Analysis and interpretation of New Zealand long-term pavement performance data

Full report: www.nzta.govt.nz/resources/research/reports/633

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

Analysis reveals dataset's potential

Analysis of the long-term pavement performance database has found there is a wealth of data available. By combining the numerical data with the maintenance records for particular sites, practitioners can gain useful insights into the economic performance and condition of pavements.

The Government Policy Statement on Land Transport 2015/16 – 2024/25 is focused on achieving value for money for land transport.

Road maintenance and renewals present an important opportunity to improve value for money. Road maintenance works that are implemented too early, while there is still remaining service life in an asset, waste money, while maintenance that is delayed too long becomes more expensive.

To avoid these scenarios, the Transport Agency uses specialised infrastructure development and management software to model when maintenance is the most economical. To provide data for these models, it established long-term pavement performance (LTPP) sites nationwide – on state highways in 2000 and on territorial local authority networks in 2003.

However, in addition to maintenance modelling, the data held in the LTPP databases could provide useful guidance on the economic performance and condition of pavements, and the relationship between the two.

Investigation by WSP Opus Research explored this potential by undertaking a comprehensive statistical analysis and review of the March 2015 LTPP dataset. Key objectives were to:

- use descriptive statistics to identify trends
- identify the key issues that cause pavements to fail, using correlations between pavement condition indices and pavement failure, including whether there was any evidence that pavements with cracking are at a higher risk of failure
- recommend whether the dataset could be restructured to provide additional benefits.

Issues of particular interest included:

- What maintenance strategies help achieve optimum lives?
- Do any maintenance strategies have a negative effect?
- Does surfacing condition affect pavement life, and if so, how?
- What is the effectiveness of different maintenance interventions and their timing?
- Is there scope to improve the LTPP experimental design?

Although the initial research intention was to focus on statistical analysis of the numerical data, it became obvious during the project that it would be more useful to combine this with a manual review of the data, by a person with extensive road engineering and maintenance experience. The review involved interpreting site photographs, notes and construction records to provide engineering explanations for the data recorded at sites highlighted during the statistical analysis.

The manual review did not identify any reliable data to show that pavements displaying cracking are at a higher risk of failure. It did, however, suggest that the current approaches to selecting maintenance treatment types, and the quality of the subsequent maintenance and reconstruction practices, may be contributing to making the level of service delivered by pavements worse after maintenance. In particular, the maintenance practice of water cutting should be reconsidered, as there was evidence that it might be contributing to more rapid deterioration in pavement condition.

Overall, the research concluded that the LTPP database contained a wealth of information, in addition to the numerical data, in the form of visual observations, records, and photographs collected by the survey contractor. This additional information could be used to provide more in-depth understanding of the distress and maintenance activities at each site. However, the database's current structure made extracting this information a time-consuming process.

The report recommended that the current arrangement of the LTPP dataset should be analysed and reorganised to provide additional benefits from the data.

'There is much scope available to improve the quality of the data in the LTPP and the RAMM databases. The data could be restructured to be more compatible with smart computing and machine learning (artificial intelligence) to make the extraction of meaningful results more affordable and hence more frequent,' the report says.

In the medium-term, this could involve data cleansing, image analysis (for example, of crack mapping and site photographs), machine learning and incorporation of data from other sources. The ultimate aim would be to remove reliance on resource and time-consuming human analysis.

The report also makes a host of shorter-term recommendations relating to the dataset and data collection practices, which although they have varying impact, when taken together with the more substantive medium-term recommendations, would be 'useful in improving the value of the LTPP database for the benefit of future research'.