SAFETY EVALUATION OF THE ADVANCED STOP ASSIST SYSTEM IN A CONNECTED VEHICLE ENVIRONMENT

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Introduction

- Certain types of vehicular conflicts, in particular, rear end are known to increase due to intersection signalization.
- In year 2013, a total of 4700 fatal crashes, 826,000 injury crashes and 1.76 million Property-Damage-Only crashes occurred at signalized intersections in the United States. About 30% of these crashes were rear-end.
- This study proposes and evaluates an Advanced Stop Assist System (ASAS) at signalized intersections via Vehicle-to-Infrastructure (V2I) communications.
- The proposed system utilizes communication data received at a roadside equipment (RSE) for provision of vehicle-specific advisory speed messages assisting drivers to come to a safe stop at the intersection.

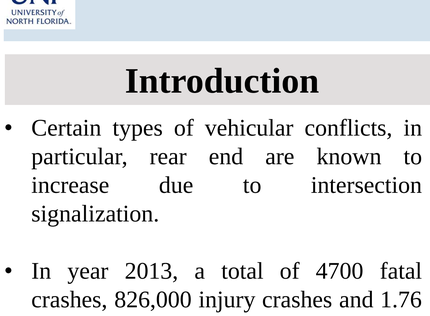

Figure 1: V2I Communication

Objectives

- Propose and demonstrate the implementation of ASAS in a microscopic traffic simulator
- Evaluate potential safety benefits of ASAS, in particular, reduction of rear-end conflicts under the connected vehicle environment with V2I capabilities

Site Description

- An intersection between Bruce B Downs and Fletcher streets, adjacent to the University of South Florida, Tampa, Florida
- Enough naturalistic driving data is available from this area which facilitated calibration of the simulation model

Figure 2: Study area, an intersection between Bruce B Downs and Fletcher streets

Methodology

- Microscopic simulation using VISSIM
- V2I wireless communications were modeled using Car2X Application Programming Interface (API)
- ASAS algorithm was developed through Component Object Model (COM)
- The algorithm forecasts the arrival times of equipped vehicles at the intersection only when the signal phase is green and provides the necessary advisory speed messages
- Another algorithm keeps track of speed and acceleration of approaching vehicles that were within the communication range when the signal was green, but arrived at the intersection on a red signal indication.

ASAS Algorithm

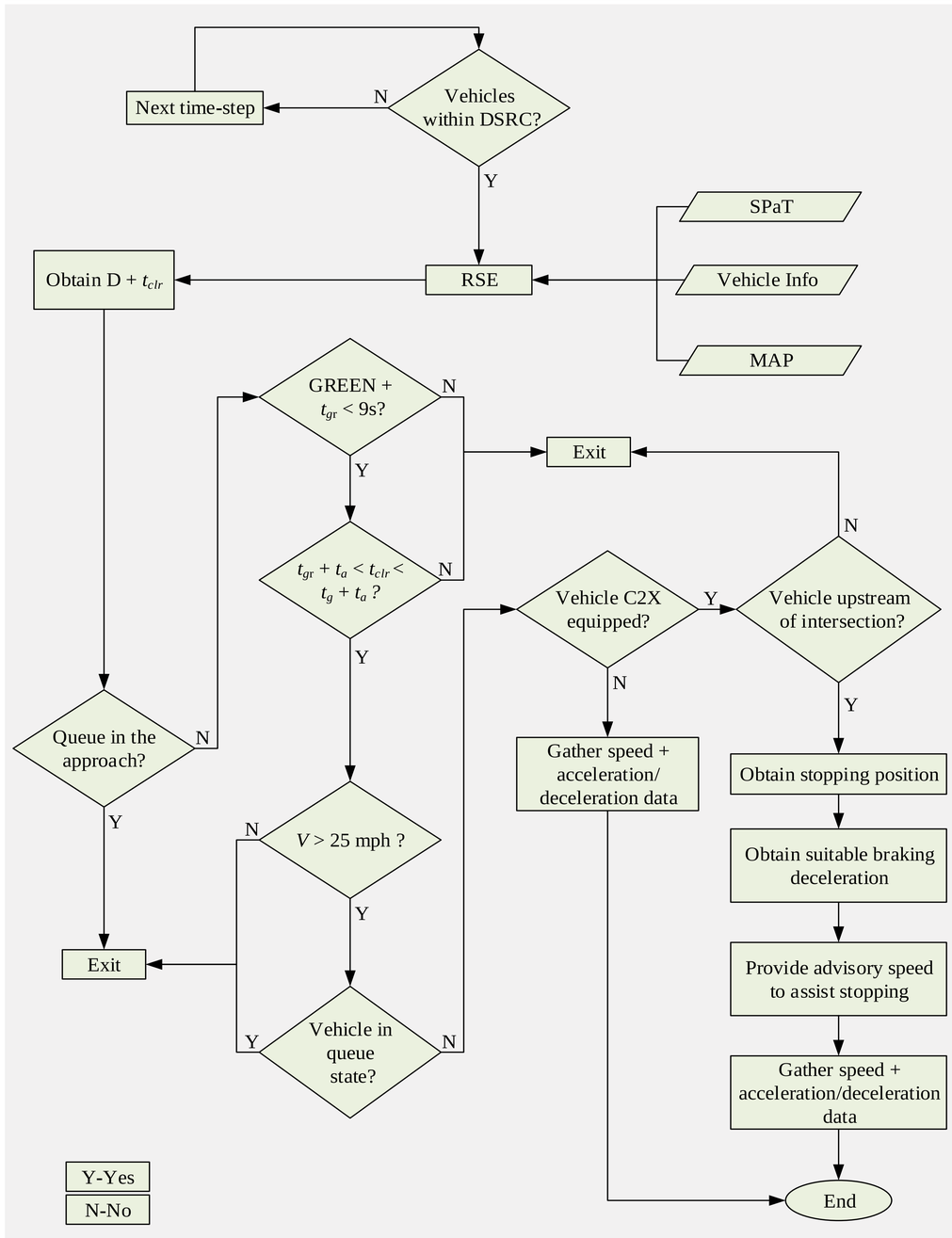

Figure 3: Algorithm for V2I communication

Results

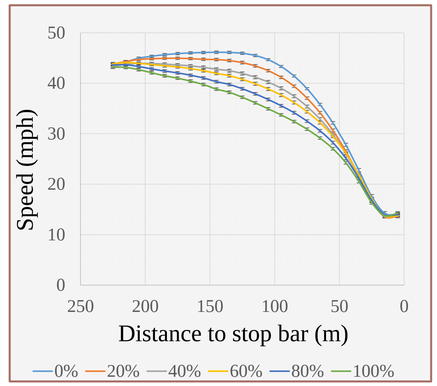

Figure 4: Speed profiles

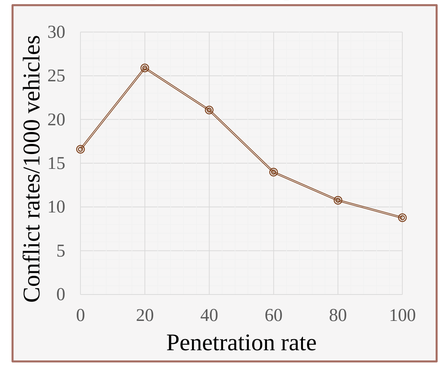

Figure 5: MaxD-based conflict rates

Findings

- The proposed system reduces the number of hard braking vehicles by approximately 50% at 100% penetration rate
- Degradation in safety conditions at penetration rates lower than 40%
- At least 60% penetration rate is required for the proposed system to indicate improved safety conditions

Limitations

- 100% compliance rate was assumed for the driver's receiving the advisory speed messages