

Executive Summary, Research Readiness Level Assessment, and Technology Transfer

Preparing for a Driverless Future

Research Objectives

This research was necessary to address fundamental questions regarding AVs, including:

- What were the lessons learned from partially autonomous farm equipment usage?
- What were rural Nebraskans perceptions of autonomous vehicles?
- How could engineers, planners, and policymakers be proactive in preparing for AVs?

Research Benefits

Nebraska and NDOT had the opportunity to become a national leader in driverless vehicle technology and implementation. Driverless vehicles could be particularly beneficial for rural Nebraskans (particularly older individuals) who live far from vital services and resources. The state of Nebraska's commitment to research and innovation in driverless vehicle technology ensured continued growth in the transportation sector as this technology evolves.

Currently, the technology is evolving too fast for engineers, planners, and policymakers, and rather than be caught reacting to a new product, NDOT was able to proactively address existing user issues with AVs and informed what the final product. Specific benefits include:

- Safety
- AV Technology
- Future Planning

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Background

Autonomous vehicles (AVs) are widely considered to be the future of surface transportation in the US, but little is understood about how people will interact with these vehicles, what they will use them for, and how they will impact our roads. However, farmers have been interacting with some degree of AV technology, primarily auto-guidance, in Nebraska for at least the last 10 years. This research first aimed to identify what transportation engineers and planners could learn from the agricultural sector when it comes to preparing for a driverless future. The research team then aimed to understand the transportation implications of AVs for rural Nebraskans to help with NDOT planning efforts around this technology. The researchers interviewed farmers and autonomous farm equipment sellers for this research project to understand existing issues and their implications for our roads.

Conclusion

Autonomous vehicles (AVs) are widely considered to be the future of surface transportation in the United States, but little is understood about how people will interact with these vehicles, what they will use them for, and how they will impact our roads. However, farmers have been interacting with some degree of AV technology, primarily auto-guidance, in Nebraska for at least the last 10 years.

The research in Section 1 first utilized in-depth qualitative interviews to understand farmers' experiences with using highly automated technology in order to inform adoption and diffusion patterns of AVs. The findings in Section 1 led to a discussion of the implications for on-road AVs for technology adoption, infrastructure, AV users, and public policy which each hold relevance for engineers, planners and policy-makers seeking to be proactive in preparing for AVs.

Section 2 applied concepts revealed through the interviews with farmers to inform a statewide survey of Nebraskans. Section 2 focused on understanding what issues related to access and mobility currently exist in Nebraska and how AVs might address those needs. By examining areas of need as well as Nebraskans' perceptions of AVs, Section 2 explored both the challenges and opportunities AVs present for Nebraska. Together, the interviews and statewide survey of Nebraskans detailed in this report offer illustrative insights for the planning and preparation of AVs.

While much of the existing research on AVs focused on the benefits for tech-savvy urbanites, this research focuses on the needs of Nebraskans in urban and rural areas. The findings of this report revealed that driverless vehicles offer potential benefits, particularly for rural Nebraskans (most notably older individuals) who live far from vital services and resources. The implications from this research will help decision-makers in Nebraska be best prepared to proactively prepare for AVs and become a national leader in driverless vehicle technology and implementation.

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NDOT Recommendations Based Off of Research Project

The research found that:

- Automated systems have been used by rural farmers for some time. Despite this; the automated systems have limitations, such as:
 - Connection limitations - farmers often don't get the Global Position System GPS signals the need to run the automated system
 - Full Autonomy has not been achieved - farmers using these systems say they had to watch the system b/c it was not error proof - farmers would need to pay attention to prevent the tractor from running off course from time to time
- The issues are not huge because everything is at low speed, with no other people or vehicles around.

What this tells us:

- Automated vehicles have a long way to go before NDOT would truly need to adjust its operations/policies for the following reasons:
 - Despite having been around for some time, automated systems for farmers are still not fully autonomous - people still need to interact.
 - Automated systems will need considerable investment in communication infrastructure before they would work reliably. Urban areas may see the necessary communications infrastructure sooner; but rural areas won't see this for a while. Most of NDOT's 10K miles of roadway are in rural areas.
- The issues experienced by farmers are lower risk because they operate at lower speeds, with no one around. In order for true automation to become widespread, the issues and risk associated with high speeds, and frequent interactions with other cars, will need to be overcome.
 - Certainly, low speed applications in urban areas might take root sooner, but it will probably be some time before automation in high speed, rural areas, actually come to fruition.

In Conclusion:

NDOT will continue to monitor the development of automated vehicles; but no new resources should be invested in the management of Automated Vehicle technology. (I.e. Some DOTs are establishing Connected and Automated Vehicles (CAV) offices and hiring teams to work on CAV policy and technology projects.) These actions are probably premature for Nebraska. Significant investments by Telecoms would be needed before the State will begin to see automation take shape on a widescale basis. Instead, the NDOT will continue to monitor technology trends and industry news.

- As provided by Ryan Huff, Lead TAC Member

Interested in finding out more?

Final report is available at:
[NDOT Research Website](#)

Research Readiness Level (RRL) Assessment

Level 1: Basic Research

Concept supported by feasibility and Department needs.

RRL 1

Technology Transfer

Upcoming Presentations

- NDOT Presentation for LRTP: 2020. "Smart Cities for the Rest of Us" Panel presentation at the Nebraska Department of Transportation's Future of Transportation Forum. Omaha, NE; June 16 (Virtual).
- Transportation Research Board Presentation: 2021. Hazelton, Josephine, & Daniel Piatkowski. "How prior experience with automated technology impacts perceptions of autonomous vehicles: A case study of Midwestern farmers." Transportation Research Board Annual Conference.

**This brief summarizes Project SPR-P1(20) M050
"Preparing for a Driverless Future"
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