別紙４

報告番号	※　　第　　号

主　論　文　の　要　旨

論文題目　Impact of drying on the structural performance of reinforced concrete slab members　（鉄筋コンクリートスラブ部材の構造性能に及ぼす乾燥の影響）

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論　文　内　容　の　要　旨

The aim of this study is to evaluate the changes in the performance of reinforced concrete structures over a long period. The concrete structures are designed for life span of multiple decades, during which the performance may degraded sunjected to various causes. Studies reflect a decrease of natural frequency of the structures with age which raises the question about performance consistency over long period. Drying, a long-term phenomena, causes non uniform volume changes inducing stresses and resulting in shrinkage cracks in the concrete structures. However, a limited quantitative studies on impact of drying on the structural performance of reinforced concrete structures are available that suggest degradation in stiifness and yielding.

To get the set objective, first, an experimental study was conducted involving identical specimens of beams with slabs with the only difference being the curing conditions. The first specimen was tested as a fresh specimen or control specimen. The second specimen was tested after about a year of drying the specimen in laboratory conditions when it reached its shrinkage equilibrium. During the drying period, the specimen was closely monitored with the impact of drying recorded in terms of shrinkage strains and shrinkage cracks.

Loading test results show that the structural performance is governed by the dominant member in a composite structure. The yielding of the specimen is observed with the yielding of large beam rebars. The initial structural stiffness of the dried specimen decreased to 77% of the wet specimen while almost no change was observed in the final yielding of the specimens. The shrinkage resulted in cracks that controlled the crack distribution under loading as well as effective cross-section of the specimen. Detailed investigations show that flexural stiffness decreased by 50% for slab in tension while there was no significant change for slab in compression. The shrinkage cracks are fine that closes in compression resulting in fully effective cross-section whereas in tension, cracked concrete does not resist tension. Therefore, the decreased lateral structural stiffness of the specimen is thrr-fourth of wet specimen, as the stiffness for half of the specimen does not decrease while for the remaining the stiffness decreases by half.

The yield stiffness and capacity are not affected as the residual stresses are released due to repeated loading and effective cracked cross-section is same for both specimens. The crack patterns are similar for both specimens with better crack connectivity and continuity in dried specimen. Hence the impact of drying can be concluded as stiffness or frequency decrease in concrete structures with little or no effect on yielding and shrinkage cracks in the structure creating performance and durability issues.