Assessing the Effectiveness of the BRT lane

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1. Context & Problem Statement

- **Context:**
  - Hanoi faces severe traffic congestion
  - BRT route 01 (Kim Ma - Yen Nghia) launched to reduce congestion
- **Reality:**
  - Mixed traffic conditions (motorbikes, cars, buses)
  - The dedicated lane is invaded by personal vehicles
- **Research question:** Is the dedicated lane effective?

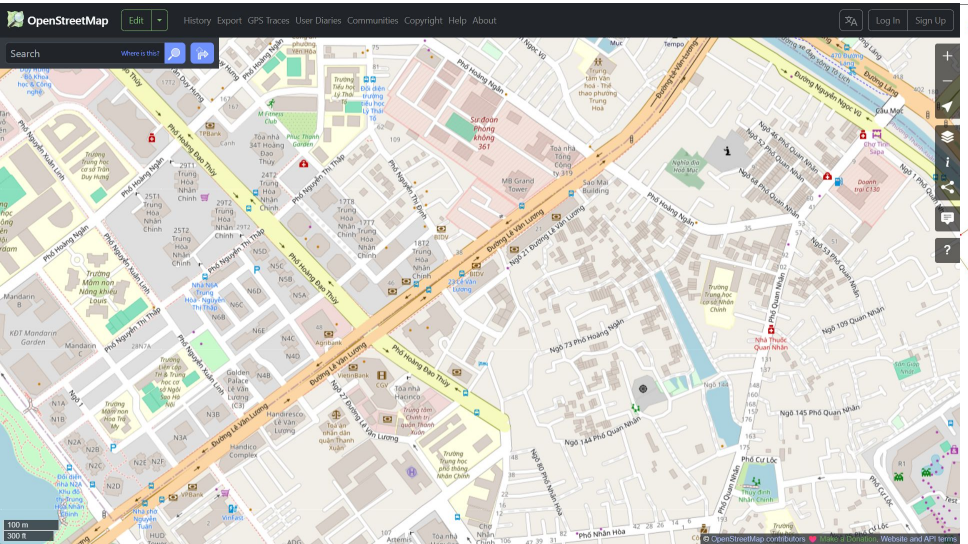
2. Methodology

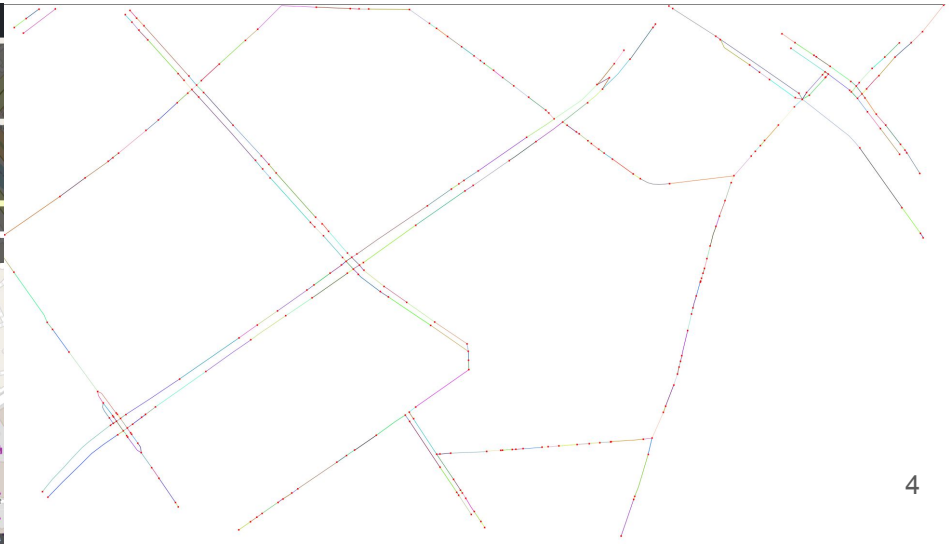
- Traditional models treat traffic as fluid flow.
- ABM treats every vehicle as an individual with decision-making capabilities.
- GAMA Platform: Native GIS support and the advanced Driving Skill (handles collision, acceleration, lane changing).

3. Input Data

- Source: OpenStreetMap raw data (.osm format)
- Key attributes extracted: highway types, lanes, traffic_signals

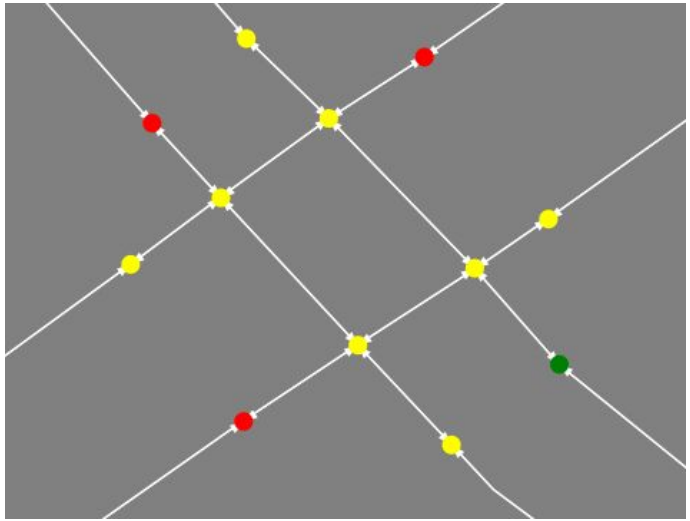
- Tool: GAMA Plugin models (Built-in utility)
  - Path: Plugin models/Driving Skill/models/Utilities/ OSM Loading Driving.gaml
- Output: roads.shp (Edges) and nodes.shp (Intersections) compliant with the Driving Skill.





4. Species

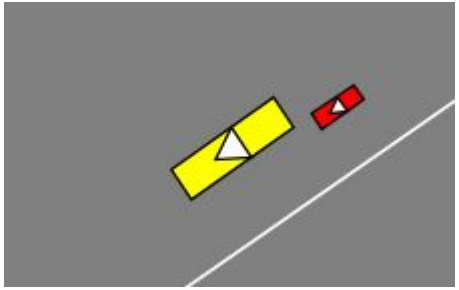
- intersection skills: [intersection_skill]
  - Path: Plugin models/Driving Skill/ models/Advanced models/Traffic.gaml
  - If its type contains ‘traffic_light’, it will simulate a traffic lights



- base_vehicle skills: [driving]
  - Path: Plugin models/Driving Skill/ models/Advanced models/Traffic.gaml
  - Shifts the position of the vehicle perpendicularly to the road in order to visualize different lanes

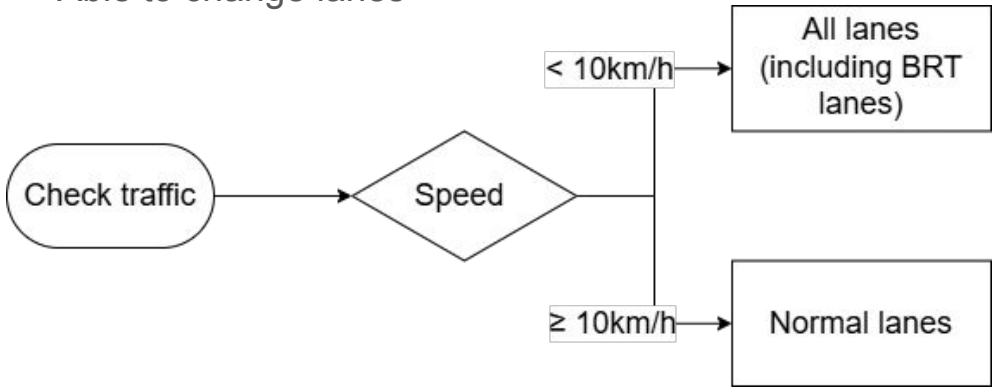
4. Species

- car parent: base_vehicle
  - vehicle_length: 5m
  - num_lanes_occupied: 2
  - allowed_lanes: [0, 1, 2]
  - passengers: random(1, 7)



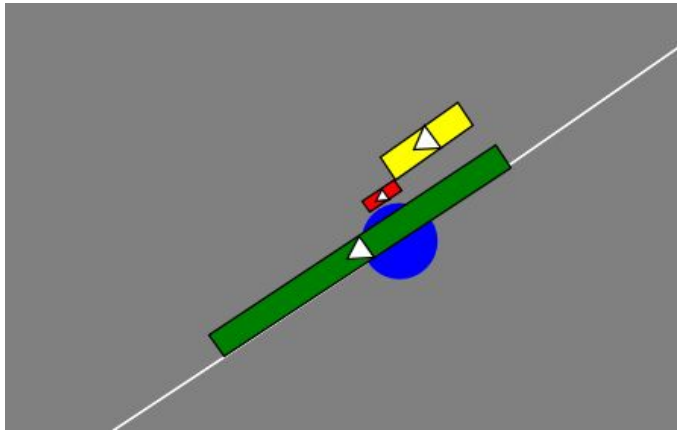
- motorbike parent: base_vehicle
  - vehicle_length: 2m
  - num_lanes_occupied: 1
  - allowed_lanes: [0, 1, 2, 3]
  - passengers: random(1, 2)

- Drive from one end of Le Van Luong street to the other
- Able to change lanes



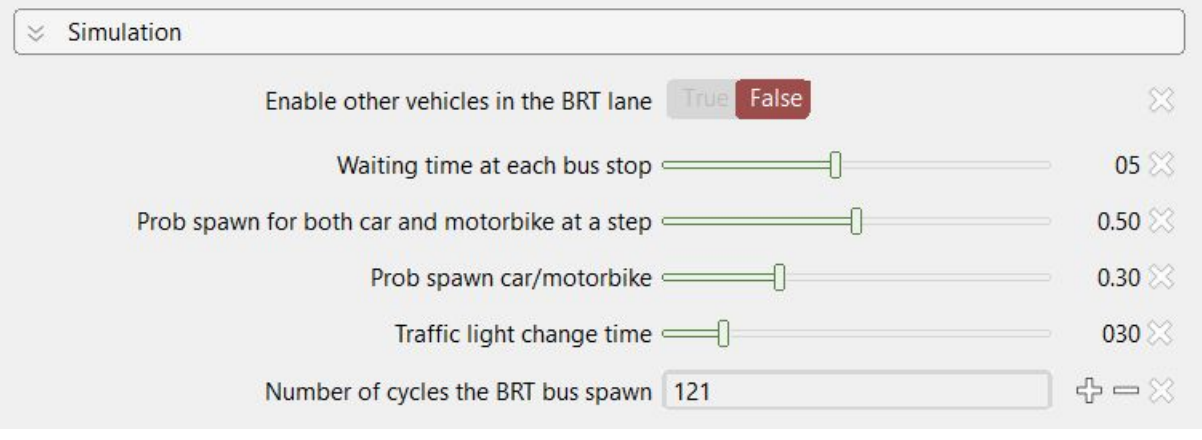
4. Species

- brt_bus parent: base_vehicle
  - vehicle_length: 18m
  - num_lanes_occupied: 2
  - lowest_lane: 4
  - passengers: random(2, 80)
  - Stopped at 2 bus stops
  - Measure travel time and speed



5. Parameters

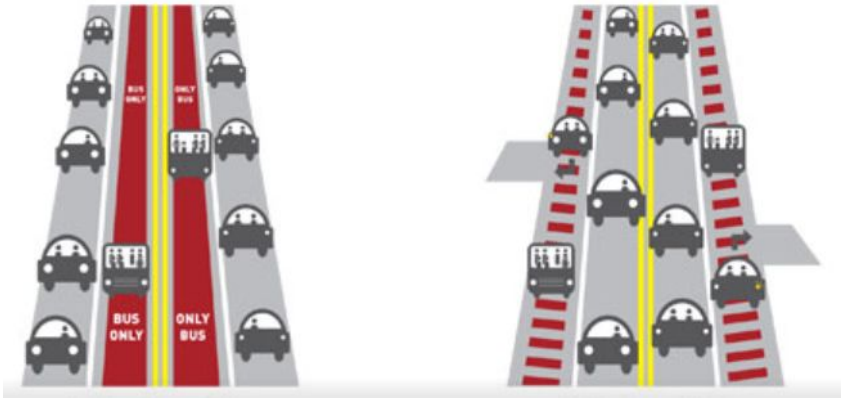
- Enable other vehicles in the BRT lane: boolean, default: false
- Waiting time at each bus stop: int, default: 5, min: 1, max: 10
- Probability spawn vehicles at each step: float, default: 0.5, min: 0.0, max: 1.0
- Probability spawn car/motorbike: float, default: 0.3, min: 0.0, max: 1.0
- Traffic light change time: int, default: 30, min: 0, max: 200
- Number of cycles the BRT bus spawn: int, default: 121, min: 1



6. Result & Model behavior

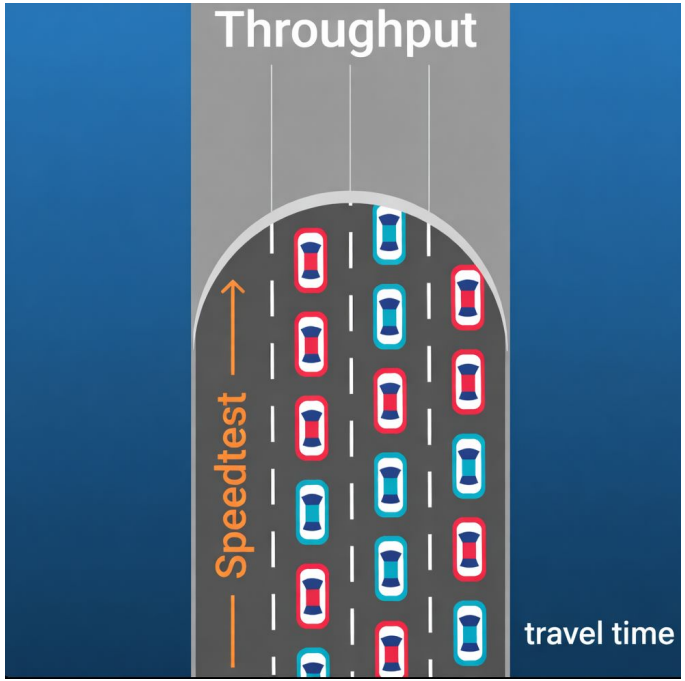
- Main behavior
  - Vehicles move in lanes.
  - Bus stops additionally at the stations.

- Model exploration
  - Hard separation: BRT lanes for buses only.
  - Mixed traffic: all vehicles can use BRT lanes.
    - Condition: when *speed < 10 km/h*.



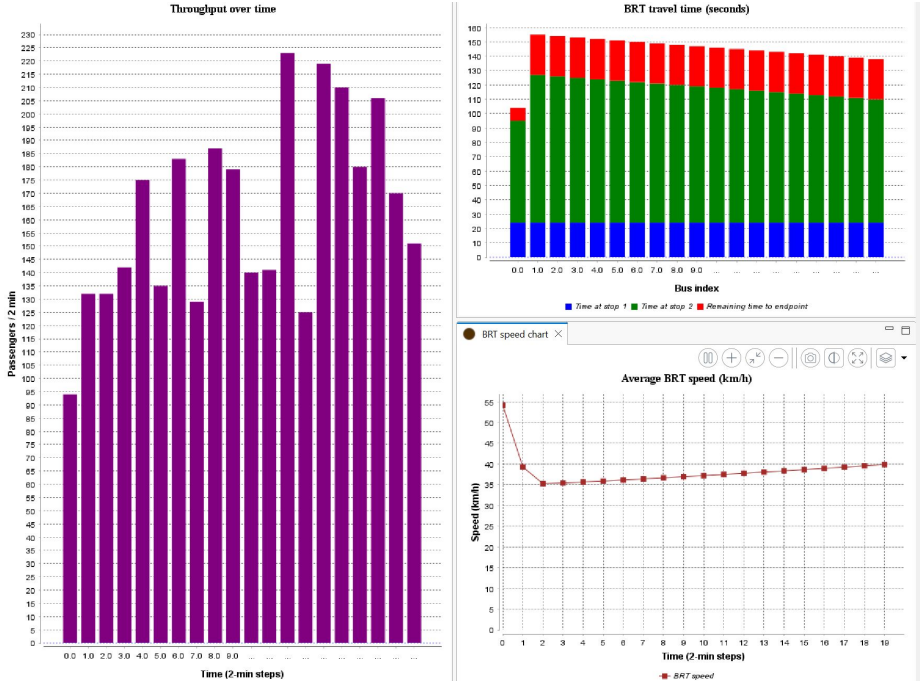
6. Result & Model behavior

- Model evaluation
  - Throughput number
    - Global reflex ***count_intersection_flow***.
    - Count the number of passenger on each vehicle.
    - Base: a traffic light between 2 bus stops.
    - Time interval: every 2 mins.
  - Bus travel time
    - Reflex ***commute*** from ***brt_bus***.
    - Count the time the bus reach each stop.
    - Base: 2 bus stops and destination.
    - Time interval: bus reaches destination.
  - Average bus speed
    - Global reflex ***report_brt_speed***.
    - Formula: *total speed / total time step*.
    - Time interval: every 2 mins.

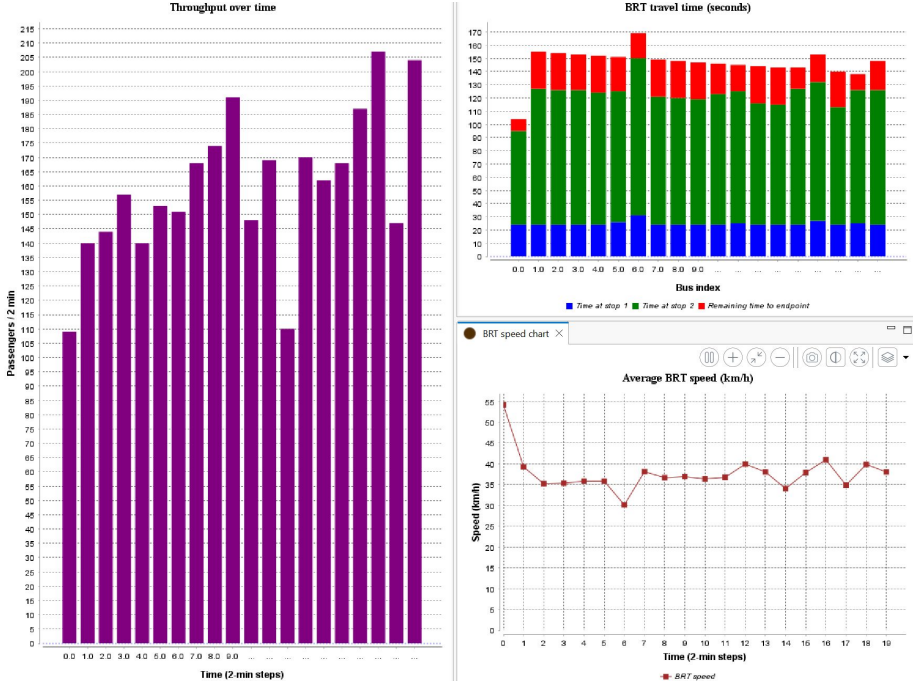


6. Result & Model behavior

- Key observation: *In mixed-traffic case, smooth traffic:*
  - Buses move slower.
  - Less passenger throughput



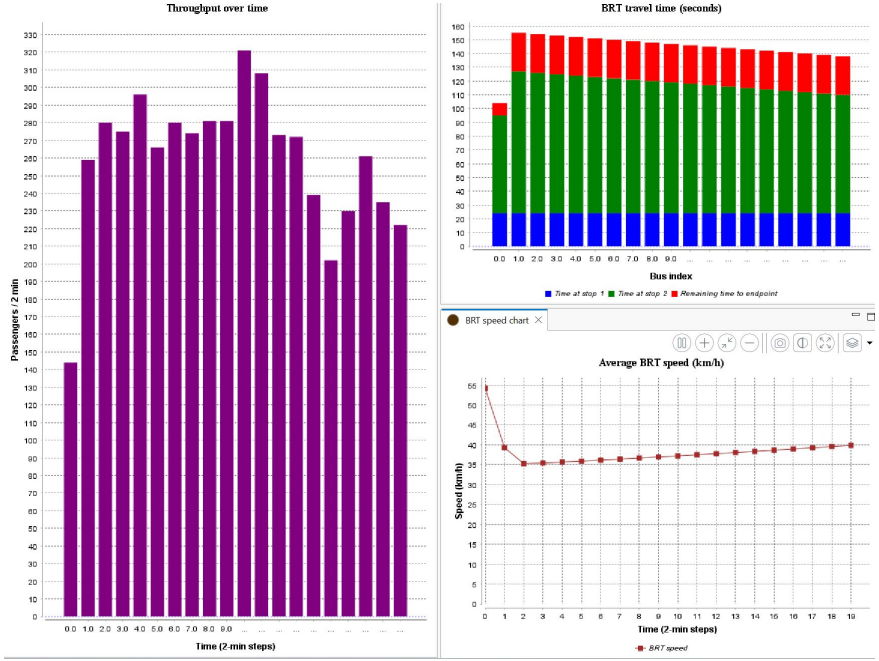
Hard separation



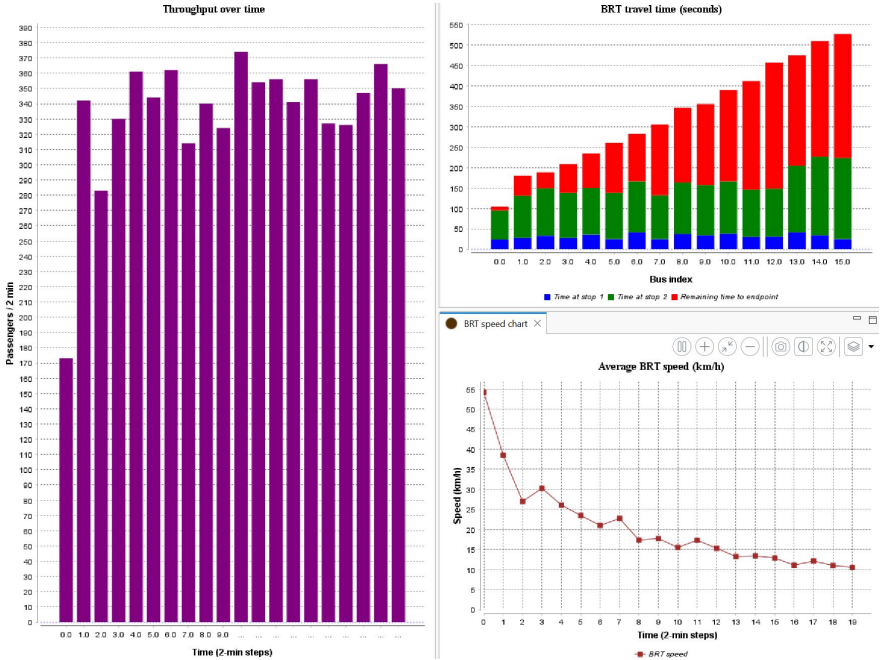
Mixed-traffic

6. Result & Model behavior

- Key observation: *Different result in rush hours:*



Hard separation



Mixed-traffic

➽ ***<u>Model answer</u>: BRT lanes don't fit the examined map well.***

7. Limitations & Challenges

- **Conceptual**: Understand the driving skill plugin

  => *Use documents.*

- **Data**: Raw cut from QGIS for lanes

  => *Use plugin utilities.*

- **Technical**: Deprecated plugin params *proba_lane_change_up*

  => *Change logic.*

8. Future Work

- **Behavior realism:**
  - Params from the plugin: compliance, aggression,..
- **New species:**
  - Passengers
  - Wait at bus stop.
  - Probability to choose buses.
  - Hop-in & hop-off.
- **New experiment:**
  - Vehicles joins BRT lanes if not blocking .
  - Consider speed and distance to the bus.

9. Reference

- **Driving skill:**
  - https://gama-platform.org/wiki/UsingDrivingSkill