

RRX availability model

an interim balance sheet

Robert Ionescu and Gregor Böck | Verkehrsverbund Rhein-Ruhr | June 4th, 2024



The VRR network area



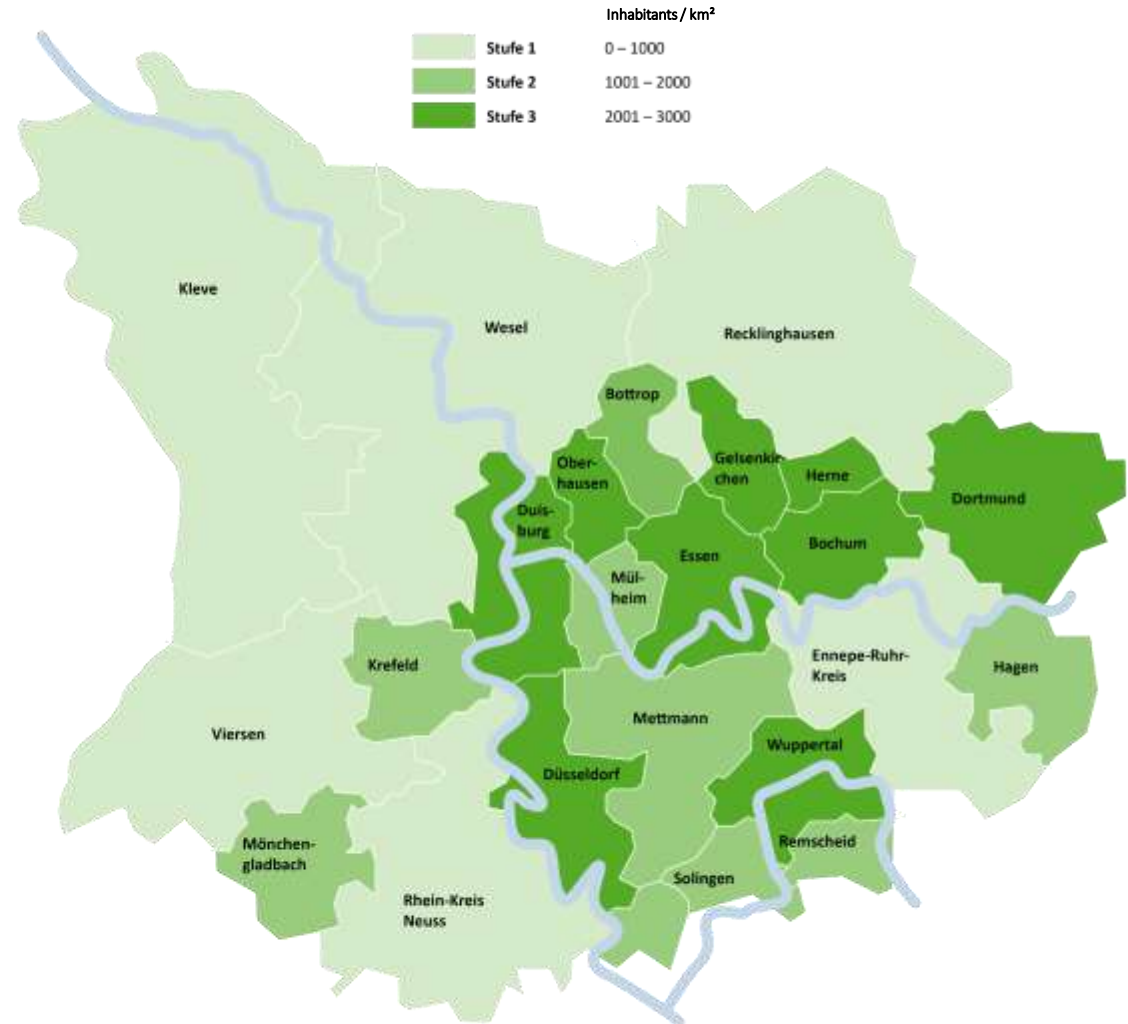
The VRR network area



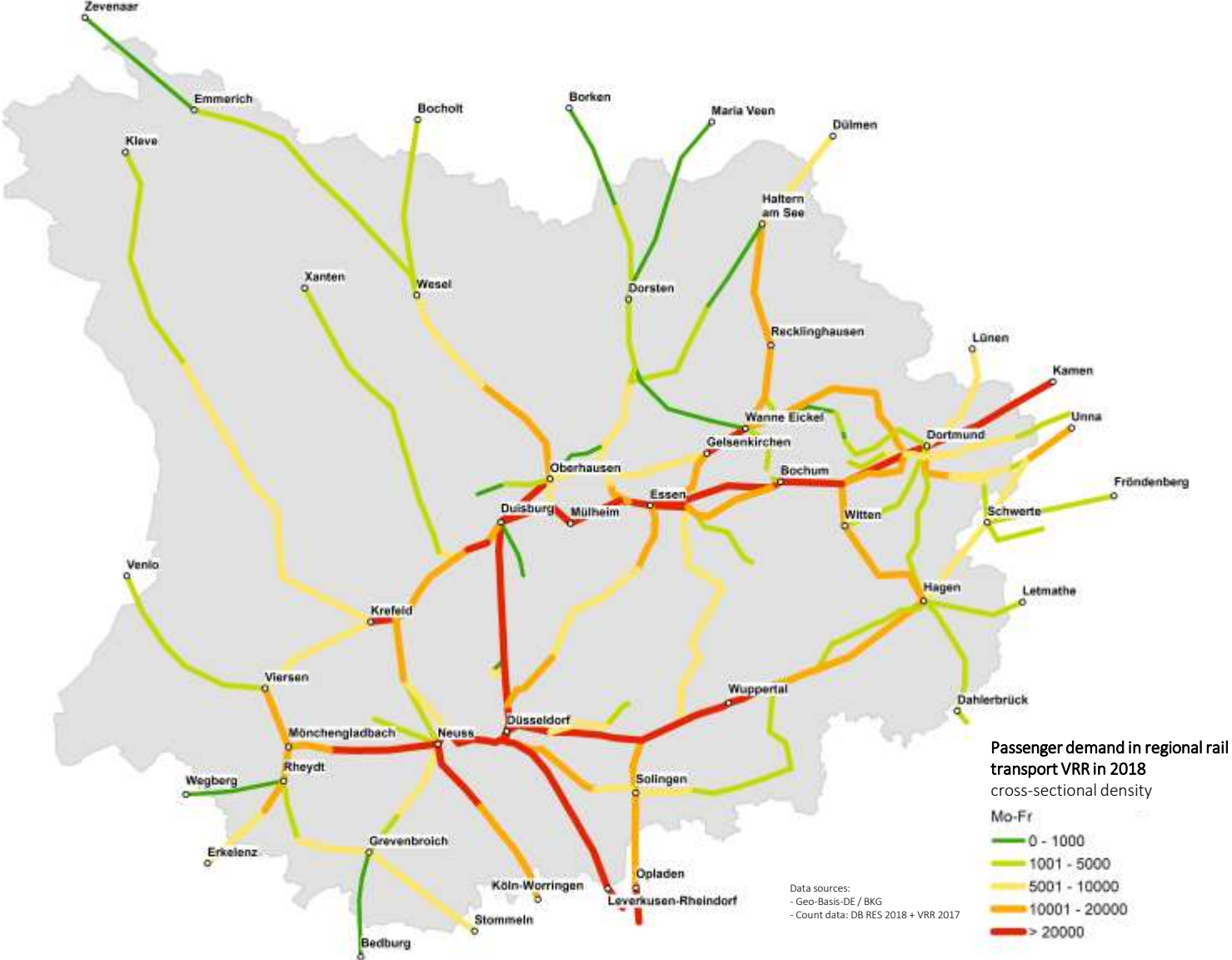
One of the largest transport associations in Europe



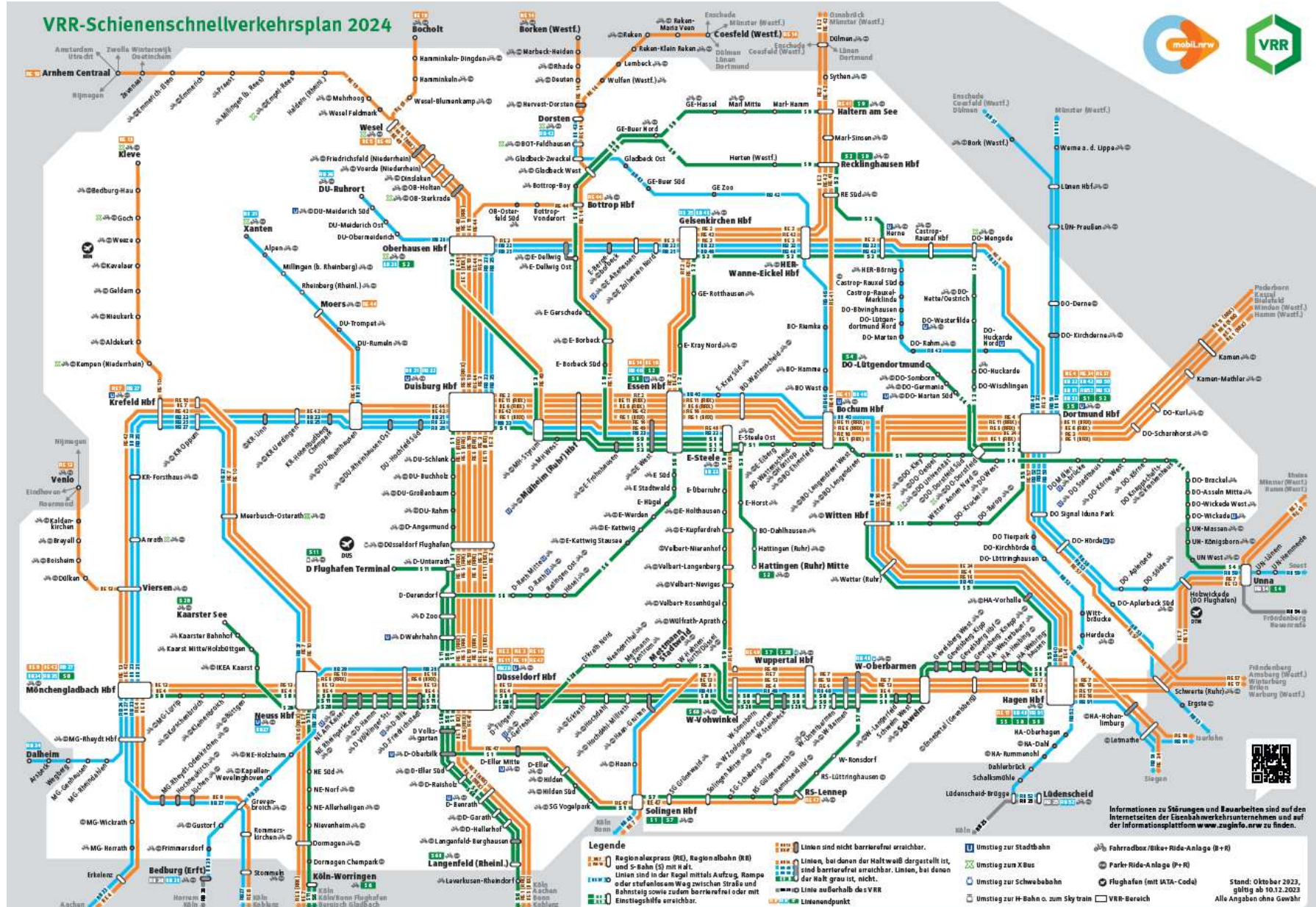
- 7.8 million inhabitants
- 23 local authorities
- More than 1.1 billion passengers per year
- Over 1.1 billion euros in fare revenue per year
- 52 short distance lines
- More than 50 million train kilometres per year



Passenger demand in regional rail transport services



Rail services network of VRR



Main Tasks of VRR



- VRR as a public contracting authority plans, organizes and orders the provision of local rail transport services
- VRR monitors daily operations on the route network
- VRR carries out tenders for the services of local rail transport services

Regular tender

- Train operating company procures the rolling stock based upon VRR requirements

Regular tender with financing for rolling stock

- Train operating company (TOC) procures the rolling stock based upon VRR requirements
- Financing offered for the rolling stock by the public contracting authority, VRR buys the trains
- The operator is responsible for operation and maintenance





Separate tender rolling stock/TOC (RRX availability model)

- Call for tender for rolling stock
- Call for tender for regional and urban rail transport services
- The manufacturer is responsible for building and maintenance, VRR buys the trains
- Operator is only responsible for operation, parking and interior cleaning

Overview of vehicles owned by VRR

VRR rolling stock financing model







Network	Number of trains	Manufacturer, type	Start of service	
S 7	9	Alstom Coradia Lint 41	12/2013	
RE 7/RB 48	35	Bombardier, Talent 2	12/2015	
RE 19/RB 35	21	Stadler, Flirt 3	12/2016	
ESN	12	Alstom Coradia Lint 54 und LINT 41	12/2017	
RE 13	20	Stadler, Flirt 3xl	12/2026	

Overview of vehicles owned by VRR

VRR availability model



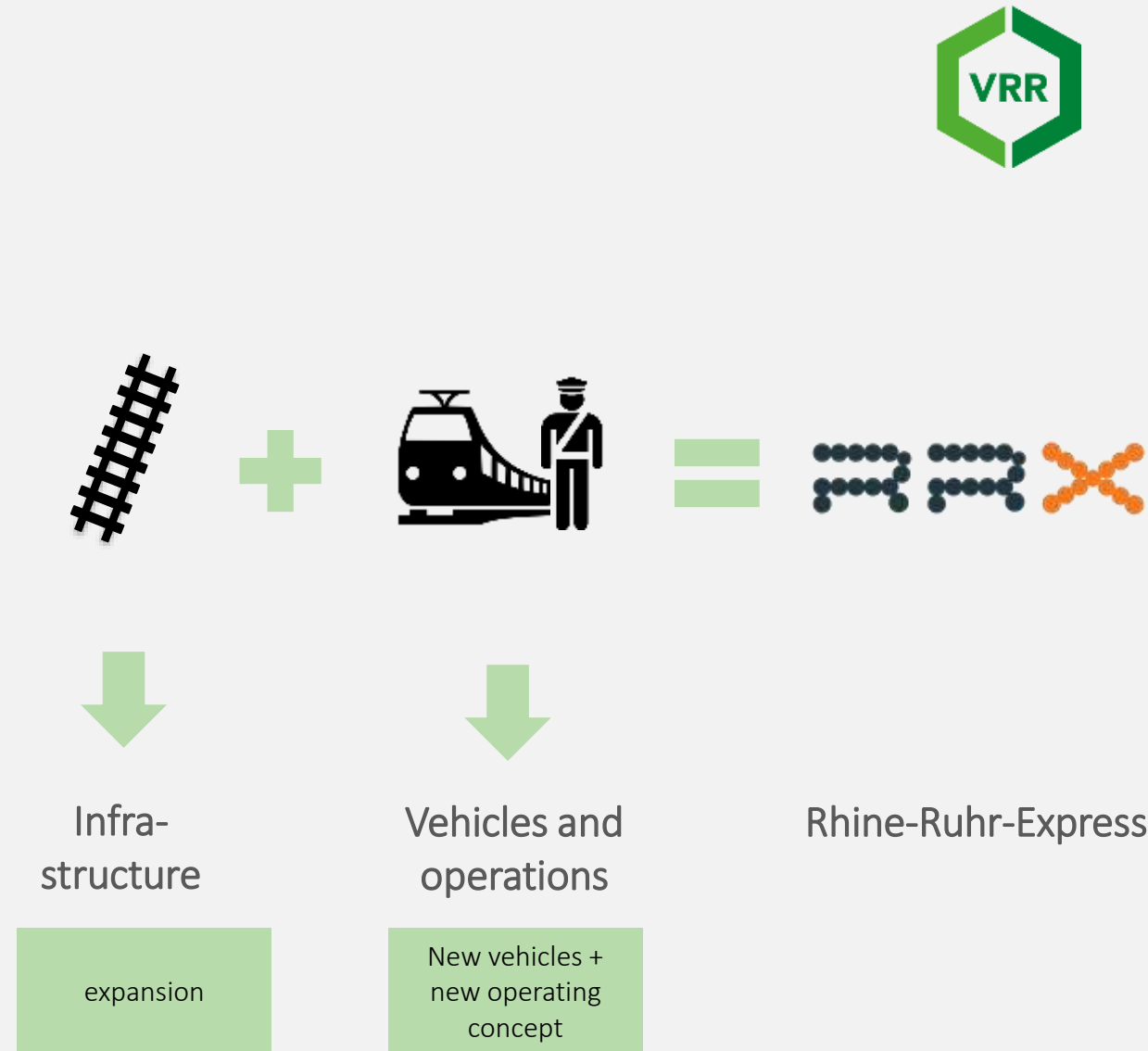
Network	Number of trains	Manufacturer, type	Start of service	
RRX	84	Siemens, Desiro HC	12/2018	
S-Bahn (new vehicles)	41	Stadler, Flirt 3 XL	12/2019	
S-Bahn (used vehicles)	48	Not bought by VRR, but operating in a contract based on availability model	12/2019	
RE 10, RE 14, RB 31, RB 36, RB 43, RB 44, RB 46	73	CAF, Civity (BEMU)	12/2026	



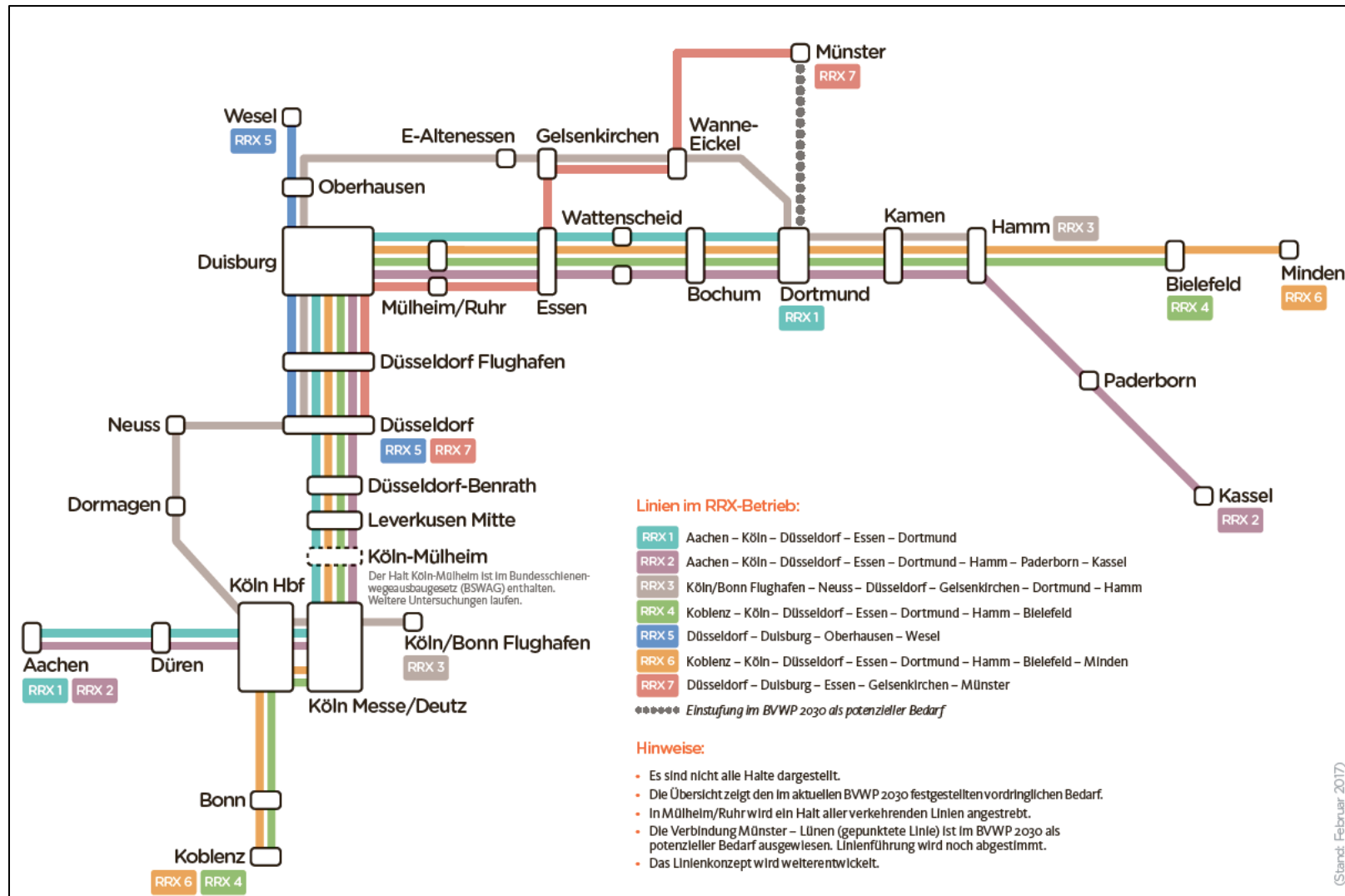
The RRX availability model

The Rhine-Ruhr-Express

- Basic agreement in 2013 on the key points of the implementation of an RRX preliminary operation
- Buy a huge number of equal trains to be flexible in operation
- Separation into a vehicle tender and an operator tender
- RRX as a premium product will be the backbone of regional transport in North-Rhine Westphalia
- Implement improvements before 2030
- Gradual implementation with changed lines
- Implementation of a vehicle pool enables flexible services in the future



RRX target network



- Seven RRX lines
- 15-minute intervals between Cologne and Dortmund
- Creation of
 - more services
 - more capacity
 - better quality

The RRX availability model

Ensuring sustainable vehicle quality



- Production and maintenance of vehicles at the lowest overall costs, i.e. life cycle costs

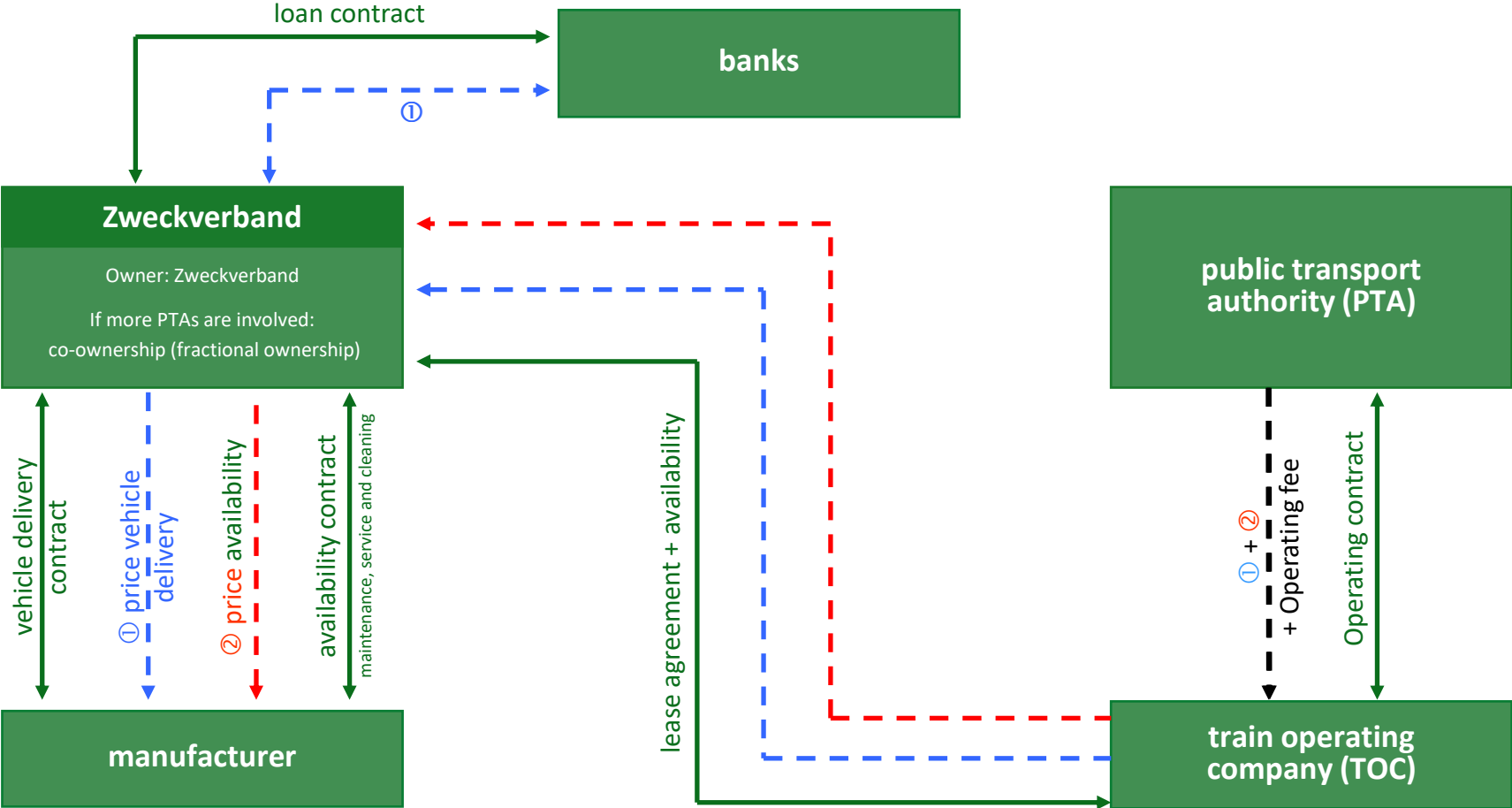
- The cost-effective use of workshops, spare parts and special tools

- Manufacturer is responsible for vehicle delivery and maintenance for appx. 30 years

- The procurement of identical, interchangeable and multi-traction/coupling-capable vehicles for several routes/sub-networks, e.g. for the RRX network

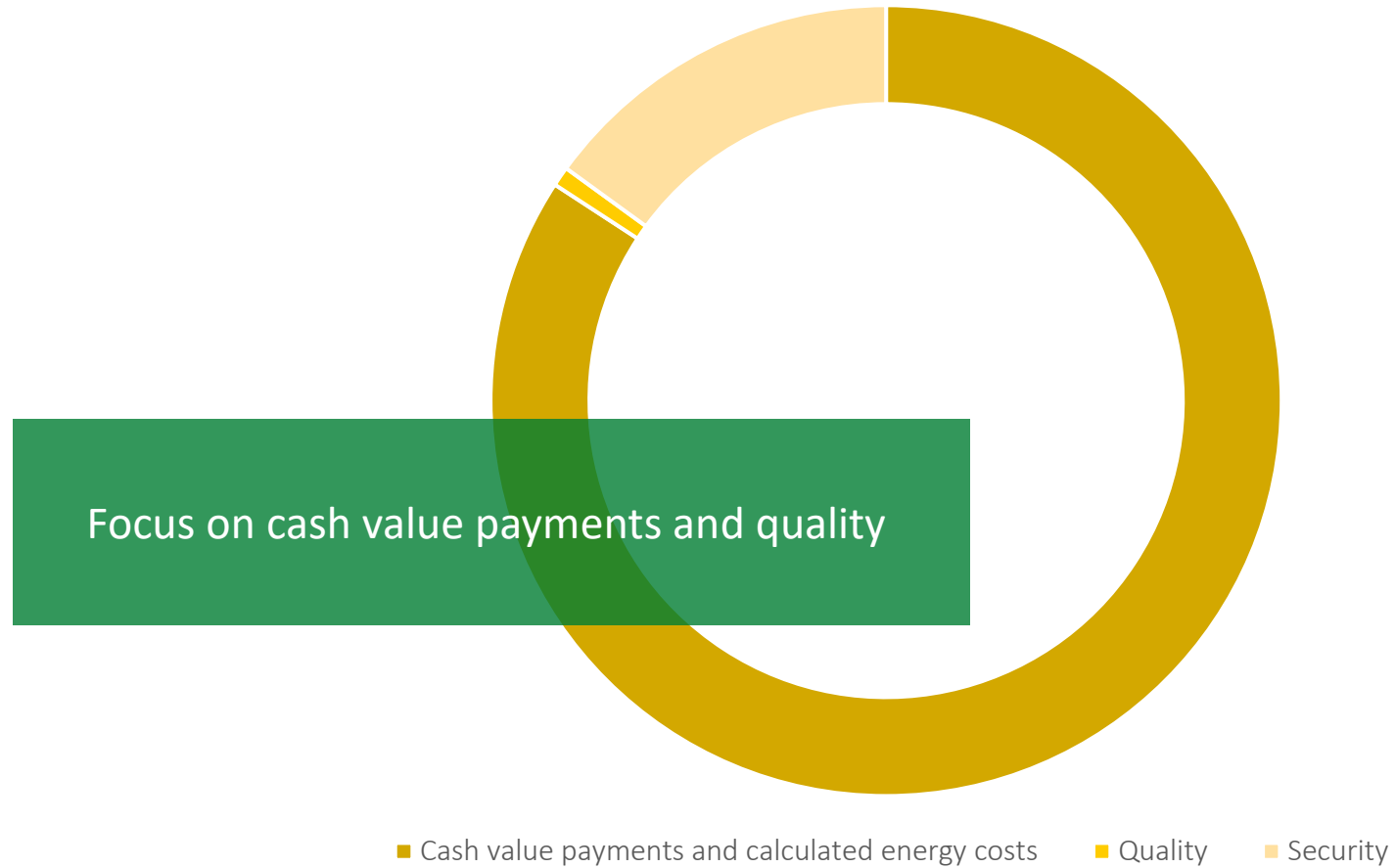
- Competition between train operating companies, which is then no longer hindered by vehicle financing issues

Contractual relationships



Award criteria

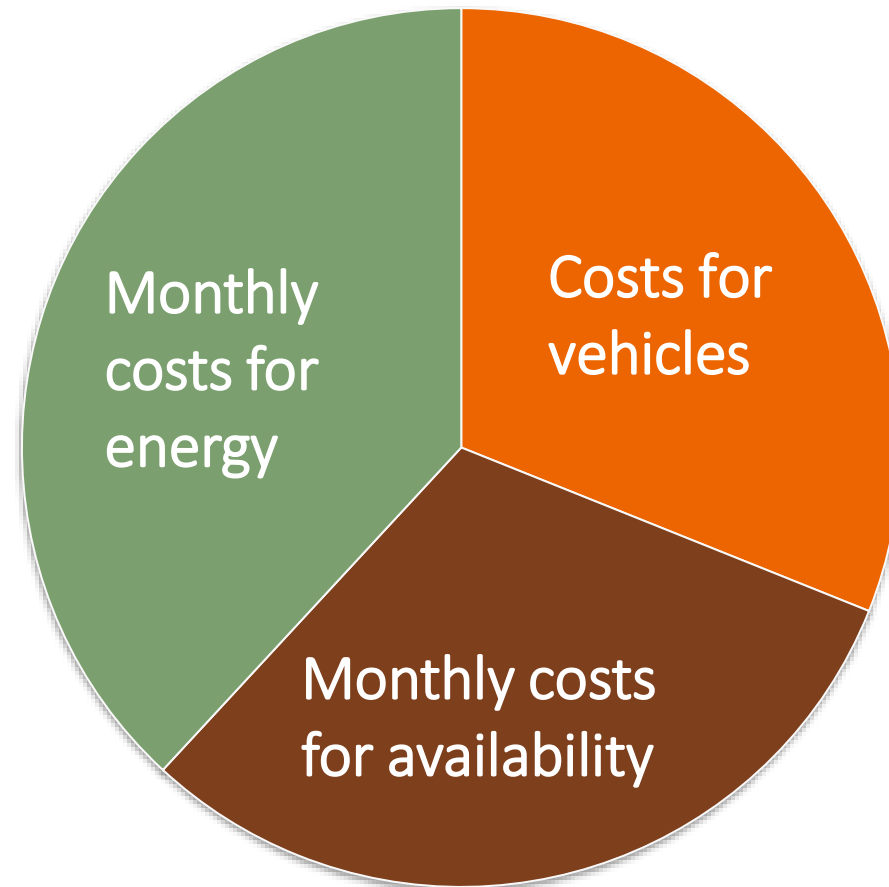
Tenders RRX and S-Bahn Rhein-Ruhr



Award criteria: focus on cost structure

The life cycle approach

- Focus on optimized design, quality and energy efficiency for vehicles over their life cycle – appx. 30 years



Award criteria: quality

- Average clear width of the outer doors on one side of the vehicle in mm (80 %)
 - RRX: minimum requirement 1300 mm
 - single-deck coaches 1400 mm
 - double-deck coaches 1800 mm
- Average floor area of all crowd spaces in a vehicle in m² (20 %)



Double-deck coach with an average clear width of the outer door of 1800 mm



Energy in the VRR availability model

- Manufacturer guarantees energy consumption for
 - Traction (driving operation)
 - Air conditioning
 - Shutdown/Parking
- Energy consumption (costs) are included in the evaluation over the life cycle of the manufacturer's tender
- Operators receive the guaranteed energy consumption to calculate their energy costs for operation
- Manufacturer guarantees are tested on a test ring and in a climate chamber
- If the tested values exceed the guaranteed values: compensation for damages over the entire term

Checking energy consumption on the test ring

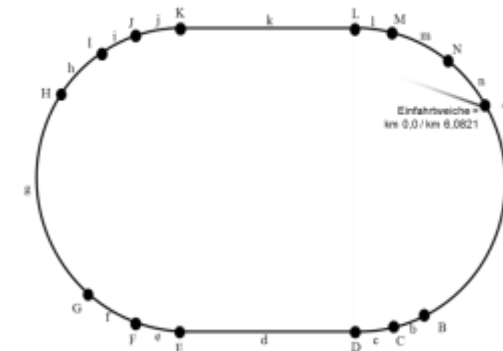
Position	Abschnittsbeginn/-ende (km)	Bemerkung	Abschnitt	Abschnittslänge (m)	Radius (m)	Überhöhung (mm)	Gradient (‰)
A	0						
			a	1223,34	700	150	+1,5
B	1,22334	NW					
			b	150,78	700	150	0
C	1,37412	UE					
			c	145	700 - ∞	150 - 0	0
D	1,51912	ÜA					
			d	696,93	0	0	0
E	2,21605	ÜA					
			e	145	∞ - 700	0 - 150	0
F	2,36105	UE					
			f	328,96	700	150	0
G	2,69001	NW					
			g	1450	700	150	-3,17
H	4,14001	NW					
			h	275,16	700	150	+3,83
I	4,41517	UE					
			i	145	700 - ∞	150 - 0	+3,83
J	4,56017	ÜA					
			j	179,84	0	0	+3,83
K	4,74001	NW					
			k	517,09	0	0	0
L	5,2571	ÜA					
			l	145	∞ - 700	0 - 150	0
M	5,4021	UE					
			m	370,02	700	150	0
N	5,77212	NW					
			n	309,98	700	150	+1,5
A	6,0821						

ID	Position (km) (Runde)		Station		Ankunft (Minuten)	Haltezeit (Minuten)	Abfahrt (Minuten)	Streckenabschnitt			V _{max} (km/h)
	von	bis	von	bis				Länge (km)	V _{max} (km/h)		
A	0	0					00:00,0				
			1	0	1,1			1,1		80	
			2	1,1	1,6			0,5		100	
			3	1,6	3,5			1,9		120	
			4	3,5	16,3			12,8		130	
			5	16,3	18,246			1,9		120	
B	18,2	3				00:09,9	00:01,00	00:10,9			
			6	18,246	24,328			6,1		130	
C	24,3	4				00:14,6	00:01,00	00:15,6			
			7	24,328	35,9			11,6		130	
			8	35,9	36,462			0,6		100	
D	36,5	6				00:22,2	00:01,00	00:23,2			
			9	36,462	37,6			1,1		130	
			10	37,6	39,9			2,3		130	
			11	39,9	41,762			1,9		130	
			12	41,762	42,574			0,8		100	
E	42,6	7				00:27,0	00:01,00	00:28,0			
			11	42,574	42,876			0,3		100	
			12	42,876	43,3			0,4		130	
			13	43,3	53,674			10,4		130	
			16	53,674	54,738			1,1		110	
F	54,7	9				00:34,6	00:01,00	00:35,6			
			17	54,738	55,838			1,1		80	
			18	55,838	66,902			11,1		130	
G	66,9	11				00:42,5	00:01,00	00:43,5			
			19	66,902	78,238			11,3		130	
			20	78,238	79,066			0,8		60	
H	79,1	13				00:50,5	00:01,00	00:51,5			
			21	79,066	81,366			2,3		80	
			22	81,366	91,23			9,9		130	
I	91,2	15				00:58,8	00:01,00	00:59,8			
			23	91,23	91,73			0,5		100	
			24	91,73	103,394			11,7		130	
J	103,4	17				01:06,4	00:01,00	01:07,4			
			25	103,394	113			9,6		130	
			26	113	113,8			0,8		130	
			27	113,8	117,8			4		80	
			28	117,8	119,8			2,2		90	
			29	119,8	121,1			1,3		60	
			30	121,1	121,64			0,5		30	
K	121,6	20				01:20,0	00:01,00	01:21,0			
			31	121,64	122,24			0,6		40	
			32	122,24	122,64			0,4		70	
			33	122,64	123,54			0,9		80	
			34	123,54	124,34			0,8		120	
			35	124,34	130,886			15,5		130	

2.6 Umgebungsbedingungen

(1) Der Hersteller führt die Berechnung der Werte nach Abschnitt 1 unter Berücksichtigung der folgenden Umgebungsbedingungen.

- Temperatur: 18°C
- Trockene Gleise
- Luftdruck 1013 hPa
- Relative Luftfeuchte 50%
- Wind <= 1 m/s



Tender experiences

- Tender led to good vehicles (new design)
- Economic result in terms of vehicle purchase price and energy consumption
- Manufacturer and operator competition has taken place
- So far, all networks have been able to start operations on time in terms of vehicle provision



S-Bahn Rhein-Ruhr (Stadler Flirt 3 XL EMU)



Rhein-Ruhr-Express (Siemens Desiro HC EMU)

Interfaces at the availability model

Tasks of the operator	Taks of the manufacturer
<ul style="list-style-type: none">▪ Operation of services▪ Circulation planning▪ Shutdown/parking▪ Interior cleaning	<ul style="list-style-type: none">▪ Maintenance▪ Exterior cleaning▪ Vandalism

 Clear separation between operational tasks and availability tasks

Daily interaction in operation

- The ultimate goal is to offer passengers high quality
- Operators are obliged to report any deviations from availability immediately (documentation system)
 - Technical defects
 - Vandalism/graffiti
 - Excessive wear
- The deviations are divided into error categories with different grace periods and reductions
- Monthly discussion of disputed errors (manufacturer/TOC/PTA): escalation and final decision
- In all projects a sample book was/is being developed to specify deviations and as a working aid for the TOC employees and maintenance staff
- Incentives/requirements for a comparatively quick fix are significantly higher

Formulated claim of the VRR

- Vehicle delivery contract defines high demands on the vehicles
- Maintenance contract defines high standards over the life cycle
 - Many annexes (specifications, energy) are therefore anchored in both contracts
 - Only operational wear and tear is permitted
- Therefore:



Experience – development of punctuality

- Improve customer satisfaction: objective improvement in many quality areas
 - Condition of vehicles
 - Punctuality
 - Capacity reductions
 - Vehicle-related failures

Trend of punctuality before and after the change of operator/vehicles

Line	1 st quarter 2018	2 nd quarter 2018	1 st quarter 2019	2 nd quarter 2019	1 st quarter 2020	Trend
RE 11	66,68 %		83,20 %			+ 16,52 %
RE 5		54,66 %		69,95 %		+ 15,19 %
RE 6			77,48 %		88,68 %	+ 11,20 %

Operational experience: flexibility

- Operators can change planned or unplanned; the vehicles are still available
 - any necessary adjustments can be implemented in a short time (e.g. Abellio insolvency)
- Surplus vehicles can be used for other purposes
 - short-term service expansions
 - replacement in the event of bottlenecks in the TOC vehicle pool (e.g. accidents, additional maintenance reserves)





Thank you for your attention!

Photo: Dirk Dominiak