not just detect presence) capabilities.

**Guidelines for Bicycle Differentiation**

The following represents a few guidelines for accurately detecting and differentiating bicycles at signalized intersections:

1. Primary detection objectives change to include bicycles. A solution that can achieve multiple detection objectives is desirable. Common intersection applications often require presence detection, bike differentiation as well as traffic data collection.

2. If using video detection, aim the camera following general guidelines and principals as recommended by the manufacturer. Calibration, aim, and proper deployment of the sunshield are vital to optimal performance.

3. Many agencies provide visual indicators for where a bicycle or motorcycle should stop for detection. Many detection solutions permit fine-tune adjustments to the sensitivity of the detectors for optimal performance.

4. Many states require that bicycles traveling at night use headlights and taillights. Sufficient roadway lighting, however, is imperative for cyclist safety. Quality lighting at intersections is recommended regardless of the detection solution chosen.

With careful consideration and planning, bicycle detection/differentiation requires no special considerations than would apply to other vehicular traffic:

- No special pavement markings necessary.
- Detection of bicycles in all lanes — no special areas marked/designated for bicycles, in order to be detected.
- Detection of metallic and non-metallic bicycles is equally accurate, negating impractical modifications of lighter bicycle wheels in order to be detected by inductive loops.
- Collection of bicycle data is easily configured.

**Solution Options**

**Video Detection**

Most video solutions detect bicycles and support multi-modal transportation and traffic management programs. A single sensor can provide complete lane-by-lane coverage of an entire approach. The key is software that provides bicycle differentiation in support of bicycle minimum green programming (Bike-Min) that is becoming more a part of, and even specified, in many traffic signal programs. It is the software that leverages the Bike-Min programming feature in many modern traffic signal controllers.

With regard to Autoscope, bicycle differentiation is a software feature that detects the presence of bicycles and distinguishes them from other types of vehicles (cars, trucks, etc.). This software feature is an option that is also backward compatible to previous genera-
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tion Autoscope Stop Line Detector (SLD) and Type 9 Detector Function group of Autoscope Presence Detectors. The area enclosed by the SLD or by the Presence “zone” is the active area for the bicycle differentiation output state. When enabled, the bicycle differentiation output state operates at the same time as the any-vehicle-detection output state.

Autoscope can combine vehicle and bike detection together and provide the appropriate additional timings with no change to the traffic controller or cabinet wiring. In addition, this capability provides additional detector strategies and traffic control operations to a cabinet with few detector inputs to the controller.

The technician can simply draw the Autoscope detector layout to combine the bike detection with the vehicle detection within the Detector Editor or Configuration Wizard of the setup. Enable bicycle differentiation for each lane in the Detector Editor. Then the technician can assign bicycle differentiation logical outputs. Now, the Autoscope processor can time a Bike Min-Green or a bike extension as appropriate to the intersection.

Agencies can also leverage video sensors’ multi-objective and multitasking capabilities. Video detection sensors can be used for advance detection, video surveillance, and traffic data collection.

Radar Detection

Similiar to video sensors, a radar sensor provides lane-by-lane detection for an entire approach. Radar uses microwaves to detect a vehicle, and often provides enough detection precision to classify a vehicle — if it has two, four or more wheels. Because of this classification capability, radar detection also supports Bike-Min programming.

In addition, a single radar sensor can also provide vehicle-tracking data, including traffic volume and speed.

In-Ground Radar Detection

These sensors are often wireless and compact. This means a single sensor can be installed in the ground in minutes with minimal construction in a dedicated bicycle approach. This provides agencies the flexibility to enhance existing detection strategies and quickly include bicycle differentiation in support of Bike-Min programming. For added capabilities such as volume, tracking and even parking detection, it only requires installing additional sensors along the dedicated bicycle approach or parking area.

Conclusion

With the number of public agencies implementing mandates and programs to promote cycling, it is easy to predict that the volume of bicyclists on our roadways will continue to grow. This is good news! Riding a bicycle for recreation or commuting is just one of the many ways to improve air quality, mitigate traffic congestion, and to adopt a healthier lifestyle. Safety must remain a priority. For traffic management professionals, there are a number of quality bicycle detection and differentiation products designed to meet the requirements of these multi-modal mandates while helping to optimize intersection timing and enhancing roadway safety.