H.K.E. Society's
POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING
Gulbarga 585-102

(An Autonomous Institution, Affiliated to VTU Belgaum and Approved by AICTE)

A
Project Report
On

"FLEXURAL FATIGUE STUDIES ON HVFA CONCRETE AND COMPOSITE BEAMS UNDER COMPOUND FATIGUE LOADING"

Submitted to the

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SYNOPSIS

Among the various industrial wastes, fly ash is one such industrial waste which is polluting the environment in different aspects. Fly ash is well accepted as a pozzolanic material to be used either as a component of blended cement or as a mineral admixture in concrete. Since high volume fly ash concrete addresses the environmental sustainability issues, it is slowly gaining momentum in construction industry.

In this project work, the behaviour of pavement quality high volume fly ash concrete and lean high volume fly ash concrete under constant amplitude fatigue loading was studied. Also an attempt was made to study the behaviour of composite sections made up of pavement quality high volume fly ash concrete and lean high volume fly ash concrete under constant amplitude and compound fatigue loading was done.

For the study, firstly the mix proportions of pavement quality high volume fly ash concrete selected from the literature was established by casting 6 cubes of size 150x150x150mm. The mix proportion of lean high volume fly ash concrete was finalized by casting 12 cube specimens, 6 each for two trial mixes. For determining static flexural strength, 5 prisms for high volume fly ash concrete, 6 prisms for lean high volume fly ash concrete and 5 prisms for composite sections were cast. The size of prism used for pavement quality high volume fly ash concrete and lean high volume fly ash concrete was 75x100x500mm, for both static and flexural studies. The static flexural strength of pavement quality high volume fly ash concrete was 5.38 N/mm^2 which satisfied the requirement of pavement quality concrete. A total number of 28 prisms each for pavement quality high volume fly ash concrete and lean high volume fly ash concrete were used for fatigue studies. A total number of 24 prisms were used for fatigue studies on composite sections under constant amplitude loading. For compound fatigue loading, eight composite specimens were used.

In the second stage of project, fatigue strength studies were carried out for pavement quality high volume fly ash concrete, lean high volume fly ash concrete and composite sections under constant amplitude fatigue loading using four stress ratios for each category. Haiver sine wave loading at a constant frequency of 4Hz was used for all specimens. S-N relation was established for all the three types of concretes which showed a non linear relation. Fatigue life of composite sections were much higher than that of pavement quality high volume fly ash concrete at any given stress ratio value. Hence it will be advantageous to use S-N relation of composite section in the design of rigid pavements.

Probabilistic analysis was carried out on pavement quality high volume fly ash concrete and lean high volume fly ash concrete fatigue results. An attempt to fit Weibull distribution for fatigue results was made. The α parameter varied from 0.30 to 1.53 for pavement quality high volume fly ash concrete and from 0.42 to 3.12 for lean high volume fly ash concrete. The parameter "u" of the Weibull distribution varied between 33.49 and 10207.45 for pavement quality high volume fly ash concrete and from 3483 to 96329.01 for lean high volume fly ash concrete. The results show that Weibull distribution parameters are dependent on stress ratio used.

Composite sections were also studied under compound loading. Cumulative damage factor value varied between 0.03 and 2.86. This indicates that Miner's hypothesis is not validated in case of composite sections.

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