IMPROVEMENT AND STABILISATION OF UNSEALED ROADS

INTRODUCTION

Preservation of existing unsealed gravel roads can be an economical and effective alternative to:

- Frequent grading maintenance intervention.
- Frequent gravel resheeting.
- Full construction of a sealed road.

The required intervention levels and timing of maintenance intervention resource may not be sufficient to protect Councils duty of care to provide safe roads.

Local gravel pits are becoming increasingly a scarce resource.

Resheeting only with single pit local gravel materials may not be a lasting solution.

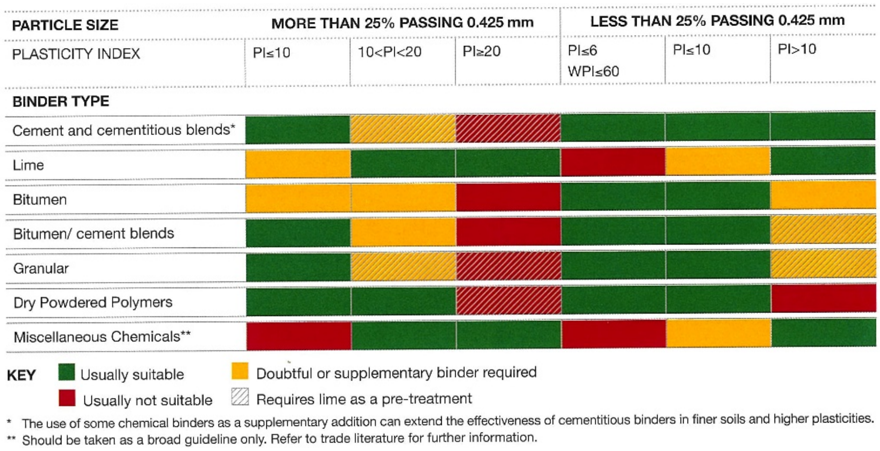
PRESERVATION AND REDUCED INTERVENTION

Improving an unsealed road by blending a combination of road materials for resheeting or using binders to mix into the existing road material should be considered to reduce construction and maintenance costs. The objective is to increase the time between grading interventions and to increase accessibility after rain or to reduce bulldust hole hazards due to long dry spells.

INVESTIGATION AND DESIGN

OPTION 1 for resheeting and stabilisation

The use of blended granular road materials or binders compared to a single Council pit gravel has the objective of getting a better unsealed road at a lower whole of life cost. A binder is a combination of road gravels or a chemical binder mixed with a single gravel. Testing using sieve analysis and Plasticity Index (PI) is required for preliminary binder selection by reference to the following table:



Source: AustStab Pavement recycling and stabilisation Guide, Table 3.2.

This requires the trial investigation to be a **granular** blend of at least two gravels and involves the following:

- The trial consists of first a low-cost commercial pit by-product with low plasticity and high CBR referred to as scalping's or similar.
- Second select a local medium plasticity low CBR Council pit gravel previously tested with sieve gradings, plasticity index, UCS, CBR, and density. Set up an excel spreadsheet with sieve grading information for both materials. Trial four different blend percentage combinations on the spreadsheet and select one or two mixes for further laboratory testing.

The trial investigation is done to achieve the following objectives:

- To raise the plasticity of the blue metal by product, increase the combined density and increase the CBR by filling the voids with clay binder in the by-product blue metal.
- To get much cheaper base material supply costs, quicker road construction time, longer whole of road life and a reduction in subgrade potholing due to lower penetration of water in the lower pavement.

If this blended gravel is used for a bitumen seal then the mix needs to be tested for UCS requiring a range 1 to 2 MPa.

Abbreviations

PI: Plasticity Index

CBR: California Bearing Ratio

UCS: Unconfined Compressive Strength

Austroads

AGPT01 Guide to pavement technology Part 1: Introduction to pavement technology.

AGPT04 Guide to pavement technology Part 4: Pavement materials.

AGPT04D Guide to pavement technology Part 4D: Stabilised materials.

AGPT04L Guide to pavement technology Part 4L: Stabilising binder.

AGPT06 Guide to pavement technology Part 6: Unsealed pavements.

ARRB

ARRB Group 2020, Best Practice Guide 2 – Unsealed roads.

Andrews, Bob and Sharp, Kieran, 2010, Evaluation of in situ stabilisation for best value management of unsealed roads

AustStab

Pavement recycling and stabilisation guide, 2015.

Low volume roads technology projects, Construction report for insitu stabilisation - Road trials - Lime cement and polymers, March 2009

Relevant Papers

Forgotten best practices for unsealed roads, 2014, Glenda Visini and Markham Parker

Stabilisation of unsealed roads, 2010, IPWEA Conference, Greg White and Andrew Middleton

Relevant TECHnotes

NTN GEN 023 Using AUS-SPEC for management of unsealed roads.

NTN DES 034 Pavement stabilisation for unsealed roads.

Relevant worksections

1113 Stabilisation

1140 Wearing course, base and subbase - unsealed

1141 Flexible pavement base and subbase

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Testing of other binder types: Lime, bitumen emulsion, foamed bitumen, foamed bitumen/lime, dry powdered polymer with lime, and other proprietary chemicals and polymers may be considered. The conclusion of any stabilisation lab testing will be a mix design and with the mix design will be a cost benefit evaluation.

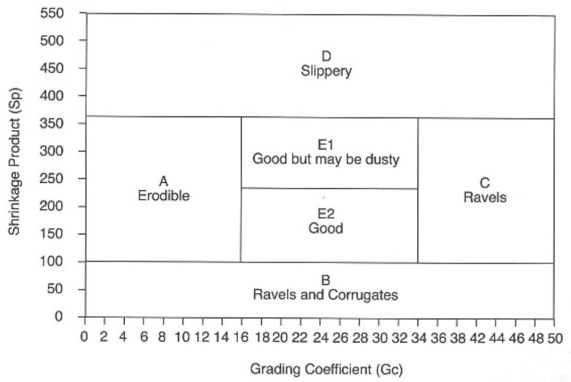
Results from Option 1

From the mix design determine whether a combination of different gravels or using stabilisation binders have sufficient benefits in road usability and reduced intervention levels. The cost of blending and stabilisation and the usability and extended life benefits can be compared with the 'do nothing' option.

OPTION 2

Cassowary Coast Regional Council used a combination of 2 or 3 local materials. Key additives were a clay, a sand blended with the existing granular high maintenance gravel. Using a purpose-built stabilising machine. The road users want to get accessibility soon after rain and have an unsealed road without potholes.

Reference Chapter 12 of the IPWEA Queensland Supervisors Handbook for the Construction and Maintenance of Infrastructure. The handbook focuses on the theoretical grading coefficient and shrinkage product. They utilise a weighted average of linear shrinkage to predict the final blended linear shrinkage. The handbook has a Figure 12.1 they use as a selection ready reckoner.



Source: "Neural networks for performance prediction on unsealed roads" by Lea, Paige-Green and Jones. RTR 1999.

Results from Option 2

The paper *Forgotten Best Practices for Unsealed Roads,* identified blending of materials used to improve the useability, longevity and the reduction of unsealed roads maintenance costs for Cassowary Coast Regional Council (Tully, Cardwell and Innisfail). Cassowary Coast Regional Council has directed substantially more budget funding into new system blended gravel resheeting in response to this material blending initiative for unsealed roads.

If the road does not need to be closed after rain events then this will reduce the need to invest in more sealed roads. Another factor was the reduced maintenance intervention time period. One job survived 3 cyclones. Ironically the unsealed system they now use was common practice 40 to 50 years ago.

USING AUS-SPEC TO DOCUMENT STABILISATION FOR UNSEALED ROAD

Use *1113 Stabilisation* to document the stabilisation of unsealed roads.

Also see AUS-SPEC TECHnote *NTN GEN 023* which provides guidance on using the specific worksections for the design, construction and maintenance of unsealed roads and *NTN DES 034* which provides an overview on factors affecting stabilisation of unsealed roads and provides basic procedure for binder selections.

CONCLUSION

- With the right gravel blends the increase in density leads to longer lifecycle for the unsealed pavements and the reduced porosity of the denser product reduces the risk of subgrade pavement potholing.
- Using blended gravel improves construction workability and thus reduces cost of construction. For unsealed roads, the use of granular blending or other binder stabilisation increases the time between grading interventions and thus reduces maintenance costs and increases accessibility after rain.
- There are many options for Councils to save money using stabilisation of existing road pavements. Councils should be exploring pavement development as ongoing initiatives for total asset management and to get better roads for less cost.

Examples of improvement and stabilisation of unsealed roads

Unsealed road damaged by potholes during wet weather

10 mm and 20 mm blue metal aggregate comparison

Dry spreading of binders

Blending of gravel

Stabilisation of unsealed pavement in progress

