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Technical Memorandum No. 92 T.R. (MT_1-47)

अपार शक्तेः स्त्रोतः गंगेयम्

Physical & Chemical Properties of Admixture, Cement, Fly ash & Aggregate

Sponsor – Executive Engineer
Jamrani Dam Construction
Division-2, Damuadhunga,
Haldwani, Nainital

Dinesh Chandra
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Roorkee **September, 2021**

Irrigation Research Institute, Roorkee

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Material Testing Unit-I

Test Report: Technical Memorandum No.:92-TR(MT$_1$-47)

Accession No. 02/08.04.2021

1.	Name & Address of Sponsor	:	Executive Engineer, Jamrani Dam Construction Division-2, Danuadhunga, Haldwani, Nainital.
2.	Reference of Sponsor's letter	:	Letter No:154/Jamrani-2/विवि,dated 18.02.2021.
3.	Details of testing charges	:	--
4.	Details of material received	:	Aggregate (Coarse & Fine), Cement, Fly ash, Admixture (Superplasticizer cum retarder) samples were received in laboratory.
5.	Tests performed in the laboratory	:	Tests of physical properties of cement with admixture. Tests of chemical analysis of cement. Tests of chemical analysis of fly Ash. Tests of chemical analysis of aggregate.
6.	Test procedure & result	:	Test of cement as per IS 4031:1991 & IS 4032:1985 (Reaffirmed-2019), test of fly ash as per IS 1727 -1967 (Reaffirmed 2013), test of aggregate as per IS 2386:1963 (Part-7) Reaffirmed 2016 were conducted as per procedure specified in respective code of practice. The test results are given in enclosed Table 1 to 6.

Disclaimer: -

1. Test results reported in this report hold good for specific admixture supplied by the sponsor.
2. No part of T.M. is to be reproduced or used in any manner without written permission of the Superintending Engineer except for official purpose by the authority sponsoring the problem.
3. This report is being issued on the specific understanding that I.R.I. will not, in any way, be involved in any action following the interpretation of the results reported in this technical memorandum.

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Research Supervisor	**Assistant Engineer-4**	**Research Officer**
		18/9/2021

Approved By

20/9/2021

(Shankar Kumar Saha)
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IRRIGATION RESEARCH INSTITUTE, ROORKEE-247667

(An ISO 9001: 2008 Certified Organisation)

ROLLER COMPACTED CONCRETE LABORATORY, MATERIAL TESTING UNIT-I

Name of Work : Roller Compacted Concrete Mix Design of Jamrani Dam

Name of Sponsor : Executive Engineer, Jamrani Dam Construction Divison-2, Damauadhunga, Haldwani, Nainital.

Sponsor Reference No. : Letter No: 154/Jamrani-2, Dated 18.02.2021.

Table 1: Consistency of Cement with Admixture

Admixture	Test Name	Test Method	Unit	Dosage by weight of Cement	Test Results	Consistency of Control Mix	Variation from Control Mix
BROCRETE S 888 (FAIRMATE)	Consistency	As per IS 4031:1988 (Part - 4) Reaffirmed 2014	(%)	0.6	28.25	29.5	1.25
				0.8	28.0		1.5
				1.0	27.5		2.0
				1.2	27.0		2.5
				1.4	26.5		3.0

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Sponsor Reference No. : Letter No: 154/Jamrani-2, Dated 18.02.2021.

TABLE -2 Physical Properties of Fly Ash

Sl. No.	Name of Test	Test Method	Unit	Test Result	Specification as per IS: 3812 (Part-1) -2013	Conformity
1.	Specific gravity	As per IS 1727 - 1967 Reaffirmed 2013	--	2.29	-	-
2.	Fineness					
	By Blaine's air Permeability method		m2/kg	325	>320	OK
	Wet Sieving on 45μ		%	25.1	< 34	OK
3.	Lime Reactivity		MPa	8.7	> 4.5	OK

TABLE - 3 Compressive Strength of Fly Ash with Cement

Sl. No.	Name of Test	Test Method	Unit	Test Result	Specification as per IS: 3812 (Part-1) -2013	Conformity
1.	Compressive Strength	As per IS 1727 - 1967 Reaffirmed 2013	MPa			
	7 Days			12.1	-	-
	28 Days			19.4	> 17.8	OK

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TABLE -4 Chemical properties of Fly Ash

	Name of the test	Test Method	Unit	Result	Conformity as per IS Code IS:3812 (Part 1): 2013	Conformity
	Loss on Ignition	As per IS 1727 -1967 Reaffirmed 2013	%	2.57	< 5	OK
	Silicon dioxide (SiO_2)		%	70.67	> 35	OK
	Aluminum Oxide (Al_2O_3)		%	16.52	-	-
	Iron Oxide (Fe_2O_3)		%	2.75	-	-
	Silicon dioxide (SiO_2) + Aluminum Oxide (Al_2O_3) + Iron Oxide (Fe_2O_3)		%	89.94	>70	OK
	Calcium Oxide (CaO)		%	2.86	-	-
	Magnesium Oxide (MgO)		%	2.71	< 5	OK
	Sulphuric Anhydride (SO3)		%	0.47	< 3	OK

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TABLE - 5 Chemical Properties of Cement (Ultratech OPC - 43)

Sl. No.	Name of the test	Test Method	Unit	Result	Conformity as per IS Code:8112:1989 Reaffirmed 2013	Conformity
1	Insoluble Residue	IS 4032 - 1985 Reaffirmed 2019	%	3.96	< 4	OK
2	Calcium Oxide (CaO)		%	52.25	-	-
3	Silicon Oxide (SiO_2)		%	17.60	-	-
4	Aluminum Oxide (Al_2O_3)		%	7.25	-	-
5	Ferric Oxide (Fe_2O_3)		%	8.15	-	-
6	Magnesia as Oxide		%	1.62	< 6	OK
7	Sulphuric Anhydride (SO3)		%	2.89	< 3.5	OK
8	Ratio of percentage of Lime to percentages of silica, Alumina, and Iron Oxide when calculated by the formula. $\frac{CaO - 0.7\ SO_3}{2.8\ Sio_2 + 1.2\ Al_2O_3 + 0.65\ Fe_2O_3}$		-	0.79	0.66 to 1.02	OK
9	Ratio of percentage of alumina (Al_2O_3) to that of iron oxide (Fe_2O_3)		%	0.89	> 0.66	OK
10	Loss on Ignition		%	4.89	< 5	OK

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TABLE - 6 Alkali Aggregate Reactivity Test

Sl No	Aggregate Size (mm)	Test Method	Unit	Result		Conformity as per IS Code:2386:1963 (Part -7), Reaffirmed 2016	Conformity
				Soluble Silica	Reduction in alkalinity		
1	40	IS 2386 - 1963 (Part -7) Reaffirmed 2016	Millimoles /Litre	26	200	Innocuous Aggregate	Ok
2	20		Millimoles /Litre	03	276	Innocuous Aggregate	Ok
3	10		Millimoles /Litre	08	156	Innocuous Aggregate	Ok
4	Fine		Millimoles /Litre	02	308	Innocuous Aggregate	Ok

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