Cellular networks of today generate a massive amount of signalling data. A large part of this signalling is generated to handle the mobility of subscribers, irrespective of the subscriber actively uses the terminal or not. Hence it contains location information that can be used to fundamentally change our understanding of human travel patterns.

This thesis aims to analyse the potential and limitations of using this signalling data in the context of road traffic information, i.e. how we can estimate the road network traffic state based on standard signalling data already available in cellular networks. This is achieved by analytical examination and experiments with signalling data and measurements generated by standard cell phones.

The thesis describes the location data that is available from signalling messages in GSM, GPRS and UMTS networks, both in idle mode and when engaged in a telephone call or a data session. The signalling data available in all three networks is useful to estimate traffic information, although the resolution in time and space will to a large extent depend on in which mode the terminal is operating.

Spatial analysis of handover signalling data has been performed for terminals engaged in telephone calls. The analysis indicates that handover events from both GSM and UMTS networks can be used as efficient input to systems for travel time estimation, given that route classification and filtering of non-vehicle terminals can be solved.

By analysing signalling data and received signal strength (RSS) measurements from cell phones, it can be seen the route classification problem in the context of estimating travel times based on handover events is non-trivial even for highway environments. However, it is presented that the problem can be satisfactorily solved for highway environments by using basic classification methods, like for example Bayesian classification.

Furthermore the thesis points out that the new era of smartphones can be an enabler for road traffic information from cellular networks in the close future. By examining measurements collected by a smartphone client, it is illustrated how the radio map for cell phone positioning can be built by participatory sensing. It is also shown that the location accuracy of RSS-based cell phone positioning is accurate enough to provide both travel time and OD-matrix estimation.