ITS Experience in Germany

Tram and bus prioritization at traffic signal systems

Conference „Transport Infrastructure Innovations – 2016“
Vilnius 16.06.2016

gevas humberg & partner
Transport Planning and Traffic Engineering Company

Dipl.-Ing. Martin Schenk
Project Manager Traffic Engineering

Content

- Preliminary notes and introduction
- General boundary conditions
  - Measures financing
  - Guidelines
  - Measures for speeding up public transport
- Prioritization methods for public transport – Green Wave
- Success in practical application – example Munich
- Summery and future prospects

Preliminary notes and Introduction

- Conflicting objectives: individual drivers require green waves, there is bicycle traffic and there are pedestrians – private transport – at traffic signal systems, and at the same time public transport customers who wish for a fast and on schedule journey. How to satisfy private and public transport?
- German traffic engineers have been concerned with the “green wave” since the early 20th century.
- It is estimated that there are more than 60.000 traffic signal systems in German cities – hence one traffic signal system is installed per 1.000 to 1.200 inhabitants.
- Over the centuries, green waves have steadily been extended and perfected by the use of microprocessors. Today, good traffic flow would be unthinkable without green waves in German cities.
- Speeding up Public Transport has been of special interest since the end of the seventies.
- In terms of environmental damaging and air monitoring the public transport will be an important contribution.

General boundary conditions
Measures financing

- Essential requirements and substantial contributions were provided by politics, as a respective legislation allowed for public transport prioritization measures to be funded.
- The “Community Traffic Funding Act” (Gemeindeverkehrs-finanzierungsgesetz GVFG) aiming at improving traffic conditions in communities was, and still is, the essential fundament for funding almost all speedup projects in Germany.
- Governmental funding aids provided by the Federal Government and the German states, amount to 60 to 90% of the project costs, enormously helping the communities, which are the commissioned authorities.

General boundary conditions
Guidelines

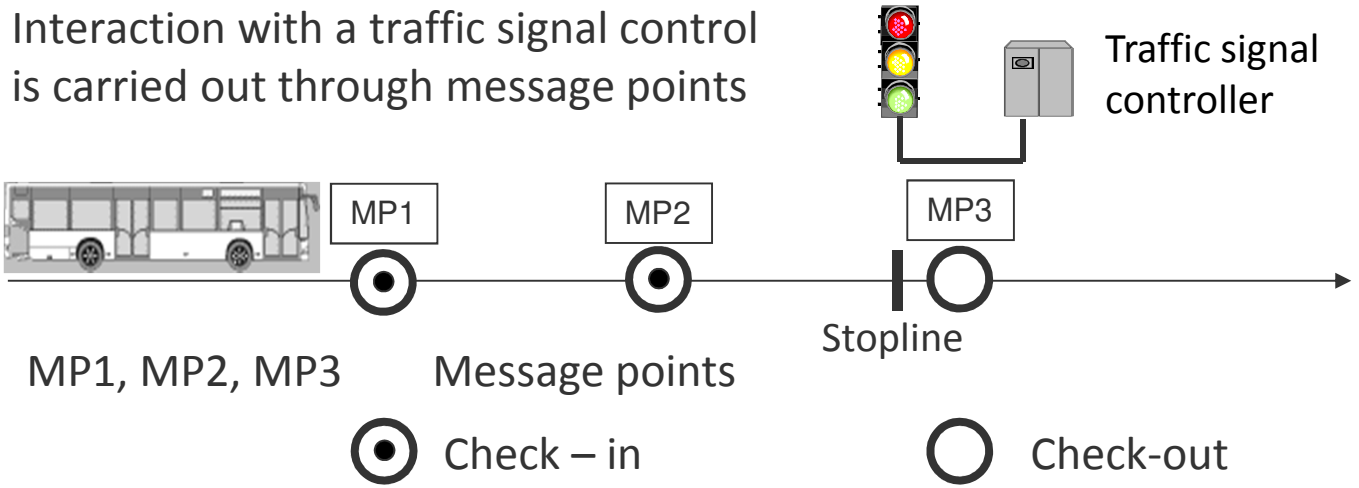
- Elementary Guideline “Guideline for traffic signals”
  - basic information on the application and use for traffic signals
  - set of uniform safety standards (method of signal control, intergreen time, construction and operation)
- Instruction “Measures for speeding up public transport”
  - tasks and aims for speeding up public transport
  - measures for elimination of disturbances (structurally and operationally)

General boundary conditions
For speeding up public transport 1/2

- The travel routes of public transport vehicles differ too much from private vehicles' routes within Green Waves
- In operational running many disorders possible:
  - varying departure times at previous traffic light systems,
  - varying passenger transfer time period
  - fluctuating stop-over periods
  - travel times between stops caused by traffic disruptions along the route
  - >> additionally deceleration and acceleration limitations lead to an unpredictability of public transport vehicle arrival times at traffic signal systems
- Efficient prioritization can particularly be obtained by traffic-dependently alterating traffic signal control in favour of public transport vehicles.

General boundary conditions
For speeding up public transport 2/2

- If the traffic flow is controlled in favour of public transport, each public transport vehicle will need to be individually registered and its travel course to be continuously monitored along the travel route.
- Any natural fluctuation during the public transport vehicle's travel course need to be compensated for by the traffic-dependent control system.
- By introducing appropriate public transport registration points – so-called reporting points – this can be solved very efficiently.
- Interaction with a traffic signal control is carried out through message points



Prioritization methods for public transport – Green Wave 1/3

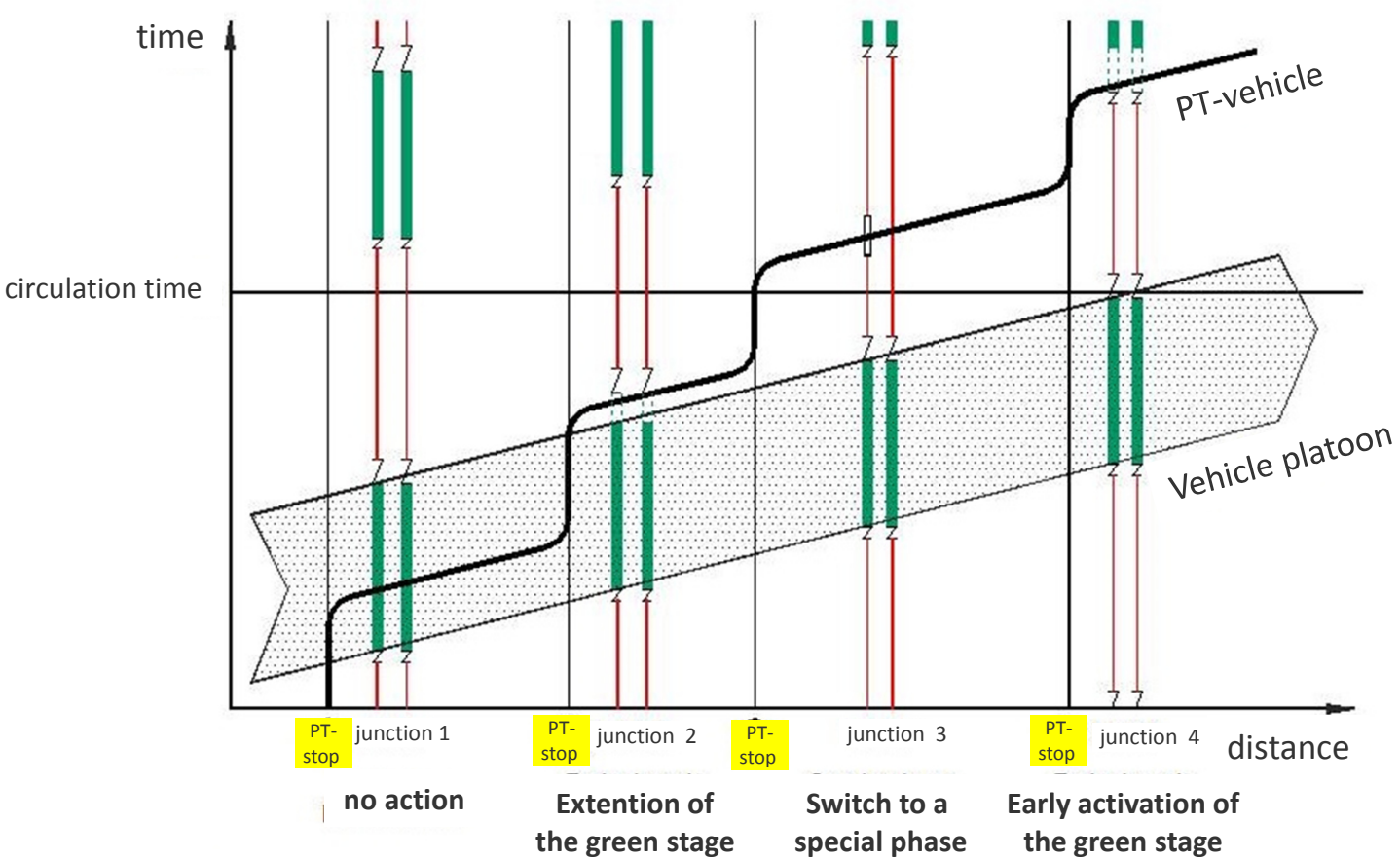
- In principle, a public transport vehicle requires just 5 seconds green time, if at the right time.
- The more time-precise a public transport traffic control alteration takes place, the less traffic disturbances occur.
- It is the traffic engineer's task to ensure the public transport's success by adopting transparent and reproducible traffic-dependent control systems.
- Prioritization of public transport is successfully achievable and recommendable, as a more balanced traffic flow control and higher acceptance can be gained from all traffic participants by considering the green waves.
- All increased planning efforts connected with this measure are highly justified by the outcome of a much higher overall benefit.

Prioritization methods for public transport – Green Wave 2/3

- The traffic control measure for public transport prioritization developed by gevas humberg & partner has been repeatedly proven and tested in Germany.
- The traffic control measure operates hierarchically with different levels of prioritization for the case that both trams and busses need to be considered:
  - Level 1: Prioritization level 1 – trams
  - Level 2: Prioritization level 2 – busses
  - Level 3: Basic state, controlling private individual traffic in (traffic-dependent) green waves without public transport alterations
- In its basic state, the system operates in a green wave mode adapted to private traffic needs in a best possible way.
- Improvements with regard to interception performance, particularly during rush hour, can be achieved by introducing additional traffic-dependent control systems for private individual traffic.
- This leads to an lower overall fault liability in individual private traffic, as well as to a creation of reserves for public transport prioritization.

Prioritization methods for public transport – Green Wave 3/3

- Options of Public Transport prioritization:
  - Early activation or extension of a green stage
  - Switch to a special Phase



Success in practical application – example Munich [1)] 1/2

- The results of the system's practical application can be pointed out by looking at the example of a main road section in Munich (average daily traffic volume of approximately 50.000 vehicles):
  - Here, an public transport speedup within a green wave was installed for two tram lines, which drastically reduced the trams' time losses.
  - 7.000 new passengers daily were gained for this line operated sector.
  - A very good tram prioritization and by increasing the travelling speed for the private individual traffic by 15% in the green wave, a noticeable improvement of the traffic situation was achieved.

[1)] Reference: König, "Problem oder Problemlöser? – Die Rolle des ÖPNV in der aktuellen Umweltdebatte", in: Der Nahverkehr

Success in practical application – example Munich 2/2

- The practical success of public transport speedup in the total area of Munich since 1994:
  - All of the 10 Munich tram lines as well as 4 bus lines underwent the speedup process.
  - Currently there are 240 traffic signal systems in Munich equipped with public transport speedup components:

Average schedule speed	= 20.2 km/h
Increase of schedule speed	= 22%
Improvement in punctuality	= 38%
Financial advantage	= 15%
Savings in operation costs	= 4.2 Mio. € / year
Increase in passenger numbers	= 7 - 16% / tram

Summary and future prospects

- The displayed system provides a compatibility of speeding up public transport on the one hand, and the advantages of green waves on the other hand, in terms of compensation and overall optimization.
- For a successful implementation of speeding up public transport the consideration of the needs of all road users is required.
- The success goes hand in hand with the quality of the traffic-dependent control systems.
- The benefits result mainly from a good planning and prioritization strategy, the technical system and the components should guarantee an optimal and stable performance.
- The system can be complemented and improved by developing a “Dynamic public transport prioritization grade”.