

# Energy efficient time table planning

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## ENERGY EFFICIENCY IN PLANNING

*INFLUENCING ENERGY EFFICIENCY AT AN EARLY STAGE*

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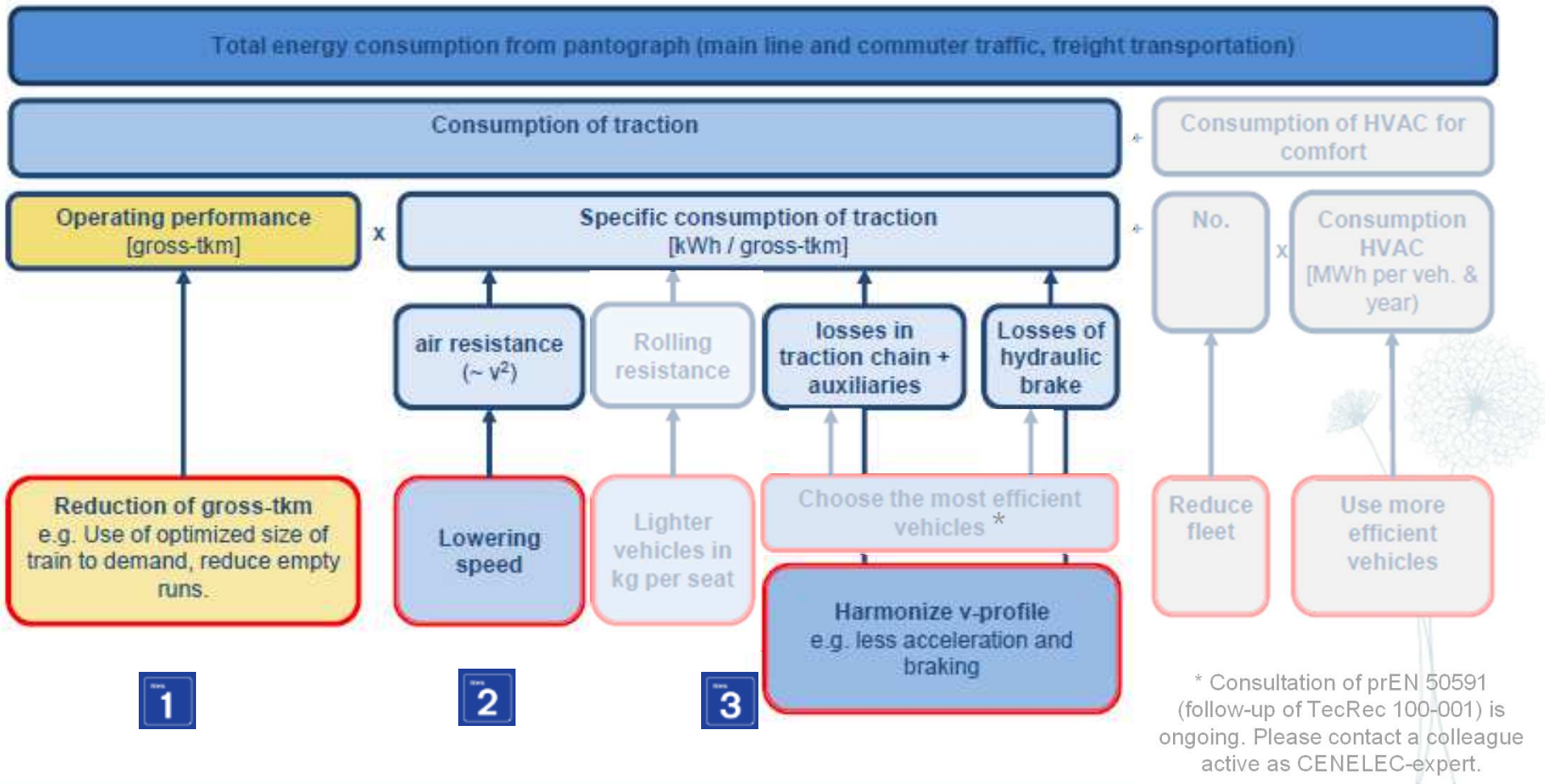
*Energy Efficiency, the best fuel to move our trains!*

# BIGGEST INFLUENCE ON ENERGY EFFICIENCY IS AT EARLY STAGE OF STRATEGY AND PLANNING.





# INFLUENCING FACTORS ON ENERGY CONSUMPTION



# REDUCTION OF GROSS-TKM



## e.g. Optimised train sizes.

Adjusting train size to demand, by using smaller trains for regional traffic on long distance traffic routes at off-peak hours.



## Optimising routes in network.

e.g. avoiding parallel routes with low load factor in off-peak times (e.g. parallel IC and Regio)



# LOWERING SPEED




Reducing speed reductions at infrastructure

longer running times (1 minute) to reduce peak speed peaks

stops on request

Shorter stopping times in train station in off-peak hours.

**Streckentabelle A-Stadt – E-Dorf**

| Weichen, Pfeiftafel, usw.<br>km-Lage  | km   | Neigung in ‰ |    | Zugreihen          | A  |    |    | D  |
|---|------|--------------|----|--------------------|----|----|----|----|
|   |      | +            | -  |                    | 50 | 40 | 30 |    |
|   | 0    |              |    | <b>A-Stadt</b> 30  | 30 | 30 | 30 | 30 |
| km 0.68 Weiche  |      |              |    | km 0.70            | 50 | 40 |    | 50 |
|   |      | 10           | 17 | km 1.20            |    | 50 | 50 |    |
| km 1.75 Weiche  |      |              |    | km 1.70            | 40 | 40 | 40 | 40 |
| km 2.65 Weiche  |      |              |    | km 2.70            | 50 | 50 | 50 | 50 |
|   | 3.96 |              |    | ↓ <b>B-Dorf</b> 30 |    |    |    |    |
| 2  |      | 13           | 5  |                    |    |    |    |    |
|   | 6.08 |              |    | ↓ <b>C-Dorf</b> 30 |    |    |    |    |
|    |      |              |    |                    |    |    |    |    |
|   |      | 13           | 10 | <i>D-Dorf</i>      |    |    |    |    |
|  |      |              |    |                    |    |    |    |    |
|   | 9.62 |              |    | ± <b>E-Dorf</b> 30 |    |    |    |    |



# HARMONIZE V-PROFILE

3

## e.g. Priorities in planning.

Currently, the priorities of planning are as follows: First comes the main lines, then commuter traffic and third freight traffic.

This leads to several planned and unplanned stops of heavy freight traffic (>1000t!) with energy losses, because a light commuter train has a higher priority.

These stops of heavy freight trains can be reduced, if the traffic is prioritized according to the average speed.



## Drivers for energy efficiency (Wim Bontinck)

$$\frac{\text{energy}}{\text{passengers} - \text{km}} = \frac{\text{energy}}{\text{gross} - \text{tkm}} \times \frac{\text{gross} - \text{tkm}}{\text{seat} - \text{km}} \times \frac{\text{seat} - \text{km}}{\text{passengers} - \text{km}}$$

- Type of train service (TGV/IC/L)
- Driving style
- Technology rolling stock
- Comfort services
- Losses in fixed installations
- Time table planning
- Traffic management
- Parked trains

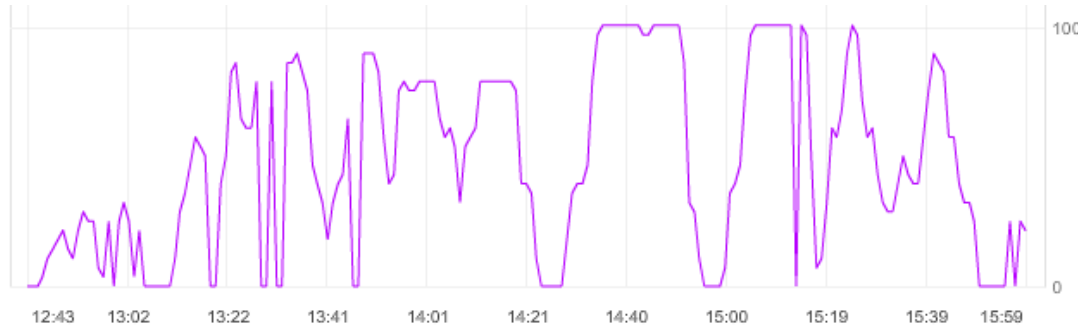
**Choice of rolling stock**  
e.g. double deck, lighter train

**Load factor**

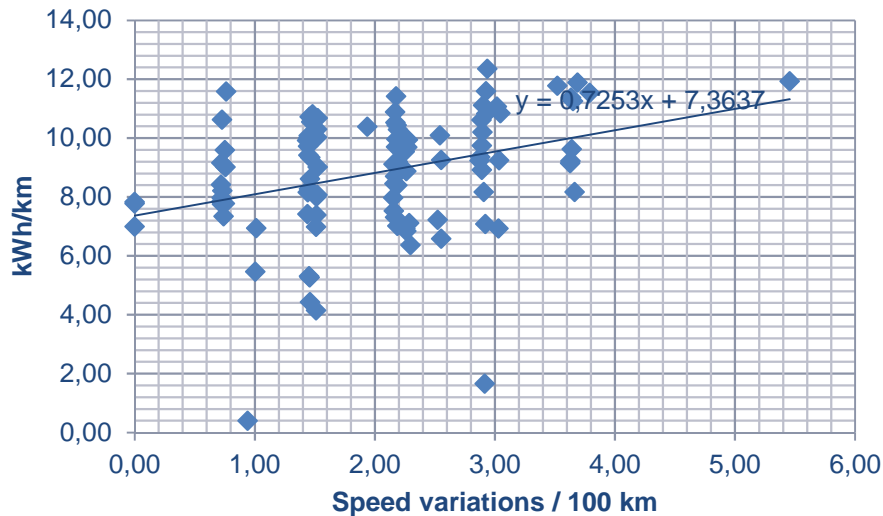
- Organisation train services
- Tariffs
- Usage of rolling stock



# Avoid unplanned stops

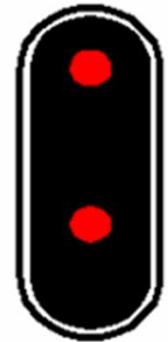


Registration of speed profile of a cargo train.



Passenger train between Paris and Cherbourg  
(from presentation Dominique Vastel)

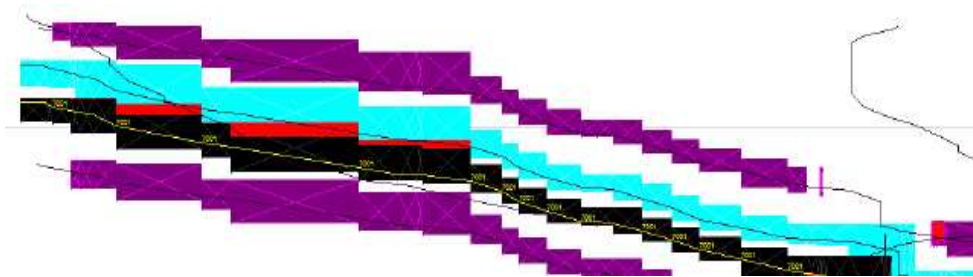
Each extra stop increases consumption with 4%.  
(study by Zaki Hadj Mehend)



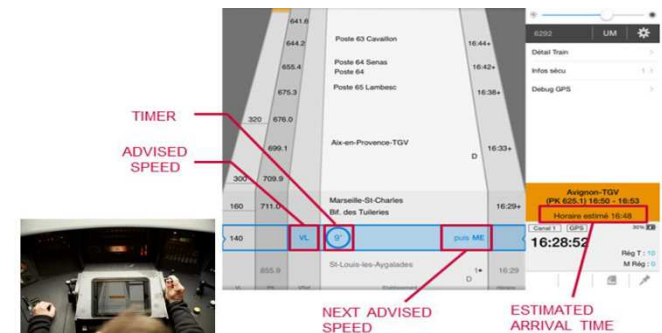
Additional stop



# Avoid conflicts already in planning



Detection of conflicts in planning phase (with LUKS).

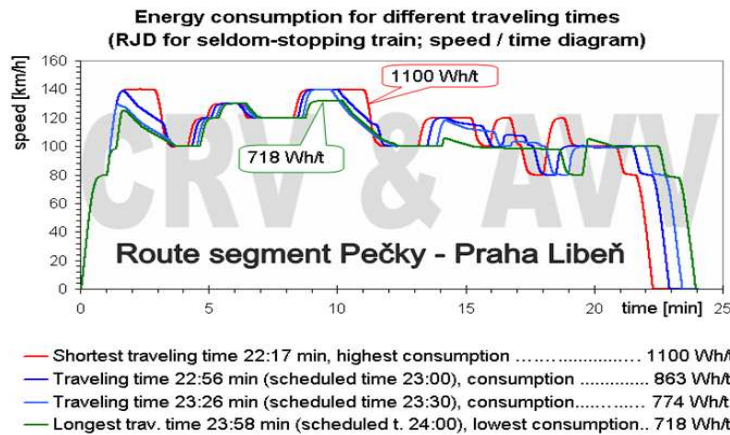


And possibly even feedback to drivers via C-DAS or ATO (stakeholder workshop in autumn 2018)

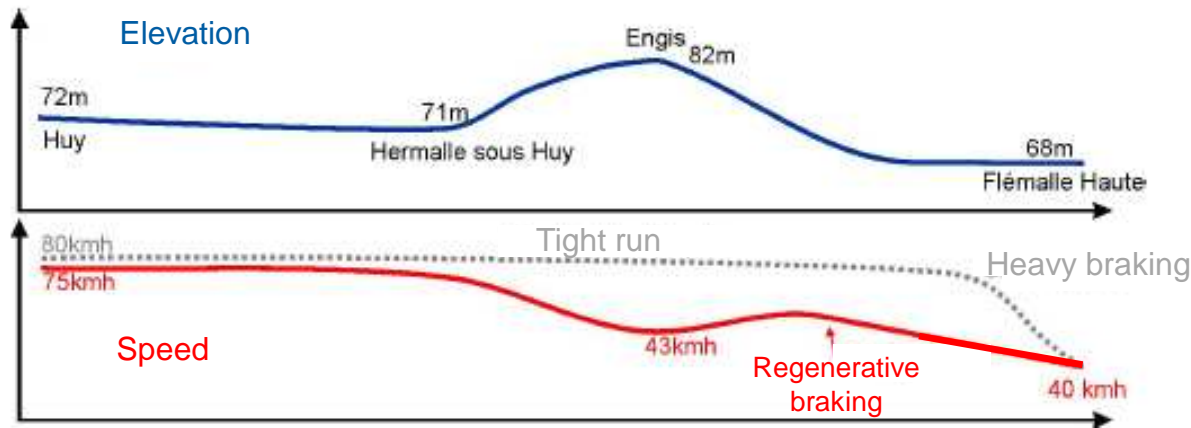


If conflict remains in planning, then Traffic Management will have to handle this conflict every day again.

# Add spare time to permit eco-driving



- Automatic Train Operation is already 25 years operational in Czech Republic
- 8% spare time to time table results in 35% reduction of energy consumption



- One of first experiences of e-drivers of Linesas.
- Start coasting 8 km in front of speed restriction. .





# It's Eress Forum time

and we're off to Rome on June 13.

To see all details and get registered

[www.erness.eu](http://www.erness.eu)

All you need to know on on-board energy metering, settlement and billing

Program: EU framework, standardisation update, Eress Award, train-data handling, case studies, big data coming from meters