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Strength Characteristics in the concrete with a Surface Enhancement Method

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1. Introduction

In this study, dewatering performance-based sheets are attached to the inside of form in order to improve the durability of structures in N.P.P(nuclear power plants) through concrete surface enhancement. Then, the influence of dewatering sheet by removing the residual water inside the concrete analyzed on the strength.

2. Design of experimental and method

2.1 Design of experiment

The experimental plan in this study is presented in Table 1. First, regarding the concrete mixture, the standard mixture was determined by a target slump of 100±25 mm, a target air content of 5±1%, and a 20% of fly ash (FA) replacement to an 80% of portland cement (OPC) at a W/B 45, 50 2 level. Then, the experiments were planned for comparing dewatered surface using 40 ㎛ sheet and normal reference surface with each side of same test specimen. In the case of fresh concrete, slump and air content were measured and rebound values measured by Schmidt hammer and compressive strength were measured under the given age in hardened concrete

Table 1: Design of experiment

Factor		Level
Mixture	W/B(%)	45, 50
	Target slump(mm)	100±25
	Target air content(%)	5±1
	Sheet types	None, 40 ㎛ sheet
Experi-ment	Fresh concrete	·Slump ·Air content
	Hardened concrete	·Schmidt hammer (56 days) ·Compressive strength (91 days)

2.2 Materials

The physical properties of the materials used in this study are noted in Tables 2~6.

Table 2: Physical properties of dewatering sheet

Pore size		Concrete side	Form side
horizontal	vertical		
100 ㎛	40 ㎛	Polyethylene film	Polypropylene

Table 3: Physical properties of cement

Density (g/cm^3)	Blaine (cm^2/g)	Compressive strength(MPa)		
		3 days	7 days	28 days
3.15	3 156	20.9	28.4	38.9

Table 4: Physical properties of FA

Density (g/cm^3)	Blaine (cm^2/g)	SiO_2 (%)	lg. loss(%)	Activity Factor(%)
2.13	3 637	50.7	3.40	97

Table 5: Physical properties of aggregate

Aggregates	Density (g/cm^3)	F.M	Passing amount of 0.08 mm sieve(%)
Fine Agg.	2.5	2.8	0.6
Coarse Agg.	2.6	6.3	0.4

Table 6: Physical properties of admixtures

Kinds	Main ingredients	Appearance	Density (g/cm^3)
SP	Polycarbonate	Fluid	1.05
AE	Negative ion	Fluid	1.04

2.3 Experimental methods

In the experiments for the fresh concrete, the slump and air content were measured based on the KS F 2402 and KS F 2421, respectively. In the case of the hardened concrete, the rebound value measured by Schmidt hammer and compressive strength were measured based on the KS F 2730 and KS F 2423, respectively, at the age of 91 days.

3. The result of an experiment

3.1 Fresh Concrete

(1) Slump and air content

Fig. 1 shows the slump and air content in concrete according to W/B ratios. The mixture design with the ratios of 45 and 50% satisfied the target slump and air content of the structures in N.P.P.

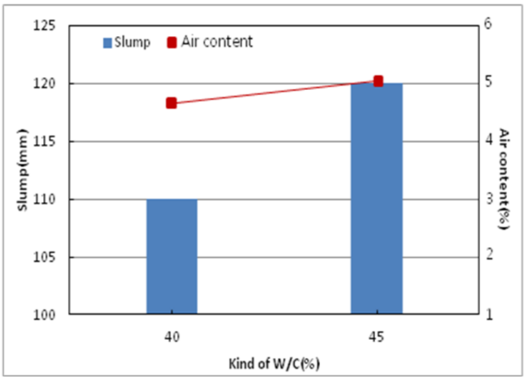

Fig. 1. Slump and air content according to types of W/B

3.2 Hardened Concrete

(1) Schmidt hammer

Fig. 2 shows the rebound values measured by Schmidt hammer of the dewatered surface and reference sheet surface. In the case of the W/B ratio of 45%, the rebound values in the dewatered surface showed higher values than the reference surface. Also, the bottom section exhibited an increase in the rebound value than the top section. In the case of the W/B ratio of 50%, dewatered surface also showed high rebound values.

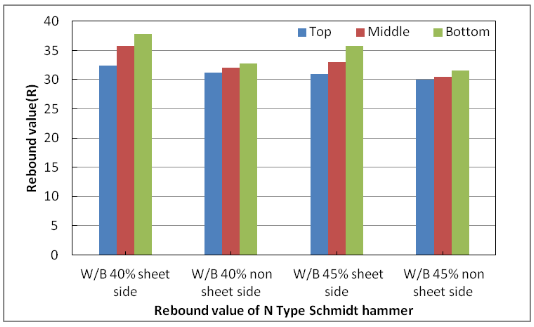

Fig.2. Schmidt Hammer values according to types of W/B and measuring points

(2) Compressive strength

Fig. 3 represents the compressive strength of the dewatered surface and reference surface according to W/B ratios. In the case of the mixture with W/B 45%, the compressive strength of the dewatered surface with showed a higher level than that of reference surface. Also, the core from middle and bottom section showed a higher strength level than that of the top sections. In the case of the mixture with W/B 50%, it showed a similar result to the case of W/B 45% in which the dewatered surface showed higher strength values. It is considered that the lateral pressure of the bottom section in concrete exhibited a higher level than that of the top section relatively and that leads to discharge greater residual water through sheet having 40㎛ water path inside. Thus, the strength of dewatered surface is increased.

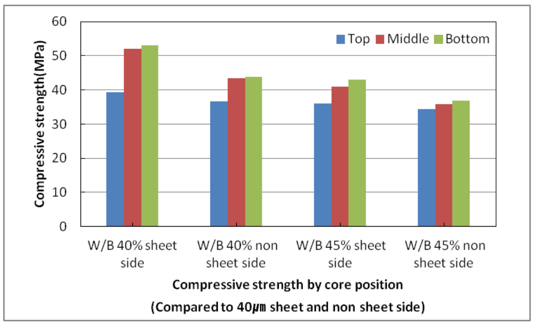

Fig.3. Compressive strength according to types of W/B and measuring points

(3) Compressive strength development

Fig. 4 shows the development rate of compressive strength in dewatered surface and reference surface according to W/B ratios. compressive strength in the dewatered surface represented about top is 5~7%, middle is 14~20%, and bottom is 17~21% higher levels than the reference surface respectively. Also, the previously presented graph of the compressive strength, the middle and bottom sections showed higher strength values than the top section.

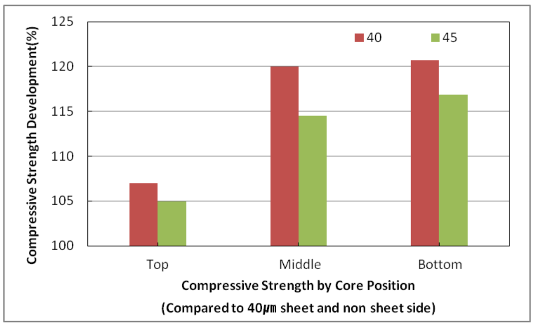

Fig.4. Compressive strength development rate according to types of W/B and measuring points

4. Conclusions

(1) In the case of the Schmidt Hammer rebound value in hardened concrete, dewatered surface represented higher strength levels than the reference surface.

(2) Regarding the compressive strength, dewatered surface represented higher strength values than reference surface and bottom section in the test specimen showed higher increases in strength than the top section.

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