USING GIS TO IDENTIFY THE OPTIMAL SITE FOR PHASE 2 OF THE PROPOSED HIGH-SPEED RAIL IN THE TORONTO-WINDSOR CORRIDOR

INTRODUCTION

High-speed rail (HSR) operates at a faster speed than conventional rail traffic and is exclusive to passenger transport. In 2016, the Ministry of Transportation of Ontario (MTO) released a Special Advisory Report outlining two phases for an HSR project in Ontario’s Toronto-Windsor Corridor (TWC). Phase 1 between Toronto and London would be completed by 2025 while Phase 2, a proposed new-build track extending from London, through Chatham, to Windsor, would be completed by 2031. Ontario’s HSR project is anticipated to contribute to the province’s goal of transitioning to a low-carbon economy by 2040. The project would focus on improving connectivity between the Greater Toronto and Hamilton Area. In 2019, the proposed project was halted with a government change, raising concerns over the future of Canadian inter-regional travel. Phase 2, the new-build line, requires additional socioeconomic and environmental analysis to identify the most suitable route with limited impacts from construction and operation. This research analyzes Phase 2 using GIS-based tools and a multi-criteria evaluation (MCE). Key socioeconomic and environmental factors are expressed as constraints and criteria and evaluated using a pairwise comparison and weighted analysis. A suitability analysis is conceptualized using MCE in Figure 6 to show the most suitable areas for the Phase 2 new-build track construction in the TWC.

PROBLEM CONTEXT

- Canada remains the only G7 country without HSR.
- Population in the Greater Toronto & Hamilton Area (GTHA) is expected to grow by 45% by 2041.
- Pressure on the provincial government to develop sustainable and economical inter-regional travel resulting from this growth.
- Plans for retrofitting existing lines and developing new HSR lines puts pressure on the socio-economic and natural environment.
- These potential impacts from new-build development must be studied and evaluated using GIS-based applications to address these challenges.

RESEARCH OBJECTIVES

1. Identify the socioeconomic and environmental variables that influence the development of an optimal HSR route.
2. Design a GIS analysis model using the MCE method by preparing the constraints, criteria, and assigning criteria weights to aggregated data.
3. Apply the MCE model to determine the optimal route for an HSR system.
4. Evaluate the strengths and limitations of the MCE model and suggest recommendations for future HSR transportation planning.

PURPOSE OF RESEARCH

The purpose of this research is to identify the optimal location for Phase 2 of the HSR in the London-Windsor region of the TWC, using an MCE to ensure minimal socio-economic and environmental impacts of the new rail line.

CONCEPTUAL MODEL

This conceptual map (Figure 2) demonstrates the steps to determine the suitability of a High-Speed Rail in Southern Ontario.

STUDY AREA

Figure 1. Map of the selected study area found in Phase 2 of the TWC

RESEARCH AREA

The socioeconomic and environmental variables that influence HSR planning were identified and classified as constraints and criteria (Figure 2).

RESULTS

CONSTRAINTS

- Constraints show areas with zero suitability (traversable) and areas with high suitability (grey).

CRITERIA

- Higher ranked areas have high suitability development (green).
- Lower ranked areas have zero suitability for development (orange).

FINAL OUTPUT

- Areas with higher rank (orange) are most suitable for development.

Figure 6. Constraint raster of existing rail stations, slope, built-up areas, and parks and protected areas.

Figure 5. Criteria raster of existing rail stations, slope, proximity to waterbodies, and environmentally sensitive areas.

CONCLUSIONS

- For the future, it would be beneficial to add more data to the model including existing rail lines, built-up areas for noise, and utility infrastructure. This would have allowed for a more detailed, accurate and refined suitability score that would assist in the projects moving forward. Further analysis is recommended.

REFERENCES


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