Transport modelling
BMEKOKUM209

VISSIM introduction

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Overview of the second part - VISSIM

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<th>Date</th>
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<tr>
<td>11.09</td>
<td>Introduction and practice</td>
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PTV models

**Macroscopic:**
Transport needs modelling – VISUM
Choices on flow level

**Microscopic:**
Traffic flow modelling – VISSIM
Choices on driver level

Source: PTV Vision® - Analyzing the Transportation System
Simulation

• Simulation is the imitation of the operation of a real-world process or system over time.
• The act of simulating something first requires that a model be developed; this model represents the key characteristics or behaviors/function of the selected physical or abstract system or process.
• The model represents the system itself, whereas the simulation represents the operation of the system over time.
Why Use Traffic Simulation?

• Better Representation of Real Life Traffic
• Flexible Geometry
• System Wide Analysis
• Upstream/Downstream Queuing
• Multi-Modal (Transit, Bicycle, Peds, etc.)
External Factors
Keywords

- System: the real-world process to imitate;
- Model: the set of assumptions, in the form of mathematical or logical relationships, put forward to help understand how the corresponding system behaves;
- Entities: people or vehicles that act in the system;
- Time: an explicit element of the system.
Micro-simulation

- Microsimulation is a category of computerized analytical tools that perform highly detailed analysis of activities such as highway traffic flowing through an intersection.

- A numerical technique for conducting experiments on a digital computer, which may... involve mathematical models that describe the behaviour of a transportation system over extended periods of time.” (May 1990)
What Microscopic Traffic Simulation is

- Models Individual Vehicles
- Based on probability and stochastic processes
- System Wide Multi-Hour Analysis
- Impacts to System over Time and Space
- A model that includes Driver Behavior Characteristics
- Multi-Modal (Transit, Peds, Bikes, Autos, Trucks)
- A tool that can have visual Representation with 2D and 3D
- Requires more data and effort
- PARAMICS, VISSIM, AIMSUN, SIMPAS
Traffic micro-simulation entities

- Driver and vehicle characteristics.
  - Physical size: length and width
  - Mechanical capacity: maximum acceleration or deceleration
  - Driving behaviour: desired speed, reaction time, gap acceptance, aggressiveness, etc.
Driver Behaviors in Mixed Traffic
When To Use Micro simulation

- System analysis (coordination)
- Congestion / spillback / bottleneck
- Queuing / storage
- Closely spaced ramps
- Bus / multimodal / its / ramp metering
- Signal pre-emption
- Complex or unique geometry
Traffic micro-simulation models

- Car-following model
- Lane-changing model
- Gap-acceptance model
- Lane-choice model
- Models of intersection controls
• Link-connector
• Developed by PTV in Germany
• Advantages:
  • Extensive transit modeling capability
    • Light rail
    • Bus transit with bus stations
    • Route assignment based on schedule
  • Explicit pedestrian & cyclist modeling
  • 3d graphic output / impact of grades
  • Advanced signal control logic
    • Important for demand responsive operation
    • Important for signal preemption
DATA COLLECTION

- Geometry & layout
- Traffic control: signal & sign
- Volumes (reconcile counts)
- Data for calibration
  - Travel time
  - Avg & freeflow speed
  - Queue length
  - Observations / warning signs
CALIBRATION/VALIDATION

- Driver behavior
- Startup delay & reaction time
- Minimum headway/gap acceptance
- Lane change parameters
- Car following sensitivity

- Vehicle characteristic
- Traffic composition
- Maximum acceleration / deceleration

- Roadway characteristics
- Free flow speed
- Channelization
- Parking activity
Appropriate Use of VISSIM

- Where over-saturated conditions exist, and particularly where exit-blocking occurs, or where queues interact with other facilities;
- Where network infrastructure changes dynamically throughout the modelled period (e.g. VA or SCOOT signal control, demand-dependency, bus priority at signals);
- Where accurate journey time prediction is important as an improvement measure (e.g. bus priority scheme);
- Where it is necessary to visually demonstrate the operation of a scheme, traffic management technique or control strategy for use in a stakeholder consultation or Public Inquiry.
Network - behavior in lane

• Strict

• Free
Base data – vehicles, pedestrians

- Class: Composition of types
- Type: Vehicles with similar driving behavior
- Vehicle category: Essential behavior
Route-choice models

- Static origin/destination routes
- For intersection, combined or through network
Route-choice models (2)

- Traffic - Route-choice models
  - Dynamic routes – based on simulated data
Route-choice models (3)

Dynamic Traffic Assignment – close to VISUM
Behaviours in traffic

Car following

Lane change
Car following model – Wiedemann Model

- Psychological factors
  - Desired speed
  - Desired safety distance

- Physical factors:
  - Limits of detection
  - Driving errors
Traffic control – priority rules

Min. Gap Time: 3 sec
Min. Headway: 25 ft
Traffic control – traffic signals

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Evaluations

- System level
  - General time loss
  - Average travel times
  - Running distances
- Intersections
  - Time loss in intersection
  - Queue length
  - Number of stops
- Road sections
  - Traffic density
  - Traffic volumes
  - Speeds
- Public Transport
  - Travel times
  - Deviations in travel times
  - Passengers waiting times
- Emissions
- Traffic control
  - Average cycle time (if not fix)
  - Average green time (if not fix)
- Also available for selected routes
Applications

Motorway
• Testing type of junctions
• Merging sections
• Bottlenecks (discontinued lanes)
• Ramp, ramp metering
• HOV, HOT lanes
  • High Occupancy Vehicles
  • High Occupancy or Tax
• Road toll gates
Applications (2)

Urban road network

- Testing type of junctions
  - Uncontrolled
  - Roundabout
  - Traffic lights

- Different control types
  - Fix
  - Adaptive
  - Central control

- Greenwave
Applications (3)

Public transport

• Public transport performances
  • Queue length
  • Bus stop types
    • Bus lay-bay
    • On lane

• Public transport priorization
  • Bus lanes
  • Bus green gates

• Rails, trams, buses, etc.
Applications (4)

Intelligent Transport Systems
• Dynamic speed control
• Dynamic route suggestions
• Variable-message sign
• Ramp metering