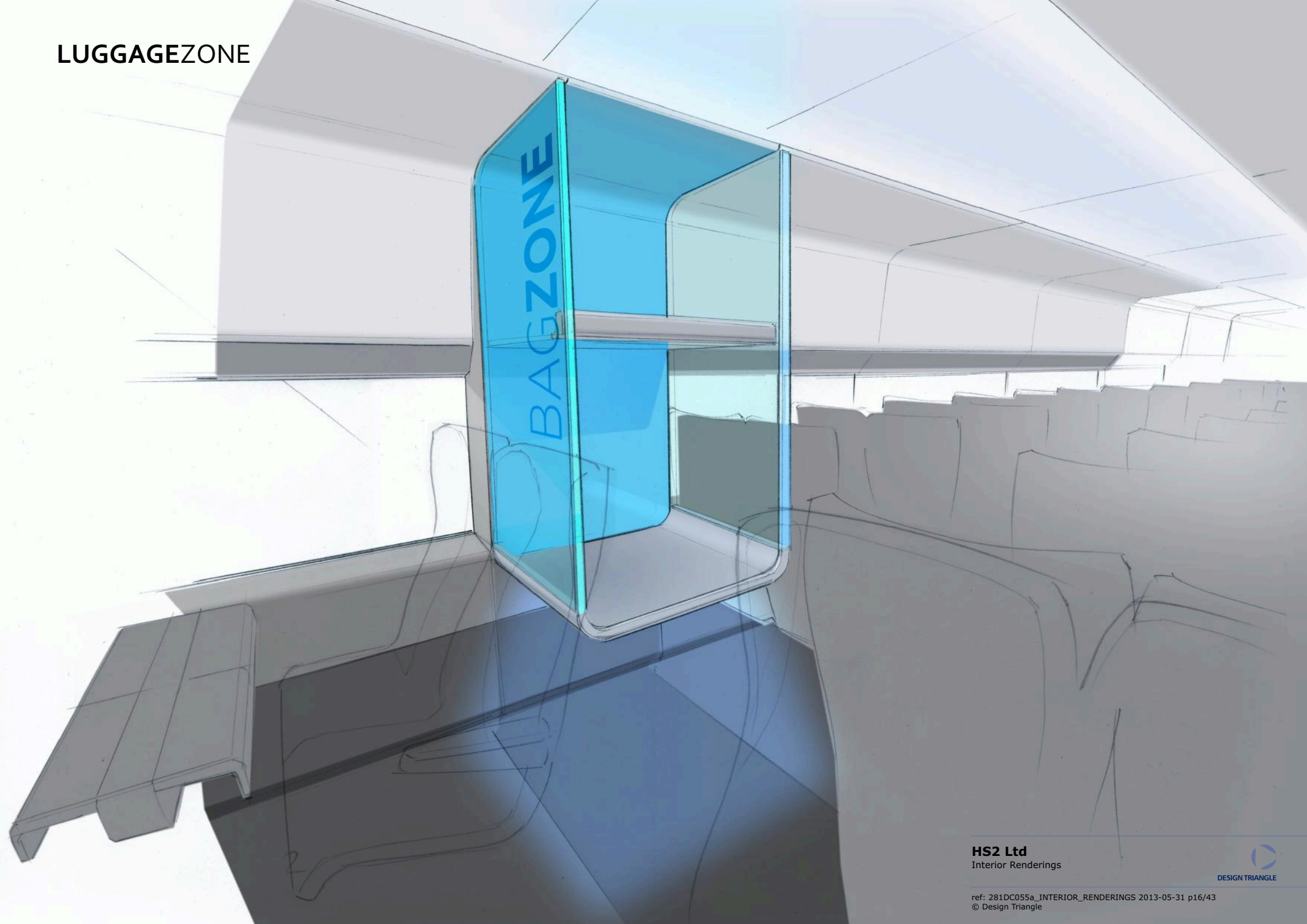
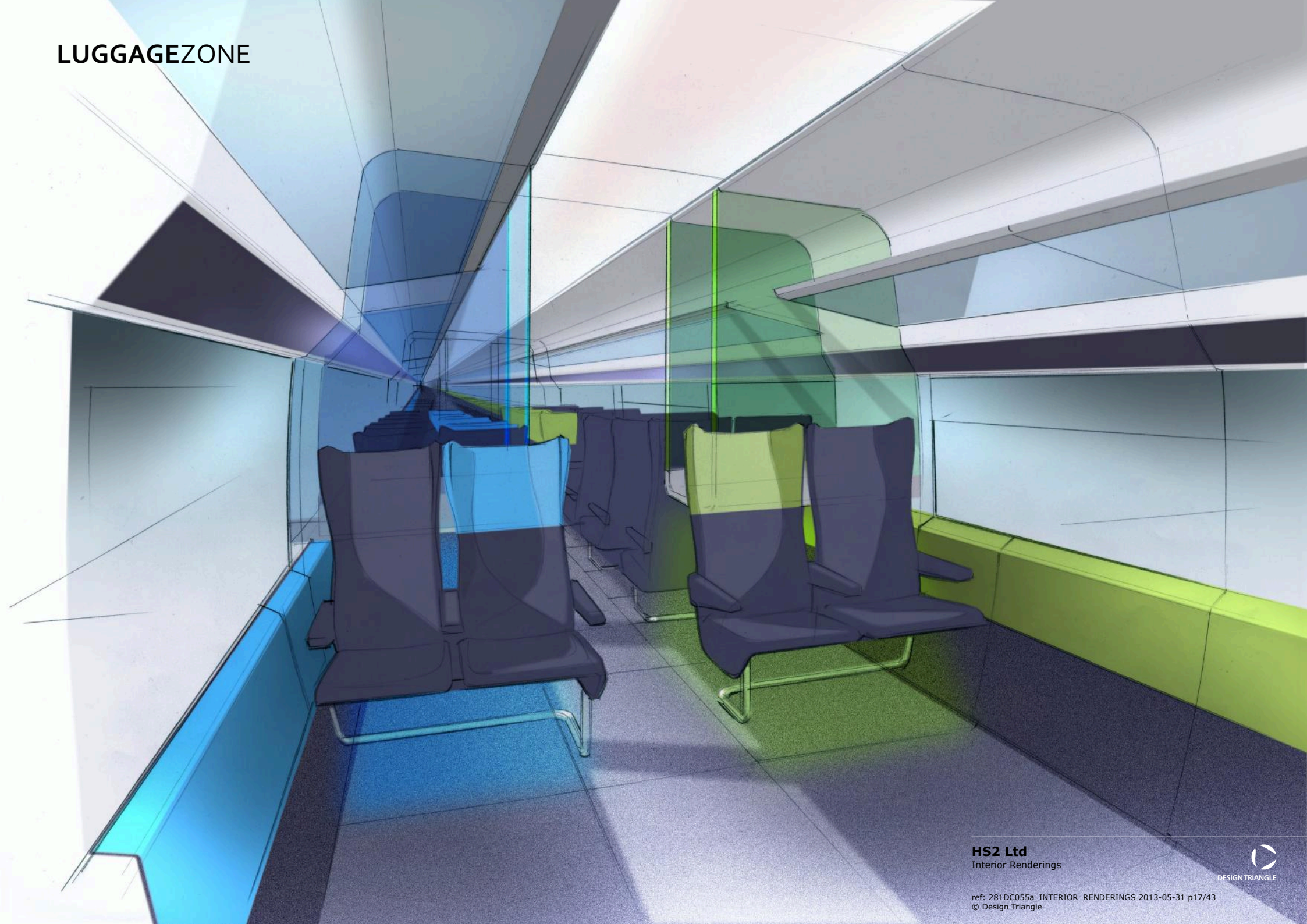


LUGGAGEZONE

LUGGAGEZONE



LUGGAGEZONE



SPACEZONE





QUIETZONE

QUIETZONE



QUIETZONE



COMPACTZONE

COMPACTZONE



COMPACTZONE



COMPACTZONE



COMPACTZONE



CATERING

CATERING

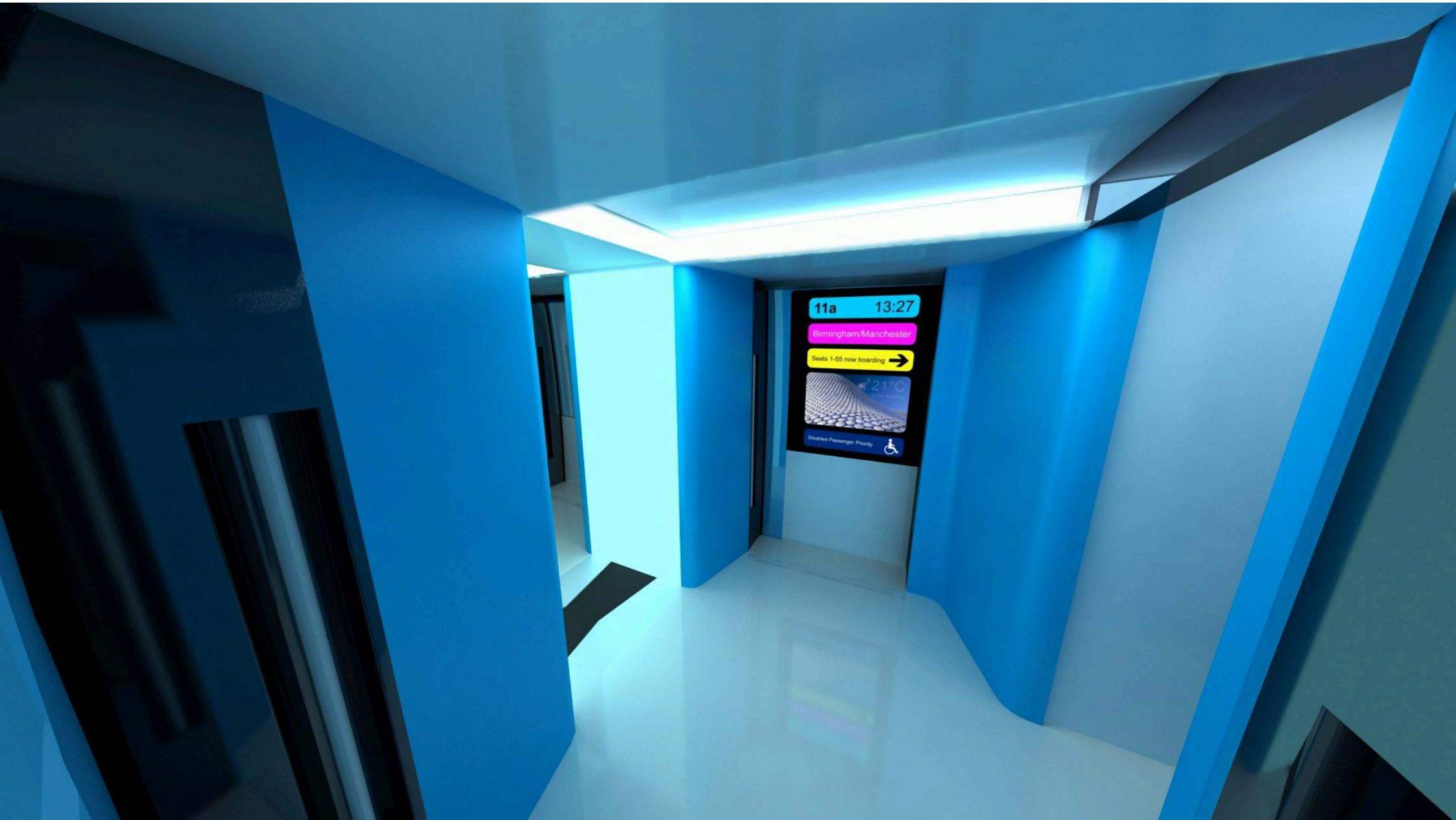


CATERING



VESTIBULE

VESTIBULE



VESTIBULE



VESTIBULE



TOILETS

TOILETSTANDARD



TOILET UNIVERSAL ACCESS



TOILET UNIVERSAL ACCESS



TOILET UNIVERSAL ACCESS



CREW

CREW



CREW



APPENDIX 14 - STATION DWELL TIME ESTIMATES

Estimating the effects of passenger capacity and the number of doorways on the Station Dwell Times.

Note:

1. These dwell time estimates assume that passengers are standing near the correct doorway when the train arrives.
2. 'Worst Case' refers to the distribution of passengers between doorways varying by 20% from uniform.

1. CONVENTIONAL BOGIE TRAIN

		Conventional Bogies		
		Target Capacity Train		
		Most Stations (mean)	Birmingham Interchange (mean)	Birmingham Interchange (worst case)
Passengers in 200m Train	-	550		
Passengers in 400m Train	-	1100		
Percentage of Passengers Boarding/Alighting	(%)	33%	67%	67%
Passengers Boarding/Alighting	-	366.7	733.3	733.3
No of Doorways	-	28	28	28
Passengers / Doorway	-	13.095	26.190	26.190
Allowance for Passenger Distribution Variation	(%)	0%	0%	20%
Passengers / Doorway	-	13.095	26.190	31.429
Passengers / Doorway (rounded)	-	13	26	31
Max Time per Passenger	(s)	2.9	2.9	2.9
Boarding / Alighting Time	(s)	37.7	75.4	89.9
Train Arrival / Departure Time	(s)	18	18	18
Station Dwell Time	(s)	55.7	93.4	107.9

		Conventional Bogies		
		Varied Short Distance Train Layout (281LL071)		
		Most Stations (mean)	Birmingham Interchange (mean)	Birmingham Interchange (worst case)
Passengers in 200m Train	-	541		
Passengers in 400m Train	-	1082		
Percentage of Passengers Boarding/Alighting	(%)	33%	67%	67%
Passengers Boarding/Alighting	-	360.7	721.3	721.3
No of Doorways	-	28	28	28
Passengers / Doorway	-	12.881	25.762	25.762
Allowance for Passenger Distribution Variation	(%)	0%	0%	20%
Passengers / Doorway	-	12.881	25.762	30.914
Passengers / Doorway (rounded)	-	13	26	31
Max Time per Passenger	(s)	2.9	2.9	2.9
Boarding / Alighting Time	(s)	37.7	75.4	89.9
Train Arrival / Departure Time	(s)	18	18	18
Station Dwell Time	(s)	55.7	93.4	107.9

		Conventional Bogies		
		Varied Long Distance Train Layout (drawing 281LL076)		
		Most Stations (mean)	Birmingham Interchange (mean)	Birmingham Interchange (worst case)
Passengers in 200m Train	-	505		
Passengers in 400m Train	-	1010		
Percentage of Passengers Boarding/Alighting	(%)	33%	67%	67%
Passengers Boarding/Alighting	-	336.7	673.3	673.3
No of Doorways	-	28	28	28
Passengers / Doorway	-	12.024	24.048	24.048
Allowance for Passenger Distribution Variation	(%)	0%	0%	20%
Passengers / Doorway	-	12.024	24.048	28.857
Passengers / Doorway (rounded)	-	12	24	29
Max Time per Passenger	(s)	2.9	2.9	2.9
Boarding / Alighting Time	(s)	34.8	69.6	84.1
Train Arrival / Departure Time	(s)	18	18	18
Station Dwell Time	(s)	52.8	87.6	102.1

2. ARTICULATED BOGIE TRAIN

		Articulated Bogies		
		Target Capacity Train		
		Most Stations (mean)	Birmingham Interchange (mean)	Birmingham Interchange (worst case)
Passengers in 200m Train	-	550		
Passengers in 400m Train	-	1100		
Percentage of Passengers Boarding/Alighting	(%)	33%	67%	67%
Passengers Boarding/Alighting	-	366.7	733.3	733.3
No of Doorways	-	20	20	20
Passengers / Doorway	-	18.333	36.667	36.667
Allowance for Passenger Distribution Variation	(%)	0%	0%	20%
Passengers / Doorway	-	18.333	36.667	44.000
Passengers / Doorway (rounded)	-	17	34	40
Max Time per Passenger	(s)	2.9	2.9	2.9
Boarding / Alighting Time	(s)	49.3	98.6	116.0
Train Arrival / Departure Time	(s)	18	18	18
Station Dwell Time	(s)	67.3	116.6	134.0

		Articulated Bogies		
		Varied Short Distance Train Layout (281LLo84)		
		Most Stations (mean)	Birmingham Interchange (mean)	Birmingham Interchange (worst case)
Passengers in 200m Train	-	493		
Passengers in 400m Train	-	986		
Percentage of Passengers Boarding/Alighting	(%)	33%	67%	67%
Passengers Boarding/Alighting	-	328.7	657.3	657.3
No of Doorways	-	20	20	20
Passengers / Doorway	-	16.433	32.867	32.867
Allowance for Passenger Distribution Variation	(%)	0%	0%	20%
Passengers / Doorway	-	16.433	32.867	39.440
Passengers / Doorway (rounded)	-	18	37	44
Max Time per Passenger	(s)	2.9	2.9	2.9
Boarding / Alighting Time	(s)	52.2	107.3	127.6
Train Arrival / Departure Time	(s)	18	18	18
Station Dwell Time	(s)	70.2	125.3	145.6

		Articulated Bogies		
		Varied Long Distance Train Layout (281LLo83)		
		Most Stations (mean)	Birmingham Interchange (mean)	Birmingham Interchange (worst case)
Passengers in 200m Train	-	469		
Passengers in 400m Train	-	938		
Percentage of Passengers Boarding/Alighting	(%)	33%	67%	67%
Passengers Boarding/Alighting	-	312.7	625.3	625.3
No of Doorways	-	20	20	20
Passengers / Doorway	-	15.633	31.267	31.267
Allowance for Passenger Distribution Variation	(%)	0%	0%	20%
Passengers / Doorway	-	15.633	31.267	37.520
Passengers / Doorway (rounded)	-	17	33	40
Max Time per Passenger	(s)	2.9	2.9	2.9
Boarding / Alighting Time	(s)	49.3	95.7	116.0
Train Arrival / Departure Time	(s)	18	18	18
Station Dwell Time	(s)	67.3	113.7	134.0



APPENDIX 15 – SEAT SPACE

Seat Pitch and Seat Space

Seat Pitch, for unidirectional seating, is the distance between the same point on consecutive seats. This is widely used, as it is easy to measure and easy to show on a layout drawing.

Seat Space, for unidirectional seating, is the distance between the seat squab cushion and the rear surface of the seat in front. This is the real measure of the space available for the passenger.

A modern seat, with a slim but comfortable squab cushion, maximises the Seat Space available to the passenger for a given Seat Pitch.

Ergonomic Requirements

Research carried out using recent anthropometric data for the UK population suggests that the following seat pitches would, in theory, leave adequate knee space for 95th percentile UK males, if combined with a thin seat back:

- unidirectional seat pitch: 720 mm
- facing seat pitch: 1714 mm (measured at the top of the seat back)

For comparison, ECE regulations for buses require minimum unidirectional seat pitches as follows:

- Class I city buses: 650 mm
- Class II interurban buses or coaches: 680 mm
- Class III touring coaches: 750 mm

Drawing 281LL006, in Annex B, illustrates the following seat pitches, using a thin but comfortable seat back:

- unidirectional seat pitch: 800 mm and 820 mm
- facing seat pitch: 1875 mm (measured at the top of the seat back)



These appear to allow adequate knee room. However, these pitches are shorter than used in most high speed trains.

Typical Seat Pitches in Existing High Speed Trains

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The longer pitch layouts may result partly from thicker seat backs, which waste space. However, it is also likely that increased legroom has been allowed.

Seat pitches in other existing UK trains are shown in Appendix 9. These show Standard Class pitches of 770-840mm, shorter than the high speed trains surveyed.

First Class seat pitches for the UK trains are 1050-1130mm, longer than the high speed trains.

A satisfactory seat pitch is more likely to be a perception of the space available while sitting in the seat, or while entering or leaving the seat space. It is likely to be wider than the pitch specified by anthropometrics alone.

Longer seat pitch will undoubtedly give an improvement in the passenger experience.

The final choice of seat pitch will be a balance between seating capacity and perceived passenger experience, whilst ensuring passenger safety.



Priority Seating

The PRM-TSI requirements for Priority Seats include:

- uni-directional seats:
 - o distance between front of squab and seat in front: 680mm minimum
 - o distance between front of cushion and seat in front: 230mm minimum
- facing seats:
 - o distance between front of cushions: 600mm minimum
 - o distance between front of cushion and table: 230mm minimum

These requirements are likely to impose a slightly higher seat pitch (860mm) on unidirectional Priority Seats than the 810mm minimum proposed in this report. (This will depend on the dimensions and shape of the seat.)

The requirements would also impose a folding table if any of the Priority Seats were in facing arrangement.

Crashworthiness

Seat pitch in unidirectional seating may be limited by crashworthiness standards in that passenger impact energy levels increase rapidly with increased seat pitch.



Effect of Seat Pitch on Passenger Capacity

A shorter seat pitch will result in a higher seated capacity. Obviously, seat pitch must take full account of the anthropometrics of the passenger population and, more critically, the effect of perceived space on the passenger experience.

Drawing 281LL026, in Annex B, shows the effect of seat pitch on capacity for a given saloon length. It shows that increasing the seat pitch from 810mm to 850mm loses 4 seats in a 19 metre saloon. Increasing the seat pitch to 900mm loses a total of 8 seats. Increasing the seat pitch to 960mm loses a total of 16 seats. Assuming at least 5 Standard seating cars, this translates to the loss of at least 80 seats in a 200 metre unit.

Seat Pitch	Carriage Capacity	Seats Lost Per Car
810mm	88	-
850mm	84	4
900mm	80	8
965mm	72	16

The following study demonstrates this effect graphically.

Effect of Seat Pitch on Car Seated Capacity

Based on drawing no. 281LLO26 - unidirectional seating with one bay of facing seats in the middle of the car and one luggage stack at each end

Saloon interior length overall: 19080 mm
 Minus a 787 mm luggage stack: 18293 mm
 Minus 10mm clearance at each end: 18273 mm

Seat Pitch (mm):	790	795	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875
Centre bay seat pitch (mm):	1655	1665	1675	1685	1695	1705	1715	1725	1735	1745	1755	1765	1775	1785	1795	1805	1815	1825
Interior length minus centre bay (mm):	16618	16608	16598	16588	16578	16568	16558	16548	16538	16528	16518	16508	16498	16488	16478	16468	16458	16448
Number of unidirectional seat rows:	21.04	20.89	20.75	20.61	20.47	20.33	20.19	20.06	19.93	19.79	19.66	19.54	19.41	19.28	19.16	19.04	18.92	18.80
Integer number of seat rows:	21	20	20	20	20	20	20	20	19	19	19	19	19	19	19	19	18	18
Car Seating Capacity:	92	88	88	88	88	88	88	88	84	84	84	84	84	84	84	84	80	80

Seat Pitch (mm):	880	885	890	895	900	905	910	915	920	925	930	935	940	945	950	955	960	965
Centre bay seat pitch (mm):	1835	1845	1855	1865	1875	1885	1895	1905	1915	1925	1935	1945	1955	1965	1975	1985	1995	2005
Interior length minus centre bay (mm):	16438	16428	16418	16408	16398	16388	16378	16368	16358	16348	16338	16328	16318	16308	16298	16288	16278	16268
Number of unidirectional seat rows:	18.68	18.56	18.45	18.33	18.22	18.11	18.00	17.89	17.78	17.67	17.57	17.46	17.36	17.26	17.16	17.06	16.96	16.86
Integer number of seat rows:	18	18	18	18	18	18	17	17	17	17	17	17	17	17	17	17	16	16
Car Seating Capacity:	80	80	80	80	80	80	76	76	76	76	76	76	76	76	76	76	72	72

Note:

1. The seating capacity will depend on the internal length of the car, minus any luggage stacks and other facilities.
2. The centre bay pitch has been set at twice the unidirectional pitch, plus 75 mm.

Seated Capacity vs. Seat Pitch

