

- **Sand Manufacturing Technology & Its Evolution in India**





# RIVER SAND MINING: RISKS & SUSTAINABLE ALTERNATIVE

LARSEN & TOUBRO



- Ecological Imbalance
- Affecting Aquatic Life
- Reduction in Water Table
- Ground Water Depletion
- Water Scarcity
- Detrimental Effect on Civil Structures on Rivers (Bridges / Dams)
- Destruction of flora and fauna of surrounding areas
- Dredging / Transportation → Pollution → Higher Carbon Footprint

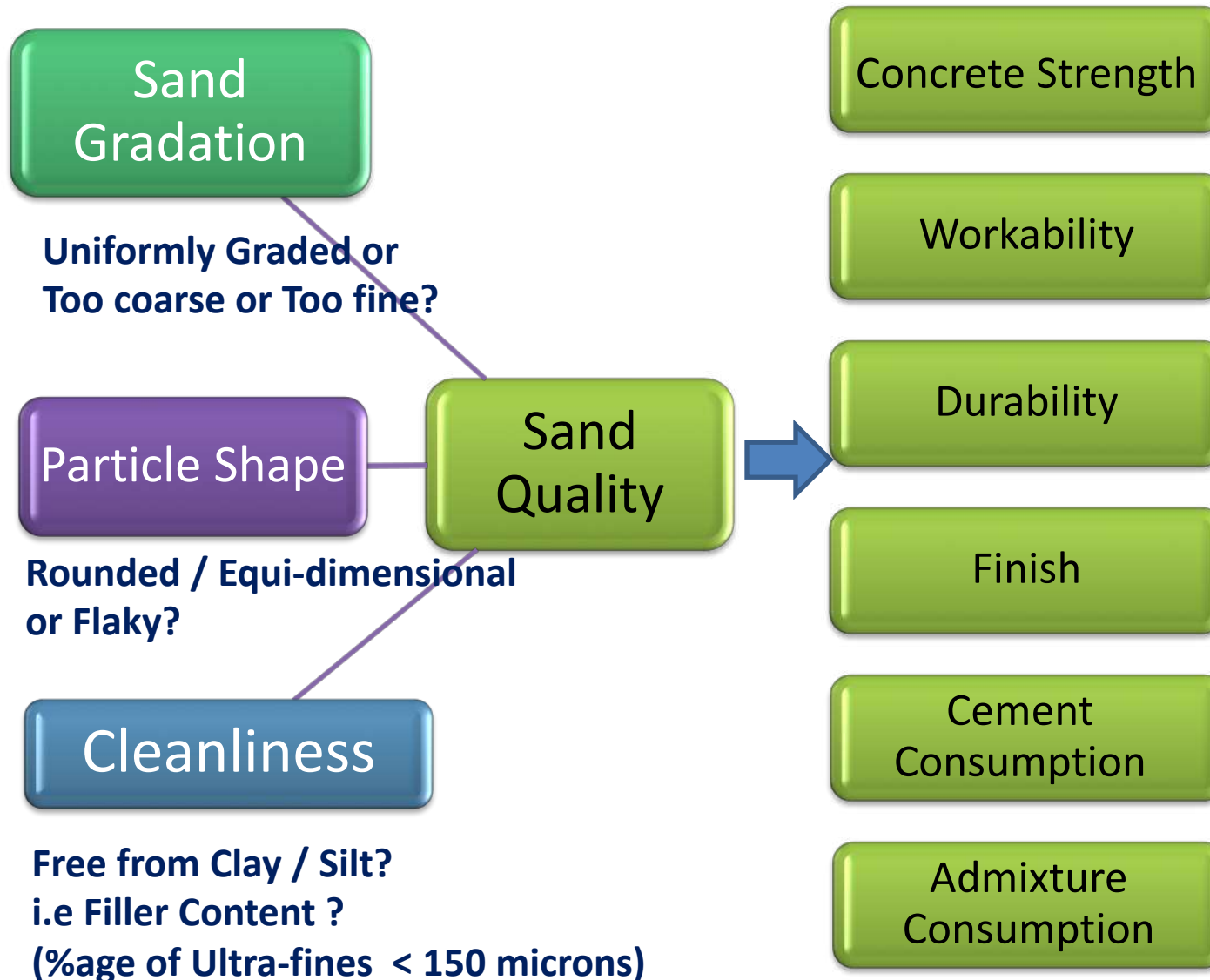


## SUSTAINABLE ALTERNATIVE TO RIVER SAND: E7





# SAND QUALITY ASPECTS AND ITS EFFECT ON CONCRETE



**“GLOBALLY, KEMCO ‘e-7’ IS THE ONLY TECHNOLOGY WHICH ADDRESSES ALL 3 QUALITY ASPECTS IN ONE INTEGRATED PLANT & CAN PRODUCE SAND OF DESIRED ‘FM’ IN AN AUTOMATED PROCESS”**



# Inconsistent River Sand Gradation

River Sand Too coarse in Mumbai, required screening and other processing



Himalayan River Bed Material required processing to extract Sand



Yamuna Sand too fine in Gradation



# Impurities in River Sand





# PRESENT SCENARIO SAND MINING IN INDIA

LARSEN & TOUBRO

## RIVER SAND MINING

**Hurt real estate sector reeling under sand bans**  
Govind Kamat Maad, TNN May 19, 2013, 12.18AM IST

**Tamil Nadu will not tolerate illegal sand mining: Jayalalitha**

Press Trust of India  
May 17, 2012

**Illegal sand mining: Geology department to auction 18 seized trucks**

SURAT: Geology department of the state government has decided to auction 18 trucks... from Tapi riverbed during the raid carried out on April, 17, 2013

**Now, sand is as dear as gold in Hassan**

By BR Udaya Kumar ; 22nd August 2011 02:57 AM  
HASSAN: At present one has to shell out Rs 20,000 for a truck load of sand

**Villagers protest illegal sand mining in Kheralu**  
Paul John, TNN Jul 24, 2012, 11.21AM IST  
AHMEDABAD: Residents of Dedasan and Chailpur villages in Kheralu taluka have taken to the streets, protesting the indiscriminate sand mining along the Sabarmati river.

**Illegal sand mining thrives in Satluj riverbed, sand dunes**  
Dinesh K Sharma, TNN Sep 2, 2012, 02.26AM IST  
FEROZEPUR: Despite a ban on removing sand from riverbeds and small sand dunes, illegal mining of sand on the banks of Satluj in Ferozepur has been going on a large scale.

**Journalists attacked by sand mining mafias in Madhya Pradesh**  
P Naveen | TNN | Apr 17, 2016, 10.32 PM IST

**India's illegal sand mining fuels boom, ravages rivers**  
By Rama Lakshmi,  
<http://articles.washingtonpost.com>  
Officially, India uses more than 400 million tons of sand for construction in a year, but environmental activists say the illegal mining pushes the real figure over a billion tons.

May 19, 2012 Washington Post

**Sand Mafia allegedly set on fire Maharashtra tehsildar's vehicle**

Press Trust of India | Thursday May 3, 2012  
A tehsildar escaped unhurt ...Jalgaon district of Maharashtra, police said.

**Illegal sand mining to be cognizable offence : Cabinet**

TOI | 22 Nov 2013, 07:55 IST

**The Bombay High Court banned sand extraction: Deccan Herald**  
Dredging Has Hit Projects: Builders

**Sand mining rampant despite ban**  
By Express News Service  
01st September 2011 11:50 PM  
KOCHI: The ban on sand mining in the district is not proving effective...

**Sand mining: NGT sticks to stand, ban to stay in MP**

Rageshri Ganguly, TNN | Aug 1, 2015, 08.03PM IST

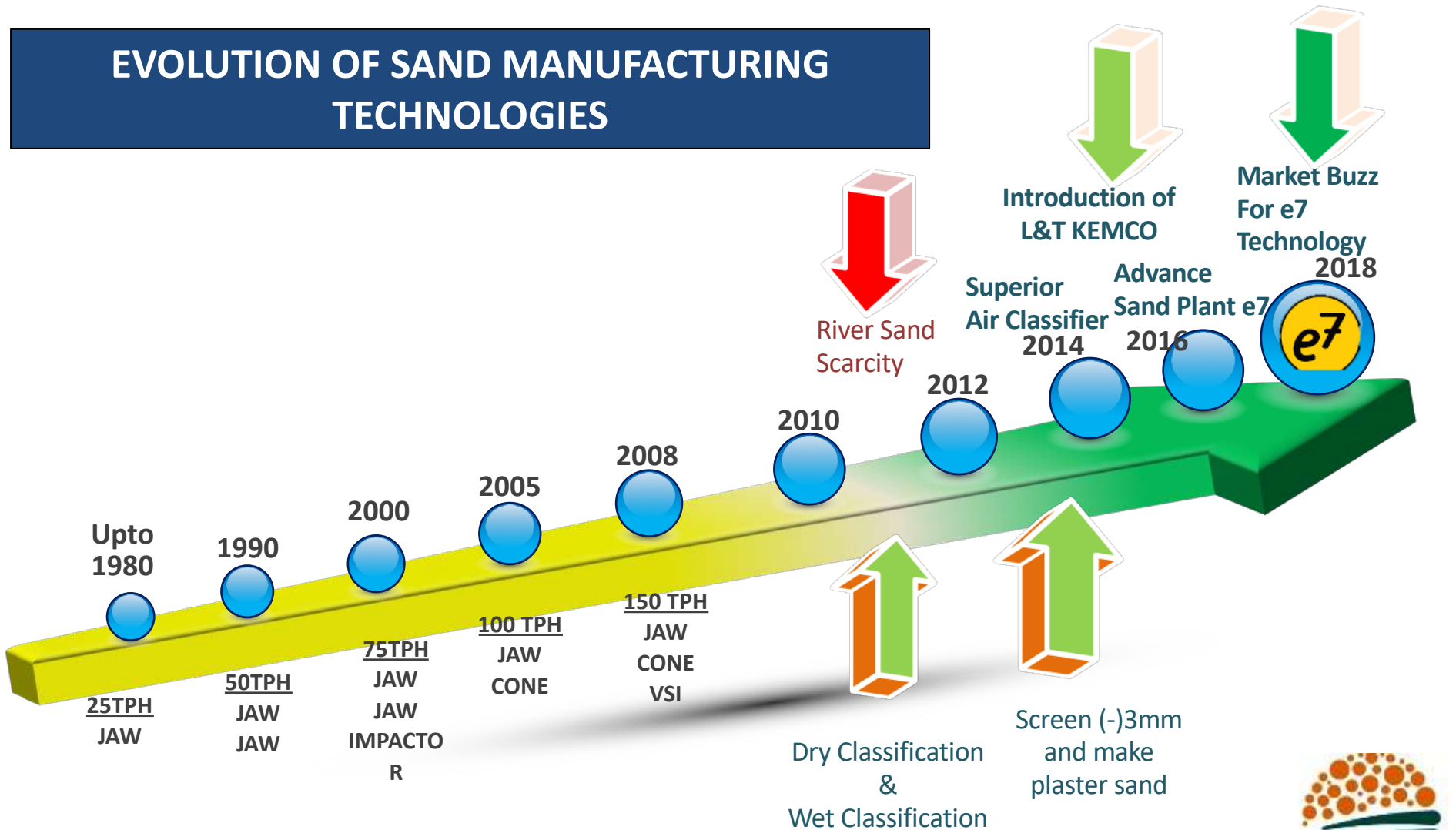
**To Complete Pending Projects Maharashtra Developers Import Sand**  
Mon Oct 26 2015 | [PROPGUIDE](#)

Sand mining, transportation banned  
Madikeri: June 7, 2015, DHNS



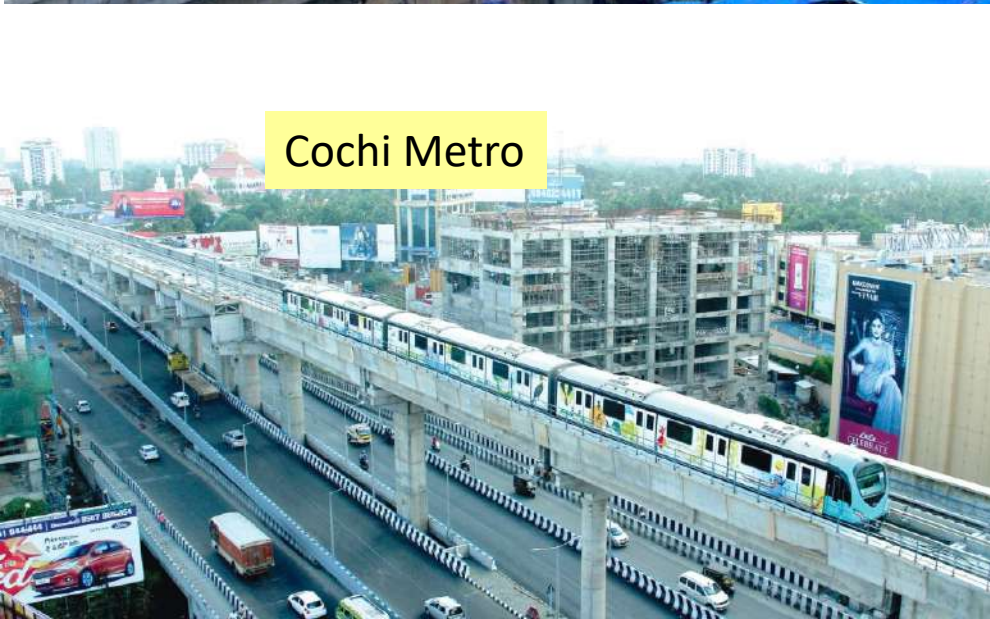


## EVOLUTION OF SAND MANUFACTURING TECHNOLOGIES



# Use of Artificial Sand

Artificial Sand used in Major construction in Maharashtra, Andhra Pradesh, Kerala, Karnatakata





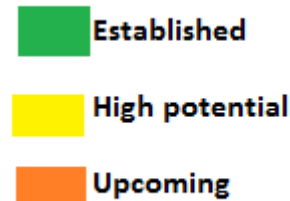
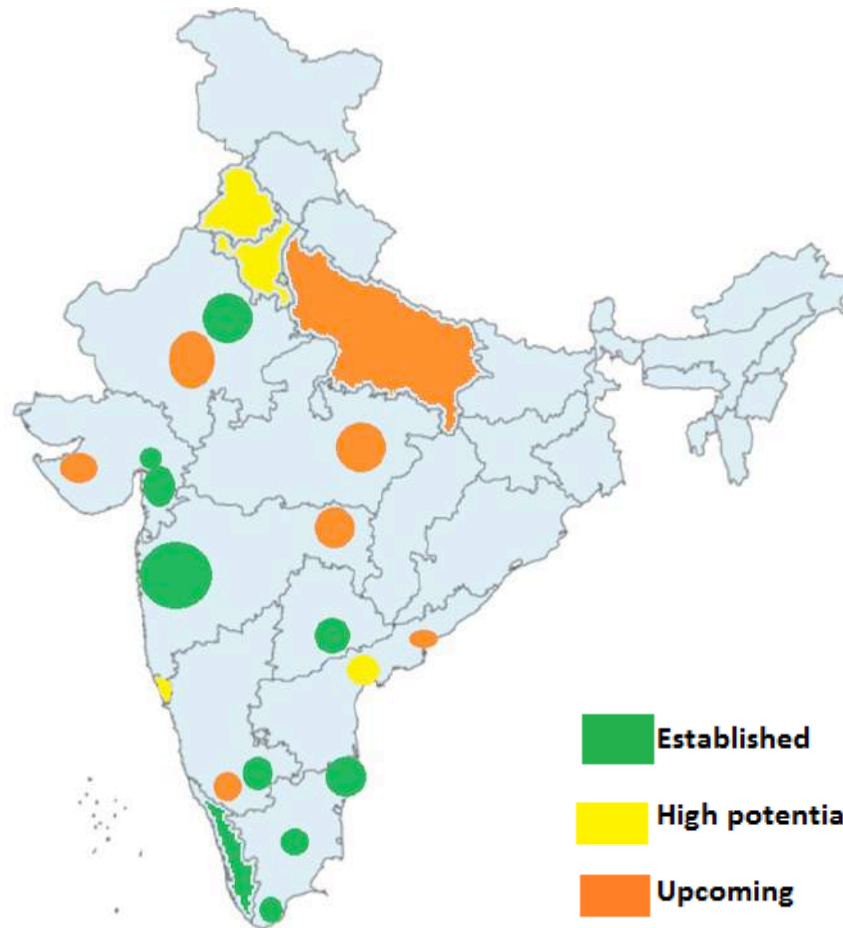
# Place - Sand Plant Demand Driver & Geographical Spread

## Geographic Distribution

State	Region
Maharashtra	Mumbai
	Nasik
	Pune
	Nagpur
Tamil Nadu	Chennai
	Namakkal
	Nagercoil
Karnataka	Bangalore
	Mysore
Telengana	Hyderabad
Andhra	Vijaywada
	Vizag
Gujarat	Vapi
	Valsad
	Chikhli
	Ahmedabad
	Jamnagar
Rajasthan	Kotputli
	Ajmer
MP	Jabalpur
	Rewa
Goa	Goa State
Kerala	Kerala State
Delhi+NCR	Delhi, Hariyana, Punjab

**Demand of Artificial Sand  $\propto$**

Non- Availability of river sand ( bans) i.e.  
(Prices of River Sand >> Cost of Crusher Dust + Cost of Processing Crusher Dust)



Green Zones have price difference of  
> Rs. 300 - Rs. 1000 / ton  
Between Crusher Dust and River Sand

Sand Processing  
Cost in e7 Plant  
@ Rs. 250/ton,

Market  
Segregation:

**Established:**  
River Sand Price  
– Crusher Dust  
Price >> Rs.  
250/Ton

**High Potential:**  
River Sand Price  
– Crusher Dust  
Price >Rs.  
250/Ton

**Upcoming:** River  
Sand Price –  
Crusher Dust  
Price ~ Rs.  
250/Ton

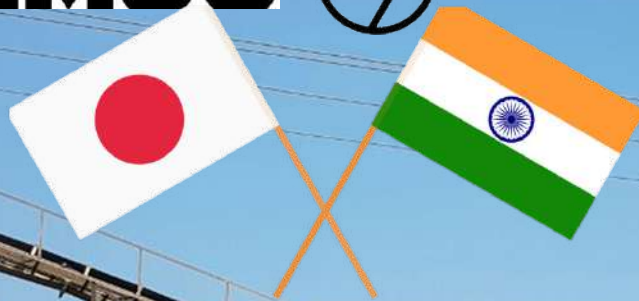


*The World's Most Advanced Dry Sand Manufacturing Systems*

L&T collaborated with Kemco, Japan to introduce World's most advanced Sand Manufacturing Technology in India and other select countries....



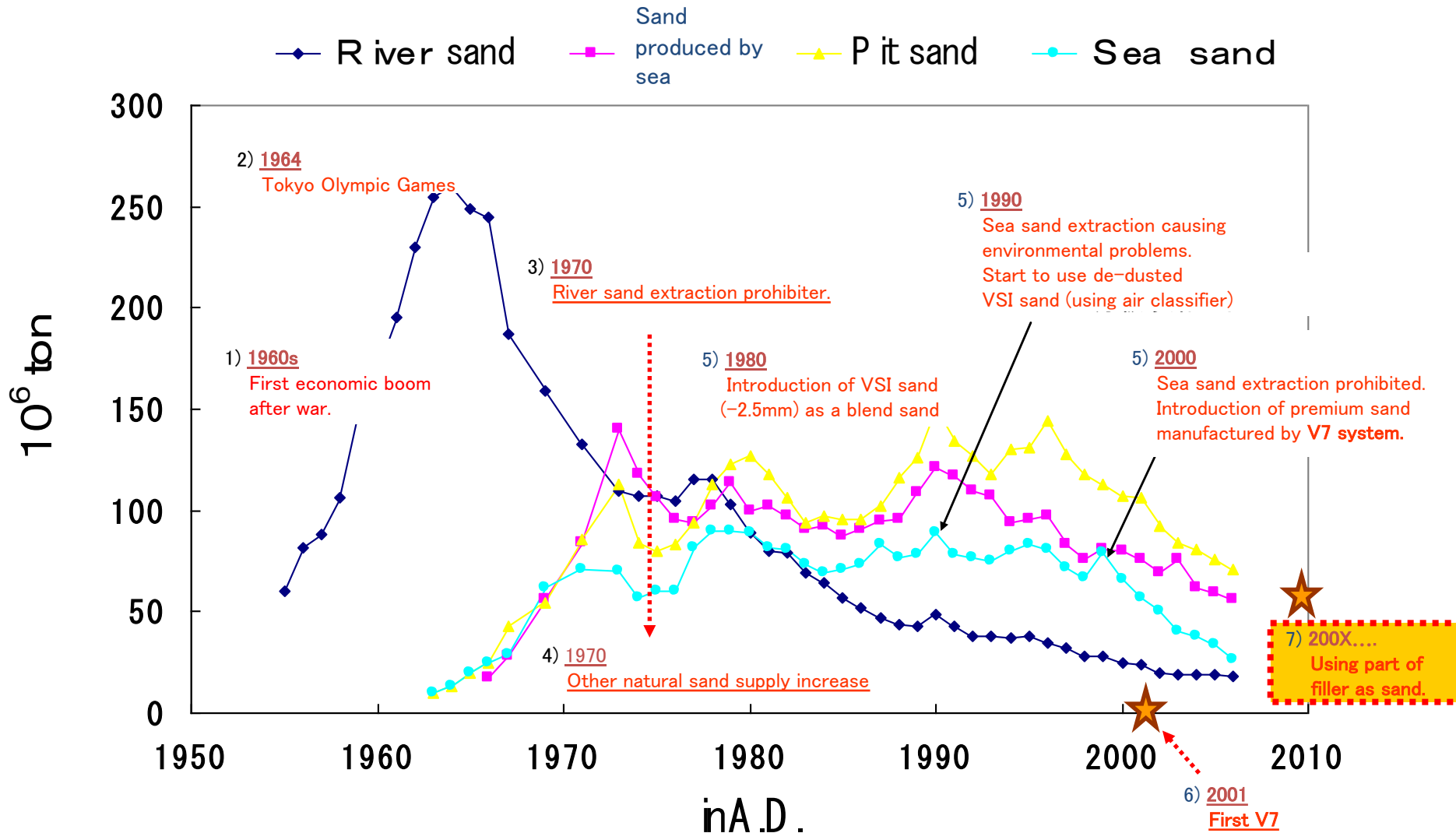
*Larsen & Toubro*





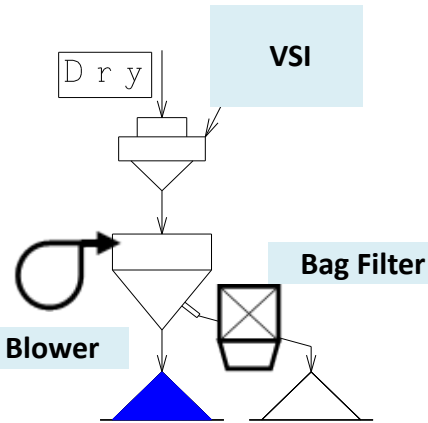
# Sand supply in Japan for last 60 years

By 2010 River sand completely replaced by Kemco Sands



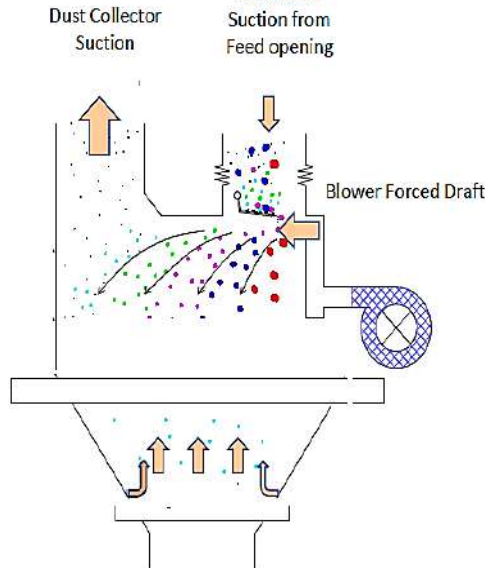
# IMPROVED AIR CLASSIFIED SAND

## Air Classification with Forced Air Circulation



### Suppliers:

- L&T-Kemco



### L&T-Kemco Air Classification Technology – (SAC)

- Forced Air Circulation apart from suction from bag filter
- PLC Controls to adjust suction volume and blower speeds

### Issues:

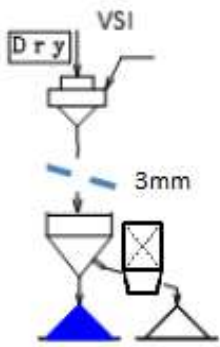
- Coarse Product
- Flaky Shape
- Difficulty in handling material in excess of 4% moisture





# e-Sepa - AIR CLASSIFIED & SCREENED SAND

## -3mm PLASTER SAND MANUFACTURING METHOD



### Suppliers:

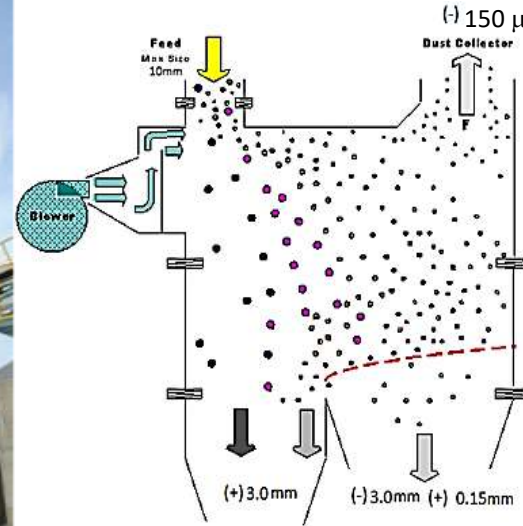
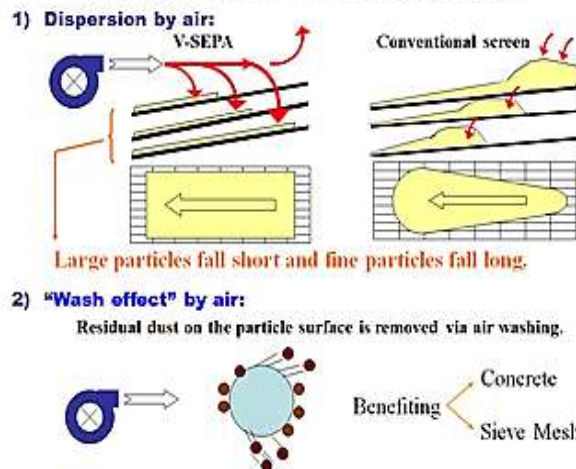
- L&T- Kemco  
in Dry  
Process

### In Wet- Process...

- Sandvik +  
CDE in wet  
process



Advantage of "Screening by Air"



L&T- Kemco Air Screening  
Technology (e-Sepa) –

- Improved Screen Efficiency due to forces air circulation
- PLC Controls to adjust suction volume and blower speeds

### Issues:

- Low Productivity of system due to re-circulation of +3-5mm
- Flaky Shape
- Difficulty in handling material in excess of 2% moisture



LARSEN & TOUBRO

# ADAVANCED SAND MANUFACTURING SOLUTIONS



 **e7 Sand Plant**





# COMPARISON OF SANDS -DIFFERENT TECHNOLOGIES

Sand Quality	Cone Sand (Crusher Dust)	VSI Sand (Crusher Dust)	VSI -> Washed Sand	VSI -> Air Classifie d Sand	VSI-> Screen @3mm-> Classifier/ Washed	e7 Sand Plant	Natural River Sand
Overall Grading						 Precise Control	 *May Vary
Cleanliness / Ultra-fines	 Dusty	 Dusty				 Precise Control	 *Chances of Clay
Fineness Modulus	 Very Coarse	 Less Coarse	 Very Coarse			 Precise Control	 *May Vary
Shape	 Very Flaky	 Less Flaky	 Less Flaky	 Less Flaky	 Less Flaky	 Equi-Dimensional	 Spherical
Surface Finish/ Interlock	 Very rough						 Smooth
Flow							



# Case: *Shri Krishan Grit Co.* LARSEN & TOUBRO

**M/s. Shri Krishan Grit Co. Kotputli**

**Customer Profile:** Established building contractor from Delhi.  
Experienced in Crushing & Sand Manufacturing

**Integrated to Metso make 3 Stage Plant (Jaw+ Cone+ VSI)**

**Product :** Concrete Sand IS 383 Zone -II, 2.7FM

**Feed Rate to e7 :** 60 TPH

**Feed Material :** Granite

**Feed Material Size :** 0/3.5 - 10 mm

**Production cost :** ~ Rs. 40 ( wear Cost)+ Rs. 60 ( Power and other Misc.)

**Product Issue :** High amount of 75-300 micron & Low 300-1.18micron due to typical material crystalline character.

**Solution :** Separate Screen to use to screen out excess 75-300 micron.

**\* This materials are good to be more in sand. Separately also salable for dry mix mortar.**



	Product FM 2.98
Size	% Passing
4.75	100
2.36	76.56
1.18	49.06
0.6	42.24
0.3	32.66
0.15	15.67

**e7 ENGINEERED CONCRETE SAND**





# Quality Sand of Mumbai Plant with improved Water absorption: 2.78



NABL Accredited Lab

Test Order/Report No: BVPL/FA: 259A1C/1636/1/2017  
Date of Receipt: 15.03.2017

Date: 23-03-21  
Page 1 of 1

L&T - STEC JV-MUMBAI

1 and T STEC Metro 3, Package 7 Project Office, 1st Floor,  
Wycel Administrative Building, Opp. Sagar Gate No.3, MIDC, Andheri-East, Mumbai-400055

## TEST REPORT ON PHYSICAL PROPERTIES OF FINE AGGREGATE

Source of Sample: Sample supplied by the customer.  
Number of Sample Tested: 02 (Two only)  
Customer's Reference: LT-STEC-AAD-QAS-P07-QS-233 dated 11.03.2017  
Condition of Sample: Satisfactory  
URN: 17008361  
Source\*: Stone Crusher at Thane  
Project\*: UGC 01 & UGC 07 of Mumbai Metro Project  
Period of Test: 20.03.2017 to 22.03.2017

### 1. SIEVE ANALYSIS: AS PER IS 2386 PART 1-1963 RA 2011:

Sl. No.	Sieve Size mm	% Passing		LIMITS AS PER IS 383-2016			
		Sample 1 CRF- Feed	Sample 2 CRF- Produce	ZONE I	ZONE II	ZONE III	ZONE IV
1	10	100.00	100.00	100	100	100	100
2	4.75	74.30	100.00	90-100	90-100	90-100	95-100
3	2.36	50.10	94.80	60-95	75-100	85-100	95-100
4	1.18	28.80	60.60	30-70	55-90	75-100	90-100
5	0.600	19.00	36.90	15-34	35-59	60-79	80-100
6	0.300	13.20	20.00	5-20	8-30	12-40	15-50
7	0.150	9.30	9.10	0-10	0-10	0-10	0-15
Fineness Modulus		4.05	2.79	NOTE- For crushed stone sands, the permissible limit on 0.150 mm Sieves is increased to 20 %. This does not affect the 5 % allowance permitted in Cl.6.3 applying the other sieve sizes.			

### 2. PHYSICAL TEST: IS 2386 PART 3-1963 RA 2011

Sl. No.	Test conducted	RESULTS	
		Sample 1 CRF- Feed	Sam CRF- P
1	Water Absorption (%)	2.96	2.
2	Material finer than 75 $\mu$ (%)	9.80	6.

\* As furnished by the customer.

- Note:
- The results relate only to the items tested.
  - Report shall not be reproduced except in full, without the written approval of the lab.
  - Any correction invalidates this report.

For Bureau Veritas (India) Pvt. Ltd.  
Construction Services Laboratory

SHABNAM KAZI

Authorized Signatory

Checked By

03/04/2017

### 1. SIEVE ANALYSIS: AS PER IS 2386 PART 1-1963 RA 2011:

Sl. No.	Sieve Size mm	% Passing		LIMITS AS PER IS 383-2016			
		Sample 1 CRF- Feed	Sample 2 CRF- Produce	ZONE I	ZONE II	ZONE III	ZONE IV
1	10	100.00	100.00	100	100	100	100
2	4.75	74.30	100.00	90-100	90-100	90-100	95-100
3	2.36	50.10	94.80	60-95	75-100	85-100	95-100
4	1.18	28.80	60.60	30-70	55-90	75-100	90-100
5	0.600	19.00	36.90	15-34	35-59	60-79	80-100
6	0.300	13.20	20.00	5-20	8-30	12-40	15-50
7	0.150	9.30	9.10	0-10	0-10	0-10	0-15
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### 2. PHYSICAL TEST: IS 2386 PART 3-1963 RA 2011

Sl. No.	Test conducted	RESULTS	
		Sample 1 CRF- Feed	Sample 2 CRF- Produce
1	Water Absorption (%)	2.96	2.56
2	Material finer than 75 $\mu$ (%)	9.80	6.70

# Quality Sand of Mumbai Plant with improved Water absorption: 2.78

RECOGNIZED R&D UNIT BY GOVERNMENT OF INDIA

**STRUCTWEL DESIGNERS & CONSULTANTS PVT. LTD.**

\*Structwel Plot 15, Sector 24,  
Off Sion Panvel Highway,  
Turbhe, Navi Mumbai-400705.

+91-22-27841010  
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**CHETAN R. RAIKAR**  
Chairman & Managing Director

ACCREDITED LABORATORY BASED ON ISO/IEC 17025

CIN : U74210MH1978PTC0020348

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CERTIFICATE NO. T-221  
T-222  
T-223

TEST REPORT NO. & DATE R&D/LAB/SAN/2016-17/SAN0239916/4426  
21/02/2017

1. Name & Address of Customer M/s. MAUER CARE SERVICES  
G4, Ankanksh Chs, Near Nandpada Police Station,  
Teen Hath Naka, Thane (West) 400 602.

2. Project / Site Self

3. Customer's Reference E Mail Did. - 08/02/2017

4. Sample

i) Description Fine Aggregate  
ii) Quantity 25 Kg  
iii) Date of receipt 08/02/2017  
iv) Condition Acceptable

5. Test method followed, if any IS : 2386 - 1963 Part - I & Part III, IS : 1542 : 1992, IS 2116 : 1980

6. Date of Testing 18/02/2017

## TEST REPORT

1. Sample Crushed Sand  
2. Source Plaster Sand  
3. Dry Bulk Density (Loose) Kg/m<sup>3</sup> 1.64  
4. Specific gravity 1.78  
5. Sieve Analysis

IS. SIEVE	Retained Wt. gms.	Cumulative Wt. Retained gms.	Cumulative % Wt. retained	% Passing	Requirement As Per IS 1542 for Plaster	Requirement As Per IS 2116 for Masonry mortar
40 mm	0.00	0.00	0.00	100.00		
20 mm	0.00	0.00	0.00	100.00	100.00	
10 mm	0.00	0.00	0.00	100.00	95 - 100	100.00
4.75 mm	0.00	0.00	0.00	100.00	95 - 100	90 - 100
2.36 mm	153.00	153.00	7.65	92.35	90 - 100	70 - 100
1.18 mm	514.00	667.00	33.15	66.85	80-100	40 - 100
600 micron	494.00	1161.00	58.05	41.95	20-65	5 - 70
300 micron	429.00	1590.00	79.30	20.70	0-15	0 - 50
150 micron	254.00	1844.00	92.20	7.80		
Passing 150 micron	156.00	2000.00	100.00	0.00		
weight of sample(gms)	2000.0					

6. Fineness Modulus 2.71  
7. Silt Content by Vol. % (at 2 hrs) 3.39  
by Wt. % 0.97

8. Water Absorption % 2.78

9. Free Moisture Content %

10. \*Deleterious Materials %

11. Bulkgage %

NOTE :

- Permissible limits for Silt Content by vol. : 8% (CPWD Specification)
- Permissible limits for Silt Content by wt. : 3% for Natural Sand & 15% for Crushed Sand (IS 383)
- This test report refers only to the sample submitted for testing.
- This test report is valid at the time of and under the conditions specified herein.
- This test report may not be reproduced in part, without the permission of this laboratory.
- Any correction invalidates this test report.
- \* Test is not under the scope of accreditation.

Vinaya Samal  
Authorized Signat

SST/D/report 2016-17/nabi/phy/fa/SAN0239916

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+91-08431844003

Pune (Laboratory)

+91-20-2554

+91-895024

T 0502

- Gradation - % Passing:  
-2.5mm ~93%; -1.18mm ~67%;  
-0.6mm~42%; 0.3mm ~21%;  
0.15mm - 7.5%
- FM ~ 2.7
- Silt ~0.97%
- Water Absorption ~2.78





# Design Mix for Laboratory trials at ACC

Concrete Trails For V7 Study		
Concrete Strength Class	M30	
Cement Content (kg / m3)	430	
Concrete Mix Design (Kg/m3)		
Cement	430	
CAI	31%	557
CAII	32%	575
Fine Aggregates	37%	665
Water	0.42	187
A/ C Ratio	4.18	

## SLUMP TESTING OF CONCRETE



# Laboratory Trial results at ACC

## Workability / Compressive Strength / Cohesivity Tests Natural Sand vs Crusher Sand vs e7 Sand

Code	Workability (mm)			Compressive Strength N/mm2			Bulk Density (Kg/m3)	Specific Gravity	Zone of Sand	Tempera ture	Cohesivity	Remarks
	0	30	60	3 Days	7 Days	28 Days						
05.03.12/NS/01	110	40	0	22.50	28.41	UT	1.69	3.03	I	30	Good	
05.03.12/CS/01	0	0	0	21.87	26.04	UT	1.66	2.76	I	29	Satisfactory	
<b>05.03.12/e7/01</b>	<b>130</b>	<b>75</b>	<b>40</b>	<b>28.87</b>	<b>33.90</b>	UT	<b>1.60</b>	<b>2.73</b>	<b>II</b>	<b>29</b>	<b>Very Good</b>	
06.03.12/NS/02	80	20	0	21.75	27.00	UT	1.69	2.90	I	30	Good	
06.03.12/CS/02	0	0	0	20.79	25.23	UT	1.65	2.78	I	30	Satisfactory	
<b>06.03.12/e7/02</b>	<b>130</b>	<b>80</b>	<b>50</b>	<b>27.06</b>	<b>33.42</b>	UT	<b>1.60</b>	<b>2.83</b>	<b>II</b>	<b>29</b>	<b>Very Good</b>	
07.03.12/NS/03	110	30	10	23.70	29.33	UT	1.68	2.97	I	29	Good	
07.03.12/CS/03	0	0	0	21.23	27.43	UT	1.63	2.70	I	29	Satisfactory	
<b>07.03.12/e7/03</b>	<b>130</b>	<b>70</b>	<b>40</b>	<b>29.35</b>	<b>33.42</b>	UT	<b>1.60</b>	<b>2.78</b>	<b>II</b>	<b>29</b>	<b>Very Good</b>	
09.03.12/NS/04	80	30	0	20.47	UT	UT	1.68	3.10	I	29	Good	
09.03.12/CS/04	0	0	0	19.44	UT	UT	1.65	2.68	I	28	Satisfactory	
<b>09.03.12/e7/04</b>	<b>130</b>	<b>70</b>	<b>50</b>	<b>27.97</b>	UT	UT	<b>1.60</b>	<b>2.73</b>	<b>II</b>	<b>29</b>	<b>Very Good</b>	



# Laboratory Trial results at Sai Rydam RMC

## Compressive Strength / Cement-Flyash Consumption Natural Sand vs Crusher Sand vs e7 Sand

Sr. No.	SOURCE	ID MARK	CEMENTATIOUS		COMPRESSIVE STRENGTH(MPA)	
	Material		Cement	Flyash	7days	28days
1	VSI Sand	CG-3	300	100	20.68	32.43
2	VSI Sand	CG-4	338	112	30.35	42.32
3	VSI Sand	CG-5	375	125	34.18	49.11
1	Classified Sand	HG-3	300	100	28.27	50.47
2	Classified Sand	HG-4	338	112	38.05	52.49
3	Classified Sand	HG-5	375	125	41.13	57.59
1	Skgc e7 Sand	DG-3	300	100	35.85	58.00
1	Skgc e7 Sand	DG-4	338	112	39.36	62.88
3	Skgc e7 Sand	DG-5	375	125	54.29	67.13
1	Vaitarna River Sand	EG-3	300	100	21.08	36.31
2	Vaitarna River Sand	EG-4	338	112	34.76	48.13
3	Vaitarna River Sand	EG-5	375	125	38.44	54.88
1	Local Crushed Rock fines	BG-3	300	100	18.57	32.98
2	Local Crushed Rock fines	BG-4	338	112	32.89	43.59
3	Local Crushed Rock fines	BG-5	375	125	32.90	46.95



# Engineered Sand

A Trademark of L&T

GREEN ALTERNATIVE TO NATURAL SAND



NATURE FOR FUTURE



Thanks

