STUDIES ON LITHOGRAPHY, PETROFABRIKS, STRAIN IN ROCKS AND THEIR DELETERIOUS EFFECTS AS CONSTRUCTION MATERIALS

By

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Dedicated
to
my parents

CERTIFICATE

This is to certify that the thesis entitled "Studies on Lithography, Petrofabrik, Strain in Rocks and their Deleterious Effects as Construction Materials" being submitted by Mr. Ravinder Kumar Khitoliya to the Indian Institute of Technology, Delhi, for the award of the degree of DOCTOR OF PHILOSOPHY is a record of the bonafide research work carried out by him. Mr. R.K. Khitoliya has worked under my guidance for the submission of this thesis which to my knowledge has reached the requisite standard.

The thesis or any part thereof has not been submitted to any other University or Institution for the award of any degree or diploma.

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PREFACE

The object of the work has been to study the Lithography, Petrofabrik and strain in rock formations which get transferred in rocks which finally prove deleterious when used as aggregate in concrete.

Further, excessive expansion has been considered the only cause for cracking in concrete which is certainly not true. In a scientific world one cannot afford to blindly diagnose the same cause for all deleterious effects in concrete. There are other possible causes and as such excessive shrinkage is not same as excessive expansion which has been proved in this work.

There is a great deal of controversy that rocks containing strained quartz are harmful and should not be used as construction material. In the present study, such rock samples have been examined for their strain analysis and petrofabrik. Some rocks have been tested for their Mortar bar expansion test, under accelerated exposure conditions. Strained quartz-bearing samples quarry which is very near to the proposed construction site is rejected on the simple basis of the presence of strained quartz. To study the factor of temperature at which strained quartz is reactive and several quarries near to the site have been rejected due to this, studies have been undertaken which

proved that rocks containing strained quartz do not react at particular temperature.

Since there is a gap of knowledge and no specification is available in the world to test rocks containing strained quartz, there is a need to develop a quick reliable test for the same. Other factors of expansion in rocks, viz., swelling/thermal expansion, which has not been viewed earlier has also been studied in the present study. Shrinkage in concrete is also serious cause but it has not received much attention and a method for measuring drying (linear) shrinkage has been proposed the study.

It is expected, that the contributions made in the present will be beneficial to the construction industry.

ABSTRACT

This work on "Studies on Lithography, Petrofabrik, Strain in Rocks and their Deleterious Effects as Construction Materials" is based on field and laboratory investigations.

It has been observed that Aravallis and Vindhyans from the Peninsular part and Upper Yamuna Valley in Garhwal Himalaya from the Extra peninsular part of the Himalayan region have been encountered during the present study. A brief description on their geology, lithography and structural setting has been provided in Chapter 3.

The quartzites samples collected from the Garhwal Himalaya and Upper Yamuna Valley have been subjected to petrofabrik and strain analysis and, on the basis of the study, it has been evaluated that rocks near thrust zone have maximum strain.

A few samples have been subjected to conventional tests and accelerated mortar bar expansion test at different temperatures, viz., 45 °C, 55 °C, 65 °C and 80 °C to study the effect of temperature on strained quartz-bearing aggregates. The relationship between temperature, expansion, time period and different percentage of alkali content in cement has been established.

The deleterious effect other than expansion, i.e., shrinkage, has been studied in Chapter 6. A method for measuring

linear drying shrinkage has been proposed. The relationship between water/cement ratio, compressive strength and shrinkage has been developed. The effect of repeated wetting and drying has been studied and it has been\ possible to conclude that effects of drying and wetting are approximately equal.

The influence of minerals in concrete due to their objectionable fabrik and composition has been studied in Chapter 7. On the basis of the study, it has been possible to establish that the use of rocks/minerals having objectionable fabrik/composition may give deleterious effects in concrete.

C O N T E N T S