TPF-5(148)  THE EFFECTS OF IMPLEMENTS OF HUSBANDRY  “FARM EQUIPMENT” ON PAVEMENT PERFORMANCE

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<th>Participating Agencies</th>
<th>Contract Duration</th>
<th>Funding</th>
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| Minnesota (Lead State), Iowa, Illinois, Wisconsin, PNAAW, Local Road Research Board (LRRB) | Start – June 2009  
End – Dec 2012 | Total Funds  
$438,000 |

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<tr>
<th>Contracted Principal Investigator</th>
<th>Agency Lead Contact</th>
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**Project Description**

The production of larger manure hauling and application equipment has been attributed to significant changes in both farm size and equipment, and a regulatory emphasis encouraging farmers to store manure as liquid and apply it in shorter time frames. The equipment innovations created from these changes, such as steerable axles, flotation tires, and new tire designs, are not reflected in state regulations because the shift has occurred at a faster rate than the research required to study the effects of this new equipment implementation. This has led to the adoption of equipment and practices that while complying with the letter of the law, may actually create more pavement damage. The objectives of this study are to determine pavement response under various types of agricultural equipment (including the impacts of different tires and additional axles) and to compare this response to that produced by a typical 10-ton road.

For this study an entirely new road was built at MnROAD called the “farm loop.” The test roadway, constructed in 2007, is typical of many rural, low-volume roads. The roadway was constructed in two sections: one section representing a typical 7-ton road in Minnesota and the other representing a typical 10-ton road.

The pooled fund had two major objectives:

1. Determine the pavement response under various types of agricultural equipment including the impacts of different tires and additional axles through the instrumented pavements at MnROAD.
2. Compare this data response to that under a typical 5-axle semi tractor-trailer and develop recommendations for determination of relative damage caused by farm equipment.
Project Results

Every March and August (2008-2010) as well as November of 2010 MnROAD tested different farm equipment vehicles and a 5-axle semi on the two sections of the “farm loop” test track. In the spring of 2009, researchers observed extensive structural failure and severe rutting on the 7-ton section, which is paved with a thinner layer of asphalt and an unpaved shoulder. During fall 2009 testing, more damage was detected on another part of the 7-ton pavement section. These pavement failures illustrate the importance of spring load restrictions for this type of roadway and suggest that 7-ton roads do not hold up under this kind of heavy equipment. The 10-ton section, which is paved with a thicker layer of asphalt and an asphalt shoulder and does not require a spring load restriction on commercial traffic, showed no signs of distress despite the larger number of heavy load applications than the 7-ton section.

Analysis of the measured top-surface subgrade stresses shows that all farm equipment vehicles cause high stresses in pavement, higher even, than stresses from a standard 80-ton semi.

Implementation Plan

Short of constructing roadways to a higher standard, the researchers developed several recommendations for implementation that aim to minimize pavement damage:

- Keep heavy farm vehicles away from the pavement edge during heavy farm use periods. This can be achieved by designating certain roads as one way except for emergency traffic for limited time periods (2-3 days). Townships in Wisconsin have begun implementing this recommendation.
- Avoid hauling during critical time periods: spring thaw, after heavy rain, in the hot afternoon.
- Tankers with multiple axles should ensure that the load is evenly distributed among the axles.