

# Estimation of origin-destination trip exchange rate based on observed link flows: Implications for Manitoba's road freight transport network

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## Abstract

Over the past few years, finding the trip exchange rates between origins and destinations (ODs) has attracted significant attention for traffic and transportation planning purposes, particularly in the context of freight transportation where commercial vehicles transport different commodities between freight generation centers. The availability of information regarding the exchange rates of different commodities between major centers is essential for freight network vulnerability and resilience analysis. However, other than some spatially aggregated information (e.g., between provinces and major urban centers), trip exchange rates are unavailable to inform freight demand models in the Canadian context. Rather, many transportation agencies develop and maintain estimates of truck traffic volume at the link level.

This study aims to infer the magnitude of trip exchange rate between origins and destinations based on the link flows observed across the road network of Manitoba. In the first attempt, we investigated the applicability of Standard Artificial Neural Networks (ANN) to this problem for a sample toy network and compared the results for three proposed ANN models. This is an ongoing research effort, and in the next step, we plan to investigate the application of Convolution Neural Networks (CNN) to the OD trip estimation and compare the result with the model already developed. Next, we plan to apply the models to an actual network (e.g., the Manitoba highway network) and expand the models using additional features as inputs that include spatial network characteristics and socio-economic characteristics of freight generation zones in the region. Applying the model to specific industries (e.g., agriculture, forestry) may facilitate further methodological refinements.

**Keywords:** origin-destination trip estimation, link flow, artificial neural network, convolutional neural network, freight transportation

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