AN INVESTIGATION INTO THE TEN PERCENT FINES TEST AND OTHER TESTS USED TO DETERMINE THE STRENGTH OF ROAD MAKING AGGREGATES

by

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PART 1, TEXT.

A thesis submitted to the Central Queensland University in

fulfilment of the requirements for the degree of Master of Engineering.

Submitted 9 September 1994.
Revised 29 March 1995.
ABSTRACT

An investigation into the Ten Percent Fines test for determining the "strength" of construction aggregates was undertaken. Correlations between this test and other aggregate "strength" tests including the Los Angeles Tests and the Aggregate Crushing Value Test were also developed. The investigation involved both a literature study and specific testing involving over 300 strength tests on a range of aggregate samples, covering a range of lithologies, particle sizes, particle morphologies, and moisture conditions.

The literature search located only a limited body of literature on this procedure, mainly in trade journals, although a much larger body of literature was located on both the Los Angeles and Aggregate Crushing tests. Testing revealed that particle morphology, principally the percentage of flaky material content, had a significant effect on strength as did aggregate moisture content. Aggregate "strength" was found to decrease with increasing flakiness and also moisture content.

A number of testing practice factors were also found to have significant impact on the reported strength. Factors resulting in higher apparent strength included increasing the rate of load application and compaction of the sample in the test mould. No consistently predictable relationship between "strength" and particle size was observed, but a trend of "strength" increase with decreasing particle size was observed. As a result of the investigation a series of draft test methods were prepared for Queensland Transport.

The major departures in these draft methods from the published method include;

(i) specification of drying/cooling conditions;
(ii) specification of sample compaction procedures;
(iii) application of a standard loading rate
(iv) change to discriminating sieve sizes for samples finer than 6.7mm.

These changes to the methods should improved the precision of the methods compared with the published methods.
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ACKNOWLEDGMENTS

The research program described in this thesis, was made possible by the support provided by Queensland Transport (QT), specifically by Don Muir (Executive Director Central) and QT's Staff Study and Research Scholarship Programme.

Special thanks are also extended to Mr David Thomas of the Civil Engineering Department of the James Goldston Faculty of Engineering, Central Queensland University, for his guidance and interest in the research. The author is also grateful to Mr Henry Crichton and Mr Michael Currie of the Rockhampton Materials Testing Laboratory of Queensland Transport for their help and assistance during the research programme. Thanks must also go to the managers of Queensland Transport's fourteen District laboratories, as well as the Central Laboratory for making available records, and providing information pertinent to this research. Many thanks go to the Central Queensland Region office staff, particularly Miss Melissa Jarvis and Mrs Sue Thorpe for typing the manuscript and providing the author with advice on the use and operation of the wordprocessing package.

Finally, I would like to thank my wife Colleen for her support and understanding during the currency of this project, without which this thesis would never have been completed.
This author certifies that, except where otherwise specified in the text, this thesis is the result of original work. No part of this thesis has been submitted elsewhere for any other qualification.

A G B Vanderstaay

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ABBREVIATIONS USED IN THIS THESIS

AC  Aggregate crushing (test) generally.
ACT  Aggregate Crushing Test, subscripts may be used to indicated whether the test was undertaken using a wet or dry sample, and to which standard.
    e.g. $\text{ACT}_{W,\text{AS}}$ = a wet ACT, determined according to the relevant Australian Standard.
ACV  Aggregate Crushing Value, expressed in percentage units, subscripts may be used as for ACT.
AS  Australian Standard.
ASnnnn  A specific Australian Standard test procedure, see references for details.
ASTMnnn  A specific ASTM test procedure, see references for details.
BS  British Standard, as published by the British Standards Institution.
BSnnn  A specific British Standard test method, see references for details.
CRB  Country Roads Board, now known as VicRoads.
CRB  Californian Bearing Ratio test.
cv  Coefficient of variation.
DMR  Department of Main Roads New South Wales, now known as Road and Transport Authority.
ISO  International Standards Organisation.
LA  Los Angeles (test) generally.
LAT Los Angeles Test, a subscript may be used to indicate the method. e.g. LAT$_{QT}$, a LAT, carried out according to the relevant Queensland Transport test method.

LAV Los Angeles Value, expressed in percentage units, subscripts have been used as described for LAT.

MC Moisture content.

n Number of data points used in a statistical analysis.

NATA National Association of Testing Authorities.

PIARC Permanent International Association of Road Congresses.

Qnnn Queensland Transport test method, see references for details.

QMRD Queensland Main Roads Department, amalgamated with several other Departments in 1989 to form Queensland Transport.

QR Queensland Rail. (formally known as Queensland Railways).

QT Queensland Transport (Department).

R Reproducibility of a test procedure.

r Repeatability of a test method.

$\rho^2$ Regression coefficient of correlation.

SABS South African Bureau of Standards.

SRA (Australian) State Road Authority.

SD Standard Deviation.

TPF Ten Precent Fines (test).

TPFT Ten Percent Fines Test. Subscripts have been used to indicate whether the test was undertaken on a wet or dry sample, and to which test standard. e.g. TPFT$_{W,BS}$, a wet TPFT, carried out according to the relevant British Standard.
TPFV  The ten percent fines value expressed in kN, subscripts may be used as described for TPFT.

UCS  Unconfined compressive strength.

W/D  Wet/Dry variation which is defined as the difference between $TPFV_D$ and $TPFV_W$, expressed as a percentage of $TPFV_D$.

\[ W/D = \frac{(TPFV_D - TPFV_W)}{TPFV_D} \times 100 \]

SUBSCRIPTS.

AS  A test performed in accordance with the relevant Australian Standard test method.

ASTM  A test performed in accordance with the relevant American Society for Testing and Materials Standard test method.

BS  A test performed in accordance with the relevant British Standard test method.

D  A dry test, applicable to ACT and TPFT.

i  A test carried out in accordance with the Imperial system of measurement. ie. LAT, ACT or TPFT.

QT  A test performed in accordance with the relevant Queensland Transport test method.

W  A wet test, applicable to ACT and TPFT.