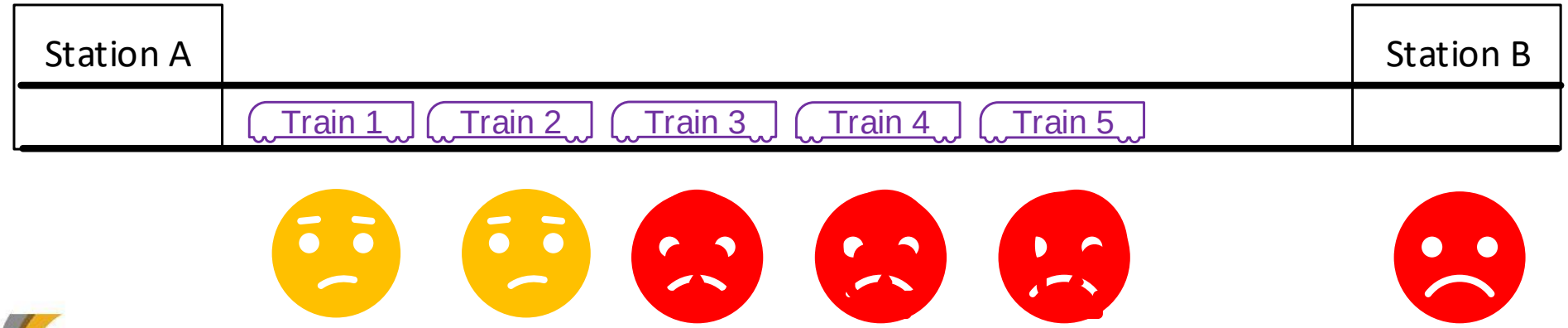
Solutions for multiple trains in a vent zone while increasing train capacity

Justin Edenbaum, PE, P.Eng

Founder of

NEVER GRAY

Solutions for multiple trains in a vent zone while increasing train capacity

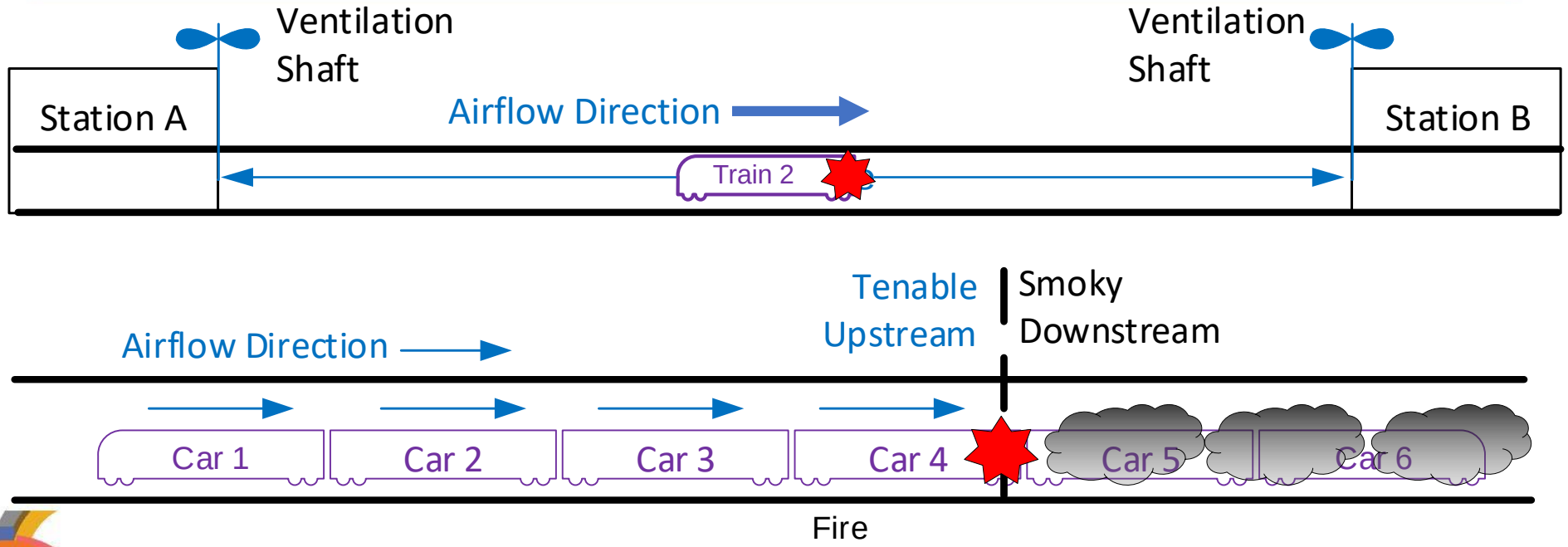


Key Presentation Take-Aways

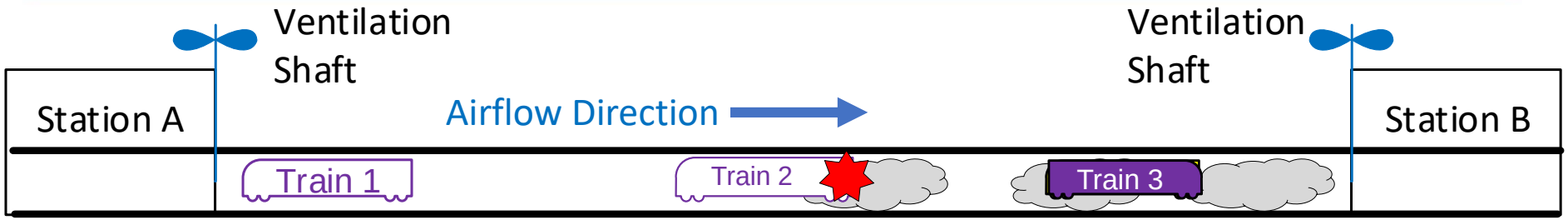
- Solutions for multiple trains in a vent zone while increasing train capacity
  - Trapped trains are the problem
  - Are more trains necessary?
  - Where are more trains?
  - Avoidance and mitigation

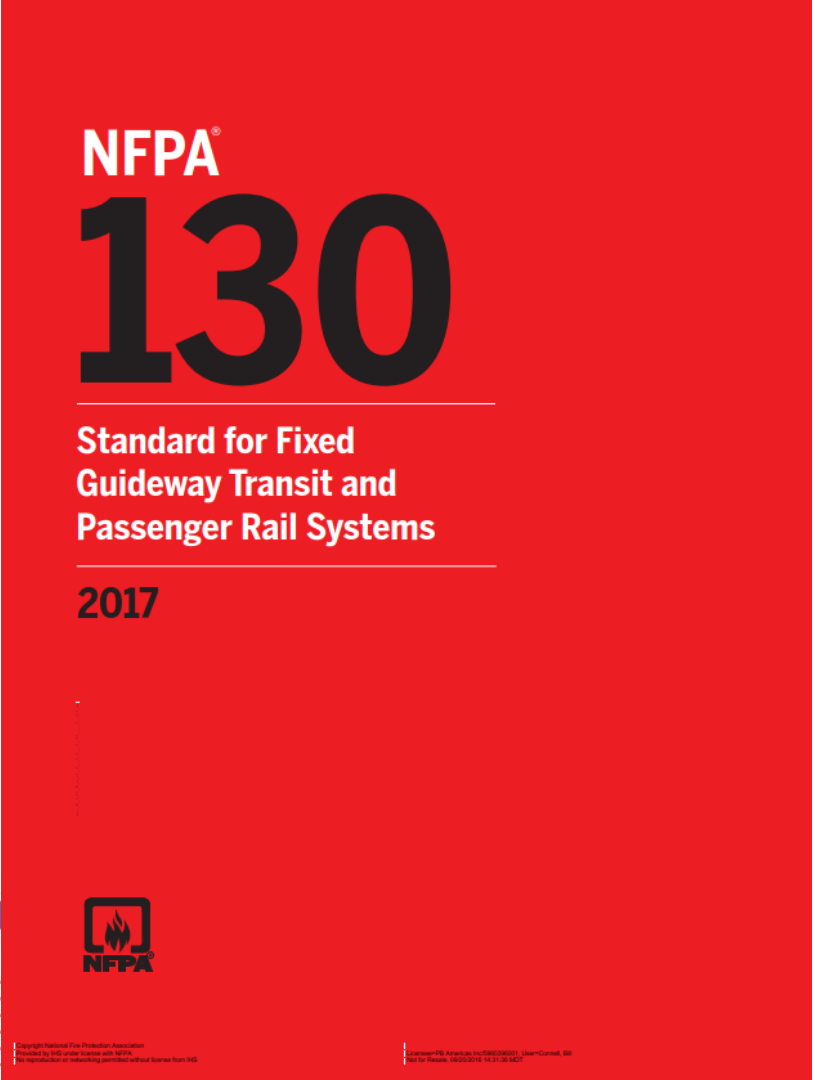
NEVER GRAY

Trapped Trains are the Problem



Trapped Trains are the Problem





ONE TRAIN PER VENT ZONE

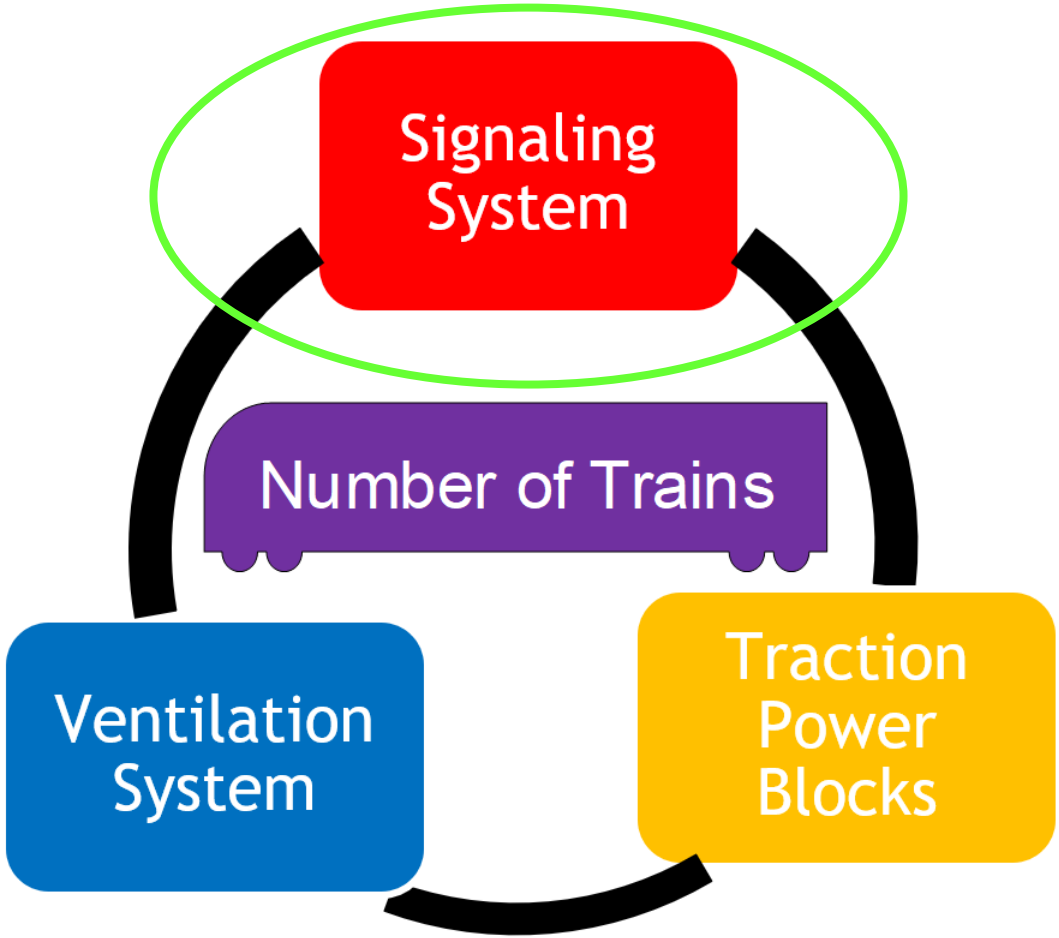
NEVER GRAY

NFPA®

130

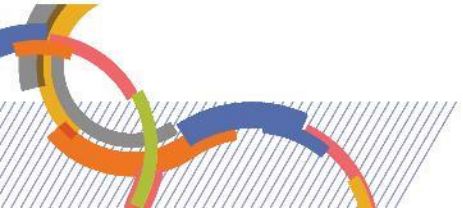
Standard for Fixed Guideway Transit and Passenger Rail Systems

2017



Agenda

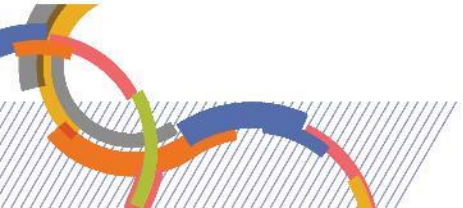
- Trapped trains are the problem
- Are more trains necessary?
- Where are more trains?
- Avoidance and mitigation



NEVER GRAY

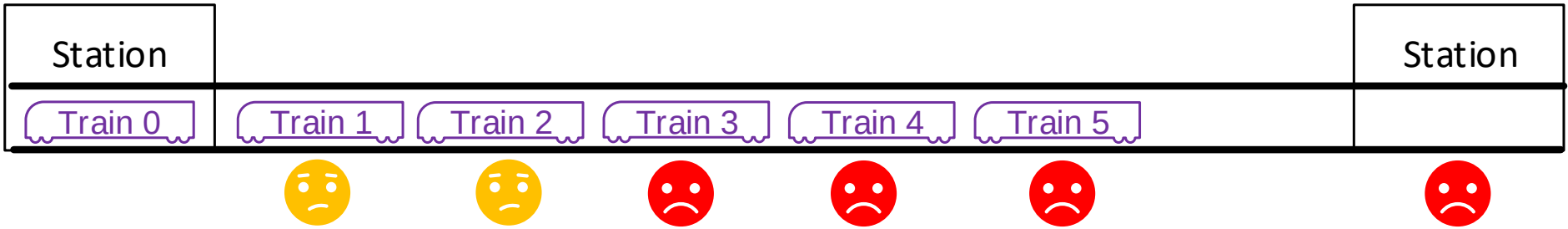
Are more trains necessary?

Operations	Headways
• Normal	• Operating headway
• Delay	
• Catch-up	• Design headway



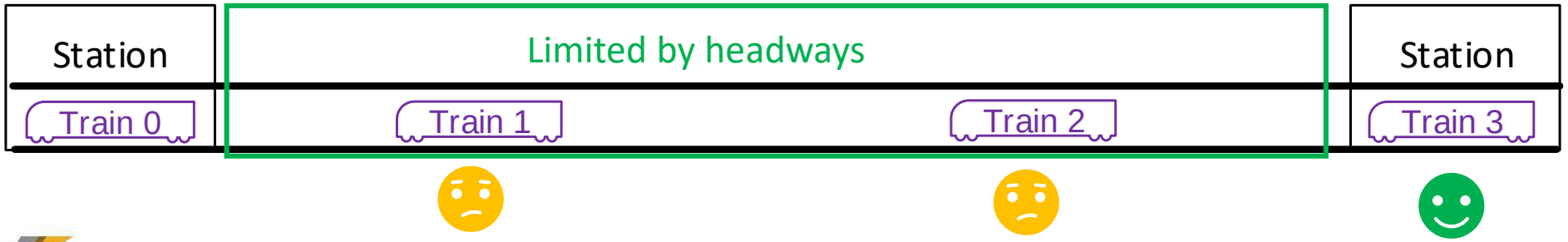
Are more trains necessary?

- Catch-up ⟵ Design headway
  - Provide service to your customers
  - Recover after delay



Are more trains necessary?

- Catch-up ⟵ Design headway
  - Provide service to your customers
  - Recover after delay

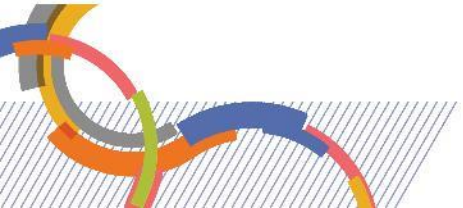


Are more trains necessary?

- Catch-up ← Design headway
  - Provide service to your customers
  - Recover after delay – Sample Case
    - ATC increase capacity
      - 120 to 90 second design headway
      - No increase in number of trains
    - No significant difference in catch-up
      - (up to 2-headway delay)

Agenda

- Trapped trains are the problem
- Are more trains necessary?
- Where are more trains?
- Avoidance and mitigation



NEVER GRAY

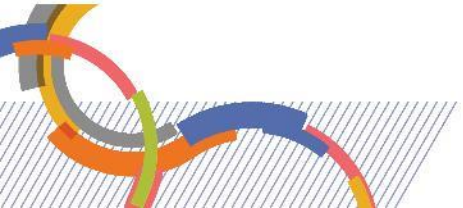
Where are more trains?

- Realistic operating and design headways
- Bottlenecks identified
  - Long tunnels
  - Merging lines
  - Terminal Stations
- Where are more trains?
  - Calculations
  - Simulations

NEVER GRAY

Agenda

- Trapped trains are the problem
- Are more trains necessary?
- Where are more trains?
- Avoidance and mitigation



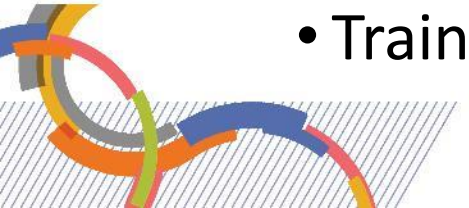
NEVER GRAY

Avoidance and Mitigations

Operations	Headways
• Normal	• Operating headway
• Delay	
• Catch-up	• Design headway

Avoidance and Mitigations

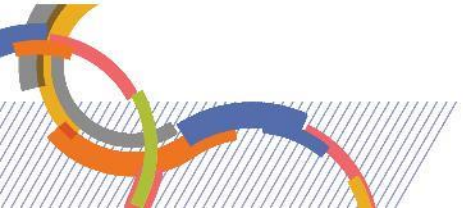
- Signaling System
  - Avoidance - Limit trains
    - Operating headway
    - Design headway
  - Mitigation for trapped trains
    - Operator intervention to exceed limits
    - Reverse capabilities
    - Trains to stations



NEVER GRAY

Avoidance and Mitigations

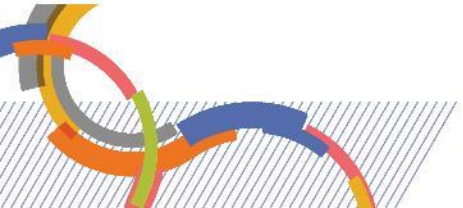
- Traction power
  - Divide traction power blocks



NEVER GRAY

Avoidance and Mitigations

- Train systems
  - Reverse cameras
  - Remove passenger emergency brake
  - Reconfigure passenger emergency brake
  - Onboard mist suppression



NEVER GRAY

Avoidance and Mitigations

- Procedures
  - Update procedures
  - Trains to stations
  - Blow in direction of train traffic
  - Drills

NEVER GRAY

Conclusion

- Solutions for multiple trains in a vent zone while increasing train capacity
  - Trapped trains are the problem
  - Are more trains necessary?
  - Where is it necessary?
  - Avoidance and mitigation