



TU Wien & Siemens
28.09.2026

Session 2: Designing Passenger-Centric Metro Vehicles and Platforms

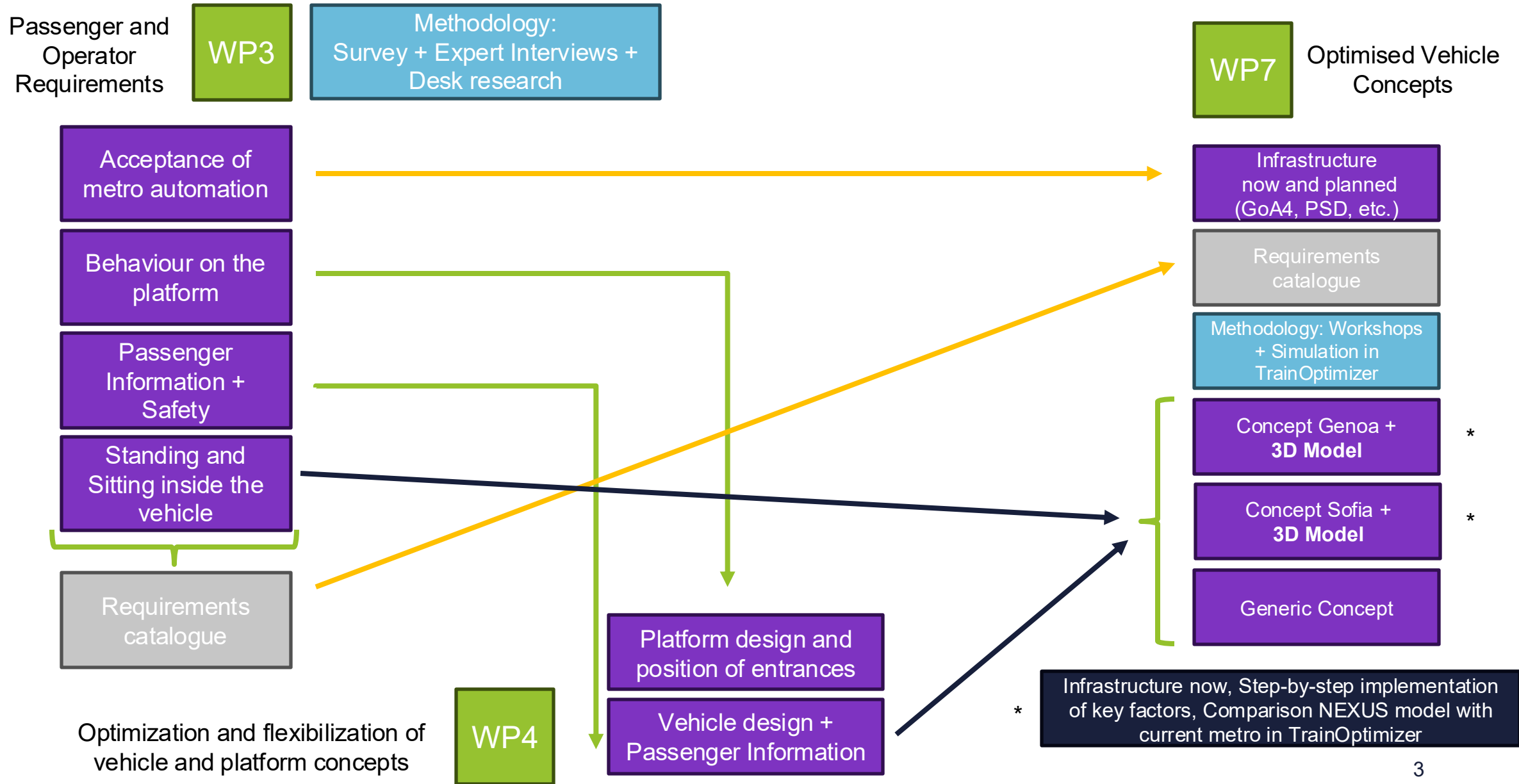


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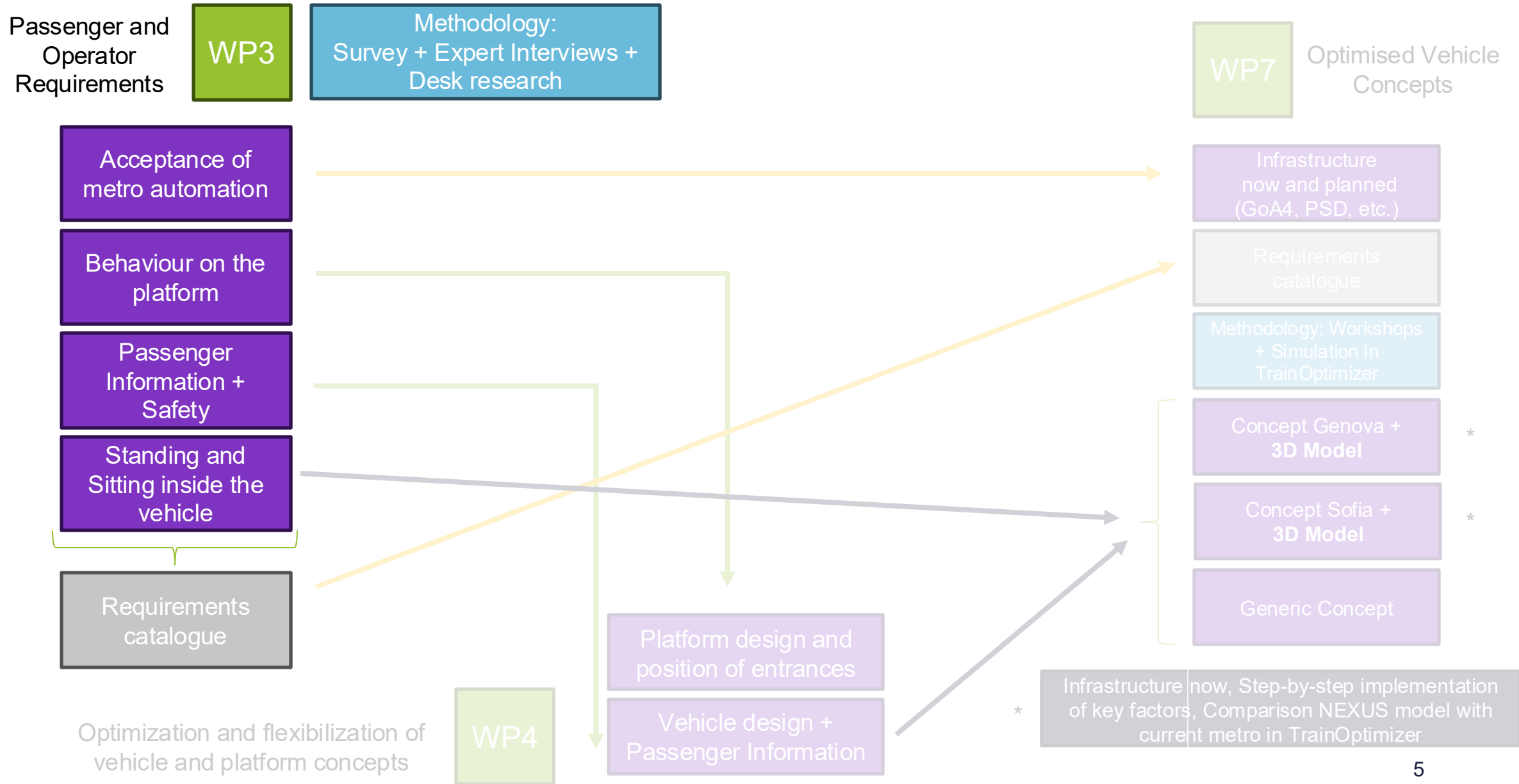
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Passenger Requirements



Results of the passenger survey

Total responses: 900

Distributed by: Sofia, Genoa, Barcelona, EPF, UITP

Key topics of the survey:

1. Acceptance of automated metro trains
2. Real-time passenger information systems
3. Perception of safety on the platform
4. Preferences regarding vehicle layout

Demographic values:

Gender:

42 % Female, 56 % Male

Age:

22.6 %	≤ 30 years,
56.7 %	31-60 years,
20.7 %	≥ 61 years

Metro use frequency:

60.3 %	Several times a week
23.9 %	Few times a month
15.9 %	Rarely / never

Results of the passenger survey

Would you take a fully automatic metro (without a driver)?

Yes: 86.9%



Most agreed benefits of an automatic metro (GoA4)

(Percentage of respondents who completely or partially agree)

- | | |
|-----------------------------------|-------|
| 1. Extended operation hours | 76.3% |
| 2. Improved real-time information | 66.7% |
| 3. More frequent schedule | 65.7% |
| 4. More comfortable ride | 57.0% |
| 5. Network expansion | 54.3% |

Most listed concerns:

- potential technological failure,
- the risk of hacking
- inadequate systems response in emergencies

Results of the passenger survey

Where do passengers prefer to wait on the platform?



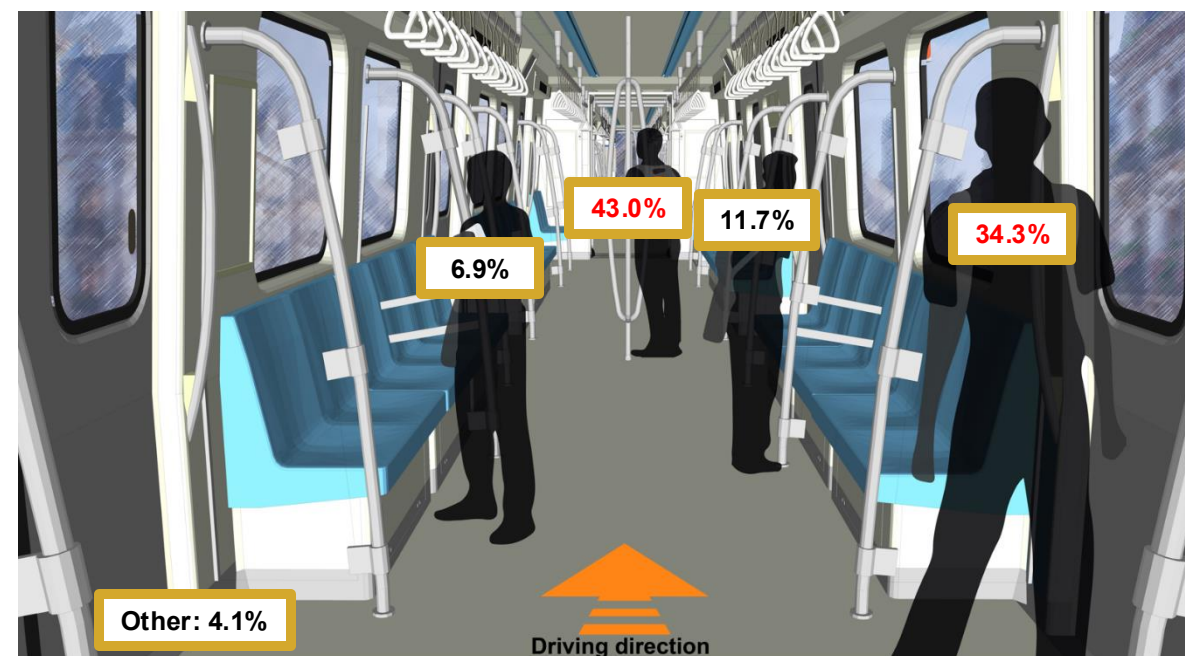
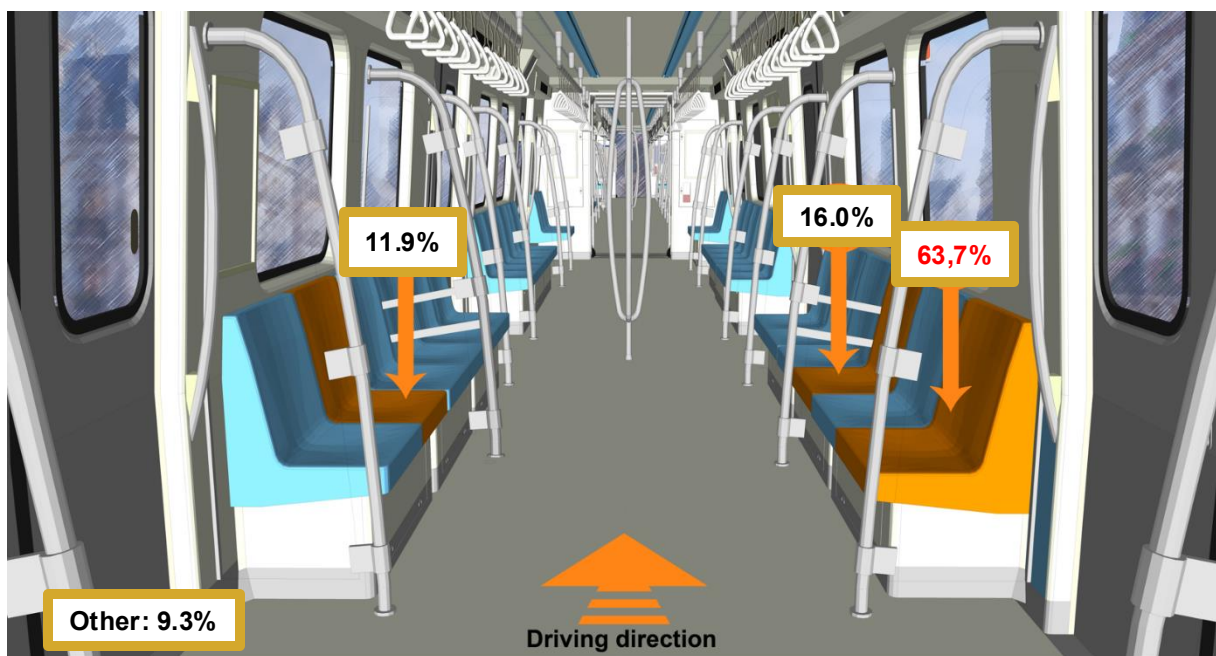
60% - female
42% - male

Feel **unsafe** on
crowded platforms
at least once a year

92% of passengers would **change** their **position** on the platform if real-time occupancy information helped them **avoid crowding** during their ride.

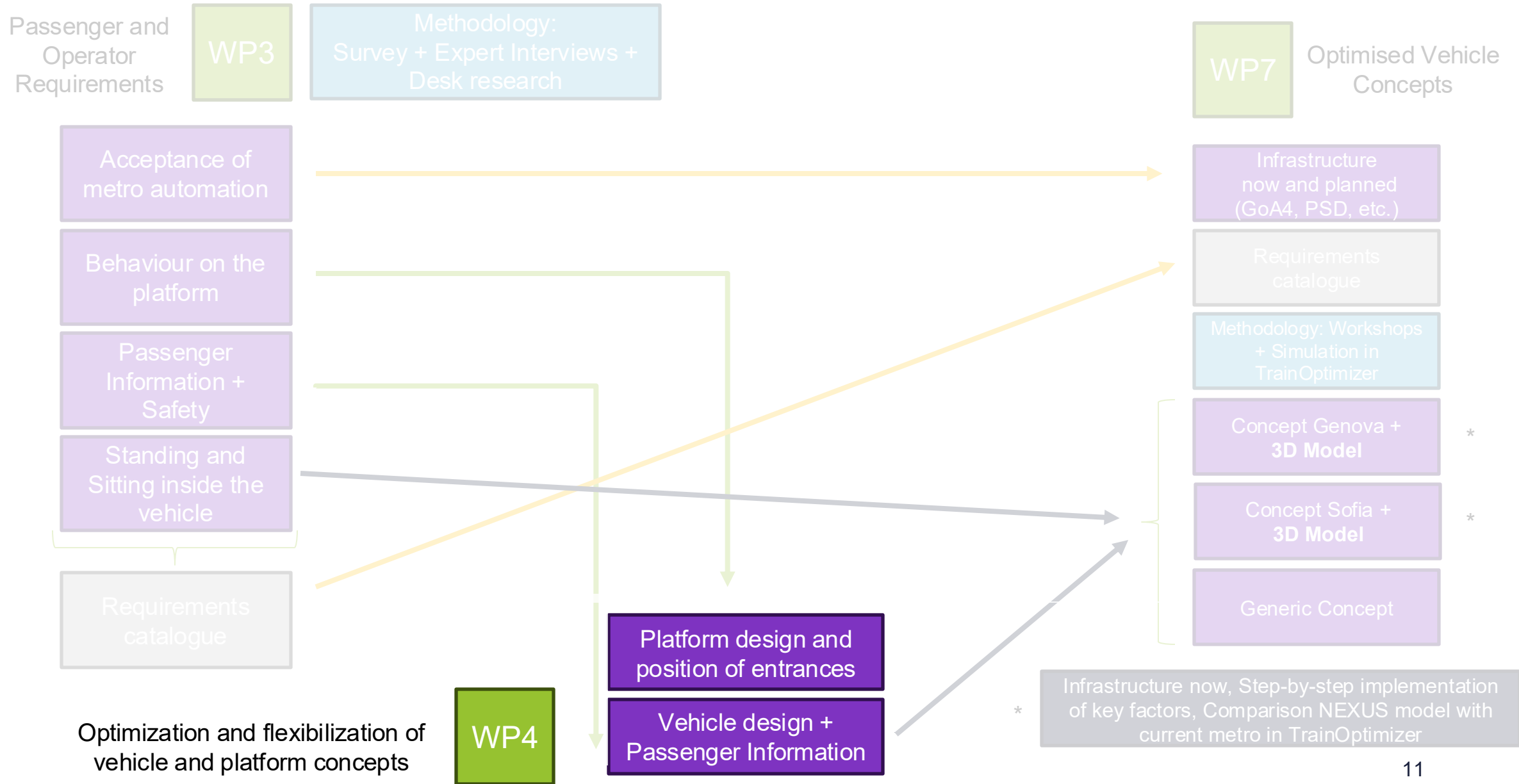
Results of the passenger survey

Which is your preferred position inside the vehicle?



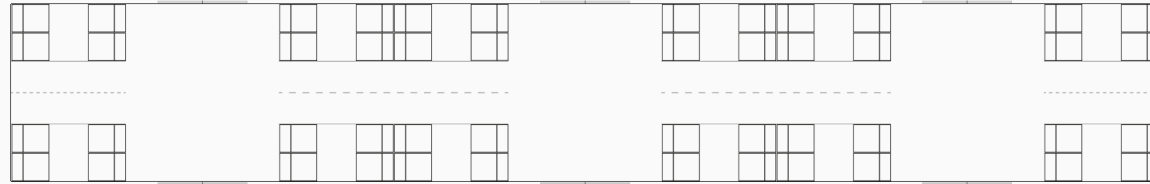


Optimization and flexibilization of vehicle and platform concepts



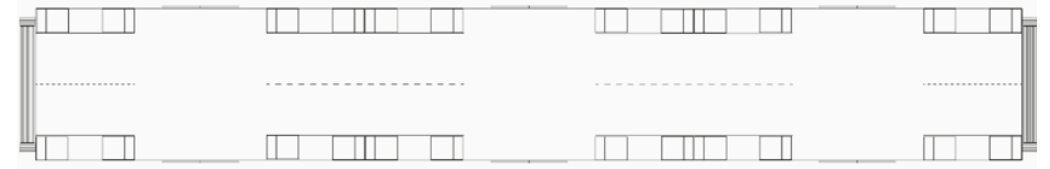
Layout 1:

3 Doors/side of the carriage
144 passengers per carriage



Layout 2:

3 Doors/side of the carriage
138 passengers per carriage



Layout 3:

3 Doors/side of the carriage
138 passengers per carriage



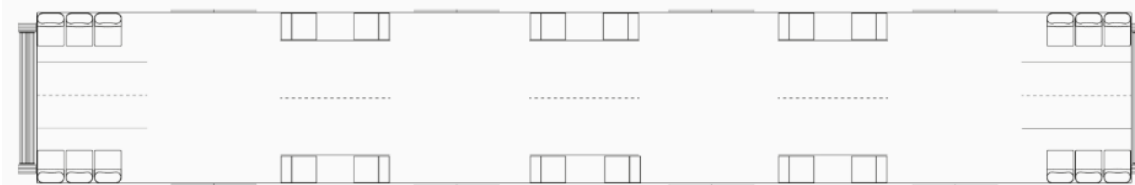
Layout 4:

4 Doors/side of the carriage
148 passengers per carriage



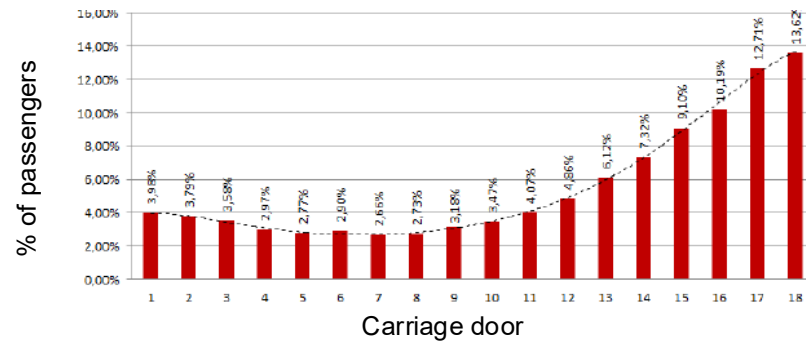
Layout 5:

4 Doors/side of the carriage
139 passengers per carriage

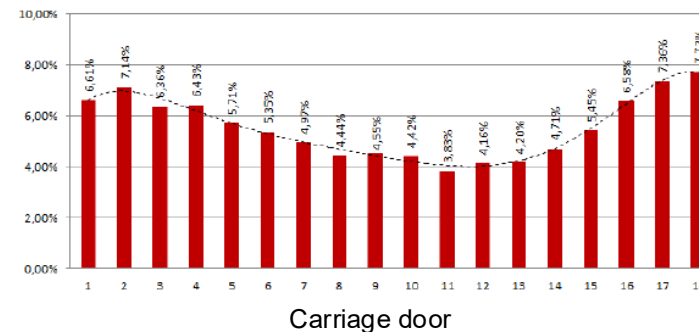
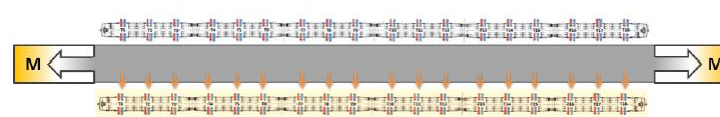


Platform concepts – Influence of station layout on passenger distribution

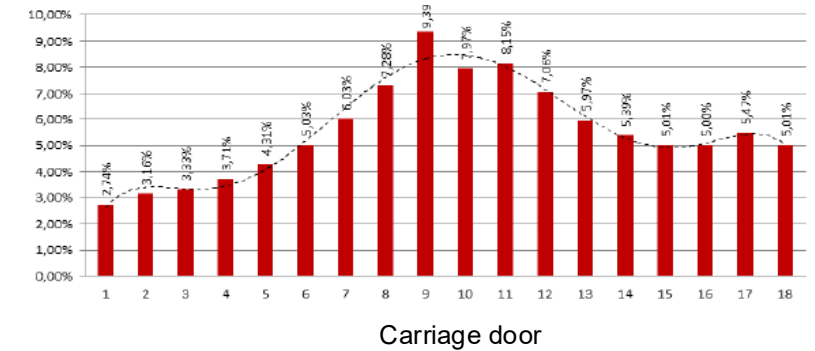
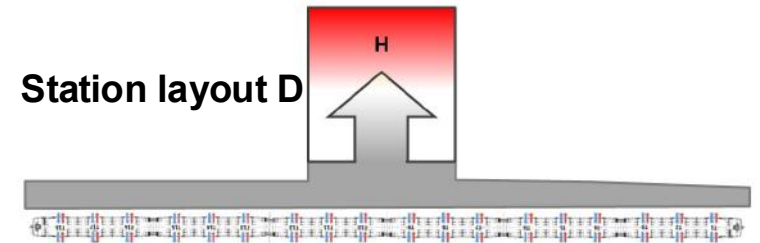
Station layout A+B



Station layout C



Station layout D



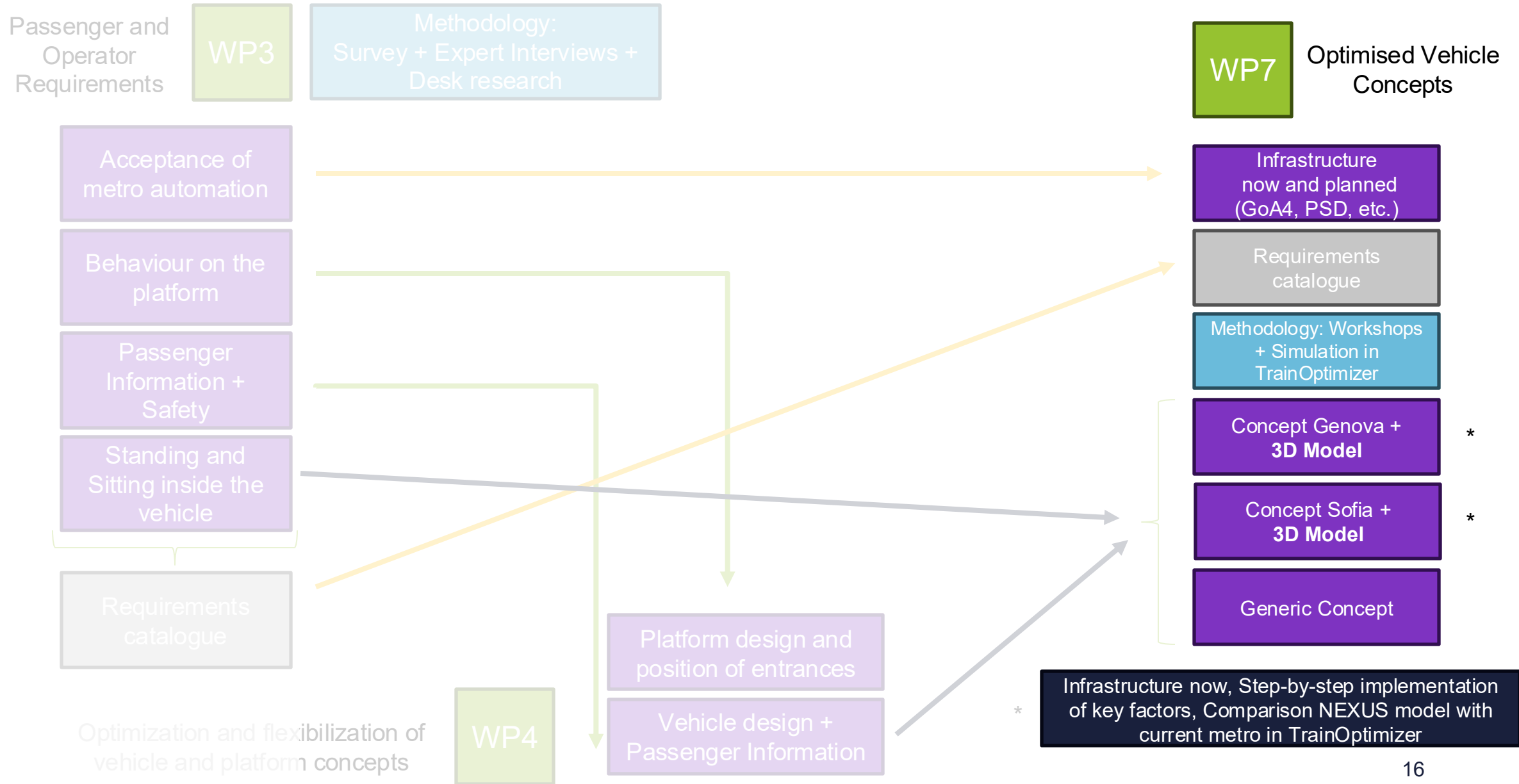
Interaction between vehicle and platform concepts

Number of doors per train	Modell	Train Layout	Capacity per carriage*	Total passenger changeover time per simulation and model weighted to 100 persons (sec)			
				Platform A	Platform C	Platform B	Platform D
18	M	1a	144	272,13	147,94	337,38	166,91
	N	1b	138	204,10	110,94	253,03	125,18
	M	2a	138	283,96	154,38	352,05	174,17
	N	2b	148	212,97	115,77	264,04	130,62
	M	3a	139	283,96	154,38	352,05	174,17
	N	3b	144	212,97	115,77	264,04	130,62
24	G	4a	138	205,32	108,86	258,06	127,26
	H	4b	138	153,99	81,64	193,58	92,91
	G	5a	148	218,62	115,91	274,77	135,50
	H	5b	139	163,96	86,93	206,12	98,92

*Entrance Area 3,5 P/m², Aisle 2 P/m²



Optimised Vehicle Concepts



Development of Vehicle Concepts

INPUTS

Infrastructure now:

- Platform dimensions
- Width of the vehicle
- Length of the vehicle

NEXUS - D3.1 and D4.2

NEXUS Workstreams

Adaptability & Demand
Future of train control
AI and Data Science

Infrastructure planned:

- No Driver's cab
- Signaling system
- CBTC
- Platform Screen Doors

Use Cases

1. Sofia – Line 4
2. Genoa
3. Generic concept

Vehicle concept

OUTPUT

1. CAD-Model
2. Description:
 - Achievable benefits
 - Challenges + Input
 - Feasibility

ITERATION & FEEDBACK

Analysis + Feedback

Siemens
Metro Operators
Advisory Board Members

TrainOptimizer

Simulation Tool for Passenger
Changeover Calculation

Version 1

...
Version 5 (final)

Key factors for Vehicle Design

User-centric factors driving the optimisation

1. Interior Layout

seating, standing, leaning, circulation of passengers

2. Special Areas

luggage, end zones (GoA4), line-specific design

3. Doors

number, width, closing behaviour

4. Information Systems

audio, visuals and location of info displays

5. Ambient

lighting, materials, climate, cleanliness

6. Exterior Design

colour scheme, markings, windows



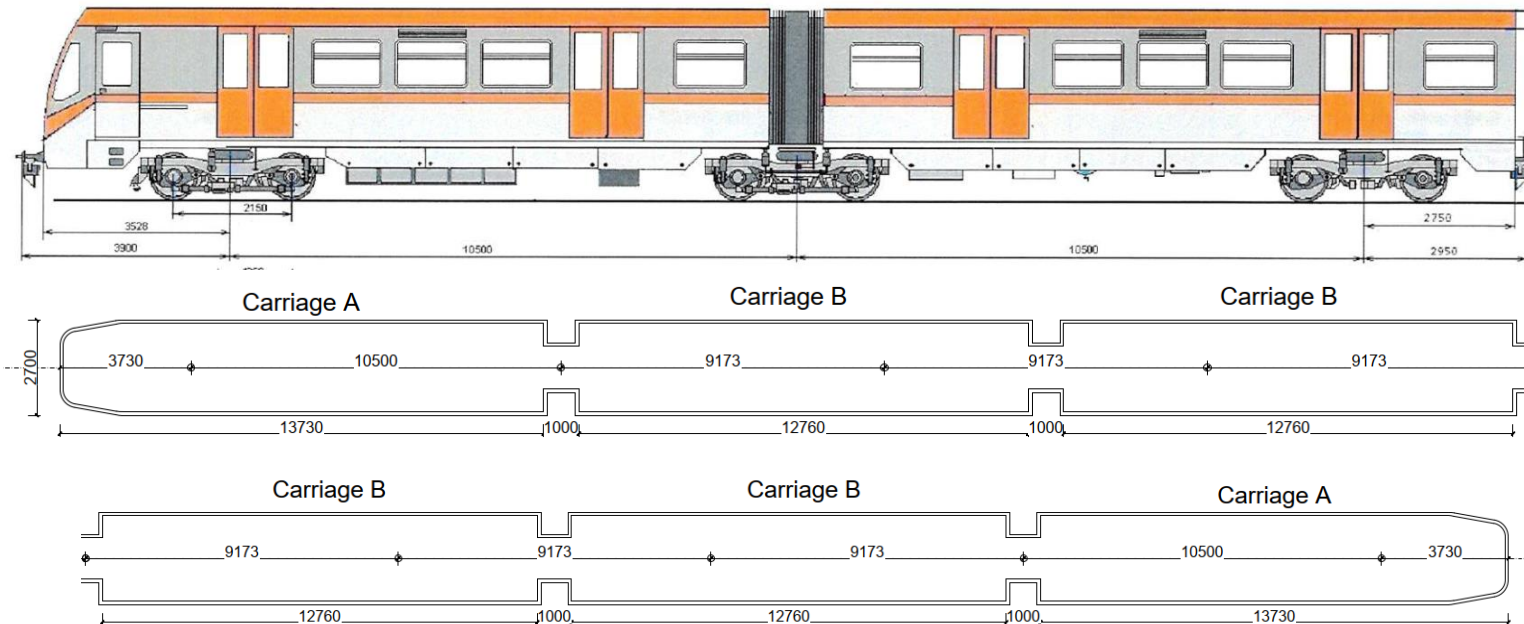
01

SOFIA



Existing Layout & Dimension

Redesign of current metro vehicle of Sofia: **Rusich 81-740.2 / 741.2**



Key Changes / Notes

Total length: 83.5 m

Mix of Jacobs's and Conventional Bogie

Max. bogie distance: 10.5 m

Vehicle width: 2.7 m

Dimension of Transitions:
length: 1.0 m; width: 1.2 m

Step 1

Step 2

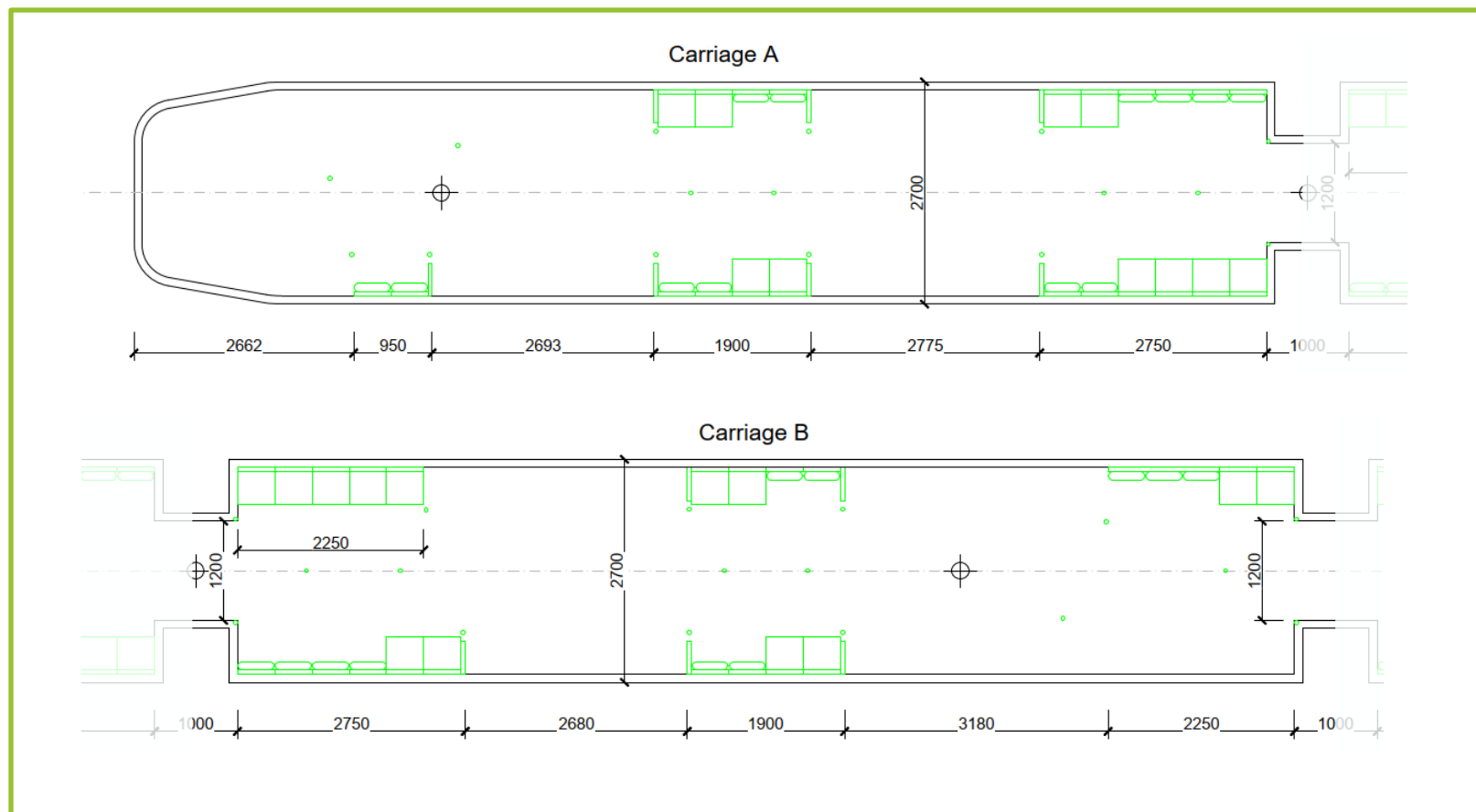
Step 3

Step 4

Step 5



Interior Layout



Key Changes / Notes

- A total of 6 carriages
- Spacious entrance area
- A mix of folding seats and regular seats - allows also luggage storage
- Vertical holding positions not directly in the entrance area

Step 1

Step 2

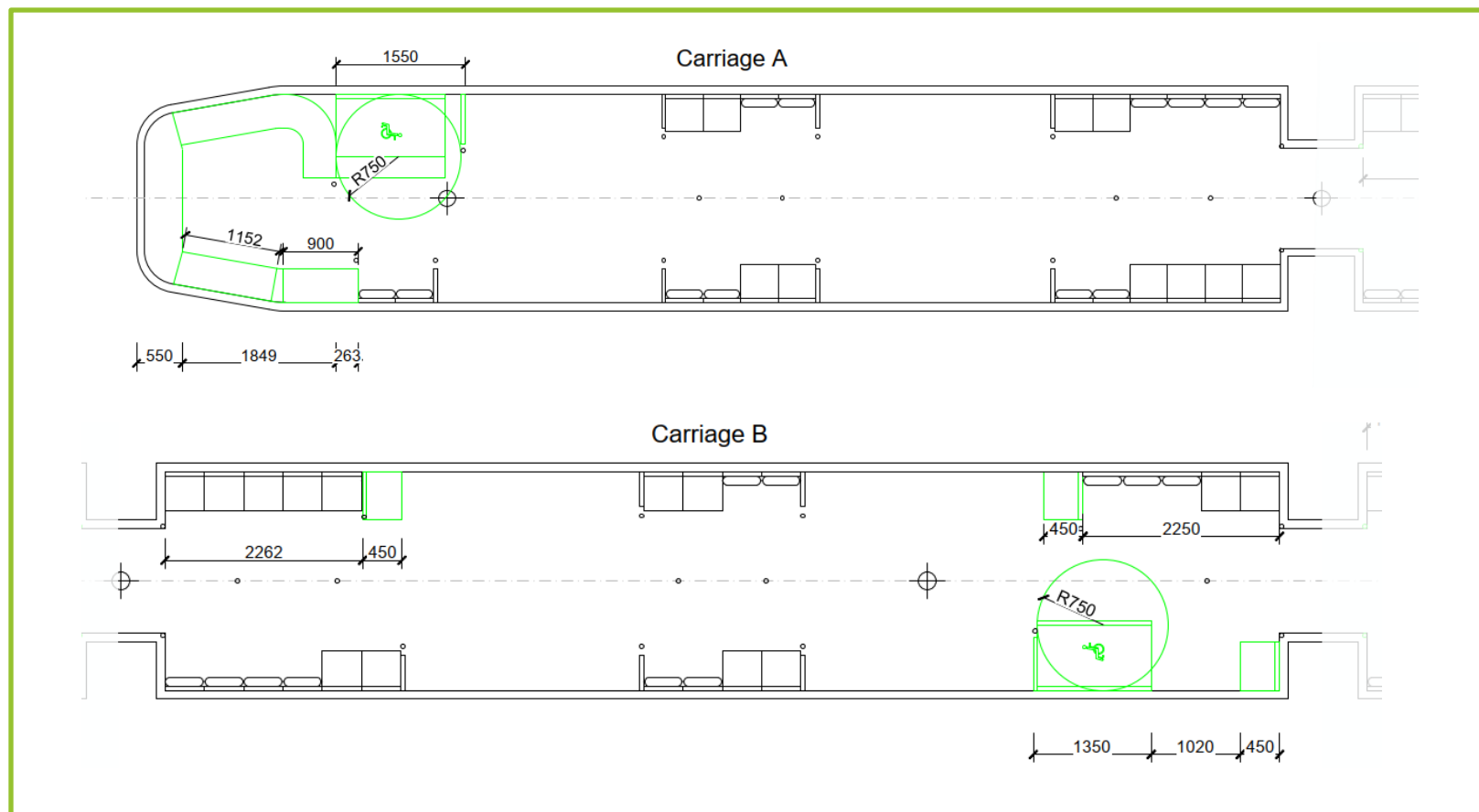
Step 3

Step 4

Step 5



Special Areas



Key Changes / Notes

- One multipurpose area per carriage for wheelchair users, strollers, etc.
- Front area brings a travel experience for families or groups
- Wider seats for passengers with special needs

Step 1

Step 2

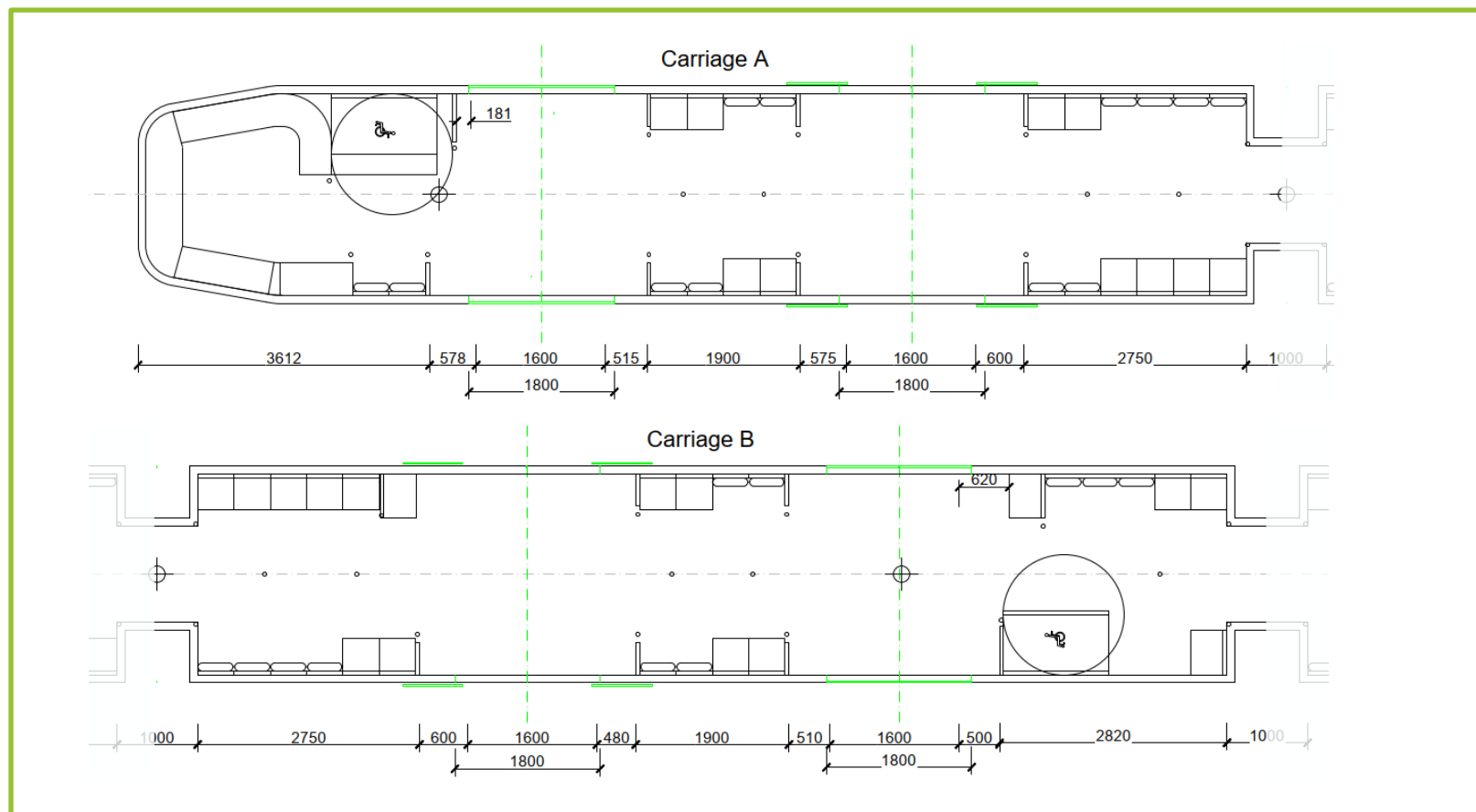
Step 3

Step 4

Step 5



Doors



Key Changes / Notes

- Door width of 1600mm which allows two separate passenger streams
- 4 doors per carriage
- Platform Screen Doors

Step 1

Step 2

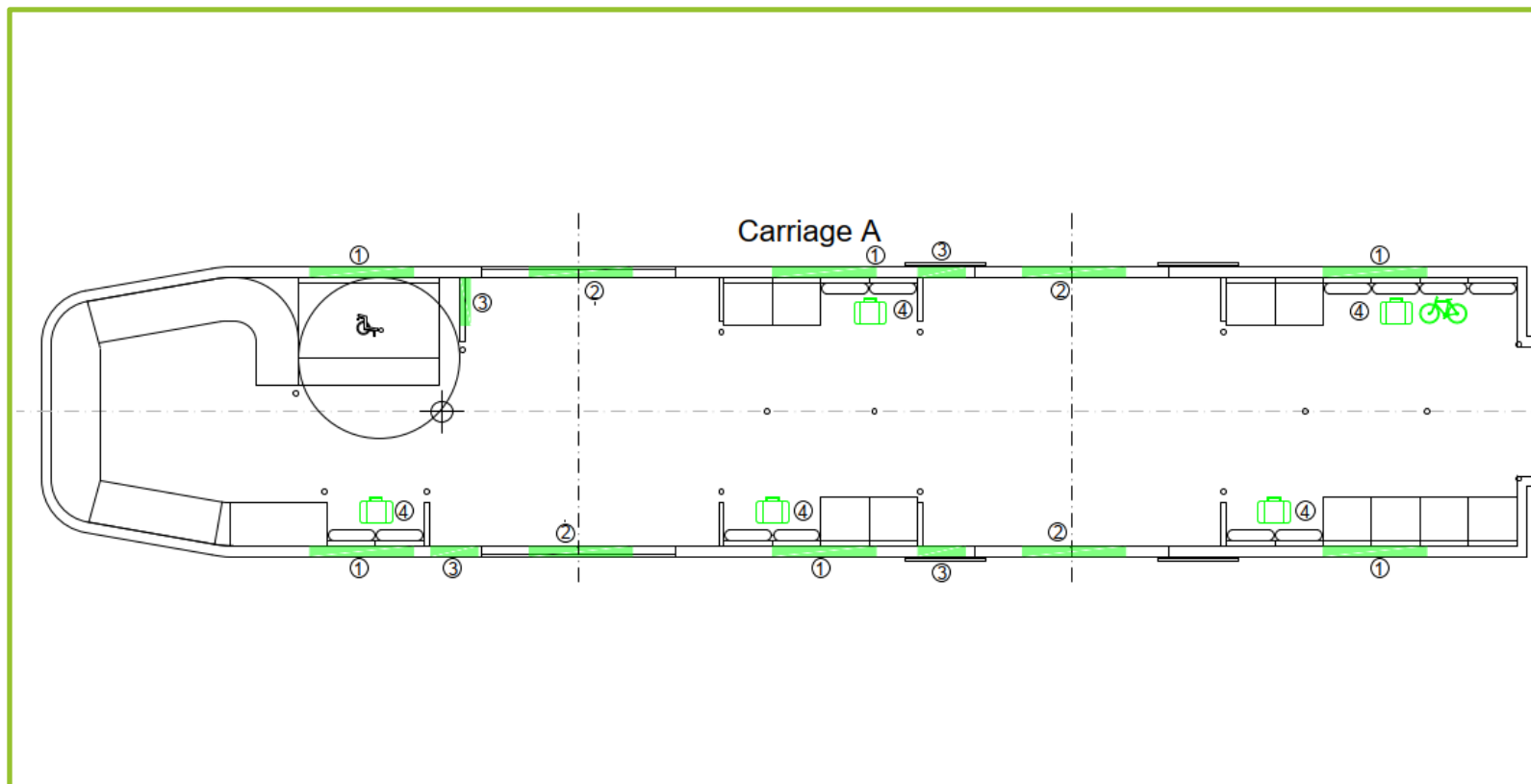
Step 3

Step 4

Step 5



Information systems



Key Changes / Notes

- ① Information about the journey
- ② Information about transport connections and alighting the vehicle
- ③ Information about emergency and individual information.
- ④ Information about how to handle baggage

Step 1

Step 2

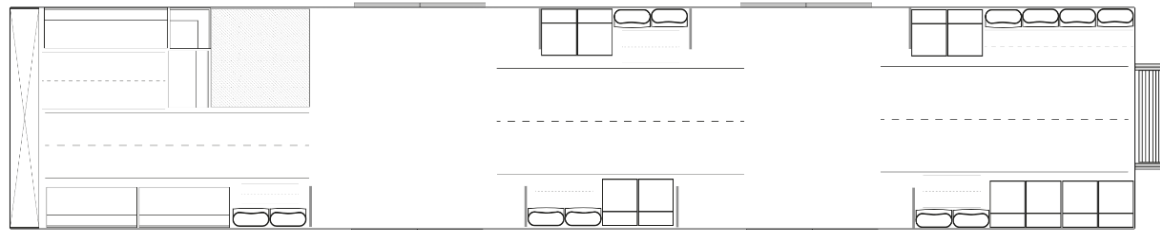
Step 3

Step 4

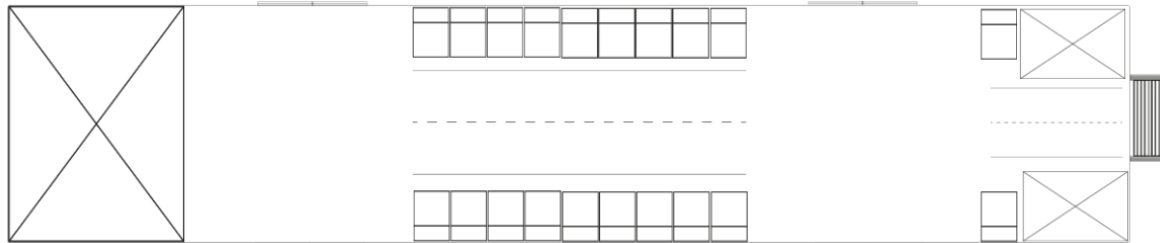
Step 5

Simulation of the vehicle concepts

NEXUS Modell



Rusich 81-740.2 / 741.2



Simulation assumptions

Entrance area	3,5 P/m ²
Multi-purpose area	3 P/m ²
Aisle	2 P/m ²

Boarding	60 %
Deboarding	60 %
Seat-Occupancy	100 %
Standing Occup.	100 %

Modell	Capacity per Fleet / 100% Occupancy	Boarding (s) max.	Deboarding (s) max.	Total (s) max.	Δ
NEXUS Modell	498	20	17	37	-15 seconds
Current Metro	510	28	24	52	- 29% Dwell-time







2 Витоша

2 Витоша

2 Витоша

2 Витоша





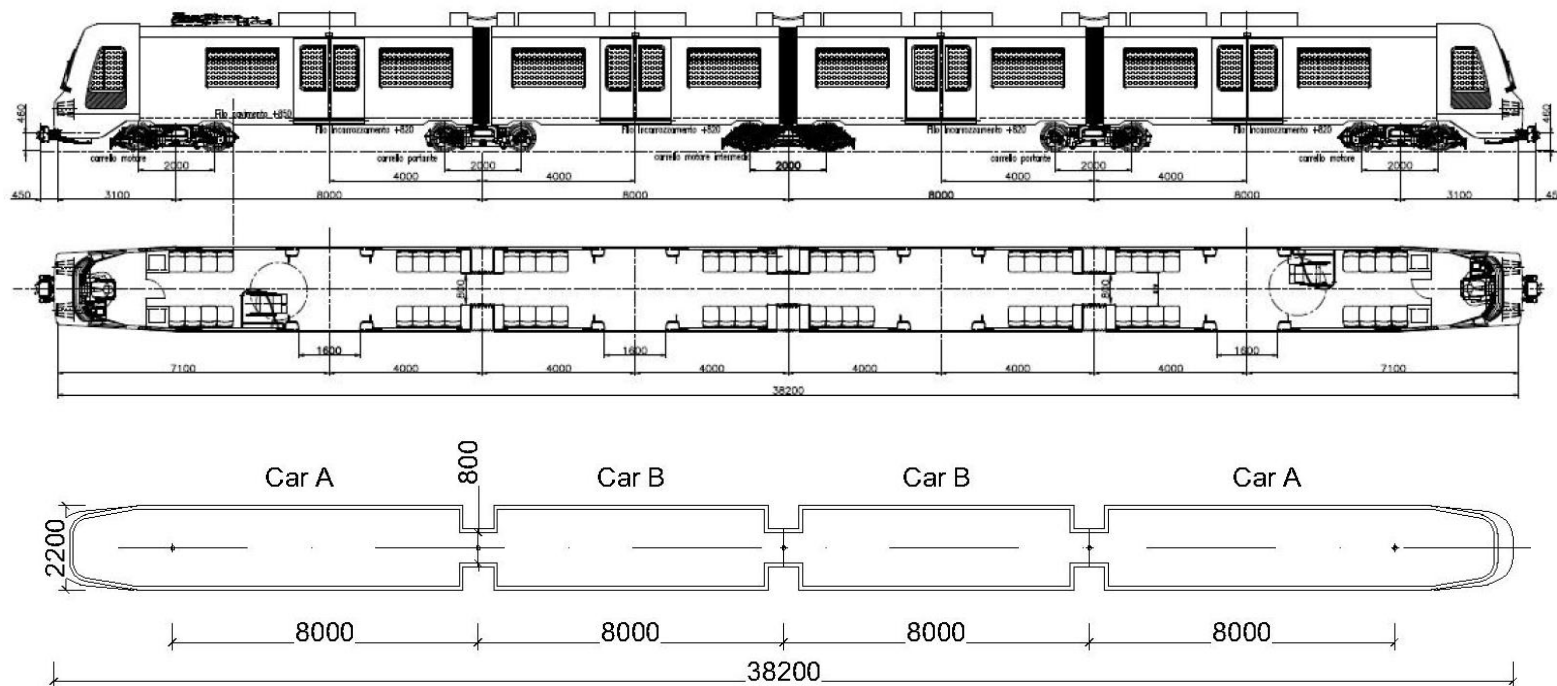


01

GENOA

Existing Layout & Dimension

Redesign of current metro vehicle of Genoa: **Hitachi Series 30**



Key Changes / Notes

Total length: 38.2 m

Jacobs's Bogie

Max. bogie distance: 8 m

Vehicle width: 2.2 m

Dimension of Transitions:
length: 1.0 m; width: 0.8 m

Step 1

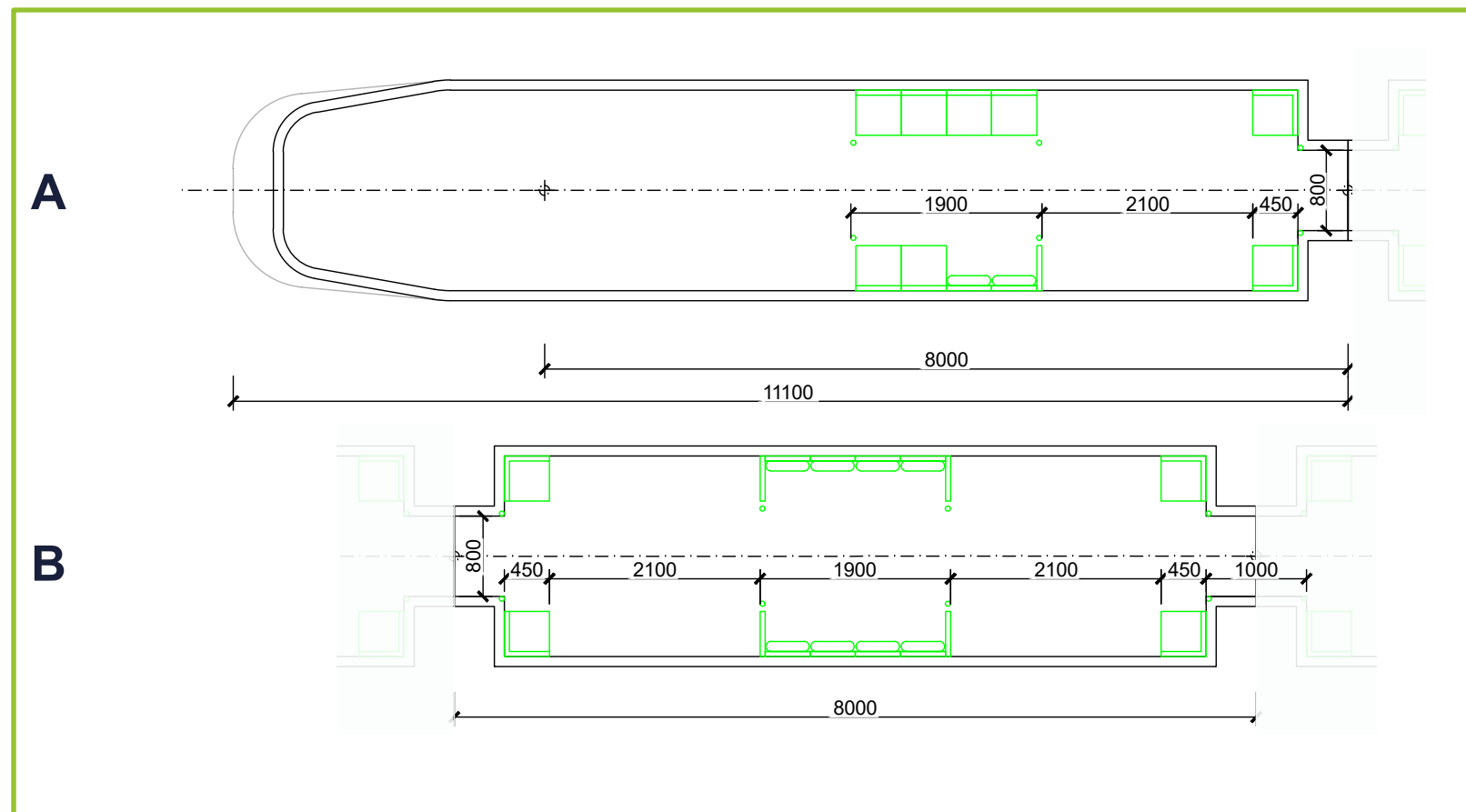
Step 2

Step 3

Step 4

Step 5

Interior Layout



Key Changes / Notes

- 4 carriages
- Spacious entrance area
- Mix of folding seats and regular seats (wall mounted)
- Vertical holding positions not directly in the entrance area

Step 1

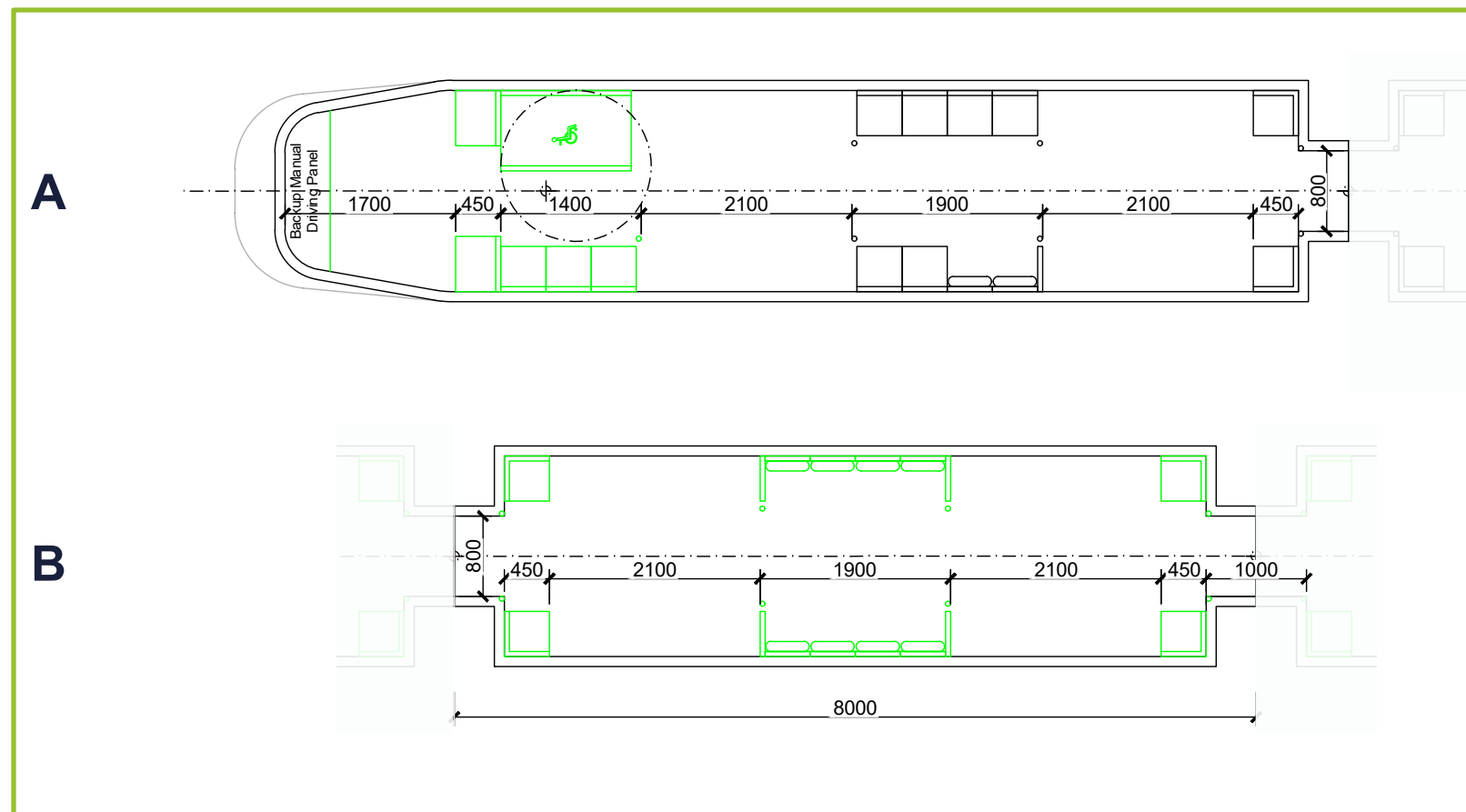
Step 2

Step 3

Step 4

Step 5

Special Areas



Key Changes / Notes

- Multipurpose area per carriage for wheelchair users, strollers, etc.
- Front area brings a travel experience for families or groups
- Wider seats for passengers with special needs
- Folding seats managed by service staff (Carriage B)

Step 1

Step 2

Step 3

Step 4

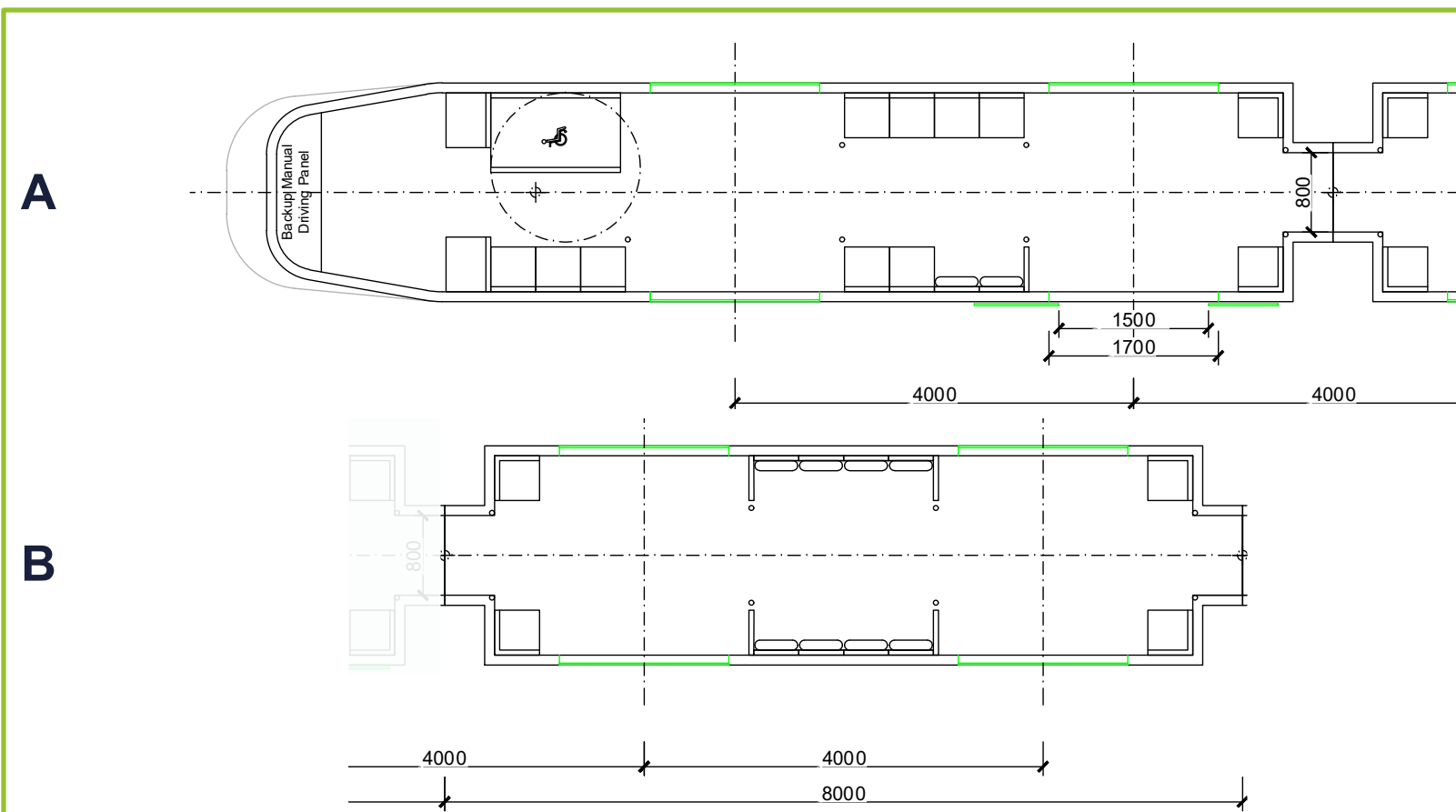
Step 5

Doors



Key Changes / Notes

- Door width of 1500mm which allows two separate passenger streams
- 4 doors per carriage
- Platform Screen Doors



Step 1

Step 2

Step 3

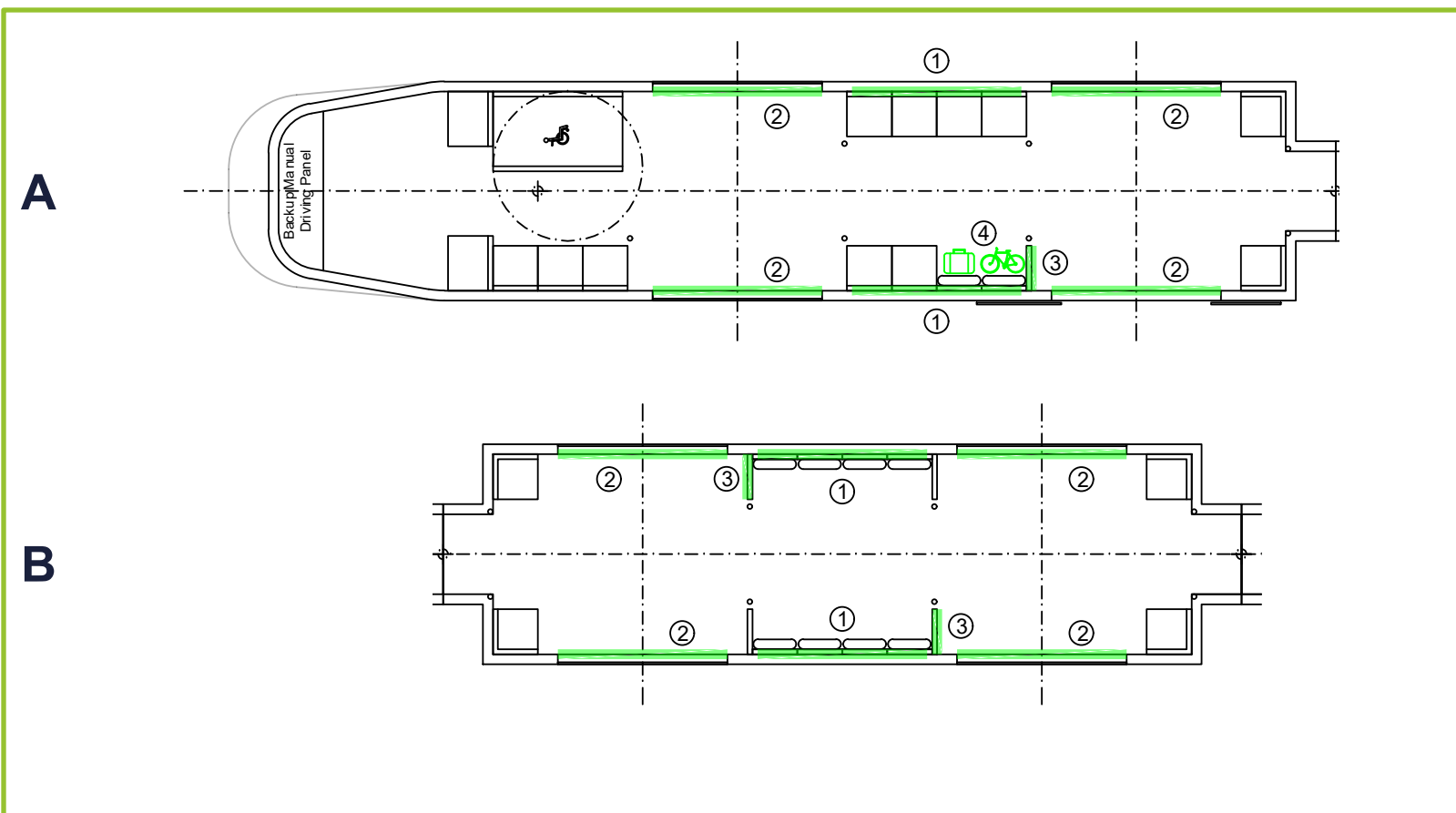
Step 4

Step 5

Information systems

Key Changes / Notes

- ① Additional information screen above seating area
- ② Information about exits; connectivity to other transport modes
- ③ Special screen next to the door - giving passengers information in case of disruption
- ④ Floor markings to mark area for luggage



Step 1

Step 2

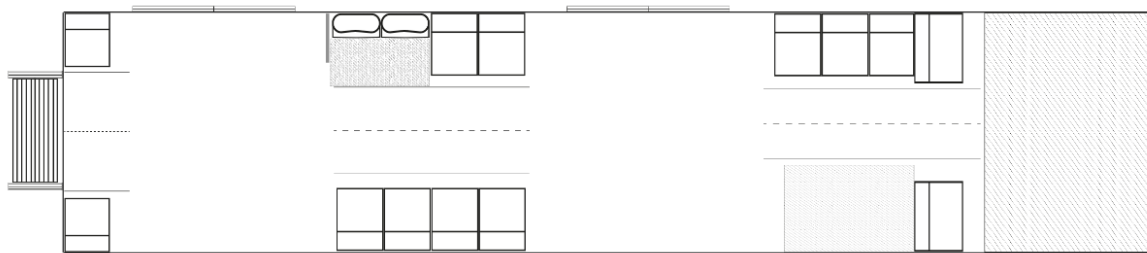
Step 3

Step 4

Step 5

Simulation of the vehicle concepts

NEXUS Modell



Hitachi Series 30



Simulation assumptions

Entrance area	3,5 P/m ²
Multi-purpose area	3 P/m ²
Aisle	2 P/m ²

Boarding	60 %
Deboarding	60 %
Seat-Occupancy	100 %
Standing Occup.	100 %

Modell	Capacity per Fleet / 100% Occupancy	Boarding (s) max.	Deboarding (s) max.	Total (s) max.	Δ
NEXUS Modell	210	19	17	36	+ 15% Capacity
Current Metro	183	20	17	37	



Principe
Darsena
San Giorgio
Sarzano
De Ferrari
Brignole







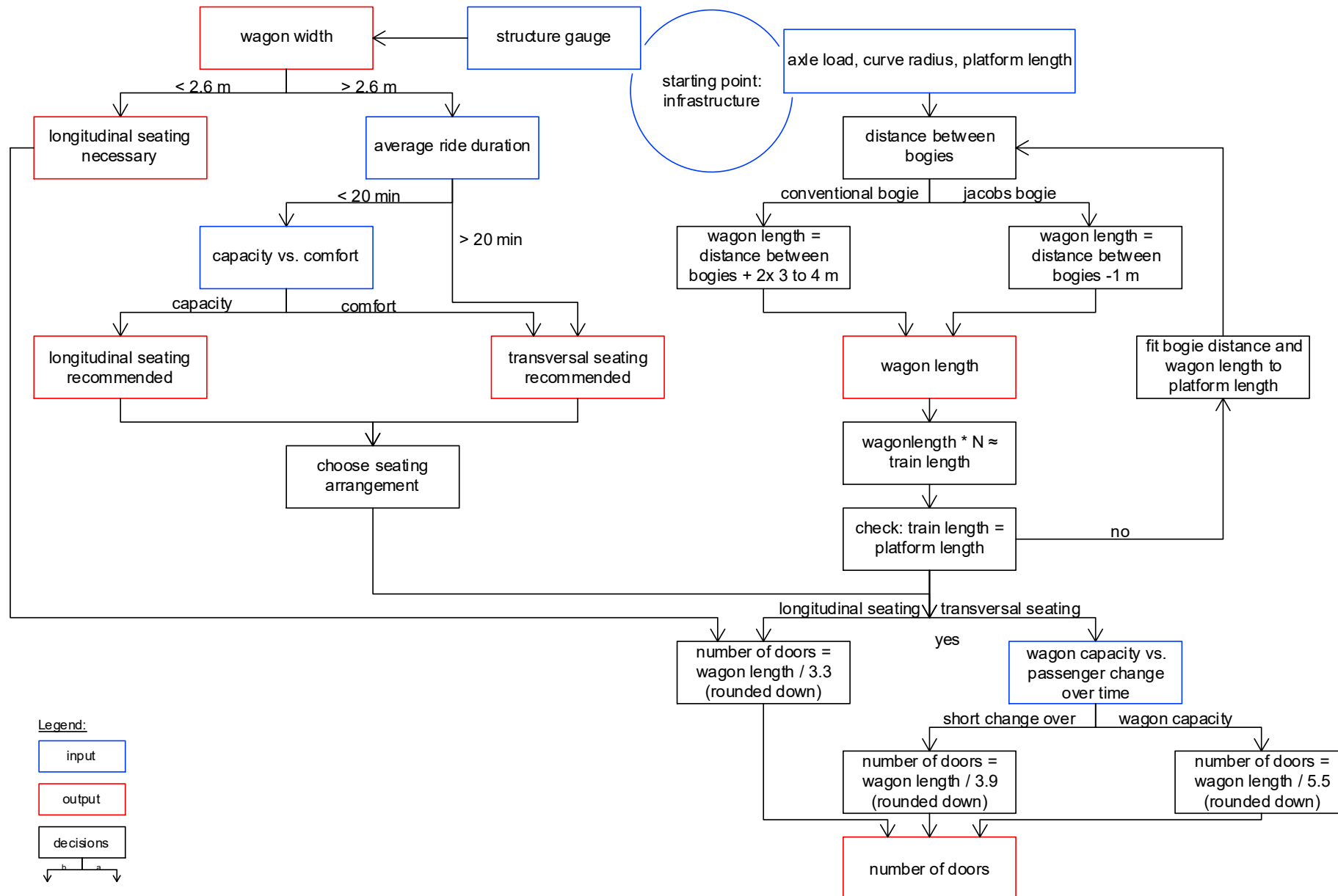


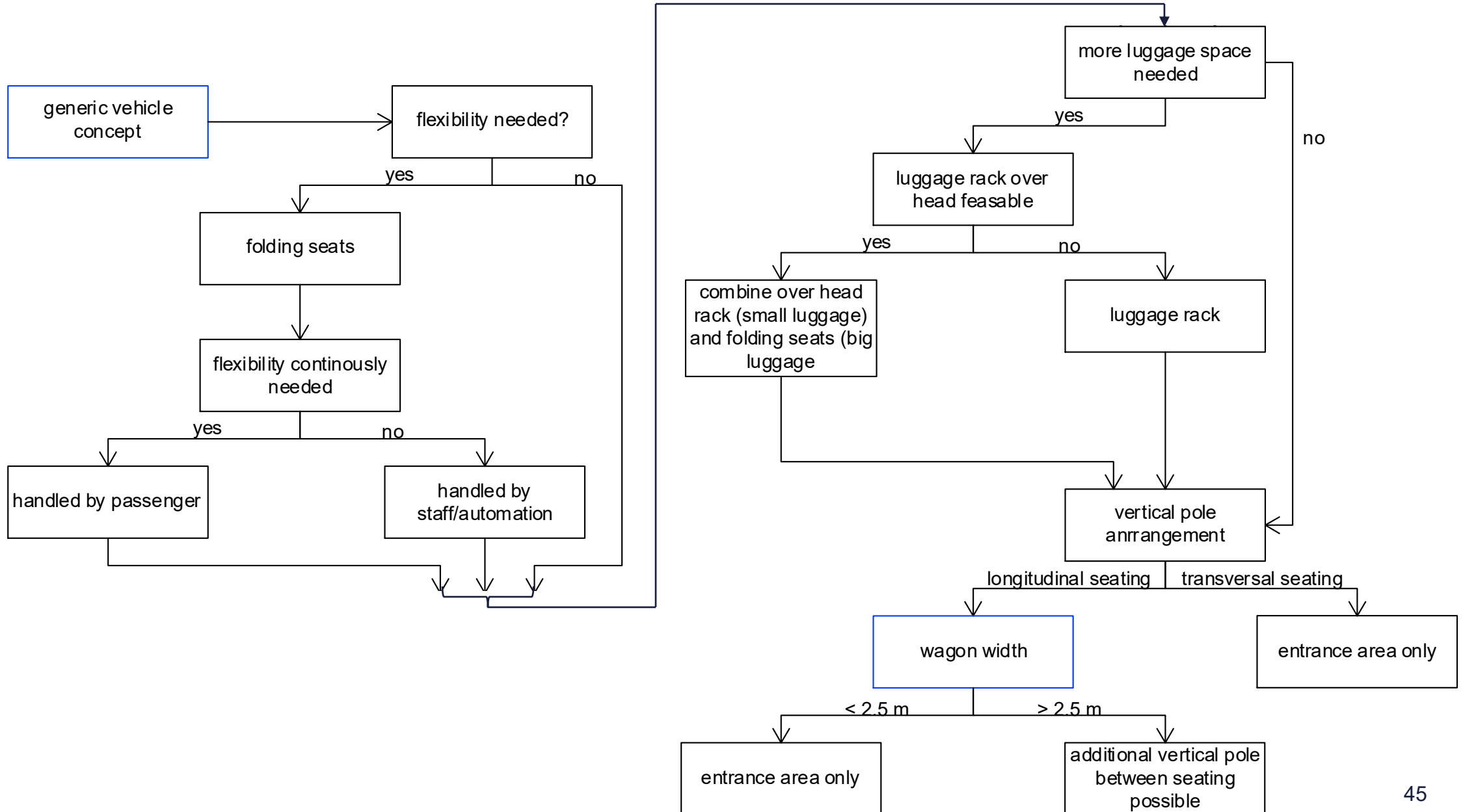




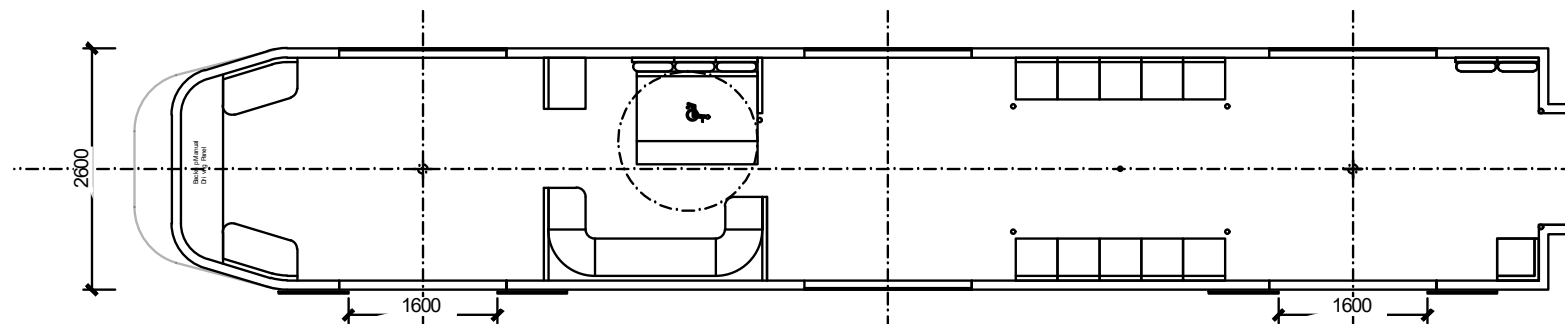
01

GENERIC

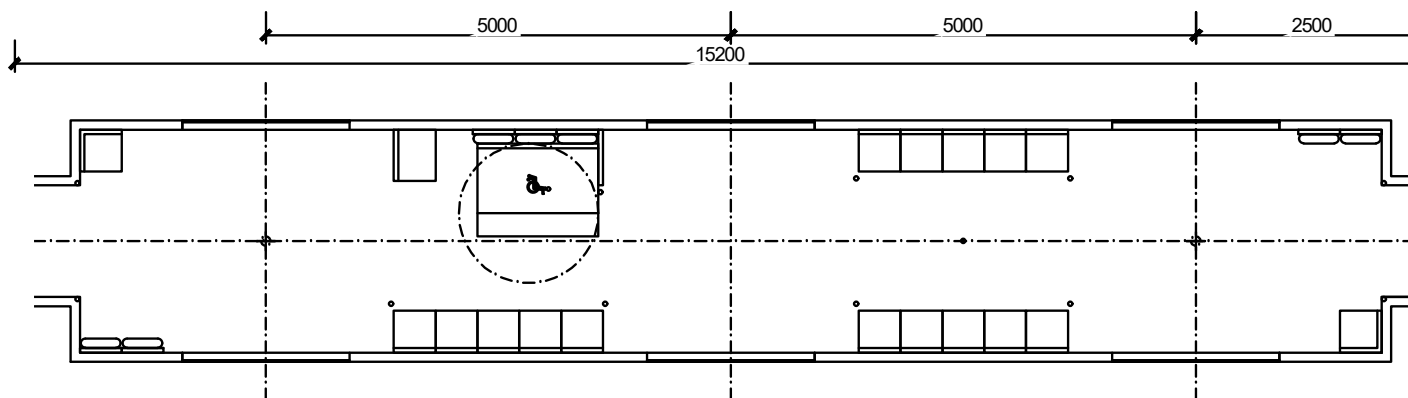




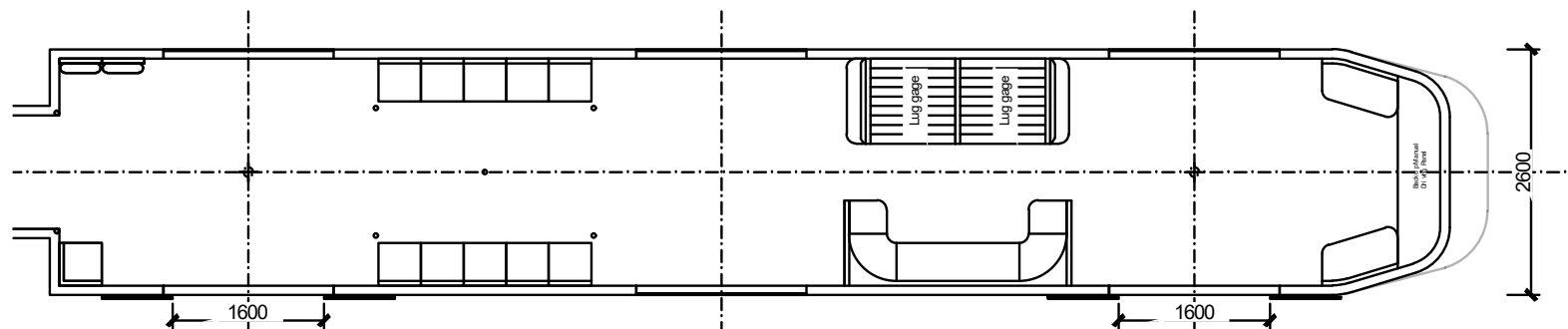
Group travel



Flexible



Airport line



color palette

dark	floor
dark	
light	ceiling
accents	interior
accents	
bright	contrast



Thank you!

Markus Haferl
Peter Schindler
Patrick Ehlers



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