Michigan Department of Transportation
RESEARCH Administration

RESEARCH SPOTLIGHT

Project Information

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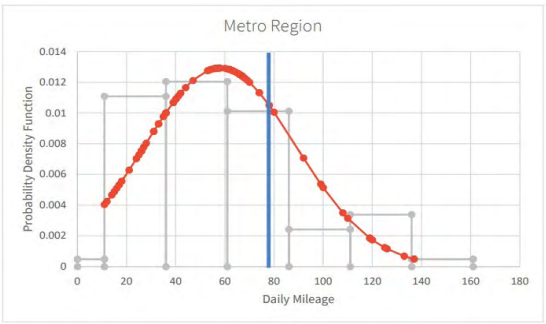
Strategies for lowering the carbon footprint of MDOT's vehicle and equipment fleet

Like other state transportation agencies that manage large and diverse fleets, the Michigan Department of Transportation (MDOT) is conscientious about its environmental impact and continually seeks opportunities to reduce its carbon footprint. With a fleet consisting of nearly 5,000 units, MDOT initiated a research study to determine the minimum operational requirements of its existing equipment, identify feasible and reasonable alternate low or zero emission equipment available in the commercial market that could meet MDOT's operational needs, and determine the financial and operational impacts of replacing existing units with low or zero emission options. The results from the study will help MDOT better understand its own equipment needs and offer a roadmap for making strategic short- and long-term decisions to meet the agency's environmental goals.

PROBLEM

To successfully maintain Michigan roads, bridges and other assets that make up the state's transportation network, MDOT manages a fleet of nearly 5,000 vehicles and equipment, ranging from standard passenger cars and trucks to heavy-duty and specialized units. Powered by traditional gasoline and diesel fuels, these units release greenhouse gases into the atmosphere and contribute to the agency's overall carbon footprint.



For each of MDOT's regions, an analysis of vehicle and equipment use patterns based on daily mileage helped to determine the feasibility of electric-powered units.

In 2022, MDOT implemented a policy that prohibits idling in state-owned vehicles and equipment except in special circumstances. The policy has worked well to lower the state's fuel consumption and emissions, as well as improve the health and safety of the transportation staff that works in and around vehicles and equipment every day. With a goal of reducing its environmental

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> *"MDOT has historically been a leader in government fleet management. This research continues that tradition."*
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> **Diane Sevigny**
> Project Manager

impact even further, MDOT strives to identify opportunities to reduce or eliminate emissions whenever possible.

Since existing vehicles and equipment will need to be replaced over time as they age or become damaged, MDOT sought to determine whether units powered by electricity or other alternative fuels might be viable options to consider. MDOT initiated this study to better understand its vehicle and equipment needs, and assess whether greener units on the market are capable of doing the necessary work.

RESEARCH

The project began with an assessment of each of the petroleum-fueled vehicles and equipment in MDOT's fleet, including each unit's location in the state. Next, MDOT user groups were invited to participate in workshops to discuss the function of each unit and to provide details regarding operational use and storage. Additional interviews, as well as surveys of other state transportation agencies, provided further insights into other states' efforts and best practices for lowering their fleets' carbon emissions.

With a better understanding of the types of vehicles and equipment that MDOT's fleet needs to include, researchers developed a list of units powered by alternative fuels that are available on the market to potentially perform the work. This list was then cross-checked against the technical specifications each of MDOT's units must have, such as engine power, operating weight and hauling capacity. The alternate fueled vehicles and equipment that met the technical specifications were evaluated for their operational feasibility for MDOT's use. The further short list was then used to conduct a cost–benefit analysis and risk assessment, which revealed the financial and related impacts of replacing MDOT's units, including upfront purchase costs, probable long-term maintenance expenses, fuel savings over the course of the unit's anticipated life cycle, and likelihood of the replacement unit's success.

RESULTS

Based on the collected data and analysis, MDOT was provided with a number of considerations for transitioning its fleet to low- or no-emissions alternatives. These include conducting pilot projects to test electric or hybrid models of a specific unit and evaluate how well they actually perform compared to MDOT's current gas- or diesel-powered model. Potential candidates for this type of study include forklifts, rollers, utility task vehicles, and heavy truck auxiliary systems. Electric-powered versions of these units are available and have been determined to meet MDOT's operational requirements. A number of key performance indicators were developed to allow MDOT to effectively assess the pilot vehicles and equipment, such as the quantity of greenhouse gas emissions saved, operating cost savings and expenses required to upgrade any facilities that would be needed to store or power the units.

Recognizing that converting MDOT's entire fleet would be a significant financial and operational investment, researchers also provided strategies that can be implemented immediately to realize carbon reductions now and prepare for broader transitions in the future. These strategies include acquiring aftermarket technologies that can be installed on existing units to reduce emissions when a unit is idling, which creates a safer work environment for MDOT staff, and assessing the electrical capabilities of MDOT's existing infrastructure.

IMPLEMENTATION

As a result of this project, MDOT now has guidance for making strategic short- and long-term changes to its fleet. By continuing to abide by the agency's idling policy and by following this new roadmap, MDOT's asset management office can work with vehicle and equipment operators to effectively lower the impact of the agency's carbon footprint and make sound investments that will help MDOT reach its environmental goals while maintaining its high operational standards.

Research Administration

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The final report is available online at MDOTjboss.state.mi.us/TSSD/tssdResearchAdminDetails.htm?keyword=SPR-1739.

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