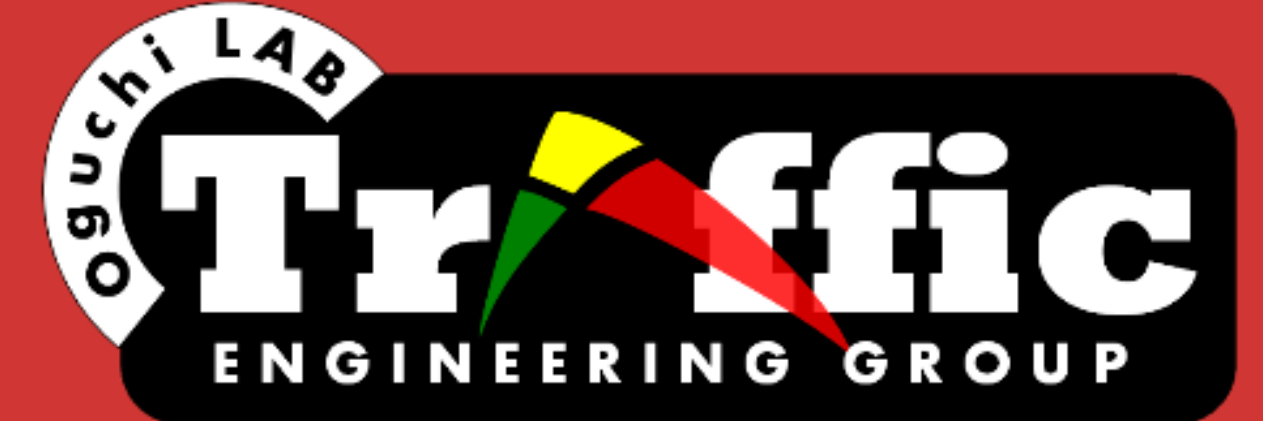


Application of Tandem Sorting Strategy to Increasing Urban Intersection Capacity: A Case Study

タンデムソーティング戦略による信号交差点の容量増強のケーススタディ



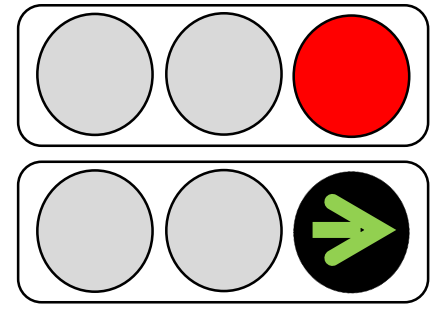
東京大学 生産技術研究所 大口研究室 (交通工学) ガスパイ, サンディ マエ

<http://www.transport.iis.u-tokyo.ac.jp/>



Background

Common in Japan:
Protected Right-turn Phase



Protected (Separate) Turning Phase

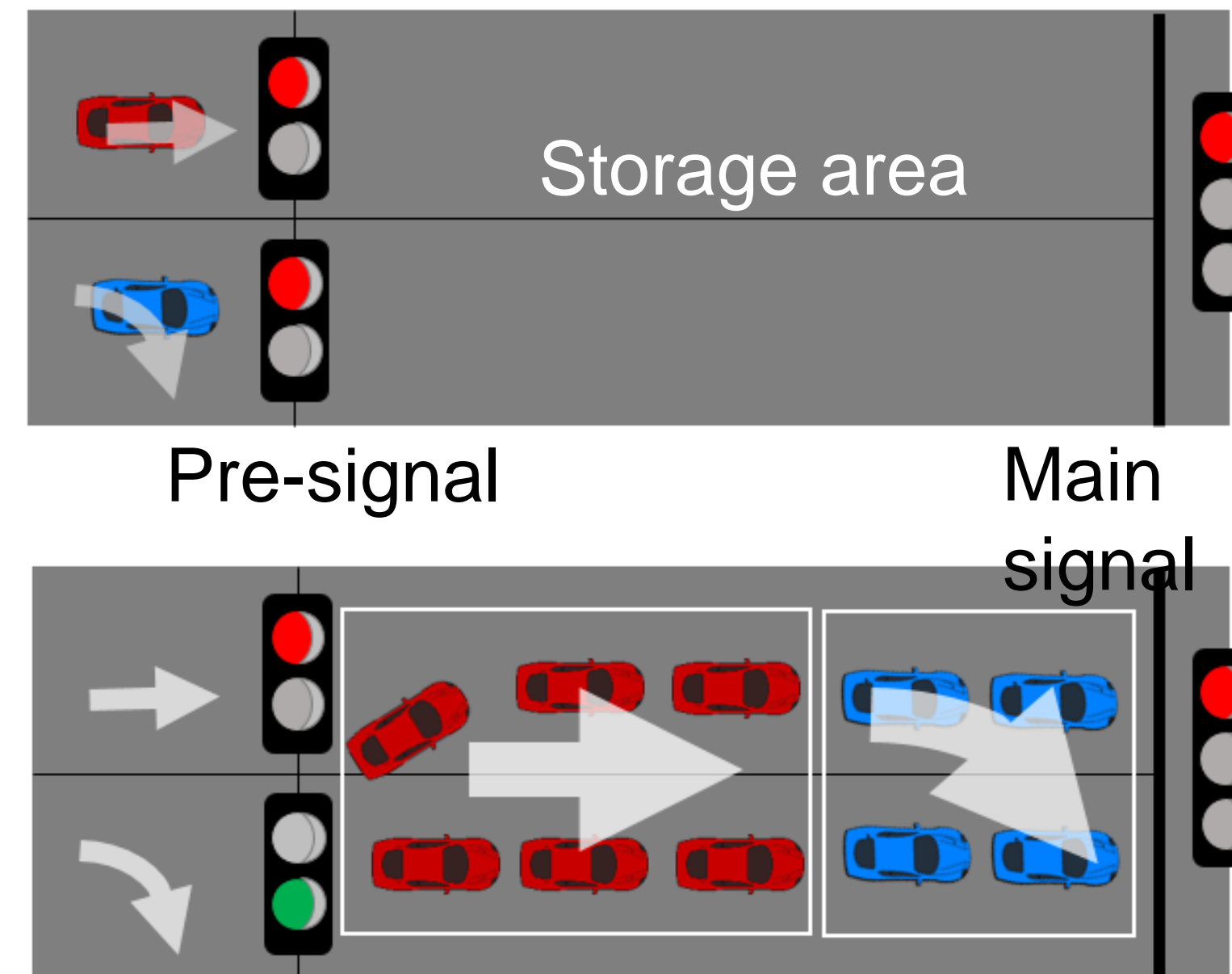
To minimize conflict between turning vehicles and opposing through traffic.

DISADVANTAGES:

- Decreases through traffic green time.
- Turning phases are not given enough green time. High delay for turning vehicles.

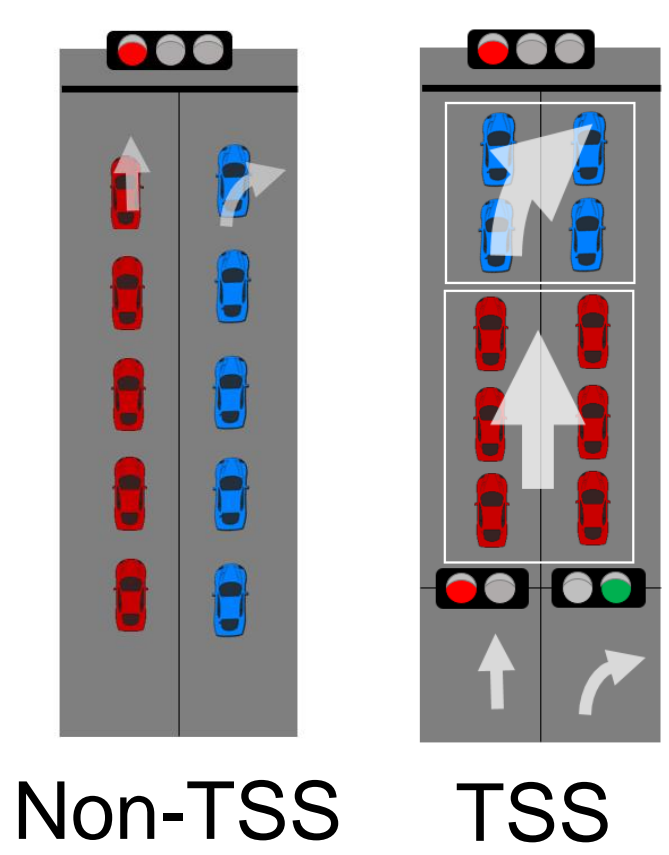
Tandem Sorting Strategy (TSS)

TSS concept was proposed by Xuan, et. al. (2011).



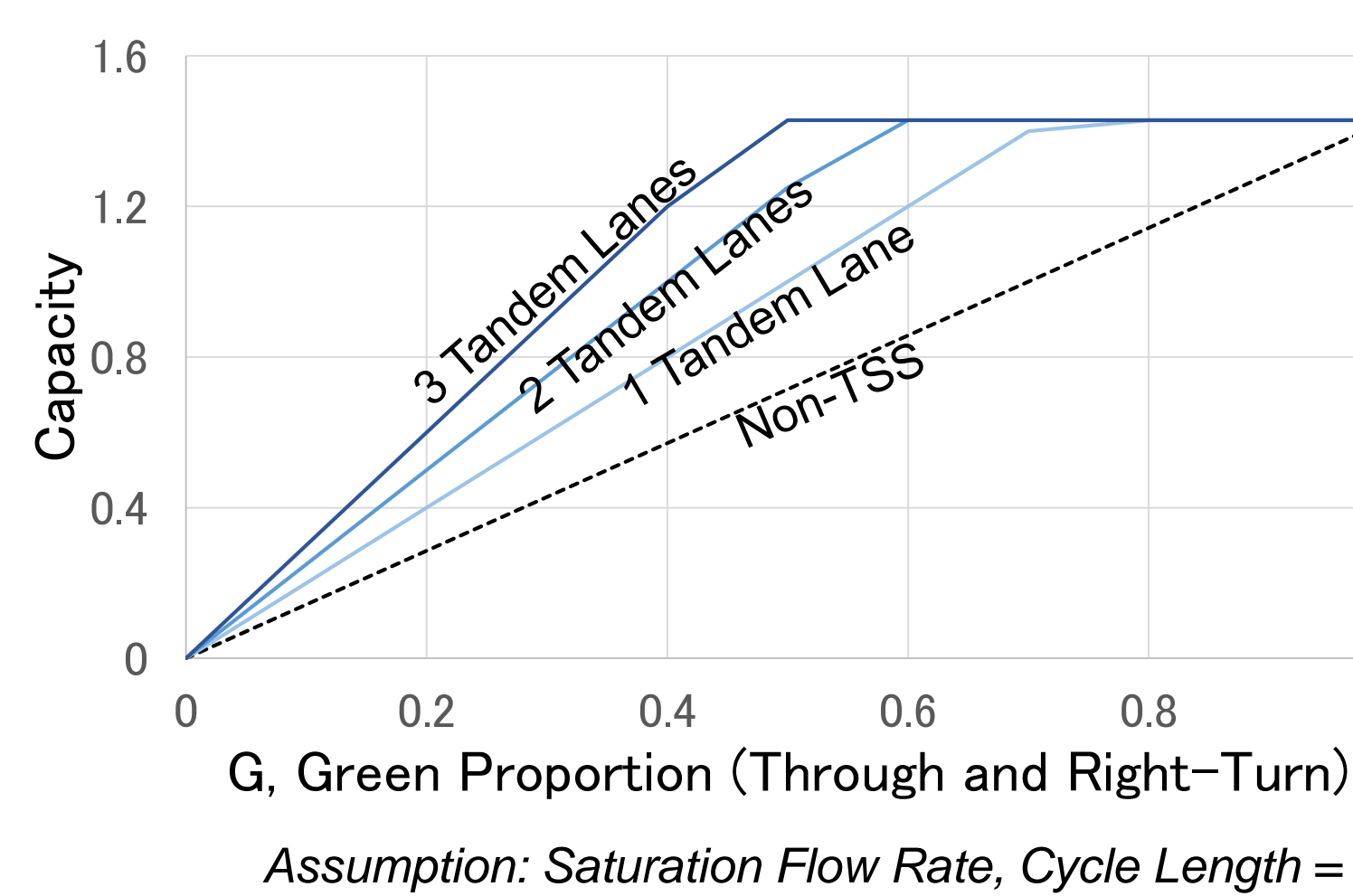
- Step 1:** Vehicles are separated by turning movement before reaching the pre-signal.
- Step 2:** Vehicles occupy (at most) all lanes in the storage area. First, the right turners. Then, the through traffic.

Benefits of TSS



- **Increased** discharge lanes
- **Higher** overall capacity
- **Lower** required green times = **Less** delay
- **Flexible** in time and space

TSS vs Conventional Intersection



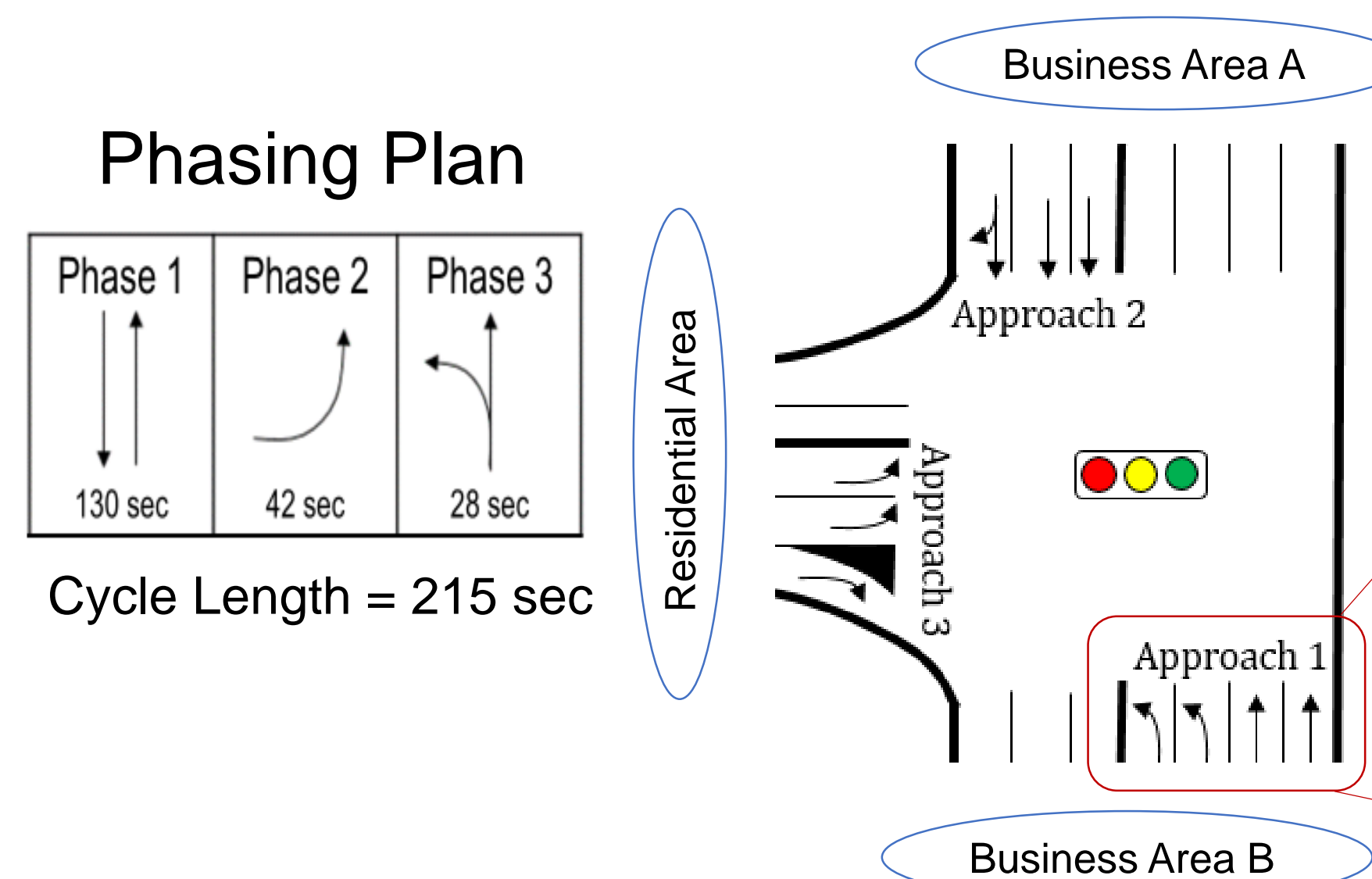
Capacity of TSS is larger than that of non-TSS.

$$Capacity = \min \left\{ \frac{G}{\left(\frac{r}{N_R}\right) + \left(\frac{1-r}{N_T}\right)}, \frac{1}{\left(\frac{r}{n_R}\right) + \left(\frac{1-r}{n_T}\right)} \right\}$$

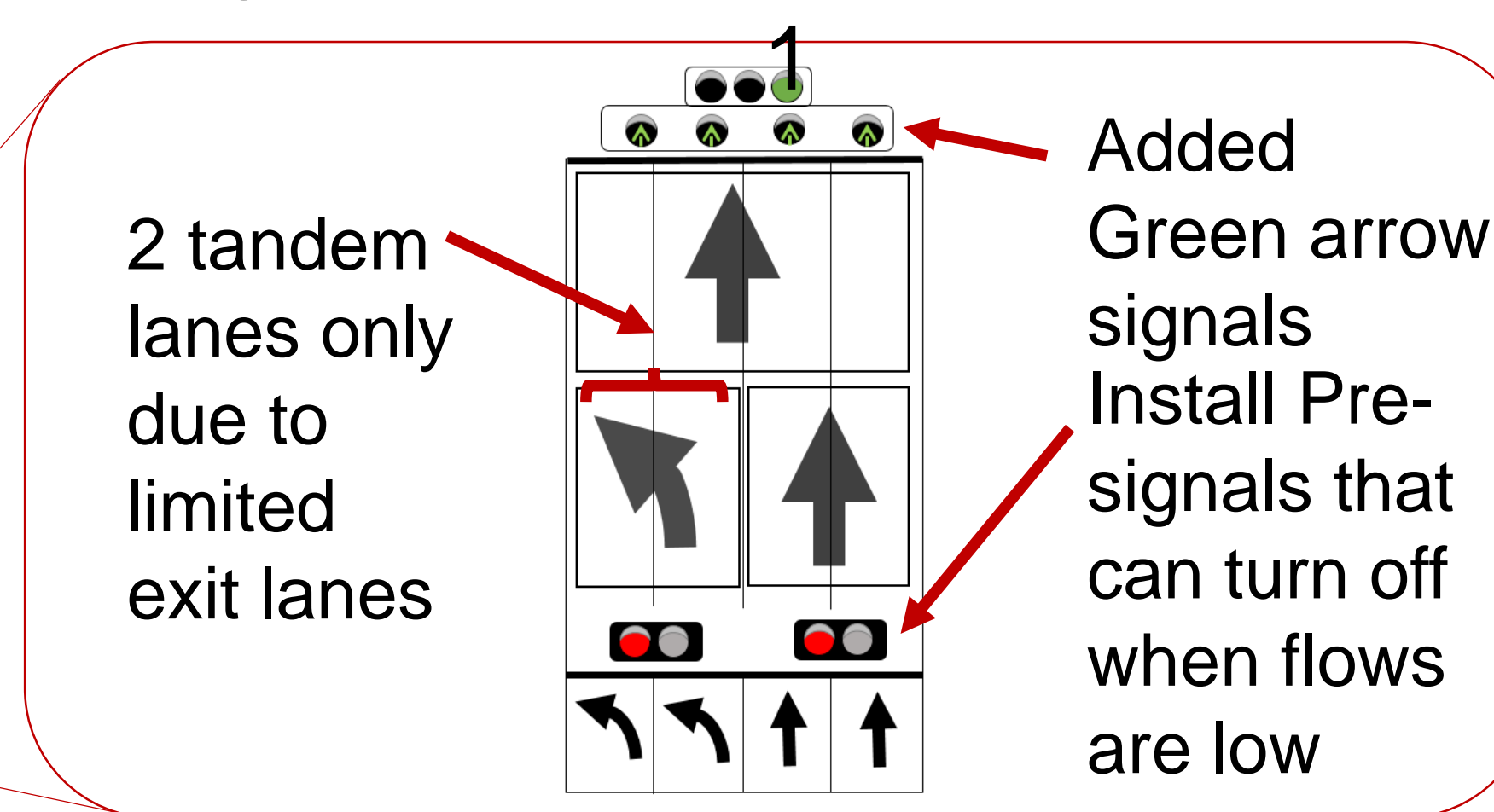
r : right-turn %
 n_T, n_R : Number of lanes upstream of pre-signal (Trough and Right-turn)
 N_T, N_R : Number of lanes downstream of pre-signal (Trough and right-turn)

Case Study of TSS in Manila

T-intersection in Manila, Philippines Capacity Improvement Strategy by applying TSS



[Stage 1] TSS is applied to Approach



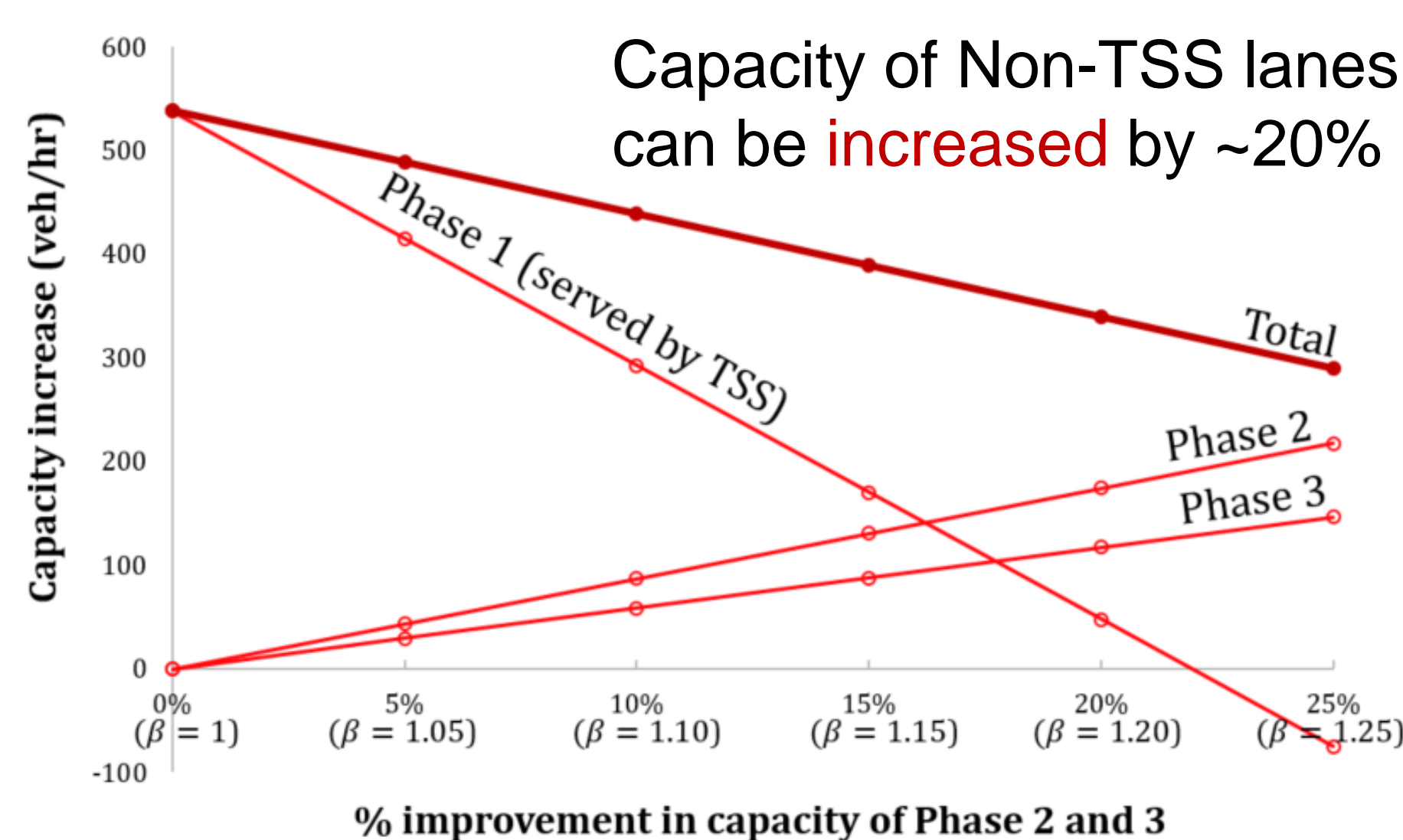
[Stage 2] Signal Parameter Optimization

- Strategy 1:
- Maintain cycle length [C=215 sec]
 - Increase capacity of Non-TSS phases by β [Pareto Improvement]
- Strategy 2:
- Decrease Cycle Length

Results of Capacity Improvement

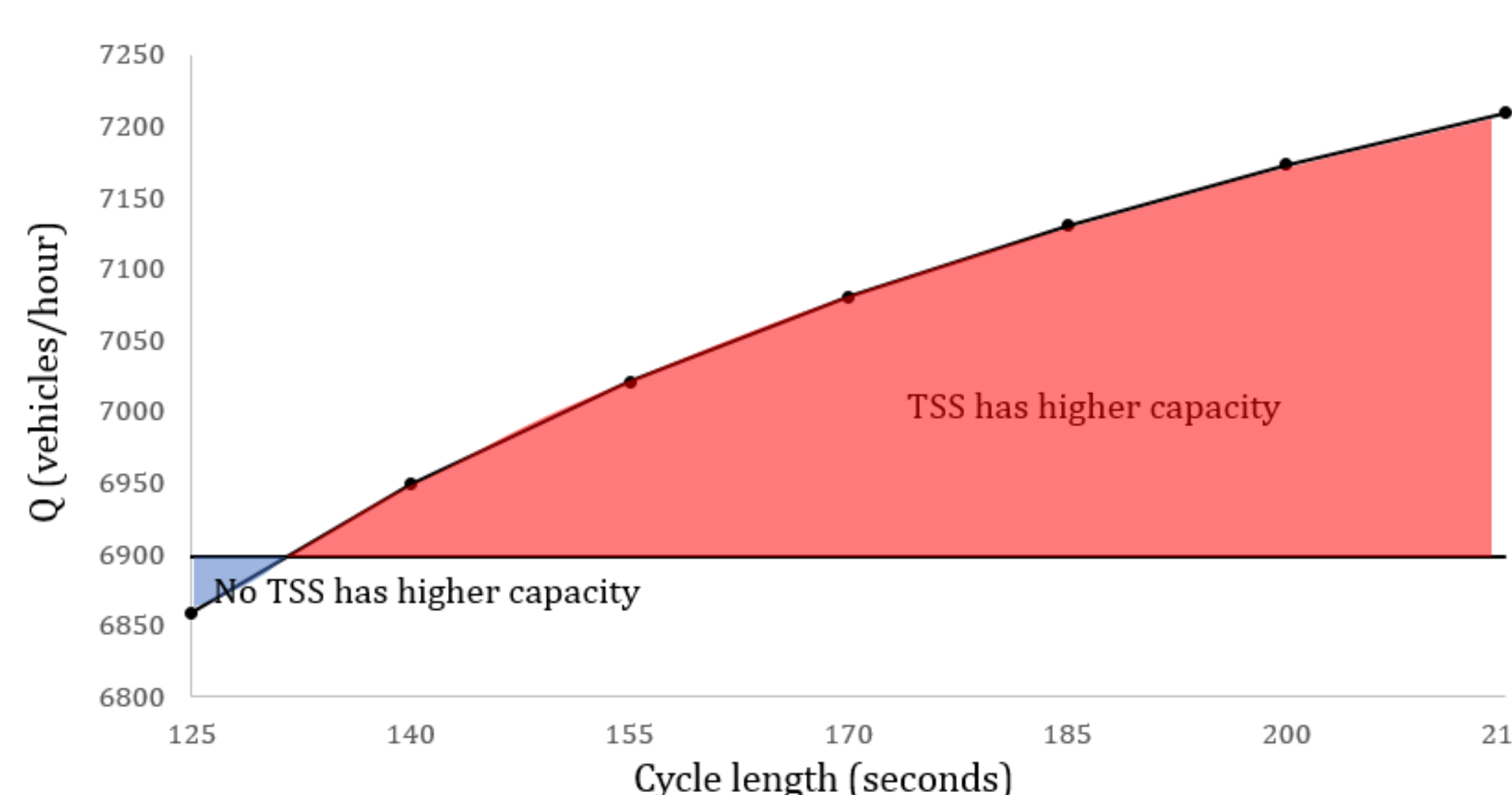
Results of Strategy 1

Pareto Improvement: Phases not served by TSS can also benefit.



Results of Strategy 2

Cycle length can be decreased to 140 seconds (75 seconds difference) and benefits are still achieved.



Challenges

TSS Capacity may be affected by:

- Storage length
- Overall link length
- Discharge failure

Failure to discharge leads to lane blockage!

Blocked vehicles are delayed by 1 cycle.

Approach Capacity reduced by half.

