4. WORK PLAN AND METHODOLOGY:

It is proposed to use one of the most widely applied estimation methods is the Lighthill-Whitham and Richards (LWR) model with an Extended Kalman filter (EKF). This not only provides a way to use traffic data to correct the model state but also allows for filtering of measurement noise.

A brief description of the first-order model with the Godunov scheme is presented, along with a description of the (traditional) G-EKF. Then, the study of L-EKF and L-UKF are described. The basis of any macroscopic model is given by two relations:

1) A partial-derivative equation (PDE) called the conservation equation that states that no traffic can be created without external influences.
2) A relationship between density and space mean speed.

To apply the EKF, a numerical solution is needed of the LWR model. Several stable numerical solutions to the LWR model exist, such as the Godunov scheme or methods based on the Lagrangian formulation. Because it is the most widely applied solution, the Godunov scheme is used.

The Kalman filter is a recursive filter that estimates the state of a linear model based on the last estimate of the state and a number of normally distributed observations. When made applicable to nonlinear models, an EKF can be used, where a linearization of the nonlinear model around its current state is used. The EKF algorithm consists of two steps, i.e., a prediction and a correction step.

Usually, the Global-EKF is applied at once to the entire network. But in the L-EKF/L-UKF, many local EKFs/UKFs are sequentially called for each cell that contains measurements, instead of constructing one large EKF for the entire network.

To show the difference between the G-EKF, L-EKF and L-UKF inaccuracy and computation time, two separate experiments are conducted: one on a synthetic data and one with real-world data.

Based on the two experiments, the Global-EKF, localization of filter for EKF and UKF are carried out, now a comparative study between these three filters needs to be validated, which of the filters can best be used.