

JOINT TRANSPORTATION RESEARCH PROGRAM

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Last Mile Delivery and Route Planning for Freight

Introduction

A robust network of transportation is necessary to support the existing and flourishing economic activities in Indiana. Congestion costs an individual approximately \$700 a year. One of the bottlenecks for congestion is at highway exits. While Indiana has a good road infrastructure to support current traffic and prevent congestion—judging by the growth rate of economic activities—the existing capacity will be saturated in the coming years.

This project aims to determine the counties and ramps that will need additional capacity to support future economic growth based on different probable scenarios. This study helps us understand the freight traffic growth

on the ramps, and a scenario-based planning tool was developed to identify potential areas that require additional capacity, while optimizing the cost associated with construction, congestion delays, and diversion of traffic flow to other less congested ramps. INDOT (Indiana Department of Transportation) will be able to use this tool to take advanced action on these forecasts in counties that face potential congestion issues.

Findings

- Many states, like Indiana have a long-term traffic management plan to cater to the growing need of the road network. While states like California predict economic activities to plan for traffic capacity,



Freight.

Chrysaetos, A. (n.d). Aerial view of the logistics park with warehouse, loading hub and many semi trucks with cargo trailers standing at the ramps for load/unload goods at sunset [Image]. Shutterstock. <https://www.shutterstock.com/image-photo/aerial-view-logistics-park-warehouse-loading-1696993459>

states like Ohio incorporate different scenarios for the traffic capacity planning process.

- Counties in Indiana can be categorized into six different clusters based on the relationship between their industry GDP composition and their aggregated freight traffic volume on highway ramps. Construction, warehousing and transportation, and manufacturing turned out to be strong drivers of freight volume flow for most counties.
- Counties like Allen, Elkhart, St. Joseph, Hamilton, Floyd, Harrison, Tippecanoe, Johnson, Monroe, and Hendricks are some examples of counties which will face high congestion on highway ramps, based on their predicted growth in freight from increased industrial activity across all five scenarios.
- Using the optimization tool, analysis of adjacent counties like Elkhart and St. Joseph resulted in recommendations to increase the capacity of all six shared ramps that cater to the demands of both the counties to reduce congestion. Between Floyd and Harrison, two out of the five shared ramps were identified as locations where capacity increase could lead to congestion reduction by optimizing the total costs.

Implementation

A model was built to predict the increase in freight flow based on the industry growth for five probable scenarios

in all Indiana counties. The mixed integer programming tool for the capacity planning of the ramps can be used to plan for future road construction projects by INDOT and help in identifying critical areas in Indiana which need immediate attention. Based on the additional capacity requirement, the tool is capable of formulating the total capital cost of expanding the capacities and calculate various tradeoffs. The tool also allows the user to plan for various scenarios and includes modifiable inputs to set congestion and competitiveness parameters. This can help in finalizing the budget required to carry forward the planned construction projects, based on the tolerance of congestion allowed.

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