

Road Investment Needs to Support Agricultural Logistics and Economic Development in North Dakota

According to the Agricultural Statistics Service, North Dakota leads the United States in the production of spring wheat, durum wheat, sunflower, barley, dry edible beans, canola, and flaxseed. In 2009, the total market value of agricultural goods produced in the state exceeded \$5.5 billion. Because of the importance of agriculture to the state's economy, this report focuses specifically on the investment needs of roads used to haul agricultural goods to market. The purpose of the study is to analyze changes in agricultural production and logistics and the importance of roadway investments to the distribution of crops produced in North Dakota.

Important changes have occurred during the last two decades that have implications for agricultural logistics and roadway investment needs:

- (1) Yields have been increasing over time resulting in more crop volume and movements from a given land area.
- (2) Crop mix has been changing over time resulting in greater densities of production.
- (3) The number of elevators has decreased over time resulting in fewer delivery options.
- (4) Shipments have become more concentrated at a fewer number of elevators. Consequently, longer farm-to-elevator hauls are required.
- (5) More grains are being transshipped from smaller to larger elevators resulting in longer combined truck trips.
- (6) The location of in-state processing and biofuels production has resulted in more intrastate truck (as opposed to interstate rail) movements.
- (7) Funding for county and local roads exclusive of oil extraction funds has grown only modestly over time (when measured in real dollars).
- (8) In contrast, construction prices have increased dramatically over time for asphalt and gravel roads. Collectively, these factors are stressing the county and local road systems used to market and distribute North Dakota products.

This study is based on a detailed crop production and distribution model in which the crops produced in each county subdivision are moved to elevators and in-state processing plants to minimize distance. Because trucking cost is typically measured on a per-mile basis, minimizing the distance of agricultural goods movements is parallel to minimizing trucking cost on a system-wide basis.

The model minimizes the total or route trip distance including transshipments from one elevator to another or from an elevator to an in-state processing plant. The demands at elevators are derived from reports to the Public Service Commission, while the demands at ethanol plants are derived from confidential surveys. Since crop supplies and demands are known, the objective of

the distribution model is to predict truck movements to minimize the ton-miles of transportation needed to satisfy elevator and plant demands. In effect, the model identifies a logistically-efficient set of truck movements that minimizes use-related vehicle depreciation and maintenance and fuel consumption. However, the model does not predict that each grower will deliver his or her crops to the closest elevator. Instead, crops are moved to meet the demands of shuttle-train elevators, plants, and other facilities. The key predictions from the model are: (1) agricultural goods require roughly 600 million ton-miles of transportation annually, and (2) the average predicted trip distance to elevators and in-state processors (including transshipment distances) is 26 miles.

Once the trips are predicted, they are assigned to the highway network and traffic statistics are compiled for thousands of individual road segments included in agricultural distribution routes. Once the traffic forecasts have been accumulated, the investment needs of each road segment are analyzed and the results accumulated. In addition to specifically analyzing agricultural logistics routes, the investment needs for other local roads not significantly affected by agricultural goods movements are estimated so that the total statewide need can be quantified.

The estimated investment needed for county and local paved roads totals \$100.5 million annually on a statewide basis. Approximately \$59 million of these needs relate to agricultural haul roads. The remainder corresponds to other county and local roads. In addition, \$110 million are needed annually for local unpaved roads. Approximately, \$43.6 million of these needs relate to agricultural haul roads. The remainder corresponds to other local roads, especially township roads. Altogether, the total estimated statewide need is \$211.5 million per year, including \$100.5 million of paved road investment needs and \$110.0 million of unpaved road investment needs.

The estimates developed in this study do not include the specific roadway investment needs attributable to the future growth of oil and gas industries in western North Dakota. Rather, the estimates presented in this report reflect the baseline investment needs throughout the state. The projected oil-related infrastructure needs presented in a separate report (*Additional Road Investments Needed to Support Oil and Gas Production and Distribution in North Dakota*) are in addition to the estimates presented in this study.