TEXAS TRANSPORTATION INSTITUTE
THE TEXAS A&M UNIVERSITY SYSTEM

Project Summary Report 9-1519-S

Project 9-1519: Freight Pipeline Feasibility Study

Authors: Stephen S. Roop, Craig E. Roco, Curtis A. Morgan, Leslie E. Olson, Jeffery E. Warner, and Dong-Hun Kang

PROJECT SUMMARY REPORT

Project Summary Report on the Technical and Economic Feasibility of a Freight Pipeline System in Texas

Planning for growth in freight transportation throughout Texas has become a significant challenge, particularly along the I-35 corridor. Reasonably, the expected construction and maintenance expenses required to accommodate this growth led to a four-year research project to investigate the technical and economic feasibility of using a freight-conveying pipeline to reduce highway truck traffic on I-35.

What We Did...

This research began with a preliminary assessment of past and current practices in the operation of freight pipelines. Once the extent of available technology was determined, the project was directed toward identifying a conceptual freight pipeline design that would hold the most promise in solving transportation problems within the state of Texas. Following this, the remainder of Year 1 work focused on establishing design and operational guidelines for development of the system's major technical components.

Research in Year 2 consisted of preliminary investigations into the most feasible design for five main pipeline components—the underground, power, transport, material handling, and control systems. This early work was accomplished by focusing on the advancement of knowledge toward the conceptual design of system components, freight movement and simulation modeling, energy analyses, geologic investigations, and transportation industry issues.

A conceptual design of the freight pipeline was completed in Year 3 based on the results of aerodynamic analyses, energy studies, and the evaluation of available technology. This provided sufficient information for the preparation of a conceptual cost estimate that included both construction and operating costs. Also, facility utilization rate estimates were based upon current and projected truck traffic volumes, which were used in conjunction with the cost estimates to prepare a public-sector economic analysis.

Cost estimates were refined in Year 4, followed by additional economic analyses from the perspectives of both the

public and private sectors. Subsequent analyses focused on the refinement of design concepts so as to incorporate the most favorable aspects of the initial design strategy and thereby provide an optimal solution to freight transportation problems in Texas.

What We Found…

Initial investigations determined that the I-35 corridor from Laredo to Dallas was the most feasible route for the successful implementation of a freight pipeline system. Furthermore, freight pipeline sizes incapable of handling truckload volumes would be of little use in solving the state's transportation problems, so a system that transports palletized freight was devised. A five-car, 125-foot transport mechanism was designed to operate over a steel running surface and vertical guideway system using electrically powered linear induction motors for propulsion. This technical design was found to be a superior means of transporting truck freight in terms of both system reliability and adverse impact minimization.

Positive net social benefits of this initial concept were shown to be possible, but the risks associated with significant cost overruns and uncertainties in utilization rates were substantial. In addition, a cash flow analysis determined that the private sector should not be expected to invest in this concept due to the absence of revenue generation from reductions in marginal truck costs (i.e., reduced collisions, congestion, pavement damage, and pollution).

Figure 1. Container Transfer from Freight Shuttle to Truck.

Finally, the transfer of truck freight to and from the pipeline was found to be a significant barrier to project feasibility. Processing times required by the complicated trans-loading process prevent this concept from being competitive with trucking times for all but direct Laredo-Dallas shipments, which makes the freight pipeline an inherently inflexible mode of transportation.

Subsequent to investigating the initial concept (a freight pipeline), the redirection of design strategies resulted in a surface transportation system that the Texas Transportation Institute (TTI) has named the "Freight Shuttle." This concept was proposed as a means of reducing project risks, and thereby improving project feasibility, by minimizing the potential for construction cost overruns and maximizing the opportunity for high utilization rates. An aboveground freight shuttle was judged to be a valid option to a freight pipeline if included as part of the Trans Texas Corridor plan, which offers, as a restricted-access

facility, security similar to that of an underground system.

The freight shuttle incorporates favorable features of the initial design, namely linear induction motors, a vertical guideway, and significant reductions in marginal trucking costs. This system also allows intermodal containers or truck trailers to be loaded for transport using container cranes, which eliminates the need for a complex trans-loading process and accommodates a larger portion of Texas' freight traffic (Figure 1).

Furthermore, at a cost comparable to that of the Laredo-to-Dallas freight pipeline, estimates showed that an entire freight shuttle network could be constructed to extend throughout the "Texas triangle" (San Antonio, Dallas/Fort Worth, and Houston), allowing truck traffic throughout the state to be removed from major highways. Finally, by capturing larger potions of freight traffic, the freight shuttle concept was found to be attractive to private investment, which fulfills the private funding goals of the Trans Texas Corridor plan (Figure 2).

The Researchers Recommend…

The favorable initial economic evaluation suggests that the Freight Shuttle concept merits additional examination and refinement. The research recommended as follow-on work includes further detailing of the system design—particularly as it pertains to the shuttle's suspension, the track design, and control systems. The recommended follow-on research also includes a detailed feasibility assessment with additional economic and simulation modeling and a detailed assessment of the public-private arrangements necessary to move the concept through the design, financing, and implementation stages.

Given the nature and scope of the effort, the study team also recommends that the Texas Department of Transportation (TxDOT) review this system relative to plans for a Trans Texas Corridor. The researchers see this approach to freight transportation as a significant step toward a more cost-effective, more environmentally sound, and less intrusive system. The pavement rehabilitation costs avoided with the system as well as the social impacts avoided, such as collision costs, congestion, and air quality, make the Freight Shuttle worthy of closer examination.

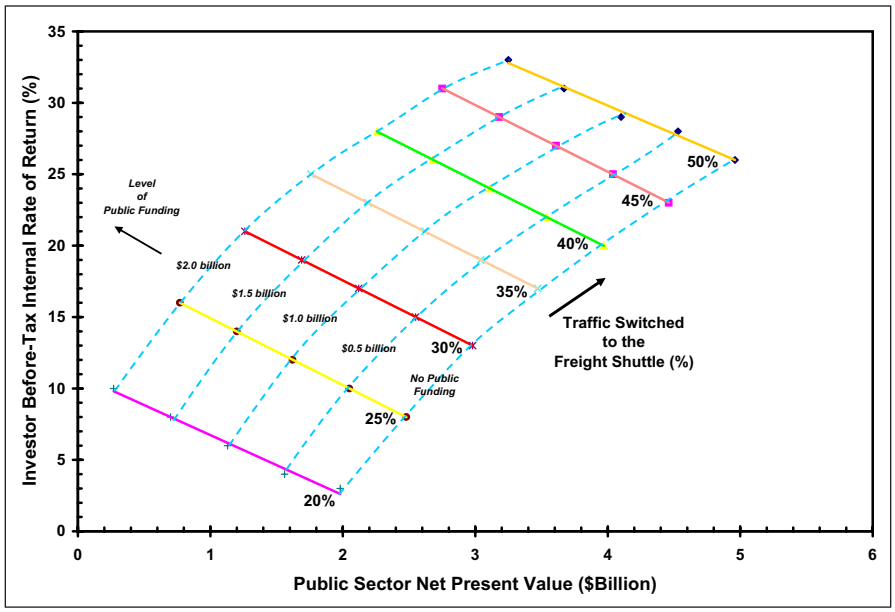

Figure 2. Freight Shuttle Economics.

For More Details...

The research is documented in:

Report 1519-1: *The Technical and Economic Feasibility of a Freight Pipeline System in Texas—Year 1 Report*
Report 1519-2: *The Technical and Economic Feasibility of a Freight Pipeline System in Texas—Year 2 Report*
Report 1519-3: *Year 3 Report on the Technical and Economic Feasibility of a Freight Pipeline System in Texas*
Report 9-1519-4: *Year 4 Report on the Technical and Economic Feasibility of a Freight Pipeline System in Texas*

Research Supervisor: Stephen S. Roop, TTI, s-roop@ttimail.tamu.edu, (979) 845-5817

Key Researchers: Craig E. Roco, TTI, c-roco@ttimail.tamu.edu, (979) 845-5817
Leslie E. Olson, TTI, l-olson@ttimail.tamu.edu, (979) 845-5817
Curtis A. Morgan, TTI, morgan-c@ttimail.tamu.edu, (979) 845-5817
Jeffrey E. Warner, TTI, j-warner@ttimail.tamu.edu, (979) 845-5817

TxDOT Project Director: Michelle Conkle, mconkle@mailgw.dot.state.tx.us, (512) 486-5023

To obtain copies of reports, contact Nancy Pippin, Texas Transportation Institute, TTI Communications, at (979) 458-0481 or n-pippin@ttimail.tamu.edu. See our online catalog at http://tti.tamu.edu.

TxDOT Implementation Status—December 2004

The researchers were very thorough in investigating the feasibility of a freight pipeline (shuttle) system. The researchers also demonstrated how a freight shuttle system could be integrated as a component of the Trans Texas Corridor. Those interested in learning more about the freight shuttle system can review Report 9-1519-4, *Year 4 Report on the Technical and Economic Feasibility of a Freight Pipeline System in Texas.*

For more information, contact Andrew Griffith, P.E., RTI Research Engineer, at (512) 465-7403 or e-mail at agriffi@dot.state.tx.us.

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Texas Transportation Institute/TTI Communications
The Texas A&M University System
3135 TAMU
College Station, TX 77843-3135