New system operates traffic signals like a conductor conducts a symphony

Modern technology is helping ODOT create a one-of-a-kind traffic signal in central Oregon, and it may shed light on what's ahead for the rest of the state.

ODOT has been operating traffic signals by computer for a while now, but with new software advances, the computers are taking more control over intersections. As a result, motorists are enjoying more flexibility.

The first signal on a state highway to get this treatment is in Bend at U.S. 20 and Purcell Boulevard. It's a popular intersection for pedestrians, but it could be dangerous when pedestrians try to cross the street and motorists are turning right. Thanks to the new technology, pedestrians will get the go-ahead to walk, but the right turn arrow stays red, keeping the cars stopped and giving the pedestrian the right of way to cross the highway.

The technology also uses video so computers can see what's going on within intersections and adjust accordingly.

New traffic signal software improves safety.

Older versions of the software couldn't show all the traffic, turns, stops, and pedestrians present at the intersection, so the computer couldn't time the lights efficiently. Now it can.

These changes don't take the human element completely out of the equation, because it's the human who orchestrates how the computers control the flow of traffic. Region 4 Traffic Operations Coordinator Dave Foster is the resident "conductor," in charge of planning and operating the new system.

"The new software lets the signal itself determine how much green time to give," said Foster. "The detectors can say 'Oops, I need to add or reduce time.' It gives me a lot more efficiency to operate the signal."

This computer-generated symphony of signals is already underway with more to follow on an ODOT highway near you soon.

Managing pavement pays off

ODOT maintains approximately 7,400 miles of state highway and 600 miles of frontage roads and connector routes. The pavement surface and structural components make up one of the largest investments in our state highway system in terms of asset value, with an estimated total replacement value over $10 billion. ODOT spends approximately $140 million annually on pavement resurfacing, reconstruction, and related maintenance activities. Everyone agrees keeping the highway network in top condition is a priority, but since budgets are limited, we have to make tough choices: Which roads should we repair first? What techniques or treatments should we use for best results? What are the projected long-term consequences if we delay or defer repairs?

A systematic approach helps balance priorities

Pavement management requires a systematic approach to managing short and long-term activities to preserve and maintain an agency's pavement network. It was one of the first asset management concepts state DOTs began using in the 1980s. Although ODOT began collecting and assessing pavement condition data on the state highway system in 1976, it wasn't until the late 1990s that we began developing a more formalized process for pavement management.

Pavement management activities include

- collecting pavement data;
- predicting future conditions;
- analyzing the impacts of funding programs; and
- identifying priorities.

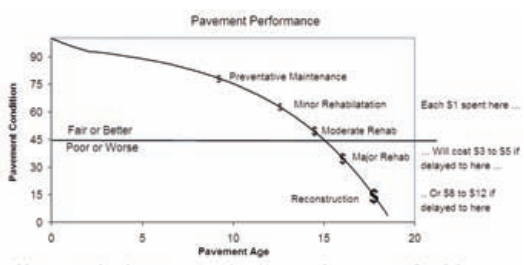
At ODOT, these activities fall under the responsibility of the Pavement Services Unit in the Highway Division. The Pavement Management Engineer and a team of pavement specialists work with a variety of data collectively known as the Pavement Management System. The PMS assists decision-makers in finding cost-effective strategies for evaluating and maintaining pavements in serviceable condition. The PMS consists of two basic components: 1) a continually growing database which contains current and historical information on pavement condition, pavement structure, and traffic; and 2) tools to assess the condition of the roads, anticipate trends, and weigh alternatives.

There is a key difference between "pavement management" and a PMS. Pavement management is the approach we use to make decisions. A PMS is the database and analysis tools we use at all levels in the agency to make better and more informed decisions. For pavement management staff, these activities are synonymous. However, senior managers involved in pavement management activities often will not be involved with the details of the PMS.

The right treatment at the right time

Engineers often hear questions such as, "Don't you ever finish working on those roads?" Those who work with pavements know that as soon as a pavement is built, it starts to deteriorate. After a certain amount of time, we are required to work on the pavement to keep it serviceable. The old saying, "pay me now, or pay me later," applies to the life of pavements.

The figure below shows a typical pavement deterioration rate with relative costs needed to maintain, or return, the pavement to a serviceable condition. During the first few years, deterioration is slow but the rate increases quickly as the pavement ages. The first 10 years of life results in only a 25 percent drop in condition, but the next 25 percent drop in condition takes less than five additional years. Over the long run, it is much more cost effective to maintain the roadway in good condition. It is clear that even if we have to apply less expensive treatments more often, the overall costs will be less if the pavement is repaired early rather than too late.



Maintenance of roadway pavements in fair or better condition costs significantly less than rehabilitating or reconstructing those in poor condition.

"Worst first" or preventive maintenance? You decide...

It is tempting to spend the lion's share of road repair budgets on fixing the worst problems first, while delaying preventive maintenance on newer roads. However, this strategy only leads to a temporary – and very costly – solution. In the long run, it costs substantially less to keep ODOT's roads in good condition through a planned program of preventive maintenance.

Examples show good pavement, top, and a poor pavement, bottom.

Preventive maintenance treatments seal the pavement surface from external environmental forces such as water and oxidation. The concept is similar to painting wood before it rots. Preventive maintenance treatments such as crack or chip seals, or thin paving, when applied to pavements that have adequate structure to carry traffic, can extend life several years at very low cost. Just like painting over rotten wood, preventive maintenance treatments will not "hold" over pavement suffering from advanced deterioration or structural deficiencies. For these pavements, thicker paving such as partial or full reconstruction or multi lift overlays are necessary.

While maintaining roads using a "best first" policy would result in savings over the long term, we have to balance that decision with public demand to remedy "worst case" problems.

Major safety problems should be scheduled for repair as soon as possible, and some roads may be beyond a level where maintenance can keep them safely patched. Unfortunately, total pavement repair needs far exceed the available budget.

The solution is a balance of thicker paving projects to address "fighting fires" (worst first) and preventive maintenance to preserve the good pavements (best first).

ODOT has implemented a program for chip seals, and we are developing a program for thin preventive maintenance paving. At first, the budgets for these programs will start out small. Over time, the goal is to increase the size of the programs so that we meet nearly all preventive maintenance funding needs while still providing sufficient allocation of funds for addressing the backlog of thicker paving needs.