

Quantifying the Number of Lane Changes in Traffic

An empirical analysis

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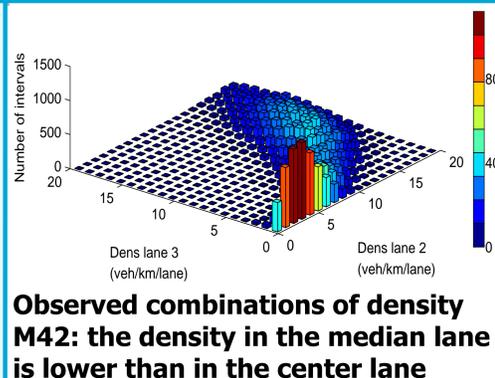
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Abstract

Since lane changes influence traffic operations, it is useful to know their frequency for various conditions. This paper studies the number of lane changes as function of the roadway characteristics. Two sites are studied, for which individual lane change data is available. The paper shows that the most constant measure is the lane change rate, i.e. the nr of lane changes per veh km driven, which is

approximately 0.5. It shows its maximum for densities just under the critical density. Furthermore, the lane change rate increases with an increase of the density in the origin lane for a constant density in the target lane. Surprisingly, the number of lane changes also increases with an increase of the density in the target lane for a constant density in the origin lane.



Available data

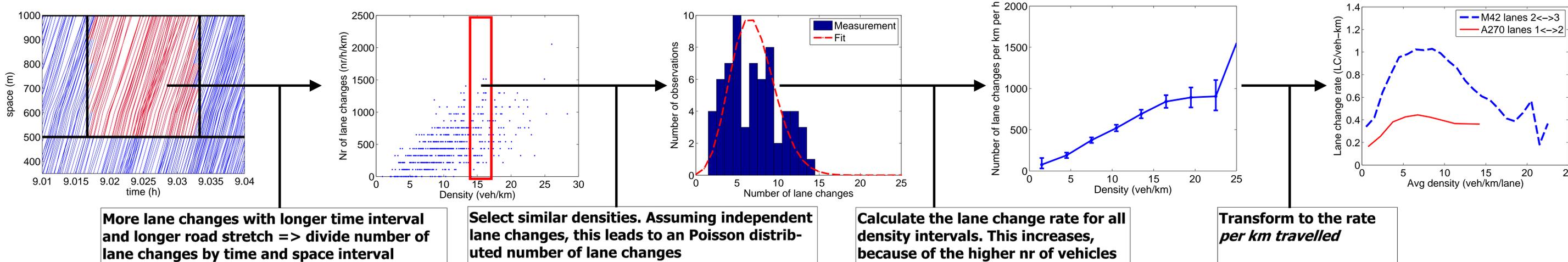
Set 1

- M42 freeway near Birmingham, UK
- 3-lane freeway
- Dual loop detectors, 100-meter interval, individual vehicle data
=> vehicle tracking throughout section (in free flow conditions)
=> lane changes recovered

Set 2

- A270 freeway, the Netherlands
- 2-lane freeway
- 5 km video tracks,
- Uncongested conditions

Lane change dependencies



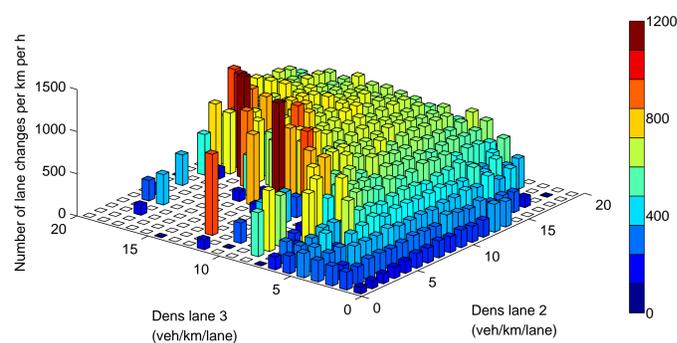
Observations

- 1) Number of lane changes increases with increasing density in origin lane
- 2) Number of lane changes increases with increasing density in target lane (!)

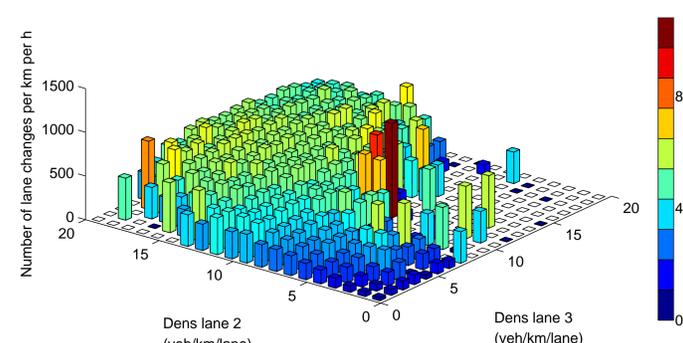
Explanations

- Future conditions not included (drivers anticipate)
- Lane changes are induced by lane changes *from* the target lane (place swapping), which occur more frequently with higher target lane density
- Separation origin lane density and target lane density artificial, and a result of the lane changing itself

Experimental average number of lane changes from lane 2 to 3



Experimental average number of lane changes from lane 3 to 2



- Daganzo's theory of slugs and rabbits:
 - faster drivers know that median lane is faster in the long run
 - they want to have a place there
 - higher densities make this desire higher (risk of not getting it)

Discussion

- Results possibly site-specific, e.g., influences or ramps
- Speed (difference) not included as explanatory variable, because no effect has been observed

Conclusions

The lane change rate is typically 0.5 lane change per vehicle-km. There is an influence of density: the maximum number of lane changes occurs at densities slightly lower than the critical density. The lane change rate from lane i to lane j increases with the density in lane i , but also with the density in lane j .