Keep the Train on Schedule, Traffic Flowing, and Pedestrians/Cyclists Safe

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Highway-Rail Intersection (HRI) Types
(Commuter/Light Rail)

1. Grade Separation
   - Construction costs
   - O & M Costs

2. Grade Crossing
   a. Right-of-way
   b. Impacts on
      i. Train operations
      ii. Traffic operations
      iii. Safety

Skyway Bridge over Brighton Blvd during construction

Ellsworth Ave /RTD Park-N-Ride Grade Crossing, R Line, Denver
Feasibility Study
(To Determine Grade Separation Vs. Grade Crossing)

- Traffic volumes
- Safety Impacts / Crash history
- Distance to adjacent intersections (particularly traffic signals)
- Queue analysis
- Effectiveness of mitigation
- Coordinated corridors
1. Static signs and/or pavement markings only
2. Provide no indication as to a train’s imminent presence
3. Driver’s responsibility to ensure that a crossing is safe before attempting to proceed
At the Crossing – Active Warning System

1. Static signs and/or pavement markings
2. Automatic gates
3. Flashing-light signals
4. Traffic signals
5. Actuated blank-out signs
6. Variable message signs
Signal Control and Timing Strategies

1. No signal priority for the train
2. Transit signal priority
3. Preemption
4. Intelligent grade crossings
5. Positive train control
No Signal Priority for The Train

- Minimal impact to traffic
- Easy to maintain signal coordination
- Center- and side-running LRT
- Actuated or fixed-time signals
Transit signal priority

1. Reduce the delay transit vehicles experience at traffic signals
2. No or minimal interruption to traffic signal coordination
3. Maintain normal signal operations and overall signal cycle
4. Two basic methods:
   • Red Truncation
   • Green Extension
Preemption

1. Impacts
   a. Traffic signal immediately transfers to a special control mode
   b. Disruptive to signal operation and coordination
   c. Requires recovery strategies to return to coordination

2. Three stages:
   a. Entry into Preemption
   b. Preemption Hold operation
   c. Exit from Preemption
Preemption

Simultaneous Preemption
Design Case

Advanced Preemption
Design Case

Similar to Simultaneous Preemption,
But the RTT Starts Earlier
Positive train control

**Slowing or stopping a train before an accident**

**Tracking the train**
- A train’s location and speed are tracked by GPS and sent to a local network operations center.
- The center can slow or stop a train remotely if it is going too fast or approaching a stop signal or misaligned switch and the engineer fails to act.

**Staying in sync**
Switches, radio towers, signals, the train and the network operations center continuously share information to track the train’s progress.
Intelligent grade crossings

1. Integrate railroad operating systems with traffic management systems
2. Provide advance warning of approach trains through interconnected information systems
3. Alert train engineer of obstacles, trapped vehicles, trespassers
4. Real-time data from traffic and transit operations can be archived and used for planning, research, performance monitoring, and policy purposes
Selecting A Signal Control Strategy

1. Controller firmware capabilities
2. Agency policy
3. Cycle length
4. Complexity of phases
5. Traffic on intersecting streets
6. Protection of min clearance times for pedestrians
7. Minimum phase times
8. Accuracy of check-out mechanisms
How Do We Know If the Strategy Works?

1. Design -> Build -> Test -> Change Design -> Reconstruct
2. Integrated System Test (Bench test)
3. Multimodal Simulation Models
Example: Denver CBD Transit System (LRT and Buses) (RTD)
Example: A Line/DUS-DIA Commuter Rail (RTD)

The first in the U.S. to have PTC built into a commuter rail system "from the ground up," complying with the new federal requirements
Example: Green Line LRT (Calgary)
Example: R Line/I-225 LRT (RTD)
Thank you

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