



Transportation Consortium of South Central States

Key Points

Project Number:

18PPPVU01

Start Date:

03/15/2018

End Date:

09/15/2019

Principal Investigator(s):

Raghava Kommalapati
Prairie View A&M University
rrkommalapati@pvamu.edu

Venkata Botlaguduru
Prairie View A&M University
vsbotlaguduru@pvamu.edu

Doeun Choe
Prairie View A&M University
dochoe@pvamu.edu

Lead Institution:

Prairie View A&M University

Funds Requested to UTC:

\$68,500

Funding Source(s):

Tran-SET

Total Project Cost:

\$68,500

Lifecycle Environmental Impact of High-Speed Rail System in the I-45 Corridor

Brief Project Description

This project will conduct a holistic life cycle assessment (LCA) study exploring the energy and environmental impact of a proposed high-speed rail system (HSR) along the Houston-Dallas I-45 corridor and the role of this transportation mode in alleviating persistent air quality problems in the nonattainment areas of Houston and Dallas. This study will develop estimates for GHG emissions and energy consumption per vehicle-kilometer traveled; and investigate scenarios of varying passenger ridership/migration level to the HSR system. The outcomes from this LCA study would provide vital information to regulators, planners and researchers studying environmental impact of fossil fuel usage in transportation sector of the south-central U.S. A comparative analysis for passenger travel by HSR, highway and air modes will establish the inventory and methodological framework for conducting future LCA studies for potential HSR routes in multiple travel corridors of the south-central U.S.

Problem Statement

The Houston-Dallas I-45 corridor was ranked as the top priority among 18 traffic corridors in Texas for the development of an Intercity Passenger Transit System, by the Texas A&M Transportation Institute. The city councils of Dallas and Houston have recently taken positive legislative steps toward construction of a 240-mile high speed rail (HSR) system connecting Dallas and Houston with Shinkansen N700 series trains at a top speed of 200 mph. At this juncture, it is imperative to examine the potential life cycle environmental impacts of the HSR system and compare it with the environmental impacts associated with existing transportation modes of highway and air travel. HSR systems powered by electricity have significantly lower releases of air pollutants and greenhouse gases during operation stage, in comparison to conventional transportation by road/air. However, this study considers the total life cycle of an HSR system including all stages from 'cradle-to-grave' such as, raw material extraction, infrastructure development, vehicle manufacturing, electricity generation, operation & maintenance, and end-of-life.



Transportation Consortium of South Central States

Objectives

The overall goal of this study is to provide an estimate of the environmental impact resulting from the total life cycle of the Houston-Dallas HSR system. Following are the major objectives to realize the overall goal:

- Develop the framework for methodological environmental LCA of current/proposed HSR corridors in south-central US
- Estimate the net change in GHG emissions and global warming potential of the Houston-Dallas HSR system
- Evaluate the effect of the HSR system in improving regional air quality of Texas with emphasis on Houston-Galveston-Brazoria area
- Compare the improvements in sustainability resulting from the HSR system under varying degrees of traffic migration/passenger adoption from existing transportation modes
- Analyze the effect of source electricity mix scenarios on the environmental impacts from the operation phase of the proposed HSR system
- Provide guidance to stakeholders, policy makers and community leaders on the potential environmental benefits/costs of HSR mode of transportation in U.S.

Intended Implementation of Research

This study will engage faculty/staff and students on a current infrastructure project and fill critical gaps in knowledge on the ecological/environmental benefits of HSR systems in the US. Dissemination of research outcomes through workshops and seminar sessions to high school students and community stakeholders within local counties would engage them in STEM education and socio-economic benefits of HSR technology. Research experience gained on LCA tools and techniques by the research team would be a valuable addition in designing LCA course modules for engineering majors and incorporating the concepts of LCA into civil and environmental engineering curriculum at the undergraduate and graduate level. More specifically, the research team will develop 3 specific LCA training modules for use in educating students. Also, the research team will directly disseminate research findings to community leaders and stakeholders in the city of Prairie View and Waller County.

Anticipated Impacts/Benefits of Implementation

The study will develop the methodological framework for conducting holistic environmental life cycle assessment for HSR systems in the U.S and build the life cycle inventory of all major unit processes in the life cycle stages of vehicle production and infrastructure construction. The anticipated results will estimate a net reduction in GHG emissions and global warming potential due to the Houston-Dallas HSR system in comparison with highway/air travel modes, from a lifecycle perspective. The overall improvements in sustainability resulting from the HSR system will be quantified under varying degrees of traffic migration/passenger adoption, requiring policy adaption to promote this alternative mode of transportation as complementary to existing infrastructure.

Weblinks:

<http://transet.lsu.edu/research/research-in-progress/>

<https://rip.trb.org/View/1505436>