**Abstract**

As per Autonomous vehicles require a high degree of localization and use of external sensors for environment recognition. However, infrastructure technology is not at the same level as current vehicle innovations. This research proposes a method for creation, transmission, and guidance of a vehicle from purely infrastructure information. This paper is focused on a technique for generating a discrete curvature-dependent path from offline database information such as GPS or geographical scans. The technique is further developed with AASHTO guidelines to increase accuracy and comply with dynamic tire limits. Results showed that this method provides a reasonable guidance parameter for autonomous vehicles.

Keywords: Trajectory Generation, Path Generation, Curvature, AASHTO, V2I, Vehicle-to-Infrastructure

**Introduction**

The overall system consists of using Vehicle to Infrastructure (V2I) Communications to send the vehicle a path to follow any given curve. A controller needs to be developed to address the trajectory and modularity in any given sedan vehicle. This path is computed offline and stored in a transmitter that resides on infrastructures. This transmitter will send the desired path and a trajectory will be computed onboard. The transmission of the signal will be desired to be small as possible.

The following assumptions were considered:

* Vehicles contains enough technology to drive itself given a set amount of data (in this case, ideal heading angle, curvature)
* Method is not built considering collision avoidance, though it could be implemented
* Only sedan vehicles were studied, but can be extended to other vehicles
* Random animals and extreme accidents are ignored
* Anomalies in the road profile such as potholes are ignored
* Road is assumed to be in drivable conditions

The end goal of this project offers a backup system to detection sensors such as camera and lidar which will allow vehicles to travel under weather disruptions. To achieve this goal, the project was divided into three main parts. The first one is vehicle local trilateration, which establishes a vehicle position through transmission in between infrastructures and vehicles. The second part involves offline path generations and the minimization of data transmission of navigation data. The third part focuses on developing a controller to navigate with the road paths from the second part. For this paper, only the second part will be analyzed.

**Problem Statement**

The problem formulation involves generating an offline path that minimizes the data size needed to traverse a curved road.

**Trajectory Generation Background**

In motion planning, a path is defined a set of possible ways a vehicle is allowed to go from Point A to Point B. While trajectory is defined as the profile needed to go through that path given different constraints. For example, many trajectories can lie inside of a given path as shown in Figure 1. Given constraints can be in the form of differential constraints from equations of motion, geometrical constraints or dynamic constraints from vehicle limits.