Artificial Intelligence for Logistics Program Conference
May 17th -18th 2023 - Ottawa

An integrated modelling approach to estimate grain truck activity in the Canadian Prairie Region

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Abstract

Network resiliency is foundational for the economic well-being of the agricultural industry in the Canadian Prairie Region (CPR) due to the agricultural sector relying so heavily on the rural road network. This makes it important to understand the movement of agricultural truck traffic in the region.

Truck traffic monitoring data and methodologies offer one approach to model truck activity. While useful for most engineering applications, these data are not well-suited for planning or forecasting purposes. In contrast, freight demand modelling approaches are designed to forecast future activity and are often tailored to specific industries. However, these approaches tend not to provide the level of detail required for engineering applications, such as road design, asset management, or understanding how road closures impact a sector's supply chain.

The modelling approach developed in this research integrates methodologies from the truck traffic monitoring and freight demand modelling fields to establish sector-specific activity patterns in the CPR. The approach consists of a 3-step commodity model, the Grain Tonnage Demand (GTD) model, which is converted to the Hopper Bottom Truck Demand (HBTD) model using truck body type data. The results of the HBTD are then compared to those obtained using the Hopper Bottom Truck Traffic (HBTT) model, which is independently developed from truck traffic monitoring data.

The comparison of the HBTD and HBTT results considers the truck kilometres travelled (TKT) by hopper bottom trucks normalized by network distance and focusing on activity in southwestern Manitoba. This research found the HBTD model to underestimate the HBTT model by 39 percent (in terms of normalized TKT). Since neither model can be considered as ground truth, the difference should not be interpreted as an error, but rather as a way to assess the relative strengths and limitations of the different modelling approaches. For the HBTD model, these limitations relate to challenges in modelling grain activity in urban areas, the exclusion of dump trucks from the model, an inability to include all segments of the grain supply chain, trip assignment assumptions, and the limited number of commodities considered. Likewise, for the HBTT model, limitations relate to data collection approaches, sampling methods, data processing techniques, the assignment of counts to the network, and the assumption that all hopper bottom trucks carry grain. Further integration of the approaches and resolution of the limitations could yield better agreement in the future.

Keywords: grain trucking, freight demand modelling, truck body type data, commodity-based modelling, truck traffic monitoring

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