



DANNYS ENTERPRISES COMPANY LIMITED

KMA IN-PLANT TREATED CEMENT STABILISED MATERIALS

PROPOSAL FOR THE USE OF KMA-CEMENT STABILISED MATERIALS FOR PAVEMENT CONSTRUCTION AND REHABILITATION IN TRINIDAD AND TOBAGO



JUNE 2018



DANNYS ENTERPRISES COMPANY LIMITED-

THE USE OF IN-PLANT CEMENT STABILISED MATERIALS FOR PAVEMENT CONSTRUCTION AND REHABILITATION IN TRINIDAD AND TOBAGO





INTRODUCTION

The construction and rehabilitation of our roads, car parks and driveways in Trinidad and Tobago, currently utilizes virgin natural aggregate materials as key components of pavement structural layers. Moreover, accompanying ongoing local infrastructural development is a continuous demand for suitable road building aggregates, for construction and upgrade applications. Depleting local natural deposits and limited supplies of quality virgin granular aggregates has prompted consideration towards alternative sources, for addressing the demands of the industry.

Fortuitously, effective global advancements in material technology, specialized equipment and construction techniques, currently provides opportunity for the improvement of a wider range of our available materials and subsequent satisfactory inclusion in our local pavement structural layers. The option of chemical stabilization of our available aggregate materials, has also provided for the consideration of more cost effective and durable pavement structural designs, utilizing layers with increased carrying capacity, in its treated form. Cement stabilization is one such technique with the chemical improvement of road building materials, producing Cement stabilised materials, which has been successfully incorporated into pavement base and sub base structural layers globally.

Cement stabilisation materials have been utilized in road construction and rehabilitation of major local carriageways for over a decade, with its introduction in Trinidad in the initial Cold In Place recycling applications by Danny's Enterprises Company Limited. Fortunately, advancements in equipment and technology now offers the attractive option of Cold In Plant treatment of aggregates, with chemical enhancement providing for the controlled production of materials of improved properties for base and sub base applications. In-plant produced cement stabilised materials display improved stiffness and moisture resilience, and as such can be included in pavement structural layers of increased capacity and durability, compared to that of similar thickness conventional granular aggregate layer systems. The cold in-plant treatment option also provides for controlled blending of available aggregates, which allows for the inclusion of a wider range of available materials for enhancement and construction applications.

This proposal aims to highlight the feasibility of an in-plant blending of our available natural granular materials, the cement treatment of the blended products and the subsequent construction of a stiffer CSM pavement layer in a durable pavement structure, as an alternative to the thick layered conventional aggregate pavement system, utilised in the traditional method of pavement rehabilitation and construction.





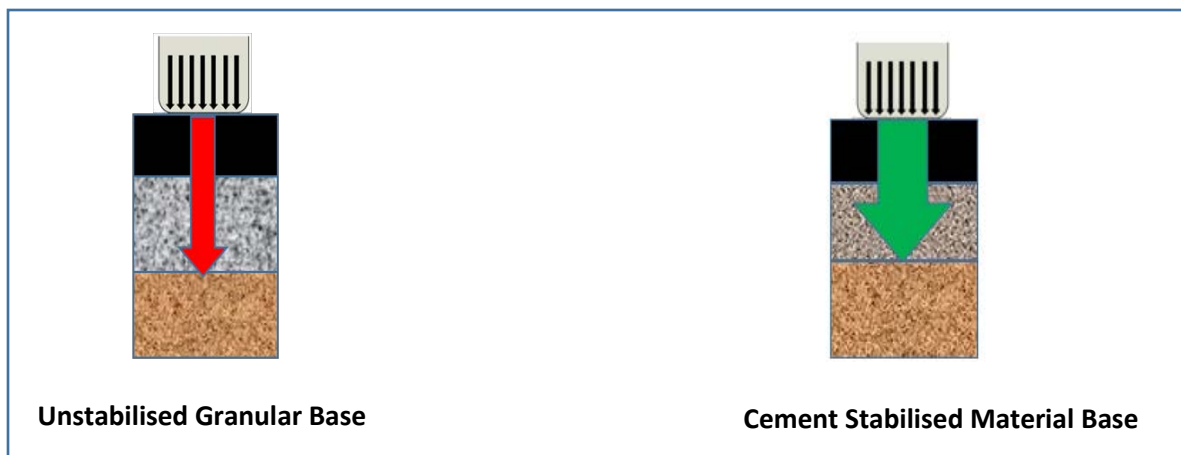
BACKGROUND

Cement Stabilised Materials

Cement stabilised materials are produced from the mixing of selected aggregate materials with cement and water, which hardens after compaction and curing to produce a stiff, durable pavement layer. The hydration of the tri-calcium silicate and di-calcium silicate compounds present in the cement produces the calcium silicate hydrate gel, which on hardening and curing holds the aggregate particles together in a tight matrix. The improvement offered by cement stabilisation allows for inclusion of available materials which would have been initially limited in terms of capacity for inclusion in stressed pavement layers.

Cement stabilisation provides for the enhancement of the parent materials for the production of a treated material of:

- 1) Improved compressive strength
- 2) Improved tensile strength
- 3) Improved stiffness
- 4) Improved durability, particularly with increased resistance to moisture
- 5) Improved workability.



Cement Stabilised Layers distribute loads over a wider area, with the cementing action leading to a stiffer layer acting as slab or beam, as opposed to that of the granular layer, which transfers imposed loads lower down the pavement, relying on frictional interlock for its strength. As a result, the required thickness of a cement stabilised material base is usually less than that of a granular base carrying similar traffic.



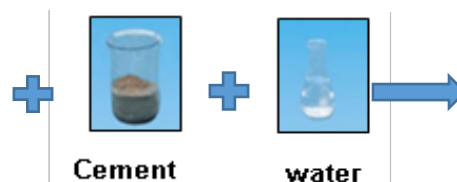


CSM PRODUCT TECHNOLOGY

This proposal aims to identify the feasibility of incorporating a CSM as a base or sub base in a stabilised pavement structure, as an alternative to the conventional aggregate system, in new construction and rehabilitation of roads, car parks and driveways in Trinidad and Tobago.

Technical Data

- The proposed cement stabilised granular blend offers the opportunity for the sustainable production of a cement stabilised material, with controlled blending and treatment executed in-plant.
- The CSM is produced from a Granular Blend (Parent Material) of limestone aggregates with the following inherent Physical Properties, prior to treatment:
 - a) Soaked CBR (5.08mm) – 58%
 - b) Atterberg Limits (LL-32% / PL-NP)
 - c) Modified Proctor- 6.2%, MDD-2240kg/m³
- CSM Strength Test Results:
 - Indirect Tensile Strength (ITS-flexural strength)- laboratory values (avg) = 350kPa (In excess of minimum 250kPa- Wirtgen Cold Recycling Technology 2016)
 - Unconfined Compressive Strength (UCS) – laboratory values (avg) > 1.5 MPa.
- Material Design and Quality Monitoring





- Construction Applications



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BENEFITS OF THE COLD IN PLANT CEMENT STABILISED MATERIAL AND CONSTRUCTION **METHODOLOGY**

- a) The benefits of a stabilised material of improved engineering strength and durability properties which provides for increased pavement layer carrying capacities and which lends to more economical, durable pavement designs and construction.
- b) The in-plant treatment provided by the Wirtgen KMA mobile cold recycling plant which promotes the controlled production of an enhanced BSM1-AGG material, for construction of stabilised pavement systems, suitable for all pavement applications.
- c) The opportunity for the improvement of locally sourced marginal aggregates, allowing for the use of local resources, whilst ensuring consistency in quality and subsequent fulfilment of requirements for its inclusion in pavement structures.
- d) The CSM produced in-plant allows the material to be pre-mixed, sampled, inspected and tested, with allowed adjustments to input parameters and mixing times as required.
- e) CSM produced in plant are laid using the conventional asphalt pavers to the desired thicknesses, grade and levels allowing for higher site production rates.
- f) Construction method allows for reduced concerns of aggregate breakdown often accompanying conventional aggregate layer construction.
- g) CSM provides for a durable layers as base or sub base layers in designed pavement structures and may also be considered for surfaces for temporary unpaved applications.

