PROJECT SUMMARY

0-6870: Integrating Underground Freight Transportation into Existing Intermodal Systems

Background

The Texas transportation system is critical to the United States economy. According to a report prepared for TxDOT, NAFTA tonnage on Texas highways and railroads is forecast by Global Insight TRANSEARCH to increase by nearly 207 percent from 2003 to 2030. Truck tonnage will grow by 251 percent while rail tonnage is forecast to increase 118 percent. The number of trucks carrying NAFTA goods will increase by 263 percent and the number of rail units will grow by 195 percent. This will have a profound impact on the Texas highway and railroad systems. Additionally, larger ships will arrive in the Port of Houston due to Panama Canal expansion. Therefore, increasing the capacity of the freight transportation system in Texas is a must, while increased land development and population make the possibility of constructing new roads, or adding new lanes and railroad tracks very difficult and costly.

The purpose of this project was to investigate the feasibility of employing a variety of underground freight mobility technologies, which allows for the optimized use of the available highway capacity. Underground freight transportation (UFT) is a class of automated transportation systems in which vehicles carry freight through tunnels and pipelines between intermodal terminals. Being able to use a part of the space under existing highways will greatly facilitate the construction of such tunnels and pipelines and reduce their construction costs.

What the Researchers Did

By considering planning and design, construction methods, cost analysis, environmental impacts, financing means, and the leadership of the Stakeholder Committee, this project examined the use of UFT in three proposed routes in Texas, namely, the Port of Houston to Dallas, the Port of Houston to a distribution center within 15 miles of the Port's point of origin, and the border crossing with Mexico in Laredo.

What They Found

The researchers considered all aspects of UFT, including planning and design, construction methods, cost analysis, environmental impacts, financing means, and input of a stakeholder committee. The operation and maintenance costs of shipping freight by UFT are approximately 1/3 to 1/10 of shipping by trucks. Compared with rail transport, transporting freight by UFT is faster, does not divide cities and communities, does not generate the delays for loading and unloading, with no noise and traffic congestions that railroads provide.

In addition, UFT has minimal maintenance costs, provides improved performance, reduces land usage[1], has less operation and maintenance costs, provides increased efficiency, and provides an opportunity for shared infrastructure. By

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Project Completed:
08-31-2016

reducing heavy trucks, UFT provides a safer environment for cars, and reduces damage to pavement and bridges. UFT reduces social costs of air, water, and noise pollution, traffic congestion and accidents, which are caused by heavy trucks. For the case of 250-mile route between Houston and Dallas, the annual social benefits of UFT are estimated to be approximately $400 M. According to the American Trucking Associations (ATA), a deficit of 48,000 drivers is expected as the New Year approaches. If the current trend continues, the organization predicts that the shortage will surge to almost 175,000 by 2024. UFT will help the trucking industry by alleviating the needs for drivers as alternative non-operator delivery can be used by trucking companies and they can benefit financially.[2]

What This Means

The second phase of this project was proposed to evaluate all aspects of tunnel and vehicle design, the propulsion system, automation, and cost in a laboratory setting, while a third phase was proposed a pilot study of UFT installation for a few mile sections. For a future project, an intra-city freight transportation route across a metropolitan area, such as between freight hubs in Fort Worth and Dallas, connected on either end by a railroad or highway, can be considered.

The Value of Research

Table 1 shows the value of this research. These analyses do not include benefits arising from reduction of overland accidents, involving trucks and trains, such as the train collision near Panhandle, Texas, on June 28, 2016. The value of research goes beyond just economic values by considering the safety and environmental impacts of other modes of freight transportation. The values of net present value (NPV) and benefit-cost (BC) ratio of each system, along with the comparison of the system's internal return rate (IRR), clearly shows the economic viability of each proposed UFT alternative.

[1]Most rural freeways in Texas have a 150 to 250 ft right-of-way (ROW). Assuming an average value of 200 ft for the ROW, a one-mile length requires an area of about 24.2 acres.

[2]http://www.roadscholar.com/investigative-report-2016-trucking-industry-forecastexpectations/

Table 1 Summary of Calculated Economic Measuresfor Various Designed UFTs with a Discount Rate of 1.5

Alternative	NPV	BC Ratio	IRR
Container Size UFT from Port of Houston to Dallas at Lancaster	$59.7 billion	3.77	12.44%
Container Size UFT from Port of Houston to Inland Satellite Distribution Center in Baytown	$3.4 billion	3.3	11.6%
Crate Size UFT from Port of Houston to Inland Satellite Distribution Center in Baytown	$1.1 billion	1.96	6.44%
Pallet Size UFT from Port of Houston to Inland Satellite Distribution Center in Baytown	$0.2 billion	1.24	3%
Container Size UFT for the Border between the U.S. and Mexico in Laredo, TX	$0.8 billion	2.48	9.92%

For More Information

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Keyword: Research