INTRODUCING PRIORITY FOR LIGHT RAIL/TRAMWAY AND OTHER SURFACE PUBLIC TRANSPORT MODES

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Abstract

Public transport vehicles spending about 30% of travel time waiting on junctions. With appropriate traffic light priority measures it is possible to reduce significantly this time. In average, traffic operation speed should be increased from 18 km/h up to 24 km/h. With higher speed, public transport should become more efficient (less vehicles and less drivers) as well as more attractive to car users. Various levels of priority should be introduced depending on the available financial resources and political willingness to provide more effective public transport system.

The following subjects are discussed:

- ***Impact of intersection/junction on the total travelling time***
- ***Priority strategy***
- ***Typical technical examples of successful solutions***
- ***Benefits***
- ***Impact on urban sustainability***
- ***Applicability of priority measures for other public transport modes running with other traffic***

Keywords: Public Transport operation, Priority on intersections/junctions, Light rail, tramway, Bosnia & Herzegovina

"Introducing priority for Light Rail/Tramway and other surface public transport modes"
"Uvodjenje prioriteta za laki šinski prijevoz i druge vidove površinskog prometa"

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Presentation will analyze and cover the following subjects:
- Impact of intersection/junction on the total travelling time
- Priority strategy
- Typical technical examples of successful solutions
- Benefits
- Impact on urban sustainability
- Applicability of priority measures for other public transport modes running with other traffic
- Ideas for introducing priority measures in the Region (Sarajevo, Zagreb, Belgrade, etc)

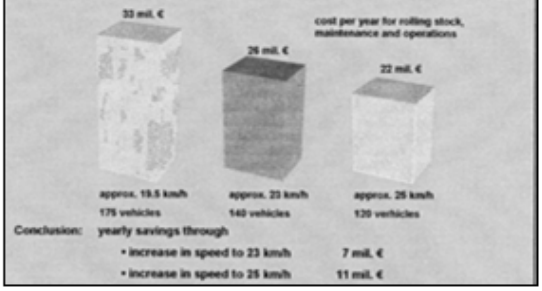
Introduction
- Public transport vehicles spending about 30% of travel time waiting on junctions.
- With appropriate traffic light priority measures it is possible to reduce significantly this time. In average, traffic operation speed should be increased from 18 km/h up to 24 km/h.
- With higher speed, public transport should become more efficient (less vehicles and less drivers) as well as more attractive to car users.
- Various levels of priority should be introduced depending on the available financial resources and political willingness to provide more effective public transport system.

WHY WE NEED PRIORITY

- Trams are driven manually 'on line of sight' and are subject to the normal codes and courtesies governing other highway users.
- When running on highway, whether segregated or with traffic, trams should, in the main, be considered as another class of road vehicle.
- Trams are controlled at signal junctions as a separate phase or within a stage of the main traffic signal operation, ensuring appropriate proceed times and clearance periods are provided.

POTENTIAL BENEFITS WITH PRIORITY

Acceleration: potential for rationalization through light rail construction



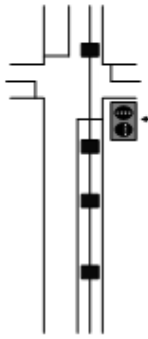
Conclusion: yearly savings through
- increase in speed to 23 km/h 7 mil. €
- increase in speed to 25 km/h 11 mil. €

PRIORITY OBJECTIVES

Levels of Priority

- No Priority Without Tram Detection
  - Junction operating fixed time or UTC with tram stage being called every signal cycle regardless of presence (Possible failure mode)
  - Junction will operate inefficiently for both trams and traffic with unused tram stages and possibly the need for extended clearance periods
- No Priority With Tram Detection
  - Tram required to wait for stage sequence but tram phase should be capable of being extended to ensure progression and clearance periods are minimised
  - Opportunity to allow opposing trams through junction at same time by use of overlapping tram phases
  - Junction should operate efficiently for other traffic but with the majority of trams being stopped for varying periods.
- Move to Tram stage
  - Tram stage follows normal termination of previous traffic/pedestrian stage
  - Flexible junction design and operation will ensure minimal delay to trams with a high percentage of trams not being required to stop.
- Full Priority
  - A tram demand being registered will immediately terminate the current running stage, depending on minimum phase periods being satisfied or proceed to another justified stage.
  - Tram driver should receive proceed signal on approach to junction and pass through without being required to stop.
  - Junction capacity and safety can be affected to a greater or lesser degree by early termination or skipping of vehicle stages.

Typical Pattern and Use of Detectors



Cancel Detector – truncates intergreen period to improve efficiency and reduce delays to other traffic

Special traffic lights for LRT

Stop Line Detector – calls or cancels LRT phase

Demand Detector – calls tram phase

Prepare Detector – prevents change or instigates move to appropriate stage.

Light rail priority principles

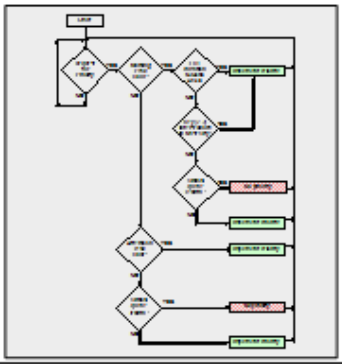
Distance corresponding to the maximum time of transition + 3 seconds (1)

If the existing loop is located before this distance, the call would be delayed accordingly

Time differences concerning transition time are smoothed (green is given in function of the longest time)

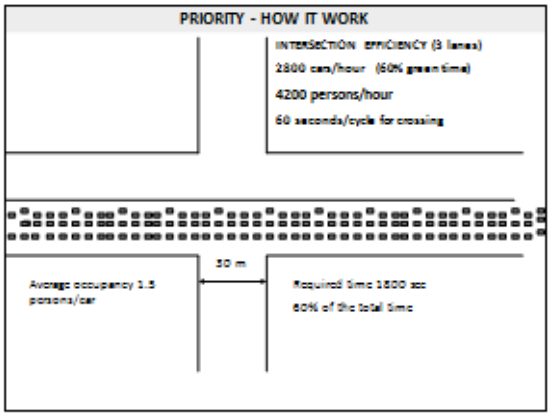
9

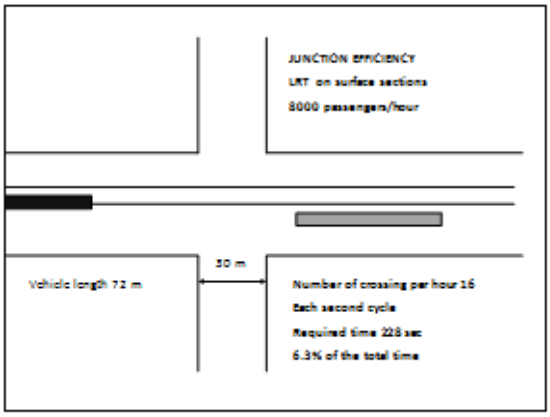
Priority strategy algorithm

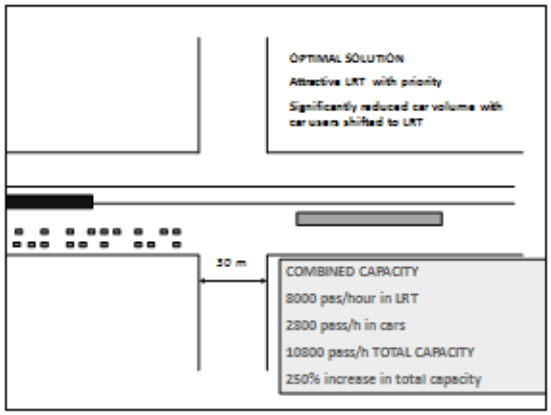


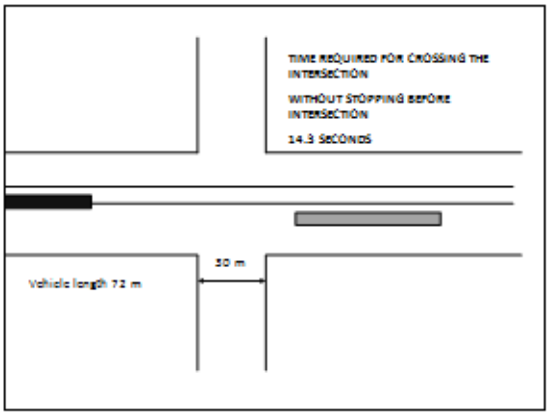
10

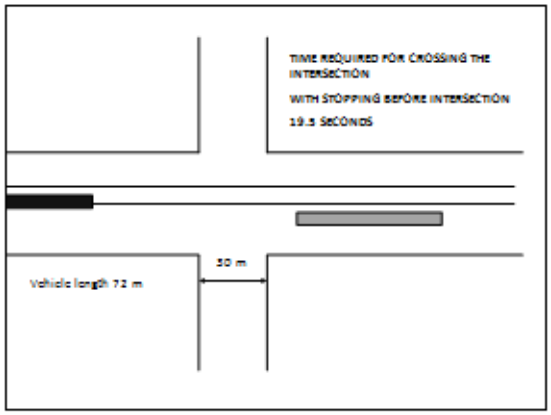
PRIORITY - HOW IT WORK

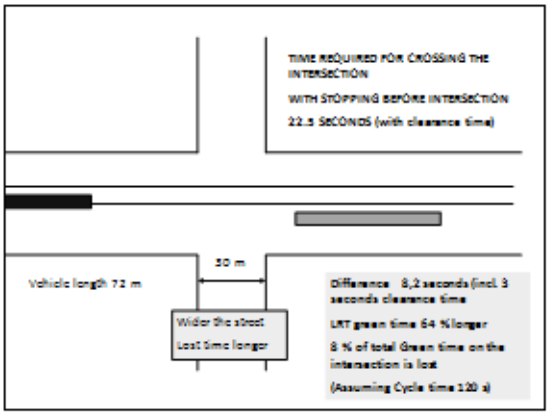




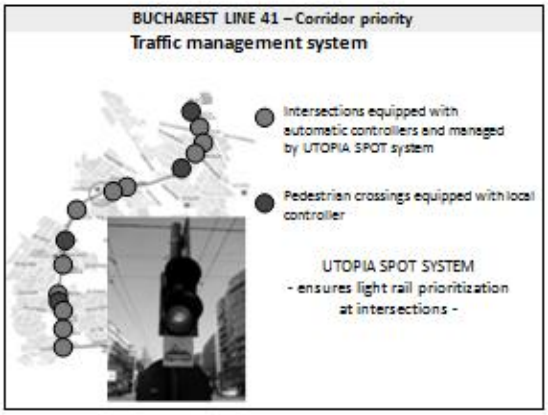

OPTIMAL SOLUTION
Attractive LRT with priority
Significantly reduced car volume with car users shifted to LRT
30 m
COMBINED CAPACITY
8000 pas/hour in LRT
2800 pass/h in cars
10800 pass/h TOTAL CAPACITY
250% increase in total capacity


TIME REQUIRED FOR CROSSING THE INTERSECTION
WITHOUT STOPPING BEFORE INTERSECTION
14.3 SECONDS
Vehicle length 72 m
30 m


TIME REQUIRED FOR CROSSING THE INTERSECTION
WITH STOPPING BEFORE INTERSECTION
19.5 SECONDS
Vehicle length 72 m
30 m


TIME REQUIRED FOR CROSSING THE INTERSECTION
WITH STOPPING BEFORE INTERSECTION
22.5 SECONDS (with clearance time)
Vehicle length 72 m
30 m
Wider the street
Lost time longer
Difference 8,2 seconds (incl. 3 seconds clearance time
LRT green time 64 % longer
8 % of total Green time on the intersection is lost
(Assuming Cycle time 120 s)


PRIORITY WORLD EXAMPLES


BUCHAREST LINE 41 – Corridor priority
Traffic management system
Intersections equipped with automatic controllers and managed by UTOPIA SPOT system
Pedestrian crossings equipped with local controller
UTOPIA SPOT SYSTEM
- ensures light rail prioritization at intersections -

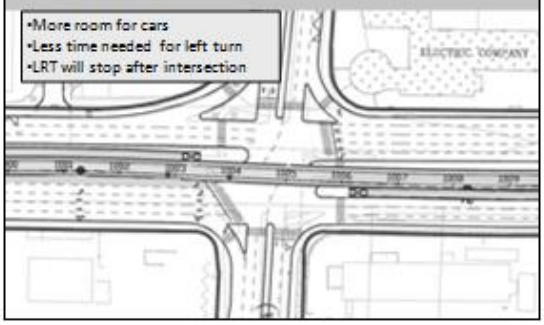
Main characteristic data for tram line 41 before and after passing the light rail

Specification	Tram line 41	Light rail 41
Frequency	2.58	2.28
Semi-travel interval	41	30
Transport capacity	4,638	6,324
Commercial speed	13.7	19.7
Vehicle frequency	20	28

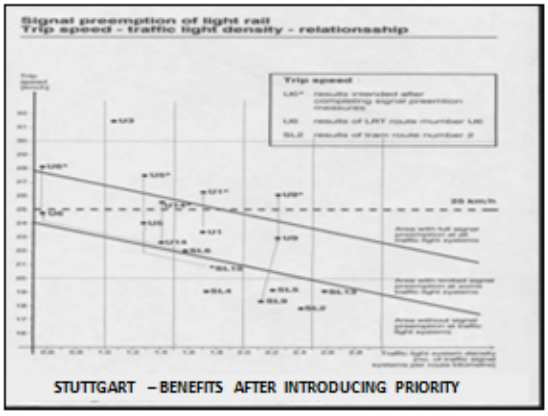
TEL AVIV – STOP RELOCATION FOR BETTER CAPACITY

Change of Stop Location

- More room for cars
- Less time needed for left turn
- LRT will stop after intersection

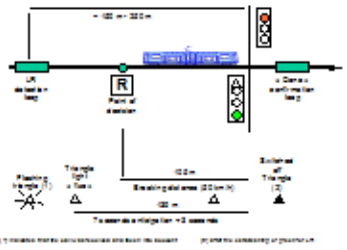


STUTTGART EAST_WEST CORRIDOR PRIORITY STRATEGY



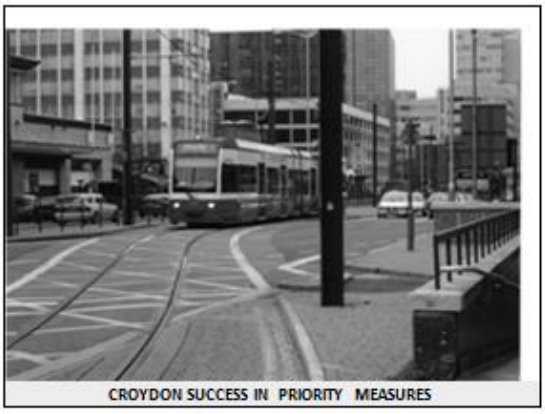
STUTTGART – BENEFITS AFTER INTRODUCING PRIORITY

LRT priority principles for signalized intersections and U-turns

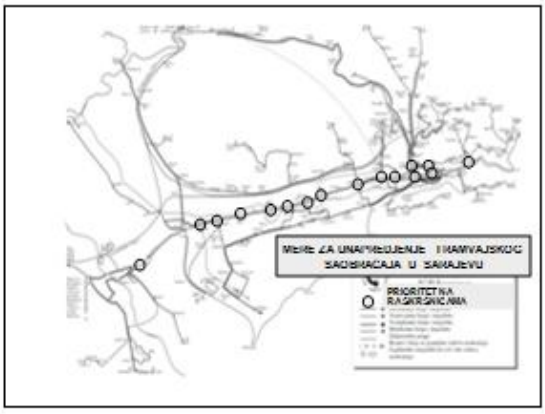


Priority system for buses and trams in Munich

Overview traffic lights	
Number of LZA (Lichtzeichenanlagen/ traffic lights) in Munich	~ 1.100
Total number of driven LZA:	**886**
thereof accelerated:	381 (43 %)
thereof non-accelerated:	505 (57 %)
Number of driven LZA /tram:	**210**
thereof accelerated:	209 (99 %)
thereof non-accelerated:	1 (1 %)
Number of driven LZA/bus:	**754**
thereof accelerated:	231 (31 %)
thereof non-accelerated:	523 (69 %)
Further estimated development	
LZA single measures 2011-2013	~ 32 LZA
Acceleration (bus) line 100	25 LZA
New build route tram St. Emmeram	19 LZA

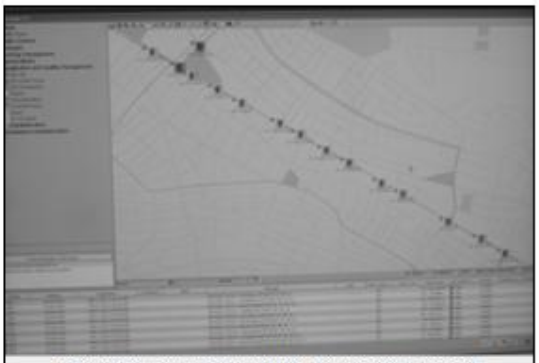


CROYDON SUCCESS IN PRIORITY MEASURES



PRIORITY INTRODUCTION IN REGION

BELGRADE – ADAPTABLE TRAFFIC MANAGEMENT SYSTEM
BULEVAR KRALJA ALEKSANDRA



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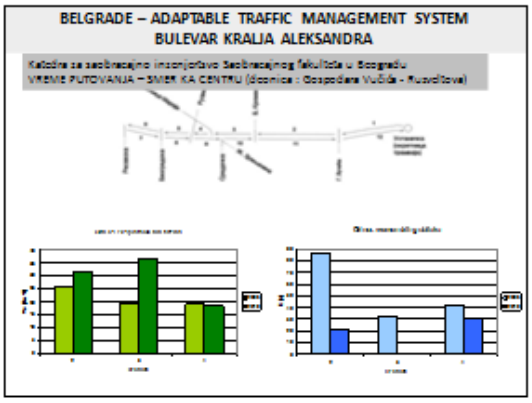

Introduction to UITP film fragment for priority solutions in several cities

- A balance between public and private modes is essential for growing mobility needs
- Light rail is eminent to solve transport problems
- To eliminate time lost at the intersections with traffic signals modern demand-responsive control measures can be implemented
- Light rail vehicles passing through intersection are low frequent compared to car traffic
- Demand responsive controllers using modern techniques adjusting the cycle of signals at the approach of light rail vehicle to ensure uninterrupted passage
- Optimising traffic movements and the structural layout of the intersection are important preconditions for full priority effects
- Successful examples of light rail priority in many cities demonstrate, that with the necessary political determination and financial resources priority measures can be completed