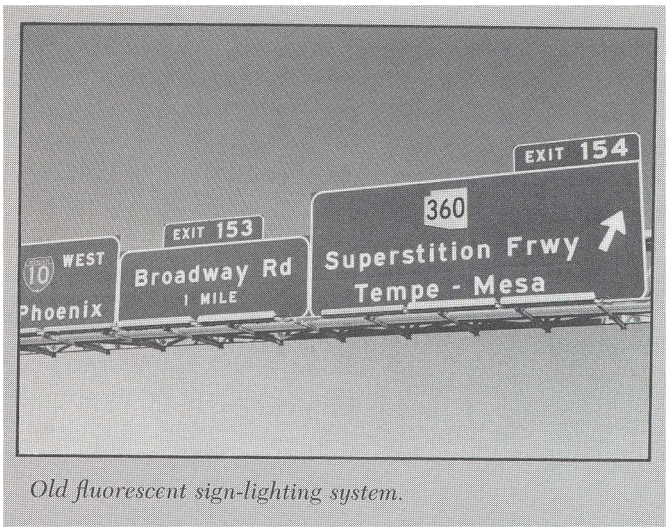
# RESEARCH PAYS OFF

# New Sign-Lighting System Saves Energy and Maintenance



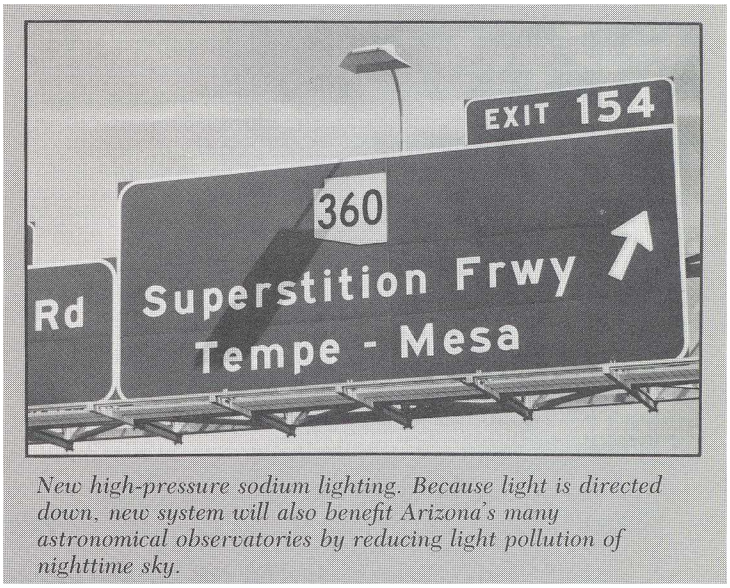
*Old fluorescent sign-lighting system.*

The growing cost of electric power and maintenance has led traffic engineering agencies around the country to seek ways to stretch their dollars further. In one example, the Arizona Department of Transportation (ADOT) has devised an efficient way to illuminate overhead signs on Arizona's highway system.

## Problem

Like many states, Arizona has been using fluorescent sign-lighting systems for more than 25 years. ADOT's annual operating and maintenance cost for electric power, cleaning, replacing lamps, and ballast replacement is about $197,000 per year for 700 overhead signs. Nationwide, the cost of electric power alone for sign lighting is estimated to be $20 million per year.

Although cost reduction is important, overhead sign-lighting systems must, above all, serve driver needs. Signing must be sufficiently visible to allow adequate response time. These factors led ADOT to initiate a research project designed to identify lighting systems that would be more power efficient; require less maintenance; and, at the same time, satisfy driver needs.




*New high-pressure sodium lighting. Because light is directed down, new system will also benefit Arizona's many astronomical observatories by reducing light pollution of nighttime sky.*

## Solution

In 1983 ADOT asked Arizona State University to identify and evaluate several alternative sign-lighting systems. Twenty-five systems, consisting of various combinations of commercially available lamps and fixtures, were subjected to photometric testing to determine which ones best met AASHTO and Illuminating Engineering Society standards for overhead signing. These standards include requirements for brightness and uniformity of lighting. The 10 best systems were then field tested at freeway locations for a year.

In field tests, power consumption was noted, a log of maintenance requirements was kept, and illumination levels were measured. Forty-five test subjects were driven past the test site at freeway speeds to determine legibility distance and to evaluate lighting uniformity, glare discomfort, and color rendition. An economic analysis including the initial capital costs and the annual operating costs of each system was conducted.

As a result of the research, a lighting system, which uses a 150-watt, high-pressure sodium lamp and a commercially available lighting fixture that distributes light evenly over a large sign panel, was recommended. The new system allows one high-pressure sodium fixture to replace two fluorescent fixtures on an average-sized sign panel, thereby reducing installation and maintenance costs. Comparable illumination levels are maintained even though only one-third as much power is consumed.

## Application

***New Signing:*** ADOT will implement the high-pressure sodium system on all new overhead signs. Between 1,000 and 1,900 new overhead signs will be installed on the 231 miles of new freeway planned for the Phoenix urban area during the next 20 years.

***Existing Signing:*** ADOT is retrofitting all existing fluorescent systems with high-pressure sodium lamps. This statewide conversion is currently under way and will be completed by fall 1988.

## Benefits

***New Signing:*** Implementing the high-pressure sodium system on new signs in the Phoenix urban area will save $353,000 per year compared with the traditional fluorescent lighting system. These annual savings include savings in power costs (at 6.1 cents per kilowatt-hour) of about $145 for an average-sized sign panel, as well as savings in maintenance and annualized capital costs.

***Existing Signing:*** ADOT estimates that the savings in energy and maintenance as a result of this conversion will be significantly greater than the $2.1 million cost of conversion. In addition, ADOT will not have to replace existing fluorescent lights when their life expires in about the year 2000. The high-pressure sodium fixtures retrofitted in 1988 will last 25 years, or until the year 2012.

These savings represent a significant payoff for this $75,000 research project.

For further information, contact Jonathan Upchurch, Associate Professor, Center for Advanced Research in Transportation, Arizona State University, Tempe, Arizona 85287-6306. Telephone 602-965-1713.

*Suggestions for "Research Pays Off" articles are welcome. Contact David K. Witheford, Transportation Research Board, 2101 Constitution Avenue, N.W., Washington, D.C. 20418 (telephone 202-334-2972).*