Pavement Recycling and Stabilisation Association

AustStab Technical Note

No.11 May 2020

Triple-Blend Stabilisation

1 Introduction

Numerous binders are available for use in stabilisation of pavement materials including cement, lime, bitumen, flyash, slag and polymers.

Preliminary selection of suitable binders can be made by reference to the binder selection chart within the Austroads Guide to Pavement Technology Part 4D: Stabilised Materials (shown below). Guidance is based on two primary host material characteristics, these being the particle size distribution and the Atterberg limits. However, the Austroads binder selection chart does not include triple blends, which can be formed by multiple binder components and combinations.

Table 2.4: Preliminary selection of binder/additive type

Particle size	More than 25% passing 75 µm sieve			Less than 25% passing 75 µm sieve		
Plasticity index (PI)	PI ≤ 10	10 < PI < 20	PI ≥ 20	PI ≤ 6 & PI x %passing 75 µm ≤ 60	PI ≤ 10	PI > 10
Binder type						
Cement and cementitious blends[1,3]	Usually suitable	Doubtful	Usually not suitable	Usually suitable	Usually suitable	Usually suitable
Lime	Doubtful	Usually suitable	Usually suitable	Usually not suitable	Doubtful	Usually suitable
Bitumen	Doubtful	Doubtful	Usually not suitable	Usually suitable	Usually suitable	Usually not suitable
Bitumen/ lime blends	Usually suitable	Doubtful	Usually not suitable	Usually suitable	Usually suitable	Doubtful
Granular	Usually suitable	Usually not suitable	Usually not suitable	Usually suitable	Usually suitable	Doubtful
Dry powder polymers	Usually suitable	Usually suitable	Usually unsuitable	Usually suitable	Usually suitable	Usually not suitable
Other proprietary chemical products[2]	Usually not suitable	Usually suitable	Usually suitable	Usually not suitable	Doubtful	Usually suitable

1. *The use of some chemical binders as a supplementary addition can extend the effectiveness of cementitious binders in finer soils and soils with higher plasticity.*
2. *Should be taken as a broad guideline only. Refer to trade literature for further information.*
3. *TMR uses triple blend and have a method based on % passing 0.425 mm sieve and linear shrinkage (Volker & Hill 2016).*

Triple blends are an appropriate binder choice when cementitious or lime binders in isolation are not considered appropriate to meet the desired strength outcome. Where host materials exhibit a plasticity index (PI) between 10% and 20% – typical of base or subbase materials blended with subgrade materials – triple blends may enable the optimisation of final strength.

Two triple blends currently used by the Queensland Department of Transport and Main Roads have shown good performance in host materials that exhibit a PI of 10-20%.

This technical note provides guidance on these types of triple blends and their selection along with performance attributes to enable asset owners to confidently consider using these binders.

2 Triple-Blend Stabilisation

Triple-blend stabilisation often involves a combined base or subbase and subgrade treatment. It is typically carried out on materials of medium plasticity by incorporating blends of lime, cement, slag and flyash. The result is a 'hybrid' pavement layer comprising clay subgrade & granular materials.

Mixing a base or subbase and subgrade with triple blends

Triple blends can be tailor-made to suit most host materials. They are useful where:

- there are materials with a plastic clay content (10% < PI < 20%);
- strength improvement in marginal gravels is required; and
- when using top-up gravel with an existing pavement or subgrade layer.

Triple-blend stabilisation will:

- increase the CBR value;
- reduce the plasticity index;
- reduce permeability (by reducing moisture sensitivity); and
- reduce shrink swell characteristics.

Triple-blend stabilisation enables foundation improvement of a larger variety of subbase and subgrade materials.

Triple blend dry powder binder in place prior to in situ mixing by a stabiliser

3 Triple Blends

Triple blends commonly used in Queensland, based on the Linear Shrinkage (LS) of the host material, are shown in the table below.

	Hydrated Lime	Cement	Flyash
LS < 6%	30%	40%	30%
LS ≥ 6%	40%	30%	30%

Other triple blends used across Australia include:

- 60/20/20 Cement/Slag/Flyash
- 50/30/20 Slag/Lime/Flyash

Triple blends may also be designed to suit a particular situation or desired outcome.

4 Mix Design Process

Mix design using triple blends requires determination of the following:

- Step 1: Particle size distribution
- Step 2: Plasticity index (PI)
- Step 3: Linear shrinkage (LS)
- Step 4: Confirm triple blend ratio
- Step 5: UCS tests
- Step 6: Working time test if required

Laboratory testing has shown increasing strength gain over time when triple blends are used. Increases of up to 50% from 7 day cured UCS tests to 28 day cured results may be observed, making the mix design process important to correlate with the design intent.

5 Supply and Spreading

Triple blend dry powder binders are commercially available in many parts of Australia in bulk pneumatic tankers.

It is important to ensure that the individual triple blend constituents comply with the relevant binder specifications as appropriate for the particular jurisdiction.

Once loaded into purpose-built spreaders, triple blends are spread at the design application rate in the same manner as for other traditional powder binders and in accordance with the relevant specification.

AustStab Limited, the Australian Pavement Recycling and Stabilisation Association, is a non-profit organisation sponsored by member companies involved in pavement recycling and stabilisation in Australia. Its purpose is to provide information on the use and practice of pavement recycling and stabilisation.

The information provided in this Technical Note is intended for general guidance only and in no way replaces the services of professionals on particular projects and no legal liability can be accepted by the AustStab for its use.

References to Austroads guides and Queensland Department of Transport and Main Roads practice were understood by AustStab to be correct at the time of publication.

For more information about AustStab, please write to the Chief Executive Officer, AustStab at enquiry@auststab.com.au, or visit the web site at www.auststab.com.au.