PAVEMENT STABILISATION FOR UNSEALED ROADS

WHAT IS STABILISATION?

Stabilisation is a process by which the intrinsic properties of a pavement material are altered by the addition of a stabilisation binder and/or granular material to meet performance expectations in its operating, geological and climatic environment.

TYPES OF STABILISATION

Category	Indicative strength after stabilisation	Common binders	Anticipated performance attributes
Subgrade	CBR > 5% (subgrades and formations)	- Lime. - Chemical binder.	- Improved subgrade stiffness. - Improved shear strength. - Reduced heave and shrinkage.
Granular	CBR > 30% (subbase and base course)	- Blending of other granular materials which are classified as binders. - Mechanical stabilisation	- Improved pavement stiffness. - Improved shear strength. - Improved resistance to aggregate breakdown.
Modified	0.7 MPa < UCS < 1.0 MPa (base course)	- Small quantities of cementitious binder. - Lime. - Chemical binder.	- Improved pavement stiffness. - Improved shear strength. - Reduced moisture sensitivity and loss of strength due to increasing moisture content. - At low binder contents, stabilised material can be subject to erosion where cracking is present.
Lightly bound	1.0 – 2.0 MPa	- Small quantities of cementitious binder. - Lime.	- Similar to Modified. - Greater rut resistance.
Bound	UCS > 2.0 MPa (base course)	- Greater quantities of cementitious binder. - Combination of cementitious and bituminous binders.	- Increased pavement stiffness to provide tensile resistance. - Some binders introduce transverse shrinkage cracking. - At low binder contents, stabilised material can be subject to erosion where cracking is present.

Factors affecting type of stabilisation

Consider the following in selecting the most suitable type of stabilisation:

- Material to be stabilised: Most stabilisation treatments will have an effect on material properties such as strength, volume stability, abrasion resistance, permeability and durability. Each property is influenced to differing degrees by the various stabilisation binders.
- Proposed use of the stabilised material.
- Climate and drainage.
- Relative costs of selected binder content.
- Transportation of binder to site.
- Availability of testing facilities for investigations, subsequent controls and construction equipment.
- Capabilities and experience of the construction personnel.
- Health and safety.

Factors affecting the performance of unsealed roads

Stabilisation design for unsealed roads is influenced by specific requirements for the following:

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 binders.
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.

Relevant TECHreport

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

Relevant TECHnotes

NTN GEN 023 Using AUS-SPEC for management of unsealed roads
NTN GEN 026 Otta seal – A different approach to road sealing
NTN DES 035 Improvement and stabilisation of unsealed roads

Relevant worksections

1113 Subgrade and formation stabilisation
1140 Wearing course, base and subbase – unsealed
1141 Flexible pavement base and subbase

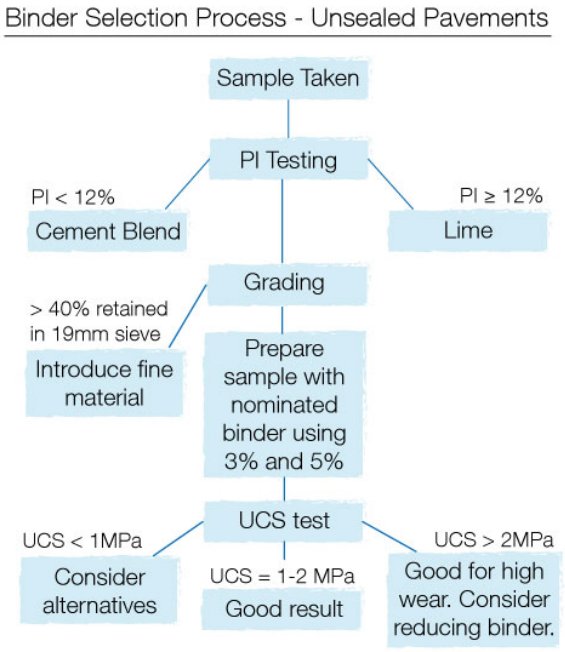
PAVEMENT STABILISATION FOR UNSEALED ROADS

- Resistance to deformation: This is governed by the degree of aggregate interlock (particle friction) and cohesion (bonding of fine soil). Strength is associated with the ability of a material to resist imposed stresses and is typically determined in terms of CBR or UCS.
- Resistance to wear: This is governed by weather and traffic. A compacted and tight wearing surface in which the aggregate is held strongly in place by the fine soil matrix will have greater resistance to deterioration from weather or traffic.
- Protection of underlying material: A relatively impermeable surface protects the underlying material from the entry of water, preventing reduction of strength or loss of stability. Permeability is measured directly or inferred from classification and index tests.

Basic procedure for the design of stabilised unsealed roads

Undertake site investigation and routine laboratory testing and consider the following factors in the design process:

- Site investigation:
  - Available historical information of the pavement materials.
  - Visual inspection for the full length of the proposed road for rehabilitation to assess variability of materials.
  - Obtain test samples that are representative of the materials to be stabilised or are made up materials of similar proportion to the final expected pavement. For example, the pavement to be stabilised could contain natural ground with some imported gravel.
- Laboratory testing:
  - Plasticity Index: Some clays or material contaminated with organic matter might not react with the binder to an adequate degree.
  - Grading: The presence of a high proportion of large aggregate will result in plucking out of the large stones on the surface causing potholing.
  - UCS: Extrapolate the UCS results from 3% and 5% to optimise the binder content.
- Thickness determination:
  - Empirical thickness design methods may be used, however common treatments of 150 to 200 mm are usually satisfactory for low to medium volume unsealed roads.



USING AUS-SPEC TO DOCUMENT STABILISATION FOR UNSEALED ROAD

Use *1113 Subgrade and formation stabilisation* and *1164 In situ pavement stabilisation* of unsealed roads 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.

In situ stabilisation processes used in unsealed roads


In situ application of binders


In situ mixing of binders


Compacting


Trimming


Stabilised unsealed pavement

Further information

For further information see the following,

www.aus-spec.com.au

and refer to the

National Worksection Matrix

for selection of worksections.