With the emergence of Advanced Traveler Information Systems (ATIS), it is possible to provide various kinds of information to road users. Travel time is one of the most understood measures for road users. By providing reliable travel time estimates it is possible to influence road users’ route choice and travel behavior, hence improving the performance of traffic networks. The goal of this research is to develop a data fusion between loop detector data and ETC (Electronic Toll Collection) data to make more accurate real-time (instantaneous) travel time estimates on expressways. Unlike previous attempt of data fusion, this research does not use historical and statistical methods for data fusion.

Loop detectors are the most common vehicle detectors for freeway traffic and suitable for instantaneous travel time estimation. But loop data does not provide an accurate image of the traffic conditions because the detectors only collect data at point-locations and not over the entire road. ETC data on the other hand gives measured travel times over the entire road. But this data arrives too late. By the time travel time is measured, traffic conditions have most likely changed already. By comparing ETC measured travel time with the estimates of the loop detectors, it is possible to evaluate and correct travel time estimations made with loop data in real-time.

Two existing models for instantaneous travel time estimation based on loop detector were considered, namely the Extrapolation model and the Nam and Drew model. These two models were first directly applied without any fusion method and compared with the actual travel time from ETC data. When the traffic condition is steady and travel time does not vary heavily over time, the results from these models were already very accurate. However, during the beginning or the end of the peak period where travel time rapidly increases or decreases, large error was observed from these two models. In this case, the error appears to be a systematic one. As a result, several fusion concepts with a particular interest in the correction of travel time during the peak period were examined.

The first one examined was a model running two models parallel, the Extrapolation and the Nam and Drew model. The estimation results at previous time-intervals were compared with the actual travel time from ETC data. The error is then used to correct the travel time estimated based on the Extrapolation model and the Nam and Drew model for the current time interval. The second concept only uses one existing estimate model as a basis: the Extrapolation model. The ETC data is used to evaluate the error in previous time intervals. Based on the trend of the current travel time estimate, either increasing or decreasing, travel time was corrected assuming that the previous error is still present in the current interval. The last concept examined in this research is very similar to the second. A moving average on the Extrapolation model was introduced to stabilize the output, which is used to identify traffic conditions. Without the moving average, the output was too instable to be used for identifying traffic conditions.

It was found that different fusion concepts provide different results. The most promising one is the last concept. By introducing a moving average, the output of the Extrapolation model was stabilized and became suitable for traffic condition identification. It turned out that applying the moving average improved travel time estimates already. In conclusion, travel time estimations by instantaneous models depending on loop data clearly have systematic errors. By examining the pattern of the error, it is possible to develop a simple fusion method that can improve the accuracy of travel time estimation.