Overview

The complexity of the roadway environment is continually increasing. A mix of large and small vehicles, motorcycles, scooters, bicycles and pedestrians all use the same infrastructure and physical roadway space. The interaction of these differing modes of transportation creates a high level of risk for crashes and potential fatalities. Human powered transportation (HPT) modes, primarily cyclists and pedestrians, are at greatest risk as they have the least protection in this environment. The utilization of these HPT modes is on the increase as the traveling public is making choices to be more environmentally friendly and more cost conscious.

Of particular interest in this investigation are the risks experienced by cyclists. A cyclist presents a unique transportation mode as they are both unprotected in the environment and have a widely varying travel speed. As an example, a cyclist can travel upwards of 50 MPH on a downhill while the same cyclist may travel at less than 10 MPH when climbing a hill. This speed variation provides a critical issue for a driver. Perception of the speed of an approaching cyclist is difficult, and as a result vehicles may take an action around a cyclist which will create an unsafe condition. An assessment of the behavior and risks associated with cycling are those which result from the behavior of drivers in the presence of a cyclist. When bicycles are on the roadway, drivers may be confronted with decisions that might lead to risky behavior both for the driver and the cyclist. Giving space around a cyclist, passing at low visibility locations, and turning in the presence of cyclist are all examples of behaviors that create potential conflict.

This better understanding of how HPT should integrate with more conventional modes of transport will provide the basis to develop improved transportation policies, better infrastructure, and multi-media educational materials.

Objectives

The primary objectives of this research are to use naturalistic study of bicyclists and survey-based data to provide a clearer understanding of how those using HPT interact with other modes of transportation; how they operate within the existing infrastructure; their impact on the environment, including minimizing greenhouse gas production and resource usage; and, ultimately, how to best integrate HPT into the overall transportation system.

Methods

Naturalistic Observation

Extensive work performed by VTTI and others has demonstrated that naturalistic study is invaluable when determining the causes of events of interest as well as contributory factors. Using millions of driving miles of continuously recorded data, including video, VTTI has shown that anecdotal evidence such as participants’ and witnesses’ recollections of events and evaluative methods such as crash reconstruction are often inadequate or, worse, misleading when characterizing events and their causes.

Data Acquisition

Data acquisition technology has evolved to the point where the activities of willing participants going about their daily lives may be recorded unobtrusively, retrieved seamlessly, and analyzed efficiently by researchers seeking to gain insight into the causal factors of conflict and the answers to other questions of interest. Highly capable data acquisition systems (DAS) that formerly filled the trunk of a car are now being used for motorcycle safety studies and can be made sufficiently small and energy-efficient for use on bicycles or persons. One such system, the VTTI MiniDAS, measures only 4” x 5” x 1”, collects continuous or event-based data, provides two channels of high quality video, and can perform advanced machine vision
analyses in real time using two high-speed digital signal processors. The proposed DAS would be powered by a battery pack combined with a data storage module that mounts readily on a (bicycle) water bottle cage and would be removed and replaced by the participant for charging and data uploading.

**Methodology**

Video and parametric data would be collected from instrumentation installed on bicycles, perhaps at several locations within the US and preferably in a region with a wide variety of riding conditions (e.g.; urban, rural, multi-modal). Parametric data collected from naturalistic installations would likely include: GPS time, location, speed, and direction; straight-line and angular acceleration; the proximity of nearby objects; and participant input. An incident button installed with the instrumentation allows participants to place flags in the data to signify events they think may be of interest to researchers. Audio, such as a rider's verbal comments could also be recorded.

A parallel data collection track could be undertaken using a web-based survey and reporting interface or thorough focus groups. Participants in the naturalistic study and others would report issues relevant to the study such as route changes, events of interest, infrastructure problems, vehicle use, etc. Involvement in this track would not necessarily be limited to those otherwise involved in the study.

The data collection would preferably be undertaken for a period of one year to allow for seasonal variance. Epochs of conventional riding as well as risky behavior both by the cyclist and drivers will be analyzed. Risk ratios for the riding behavior will be developed to establish the rider risk. The risks, the interaction of vehicle and cyclist as well as the impact of the cycling on the environment will be considered.

**Current Status**

VTTI has teamed with the Monash University Accident Research Centre on a proposal to the Australian Research Council to employ naturalistic and epidemiological methods for a study of bicyclists in Melbourne, Australia.

**Expected Results**

This work will provide new and objective data about how cyclists interact with other traffic and their surroundings, including, but not limited to: conflict causation; infrastructure utilization; conformance with traffic laws; impacts on traffic flow; environmental impact; route choice; and use of protective equipment. This research will allow improved future planning for the integration of HPT into multi-modal transportation plans. Educational and public service information regarding risks and safe behavior can also be developed based on the results of the investigation.