GRT
Global Road Technology

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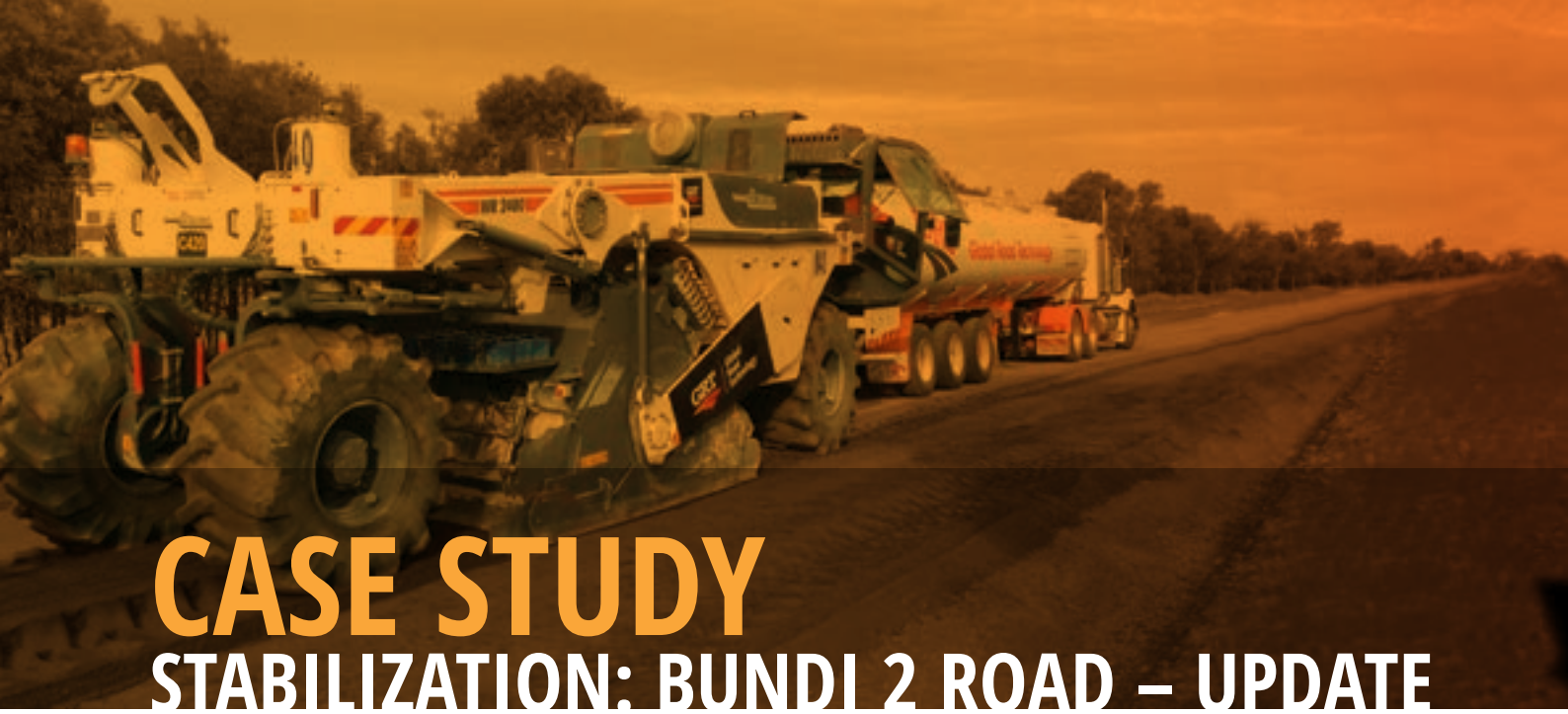
CASE STUDY
STABILIZATION IN-SITU MATERIAL REPORT



CASE STUDY
STABILIZATION: BUNDI 2 ROAD – UPDATE

INTRODUCTION

Global Road Technology (GRT) were engaged by QGC to design and construct a 1 km section of Bundi 2 Rd as a trial of its innovative design processes and construction technologies. GRT provides solutions to challenging working environments with a focus on stabilizing in-situ material to produce stronger, water resistant roads that are more economical and environmentally sustainable than conventional road design and construction processes. The key element of GRT's approach is the application of its liquid polymer products, in this case GRT7000. This Road Bulletin Update is intended to recap briefly on the project and to report on the ongoing testing and research undertaken by GRT on Bundi 2 Rd.

THE CHALLENGE

Bundi 2 Rd is a black soil road in the Western Downs Regional Council; about 20 km from the town of Wandoan. Black soil is the common name given to Black Vertosols that exhibit the shrink/swell clay characteristics that notoriously impact on infrastructure in many areas of Western Queensland. These characteristics impact on road infrastructure as they expand and then contract based on either wet or dry conditions, causing cracking and subgrade failure. If the road itself has a running surface that is black soil, it also becomes very slippery in the wet, and quickly impassable. This was the case for Bundi 2 Rd, an important local connection road, particularly since the increased presence of the CSG industry.

PROJECT BRIEF

As previously stated QGC engaged GRT to design and construct a solution for access roads and well pads on or using black soils. QGC access many gas wells across the region on tracks through farmers' properties that commonly are black soils areas. Finding an economic and environmentally sustainable solution, that provides safe, all-weather at grade access roads and well pads are a key goal for QGC as well as landholders. In order to understand the potential benefits stabilizing a thin (75 mm) granular layer over the black soil was also incorporated into the trial. With cooperation of Western Downs Regional Council Bundi 2 Rd was chosen as a trial site.

PLANNING AND DESIGN

The planning and design phase of the project involved the following key stages:

- Site inspections and sample collection: A number site visits were undertaken to record the existing road condition and take representative geotechnical samples. Elements such as existing road geometry (width, crossfall, longitudinal fall), existing drainage, and pavement condition were measured and recorded. Soil samples were collected for laboratory analysis.
- Soil classification and testing: Testing was undertaken at GRT's Yatala laboratory and then verified by NATA certified 3rd party laboratories. Initial testing included Atterbergs (Liquid Limit, Plastic Limit, Plasticity Index, Linear Shrinkage, Sieve Analysis), and moisture content. Soaked and Unsoaked CBRs and UCS tests were undertaken on the natural material to determine the existing strength characteristics of the black soil. The adjacent picture shows the shrinkage that occurred in an untreated sample (on the right) versus that stabilized by GRT7000.
- Trial Mixes: A range of mix ratios of the black soil with GRT7000 and other GRT proprietary additives were developed at varying ratios and then CBRs (unsoaked and soaked) and UCSs were performed to find the optimum soil to polymer ratio. The results of these tests fed into our proposed pavement design.
- Results: The testing indicated soaked CBR improvements of 5 to 10 times by stabilizing the material with GRT7000, significant gains in cohesive strength and large improvements in soil impermeability.

Another interesting finding was that better results were achieved when working the material at moisture contents significantly lower than Optimal Moisture Content (OMC). This led to better strength development of the stabilized material, and bound the black soil at a stable moisture content (to manage the tendency to shrink or swell).

CONSTRUCTION

Construction procedures were developed based on the requirements of the Main Roads Specification and Technical Standards and the findings of laboratory testing. A summary of the construction process follows:

- The construction process was undertaken by in-situ stabilizing the existing black soil with GRT7000 and project specific GRT proprietary additives. This was done in three passes with the stabilizer to ensure the structure of the black soil was pulverized, to "work out" the moisture locked in the clay aggregations (this was aided by the use of padfoot rollers during compaction) and to facilitate mixing of GRT7000 with the soil particles.
- Spreading, shaping and stabilizing the 75mm top layer of imported Type 2.1 pavement material with GRT7000 liquid polymer.
- Liquid polymer prime and sealing the trimmed surface. (Note: final surface has not been bitumen sealed). All works undertaken within 7 days.

ONGOING TESTING AND RESEARCH

The GRT treated Bundi 2 Rd, has provided a great platform for the observation of geotechnical performance and continuing analyses. None destructive in-situ testing has comprised predominantly of the Dynamic Cone Penetrometer, (DCP), and the Plate Load Test. In addition to this, skid resistance testing has been undertaken to determine the performance of the road surface in both dry and wet conditions.

DYNAMIC CONE PENETROMETER

The Dynamic Cone Penetrometer (DCP) utilizes a steel probe of specific dimensions that is driven into the ground using a measurable force. The rate of penetration is recorded where by correlations to engineering properties can be made. As most often, road construction is done in layers. The DCP provides a means of assessing the performance of each layer below the surface.

DCP results recorded in all weathers; wet and dry on Bundi 2 Rd, indicate that the natural subgrade below the road, being black cotton soil maintains a constant state where shrink swell potential, a problematic trait of black soil is controlled as desired. The treated layers above the subgrade that provide the backbone of the road are also performing beyond expectations where the correlation to the Californian Bearing Ratio, (CBR) is greater than > 60%.

PLATE LOAD TEST

The plate load test is purely the observation of bearing capacity. A 300mm diameter steel plate was loaded by applying the maximum available mass of 10 tonne. Dial gauges measure the instantaneous and residual deflection. Results indicated that a bearing pressure beyond 2000kpa could be applied without failure. By applying an Australian Standard safety factor of 2.5 to this result provides a certified working platform of 800kpa, enabling it to safely withstand the greatest of applied loads during traffic, and short-term static loads during the most demanding of construction processes consistent with mobile cranes and similar equipment.

FRICTION ANALYSIS REPORT

In October 2014, an analysis of the surface texture as it relates to friction and skid resistance was undertaken on Bundi 2 Rd. The test procedure utilizes a sophisticated, portable tri-axis accelerometer that is attached to the test vehicle and at a speed of 40km/h full brake application stop test is conducted in multiple locations along the road chainage. The test process is conducted using both conventional (lock up) and ABS brake modes.

The results were outstanding. In fact the surface displayed results greater than displayed by bitumen sealed roads. The benchmark for wet friction sits at 0.35 for roads of a standard the QGC will need to employ for well pad accesses – Bundi 2 Rd achieved and average result of 0.55, with the minimum result only as low as 0.51.

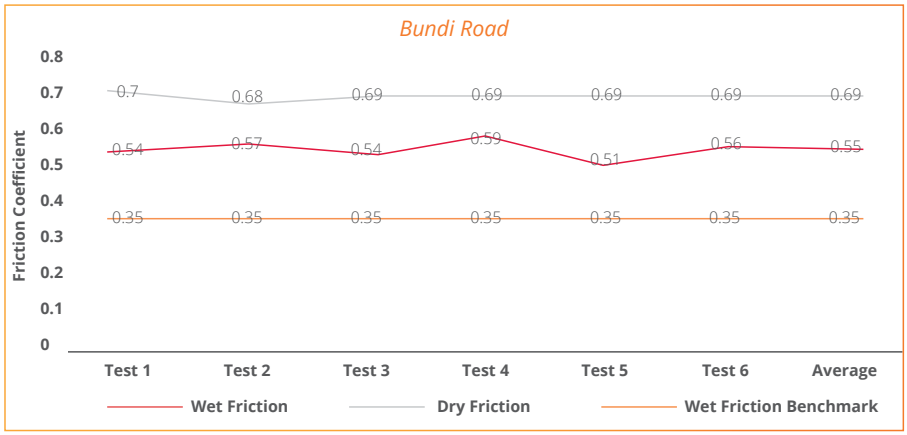


Figure 4.3.2: Friction supply results.

CONCLUSION

The purpose of the GRT stabilization trial was to treat in-situ material, thereby greatly reducing the reliance on imported material for access roads and well pads. GRT's solution delivers to QGC significant savings due to less reliance on quarried products and borrows pits, a reduction in plant utilisation, and also delivered substantial benefits to the environment.

The results of ongoing testing and research are also supporting the projections made in the planning and design phase of impressive bearing and cohesive strength gains, plus highlight the benefits that increased water impermeability has on the ongoing performance of Bundi 2 Rd. Additional benefits such as the high skid resistance results further underline the outstanding nature of the projects results.

ACKNOWLEDGEMENTS
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