

Recommendations will bring algorithm up to date

Developed over 25 years ago, the Transport Agency's treatment selection algorithm has begun to be updated, with a project recommending ways the algorithm can be modernised, strengthened and clarified.

The treatment selection algorithm is used to guide decisions about the future surface and pavement maintenance works needed for roads.

The improvement recommendations in the project report focus on improving specific aspects of the algorithm, rather than changing the core process of the algorithm itself.

Mike Tapper of Beca Ltd who led the multi-agency research project says 'The Transport Agency's treatment selection algorithm has performed well and has been broadly used since it was developed in the 1980s. It now needs to be updated to reflect current knowledge and recent experience. The fact that there is a drive to update, rather than replace it, demonstrates how well it has performed in the field.'

The treatment selection algorithm is a relatively sophisticated system capable of reflecting multiple parameters and performs well compared with similar systems used internationally.

The project report sets out a host of recommendations for updating the algorithm. However, the report comes with the caveat that since the research project began in 2012 the Transport Agency has introduced its One Network Road Classification System, which introduces a level-of-service driven regime for road maintenance investments. The report cautions that 'further analysis and consideration' is needed to understand how the updated algorithm will fit with the new system.

The treatment selection algorithm

The treatment selection algorithm is used to forecast maintenance timing and treatments for roads, with the aim of keeping roads in good condition, for the least whole-of-life cost, in the short to medium term.

The algorithm is primarily used as a project decision-making tool for road maintenance planning. Its purpose is to identify candidate sites for road asset managers' short-term forward work programmes. As such, it does not predict or quantify longer-term maintenance or renewal needs.

The algorithm calculates treatment and maintenance costs, and examines drainage and seal widening options. It also allows a variety of

economic scenarios to be tested. It can be used at both a treatment length and network level, and has also proved useful nationally for comparing and benchmarking network maintenance needs.

The current algorithm has several advantages, including its relative sophistication and inclusion of numerous parameters. However, there have been significant advancements in road maintenance understanding and practice since the algorithm was developed in the 1980s. Foremost among these are:

- The long-term pavement performance monitoring sites have yielded much practical information.
- Pavement and surface condition measurement techniques and parameters have been developed.
- Economic analysis parameters have changed.
- There is greater use of thin asphaltic surfacing.
- The vehicle operating cost model and benefit-cost ratio funding mechanisms used in the current algorithm have been superseded.
- Learnings on pavement and surfacing performance from high-speed data capture and falling weight deflectometer test data need to be incorporated.
- The quantity and accuracy of maintenance cost data is now much more prevalent, particularly with the use of RAMM Contractor.
- Past assumptions, for example the progression of maintenance requirements, need to be reviewed and replaced with evidence-based models.

The treatment selection algorithm now requires updating to reflect these and other factors.

Recommended updates

The project report recommends numerous updates to strengthen and modernise the treatment selection algorithm.

The most significant recommendation is the replacement of the current benefit-cost ratio funding mechanisms and vehicle operating cost model in the algorithm with a present value-based approach. This will also enable a more flexible approach to the use of discount factors.

The second major recommendation is to include falling weight deflectometer data, in particular, to determine the cause of pavement failure and therefore the preferred treatment type. The treatment types recommended in the project report are not very different from the current options used in the algorithm, in terms of their cost and assumed treatment form. The main difference from the recommended update will be in the basis upon which treatment options are assessed.

Other main recommendations are listed below. The research report also contains a number of smaller recommendations:

- Include historic maintenance costs in the test, in addition to the current condition, wherever the life of the current surfacing has been extended beyond its optimum intervention. This is because maintenance interventions may mask indicators that the surfacing has reached the end of its life.
- Add a new cost set table for thin asphaltic surfacing, as its routine maintenance costs are different from those for chipseal surfacing. The trigger for using asphaltic surfacing treatment would be on a 'like-for-like' basis.
- Replace the current smoothing and strengthening options in the algorithm with modified basecourse treatment and full pavement renewal options. The treatment type options within the algorithm for smoothing and strengthening could be applied to the basecourse improvement or full pavement renewal respectively.
- Use traffic as a trigger for changing from a granular or stabilised base to a full structural asphalt construction, for example greater than 20,000 vehicles per day and/or quantity of heavy vehicles.
- Retain the two-year assessment window, as without any forecasting of condition three-year criteria are difficult to achieve with any credibility.
- Adapt the algorithm process to allow for customisation according to road classification. A simple method, such as a user-defined table populated with standard default settings for each road classification, could be applied.
- Ensure a pavement renewal treatment will only be triggered if the treatment length meets particular criteria.
- Where falling weight deflectometer data is available, use a combination of radius of curvature and central deflection to determine the failure mode and therefore treatment option for pavement renewal.
- Where only high-speed data is available, and there is no falling weight deflectometer data, use the flushing test to determine a possible pavement failure and therefore the pavement renewal treatment required. (Note that a recommended test is also given for where neither type of data is available.)
- Include a more definitive test for seal layer instability, as this is a failure mechanism that is becoming more prevalent.
- Retain the current mechanism for calculating present value of future maintenance, as the logic is strong and the programming is already in place within the algorithm to perform the calculations.
- Enable the user to select the appropriate discount factor. This will make it easier in the future to reflect changes in the discount rate policy should the Transport Agency have a shift in policy on this matter.
- Discontinue the benefit-cost ratio determination, as the vehicle operating cost and benefit-cost ratio methodologies no longer match Transport Agency policies and processes. Use the present value method to assess whether to select the shape correction treatment option.
- Even if resurfacing is the selected option, evaluate the treatment length for extreme levels of distress that would indicate a pavement renewal is still required.