Upper Great Plains Transportation Institute Rail Research Update

2023 PSC Rail Safety & Stakeholders Discussion – August 10, 2023

Highway-Rail Grade Crossing (HRGC) Safety Decision Support System

A decision-making framework is needed to predict HRGC crash occurrence and severity likelihoods in the same prediction model, identify and quantify contributors to crashes and their marginal effects, quantify the effectiveness of geometric and safety countermeasure improvements, and rank the priorities for crossings in terms of safety improvement needs. A multi-year research effort led by Dr. Pan Lu has resulted in new and innovative approaches to the analysis of HRGC crash risks. As a result of this research, a hazard ranking model based on crash likelihoods is now available that can be used to classify grade crossings and crossing locations based on their simultaneous crash frequency and severity likelihoods. Some of the conclusions (based on North Dakota time-series data) are:

- Adding audible devices to crossing equipped with gates and standard flashing lights will reduce crash likelihood, property damage, injuries, and fatal crashes by 49%, 52%, 46%, and 50% respectively.
- Going from three to four main tracks results in a large increase in risks

The report can be accessed at https://www.ugpti.org/resources/reports/downloads/mpc18-354.pdf. In addition to report, an interactive app has been developed that incorporates all the findings of the research. It can be used as a simulation tool. Many of the crash modification factors (CMF) developed in the study are included in the CMF Clearinghouse. The suggested CMFs adopted by the Clearinghouse are: install standard flashing lights, install gates, and install audible devices.

Great Northern Corridor Model

The Great Northern route from Chicago to Seattle is now represented in a GIS/spatial modeling framework (TransCAD), along with the major highways in the corridor. However, the network does not include lines and roads within Chicago or the Port of Seattle. All grade crossings are precisely located on both the highway and railroad networks, with both train and highway traffic. The focus of the model is agricultural, energy, and container movements. Rail traffic is being assigned to the rail network using the waybill sample and several related sources. Highway truck traffic is being assigned using the HPMS database. By the end of the project, it will possible to analyze the effects of improvements in one section of the corridor on the entire corridor, as well as the combined effects of a series of improvements throughout the corridor. With the analytical and benefit/cost capabilities of the model, it is hoped that federal funding for the corridor could potentially be pursued in the future.

Railroad Infrastructure Models (for Planning and Policy)

Data have been compiled for all Class I railroads from 2005 through 2022. Changes in the miles of track by type (first main, second main, other main, passing, way switching, and yard) and ownership status (owned versus track that is operated under trackage rights agreements) have been analyzed. A model quantifying changes in track miles as a function of changes in gross ton miles of cars and contents has been estimated. The model and results are excellent and will be

published later this year, along with factors that can be applied in preliminary planning/corridor studies.

Legislative Study. A quick response by UGPTI to a request from the North Dakota House of Representatives provided estimates of the equivalent truckloads being transported by regional railroads and the equivalent axle loads and pavement costs that would result if the railroad traffic was moved by truck. The study quantified the benefits of originating and terminating grain and other products by rail in the State. The Dakota, Missouri Valley, and Western; the Northern Plains; and the Red River Valley and Western railroads have agreed to work with UGPTI to update the models and assure they ready for the next legislative session.

Future Research

- ***Gravel hauling by regional railroads***. A study has been requested by legislators to show the potential of moving gravel longer distances from quarries by railroads to centrally located depots, where the gravel would be transferred to trucks for final delivery to county worksites. The regional railroads will join UGPTI in this study.
- ***CO_2 Multimodal Transportation Study***. A request for one-time funding was approved by the North Dakota House for a multimodal CO2 transportation study that would identity possible networks to move CO2 into North Dakota by pipeline and railroad to support the Governor's vision of North Dakota leading the nation in carbon capture, utilization, and storage. Because the railroad network is already in place, the acquisition of new right-of-way and the exercise of eminent domain would not be needed to start transporting CO2. The CO2 is needed for enhanced oil recovery and other industrial uses. However, the North Dakota Senate declined to fund the study. Other sources of funding are currently being investigated.
- ***Biennial Freight Transportation Logistics Reports.*** UGPTI currently analyzes and publishes shipment data from elevators to markets. However, the current report only covers a portion of the supply chain and does not include information on farm-to-elevator, farm-to-processing plant, and elevator-to-processing plant movements or movements of manufactured goods. But, the Legislature has provided funding for a comprehensive study each biennium regarding the transportation patterns and needs of agricultural processors, shipments from farms to elevators, inbound and outbound shipments to and from manufacturing plants by mode and shipment type (as well as assessments of the quality of transportation services provided). An advisory panel is being formed and the initial study will commence in the fall.
- ***UAS Inspection of Regional Rail Lines.*** If federal funding becomes available, UGPTI (in partnership with the University of North Dakota and the Northern Plains UAS Test Site) will work with regional railroads to identify cost-effective, automated methods of augmenting track inspection. Data from drones will be combined with data from LiDAR and smartphone sensors positioned in hi-rail vehicles to provide a comprehensive view of the track and roadway. Machine vision and AI algorithms will be developed to mine and use the data and develop pattern recognition capabilities that can identify defects (at least those defects that can be visually detected) and monitor the roadway, rapidly updating status and condition information.