MAINTENANCE OF UNSEALED ROADS

INTRODUCTION

The objective of this TECHnote is to assist local road authorities to maintain low volume unsealed gravel roads. Local councils are responsible for 574,660 km of unsealed roads comprising more than 60% of the total road network in Australia. The dynamic and changeable nature of unsealed roads make it difficult to forecast optimal expenditures and allocation of resources.

MARGINAL ROAD MATERIALS

Councils are using local gravel pits with marginal materials that does not comply with the loading requirements of modern trucks and vehicles. There is a need for Councils to use more science and new techniques to get better usage of the existing local road materials for both sealed and unsealed local roads. The Austroads report AP-T335-18 identifies the appropriate use of non-standard materials in road construction and maintenance. These marginal materials need detail testing evaluations to achieve improved design decisions.

MAINTENANCE PLANNING FOR UNSEALED ROADS

Maintenance planning strategies are adapted to the physical condition of the pavement, traffic volume and climatic conditions. Efficient routine maintenance such as cross fall retention is the key to preventing significant road surface deterioration.

ENVIRONMENTAL INFLUENCES CREATE SEASONAL DEFECTS

Seasonal dryness and increased traffic volumes can result in higher dust emissions and ravelling. Drier areas tend to form corrugations under traffic due to the local materials being of lower plasticity, hence increasing the demand on maintenance regimes. Cold freeze-thaw conditions cause impassable wet, slippery slushy surfaces. Short daylight and inadequate surface warmth are unavailable to dry out the road surface. Wet weather can introduce further deficiencies such as scouring and washouts.

ARRB SPREADSHEET MODEL FOR DEFECT REDUCTION

The *1602 Maintenance schedules* spreadsheet should be used in conjunction with the Australian Road Research Board (ARRB) unsealed roads spreadsheet model for analysing mix % of adjacent gravels as a Stage 1 defects avoidance selection. The selection uses a chart with Shrinkage Product % and Grading Coefficient. The chart is based on many defect observations by Paige and Greene in South Africa circa 1969.

When the mix % has been determined this mix can be Stage 2 laboratory tested with a view to discovering a new material with higher structural strength and higher density impermeable gravel. Impermeable gravels allow exposed unsealed roads to shed water rather than permit percolating of water through the wearing and pavement courses and into the weaker subgrade causing potholes.

Other additional treatments such as stabilisation may also need considering if target test results are not achieved by blending.

MAINTENANCE SCHEDULING FOR UNSEALED ROADS

The *1602 Maintenance schedules* spreadsheet provides for maintenance scheduling of both sealed and unsealed roads.

For unsealed roads, one of the excel worksheets describes geotechnical testing guides for gravel pits located adjacent to Councils unsealed roads.

RESULTS FROM STAGED TESTING AND BLENDING

The net result of staged testing of blended gravels is the reduction or elimination of defects such as ravelling, corrugations, structural rutting, slippery, dusty, gouging, erodible, dispersive, and finally potholes. It may cost more to blend different gravels compared with using a single source pit. Blending may reduce the overall whole of life costs for Council by extending intervention times for both patrol grading and resheeting. This should gain increased road user satisfaction due to more customer usability of the unsealed road.

ROAD GEOMETRY AND DRAINAGE

Maintaining a cross fall of between 4 and 6% together with well-maintained table drains will reduce the ingress of moisture into the weaker subgrade. This will reduce potholing and road scour.

IMPERVIOUS GRAVEL

One of the primary objectives of gravel blending is the creation of an impervious gravel to reduce percolation through the exposed pavement. The aim is to increase the Maximum Dry Density (MDD) of the mix to greater than 2.2 and preferably more than 2.3. Testing for the permeability coefficient is an additional desirable test in addition to MDD (maximum 1 x 10^4 m/s). An impervious gravel is desirable for the unsealed wearing course or the sealed base course for the unsealed road shoulders.

Relevant publications

ARRB

Best Practice Guide 2 – Unsealed roads

Austroads

AGPT Guide to pavement technology:

Part 5 Pavement evaluation and treatment design

Part 6 Unsealed pavements

AP-T335-18 Appropriate use of marginal and non-standard materials in road construction and maintenance

IPWEA NZ

Unsealed roads tactical asset management guide

Relevant worksections

Design worksections

0052 Geometric rural road design – unsealed

0054 Rural pavement design – unsealed

Construction worksections

1113 Stabilisation

1140 Wearing course, base and subbase – unsealed

1141 Flexible pavement base and subbase

Maintenance worksections

1601 General requirements – road reserve (Maintenance)

1602 Maintenance schedules – road reserve

1603 Road reserve maintenance plan (RMP)

1604 Annexures to road reserve maintenance plan (RMP)

1616 Grading unsealed roads (PGU)

1617 Resheeting unsealed roads (PRU)

1632 Grading unsealed shoulders (SGU)

1633 Resheeting unsealed shoulders (SRU)

TECHreport

TR 08 Management of Council gravel pits in country areas – A case study

TECHnote

GEN 023 Using AUS-SPEC for management of unsealed roads

GEN 026 Otta seal – A different approach to road sealing

DES 034 Pavement stabilisation for unsealed roads

DES 035 Improvement and stabilisation of unsealed roads

MAINTENANCE OF UNSEALED ROADS

Unsealed road shoulders with pervious gravel exposes the road owner to edge break repairs.

DUST SUPPRESSION TECHNIQUES FOR SHORT SECTIONS OF UNSEALED ROADS

The following dust suppression options can be considered for treating short lengths of unsealed road say 150 m in length for temporary or medium-term relief from dust for persons with houses next to unsealed roads:

- Addition of water is very short-term.
- Addition of calcium, magnesium or sodium chloride.
- Lignosulphonates (by-products of the wood pulping process).
- EVA emulsion glue (integrating by ripping into existing gravel).
- Emulsion combination of bitumen, water and additives.
- Asphaltic concrete millings mixed into tyned gravel where close to convenient source areas.
- Otta seal surfacing with “Norwegian Road Oil” mixed/blended with screened pit gravel creating macadam of aggregates, clay and bitumen. It can tolerate high deflections over weak gravel base. For more details on Otta seal refer to NATSPEC *TECHnote GEN 026*. This Otta Seal dust suppression option is cheapest over the long term and approximates the cost of gravel resheeting.
- Normal aggregate hot bitumen spray seal. This option depends on strength of the unsealed pavement, whether additional base gravel overlay is required.

STABILENTS

Where the blended gravel still has high plasticity (PI) specifically PI over 15 and for low CBR % consider adding of lime or dry powdered polymer. In areas such as floodways or flood prone roads then stabilising with hot foam bitumen or warm bitumen emulsion could be considered. These stabilents can be reused in any future reconstruction works.

COMMERCIAL HARD ROCK CRUSHED AND SCREENED GRAVELS (BLENDING SMALL %)

Where structural rutting or slipperiness is a problem then blending of a small percentage of commercial hard rock DGB20 or DGS20 say 20% of the total mix should be tested and considered. Feasibility of this hard rock addition will depend on ex pit costs and transport costs. Whole of life costs should be used in any decision making. Finally check compliance with construction worksection *1140 Wearing course, base and subbase (unsealed roads)*.

TR 08 MANAGEMENT OF COUNCIL GRAVEL PITS IN COUNTRY AREAS – A CASE STUDY

This study provides more information for councils to build and maintain better sealed and unsealed roads. It uses a system of materials extraction and blending from different gravel pits to meet higher required performance standards. This report shows how Councils can achieve better whole of life costs and reduce budget expenditures for both sealed and unsealed roads.

MAINTENANCE TREATMENTS

- Patrol grading: Light grading is performed on a routine basis to keep the road well drained to maintain a satisfactory running surface. Heavy grading is performed where road requires reshaping after periods of heavy traffic or has suffered severe surface damage due to wet weather. Heavy grading requires reshaping and restoring the surface to a correct cross-fall profile.
- Reshaping: Involves winning swept gravel from the table drains plus scarifying the road surface and remixing the aggregate base to yield a better blending of fines and aggregates and restoration of surface cross falls.
- Resheeting: This is a periodic maintenance activity and involves replacing the eroded wearing course when it has worn away. A suitable thickness of 100-150 mm gravel is applied to prevent structural deformations in the base or subgrade.

CONCLUSION

The performance of unsealed roads is based on the material properties, road geometry, drainage, weather and traffic conditions. Due to the seasonal and weather sensitivity of unsealed roads it is difficult to predict the expenditure for the maintenance of these roads. It is important to undertake material testing for each gravel pit source and use the ARRB spreadsheet prediction modelling to determine reasons for defects on the road and to determine blending mix solutions to eliminate or reduce the defects.

Dynamic nature of unsealed roads

Warning road signs

Pavement defects

Corrugations

Pot holes

Maintenance Treatments

Resheeting

Stabilisation