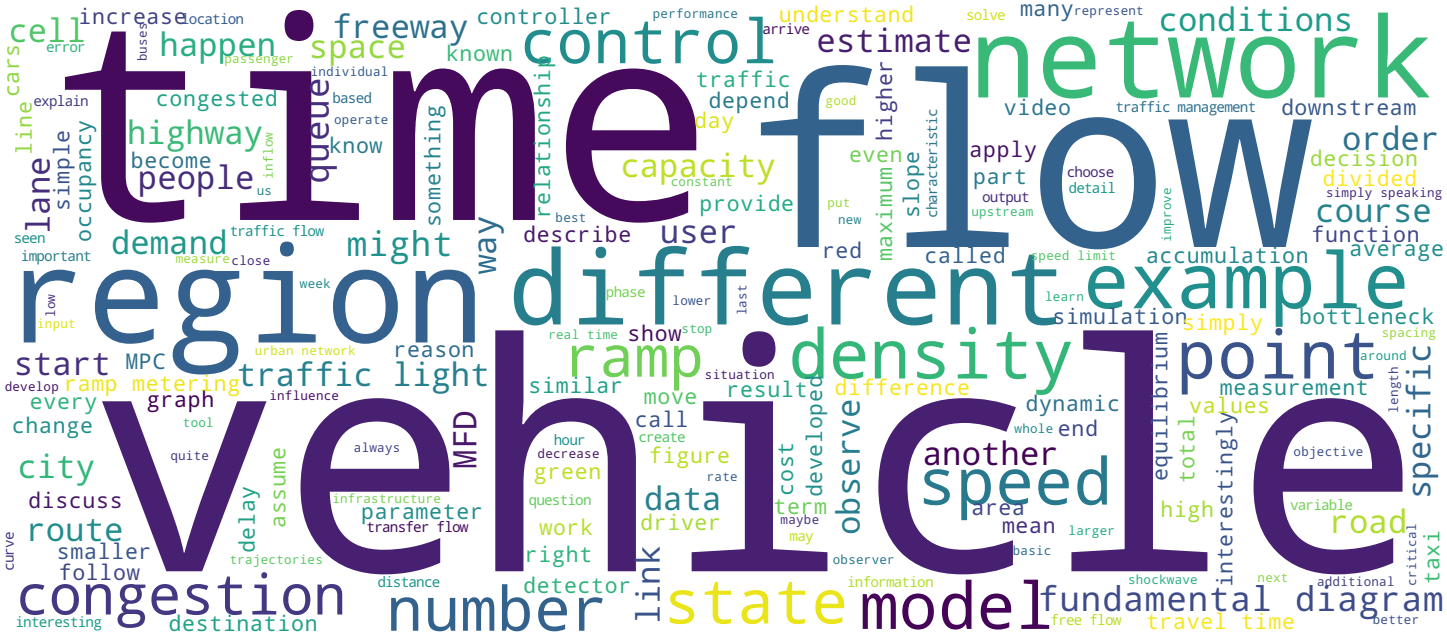
ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

URBAN TRANSPORT SYSTEMS LABORATORY LUTS



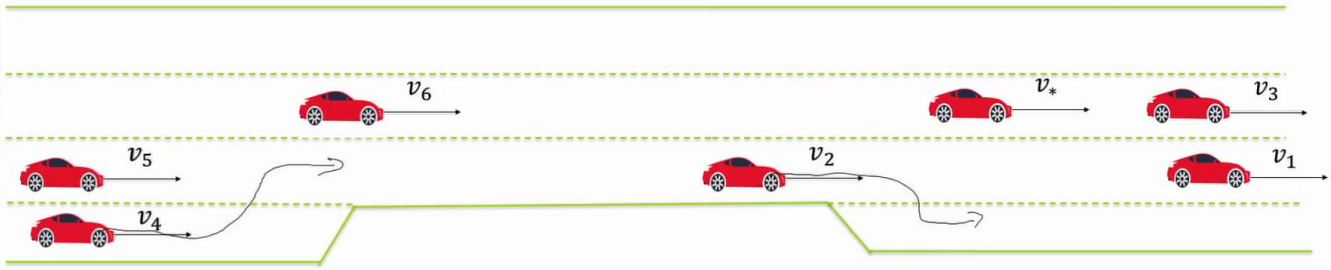
EPFL

Search MOOC

Video

Types of lane changing actions

- Mandatory: A vehicle is obliged to change a lane (e.g. on- or off-ramps)
- Anticipatory: A vehicle changes a lane to anticipate congestion downstream
- Discretionary: A vehicle decides to change a lane to be better off
- Cooperative: A vehicle changes a lane to help others



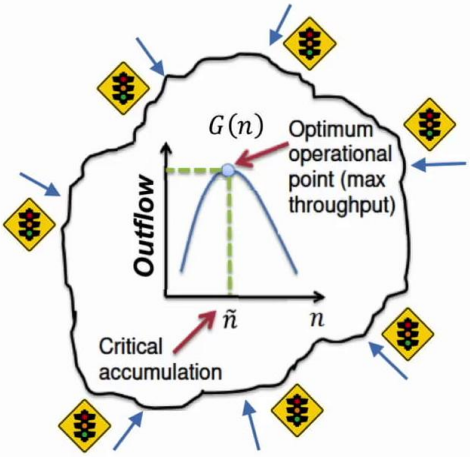
Welcome. Travelers experience significant delays when they perform their everyday trips in large cities. This course will focus on understanding urban congestion and developing ways to improve mobility through advanced traffic management schemes. Can we develop simple and elegant ways to explain and understand these interactions? The first part of this course will start from the basics and introduce important traffic variables like flow, density and speed to describe traffic congestion. Afterwards, we will develop elegant models to start the congestion evolution. Models are abstractions of the real systems that relate key variables with mathematical equations and physical intuition.

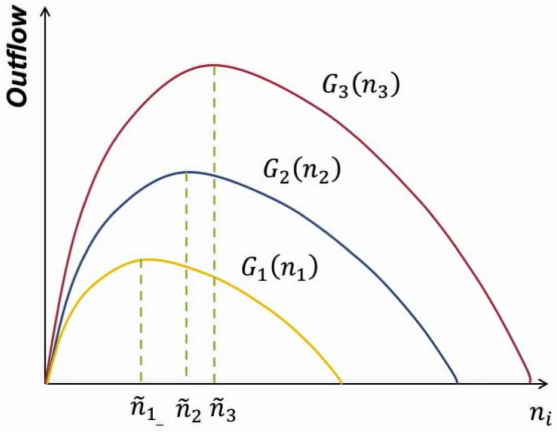
Notes

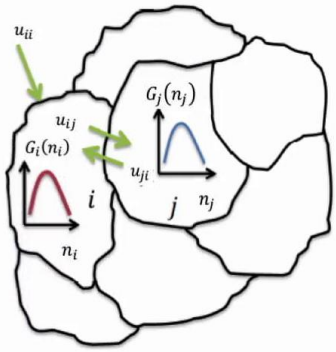
Summary

0m 12s

Control logic: from single- to multi-region







WHY MULTI-region?

- heterogeneously congested cities with multiple pockets of congestion (partitioning)
- High internal inflows (controllability)
- Avoid long queues at boundaries (equity)

LUTS publications, 2012-2018

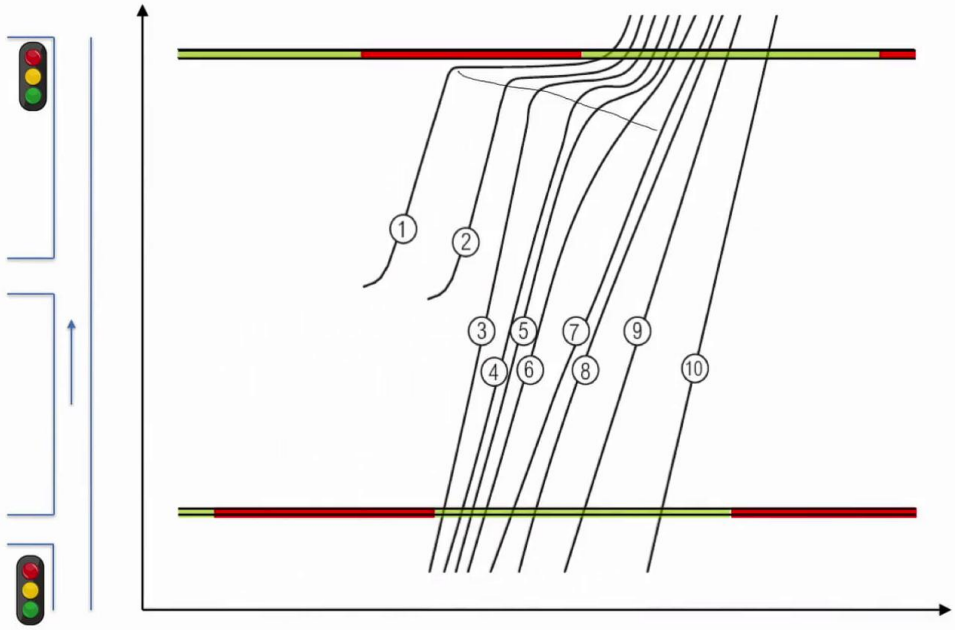
They range from very detailed ones to aggregate representations of traffic in cities.

Notes

Summary

1m 03s

Trajectories of vehicles at a traffic light

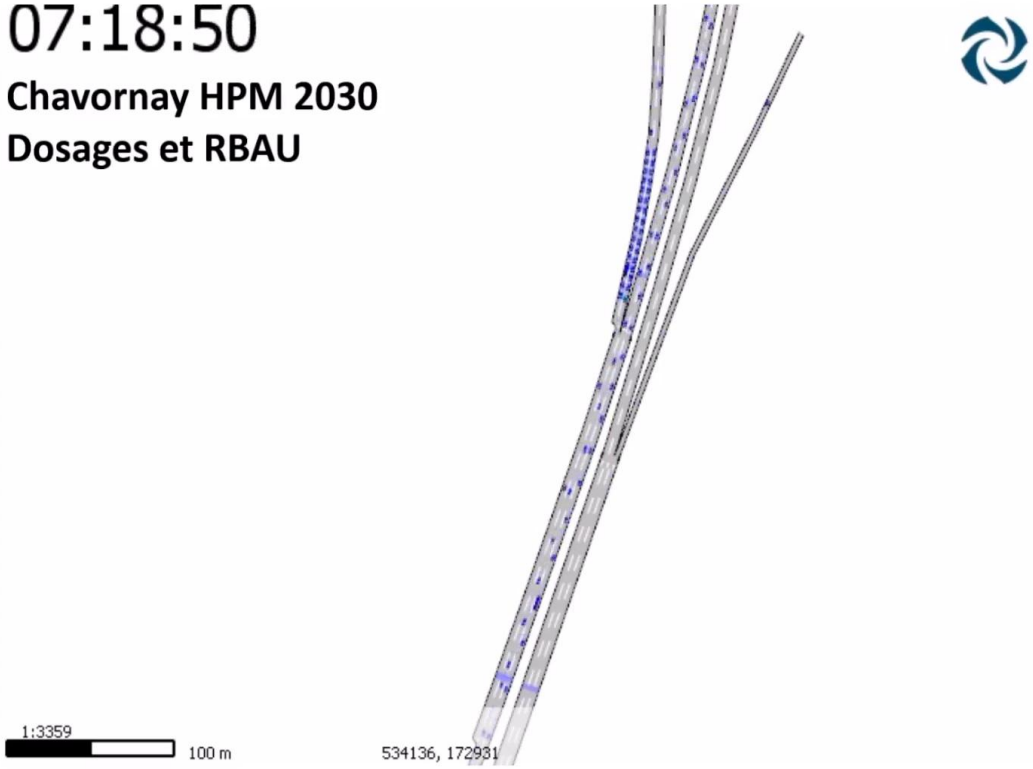


Microscopic models, for example, describe how drivers react to the actions of the driver ahead and how they change lanes in order to improve their path towards their destination. Macroscopic models describe how flow and density in a road change dynamically with the conditions that occur. For example, a traffic signal that turns from green to red. A queue of vehicles is developed when demand is higher than capacity and these queues grow with finite speed creating what is called a traffic shockwave.

Notes

Summary

1m 07s



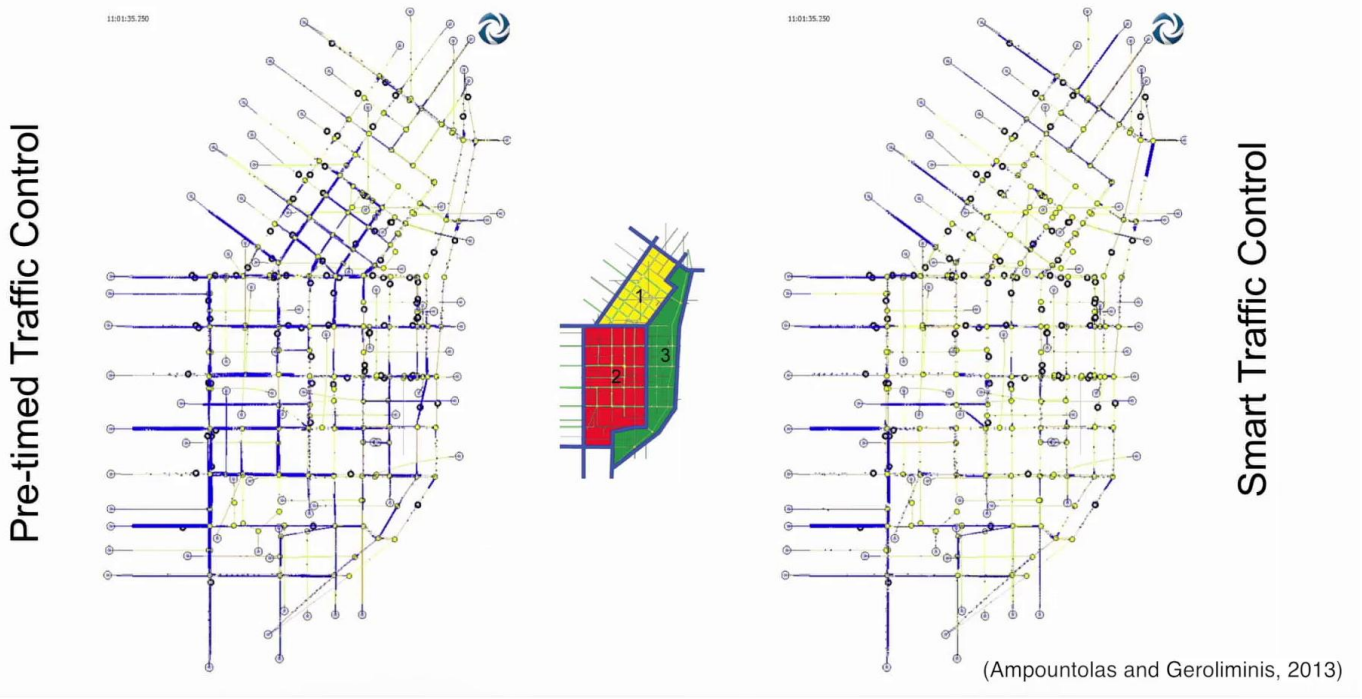
Network level models is ignore small-scale information and describe how congestion changes over time and space in different zones of a city. Aggregated relations between traffic density and traffic flow emerged in a neat way creating what is known as a Macroscopic Fundamental Diagram. As new monitoring techniques emerge, cities are gaining access to very large and diverse data set. Beside the traditional loop detectors that are installed in the pavement, cities now use data from cameras, from GPS, cell phone traces, Bluetooth, Wi-Fi whatever. Altogether this provides a very detailed image of the traffic evolution over time. If we have a good understanding of how congestion propagates in time and space, we can design smart control algorithms that increase the supply of our transport systems. For example a driver that can wait for some time on a ramp at the entrance of a highway in order to prevent the blockage at the main line of the highway.

Notes

Summary

1m 41s

Micro-simulation of different controllers

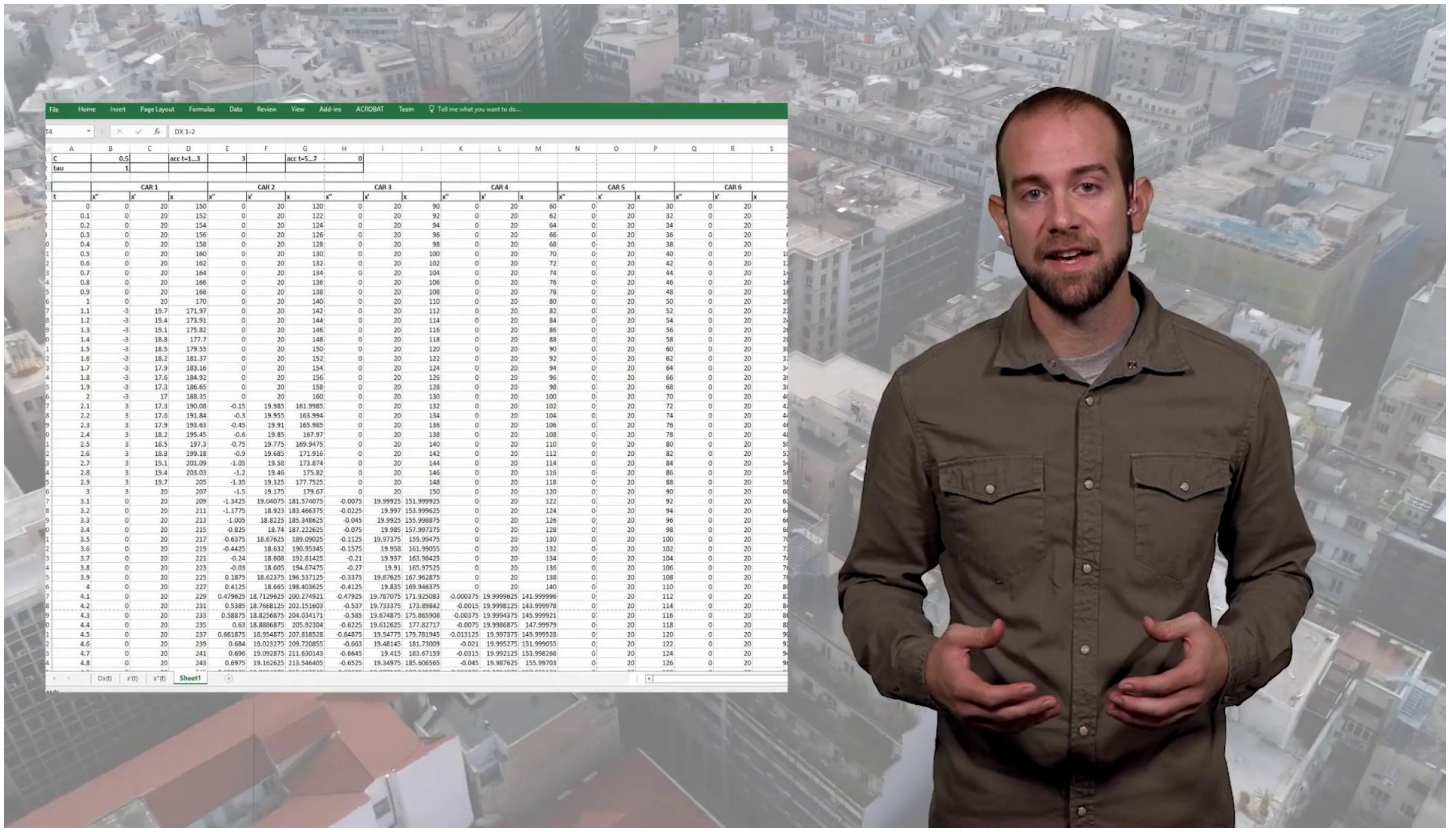


Similarly adaptive traffic lights in urban environment can manage congestion in a smart way by identifying the critical bottlenecks of the infrastructure and forming the queues of vehicles in optimal locations so as to maximize throughput.

Notes

Summary

2m 50s



At the network level, after partitioning the city in homogeneous regions, we can control the inter-transfers among regions known as parameter control by adapting some key traffic lights. We should also understand why people behave the way they do. How they choose their route, their departure time or their mode? We will see how individual decisions interact and how we can use simple tools or perhaps more complicated schemes to ensure that people take the decisions that are the best for society as a whole. This course consists of lectures, reading material, exercises but also data from different case studies that help to understand better the different types of congestion.

Notes

Summary

3m 06s

If you follow this course you will learn how to use simple models to explain the causes of urban congestion and you will also learn how to propose elegant traffic management schemes to alleviate congestion and improve mobility in urban networks. Enjoy the course.

Notes

Summary

3m 56s