RMRA: High Speed Rail Feasibility Study for Colorado
Purpose: To **determine the technical, financial and economic feasibility** of implementing high-speed intercity passenger rail service in the I-25 and I-70 Corridors and secondary corridors along I-70.

The study **will not make final decisions** on alignment or station locations. It will recommend whether further study is warranted.
Alternatives at a Glance

6 technology categories

- 79 MPH Diesel
- 110 MPH Diesel
- 120-150 MPH Electric
- 150-220 MPH Electric
- 125 MPH Maglev
- 250-300 MPH Maglev

4 route types

- Highway Right of Way
- Highway Corridor/Valley
- Unconstrained
- Freight Lines (with and without freight rail relocation – R2C2)

2 station types

- Primary
- Secondary
Conventional Rail in Freight Railroad Corridors and 4 Percent Grade I-70 Unconstrained Route

#1 – I-70 Unconstrained (4%) with Existing Rail I-25

- Allows Mix and Match
- Diesels evaluated only for I-25

Legend:
- Main Stations
- Secondary Stations
- Junction and Operational
Advanced All Axles Powered EMU and Maglev for I-70 Highway 7 Percent Grade and I-25 Highway and Greenfield Route

#2 – I-70 Highway ROW (7%) with Greenfield I-25

Allows Mix and Match

Legend
- Main Stations
- Secondary Stations
- Junction and Operational

Proposed Colorado Maglev

ICE EMU

Transrapid Maglev
## I-25 South – Preliminary Operational Assessment:
**Time, Average Speed and One Way Fare @ $.32 per mile**

| Technology       | Conventional Amtrak | Talgo TPH  | Eurostar  | ICE EMU  | Transrapid Magnet
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>79-mph Existing Rail Non tilting</td>
<td>110-mph Existing Rail Tilting</td>
<td>150-mph Existing Rail Tilting</td>
<td>220-mph HWY ROW/GF Tilting</td>
<td>300-mph HWY ROW/GF Tilting</td>
</tr>
<tr>
<td><strong>Denver - to - Colo Springs</strong></td>
<td>Joint Line 72 mi</td>
<td>1:45 41 mph $23 fare</td>
<td>1:05 66 mph $23 fare</td>
<td>0:58 74 mph $23 fare</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Greenfield 97 mi</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0:44 132 mph $25 fare</td>
</tr>
<tr>
<td><strong>Colo Springs - to - Pueblo</strong></td>
<td>Joint Line 46 mi</td>
<td>1:00 46 mph $15 fare</td>
<td>0:35 79 mph $15 fare</td>
<td>0:32 86 mph $15 fare</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Greenfield 48 mi</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0:27 107 mph $15 fare</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0:25 115 mph $15 fare</td>
</tr>
</tbody>
</table>
## I-70 East of Avon – Preliminary Operational Assessment:
**Time, Average Speed and One Way Fare @ $.32 per mile**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
<th>DIA - to - Avon</th>
<th>Denver - to - Copper</th>
<th>Copper - to - Minturn</th>
<th>Minturn - to - Avon</th>
<th>Denver - to - Black Hawk</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICE EMU</td>
<td>220-mph 4% Unconstrained w/o Clear Creek Canyon</td>
<td>2:13 142 mi 64 mph $42 fare</td>
<td>2:06 62 mph $42 fare</td>
<td>1:51 70 mph $42 fare</td>
<td>0:19 73 mph $7 fare</td>
<td>0:54 39 mph $11 fare</td>
</tr>
<tr>
<td>ICE EMU</td>
<td>220-mph 7% HWY ROW w/Vail Pass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0:54 39 mph $11 fare</td>
</tr>
<tr>
<td>Transrapid Maglev</td>
<td>300-mph 7% HWY ROW w/Vail Pass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0:53 40 mph $11 fare</td>
</tr>
</tbody>
</table>

**SUMMARY**

- **DIA**
  - to - **Avon**
  - **I-70** 130 mi
  - **Time**: 2:13
  - **Average Speed**: 64 mph
  - **Fare**: $42

- **Denver**
  - to - **Copper**
  - **I-70** 79 mi
  - **Time**: 1:22
  - **Average Speed**: 58 mph
  - **Fare**: $25

- **Copper**
  - to - **Minturn**
  - **I-70** 23 mi
  - **Time**: 0:32
  - **Average Speed**: 64 mph
  - **Fare**: $7

- **Minturn**
  - to - **Avon**
  - **UP RR** 5 mi
  - **Time**: 0:07
  - **Average Speed**: 43 mph
  - **Fare**: $3

- **Denver**
  - to - **Black Hawk**
  - **US-6** 35 mi
  - **Time**: 0:54
  - **Average Speed**: 39 mph
  - **Fare**: $11
Fare Sensitivity: Impact of Fare Options on Alternative Technologies

Revenue vs Fare Options

- Optimized Fare Zone
- 79mph
- 110mph
- 125mph
- 150mph
- 220mph
- 300mph

Revenue (in million $)
Fare cents/mile

79mph
110mph
125mph
150mph
220mph
300mph
Market Shares
(Low Gas Price Scenario for 2025)
(Central Demographic/Low Gas, 2025; for 79, 110, 125-mph)

214 Million Total Trips

79 mph Market Shares (2025)

96.0%

110 mph Market Shares (2025)

94.2%

125 mph Market Shares (2025)

87.9%
Market Shares (Low Gas Price Scenario for 2025)
(Central Demographic/Low Gas, 2025; for 150, 220, 300-mph)

150 mph Market Shares (2025)

- Auto: 88.8%
- Bus: 2.5%
- Rail: 0.2%
- Air: 0.1%

220 mph Market Shares (2025)

- Auto: 86.2%
- Bus: 11.3%
- Rail: 0.1%
- Air: 2.3%

300 mph Market Shares (2025)

- Auto: 84.8%
- Bus: 12.8%
- Rail: 0.1%
- Air: 2.3%

214 Million Total Trips
4 % Grade Capable Electric Locomotive w/ 2nd Car Assist
Ridership: Millions of Riders
150-mph Electric Rail
(Central Demographic/Low Gas, 2025)

I-25 – Existing Rail; I-70 – Unconstrained (4%)

150-mph: 15.53 Million per year

* Selected Stations and Routes are for Analysis Purposes Only
7% Grade Capable All Axles Powered Tilting EMU
Ridership: Millions of Riders
220-mph Electric Rail
(Central Demographic/Low Gas, 2025)

I-25 – Greenfield; I-70 – ROW (7%)

220-mph: 20.69 Million per year

* Selected Stations and Routes are for Analysis Purposes Only
Ridership: Millions of Riders
300-mph Maglev
(Central Demographic/Low Gas, 2025)

I-25 – Greenfield;  I-70 – ROW (7%)

300-mph: 23.65 Million per year

* Selected Stations and Routes are for Analysis Purposes Only
Market Shares  
(Central Gas Price Scenario for 2035)  
(Central Demographic/Central Gas, 2035; for 79, 110, 125-mph)

79 mph Market Shares (2035)

212 Million Total Trips

110 mph Market Shares (2035)

125 mph Market Shares (2025)
Market Shares (Central Gas Price Scenario for 2035)
(Central Demographic/Central Gas, 2035; for 150, 220, 300-mph)

150 mph Market Shares (2035)
- Air: 12.0%
- Bus: 0.3%
- Car: 3.7%
- Rail: 84.1%

220 mph Market Shares (2035)
- Air: 16.0%
- Bus: 0.3%
- Car: 3.4%
- Rail: 80.3%

300 mph Market Shares (2035)
- Air: 17.5%
- Bus: 0.3%
- Car: 3.3%
- Rail: 79.0%

212 Million Total Trips
Financial Analysis
(for Federal Funding Participation)

FRA requires a Positive Operating Ratio > 1.00

\[
\text{Operating Ratio} = \frac{\text{Operating Revenue}}{\text{Operating Cost}}
\]

Means the system can run without an operating subsidy.
Economic Analysis

FRA Requires a Positive Cost Benefit Ratio > 1.00

Cost Benefit Analysis = \frac{\text{Economic Benefit}}{\text{Economic Cost}}

Means the system produces a positive net contribution to the economic well-being of the Country.
I-25 ONLY 2035 / Central Gas

I-25 Existing Rail

Option 1: 79-mph

Conventional Amtrak

Diesel Train

I-25 Existing Rail route only (provides no service to the I-70 Corridor)

Operating Ratio: 0.64
Cost-Benefit Ratio: 0.19
Total Cost: $2.9 Billion

OPTION 1: Capital Costs

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>I-25</td>
<td>2.7</td>
<td>Billion</td>
<td></td>
</tr>
<tr>
<td>I-70</td>
<td>/</td>
<td>Billion</td>
<td></td>
</tr>
<tr>
<td>Vehicle</td>
<td>0.1</td>
<td>Billion</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>2.9</td>
<td>Billion</td>
<td></td>
</tr>
</tbody>
</table>

Only Serves I-25
110-mph
I-25 Existing Rail

I-25 ONLY 2035 / Central Gas

Talgo T21

High-Speed Diesel Train
(I-25 Existing Rail Route Only)*
* Provides no service to the I-70 Corridor

OPTION 2: Capital Costs

<table>
<thead>
<tr>
<th></th>
<th>I-25</th>
<th>I-70</th>
<th>Vehicle</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.7</td>
<td>/</td>
<td>0.2</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Only Serves I-25

Operating Ratio: 1.14
Cost-Benefit Ratio: 1.04
Total Cost: $2.9 Billion
I-25 & I-70 2035 / Central Gas

150-mph, 4% Grade
I-70 Unconstrained
& I-25 Existing Rail

High-Speed Electric Train
(I-70 Unconstrained &
I-25 Existing Rail Routes)

OPTION 4: Capital Costs

<table>
<thead>
<tr>
<th>Route</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-25</td>
<td>2.9 Billion</td>
</tr>
<tr>
<td>I-70</td>
<td>15.6 Billion</td>
</tr>
<tr>
<td>Vehicle</td>
<td>0.4 Billion</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>18.9 Billion</strong></td>
</tr>
</tbody>
</table>

No Service West of Eagle County Airport

Operating Ratio: 1.58
Cost-Benefit Ratio: 1.02
Total Cost: $18.9 Billion
I-25 & I-70 2035 / Central Gas

220-mph, 7% Grade
I-70 ROW
& I-25 Greenfield

Very High-Speed Electric Train
(I-70 Highway Right-of-Way & I-25 Unconstrained Routes)

OPTION 5: Capital Costs

<table>
<thead>
<tr>
<th>Route</th>
<th>Cost (Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-25</td>
<td>6.0</td>
</tr>
<tr>
<td>I-70</td>
<td>13.3</td>
</tr>
<tr>
<td>Vehicle</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19.9</strong></td>
</tr>
</tbody>
</table>

*No Service West of Eagle County Airport*

Operating Ratio: 1.84
Cost-Benefit Ratio: 1.28
Total Cost: $19.9 Billion
7% Grade, I-70 ROW & I-25 Greenfield

I-25 & I-70 2035 / Central Gas

**Option 6: 300-mph (7% GF)**

- SS
- C
- FC
- DIA
- GJ
- EA
- A
- P
- TR

**Transrapid Maglev**

**Ultra High-Speed Magnetic Levitation Vehicle**

*I-70 Highway Right-of-Way & I-25 Unconstrained routes*

**Option 6: Capital Costs**

- I-25: 19.2 Billion
- I-70: 15.6 Billion
- Vehicle: 1.8 Billion
- TOTAL: 36.6 Billion

*No Service West of Eagle County Airport*

**Operating Ratio: 2.44**

**Cost-Benefit Ratio: 0.86**

**Total Cost: $36.6 Billion**
I-25 & I-70 2035 / Central Gas

220-mph, 7% Grade, I-70 ROW & 110 mph I-25 Existing Rail

Very High-Speed Electric Train (I-70 Highway Right-of-Way Route) & High-Speed Diesel Train (I-25 Existing Rail Route)

OPTION 7: Capital Costs

<table>
<thead>
<tr>
<th>Route</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-25</td>
<td>2.5</td>
</tr>
<tr>
<td>I-70</td>
<td>13.3</td>
</tr>
<tr>
<td>Vehicle</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16.3</strong></td>
</tr>
</tbody>
</table>

Operating Ratio: 1.44
Cost-Benefit Ratio: 1.02
Total Cost: $16.3 Billion

Transfer at Denver
No Service West of Eagle County Airport
I-25 & I-70 2035 / Central Gas

220-mph, 7% Grade, I-70 ROW & 150 mph I-25 Existing Rail

Very High-Speed Electric Train (I-70 Highway Right-of-Way Route) & High-Speed Electric Train (I-25 Existing Rail Route)

OPTION 8: Capital Costs

I-25: 2.9 Billion
I-70: 13.3 Billion
Vehicle: 0.6 Billion
TOTAL: 16.8 Billion

No Service West of Eagle County Airport

Operating Ratio: 1.68
Cost-Benefit Ratio: 1.20
Total Cost: $16.8 Billion
I-25 & I-70 2035 / Central Gas

300-mph, 7% Grade, I-70 ROW & 110 mph I-25 Existing Rail

Ultra High-Speed MagLev Vehicle (I-70 Highway Right-of-Way Route) & High-Speed Diesel Train (I-25 Existing Rail Route)

Transrapid Maglev

Talgo T21

OPTION 9: Capital Costs

<p>| | | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>I-25</td>
<td>2.6</td>
<td>Billion</td>
</tr>
<tr>
<td>I-70</td>
<td>15.6</td>
<td>Billion</td>
</tr>
<tr>
<td>Vehicle</td>
<td>1.3</td>
<td>Billion</td>
</tr>
<tr>
<td><strong>TOTAL</strong>:</td>
<td><strong>19.5</strong></td>
<td><strong>Billion</strong></td>
</tr>
</tbody>
</table>

Transfer at Denver

No Service West of Eagle County Airport

Operating Ratio: 1.89
Cost-Benefit Ratio: 1.04
Total Cost: $ 19.5 Billion
Next Step
Alternative
Federal Railroad Administration Policy Disconnects

$8 Billion in ARRA and PRIIA Federal Grant Funding to states for improvements to Freight Railroad infrastructure and the purchase of heavy, slow, rigid, conventional rail vehicles for passenger operation in Amtrak Corridors

FRA Intercity Passenger Rail Service must use heavy, slow, loud, rigid, conventional rail vehicles on Freight Railroad tracks due to the potential of collisions with Freight Trains

No current FRA Policy for building unique, dedicated, completely grade separated, SAFE, electric powered, true high speed rail guideways required for Bullet Trains and Ultra High Speed Maglev Vehicles

No National HSR Passenger Standard Developed by the FRA – Every state creates their own Intercity Passenger Rail Network with no guarantee of Interoperability between states

FRA Intercity Passenger service to follow Freight Railroad Tracks which were designed to move very heavy loads at low speeds through industrial corridors. Passengers want to move at high speeds along highway corridors where the West has grown over the past 50 years.
Thank You

Harry Dale
Chairman, Rocky Mountain Rail Authority
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hjd173@wispertel.net
http://rockymountainrail.org