EFFECT OF CURING CONDITION ON FLEXURAL BEHAVIOR OF CHEMICAL PRESTRESSED REINFORCED MORTAR

University of Tokyo		Member of JSCE	○Yasushi TANAKA
University of Tokyo		Member of JSCE	Raktipong SAHAMITMONGKOL
University of Tokyo	IIS	Member of JSCE	Toshiharu KISHI

1. INTRODUCTION

It have been recognized that the utilization of expansive concrete to prestress the reinforced concrete members can improve the flexural behaviors of the member. The chemical prestressed reinforced concrete (CPRC) owns the higher cracking load as well as the better dispersion of cracks than those of RC [1, 2]. However, CPRC sometimes fails to gain these preferable features in practice. Loss of chemical prestress due to shrinkage and creep is believed to be main cause of the cases. However, it is still not clear enough either chemical prestress or chemical prestrain has importance for crack resistance. As the result, no effective measure to guarantee the cracking resistance mechanism have been established. This paper represents an attempt to clarify the effect of drying shrinkage on flexural behavior of CPRC member especially their cracking load.

2. EXPERIMENTAL PROGRAM

This experiment was an attempt to investigate the cracking of CPRC members with different reinforcement ratio and curing condition. Behaviors of six 120-cm long beams with 10cm×10cm cross sections were examined under flexural load. Three sizes of steel bars, namely, D6, D10, and D13 were used as longitudinal reinforcement.

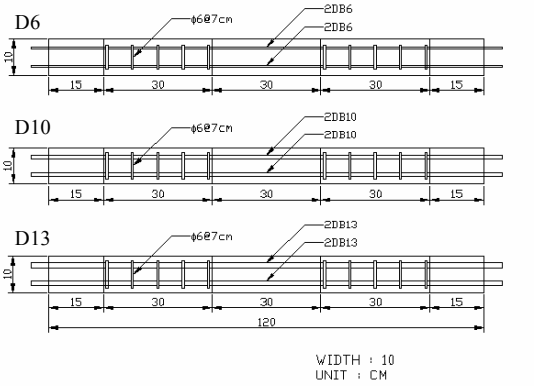

Fig1. Reinforcement arrangement

Fig.1 shows the reinforcement arrangement which was symmetric: two compressive reinforcing bars and two tensile reinforcing bars were arranged with effective depth of 7.5 cm. D6-steel stirrups were provided within shear span, while no stirrup was arranged within constant-moment span.

The expansive mortar with water to cement ratio of 0.5 was used. The amount of expansive agent to powder ratio was 0.15. The frameworks were removed at 24 hrs after casting and the measurement of prestrain in re-bars started. This measurement of

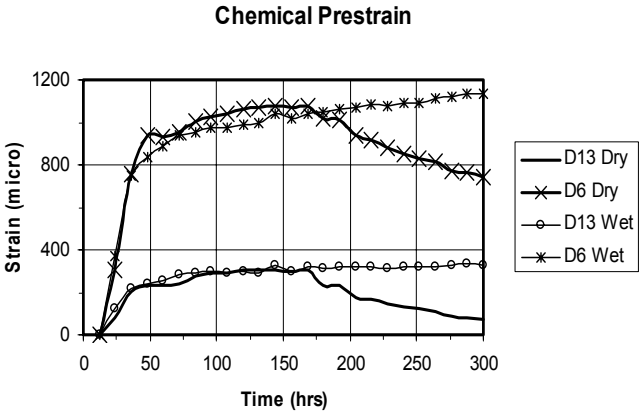

Fig.2: Loss of chemical prestrain due to drying shrinkage

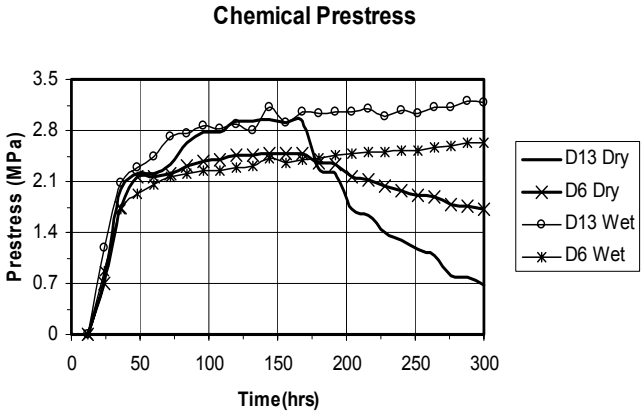

Fig.3: Loss of chemical prestress due to drying shrinkage

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Address: University of Tokyo 3-4-1 Komaba Meguro-ku Tokyo153-8505 Tel. 03-54526394

prestrain continued until loading. One set of beams was kept under wet curing condition, while the other was kept under wet curing for first 7 days and left in air-dry until loading.

The beams were loaded at 14 days after casting. The constant-moment and shear-span were 30 cm. Pie-gages were attached to the specimens within the mid-span interval to recorded the crack widths during loading.

3. EXPERIMENTAL RESULT

3.1 Effect of Curing Condition on Chemical Prestress and Chemical Prestrain

Fig.2 shows the chemical prestrain in each specimen and loss of prestrain due to drying condition. It can be seen that the reduction rate of the prestrain are same regardless of reinforcement ratio. The corresponding chemical prestress in each specimen is given in Fig.3. The loss of prestress is faster for member with higher reinforcement ratio.

It is then clear that the members with higher reinforcement ratio suffer more from drying shrinkage. The results suggest that the reinforcement ratio should be carefully design to avoid loss of prestress and prestrain.

3.2 Load-Deflection Relationship

The impact of drying environment on load-deflection relationship is shown in Fig.4. The CPRC member under dry condition failed to gain the good initial part of load-deflection curves as that of the member under wet condition. However, it should be noted that this effect is relatively small to yield strength and the magnitude of this effect seems to be affected by the size of reinforcing bars [Fig.5].

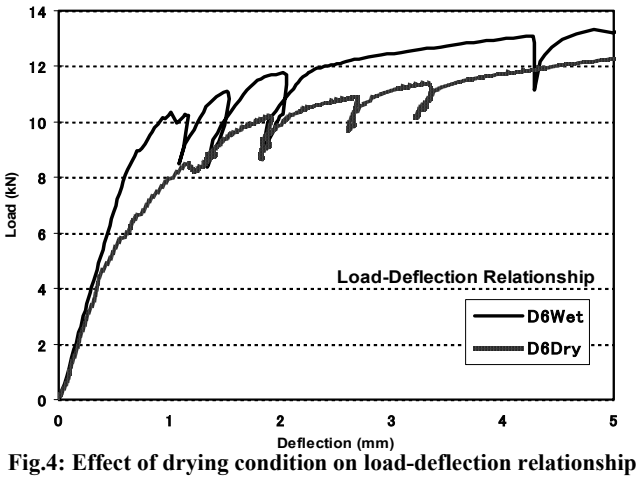

Fig.4: Effect of drying condition on load-deflection relationship

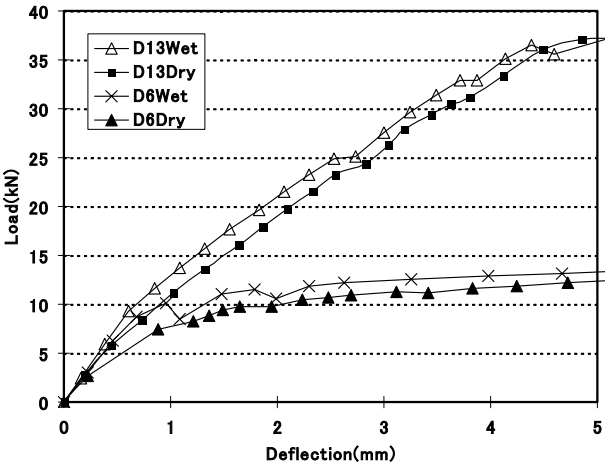

Fig 5: Comparison of effect of drying on members with different reinforcement ratios

4. DISCUSSION

The experimental results show that drying environment might downgrade the magnitudes of prestress and prestrain. As the result, satisfied flexural behaviors might not be obtained. The experimental result shows the importance of shrinkage or creep on the prestress effect. Since magnitude of chemical prestress is approximately one-tenth of those of mechanical prestress, the loss of prestrain and prestress should not be neglected.

Since loss of chemical prestress and chemical prestrain are at different rates, the study on difference between chemical prestress and chemical prestrain is essential to ensure the efficient utilization of CPRC.

5. CONCLUSION

- The loss of prestress and prestrain due to drying environment might be more severe for the members with higher reinforcement ratio.
- The reduction of prestress and prestrain not only downgrade the flexural behaviors but also increase the deflection of CPRC member.

6. REFERENCE

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