



Introduction

Recent work has shown that a reduction in thickness of concrete pavements could be considered when concrete, designed to meet a specified compressive strength, is made with crushed rock aggregates.

Background

The current design curves, based on empirical formulae given in the TRL Research Report 87 “Thickness design of concrete roads”⁽¹⁾, were established in the mid 1980’s. The empirical data from 29 unreinforced and 42 reinforced concrete highway pavements has been found to be based predominantly on the performance of concrete pavements made with siliceous gravel aggregates.

The structural performance of concrete pavements is related to the flexural strength of the concrete rather than the compressive strength. Concretes of the same compressive strength constructed using crushed rock have a higher flexural strength than concrete constructed using more rounded siliceous gravel aggregates.

Technical Guidance Sheet R1⁽²⁾ explains the use of the empirical formulae given in RR87 and Technical Guidance Sheet R2⁽³⁾ provides examples of the use of the formulae using different values for the variables, including concrete strength. In order to use the equations for concretes made with a particular aggregate, for example a crushed limestone, a flexural/compressive strength relationship for that type of aggregate is required to compare it with the compressive strength of a typical siliceous gravel aggregate.

The figure below illustrates typical relationships between flexural and compressive strengths for concretes made from gravel aggregates and concretes made from crushed limestone aggregates.

For the illustration given, the limestone aggregate concrete with a compressive strength of 50 MPa (50 MPa is assumed to be the mean compressive strength of a C40 AE mix, meeting the requirements of the Highway Agency Specification) can be enhanced to 65 MPa for use in the empirical formulae.

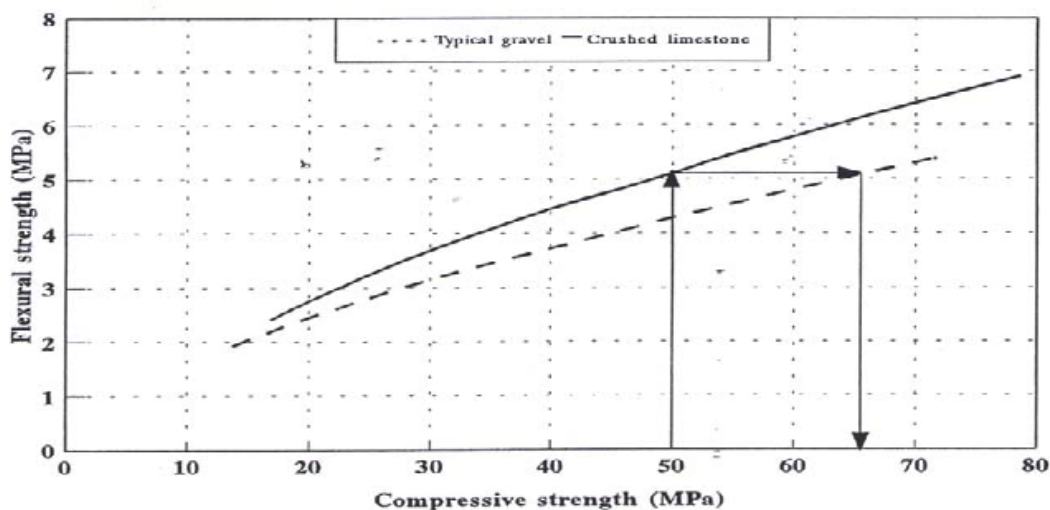


Fig 3. Illustrative relationships between flexural strength and compressive strength
[Jones and Kaplan (1957)]

The graph on the reverse for the flexural/compressive strength relationship of a crushed limestone is typical, but not necessarily appropriate for widespread use. Before using this depth reduction process, it is important to establish an equivalent curve for the actual concrete to be used.

Other Benefits

Concrete constructed using limestone aggregates will have a lower thermal coefficient of expansion than for concretes constructed using siliceous gravel aggregates. This enables joint spacing to be opened up for jointed pavements constructed using limestone aggregates. For continuously reinforced concrete pavements, the use of limestone aggregates results in narrower cracks and less spalling of the cracks than the siliceous gravel.

References

- ⁽¹⁾ Mayhew, HC and Harding, HM.
Thickness design of concrete roads.
Transport and Road Research Laboratory.
Research Report 87. London, HM
Stationary Office 1987.
- ⁽²⁾ Britpave, Technical Guidance Sheet R1.
Empirical Highway Pavement Design.
- ⁽³⁾ Britpave, Technical Guidance Sheet R2.
Examples of Highway Pavement Design.

Acknowledgements

Guidance Sheet R3 is one of a series of guidance notes prepared for use by Britpave members

Sheet prepared by: Jonathan Green
(Burks Green)

Reviewed by: Alex Lake
(Burks Green)

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