Project Sihlstrasse

Filip Meier and Sebastian Honegger

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Overview

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Introduction project Sihlstrasse

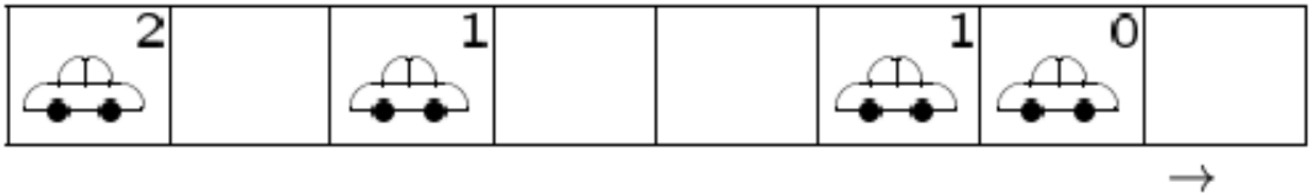
Figure: *Reference:* Neue Verkehrsorganisation Uraniastrasse (project booklet), *Tiefbauamt Stadt Zuerich*,

Project Questions

1. Are the streets still large enough to manage the traffic jam peaks on working days?
2. What is the impact on the neigbourhood streets?

Simulation-model

Chowdhury-Schadschneider-model:
Start configuration:



1. **Acceleration:** If $v_n < v_{\max}$ at time t, the car n will accelerate is velocity about one unit:

$$v_n \rightarrow v_n' = \min(v_n + 1, v_{\max}) \tag{1}$$

v_n' represents the new velocity at time $t + 1$.

Figure Reference: Physik des Strassenverkehrs, *Andreas Schadschneider*,http://www.thp.uni-koeln.de

Simulation-model

2. **Slow down because of cars or traffic lights**
   1. case: The traffic light is red:

$$v_n' \rightarrow \min(v_n, d_n, s_n) \tag{2}$$

   2. case: The traffic light is green:
      a. The traffic light get red in the next time step:

$$v_n' \rightarrow \min(v_n, d_n, s_n) \tag{3}$$

      b. The traffic light is not getting red:

$$v_n' \rightarrow \min(v_n, d_n) \tag{4}$$

Figure Reference: Physik des Strassenverkehrs, *Andreas Schadschneider*,http://www.thp.uni-koeln.de

Simulation-model

3. **Randomization** If $v_n'' > 0$, the velocity of car n will be randomly with the probability p reduced about one unit:

$$v_n'' \rightarrow v_n''' = \begin{cases} \max(v_n'' - 1, 0) & \text{with probability} \quad p \\ v_n'' & \text{with probability} \quad 1 - p \end{cases} \tag{5}$$

Figure Reference: Physik des Strassenverkehrs, *Andreas Schadschneider*,http://www.thp.uni-koeln.de

Simulation-model

4. **Drive:** The car n drives with the new velocity $v_n(t+1) = v_n'''$ about $v_n(t+1)$ cells:

$$x_n(t+1) = x_n(t) + v_n(t+1) \tag{6}$$

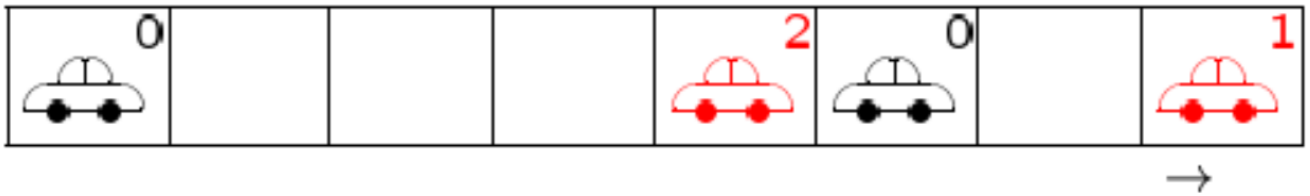
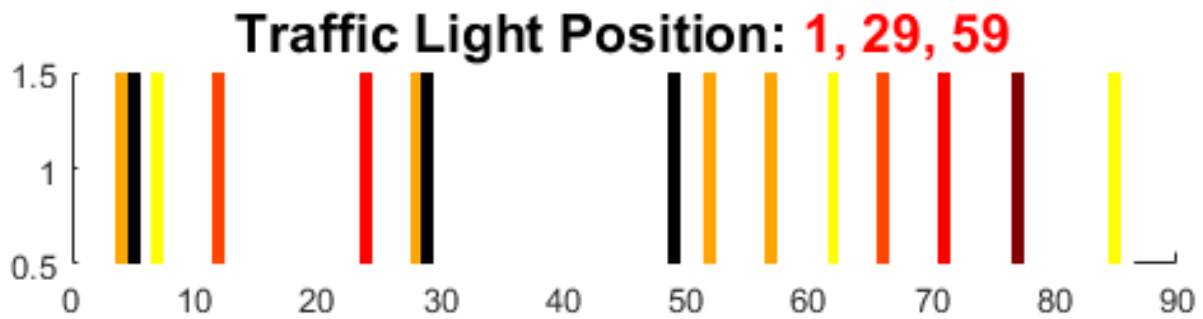


Figure Reference: Physik des Strassenverkehrs, *Andreas Schadschneider*,http://www.thp.uni-koeln.de

Implementation of the model

Color-code for street and velocity:

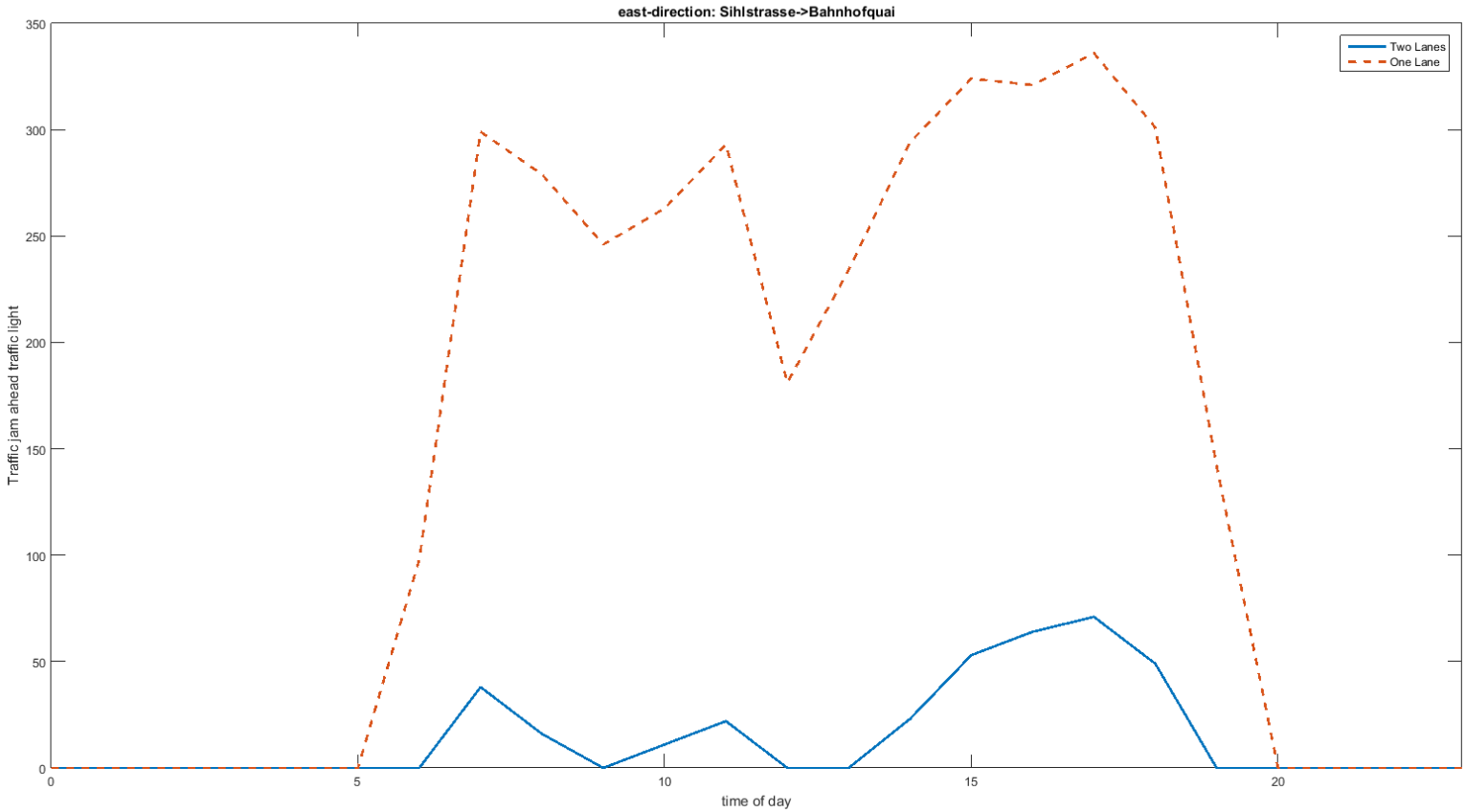
```
colormap = [    0.0,        0.0,        0.0 ;   %black=1        <=> Speed==0
                1.0,        1.0,        0.0;    %yellow=2       <=> Speed==1
                1.0,        165./255.,  0.0;    %orange=3       <=> Speed==2
                1.0,        69./255.,   0.0;    %orange red=4   <=> Speed==3
                1.,         0.0,        0.0;    %red=5          <=> Speed==4
                128./255,   0.0,        0.0;    %maroon=6       <=> Speed==5
                1,          1,          1];     %white=7        <=> free_road
```



Assumptions: Unknown parameters

- **Input:** cars per hour
  - official data set from city of zurich (number of cars which pass traffic light Bahnhofstrasse)
  - values Sihlstrasse: $[115, 74, 52, 46, 51, 128, 508, 719, 698, 656, 691, 706, 607, 652, 704, 732, 746, 751, 729, 559, 397, 335, 325, 247]$
- **Traffic lights:**
  - Position: -
  - 4 steps red, 11 steps green (synchronous: green $\Leftrightarrow$ red)
- **Output:** cars per hour
  - last traffic light...
  - Output: 600 cars/hour

Results



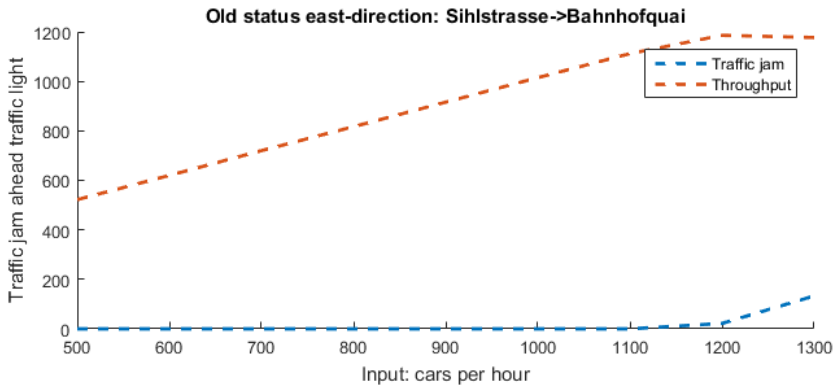
- **Traffic jam:** around 300 cars ($\approx 2.2\,\mathrm{km}$) more at the peak times
- Reasons:
  - less space for cars (one lane): $+86$ cars
  - less throughput of the street: $+200$ cars

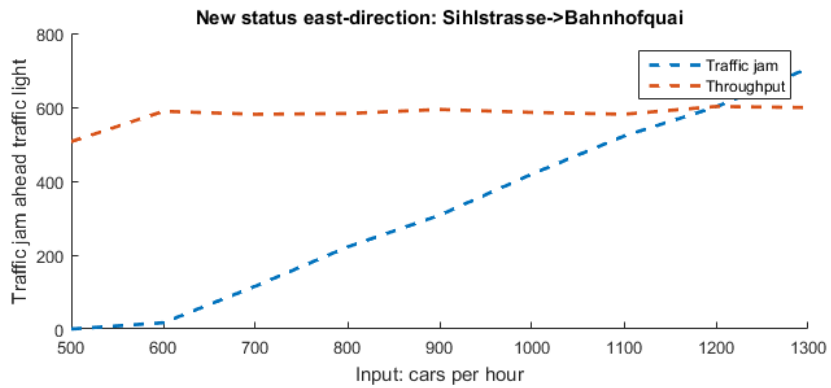
Bottleneck?

- *"Diese Verkehrsmenge auf der Ausweichroute kann zu den Hauptverkehrszeiten weder zusaetzlich am Knoten Sihlporte noch am Knoten Urania-/Bahnhofstrasse verarbeitet werden. Dies hat aber keinen Einfluss auf die tatsaechliche Kapazitaet, weil ohnehin der Knoten Uraniastrasse/Bahnhofquai leistungsbestimmend ist, sowohl heute wie im zuknftigen Zustand."* (City of Zurich, project booklet)

- What if:
  - Traffic lights: always green
  - Output: ∞

- Conclusion:
  - bottleneck is not given by the last traffic light (Output) **if** the capacity is bigger than 600 cars per hour.





Conclusion

- Simulation is working for both situations:
  - one lane or two lanes
  - both direction
  - different parameters (input, output)
- 300 cars more for the one lane simulation, high impact on the neighbourhood streets
- Future improvements:
  - traffic light set-up: red and green circuit (asynchronous)