

SOUTH WAIRARAPA DISTRICT COUNCIL

27 NOVEMBER 2013

AGENDA ITEM C5

ROAD TREATMENT REPORT

Purpose of Report

This report covers what can be done to gravel roads from doing nothing through to fully sealing. This is a general report discussing the various treatments available, expected life of those treatments, and costs involved.

Recommendations

Officers recommend that the Council:

1. *Receive the information.*

1. Executive Summary

Unsealed roads have a number of negative impacts relative to sealed roads. These include, dust nuisance to neighbouring properties, damage to adjacent crops, reduced driver comfort and increased vehicle maintenance costs, reduced safety, higher number of customer complaints and requests for improvements, and resident expectations.

There are numerous techniques and products that can be used on unsealed roads from doing nothing up to sealing them and also numerous forms of sealing that can take place as well. Evaluation of these various treatments and priority has been primarily been via Cost Benefit Analysis or Whole of Life costing.

In general unsealed roads have been the "poor cousin" to that of sealed roads rather than looking at them as their own asset in their own right. Maintenance has been repetitive and based on techniques passed down from grader driver to grader driver. Grading and re-metaling have been the only forms of maintenance and seen as the cure to all ills with the only other solution being to seal it.

Once sealed the maintenance cost are two times that of an unsealed road.

Council, is currently letting the 2014/17 roading contract which gives options to maintain the status quo or look at the alternative options for changes in unsealed maintenance.

2. Background

Increasing numbers of urban people, looking for an improved lifestyle, are moving into rural areas serviced with gravel roads, and this has led to a significant increase in complaints to local authorities regarding dust emissions.

There are numerous publications from both international and New Zealand engineers that discuss the social, safety, asset management and environmental problems caused

by the large quantities of dust particles emitted from unsealed gravel roads, and their treatment. The problems include:

- *ratepayer complaints regarding nuisance dust, claiming that it affects their standard of living*
- *causes a loss of value of housing*
- *reduced crop yield in horticulture within 200m of the roadway*
- *reduced animal production on farms within 200m of the roadway*
- *loss of fine aggregate, and the effect of that on future maintenance costs*
- *the need for regular reshaping and grading*
- *safety issues related to visibility, because of dust clouds produced by vehicles, and increasing*
- *accident potential risks*
- *increased vehicle operating costs*

A review of New Zealand research showed that most conventional dust suppressant agents used in this country generally only last 2–3 months and then have to be re-applied. Most of the commercialised materials have not proven to be cost effective, but their use has been necessary to satisfy users and local residents. In some regions, waste oil has been (and still is) applied by residents and local authorities alike, because of its low cost and good performance, compared to the alternatives.

Also many of the products that are used in Australia and other countries are not available in New Zealand. Within Australia there has been a major change towards soil stabilisers that has stemmed from the mining industries need to have large unsealed areas more amendable for workers and useable for equipment such as haulage equipment.

For this reason SWDC conducted 2 trials of roads being stabilised with polymers 2 years ago with poor results. This highlighted the differences in soil types and for SWDC primarily in grading and lack of Plasticity Index (PI) compared to main other areas and countries.

Council has received requests to seal roads “seal extensions” to improve the amenity of the road and adjacent property’s. The reasoning generally is presented by the affected resident in the form of “the road needs to be sealed because”. Starting from the issue e.g. dust or safety there are many various options that can be considered other than sealing. Signage, increased maintenance, road geometry etc. are all viable options to address safety. Products used as well as techniques can also change road characteristics in unsealed pavements.

3. Discussion

3.1 Evaluations

There are numerous techniques and products that can be used on unsealed roads from doing nothing up to sealing them and still numerous forms of sealing that can take place as well.

Evaluation of these various treatments and priority has been primarily been via Cost Benefit Analysis or Whole of Life costing.

Cost-benefit analysis (CBA) is a systematic process for calculating and comparing benefits and costs of a project, decision or government policy, CBA has two purposes:

1. To determine if it is a sound investment/decision justification/feasibility)
2. To provide a basis for comparing projects. It involves comparing the total expected cost of each option against the total expected benefits, to see whether the benefits outweigh the costs, and by how much.

CBA is related to, but distinct from cost effectiveness analysis. In CBA, benefits and costs are expressed in monetary terms, and are adjusted for the time value of money, so that all flows of benefits and flows of project costs over time (which tend to occur at different points in time) are expressed on a common basis in terms of their "net present value."

Whole of life costing also commonly referred to as "cradle to grave" or "womb to tomb" are costs considered to include the financial cost which is relatively simple to calculate and also the environmental and social costs which are more difficult to quantify and assign numerical values. Typical areas of expenditure which are included in calculating the whole life cost include, planning, design, construction and acquisition, operations, maintenance, renewal and rehabilitation, depreciation and cost of finance and replacement or disposal.

Vehicle operating costs (VOC) is associated with reduced pavement roughness are an established key component of road improvement benefits. The increasing emphasis of road agencies on asset management, a major component of which is economic evaluation of whole of life pavement options, has made accurate estimation of road roughness vehicle operating cost VOC relationships of increasing importance. However, in Australia, a shift in emphasis from research to application has resulted in a relative hiatus in further development of VOC roughness relationships. Renewed interest by transport agencies coupled with advances overseas have generated momentum to increase research in the area.

3.2 Treatment

There are numerous treatments that can be used on unsealed roads.

- Organic non-bituminous products
- Water attracting chemicals
- Waste oil
- Petroleum passed products
- Electro-chemical products
- Microbiological products
- Polymers

The general difficulty in using more specialised treatments is that they need to be tailored to the road they are being applied to and while unsealed roads are one of councils largest asset groups, they are not analyzed very deeply. They receive generally two treatments being grading and re-metaling and both of those are done in an often varied non-diagnostic or analytical manner. However as shown in the ARRB unsealed road manual efficiencies of over 30% are achievable from using a road by road approach to unsealed maintenance. Where sealed roads are subject to treatment designs, roughness counts etc. unsealed roads can be subject to similar testing in grading and PI add well as permeability etc. testing.

3.3 Costs

Currently the sealed road network in maintenance and renewal costs approximately \$3,159 a km/y whereas the unsealed road network costs \$1,616 km/y. Any extension of the sealed road network more than doubles the future costs of the pavement.

These costs are considered a minimum as they do not take into account drainage, line marking and other cost centres that are disproportionately spent against sealed roads over unsealed. Furthermore, urban roads also receive greater funding over rural in signage and other costs centres which are generally sealed.

Any improvement to the maintenance regime on our existing unsealed network will result in a higher per kilometre maintenance costs. Also the use of very cheap river

metal on roads enables council to achieve very high re-metaling rates but with a very poor life span.

As shown in figure 2 treatments applied to unsealed roads can extend the life and quality of the pavement. For example the process currently championed with in Australia is to perform a grading on the current pavement and import the missing graded material only, mixing that back with the existing pavement. This decreases the material used and cartage as well as has a very positive greenhouse effect. However what is gained in the savings is often lost in the methodology.

The use of salts is very common outside New Zealand but may not achieve the full lifespan due to a damper climate. The use of lime/cement/fly ash and other compounds is uncommon due to the cost being higher than the simplicity of putting more metal on a road.

3.4 Pavement Modification Difficulties

Unsealed roads in rural areas have a vast difference in construction. Many are simply local gravels often open graded from the rivers or quarried from local pits and sources. The binders, clay and fines are also mixes of local and imported materials.

Others are cut and filled with blended graded aggregates and constructed to a high standard.

To modify these roads to a sealing standard requires a re-construction of the entire pavement including drainage and off road infrastructure.

3.5 Safety

A number of issues that may contribute to the incidence and severity of crashes on unsealed roads including:

- inappropriate speeds
- driver inexperience
- driver's mind-set
- traffic mix/composition
- speed limit
- inconsistent and varying standards
- roadside hazards
- haphazard maintenance
- longer emergency services response time and limited funding
- poor sight distance for overtaking
- poor curve delineation
- steep embankments
- roadside hazards in the clear zone
- loose material on the pavement surface

Most of these issues can be dealt with via treatments other than sealing and other factors. The sealing of a road can often increase the issues for safety due to excessive speed etc.

3.6 Procedure

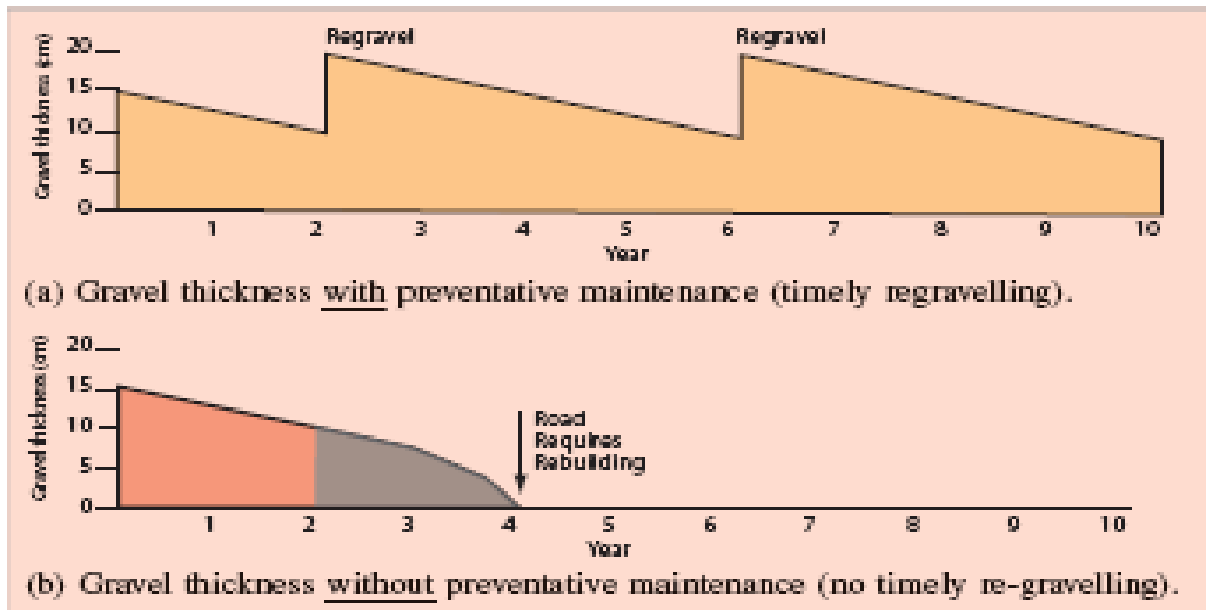


Figure 1 Gravel Road Preventative maintenance

As shown in figure 1 to maintain unsealed roads well and provide the best level of service, good preventative maintenance techniques are required. Current grading maintenance is “dry grading” which consists of a grader only. The best practice guides show that grading with the addition of water and compaction not only extends the pavement life but drastically increases the levels of service.

Gravel versus sealed roads: Life cycle analysis

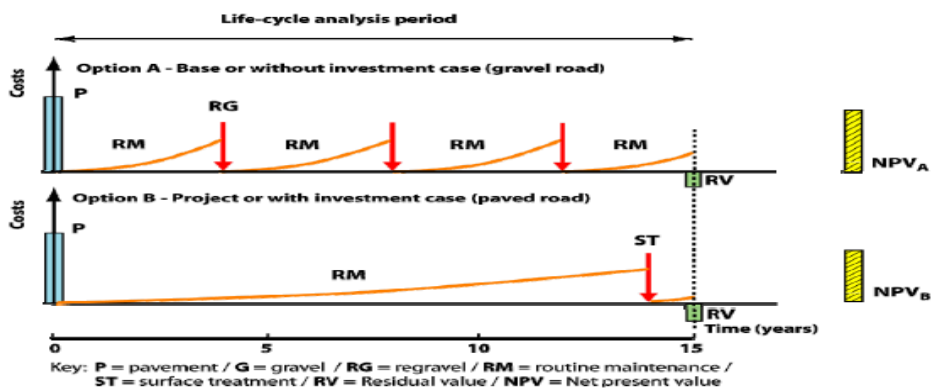


Figure 2 Lifecycle analysis

As shown in figure 2 lifecycle costs can be viewed in a net present value format to evaluate all methods. In some cases it is more cost effective or equivalent to regularly perform a method with a short life expectancy (dry grade) rather than a longer term treatment. This does not take into consideration the inconvenience to users or the “perspective” of redoing work or poor workmanship.

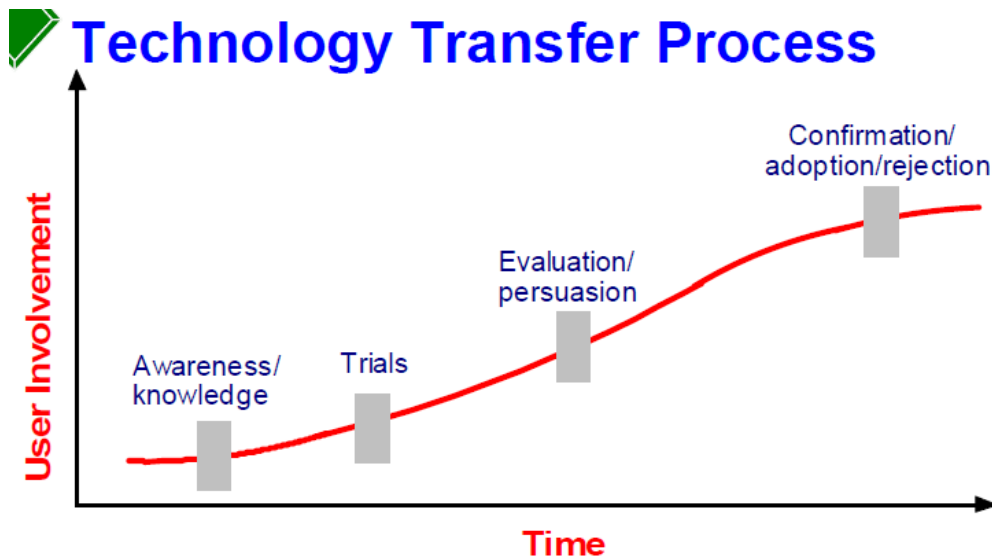
3.7 The Problem

Blading a road with a chemical treatment often requires a different methodology from that to which most motor grader operators are accustomed.

After gaining some experience with the mechanisms of dust control and soil stabilization, operators must adjust their practices to accommodate them or they may do more harm than good. This is easier said than done. Old habits die hard, and the fact that unpaved roads are no longer maintained the way they used to be, or as often, may be difficult for some to absorb.

Consequently, one of the biggest challenges when trying new techniques including the materials used and road preparation methods discussed in the ARRB unsealed Roads Manual-is to get everybody (managers, superintendents, supervisors, operators, crews, etc.) to buy in to the idea.

With the new roads contract being let this year it will give council an opportunity to instigate change and review processes and procedures.



3.8 Summary

- Maintenance on metal roads is less than half that of sealed roads
- The greater the length of sealed road the greater the maintenance costs
- There is more flexibility in maintaining unsealed roads, which may become more important as the changes to the FAR regime are known

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