Submitted To

Rocky Mountain Rail Authority

March 2010

High-Speed Rail Feasibility Study
Executive Summary

Submitted by

TEMS

Transportation Economics & Management Systems, Inc.

in association with
Quandel Consultants, LLC
GBSM, Inc.

Executive Summary

1.1 Introduction

The Rocky Mountain Rail Authority (RMRA), a multi-jurisdictional government body comprised of more than 50 Colorado cities, towns, counties and transit authorities, has determined that, based on Federal Railroad Administration (FRA) criteria, high-speed rail is feasible in Colorado's I-70 and I-25 corridors. The FRA considers trains capable of reaching speeds greater than 90 mph high-speed rail.

Colorado has a unique transportation challenge. Our mountain resorts and metropolitan areas play a special role as national and international attractions. The vast majority of the state's commercial and recreational centers are connected by just two major highways, I-70 and I-25. Traffic congestion is increasing in both corridors, impeding travel during weekdays on I-25 and weekends on I-70.

This study evaluated the I-70 corridor from Denver International Airport (DIA) to Grand Junction. I-70 serves as a gateway to more than twenty world-class recreation resorts including Aspen/Snowmass, Beaver Creek, Breckenridge, Copper Mountain, Keystone, Steamboat Springs and Vail. Central City and Blackhawk have formed a multi-casino complex that attracts large numbers of visitors every year. The topography of the corridor creates unique transportation challenges – challenges that can be hampered by unpredictable weather and travel patterns year round.

The study evaluated the I-25 corridor from Cheyenne, WY to Trinidad, CO, passing through the metropolitan areas of Fort Collins, Denver, Colorado Springs and Pueblo along the way. I-25 connects Colorado's growing metropolitan areas along the Front Range. These communities comprise rapidly growing cities and towns with significant commercial and recreational centers.

As a result, the I-25 and I-70 corridors not only have the conventional intercity travel patterns of business, commuter and social trip making, but their demand is overlaid by very-substantial, highly focused flows of local communities along I-25 and out-of-state tourists from DIA to the resorts and vacation spots along both the I-70 and I-25 corridors. All of this combines to challenge Colorado's transportation infrastructure in both corridors.

The 18-month feasibility study, conducted with significant financial and technical support from the Colorado Department of Transportation (CDOT), focused on determining whether options exist that are capable of meeting FRA technical, financial and economic criteria for high-speed rail feasibility.

The study considered a full range of technology options from conventional Amtrak service (with maximum speeds of 79 mph) through high-speed train and magnetic levitation technologies that have maximum speeds of up to 300 mph. It also evaluated a comprehensive set of possible corridors including highway routes, existing and abandoned rail routes, and completely new Greenfield routes. General station locations were also evaluated based on potential market-demand and existing local planning efforts.

Combinations of technologies/routes/stations were analyzed and optimized through a dynamic evaluation process that focused on technical and economic feasibility. In addition, input was

gathered from a steering committee comprised of technical and policy level representatives that met monthly and from teams of local agency stakeholders in both corridors that met at key milestones.

Among the most critical FRA feasibility criteria for high-speed rail are:

- **Positive (>1.0) operating ratio** – This means that, unlike public highways and local transit systems, the project does not require any government subsidies to cover its cost of operation;
- **Positive (>1.0) cost-benefit ratio** – This means that for every dollar of capital and operating costs, the project creates economic benefits greater than one dollar.

The study identified a number of options between Fort Collins and Pueblo in the I-25 corridor and Denver International Airport and Eagle County Airport in the I-70 corridor that exceed the FRA's threshold for high-speed rail feasibility.

For illustrative purposes, one of those options was further optimized and used to develop a sample implementation plan as part of this report. That implementation plan identifies four potential phases for having high-speed rail operational in Colorado as early as 2021.

While the study demonstrates that high-speed rail service in Colorado meets the FRA's tests for feasibility, it is important to note that, as a feasibility study, this study does not make final decisions. Its focus is to determine if feasible options exist and warrant additional analysis. Future studies (e.g. a State Rail Plan, a local transit integration plan and necessary environmental clearance studies) will be responsible for making the ultimate decisions about alignments, technologies, station locations, financing approaches and implementation schedules. It is important to recognize that the options analyzed in this report are not the only options that should be considered in future studies.

1.2 Alternatives Overview

The Feasibility Study took a market-based approach to developing its alternatives. This approach identified potential station locations based on their ability to create intercity trips either as origins (population centers) or destinations (business, entertainment or recreation destinations). While local rail transit (e.g. RTD's light rail and commuter rail system) typically has stations every few miles, high-speed rail station spacing is typically much farther apart (typically 20-50 miles apart) to optimize travel times. More than 40 potential stations were included in the development of alternatives for this study.

Representative route options connecting the potential stations were developed for both the I-25 and I-70 corridors. These representative routes were used to develop mileage and infrastructure cost estimates for various alternatives.

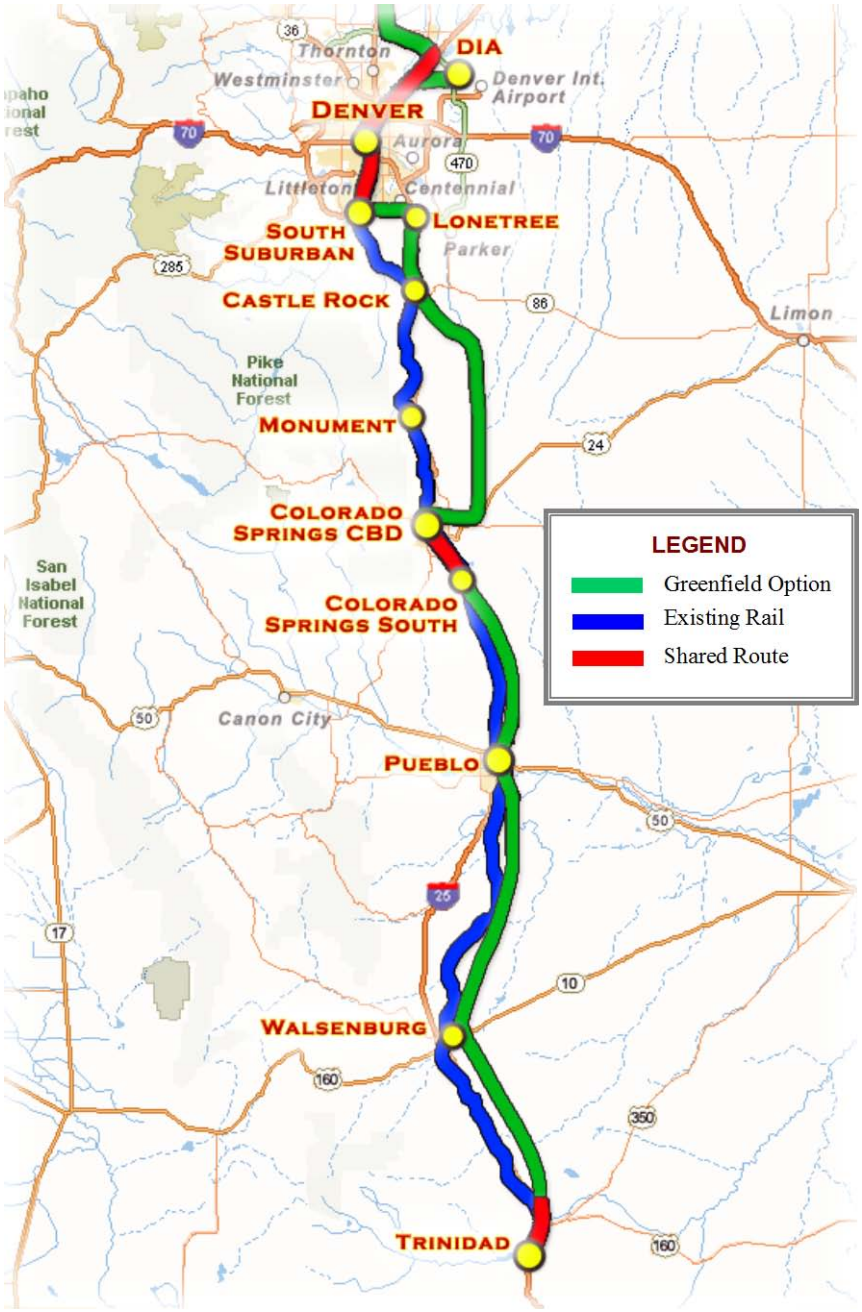
The routes were organized into three categories:

- **Existing Rail** – Using either the tracks or right-of-way of an existing rail corridor. These routes are generally flat (no greater than 3 or 4-percent grades), but can have numerous horizontal curves because they were designed for slower travel speeds. Because existing rail routes were designed to move goods and not people, the routes typically provide less ideal station locations in population centers along highway corridors.

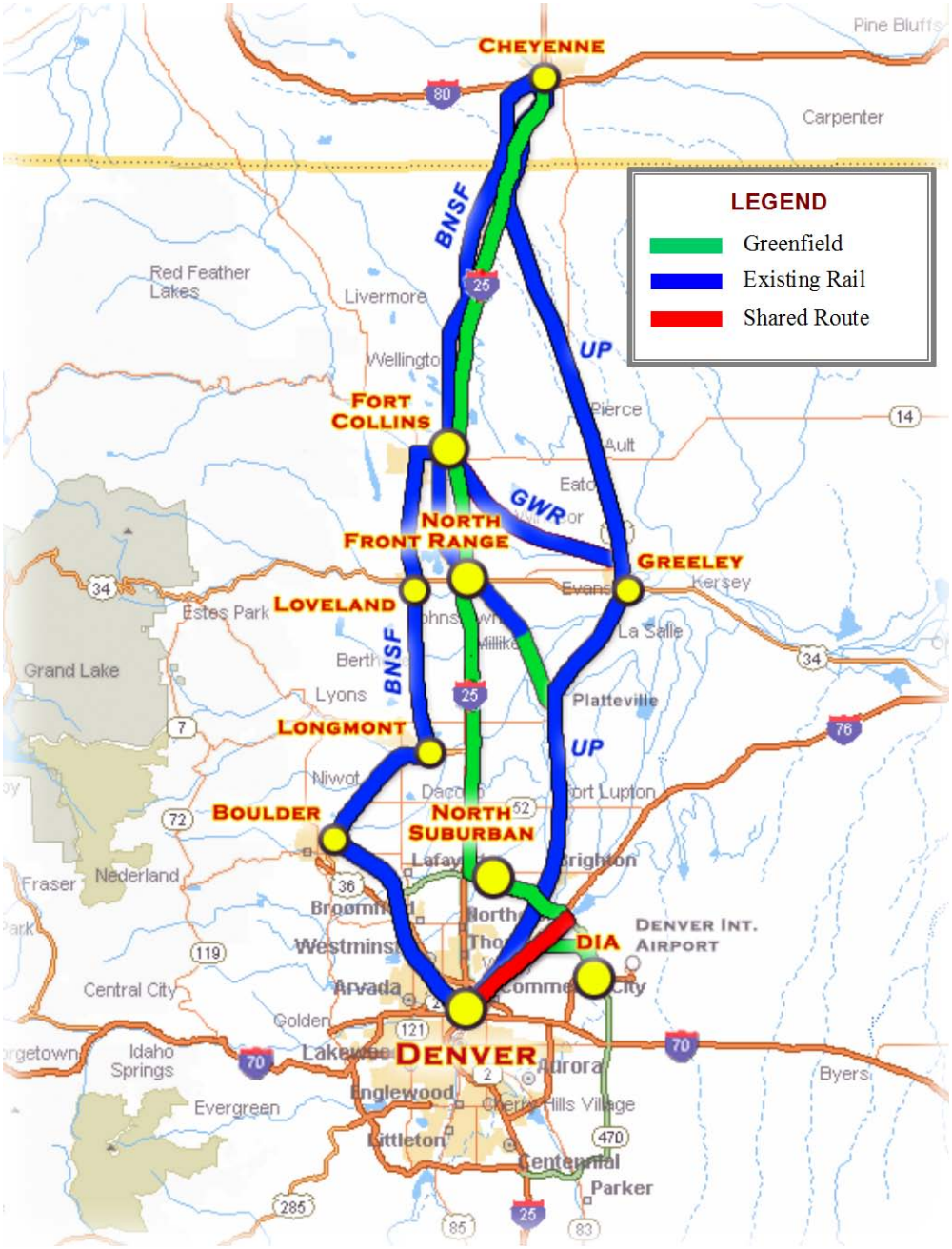
- **Constrained/Highway Right-of-Way –** Solely within, or contiguous to, the I-70 or I-25 highway rights-of-way. These routes can be steeper, with grades as steep as 7 percent. Highways are generally designed to connect population centers.
- **Unconstrained/Greenfield –** A route outside the I-70 and I-25 highway rights-of-way. These routes take advantage of avoiding limitations of existing rail or highway corridors. As a result, they are generally straighter and flatter than the other two route categories.

These maps provide a more detailed look at the specific routes analyzed in the feasibility study.

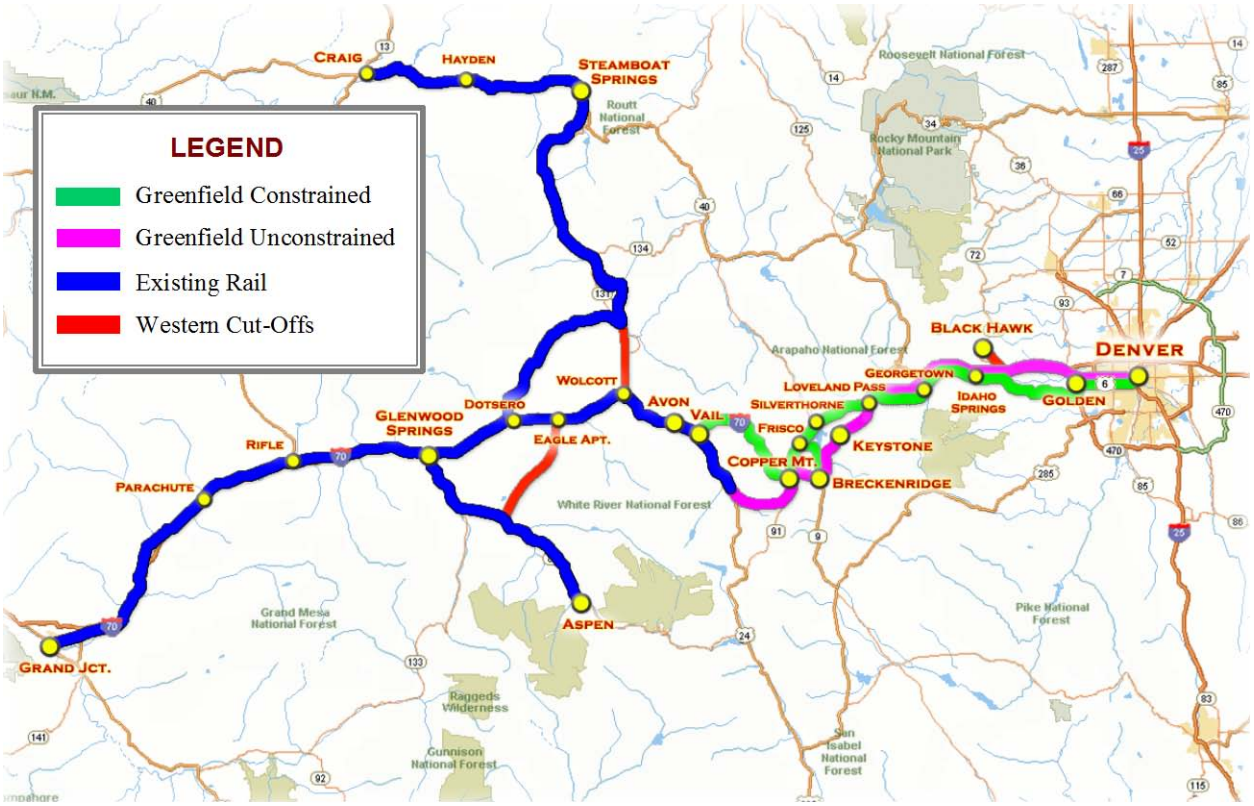
Potential Routes within the I-25 South Corridor



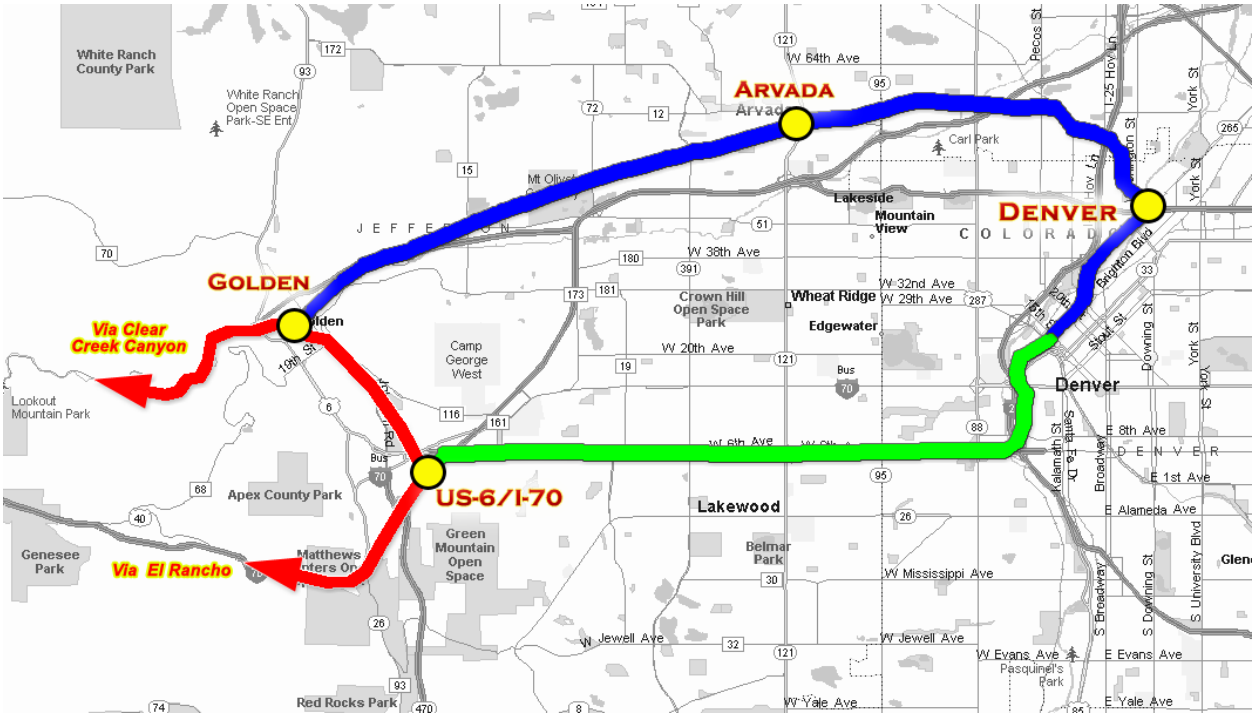
Potential Routes within the I-25 North Corridor



Potential Routes within the I-70 Corridor from Denver to Grand Junction, Aspen and Craig



Potential Routes within the I-70 Corridor from Denver to Golden



Regarding vehicle technologies, the study evaluated six types of proven technologies that are currently in revenue service. By limiting the analysis to proven technologies, detailed cost and performance evaluations and comparisons were able to be developed based on transit systems already in operation. The technology categories evaluated included:

Category	Avg. Operating Speed	Max. Operating Speed	Examples of In-Service Operation
 **Diesel Rail**	30-50 mph	79 mph	Amtrak (shown), New Mexico Rail Runner, Salt Lake City Front Runner
 **High-Speed Diesel**	50-70 mph	110-130 mph	Spanish Talgo (shown), German InterCity Express-TD
 **High-Speed Magnetic Levitation**	60-70 mph	125 mph	Japanese HSST (shown), American Maglev
 **High-Speed Electric**	70-150 mph	120-150 mph	Eurostar (shown) in U.K./ France/Belgium, German InterCity Express-T, American Acela
 **Very High-Speed Electric**	120-200 mph	150-220 mph	German InterCity Express (shown), French TGV, Japanese Shinkansen
 **Ultra High-Speed Magnetic Levitation**	250 mph	250-300 mph	Transrapid Maglev (shown) in Germany and Shanghai

1.3 FRA Feasibility Criteria

In its evaluation of high-speed rail alternatives, the FRA emphasizes its financial and economic feasibility criteria for public-private partnership. These are:

- **Positive (>1.0) Operating Ratio** – This is developed by dividing a project's operating revenues by its operating costs. An operating ratio greater than one indicates that, unlike highways and local transit systems, the project does not require any government subsidies to be a self-sustaining and franchisable system in terms of its day-to-day finances.
- **Positive (>1.0) Cost-Benefit Ratio** – This is developed by dividing a project's total economic benefit by its total cost. A cost-benefit ratio greater than one indicates that the project makes a positive contribution to the economy from an economic perspective. In other words, for every dollar invested in the system, there is an economic return greater than one dollar.

Definitions and assumptions about the factors that create these ratios are below. At the level of analysis contained in a feasibility study, the projections for cost estimates, cost-benefit ratios and operating ratios all have a margin of error of +/- 30%.

The FRA also identifies six high-speed rail feasibility factors that must be considered. These are:

1. **90 MPH Speed** – Whether the proposed corridors include rail lines where railroad speeds of 90 miles or more per hour are occurring or can reasonably be expected to occur in the future.
2. **Ridership** – The projected ridership associated with the proposed corridors.
3. **Maximum Cruise Speed** – The percentage of the corridors over which trains will be able to operate at maximum cruise speed, taking into account such factors as topography and other traffic on the line.
4. **Non-Rider Benefits** – The projected benefits to non-riders, such as congestion relief on other modes of transportation servicing the corridors.
5. **Financial Support** – The amount of Federal, state and local financial support that can reasonably be anticipated for the improvement of the line and related facilities.
6. **Property Owner Cooperation** – The cooperation of the owner of the rights-of-way that can be reasonably expected in the operation of the high-speed rail passenger service in the corridors.

Key assumptions that went into the evaluation of these feasibility criteria include:

- **Ridership and Revenue Forecasts** – Developed in 10-year intervals from 2010 to 2050. Revenues include passenger fares, onboard services and express parcel revenues.
- **Capital Costs** – Include rolling stock, track, right-of-way purchase or easement fees, bridges, tunnels, fencing, signals, grade crossings, maintenance facilities and station improvements.
- **Operating Expenses** – Include equipment maintenance, track and right-of-way maintenance, administration, fuel and energy, train crew and other relevant expenses.
- **Economic Benefit –** To calculate the cost-benefit ratio, the economic benefit derived from the project must be determined. For this study, the economic benefits included in the analysis

include Consumer Surplus (stated preference surveys conducted throughout Colorado in 2008 and 2009 helped determine the value of the additional benefit, beyond the ticket price paid, high-speed rail passengers would receive from the service).

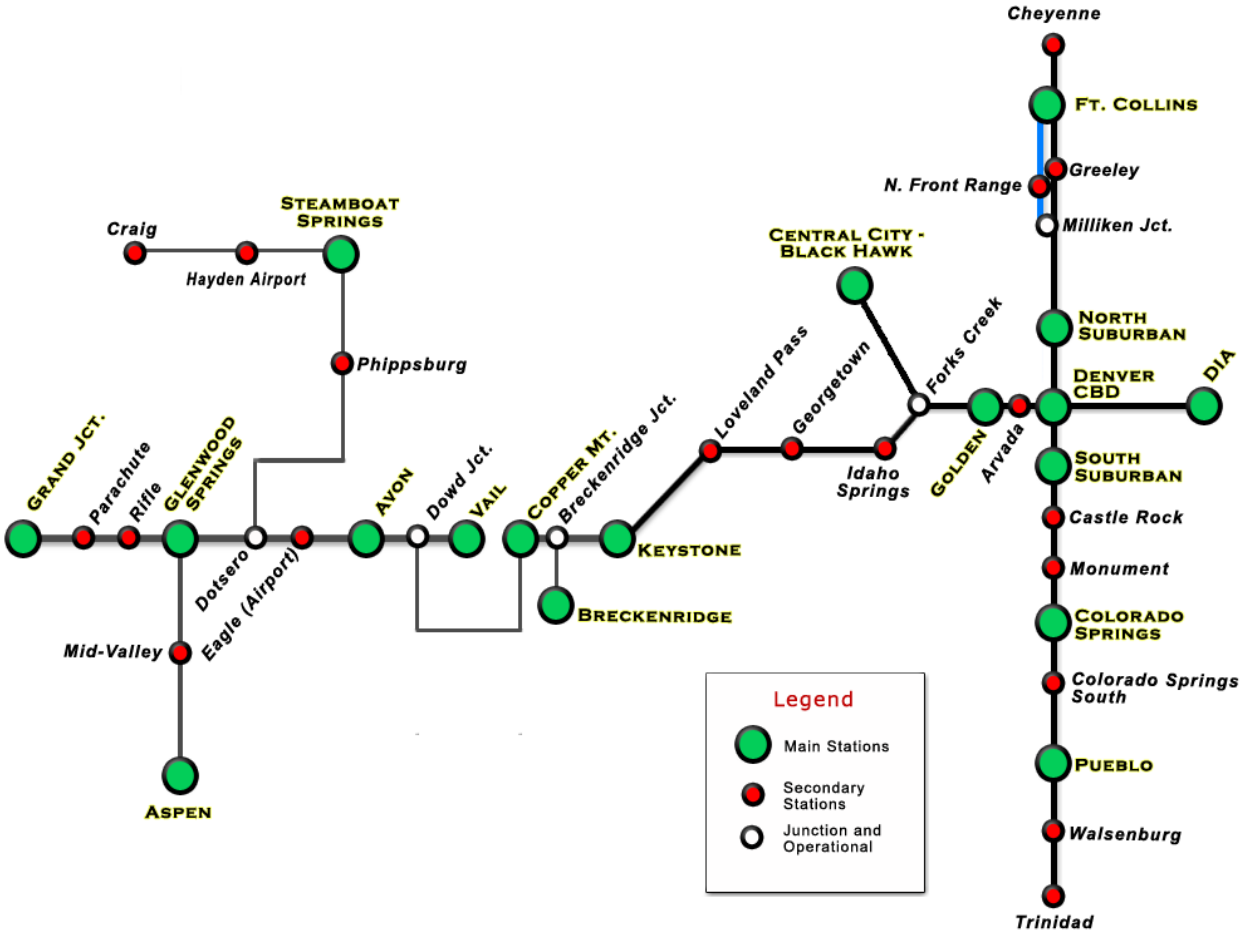
- **Other Mode and Resource Benefits** – Includes reduced highway congestion which saves time for highway travelers not using the high-speed rail system and reduced emissions by diverting auto and air travelers to the high-speed rail system.

1.4 Alternatives Feasibility

In considering the feasibility analysis, it is important to remember that – unlike more detailed studies that are intended to select one proposed project – the intent of this study was to determine whether feasible FRA options existed. As a result, the analysis does not evaluate every possible alternative or every possible nuance to those alternatives. The study used a dynamic evaluation process that evaluated two groups of alternatives, each comprised of three different technology categories.

The two groups of alternatives are depicted on the next two pages.

Group 1: I-70 Unconstrained and I-25 Existing Rail – These routes had no grades steeper than 4 percent and included the diesel rail train (only in the I-25 corridor), high-speed diesel train and high-speed electric train.

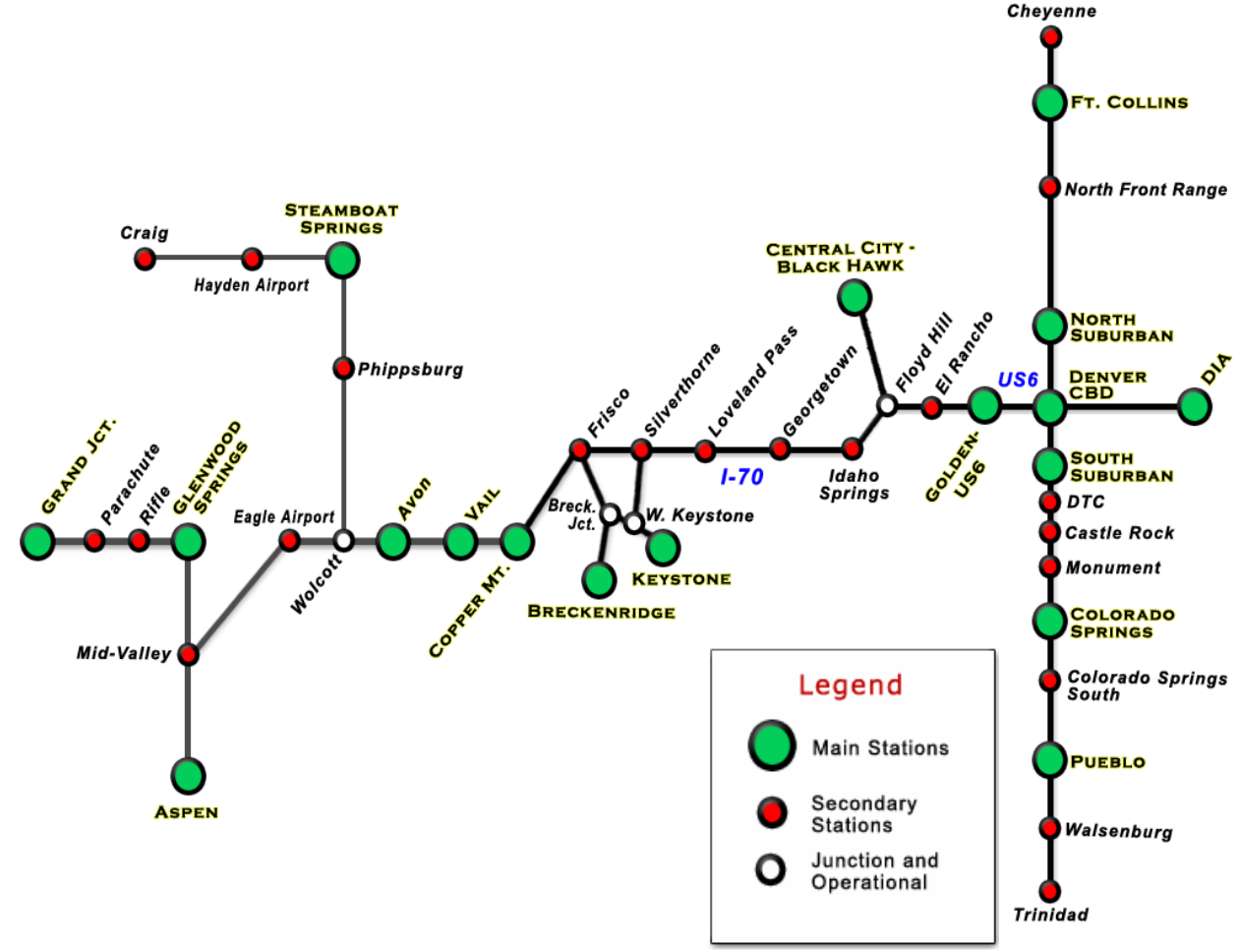


Diesel Rail

High-Speed Diesel Train

High-Speed Electric Train

Group 2: I-70 Highway Right-of-Way and I-25 Unconstrained – These routes included grades as steep as 7 percent and included the high-speed magnetic levitation vehicle, very high-speed electric train and ultra high-speed magnetic levitation vehicle.



High-Speed Magnetic Levitation

Very High-Speed Electric Train

Ultra High-Speed Magnetic Levitation

Many factors made this evaluation of the feasibility of high-speed rail in Colorado unique. One very unique factor to Colorado is the price-sensitivity of likely travelers. While high-speed rail corridors with strong intercity business travel (e.g. the Acela in the Northeast Corridor) are capable of supporting fares in the range of $0.40-$0.50 per mile, Colorado's strong tourism base created greater fare sensitivity among travelers. The study found that a high-speed rail system in Colorado would support fares closer to $0.25-$0.35 per mile. This had a direct impact on the ability of the options to achieve a positive cost-benefit ratio.

Another unique factor Colorado is its mix of tourist and urban attractions. With Denver International Airport (DIA) providing easy access to the East and West coasts, Europe, Asia and Latin America, Colorado is now easily accessible from across the world. In addition to the commercial benefits associated with this access, I-70 serves as a critical link to the most important ski and recreational centers in North America while also becoming a critical east/west trucking connection for the distribution of goods over the continental divide.

Historically, I-70 and I-25 were able to absorb the commercial, tourist and regional travel flows. In recent years, the increase in traffic has been so rapid that, for large parts of the day on weekdays and weekends, both highways are reaching capacity in tourist areas and key commuter segments. This does not even account for highway impacts and closures associated with storms, accidents, rock slides and other uncontrollable factors. This issue is exacerbated by projections that Colorado's population will double in the next forty years and tourism will continue to grow at a similar rate.

Colorado's transportation infrastructure – including DIA, I-25 and I-70 – laid the foundation for the region's success and economic growth. To enable the state and the Rocky Mountain West to achieve its vision for the future, new facilities are needed to link DIA to cities along the Front Range and the world-class recreational areas of the I-70 corridor. As with developing the original transportation facilities, the cost of developing a new facility, such as high-speed rail, will be considerable. But the economic benefits it could bring are significant. In fact, the projected benefits are only exceeded by what could be expected in our country's most popular tourist destinations like Orlando, Las Vegas and Southern California.

The initial evaluation found that none of the full-system alternatives (Cheyenne, WY to Trinidad, CO in the I-25 corridor and Denver International Airport to Grand Junction in the I-70 corridor) were capable of meeting the FRA's feasibility criteria.

In response to these initial results, three steps were taken:

- **Truncation**: Analysis of the full-system alternatives found that the parts of the system north of Fort Collins, south of Pueblo and west of Eagle County Airport comprised 40-50 percent of the system's capital cost, yet only generated 3-6 percent of the system's ridership.

  As a result, truncated alternatives between Fort Collins and Pueblo in the I-25 corridor and Denver International Airport and Eagle County Airport in the I-70 corridor were subjected to the same feasibility analysis.
- **Mix and Match**: An evaluation of using different technologies in the two truncated corridors was completed. This reduced capital costs and maintained the same level of service, but helped determine the impact of not allowing a "one-seat ride" between the two corridors (e.g. boarding a train in Colorado Springs and getting off that train in Vail).

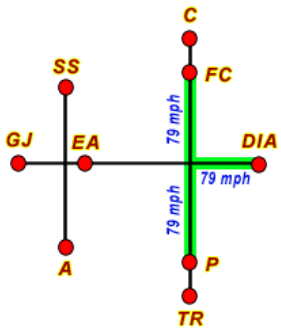
- **Western Strategies**: An evaluation of the feasibility of implementing a separate diesel rail service along the existing rail right-of-way west of Eagle County Airport that would tie into the high-speed rail system at Eagle County Airport or possibly other destinations along the existing rail line east of the airport.

The graphics on the following pages use the following abbreviations:

- C – Cheyenne, WY
- FC – Fort Collins, CO
- DIA – Denver International Airport
- P – Pueblo, CO
- TR – Trinidad, CO
- EA – Eagle County Airport
- SS – Steamboat Springs, CO
- A – Aspen, CO
- GJ – Grand Junction, CO

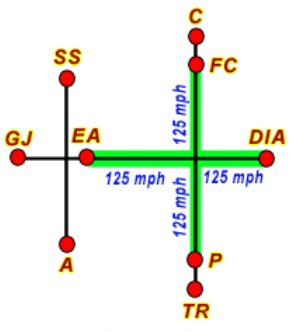
After truncation, three options were determined to be infeasible because their cost-benefit ratios (benefit divided by cost) were less than one, meaning the projects' costs exceed their benefits.

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



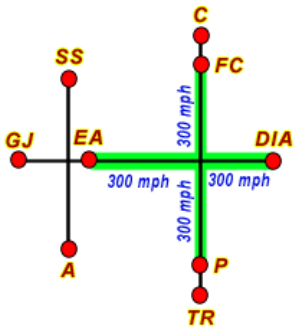
Operating Ratio: 0.64
Cost-Benefit Ratio: 0.19
Total Cost: $2.9 Billion

High-Speed Magnetic Levitation Vehicle
I-70 Highway Right-of-Way & I-25 Unconstrained routes



Operating Ratio: 1.88
Cost-Benefit Ratio: 0.75
Total Cost: $31.6 Billion

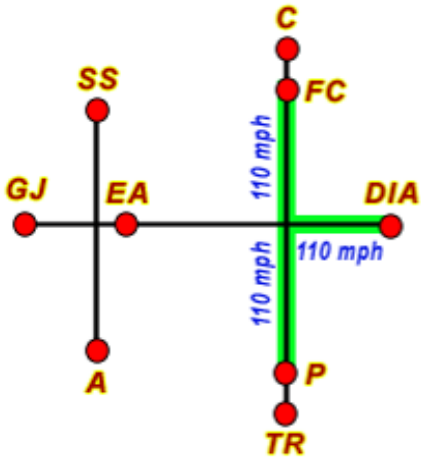
Ultra High-Speed Magnetic Levitation Vehicle
I-70 Highway Right-of-Way & I-25 Unconstrained routes



Operating Ratio: 2.44
Cost-Benefit Ratio: 0.86
Total Cost: $36.6 Billion

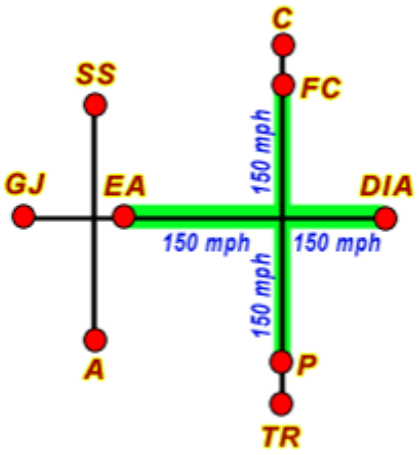
The truncation analysis found three feasible options. They had a positive operating ratio, thus they wouldn't require an operating subsidy. They were also able to produce a positive cost-benefit ratio because the economic benefit created by these options exceeds their costs.

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



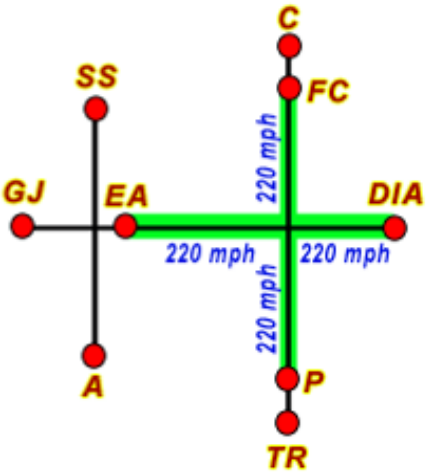
Operating Ratio: 1.14
Cost-Benefit Ratio: 1.04
Total Cost: $2.9 Billion

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



Operating Ratio: 1.58
Cost-Benefit Ratio: 1.02
Total Cost: $18.9 Billion

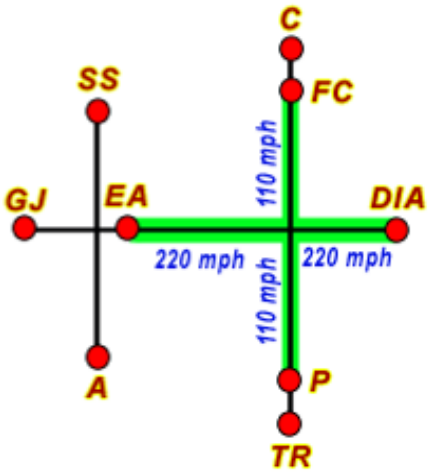
Very High-Speed Electric Train
(I-70 Highway Right-of-Way & I-25 Unconstrained Routes)



Operating Ratio: 1.84
Cost-Benefit Ratio: 1.28
Total Cost: $19.9 Billion

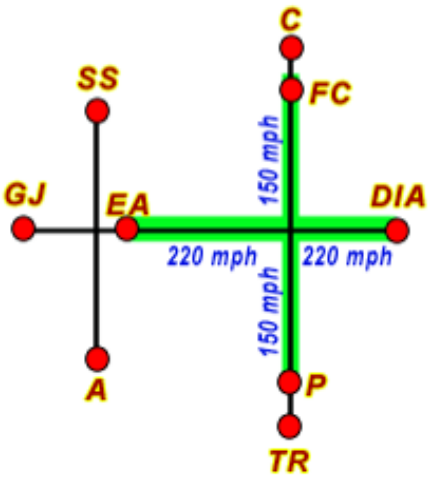
Three new "mix and match" options were then developed to evaluate how using different technologies in the corridors would affect feasibility. This analysis found all three options were feasible.

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



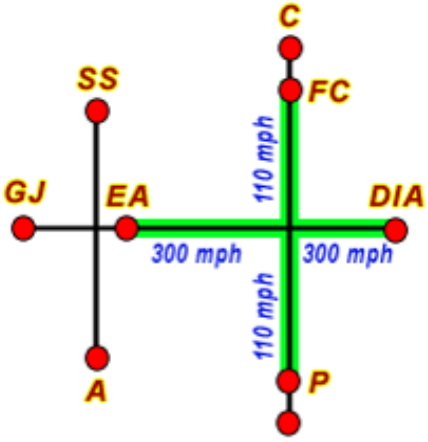
Operating Ratio: 1.44
Cost-Benefit Ratio: 1.02
Total Cost: $16.3 Billion

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



Operating Ratio: 1.68
Cost-Benefit Ratio: 1.20
Total Cost: $16.8 Billion

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



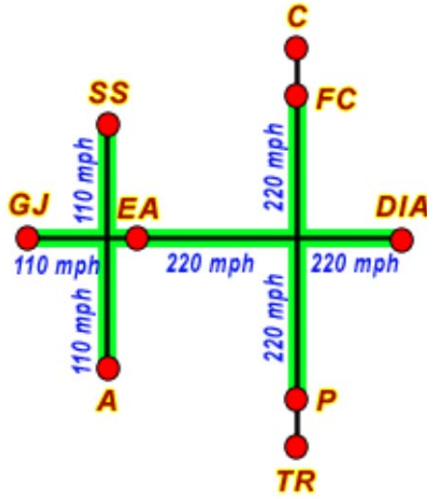
Operating Ratio: 1.89
Cost-Benefit Ratio: 1.04
Total Cost: $ 19.5 Billion

After identifying six feasible options between Fort Collins and Pueblo in the I-25 corridor and Denver International Airport and Eagle County Airport in the I-70 corridor, an additional analysis was completed to determine whether feasibility could be maintained by adding a high-speed diesel train service using the existing rail right-of-way west of Eagle County Airport to Steamboat Springs, Aspen, and Grand Junction.

This could be a relatively low-cost baseline service that could connect these important western Colorado communities to the system. Another interesting option is that the high-speed diesel trains on this western connection could actually provide service as far east as Silverthorne and Keystone by running "under the wire" of the very high-speed electric train.

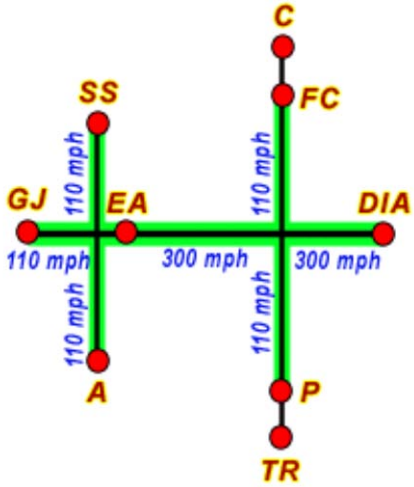
The two western extension options that were evaluated both proved feasible.

Very High-Speed Electric Train
(I-70 Highway Right-of-Way & I-25 Unconstrained Routes)
High-Speed Diesel Train
(Existing rail Route West of Eagle County Airport)



Operating Ratio: 1.66
Cost-Benefit Ratio: 1.21
Total Cost: $ 21.1 Billion

Ultra High-Speed MagLev Vehicle
***(I-70 Highway Right-of-Way Route)* &**
High-Speed Diesel Train
(I-25 Existing Rail Route & Existing rail Route West of Eagle County Airport)



Operating Ratio: 1.78
Cost-Benefit Ratio: 1.03
Total Cost: $20.7 Billion

In summary, eight of the options evaluated in this phase of the feasibility study were capable of meeting the FRA's criteria for a feasible high-speed rail system. As one would expect in a dynamic process like this, variations of these eight alternatives that seem logical were discussed but never subjected to the full feasibility evaluation.

Future studies should evaluate these and other alternatives to determine the best option for Colorado.

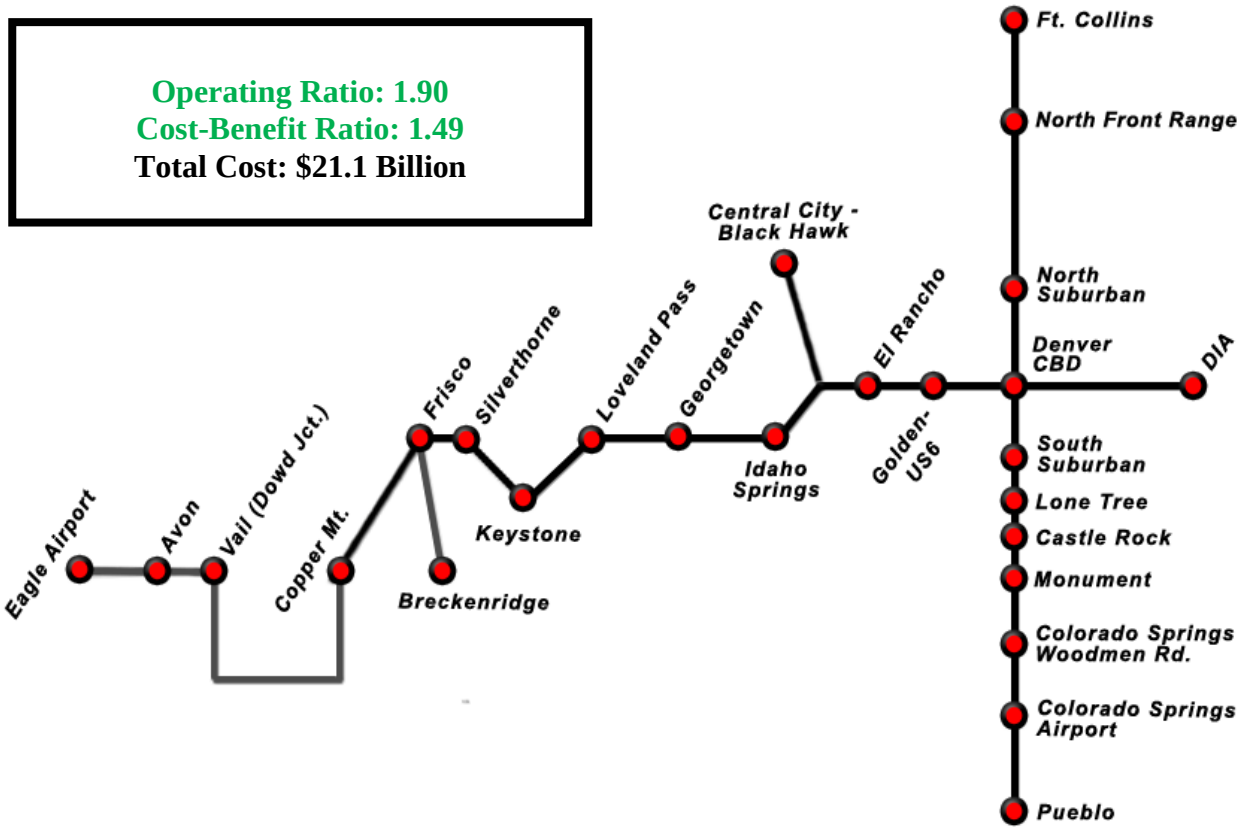
1.5 FRA Developed Option and Implementation Plan

Following the determination that multiple feasible options exist, the RMRA selected one option – the option that best exceeded FRA feasibility criteria –to further refine, analyze and use as the test-case scenario for developing an implementation plan. This option, known as the FRA Developed Option, uses the very high-speed electric train (with average speeds of 120 to 200 mph and a maximum speed of 220 mph) in the I-70 Highway Right-of-Way and I-25 Unconstrained routes.

The FRA Developed Option should not be considered a "preferred alternative" because only through further studies regulated by the National Environmental Policy Act (NEPA), can a preferred alternative be selected.

For the purposes of the analysis in this report, the FRA Developed Option (depicted below) is comprised of:

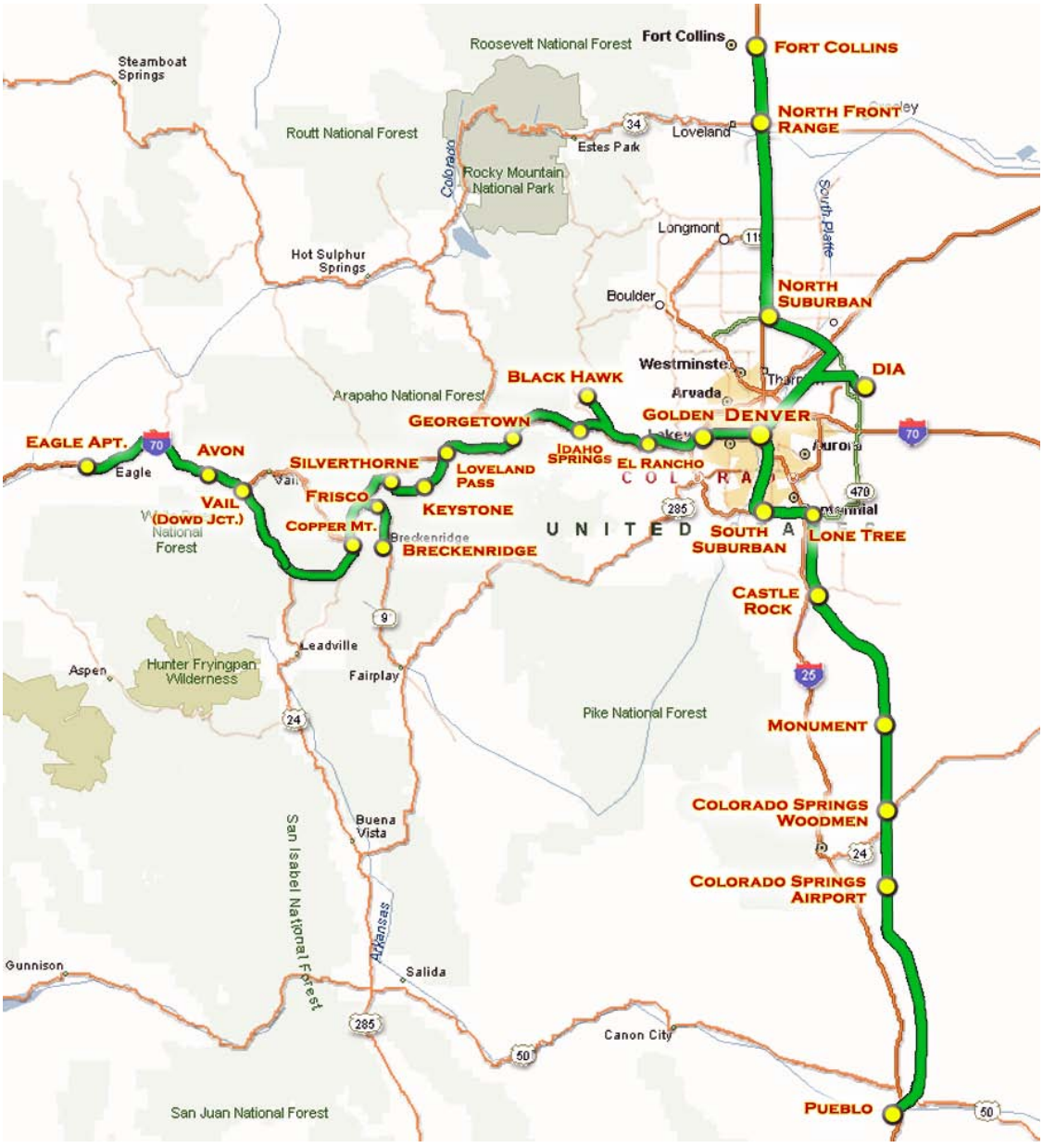
- **I-25 Corridor** – The same unconstrained route between Fort Collins to Pueblo that was used to analyze the initial very high-speed electric train alternative.
- **I-70 Corridor** – Unlike the initial very high-speed electric train alternative that followed the I-70 right-of way exclusively, the route was optimized to include a combination of I-70 Right-of-Way and unconstrained alignment segments.



The cost of the FRA Developed Option (depicted below) is $21.13 billion. Even with this steep cost, the FRA Developed Option has the best operating and cost-benefit results of any option evaluated in this study. The cost-benefit ratio (benefits divided by cost) is 1.49 and the operating ratio (revenues divided by operating costs) is 1.90.

Because the system will have a positive operating ratio, it could be operated, and even partly developed, with private funds. The building of the system would provide a very powerful boost to the economies of the I-25 and I-70 corridors, the state of Colorado, and the country. The project would also generate $33 billion of benefits (e.g., jobs, income, property values, and economic wealth) to Colorado that will enhance the tax base and improve quality of life.

FRA Developed Option High-Speed Rail Route



While future studies will need to determine final alignments and phasing, the study team developed an implementation plan for the FRA Developed Option to jump-start consideration of implementation options for the next planning phase.

By 2035, the FRA Developed Option is estimated to annually carry nearly 35 million passengers and generate more than $750 million in revenue.

In the I-25 corridor, this option produces travel times much faster (90-100 mph average speeds) than the automobile. There is sufficient demand to support trains every 15 to 30 minutes throughout the day. In the I-70 corridor, while train speeds are lower due to the severe curve and grade limitations, travel times (60-70 mph average speeds) are still competitive with travel by automobile.

As discussed earlier in this summary, the high recreational demand of the Colorado market makes it much more sensitive to fares. While Amtrak's Northeast Corridor Acela high-speed rail service charges an average of 60-cents per mile, analysis of the FRA Developed Option assumes an average of 35-cents per mile.

Based on this information, the table below provides some examples of average travel times and fares for one-way trips using the FRA Developed Option:

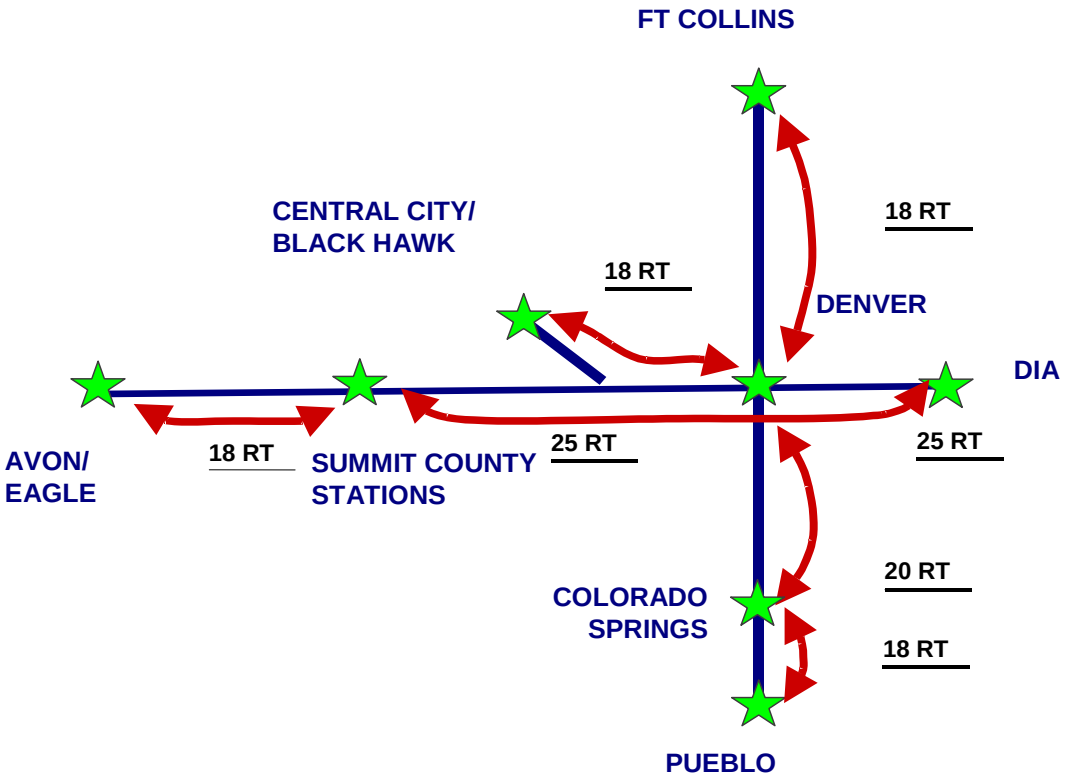
Example One-Way Average Fares ($2008) and Travel Time

Route	Example Average Fares	Travel Time
I-25 Corridor	**Fare**	**Train Time**
DIA - Colorado Springs	$32	1:00
Downtown Denver - Pueblo	$40	1:15
DIA - Ft. Collins	$30	1:00
I-70 Corridor	**Fare**	**Train Time**
DIA – Keystone	$30	1:15
Downtown Denver - Vail	$40	2:00
Cross-Corridor	**Fare**	**Train Time**
Colorado Springs - Avon	$65	3:00
Silverthorne - Fort Collins	$48	2:00

The FRA Developed Option can support a very comprehensive service in Colorado. During peak periods, the system shows demand for two-to-three trains per hour. This includes 18 to 20 trains per day in the I-25 corridor and 18-25 trains per day in the I-70 corridor. In addition to these, it includes 18 trains per day to Black Hawk and Central City.

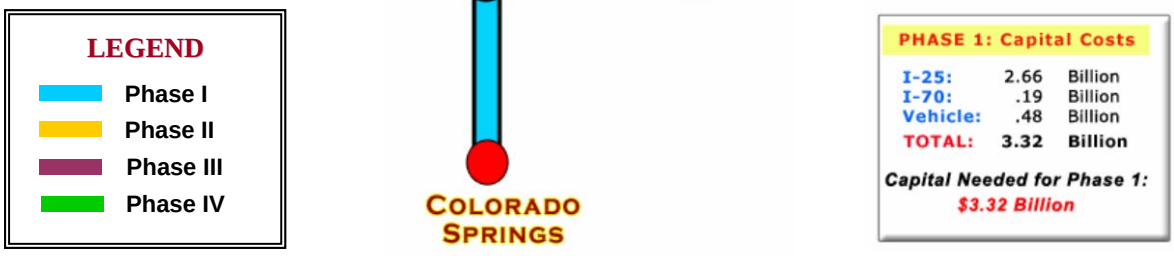
The graphic on the next page illustrates the number of daily round trips needed to meet estimated travel demand within each segment of the FRA Developed Option in 2035.

Daily Round Trip (RT) Train Service Pattern for FRA Developed Option (220-mph Electric Rail)

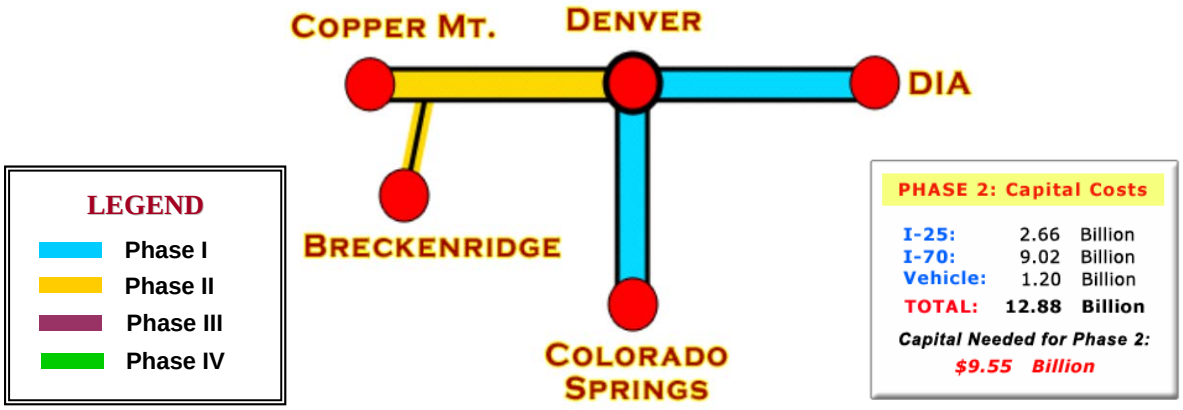


For the purposes of this plan, development of the project is divided into four phases. These phases could be pursued simultaneously in order to maximize efficiencies and accelerate the development schedule.

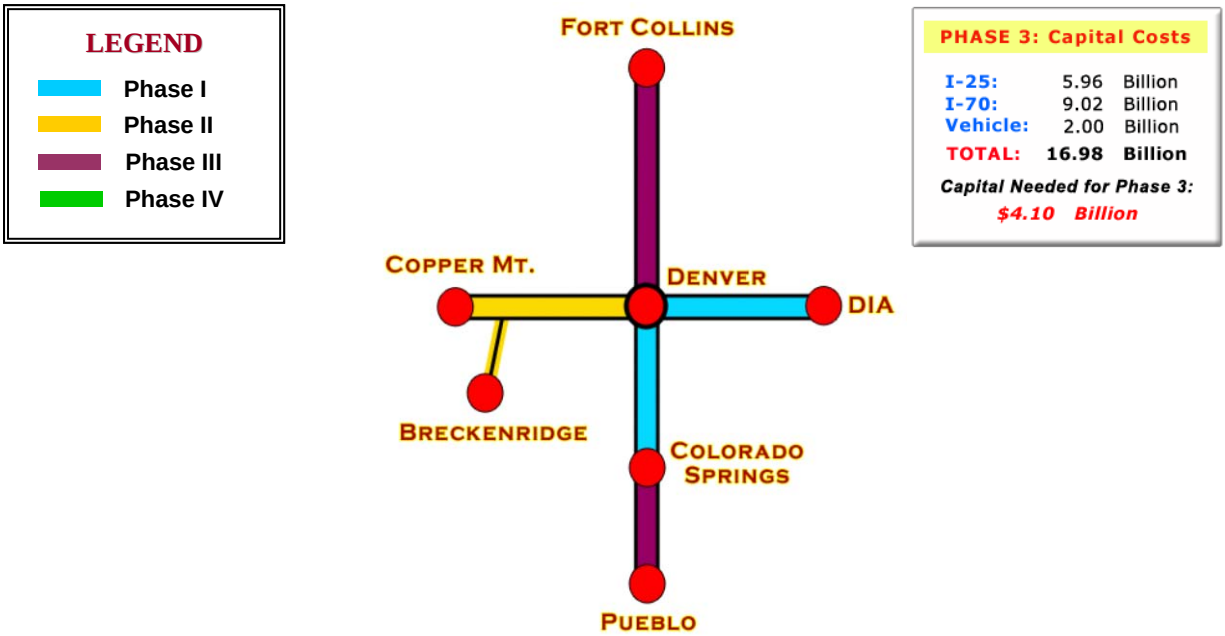
Phase I (5 years of project development and environmental clearance; 6 years of design and construction) would build the initial segments from Denver International Airport (DIA) to downtown Denver to Colorado Springs. Ridership projections have consistently shown that these will be the peak load segments for the entire system, so they are a logical first phase.



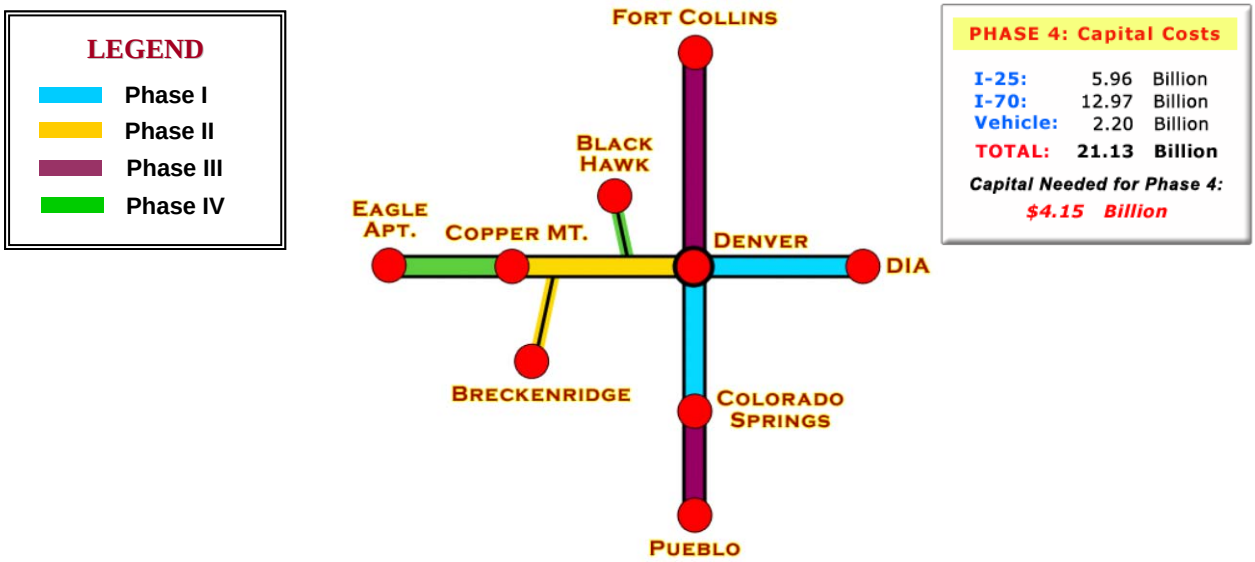
Phase II (5 years of project development and environmental clearance; 9 years of design and construction) would extend I-70 from downtown Denver to the Summit County resorts (e.g. Keystone, Breckenridge and Copper Mountain). This will likely be the most difficult and expensive segment to construct because of extensive tunneling needed for I-70 crossing the Continental Divide. Rather than avoiding this segment, since its construction is likely to take the longest, it is essential to gain the environmental clearance and funding commitments needed to get the earliest start possible on the I-70 tunnels. Construction on Phase II should proceed concurrently with development of other segments even if those segments can be completed first.



Phase III (8 years of project development and environmental clearance; 6 years of design and construction) would extend I-25 north to Fort Collins and south to Pueblo. Depending on the level of funding and issues identified during future studies, Phase III may be able to be completed before Phase II. However, this analysis assumes that Phases II and III will open concurrently.



Phase IV (8 years of project development and environmental clearance; 6 years of design and construction) would extend I-70 west to Eagle County Airport and also complete the branch line to Black Hawk. Construction of a line from Copper Mountain west to Eagle County Airport via Pando does not entail major tunneling and uses existing rail right-of-way, so it may be possible to complete earlier than Phase II. However, this analysis assumes this phase will open concurrently with Phases II and III.



1.6 Right-of-Way Risk Analysis

Small portions of the FRA Developed Option are in existing freight rail right-of-way. In an effort to better understand the benefits and impacts of this approach, the RMRA asked the study team to evaluate modifications to the FRA Developed Option that would not require the use of any freight rail right of way and/or could allow the utilization of technologies that may not comply with current FRA requirements for sharing right-of-way with freight trains.

The analysis found that avoiding freight right of way increased capital costs and required some service changes, but that cost benefit ratios still exceeded FRA requirements for feasibility. This means that the feasibility of high-speed rail is not dependent on the use of freight right-of-way.

The analysis included an evaluation of three key areas:

- In the Denver area, two route options were developed:
    - **Option 1**: An Elevated option over existing rail right-of-way, using the Joint Line, Consolidated Main Line and Brush Line rights-of-way.

  - **Option 2**: A Bypass alternative via E-470. This bypass option misses the Suburban South station at Littleton, but adds stops at Parker and Aurora. It eliminates use of all but a short stretch of Consolidated Main Line right-of-way that is still required to link downtown Denver to US-6 and the I-70 corridor, but adds a new easterly alignment to E-470 and DIA.
- In the Colorado Springs area, a bypass option was developed to avoid the need for sharing freight rail right-of-way. This would require locating stations near the airport and at a suburban location.
- In the I-70 corridor west of Pando, an unconstrained route was developed to avoid the need for sharing Union Pacific right-of-way.

From a performance and user-experience perspective, these options have benefits and drawbacks. Among them are:

- Improved travel time and access to Denver International Airport, particularly from the north
- Worsened travel time to downtown Denver from both from I-25 North and the I-70 corridor by 15-30 minutes
- Worsened travel time to downtown Denver and the I-70 corridor with the E-470 bypass option by 5-12 minutes
- Negligible impact to north-south (e.g. Pueblo to Fort Collins) and east-west (e.g. Vail to DIA) travel time. If, however, a diversion via the DIA terminal were included, a Pueblo to Fort Collins trip via the E-470 bypass would take longer than the more direct routing via downtown Denver.
- Increased ridership with the E-470 bypass by adding an Aurora station at Peoria Street and Smith Road

From a feasibility perspective, all of the options evaluated were still capable of meeting FRA feasibility criteria. This is an important consideration, particularly as it relates to future studies, because it indicates that these and other options warrant further, more detailed analysis.

1.7 Next Steps

Now that the RMRA has determined that high-speed rail is feasible in Colorado, it will be important to seriously integrate it as part of the state's solution to its transportation challenges. This study makes a number of recommendations about how the state should go about doing that.

- **Develop a Colorado State Rail Plan** – This is a pre-requisite for federal high-speed rail funding eligibility under the Passenger Rail Investment and Improvement Act (PRIIA). CDOT recently received federal funding for this study and will solicit proposals on it in 2010.
- **Develop a Metro Denver Transit Connectivity Study** – There remains some question of how high-speed rail and RTD's FasTracks system can best be integrated. CDOT also received funding for a study that will address interoperability (e.g. joint stations, shared infrastructure, etc.) of the two systems in the metro Denver area.

- **Coordinate with the Freight Railroads** – Future studies will determine whether the preferred high-speed rail solution for Colorado will require railroad right-of-way or not. As part of this study, the Union Pacific and BNSF railroads have both indicated that they are willing to negotiate with CDOT for a positive outcome. Continued discussions will be important.
- **Request High-Speed Rail Corridor Designation** – After determining the feasibility of high-speed rail in Colorado and developing a State Rail Plan, it is recommended that Colorado work with the Federal Railroad Administration to secure designation as a high-speed rail corridor. This will help open the door for additional funding opportunities to support efforts to implement the recommendations in this plan.
- **Expand the Coalition of Supporters** – The formation of the RMRA and the completion of this study helped organize and grow a powerful coalition of high-speed rail supporters in Colorado. This coalition can be very helpful and influential in ensuring that the findings and recommendations in this report are taken seriously and implemented.

1.8 Conclusion

The feasibility of high-speed rail in Colorado represents a tremendous transportation and development opportunity for the Colorado and the Rocky Mountain west.

High-speed rail can provide a more efficient and cost-effective means of connecting Colorado's commercial centers with one another as well as the national and international destinations served by the state's airports. High-speed rail also provides a more reliable, enjoyable and convenient way for tourists from all over the globe to get to some of the most important and popular recreational resort destinations in North America and the world.

The economic benefits of such an investment are considerable. While the costs of implementing high-speed rail are large, as would be expected given the mountainous conditions in the I-70 corridor ($16 billion to $21 billion for service in both corridors), analysis indicates that investing in high-speed rail would generate an impressive $33 billion of benefits to Colorado. These benefits are generated by the rapid growth of the state and its need to accommodate a doubling of its population over the next 30-40 years.

High-speed rail is by no means the silver bullet that solves all of Colorado's transportation challenges. But, as this study clearly shows, it is a critical part of that solution and will be invaluable to the growth of the state's economy.