

NEVADA DEPARTMENT OF TRANSPORTATION

FFY 2014 RESEARCH PROBLEM STATEMENTS

I. PROBLEM TITLE: Mechanistic-Based Pavement Damage and Associated Cost from Oversize and Overweight Vehicles in Nevada.

II. PROBLEM DESCRIPTION

The movement of overweight and oversized vehicles on nation's highway has become more common over years and a vital economic necessity for many important industries such as chemical, oil, electrical, mining and defense etc. The Nevada Department of Transportation and the Department of Motor Vehicles issue an average of 3500 overweight/oversize permits a month and over 40,000 permits each year. Such large and heavy truck operations will have a major impact on highway maintenance costs, traffic congestion, and public safety.

Pavement damage from the overweight and oversize vehicles is one of the major contributors to the overall cost associated with such moves (other attributed costs are for supporting, permitting, routing, and enforcing truck operations). When a set of simple guidelines reveal the need for a travel permit, a Nevada permit can be readily obtained by paying a fee without any consideration given to the consequence of the vehicle travel on pavement damage. A closer review of travel permit compliance levels of Nevada and other Western states reveals that Nevada's requirements are not stringent and permit fees are much lower.

The current Nevada permit fee and fine structure applied to the two major classifications of overweight/oversize vehicles traveling on state roads was last modified over two decades ago. Hence, there is a clear need to revise the current system to better address the associated costs with such large and heavy vehicles moves. An appropriate permit fee and fine structure would not only increase the state revenue but would also provide more funds to maintain and expand the current infrastructure.

Though the overall costs attributable to overweight and oversize vehicle moves include damage to concrete pavements and bridge structures, the focus of this work is on flexible pavements as it constitutes more than 97% of Nevada's highways.

III. OBJECTIVE:

The objective of this study is to estimate the damage potential on flexible pavements and the corresponding cost attributed to oversize and overweight vehicles in Nevada.

IV. CURRENT PRACTICE and RELATED RESEARCH:

Many of such overweight and oversized components are much larger in size and weight and they often require specialized trailers and hauling units. It should be noted that the tires used on the transport vehicles are often conventional (singles or wide base), which enables the ready use of existing methodologies and procedures in addressing critically important issues such as

pavement-tire interaction stresses, pavement distress modes and corresponding critical pavement response parameters etc. However, the axle and tire configurations are variable, often assembled to suit the load components being transported. As noted above, the current NDOT practice includes both fixed and variable rate fees but does not use pavement damage in the assessment of the permit fees.

It is well known that overweight trucks impart much higher damage to pavements. Some state DOTs (e.g. LDOT, TxDOT) have incorporated this concept into their current fee structure resulting in much higher permit fees than Nevada's. Mechanistic-based pavement damage analysis recommended here is more realistic and are now routinely-used in damage investigations by pavement engineers (e.g., AASHTO Mechanistic-Empirical Pavement Design Guide procedure). The strong merits of mechanic-based (ME) approach include the applicability of the methodology to any set of pavement structure, materials and loading conditions. In particular, the ability to handle different loading conditions (tire configuration, and tire load and pressure) makes the ME approach ideal for the investigation of pavement damage brought on by overweight vehicles.

V. RESEARCH METHODOLOGY:

Accomplishment of the objective of this study will require at least the following activities.

- A. Collect and review information relevant to oversize and overweight vehicles fee and fine structures in Nevada and neighboring states.
- B. Identify the influential factors to be considered in the development of pay factors using a mechanistic-based approach under Nevada's conditions (climate, material properties, and performance models).
- C. Conduct a comprehensive pavement analysis to predict pavement performance and estimate potential pavement damage under oversize and overweight vehicles in Nevada.
- D. Estimate the cost attributed to overweight and oversize vehicles movement in Nevada based on the potential pavement damage.
- E. Establish pay factors guidelines and revise permit fee structure (possibly multiple tiers) based on the findings from this study.

VI. IMPLEMENTATION POTENTIAL:

Several states around the country have recently or are currently revising their permit fee and fine structure for overweight and oversize vehicles to better reflect the actual costs associated with such moves. The State of Nevada permit fee and fine structure is outdated and necessitates a constructive data-driven evaluation and revision. The cost associated with the potential pavement damage due to overweight and oversized vehicles should be major contributor to the overall cost of the permit fee. This research study will result in proposed permit fee structure changes based on a mechanistic evaluation and an estimate of pavement damage from overweight and oversized vehicle moves under Nevada's conditions. The proposed research falls under the Concept stage.

While no known socio-economic barriers are anticipated, the implementation of the findings from the study may face political barriers from the trucking industry and the State Legislature.

VII. URGENCY AND PAYOFF POTENTIAL:

Overweight and oversize vehicle operations have a major impact on pavement performance and highway maintenance costs. The current permit fees and fines in the State of Nevada are not adequately addressing the overall costs of such vehicles operations (e.g. supporting, permitting, routing, etc.) and in particular the costs attributed to the potential pavement damage from oversize and overweight vehicle moves. A preliminary literature search shows that Nevada’s requirements are not stringent and permit fees and fines are much lower compared to those in surrounding states for the same vehicle loads and configurations. There is an urgent need to determine and quantify any additional fees associated with the pavement damage and added maintenance costs caused by overweight and oversize vehicles compared to standard vehicles under Nevada’s conditions. Based on the findings of this research and the implementation of the new permit fee structure, NDOT, DMV and DPS will potentially experience an increase in its revenue providing additional funds that can be used for maintaining and improving the current transportation network.

VIII. ESTIMATED BUDGET:

An estimated budget for this project is \$150,000.

IX. DATE AND SUBMITTED BY: February 22, 2013

Elie Y. Hajj, Ph.D. Assistant Professor of Civil Engineering University of Nevada, Reno /MS257 Reno, Nevada 89557 T: (775) 784-1180 F: (775) 784-1429 Email: elieh@unr.edu	Raj V. Siddharthan, Ph.D., P.E. Professor of Civil Engineering University of Nevada, Reno /MS258 Reno, Nevada 89557 T: (775) 784-1411 F: (775) 784-1390 Email: siddhart@unr.edu
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X. NDOT CHAMPION, COORDINATION AND INVOLVEMENT:

Jeffrey Richter, Manager Over Dimensional Vehicle Permits Administrative Services Division Nevada Department of Transportation T: (775) 888-7058 F: (775) 888-7103 Email: jrichter@dot.state.nv.us	Michele Maher Principal Materials Engineer Materials Division Nevada Department of Transportation T: (775) 888-7737 Email: mmaher@dot.state.nv.us
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Stakeholders:

NDOT – Over Dimensional Vehicle (ODV) Permits Office
NDOT – Materials Division
NDOT – Performance Analysis Division
NDOT – Maintenance and Asset Management Division
Nevada Department of Motor Vehicles – Motor Carrier Division
Nevada Department of Public Safety – Nevada Highway Patrol
Nevada Taxpayers