Contractors Best Practice for Maintenance Intervention Strategies for Unsealed Roads

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Abstract

This paper describes and discusses a contractor's experience in compiling and implementing best practice in a maintenance intervention strategy for low volume unsealed roads. In the development of the strategy, five key features were emphasised:

1. ***Responsiveness** – to the road authority, the consultant, the public and change in demand on the network.*
2. ***Information Management** – systems to manage and report on data and information*
3. ***Planning** - the programming and co-ordination of all authorities within the contract*
4. ***Implementation** – making it happen in the field*
5. ***Confidence** – through effective maintenance operations and management of the above we will give the confidence that the*

roading network is being effectively and efficiently managed and maintained.

This paper discusses the above factors, and explains how these are being implemented in practice as part of a comprehensive maintenance intervention strategy, including training for grader operators, which is covered in more detail.

Introduction

Maintenance intervention strategies (MIS) vary between unsealed road networks and involve the management of all variable influences to deliver a predetermined level of service to the road user.

The strategy is influenced by local network demands, season variations, regional operator methodologies and availability of quality maintenance aggregates.

This paper gives an overview of all the variables influencing the decision making process, with the paper focusing on the key areas for discussion to improve current best practice.

Network Demands

Understanding the network demands requires an understanding and knowledge of the past, present and future requirements of the unsealed network.

The demands on the network are considered one of the major factors influencing the level of service, rate of deterioration and ongoing maintenance requirements and as such are seen as a critical component in the successful management and maintenance of the unsealed network.

The following are the major contributing factors to determining future demand requirements:

- Dairy operations
- Forestry harvesting
- Tourist routes and destinations
- Percentage of heavy vehicles

Demands on an unsealed network are forever changing and a contractor needs to take a flexible management approach to maintain a consistent level of service in an ever-changing environment.
This is achieved by:

- Managing from the bottom up
- Giving network ownership to the grader operator

- Having contingency resourcing strategies established to be engaged during times of peak demand
- Establishing proactive programming and identification practices

Road Hierarchy

Dividing the roading network into a hierarchy by traffic demand is a simple method of classifying roads with similar level of service requirements. This is an effective method of developing inspection and programming frequencies for identification of cyclic maintenance activities.

Response times can be assigned to the roading hierarchy as an operational performance measure to confirm the level of service.

Cyclic Maintenance

Maintenance operations are classified into reactive maintenance activities that occur after identification of the defect and proactive operations, which involve the advanced prediction of future defects.

Generally maintenance activities will be undertaken in two categories:

1. Cyclic (Proactive) maintenance comprises of the following activities:

    - Cyclic maintenance grading
    - Drainage maintenance
    - Wear course metalling
    - Vegetation control

2. Periodic (Reactive) maintenance activities:

    - Periodic maintenance grading
    - Spot metalling
    - Shape restoration metalling
    - Potholes and digouts

Maintenance Grading

The primary purpose of cyclic maintenance grading is to provide the roaduser with a safe driving surface through the elimination of corrugations and rutting, retaining a consistent aggregate wearing course and maintaining the pavement crossfall (4-6%).

Cyclic grading frequencies are influenced by various factors including:

- Network demands
- Pavement condition
- Climatic conditions
- Shape
- Standard of drainage structures
- Community levels of service expectations

On larger unsealed networks cyclic maintenance grading is generally managed by dividing the network into sub networks to encourage operator ownership, accountability, and ensures a consistent level of service is maintained across the entire network.

Benchmarking can also be carried out between sub networks focused on operator productivity and quality.

Periodic Maintenance Grading

Where road sections have deteriorated below the specified level of service between cyclic grading frequencies, which pose a safety hazard or have developed into localised defects, these areas will be addressed independently to scheduled cyclic maintenance grading by:

- Periodic maintenance grading scheduled between cyclic grading frequencies
- Grading in conjunction with spot metalling or shape restoration metalling operations.

Maintenance Metalling

In the assessment of aggregate replenishment quantities the following influences need to be taken into consideration:

- Network demands
- Aggregate loss (varies widely between regions)
- Quality of local materials
- Whether the existing surface material is bound or loose
- Ongoing cyclic grading costs
- Roaduser costs

The quantity and quality of maintenance aggregate applied each year is generally under valued and often the first item to be trimmed when budget overruns occur in other operational activities.

Table .1 is a sample of local authority networks that demonstrates the significant variances in maintenance aggregate quantities between regions that range from 23 – 76 m^3/road km/year.

Table 1: Unsealed Road maintenance metalling quantities

District Council	m^3/Year	Network Length (km)	m^3/km/year
Waimakariri	16,000	700	23
Southland	42,000	1800	23
Selwyn	30,000	1100	27
Ashburton	36,000	1200	30
Banks Peninsula	11,000	340	32
Hurunui	33,000	800	41
Westland	15,000	335	45
Central Otago	80,000	1400	57
Far North	70,000	924	76

In our experience the annual metalling quantity is influenced more by the availability, cost and quality of local materials opposed to traffic demand.

The management of annual maintenance metalling quantities is divided into three categories:

- Spot metalling (reactive)
- Wearing Course metalling (proactive)
- Shape restoration (reactive)

Approximately 60-70 percent of the annual budgeted aggregate quantity should be consumed between the wearing course and shape restoration operations (cyclic activities).

If less than 60 percent is being utilised between wearing course and shape restoration activities it is a good indication that one or more of the following operations needs to be reviewed:

- Cyclic grading frequencies are insufficient
- Total maintenance aggregate quantity is insufficient
- Selection and programming practices need to be reviewed
- Network demands many have changed

These activities are generally completed as a bulk operation at a favourable time of the year when pavement moisture content is at an optimum for maximising binding and compaction between the existing and new materials.

Wearing course and shape restoration operations are best programmed as a periodic maintenance grading operation to ensure the best results are achieved.

Spot metalling is used to supplement cyclic maintenance metalling operations and is a reactive method of attending to public requests and areas of localised defects including; scouring, potholes, exposed rock, rutting and saturated subgrade.

Preventative Maintenance Options

The objective of preventative maintenance is to reduce the ongoing life cycle maintenance costs by eliminating or minimising reoccurring maintenance sites.

This is normally achieved by the identification of high stress sites such as single lane bridge approaches, steep gradients and sharp radius corners. Construction and chip sealing or placement of clay bound wearing courses can reduce the long term costs to both the client and contractor, but need to be analysed on a site by site basis and are often ruled out by the contract term (5 years) limiting the return period for the contractor to recover the capital costs.

Cost sharing of such preventative maintenance sites is one means of both client and contractor jointly benefiting from unsealed preventive maintenance treatments.

Performance Monitoring

Current practice for performance measure of unsealed networks involves operational specifications by; defect type, associated tolerances and response times.

There is a real need to move away from this prescriptive method specification that in a significant amount of cases is measured by client and roaduser perception.

We need to become more focused on the end result, which is providing a smooth comfortable ride to the roaduser through roughness measurement.

With the future trend for local authorities to move towards performance based contracts, Fulton Hogan have engaged in a trial of the Opti-Grade system which has been developed in Canada by the Forestry Engineering Research Institute of Canada (FERIC).

This performance measurement system has been developed and proven in the management of unsealed forestry haulage roads in Canada and we believe this technology can be transferred to the New Zealand environment to reflect an unsealed networks condition.

The system consists of an accelerometer mounted on a vehicle axle connected to a small data logger on board the vehicle. Location reference data is captured from a GPS unit installed on the vehicle.

The software analyses the data on predetermined roughness criteria to develop a network performance report.

It is intended to use the Opti-Grade system both as a network condition measurement tool but also as an operational tool to determine intervention levels for cyclic maintenance grading.

The role of the Maintenance Grader Operator

Maintenance grading is **not** a precise science but an operator skill that varies between operators depending on experience, knowledge, training, plant preferences, techniques, material and weather conditions.

In practice a significant amount of the decision making and variable influences involved in a MIS that has been discussed in this paper are decisions that are understood at a management level but are put into practice and managed on a daily basis through the grader operator or unsealed roads supervisor in the field.

This person is often making subconscious decisions on a road-by-road basis, based on the individual's knowledge and experience.

Often local operator knowledge and grading techniques are not taken into consideration when developing MIS. Discussing current practice with the operator should be the first point of contact when developing or reviewing strategies.
To achieve best practice in the field it is critical that management personnel openly communicate the theory behind the MIS to ensure buy in from the operator.

If operator buy in is not achieved the likelihood of successfully implementing or modifying the strategy is significantly reduced.

Grader Operator Training

Sharing of ideas and techniques between experienced operators can be achieved by field workshops and operator demonstrations involving several operators. This gives a good forum for discussion of different grading methods and machinery set ups to deal with varies issues including:

- Understanding the machinery capabilities
- Cutting and spreading techniques
- Number of passes (3,4,5...) dependent on road width and material type
- Mouldboard positioning
- Placement of windrows
- Material segregation issues

- Blending techniques
- Use of other implements- Windrow eliminators
- Appropriate techniques for dealing with seasonal variations in pavement condition- use of Sandvik picks
- Grader bounce or looping resulting in reduced production and resulting in pavement corrugations

The training of machinery skills is best achieved through hands on tuition in the field from an experienced operator.

Operator rotation for a period of one or two weeks at a time on a new network environment is a good training practice that exposes the individual operator to rethink the techniques to deal with the new pavement conditions.

Grader operator training is a two way process, which is about management personnel (planners) gaining a knowledge and understanding of the grader operator's (implementation doers) techniques and plant methods and striving to achieve the same outcomes.

Summary

The successful implementation of an unsealed roads maintenance intervention strategy is not a precise science and is highly dependent on achieving ownership of the strategy by the implementation crew.

More consultation with experienced operators is needed to maximise the local knowledge and experience that already exists, to understand the ever-changing influences that need to be evaluated on a daily basis.