

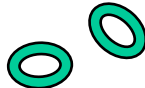


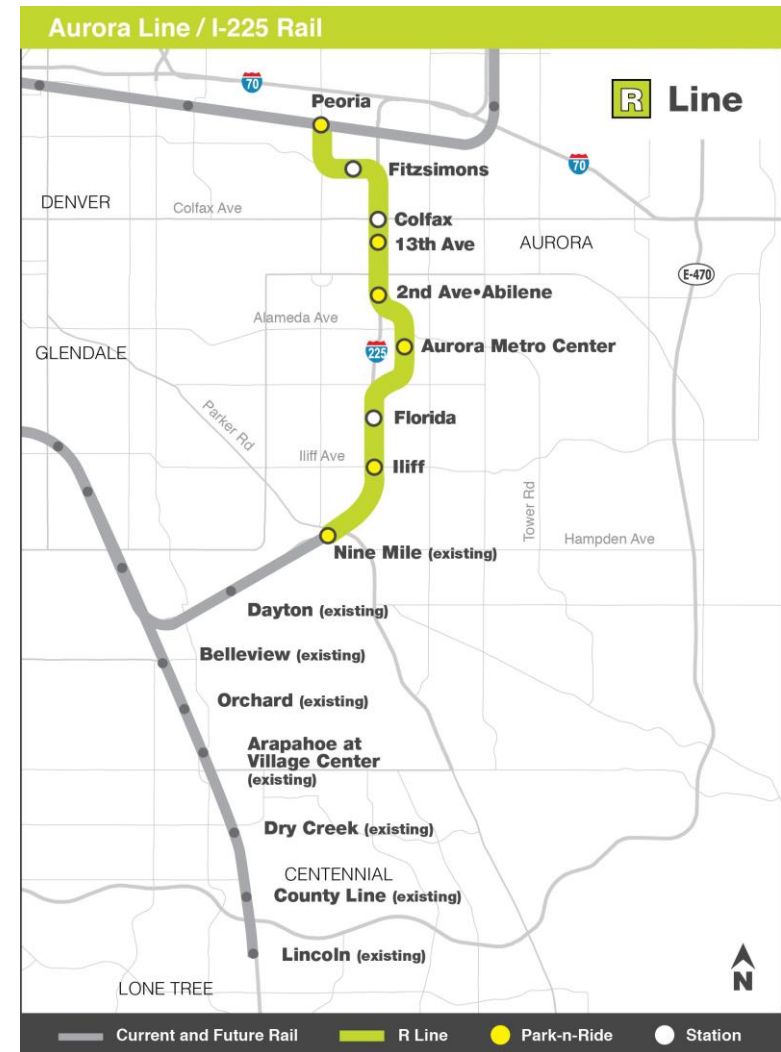
Developing a Schedule for the R Line: RTD's New Suburban Light Rail

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Link between Planning and Scheduling: I-225 Corridor Project

- Project history
- Examples throughout the planning process
 - Strong link 
 - Broken link (Value Engineering) 
 - Missing link 
- Current performance



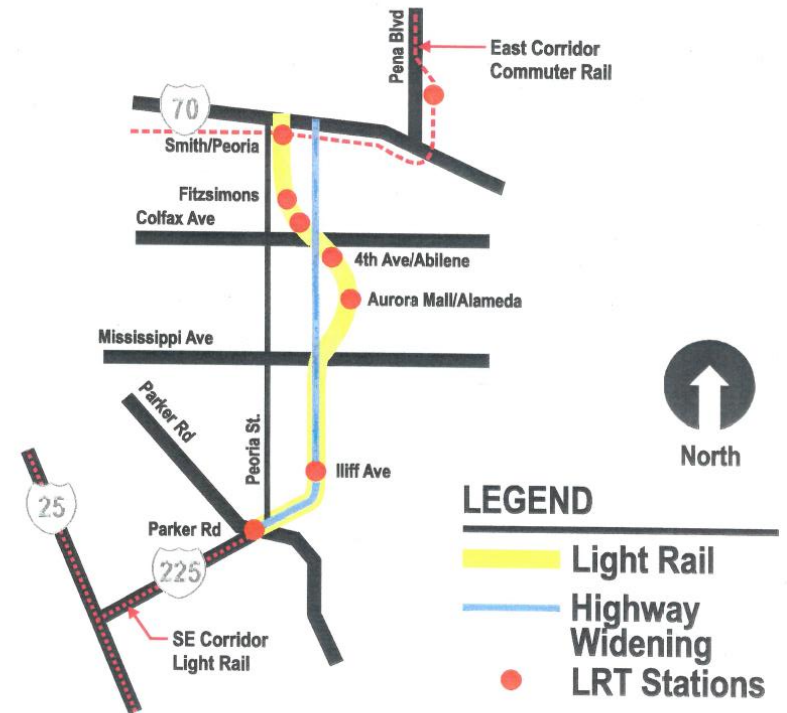
I-225 Corridor Project History

- Major Investment Study (2001)
- FasTracks Plan (2004)
- 3 Corridor Scoping Study (2006)
- Environmental Evaluation / 30 percent design (2009)
- Design/Build Contract Awarded (2012)
- Construction Began (2013)
- Opened for Revenue Service (2017)

Major Investment Study (MIS)

- Deviations
- Frequent service and optimistic travel times
- Unrealistic fleet requirements → no maintenance facility recommended
- Simplified operations assumptions

Figure 5-1: Locally Preferred Alternative

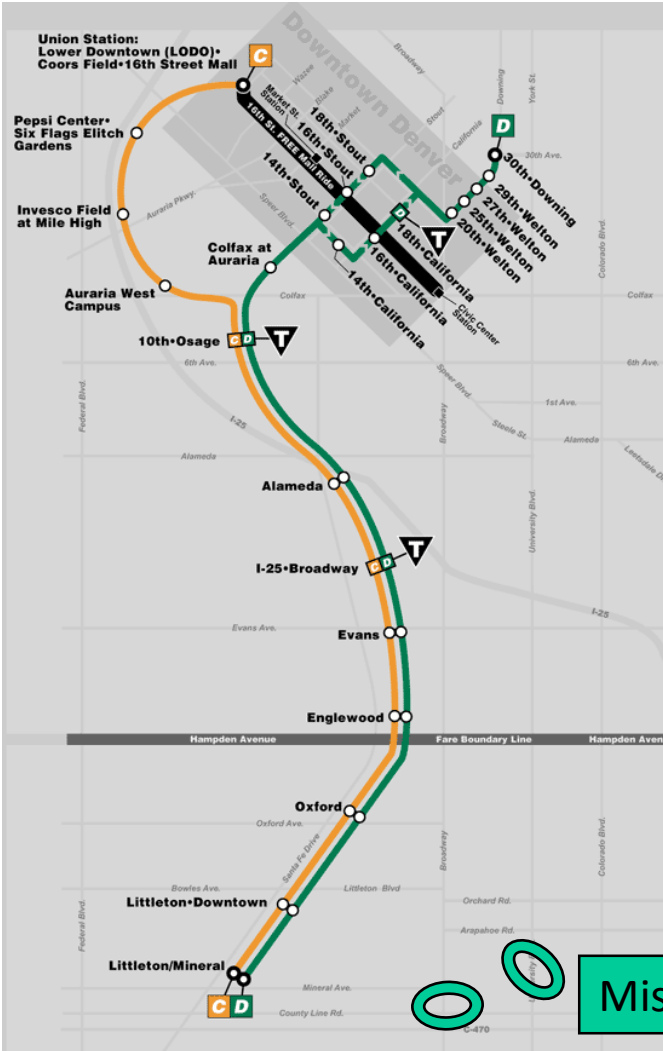


Source: RTD, 2001



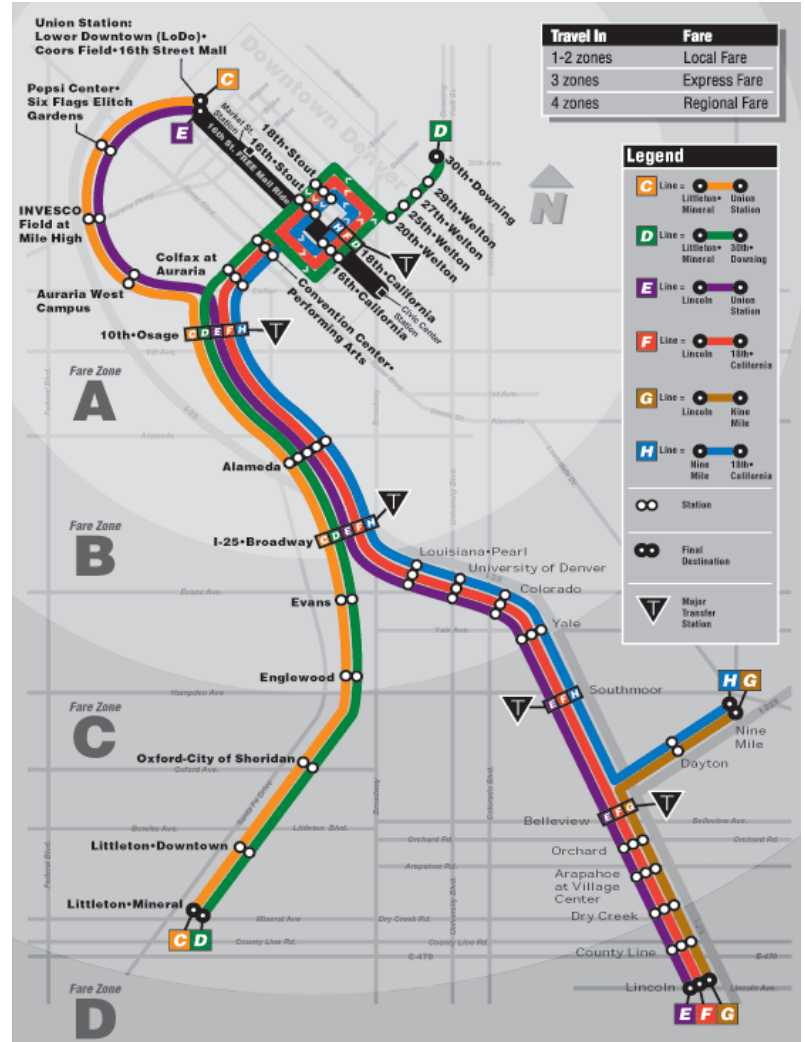
Light Rail System During Initial Planning

RTD Light Rail System: 2001 - 2006

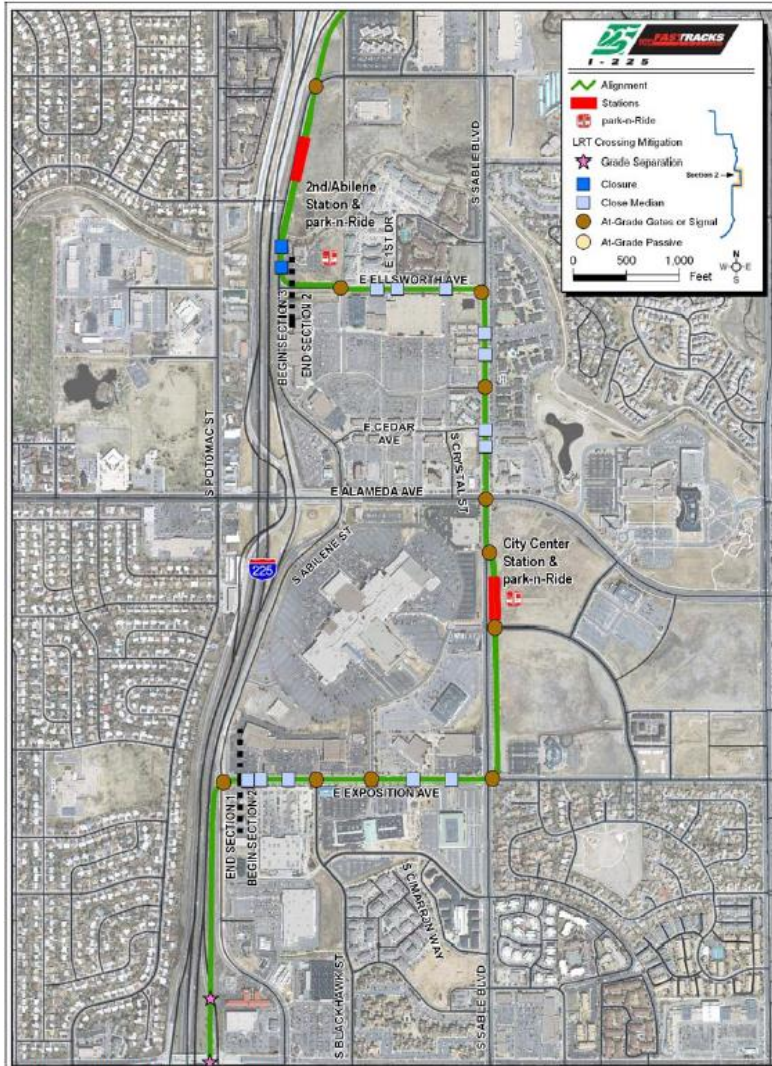


Missing Link

RTD Light Rail System: 2006 - 2009



Environmental Evaluation (EE) Alignment



Source: Fastracks I-225 Team, 2009

- Maintained and added deviations
- 25 signalized at-grade crossings



At-Grade Signalized Intersection Treatment

The project team assumed that LRT vehicles will not generally be provided preemption at signalized intersection crossings. This assumption minimizes vehicular delay, but increases overall corridor LRT travel times. Signal preemption is, however, assumed at the two lateral crossings of Sable south of Alameda and Peoria at 25th and at the two non-intersection locations with gates (4th Avenue, 13th Avenue). Signal timing will be addressed in coordination with the City of Aurora after the final design is complete on a case-by-case basis to provide an appropriate balance between vehicular delay and LRT travel times.

Source: FasTracks I-225 Environmental Evaluation, Transportation Systems Technical Report, 2009

Example Intersection Addressed with the City



Source: RTD, 2017



Environmental Evaluation Operating Plan

- Operating plan fundamentally changed during EE study as a result of input from rail scheduling

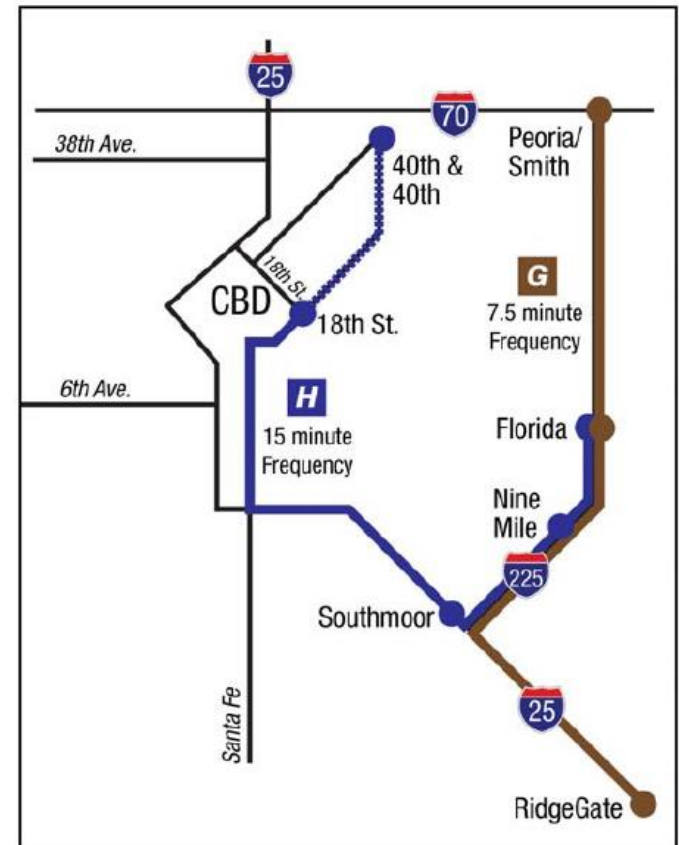


Figure 2.1 Preferred Alternative 2035 Operating Plan and Peak Period Frequency

Source: Fastracks I-225 Team, 2009



Strong Link

Environmental Evaluation Operations Details

- Pocket track at Florida station
 - Minimum length to accommodate a 4-car train
 - No opportunity for mid-day car cuts
- No additional storage or maintenance facilities were added to the project based on outdated assumptions made during the MIS

Florida Station Pocket Track



Source: RTD, 2016



Broken Link

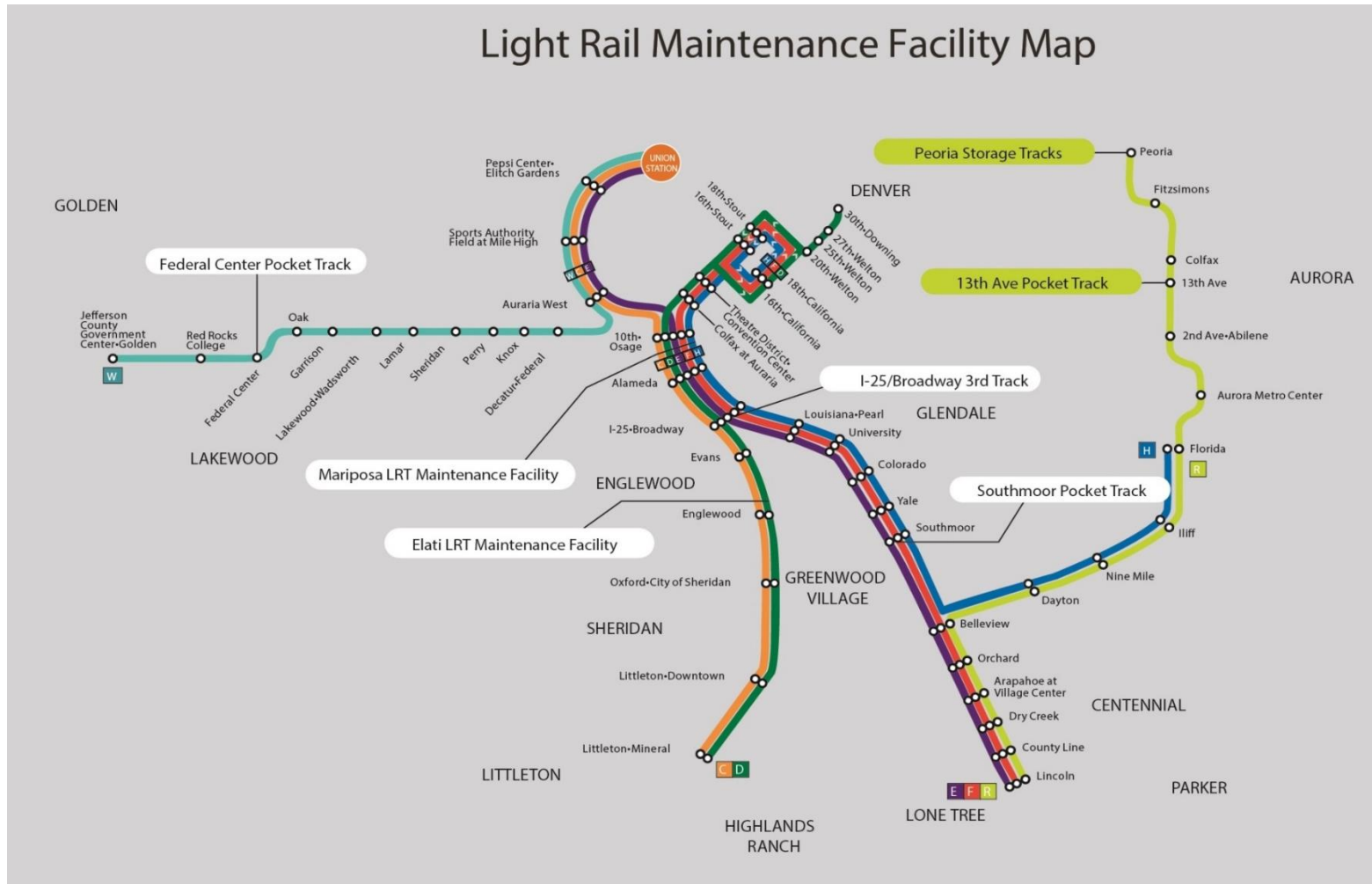
Design/Build Project

- 2012: RTD received unsolicited proposal to complete construction of the I-225 corridor
 - Contractor assumed 30% design was ready for construction
- Many issues still needed to be addressed
 - Treatment of at-grade crossings
 - Stakeholders had not agreed on final alignment
 - Rail storage and maintenance facilities



Broken Link

Addition of Storage Facilities



Source: RTD Planning, 2012



Strong Link

Peoria End of Line Station

R Line Tail Tracks
(18 LRVs)

A Line Commuter
Rail Platform

R Line Light Rail
Platform

Light Rail
Maintenance "Shed"



Scheduling Challenges with Storage Tracks

- LRVs must be scheduled to return to the main (Elati) maintenance facility every other day
- Most trains still start from Elati facility
 - 30 minute deadheads
- End of line not ideal for minimizing deadheads
- Storage shed with light cleaning equipment located near platform not tail tracks



Broken Link

13th Avenue Station / Pocket Track

Pocket Track

RTD Bus Facility
Parking



Intersection Treatments

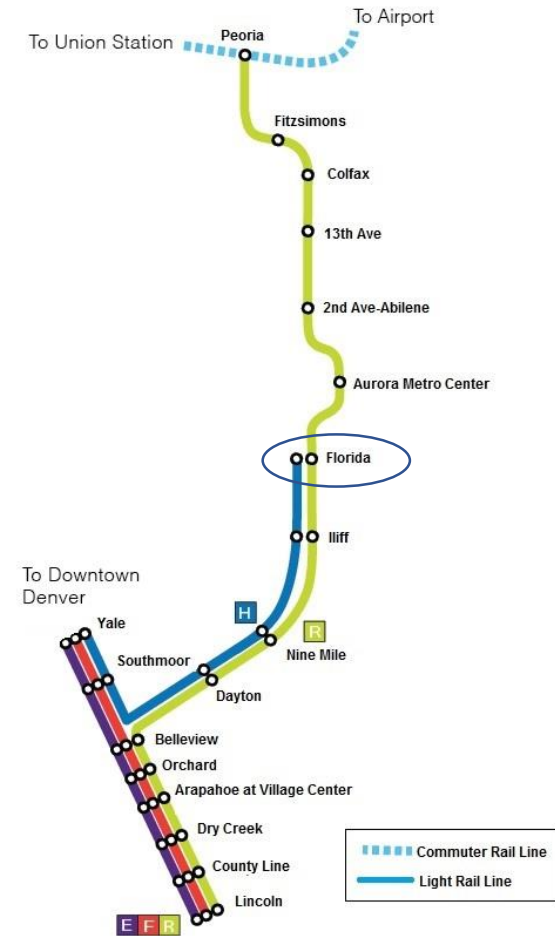
- Per the EE, preemption was not used at all grade-crossings
- Worked with City of Aurora, Colorado Public Utilities Commission (PUC), and Design/Build contractor to determine “concept of operations” for all 12 signalized crossing
 - Full preemption (most gated crossings)
 - Transit Signal Priority (ungated)
 - Right time to proceed (gated crossings of two major arterials)
- Travel times through crossings determined through VISSIM and bench testing



Rail Simulation

- LTK TrainOps software
- Travel times
- Fleet requirements
- Schedule to accommodate junction slotting
 - Included recovery time at Florida Station for Southbound R Line trains

Line	Simulated Travel Times (mm:ss)			
	Direction	Average	Minimum	Maximum
R	North	54:37	51:59	57:56
R	South	58:27	58:00	61:06



Source: RTD, 2016

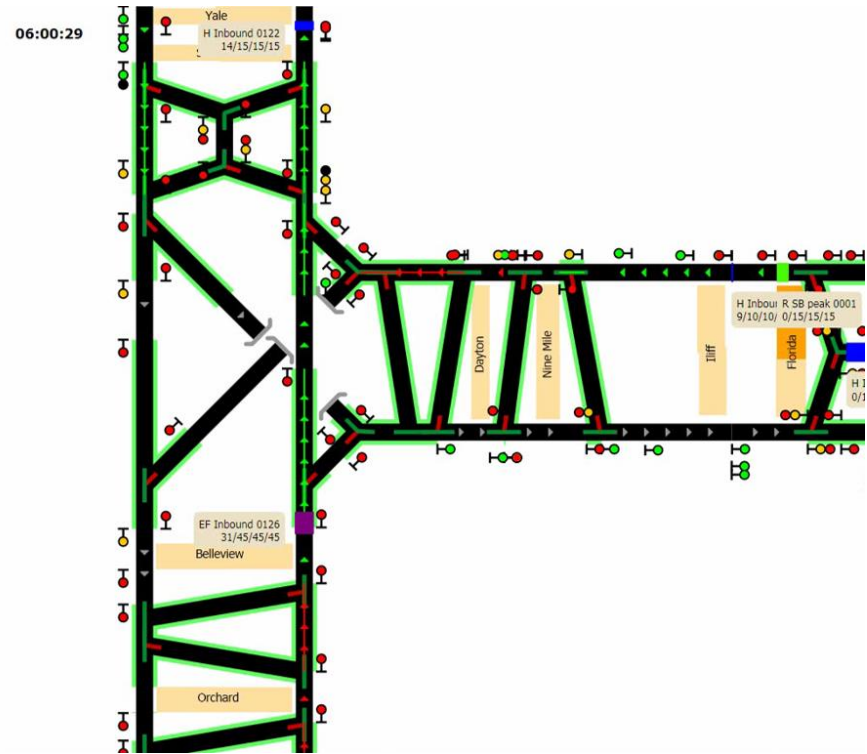


Strong Link

Simulation Results

- Southbound schedule recovery time at Florida critical for:
 - Junction slotting
 - Minor disruptions to existing service

Florida Station Schedule Recovery	
Hold Time (Min)	Trips
0	4
0-1	2
1-2	6
2-3	5
3+	0
Total	17



Source: LTK, 2016



Strong Link

R Line Operations

- Opened for revenue service Feb 24, 2017
- Intersection operations generally working well
 - Significant delays at the two right time to proceed crossings
- Reduced Florida Station recovery time in May 2017
- Ridership is low
 - R Line < 5,000 riders/day
 - 38 boardings/service hour
- Corridor design challenges result in operating more service than warranted

Key Takeaways

- Transit operations does not always drive project decisions
- Difficult to make changes during a design/build project
- Input from schedulers is critical to the success of capital projects



Source: RTD, 2017

Questions

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