Lane Changing Behaviour on Motorways

Master‘s Thesis of Mohd Faizan Parvez

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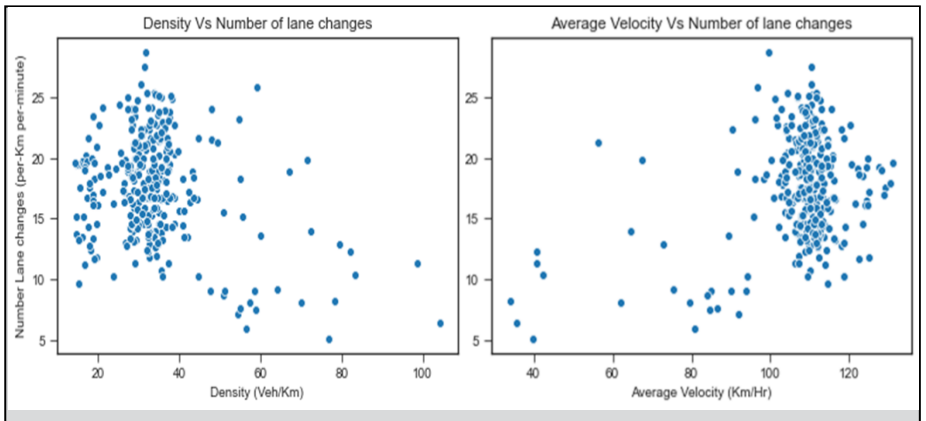


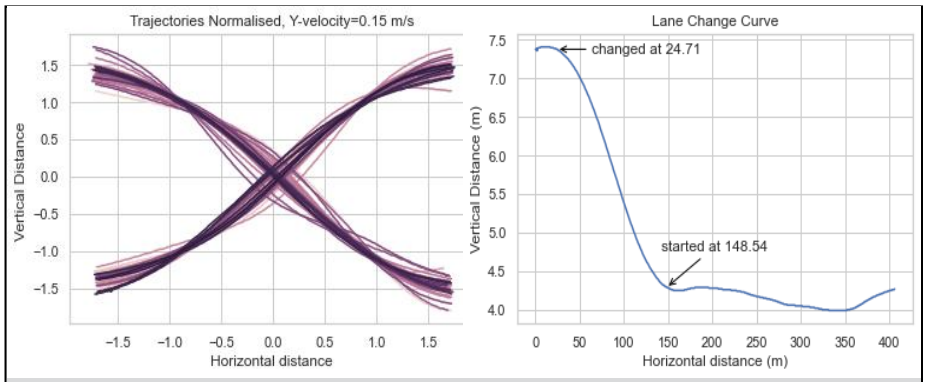
- The variation of density and average speed w.r.t number of lane changes (NLC) for an interval of 5 mins can be seen in the figure shown above.
- The variation of flow was also analysed against NLC, but no clear variation was observed.
- The NLC were smaller for high density and low average velocity values.

Objectives:

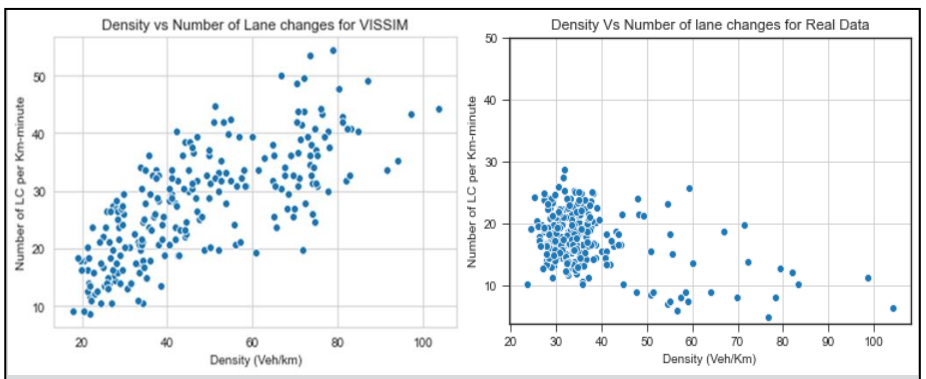
- Literature research.
- Data analysis of single vehicle trajectories.
- Identification of factors influencing Lane changing (LC).
- Factors influencing LC time.
- Comparison with state-of-the-art microscopic simulator (PTV Vissim).

Summary of lane changing duration and distance			
Variable	Cars	Trucks	All (Truck + Car)
Mean Duration (sec)	6.43	6.77	6.47
Min Duration (sec)	3.76	3.72	3.72
Maximum Duration (sec)	11.36	12.76	12.76
Standard Deviation (Duration)	1.06	1.16	1.08
Mean Distance (m)	199.69	165.79	195.44
Min Distance (m)	28.67	23.90	23.90
Max Distance (m)	358.41	325.17	358.41
Standard Deviation (Distance)	45.44	38.97	46.07

- This study also determines the factors affecting the lane changing duration such as: turning direction (left or right), types of vehicles (trucks and cars), presence of adjacent vehicles in the longitudinal direction in the target lane, distance headway to the preceding vehicle, and different density, flow, and average speed values.
- The average left turn duration was found to be shorter than the right turn duration for cars, and vice versa for trucks. If an adjacent vehicle was present in the target lane at the time of the lane change, then the average lane change duration was found to be shorter than without the adjacent vehicle; this was however opposite in the case of a right turn.
- No clear variation of the lane change duration was observed with the flow and average speed values. However, lane changes with larger durations were not found at a higher density values.
- The average duration of lane change was also found to be shorter for a shorter headway to the preceding vehicle in the same lane. The average duration also increased with the increase in the headway to the preceding vehicle.



- Lane change duration were obtained based on the velocity of 0.15 m/s in the Y-direction in the current and in the final lane.
- The starting and the ending point of a lane change on the complete trajectory of a vehicle can be seen in the „lane change curve“ and the general shape of the lane change trajectories can also be seen in the normalised trajectories shown above.



- A network similar to the real data was modelled in VISSIM. The desired speeds distribution and percentage share of heavy vehicles were derived from the real data. The lane change duration in VISSIM was also adjusted similar to the real data.
- The NLC in VISSIM was found to be more than the real data.
- The NLC in VISSIM increased with the increase in density and flow values.

Limitations and recommendations:

- The data was concentrated around the average values of density, flow, and speed. Therefore, the regions with high and low values of density, flow and speed could not be investigated comprehensively.
- The calibration of car following and lane changing parameters was not done in VISSIM and better results are expected after the calibration of the VISSIM model.

Conclusions:

- Small NLC were observed for higher density and lower average speed values.
- Lane change duration could be determined precisely.
- Left-preceding gaps were found to be less critical than left-following gaps. Right-following gaps were found to be less critical than right-preceding gaps.
- Lane change duration and distance have a huge impact on the performance of microscopic models and simulators.