

# **COMPOSITE PAVEMENTS UTILISING THE DENSIPHALT GROUTED MACADAM & ALTERNATE BASES DESIGN OPTIONS**

Sustainability and environmental issues are becoming important factors within the construction industry and there is encouragement to be innovative and to consider the use of alternative materials in lieu of primary aggregates / binders / resources. There are a wide range of materials available for use in construction today including alternative materials for use as hydraulic binders; such as pulverised fuel ash and ground granulated blast furnace slag, and alternative materials for use as aggregates; such as asphalt road planings, steel and blast furnace slag, demolition material, incinerator bottom ash and even glass and rubber tyres!

Traditional Composite pavements are recognised as bituminous toppings over CBM bases.

Historical grouted macadams have utilised resins & polymers as a grout to fill voids in asphalt. Densiphalt is a new generation of grouted macadams established tried & tested over 10years and marketed in the UK as an alternative surfacing / pavement system to concrete, utilising microsilica technology to fill the voids in an Open Graded Asphalt(OGA), which due to its combined properties exhibits microcracking which allows it to be truly semi flexible & as a consequence utilise alternate bases which can deliver sustainability, reduced depths & costs.

The specification of the basecourse material & the specification of Densiphalt ie depth, reinforced, size, strength etc is determined by factors such as environmental, cost, programme, design – dynamic or static loadings, etc.

The specification of Densiphalt ie depth, reinforced, size, strength etc is determined by factors such as type and frequency of trafficking, design life and requirements for a functional slab.

The result is a truly alternate composite pavement.

CiP Densiphalt Ltd have been installing the Densiphalt surfacing / pavement system in the UK for 10 years now and have a vast knowledge and database of designs to cater for all types and frequencies of various traffic loads, for internal and external applications, dynamic and static. Supported with design calculations from Densit and their design engineers, Ramboll who have been calculating Densiphalt designs for many years now worldwide. CiP Densiphalt Ltd offer a 12 year guarantee for all new build application with the Densiphalt pavement system.

## **Design for Densiphalt pavements**

Pavement designs can be carried out using a number of alternative design methods. Based on the input details required the commonly used design methods can be categorised in the following levels:

- Design Catalogue
- Design Charts

- **Analytical-Empirical Approach**

In the 'Analytical-Empirical Approach' (sometimes referred to as 'Mechanical-Empirical Approach') all input would be variable, both in regard to the materials and the loads.

Among the advantages in using the 'Analytical-Empirical Approach' are use of available non-standard materials (avoiding long hauling of standard quality materials), design to the actual and non-standard loads (type, odd-size and applications) and stage construction design incorporating sub base depths & materials.

The 'Analytical-Empirical Approach' is well suited for semi-flexible pavement systems, taking into account the special material properties, and can be applied to pavement structures throughout the world.

It should be noted that any pavement selection should be based on technical performance of the materials proposed, economical consequences (life-cycle-costs) and construction condition (such as timeframe, contractors etc.).

**Please see attached design methodology.**

For new build constructions the alternate/innovative/sustainable bases can be;

### **Stabilisation**

In situ soil stabilisation involves improvements of unsuitable and unworkable ground by mixing in combinations of lime, cement, PFA and various other types of hydraulic binders with existing soils such as clay, silt gravel, sand etc. The mixing of additives dramatically improves the engineering properties of the soils at a fraction of the cost of meeting specifications by other means.

This process can also be effected off site so as to achieve greater consistency. Long term soil/lime pozzolanic reactions result in the formation of cementing agents, which increase strength and durability. This is known as **stabilisation**.

**Foamix** is a recycled material that can be used as a basecourse / roadbase for new build road constructions.

It utilises foamed bitumen which involves the injection of cold water into hot penetration grade bitumen through a special spraybar. The foamed bitumen expands from 10 to 15 times its original volume and is then mixed with cold moist aggregates to produce a unique material.

Foamix is a site mixed (ex situ) operation effected through the use of mobile mixing plants. The main emphasis on Foamix is the use of recycled aggregates and in particular recycled asphalt plantings. Other materials used are broken concrete and masonry that will be screened and re-graded for use as aggregates in asphalt.

**Slag Bound Materials(SBM)** is a recycled material that can be used as a sub base / basecourse / roadbase for new build road constructions.

SBM uses granulated blast furnace slag as a hydraulic binder for any suitable aggregate. Granulated blast furnace slag is a by-product of iron production and is produced by rapid water chilling of blast furnace slag. It is activated with a lime - based catalyst for use as a binding material for aggregates. Air - cooled blast furnace slag / steel slag can also be used as a secondary aggregate. Air-cooled blast furnace slag is a by-product of the manufacture of iron by chemical reduction in a blast-furnace.

## **CBM utilising Incinerator Bottom Ash(IBA)xxxx**

### **Road Recycling**

In-situ Road Recycling is a specialised form of in-situ stabilisation which reconstructs roads by using the existing road as a 'quarry' to provide re-processed aggregate, which is re-bound by mixing in additives such as foamed bitumen, cement and PFA to create a stabilised road base/binder course layer this is similar in performance to conventional materials but with big environmental and commercial benefits.

Basically, our purpose built road recycling machinery pulverises the existing road aggregate down to its original unbound state and the same machinery adds bitumen and/or cement in measured quantities to achieve compliance with specifications

### **Design and Specification**

Deep In-situ Recycling is designed in accordance with Transport Research Laboratory Report 386 'Design Guide and Specification for Structural Maintenance of Highway Pavements by Cold In-situ Recycling. Design guidance is given lives up to 30msa. Sections of this document area also incorporated into The Specification for Highway Works.

CBM

Foamix

SBM

### **Benefits**

- Considerable time savings
- Produces a designed asphalt or CBM road base
- Substantial cost savings
- Eliminates dumping of spoil from excavation
- Uses minimal new material, conserving natural resources
- Environmentally responsible process
- Lower landfill costs
- Less imported material
- Quicker construction
- Large cost savings
- Keep sites working in wet weather
- Saves natural resources
- Re-uses what is on site