

Research Pays Off

Arizona DOT Adopts PMS and Save\$ A Bundle

Until the mid-1970s, the Arizona Department of Transportation (ADOT) focused on the construction of new roads. But, as the Interstate system neared completion, the emphasis shifted to preservation of the present road network, which represented an investment of more than \$2 billion and a replacement value of more than \$6 billion. How to preserve this investment presented state officials with a budgetary and maintenance dilemma.

PROBLEM

Arizona's roads vary from heavily traveled Interstate highways to sparsely traveled secondary roads, and its climate ranges from hot desert to highlands where snow is common. The need for maintenance and rehabilitation activities in each of the state's seven districts was determined by the respective District Engineer and differed widely. In 1974, the ADOT allocated \$25 million to pavement preservation (i.e., resurfacing as opposed to patching and crack-filling) and, by 1978, the preservation budget had increased to \$52 million. What was needed was a decisionmaking tool that would help the ADOT keep track of the condition of its 7400-mile road network and allocate available preservation funds effectively.

SOLUTION

In 1978, the ADOT contracted with Woodward-Clyde Consultants, San Francisco, California, an engineering consulting firm, to assist in the development of such a decisionmaking tool. The ADOT and Woodward-Clyde consultants through extensive technical research derived a pavement network optimization methodology composed of cost models, design constraints, performance prediction models, and management standards necessary for a cost-minimization calculation. This research was so innovative it won the 1982 International Prize from the Institute of Management Science. The Arizona Pavement Management System (PMS) is the product of the work conducted by this team of management scientists, highway engineers, statisticians, and computer specialists working with the ADOT research staff.

The PMS served as a basis for devising defensible one-year and five-year preservation budgets and predicting the consequences of budget levels on road conditions. The PMS development process, completed in 1980, was



tested with real and hypothetical data. Implementation began at that time. A pavement management group of 11 ADOT personnel became responsible for its operation.

APPLICATION

The PMS has changed the pavement maintenance and rehabilitation decisionmaking process in Arizona from a subjective nonquantitative method to one that integrates management policy and engineering inputs. It provides the maximum benefits from funds available for pavement preservation.

The PMS was first applied to the 1980-1981 highway preservation program after cost estimates for the fiscal year had been determined by the previous process. The PMS process resulted in the substitution of a \$32 million preservation program for the \$46 million program developed by pre-PMS methods. The \$14 million saved and subsequently spent on other highway-related projects occurred due to two factors. First, the tendency had been to allow the pavements to deteriorate to a rather poor condition before preservation action was taken. However, analysis shows that less substantial but slightly more frequent preventative measures keep the pavements in good condition most of the time at less overall cost than more substantial and costly corrective measures. Second, past corrective actions were often quite conservative, i.e., involving asphaltic concrete resurfacing of up to 5 in, based on the assumption that the thicker layer would ensure a longer period of time before the pavement deteriorated to unacceptable standards. The PMS prediction models indicate that there is no significant difference between the rate of deterioration of pavements resurfaced with 3 in and 5 in of asphaltic concrete.

BENEFIT

The development of a PMS in Arizona has resulted in enormous cost savings. The \$600,000 spent on research, including outside contracts and staff time and expenses, was recovered more than 20 times over during the first year of its implementation. The state expects to save more than \$100 million over the next 5 years by applying the PMS to pavement preservation programming. William Ordway, ADOT Director, notes, "Unlike industry, state government does not make a profit, but rather is charged by the public with providing the best possible service per tax dollar. This optimization process gives ADOT the confidence that, indeed, it is getting the most benefits from limited funds."

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