

How customer-oriented vehicles significantly increase operational efficiency

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As an operator you want:

■ Happy passengers!



<https://www.istockphoto.com/de/vektor/kinder-jungen-und-m%C3%A4dchen-auf-einem-comic-zug-gm505948256-83883243>
https://www.sncf-voyageurs.com/en/?utm_source=site_SNCF&utm_medium=Env_SNCF&utm_campaign=lien-de-menu
<https://www.sbb.ch/de/bahnhof-services/waehrend-der-reise/service-im-zug.html>
<https://www.bahn.de/willkommen-next-db>
<https://regiojet.de/service/service-in-zug/relax>
<https://www.trenitalia.com/it/intercity-e-internazionali/eurocity.html>
<https://www.oebb.at/de/reiseplanung-services/im-zug/abteile-komfortklassen>

www.TrainOptimizer.com



But you also want:

Profit – by selling tickets

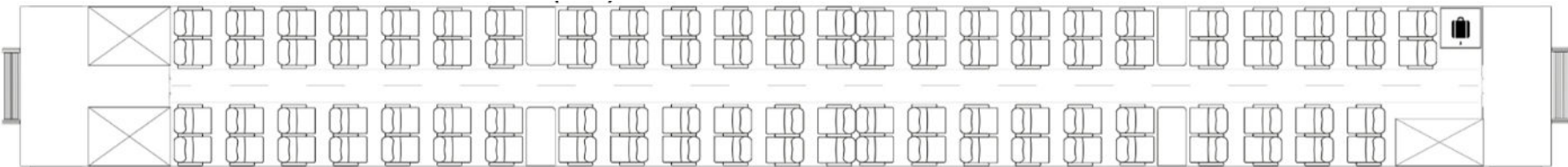




Usual procedure

Transport as many passengers as possible:

→ Maximise the number of seats



Sounds like a good idea, **BUT....**





Effect of seat maximisation

- **Energy** demand rises
- **Loss** instead of profit
- Decreasing **punctuality**
- Lower **capacity**
- Dissatisfied **passengers**



Focus on profit leads to loss in efficiency

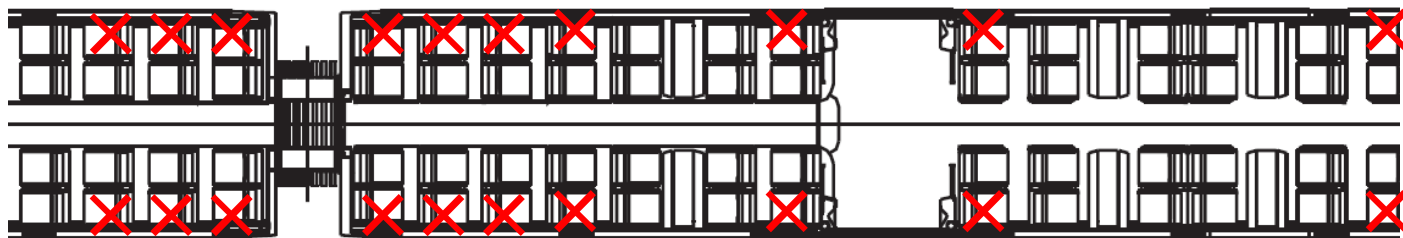


Why?



Passenger flow/occupancy - main influences

Seat selection



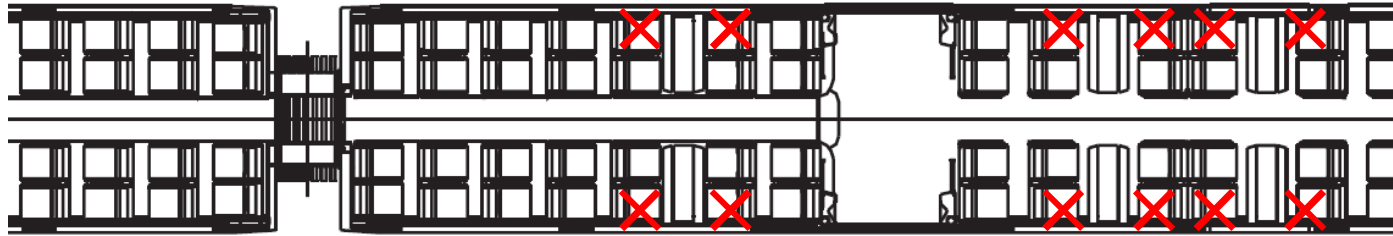
Passengers avoid "locked-in" seats wherever possible

→ Row seating: Window seat



Passenger flow/occupancy - main influences

Seat selection



Passengers avoid "locked up" seats where possible

→ Row seating: Window seat

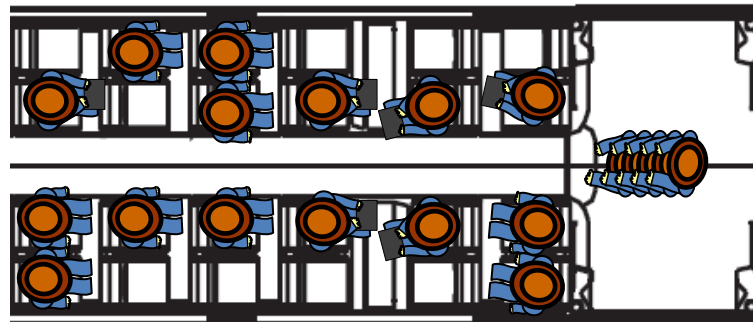
→ Vis-à-vis seating with table: window seat



Passenger flow/occupancy - main influences

Seat selection - problems due to "shunned" seats

- Defacto loss of seats, lower capacity
- Impairments in the passenger flow
- Passengers trying to get to window seats cause a **backlog**



Layout source: <https://www.oebb.at/dam/jcr:b697320b-4493-48f2-a9f4-b8ff3af4d4ec/datenblatt-cityjet-eco.pdf>



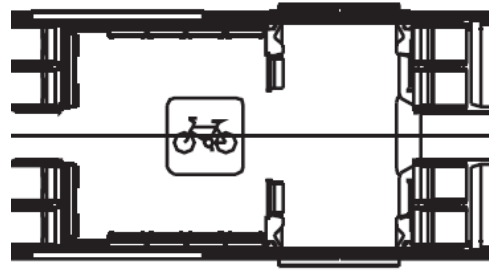
Passenger flow/occupancy - Improvements

Seat selection - create good accessibility to seats

- Partly single seats
- More vis-à-vis seating without large tables

Accessibility of seats & luggage/prams/bikes:

- Multi-purpose compartments with folding seats

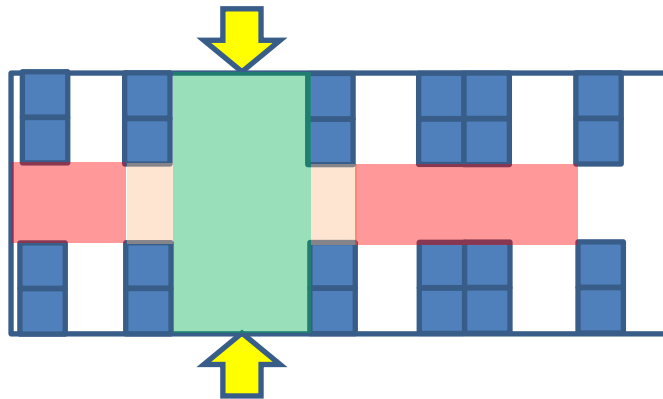


Layout source: <https://www.oebb.at/dam/jcr:b697320b-4493-48f2-a9f4-b8ff3af4d4ec/datenblatt-cityjet-eco.pdf>



Passenger flow/occupancy - entrance/interior

"Unpopular seats" & "Unpopular areas" → "Being locked in"



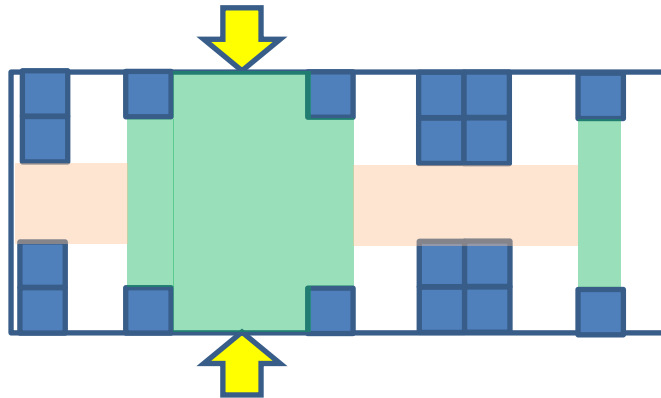
Entry: Max. 3.5 pers/m²!

Aisle: Max. 1.5 pers/m!



Passenger flow/occupancy - entrance/interior

Better for capacity and passenger flow:



Entry: Max. 3.5 pers/m²!

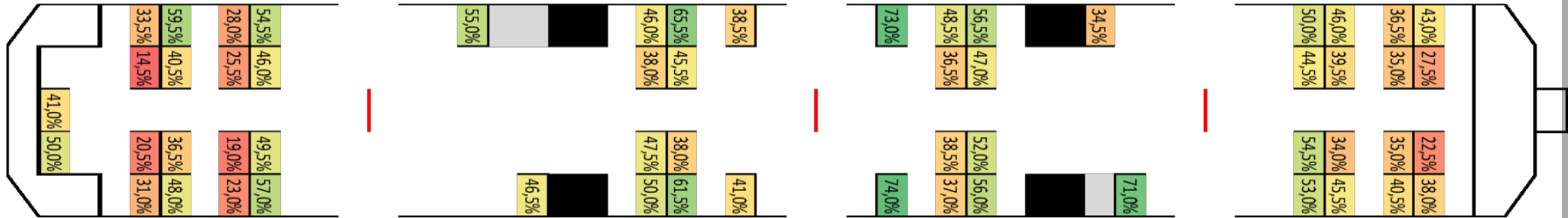
Aisle: Max. 1.5 pers/m!



Passenger flow/occupancy - "unpopular" spaces

- Easily reach the exit
 - from the respective area
 - from the seat

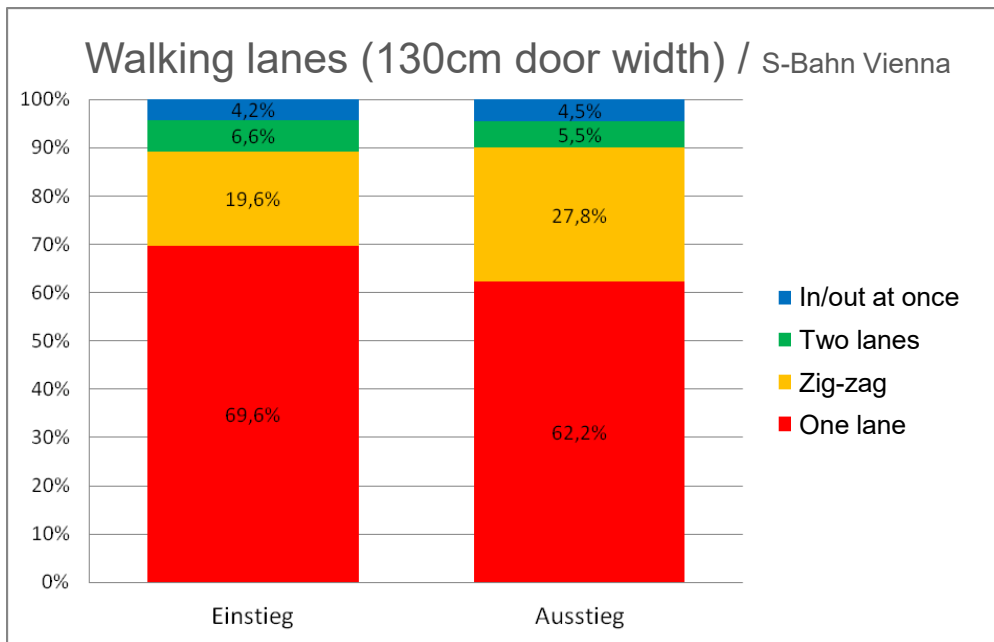
Occupancy rate of the respective seats (U6 in Vienna, type T6)



Source: KUBANIK, Martin: Fahrgastverteilung in urbanen Nahverkehrsmitteln der Städte Wien und Graz, Diploma thesis FH St.Pölten, 2017

Door width - walking lanes

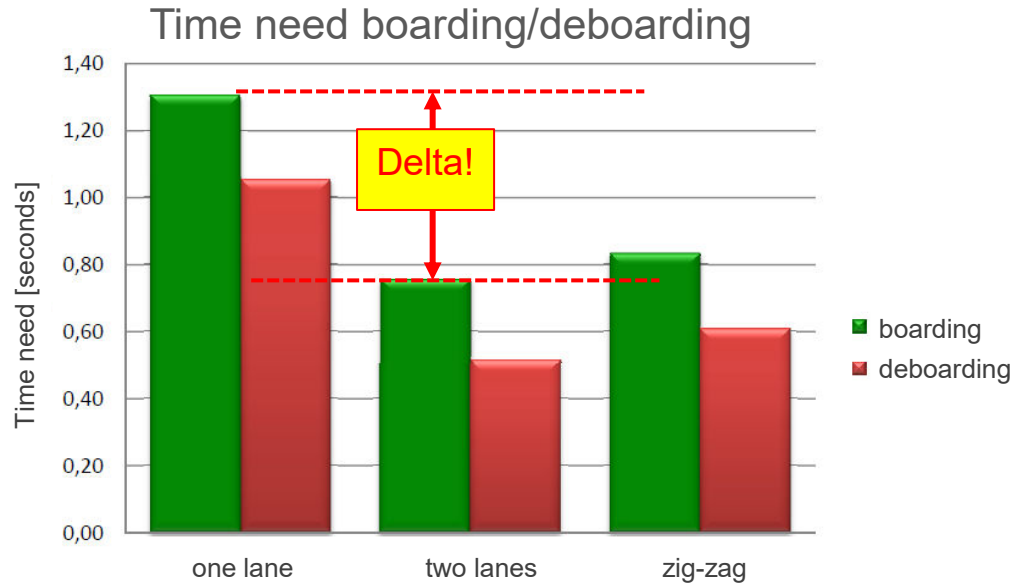
Door width 130cm → in 90% not two walking lanes





Passenger changeover time - Door width

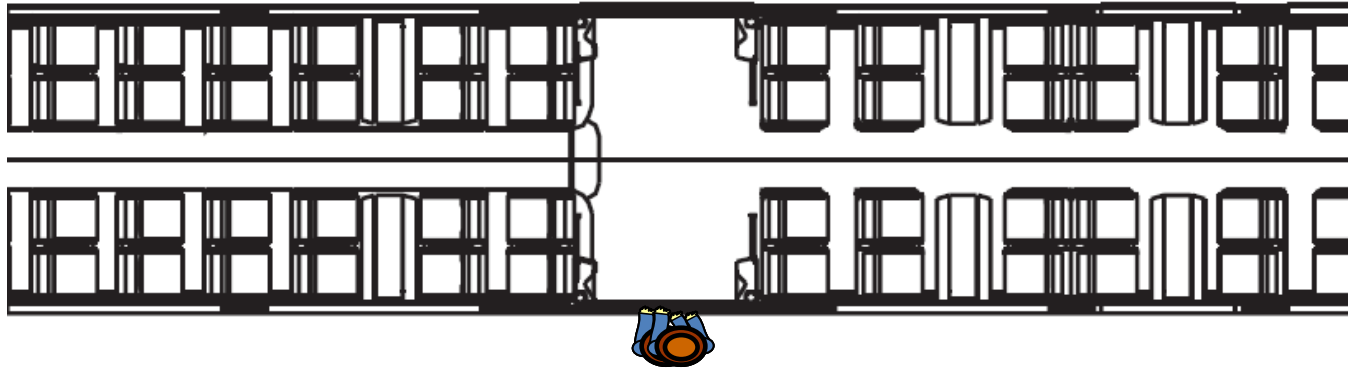
Door width 160cm → Passengers get off and on in parallel - big time difference!





Interaction interior - entry

Passenger flow division - backlog from the interior is reduced

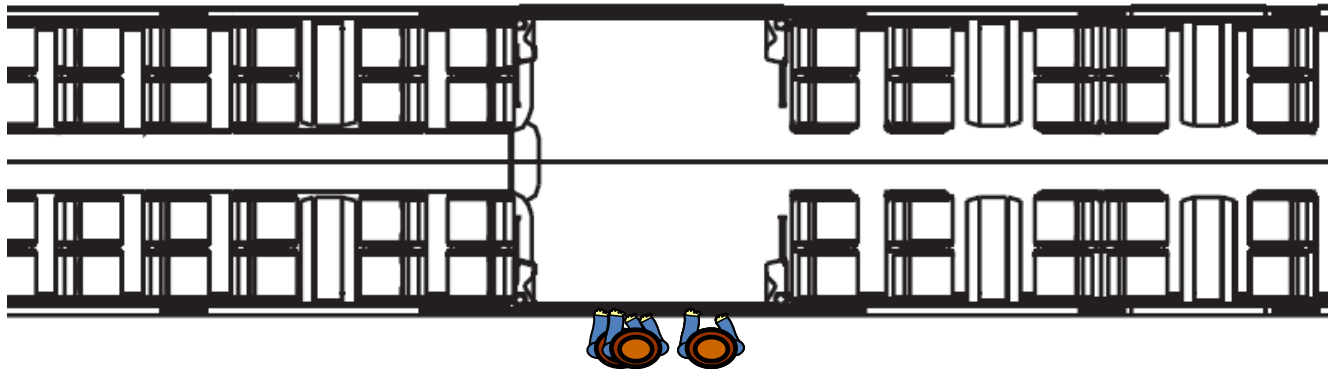


Problem: Door widths below 160cm - entry mainly behind each other



Interaction interior - entry

Passenger flow division - Wider door (min. 160cm)

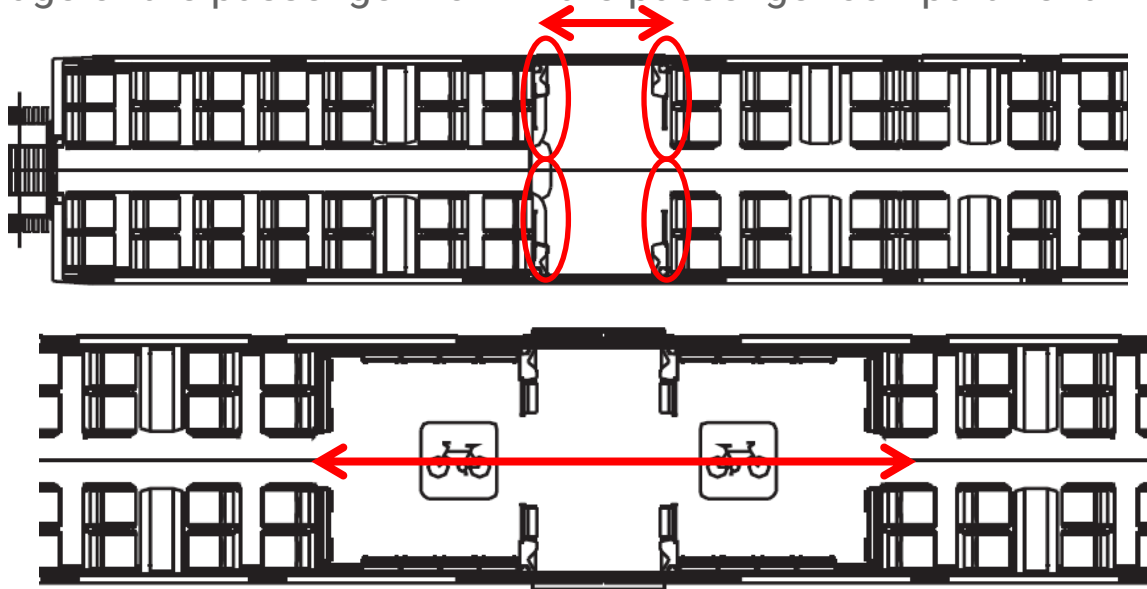


Backlog from the interior occurs more quickly

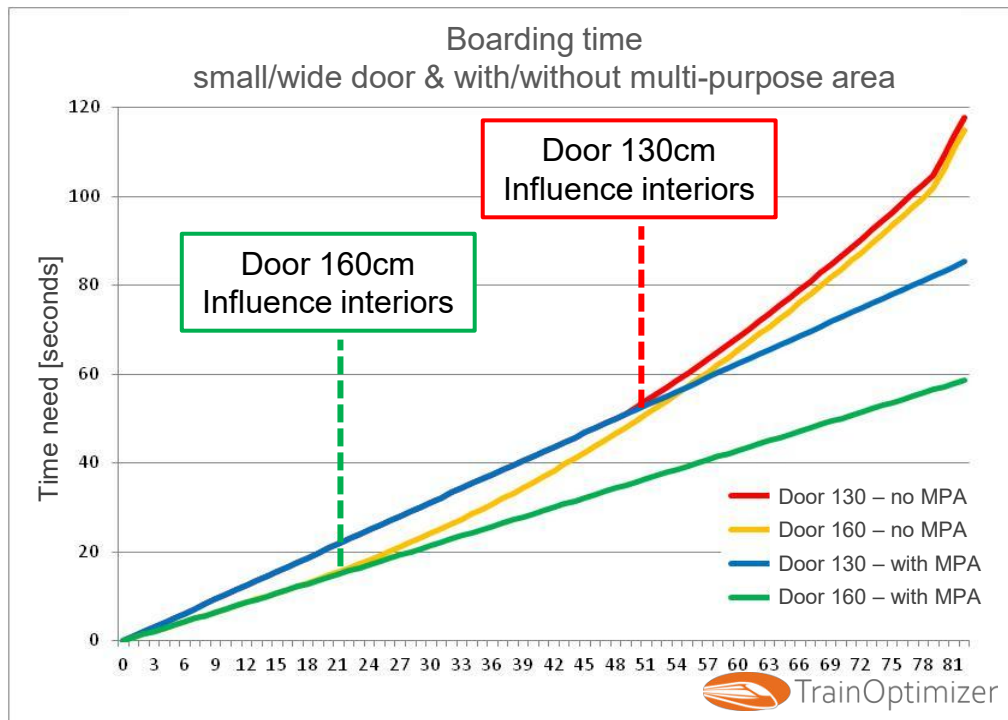
Important for short passenger changeover

Door width min. 160cm - Standback min. 25cm

Good drainage of the passenger flow in the passenger compartment



Layout comparison - door width/multi-purpose area





Basic requirements for luggage accommodation

- **Two principles:** Travellers want
 - to **avoid lifting** their luggage!
 - **visual contact** with the luggage!
- **Additionally:**
 - **Sufficient space** for luggage storage!



Effect of disregard

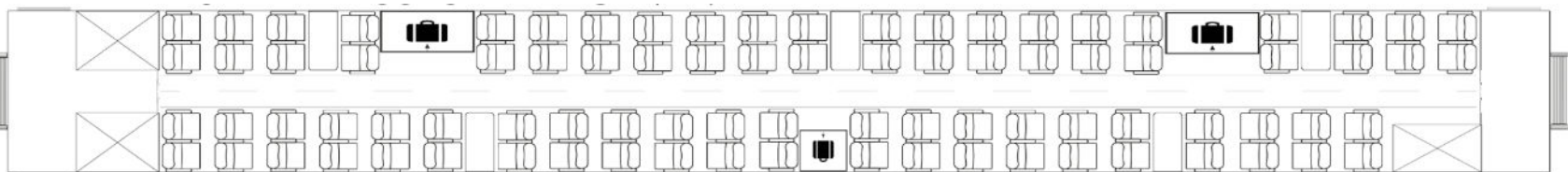
- **Luggage** is stowed **on seats, in aisles** etc.
 - **Decreasing** seat occupancy rate
 - **Obstructions** in passenger flow
 - **Longer** dwell time
 - **Decreasing** comfort

Example layouts

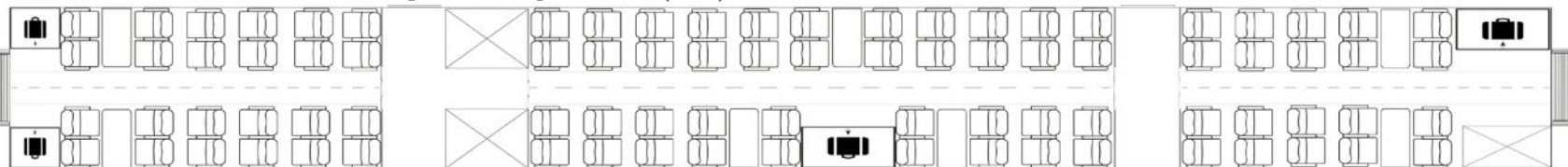
- **Maximum** number of seats (V1)



- **Improved luggage storage** (V2)



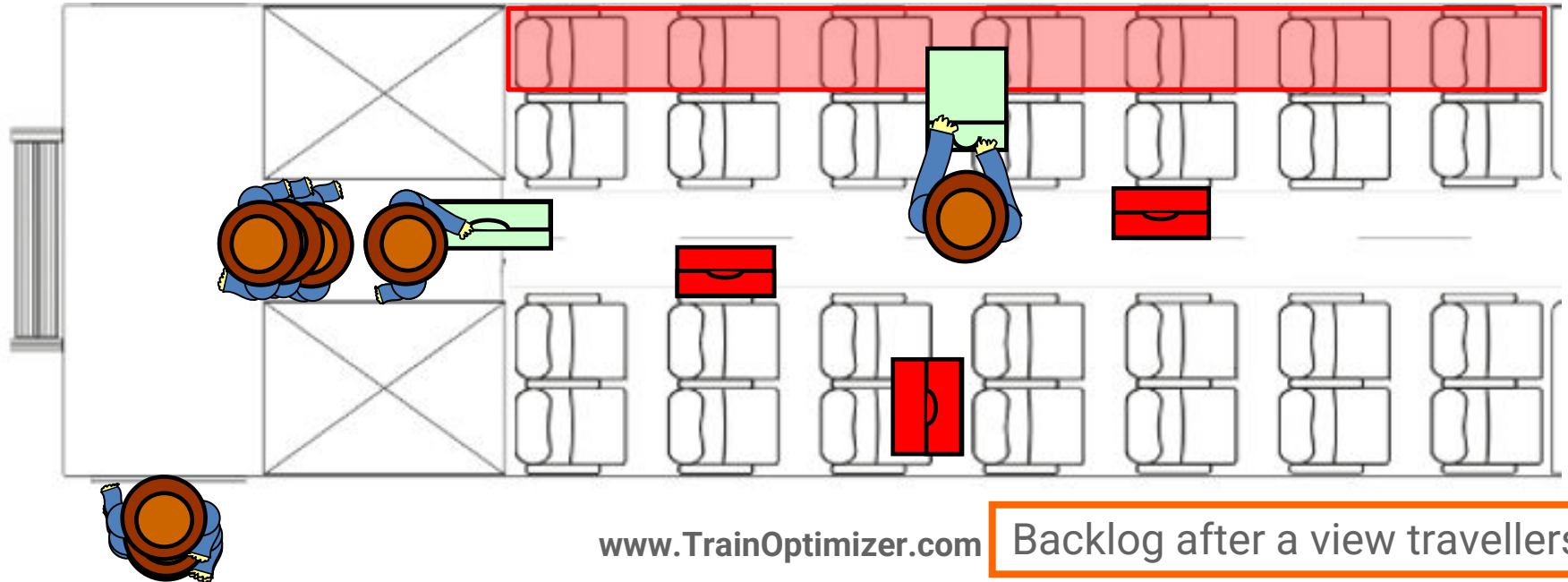
- **Doors in the quarter points** (V3)





Example layout (V1) [Overhead shelves only]

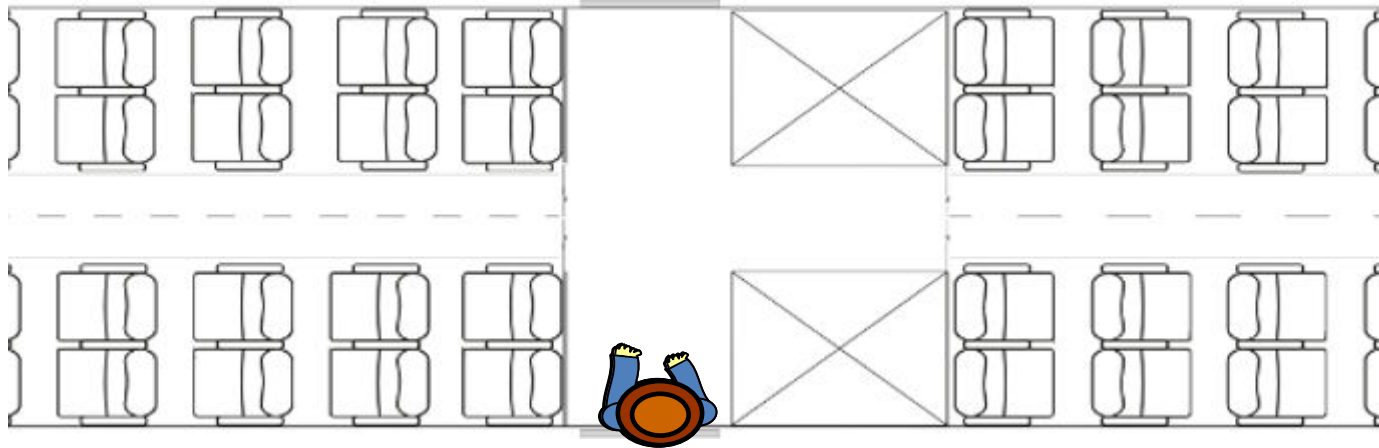
Undeliked → Luggage in the aisle or on seats
if used → Long time requirement for stowing





Example layouts (V3)

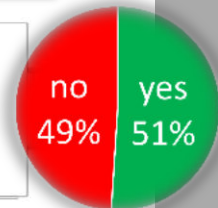
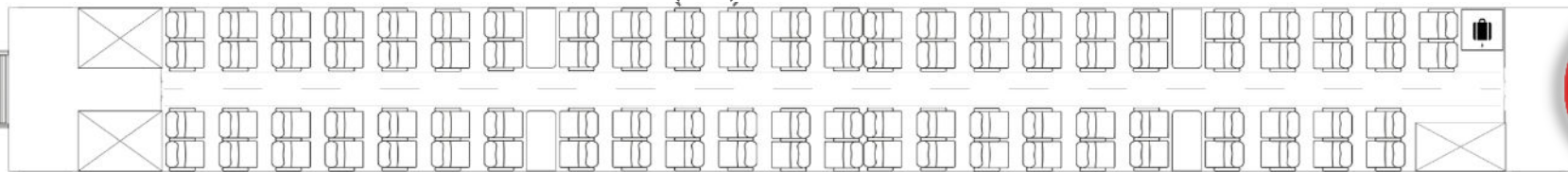
- Passenger flow division → **backlog** from the interior **is reduced**



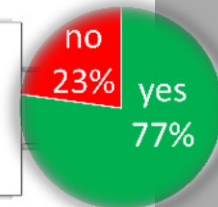
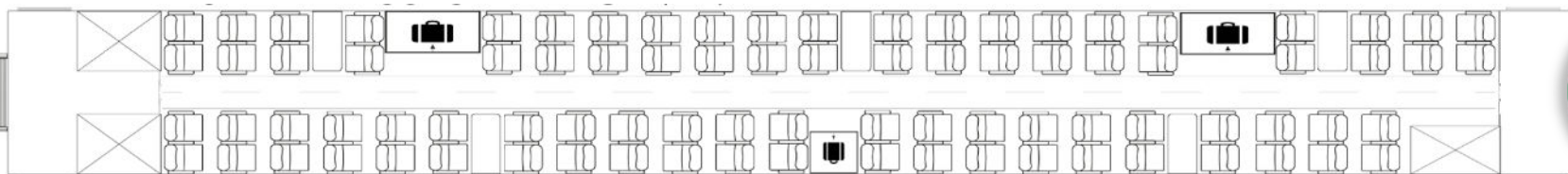


Example layouts – **baggage stowability**

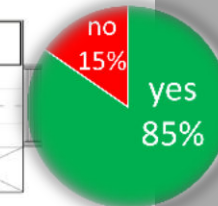
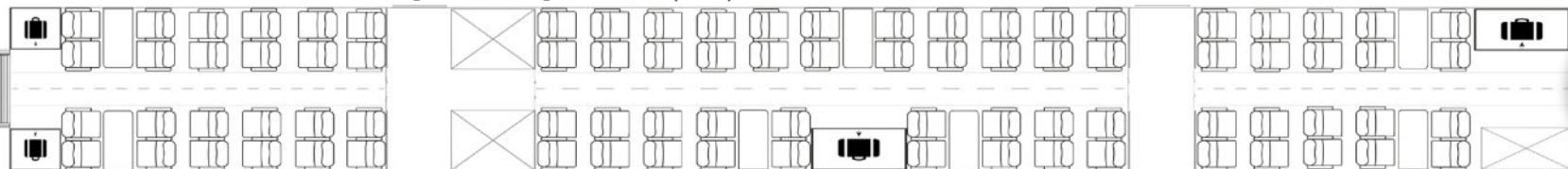
- **Maximum** number of seats (V1)



- **Improved luggage storage** (V2)



- **Doors in the quarter points** (V3)

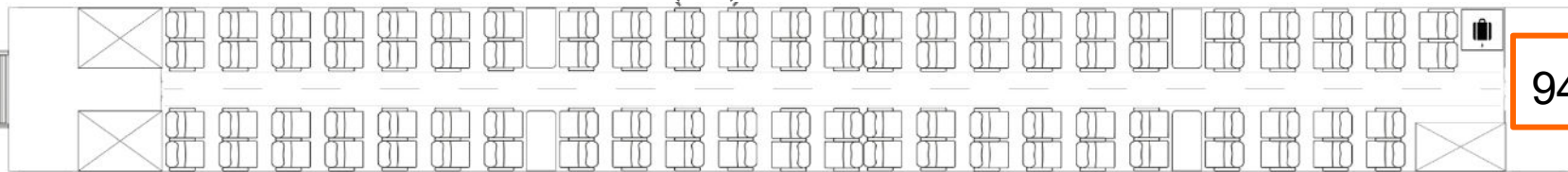




Example layouts – seat capacity

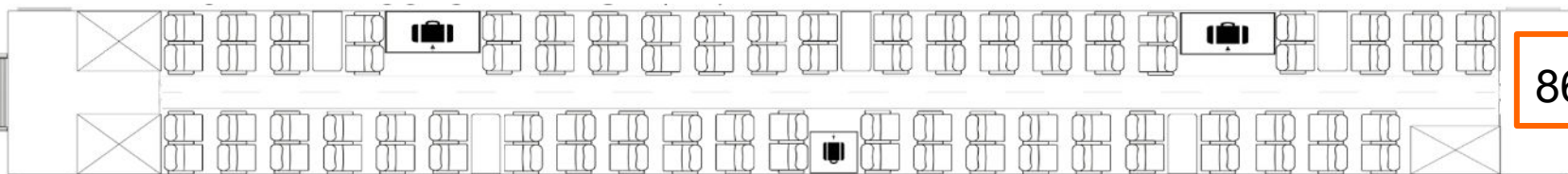


- **Maximum** number of seats (V1)



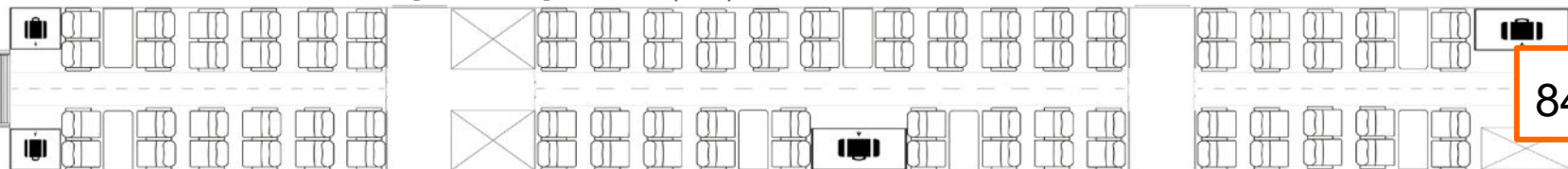
94 → 77

- **Improved luggage storage** (V2)



86 → 79

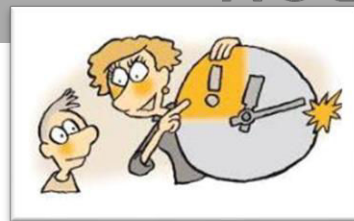
- **Doors in the quarter points** (V3)



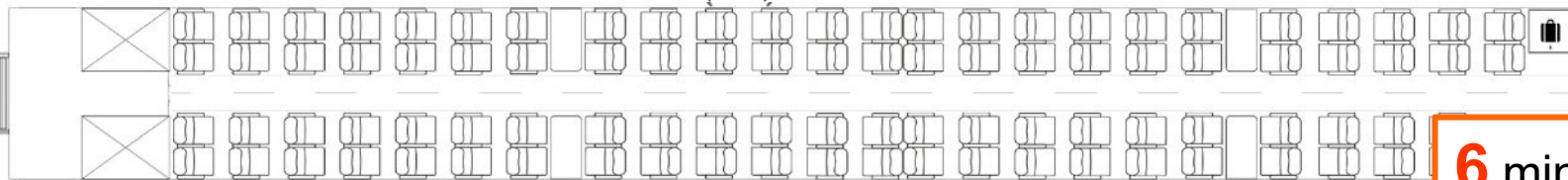
84 → 79



Example layouts – dwell time



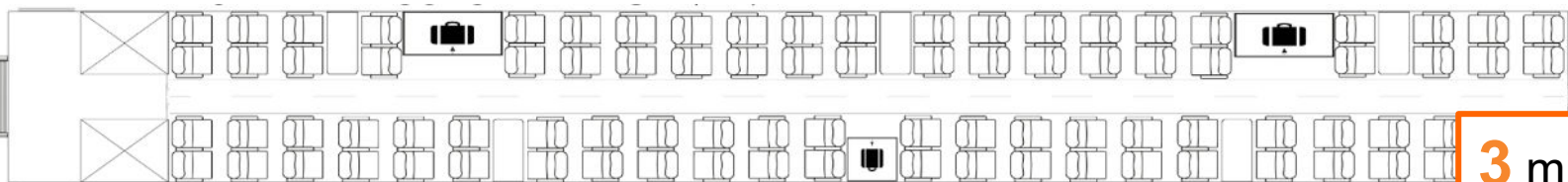
- **Maximum** number of seats (V1)



270 sec

6 min

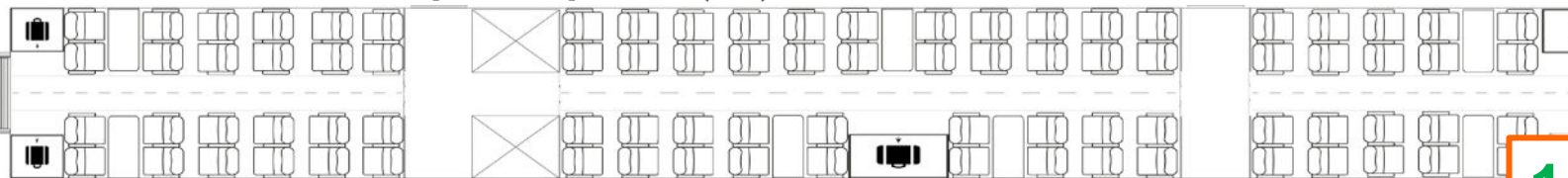
- **Improved** luggage storage (V2)



163 sec

3 min

- **Doors in the quarter points** (V3)



88 sec

1,5 min

60% passenger change over



Fewer seats mean:

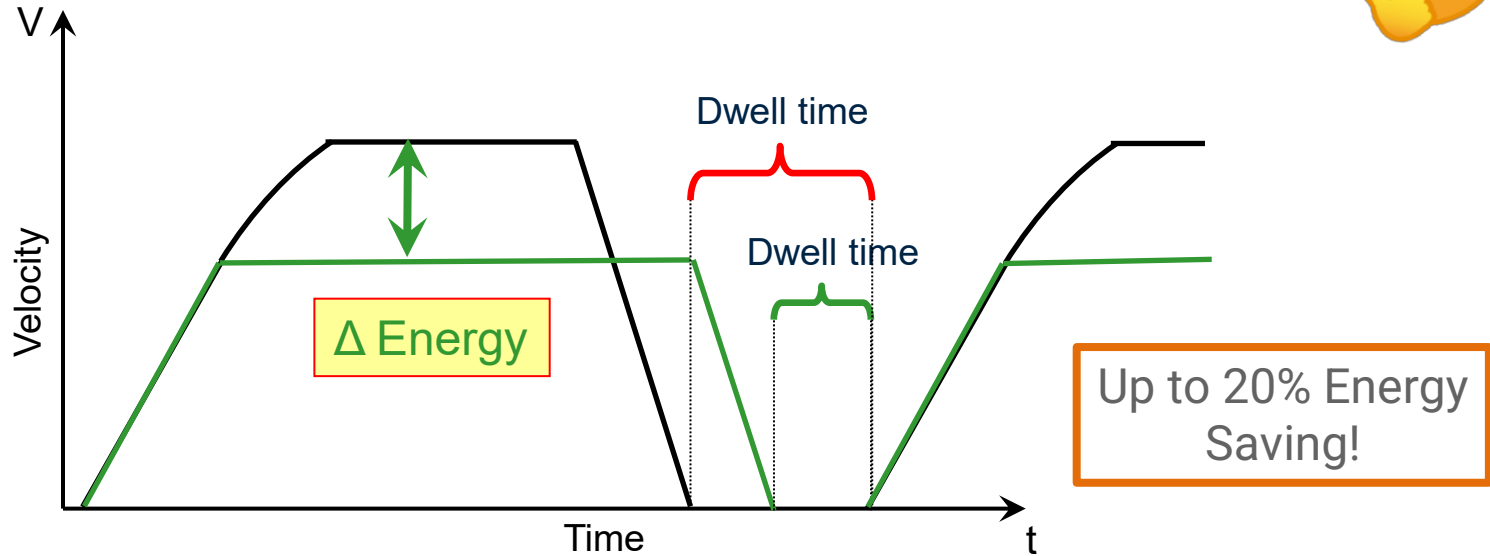
- **More** available **seats**
- More **comfort**
- Shorter dwell time
 - Higher **punctuality**
 - Save **energy**
 - Save **money**
- **Happy passengers**





Saving energy and money through fewer seats?

Shorter dwell time $\rightarrow$ Longer possible travel time $\rightarrow$ lower velocity



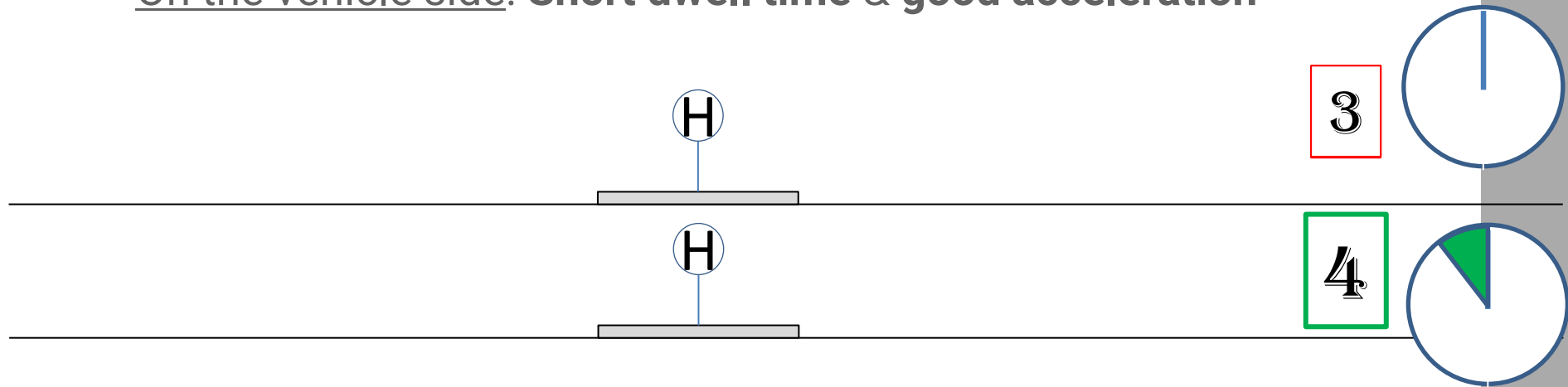


Capacity – Passenger in the train

- Relevant:
 - Actual **achievable seat occupancy**
 - All **areas** of the carriage **equally attractive**
 - Even **distribution** of passengers **along the train**

Capacity – Trains per time unit

- Relevant: **Short train interval**
- Travel time + dwell time
- On the vehicle side: **Short dwell time & good acceleration**





How do we know all this

- **25 years of research** in passenger behaviour!
 - Behavioural data from **400k passengers!**
 - Passenger change over time **measurements** of 20k passengers!
 - **Survey data** from 60k passengers!

Europe wide



What do we offer? → TrainOptimizer® Service

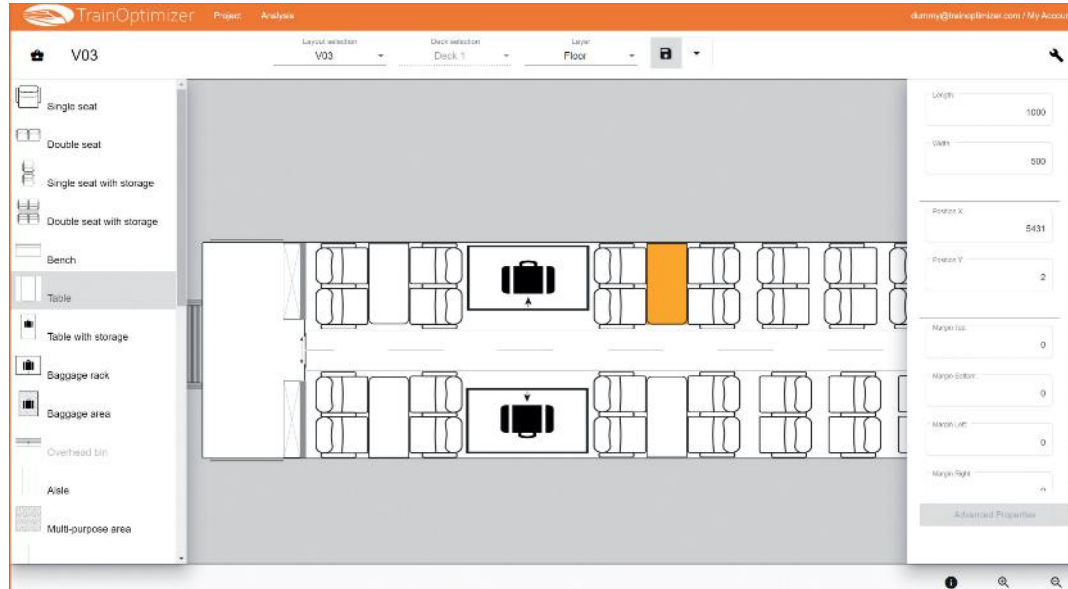
- Tailor-made **consulting** (we support you personally)
- TrainOptimizer®-**Software** (for your own application)
- **Aim of the service:**
 - Shorter dwell time
 - Better luggage accommodation
 - Higher seat occupancy
 - More passenger comfort

And many others



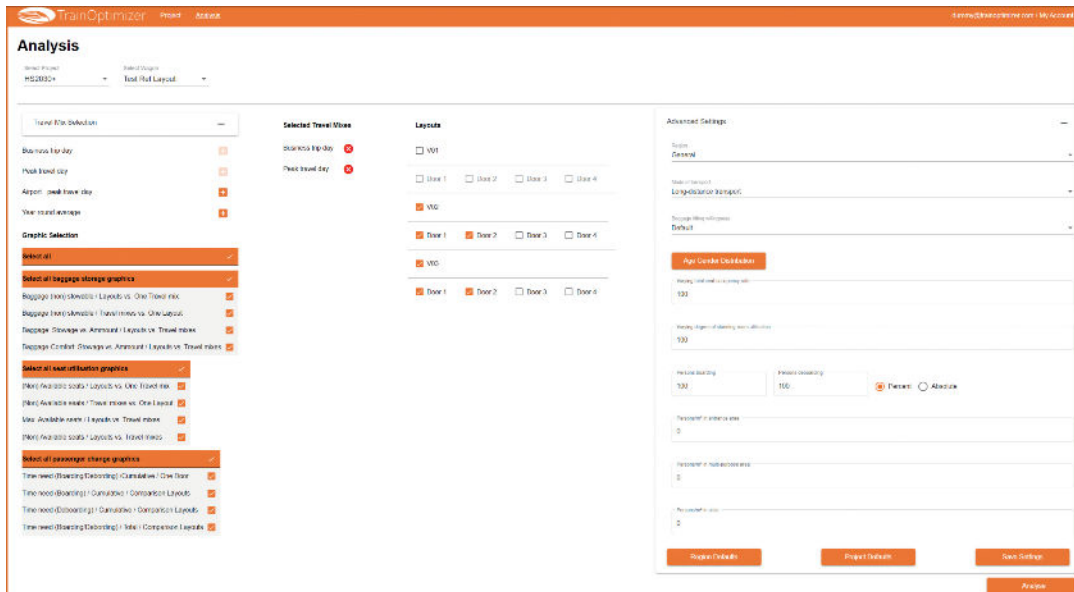
Insight into the software

- Step 1: Simply create layouts



Insight into the software

- Step 2: Select desired parameters



The screenshot displays the 'Analysis' step of the TrainOptimizer software. The interface is divided into several sections:

- Travel Plan Selection:** Includes options for 'Business for day', 'Peak travel day', 'Airport - peak travel day', and 'Your travel scenario'.
- Graphic Selection:** A list of checkboxes for selecting various graphics, such as 'Select all baggage storage graphics', 'Baggage time (Schedule) / Layout vs. One Travel time', 'Baggage time (Schedule) / Travel time vs. One Layout', 'Baggage Storage in Arrivals / Layout vs. Travel time', 'Baggage Comfort: Storage vs. Arrivals / Layout vs. Travel time', 'Select all seat utilization graphics', 'Peak Available seats / Layout vs. One Travel time', 'Peak Available seats / Travel time vs. One Layout', 'Use Available seats / Layout vs. Travel time', 'Peak Available seats / Layout vs. Travel time', 'Select all passenger change graphics', 'Time need (Boarding/Boarding) / Comparison / One time', 'Time need (Boarding) / Comparison / Comparison Layouts', 'Time need (Boarding) / Comparison / Comparison Layouts', and 'Time need (Boarding/Boarding) / Time / Comparison / Layouts'.
- Selected Travel Times:** Includes 'Business Trip-day' and 'Peak travel day'.
- Layouts:** Includes 'VOT', 'Show 1', 'Show 2', 'Show 3', 'Show 4', 'WVG', 'Door 1', 'Door 2', 'Door 3', 'Door 4', and 'WVG'.
- Advanced Settings:** Includes 'System', 'General', 'Mode of transport', 'Long-distance transport', 'Baggage filling (kg/comp)', 'Default', 'Apply Config. Combination', 'Loading (and unloading) rate', 'Loading (kg/m³) of loading area utilization', 'Person boarding', 'Person disembarking', 'Person in arrival area', 'Person in platform area', and 'Person in train'.

Insight into the software

- Step 3: Result - Easy to understand charts





References

Our Customers include:

- DB-Fernverkehr
- DB-Regio
- SBB
- ÖBB
- Siemens
- Alstom
- Bombardier
- NÖVOG
- Ace4rail
- City Airport Train Vienna
- And others

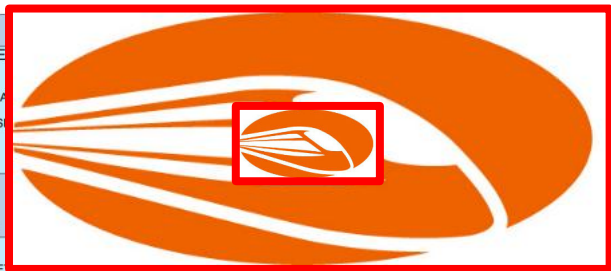
Project examples:

- ICE3 / ICE3neo / ICE4 / ICE-L
- S-Bahn München
- Railjet / Railjet 2
- Railjet Double Deck Train
- Nightjet
- Himmelstreppe / Ötscherbär
- Citybahn-Waidhofen
- Waldviertler Schmalspurbahnen
- Schneebergbahn
- Flexity
- ETR610
- TWINDEXX Swiss Express
- Flirt
- CAT-KISS
- Future concepts für DB-FV / DB-Regio / SBB
- And others



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