Intelligent transportation is a key component of smart cities. One of the technologies intended to make the transportation systems more secure and efficient is car-to-car communications. Research in VANETs (vehicular ad-hoc networks) is multidisciplinary. Areas such as traffic theory, physics, statistics, networking protocols, sensing, power management, propagation channels, and routing and control must be considered.

**Introduction**

For VANET connectivity, any two successive vehicles must be within the communication range. Topology highly depends on traffic conditions, causing the network to behave differently in different traffic phases.

**Traffic data used**

Sensors on the I-80 road in California. Courtesy of Berkeley Highway Laboratory (BHL) project (http://bhl.path.berkeley.edu/).

**Connectivity Probability (effect of safe distance)**

Headway distribution of single lane free-flow traffic is better modeled using the shifted exponential distribution. The estimated connectivity probability is changed considerably.

**Connection Duration**

Connection duration between any two vehicles is a function of the communication range and the relative velocity between them.

In the transition phase, velocity distribution is not Gaussian.

**Moment Analysis (for traffic phase transition detection)**

We follow the evolution of the first four statistical moments of vehicle spacings, for individual lanes at regular time intervals.

The skewness and kurtosis provide sensitive probes for the critical densities for transitions between phases.

**Ongoing and future research directions:**

- Studying the effect of the communication channel and introducing realistic simulations of VANETs.
- Considering the effect of the safe distance between cars on the congested traffic phase(s).
- Dynamic communication range assignment in VANET that takes into account the traffic conditions.

**Publications:**