Integration of Dynamic Traffic Assignment and the Traditional Transportation Planning Model

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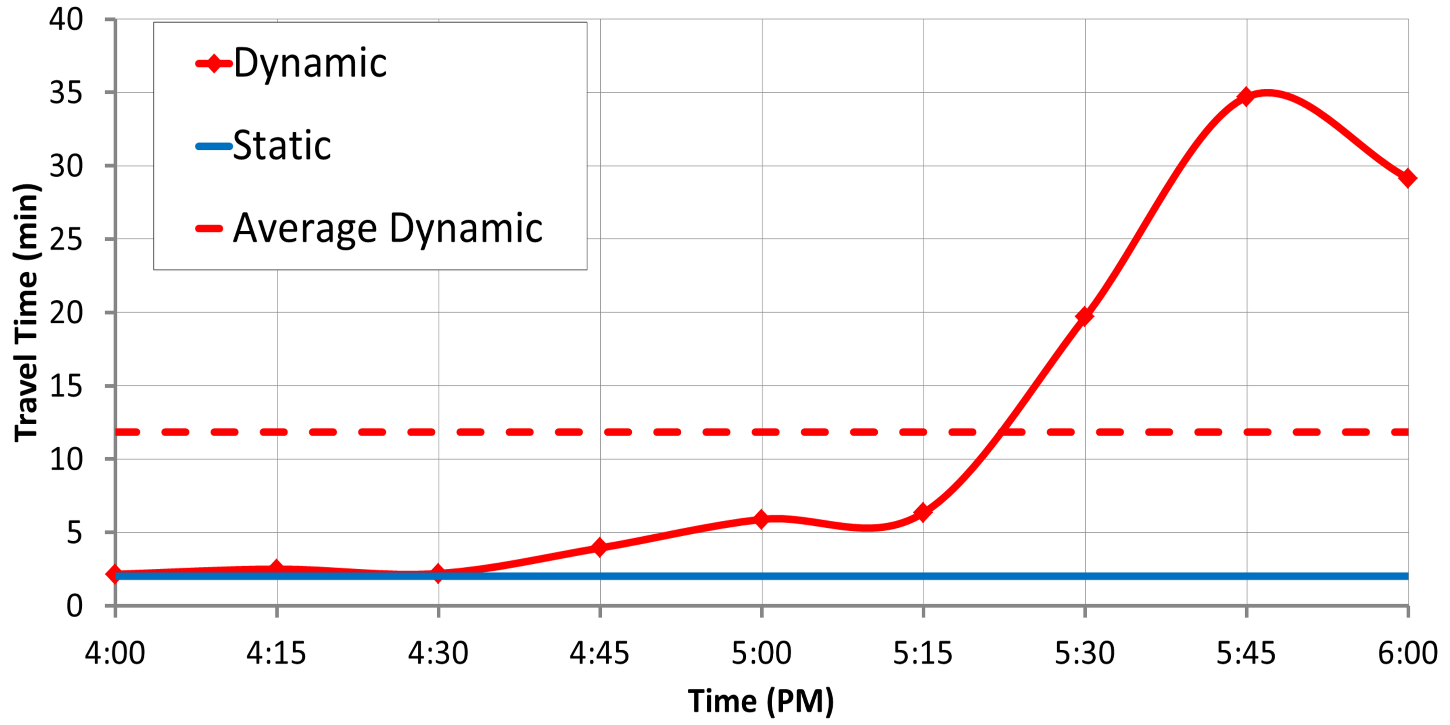
Abstract

The majority of dynamic traffic assignment (DTA) applications are operational in nature, where DTA is used as a standalone device. Outputs from the model are rarely applied outside of the project scope or used to inform high-order planning decisions. The goal of this research is to develop an efficient, uncostly, and intuitive approach to use the detailed information from DTA in the traditional transportation planning model. The proposed method allows the agency to conduct traffic analysis at the subnetwork level while integrating DTA and the four-step model at the regional level. This structure is beneficial for several reasons: (1) it avoids the long convergence time of regional DTA models, (2) detailed information is retained only where detail is needed — the subnetwork, and (3) it retains a connection between the subnetwork and regional area, thus regional impacts caused by subnetwork modifications are captured.

Introduction

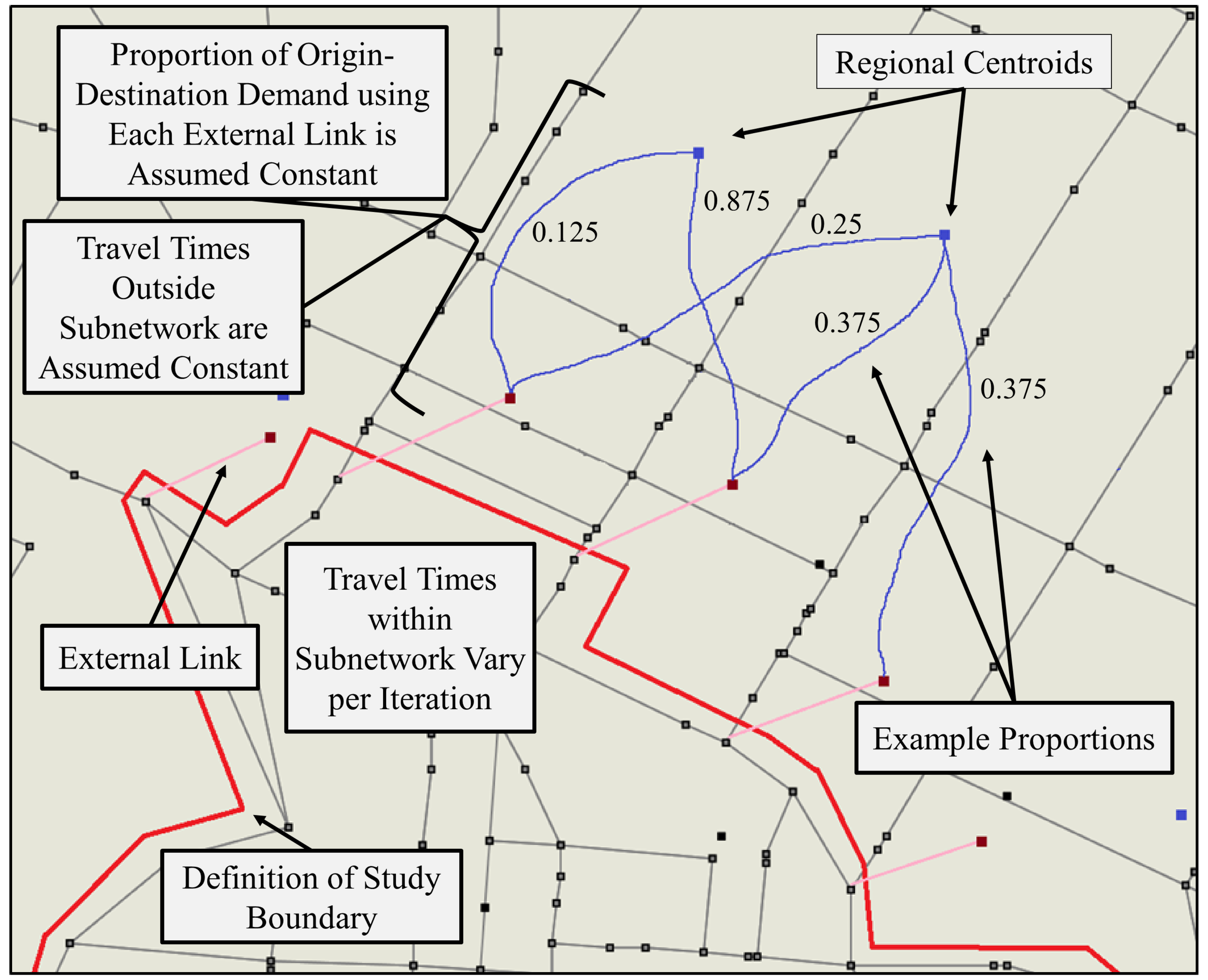
In order to evaluate the vast spectrum and growing trend of time-dependent demand policies in practice, time must be variable in the modeling process. The standard four-step model with static traffic assignment is incapable of evaluating these policies. To illustrate the practical differences between dynamic and static traffic assignment, both methods were implemented on the downtown Austin, TX subnetwork.



Combining the traditional four-step planning model with DTA is the most cost-effective approach (and may be the only available approach) to add temporal dynamics to existing high-order planning processes.

Methodology

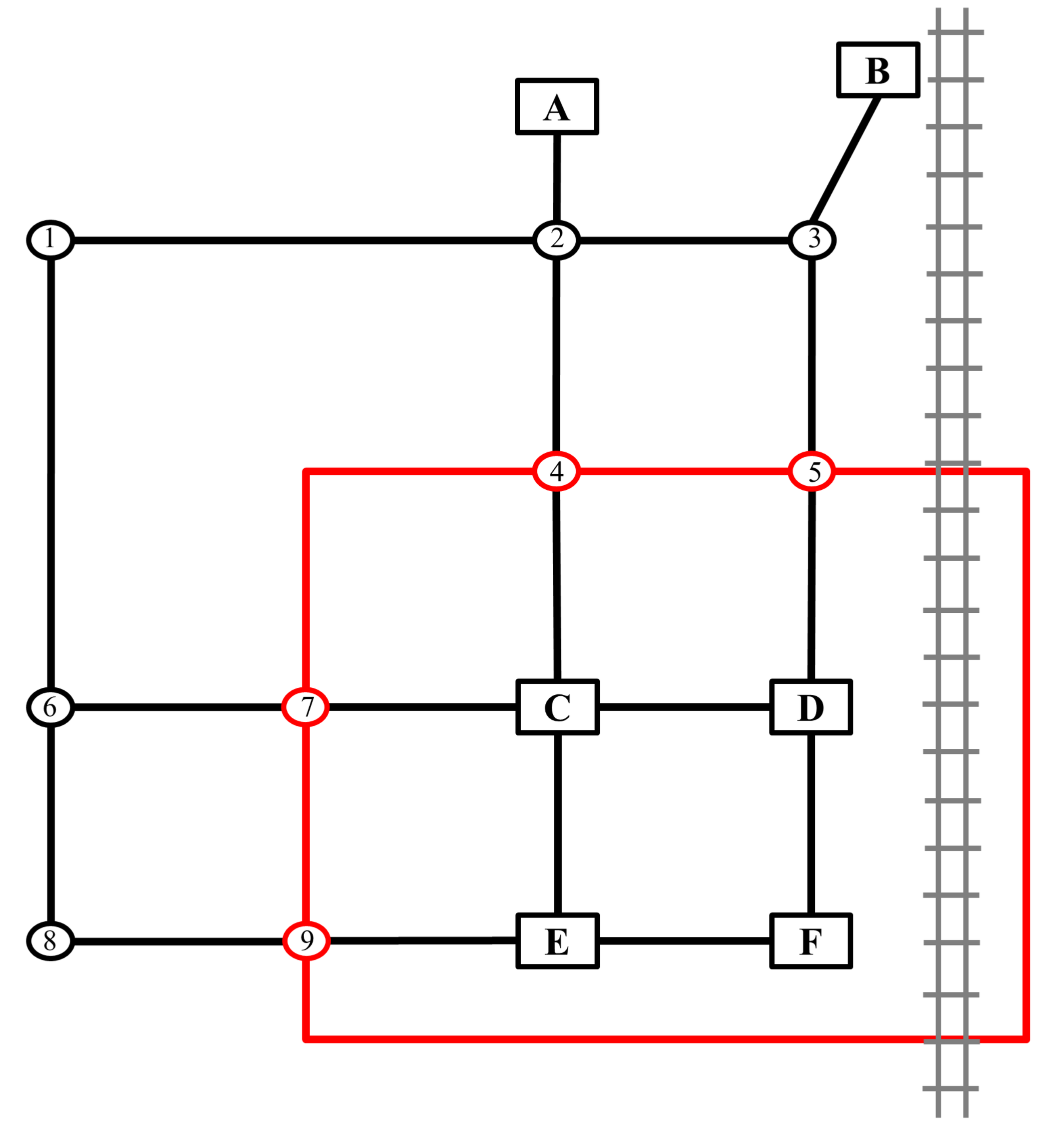
The proposed method involves replacing static traffic assignment with dynamic traffic assignment in the traditional planning model. The objective is to utilize the more complete traffic information from DTA while minimally changing the existing four-step process. The method first requires complete regional implementation for the base condition (such as the base year network). Paths or portions of paths outside the subnetwork are assumed to have constant travel time. Proportion of total demand for each origin-destination pair that use an external connector is also assumed constant. This is required in order to convert the regional origin-destination matrix into the subnetwork origin-destination matrix.



After the initial base condition, DTA is implemented at the subnetwork level. Travel times within the subnetwork will vary at each iterative loop of the four-step process. The shortest path travel time from each external connector to each subnetwork centroid (and vice versa) is determined. This information is then used to update the regional path travel times, which can be used as input in the trip distribution or mode choice steps.

Ilustrative Example

The network below is used to compare three integration methods: the proposed method, subnetwork integration only, and complete regional integration. The study boundary is indicated in red and represents a downtown area with regional connections via a rail service and surrounding highway network.



	Regional Network	Subnetwork Only	Proposed Method	(Subnetwork – Regional)	(Proposed – Regional)
Total Volume	11,995	11,356	11,724	-639	-271
RMSE	(Base)	151.98	43.83	-	-

Error associated with the proposed method is much smaller than the error associated with integration at the subnetwork level only. By allowing some interaction between the subnetwork and regional outputs, more information can be used in the four-step planning convergence loop (e.g., transit lines extending outside of the subnetwork can be modeled via the mode choice step occurring at the regional level). Also by allowing this interaction, subnetwork regions may be modeled at a finer spatial area saving time, effort, and storage from unwanted data.