Hybrid Vehicular Communications Optimization For Cooperative Intelligent Transport Systems

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Introduction

- The goal of this phd topic is to propose hybrid network architecture for C-ITS, that combines standards used for vehicular networks such as IEEE 802.11p/ETSI ITS-G5 and a cellular technology. Then a performance study of the proposed architecture will be done.

- We started by studying ETSI ITS-G5 European standardization dedicated for vehicular communications.

- We are focusing on Green Light Optimal Speed Advisory (GLOSA) application as a particular ITS service.

- We proposed an algorithm for GLOSA after studying several limitations in related work.
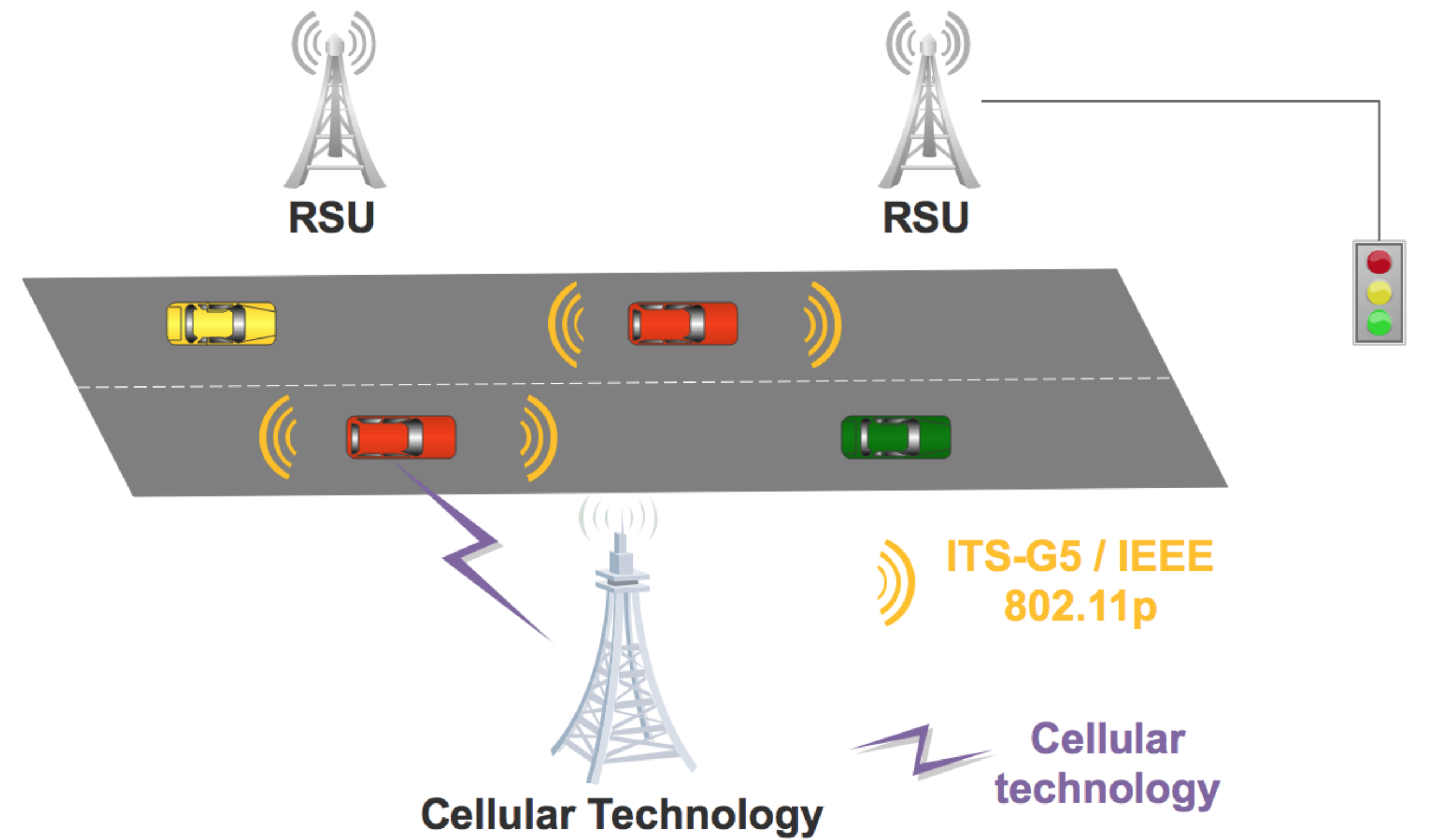
Speed Advisory Estimation

- We consider uniformly varied motion and Uniform straight movement.

- We consider both acceleration and deceleration cases as shown in the figure below.
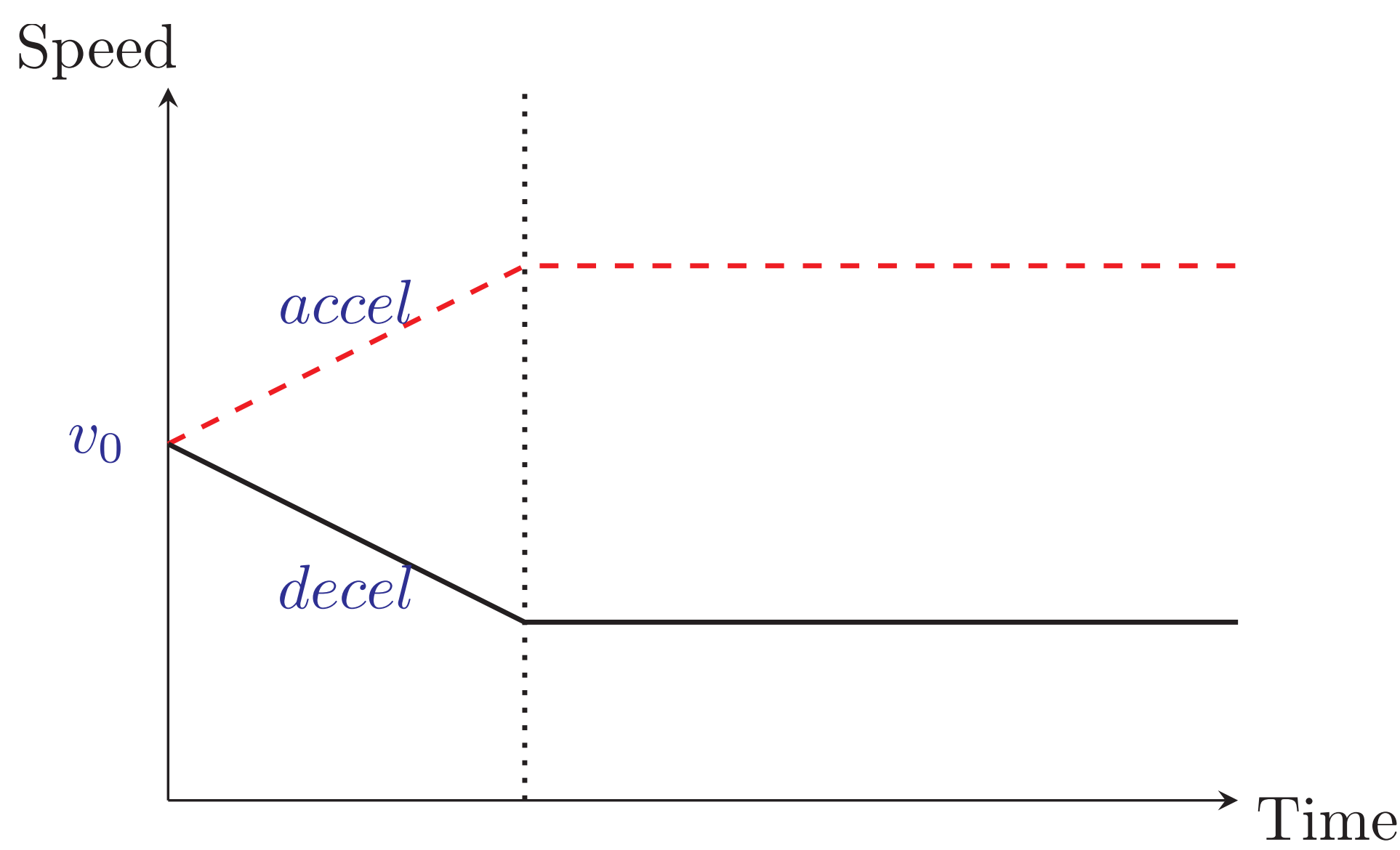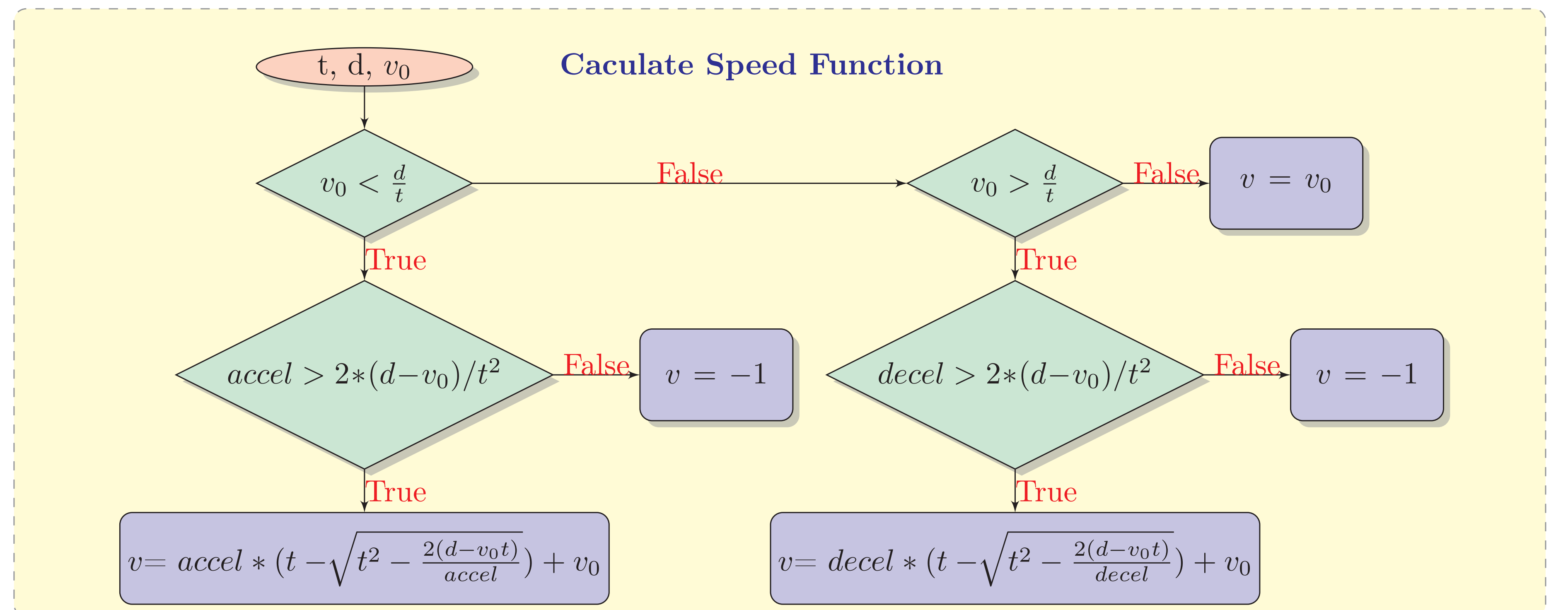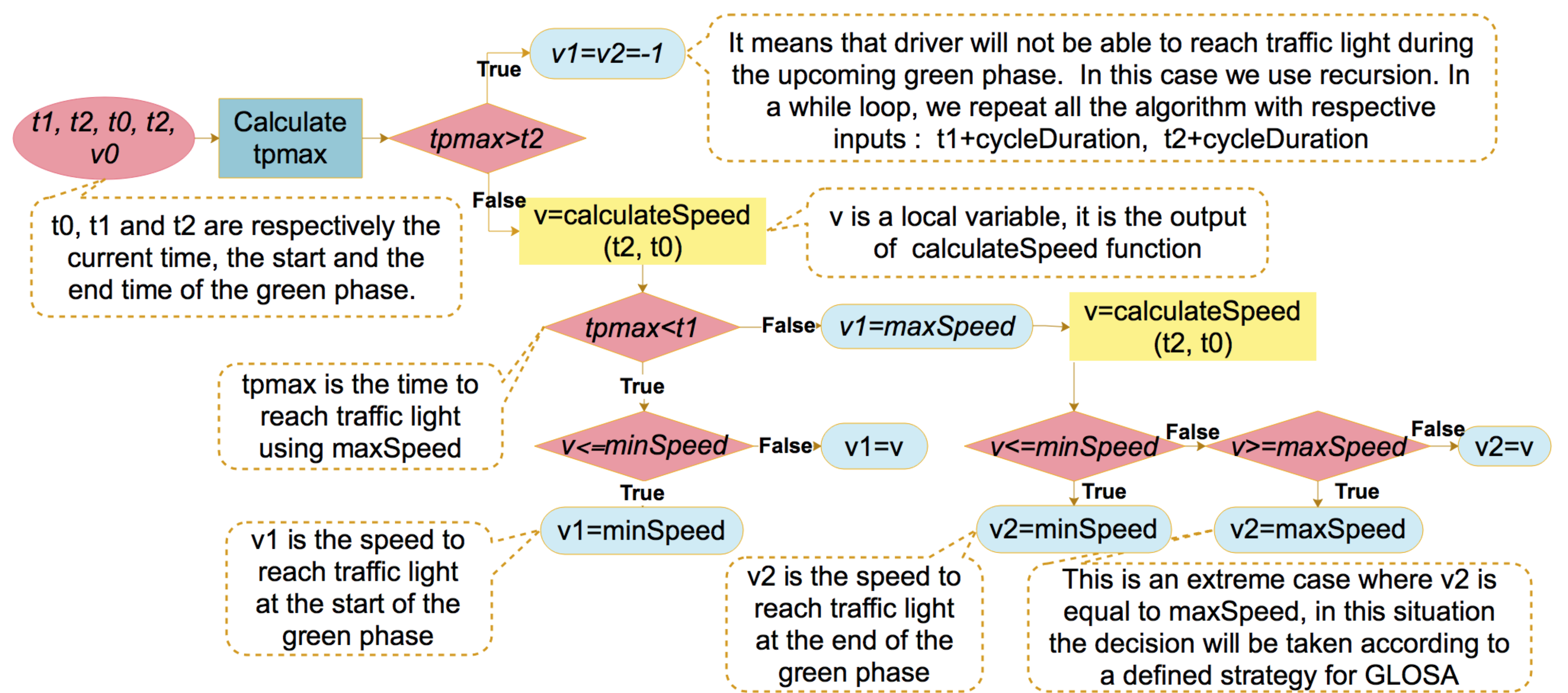

Equation (1) is obtained after resolving a system of equations. The below conditions should be verified.

$$v_{conseil}(t) = a * (t - \sqrt{t^2 - \frac{2(d - v_0 t)}{a}}) + v_0 \quad (1)$$

$$\begin{cases} If\ v_0 < \frac{d}{t} \Leftrightarrow a > 0 \\ If\ v_0 > \frac{d}{t} \Leftrightarrow a < 0 \end{cases}$$

$$\begin{cases} If\ a > 0,\ a > \frac{2*(d - v_0 t)}{t^2} \\ If\ a < 0,\ a < \frac{2*(d - v_0 t)}{t^2} \end{cases}$$

Speed Advisory Boundaries FINder Algorithm (SABIN)

Future Work

- The proposed Algorithm "SABIN" for GLOSA will be tested for various scenarios and use cases in order to validate our implementation.

- Second, we will evaluate ITS-G5 network performance of ITS services (GLOSA, CAM, DENM etc..).

- We will study ETSI ITS-G5 limitations and then we will propose hybrid network architecture that combines ETSI ITS-G5 and a cellular technology.

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Results

The results below are obtained using V_1 as speed advisory. Fuel consumption and speed comparison between GLOSA and non GLOSA systems are presented.