

Abstract

Overtaking of vehicles comprises of two steps: moving into the adjacent lane, and returning to the original lane after passing. Vehicle overtaking is a common movement on highways and high-speed arterials. At the same time, it is a very difficult and complex manoeuvre since while overtaking, the overtaking vehicle has to accommodate the movement of the overtaken vehicle as well as that of the oncoming vehicle on the opposing lane. When overtaking is carried out in heterogeneous traffic conditions, this becomes even more complex as different vehicle types have different sizes and different acceleration/deceleration characteristics.

This study analyses the behaviour of drivers while overtaking. An instrumented vehicle is used to collect data from urban arterial roads of Kanpur, India. An algorithm is developed to identify and track the objects around the instrumented vehicle from the point cloud collected using LiDAR. These objects include vehicles, non-motorized users, and other static and dynamic objects on the road. Data were collected for both divided four-lane roads and undivided two-lane roads. Overtaking times for both the sides of overtaking and for different types of vehicles are analysed. A new variable “excess distance” is introduced and used as a surrogate for the lateral and longitudinal headways maintained during overtaking.

Results showed that on divided four-lane roads, the side of overtaking plays an important role in determining the overtaking behaviour of the drivers. Upon overtaking from the left-hand side, both two-wheelers and four-wheelers took more time as compared to the right-hand side. On undivided two-lane roads, the effect of type of overtaken vehicle is found out to be significant. Four-wheelers took lesser time to overtake two-wheelers as compared to the time taken in overtaking four-

wheelers. It is observed, as expected, that while overtaking at higher speeds, overtaking vehicles maintained greater excess distances with the overtaken vehicle. However, on divided four-lane roads, the rate of excess distance with respect to average overtaking speed was higher when four-wheelers overtook four-wheelers as compared to the rate when two-wheelers overtook four-wheelers. It is also observed that this rate is higher for all vehicles overtaking on divided four-lane roads as compared to the undivided two-lane roads. Commencement of overtaking from the left-hand side indicates the presence of faster vehicles in the left lane (showing the poor lane discipline in Indian traffic conditions). It is also observed that the driver's overtaking behaviour is affected by the presence of an oncoming vehicle, and the type of overtaken vehicle.

Keywords: Overtaking time, Excess Distance, LiDAR, Vehicle Tracking