



SPR RESEARCH PROGRAM SECOND-STAGE PROBLEM STATEMENT FY 2009-10

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I. PROBLEM NUMBER

CM-10-02, CM-10-04

II. PROBLEM TITLE

Fleet Condition Model Standards Updating and Electronic Submission of Supplementary Field Data

III. RESEARCH PROBLEM STATEMENT

ODOT Fleet Services provides management of ODOT's fleet, which consists of approximately 5,000 pieces of active equipment worth approximately \$340 - \$390 million dollars. This equipment includes a variety of small and large trucks, cars, as well as heavy machinery such as graders, bulldozers, and many types of tractors. This equipment represents a substantial investment and is a vital set of resources used to maintain Oregon roads and highways. Equipment replacement decisions over time will have a major impact on road maintenance as well as the economics of fleet operation. A current project concluding in March 2009, being jointly conducted by Oregon State University, ODOT Fleet Services, and ODOT Research has focused on the development of a new Fleet Condition Model tool and the methods used to prioritize equipment replacement utilizing available data. The main components of this project are:

- Perform an assessment of the state-of-the-art in fleet replacement models in use by other DOTs, government agencies, and private industry.
- Design, develop, document, and test a new and improved fleet condition model.
- Evaluate equipment replacement prioritization models that utilize available equipment cost and usage data.
- Conduct a theoretical analysis of equipment replacement that explicitly considers the interdependencies between replacement decisions and equipment utilization.

All of the components listed above have been, or are being completed successfully. However, during the completion of this project two noteworthy realizations surfaced that form the basis of the current proposed research project. The first realization is that replacement decisions based purely on cost and usage data will be limited in their effectiveness since cost and usage data cannot capture other important factors that should influence replacement decisions. Examples of such factors are the existence of special features that make a particular piece of equipment especially useful, or the fact that some equipment is uncharacteristically unreliable. The second realization is that the newly developed Fleet Condition Model computes equipment replacement rankings utilizing fixed age and usage standards. These standards may differ among equipment classes. The assumption was that these standards are up-to-date and represent some ideal values for each equipment class. A comparative analysis of average age and average usage within an equipment class versus the age and use standards for that class indicate no consistency across different equipment classes. For example, in some equipment classes, the average age is quite a bit less than the age standard, and for other classes the result is the opposite. ODOT Fleet Services acknowledges that these standards need to be updated.

The specific problems to be addressed are:

1. **The creation of an electronic system for equipment crews to enter supplementary data that can be used as part of the equipment replacement prioritization process.** The specific data to be entered, the development of a system for entering the data, and the processes for integrating the data with Fleet Services data need to be addressed.
2. **The establishment of a sound data driven procedure for establishing appropriate age and use standards for different equipment classes.** Applying this procedure to ODOT's various equipment classes will be completed and incorporated into the Fleet Condition Model.

IV. RESEARCH OBJECTIVES

The goal of this research project is to increase the effectiveness of the replacement rankings and decisions made by ODOT Fleet Services. This will assist them in better managing equipment replacement decisions.

To achieve this goal, the proposed project has two components that involve research and implementation.

Research Component

The research component will address what supplementary information from equipment crews will have the biggest impact in increasing the efficiency and most importantly, the effectiveness of the overall replacement process. Care must be taken to focus on information specific to equipment, and not give equipment crews the false impression that they are providing their “own” rankings of maintenance equipment. Another research task will be to determine how age and use standards should be determined. The outcomes of this task will then be applied to ODOT equipment data to arrive at standards. The initial approach utilized to establish standards will be simulation. The operation of equipment classes over time will be simulated and replacements utilizing different values for age and use standards can be experimented with to find optimal values. Historical ODOT usage and cost data will serve as inputs to these simulations. Analysis will also be conducted on the potential long run economic impact of optimal standard values to understand their impact on fleet operational costs. This will also affect how often the standards should be updated. Specific tasks that must be completed utilizing this approach are:

- Analysis of historical usage and cost data by equipment class,
- Development of the simulation models,
- Determining the proper measures and use of the model for experimentation of standards,
- Conduct experimentation,
- Statistical analysis of the experimental results.

Implementation Component

The implementation component involves the design, development, documentation and testing of a web based system to obtain supplementary data from equipment crews. A key step in this area is to coordinate closely with the Transportation Application Development (TAD) Section, Information Systems (IS) Branch of ODOT's Central Services Division. Decisions to be made include:

- Selection (in coordination with TAD's IS branch) of a compliant web-based development platform.
- Follow ODOT IT requirements in the design of the database system. The data elements of the database will be in accordance with the results obtained from the research component.
- Network location (i.e., server) where the data collected from crews will be stored.

It is anticipated that the TAD IT resources required will provide design requirements, and periodic review of designs (approximately 1 hour per month) as the system development progresses.

Finally, a process has to be developed to incorporate the supplementary data provided by maintenance crews into the improved Fleet Condition Model. A process for archiving and retrieving supplementary data over time will be developed so that the data may be utilized for other purposes such as identifying specific types of equipment favored by equipment crews.

V. WORK TASKS, COST ESTIMATE AND DURATION

The total project duration is estimated to be 15 months.

Work Task	Estimated Duration
Interview different equipment crews and Fleet Services personnel to determine what supplementary data will be the most effective for enhancing replacement priority rankings. Determine how this supplementary data will be used with the existing data and ranking procedures.	Three Months
Perform a literature review to evaluate any existing methods for establishing age and use standards.	One Month
Develop and test methods for determining optimal age and use standards for an equipment class. Apply these methods to ODOT equipment classes.	Six Months
Modify existing ODOT fleet condition model to include the use of supplementary data provided by the equipment crews.	Six Months
Develop and implement electronic data collection system for equipment crew supplementary data.	Nine Months

Create system documentation, and final report.	One Month
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The total project budget to support faculty time, graduate research assistant time and tuition, supplies, and travel is \$183,157 and is shown below.

Category	Amount
ODOT Admin	\$ 10,000.00
Faculty staff + Fringe	\$ 43,506.00
Student Support	\$ 82,629.00
(Wages, Fringe, Tuition)	
Supplies	\$ 1,000.00
Travel	\$ 2,000.00
Overhead	\$ 44,022.00
TOTAL	\$ 183,157.00

VI. IMPLEMENTATION

Results of the methods used to determine age and use standards, the final age and use standards established for ODOT equipment classes, and the supplementary data requested from equipment crews will be documented in the final report for ODOT Research. It may also be presented at relevant transportation related conferences, and transportation related journals. Extensions and modifications to increase the effectiveness of the fleet condition model will be built around the existing MS-Access model and will be done in conjunction with TAD's IS branch.

VII. POTENTIAL BENEFITS

The research will assist the Oregon Department of Transportation and DOTs nation-wide to better assess and manage equipment needs. The establishment of up-to-date standards and the use of supplementary data provided by maintenance crews will help ODOT manage its equipment fleet more economically, and do the best job possible in providing needed equipment for road maintenance.

VIII. SUBMITTED BY

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