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**ASSISTANCE WITH THE FEDERAL
HIGH-SPEED RAIL CORRIDOR
APPLICATION PROCESS**

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Research Report 2907-1F
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IMPLEMENTATION STATEMENT

TxDOT can use the information presented herein to serve as the core document in any petition submitted to the Secretary of Transportation for federal assistance in corridor planning activities. The corridor feasibility study workplan that was developed can represent the expected deliverables from contractors in a potential Request for Proposal issued from TxDOT.



DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official view or policies of the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation.



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SUMMARY

In April of 1993, the Clinton Administration announced a \$1.3 billion national high-speed rail initiative. The Secretary of Transportation reported the Administration's intent as a partnership between the federal government and the state and local communities to build high-speed rail (HSR) corridors that would create jobs and growth across the United States. In response to the Administration's high-speed rail initiative, a bill was introduced in the House and Senate entitled the "High-Speed Rail Development Act of 1993." Under this Act, federal funds would be available to assist local and state governments in developing high-speed corridors designated by the Secretary of Transportation.

In spite of a favorable report from Congress, the High-Speed Rail Development Act of 1993 did not pass. Given this state of affairs, the Committee on Energy and Commerce, in conjunction with the U.S. Department of Transportation, deemed it necessary to develop significantly scaled-back legislation. In comparison to the High-Speed Rail Development Act of 1993, which was a well-financed program emphasizing corridor construction and development, the new bill introduced in the House (H.R. 4867) is a modest advance forward in the development of steel-wheel high-speed rail activities. H.R. 4867, by authorizing federal assistance with corridor pre-construction activities, provides the state of Texas with an opportunity to remain an active participant in high-speed rail.

This project developed a workplan for a feasibility study of possible high-speed rail corridors in Texas. This workplan will serve as the core document in any petition submitted to the Secretary of Transportation, and will represent the expected deliverables from contractors in a potential Request for Proposal issued from TxDOT.



CHAPTER I. ASSISTANCE WITH THE FEDERAL HIGH-SPEED RAIL CORRIDOR APPLICATION PROCESS

INTRODUCTION

On April 28, 1993 the Clinton Administration announced a \$1.3 billion national high-speed rail initiative. The Secretary of Transportation reported the Administration's intent as a partnership between the federal government and the state and local communities to build high-speed rail (HSR) corridors that would create jobs and growth across the United States. The Administration's high-speed rail program had three basic components: corridor designations, master plan development, and federal funding assistance to states and localities for projects identified in the master plan (*Reed, 1993*).

Initial review of high-speed rail transportation by the United States Congress has proven to be positive. Statistics from the French and Japanese high-speed rail systems show that it may offer a safe and efficient alternative to aviation and motor vehicle travel for intercity transportation in certain corridors linking major metropolitan areas in the United States. Furthermore, an electrically driven high-speed system offers environmental advantages over other modes of intercity transport. Innovations in HSR will require new technologies, the development of which can have the secondary benefit of expanding the competitiveness of U.S. industry. High-speed rail also has the potential to relieve congestion experienced in densely populated corridors. Ridership statistics from Amtrak's Metroliner service between Washington, D.C. and New York show that Americans will use high-speed rail when that mode of transport is available (*103D Congress*).

In a series of published policy resolutions, the American Association of State Highway Transportation Officials (AASHTO) placed itself as a proponent of the national high-speed program and urged its enactment by Congress. Citing reasons such as the United States' dependency on its ability to move people and goods efficiently as an important means of

remaining competitive in the global economy, AASHTO strongly praised the Administration's high-speed surface transportation proposal (*AASHTO, October 1993*).

HIGH-SPEED RAIL DEVELOPMENT ACT OF 1993

In response to the Administration's high-speed rail initiative, a bill was introduced in the House (H.R. 1919) to establish a program to facilitate the development of national high-speed rail. The bill was cited as the "High-Speed Rail Development Act of 1993." Simultaneously, a similar bill was introduced in the Senate as S.839. Under this Act, federal funds would be available to assist local and state governments in developing high-speed corridors designated by the U.S. Secretary of Transportation.

Congress developed certain stipulations which must be followed in the development of the high-speed rail corridor. First, the states and localities should take the prime responsibility for the implementation of the high-speed rail service. Also, the proposed high-speed rail service should not receive federal subsidies for operating and maintenance expenses. However, it was projected that federal assistance would be needed for the research, development, and the demonstration of new high-speed rail technologies. Furthermore, federal financial capital assistance might be necessary to supplement state, local, and private financial commitments to the development of the high-speed rail infrastructure. Initial reports from the Administration stated that an approved state petition may put an applicant state in a position to receive up to 80% of the cost of development in federal grants (*AASHTO, November 1993*).

A state had to show its intention to participate in having a designated corridor route through the state's governor sending a petition that encompassed the proposed corridor to the Secretary of Transportation. The corridor had to serve two or more major metropolitan areas in the United States that the Secretary determined had potential for cost effective intercity public transportation as part of the nation's transportation system. The governor's petition had to include characteristics of the proposed high-speed rail corridor which would be used by the Secretary of

Transportation in determining the corridor's merit.

Despite the favorable report from Congress, this legislation did not pass. Severe budget restraints and other factors compelled the Committee on Energy and Commerce, in consultation with the U.S. Department of Transportation, to develop significantly scaled-back legislation.

HIGH-SPEED RAIL DEVELOPMENT ACT OF 1994

On August 1, 1994, H.R. 4867 was introduced in Congress, authorizing activities to assist in the implementation of high-speed rail transportation for a period of three years, ending September 30, 1997. This bill would authorize the appropriation of \$184 million over the fiscal years 1995 through 1997 for the planning of high-speed rail corridors and the development of high-speed rail technology. For fiscal year 1995, the legislation authorizes \$29 million for both corridor planning and development of high-speed rail technology. The authorization for corridor planning for fiscal years 1996 and 1997 is \$40 million and \$45 million respectively. The bill specifically prohibits financial assistance to be provided for corridor planning with respect to the main line of the Northeast Corridor, between Washington, D.C. and Boston, Massachusetts. In addition, the wording of the bill specifically emphasizes that any appropriation is to be applied to steel-wheel high-speed rail and does not include magnetic levitation technology.

The bill:

- Allows the U.S. Secretary of Transportation to provide financial assistance to states or public agencies for eligible high-speed rail corridor planning activities,
- Establishes criteria for the Secretary to consider when funding eligible corridor planning activities, and
- Allows the Secretary to provide financial assistance for developed technology improvements to assist in the implementation of high-speed rail service in the United States.

In terms of corridor planning, the Secretary may provide up to 50 percent of the publicly funded costs associated with eligible activities. No less than 20 percent of the publicly funded costs associated with eligible activities shall come from state and local sources, not including funds from any federal program. H.R. 4867 outlined 12 corridor planning activities eligible for federal funding:

1. Environmental assessments,
2. Feasibility studies emphasizing commercial technology improvements or applications,
3. Economic analyses, including ridership, revenue, and operating expense forecasting,
4. Assessing the impact on rail employment of developing high-speed rail corridors,
5. Assessing community economic impacts,
6. Coordination with state and metropolitan area transportation planning and corridor planning with other states,
7. Operational planning,
8. Route selection analyses and purchase of rights-of-way for proposed high-speed rail service,
9. Preliminary engineering and design,
10. Identification of specific improvements to a corridor, including electrification, line straightening and other right-of-way improvements, bridge rehabilitation and replacement, use of advanced locomotives and rolling stock, coordination with other modes of transportation, parking and other means of passenger access, track, signal, station, and other capital work, and use of intermodal terminals,
11. Preparation of financing plans and prospectuses, and
12. Creation of public/private partnerships.

In comparison to H.R. 1919, which was a well-financed program emphasizing corridor construction and development, H.R. 4867 is a modest advance forward in the development of steel-wheel high-speed rail activities. The bill authorizes preconstruction activities for corridor planning and requires the Secretary of Transportation to consider a broad range of criteria in providing financial assistance. Over 13 criteria were specified in the bill. These included:

1. The relationship of the corridor to the Secretary of Transportation's national high-speed ground transportation policy,
2. The extent to which the proposed planning focuses on systems which will achieve sustained speeds of 202 kph (125 mph) or greater,
3. The integration of the corridor into metropolitan area and statewide transportation planning,
4. The potential interconnection of the corridor with other parts of the nation's transportation system, including the interconnection with other countries,
5. The anticipated effect of the high-speed rail service on the congestion of other modes of transportation,
6. Whether the work to be funded will aid the efforts of state and local governments to comply with the Clean Air Act,
7. The past and proposed financial commitments and other support of state and local governments and the private sector to the proposed high-speed rail programs, including the acquisition of rolling stock,
8. The estimated level of ridership,
9. The estimated capital cost of corridor improvements, including the cost of closing, improving, or separating highway-rail grade crossings,
10. Rail transportation employment impacts and community economic impacts,
11. The extent to which the projected revenues of the high-speed rail service, along with any financial commitments of state or local governments and the private sector, are expected to cover capital costs and operating and

maintenance expenses,

12. Whether a specific route has been selected, specific improvements identified, and capacity studies completed, and
13. Whether the corridor has been designated as a high-speed rail corridor by the Secretary of Transportation.

HIGH-SPEED RAIL IN TEXAS

On August 19, 1994 the Texas High-Speed Rail Authority voted to rescind the franchise to TGV to build a high-speed rail system in Texas. This, along with the lack of action on the part of Congress on House and Senate bills H.R.1919 and S.839, effectively ends any promise of high-speed corridor development for Texas in the near future.

It is important that Texas continue as a player in high-speed rail. The alternative is to serve Texas's growing travel demand on existing transportation systems (air and highway). These systems, which are already approaching capacity, will be further burdened by future increases in trip demand. Requiring the present modes to absorb these volumes of travelers will necessitate considerable expansion of their capabilities at a substantial cost to the public and private sectors.

The case for high-speed rail in the state of Texas is a good one. Texas is the second most populous state in the union, has geography amenable to relatively low-cost high-speed corridor development, and has major metropolitan centers ideally situated to take advantage of the efficiencies of high-speed rail. House bill 4867, with its emphasis on corridor planning, represents an opportunity for the state of Texas to continue to investigate high-speed rail alternatives.

ORIGINAL OBJECTIVES OF THE PROJECT

In August of 1992, the Texas Department of Transportation (TxDOT) submitted to the Federal Railroad Administration an application for the designation of a high-speed rail corridor between San Antonio and Laredo. This application was one of fifteen submitted nationwide in response to Section 1010 of ISTEA. Although the San Antonio-Laredo corridor was not one of the five corridors selected by the U.S. DOT, TxDOT staff gained valuable experience in the preparation of the application. Given this experience, it was recognized that TxDOT needed to build on the knowledge acquired during the application process and place itself in a position to respond expeditiously when the governor received notification of a corridor selection opportunity.

In the event that the Administration's national high-speed rail transportation proposal were enacted, it was necessary that TxDOT be prepared to meet the high-speed rail corridor selection criteria defined by the U.S. Department of Transportation. In doing so, TxDOT needed to be fully aware of the requirements of the federal high-speed rail corridor program in coordination with its own statewide transportation planning process. Furthermore, TxDOT had to be aligned to coordinate efforts with adjoining states in the case of developing a continuous corridor or a joint petition.

In order to satisfy the original objectives of the project, the Texas Transportation Institute was to implement a work plan to assist TxDOT in the corridor application process. The work plan was to outline steps that would focus on defining the requirements of the federal high-speed rail corridor program and monitoring its progress through Congress, coordinate the high-speed rail corridor application with the statewide transportation plan, and establish working relationships with other involved parties or states.

As stated previously, with the failure of Congress to act on the Administration's \$1.3 billion national high-speed rail initiative, corridor development activities are effectively

frozen for the foreseeable future. H.R. 4867, by authorizing federal assistance with corridor pre-construction activities, provides the state of Texas with an opportunity to remain an active participant in high-speed rail. Given the realities of this situation, the original objectives of the project were amended to focus more on corridor planning activities rather than issues associated with corridor development.

AMENDED OBJECTIVE OF THE PROJECT

Assuming the House and Senate pass the High-Speed Rail Development Act of 1994 and funds are appropriated for corridor planning activities, a petition would be made to the Secretary of Transportation requesting consideration for federal assistance. The guidelines concerning the submission of petitions are currently being developed by the Federal Railroad Administration. Although petition guidelines are currently under development and are not available to provide direction, research on previous petitions has illustrated that successful submissions are ones that demonstrate a thorough definition and grasp of the work to be performed.

Toward this end, the objective of the project was amended to provide for the development of a workplan for a feasibility study of possible high-speed rail corridors in Texas. This workplan will serve as the core document in any petition submitted to the Secretary of Transportation, and will represent the expected deliverables from contractors in a potential Request for Proposal issued from TxDOT. The workplan, which serves as the principal deliverable for this project, begins in chapter 2.

CHAPTER II. FEASIBILITY STUDY WORKPLAN

TASK A - SUMMARY OF EXISTING SITUATION

The work for Task A will involve the collection and evaluation of available data applicable to the project. Additionally, this activity will accomplish the initial planning of all activities required to complete this assignment and will provide for coordination and meetings with appropriate operating and engineering personnel of Amtrak, Union Pacific, Southern Pacific, Santa Fe, and Burlington Northern. Data collection and review conducted for this task will also include interviews with appropriate railroad operation and maintenance personnel to gain an understanding of operating procedures, track maintenance requirements, and traffic interruption policies. The information required will include:

- Station maps,
- Operating rules and timetables,
- Track charts,
- Track and maintenance standards for Amtrak, Union Pacific, Southern Pacific, Santa Fe, and Burlington Northern,
- Railroad policies and procedures,
- Safety standards and policies,
- Texas Turnpike Authority 1989 Texas Triangle High-Speed Rail Study,
- Track and bridge inspection reports, and
- TxDOT inventory of corridor grade crossings, ADT of crossroads, and the age and condition of protective devices.

Detailed inspections of the track, structures, and other facilities along the various rights-

of-way will be performed. The inspection will examine and assess the following rights-of-way elements:

- Roadway, including subballast, drainage, and brush and weed conditions,
- Ballast,
- Ties,
- Surface and alignment of track,
- Bridges,
- Clearances,
- Grade crossings, and
- Yards and equipment maintenance facilities.

In addition to the field inspection, available mapping and aerial photography will be used to evaluate drainage patterns and identify potential right-of-way limitations and encroachment. The inspection will serve as the basis for rehabilitation alternative assessment and cost analyses, and will provide engineering data to support other tasks to be performed for this project.

TASK B - MARKET RESEARCH

Information will be compiled and collected to address the following issues:

- The total magnitude of travel between city pairs in the corridor,
- The composition of the total corridor travel market in terms of trip purpose and trip maker socioeconomic characteristics,
- The factors considered by trip makers in the choice of travel mode,

- The trade-off relationship between travel time and travel cost, and
- Travelers' attitudes regarding rail service.

The consultant team will assist in the design of surveys of highway, rail, and air travelers. This assistance will include input into the choice of survey site locations, the number of samples required to meet statistical validity requirements, and the design of the survey questionnaire. Data collected from the surveys will support research in the following areas:

- Proportion of which travel markets will be captured by a given level or type of rail service,
- Business leader attitudes toward and perceptions of rail service, their level of support, and their perceived benefits, and
- Government leader attitudes toward and perceptions of rail service and any information they might need to help them in their decision on whether to support rail service.

Following the synthesis of the market research information, the consultant team will develop models to replicate intercity travel in the corridor which can be used to forecast both total travel and potential ridership for each rail option. These would include, but not be limited to, the following:

- Total Demand Model: estimates of the total number of intercity trips for each origin-destination pair and trip purpose based on demographic and economic data,
- Modal Split Model: predictions of the proportion of total trips by mode. Mode choice for each trip purpose will be modeled using both stated preference and revealed preference,
- Mode Choice Model: estimates of mode choice using both stated preference and revealed preference, and

- Induced Travel Model: predictions of the types of travel which may occur as a result of new rail transportation services (i.e., more frequent trips by intercity travelers; trips by new intercity travelers attracted by higher levels of service; and trips generated by residential and commercial development in adjacent areas).

TASK C - RIDERSHIP FORECASTS AND ASSOCIATED REVENUES

Ridership forecast analyses will be conducted along guidelines designed to promote credibility for the demand forecasting process and to provide a common basis for comparison of forecasts from different studies. The primary components of these guidelines include the following:

- The collection of current travel data for the corridor being examined,
- A clear statement of all assumptions built into the forecasts,
- The use of multiple forecasting approaches including market research based techniques,
- Preparation of a range of forecasts including statements of the probability of a particular level of utilization being achieved,
- A high enough level of detail used in the forecasts to adequately test their reasonableness and answer questions commonly posed by government officials,
- Sensitivity tests of key input variables, and
- A formal program of independent technical review.

The task of preparing the required rail patronage forecasts may be organized into the following subtasks:

- Define high-speed rail influence area,

- Define market segments,
- Calibrate demand models,
- Forecast future year planning variables,
- Define assumptions for mode service characteristics,
- Prepare future year ridership forecasts,
- Assess transportation impacts, and
- Conduct sensitivity/uncertainty/reasonableness analyses.

Define High-Speed Rail Influence Area

This subtask allows the study area to be focused to consider only origin-destination movements with a significant potential for using the improved rail system. Prior work in the corridor will be used to identify the corridor influence area. The study area will include all significant generators or attractors of trips that might use the rail system as well as other transportation facilities that would compete with rail.

Define Market Segments

The overall population of corridor travelers will be subdivided into a series of market segments. The primary determinants of these market segments relate to characteristics of the trip itself (trip purpose, length, duration, frequency, etc.) and to characteristics of the trip-makers (auto availability, income, number of people traveling together, etc.).

Calibrate Demand Models

In structuring the adopted modeling system, the contractor will address several issues in the model calibration task. These include:

- The structure and accuracy of prior corridor travel forecast models,
- The level of accuracy that is desirable and achievable, and
- The best way to incorporate market research activities into the forecasting models.

Forecast Future Year Planning Variables

A range of forecasts will be developed representing optimistic, most likely, and pessimistic assumptions regarding corridor development. Travel forecasts will be prepared so that the range of rail usage can be determined.

Define Assumptions for Mode Service Characteristics

This subtask applies not only to the rail services to be considered for the corridor, but also to the service levels to be provided by other transportation modes. Assumptions that must be clearly defined here include highway travel time, system capacities (for example, whether or not major highway improvements are implemented), and air fares. System capacity may also be a consideration for air services in that existing corridor air terminals may not be able to serve all components of future demand.

It is expected that several scenarios will be considered in this definition of assumptions, particularly in areas having a direct impact on rail usage. An obvious example is the future availability and price of fuel for private motor vehicles.

Prepare Future Year Ridership Forecasts

Rail revenues accruing from each usage forecast will be calculated. The ridership and revenue forecasts will report overall numbers of rail users. This basic data would be supplemented with additional information identifying where this ridership is captured from. Ridership would be reported by market segment and other classifications of travel characteristics such as weekday versus weekend, season of year, and peak periods.

In addition to the rail mode, forecasts would be prepared for the other alternative modes in the corridor (highway, air, and bus). These forecasts would also be reported by market segment and travel characteristic. An evaluation would be made of the ability (from a capacity standpoint) of the other modes to carry the projected travel demands and to identify capacity shortfalls.

Assess Transportation Impacts

The consultant team will compare travel forecasts by mode with base case figures to identify diversions to the improved rail services.

Effect of Rail Operations on Air Passenger/Freight Demand

The demand models will produce estimates of passenger travel by mode for each alternative. The Consultant Team will also contact airline representatives to assess their reactions to rail system improvements and their interest in intermodal cooperation.

Energy Savings from Diverted Air Traffic

Data describing the fuel consumption characteristics of aircraft currently operated in the corridor will be requested from aircraft manufacturers and airlines. How fuel

consumption rates can be expected to change in the future will also be evaluated. The travel demand forecasts will be used to calculate the reduction in air service likely to be associated with rail service improvement. These reductions will then be translated to reductions in fuel used for air service and compared to the rail service energy increases.

Conduct Sensitivity/Uncertainty/Reasonableness Analyses

The purpose of this task will be to quantify the range of error that might be present in the study forecasts. The process will consist of first identifying the variables that play a major role in estimating rail usage. Sensitivity tests will then be conducted to determine how variations translate to a change in rail usage. Probability estimates of a given level of variation (error) in the forecasting analyses will be made, allowing for an interval of confidence to be determined. The sensitivity tests will also be used to measure the impact of different rail fare structures on patronage and to evaluate the effect of changing assumptions about future year conditions (e.g., fuel prices and availability).

TASK D - PACKAGE AND EXPRESS FORECASTS

Interviews will be conducted with representatives of businesses providing these types of services as well as with businesses expected to be users of such services. The intent of the interviews will be to obtain an estimate of existing demand. As in the patronage forecasts, a series of market segments would be defined for use in subsequent forecasts.

This system of market segments might include the following:

- Financial institutions,
- Legal services,
- Governmental organizations, and
- Manufacturers of high value, low volume products.

TASK E - EQUIPMENT EVALUATION

Information regarding the equipment of both domestic and foreign passenger systems will be assembled and codified to serve as a point of reference of current technology. This information will include vehicle dimensions, performance, propulsion, braking systems, and any unique features such as body-tilting or articulation. Operations and maintenance experience will also be documented along with the benefits and perceived problems of each system.

The evaluation of potential passenger equipment will be comprehensive. Evaluations of equipment will include the ability to accommodate passengers with restricted mobility as well as the equipment's impact on the environment (e.g., ambient noise, ground-borne vibration, and air pollution).

Ability to Use Existing Railroad Rights-of-Way

A field survey structured to verify data on the condition and clearances of the present corridor will be undertaken and the resulting data used to compile a profile of rolling stock, track, and wayside clearances. Clearance data collected from suppliers will be used to establish clearance requirements for each vehicle.

Information on clearance requirements of the vehicles being surveyed will be compared to the clearance requirements of the corridor. Clearances will be verified under static and maximum vehicle clearance requirements under worst-case speed, superelevation, and curving conditions.

Method of Vehicle Banking for Passenger Comfort

The consultant team will review manufacturer's testing and documentation of operations to evaluate the potential for operating tilting technologies on the corridor. Rolling stock will be classified according to its type of tilting mechanism. The operating principles of the mechanism will be described and operational experience collected. Efforts will be made to substantiate the practicality and maintainability of each design in actual operation and to assess the effect on passenger comfort.

Freight Capacity

All passenger systems have some freight capability, typically oriented to baggage and mail/package express. The consultant team will assess cargo capacity typically provided on standard vehicle types.

Safety of Operation

The consultant team will assess potential safety issues and recommend measures to ameliorate safety concerns. Operators of the equipment under consideration will be contacted regarding their experience with accidents, fires, and other safety issues. Any known accident or unsafe condition will be investigated to assess equipment performance and the need for design changes.

Energy Usage

Data on energy use for train operation will be collected from equipment suppliers, literature reviews, manufacturer's specifications and operating experience when obtainable. Operating conditions such as average speeds and number of stops will be standardized. Results will be reported in standardized units (e.g., energy units or constant

dollars).

Environmental Factors

The review of rail passenger technologies will include assessing effects in the following environmental areas: noise, vibration, right-of-way width, visual, and air and water quality. The consultant team will collect data from manufacturer's specifications and from operating agencies currently using the equipment.

In particular, the consultant team will collect available data on ambient conditions in streams and other water bodies and will identify flood plains and wetlands using FEMA maps and other information. Potential water quality impacts will be described and information will be developed for wetlands including impacts, minimization of impacts, and restoration and preservation methods. Additionally, the consultant team will assess and compare the impact on environmentally sensitive areas of the addition of commuter rail to an already existing rail corridor.

Impact of Inclement Weather on Performance

A profile of weather extremes will be created for the corridor including maximum and minimum temperatures, wind speed, maximum precipitation in 24 hours, and dust conditions. The equipment under consideration will be evaluated to determine the extent to which the supplier has designed the equipment to meet such conditions.

Americans With Disabilities Act (ADA)

Requirements for complying with ADA dictate that information be collected and an assessment be made of the method, effectiveness, and cost for providing handicap accessibility with each vehicle type. Data sources are manufacturer's specifications and

any available operating reports. Technological alternatives will be described and inability to comply will be noted. Further, needs for station and vehicle design congruence will be noted.

TASK F - INFRASTRUCTURE IMPROVEMENTS

Location-specific improvements required to achieve 202 kph (125 mph) will be defined and evaluated. Candidate improvements will be ranked in terms of their cost-effectiveness and other important measures of effectiveness, including environmental effects. Service frequencies will be an important consideration in determining necessary capacity improvements, particularly in determining the appropriate locations for passing sidings or double-tracking within the single-track portions of the corridor.

Potential improvements to the corridor will be examined from several perspectives to identify those features and characteristics that will permit the attainment of the 202 kph (125 mph) objective. The significant features and characteristics that will be examined include:

- Service characteristics: frequency of service, maximum operating speed, trip times, reliability of operation, schedule adherence, peak loadings, station locations, number of stops, mix of passenger and freight service on the same right-of-way, and average running speed,
- Route characteristics: route profile, curvature, grade, track superelevation, grade separation, municipal ordinances, and turnout sizes,
- Communications and signals characteristics: type of signal system, cab signals, automatic train control, automatic train stop, and susceptibility to interference,
- Environmental characteristics: all-weather service capability, air quality, noise and vibration, water quality, traffic and parking, construction impacts, and consistency with local plans,

- Safety characteristics: accident frequency, type, and severity, grade crossing devices, and station platforms,
- Maintenance characteristics: frequency of failures between scheduled maintenance, and the degree of emphasis placed on preventive maintenance versus repair after failure, and
- Surrounding land use characteristics: rail system operation through urban areas, and joint development of stations.

Quantifiable Measures of Effectiveness

Measures of effectiveness will be developed against which the 202 kph (125 mph) speed objective and related corridor improvements can be evaluated. The emphasis will be on quantifiability.

Measures of Cost-Effectiveness

- Capital costs per passenger and per passenger-mile
- Operating and maintenance costs per vehicle-mile or seat-mile
- Incremental operating and maintenance costs per passenger and passenger-mile
- Incremental operating and maintenance costs per added train
- Operating, maintenance and capital costs per station

Measures of Level of Service

- Number of trains per day (peak and off-peak)
- Average passenger wait time
- Trip times

- Number of stops
- Average travel times per passenger
- Average travel times for selected origin-destination pairs

Cost/Revenue Evaluation Measures

- Daily passenger revenue
- Passenger revenue per vehicle-mile
- Governmental contribution (federal, state, or local)
- Average fare
- Ratio of passenger revenue to operating and maintenance costs

Rail Freight Interface

The differing operational characteristics, needs, and priorities of rail freight and rail passenger services create interaction problems as traffic densities increase. To assess the potential for enhanced rail passenger services and freight services to coexist, the consultant team will define and analyze interaction issues and conflicts. Trade-off proposals will be developed and analyzed. The team will review them with the relevant entities and provide conclusions and recommendations in the following areas:

Physical

- Differing superelevation of curves for high speed passenger service and freight trains,
- Differing track maintenance requirements, and
- Curvature issues and overhead clearance requirements.

Operational

- Operating and capacity problems resulting from mixing freight and passenger trains of different speeds,
- Impacts of different operating speeds on wayside signals and grade crossing protection, and
- Accident severity issues associated with high-speed passenger trains speeding by freight trains.

Service

- Maintaining schedules under dissimilar operating speeds,
- Balancing freight customers' needs and passenger schedules, and
- Maintaining freight access to shippers/receivers.

TASK G - TRANSPORTATION AND ECONOMIC BENEFITS

The purpose of this task will be to identify the benefits to be derived from an improved intercity corridor and to provide estimates of their magnitude.

Transportation Benefits

Infrastructure Savings

Efficient rail passenger service will decrease the pressure of demand for new and upgraded facilities in other modes of transportation, most notably highways and airports. This relief in auto and airline demand will be in the form of deferred or canceled investment. These deferred infrastructure investments will be identified for highways and

air terminals.

Travel Time/Cost Savings

Estimates of travel time and cost savings will be made using the outputs of the ridership forecast. An important consideration will be origin-destination travel times, especially for captured air trips.

Public Safety

The historic accident rate for similar types of services will be identified and compared to other modes of travel on a passenger-mile basis.

Economic Benefits

Direct Statewide Economic Impacts

Economic impacts resulting from direct construction project expenditures will be determined. Key inputs will be the cost estimates of infrastructure improvements, equipment evaluations, and accepted economic models. The output from this work will consist of:

- Total direct construction costs by category,
- Total direct construction purchases,
- Direct construction-related jobs, and
- Direct salary and wages of construction-related employees.

There are several approaches to identifying economic impacts: economic base models,

econometric models, and input/output models. An input/output model is suggested for this proposed project. Input/output models that will be examined for possible use will be RIM II, the model maintained by the U.S. Bureau of Economic Analysis, and the model maintained by the Texas Comptroller of Public Accounts.

At a basic level, input/output models can determine the level of purchases from numerous economic sectors. This will be done for purchases from both within and without the state of Texas. The following list shows economic sectors that will be examined.

Agriculture	Fisheries	Coal mining
Apparel	New construction	Maintenance and repair
Food	Textiles	Petroleum/natural gas
Paper	Printing/publishing	Chemicals
Primary metals	Motor vehicles	Nonelectric machinery
Electric machinery	Fabricated metals	Transportation
Communication	Utilities	Finance
Insurance	Real estate	Lodging
Amusement	Health services	Households

Urban Impacts

The economic impacts of the proposed project will tend to concentrate in the urban areas of the state. This concentration results mainly from the fact that the labor force and industries are primarily to be found in urban areas, relocation costs are higher in urban areas, and construction costs will focus on station locations. Both direct and indirect economic impacts of expenditures in urban areas will be examined for each city with a station.

Station Impacts On Community Development

In addition to the urban impacts of construction expenditures, there may be considerable

economic benefits induced by the development of downtown and suburban stations. Due to the limited number of passenger terminals in the U.S. serving high-speed rail, a case study approach will be used to determine the key factors leading to induced development. A case study approach will be used, as opposed to models or other statistical techniques, because of the number of unknown and nonquantifiable aspects of this analysis. Interviews will be conducted with local officials of urban areas served by the proposed project.

Indirect Economic Impacts

Indirect economic benefits arise as an industry takes its sales dollars and buys materials from its suppliers, who in turn purchase materials to replenish their inventories. As the direct construction expenditures are spent and respent, the overall impact is magnified or multiplied many times the original outlay. The output from the determination of indirect economic impacts will consist of:

- Total direct and indirect purchases by industry,
- Total direct and indirect salaries and wages by industry, and
- Total direct and indirect jobs (person-years) by industry.

Operating Impacts

In addition to the construction impacts, the annual operating impacts will also generate both direct and indirect economic benefits. These economic benefits are regenerated each year. The annual economic impact resulting from the operation of the passenger rail system will be determined. The output from the work will consist of:

- Total operating jobs,

- Direct economic operating impacts,
- Indirect economic operating impacts, and
- Purchases and earnings.

Tourism

Impacts on tourism will be analyzed in terms of factors such as number of trips and tourist days. Tourism trips will be available from ridership forecasts and published data from visitor bureaus and similar organizations.

Energy

Construction Energy. The total amount of energy required to construct the system will be determined. This will include energy required to produce materials (e.g., aggregate, steel) and the energy for construction equipment.

Operating Energy. The total annual energy required to operate the service will be calculated. The primary factors used in this estimate will be frequency of service, size of trains, source of power, and speed.

New Technology

The consultant team will determine the extent to which Texas firms can successfully commercialize and manufacture new transportation technologies associated with improved rail service and will identify existing capability in the region. Locational and technical requirements for the successful manufacture of the technologies will be defined and compared to the competitive characteristics of Texas's research and development and manufacturing environments to identify opportunities for successfully producing these

technologies.

The team will recommend steps for attracting producers of new technologies to the area, possibly including cooperative effort with or acquisition of high-speed rail technology from countries such as France, Germany, Great Britain, Sweden, and Japan. The role of the government, industrial consortiums, transportation companies, and others will be explored and steps for developing the regional industrial capability associated with improved rail service will be identified.

TASK H - OPERATION AND BUSINESS PLAN

Based on projected revenues, capital costs, Amtrak, Burlington Northern, Santa Fe, Union Pacific, and Southern Pacific labor agreements, wage rates, and material/supply costs, a business plan will be prepared that will provide for a prudent approach to market effects of services before making heavy capital or operating fund investments.

Capital cost estimates will be developed by the consultant team for the 202 kph (125 mph) speed objective, based on design concepts and rolling stock needs. Unit costs will be based on current market conditions. Operating and maintenance costs will be tabulated and adapted to Texas circumstances as necessary.

In addition to compiling cost data from suppliers, the consultant team will develop independent estimates and conduct a life-cycle analysis. All costs will be stated in 1994 dollars. At a minimum, the following items will be included in the operating plan:

Operations

- Train crews,
- Station agents, and

- Dispatching operators.

Maintenance of Equipment

- Inspections,
- Running repairs,
- Cleaning,
- Servicing,
- Heavy repairs, and
- Fueling.

Maintenance of Way

- Tracks and turnouts,
- Bridges and buildings,
- Communications and signals,
- FRA inspections, and
- Routine maintenance.

Special Services

- Food/commissary,
- Information, and
- Ticketing/reservations.

Contract services

- Marketing, and
- Stations, parking, cleaning, and security.

The operating plan will be one that offers the most potential for maximizing the coverage of costs by revenues. For that operating plan, a business plan will be detailed for the first year. A methodology will be developed to evaluate and annually update the business plan. A set of indicators will be developed to provide immediate opportunities and to control costs. Business plan development will include the following items:

Marketing

- Market responsiveness,
- Advertising, and
- Publicity.

Operational

- Added cars,
- Added trains, and
- Trial service.

Capital

- Added parking,
- Station improvements, and
- Increased station access.

TASK I - FINANCIAL ANALYSIS

The consultant team will investigate the methods through which rail objectives might be financed, considering sources of private funds, public investment, and government involvement. The development and analysis of the financial plan will include:

- The determination of funding needs through an iterative analysis of capital and operating requirements and fund availability,
- The investigation of external public funding sources (e.g., the federal government, Amtrak, etc.),
- The investigation of financing options, including both traditional tax-exempt borrowing and innovative public-private techniques,
- The review of available data on the financing structures proposed for high speed and other innovative rail projects in the U.S. and abroad, and
- The analysis of farebox revenue potential.

Benefit Capture Methods

The consultant team will analyze mechanisms and potential contribution levels of benefit capture methods (including special assessments, tax increment financing, impact fees, and sale of development rights). This process will include identification of the various benefit capture techniques and evaluation of them according to the following criteria:

- The magnitude of potential contribution to the project,
- The revenues from assessments on existing businesses,
- The impact of potential assessments on existing businesses,
- The competitive position of station areas in attracting new business,
- The practicality and legality of implementation, and
- The history of the respective methods in providing financial support for other transportation projects.

Commercial Development Revenues

The consultant team will analyze revenue potential for commercial development within and immediately around the stations on land potentially owned by the rail service developer. This analysis will include the following steps:

- Review the experiences of other transportation facilities in spawning new commercial development around their interchanges/stations,
- Identify critical factors that determine the level of new development created,
- Estimate a range of total square feet of new commercial development that could occur immediately around stations in the system,
- Apply a range of value capture rates (profit diverted to the rail project) and estimate potential contributions to the project,
- Weigh the costs of acquiring and holding the land around the stations with the payoff to project revenues, and
- Compare the costs/benefits of land acquisition with special taxing district alternatives.

Regulatory Issues

The consultant team will identify restrictive covenants, regulations, and legal barriers as well as federal, state, and local legislative requirements for overcoming them. In conducting this task, the team will rely upon its extensive understanding of legal and regulatory barriers to public-private partnerships in transportation infrastructure, as well as discussions with selected state planning officials.

Risk Analysis

The consultant team will consider legislative and policy actions to mitigate the following project risk factors and recommend a plan for allocating and mitigating these risks:

- New technology risk,
- Initial planning expenditures risk,
- Construction cost risk,
- Permitting and environmental mitigation risk,
- Business/revenue risk,
- Ancillary commercial development risk,
- Phased construction risk,
- Cost of capital risk,
- Tort liability risk,
- Change of law/long-term policy risk, especially to private sector participants in the project, and
- Price/profit regulatory risk.



REFERENCES

103D Congress. "H.R. 1919: Report No. 103-258. "High-Speed Rail Development Act of 1993," September 30, 1993.

103D Congress. "H.R. 4867: Report No. 103-692. "High-Speed Rail Development Act of 1994," August 10, 1994.

AASHTO. Policy Resolution Pr-20-93: "The Administration's High-Speed Surface Transportation Proposal," October 24, 1993.

AASHTO. "High-Speed Rail Bill Reported." *AASHTO Journal*, November 12, 1993.

Reed, C. "Clinton Administration Announces High-Speed Rail Initiative," *On Track High-Speed Ground Transportation Update*, Volume III, No. 1, Spring 1993.

