Capacity Calculation Methodology for Unsignalized T-intersection

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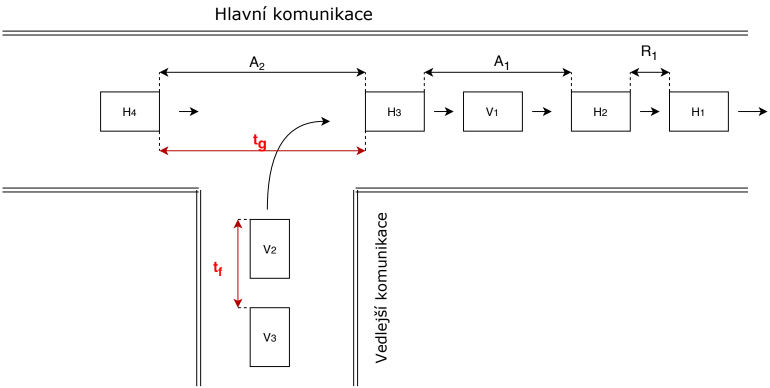
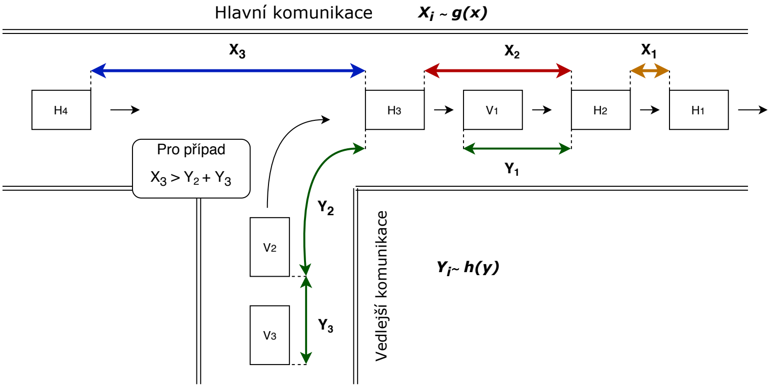
Gap acceptance theory

- How will the drivers be able to utilize a particular gap?
- What is the minimal gap all drivers are going to accept?
- Application: capacity calculations for unsignalized intersections, ovetaking, etc.

Given situation



Using probability



Critical gap

- 50 % of drivers accept given gap and 50 % refuse it,
- Acceptance:

$$Y_i \leq \overbrace{X_j - \sum_{m=\ell}^{i-1} Y_m}^{\text{always positive}}$$

- Assumptions:
  - Saturated state of traffic,
  - no congestion on the main road,
  - independance of neighbouring gaps.

Approach of Werner Siegloch (1973)

- Siegloch function $s(t)$

$$s(t) = \sum_{n=0}^{+\infty} n \cdot P_k(t)$$

- Capacity computation:

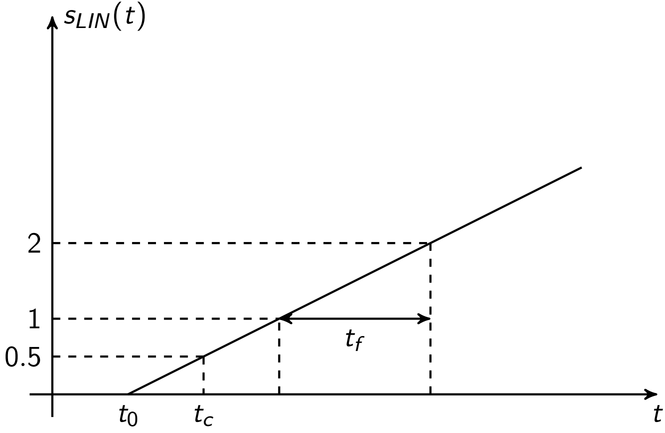
$$C = q_p \int_0^{+\infty} g(t) \cdot s(t)\mathrm{d}t,$$

- Approximation of Siegloch function $s_{LIN}(t)$

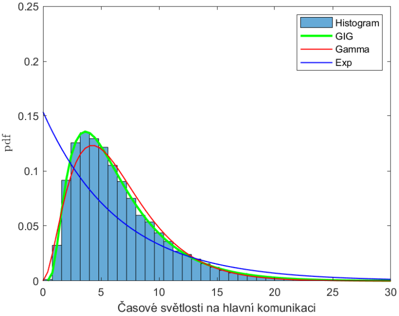
$$s_{LIN}(t) = \theta(t - t_0)(\frac{t - t_0}{t_f}),$$

$$C \approx q_p \int_0^{+\infty} g(t) \cdot s_{LIN}(t)\mathrm{d}t.$$

Interpretation of linear approximation of Siegloch function



Probability distributions used in traffic



- Exponential distribution

$$g(x) = A\theta(x)\mathrm{e}^{-\lambda x},$$

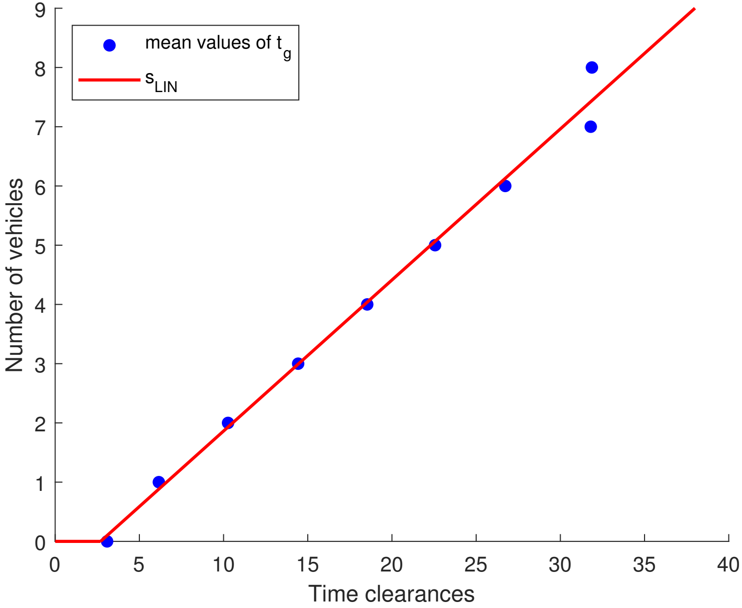
- Gamma distribution

$$g(x) = A\theta(x)x^{\beta}\mathrm{e}^{-\lambda x},$$

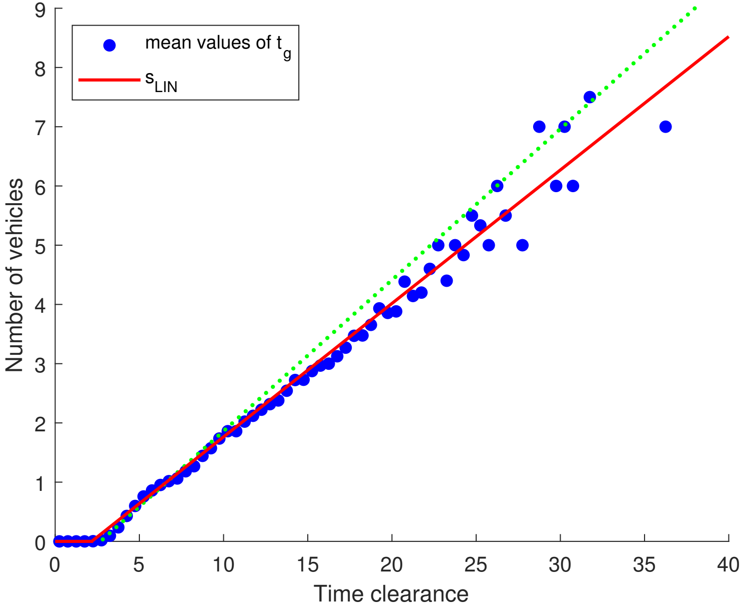
- Generalized Inverse Gaussian distribution (GIG)

$$g(x) = A\theta(x)x^{\alpha}\mathrm{e}^{-\frac{\beta}{x}}\mathrm{e}^{-\lambda x}.$$

Standard way of finding $s_{LIN}(t)$



Correct use of $s_{LIN}(t)$



Capacity computations

	q_p	t_0	t_f	Capacity C_1	C_2	C_3	C_4
Dataset Munich 1	716.7	2.835	4.633	569.5	395.0	393.5	375.2
		2.271	4.423	517.9	392.9	390.8	
Dataset Munich 2	601.6	2.695	4.656	585.1	460.1	457.8	441.8
		2.248	4.439	557	457.9	455.8	
Dataset Dresden	516.2	2.327	4.544	581.7	495.2	494.4	490.3
		2.45	4.442	570.4	481.5	480.5	