Simulation-based evaluation of a new method to improve the real-time Origin-Demand matrix estimation using Floating Car Data

Master's Thesis of Hekmat Dabbas

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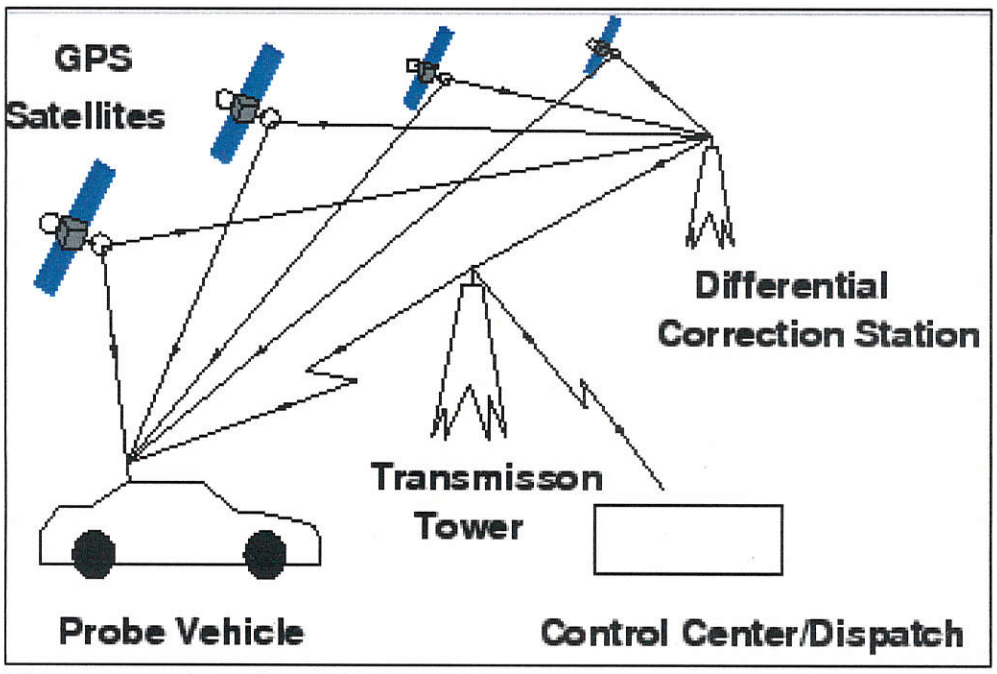


Picture source: https://www.civil.iitb.ac.in/

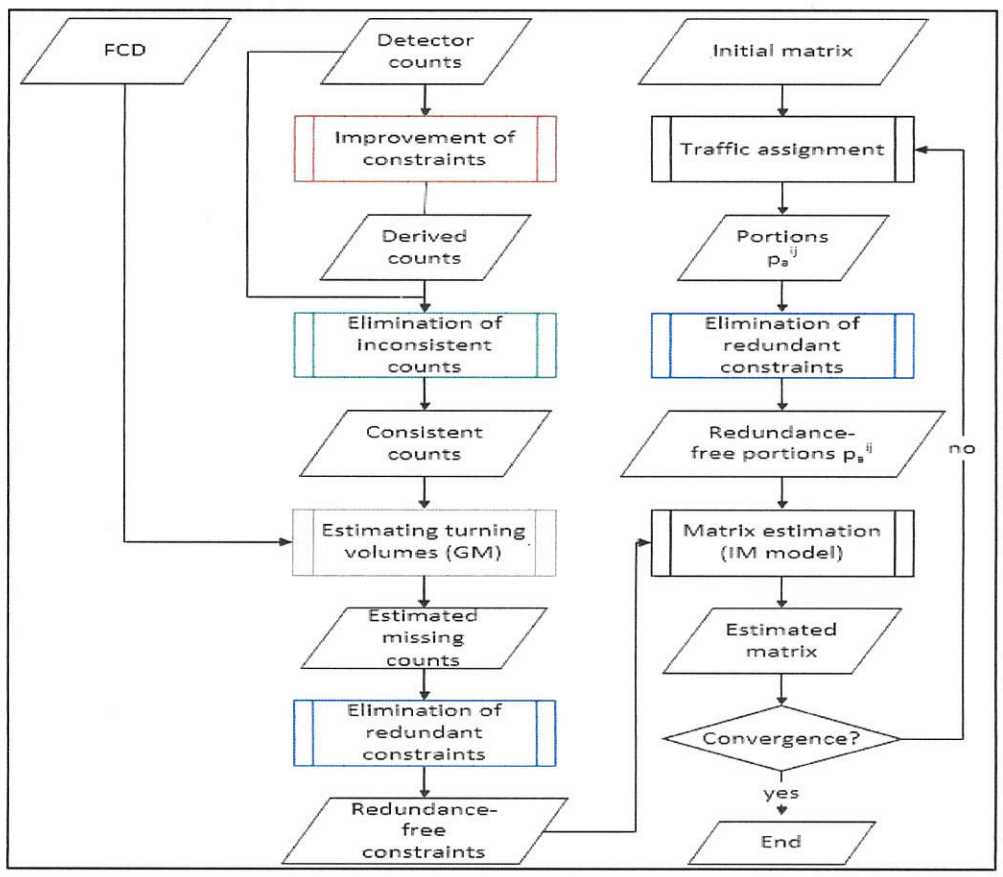
Having a good quality Origin-Destination (OD) matrix for an area in which traffic planners are aiming to carry out a project is considered to be crucial. This matrix can be used as an input for traffic assignment model or generally for a traffic simulation model and can be used also to validate the detector data that are used to assign the traffic demand to a model.

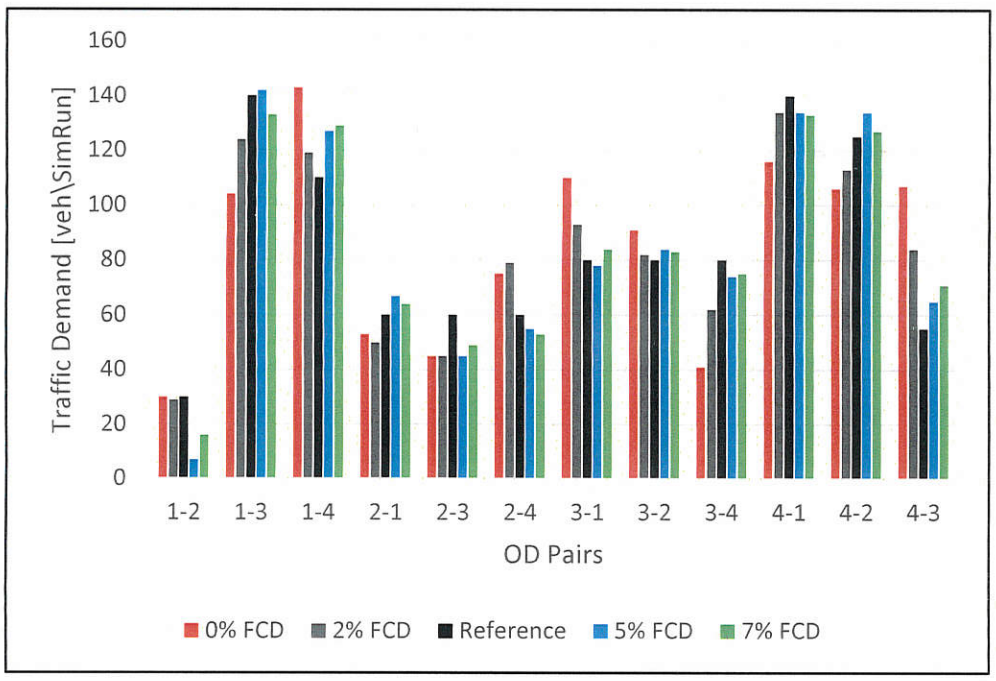
The regular estimation methods estimate good OD matrices but with some drawbacks. Therefore, there is always room for enhancing the quality and mitigating the drawbacks. The key player which influences the quality of the estimated matrix is the data that is used as input in the estimation method. Hence, improving the quality of the input would directly affect the result. Floating Car Data (FCD) can be used for this purpose. In addition to the fact that FCD are real-time data, FCD provides valuable information about vehicle turning choices.

The general aim of the thesis is to enhance the quality of the estimated OD matrices which are extracted by Information Minimization model (IM). The IM model generates better results when the number of the used constraints is increased. The Gravity Model (GM) can be elaborated along with link counts and FCD as inputs to generate the turning volumes. These turning volumes can be fed to the IM model as additional constraints.

To insure the good quality of the input data three checks should be performed before starting the OD matrix estimation process:

- Improvement of constraints: to check whether no more counts can be derived and used as a constraint to the IM model
- Consistency check: to check whether the number of leaving vehicles equals to the number of entering vehicles on network and intersection scale
- Redundancy check: to check whether the values of the links or turnings are not redundant and, hence, do not result in a biased constraints values





The statistical tests: Root Mean Square Error (RMSE), Relative Root Mean Square Error (RRMSE) and the Correlation Coefficient (Rxy) are used to compare the resulted OD matrices to the reference matrix.

The results of these statistical tests indicate that the employment of the FCD in the OD matrix estimation process has a good impact on the quality of the extracted matrix. The reduction of the error values of the estimated matrices is noticeable. Moreover, the linear relationship between the values of the estimated OD matrices and their correspondents in the reference matrix is significantly reinforced.

By using higher FCD penetration rates, the quality of the estimated OD matrix improve. However, the growth of the quality tumbles at a certain threshold (in the thesis 7%) as any further achieved improvement is negligible.