

Trajectories and Microscopic Traffic Variables

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<https://www.GoTrafficGo.com>

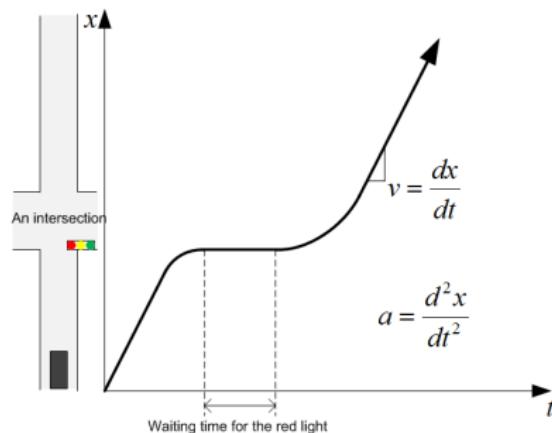
March 19, 2025

Vehicle Trajectory

Definition: The **position** (x) of a vehicle through **time** (t)

A graphical representation of $x(t)$ in the t - x plane, i.e., time-space diagram, where x and t are **distance** and **time**.

- **Speed** $v = dx/dt$ – the slope of trajectory
- **Acceleration** $a = d^2x/dt^2$

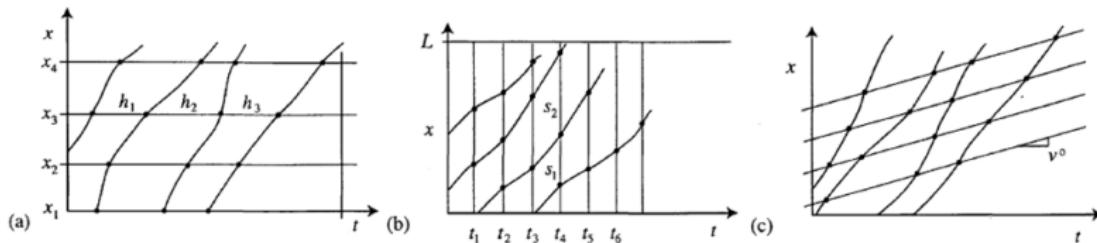


It contains almost all information of vehicle dynamics

Gathering trajectories

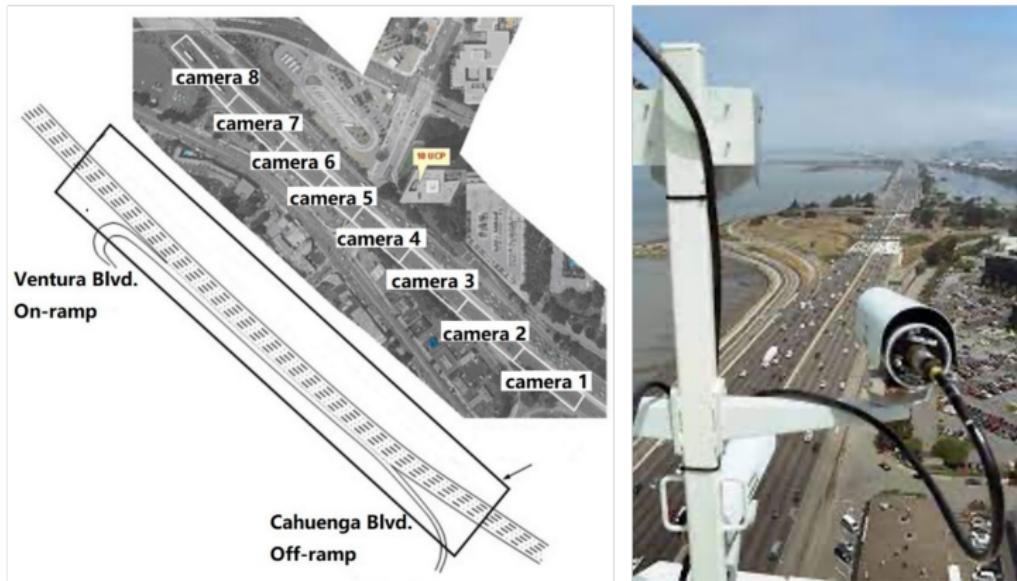
Three ways of **gathering** (t, x) trajectory data:

- Roadside observers at various locations;
- Aerial photographs at different instants;
- Moving observers.



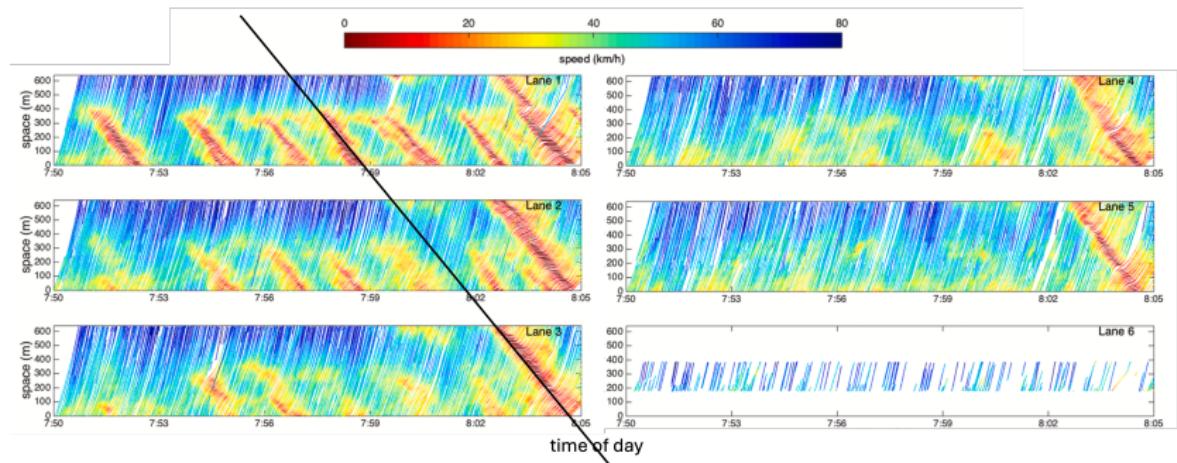
Empirical trajectories

Next Generation Simulation (NGSIM) trajectories



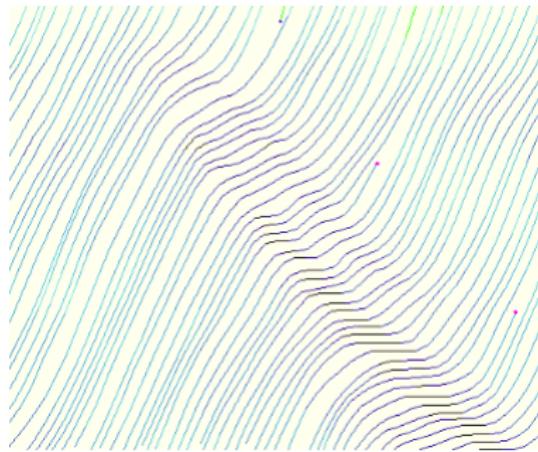
Empirical trajectories

Next Generation Simulation (NGSIM) trajectories



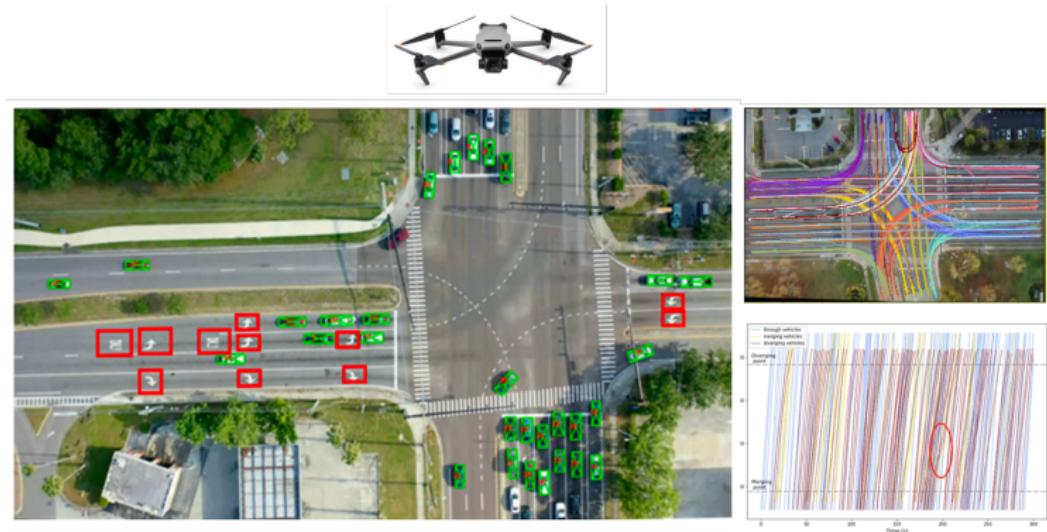
Empirical trajectories

Next Generation Simulation (NGSIM) trajectories
for the left lane in the vicinity of Lankershim Avenue
on US-101 freeway in Los Angeles, CA.



Empirical trajectories

More recently, drones



Empirical trajectories

Video

Microscopic traffic variables

Microscopic variables of Vehicle-b to Vehicle-r

x-axis

- s - space
- d - distance to front vehicle
- L - vehicle length

t-axis

- h - headway
- g - gap
- o - occupancy
 $(= L/v, \text{ if constant speed})$

Note: may be slight differences in the definitions.

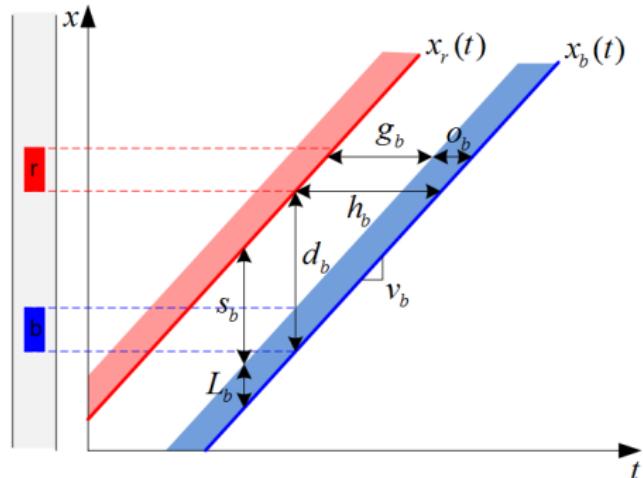


Illustration of microscopic variables when taking the rear bumper of a vehicle as the reference point for the vehicle trajectory.

Recommended reading

Transportation Research Part C 114 (2020) 225–240



Contents lists available at ScienceDirect

Transportation Research Part C

journal homepage: www.elsevier.com/locate/trc



Trajectory data-based traffic flow studies: A revisit

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ARTICLE INFO

Keywords:

Traffic flow
Trajectory data
Data collection
Big data

ABSTRACT

In this paper, we review trajectory data-based traffic flow studies that have been conducted over the last 15 years. Our purpose is to provide a roadmap for readers who have an interest in the latest developments of traffic flow theory that have been stimulated by the availability of trajectory data. We first highlight the critical role of trajectory data (especially the next generation simulation (NGSIM) trajectory dataset) in the recent history of traffic flow studies. Then, we summarize new traffic phenomena/models at the microscopic/mesoscopic/macrosopic levels and provide a unified view of these achievements perceived from different directions of traffic flow studies. Finally, we discuss some future research directions.

Thank you!