

Technical Memorandum No. 92 T.R. (MT<sub>1</sub>- 43)



अपार शक्तेः स्रोतः गंगेयम्

# *Physical & Chemical Properties of Admixture, Cement and Aggregate*

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

**Dinesh Chandra  
Chief Engineer Level-1 (Design) & Director**



**Irrigation Research Institute  
Roorkee – 247667  
(An ISO 9001:2008 Certified Organisation)  
Website: [www.iri-roorkee.res.in](http://www.iri-roorkee.res.in)**

# Irrigation Research Institute, Roorkee

(Website: [www.iriroorkee.res.in](http://www.iriroorkee.res.in))

## Material Testing Unit-1


Test Report: Technical Memorandum No.:92-TR (MT<sub>1</sub>- 43)

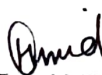
Accession No. 02/08.04.2021


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/विधि, 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 are received in laboratory.
5. Tests performed in the laboratory : Tests of Physical and Chemical Properties of Admixture.  
Tests of Physical Properties of Aggregate.  
Tests of Physical Properties of Cement.
6. Test procedure & result : Test of admixture as per IS 9103:1999 (Reaffirmed-2018), test of coarse & fine aggregate as per IS 2386 -1963 (Reaffirmed 2016), test of Cement as per IS 4031:1991 were conducted as per procedure specified in respective code of practice. The test results are given in enclosed Table 1 to 9.
7. Test under progress : Chemical testing of various materials are under progress.

### 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.

  
(Priya Semwal)  
Research Supervisor

  
(Md. Hamid Hassan)  
Assistant Engineer-4

  
19/11/2021  
(Bijendra Pal)  
Research Officer

Approved By

  
(Shankar Kumar Saha)  
Superintending Engineer  
Research Circle  
Irrigation Research Institute, Roorkee

**IRRIGATION RESEARCH INSTITUTE, ROORKEE-247667**


*(An ISO 9001: 2008 Certified Organisation)*


**ROLLER COMPACTED CONCRETE LABORATORY, MATERIAL TESTING UNIT-1**


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: Physical and Chemical Properties of Admixture.**

Sl. No.	Admixture	Particulars	Results	Conformity As per IS 9103-1999 (Reaffirmed 2018)	Conformity
1	BROCRETE S 888 (FAIR MATE)	Dry material Content (%)	16.0	12 - 17	OK
2		Relative Density	1.05	1.05 - 1.09	OK
3		pH Value	5.28	Within $\pm 1$ of the value stated by Manufacturer stated value, i.e., 6 - 8.5	OK

  
(Rakhi Upadhyay)  
Scientific Assistant

  
(Priya Semwal)  
Research Supervisor

  
(Md. Hamid Hassan)  
Assistant Engineer-4

# IRRIGATION RESEARCH INSTITUTE, ROORKEE-247667

*(An ISO 9001: 2008 Certified Organisation)*

## ROLLER COMPACTED CONCRETE LABORATORY, MATERIAL TESTING UNIT-1

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 2: Setting Time (Initial & Final) of Admixture with Cement.**

Sl. No.	Admixture	Test Name	Test Method as per	Dosage by weight of Cement (in %)	Test Results (in min)	Setting Time of Control Mix (in min)	Variation from Control Mix (in min)	Conformity Criteria as per IS: 8112 - 2013	Conformity
1	BROCRETE S 888 (FAIR MATE)	Initial Setting Time	IS 4031:1988 (Part - 5) Reaffirmed 2014	0.6	195	155	40	> 30 min. for control mix	OK
2				1.0	190		35		OK
3				1.4	210		55		OK
4		Final Setting Time		0.6	305	260	45	< 600 min. for control mix	OK
5				1.0	345		85		OK
6				1.4	290		30		OK

*Rakhi*

(Rakhi Upadhyay)  
Scientific Assistant

*Priya*

(Priya Semwal)  
Research Supervisor

*Amid*

(Md. Hamid Hassan)  
Assistant Engineer-4

**IRRIGATION RESEARCH INSTITUTE, ROORKEE-247667**

*(An ISO 9001: 2008 Certified Organisation)*

**ROLLER COMPACTED CONCRETE LABORATORY, MATERIAL TESTING UNIT-1**

Name of Work : Roller Compacted Concrete Mix Design of Jamrani Dam  
Name of Sponsor : Executive Engineer, Jamrani Dam Construction Div-2, Damauadhunga, Haldwani, Nainital.  
Sponsor Reference No. : Letter No: 154/Jamrani-2, Dated 18.02.2021.

**Table 3: Physical Properties of Cement.**

Sl. No.	Name of Test Performed	Unit	Testing Procedure	Result	Conformity Criteria as per IS: 269 -2015	Conformity
1	Standard Consistency	%	IS 4031:1988 (Part - 4), Reaffirmed 2014	28.5	--	--
2.	Fineness (Blaine's air Permeability method)	m <sup>2</sup> /kg	IS 4031:1999 (Part - 2) Reaffirmed 2018	324	Not less than 225 m <sup>2</sup> /kg	OK
3.	Soundness (Le-Chatelier method)	mm	IS 4031:1988 (Part - 3) Reaffirmed 2014	1.0	Not more than 10 mm	OK
4.	Specific Gravity	-	IS 4031:1988 (Part - 11) Reaffirmed 2014	3.09	--	OK
5.	Initial Setting Time	minute	IS 4031:1988 (Part - 5) Reaffirmed 2014	150	Not less than 30 minutes	OK
6.	Final Setting Time	minute		230	Not More than 600 minutes	OK
7.	Compressive (Strength 72±1 hour)	MPa	IS 4031:1988 (Part - 6) Reaffirmed 2014	24.8	Min. 23 MPa	OK
8.	Compressive Strength (168±2 hour)	MPa		36.5	Min. 33 MPa	OK
9.	Compressive Strength (672±4 hour)	MPa		45.5	Min. 43 MPa.	OK

*Rakhi*

**(Rakhi Upadhyay)**  
Scientific Assistant

*Priya*

**(Priya Semwal)**  
Research Supervisor

*Hamid*

**(Md. Hamid Hassan)**  
Assistant Engineer-4

**IRRIGATION RESEARCH INSTITUTE, ROORKEE-247667**

*(An ISO 9001: 2008 Certified Organisation)*


**ROLLER COMPACTED CONCRETE LABORATORY, MATERIAL TESTING UNIT-1**

**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 4: Physical Properties of Aggregate.**

Sl. No	Test Name	Aggregate Type	Test Method	Result (%)	Conformity Criteria as per IS 383: 2016	Conformity
1	Material Finer than 75 $\mu$	Fine Aggregates (Natural)	IS 2386:1963 (Reaffirmed 2016) Part-1	2.8	< 3.00	OK
2	Combined Flakiness & Elongation	40 mm		78.1	<40% for uncrushed or crushed aggregate. However, the Engineer-in-Charge at his discretion may relax the limit keeping in view the requirement, and availability of aggregates and performance based on tests on concrete.	NOT OK
3		20 mm		30.1		OK
4		10 mm		19.0		OK
5	Clay Lumps	40 mm	IS 2386:1963 (Reaffirmed 2016) Part-2	0.2		< 1.00 %
6		20 mm	0.3	OK		
7		10 mm	2.7	NOT OK		
8	Water Absorption (%)	40 mm	IS 2386:1963 (Reaffirmed 2016) Part-3	0.48	< 5%	OK
9		20 mm		0.60		OK
10		10 mm		0.77		OK
11		Sand		1.36		OK

  
(Rakhi Upadhyay)  
Scientific Assistant

  
(Priya Semwal)  
Research Supervisor

  
(Md. Hamid Hassan)  
Assistant Engineer-4

**IRRIGATION RESEARCH INSTITUTE, ROORKEE-247667**

*(An ISO 9001: 2008 Certified Organisation)*

**ROLLER COMPACTED CONCRETE LABORATORY, MATERIAL TESTING UNIT-1**

**Name of Work** : Roller Compacted Concrete Mix Design of Jamrani Dam  
**Name of Sponsor** : Executive Engineer, Jamrani Dam Construction Div-2, Damaua Dhunga, Haldwani, Nainital.  
**Sponsor Reference No.** : Letter No: 154/Jamrani-2, Dated 18.02.2021.

**Table 5: Physical Properties of Aggregate.**

Sl. No	Name of Test	Aggregate Type	Test Method	Unit	Result	Conformity Criteria as per IS 383: 2016	Conformity
12	Bulking of Fine Aggregate	Natural Sand	IS 2386:1963 (Reaffirmed 2016) Part-3	%	8.0	-	-
13	Specific Gravity	40 mm		-	2.68	2.1 - 3.2	OK
14		20 mm		-	2.68		
15		10 mm		-	2.65		
16		Fine		-	2.64		
17	Bulk Density (Loose)	40 mm	IS 2386:1963 (Reaffirmed 2016) Part-3	Kg/m <sup>3</sup>	1.380	-	-
18		20 mm			1.420		-
19		10 mm			1.360		-
20		Fine			1.650		-
21	Bulk Density (Compacted)	40 mm	IS 2386:1963 (Reaffirmed 2016) Part-3	Kg/m <sup>3</sup>	1.520	-	-
22		20 mm			1.570		-
23		10 mm			1.510		-
24		Fine			1.750		-
25	Voids	40 mm	IS 2386:1963 (Reaffirmed 2016) Part-3	%	49.0	-	-
26		20 mm			46.0		-
27		10 mm			49.0		-
28		Fine			38.0		-
29	Impact Value	12.5 - 10 mm	IS 2386:1963 (Reaffirmed 2016) Part-4	%	17.2	<30%	OK
30	Crushing Value	25 - 20 mm			21.6	<30%	OK
31	Abrasion Value	40 mm			18.6	<30%	OK
32		20 mm			15.5		
33		10 mm			27.7		

*Rakhi*

**(Rakhi Upadhyay)**  
Scientific Assistant

*Priya*

**(Priya Semwal)**  
Research Supervisor

*Hamid*

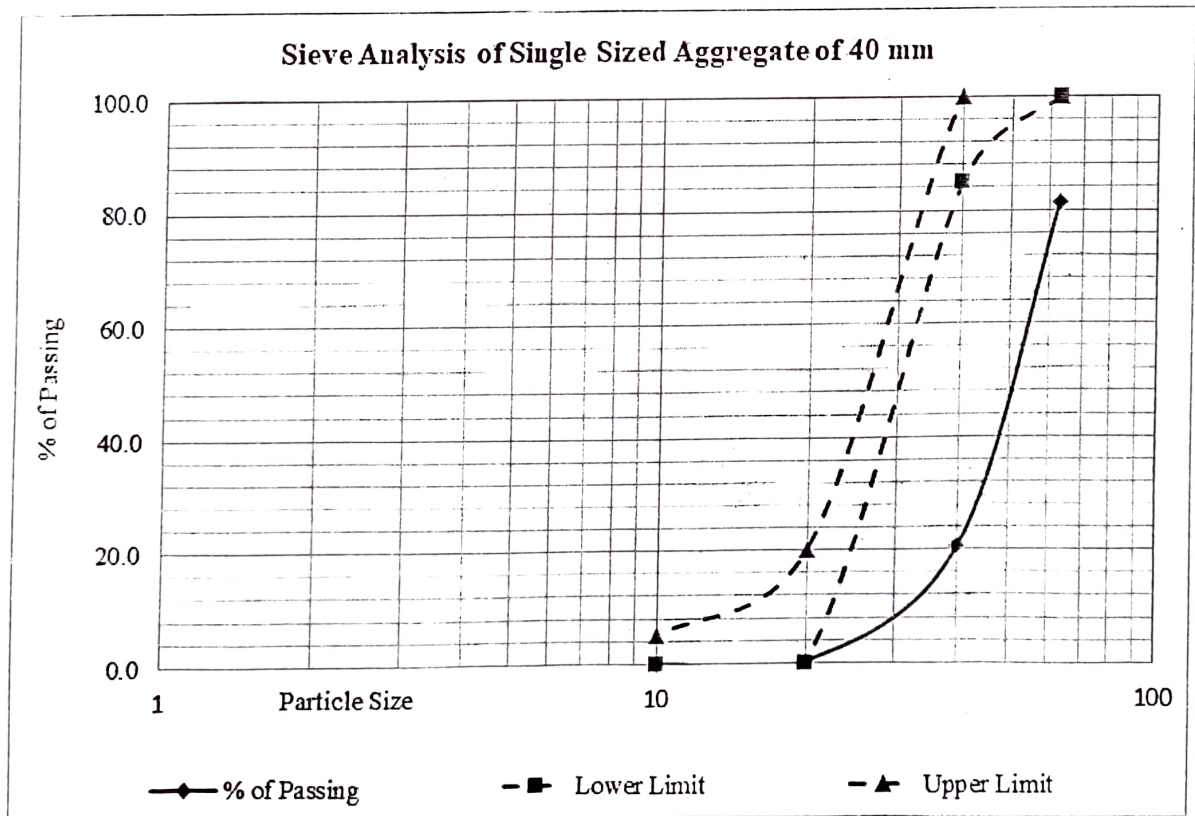
**(Md. Hamid Hassan)**  
Assistant Engineer-4

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 6: Sieve Analysis for Coarse Aggregate of 40 mm (Single Sized)**

Sl. No.	IS Sieve (mm)	Reference	Percentage Passing	Conformity Criteria As Per IS:383-2016	Conformity
1	63	IS:2386 (Part-1)-1963 (Reaffirmed 2016)	81.1	100	NOT OK
2	40		20.6	85-100	NOT OK
3	20		0.2	0-20	OK
4	10		0.0	0-5	OK

Note: % of passing from IS Sieve 63 mm and 40 mm is not as per standard for the grading of 40 mm. Also, the aggregate does not come under the grading of 63 mm aggregates size.



*Rakhi*  
 (Rakhi Upadhyay)  
 Scientific Assistant

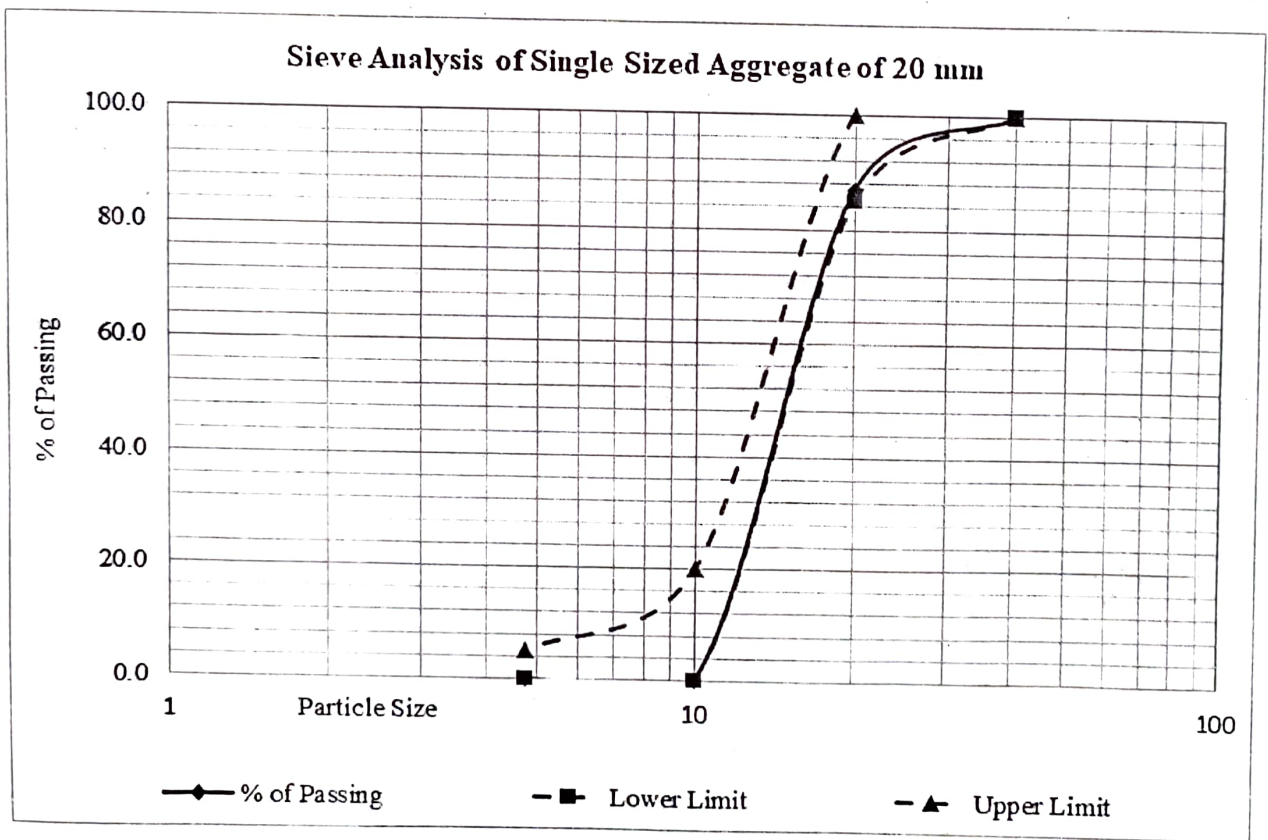
*Priya*  
 (Priya Semwal)  
 Research Supervisor

*Hamid*  
 (Md. Hamid Hassan)  
 Assistant Engineer-4

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 7: Sieve Analysis for Coarse Aggregate of 20 mm (Single Sized)**

Sl. No.	IS Sieve (mm)	Reference	Percentage Passing	Conformity Criteria as Per IS:383-2016	Conformity
1	40	IS:2386 (Part-I)-1963 (Reaffirmed 2016)	100.0	100	OK
2	20		87.1	85-100	OK
3	10		0.0	0-20	OK
4	4.75		0.0	0-5	OK



*Rakhi*

(Rakhi Upadhyay)  
Scientific Assistant

*Priya*

(Priya Semwal)  
Research Supervisor

*Amid*

(Md. Hamid Hassan)  
Assistant Engineer-4

# IRRIGATION RESEARCH INSTITUTE, ROORKEE-247667

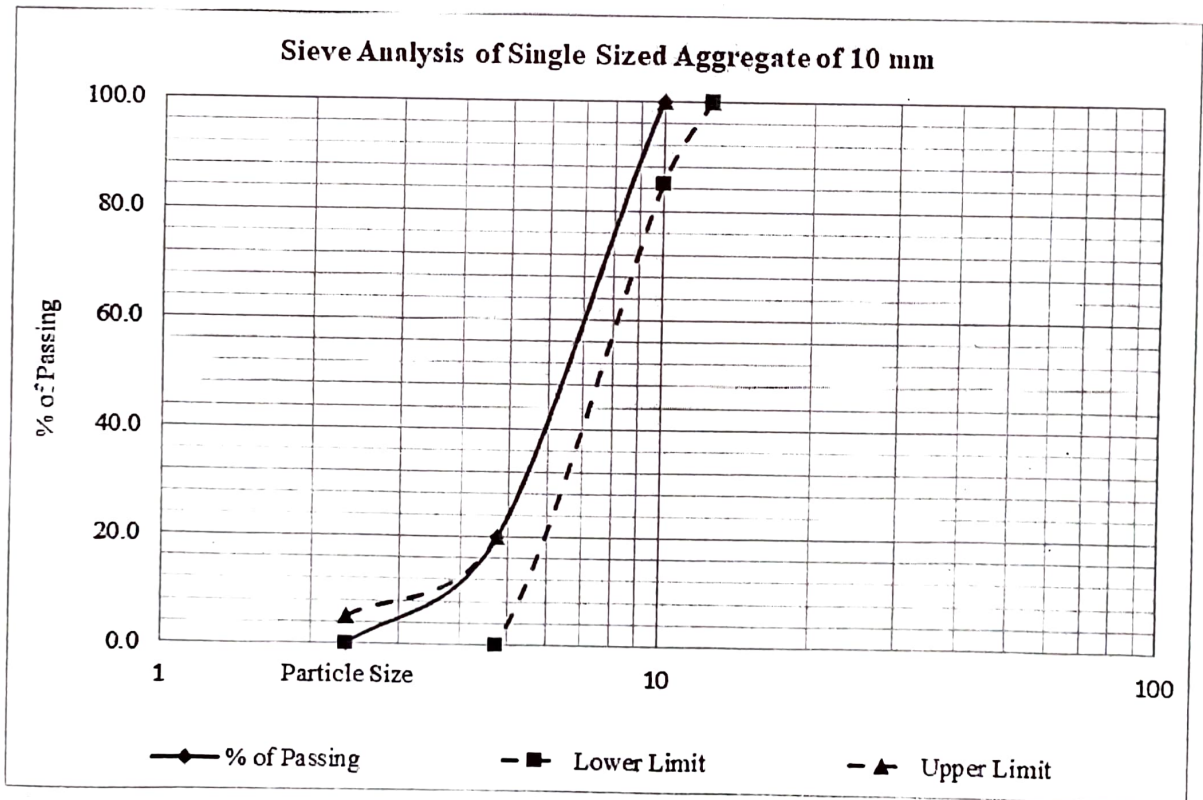
(An ISO 9001: 2008 Certified Organisation)

## ROLLER COMPACTED CONCRETE LABORATORY, MATERIAL TESTING UNIT-1

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 8: Sieve Analysis for Coarse Aggregate of 10 mm (Single Sized)

Sl. No.	IS Sieve (mm)	Reference	Percentage Passing	Conformity Criteria as Per IS:383-2016	Conformity
1	12.5	IS:2386 (Part-I)-1963 (Reaffirmed 2016)	100.0	100	OK
2	10		100.0	85-100	OK
3	4.75		19.9	0-20	OK
4	2.36		0.0	0-5	OK



*Rakhi*  
(Rakhi Upadhyay)  
Scientific Assistant

*Priya*  
(Priya Semwal)  
Research Supervisor

*Amid*  
(Md. Hamid Hassan)  
Assistant Engineer-4

**IRRIGATION RESEARCH INSTITUTE, ROORKEE-247667**

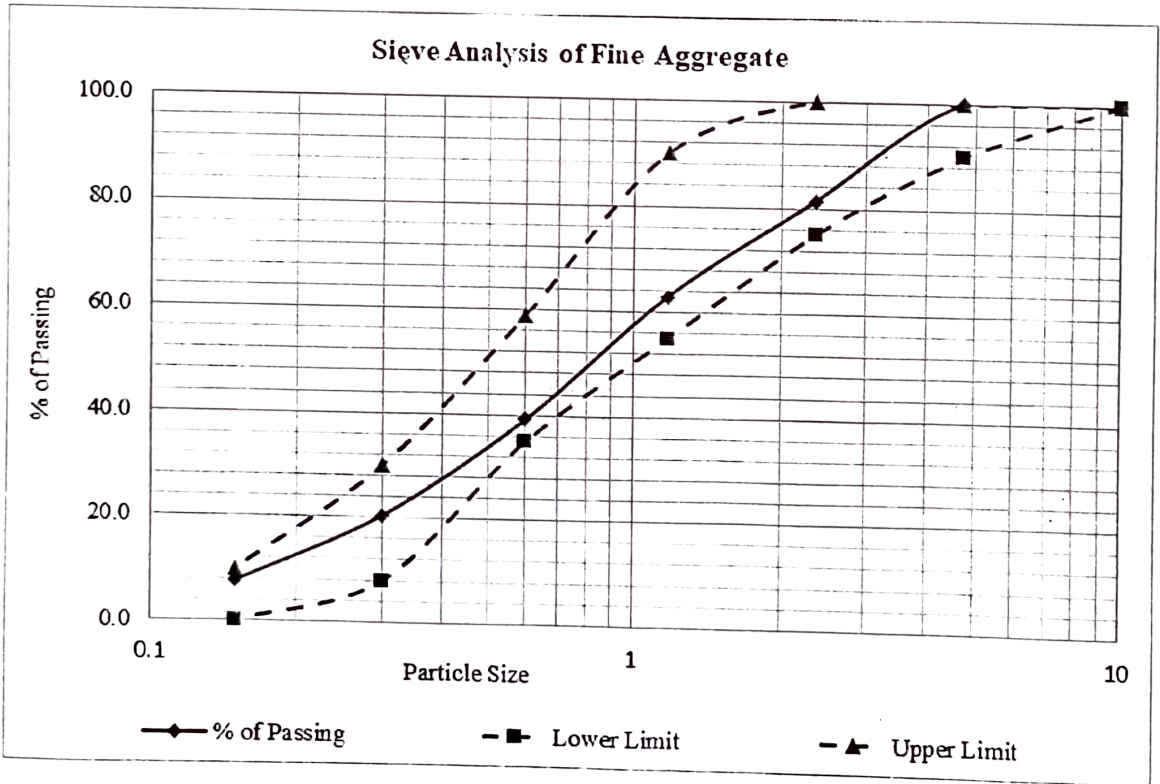
*(An ISO 9001: 2008 Certified Organisation)*

**ROLLER COMPACTED CONCRETE LABORATORY, MATERIAL TESTING UNIT-1**

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 9: Sieve Analysis for Fine Aggregate**

Sl. No.	IS Sieve (mm)	Reference	Percentage Passing (%)	Conformity Criteria for Grading Zone II as per IS: 383-2016	Conformity
1	10	IS:2386 (Part-I)-1963 (Reaffirmed 2016)	100.0	100	OK
2	4.75		100.0	90-100	OK
3	2.36		81.4	75-100	OK
4	1.18		63.0	55-90	OK
5	0.60		39.2	35-59	OK
6	0.30		20.4	08-30	OK
7	0.15		7.6	0-10	OK



*Rakhi*  
 (Rakhi Upadhyay)  
 Scientific Assistant

*Priya*  
 (Priya Semwal)  
 Research Supervisor

*Amid*  
 (Md. Hamid Hassan)  
 Assistant Engineer-4