

( )

< . , , >

1.

2003 2 4 m<sup>3</sup>

1960~1970

9,600 m<sup>3</sup>

97 14 m<sup>3</sup> 5

1990

11 m<sup>3</sup>

가 , 5

. < 1> 1997

2003

1,740 가

53% 930 2003

1,800

가

131 m<sup>3</sup>

가 30.5% 40 m<sup>3</sup>

가 . , , , , < 2>

< 1> ( / )

		가			
1996	28,425	833	14,981	3,398	1,244
1997	47,777	811	25,469	7,489	2,372
1998	47,693	655	28,165	7,867	1,532
1999	62,221	968	39,819	9,317	2,849
2000	78,777	1,311	49,352	11,388	4,744

가 .

< 2>

	( / )			
1996	28,425	10,988	848	16,589
1997	47,777	9,747	1,457	36,573
1998	47,693	7,112	1,007	39,574
1999	62,221	10,600	1,278	50,343
2000	78,777	10,021	2,071	66,685

1> Jaw crusher 500mm

2 Jaw crusher 200~300mm

40~25mm, 25~9mm, 9mm

3>

KS

1>

2>

3>

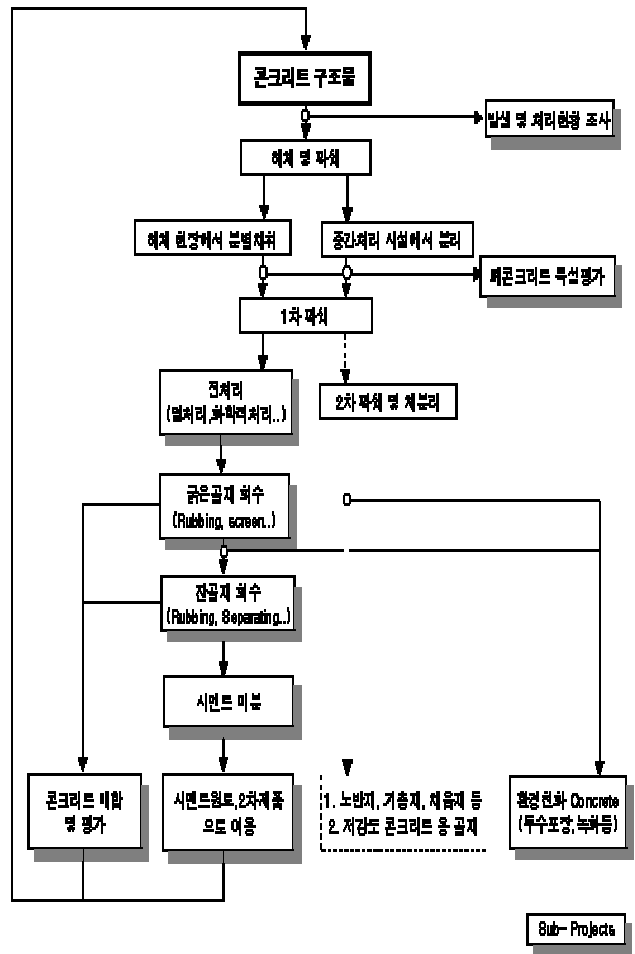
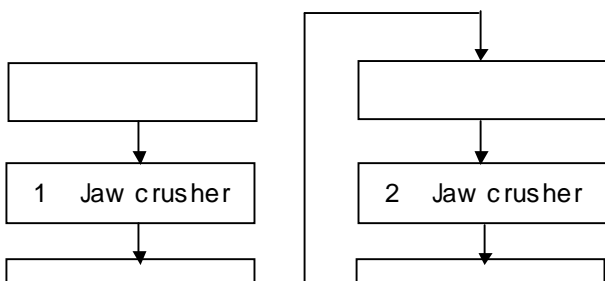
KS

2

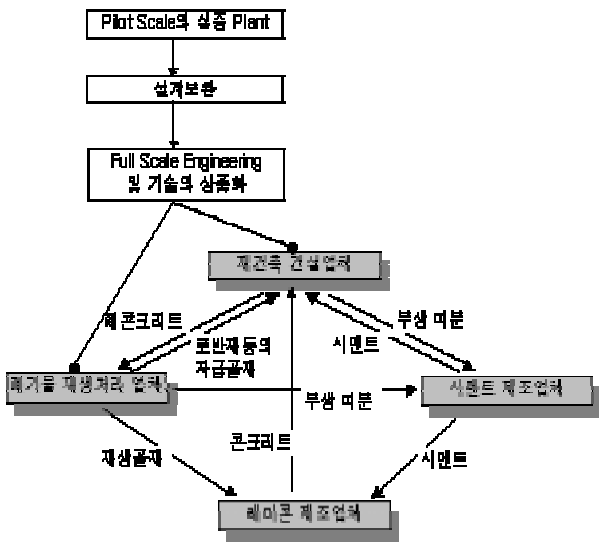
가

3>

S	40mm 25mm	: 2.6, : 2.4
I	25mm 9mm	: 2.22 (25mm) 2.20 (9mm) : 5.37 (25mm) 5.91 (9mm)



2>



< 3>

2.

2.1

S ( ), S ( ), W ( )

Reference

2.2

< 4>

40~50mm

가

Jaw crusher

1

가

, 2

ball mill

ball mill

2

mill

, ball

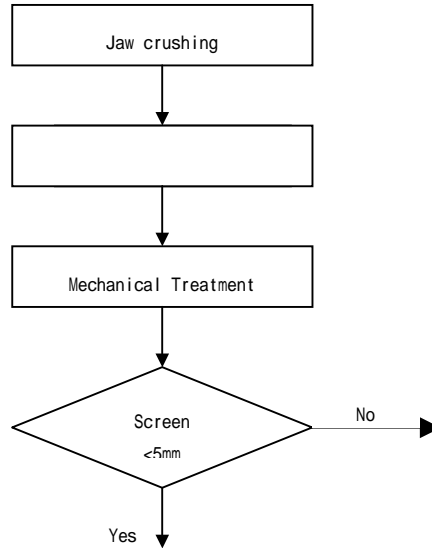
40~5

mm

( )

40%

< 4>



< 4>

< 4>

	S ( ), W ( ),	
	200 / 250 / 300 / 350	
Ball mill	2	
	Ball charge	A/B/C*
		200~600
		20~50 RPM

\* Ball charge

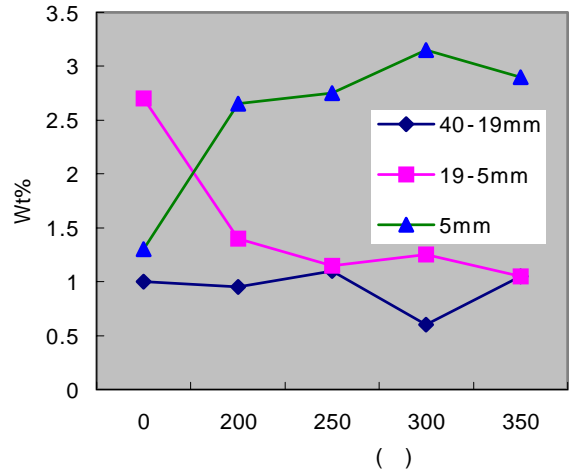
	60mm	50mm	40mm	30mm
A	10	20	30	60
B	5	29	30	60
C	0	19	48	108

2.3

KS F 2503

2.4

가



< 5>

( OPC )

< 5>

90

60

2  
120

KS F 2402

, KS F 2421

3.

3.1

Ball mill

가  
가

5mm

가

< 6>

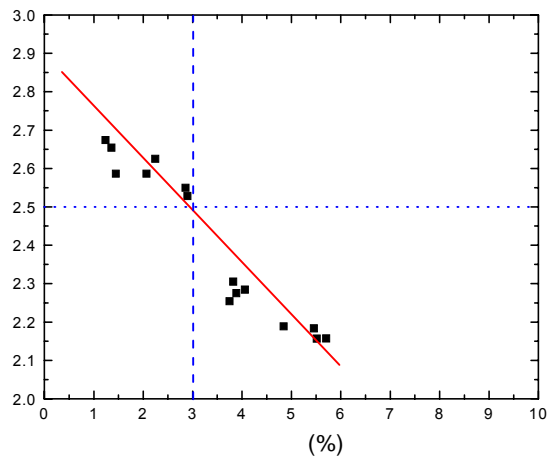
Φ10×20cm

10×10×40cm

20±3□

< 5>

	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	SO <sub>3</sub>	LOI
OPC	21.91	6.29	3.02	61.73	2.86	2.26	1.37
					(h:m)		
		(cm <sup>2</sup> /g)	(%)				
OPC	3.14	3,421	0.03	4:15	7:25		



< 6>

가

### 3.2

Ball

40~19mm, 19~5mm

5mm

< 7>

< 6>

	Ball type		RPM	(%)
200	A	200	30	47
		300	30	37
		400	30	30
250	A	200	30	45
		300	30	31
		400	30	28
300	A	200	30	37
350	A	200	30	42

가 가

가

가

가 가

### 3.3

< 6>

ball charge RPM

ball mill

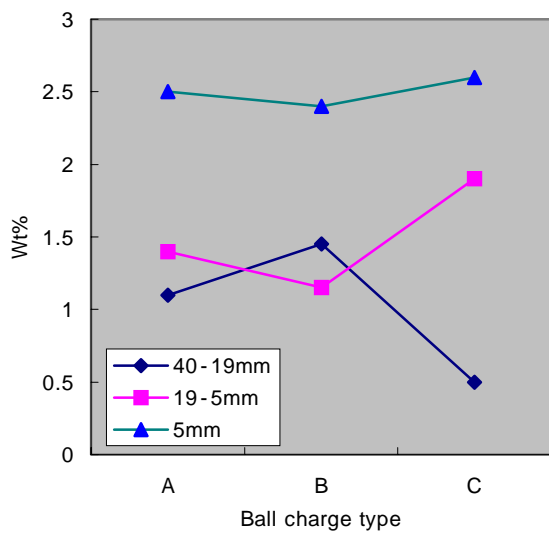
가

가  
가

가  
가

300

350



### 3.4

40%

(70%~50%)

> 7

가

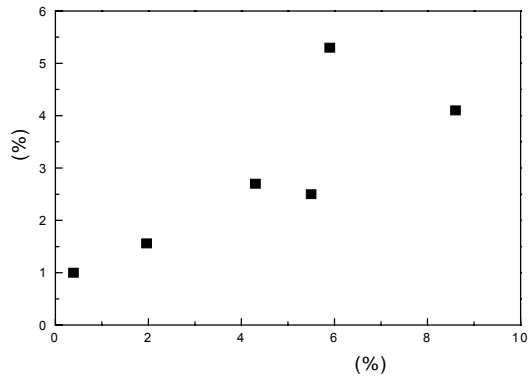
< 7> Ball

< 7>

	(%)		(%)
D-1	74	2.3	4.94
L-4	67	2.4	3.86
L-5	62	2.4	3.28
L6	67	2.38	3.82
L-7	74	2.3	4.94
C-F	80	2.33	4.28

\* L: Lab

C, D : C D



< 8>

< 8>

		Ball mill			(%)		
		Ball charge		RPM			
Ref.1	300	A	200	30	40	2.58	1.12
Ref. 3	350	A	200	30	40	2.59	0.81
C-1	200	A	200	30	44	2.47	2.49
C-2	200	A	300	30	37	2.52	1.81
C-3	250	A	200	30	44	2.54	2.11
C-4	250	A	400	30	28	2.61	1.25
C-5	300	A	200	30	37	2.54	2.17
C-6	300	A	200	30	55	2.50	2.52
C-7	350	A	200	30	42	2.58	1.85

가  
가  
가  
가  
가  
가

< 8>

40 %  
< 8> , < 9>

< 9>

		1	2	3
(%)	3.0	3	5	7
	2.5	2.2		

가

가

2

가

C

가

5mm

(C-1~C-7) Ref

가

가

가

3.5

가

가

가

Ref.

가

C2~C7

< 9>

< 10>

가

Jaw crusher

3.5.1

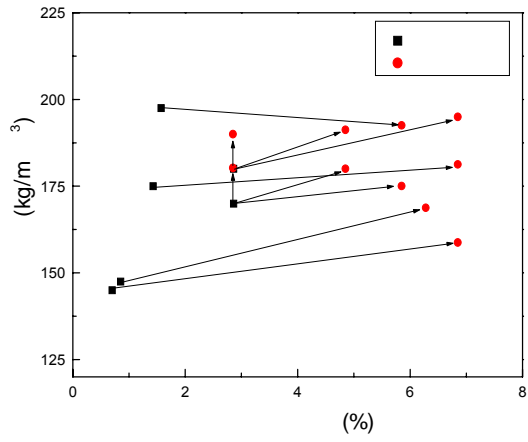
, 1

ball mill

가

< 10>

	(mm)	(cm)	(%)	(%)	(S/a)	(kg/m <sup>3</sup> )				(kg)				( )
						W	C	S	G	W	C	S	G	
	25mm	12	1	55	37	174	316	689	1173	6.26	11.3	24.8	42.2	0.1~0.3%
	25mm	12	1	55	37	174	316	689	1082	6.26	11.3	24.8	38.9	

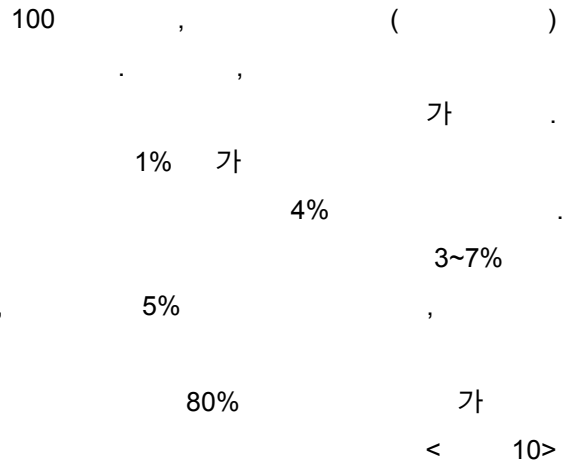


< 11>

가  
가

3.5.2

< 9>



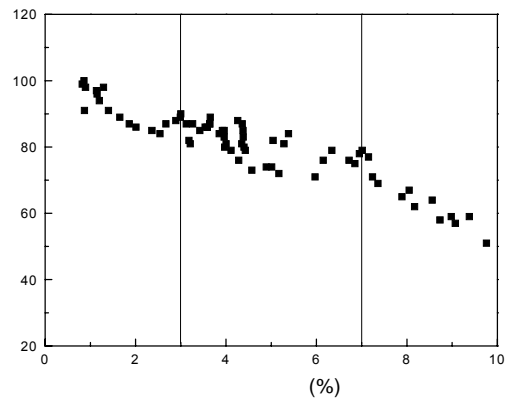
< 9>

가  
가  
가 5% 가  
가 5~15kg/cm³ 가  
가

< 11>

( : cm)

	11	6.2
10	7	4.8
20	4	2.5



< 10>



4.

, Vol.12, No. 5, p23~28, 2000

3) , , Vol.13, No.4, p118~125, 2001

4) T. Ishikura , Development of production techniques on high quality recycled aggregate, , Vol.37, No.7, 1999

5) M. Tamura , Development of Recyclable concrete based on material conservation, Vol.38, No.11, 2000.

6) , , Vol.3, No.3, 2002

ball mill

1) 1 200, 250, 300, 350 가 , 가 2 가 ,

2) 2 , ball milling

3) Ball milling , ball milling 가 , RPM ball

4) 가 KS ( 2.5 , 3.0 ) 2.5~2.59, 2.52~0.81

5) 가 가 가 5% 가 5~15kg/cm3 가 1% 가 4%

< >

1) , , Vol.9, No.6, p11~17, 1997

2) 1, ,