An Analysis of Stand-alone GPS Quality and Simulated GNSS Quality for Road Pricing

Use of GPS for road pricing has often been suggested as the way of creating more efficient charging strategies than existing systems based on cordon lines or time use. In Denmark, Copenhagen participated with the AKTA project in the PRoGRESS programme, sponsored by the EU. The major part of the AKTA project was to equip 500 cars with GPS receivers. The paper presents the methods and results from a study of GPS quality in relation to road pricing in a dense urban area. The collected data from 500 cars over a two-year period in the Copenhagen region was analyzed in order to determine whether the stand alone GPS quality and reliability is adequate for implementation of an operational road pricing system in Copenhagen. The results from the analysis show that the satellite availability in Copenhagen is not sufficient to form the basis for a reliable operational road pricing system. The narrow street canyons in downtown Copenhagen prevent a sufficient amount of satellite signals to reach street level, which causes too many gaps in the position logs to implement a fair and reliable taxation scheme. The need for augmentation is evident, and with the advent of Galileo within a few years, it is relevant to investigate how integrated GPS/Galileo receivers will change the situation. With a Galileo simulator, an analysis of the GNSS (Global Navigation Satellite Systems) availability in the streets of Copenhagen was carried out. The results show, that there will still be streets in downtown Copenhagen were the receiver–satellite geometry represented by the HDOP is not sufficient for reliable positioning during the full 24 hours of a day, even when combined GPS-Galileo receivers are introduced.