1 High-Speed Rail Planning Process

1.1 Study Objectives

This Rail Feasibility Study has been prepared for the Rocky Mountain Rail Authority (RMRA) to provide an assessment of the feasibility of providing intercity rail service in the I-70 and I-25 corridors as shown in Exhibit 1-1, including secondary corridors to Craig through Steamboat Springs, Aspen, Breckenridge, Winter Park, and Central City. In assessing feasibility and evaluating options, it specifically uses the Federal Railroad Administration's (FRA's) public-private criteria[1] and six feasibility factors that are critical to receiving a FRA High-Speed Rail Designation for each project corridor.

Exhibit 1-1: Potential Colorado High-Speed Rail Corridors

[1] High-Speed Ground Transportation for America, USDOT FRA 1997, and Maglev Deployment Program: USDOT FRA, 1999

By meeting FRA criteria, the RMRA High-Speed Rail Feasibility Study provides a mechanism for supporting:

- Designation of Colorado I-70 and I-25 corridors as high-speed rail corridors
- Potential Federal funding (most likely 50-80 percent) for a proposed project
- Creation of a high-speed rail project that might be developed as a public-private partnership by the communities of Colorado.

The overall objective of the study is to complete a fresh, objective assessment of the feasibility of implementing high-speed rail service in the Colorado corridors and to identify the next steps that should be pursued by RMRA and partner agencies in the implementation of that service. By building on previous efforts, coordinating closely with other ongoing relevant studies, surveying stakeholders within the two corridors, and identifying the most effective high-speed rail options for each corridor, the RMRA and Colorado are positioned to gain high-speed rail designation from the FRA for the two corridors.

The FRA public-private partnership criteria, which are explained further in Chapter 9, are:

1. Positive operating ratio (operating revenue/operating costs > 1.00)
2. Positive cost benefit ratio (total project benefit/total project cost > 1.00)

The six FRA high-speed rail feasibility factors are as follows:

1. 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. The projected ridership associated with the proposed corridors.
3. 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. The projected benefits to non-riders, such as congestion relief on other modes of transportation servicing the corridors.
5. The amount of Federal, state and local financial support that can reasonably be anticipated for the improvement of the line and related facilities.
6. 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.

Additional objectives for the study are as follows:

1. To identify the most feasible technology(s) that are applicable for Colorado (recognizing that these technologies may vary depending on the corridors).
2. To identify the need for and benefits to Colorado of implementing high-speed rail service.
3. To identify opportunities and concerns of local governments within the corridors regarding implementation of high-speed rail service.
4. To define potential station locations and pros and cons of each.
5. To identify the opportunity to maximize the use of existing transportation corridors.

6. To identify recent and emerging vehicle and guideway technology innovations having potential to minimize cost and environmental impacts, particularly in the mountainous terrain of the studied corridors. This has been addressed in Appendix K.
7. To identify systems that are inter-operable in the primary corridors and that could be developed in system phases.

1.2 Alternatives Development and Business Planning Process

To ensure all of the FRA criteria and factors are fully evaluated, the study team has used a Business Plan Approach. As specified by the FRA, the selection of an appropriate high-speed rail system is "market driven." The difference in the selection of one high-speed rail option over another is heavily dependent on the potential ridership and revenue. A set of reasonable alternatives have been developed for evaluation based on the potential of each alignment option to improve market access, raise train speed, or to reduce cost. These alternatives provide a full range of tradeoff options for configuring the rail system to best meet Colorado's need.

To ensure that market potential is properly measured, the TEMS Business Plan Approach carries out a very detailed and comprehensive market analysis. The output of this market analysis is then used to determine the right rail technology and engineering infrastructure for the corridors. The Business Plan Approach, as shown in Exhibit 1-2, sets out a six-step process for accessing corridors and measuring FRA issues and criteria. The six steps are:

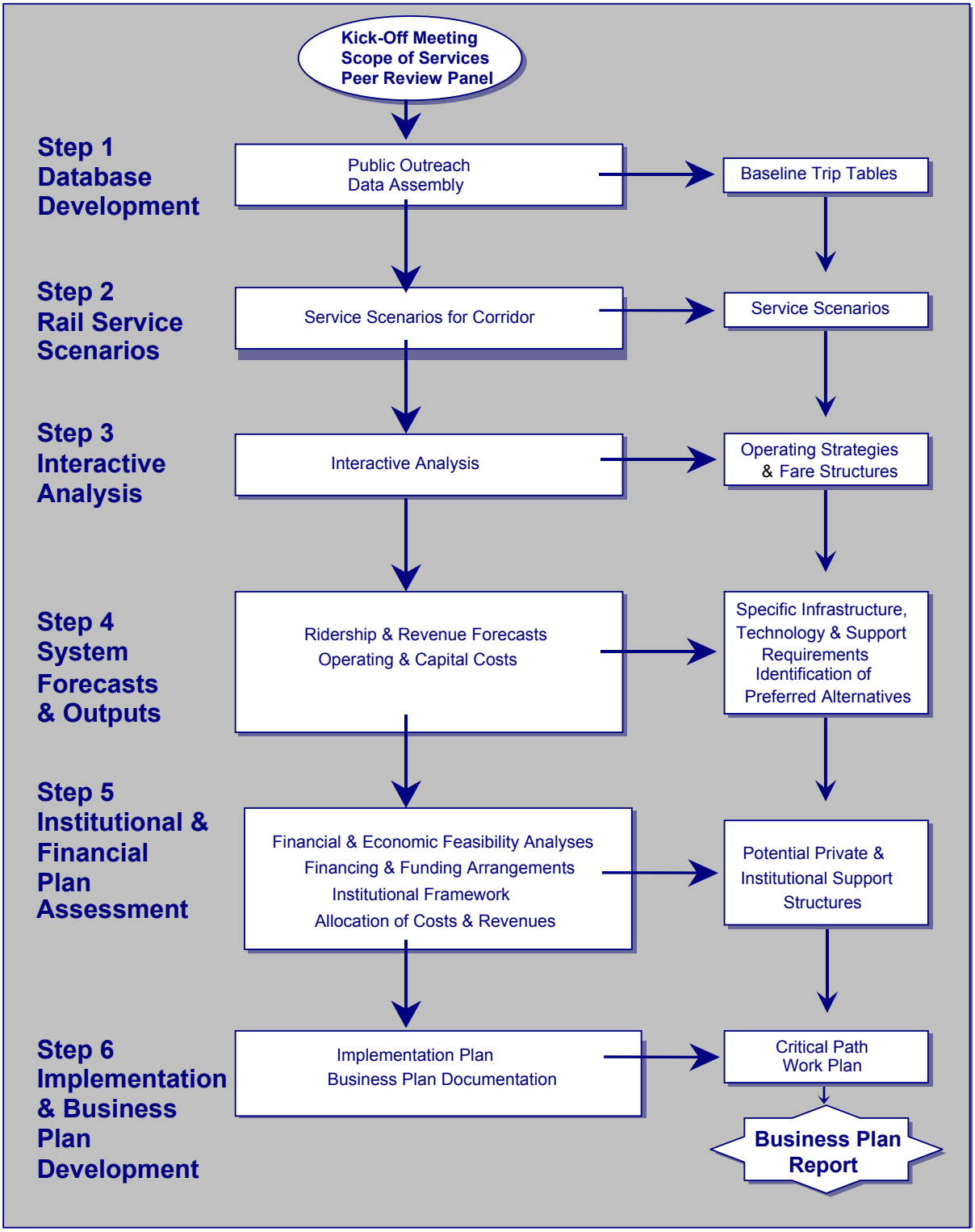
1. Public Outreach and Database Development – Assembling the engineering, market, operational, technology, and community station data as input to the process.
2. Formulation of Rail Service Scenarios – Setting up the rail/maglev options to be considered for the study.
3. Interactive Analysis – Assessing engineering, market, operational, technology, and land use data to identify and develop the most effective rail/maglev alternatives.
4. System Forecasts and Outputs – For the most effective alternatives, generating ridership, revenue, operating costs, capital costs, and financial and economic feasibility solutions.
5. Assessment of Institutional and Financial Plan Options – Developing the institutional framework, and funding plan for developing the Rocky Mountain Rail System.
6. Implementation and Business Plan – Developing both Implementation and Business Plans along with pro forma financial cash flows.

The study methodology was developed to ensure an appropriate balance between market potential, train operations, and engineering costs for a feasibility study. It provides an understanding of the financial and economic value of selected alternatives and the needs of the implementation process in terms of both the timeline to implement the proposed system and the funding requirements during implementation. The method reflects closely the procedures adopted by the USDOT FRA for high-speed rail and maglev planning as defined by their own publications:

- High-Speed Ground Transportation of America, USDOT FRA, Sept. 1997
- Maglev Deployment Program, USDOT FRA, 1999

The result is an assessment that is intended to fully satisfy Federal requirements for qualifying for high-speed corridor designation and funding, while remaining sensitive to local needs and preferences.

Exhibit 1-2: Business Plan Six-Step Process



1.3 Public Involvement Process

The public outreach process was designed to ensure that the study is sensitive to the ideas and concepts of the communities along the I-70, I-25 and secondary corridors and recognizes their needs for improved transportation, as well as their concerns about quality of service, system cost, the environment, and economic development. The aim of this process has been to ensure that the communities' voices are heard, and that the high-speed study is designed to maximize their interests. To meet this need the following outreach program was implemented. The outreach program is described more fully in Appendix M.

In each of the two primary corridors and secondary corridors specified previously, appropriate local government, MPO, Transportation Planning Regions (TPR), Transportation District or Authority, Public Land Agency, and the I-70 Coalition have been consulted regarding possible alignments (on-grade or aerial), station and vehicle support facility locations, and vehicle technologies. To do this, three Corridor Input Teams were formed: I-70 Corridor Input Team, Denver Metro Input Team, and I-25 Corridor Input Team. For each Input Team, a series of workshops were conducted. The Corridor Teams met three times:

- Scoping (September 2008) to gather data on local needs and desires.
- Alternatives Selection (December 2008) to help develop high-speed rail alternatives.
- Alternatives Analysis (April 2009) to gather data on the evaluation process and results.

These workshops explored the following:

- Identification of regional transport needs and the role of high-speed rail.
- Identification of potential station locations (note: the I-70 Coalition Land Use Planning Study provided proposed station locations and potential alignments for the I-70 corridor.)
- Identification of willingness of local governments to implement land use planning and zoning changes necessary to support the rail passenger alignment, location and development of rail stations and associated Transit Oriented Development, and vehicle support facilities.
- Identification of potential community, social and economic issues related to the development of high-speed passenger rail service.
- Identification of potential impacts to public lands.

Input relating to the rail system alternatives has been obtained from RMRA member jurisdictions (see Appendix A) and Colorado's general public and incorporated into the study. The study team has coordinated with business, non-profit and economic development organizations to develop a community partnership program. As part of this program, the study team has developed a series of communication tools including project website, community partnership program, media relations, and community presentations. These were used in providing communications updates for participating organizations to distribute to their members and other interested stakeholders across the diverse regions of the study area. The Business Plan identifies how the high-speed rail proposals meet areas of concern, identifies outstanding issues, and specifies critical travel needs assessed through this public outreach process.

1.4 Peer Review Process

A Peer Review Process has been implemented into the study plan.

- The initial set of meetings validated the study process and methodology including information on technology, engineering, and market alternatives.
- The second set of meetings provided review and comment on the study findings.

At each panel meeting, the study team made a PowerPoint presentation of its approach, assumptions, methodologies, findings and conclusions. The study team has coordinated its work with the Project Management Consultant (PMC) who organized and provided logistical support to the Peer Review Panel process. The study team worked with the PMC to define Peer Review Panel objectives and agendas, and to serve as a resource to the panel, providing requested information and meeting with the panel to review study information.

1.5 Study Process

For both the I-25 and I-70 corridors, this study evaluated a broad range of technologies ranging from a conventional 79-mph Amtrak service up to a 300-mph Transrapid maglev. Specific technologies and alignments are described in more detail in Chapter 4. These route and technology options were compared based on the costs and benefits of each technology (e.g., 110-mph diesel vs. 220-mph electric vs. 300-mph maglev) and alignment option (e.g., current rail rights-of-way vs. new greenfield alignments.)

Evaluation of the route/technology options was based on the following objectives:

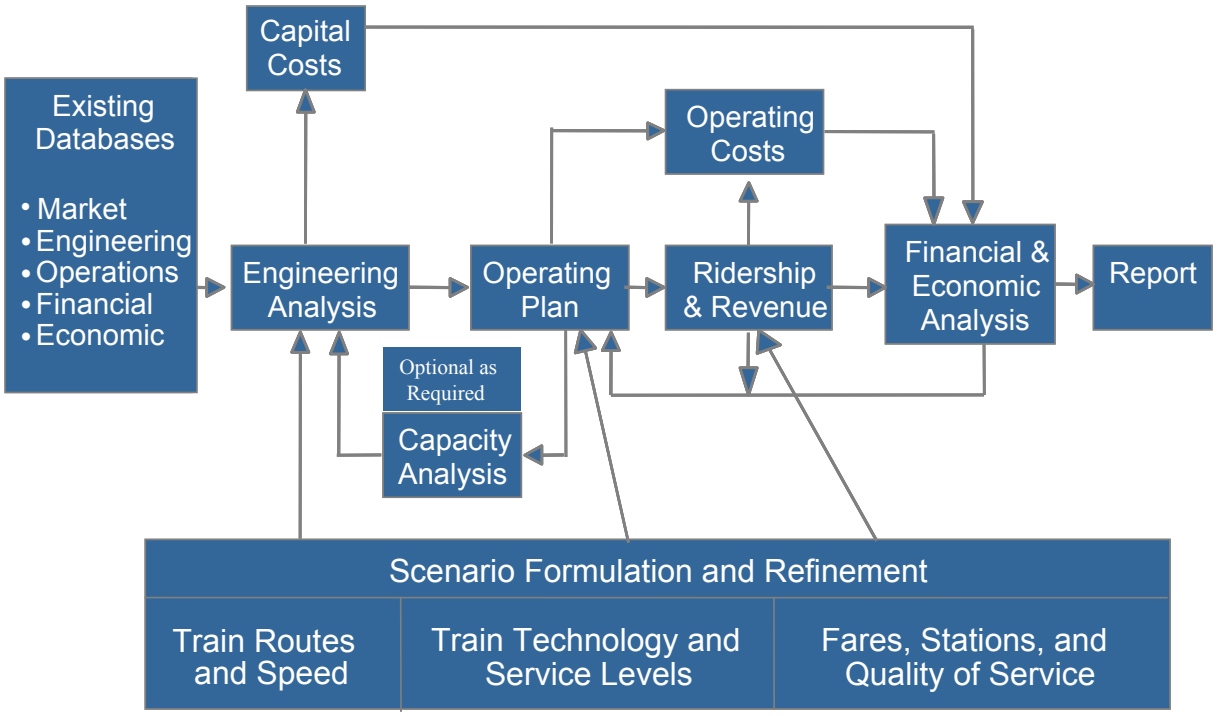
- Minimize travel time between major cities
- Maximize regional accessibility
- Minimize impact of topographical features on the route
- Minimize environmental constraints
- Minimize disruption to residential and commercial developments

The study entailed an interactive and quantitative evaluation, with regular feedback and adjustments between track/technology assessments and operating plan/demand assessments. It culminated in a financial and economic assessment of alternatives, with institutional issues addressed in a workshop with decision-makers and staff. Exhibit 1-3 illustrates the process that led up to the financial and economic analysis.

The study investigated the interaction between alignments and technologies to identify optimum trade-offs between capital investments in track, signals, other infrastructure improvements, and operating speed. The engineering assessment included aerial and/or ground inspections of significant portions of track and potential alignments, station evaluations, and identification of potential locations and required maintenance facility equipment for each option. *TRACKMAN*™ was used to catalog the base track infrastructure and improvements. *LOCOMOTION*™ was used to simulate various train technologies on the track at different levels of investment, using operating characteristics (train acceleration, curving and tilt capabilities, etc.) that were developed during the

technology assessment. The study identified the infrastructure costs (on an itemized segment basis) necessary to achieve high levels of performance for the train technology options evaluated.

Exhibit 1-3: Interactive Analysis Process



A comprehensive travel demand model was developed using the latest socioeconomic, traffic volumes (air, bus, auto, and rail) and updated network data (e.g., gas prices) to test likely ridership response to service improvements over time. The ridership and revenue demand estimates, developed using the *COMPASS*™ demand modeling system, are sensitive to trip purpose, service frequencies, travel times, fares, fuel prices, congestion and other trip attributes.

A detailed operating plan was developed and refined, applying train technologies and infrastructure improvements to evaluate travel times at different levels of infrastructure investment. Trip frequencies were tested and refined to support and complement the ridership demand forecasts and to estimate operating costs.

Financial and economic consequences were analyzed for each option over a 30-year horizon using FRA approved criteria. The analysis provided a summary of capital costs, revenues, and operating costs for the life of the project, and developed the Operating Ratio and Cost Benefit Ratio for each option.

1.6 Report Structure

The following is the report structure for the Rocky Mountain High-Speed Rail Feasibility Study.

Chapter 1: High-Speed Rail Planning Process

This chapter documents RMRA goals and objectives and the TEMS team response, including the Business Planning process. It includes a discussion of the following:

- Alternatives development process
- Public involvement process
- Peer Review Panel review process

Chapter 2: Target Markets

This chapter documents the character of travel in Colorado, in particular critical intercity travel from key locations such as the big cities (Denver and Colorado Springs), Denver International Airport (DIA), and the mountain resorts. Consideration is given regarding anticipated changes in markets over time.

Chapter 3: Infrastructure Needs

This chapter is divided into two sections. The first section defines potential routes in the I-25 and I-70 corridors, describing existing conditions and the ability to develop effective alignments along each corridor. The second part introduces basic engineering standards and infrastructure elements that are needed for developing an effective fixed guideway system. This chapter provides the background needed to understanding the route and technology options and operating plans that are presented in Chapters 4 and 5. The basis for the derivation of detailed capital cost estimates are presented in Chapter 8.

Chapter 4: Route and Technology Options

This chapter includes a review of existing technologies that might be used to provide service in the I-25 and I-70 corridors. It includes the rationale for defining equipment technology groupings, and the matching of specific technologies to route alignment options. Conventional rail technologies are limited in their ability to tackle heavy mountain gradients and have been restricted to grades of 4 percent or less. An "Unconstrained" network option, meaning that the alignment is allowed to deviate from the I-70 highway corridor, was developed for this evaluation. Newer high-speed rail or maglev technologies are able to cope with heavier gradients up to 7 percent on the existing I-70 highway alignment. A second "I-70 Right-of-Way" network option was developed for this evaluation.

Chapter 5: Operating Plans

This chapter describes the development of a range of alternative technology and route options in the I-25 and I-70 corridors. A critical element is the estimation of travel times and potential frequencies for each alternative.

Chapter 6: Travel Demand and Forecasting

This chapter describes the level of traffic and revenue generated by each alternative developed in Chapter 5 and its potential revenue. The detailed demand model and its calibration are described in Appendix B.

Chapter 7: Operating Costs

The character of the operation plan that optimizes each option is described together with its operating costs.

Chapter 8: Capital Costs

In this chapter, the infrastructure plan and capital costs for each route option are described. The chapter describes the capital cost development process and identifies the 2008 unit costs. The analysis provides capital costs on a segment basis; segmentation detail is provided in Appendix E and F.

Chapter 9: Evaluation of Alternatives

This chapter describes the financial and economic methodology used to evaluate and refine the proposed alternatives, and to identify the FRA Developed Option. The refinement process included "truncation" of weak segments, and the "mix and match" of both routes and technologies as appropriate.

Chapter 10: Implementation Plan for the FRA Developed Option and Risk Assessment

This chapter describes the implementation plan for the FRA Developed Option. It includes key milestones and phasing for the development of the system based on currently available information. For this option, a detailed financial plan and both sensitivity and a risk analysis is developed. The sensitivity analysis considers socioeconomic, transportation, operating and capital costs, and revenue ranges. The risk analysis considers "downside" factors and includes a quantitative analysis comparison of a totally non-freight railroad corridor compared to use of existing rail corridors. Funding options/strategies are defined.

Chapter 11: Funding Alternatives

This chapter describes the major funding sources for high-speed rail development, including the potential role of Federal, State, and local government. It also considers the opportunity for public-private partnerships, and the role that the private sector can play in operating and maintaining the trains and infrastructure, as well as in building stations through joint development partnerships.

Chapter 12: Conclusions and Next Steps

This chapter sets out the conclusions of the study, describing the key ridership, revenue, operating costs, capital costs and implementation results. It then describes steps needed to move the system forward, including requirements for PEIS, EIS, Design and Construction of both infrastructure and vehicles, and Funding.