

VBZ Innovation – Existing Projects and Potential Collaboration

VBZ Engineering & Innovation Team

Innovation @ VBZ

of technological development is The pace constantly accelerating, giving rise to new products and business models. Even well-established public transportation operators, such as Verkehrsbetriebe Zürich (VBZ), must adapt to this changing landscape.

Institutions like VBZ know that they can not exclusively rely on their traditional business models

InnoTram – A Vehicle for Collaboration

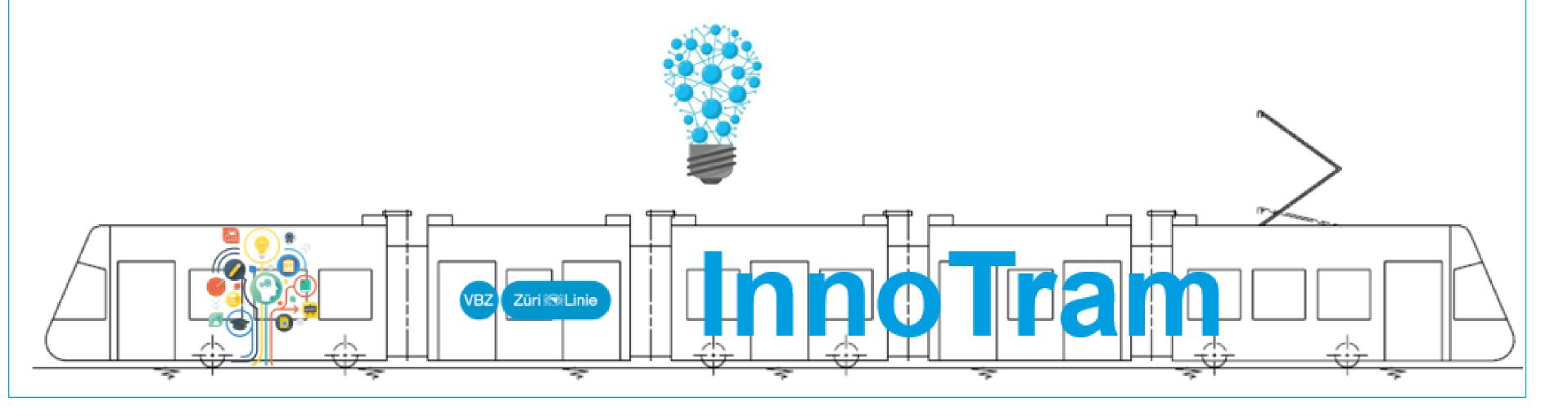
VBZ has allocated one tram specifically for research and the testing of new technologies... the InnoTram.

This consolidation simplifies operations for drivers and maintenance staff, while also facilitating easier publicity and sharing of innovation projects within VBZ and to the general public.

The InnoTram also serves as a collaboration platform for research institutions and suppliers.

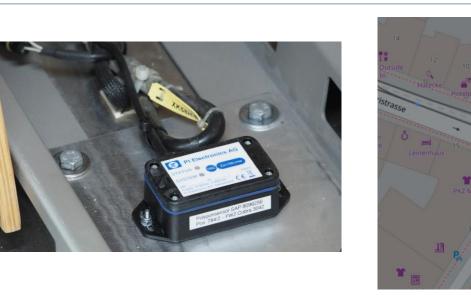
they also need to explore new services, \rightarrow products and solutions in order to meet the expectations and needs of their customers.

About 10 years ago, VBZ launched an "Innovation Management" program to professionally develop internal ideas and improvements. Additionally, the program aims to establish knowledge-sharing among other transport providers, suppliers and research institutions.



Existing Projects

Copra Tra	m: Polygon I	Jetektic	ט חכ	asn	poarc	1
Trams mit 'Bad' Fahrwerke	Trams	Fahrzeug Nr. FV	V1 FW2	FW3	Letzter Bericht	_
Fahrzeug Nr. FW1 FW2 FW3		3002 G	ood Bad	Good	19.06.2022	4
3002 Good Bad Good	10	3003 C	itical Critica	Good	20.06.2022	
3016 Bad Critical Good	63	3004 Cr	itical Good	Good	20.06.2022	
3060 Bad Good Good		3005 G	ood Good	Good	20.06.2022	
		3006 G	ood Good	Good	17.06.2022	
	FW Good	3008 G	ood Good	Good	20.06.2022	
		3009 G	ood Good	Critical	20.06.2022	
		3010 G	ood Critica	Good	20.06.2022	
	166	3011 G	ood Good	Good	20.06.2022	
		3013 G	ood Good	Good	20.06.2022	
		3015 G	ood Good	Good	11.06.2022	
Keine Berichte seit mehr als 5 Tagen	FW Critical	3016 Ba	d Critica	Good	19.06.2022	
÷		3017 G	ood Good	Good	20.06.2022	
Fahrzeug Nr. Letzter Bericht Tage ohne Kontaktaufnahme		3018 G	ood Good	Good	20.06.2022	
3047 12.05.2022 40	20	3020 G	ood Good	Good	18.06.2022	
3015 11.06.2022 10		3021 G		Good	20.06.2022	
		3022 G		Good	20.06.2022	
	FW Bad	3024 G	ood Good	Good	20.06.2022	
	1 W Dau		itical Good	Good	20.06.2022	
		3026 G		Critical	20.06.2022	
	2	3027 G	ood Bad	Good	20.06.2022	



Wheelset and Infrastructure Monitoring with Accelerometers.¹

Heizleistung vs. Aus	sentemperatur						
45.0			Senkung der Ter	Senkung der Temperatursollwerteinstellungen Heizung			
40.0			2°C	2°C	4°C		
35.0			$20^{\circ}C \rightarrow 18^{\circ}C$	$18^{\circ}C \rightarrow 16^{\circ}C$	$20^{\circ}C \rightarrow 16^{\circ}C$		
.0	Gruppe 2 - 18°C/22°C	Jahresenergieeinsparungen: 1 Tram	11.4 MWh	14.4 MWh	25.8 MWh		
25.0		Jahresenergieeinsparungen:	4.0.014	4.0.01/			
20.0		Cobra-Elotte (88 Ez.)	1.0 GWh	1.3 GWh	2.3 GWh		



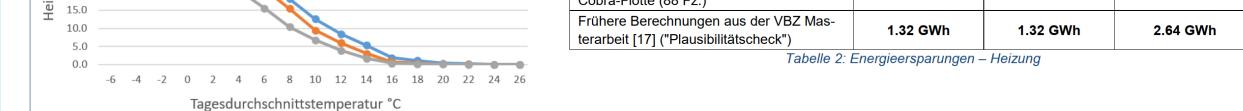
Pantograph Mounted

Overhead Line Monitoring

and Diagnostic System

Additional ongoing and planned projects include:

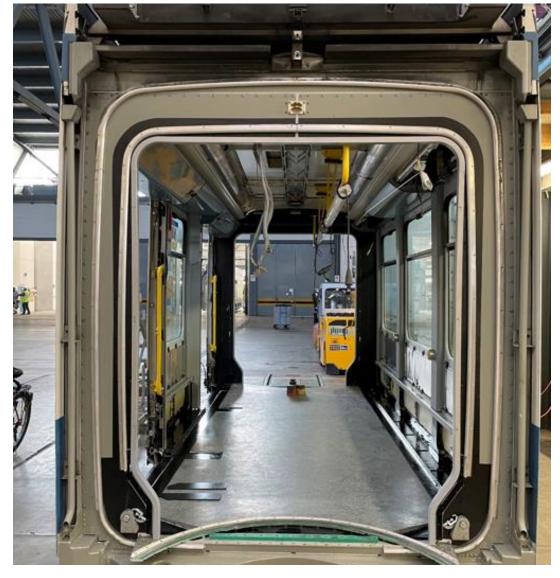
- Measuring the impact of the Corona 'All Doors Open' Policy on Vehicle Air Quality.
- Cloud Based 'Driver Advisory System' for Trams
- Evaluation of LED Interior Lighting
- Technology upgrades including driver microphone, vehicle grounding, precise vehicle locating (Depot Management System), and air treatment technology.



Quantification of Energy Savings in Tram Operation Achieved Through Passenger Compartment Temperature Reductions.²

CONFIDENTIAL

Collaboration with Suppliers



Future Interior Design Possibilities

- Optimization of heating and air conditioning systems on eBuses.
- Implementation of vehicle ID Beacon senders for app-based services.



ID Beacon for app-based services

Collaboration

VBZ is actively seeking collaberation projects and welcomes project proposals for evaluation and discussion. Given the city of Zürich's open data policy, there are numerous areas for potential project work (examples currently being studied are energy consumption data as well as cabin-temperature). Further areas for project work could be: • Evaluation and study of the new battery bus fleet. The battery buses generate a lot of data for various systems, presenting an opportunity for analysis and research.

- Assessing energy savings (and energy savings potential) through further optimization of heating and A/C.
- Conducting studies on vehicle interior design to enhance passenger comfort and experience.
- Optimization of tram and bus stops to improve efficiency, accessibility and user experience.
- Exploring methods to reduce traction energy consumption for trams and/or buses operated in the VBZ city periphery and suburban lines
- ... what else would you like to work on?

Contact

Geoff Klein VBZ Verkehrsbetriebe Zürich Luggwegstrasse 65 8048 Zürich Email: geoffrey.klein@vbz.ch Website: www.vbz.ch Phone: +41 79 310 5514



References

- 1. Klein G., Roth D., Menzi P., Strimer S. (2012, October). Zustandsorientierte Wartung: Polygonfrüherkennung beim Cobra-Tram, Schweizer Eisenbahn Review 524 - 526.
- 2. Klein G., Inderbitzin F., Gödicke M. (2023, January) 239 Energieeinsparung im Trambetrieb bei verschiedenen Innenraum Temperatursollwerteinstellungen -Quantifizierung und Flottenerfahrungen, Bundesamt für Verkehr BAV Programm Umsetzung der Energiestrategie 2050 im öffentlichen Verkehr (ESöV 2050)