IQA

Technical Committee

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Supporting your on-going professional development

ROADBASE MATERIALS

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Introduction

Roadbases are granular quarry materials which are used in the construction of road pavements. They may be derived from many sources, different geological deposits, production techniques or combined material blends, but they all must be able to be placed and compacted to form a rigid layer within a road pavement. Road bases are essential to the life of most quarries as they may be used to consume and return profit on fine materials which may not otherwise be saleable on their own.

In hard rock quarries by the careful combination and mixing of constituent materials, a large range of different roadbases may be produced. A series of combination designs may be developed to allow more efficient stock-balancing to be achieved, within the quarry, by consuming all the materials that are being produced, while making main line aggregate products.

Similarly, in gravel deposits road bases may be developed to take advantage of the natural plasticity that may be present in the clay-based sedimentary materials. By combined blending of plastic and non-plastic materials a range of different roadbases may be produced.

In this way well-designed road bases can not only save money but can create new potential income streams for a quarry by utilising stock that may have been previously written off or unused.
Unwanted materials such as scalpings, crusher fines or other excess material stock, may become important ingredients in new combined products, which may be used to create successful alternatives to traditional roadbase materials.

With the current high demand for quarry products, in most areas, the use of quarry blended roadbases has never been more attractive or important for achieving quarry stock balance.

In addition large progress has been made in incorporating recycled products such as: crushed concrete, Recycled Asphalt Pavement (RAP), Slag and other materials to produce roadbase alternatives, which may provide an edge in winning sensitive environmentally focussed projects.

To be suitable for use in road pavement construction, a roadbase material must have minimum and consistent properties and should be able to be handled without being prone to segregation (separating into different size fractions). So what are the important road base properties?

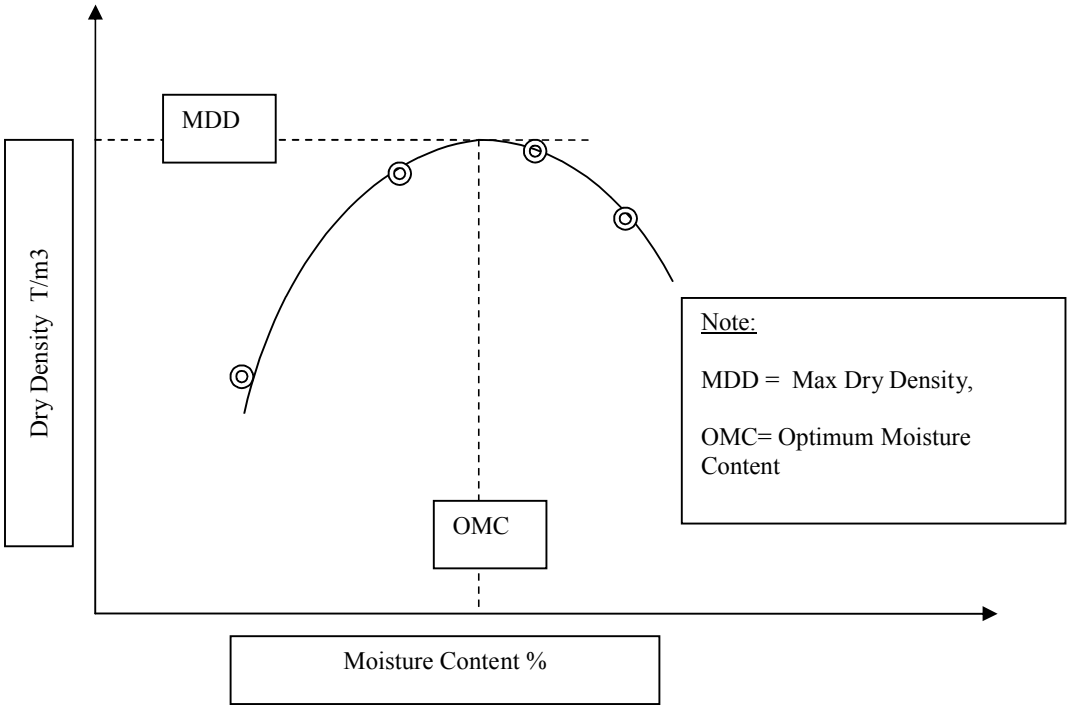
Road base Properties- What is important?

Property	Details
Grading or Particle Size Distribution	Indication of likely aggregate interlock
ABC Ratio of Fines	Indication of fines interaction
Plasticity Index (PI)	Clay content of fines. Water sensitivity of material
Max Dry Comp Strength (MDCS)	Material Dry Compressive Strength <19mm particles.
Particle Shape	Shape of aggregate indicates potential material packing.
Wet / Dry Strength Variation	Strength of aggregate fraction in Wet and Dry condition and strength variation as a percent. -19.0mm to +9.5mm is common. Water sensitivity of material
Shear Strength Texas Tri-Axial	Indication of likely shear strength of roadbase material

**Note: source is Road and Traffic Authority Specification- RTA 3051 above for example only; other specifications may apply in other regions.*

The interaction between the coarse and fine particles within a roadbase, determine whether it will bind, during field placement and compaction, to form the required stiff pavement layer. By aggregate inter-lock, plasticity of the fine materials or a combination of both, roadbases may bind together to form a stiff material layer and this will occur more readily at the Optimum Moisture Content (OMC) of the roadbase material.

The OMC for a roadbase, is the quantity of moisture within the material which, under the application of a standard compactive effort, provides the maximum dry density that the roadbase material can achieve.



Fresh roadbase is usually delivered just below OMC to allow small moisture adjustment to be made onsite, to accommodate rain or site moisture conditions and not exceed the OMC.

When the OMC of a roadbase is exceeded the roadbase may "heave", (roll like a wave), during placement, under the compactive effort of the roller, and despite numerous passes, required in-situ density may not be achieved.
To overcome this problem the surface of this partially compacted wet roadbase layer is usually re-opened by the use of grader "tynes", or other means, and the roadbase is allowed to dry back until it is at or below Optimum Moisture Content at which point re-compaction can be attempted.

The potential danger with this practice is that repeated roller compaction and then re-compaction of the same roadbase material, may cause roadbase breakdown and interfere with it's ability to bind and provide the required shear strength to the pavement. For this reason the placement and compaction of roadbase materials should be avoided if possible during heavy rain falls, as this may interfere with the OMC of the material and the achievement of in-situ density.

Responsibility of the Contract Parties.

The pavement designer or specifier is to provide a specification that ensures the quality and consistency of the required roadbase materials are confirmed and that the engineering properties of the in-situ pavement are realistic and achievable.

The quarry supplier delivering the roadbase would be expected to provide a material slightly below OMC which is capable of being placed and compacted to achieve the required in-situ density. The suitability of the roadbase material would have to be confirmed by conducting laboratory testing initially and further ongoing production testing would also be expected to confirm roadbase consistency of supply.

The placing contractor takes receipt of the road base material and is responsible for the final moisture content of the roadbase at the time of placement. The preparation of the ground and other material layers beneath the roadbase, correct roadbase layer thickness, choice of roadbase compactive equipment and achievement of in-situ density is also their responsibility.

If layer thickness is too thin during placement the compactive effort exerted may induce artificially high breakdown in the roadbase, or where it is too thick insufficient compaction and lack of in-situ density. During hot and dry extended periods of placement the roadbase should not be allowed to dry out as achievement of in-situ density may also be compromised.

Conclusion

Roadbases are very important to the life of a working quarry. Well designed roadbases consume fine materials which may not have any other market and may also be used to achieve more efficient stock balancing within the quarry.
The use of recycled materials in roadbases is becoming more common in today's market and when well designed, can make very successful roadbase materials.

To successfully produce compacted dense roadbase pavement, designers, suppliers and contractors must clearly understand their responsibilities and work together towards the same outcome.

References

RTA QA Specification 3051- Unbound and Modified Base and Subbase Materials For Surfaced Road Pavements- Ed 5 – June 1998
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Author: - *This document was produced by Michael van Koeverden, Owner/ Director of Concrete, Quarry, Technical, CQT Services Pty Ltd, a specialist consultancy, established to provide a uniquely professional technical service to the concrete and quarry industries-* michael.cqt@optusnet.com.au
Editor & Enquiries: Greg Bondar – IQA Chief Executive Officer

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The Institute of Quarrying Australia (IQA)
PO Box 51 Blakehurst NSW 2221
Ph: +61 2 9546 2257 and Fax: +61 2 9546 8852