The Research on the Mechanical Properties of Concrete Mixed by the River Sand of Debris Flow in Dongchuan

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Abstract: This article designed to make a comparison between the concrete mixed by the river sand of debris flow in Dongchuan, Yunnan province and the concrete made from the mixed sand in its working performance and mechanical property. By the numerous experiment testing results, we can find out the advantages and disadvantages of the both materials.

Introduction

The river sand of debris flow in Dongchuan, Yunnan province has the feature of less silt content, low price and abundant resources. And if we can make good use of local materials, the transportation cost and natural river sand can be greatly saved, and construction cost will reduce by 10%. There are many factors which can affect the quality of concrete mixed by river sand of debris flow, such as the water-binder ratio, the kind of cement, the kind and grade of the materials, the kinds of vibrating mode, curing methods, temperature, additive, curing the environment, etc.

Raw materials and experiment

Cement: Kunming cement co., LTD. Fine aggregate: mountainous sand and manufactured sand in county Jinning of Yunnan province, and debris flow river sand in Dongchuan region. Coarse aggregate: Yunnan construction group, 5-10 mm stone of melon seeds, 10-20 mm gravel. Water: Tap water from Kunming. Fly ash: Kunming II grade fly ash of power plant. Slag: Kunming iron and steel co., LTD., S75 level. Additive: Shanghai poly carboxylic acid produced VIVID-500 super plasticizer.

The concrete mixing ratio are shown in Table 1 and Table 2. (B-binder, W-water, C-cement, S-sand, Mou-S-mountain sand, Man-S-manufactured sand, Df-S-debris flow sand, Ad- admixture)

Table 1 Consumption of fly ash and slag are 15% of the ratio of concrete

NO.	B	W	C	Sand	Mou-S	Man-S	Df-S	Stone	Ad[%]	W/B	Sand ratio [%]
A1	257	175	180	896	/	/	896	1052	1.0	0.68	46.0
A2	257	175	180	896	151	745	/	1052	1.0	0.68	46.0
B1	273	175	190	874	/	/	874	1068	1.1	0.64	45.0
B2	273	175	190	874	156	728	/	1068	1.1	0.64	45.0
C1	292	175	204	846	/	/	846	1077	0.5	0.60	44.0
C2	292	175	204	846	141	705	/	1077	0.5	0.60	44.0
D1	313	175	219	827	/	/	827	1074	1.6	0.56	43.5
D2	313	175	219	827	138	689	/	1074	1.6	0.56	43.5
E1	337	175	236	798	/	/	798	1080	0.9	0.52	43.0
E2	337	175	236	798	133	665	/	1080	0.9	0.52	43.0
F1	365	175	256	772	/	/	772	1088	1.0	0.48	41.5
F2	365	175	256	772	129	643	/	1088	1.0	0.48	41.5
G1	398	175	279	740	/	/	740	1087	0.4	0.44	40.5
G2	398	175	279	740	123	617	/	1087	0.4	0.44	40.5
H1	438	175	307	697	/	/	697	1090	0.7	0.40	39.0
H2	438	175	307	697	116	581	/	1090	0.7	0.40	39.0
I1	486	175	340	652	/	/	652	1087	1.0	0.36	37.5
I2	486	175	340	652	109	543	/	1087	1.0	0.36	37.5
J1	547	175	383	591	/	/	591	1087	1.0	0.32	35.5
J2	547	175	383	591	99	492	/	1087	1.0	0.32	35.5
K1	580	175	406	560	/	/	560	1086	0.9	0.30	34.0

Table 2 Dosage of fly ash and slag were 20% of the ratio of concrete (Kg/m^3)

NO.	B	W	C	Sand	Mou-S	Man-S	Df-S	Stone	Ad[%]	W/B	Sand ratio [%]
a1	257	175	154	896	/	/	896	1052	1.0	0.68	46.0
a2	257	175	154	896	151	745	/	1052	1.0	0.68	46.0
b1	273	175	164	874	/	/	874	1068	1.1	0.64	45.0
b2	273	175	164	874	156	728	/	1068	1.1	0.64	45.0
c1	292	175	175	846	/	/	846	1077	0.5	0.60	44.0
c2	292	175	175	846	141	705	/	1077	0.5	0.60	44.0
d1	313	175	188	827	/	/	827	1074	1.6	0.56	43.5
d2	313	175	188	827	138	689	/	1074	1.6	0.56	43.5
e1	337	175	202	798	/	/	798	1080	0.9	0.52	43.0
e2	337	175	202	798	133	665	/	1080	0.9	0.52	43.0
f1	365	175	219	772	/	/	772	1088	1.0	0.48	41.5
f2	365	175	219	772	129	643	/	1088	1.0	0.48	41.5
g1	398	175	239	740	/	/	740	1087	0.4	0.44	40.5
g2	398	175	239	740	123	617	/	1087	0.4	0.44	40.5
h1	438	175	263	697	/	/	697	1090	0.7	0.40	39.0
h2	438	175	263	697	116	581	/	1090	0.7	0.40	39.0
i1	486	175	292	652	/	/	652	1087	1.0	0.36	37.5
i2	486	175	292	652	109	543	/	1087	1.0	0.36	37.5
j1	547	175	328	591	/	/	591	1087	1.0	0.32	35.5
j2	547	175	328	591	99	492	/	1087	1.0	0.32	35.5
k1	580	175	348	560	/	/	560	1086	0.9	0.30	34.0

Discussion of the testing results

The performance of the new mixing concrete.

The testing results are shown in Fig. 1 and Fig. 2.

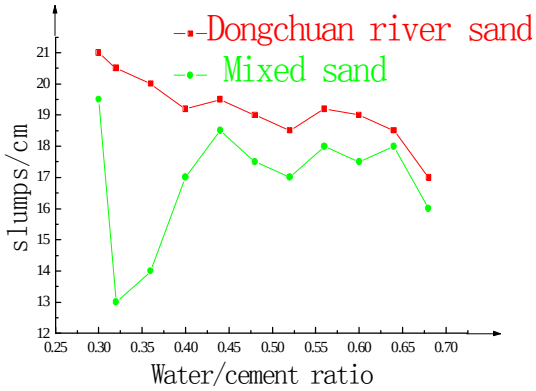

Fig. 1 Concrete slump comparison of different of kinds of sand

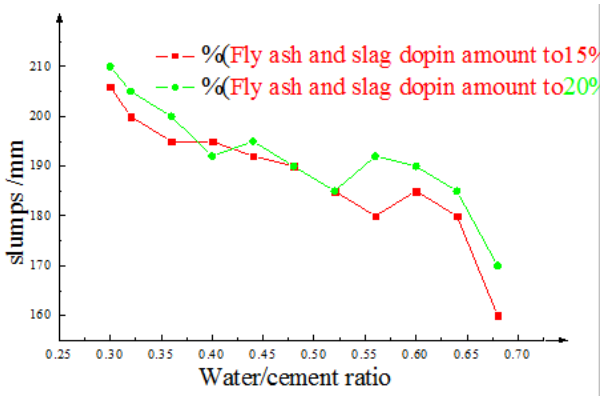

Fig. 2 Concrete slump comparison different mineral admixtures

In Fig.1 it shows that the river sand concrete of debris flow in Dongchuan is superior to the mixed sand in slump performance under the same conditions. And with the increase of the water-binders ratio, the former has better stability than the latter. Especially the shape and surface structure have great influence on the working performance of fresh concrete. In Fig.2 it shows that mixture slump of 15% fly ash and 15% S75 ore powder is less than 20% fly ash and 20% S75 ore powder at the same water. Because of fine mineral particles can fill in the cement particles, which reduces the air void of gelled material and accordingly reduced the water filled in solid particles. This also increased the particle layer water film on the surface of the water, for the good of slurry liquidity [3].

The intensity of the concrete

The influences of the mineral mixture on the concrete strength are shown in Fig. 3 and Fig. 4.

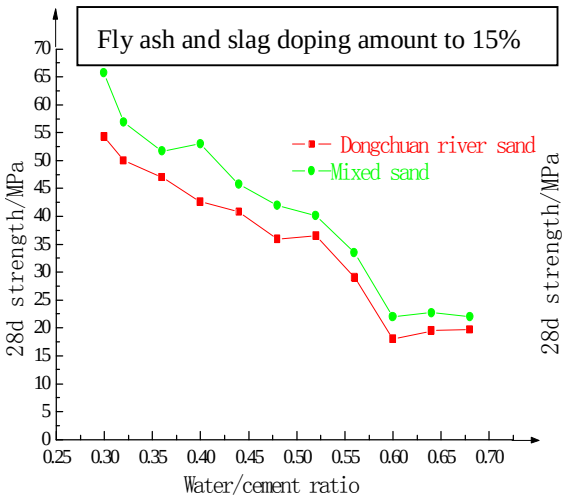

Fig. 3 Contrast of 28d concrete strength of debris flow river sand and mixing sand

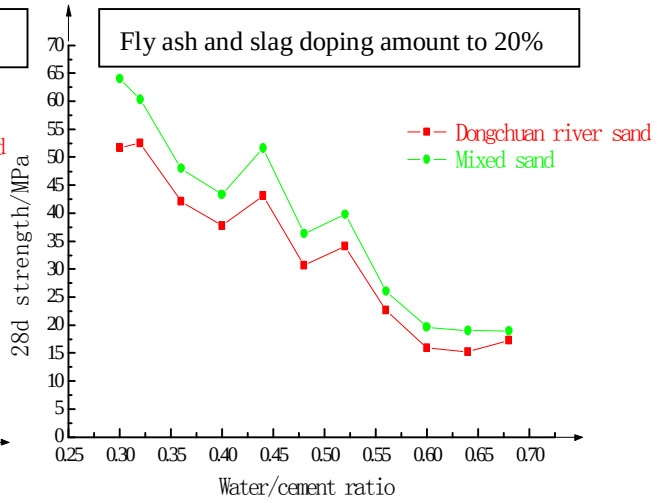

Fig. 4 Contrast of 28d concrete strength of debris flow river sand and mixing sand

In Fig. 3 and Fig. 4, under the same conditions, the strength of the river sand concrete of debris flow in Dongchuan is slightly lower than the mixed sand concrete. Dongchuan debris flow contains large

amount of silt content, dirt and organic matter, which have disadvantages in the concrete. What's more, the stone powder in artificial sand is good to the strength of the concrete.

The impacts of different admixture on the concrete strength are shown in Fig. 5 and Fig. 6.

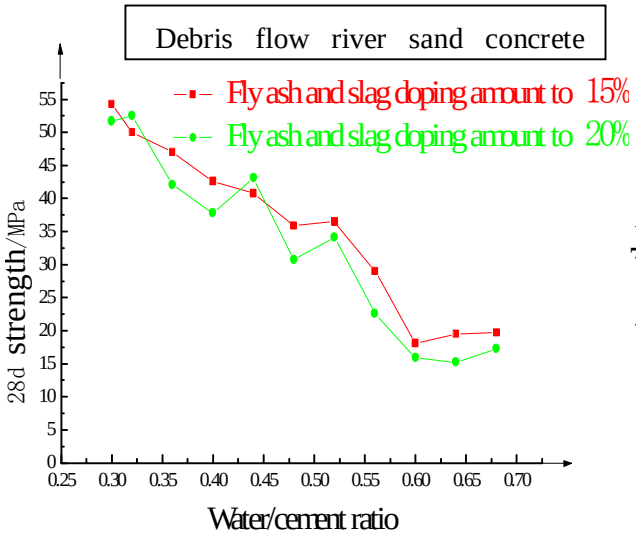

Fig. 5 Contrast of 28d concrete strength of debris flow sand with admixture 15% and 20%

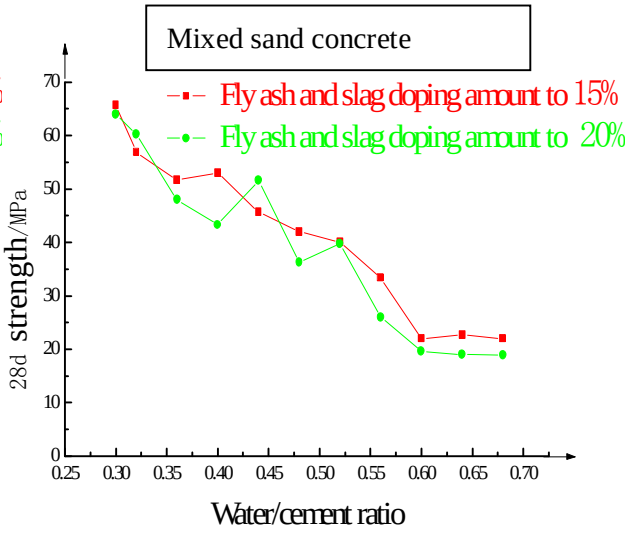

Fig. 6 Contrast of 28d concrete strength of mixed sand with admixture 15% and 20%

Conclusions

The strength of debris flow sand concrete is slightly lower than that of the mixed sand, but the workability is better than that of mixed sand concrete. As for debris flow sand concrete, both fly ash and slag content have influence on the working performance and mechanical properties of the concrete. When the adding amount is 15% the concrete have higher compressive strength but the working performance is a bit poor. When the adding quantity was 20% the concrete has low compressive strength but work performance is good. Concrete strength decreases with the increase of the dosage of fly ash and slag.

Acknowledgements

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