Dynamic Exit Gates – Troublemaker or Silver Bullet?

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Agenda

1. Problem Statement
2. Background
   - Quiet Zones
   - Existing and Planned RTD Operations
3. References
   - Publications
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4. Conclusions

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Problem Statement

- RTD's Fastracks corridors are using quiet zones
- The quiet zones need four quadrant gate SSMs
  - Should we use timed or dynamic exit gates?
    - The LRT design criteria include timed exit gates
    - The CRT system is using dynamic exit gates
  - How do we accommodate all users?
    - Colorado statute defines bicycles as 'vehicles'
    - Current dynamic exit gate detection systems do not reliably detect bicycles and similar users

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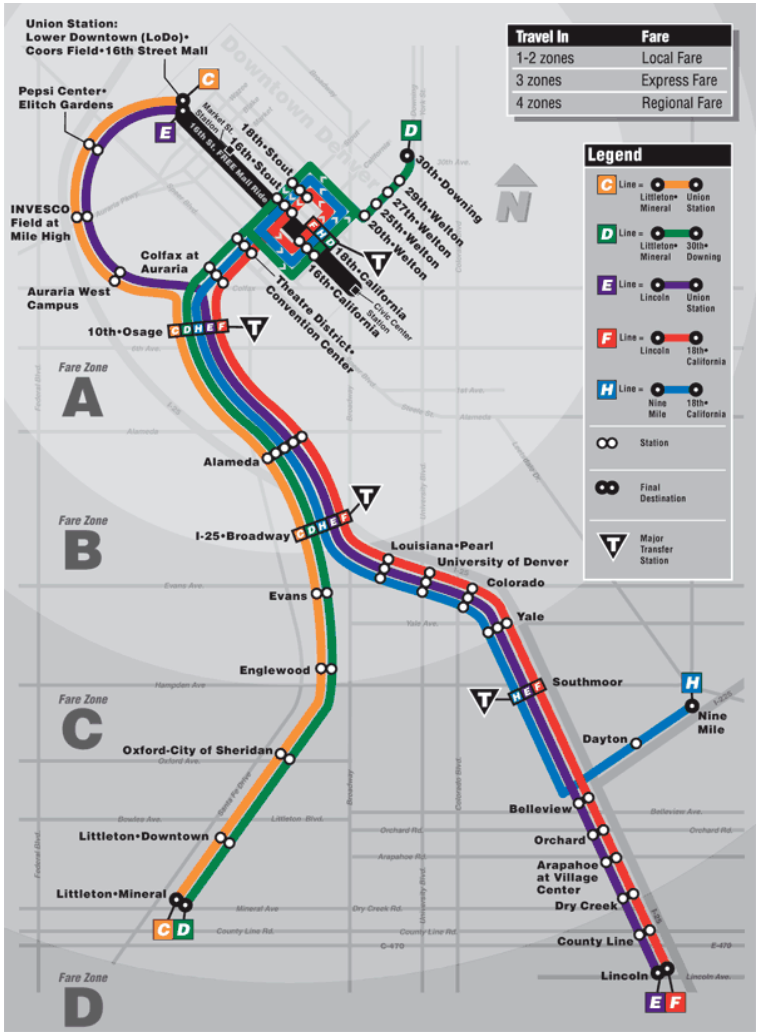
Existing RTD System

- Four Light Rail Corridors
  - Central (1994)
  - Southwest (2000)
  - CPV (2002)
  - Southeast (2006)
- Bus Routes
  - Local
  - Regional
  - Express
- Park-n-Ride system
- Paratransit



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RTD Fastracks Program

- 122 miles of rail transit
  - 2 light rail lines
  - 4 commuter rail lines
- 18 miles of bus rapid transit
- 57 new rail and/or BRT stations
- 31 new Park-n-Rides
  - 21,000+ parking spaces
- Denver Union Station Redevelopment

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Commuter Rail versus Light Rail

Commuter Rail

Typically serves longer distances with fewer stops; top speed of 79 mph, 90 seated passengers plus 140 standees

Light Rail

Typically serves shorter distances with more stops; top speed of 55 mph, 64 seated passengers plus 80 standees

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Existing RTD Operations (LRT)

- Central Corridor
  - Two at-grade crossings shared with Union Pacific RR
  - No exit gates
  - Traffic signal control in downtown
- Southwest (C and D lines)
  - No added crossings (uses Central Corridor and CPV)
- Central Platte Valley (CPV)
  - Three gated crossings
  - Reconfigured with West Corridor
- Southeast (E, F and H lines)
  - No added crossings (uses Central Corridor and CPV)

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Fastracks RTD Operations (CRT and LRT)

LRT Corridors

- Not under FRA rule
- W Line (2013)
  - Multiple at-grade crossings with timed exit gates
  - RTD established quiet zone similar to FRA rule
- R Line (late 2016)
  - Multiple at-grade crossings with timed and dynamic exit gates
  - RTD intends to establish quiet zone similar to FRA rule
- Southeast & Southwest Extensions
  - One crossing on Southeast
  - Not yet designed

CRT Corridors

- FRA Quiet Zones planned
- CU A Line / G Line (2016)
  - Multiple at-grade crossings with dynamic exit gates*
- B Line (2016)
  - No public at-grade crossings in current phase
  - Future segment not designed; multiple at-grade crossings planned
- N Line (2018)
  - Four at-grade crossings
  - Exit gates being designed

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Why Quiet Zones?

- Result of environmental evaluations
  - NEPA studies in Federally-funded corridors
  - EEs in non-federal corridors
- Noise impacts were identified as impacts
  - Residential areas along most corridors
- Quiet zones used as a key noise mitigation

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Quiet Zones

- Enabled by Federal legislation (49 CFR 222)
- Train Horn Rule
  - Requires the use of train horns at public crossings
  - Provides options to silence horns (Quiet Zones)
  - Local agency application and reporting
- Safety must be maintained in Quiet Zones
  - Supplemental Safety Measures (Appendix A)
  - Alternate Safety Measures (Appendix B)
  - More significant monitoring and reporting with ASMs

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Why Choose Exit Gates as an SSM?

- Medians
  - Adjacent intersections preclude use
- Closures
  - Neighborhood and transportation disruptions
- One-way systems
  - Neighborhood and transportation disruptions
- Exit Gates
  - No fatal flaws identified
  - MUTCD identifies them for use in locations where queuing is a concern

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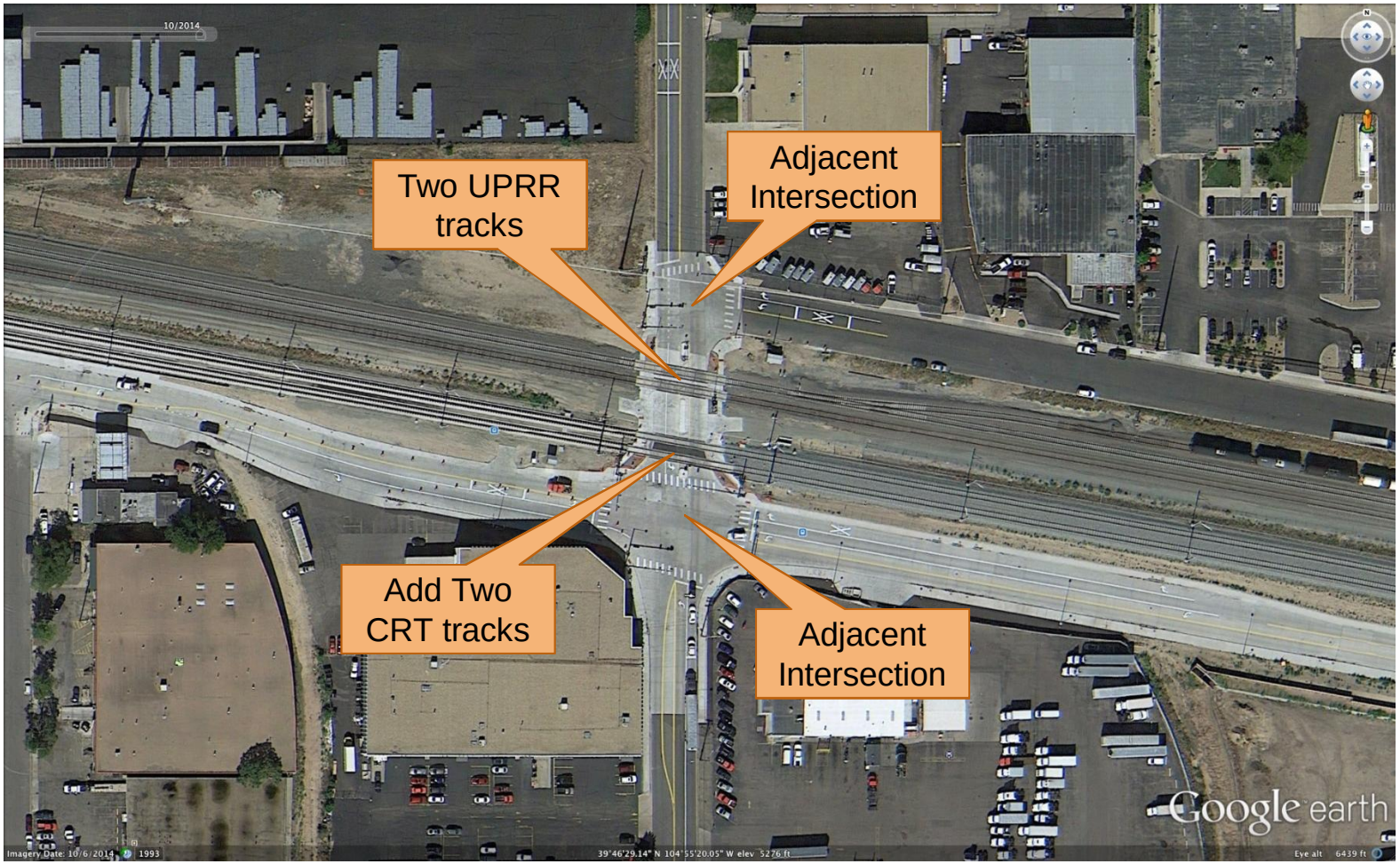
Example – Holly Crossing



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Exit Gate Operating Modes

Timed Exit Gates

- Approximately 30 seconds before train arrival, flashing lights activate
- Four seconds later, entrance gates begin to descend, taking 10-12 seconds
- Exit gates begin to descend after a calculated clearance interval expires

Dynamic Exit Gates

- Approximately 30 seconds before train arrival, flashing lights activate
- Four seconds later, entrance gates begin to descend, taking 10-12 seconds
- If no vehicle is detected, exit gates begin to descend about one second after the entrance gates.
- If a vehicle is detected, exit gates remain up until the detection clears

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National References - Traffic

- MUTCD (2009)
  - Provides for the use of exit gates with timed or dynamic operation
  - *California MUTCD*
    - *Only allows dynamic operation*
    - *Agrees with CA PUC and CALTRAC*
    - *Human-powered vehicles excluded*
- FHWA Traffic Detector Handbook (2006)
  - Discusses loops, including effectiveness and limitations
  - Does not reflect recent advances in detection technologies

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National References - Rail

- Train Horn Rule
  - Provides information for dynamic and timed exit gates
  - Higher effectiveness for timed exit gates

    The higher effectiveness rate for four quadrant gates without presence detection does not mean that they are inherently safer than four-quadrant gates with presence detection. Four-quadrant gates with presence detection have been assigned a lower effectiveness rate because motorists may learn to delay the lowering of the exit gates by driving onto the opposing lane of traffic immediately after an opposing car has driven over the grade crossing. Since the presence detection will keep the exit gate raised, other motorists at the crossing who observe this scenario may also be tempted to take advantage of the raised exit gate by driving around the lowered entrance gates, thus increasing the potential for a crossing collision.
- AREMA C&S Manual
  - Mentions dynamic and timed exit gates
  - Brief discussion of exit gate timing

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Other System References

- Northeast Corridor – Amtrak (FRA)
  - School Street – dynamic exit gates with delay
- Long Island Railroad (FRA)
  - Little Neck Pkwy – dynamic exit gates
- New Jersey Transit (FRA)
  - Montclair / Boonton Line – dynamic exit gates with a limit on how long the exit gate stays open
- Chicago CTA (FRA)
  - Avoids exit gates due to perceived issues
- LA Metro Blue Line (FRA)
  - Timed exit gates

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General Conclusions

- Exit gates are relatively uncommon
  - Several systems responded that they do not use them
- No industry standard for exit gate operation
  - Five systems reviewed – five different operating modes
- Existing operators take different approaches
  - No apparent criteria within these agencies
- Several sources mentioned ongoing studies

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RTD Approach

- RTD's long-term goal is to settle on an approach
  - May or may not be consistent between LRT and CRT
  - New detection technology is expected to play a role
- In the interim, RTD is doing the following:
  - Continuing with timed exit gates on the W line (LRT)
  - Moving forward with both dynamic exit gates and dynamic exit gates with timed delay on the R line (LRT)
  - Using dynamic exit gates with timed delay on CRT
  - Testing detection technology on W Line (LRT)
    - Results are promising, but not definitive

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