POLYHACK ETH 2020

SBB Challenge
«Show me the bottleneck»

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What SBB wants

Problem:

Construction sites are **manually** entered into database

Currently staff must check **"by-eye"** to identify bottlenecks

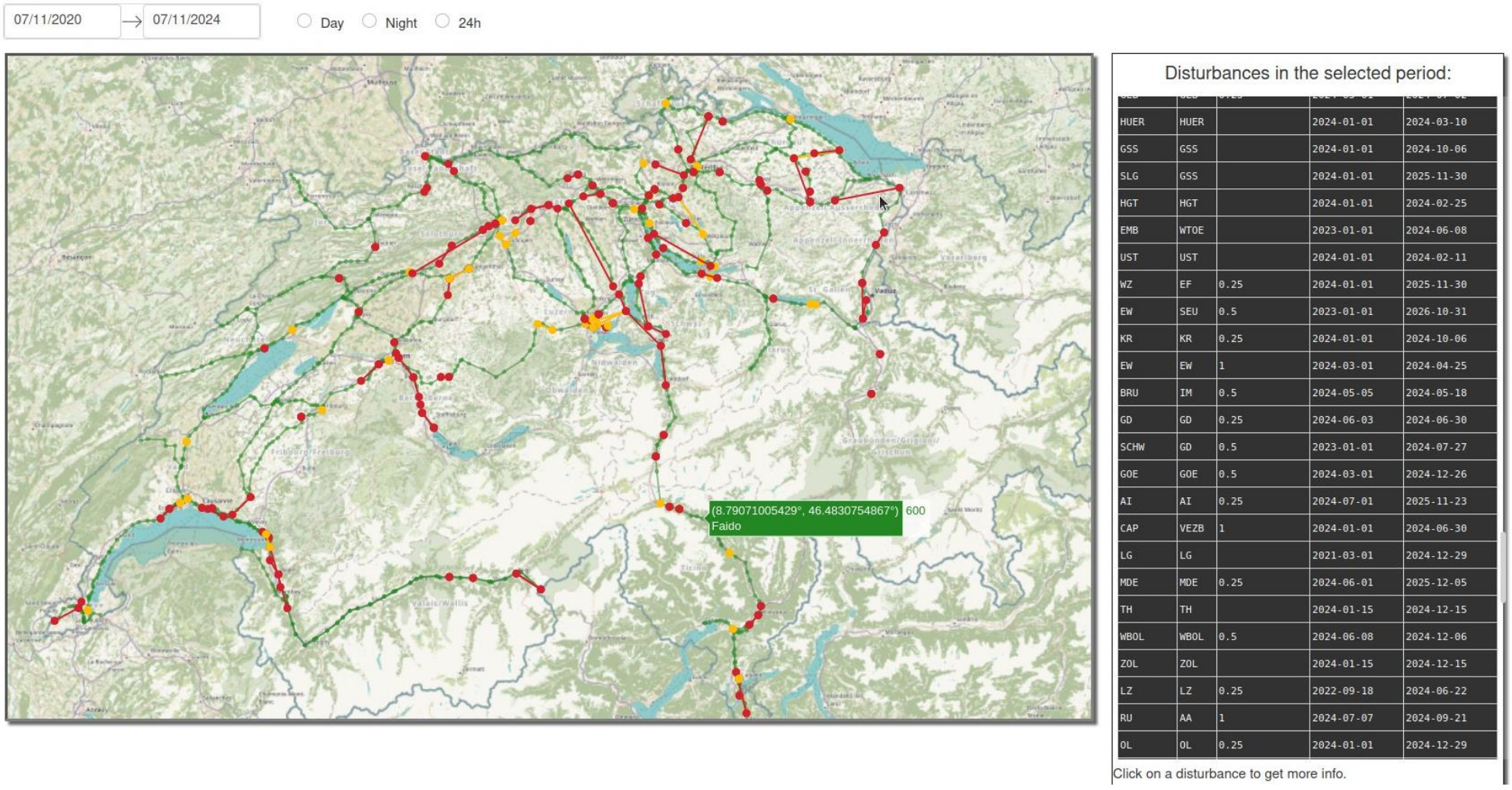
What SBB wants:

Visualization of planned construction sites

Support function for staff to **plan & schedule** upcoming projects

Analysis of most critical **strain situations** for the network

The Result – map overview



Disturbances in the selected period:

HUER	HUER		2024-01-01	2024-03-10
GSS	GSS		2024-01-01	2024-10-06
SLG	GSS		2024-01-01	2025-11-30
HGT	HGT		2024-01-01	2024-02-25
EMB	WTOE		2023-01-01	2024-06-08
UST	UST		2024-01-01	2024-02-11
WZ	EF	0.25	2024-01-01	2025-11-30
EW	SEU	0.5	2023-01-01	2026-10-31
KR	KR	0.25	2024-01-01	2024-10-06
EW	EW	1	2024-03-01	2024-04-25
BRU	IM	0.5	2024-05-05	2024-05-18
GD	GD	0.25	2024-06-03	2024-06-30
SCHW	GD	0.5	2023-01-01	2024-07-27
GOE	GOE	0.5	2024-03-01	2024-12-26
AI	AI	0.25	2024-07-01	2025-11-23
CAP	VEZB	1	2024-01-01	2024-06-30
LG	LG		2021-03-01	2024-12-29
MDE	MDE	0.25	2024-06-01	2025-12-05
TH	TH		2024-01-15	2024-12-15
WBOL	WBOL	0.5	2024-06-08	2024-12-06
ZOL	ZOL		2024-01-15	2024-12-15
LZ	LZ	0.25	2022-09-18	2024-06-22
RU	AA	1	2024-07-07	2024-09-21
OL	OL	0.25	2024-01-01	2024-12-29

Click on a disturbance to get more info.

The Result – planning support

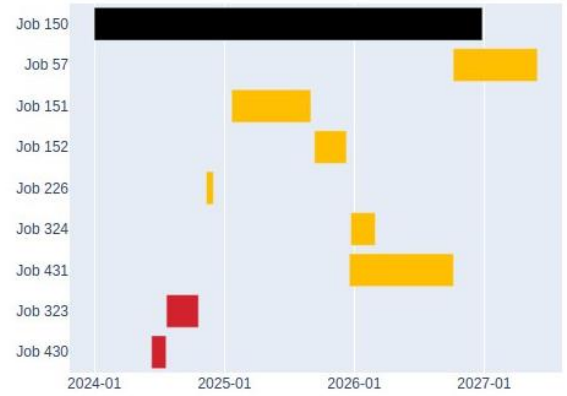
07/11/2020 → 07/11/2024 ○ Most severe ◉ Most Conflicts

Planned Project

Identifier	Red. Capacity	Building from	Building till
150		2024-01-01	2026-12-27

Conflicting Projects

Identifier	Umsetzung	Red. Capacity	Building from	Building till
57	Sperre Strecke Tag	0.25	2026-10-06	2027-05-31
151	Sperre Strecke Nacht	0.25	2025-01-21	2025-09-01
152	Sperre Strecke Nacht	0.25	2025-09-11	2025-12-10

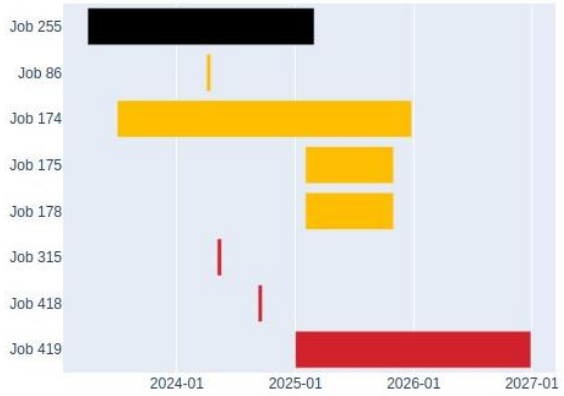


Planned Project

Identifier	Red. Capacity	Building from	Building till
255		2023-04-01	2025-02-28

Conflicting Projects

Identifier	Umsetzung	Red. Capacity	Building from	Building till
86	Sperre Strecke 24 Std	0.25	2024-04-02	2024-04-15
174	Sperre Strecke Nacht	0.25	2023-07-01	2025-12-26
175	Sperre Bahnhof 24 Std	0.25	2025-02-01	2025-10-31

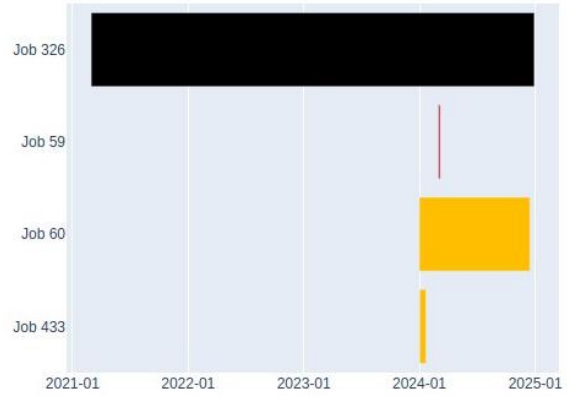


Planned Project

Identifier	Red. Capacity	Building from	Building till
326		2021-03-01	2024-12-29

Conflicting Projects

Identifier	Umsetzung	Red. Capacity	Building from	Building till
59	Sperre Strecke Nacht	0.5	2024-03-01	2024-03-07
60	Sperre Bahnhof Nacht	0.25	2024-01-01	2024-12-15
433	Sperre Strecke Nacht	0.25	2024-01-02	2024-01-22



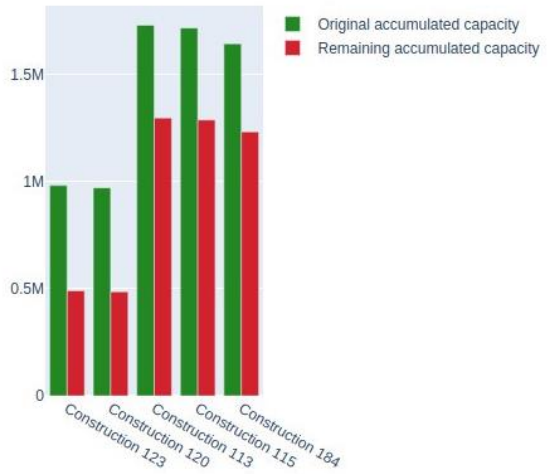
The Result – capacity management

07/11/2020 → 07/11/2023 ◉ Most severe ○ Most Conflicts

Strongest Reduction on Train Numbers

Index	Construction	Line	Region	Start Point	Time Start	Time End	Red. Capacity	Usual Trains	Red. Train Capacity
123	Sperre Strecke 24 Std	103	RME	LGUT	2023-06-30	2032-11-18	0.5	104630	491474.34
120	Sperre Strecke 24 Std	103	RME	LGUT	2023-06-30	2032-11-18	0.5	103480	486072.49
113	Umsetzung	103	RME	BWY	2016-01-01	2026-07-16	0.25	164209	432904.41
115	Umsetzung	103	RME	BWY	2016-01-01	2026-07-16	0.25	163009	429740.85
184	Sperre Bahnhof 24 Std	103	RME	BN	2017-06-30	2027-12-30	0.25	156575	411277.48
185	Sperre Bahnhof 24 Std	103	RME	BN	2017-06-30	2027-12-30	0.25	155420	408243.63
160	Sperre Bahnhof 24 Std	21	RME	BNBS	2023-01-09	2033-06-19	0.5	48396	252852.53
162	Sperre Bahnhof 24 Std	21	RME	BNBS	2023-01-09	2033-06-19	0.5	48327	252492.02
112	Sperre Strecke 24 Std	103	RME	BWY	2021-08-02	2025-09-14	0.25	164209	169157.76
114	Sperre Strecke 24 Std	103	RME	BWY	2021-08-02	2025-09-14	0.25	163009	167921.6

Reduction on Train Numbers



Key Features– map overview

Based on a user-selected time frame:

- Simple exploration of individual train lines

- Clear Identification of bottlenecks in the network

- Direct access to construction site specific information

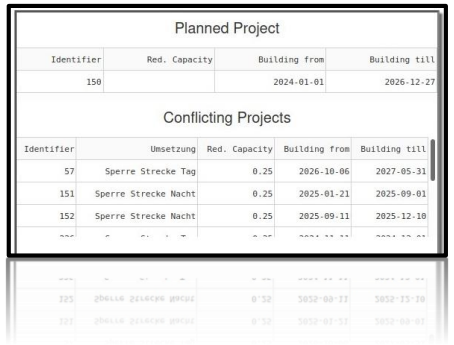
EW	SEU	0.5	2023-01-01	2026-10-31
KR	KR	0.25	2024-01-01	2024-10-06
EW	EW	1	2024-03-01	2024-04-25
BRU	IM	0.5	2024-05-05	2024-05-18

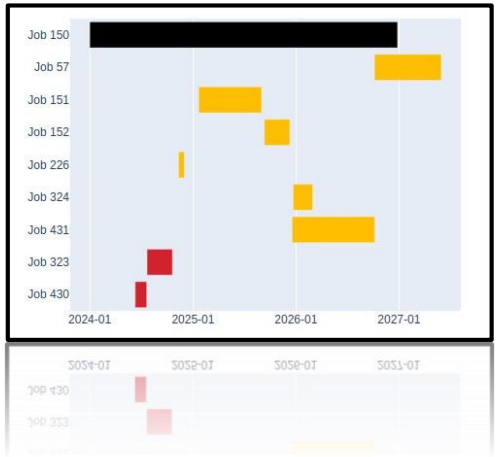
- Filtering capacity by day and night

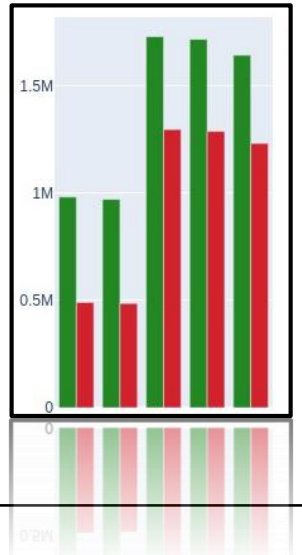
Key Features– map overview

Based on a user-selected time frame:

- Support in scheduling constructions projects
- Highlighting conflicting projects
- Showing calendar overview of planned & conflicting projects
- Highlighting most severe network capacity strain
- Estimating number of necessary train reschedules







Technical features

» Entire code base in **python**

» Modular code base, future extensions in mind

» User friendly web interface built with **Dash**

» Powerful plotting capabilities with **plotly**

Loading pipeline

- Direct access to data from the SBB API
- Prefiltering of lines
- Adaptable data processing
- Advanced data analysis by project & capacity

Conclusion & Acknowledgements

1. Easy to use
2. Clear Visualisation
3. Fully automated
4. Detailed analysis
5. Support with bottleneck identification & planning

Thank you SBB!

Thank you to the Polyhack team!