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Transport operation

Railline capacity analysis
(by the calculation method of DB)

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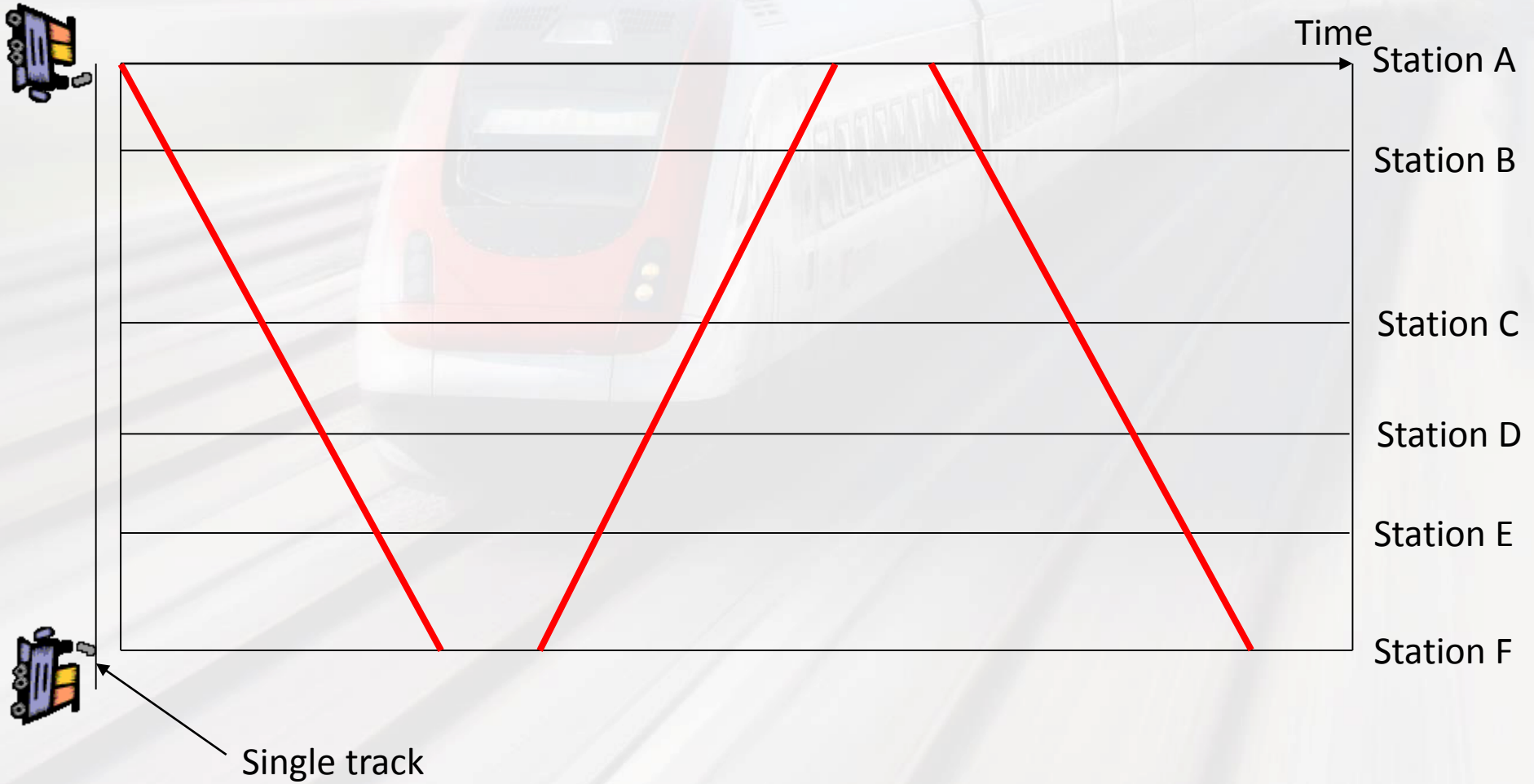
Timetable

- Operation plan of the rail network
- Defines all train movements
- Defines and coordinates the work plans of the services and workplaces related to the rail-traffic

Grafical timetable presentation



Timetable variations
Clock-face scheduling

- Integrated: includes all lines/routes/route-types even for other transport modes (train-bus-ship)
- Periodic: route types depart by same period
- Symmetrical:
  - In time: same route-types crosses each other at whole hour (and at half-hours)
  - In space: different route-types' crosses placed at the same station (hub)
  - Result: optimal interchange system

Timetable variations
Clock-face scheduling

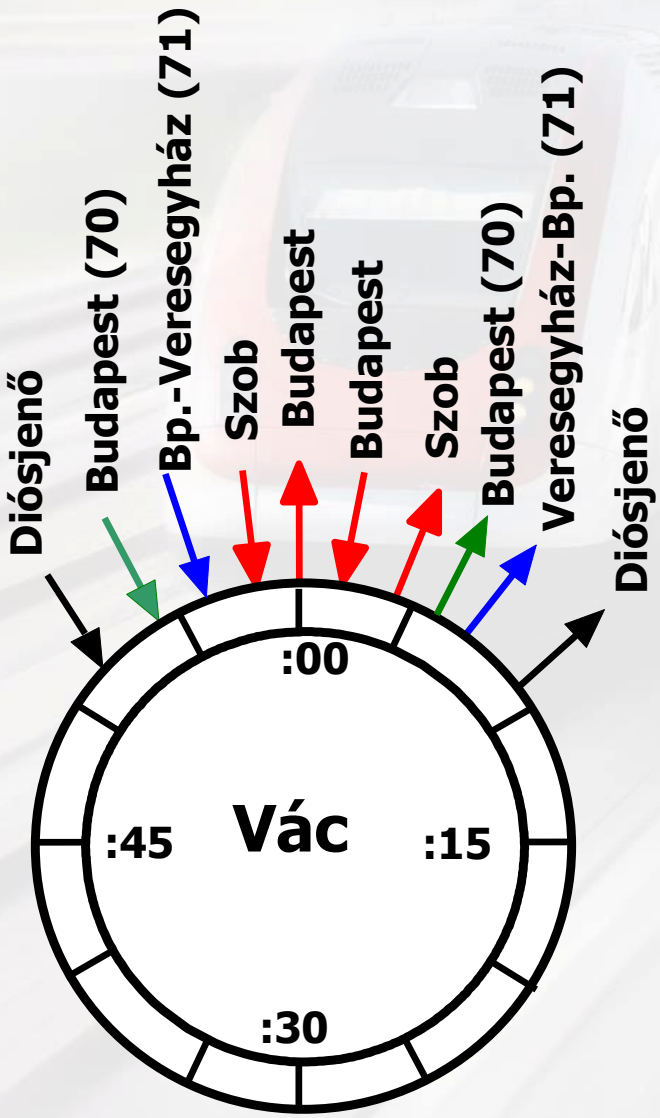
- Hourly recurring traffic situation
  - Passengers can memorise the timetable easier
- Hourly trains (buses) can be competitive with private transport
- Provides more efficient usage of personnel, infrastructure and vehicles
- More effective resource planning

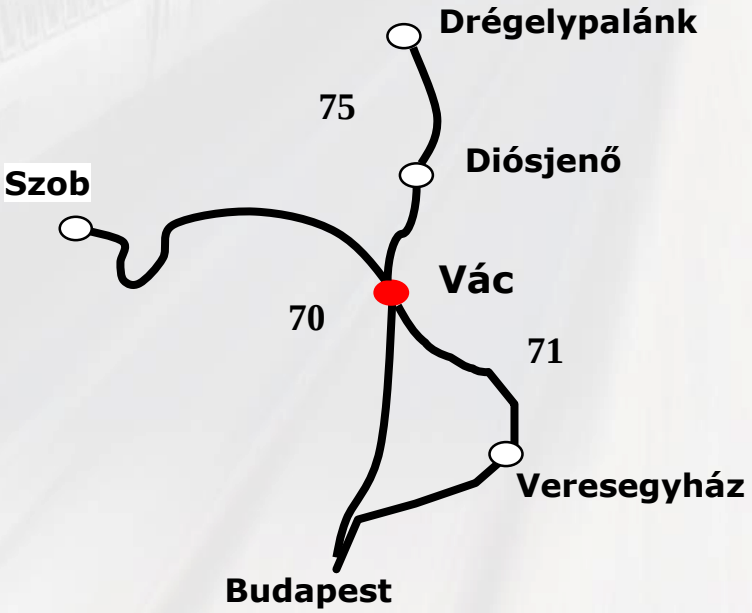
Timetable variations
Integrated timetable

Makes easier the travelling, because where we get off the train, we know:

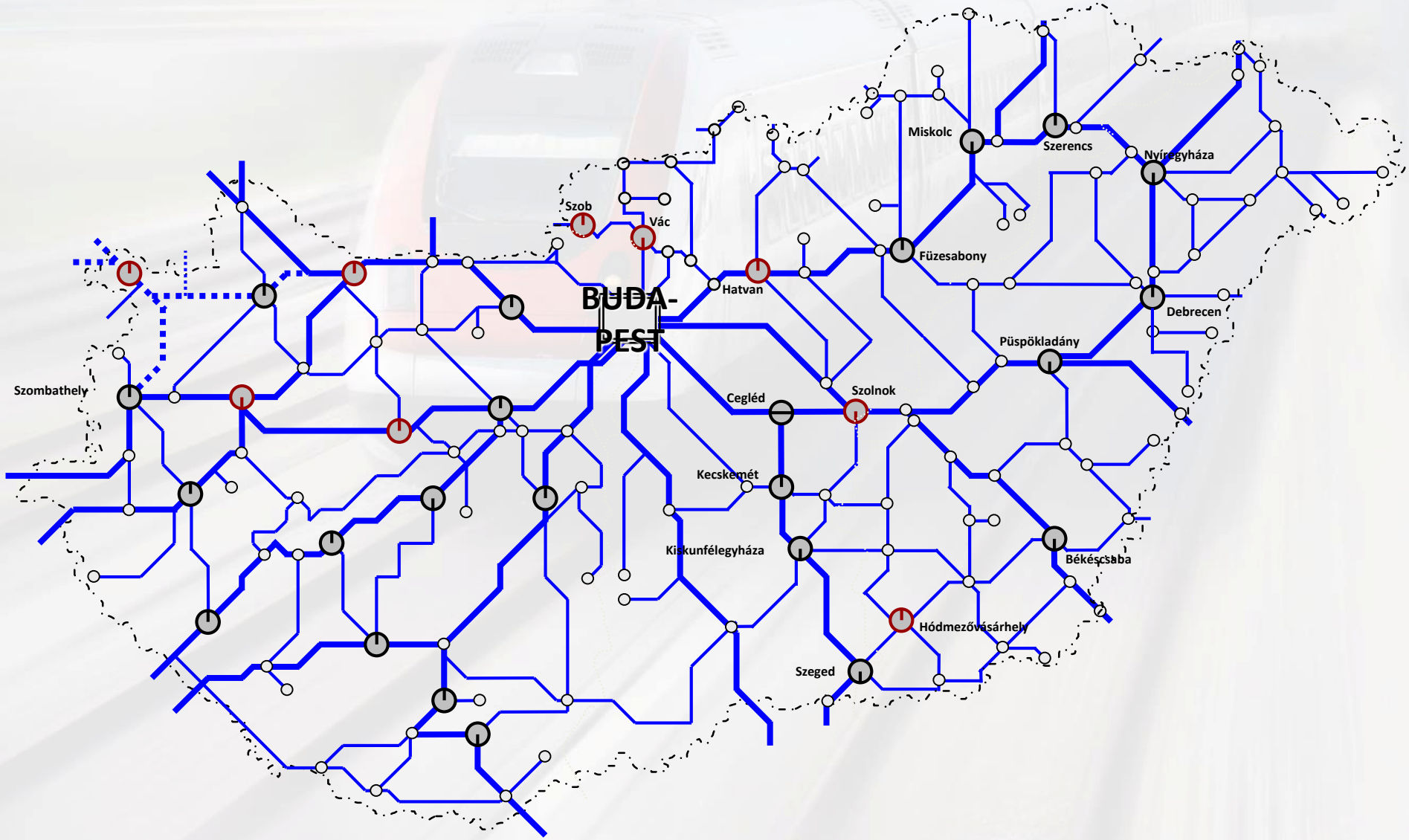
- When a train departs to the same direction (after 1 hour)
- When a train departs to the opposite direction (after 2τ minutes)
- There are connections within minutes (if we are in a hub)

Timetable variations
Integrated timetable





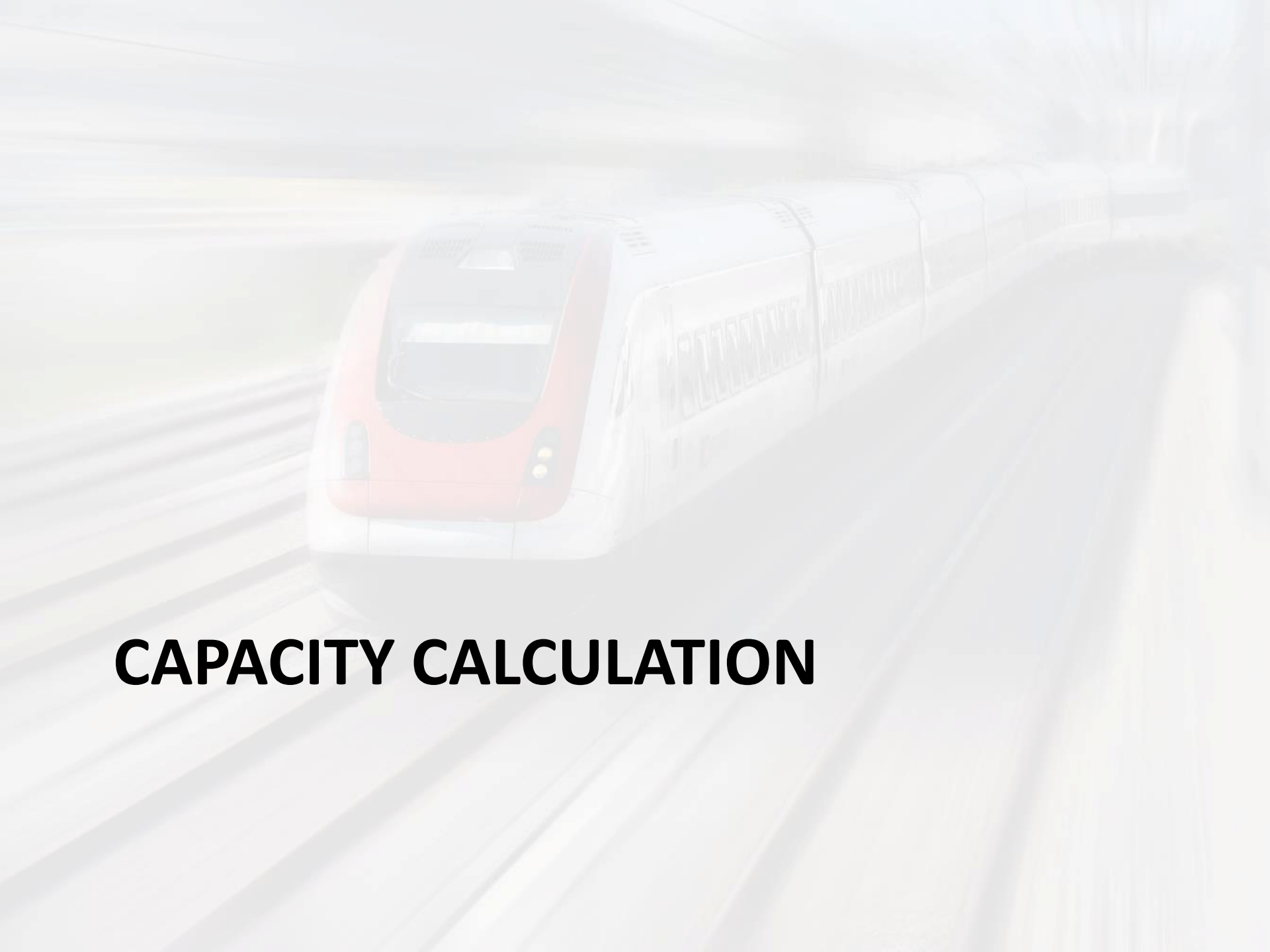
Timetable variations
Integrated timetable



Timetable variations
Integrated timetable

Allows the *timetable based infrastructure development*:

- All hubs need to be located 30 (or 60) minutes from each other
- Two solutions:
  - Increase track velocity
  - Increase the number of the tracks (at least in some sections)



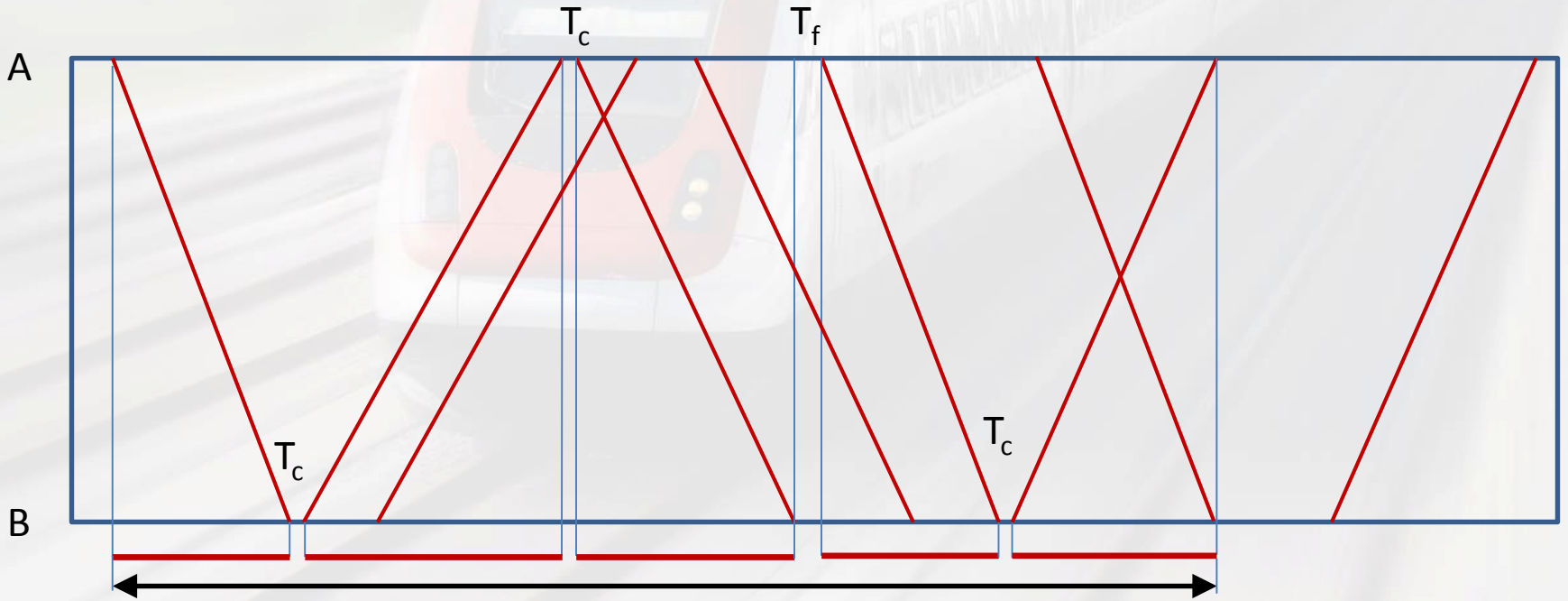
CAPACITY CALCULATION

Time requirement of follow-up and crossing

	Electronic signalling and interlocking system
Follow-up time (T_f)	1 min
Crossing time (T_c)	2 min

Capacity calculation

Defining the *theoretic productive time base (t_p)*



$$t_p = \sum t_t + \sum T_c + \sum T_f$$

Theoretical capacity values

- Daily utilisation rate:

$$\eta = \frac{t_p}{1440}\ (\%)$$

- Theoretic number of trains between the stations:

$$N_{max} = \frac{N}{\eta}\ ({}^{train}/_{day})$$

Reserve time

	Reserve time (r)
Station-term operation	5 min
Automatic block system	3 min

Practical capacity values

- Practical utilisation rate:

$$\eta_p = \frac{t_p + N * r}{1440} \ (\%)$$

- Practical number of trains between the stations :

$$N_p = \frac{N}{\eta_p} \ (^{train}/_{day})$$

Available reserve time

- Available reserve time:

$$r_a = \frac{1440 - t_p}{N} \ (min)$$

TASK

Description

- Passenger trains run hourly between stations ‚A' and ‚B' adjusted to an integrated timetable. (There are no other trains between the two stations.)
- The timetable operates every day between 4 AM and midnight.
- Travel time between the two stations is t_t minutes.
- Trains from ‚A' to ‚B' depart τ minutes after the hour.

Data

- t_t = 5 + (first character of the Neptun-code)
- τ = (second character of the Neptun-code)
- T_c = 2 minutes
- r =
  - 3 min, if ΣNeptun-code is even (only the numbers)
  - 5 min, if ΣNeptun-code is odd (only the numbers)

- A-1
- B-2
- C-3
- D-4
- E-5
- F-6
- G-7
- H-8
- I-9
- J-10
- K-11
- L-12
- M-13
- N-14
- O-15
- P-16
- Q-17
- R-18
- S-19
- T-20
- U-21
- V-22
- W-23
- X-24
- Y-25
- Z-26

!!! If $2*t_t + 2*\tau + T_c > 60$, double track !!!

Tasks

- Draw:
  - Timetable between 13:30PM and 16:30PM
- Calculate:
  1) Daily number of trains (N)
  2) t_p
  3) η
  4) N_{max}
  5) η_p
  6) N_p
  7) r_a