Plastic Waste Management
Best practices through Clean Kerala Company

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GOVERNMENT OF KERALA
सत्यमेव जयते

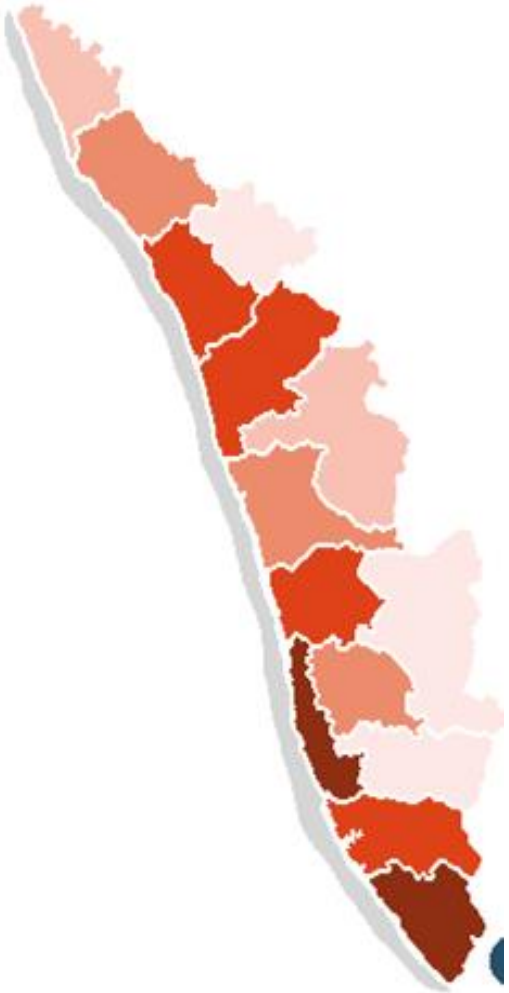
മാലിന്യമുക്ത കേരളം

स्वच्छ भारत
एक कदम स्वच्छता की ओर

Clean Kerala
Company Limited

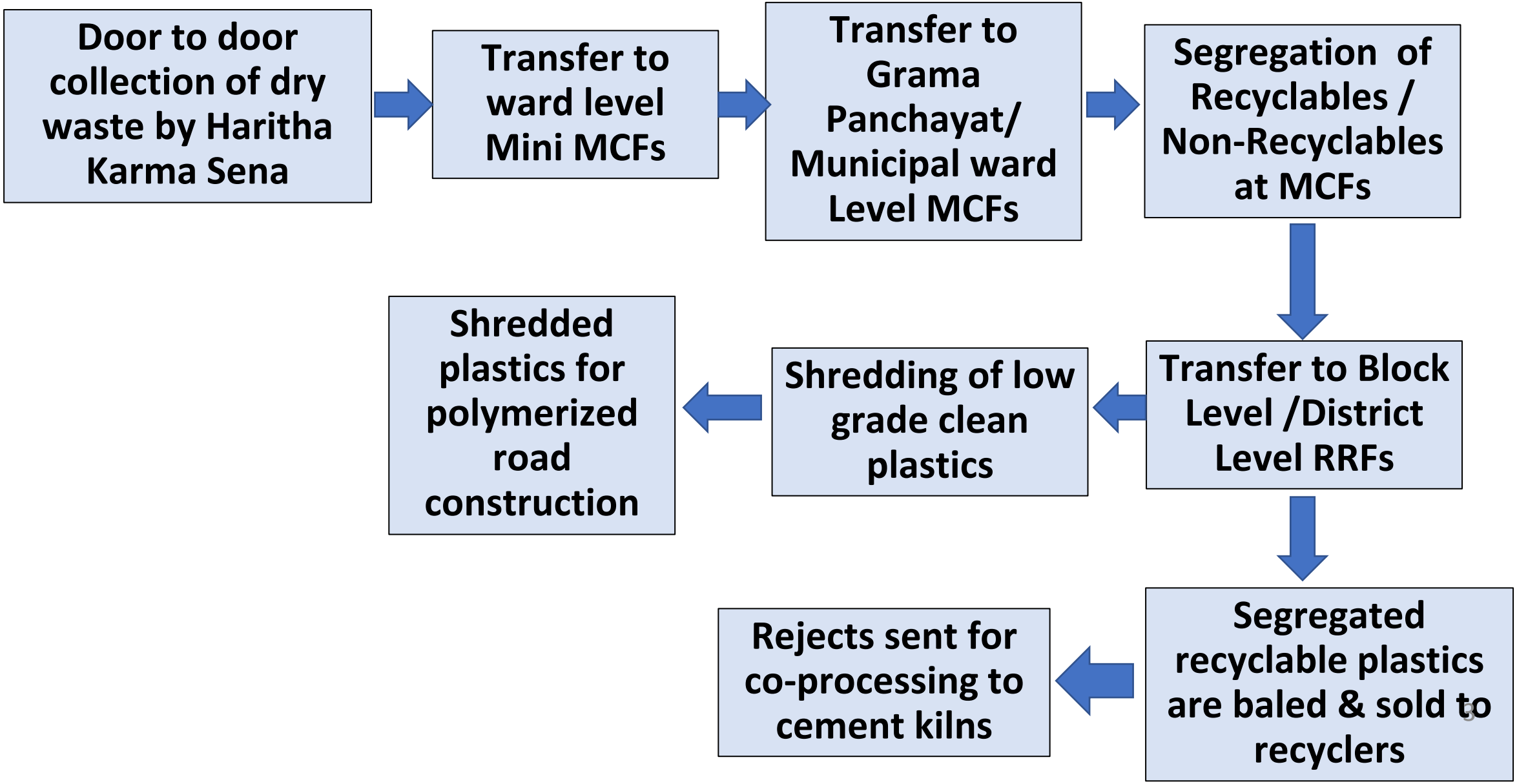
About Kerala

- Population: 34 million
  2.76% of India's population
- Area: 38,863 sq. km
- Population Density-
  - Kerala 860 per sq. km
  - India : 382 per sq. km



Local Self Government Institution	Nos	Population (Cr)
Corporation	6	0.31
Municipality	87	0.45
Grama Panchayat	941	2.58
Total	1034	3.34

The Process of Dry Waste Management



HOUSEHOLDS

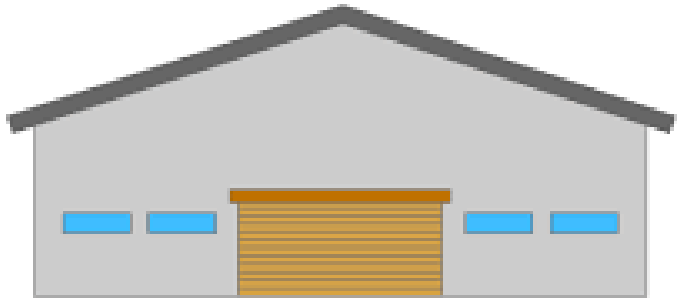
HARITHA KARMA SENA

SEGREGATED COLLECTED WASTE TRANSPORTED TO MCF

MCF

TRANSPORTATION OF MATERIALS FROM MCF TO RRF

RRF



TRANSPORTATION OF SORTED MATERIALS FROM RRF TO RECYCLERS

RECYCLING PLANTS/AGENCIES

NON-RECYCLABLES FROM RRF SEND TO CEMENT KILNS

CEMENT KILNS

ROAD CONSTRUCTION

WORST QUALITY SHREDDED PLASTIC FOR ROAD TARRING

Dry waste- Door to Door Collection

- Haritha Karma Sena (HKS) or Green Task Force - a Micro Enterprise Unit formed with 2 persons in each ward of LSGI
- As on 30.01.2024 **35,351** HKS members are functional in **the LSG**Is of Kerala.
- The user fee collected depends upon the local bodies;
- Collection fee of **Rs.50/month** for **households** and **Rs.100/ month** for **institutions** (for about 2 sacks)

Clean Kerala Company Ltd

- Clean Kerala Company Limited, formed under the Local Self Government Department, Government of Kerala
- The Company's activities mainly include the collection, segregation, storage, recycling production of shredded plastic and scientific disposal of non-recyclable wastes.

- **Projects**

- Supporting LSGIs in Dry Waste Management
- Collection of Recyclable Plastic Materials from LSGIs through HKS
- Training, awareness and capacity building of LSGIs, HKS and other departments
- Supply of Shredded Plastic for Polymerised Road Construction
- Operation and Maintenance of RRFs
- Collection of E-waste from Offices, Educational institutions, households, etc
- Collection and disposal of non-recyclable waste from the LSGIs
- Re-build Kerala Initiative Projects (Recycling facilities for plastic, e-waste and glass)

Waste Collection Calendar-2024

SI No.	Item collected by CKCL	Collection Month
1	E-waste	January, July
2	Clothes	February
3	Hazardous waste (picture tube, bulb, tube, mirror)	March, October
4	Chapels, bag, Thermocol, Upholstery Leather, mattress, Pillow etc	April, November
5	Glass, bottles, broken glass	May, December
6	Tyres	June
7	Polyethene Printing sheets (Flex), other scraps	August
8	Medicine Strips	September

Mini - Material Collection Facility

- “Mini MCF” is a system for temporary storage at **ward level** for the waste collected from households and commercial establishments by Harita Karma Senas.

- The collected materials are transported from Mini MCF to the nearest Material Collection Facility (MCF)

Mini-MCF in Aryad GP in Alappuzha Dist.

Material Collection Facility (MCF)

- Facility to store collected dry waste from mini-MCF/Houses/Institutions
- Established in Grama Panchayats and wards of Municipalities and Corporations
- Segregation of recyclables and non-recyclables happen at MCFs

MCF in Aryad GP in Alappuzha Dist.

Segregation at MCF

- Collected materials are segregated at MCF and recyclable items sold from MCF through CKCL
- Plastics, non-recyclable rejects from MCF forwarded to RRF for secondary segregation & shredding

Poovachal GP, Trivandrum District

Material Collection Facility (MCF) - Chittoor Municipality

Resource Recovery Facility (RRF)

- Fully mechanised facility to process the collected non-biodegradable materials from MCF

  (Shredding machine, Baling machines, dust remover and conveyor belts available)

- Established in Block/ Municipalities and District Level
- Operation and Maintenance by the CKCL
- Further segregates waste into recyclables and non-recyclables
- Recyclable waste sold to recycling industry
- Low grade plastics shredded and sent for road tarring
- Rejects or non-recyclable waste sent to cement factories for co-processing/ safe disposal.

Resource Recovery Facility
(RRF at Thiruvananthapuram Municipal Corporation)

Resource Recovery Facility in Mundur BP in Palakkad

Resource Recovery Facility in Bharanikkavu BP in Kollam

Baled material storage at RRF

RRF at Poovachal GP, Tvm

Material collection rates per kg (CKCL)

Sl No.	Item	Rate (Rs.) for LSGI	
		Baled	Unbaled
1.	HM (high molecular high-density polyethylene)	8	5
2.	CHM Mix (Colour mixed high molecular Polyethylene)	9	5
3.	PP (Polypropylene)	16	14
4.	Print PP (Printed Polypropylene	9	6
5.	LDPE 1(Low-density Polyethylene)	22	16
6.	LDPE 2	11	9
7.	Milk cover -LDPE	14	11
8.	HDPE (High-density polyethylene)	20	18
9.	Hard Plastic	11	9
10.	Pet Bottle	16	13

Sl No.	Item	Rate (Rs.) for LSGI	
		Baled	Unbaled
11.	Liquor Bottle (Plastic)	15	12
12.	Non-woven	6	5
13.	Newspaper	9	
14.	Cardboard	6	4
15.	BB (Mix Paper)	5	4
16.	Glass Bottle (Beer)	1	
17.	Glass Waste	0.75	
18.	Aluminium Can	50	40
19.	Steel	25	
20.	Iron Scrap	15	
21.	Oil Cover	5	2

Information On Reject Wastes Collected Through Clean Kerala Company Agencies in the District		
Districts	**Rejects (Kg)**	**Footwear, Bags, Thermocol (Kg)**
Thiruvananthapuram	5,85,120	61,196
Kollam	589899	9400
Pathanamthitta	444277	982
Alappuzha	144470	10670
Kottayam	1154279	64000
Idukki	2096433	1352
Ernakulam	4440840	4550

Information On Reject Wastes Collected Through Clean Kerala Company Agencies In The District		
Districts	**Rejects (Kg)**	**Footwear, Bags, Thermocol (Kg)**
Thrissur	2016413	22950
Palakkad	2823755	0
Malappuram	3156530	0
Kozhikode	1007382	0
Wayanad	1513375	743680
Kannur	930374	0
Kasaragod	723945	231100
TOTAL	**2,16,27,092**	**11,49,880**

AGENCIES ASSOCIATED WITH CKCL FOR COLLECTING NON-RECYCLABLE WASTE

Sl. No	Agency Name	Storage Capacity of agency's godown	Cement Factories
1	Tiffot Private ltd	35,000 Sq Ft	Dalmia, Chettinad and Ultratech
2	AMR logistics	19,000 Sq Ft	Dalmia
3	Baymax	10,000 Sq ft	Dalmia
4	Green Evo Tech	15,000 Sq Ft	Chettinad
5	Malabar Metal	50,000 Sqft	Dalmia
6	Mahayoobha Eco Solution	35,000 Sq Ft	Dalmia
7	Recity	4,000 sqft	Dalmia
8	Nothing is waste	4,000 sq ft	Dalmia
9	Greenway Eco Solutions	10,000 sqft	Dalmia
10	Green Field Plastics	10,000 sq.ft	Dalmia

AGENCIES ASSOCIATED WITH FOR COLLECTING NON-RECYCLABLE WASTE

Sl. No	Agency Name	Storage Capacity of agency's godown	Cement Factories
11	Ekaiva	3000 sq.ft	JK cements
12	Malabar Eco Solutions	25000 sq.ft	Dalmia
13	Tonoplast	22000 sq.ft	Dalmia
14	Orio Industries	6000 sq.ft	Dalmia
15	Amare and Alate Construction	9000(district RRF)	Dalmia and Chettinad
16	MRM Eco Solutions	15000 sq ft	Chettinad and ACC
17	East Link Traders	60000 sq ft	Dalmia
18	A&A Traders	10000 sq ft	Chettinad
19	PK Metal	5000 Sq ft	Dalmia
20	Gleco Trash	25000 Sq ft	Dalmia

DETAILS OF AGENCIES ASSOCIATED WITH CKCL FOR COLLECTING NON-RECYCLABLE WASTE

Sl. No	Districts	No. Of Agencies	No. Of GPS Enabled Vehicles
1	Thiruvananthapuram	8	16
2	Kollam	7	16
3	Pathanamthitta	4	12
3	Alappuzha	6	14
5	Kottayam	8	20
6	Idukki	8	16
7	Ernakulam	7	18

DETAILS OF AGENCIES ASSOCIATED WITH CKCL FOR COLLECTING NON-RECYCLABLE WASTE

Sl. No	Districts	No. Of Agencies	No. Of GPS Enabled Vehicles
8	Thrissur	7	20
9	Palakkad	5	12
10	Malappuram	8	16
11	Kozhikode	8	16
12	Wayanad	3	6
13	Kannur	6	18
14	Kasaragod	4	10
	TOTAL	**89**	**210**

Shredded Plastic Production for Polymerised Road Construction coordinated by CKCL

- Plastic waste consisting of carry bags, disposal cups, polystyrene, multilayer films, polyethylene and polypropylene foams is shredded into small pieces (between 1.6mm-2.5mm).
- Shredded plastics are produced from 164 local bodies.
- The process of road construction with plastics demands no additional machinery and is an in situ process.
- The overall consumption of bitumen is reduced by about **7-10%** and the construction cost is also reduced considerably *(detailed cost comparison added in next slides)*

Investment, cost and returns

- 1 ton of bitumen costs Rs 50,260 whereas the same quantity of waste plastic would cost only Rs. 22,000.
- For the construction of a road surface of 3,000 sqm area (1 KM road of width 3 m) with shredded plastic, savings would be about 306.6 kg of bitumen or Rs.10,000
- Furthermore, since there are significantly less potholes on plastic roads, there is no need to undertake maintenance for five years.

Comparison of road construction using plastic & conventional method			
Item	**Area in m2 (1 kmx3m)**	**Qty of bitumen required/sq metre**	**Bitumen quantity required/km**
Ordinary tarring (20 mm chipping carpet)	3000	1.46 kg/m2	4380 kg
Plastic tarring (20 mm chipping carpet)	3000	1.3578 kg/m2	4037.4 kg
Savings in Bitumen quantity /Km when substituted with shredded plastic			=(4380)-(4037.4) **=306.6 kg**
Cost difference/kg of bitumen and shredded plastic			=Rs. 50.26-Rs. 22 **=Rs. 28.26**
Cost savings with using shredded plastic for 1 Km road (20 mm chipping carpet) **(3m wide)** =(bitumen saved per km) x (cost difference/kg of bitumen and shredded plastic) x Contractor profit and overhead charges			306.6x28.26x1.2 **=Rs. 10,397/km**

Use of shredded plastics in polymerized road construction

- **3,552.031 tonnes** of shredded plastics have been produced from 2016 till November 2023
- Out of which **3,114.029 tonnes** used for constructing **5,598.83 km** of polymerized road by the local self-government institutions,NHAI and Public Works Department.

Shredded Plastic Production	
2016-2017	23.82
2017-2018	174.78
2018-2019	439.187
2019-2020	665.593
2020-2021	1000
2021-2022	739.765
2022-2023	371
2023-2024 (Till November)	137.886
Total	3552.031(MT)

Shredded Plastic sales details				
Year	Sale(MT)			
	NHAI/others	PWD	LSGI	Total
2016-2017	0	5.11	18.71	23.82
2017-2018	0	52.4	122.38	174.78
2018-2019	0	136.09	143.86	279.95
2019-2020	5.03	303.92	305.92	614.87
2020-2021	6.15	379.8	529.8	915.75
2021-2022	2.528	370.659	361.578	734.765
2022-2023	0.226	273.695	96.173	370.094
2023-2024 (Till November)	0	57.92	23.7	81.62
Total	13.934	1579.594	1602.121	3114.029

Length of Road				
Year	NHAI/others (KM)	PWD (KM)	LSGI(km)	Total(km)
2016-2017		5.11	46.78	51.89
2017-2018		52.4	305.95	358.35
2018-2019		136.09	359.65	495.74
2019-2020	5.03	303.92	764.8	1073.75
2020-2021	6.15	379.80	1324.5	1710.45
2021-2022	2.528	370.66	903.9	1277.13
2022-2023	0.226	273.70	240.4	514.35
2023-2024	0	57.92	59.3	117.17
Total	13.93	1579.60	4005.30	5598.83

Flow Chart of Polymerized Road Construction Process

1. Cleaning of Plastic waste

2. Shredding of Plastic

3. Mini Hot Mix Plant

4. Aggregate transfer to puddler

5. Addition of Plastics

6. Addition of Bitumen

7. Aggregate – Plastic Bitumen-Mix

8. Road Layering

SHREDDED PLASTICS USED FOR ROAD TARRING AT KATHIROOR GP

Beach Road, Thikkodi GP, Meladi BP constructed using shredded plastic

The advantages of using plastic in road construction : (As per IRC: SP: 98- 2013)

- Higher resistance to deformation.
- Higher resistance to water induced damages.
- Increased durability and improved fatigue life.
- Improved stability and strength.
- Environment friendly disposal of waste plastic

Substituting bitumen with shredded plastic in road construction

- Studies have revealed that waste plastics have great potential for use in bituminous construction as its addition in small doses, **about 5-10%**, by weight of bitumen helps in **substantially improving the Marshall stability, strength, fatigue life and other desirable properties** of bituminous mix, leading to improved longevity and pavement performance.

- The returns include a clean environment free from plastic waste; better roads without any deformation from rain or traffic load; saving natural resources; and using plastic waste effectively in an eco-friendly manner

Co-Processing : Definition

- Co-processing is the use of waste as source of energy or raw material, or both to replace natural resources and fossil fuels.
- Waste materials used for co-processing are referred as refuse derived fuel (RDF)

Why Co-processing of plastic waste?

- Environmentally sound utilization of waste as resource or energy recovery
- Co-processing in cement Kiln is considered as an effective and sustainable option.
- Dual benefit in co-processing
  - in terms of utilizing the waste as a supplementary fuel
  - safe disposal of plastic waste

Co-processing of plastic waste

- In co-processing, plastic wastes are disposed safely at a higher temperature of up to 1450 ^{o}C

- The acidic gases, if any generated during co-processing gets neutralized in the large alkaline environment available within the kiln system.

Collection and safe disposal of non-recyclables by CKCL to cement factories

- CKCL entered into an agreement with **Dalmia Cement** (Bharath) Limited for the co-processing of non recyclable waste.
- CKCL associated with **15 agencies** having agreement with cement factories such as Dalmia Cement, Chettinad Cements
- Most of the waste sent to cement kilns after converting it to RDF.
- During the last two financial years **1,63,633.32MT** reject waste collected and sent to cement factories

FY	Dalmia	Chettinad	Total (MT)
2021-22	1914.623	1276.415	3191.038
2022-23	96265.28	64176.85	160442.1
Total	**98179.9 MT**	**65453.27 MT**	**163633.2 MT**

Relevant Government Orders

G.O (RT)NO. 1673/2021/LSGD DATED 06.09.2021

G.O (RT)NO. 2112/2019/LSGD DATED 27.09.2019

- Inert waste is collected as per the above government orders.
- Only GPS-equipped vehicles are used for waste collection.
- Government-mandated manifest is used for the collection of waste.
- Fixed fee (**Rs. 10/- per kg**) is collected by CKCL from local self-government bodies as per government orders for waste collection and processing in cement factories.
- **Rs. 8.00 per kg** (including GST) is paid to agencies partnering with CKCL to collect waste from local self-government bodies and deliver it to cement factories.

Details of cost incurred for co-processing

- Segregation and baling charges : **Rs. 2.00 /kg**
- Transportation charges : **Rs.3.00/kg**
- Loading charges : **Rs. 0.50 /kg**
- Processing charges in Dalmia : **Rs. 0.50 /kg (for CKCL)**
- Processing charges in Dalmia and Chettinad **Rs. 1.00 to 1.50 (for other agencies)**

Co-processing of plastic waste -benefits

- **Reduces**
  - Required number of landfills
  - Pollution caused by waste dumping
  - Greenhouse gas emissions
  - Environmental impact of extraction of fossil fuels through mining
  - Dependence on primary resource market
  - Cost of production of cements
- **Mitigates climate change impacts**
  - Reduce large quantity of GHG emissions
- **Promotes circular economy**

Thank You!