Automated Train Operation

an important building block for modern railway industry

ProRail

24/7

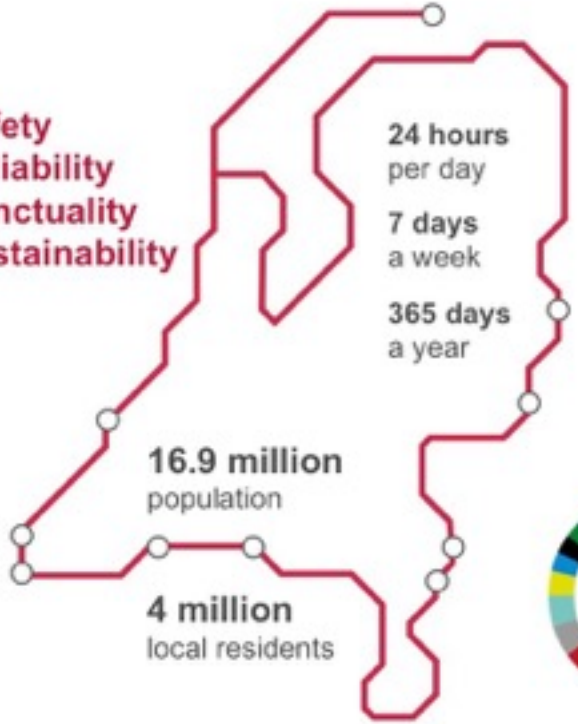
Passenger transport

1.1 million
passengers per day

9 operators
of passengers

147 million km.
passenger transport per year

Safety
Reliability
Punctuality
Sustainability



24 hours
per day

7 days
a week

365 days
a year

16.9 million
population

4 million
local residents

Freight transport

3.3 million
trains per year

54 milliard
Freight tonne-kilometers
per year

21 railway undertakings

11 million km.
freight transport per year

Source: Jaarverslag ProRail 2016

ATO in mass transit

Unattended Train Operation (GoA 4)
VAL Lille (1983)

Adaptive Cruise control (GoA 2)
Automated acceleration and deceleration
London Victorialine (1967!)

Driverless Train Operation (GoA 3)
London Docklands Light Railway (1987)

Other modes are developing fast …

Why is ATO important for the Inframanager ?

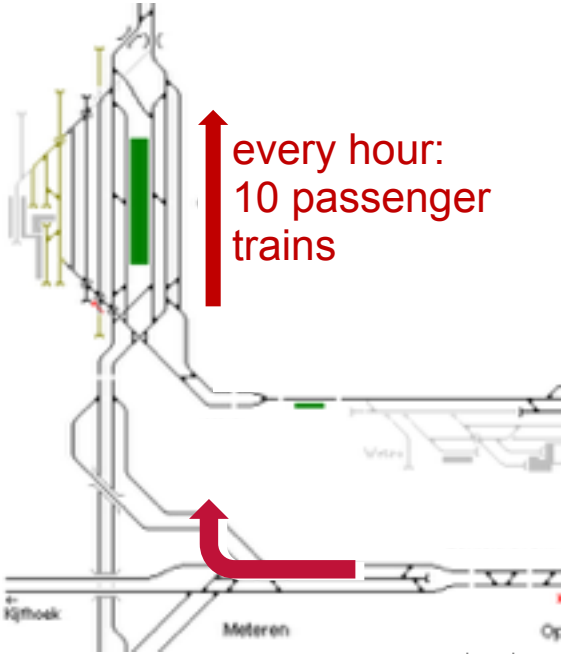
ATO is a need to have for the future of the railways

1. How can ATO enhance the utilization of infrastructure capacity?
2. Track Side must develop!
   Intelligent traffic management
3. IM enables business cases of its customers
   RU ‘s, regional governments
4. ATO is important for innovative climate in the railway industry

Potential business case GoA 2

Steer a freight train in a path

- A freight train from the Betuweroute merges between high frequent passenger services
- The freight train must run precisely in its path
- ATO (GoA2) calculates the optimal speed profile and runs the train according to it



source www.sporenplan.nl

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Potential business case GoA 2 - 4

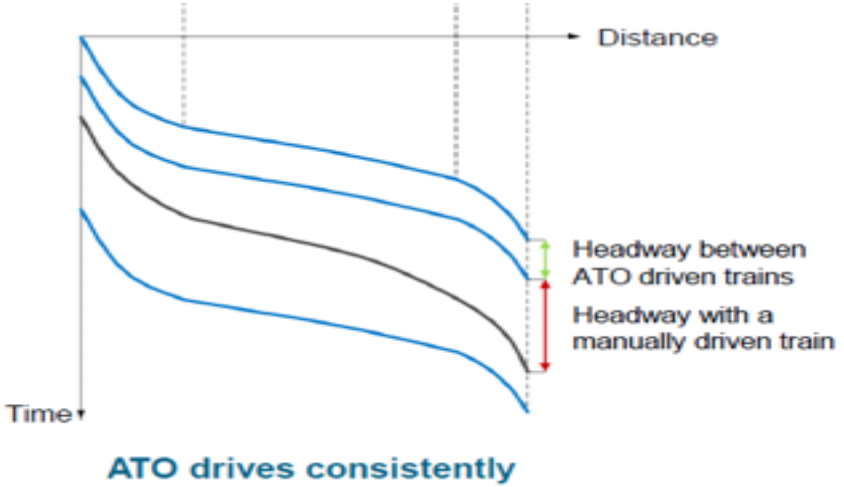
Facilitate an ambitious region

- Province of Groningen presents itself as an innovative region
- Capacity for an extra hourly train service on a mostly single track line
- Cost reduction on rural lines

Potential business case GoA 2

Maximize the use of infra capacity in a bottleneck

- Expanding the capacity in bottlenecks is often difficult and expensive
- Postpone the building of a new tunnel saves a lot of money, e.g Schiphol (requires the cooperation of the RU!)
- ProRail follows the Thameslink ATO GoA2 project with great interest!



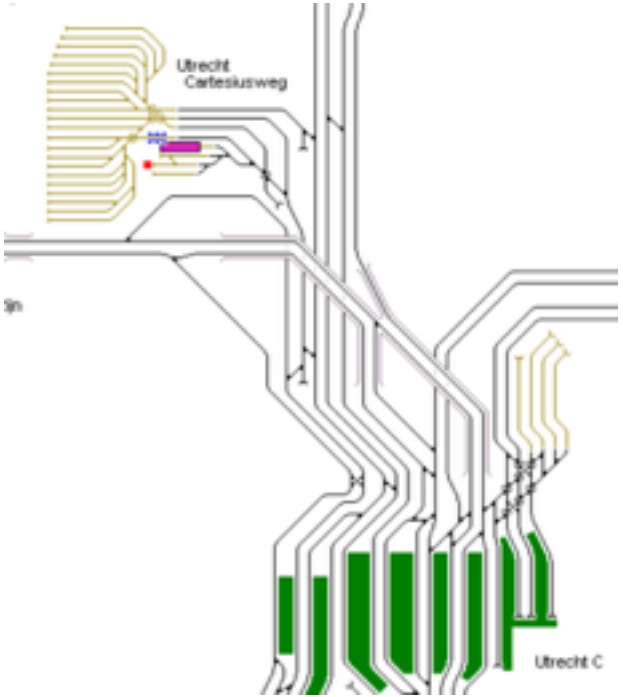
Potential business case GoA 3 - 4

Flexible and cost effective shunting (RU's!)

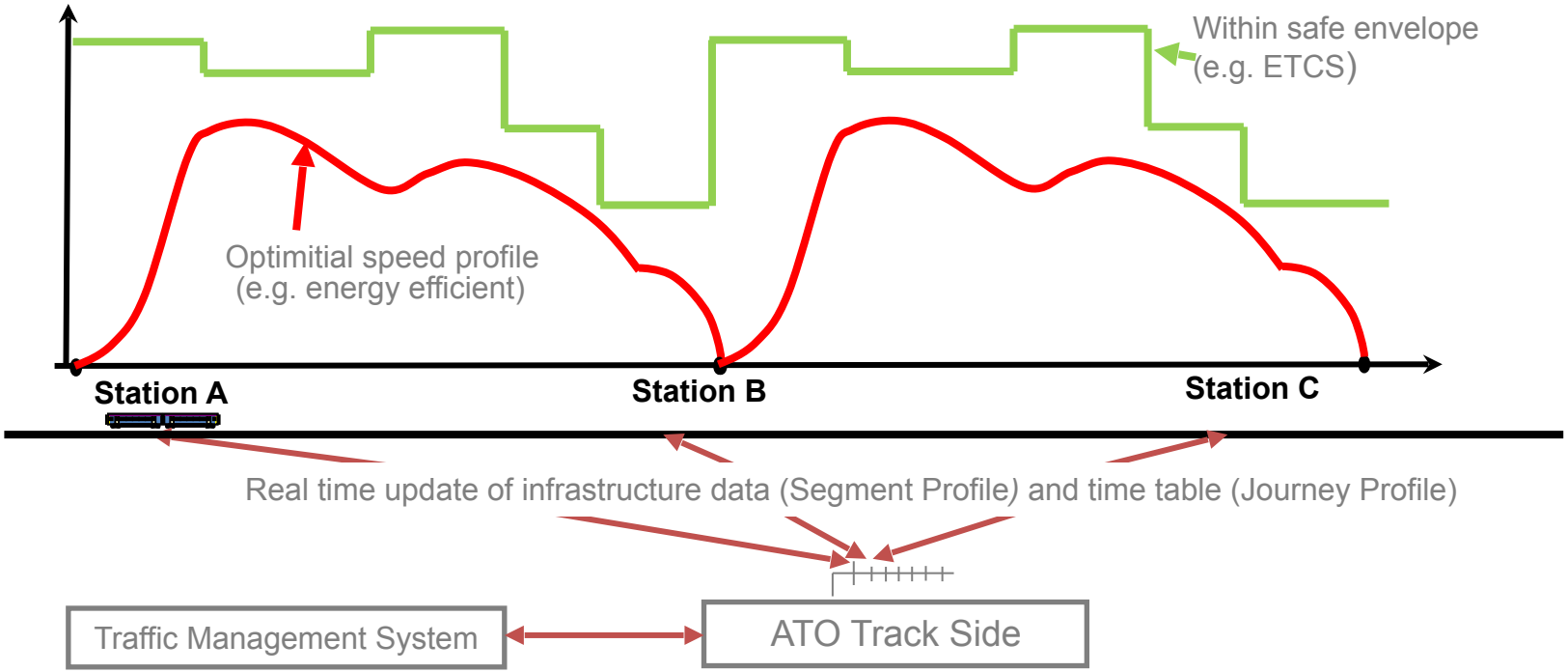
Freight wagons in Port of Rotterdam area -> Self propelled?

Passenger rolling stock (inspired by SBB)

- Bring empty rolling stock from a station to the yard and back
- Flexible handling of rolling stock in disturbed situations



ATO focus is now on automatic driving

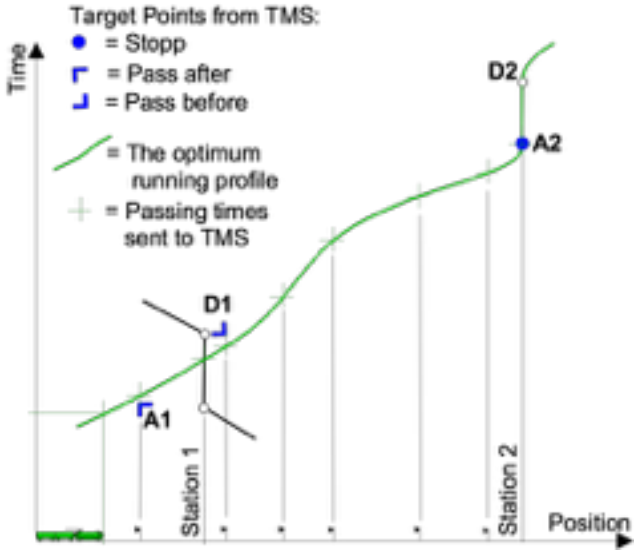


Dense traffic requires an intelligent TMS

Always ensure feasible journey profiles for all trains

- Precise prediction of passing times
- Which timing points are important ?
- Introduce “Train Path Envelope”?
- Slot management?
- Energy management?

New concepts must be developed!



Man is the measure of automation *

Train drivers – signal operators – dispatchers

Design of the system
- Take human characteristics into account from the start

Migration
- Pace of automation
- Driver Advisory Systems on the road map

Tests!
- Experience your future!

* Man is the measure of all things - Protagoras (5th Century BC)

GoA2: “Driver is responsible for safety”

Feasible in all circumstances?

…one hour between noise screens...
…no junctions, hardly any other trains…

1.	Extremely alert	Active
2.	Very alert	
3.	Alert	
4.	Rather alert	
5.	Neither alert nor sleepy	
6.	Some signs of sleepiness	
7.	Sleepy, but not difficulty remaining awake	Sleepy
8.	Sleepy, some effort to keep alert	
9.	Extremely sleepy, fighting sleep	

“Human Factor”

Many research questions…..

- **Transition of control**: How is safety guaranteed when a driver must take over? How can a driver **monitor** whether the automatic unit is performing correctly?

- What about **training**? “the higher the level of automation, the more extensive the training must be”

“Human Factor”

Many research questions…..

- To what extent is **uniform handling and operation** required for safety, performance, and work load ?(RU ‘s, trains, countries)
- How can **under- and overload** of drivers and signal operators be avoided?
- How can automation be made **attractive** for drivers to enhance acceptance?
- What is the perspective for drivers on the **labour market**?

ATO over ERTMS

Not the only solution needed

Expected roll out of ERTMS in the Netherlands

- Around 1/3 of the network
- 2024 – 2028 (?)

ATO over ATB (national ATP) needed

- Safety case ?
- Transitions in the network?

From talking to testing

Boosting the development

Involve stakeholders
- Operators
- National Safety Authority

….

Feed the specifications review process
- National issues?
- Development of the business case

ATO is a need to have for the future of the railways

ATO has potential benefits …

- Quality of service
- Utilization of the network capacity
- Sustainability
- Operational costs

Successful implementation requires:

- A more prominent role for the human factor
- More attention for the development of traffic management
- Business cases as a driving force
- Testing !