DEPARTMENT OF ROAD TRANSPORT South Australia

Details of a recent lab evaluation of **ROADBOND EN 1** conducted by the **DEPARTMENT OF ROAD TRANSPORT South Australia** are summarized in this document. The evaluation was conducted by Mr. R. Brimble, Supervising Technical Officer, Geotechnical & Pavements Unit, Materials Services Section. Mr. Brimble utilized the Australian developed Universal Materials Testing Apparatus (UMATTA). The apparatus is a computer controlled, electro-pneumatic, Repeated Load Triaxial Test (RLTT) machine. It is capable of dynamically applying a range of pavement related stress conditions to test specimens in the laboratory.

The UMATTA enables a material's performance characteristics, both permanent (plastic) and resilient (elastic) strains to be determined in relation to applied axle loading within any pavement structure. The evaluation is based upon the determination of stiffness (Resilient Modulus) and deformation (plastic strain, rutting potential) of a soil material treated with **ROADBOND EN 1** and/or cement.

Resilient Modulus

Individual specimen test parameters are given in the table below:

Test #	Additive	Cure Time	Perm Strain	Resilient Modulus (Mpa)
1	ROADBOND EN 1	28	0.07	3301
2	ROADBOND EN 1	7	0.33	4472
3	Water	28	0.57	285
4	Water	7	0.24	591
5	ROADBOND EN 1 w/2% NP cement	7	*	~8000
6	2% NP cement	7	0.04	3844
7	4% NP cement	7	*	~8000

*** Indicates no permanent strain was recorded by the testing system at preconditioning stresses for this test. Where modulus values are indicated as ~8000, the measured values have exceeded the limit of resolution of the strain measuring devices.**

Rutting Potential (Deformation)

Australian empirical subgrade design procedures attribute pavement rutting to subgrade materials only, with a maximum limit of 25mm for a suggested 20 year design life. In mechanistic design, rutting of the base course, subbase and lower subbase materials is considered in the overall determination of the pavement rutting potential. The following chart illustrates the results of the test.

Test #	Additive	Cure Days	Rutting Potential
1	ROADBOND EN 1	28	0.7
2	Untreated	28	2.7
3	ROADBOND EN 1	7	2.0
4	ROADBOND EN 1 plus 2% NP	7	*
5	Untreated	7	1.1
6	2% NP cement	7	1.0
7	4% NP cement	7	*

*** Indicates no permanent strain was recorded by the testing system at preconditioning stresses for this specimen, consequently rutting potentials could not be calculated.**

It is shown from the results that the test specimens containing **ROADBOND EN 1** show lower rutting than the raw material when moisture states and curing times are taken into consideration. This form of analysis has enabled a quantitative assessment of the **ROADBOND EN 1** with regard to its potential to act alone or in combination with known stabilizers as a stabilizing additive for selected roadbase materials.

A comparison of tests 1 and 2 indicate that rutting potential has been reduced for the **ROADBOND EN 1** treated material by 74%. (2.7mm reduced to .7mm)

The potential of **ROADBOND EN 1** in reducing required cement stabilizer quantities can be seen in comparison of tests 4 and 7. Here similar tests results have been achieved by replacing 50% of the cement with **ROADBOND EN 1.** A combination of **ROADBOND EN 1** and 2% cement produced a similar result to that of 4% cement with respect to rutting.

Conclusions

The following conclusion were drawn by the **DEPARTMENT OF ROAD TRANSPORT South Australia** based on their test:

1. Testing has indicated that **ROADBOND EN 1** has material stiffness enhancing properties that increase with time.
2. Test results have shown **ROADBOND EN 1** to increase material stiffness (modulus) for the full range of stress states tested and to decrease the permanent strains for a given state of stress. (preconditioning stresses)
   - The increased material stiffness indicates a higher bearing capacity for the **ROADBOND EN 1** stabilized material than the raw product.
   - The reduction of permanent strain development indicates the **ROADBOND EN 1** ability to reduce the rutting potential of the treated material.
3. Using **ROADBOND EN 1** as the stabilizer produces equivalent results to that of using 2% cement with respect to pavement life. (subgrade rutting)
4. When moderate base stabilization is considered, as in the case of 2% cement, significantly savings may be gained by using **ROADBOND EN 1** instead of cement, depending on material suitability and load design requirements.