TriMet Light Rail Simulation Study for On-Time Performance Improvement

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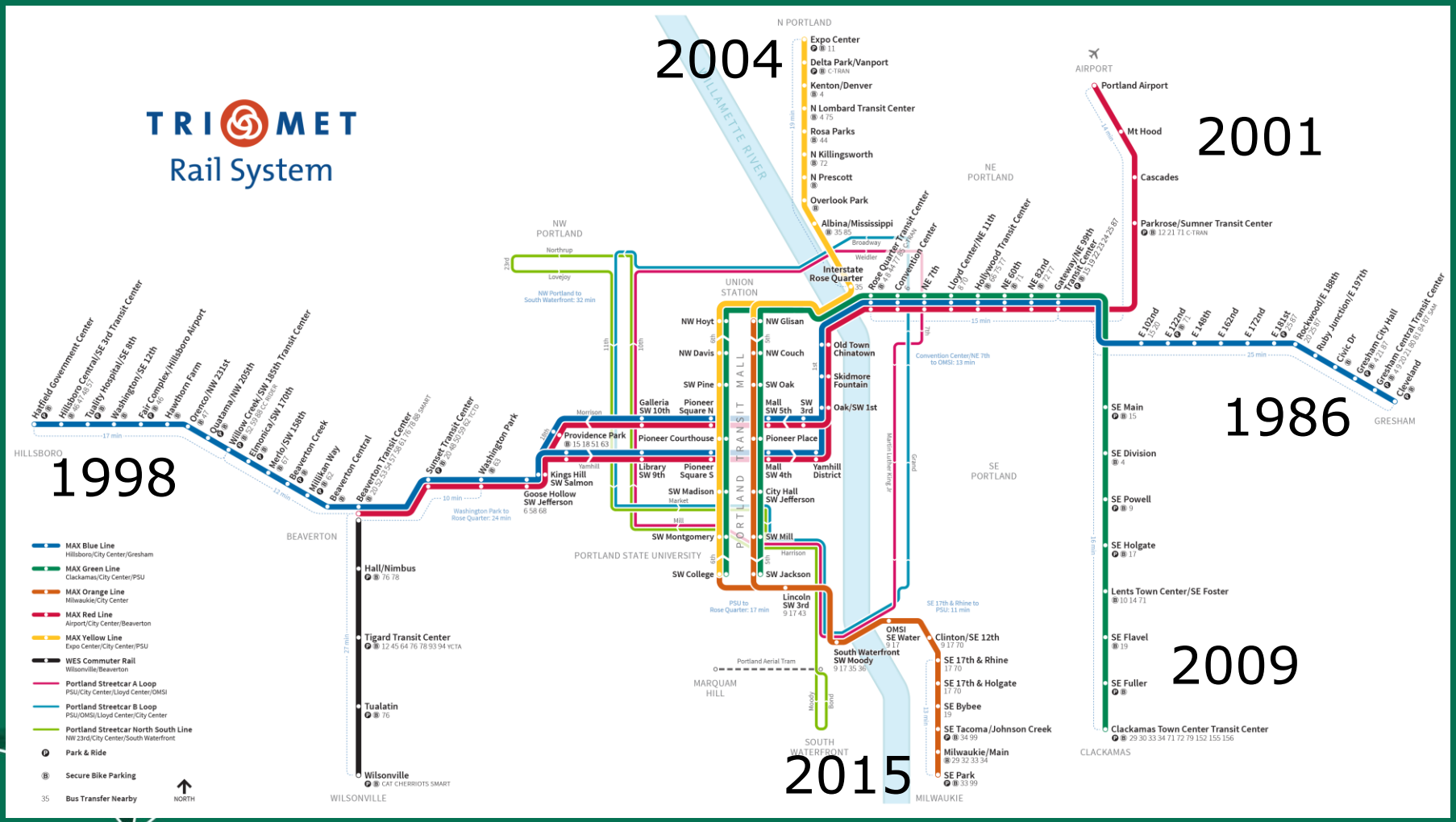
Topics of Discussion

- History and Role of TriMet Simulation
- Calibrating the System Simulation Model
- Performance Results for Existing Network
  - Identifying operationally problematic areas
- Concepts for Operational Improvement
- Results, Conclusions and Takeaways

Expansion of the MAX System



TriMet Simulation History

- 1994-5: Gated crossing near intersection
- 1995-7: MAX Transit Mall capacity analysis
- 1996-7: N/S DEIS Transit Mall and Steel Bridge
- 1999: Airport Extensions Operations Analysis
- 2002-4: South Corridor SDEIS CBD capacity analysis & North Corridor Operations
- 2010: Orange Line Shared transitway analysis

Need For Simulation

- MAX system became too complex for analysis by inspection or calculation
- On-Time Performance declined
- Value and impact of improvements and changes could not be determined
  - Alignments, signals, schedules, extensions
- A system wide simulation model was needed

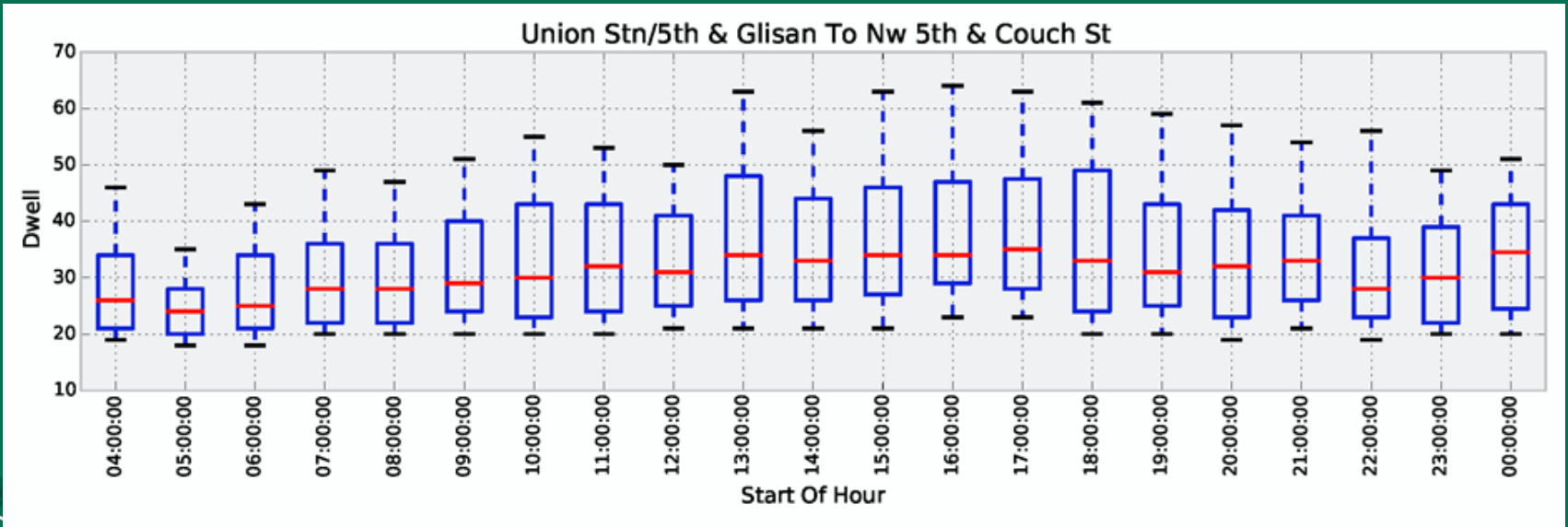
Establishing the Model

TrainOps rail simulation model of MAX:

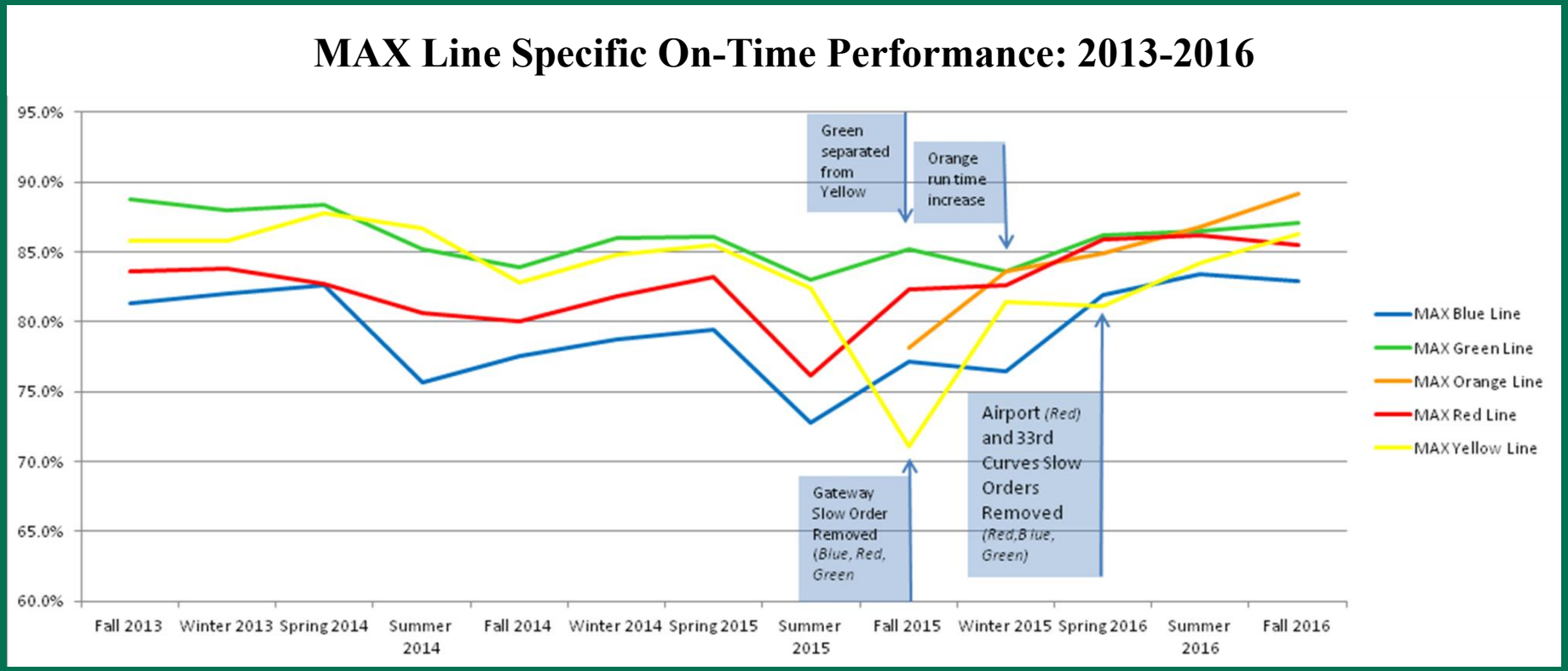
- Track alignment, including
  - Platforms, switches, speeds, grades & curves
- Signal locations and logic
- Complete Operating Plan with yard moves
- Vehicle type, tractive effort and ridership

Variability

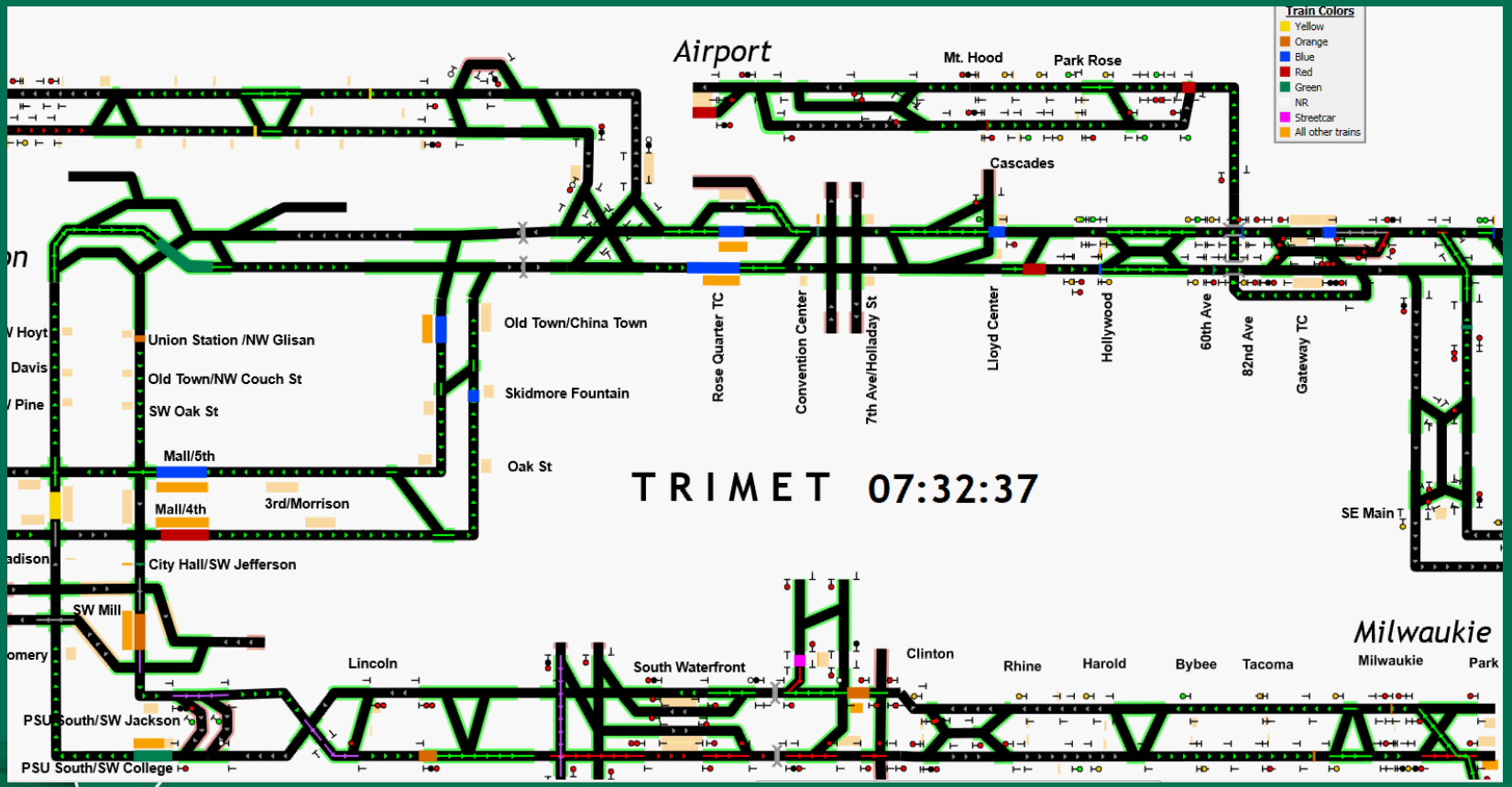
- Dwell time variability based on log-normal distribution of station specific dwell data
- Incorporates adjacent intersection delay



Calibration



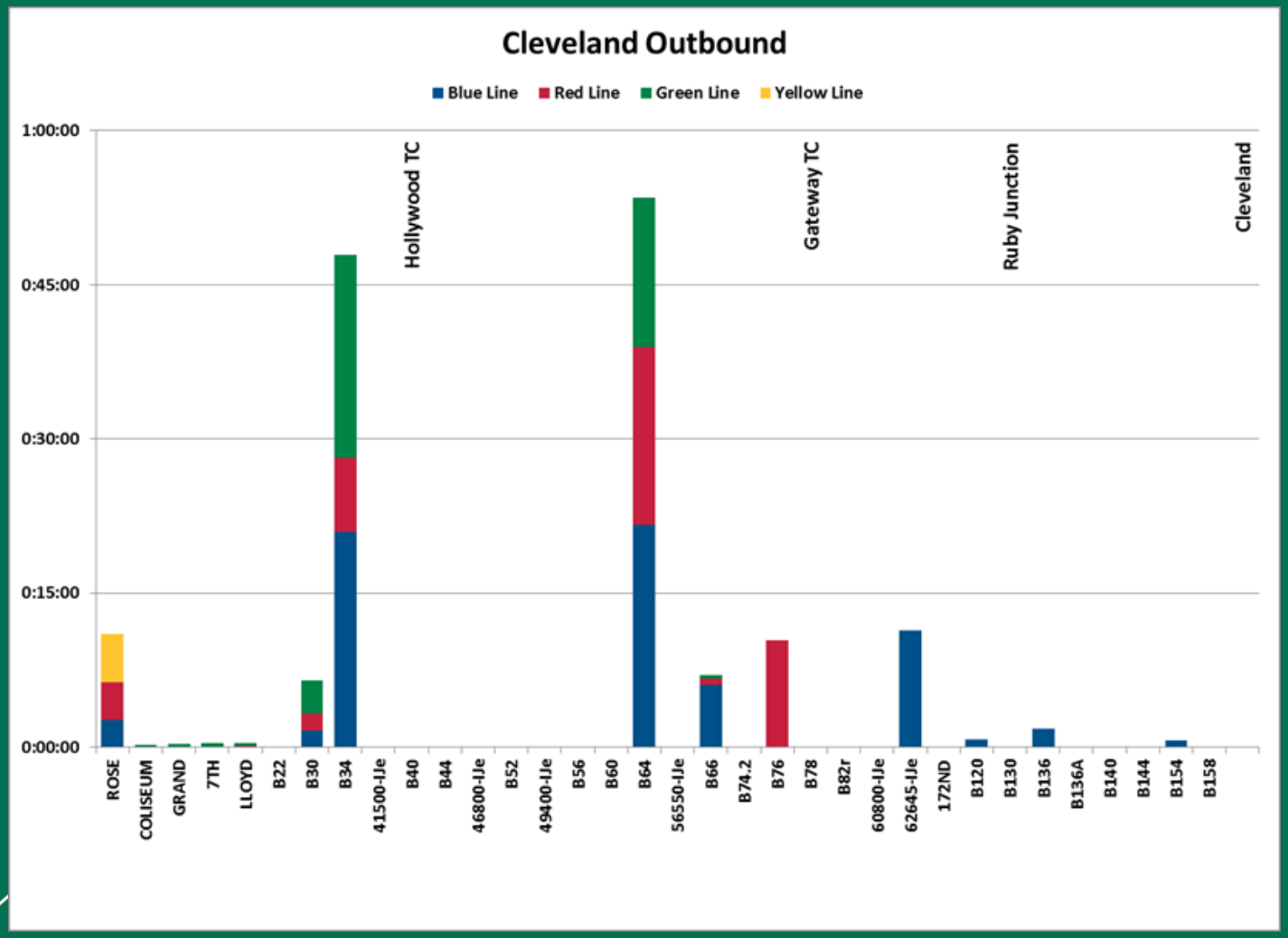
MAX System Simulation



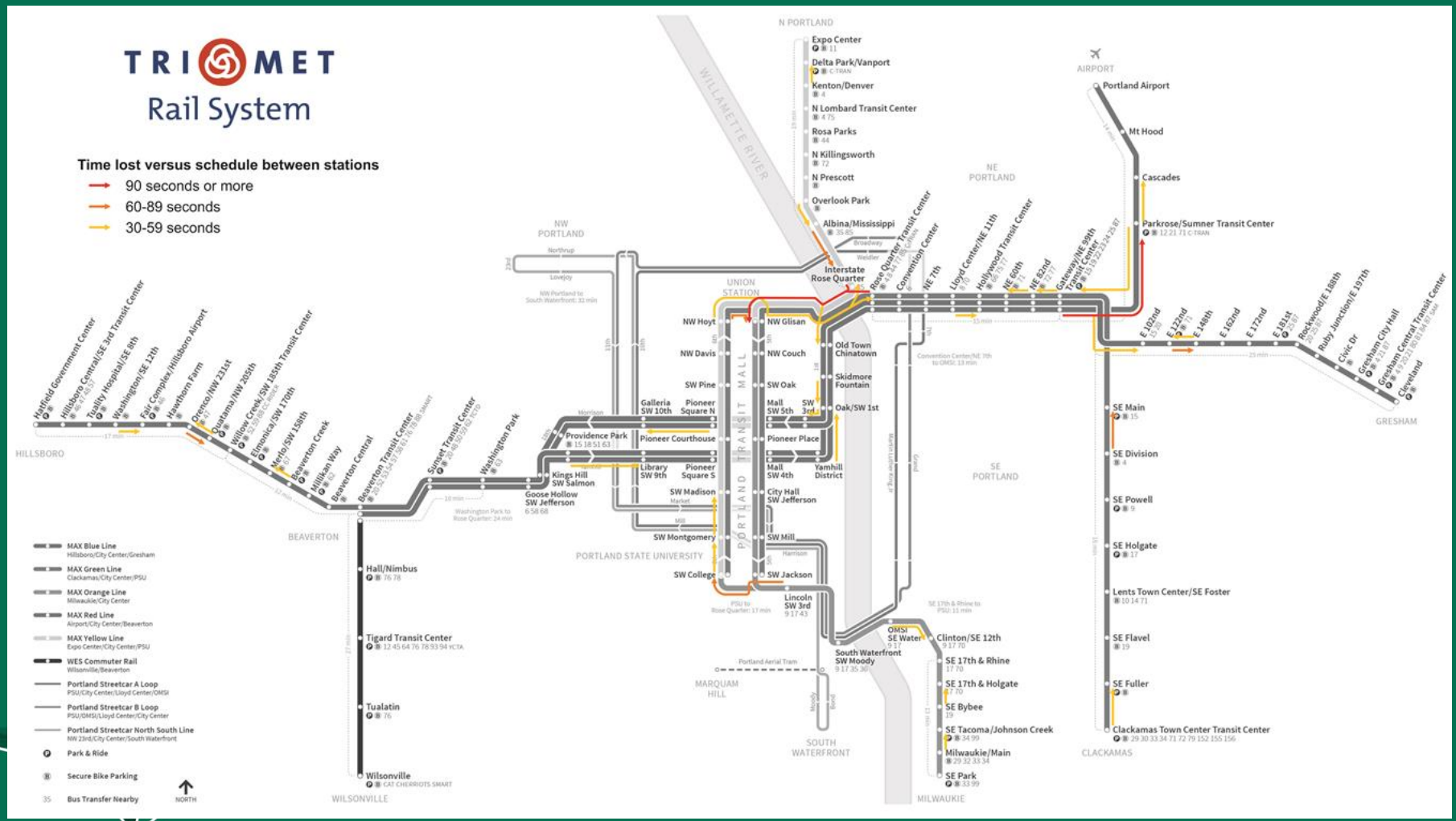
Results: On-Time Performance

Simulated vs. Real World MAX OTP		
Line	**Real World OTP**	**Calibrated Baseline Simulated OTP**
Blue	83.2%	83.7%
Red	85.9%	84.5%
Green	86.8%	87.9%
Yellow	85.3%	87.8%
Orange	88.0%	88.0%
Overall	**85.10%**	**85.58%**

Results: Signal Delay by Location

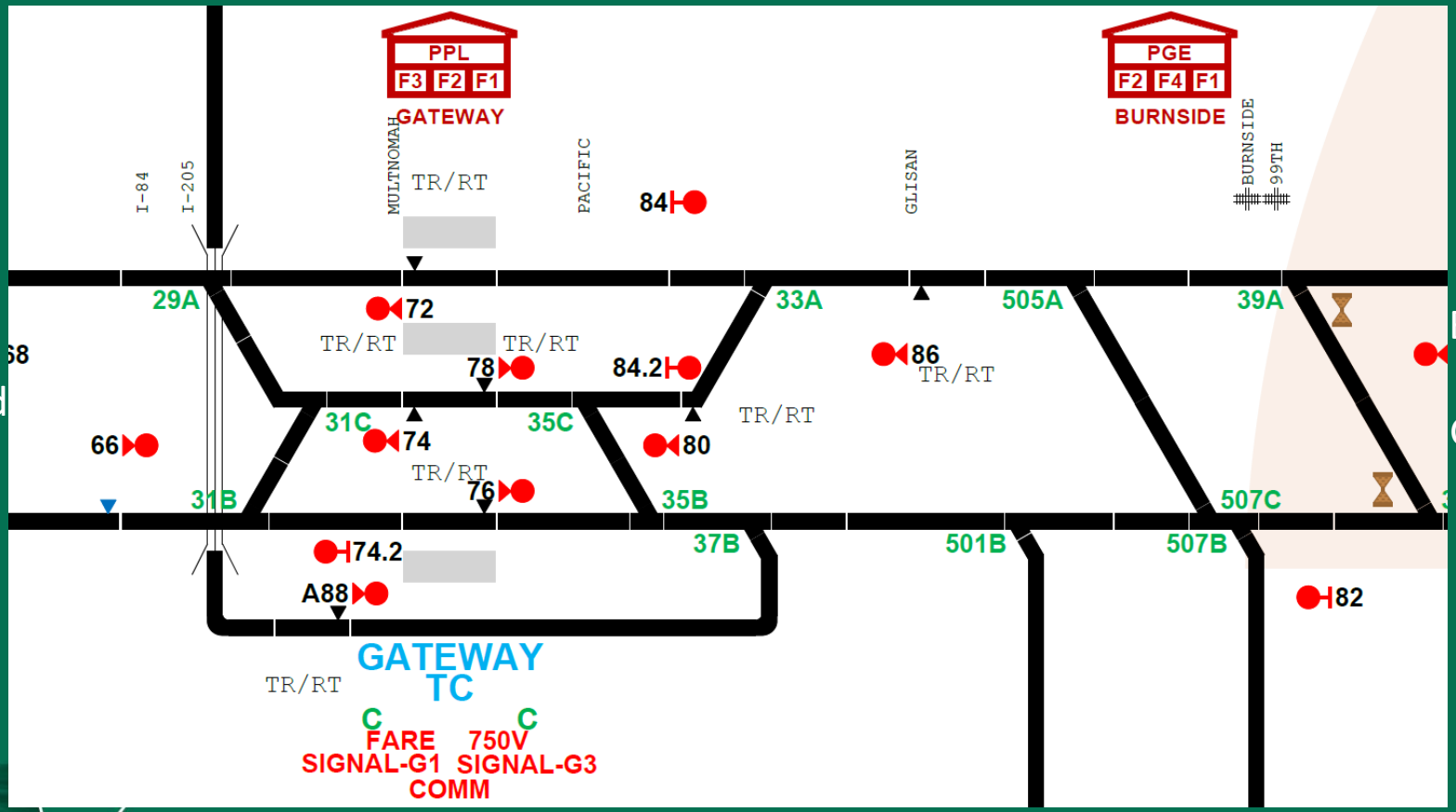


Results: Schedule Adherence



Areas Prone to Delay: Gateway

Red Line to Airport

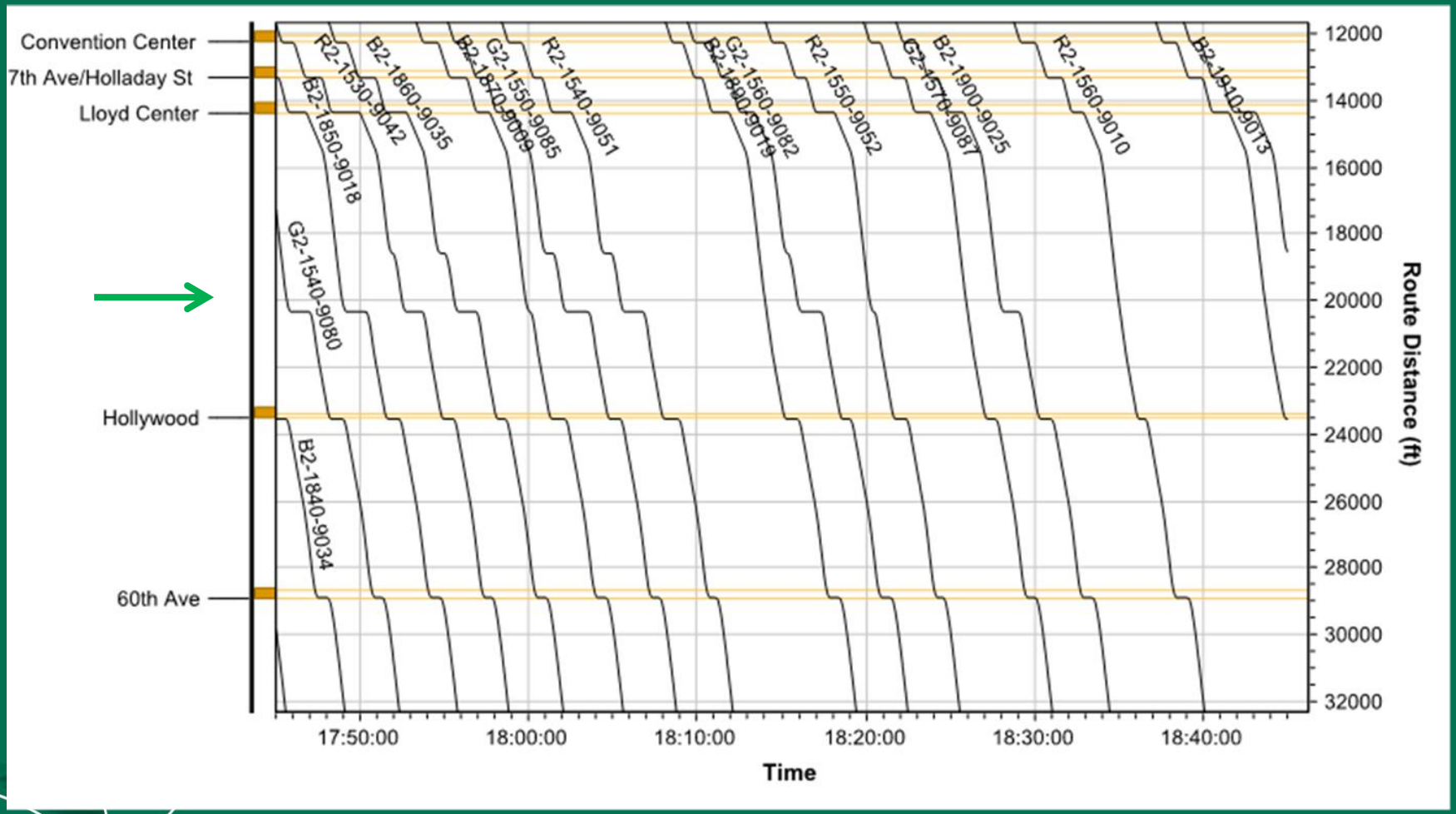


Blue Line to Portland City Center

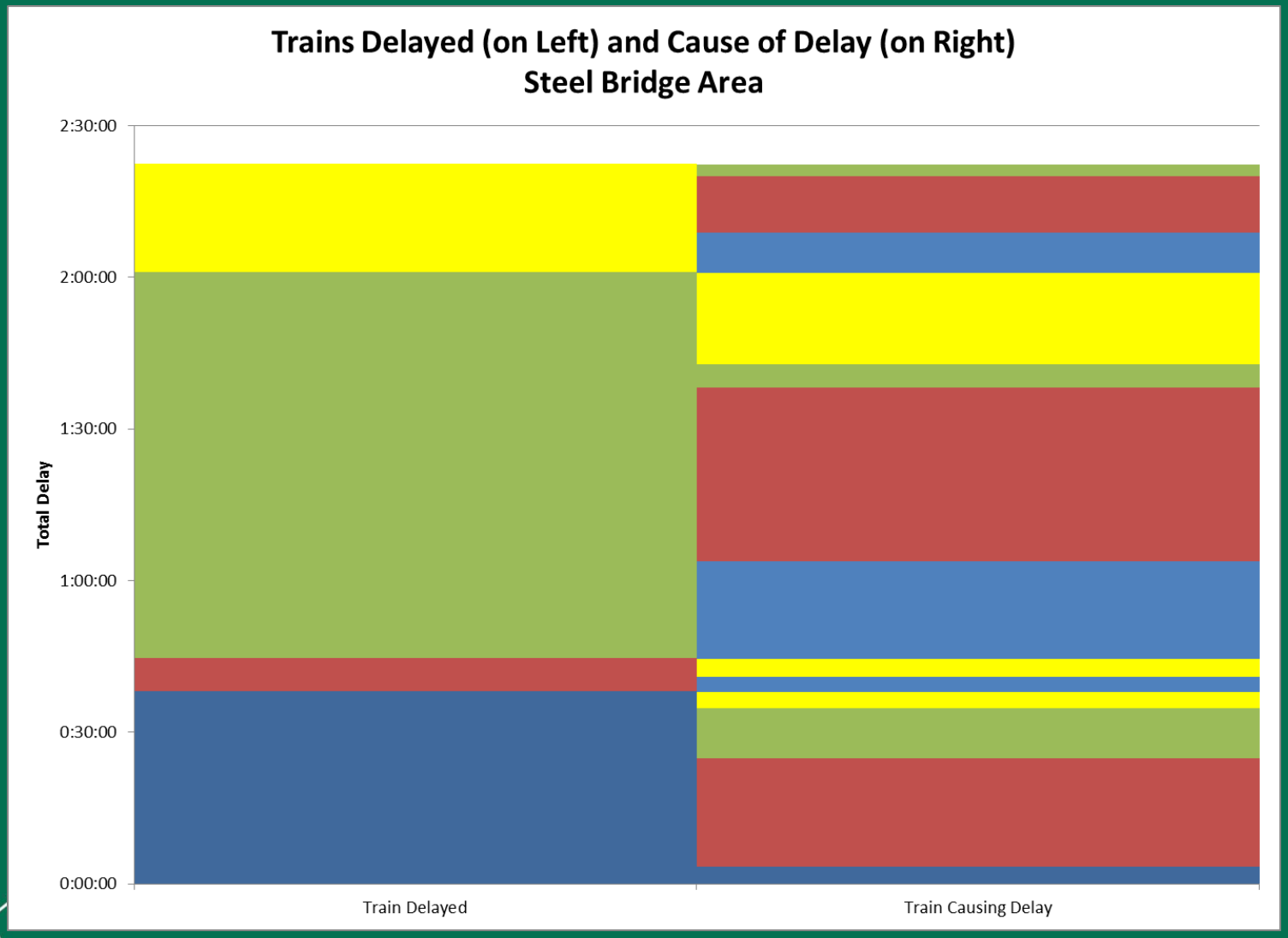
Blue Line to Gresham

Green Line to Clackamas

Areas Prone to Delay: Sullivan's Gulch



Areas Prone to Delay: Steel Bridge



Concepts for Operational Improvement

- Workshop conducted with LTK and multiple departments within TriMet.
- Goal: Brainstorm ways to improve MAX OTP
  - Informed by results of baseline simulation
- Result: 10 Concepts for Operational Improvement

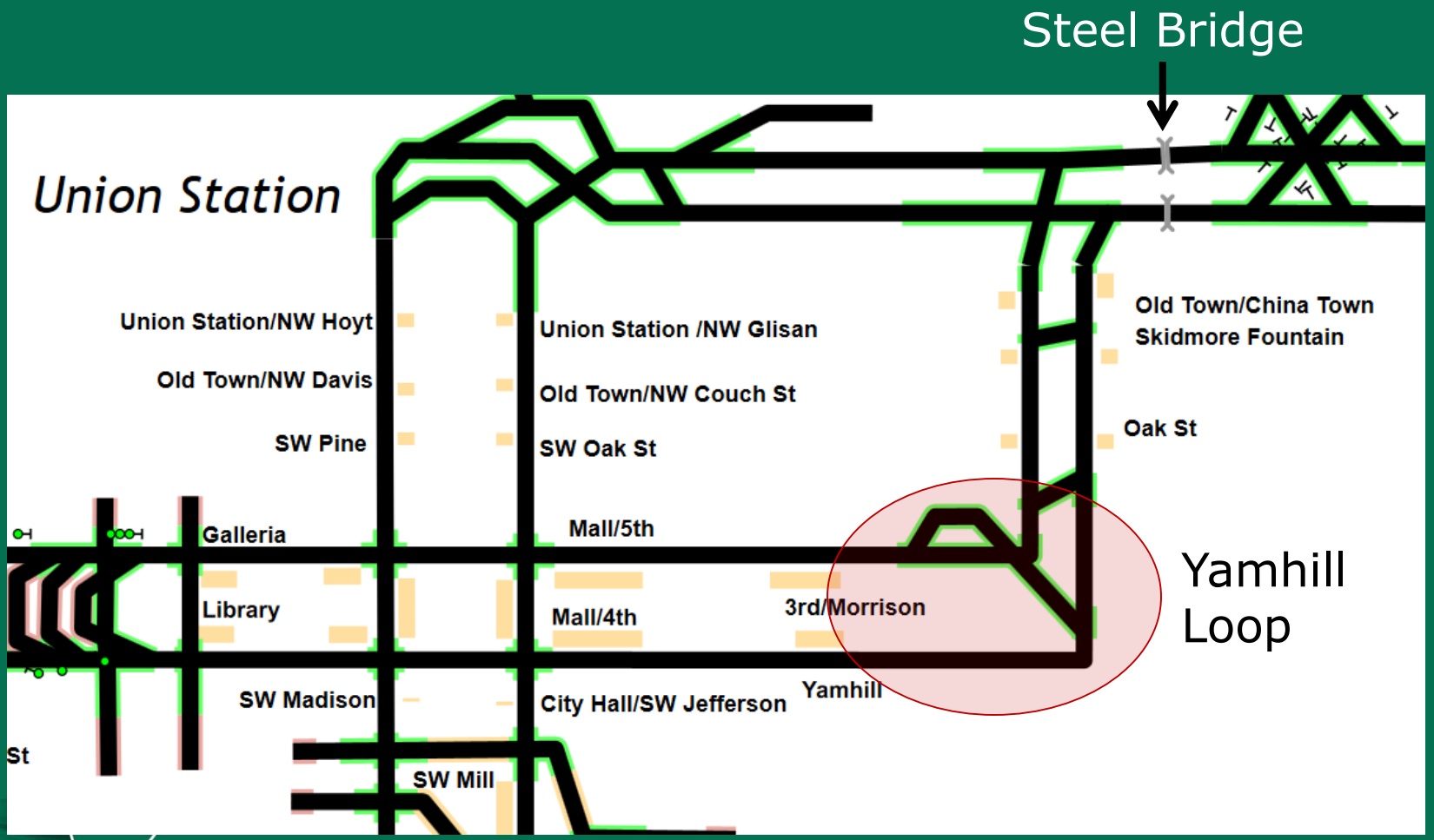
Concept 3:
Move Gateway Operator Changes

- 10 Blue and Green Line MAX Trips have daily operator changes at Gateway
- Dwells of two minutes required for change
- Operator changes moved to adjacent stations that are not system capacity constraints
- Long Gateway dwells eliminated to improve train flow

Concept 9a:
New Gateway Airport Inbound Station

- Eliminate Red Line single track constraints and crossover conflicts at Gateway
- New track to serve inbound trains on new alignment
- New station constructed near existing one
- New track connects to inbound Banfield Line

Concept 11:
Yamhill Loop Track



Results of Concepts for Operational Improvement

On-Time Performance Summary of Concepts for Operational Improvement							
Concept	**Blue**	**Red**	**Green**	**Yellow**	**Orange**	**Overall**	**Δ from Existing**
Existing	83.69	84.46	87.96	87.82	88.04	85.58	-
1	83.64	86.97	85.76	88.60	88.67	85.78	0.20
3	84.84	90.87	88.18	87.37	87.86	87.09	1.51
6	89.74	88.86	89.11	86.00	92.79	89.43	3.84
9a	86.04	96.10	90.16	84.92	87.32	88.46	2.87
11	83.26	84.76	88.47	87.93	88.49	85.62	0.03
12	83.69	84.46	87.96	87.82	88.04	85.58	0.00
13	84.66	91.25	87.67	87.60	88.31	87.12	1.54
14	84.78	83.73	87.81	90.61	90.20	86.49	0.91
15	83.55	84.17	88.47	87.82	88.13	85.57	-0.01
16	83.72	82.25	84.65	86.48	86.78	84.35	-1.23

Conclusions

Operations Simulation was crucial to:

- Accurately modeling MAX operations
- Identifying the network's underperforming areas
- Developing concepts to improve OTP
- Determining the effectiveness of each concept
- Identifying synergies with concept combinations