

Executive Summary, Research Readiness Level Assessment and Technology Transfer

Improvement of Low Traffic Volume Gravel Roads in Nebraska

Research Objectives

Recommended modifications to surface gravel aggregate specifications within the publication, Standard Specifications for Highway Construction, using material characterization and field verification.

The performance evaluation of the gravel were field verified using remote sensing technology in terms of unraveling and spreading for a one-year cycle. Using statistics, the gravel road's performance were related to aggregate characteristics to support a modified specification.

Research Benefits

The research provided recommendations for specifications on surface gravel using native Nebraska materials from various regions of the state. This utilized regionally sourced engineered gravel throughout various regions of the state for improved performance of the life-cycle cost and improve roadside safety. The regionally sourced materials would reduce transportation costs of the materials to sites and an improved gravel mix would reduce the required maintenance interval.

Background

In the state of Nebraska, over one-third of roadways are unpaved, and consequently require a significant amount of financial and operational resources to maintain their operation. Undesired behavior of surface gravel aggregates and the road surfaces can include rutting, corrugation, and ponding that may lead to reduced driving safety, speed or network efficiency, and fuel economy. This study evaluated the parameters that characterize the performance and condition of gravel roads overtime period related to various aggregate mix designs. The parameters, including width, slope, and crown profiles, were examples of performance criteria. As remote sensing technologies have advanced in the recent decade, various techniques have been introduced to collect high quality, accurate, and dense data efficiently that can be used for roadway performance assessments.

Conclusion

Within this study, two remote sensing platforms, including an unpiloted aerial system (UAS) and ground-based lidar scanner, were used to collect point cloud data of selected roadway sites with various mix design constituents and further processed for digital assessments. Within the assessment process, statistical parameters such as standard deviation, mean value, and coefficient of variance are calculated for the extracted crown profiles. In addition, the study demonstrated that the point clouds obtained from both lidar scanners and UAS derived SfM can be used to characterize the roadway geometry accurately and extract critical information accurately.

Principal Investigator

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

NDOT Recommendations Based Off of Research Project

This research provided assessment techniques using UAS and ground-based LIDAR to evaluate test sections of roadways using different aggregate mix designs. These point clouds captured roadway width, slope, and crown profiles which can then be used to evaluate the long-term performance of the gravel road bed which has incorporated different road gravel mix designs recommended by the research team. The Department recommends the validation of this approach by performing a field implementation study using traditional assessment methods and the proposed remote sensing assessment methods to determine the performance of the recommended road gravel mix designs to compare with the performance of the traditional mix design currently used.

- As provided by Mark Lindemann, Lead TAC Member

Research Readiness Level (RRL) Assessment

Level: Development – Field Level

Research/Technology developed in an operational environment (real-world situation).

RRL 3

Technology Transfer

International Society for Maintenance and Rehabilitation of Transport Infrastructures (iSMARTi). - Journal Publication

- Liao Y, Wood RL (2020). "Discrete and Distributed Error Assessment of UAS-SfM Point Clouds of Roadways" Infrastructures, 5(10), 87; <https://doi.org/10.3390/infrastructures5100087>

Highway Engineering Exchange Program- Presentation

- Liao Y, Wood RL (2017). Distributed Infrastructure Assessment of Gravel Roads via Point Clouds. IHEEP 2017, Lexington, KY. http://heep.org/esp/files/2017/ESP_Liao.pdf

This brief summarizes Project SPR-P1 (16) M040
 “Improvement of Low Traffic Volume Gravel Roads in Nebraska”
 Nebraska Department of Transportation Research Program