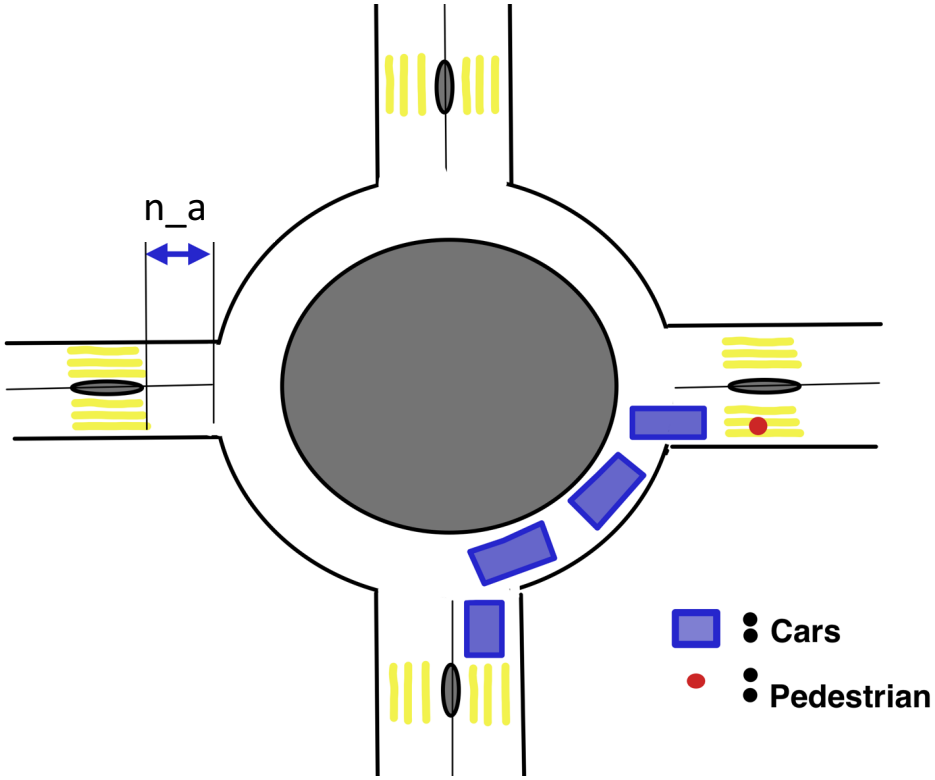
ETH zürich

The impact of pedestrians on roundabout‘s entry

A simulation in the context of the lecture, Modelling and Simulating Social Systems with MATLAB

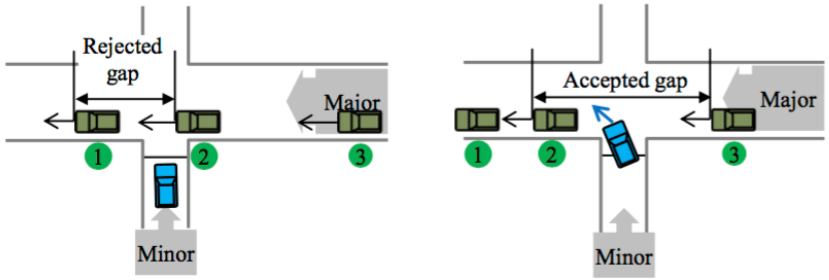
Introduction



Research Question:

Is a reasonably small increase of the storage space between the yield line and the crosswalk “n_a “ has a significant positive impact on the entry capacity “Cs” ?

Gap acceptance theory



(a) Rejected gap (b) Accepted gap

Fig. 1

- Minorflow: Vehicles intending to merge into the roundabout
- Majorflows: Pedestrians crossing and circulating vehicles
- Entry-capacity Cs: How many vehicles can enter one accepted gap and how accepted gaps are provided
- Roundabout ⇔ two unsignalized intersections to cross and merge into.

The model

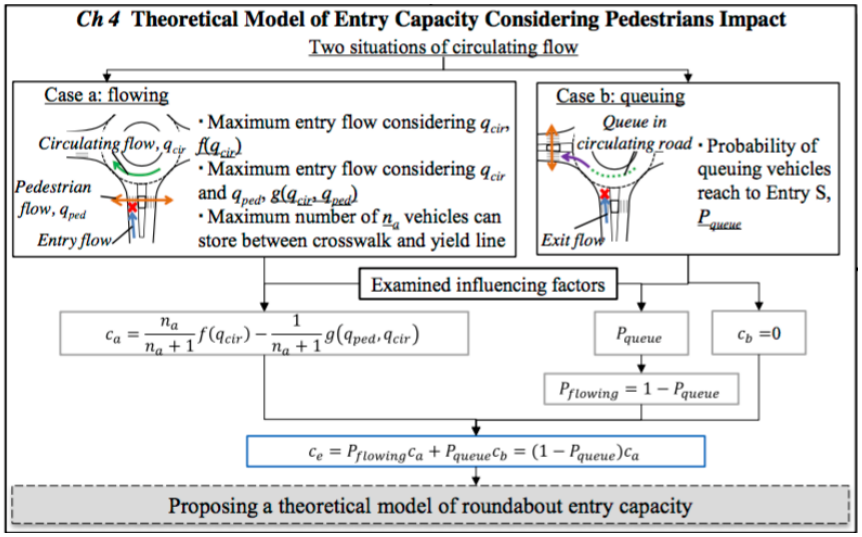
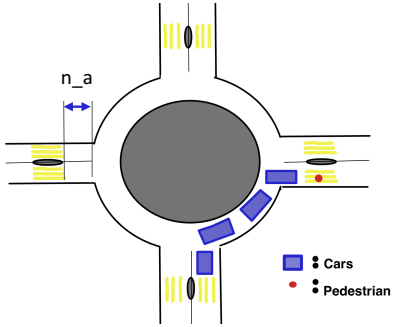
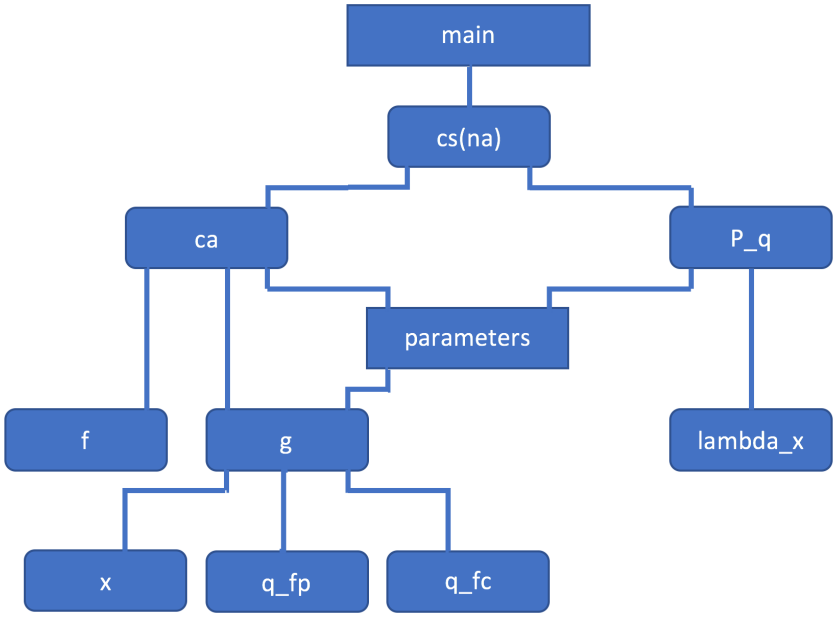


Fig. 2



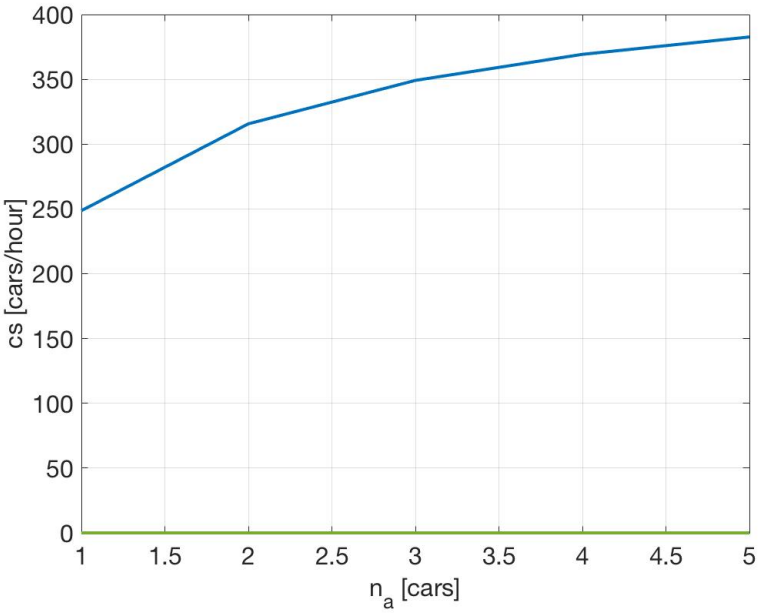
- Circulation flow divided in flowing traffic (Ca) queuing traffic (Pq)
- Ca(n_a) is adjusted with f and g
- f = maximum entry flow without considering pedestrians (simple case)
- g = maximum entry flow considering pedestrians but without storage space (calculated using Queue theory)
- Pq is estimated using queuing theory

The implementation



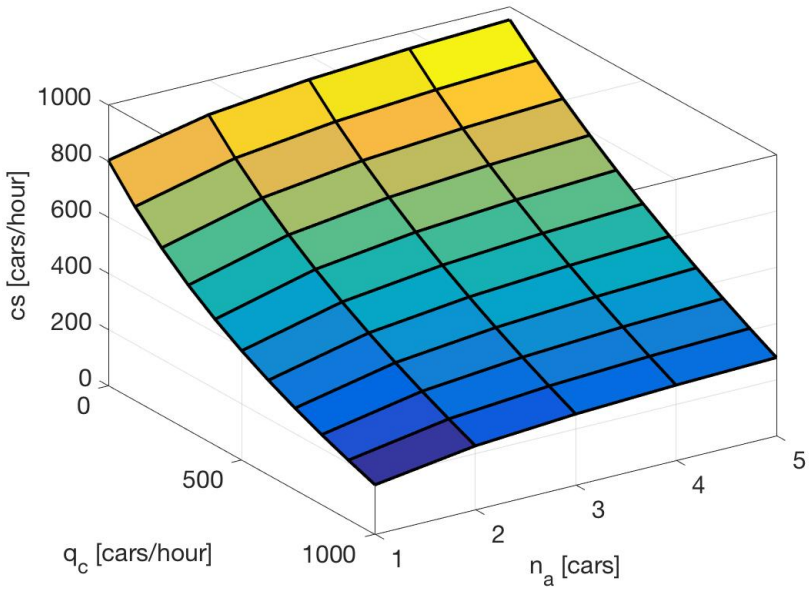
- Two different Implementations
- First shows the impact of a growing n_a
- Second shows the difference between n_a =1 and n_a =2 over a day.

Results and Discussion



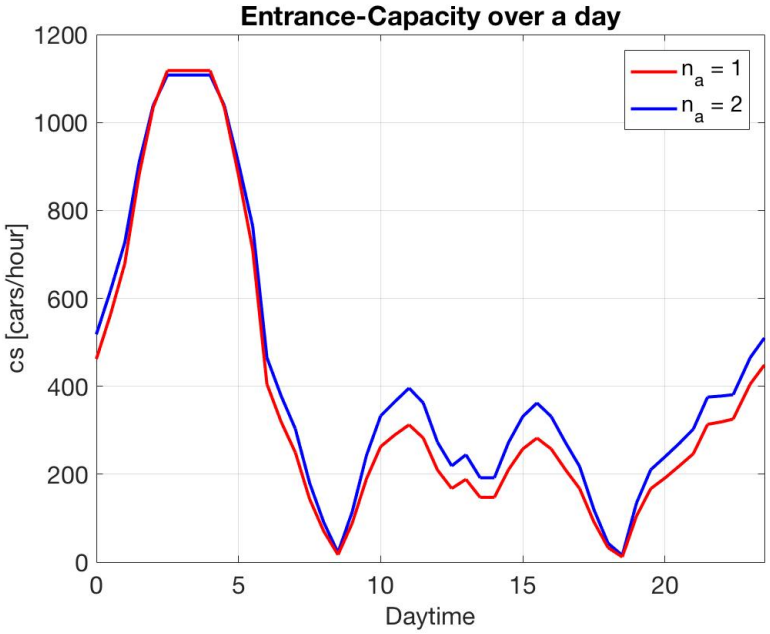
- Fitting parameters because of the simplified model
- Values in the same range as in the model from Dr. Eng. Nan Kang and Dr. Eng. Hideki Nakamura
- A big change of cs from n_a = 1 n_a= 2

Results and Discussion



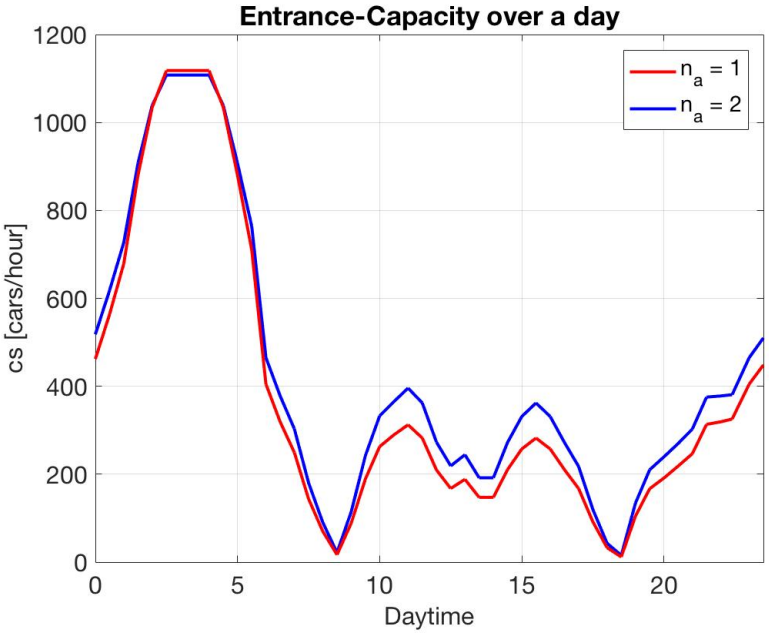
- Impact of n_a remains for changing q_c
- n_a = 2 is the most promising value

Results and Discussion



- First implementation was not very accurate
- q_c, q_cprime, q_p and q_pprime vary over 24 hours
- Only an improvement of eleven percent over a day
- Big improvement between 10am and 5pm

Results and Discussion



- Behaves as expected
- Model is highly simplified but still gives consistent results
- n_a might have a big influence
- Next step actual data of a roundabout

Conclusion

Research Question:

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References

- Fig. 1: http://ir.nul.nagoya-u.ac.jp/jspui/bitstream/2237/20517/2/10680本文.pdf
- Fig. 2: http://ir.nul.nagoya-u.ac.jp/jspui/bitstream/2237/20517/2/10680本文.pdf